PET personal computer reviewed

electronics today

MAY 1979 INTERNATIONAL

$1·40*
NZ $1.50

BREAKTHROUGH – ELECTRONIC TRANSLATOR

VENUS – pioneer probe results

SUPERB 60W LOW DISTORTION AMPLIFIER MODULE TO BUILD

THE JVC QUARTZ-LOCKED TURNTABLE.

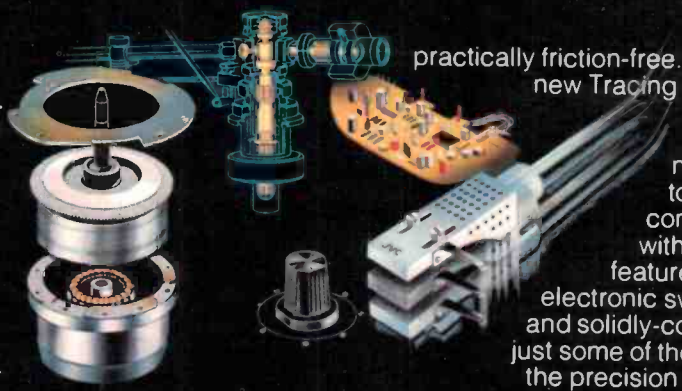
First we invented it. Now we've made it more precise than ever.

The turntable evolution comes full swing with the introduction of the new Quartz turntable series. We introduced the first quartz-controlled turntable in 1974, and we've been improving our designs ever since. Including:

Super Servo Frequency Generator
To detect minute variations in platter speed, and send corrective information to the electronic circuit controlling turntable rotation, it provides near-perfect speed accuracy. And, our Super Servo is factory-set for years of accurate, dependable use.

Direct Drive DC Servomotor
For quick-start/stop and high-torque operation. Our powerful motor drive system and its companion speed-monitoring circuits reduce wow-and-flutter and speed drift nearly to the vanishing point.

Gimbal Support and TH Tone Arm
Our exclusive unipivot gimbal support holds the tone arm firmly, yet is practically friction-free. We also developed a new Tracing Hold (TH) tone arm to provide stability and tracing accuracy needed for a cartridge to follow even the most complex record grooves without error. These, plus features like digital readout, electronic switching mechanisms and solidly-constructed bases, are just some of the reasons to consider the precision of JVC's Quartz-Lock series for your music system. And you can choose from manual, semi-automatic or totally-automatic models—JVC's most comprehensive turntable line ever. See them at your JVC dealer soon.



QL-A7

For details on all JVC Hi-Fi Equipment write to the JVC Advisory Service, Post Office Box 307, North Ryde, N.S.W. 2113

JVC
the right choice

QL-F4

WT92/78

AUSTRALIAN OWNED AND PRODUCED

May 1979, Vol.9, No. 5.

electronics today INTERNATIONAL

Acting Editor: Roger Harrison VK2ZTB
Managing Editor: Collyn Rivers
Project Manager: Phil Wait VK2ZZQ
Special assign: Les Bell GM4CFM
Editorial Staff: Phil Cohen
Jonathan Scott VK2YBN
Jan Vernon
Assembly: Bill Crump
Simon Bracken

This remarkable piece of electronic technology was 'pie in the sky' just a few short years ago. It has just been released in Australia — turn to page 29 to see just what it can do.

A Modern Magazines Publication
* Recommended retail price only

Registered for posting as a publication — Category B

PROJECTS

FEATURES

NEWS & INFORMATION

PROFESSIONAL

On location: Stanton is there where TGIF (Thank God, It's Friday) is filmed.

Go to the Club called *Osko's* in the Los Angeles Area. Revel in the sound around you, supplied to *Osko's* by Sound Unlimited Systems, Inc., a prime packager of Disco systems. They have supplied 90 systems to Stationary facilities and 60 to Mobile operations.

Sound Unlimited swears by Stanton's 500AL because they have used it for many years until Stanton came out with the 680 EL. Now they use this model exclusively in all of their installations, and endorse it without reservation.

Whether your usage includes recording, broadcasting, archives, Disco or home entertainment, your choice should be the overwhelming choice of the Professionals in every field . . . Stanton Cartridges.

P.S. "Thank God It's Friday" has turned out to be a dynamite film starring Disco Star, Donna Summer.

STANTON!

And remember, you can't get the best out of your Stanton Cartridge unless you use a genuine Stanton Stylus.

Sole Australian Distributors

LEROYA INDUSTRIES PTY LTD

W.A. Head Office: 156 Railway Pde., Leederville 6007. Phone 381 2930.
N.S.W. Office: 7 Jordan Rd., Wahroongah 2076. Phone 487 2543.

News Digest

Turbulent Jupiter

This dramatic photo of Jupiter is one of many sent back already by NASA's Voyager 1 spacecraft, which went within 350 000 km of the centre of the giant planet. It shows the 'red spot' (upper right) and details of the enormous turbulence of a planet which has been described as Wagnerian.

At first glance, the repeating nodes flowing to the bottom left hand corner of the picture are reminiscent of the patterns produced by putting a stationary bar into a wind tunnel. Does this mean that the large white oval is a (relatively) solid structure in a gigantic wind?

Voyager 1 will continue to travel through the Solar System, reaching Saturn in November 1980, an encounter which should provide some even more interesting photographs.

This view of Jupiter is from the Voyager 1 spacecraft and shows the giant 'red spot' feature which is one of the mysteries of the giant planet.

Pioneer-Venus, latest results

Late data from NASA arrived just before deadline for this issue with some interesting results from the Pioneer Venus 2 probe – see our story on this mission (commencing page 20) for background.

The picture here is of the first high resolution infrared image of Venus' clouds, constructed from data obtained by the Pioneer Venus Orbiter Infrared Radiometer during orbit 10 on 14 December 1978. The wavelength is 11.5 microns, sensitive to the temperature of the planet's cloud tops. Spatial resolution is about 100 km. The area covered in the image is a 10° wide strip near Venus' north pole and shows a bright feature with temperatures approaching 260°K (–13°C). North is towards the bottom in this view. The hot feature (centre) is roughly 1100 km wide and 15 km below the cloud tops.

The high temperature is indicative of substantial clearing of the clouds near the pole. The high resolution pass ended at a maximum latitude of 80°N (bottom), so it is possible that even higher temperatures occur farther north. Surrounding the high latitude hot spot is a dark region which is as much as 45°C cooler. Discernable structure may be seen within this dark region, which is believed to be the cool "collar" of clouds seen in earlier, low resolution maps.

Atmospheric makeup of Venus, according to a NASA report in Feburary, is given in the table below.

Venus atmospheric makeup via Pioneer Venus 2

Constituent	fraction
Carbon dioxide	97%
Nitrogen	1–3%
Water vapor*	0.1–0.4%
Helium	250ppm
Sulfur dioxide*	240ppm
Neon	6-250ppm
Argon	20–200ppm
Oxygen*	60ppm
Sulfuric acid**	–
Elemental sulfur**	–

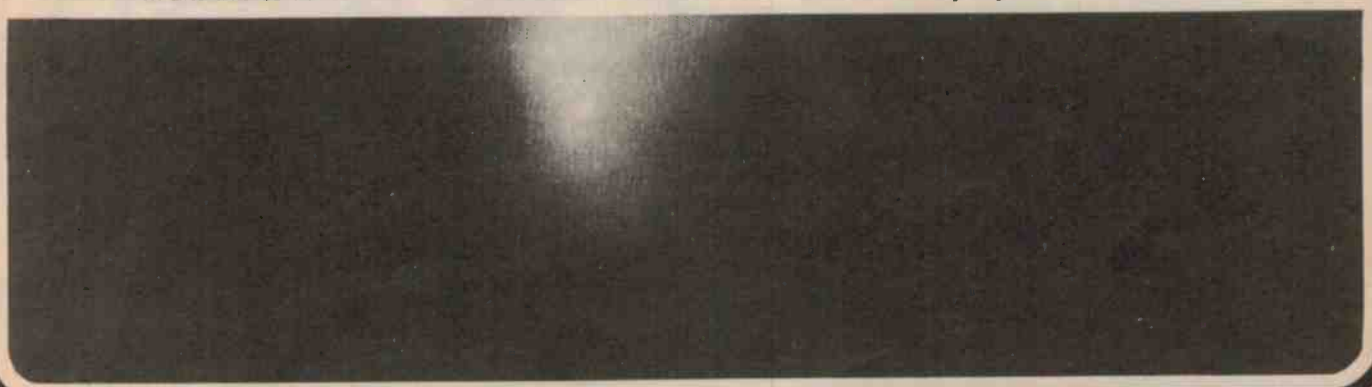
** below cloud layer*
*** in clouds: other sulfur compounds probable*

UK Schools Grant

Kids in the UK will no doubt benefit from a £12 M government grant to schools and colleges to help teach them about micro-electronics and computing. The British government has always been very enthusiastic about the microprocessor boom which, in theory at least, is in line with the UK's history of heavy research-and-development based industry. This move is part of a 'panic buying" campaign to bootstrap British industry into a field which has long been dominated totally by the US and Japan.

Much of the money from the grant will be used to provide better teaching facilities, such as computer-aided learning, which will no doubt reduce the load on 'live' teachers – in a country where teacher unemployment is a major problem.

Well, it's a step in the right direction, anyway.



Sydney's First

HOME COMPUTER SHOW

LOWER SYDNEY TOWN HALL MAY 24 – 27
OPEN DAILY 10 a.m. – 6.00 p.m. (Sat. 8 p.m.)

More than 6,000 hobbyists, students, accountants, lawyers, doctors, brokers, retailers, business people, programmers, research scientists and home owners crammed into Melbourne's first Home Computer Show late last year.

It was hailed as an oustanding success by everyone concerned.

Sydney's first Home Computer Show will be BIGGER, BRIGHTER and BETTER! It will contain the widest range of microprocessor-based computers, kits, components, peripherals, software, gadgetry and wizardry ever assembled under one roof in Sydney!

Exhibitors will include:
AJF Systems & Components P/L
Anderson Digital Equipment P/L
ASP Microcomputers
Calculator Supermarket
Computerland
Dick Smith Electronics
A J & J W Dicker P/L
The Dindima Group P/L
Economic Digital Control P/L
Electronics Today International
Futuretronics Australia
Honeywell P/L
Micropro Design/Temac Electronics
Microprocessor Applications
Mitsui & Co Ltd
Programmable Calculator Systems & Sales
Semcon Microcomputers P/L
Strand Electric Division
Tandy International
TCG Systems Automation P/L
Warburton Franki (Sydney) P/L

FREE BONUSES!

Everyone attending the Home Computer Show will receive –
*free ticket to attend a series of lectures and demonstrations being conducted by the Micro Enthusiasts Group (Sydney) in conjunction with the Show;
*free raffle ticket for a valuable prize.

CHESS CHAMPIONSHIP!
A section of the Show has been set aside for a Chess Championship between humans and computers and also a championship among the computers themselves.

Further details:
Australian Seminar Services Pty Ltd
Phone: Sydney (02)290 2348
Melbourne (03)267 4311

ADMISSION:
Adults $2.00
Children $1.00
STUDENTS $1.00

News Digest

US To Go 9 kHz?

The US Federal Communications Commission has been petitioned by the National Telecommunications and Information Administration to reduce the spacing between AM radio channels from 10 kHz to 9 kHz. The NTIA states that this 'could increase the number of broadcast stations, with opportunities to enhance local ownership by minority and special interest groups, augment program diversity and alleviate some of the problems of daytime stations'. Apparently, since the rest of the world (well, a lot of it) changed to 9 kHz spacing, the US has had problems with heterodyne interference.

Amateur and CB Training Courses

Newcastle Technical College and some other colleges are conducting courses for operators of two way radio equipment which includes the serious CBer who wants more from his/her hobby and those persons who wish to sit for the Novice (NAOCP) or Full Call (AOCP) Amateur licence.

An introductory "Two Way Radio User's Course" is designed for keen CBers, prospective amateurs, and others using two way radio for business purposes. Two further "Technical Principles of Two Way Radio" courses take the student to first the level of the Novice and then the Full Call standard.

The User's course is three hours per week consisting of theory and demonstrations. The technical principles classes are of four hours duration. These consist of Theory, Morse and Practical. Students obtain "hands-on" experience with test equipment in these courses.

Novices are exempt from the User's and "Tech Prin 1" courses. They may join the course when the next "Tech Prin 2" commences and study for the Full Call.

A workshop class is conducted on Wednesday nights for two hours. This course is an option for both interested persons who wish to improve their workshop skills. The student provides his/her own materials and with practice can produce work of a high standard.

The college radio station is available for use by students when a responsible licenced person is present.

The next User's Course is due to start in the week commencing Monday, 21 May '79. There is no age restriction.

Please address all enquiries to: *The Senior Head Teacher, School of Radio and T.V., Newcastle Technical College, Maitland Road, Tighes Hill, N.S.W. 2297 or phone (049) 610461 ext 367.*

ETI – Bigger and Better !

Readers will notice quite a few things different, beginning with our June issue.

- The magazine will be BIGGER for a start – and 'square backed'
- And BETTER – changes in layout style will make the magazine 'work' better for the reader.

Here's what we've planned to date:

- A big new Hi-Fi section – the technology of Hi-Fi equipment is undergoing a rapid transformation. We'll be bringing you in-depth articles on what's happening in the Sound Business along with authorotative reviews from foremost consulstants Louis Challis and Assosciates.

- Communications – We've covered events in this fields of Amateur Radio, CB and SWL for some time. However, the communications horizon is very broad, affecting almost every phase of our daily lives. We'll bring you news, features and practical articles extending our coverage of this fascinating field.

And of course, this is in addition to our regular articles and features: Printout, Amateur News, Ideas for Experimenters, Predictions, Kits for ETI projects, Mini Mart ..... they'll all be there.

And projects? We're aiming to make them easier for you to build, concentrating on using readily-available parts or having special parts made available.

AND THE BEST NEWS OF ALL – cover price, still. . . . . $1.40!

National's Naked-8

A new device from National – the ADP0801 – seems to be the answer to those who find the software-driven 555 timer approach to A-D a bit amateur.

Claimed to need *no* external components to interface with a bus, the device has a differential input and a true twos-complement output. The conversion time is 100 microseconds and the whole thing runs off a single 5 V supply. The cost is a ridiculous $US2.75 (admittedly in hundred-piece orders). Perhaps now we'll see a couple of analogue inputs as standard on micro development systems.

Watron Watches are Solar Desist.

A year ago an advertiser in this and other magazines offered multifunction, solar-assisted watches at $65 – a good price at the time. These were advertised by the Chan Merchandising Company. A number of people purchased these watches, amongst them were several with connections with Modern Magazines.

Despite the solar units these watches went flat quite quickly. Further investigation has revealed that the solar panels were wired in backwards – resulting in solar *desist*, rather than assist. It is possible to reverse the panel, though it is extremely fragile and brittle, and the watch works fine, even battery-less, in an average-lit office. Unfortunately, if you expose it to sunlight with no batteries, without the panel reversed, you will damage the IC.

If you have such a watch, we suggest you repair it in a dull room immediately!

Programmable 16 Channel VHF/UHF Scanning Receiver

GFS Electronic Imports of Mitcham, Victoria have just announced the release of a new Crystal-less Programmable VHF/UHF scanning receiver. Manufactured in Japan by J.I.L. (for whom GFS are Australian agents) the receiver is known as the SX-100.

Using microprocessor control, any 16 of approximately 32,000 channels between 30-54 MHz, 140-180 MHz and 410-514 MHz can be programmed into the SX-100's memory by just punching up the required frequencies on its control keyboard.

Frequency readout, channel number, time and date display are all provided by a large green digital readout. Both scanning speed and scanning delay can be varied from front panel controls. Sensitivity is claimed to be 0.5 uV.

The SX-100 works from 220-240 volts AC or 12-16 volts DC power and is suited to installation in a vehicle or for base operation from the home or office. It measures only 21 cm wide by 7 cm high by 23 cm deep.

The SX-100 sells for $299 plus sales tax ($392 inc S/T). For more information contact *GFS Electronic Imports, 15 McKeon Road, Mitcham, 3132; phone (03) 873 3939.*

APPLIED TECHNOLOGY PTY. LTD.

ONE STOP TECHNOLOGY SHOP

7400 TTL SERIES

SN7400N	.25
SN7401N	.25
SN7402N	.25
SN7403N	.25
SN7404N	.35
SN7405N	.35
SN7406N	.50
SN7407N	.50
SN7408N	.35
SN7409N	.35
SN7410N	.25
SN7411N	.35
SN7412N	.35
SN7413N	.55
SN7414N	.85
SN7416N	.60
SN7417N	.60
SN7420N	.25
SN7421N	.45
SN7422N	.40
SN7423N	.35
SN7425N	.35
SN7426N	.40
SN7427N	.40
SN7430N	.25
SN7432N	.35
SN7437N	.45
SN7438N	.45
SN7439N	.45
SN7440N	.35
SN7441N	1.30
SN7442N	.70
SN7443N	1.20
SN7444N	1.50
SN7445N	1.50
SN7446N	1.40
SN7447N	.95
SN7448N	.95
SN7450N	.35
SN7451N	.35
SN7453N	.35
SN7454N	.35
SN7460N	.35
SN7470N	.60
SN7472N	.45
SN7473N	.60
SN7474N	.60
SN7475N	.65
SN7476N	.45
SN7480N	1.00
SN7485N	1.30
SN7486N	.50
SN7489N	1.90
SN7491N	.50
SN7491N	1.00
SN7492N	.55
SM7493N	.50
SN7494N	1.10
SN7495N	1.10
SN7496N	1.25
SN7497N	2.75
SN74100	2.25
SN74109N	1.00
SN74116N	1.80
SN74123N	.80
SN74125N	.75
SN74126N	.75
SN74132N	1.15
SN74136N	1.15
SN74145N	1.25
SN74147N	3.00
SN74150N	1.75
SN74151N	1.10
SN74152N	1.10
SN74153N	1.10
SN74154N	1.70
SN74155N	1.75
SN74156N	1.75
SN74157N	1.10
SN74160N	1.65
SN74161N	1.65
SN74162N	1.95
SN74163N	1.95
SN74164N	1.95
SN74165N	1.95
SN74166N	1.95
SN74167N	4.00
SN74173N	2.75
SN74174N	1.95
SN74175N	1.75
SN74179N	2.10
SN74180N	2.10
SN74181N	3.50
SN74182N	1.75
SN74190N	1.75
SN74191N	2.60
SN74192N	2.25
SN74193N	2.25
SN74194N	2.30
SN74195N	2.30
SN74196N	2.75
SN74200N	1.00
SN74279N	1.00
SN74365N	1.00
SN74366N	1.00
SN74367N	1.00
SN74368N	1.00

74LS00 SERIES

74LS00	.30
74LS01	.30
74LS02	.30
74LS03	.30
74LS04	.35
74LS05	.35
74LS08	.30
74LS09	.30
74LS10	.30
74LS11	.30
74LS13	.60
74LS14	1.20
74LS15	.35
74LS21	.35
74LS22	.35
74LS26	.40
74LS27	.30
74LS28	.40
74LS30	.30
74LS32	.35
74LS37	.45
74LS38	.45
74LS40	.45
74LS42	.70
74LS47	.70
74LS51	.45
74LS54	.45
74LS55	.50
74LS73	.65
74LS74	.45
74LS75	.65
74LS76	.70
74LS78	.80
74LS83	1.25
74LS85	1.25
74LS86	.45
74LS90	.75
74LS93	.95
74LS95	1.40
74LS96	1.60
74LS107	.70
74LS109	.70
74LS111	.70
74LS112	.70
74LS113	.70
74LS123	1.50
74LS125	.75
74LS132	.75
74LS136	.75
74LS138	.95
74LS139	.95
74LS151	1.10
74LS153	1.10
74LS155	1.10
74LS157	1.10
74LS158	1.90
74LS160	1.90
74LS161	1.90
74LS162	1.90
74LS193	1.90
74LS164	1.30
74LS170	3.50
74LS174	1.00
74LS175	.90
74LS181	3.95
74LS190	2.10
74LS191	1.20
74LS192	1.20
74LS193	1.20
74LS194	1.35
74LS195	1.35
74LS197	1.85
74LS253	1.85
74LS257	1.65
74LS258	1.85
74LS279	.85
74LS290	1.45
74LS293	1.55
74LS298	2.75
74LS367	.75
74LS368	.75
74LS374	2.95
74LS375	1.25
74LS386	.95

CMOS SERIES

CD4000	.20
CD4001	.20
CD4002	.23
CD4006	1.50
CD4007	.35
CD4009	1.10
CD4010	1.10
CD4011	.20
CD4012	.35
CD4013	.55
CD4015	1.20
CD4016	.55
CD4017	1.20
CD4018	1.40
CD4019	.65
CD4020	1.50
CD4021	1.45
CD4022	1.60
CD4023	.30
CD4024	.95
CD4026	2.10
CD4027	.75
CD4028	1.10
CD4029	1.45
CD4030	.65
CD4035	1.50
CD4040	1.25
CD4041	1.25
CD4042	1.25
CD4043	1.35
CD4044	1.35
CD4046	1.75
CD4047	2.50
CD4048	1.35
CD4049	.60
CD4050	.60
CD4051	1.20
CD4053	1.20
CD4056	2.95
CD4059	9.95
CD4060	2.50
CD4066	1.00
CD4068	.40
CD4069	.35
CD4070	.40
CD4071	.35
CD4072	.45
CD4076	1.85
CD4081	.40
CD4082	.50
CD4093	.99
CD4098	2.49
MC14409	14.95
MC14410	14.95
MC14411	14.95
MC14419	4.95
MC14433	19.95
MC14506	.75
MC14507	.99
MC14562	14.50
MC14583	3.50
CD4508	3.95
CD4510	1.35
CD4511	1.35
CD4515	2.95
CD4518	1.50
CD4520	1.45
CD4566	2.25

LINEAR SERIES

LM301CN or H	.35
LM307CN or H	.65
LM308CB or H	1.35
LM309K	1.50
LM311H or N	.85
LM317K	2.90
LM320T-5	1.50
LM320T-12	1.50
LM320T-15	1.50
LM323K-5	8.25
LM324N	1.35
LM339N	.90
LM340K-5	2.40
LM340K-12	2.40
LM340K-12	2.40
LM340K-15	2.40
LM340T-5	.90
LM340T-6	.90
LM340T-8	.90
LM340T-12	.90
LM340T-15	.90
LM340T-18	.90
LM340T-24	.90
LM380N	1.20
LM381N	1.50
LM382N	1.50
NE555V	.35
LM556/5566N	.90
NE565N or H	1.95
NE566CN	2.50
NE567V or H	2.65
NE571N	11.95
LM709N or H	.75
LM723N or H	.55
LM741CN	.35

SOLDER WIRE WRAP

8 PIN	.25	.65
14 PIN	.33	.75
16 PIN	.35	.80
18 PIN	.50	.90
20 PIN	.60	1.20
22 PIN	.75	1.30
24 PIN	.80	1.90
28 PIN	.90	2.20
40 PIN	1.00	2.40

MICRO PROCESSOR PARTS

2650	CPU	$21.00
2608	PIPBUG ROM	19.75
6800	CPU	11.00
SCMP II	CPU	12.75
4116	Dynamic RAM	17.50
2114	4K STATIC	7.95
2102	1K STATIC	1.75
2708	EPROM	15.00
1602	UART	7.95
Z80	CPU	19.50
280	CTC	17.50
280	PIO	17.50

OPTO

FND500	CC	1.25
FND507	CA	1.25
FND357	CA	1.15
FND350	CC	1.15
RED LEDS		.20
YELLOW LEDS		.35
GREEN LEDS		.35

DIODES

IN4148	.07
IN4001	.05
IN4004	.08
MDA3501 35ABRIDGE	3,75
MDA3504 35A BRIDGE	4.50

TRANSISTORS

BC547, 8, 9	.15
BC557, 8, 9	.15
BD139	.55
BD140	.55
2N3055	.85
MJ2955	.95
C106Y1	.65

*PRICES INCLUDE SALES TAX

APPLIED TECHNOLOGY PTY. LTD.

MAIL ORDER BOX 355, HORNSBY.

PLEASE ADD $2.00 TOWARDS POST & PACKING.

bankcard

1A PATTISON AVE., WAITARA. PHONE: (02) 487-2711 (3 lines)

News Digest

CORRECTION

Last month's lead item in News Digest, on page 5, about the Allsop cassette head cleaner, had typesetting errors in the address. Correct address details for CPI, who market the product, is:

CPI (Aust.) Pty. Ltd., P.O. Box 246 Double Bay, 2028. Phone: 36-3703, Telex: 23381.

Magnavox Scores A Direct Hit

Last month (ETI April 79, p. 7) we reported on the release of a new video-disc system by Magnavox. The first reports of the popularity of the system are taking the world of marketing by surprise.

The city chosen for the release of the system was Atlanta, Georgia. Three stores started selling the machines, which allow pre-recorded discs carying TV programme material to be played on a normal TV set. All three stores sold out completely on the first morning. The co-owner of one of the stores had this to say, "Demand exceeded supply by six or seven times. We were sold out within five minutes of our opening Friday morning . . . The Atlanta market will consume more players than Magnavox can produce at least until spring 1979."

Magnavox president, K. Meinken, predicts that the videodisc market (including players and discs) will reach $US1 billion/year within a few years. Nationwide US distribution of the system should be achieved by 1980.

Power Kites?

Two researchers at Sydney University have proposed that high-altitude gliders tethered to the ground by current-carrying cables could provide a cheap and reliable energy resource.

The gliders would carry turbines which tapped power from subtropical jet streams. At 11 000 metres these winds have a speed range of 15 to 100 m/s. A 40 m wingspan prototype glider would provide an estimated 1 MW average output.

The originators of the idea – Bryan Roberts and Clive Fletcher – want to build such a prototype in the hopes that it will enable the design of a full-scale 85 MW device for use in NSW.

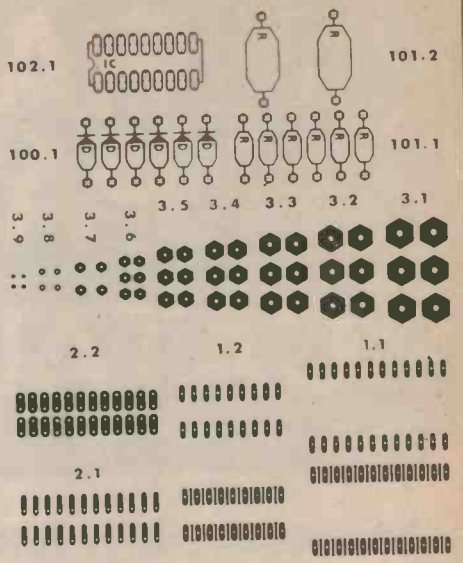
One problem which has always faced a similar approach – the use of ground-based windmills – is the large variation in wind conditions which occur at ground level. Roberts and Fletcher calculate that high-altitude winds exceed the minimum speed required for glider operation for all but an average half day per month. The winds are at their highest in winter and maintenance could be carried out when electricity demand (and wind speed) was low, in the summer.

Odds and Sods

The US Air Force Weapons Lab will be launched via a March 1980 Shuttle. One of the experiments will be to test optical waveguides and other electro-optical devices in a space environment.

* * *

Sony have released a videocassette system for cars which includes a 13 cm colour monitor. The system will only play back pre-recorded video cassettes and has no recording or receiving facilities.



This printed circuit artwork aid is shown reduced in size. The actual size of the sheet is 97 x 124 mm.

Printed Circuit Artwork Aid

Robert P. Nederpelt Electronics, of Perth WA, are looking for distributors in all states for their printed circuit development aids.

Available on self-adhesive PVC, the range includes pads and overlay symbols. RPN hope to increase the range substantially in the near future.

The company also does pc production, plating and silk screening as well as custom graphics. Contact: *Robert P Nederpelt Electronics, 22 Benara Road, Morley, WA 6062 (ph (09) 279 4716).*

We understand this to be the only such product produced in this country and wish the manufacturers all the best and many happy exports!

Hand LCD DMM

The model 935 from Data Precision is designed as a low-cost user-oriented device. Interesting features include a choice of either 2.8 V or 250 mV resistance measurement voltage and a spare fuse built in (we were particularly fond of this feature, as we recently blew the current fuse on our Fluke DMM and had to send away for re-placements!). The whole thing, including leads, manual and battery, costs $149.

Kenelec (Aust.) Pty. Ltd., 142 Highbury Road, Burwood, VIC. (ph (03) 288 7100).

RADIO PARTS GROUP CATALOGUE

A comprehensive fully illustrated reference book with more than 12,000 lines described in detail.

THE CATALOGUE PRICE MAILING SERVICE

Over many years we have developed an effective computerised price service and catalogue which has become the reference book for the electronics trade. Order your copy now and increase your product knowledge and efficiency.

For your annual subscription of $20 you will receive:

- 4 illustrated catalogue sections (available now!) plus free semiconductor data catalogue
- A new heavy-duty, long-lasting silver polypropylene cover fitted with a magazine holder with 6 metal rods for easy insertion of each section and price list
- Updated computerised price services
- Monthly specials lists, manufacturers' surplus stock offers and the latest information on new products
- Current valve and semiconductor availability lists

— TRANSISTORS — TRIACS — SCR's — DOIDES — CMOS —

— VOLTAGE REGULATORS —

— LINEAR — INTERFACE —

NEW SEMICONDUCTOR DATA CATALOGUE

ONE COPY FREE

to each catalogue subscriber

A manual containing technical drawings, specifications, pin connections and circuit details of the widest range of semiconductor devices available anywhere in Australia.

— MOS/LSI — OPTO ELECTRONICS — MICROPROCESSORS —

To RADIO PARTS Group
PO Box 124
North Melbourne 3051

Please send me your comprehensive catalogue and price lists for a period of 12 months

Enclosed is my Cheque/Money Order/Order No.

(if Account Customer) .....
or please debit
my Bankcard No. .....

for ..... copies at $20.00 each.

Name .....

Company Name .....

Address .....

.....

Please print clearly to ensure correct mailing

News Digest

Video Scope

What with the spread of VTR, VCR and videodisc, it seems as though there's going to be a lot more TV repairmen around.

The model CS-1572 'scope from Trio is a 30 MHz dual trace machine designed specially for TV work. One interesting feature is its ability to separate the first and second fields of a video signal and display them side by side in a dual-trace mode. It will also trigger automatically on either line or frame periods.

Trio-Kenwood (Australia) Pty. Ltd., 31 Whiting Street, Artarmon, Sydney, 2064. (Ph: (02) 438-1277).

CB Radio in Britain

There is still much argument occurring in Britain as to whether Citizens band radio should be legalised. James Bryant, President of the Citizens Band Association, recently sent a letter to British Prime Minister James Callaghan urging him to take measures to legalise CB radio and pointed out what is considered by his association to be a growing increase in the illegal use of Citizens band equipment in Britain.

Apparently, four UK manufacturers (not yet named) are already prepared to manufacture CB sets if they should be declared legal. Bryant stated that the United Kingdom and Eire are the only European countries which do not allow private citizens some form of radio-communication.

It has been said that if Britain adopted the US system this would lead to a flood of Japanese-manufactured equipment into the country. The Citizens Band Association have therefore pointed out that every set sold could employ modern silicon chip technology fitted into the set at the factory which would transmit a unique identifying signal; it would not be possible for a person to change this set identifying signal without the resources of a microelectronics factory and the equipment could be made so that it would not transmit without it.

Such a system would not only prevent Japanese sets from under-pricing the market, but would also greatly reduce the administration costs of the system whilst rendering criminal and antisocial use impractical. (Idealistic fools . . . Ed.)

Most countries use amplitude modulation in the 27 MHz band but the Citizens Band Association feel that this is impractical in such a heavily populated country as Britain. They suggest that unused parts of the 220 to 240 MHz band or frequencies of about 900 MHz might be suitable, especially as only a relatively small bandwidth of possibly less than 1 MHz is needed.

The Association fear that if the number of illegal users of CB equipment continues to grow, the Government could be forced to adopt a legalised system similar to that used in America and that this would prevent the later adoption of a better system. The Association feels that Britain should lead the world into the adoption of a Citizens band system which enables each transmission to be readily identified.

Nevertheless, there is still a considerable amount of feeling against the legalisation of this form of communication in Britain.

From Brian Dance in the UK.

CE Show Ad Award

In a rather unusual step, the promoters of the Australian Consumer Electronics Show, to be held in the Sydney Showgrounds from July 18th to 22nd, have offered three prizes for the best *advertisement* placed by importers, wholesalers and manufacturers of consumer electronics equipment.

The three awards are for:

1) Best colour advertisement from a magazine or newspaper
2) Best black and white advertisement in a magazine or newspaper.
3) Best advertisement in a trade magazine.

All ads placed between 1 July 78 and 30 June 79 will be eligable. Entries stating category, should be submitted to *Riddell Exhibition Promotions Pty. Ltd, 166 Albert Road, South Melbourne, VIC 3205, (ph (03) 699 1066),* by June 30th 1979.

The winners will be announced at the opening of the show and as a special bonus the ten best entries will be on display at the show, where they will no doubt attract a large amount of interest.

Elmeasco Exhibitions

Elmeasco Instruments will be holding exhibitions in Sydney and Melbourne during May. They will be held at the US Trade Centre in Sydney on 21-22 May and in Melbourne at the Commodore Matthew Flinders Motel over 24-25 May.

A new range of counters from Fluke will be released at the shows and the new Biomation K100D digital logic analyser will be demonstrated.

Visitors will be able to check the accuracy of their multimeters free of charge on a Fluke 5100 series secondary standard. It is also anticipated that brief lectures on instrumentation trends will be given by representatives from some of the manufacturers.

Further information and invitations can be obtained by calling *Elmeasco in Sydney (736 2888) or Melbourne (233 4044).*

TANDY ELECTRONICS

REALISTIC®

C.B. SALE

Sale Ends 2nd. June 1979.

SAVE $70

199.95

Regular Retail Price 269.95

Feature Packed! Our Best AM/SSB Mobile

•Noise Blanker •RF Gain Control •LED Dimmer Control •PA Switch

Realistic TRC-449. Designed to get through where AM won't! Combines PLL circuitry for ultra-precise frequency control and a clarifier for superior SSB reception. AM plus upper and lower sidebands triples the effective number of channels from 18 to 54 and sideband operation increases the effective range to provide more "Talk Power" than AM sets. Dual IF's and crystal/ceramic filters assure superb selectivity. A switchable blanker cuts out impulse noise. And a special PA switch lets you use the "449" as a 5-watt public address amplifier and continue to receive CB calls at the same time. With adjustable mounting bracket, push-to-talk dynamic mike, power cord with inline fuse.

21-9449

Specifications

Sensitivity for 10dB S + N/N: SSB, AM, 0.25uV. Adjacent Channel Selectivity at 10 kHz: 65dB. Image Rejection: 80dB. Clarifier Range: ± 1.25 kHz variable. Audio Output: 4 Watts. RF Power Output: 12 watts P.E.P. SSB maximum; 4 watts AM maximum. Power Requirement: 12VDC positive or negative ground. Size: 6.0x20x26.6cm.

Tandy's AM/SSB Base Goes Mobile, Too!

•Auto Modulation Control •PA •LED Channel Readout •ANL

Realistic TRC-458. Join the swing to "sideband" with one of the finest base/mobile rigs on the market today! Puts your signal across with far more power than the best AM radios. PLL circuitry for rock-stable performance on all 18AM and 36 upper/lower sideband channels. Crystal lattice IF filter cuts adjacent channel interference and automatic modulation control gives you full time "Talk Power" ... no power mike needed! With mike, adjustable mounting bracket, AC and DC power cords.

21-9458

SAVE $50

Regular Retail Price 449.95 **399.95**

Specifications

Sensitivity: (For 10dB S + N/N) SSB. 0.25 microvolt, AM, 0.5 microvolt. Adjacent Channel Selectivity at 10 kHz - 70dB. Image Rejection: 80 dB. RF Output: 12W P.E.P. SSB max. 4W AM max. Power Requirement: 240 VAC or 12 VDC pos. or neg. gnd. Size: 10.1x29.2x34.2cm.

"Disappearing" Trunk Mount

SAVE $7

2.95

Regular Retail Price 9.95

•Hides in trunk when not in use

Use with trunk or roof mount— antenna slides off bracket in seconds and stores inside trunk. Complete with all necessary hardware. 21-530

No-Hole Trunk Mount Antenna

SAVE $22

12.95

Regular Retail Price 34.95

Mounts on centre or either side of boot lid and secures with just two sets of screws. Has base loading coil and stainless steel shock spring and whip. 21-908

PL-259 Plug

SAVE $170

SAVE $3

99¢ Pkt. Of 2.

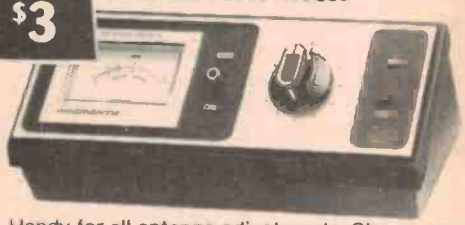
Regular Retail Price 2.69

UHF-type connector, screw-on lock. 278-205

MICRONTA® 2-Position Switch/SWR Meter

16.95

Regular Retail Price 19.95



Handy for all antenna adjustments. Shows percentage of reflected power from 0-25%. Handles up to 500 watts of RF power. Requires no external power source. 21-521

CB Mounts for theft Protection — *Make it easy to remove your CB for safe keeping!*

CB Underdash Mount

11.95

SAVE $5

Regular Retail Price 16.95

Female half attaches permanently to transceiver and slides instantly on or off nylon guides of male bracket, which mounts permanently under dash of vehicle. 21-566

CB Floor Mount

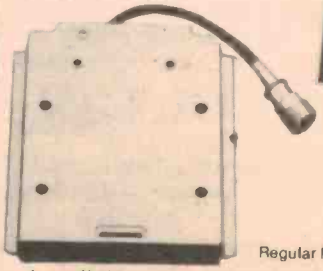
11.95

SAVE $5

Regular Retail Price 16.95

For when there's no room under the dash. All the removal-insertion features of underdash mount #21-566. Female bracket is easy to install above transmission hump. 21-568

Extra Mount for 21-566



SAVE $2

5.95

Regular Retail Price 7.95

Install this extra mount in RV, boat or car and use the same CB in 2 vehicles. 21-567

Mail Orders Available from any Tandy Electronics Store or Tandy Electronics Mail Order Dept. 280 Victoria Road, Rydalmere. N.S.W. 2116.

News Digest

BWD Service Now In SA, NT

Getting electronic equipment serviced in the more remote parts of the country is a constant headache for those who live and work there. A new agreement between BWD Electronics and Protronics should make things a little easier. BWD products will now be sold and service in South Australia and the Northern Territory through Protronics.

The photo shows Bob Crabbe (left), managing director of Protronics, with B. Owen (signing the agreement) and Ron West of BWD.

Protronics, 174-180 Wright St., Adelaide, SA 5000 (Ph: (08) 212-3111).

Pocket 'Scope On The Horizon

The UK's Royal Signals and Radar Establishment (Hurrah!) is working on a method of addressing liquid crystal displays continuously, eliminating flicker.

In a prototype, a 4 kHz 100 by 100 element display is driven by 15 V CMOS. The researchers say that the technique is eventually capable of producing a 1000 by 1000 element array.

The long term aim of the project is to produce a pocket oscilloscope with storage facilities, a 500 mW power consumption and a 2.5 MHz bandwidth.

The best of British to them.

(This news item was written by an expatriate from that funny little island slowly sinking in the North Sea sandbanks . . . Ed.)

Quark Park or Antimatter Platter?

Two physicists at the University of Chicago have postulated that if quarks (the 'fundamental' fundamental particles which make up all matter) can be isolated, it may be possible to generate new types of matter which are 'matter' and 'antimatter' to each other but don't react with ordinary matter.

Now, antimatter/matter reactions are known to be the most efficient in terms of mass to energy conversion (see 'Star Trek') and so these two materials, which could be stored in 'ordinary' matter containers, would generate large amounts of energy when mixed.

Another possibility is to use the new type of matter to hold 'normal' antimatter, which would presumably be easier to synthesise, but which can't be stored in 'normal' matter containers.

FM Confusion

The refusal of the Department of Post and Telecommunications to come to a decision over commercial FM licences is angering Pioneer.

In a recent press release they have called on the P & T Department to "stop procrastinating" and bring Australian laws into line with the US, where hundreds of high-quality specialist FM stations are dotted all over the country.

Pioneer are also obviously concerned over the 35% import tariff on FM receivers which was designed to protect a "non-existent" indigenous industry.

ETI Britain Biggest

The latest audit of magazine circulations in Britain shows our British edition to be number one! Electronics Today International (UK) circulation is 58 756, Practical Electronics – 58 374, Everyday Electronics – 58 075, Practical Wireless – 57 244.

Electronics Today International is published in three languages in five international editions – Australian, British, Canadian, German and Dutch.

Superconducting Generator

Under a $US19 million contract, Westinghouse Electric will produce a commercial superconducting generator for Electronic Power Research Inst. of California in the next five years.

Rated at 300 MW, the generator will have its windings cooled to 4 K (–420°F). This will reduce electrical losses in the system to half that of a conventional one.

It doesn't seem all *that* long ago that superconductivity was hailed as a research advance which *could* provide cheaper power at some time in the future. We only hope we'll be able to say that about nuclear fusion in a few years time.

JOHNSON: Hong Kong san!

Mr. Bob Johnson has been appointed manager to Dick Smith Electronics' retail Duty Free shop in Hong Kong.

Bob, who is a bachelor and hails originally from Roseville in Sydney, was formerly manager of the Gore Hill Dick Smith store, the largest in Australia. Bob is well-known to the Trade and hobbyists on the North Shore of Sydney.

A company flat is provided with the job (gee . . . some guys get all the breaks!).

Unitrex Contest

The winner of the March contest was M McBride of Tamworth, who provided the answer: XXX = 324, y = 8 or 9, x = 6.

Many people (and we had about a hundred entries) thought this problem rather easy. Interestingly enough, the more difficult the problem, the more people complained about it being easy! Must be something to do with the level of interest.

This ends the present run of contests – we'll be giving the winner and the solution of April's contest next month.

Meanwhile – have any of you got any problems for us to publish? It'll get your name known and give everyone a bit of fun! The problem should be stated in less than 200 words with no diagrams and should have a short and unique answer.

Send your ideas to: Contest Suggestions, ETI Magazine, 15 Boundary Street, Rushcutters Bay, Sydney 2011.

Errata

In the Curve Tracer project, ETI 143, in January 79, the top of RV1 should go to the AC side of BR1 – the overlay is correct but the circuit diagram is wrong.

SOUND

REVOLUTIONARY 'MAGNETIC FIELD' AUDIO AMPLIFIER

Carver Corporation's Model M400 amplifier using the unique 'magnetic cavity' was released in the US a few short months ago. Employing FETs throughout, except for bipolar silicon output transistors, Carver Corp. claims that the M400 has a slew rate around 80 volts per microsecond, hum and noise over 100 dB down, 0.05 % distortion and a frequency response from 1 Hz to 250 kHz – all for an expected retail of US$300!

IT REALLY DOES EXIST. We first reported Bob Carver's Magnetic Field Audio amplifier in our November issue saying . . . *"we hear from normally authoritative sources that Bob Carver – founder of Phase Linear – has developed a totally new concept in audio amplifiers which . . . stores energy in a magnetic field rather than in power supply capacitors . . . his new device generates no heat, weighs a mere five kilos for vast numbers of watts and lasts for ever".*

It seemed a bit hard to take seriously – even though we were totally aware of Bob's previous efforts such as the range of Phase Linear super-amps and the Autocorrelator noise reducer.

But it seems as if this revolutionary concept in audio amplifiers is for real – patent protection has been arranged and preliminary details have been released.

Bob's basic concept is to store energy in a magnetic field rather than very large value electrolytic capacitors – eliminating at the same time the need for a bulky expensive power transformer.

Our circuit drawing shows the essential features. The heart of the circuit is the magnetic cavity (MC). This is basically similar to the AM detector transformer used in conventional AM radios but constructed on a grand scale. A further and significant difference is that the transformer is arranged such that an output occurs as the primary field collapses rather than builds up.

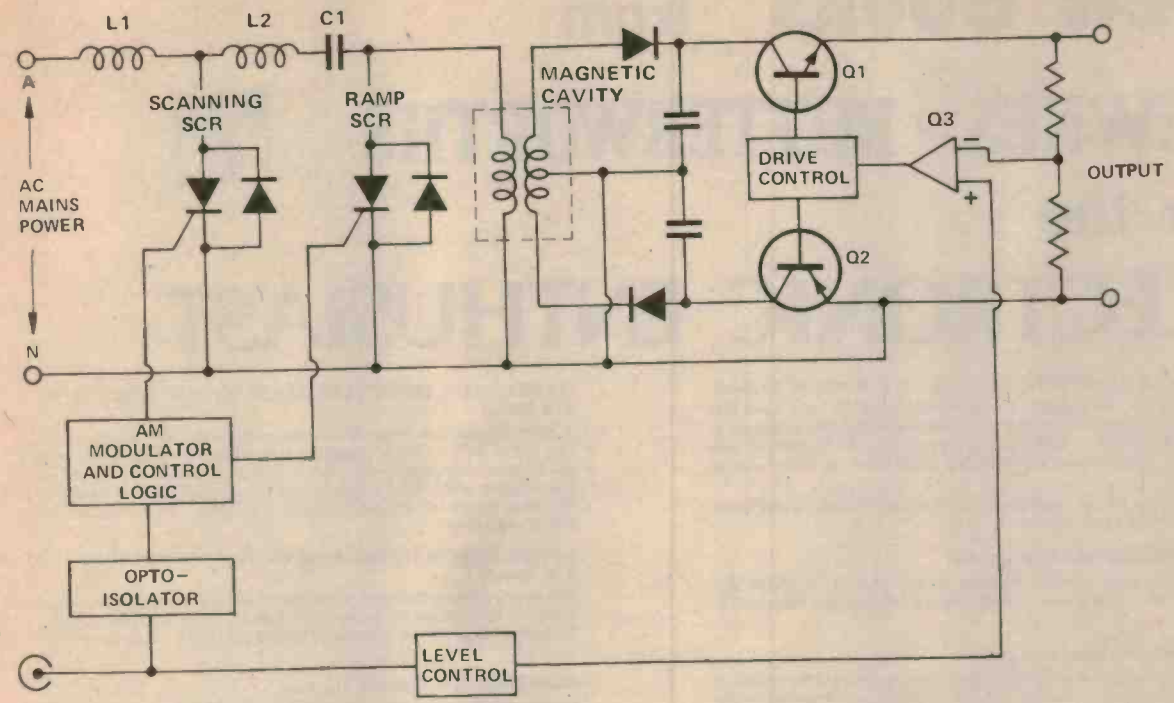
The secondary winding of the magnetic cavity is centre-tapped and the resultant full-wave output is rectified by a pair of high current diodes – the output waveform is thus a conjugate pair of time-varying audio voltages. Further circuitry, described later in this article, provides a feedback loop to remove commutation noise and reduce distortion.

The primary of the magnetic cavity is energised by an amplitude-modulated current (corresponding to the audio signal voltage). The current signal is produced from the audio input, via the optical isolator and modulation and control logic, to the scanning SCR, the ramp SCR, a pair of scanning and commutating diodes, and L1, L2 and C1.

This current signal energises the primary of the magnetic cavity. The time taken for this is called the 'ramp period'. The primary energy is then reflected in the secondary windings (and thence to the speaker) during the subsequent 'scan period'.

As our graph shows, the ramp and scan periods are made up of four separate timing intervals. During the period $t_o - t_2$ an incoming audio signal has caused a magnetic field to 'ramp' up in the primary of the magnetic cavity. At t_2 the field has reached its peak and is beginning to collapse. This collapsing field generates an associated decaying current i_1 and this decaying current falls to zero when the energy in the primary field falls also to zero (point t_3). During the time period $t_2 - t_3$, the control logic provides a positive signal on the gate of the scanning SCR, however this SCR will not again conduct until sufficient voltage is applied between its anode and cathode.

Throughout the scanning period, energy is of course being transferred from the primary of the magnetic cavity to the secondary – and thence to the speaker load.



This schematic shows the major operating components

At time t_3 the direction of current is reversed – current being no longer maintainable by cavity inductance – and the scanning diode is reverse biased – this causes the scanning SCR to be forward biased and current flows as shown in our sketch.

Summarising then, energy stored in the magnetic cavity is caused to shuttle around the circuit of L1, L2, C1 and the speaker load depending on instructions from the control logic.

Noise and distortion

Components Q1 – Q3 form a feedback loop which reduces the inherently poor bandwidth, noise and distortion to very acceptable levels. Theoretically the circuit has some quite strong objections – at low frequencies Q1 and Q2 will act much as switches except that the feedback correction voltage developed by Q3 will adequately cancel aberrations – but at higher frequencies, i.e. 10 kHz – 20 kHz the modulator circuit is unable to follow accurately the audio input signal. Hence the filtered output from the magnetic cavity is a dc level with a superimposed ac signal and Q1 and Q2 thus operate much as any other conventional amplifier.

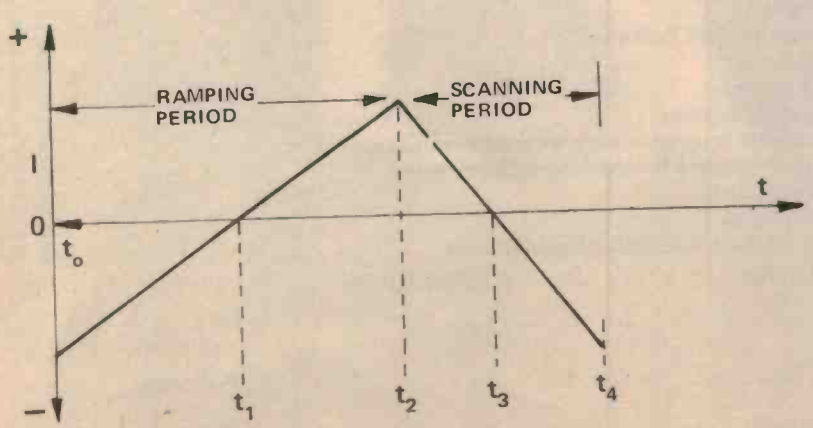
Nevertheless as less power is generally required at high audio frequencies than at mid frequency and low frequency, amplifier efficiency is very high if fed with music signals. This situation does not of course apply if the amplifier is fed with a high frequency steady tone.

Bob Carver's radical amplifier will be rated in accordance with FTC rules – the specification is expected to include power output: 200 watts-per-channel into eight ohms from 20 Hz to 20 kHz. Total harmonic distortion is expected to be less than 0.08% across this range.

Signal noise ratio is expected to be 100 dBA below rated maximum output. All-up weight is an incredible 5.5 kg.

As far as we are aware the magnetic field amplifier exists at present solely as a prototype unit but we understand that Bob Carver has very real plans for putting the unit in to production at a presently projected price of US $300 or so.

It's a fascinating concept, one that will cause amplifier designers and manufacturers world-wide to furiously rethink their design philosophies. It may even herald the coming of a new hi-fi technology. ●



During the ramping period energy builds up in the primary of the 'magnetic cavity'. Throughout the scanning period energy is transferred from the primary to the secondary of the magnetic cavity and thence to the speaker load via Q1 and Q2.

New Books from NEWNES - BUTTERWORTHS for the ELECTRONIC ENTHUSIAST

QUESTIONS & ANSWERS ON RADIO AND TELEVISION, H. W. Hellyer
Starting with the fundamentals of electricity and sound and radio waves, this manual takes the reader step-by-step in question and answer form to a thorough grasp of the principles of radio and television reception and transmission, with emphasis on the techniques and operations employed in day-to-day practical work.

This new edition has been extensively revised and includes new illustration and new section on the use of transistors.

ELECTRONIC COMPONENTS, M. A. Colwell
Fully illustrated guide to modern electronic components, what they are and what they do. Invaluable to students, technicians and hobbyists and newcomers to electronics.

ELECTRONIC DIAGRAMS, M. A. Colwell
Clear, concise descriptions and illustrations of circuit symbols and the methods of reading circuit diagrams, flow charts, graphs and oscillograms. Progresses through the logical steps of building circuits from elementary symbols up to complex systems. An ideal beginner's first book, invaluable to students, technicians, hobbyists and service engineers.

PRACTICAL ELECTRONIC PROJECT BUILDING, M. A. Colwell
A practical aid to building circuits with help in avoiding common faults and in trouble-shooting.

SIMPLE CIRCUIT BUILDING, M. A. Colwell
Learn about electronic circuits from basics to complex systems without the conventional theoretical approach usually found elsewhere.

PRINTED CIRCUIT ASSEMBLY, M. A. Colwell & M. J. Hughes
Fully illustrated elementary guide to the design and manufacture of printed circuit boards and assembly of components. Extremely useful to students, technicians, hobbyists and artists preparing artwork.

PROJECT PLANNING AND BUILDING, M. A. Colwell
How to convert an idea or a given circuit into a practical model; full of practical information.

110 INTEGRATED CIRCUIT PROJECTS FOR THE HOME CONSTRUCTOR, R. M. Marston
A completely rewritten edition containing a practical introduction to five specific i.c.s. The projects range from simple low-level amplifiers to precision measuring and indicating instruments, and include a host of unusual gadgets. All i.c.s. are internationally available and all circuits have been fully evaluated by the author. The book should be of equal interest to the amateur, the student and the professional engineer.

110 SEMICONDUCTOR PROJECTS FOR THE HOME CONSTRUCTOR, R. M. Marston
This book presents information on established and new semiconductor devices by way of circuit design rather than by long winded theory. All circuits have full componept values and are accompanied by brief but explicit descriptions of their operation.

RADIO CIRCUITS EXPLAINED, G. J. King
Circuits used in modern radio receivers are examined in detail ranging from the simple transistor radio to the specialised hi-fi receiver. The book will provide a clear understanding of principles and operation and design parameters of contemporary sets. Invaluable to radio and audio service technicians, to the student and to anyone interested in radio.

BASIC CARRIER TELEPHONY – Revised 3rd Edition, D. Talley
A basic course in the principles and applications of carrier telephony and its place in the over-all communications picture. Abundantly illustrated, with questions and problems throughout, and requiring a minimum of mathematics, this revised edition will be most useful to personnel throughout the communications and electronics fields.

HOW TO PLAN AND INSTALL ELECTRONIC BURGLAR ALARMS, H. Bierman
The complete do-it-yourself guide to today's sophisticated security and surveillance systems. It covers all of the basic security systems, explaining operating principles . . . analyzing the different components . . . mapping out circuitry . . . and providing construction and installation techniques. Includes the most advanced systems – photoelectric, microwave and ultrasonic. Discusses alarm kits currently available. Tells how you can get into the electronic security business. Even offers some intriguing information on electronic eavesdropping.

Please send me the following books . . .

49110L	( )	Q & A's Radio and Television	$ 3.00
43438L	( )	Electronic Components	$ 4.50
43447L	( )	Electronic Diagrams	$ 4.50
33225L	( )	Practical Electronic Project Building	$ 4.50
47979L	( )	Simple Circuit Building	$ 4.50
43456L	( )	Printed Circuit Assembly	$ 4.50
33234L	( )	Project Planning and Building	$ 4.50
36669L	( )	110 Integrated Circuit Projects for the Home Constructor	$ 7.00
50116L	( )	110 Semiconductor Projects for the Home Constructor	$ 7.00
36909H	( )	Radio Circuits Explained	$12.50
51482L	( )	Basic Carrier Telephony	$ 9.00
51124L	( )	How to Plan and Install Electronic Burglar Alarms	$ 6.50

( ) Cash Enclosed ( ) Please Bill Me

NAME: .....

ADDRESS: ..... Postcode .....

SIGNATURE: ..... Date: .....

(Recommended Domestic Retail Prices include postage and are subject to change without notice. This order is subject to acceptance by the Head Office of Butterworths.)

MAIL TO: BUTTERWORTHS PTY. LTD., 285 Pacific Highway, Chatswood, N.S.W. 2067.

Fluorescent Displays Replace VU Meters

Conventional moving-coil meters on hi-fi equipment are being supplanted by fluorescent bar-graph displays on this year's new releases — here's the 'inside' story.

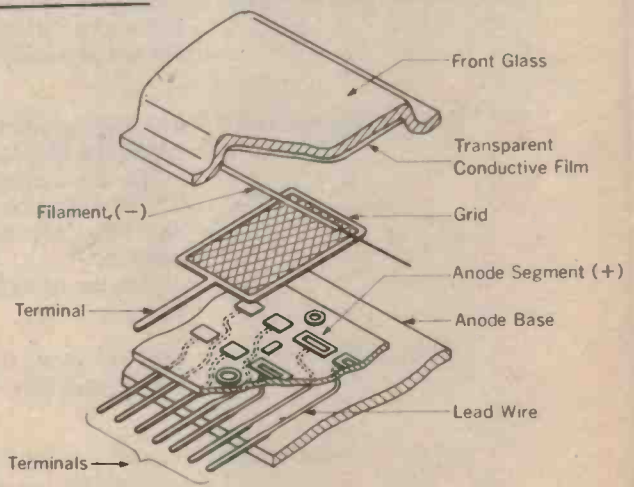
OUR ATTENTION was drawn to this trend in audio equipment design by a recent release from National Technics. Their two latest front-loading stereo cassette decks, the RS-M22 and RS-M33, feature these new displays, replacing conventional twin moving-coil VU meters common on this type of equipment to date.

Compared to a conventional meter, National claim the fluorescent bar-graph display has the following advantages:

- fast response time
- no overshoot
- excellent accuracy
- high reliability

A minimum response time of 5 uS is typical, according to the Technics release, and accuracy is within +/– 0.1 dB at 0 scale and within +/– 0.5 dB across the rest of the scale. As the display uses digital techniques for its operation, response time may be selected for both 'peak' and 'VU' scale reading.

The construction ensures a rugged display device with a lifetime specified at 100 000 hours and greater resistance to shock than a moving-coil meter.



A cutaway, exploded view of portion of the fluorescent display showing the internal construction and arrangement of the special fluorescent anodes.

The device body is a flat vacuum tube sandwiching a filament, grid and anode elements between a glass base and moulded glass front panel which has a transparent conductive film on the under surface. The filament is heated by passing a current through it, causing it to emit electrons. These are attracted to the anodes, passing through the control grid. When electrons strike the anodes they fluoresce, emitting light.

There are no moving parts and control is enitrely electronic resulting in an extremely fast response time.

The anode shape is designed for easy viewing and a number of parameters can be seen at a glance — both peak and VU indications are available at the one time on the Technics display.

As the display emits light it can be easily read and interpreted from a distance. Brightness can be varied, either under manual or electronic control. The left and right hand channel displays are aligned in parallel allowing instant comparison.

The levels above 0 VU are displayed as rectangles with bright edges, whereas levels below this point are indicated by solid bright squares resulting in a display that can be interpreted at a glance.

The scale is divided into 12 steps between –20 dB and +8 dB with finer divisions around the 0 VU area. A newly developed monolithic IC drives the display and, since a full-wave rectifier circuit is used, the display will produce an accurate indication even when presented with an asymmetrical waveform.

It seems inevitable that these flourescent bar-graph displays will enjoy wide success in both the consumer and professional audio equipment market. ●

Technics' M22 stereo cassette deck featuring a fluorescent bar-graph VU/peak meter.

SOUND BRIEFS

Stereo AM – Latest

The USA's Federal Communications Commission is about to make a definitive ruling on standards for AM stereo broadcasting. The final choice of which of the five competing systems (detailed in ETI July 1977) will be used is being made right now.

In the meantime the IHF have asked the FCC to designate a date before which AM stereo transmissions may not legally begin. This they say is to 'allow for an orderly marketplace transition.

Tandberg Lives!

Sorry to disappoint a number of interested parties — but Tandberg really is alive and well – and still living in Oslo! The audio industry has been alive with rumours of the company's imminent financial collapse for the past two or three months.

It's no secret that Tandberg have been through a difficult period, but their audio and educational divisions have just been recapitalized and given long term loan guarantees by the Norwegian government.

Metal-particle Tape Standards

Standards for metal particle tapes have been tentatively agreed at a recent conference of the Electronics Industries Association of Japan. Although technical details are not yet available it is expected that a formal announcement will be made shortly.

Cassette Alignment Kit

The Mincom division of 3M (950 Pacific Highway, Pymble, 2073) is currently marketing the Wollensak cassette recorder alignment kit.

The kit contains the following: one 1 kHz full track reference level cassette, one 8 kHz full track azimuth cassette, one 10 kHz full track azimuth cassette, one 3 kHz full track flutter cassette, a head alignment gauge and a Wollensak/3M torque cassette.

Kits are ordered via 3M from the USA. Cost is $150 each.

Straight-line Tracking

CEC are about to release a line of five straight-line tracking turntables including two fully automatics. Other units are shortly expected from Aiwa and Mitsubishi.

Bodysonic

Pioneer (in the US) is about to market a car stereo system which includes a cushion backrest containing a special amplifier and transducer which sends 'sound' impulses directly into the body!

The device was shown at the recent US CES. The system marketed as Bodysonic may also be marketed for domestic and cinema use.

CES Shapes Up

With 65 percent of space for the '79 Australian Consumer Electronics Show already booked, organisers are predicting the most prestigious gathering of consumer electronics exhibitors in the Show's remarkable four year history.

The Show will be held at the Sydney Showgrounds from Wednesday, July 18 to Sunday, July 22. Industry leaders and previous supporters of the CE Show including National Panasonic, Pioneer, Yamaha, Sanyo, Akai, Hitachi, Superscope, Philips – have all increased the size of their exhibits over last year. Confirmed new exhibitors include Trio-Kenwood, Audio Engineers and HMV Healing.

When the Show opens more than 60 exhibitors are expected to pack the Commemorative and Manufacturers Pavilions for Australia's only true national CE Show.

Organisers recommend that every trade buyer makes sure they're in Sydney in July to place orders for the Christmas period. Special accommodation and group airline rates can be obtained from the organisers: Riddell Exhibition Promotions Pty. Ltd., 166 Albert Road, South Melbourne, Victoria, 3205. Telephone (03) 699.1066.

Sanyo/Uher

Our spies in the UK tell us that the industry there is agog with rumours that Sanyo have bought out the German Uher tape-deck company. Uher say it's all not true. More next month . . . we hope.

Super-Cassettes

The USA's In Sync Laboratories have arranged with the Connoisseur Society to record a substantial quantity of Connoisseur's albums as 'state-of-the-art' pre-recorded cassettes.

The cassettes will be made from duplicate masters recorded at 15 ips using du Pont Crolyn II and BASF Pro II tape.

Only hi-fi, everything hi-fi.

Sansui

Unlike any other!

Sansui's Pure Power G-7500 DC stereo receiver is unlike any other because of the exceptional musical quality of the reproduced signal. To achieve such quality, Sansui engineers went beyond conventional specs to annihilate TIM — transient intermodulation distortion.

TIM ordinarily occurs with the complex, pulsive signals that are typical of the actual music you enjoy hearing. Proof that Sansui has virtually eliminated such distortion is the super-high 60V/μsec. slew rate and very fast 1.4μsec. rise time. We believe that no other amplifier, let alone receiver — at any price, can match such performance.

Radically reduced TIM is only one benefit from Sansui's original DC circuitry. Eliminating capacitors in the NF loop and inputs and outputs is another vital step towards pure power for pure sound. An extraordinary frequency range — from DC (zero Hz) to 200,000 Hz — assures the cleanest and clearest sounds you've ever heard.

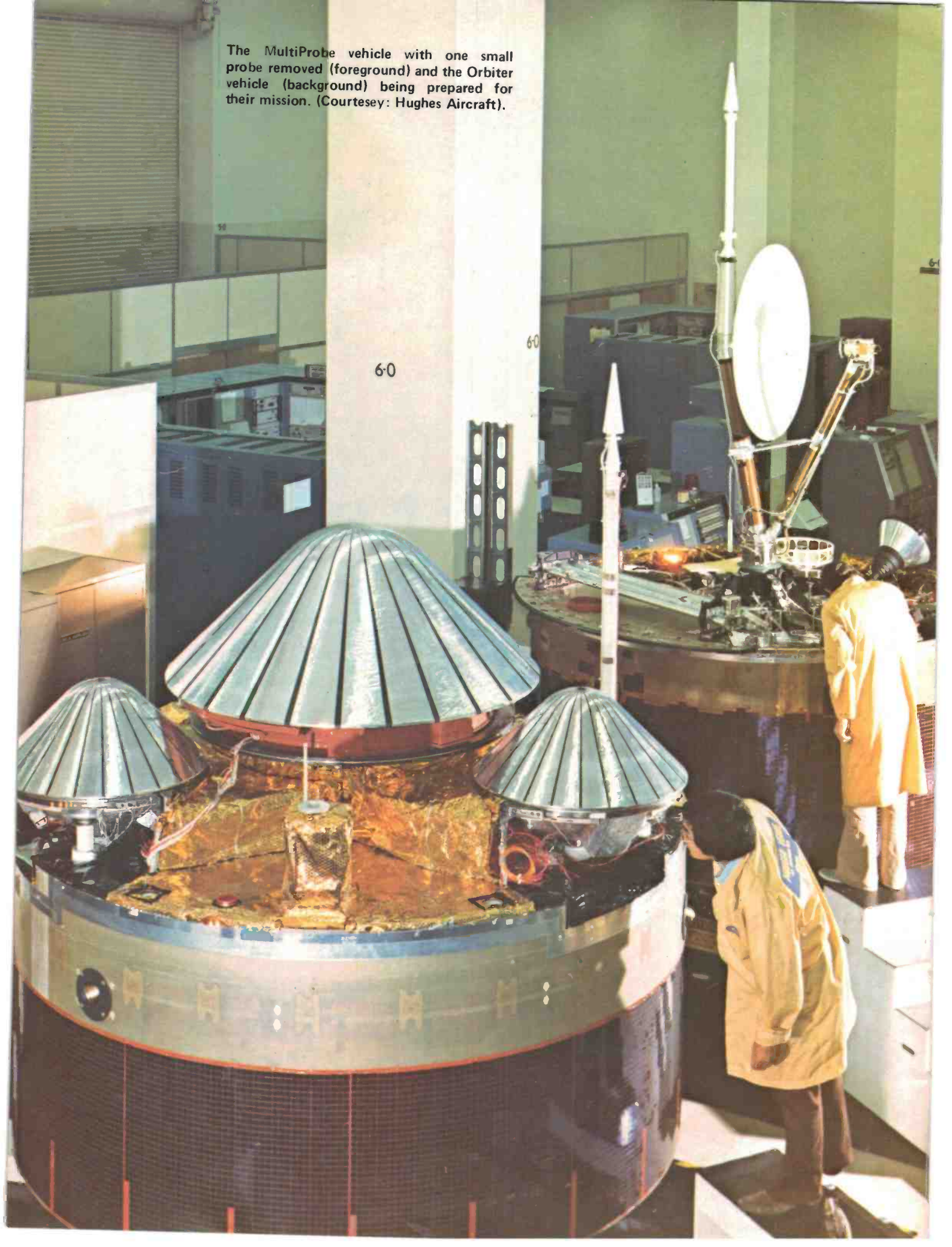
New standards. New features. A full 90 RMS watts per channel with low 0.025% T.H.D. Sansui's unique DC configuration means pure power for pure music. The same outstanding basics can be enjoyed in our other Pure Power receivers:

G-5500 (60 watts 0.03% T.H.D.)
G-4500 (40 watts 0.1% T.H.D.)
G-3500 (26 watts 0.1% T.H.D.)

For receivers that deliver the best, come to Sansui.

SANSUI
G-7500

SANSUI ELECTRIC CO., LTD. 14-1 Izumi 2-chome, Suginami-ku, Tokyo 168, Japan
VANFI (AUST.) PTY. LTD. 162, Albert Road. South Melbourne, Victoria 3205, Australia Tel: 699 5473
283 Alfred Street, North Sydney, N.S.W. 2060, Australia Tel: 929 0293



The MultiProbe vehicle with one small probe removed (foreground) and the Orbiter vehicle (background) being prepared for their mission. (Courtesey: Hughes Aircraft).

VENUS PROBE first results

In our June 1978 issue, Brian Dance described the American Pioneer Spacecraft designed for the mission to Venus. He now reports on the first results.

READERS OF LAST June's issue of ETI will remember that two US spacecraft were sent to Venus. The Orbiter vehicle reached the planet on 5 December 1978 and commenced to orbit Venus, making measurements and taking photographic data. It is expected to remain operational for at least eight months.

The second spacecraft carried a large probe and three small probes – apart from the vehicle itself which was known as the 'Bus'. This arrived near the planet on 9 December, 1978 and the instrument laden probes descended to the surface Venus making measurements as the craft traversed its atmosphere.

A preliminary analysis of the data returned to earth from the Bus probes and the Orbiter has provided us with much information about the characteristics of the Venusian atmosphere, the formation of the inner planets and the surface features of Venus. However, much work remains to be done with the information already obtained from this two-spacecraft mission and further data is continually coming to us from the Orbiter vehicle.

Radar Mapping

The Orbiter carries a radar for 'mapping' the surface of Venus. Results indicate that the surface topography of the planet is somewhat like that of earth with both mountain regions and large areas of fairly flat land. This is in sharp contrast to the rough, cratered surface of the Moon and Mars. The Orbiter's radar system has been able to examine previously unexplored regions of the Venusian surface.

In contrast to the relatively smooth surface of much of the planet, in one region a change in altitude of some 3050 metres (10,000 feet) was found over a region some 120 km (75 miles) in length. The Americans state that this is comparable with the crest of the front range of the Rocky Mountains near Denver, Colorado and the Great Plains out to the East. However, many more radar scans by the Orbiter craft will be required in order to obtain a good overall picture of the Venusian surface.

It should be remembered that Venus is covered in thick cloud, so nothing is seen of its surface, thus radar must be used to penetrate the clouds. The probes from the Multiprobe spacecraft descended to the surface of the planet and the Day Probe (which entered the illuminated side of the planet) showed the presence of a fine dust. This small probe, weighing over 90kg, impacted on the surface at a velocity of some 35 km/hour (22 miles per hour) and the fine dust took some three minutes to settle after the impact.

Although it was not specifically designed to survive impact with the surface of the planet, the Day Probe transmitted information back to earth for 67 minutes after it landed before the high temperature of the Venusian surface raised the internal temperature of the probe to the point where the electronics ceased to function. Communication was then lost.

Atmospheric composition

It has been known for some time that the Venusian atmosphere contained a high percentage of carbon dioxide, but the probes sent into the atmosphere have allowed much more precise measurements of the atmospheric composition.

The carbon dioxide content was found to be some 97%, with nitrogen varying from 1% to 3% and water vapour 0.1 to 0.4%. The inert gases found in the atmosphere include helium (0.025%), neon (0.0006% to 0.025%) and argon (0.002% to 0.02%). The concentration of sulphur dioxide (0.024%) exceeds that of oxygen (0.006%), whilst there is some evidence of the presence of sulphuric acid and elemental sulphur in the clouds of Venus. It is expected that other sulphur compounds will be found after the data has been analysed more thoroughly.

The two small probes which descended on the night side of the planet (see Fig. 1) detected an unexpected glow which increased in

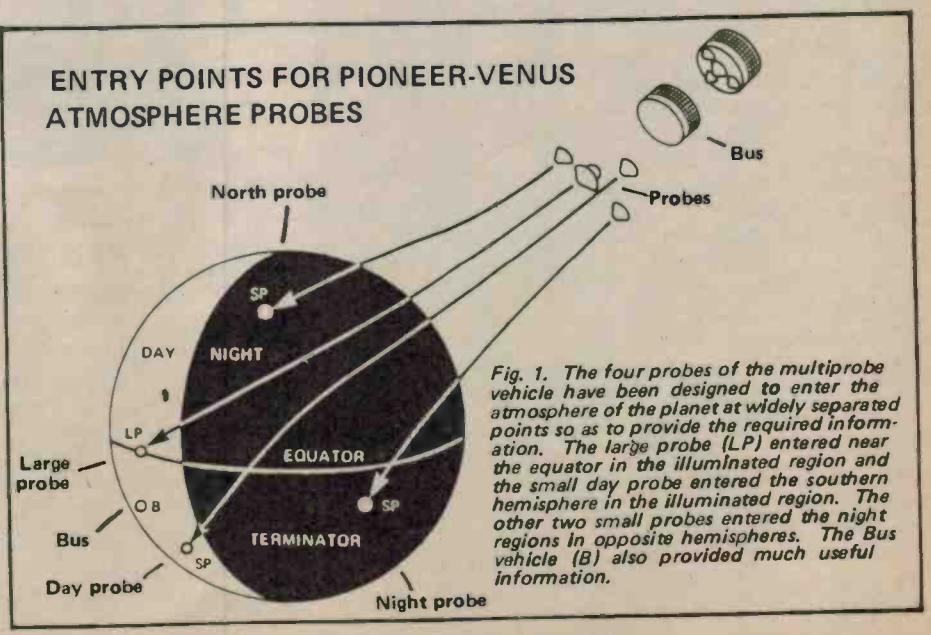


Fig. 1. The four probes of the multiprobe vehicle have been designed to enter the atmosphere of the planet at widely separated points so as to provide the required information. The large probe (LP) entered near the equator in the illuminated region and the small day probe entered the southern hemisphere in the illuminated region. The other two small probes entered the night regions in opposite hemispheres. The Bus vehicle (B) also provided much useful information.

intensity as they descended. It has been suggested that this glow could come from chemical reactions on the surface or in the very dense, very hot atmosphere just above the surface. These reactions appear to involve sulphur compounds. However, scientists have not yet completely eliminated the possibility that this glow came from heated or electrically charged surfaces of the small probes themselves, in which case they would be nothing to do with the environment of the planet.

Unexpectedly, the concentration of primordial argon and neon on Venus is several hundred times that on earth. These results seem to challenge most of the theories of the formation of the solar system, since it is most generally accepted that the Sun and the planets were formed at about the same time with the planets initially present as a cloud of gas surrounding the Sun and of a similar composition to the Sun.

It was assumed before the Pioneer Venus results became available that the volatile elements present in the atmospheres of the inner planets were originally trapped in the material from which these planets were formed and that these elements subsequently were released into the atmospheres of the planets. Any such elements subsequently were released into the atmospheres of the planets. Any such elements originally present in the atmosphere of one of the inner planets would presumably have been swept away by a strong solar wind if they had not been pulled into the Sun in its early life. Only the large outer planets such as Jupiter and Saturn were assumed to have a high concentration of primordial volatile gases.

The initial Pioneer Venus results have shown that this is not the case. It has therefore been necessary to re-model our ideas as to the temperature distribution of the cloud of gas from which the planets condensed. Instead of the gas cloud being hotter near the sun (as has always been assumed), it seems that it could have had a fairly constant temperature throughout, since this could explain the increase in the concentrations of the light gases as one moves towards the centre of the system. If the gases were absorbed on dust grains, the abundance of the gases would be highest where their pressure was greatest namely at or near the centre of the gas cloud. The dust would later form rock containing trapped gases which would eventually form the inner planets. Alternatively, the gases could become trapped inside the completely formed planets before the temperatures of the Sun rose.

The presence of neon and argon in approximately the same proportions on the earth and on Venus provides support to the suggestion that a more or less uniform process occurred in this region of the solar system during its formation and resulted in a steady increase in the density of all materials as one moves towards the Sun.

The Greenhouse Effect

When radiation can enter a region but not escape, the region must heat up. This type of phenomenon is known as the 'Greenhouse Effect', since it is responsible for the well-known phenomenon that the inside of a greenhouse is considerably hotter than the outside on a sunny day.

Visible light and near infra-red radiation from the Sun can pass through the glass of a greenhouse to raise the temperature of the soil and of the plants, whereas the long wavelength radiation in the far infra-red emitted by the relatively cool objects inside the greenhouse cannot pass through the glass. Thus a greenhouse traps heat energy.

The intense heat of Venus (about 460°C on the surface) seems a result of a greenhouse effect.

Venus is a very bright object in the sky, since it reflects some 75% of this total incoming sunlight; this is due to the dense clouds which always cover its surface. However, of the remaining 25% of the incident radiation, some 60% is absorbed in its clouds, 15% in the atmosphere above the clouds, 15% in the lower atmosphere and some 10% at the surface of the planet.

Heat is prevented from leaving Venus easily by the presence of the high percentage of carbon dioxide in the atmosphere, but nevertheless scientists were puzzled because this could not completely account for the very high surface temperatures on the planet. Strangely enough the Pioneer Venus mission has shown that the 0.1% to 0.4% of water vapour present in the Venusian atmosphere is the other component of the powerful heat trap, but particles of solid and liquid sulphur are also believed to play some part in trapping the heat on the planet.

It is rather surprising that the amount of carbon dioxide and its compounds are rather similar on Venus and earth, but on earth the carbon dioxide is trapped in the form of carbonates (such as calcium carbonate, present as chalk and limestone). On Venus, the carbon dioxide is present in the atmosphere. Both planets have similar amounts of nitrogen. However, Venus has a very much smaller amount of water than earth.

It has been suggested that the water originally present on Venus circulated to the top of the atmosphere where it was broken into its elements by the short wavelength ultra-violet light from the sun. The light hydrogen atoms could easily escape into space, but one is then puzzled as to what has happened to the oxygen formed from the water. Could it be locked in the Venusian rocks in the same way that the earth's carbon dioxide is present as carbonates and also dissolved in the sea?

An image of Venus made by the Cloud Photopolarimeter on board the Orbiter vehicle 65,000 km from the planet. This image was taken during the craft's 45th orbit on 18th January 1979, the phase angle being 51°. Note the polar ring markings. (Courtesy: NASA, Ames Research Centre).

The Clouds

The clouds of Venus have a total thickness of some 20 km (12 miles) and consist of three distinct layers:

(i) The uppermost layer, some 14 km deep consists probably of droplets of sulphuric acid at a temperature around 13°C. Particle diameter is about 1 μm and the density some 300 particles per cm^3. This layer extends from 56 to 70 km altitude.

(ii) The intermediate cloud layer is some 6 km in depth (49.5 to 56 km altitude) and consists of a mixture of

particles at a temperature 20°C. The largest particles may be solid sulphur and have a diameter of some 10 μm, whilst the smallest particles are sulphuric acid (about 1 μm or more) and apparently another liquid makes up the third component with drops some 4 μm in diameter. The density is about 100 particles per cm^3.

(iii) The densest of the three layers is the lowest, lying between 47.5 and 49.5 km altitude. At a density of about 400 particles per cm^3 it is the only layer opaque enough to resemble the clouds found on earth. It contains many large particles (10 μm or more diameter) which may possibly be solid and liquid sulphur together with a few sulphuric acid particles. The temperature is near 202°C.

There is a low density misty layer from the base of the bottom cloud layer to about 30 km in altitude, but there appears to be no particles in the atmosphere at altitudes of less than 30 km. Elemental sulphur is not found above a height of 56 km (35 miles), but ultra-violet light can penetrate to this altitude and be absorbed by the sulphur — probably leading to dark cloud markings in some ultra-violet images of Venus.

Radiometer results

The infra-red radiometer carried by the Orbiter vehicle has shown that the cloud tops have about the same temperatures during the day and night and vary little in height from day to night. A Venusian night lasts some 56 earth days. It is surprising that the atmosphere above the cloud tops at the poles of the planet is some 10°C hotter than at the equator. This differs from earlier observations. A wide ring of colder and higher clouds circles the poles at about 70° latitude, the temperature being some −58°C. A vortex seems to create a polar 'hole' with low cloud tops.

The ionosphere

Venus has an ionosphere on its night side. This was puzzling because ionising radiation from the Sun (X-rays and ultra-violet) cannot reach the night side of the planet during the long Venusian night. Pioneer work found that very long lived metallic ions (mainly iron and magnesium from meteorites) were present and could explain the presence of Venus' night time ionosphere. Various ions found there include atomic and molecular oxygen, carbon monoxide and carbon dioxide, atomic nitrogen, helium, hydrogen, etc.

The solar wind interacts with the atmosphere of Venus much more strongly than was expected. As Venus has almost no magnetic field, the solar wind is not swept away from the planet as is the case with the earth, so it interacts directly with the top of the Venusian atmosphere and ionosphere.

To Venus

What would a traveller see as he travelled through the atmosphere to the surface of Venus?

As he moves towards the surface, he would see somewhat yellow sulphurous clouds beneath him before he enters the clouds about 70 km from the surface. The Sun would begin to grow dim at about 66 km altitude and would no longer have a visible disc at 63 km as he tries to view it through a diffuse yellow cloud of sulphuric acid particles. One often sees a similar image through the earth's clouds. At 63 km visibility is some 6 km and the temperature 13°C with the pressure half that on the earth's surface.

The visibility falls to about 1.5 km at 49.5 km altitude and the temperature is a comfortable 20°C.

Under the lowest cloud layer there is a clear space followed by a faint haze region, but the haze clears at 30 km and the visibility increases to some 80 km in the environment where dispersed light comes through the yellowish clouds to illuminate the scene. The illumination is not unlike a cloudy bright day on the earth, but the temperature at 30 km altitude is about 310°C.

When the traveller reaches the planet's surface, he would not be able to ascertain even the approximate location of the Sun in the sky. Only 10% of the incident sunlight reaches this level and the temperature is around 455°C. Only the longest visible wavelengths in the red region can travel any appreciable distance through the atmosphere at the surface of the planet which is 91 times as dense as the atmosphere at the surface of the earth. Everything appears red with a considerable amount of refraction and distortion of landmarks. Visibility is some 3 km, but the light intensity is comparable to a rather dark and gloomy day on the earth.

Future results

It is expected that calculations of the Venusian wind velocities along all of the four probe flight paths will soon become available. Further details of the composition of the Venusian atmosphere and of the cloud droplets which entered the mass spectrometer of the large probe should also be made available in the fairly near future. The Orbiter vehicle will continue to send data and pictures of Venus back to earth for a considerable time and this will contribute much more information to increase our knowledge about this interesting planet.

One of the problems in the design of the Pioneer equipment was the reduction of effects due to cosmic rays changing the contents of the memories without damaging them. In one spacecraft 16 'bit-flips' had occurred by about the end of October, but only five in the memory of the other craft. Precautions had to be taken to prevent the firing of the Orbiter insertion motor at the wrong time due to a memory 'bit-flip'. The probability of a 'bit-flip' producing a late turn on of a probe transmitted was about one in 700, but in this event an accelerometer switch would have turned on the equipment and some upper atmosphere data would have been lost.

In conclusion we must remind ourselves that this mission to Venus has been made possible by the achievements of microelectronics combined with huge earth station aerials. This work on Venus has undoubtedly helped man to learn not only about this planet, but also to improve his electronic and engineering techniques which will have many and varied applications in the future. ●

AMPEX 360 Professional Series Cassettes

Low noise/high output
Wide dynamic range
Ferrosheen ™ polished oxide surface
Superior quality shell and components

HERE'S A UNIQUE OPPORTUNITY to obtain world-famous AMPEX tape cassettes at truly bargain prices.

The AMPEX 360 series are standard tape cassettes but made to professional standards using professional grade materials. They are made specifically for applications in which consistent and reliable performance is as essential as top quality electromagnetic properties. The tapes are of course completely suitable for all general purposes — the main difference between AMPEX 360's and many other tape cassettes is that these are made properly!

The Ampex Professional Series cassette has a wide dynamic range due to its low noise/high output oxide formulation, providing clean, well defined response across the spectrum.

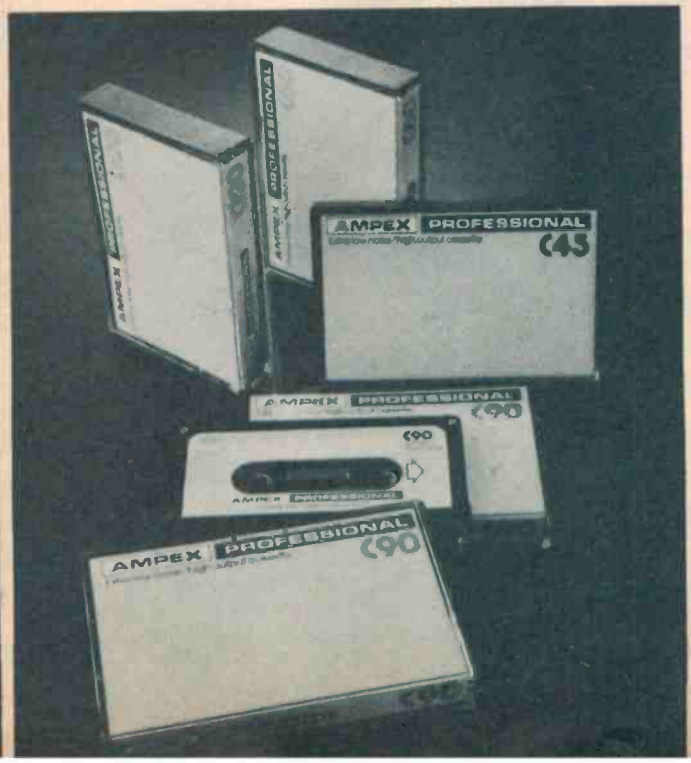
The recording surface is polished by the exclusive Ampex Ferrosheen ™ process ro produce a glass-slick oxide surface that achieves close tape-to-head contact, maintaining sound fidelity.

The shell, and its internal components, are precision products designed for the highest mechanical reliability. The pressure pad system is a felt/beryllium copper spring assembly. Rotating guide rollers run on lubricated stainless steel pins.

A special formulation in the interior top and bottom liners reduces tape edge friction and minimises possible wow and flutter. The cushioning effect created by the liners helps to reduce mechanical noise to a practically inaudible level. The convex shape of the liners causes a spring-like action which controls tape torque and tape alignment and helps in forming a uniform tape pack for smooth, jam-free operation.

The cassette shells are assembled with five screws to maintain precise internal dimensional uniformity. The shell may be dis-assembled for editing or splicing if required.

Windows, which allow visual inspection of the tape packs, are made of solid transparent polystyrene to protect the tape from dust.



CHARACTERISTICS	SPECIFICATION
CASSETTE TAPE SYSTEM	
PLASTIC SHELL	
Dimensions:	Manufactured in conformance to Philips Dimensional Standards.
Materials of Construction:	High heat, medium impact polystyrene.
Torque Control Liners:	Graphite coated, preotensioned polyester.
Pressure Pad Assembly:	Felt/Beryllium copper spring.
Magnetic Shielding:	Full-width steel.
Closure Method:	5-screw assembly.
Tape position Windows:	Rigid polystyrene. Welded.
Tape Guide System:	Rotating guide rollers operating on lubricating stainless steel pins.
SYSTEM PERFORMANCE	
Rotating Torque:	Less than 25gm/cm without hold-back.
Wow and Flutter:	Less than 0.10% DIN weighted.

INTRINSIC MAGENTIC OXIDE PROPERTIES		
Coercivity (Hci) in oersteds	290	290
Retentivity (Brs) in gauss	1100	1100
Erasure (1000 oersted field) in db	−60	−60
PHYSICAL PROPERTIES		
Base film thickness in mils	0.50	0.30
Base film type	Tensilized polyester	Tensilized polyester
Oxide coating thickness in mils	0.20	0.17
Total thickness in mils	0.70	0.47

AMPEX CASSETTES

SPECIAL READER OFFER!

Each cassette is packaged in a transparent "Norelco" container. The insert label is reversible, providing space for programme contents and title to be written or typed.

Dindy Marketing has arranged with Ampex for Dindy to offer these tapes to our readers for a limited period of time, and at genuinely bargain prices. Electronics Today International has tested these tapes and supports Ampex's claims for performance and quality.

NOTE: Dindy has available ex-stock – 10,000 C45's; 40,000 C60's and 10,000 C90's. If demand exceeds Dindy's stock, Ampex has agreed to make further supplies available to Dindy within two weeks notice.

Due to the extreme care taken in manufacture, it is extremely unlikely that any faulty cassettes will be found – in the improbable event that you receive a faulty cassette, Dindy guarantee to replace it (at their discretion) within 21 *days.*

Organisations able to purchase at sales-tax free prices should enclose a valid sales-tax certificate and deduct C45 (10c); C60 (11c); C90 (12c) for each cassette.

This offer is made by Dindy Marketing and this magazine is acting as a clearing house for orders only. Cheques should be made out to 'Ampex Offer' and sent together with the order form to 'Dindy Offer', Electronics Today Int., 15 Boundary Street, Rushcutters Bay, NSW, 2011. ETI will process the orders and pass them on to Dindy who will send out the goods by IPEC or certified mail. Please allow approximately four weeks for delivery.

SPECIAL BARGAIN PRICES

Quantity	1 – 50	51 – 100	101 – 200	201 +
C45	$1.25	$1.20	$1.15	$1.10
C60	$1.35	$1.30	$1.25	$1.20
C90	$1.45	$1.40	$1.35	$1.30

Plus postage – $2.00 (any quantity).
If valid sales tax certificate enclosed deduct 10 cents – C45's, 11 cents – C60's, 12 cents – C90's.

AMPEX OFFER

Send to: Electronics Today International
15 Boundary Street
Rushcutters Bay, NSW 2011

Please supply:

Quantity

.....C45 .....$.....

.....C60 .....$.....

.....C90 .....$.....

Postage (any quantity) $2.00

TOTAL:

Name .....

Address .....

.....Postcode .....

Please make cheques/postal notes payable to 'Ampex Offer' and send together with the order to 'Ampex Offer', Electronics Today International, 15 Boundary Street, Rushcutters Bay, NSW 2011. Offer closes 15 July 1979.

Fibre Optic Data Link Breakthrough

Optical fibres are rapidly coming into service in telecommunications and television systems. A new development using lightweight fibres for interference-free telemetry uses data transducers which simply clip on to the fibre, much as you clip a peg to a clothes line. Report from Prof. D E N Davies and Dr. B Clushaw, University College, London.

OPTICAL FIBRES ARE thin strands of glass or silica (quartz) which can guide light over long distances. No thicker than a human hair, they can carry information if the light travelling along them is suitably coded.

The attenuation of an optical fibre has fallen dramatically over the past five years from over 40 dB/km to figures now typically in the region of 1 dB/km.

People are mainly interested in optical fibres for public telephone networks. One strand can carry thousands of telephone conversations while taking up a very small space, so that theoretically the telephone administrations can considerably expand their facilities without having to lay new ducting under the streets.

Optical fibres have several interesting properties when compared with conventional copper cables for transmitting information. A fibre does not radiate the signal it carries, nor is it affected by any local electromagnetic interference. So fibres may be freely used in areas of strong electromagnetic fields that might otherwise cause interference; e.g.: in the electrical power industry.

This makes them useful for aircraft and satellites, too, where a great deal of copper cabling has hitherto been used to shield unwanted signals rather than to transmit information; here the fibres' light weight is another advantage. Because the fibre is an electrical insulator, it does away with expensive voltage and current transformers normally needed when coupling electrical measuring instruments to high-voltage power lines. Interference problems often caused by current flowing in earth loops are also avoided when fibres are used.

Hazardous Applications

An optical signal travelling along a fibre does not cause a spark when exposed to the atmosphere through a chance break in the cable. This means that optical fibres can be used in hazardous areas, such as in chemical and petroleum plants, without risk of fire. Such fibres are a cheap means of communicating through areas where so-called 'intrinsically safe' equipment is normally called for, without degrading performance.

Passing the Information

The information is usually passed along the fibre by modulating a light source. The source itself may be a light-emitting diode (LED) or a laser. With the former,

A typical transducer attached to an optical fibre. The ultrasonic pressure wave the transducer launches into the fibre imposes a linearly-related phase change on the light waves passing along it.

the light may be modulated only by changing its intensity. In the latter, we can still change the intensity but, because a laser is an optical equivalent of an ordinary radio transmitter (which means it is a 'coherent' or pure source), we can also put information on to an optical 'carrier' wave by varying its phase.

Being able to modulate the light by varying its phase has a number of interesting consequences as we shall see later. But it is useful to point out at this stage that the phase of an optical signal passing along a fibre may be changed by altering the length of the fibre or the temperature, or by applying mechanical pressure to the fibre. So, if the fibre carries coherent light from a laser, it is important that the modulation and detection technique for the wanted information is insensitive to such physical or environmental changes.

Data Highways

These properties of optical fibres have led to a range of applications well beyond the original idea of using them for telephone work. Interest in optical-fibre information distribution systems is growing, and there is a plan for an optical-fibre communication network throughout a new city in Japan.

Communication and telemetry in many industrial and military applications involve the use of one-way or two-way 'data high-ways', which allow information to be fed in and/or received at a number of points simultaneously. A number of data highway systems now incorporate optical fibres, but the components used in optical junctions cause considerable loss of signal strength; a loss in the region of 3 dB or more is typical. Even plugs and sockets can lose up to 1 dB. Moreover, because it is essential to break the optical path when introducing a new data signal, it is often necessary to regenerate a new data signal from the old one at each feed-in point.

The data is usually sent around the high-way in the form of a synchronized binary signal, divided into time slots corresponding to the various data sources. The information is coded by a simple on/off technique, so the sources of light may be lasers or LEDs.

Phase Modulation

One exception to this general scheme of things is a unique form of data highway ▶

Fibre Optic Data Link Breakthrough

now being developed at University College, London. It offers simple, one-way telemetry from many sources to one destination, using a laser and exploiting phase modulation introduced in the fibre path by a pressure change on the fibre.

The laser used is highly coherent, with low noise. At present a gas laser is being used, but developments in solid-state laser technology and improvements in the system will soon enable the use of a solid-state source. The output from the laser is fed into a length of multimode optical fibre, so-called because it has numerous possible paths for the rays to travel from input to output, involving slightly different overall path lengths.

Phase modulators are attached to the fibre at various input points. Each modulator operates at a distinct sub-carrier frequency and is keyed on and off in pulses representing the data. Its output modulates the wave travelling in the fibre by shifting its phase to and fro at a rate corresponding to the sub-carrier frequency. At any instant, the phase shifts introduced by all the modulators add together, thereby producing a complex overall phase modulation that can be analysed back into the components generated by the individual modulators.

The phase modulation technique is particularly simple. An ultrasonic, piezo-electric transducer is attached to the fibre and energized at its resonant frequency with the required data signal. An ultrasonic pressure wave is thereby launched into the fibre and a phase change linearly related to the pressure changes is imposed on the light passing along the fibre. This means that information can be injected without breaking the optical path. A single laser source and a single fibre with no direct connectors can provide access to a very large number of data sources and carry the data to a common reception point. The associated electronics system is simple, too, for there is no need to regenerate the entire data stream.

Noise Problems

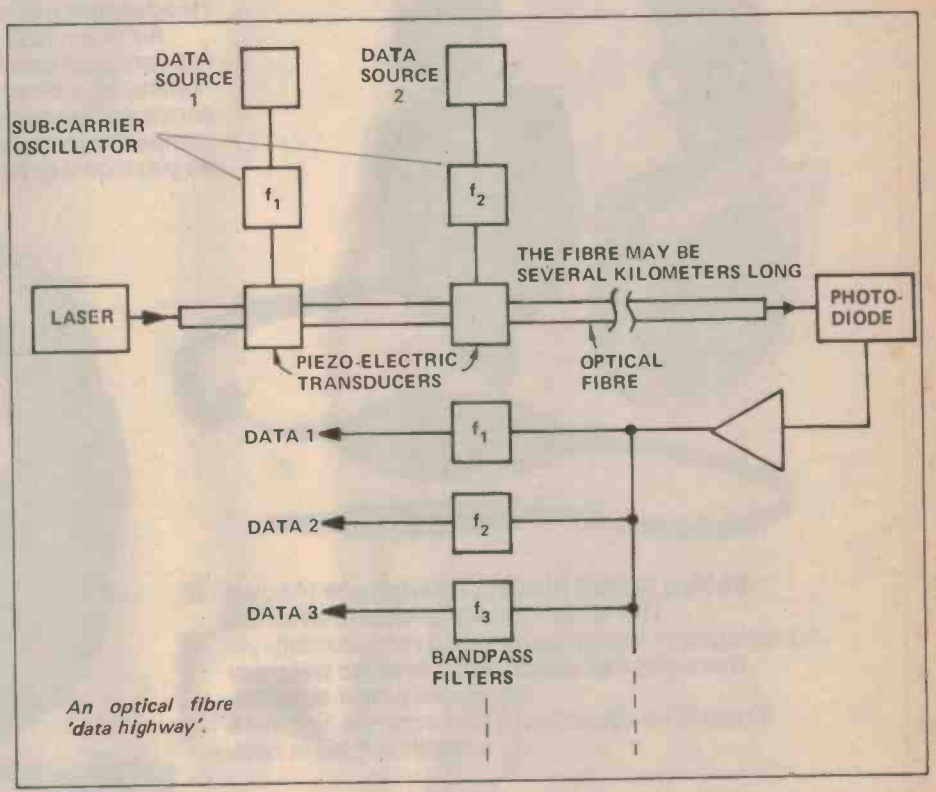
Optical fibres are extremely sensitive to changes in pressure — so sensitive that pressure variations a lot smaller than those caused by sound waves at the threshold of hearing are strong enough to give a detectable change in the optical output signal. This means that the fibres are highly microphonic; that is, they are sensitive enough to pick up ambient noise, so the sub-carrier frequencies of the modulators must be well above the upper limit of the noise spectrum, which may be as high as 50 kHz.

This extreme sensitivity gives the phase-modulated data highway an important advantage. The ultrasonic power needed to modulate the light in the fibre is roughly proportional to the square of the bandwidth or range of frequencies contained in the modulation. For many data signals, for example those from temperature flow rate sensors, the bandwidth is less than 1 kHz. This means that the power needed for modulation is about 100 μW and the power consumed by the circuits which handle this is only in the milliwatt region. So it is realistic to think of a data input station run by a battery that would have years of life. For equipment to sense data in hazardous areas, where the hardware has to be sealed in a box, without power leads, this is important. It is also an attractive feature where data has to be collected from a large number of sensors in, say, a pipeline system, where it is better not to have to distribute electrical power to the data input points. Moreover, because the optical fibres do not attenuate the signal heavily, a link could be several kilometres long.

Research Continues

In multimode fibres, the multipath propagation of the light causes interference between the rays arriving at a phase-sensitive detector, somewhat akin to the fading met with in short-wave radio, so we have to provide means of detecting the rays from the different paths separately and combining the outputs to give an acceptable level. The University College team is now investigating a number of simpler, alternative systems for overcoming this problem.

Probably the most important advantage of the phase-modulated data highway is the fact that you can feed data into it wherever you like, without breaking into the optical path with a coupler. All we have to do is clip on the transducer, rather like putting a peg on a clothes-line. That, and the low power needed, is what makes it so attractive for telemetry. ●



An optical fibre 'data highway'.

TWO HEADS ARE BETTER THAN ONE

There are good reasons why these two superb Philips models make such a fine contribution to the unique characteristics of headphone listening. Each, in its own way, offers ultimate performance and remarkable value in the realm of Hi-Fi stereo equipment.

That is why two heads are better than one. It gives your customers the choice of two exceptional systems in design technology.

Philips N6325 Electret Headphone (Above)
The electret principle embodies all the advantages of electrostatic sound reproduction, yet manages this without cumbersome weight or expensive power supplies.
There is no reduction in performance, but there is a significant fall in cost.

Philips N6330 Electrodynamic Headphone (Below)
Although N6330 (Philips' range leader) is a conventional electrodynamic headphone, there is nothing conventional about the revolutionary design concepts that ranks these phones with any competitor in the world today. And **not** as expensive as you would expect.

Service
Service
Service

For further information send coupon to:
Philips Central Service Division,
443 Concord Road,
Rhodes, N.S.W. 2138.

PHILIPS

Please send me further information on:
☐ N6325 ☐ N6330
Name:_____
Position:_____
Company:_____
Address:_____
_____ Telephone:_____

ETI May

Remarkable Electronic Translator

Recent advances in electronic technology have allowed the development of some remarkable gadgets. Electronic translators have only recently appeared, but it seems the Craig Corporation have done their homework on market needs and produced an immensely useful machine.

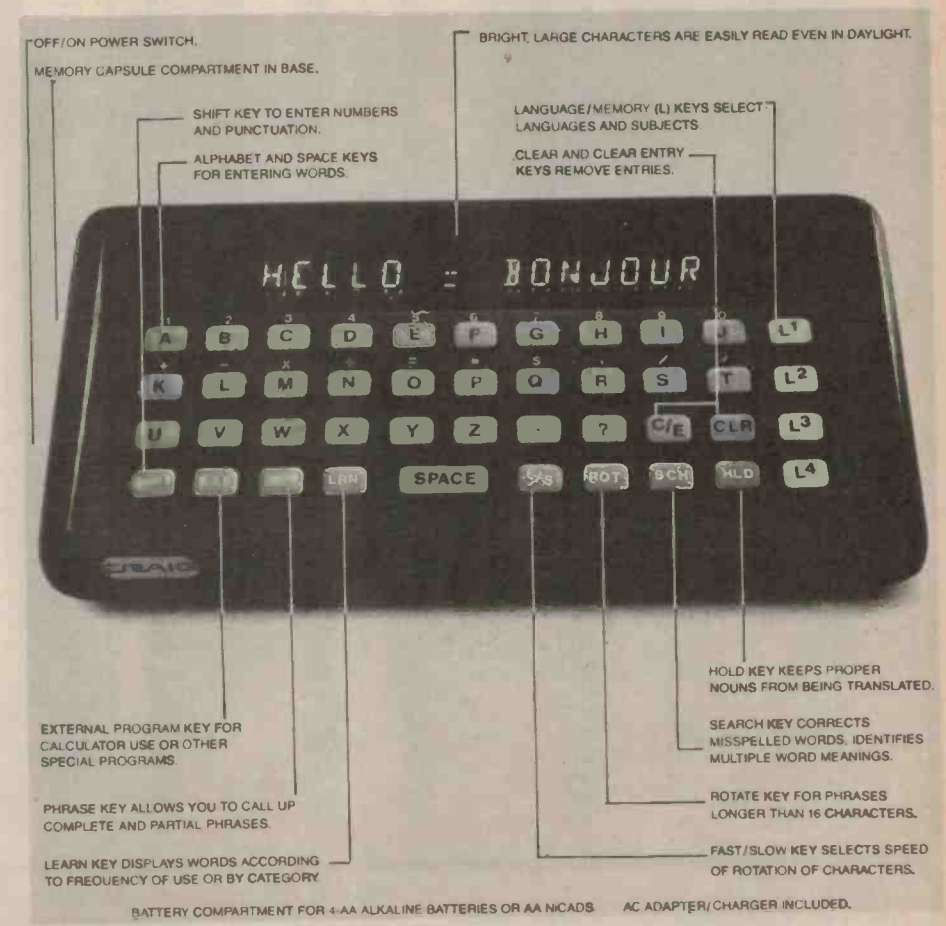
DEVICES that translate one language to another have existed in writers' imaginations for countless years — for it is only movie-makers who assume that alien cultures invariably speak American — generally with a West coast accent.

So it is no great surprise to find that several innovative companies have been seeking to make fiction a reality. But it *is* a surprise to find out just how well it's been done — one of these devices at least, makes the fictional versions seem positively archaic.

We're referring to the newly released Craig M100 which, apart from being a most powerful handheld translator that interprets foreign languages instantaneously, provides instant metric conversions, has a built-in four function calculator, and can provide information on a whole host of subjects at the touch of a key!

The unit's versatility comes from interchangeable memory capsules which plug into the back of the device. One capsule, which is permanently installed, contains a program for metric conversions and calculator functions.

Of the three interchangeable capsules, the first (which corresponds to keyboard command L1) is normally programmed with one's own language: English is assumed for units sold in English-speaking countries. The second and third capsules may be programmed each with your choice of one language: English, French, Italian, German, Spanish and Japanese being currently available. ▶



This picture illustrates the simplicity of the translator's keyboard — similar to pocket calculators, and the range of functions built in. Memory capsules are inserted on the underside of the unit.

MORE FOR YOUR DOLLAR

NOW IN AUSTRALIA

A NEW CONCEPT IN DIRECT MAIL ORDERING

– NO COUNTER SALES MEAN MUCH LOWER PRICES

*SPECIAL INTRODUCTORY OFFER!

You get a free $5 gift pack of electronic components with each order for this month only. Limit of one gift per customer. Mail all orders to: SEMIS, 2 Guildford Lane, Melbourne. Vic. 3000.

All components prime, full spec, by major manufacturers

LINEAR

LM301	.25
LM304H	1.40
LM305H	.65
LM307CN	.32
LM308	.60
LM310N	1.75
LM311	.55
LM318	2.25
LM324N	.65
LM334Z	1.10
UA339PC	.50
LM349N	1.45
LF356	.90
LF357N	.90
LM358N	.60
LM370N	2.50
LM373N	3.30
LM380	.85
LM381N	1.50
LM382N	1.30
LM386N	.90
LM387N	1.10
LM391N	1.40
LM393AN	.70
555	.25
556	.60
LM565CN	1.10
LM567CN	1.20
TBA641-BX1	2.00
LM709-CN	.50
UA710CA	.55
723	.40
LM723CH	.54
LM733CN	.75
741	.20
UA747PC	.85
LM748CN	.45
LM1458N	.50
LM2902N	1.20
LM3039H	.78
CA3065	.50
CA3130	1.05
CA3140T	1.05
UA3401	.60
LM3900N	.65
LM3909N	.85
LF13741N	.50
LF13741H	.50

TRANSISTORS

2N301	1.80
2N1711	.45
2N2219A	.35
PN2222	.18
2N2222	.20
2N2646	.55
2N2647	.90
2N2904	.40
2N2905	.35
2N2906	.30
2N2907	.25
2N3053	.35
2N3054	.60
2N3055	.45
2N3563	.18
2N3564	.25
2N3565	.18
PN3566	.18
PN3567	.18
PN3568	.18
2N3569	.18
2N3638	.18
PN3638	.18
2N3638A	.21
PN3642	.14
PN3643	.16
PN3644	.16
PN3645	.16
2N3646	.16
2N3694	.10
2N3702	.20
2N3704	.25
2N3819	.25
2N3904	.18
2N3906	.16
2N4032	.45
2N4033	.80
2N4250	.12
2N5458	.40
2N5459	.40
AC127	.80
AC128	.60
AC187	.65
AC188	.65
AD149	1.60
AD161	1.35
AD162	1.35
AY6112	.40
AY6119	.40
AY6120	.40
AY6121	.40
AY8110	.50
AY8139	.40
AY9139	.40
BC107	.16
BC108	.16
BC109	.16
BC147	.10
BC177	.20
BC178	.20
BC179	.20
PC208	.15
BC547	.12
BC548	.12
BC549	.12
BC557	.14
BC558	.14
BC559	.14
BD137	.35
BD138	.35
BD138	.26
BD140	.26
BD234	.41
BD237	.47
BF115	.45
BF173	.60
BF180	.35
BF198	.10
BF199	.10
BFY50	.26
BSV17	.65
BU126	2.45
BUX80	6.75
FT2955	1.15
FT3055	.65
MEL12	.75
MJ802	2.95
MJ2955	.60
MJE2955	1.20
MJE3055	1.20
MPF102	.35
MPSA05	.18
MPSA14	.24
OA675	.10
OC910	.60
OC912	.60
OC925	.10
SE1010	.18
TIP31A	.25
TIP32A	.25
2SD200	1.00
TIP2955	.70
TIP3055	.65

TTL 7400 SERIES

7400	.14
7401	.16
7402	.14
7403	.18
7404	.16
7405	.20
7406	.18
7407	.30
7408	.16
7409	.20
7410	.14
7411	.22
7412	.26
7413	.28
7414	.32
7416	.40
7417	.40
7420	.16
7421	.16
7423	.35
7426	.24
7427	.24
7430	.16
7432	.24
7437	.30
7438	.30
7440	.20
7441	.90
7442	.35
7443	.65
7444	1.20
7447	.50
7448	.50
7450	.18
7451	.18
7453	.20
7454	.18
7470	.35
7472	.30
7473	.30
7474	.25
7475	.25
7476	.25
7480	.60
7485	.85
7486	.36
7490	.24
7491	.50
7492	.26
7493	.26
7494	.80
7495	.35
74107	.40
74121	.36
74122	.60
74123	.30
74126	.50
74132	.75
74145	.80
74150	.65
74151	.36
74153	.65
74154	.65
74157	.45
74160	.60
74164	.55
74165	.55
74175	.75
74192	.65
74193	.65
74221	.75
74365	.75
74367	.55

CMOS

4000	.20
4001	.18
4002	.18
4006	1.05
4007	.20
4008	1.00
4009	.65
4010	.65
4011	.18
4012	.18
4013	.42
4014	1.00
4015	1.00
4016	.41
4017	1.05
4018	1.00
4019	.52
4020	1.05
4021	1.05
4022	1.05
4023	.18
4024	.70
4025	.18
4026	1.55
4027	.60
4028	.78
4029	1.10
4030	.33
4040	.95
4041	.80
4042	.80
4043	.85
4044	.85
4046	1.30
4049	.40
4050	.40
4051	.70
4052	.70
4060	1.30
4066	.65
4068	.29
4069	.18
4070	.27
4071	.27
4072	.27
4073	.27
4075	.27
4077	.27
4078	.27
4081	.27
4082	.27
4093	1.30
40174	1.05
4510	1.05
4511	1.05
4518	1.05
4519	.65
4520	1.05
4541	1.30
4560	2.60
74C00	.22
74C02	.22
74C04	.22
74C08	.22
74C10	.22
74C14	.40
74C20	.25
74C30	.25
74C32	.25
74C48	1.40
74C73	.65
74C74	.65
74C76	.65
74C83	1.25
74C85	1.10
74C90	.85
74C93	.85
74C95	.55
74C107	.60
74C150	2.40
74C151	1.50
74C160	.80
74C162	.80
74C175	.80
74C192	1.10
74C193	1.10
74C195	.90
74C221	1.30
74C373	1.60
74C901	.50
74C902	.50
74C907	.50
74C925	4.10
74C927	4.10
80C95	.60
80C97	.60
80C98	.60

TTL 74LS SERIES

74LS00	.15
74LS01	.20
74LS02	.15
74LS03	.18
74LS04	.18
74LS05	.18
74LS09	.18
74LS10	.18
74LS11	.18
74LS14	.70
74LS20	.18
74LS21	.18
74LS22	.22
74LS26	.28
74LS27	.18
74LS28	.30
74LS30	.22
74LS32	.22
74LS33	.32
74LS37	.30
74LS38	.30
74LS40	.18
74LS42	.75
74LS51	.25
74LS54	.25
74LS55	.25
74LS73	.50
74LS74	.40
74LS75	.45
74LS85	.95
74LS86	.35
74LS90	.45
74LS92	.80
74LS93	.65
74LS107	.35
74LS109	.35
74LS112	.35
74LS123	.90
74LS125	.55
74LS126	.55
74LS132	.80
74LS138	.80
74LS151	.60
74LS154	1.20
74LS157	.60
74LS163	.70
74LS174	.60
74LS175	.60
74LS190	.95
74LS192	.70
74LS193	.70
74LS196	.90
74LS221	.90
74LS257	.50
74LS365	.55
74LS366	.55
74LS367	.55
74LS368	.55
74LS374	1.40

S.C.R.

C106Y	.30
BT100A300R	.50
C106D1	.50

DIODES

1N914	.04
1N4001	.06
1N4004	.06
1N4007	.12
1N5625	.35

ZENER DIODES

400mw 3.3 v to 36v	.12
1 watt 3.3v to 36v	.20

VOLTAGE REGULATORS

309	1.10
317	2.10
7805	.70
7806	1.00
7808	1.00
7812	.70
7815	1.00
7824	1.00
7912	1.10
7915	1.10
78L05	.35
78L12	.35
78L55	.35
79L05	.60
79L12	.60
79L15	.60

OPTO

FND 507	1.40
FND 537	1.00
FND 500	1.00

STANDARD LEDS

RED	.12
GREEN	.20
YELLOW	.25
CLIPS	.02

MICROS

2102	1.20
2114	6.00
2708	11.00

TERMS: Minimum Order $10 Aust.
Bankcard accepted

• We specialise in fast, prompt service with total customer satisfaction. • All items are guaranteed 30 days from date of shipment — user damage excepted. • Postage and handling: Add $1.50, orders over $50 add $3. All orders sent certified mail. • All prices plus sales tax if applicable. Cmos, TTL, Micros, Leds are plus 15 percent. All others plus 27½ percent. • Prices valid 2 months from date of issue. • School and government orders accepted.

Translator

However, if translation into one language is sufficient the third language capsule may be replaced by any one of a range of alternatives currently being developed by Craig.

Alternative capsules include – a single phonetic capsule which helps the user pronounce all the programmed languages, a calorie counter, a bar guide (!) and a wide range of general information capsules.

The Unit in Use

The basic idea is to type in a phrase or sentence in a simplified version of your own language, then by pressing the appropriate key (L2 or L3) the translated version of what you have entered will appear on the large fluorescent display in the language you have chosen.

Pressing the 'rotate' key causes the information to move 'around' the screen. The speed of this movement is switchable between fast and slow.

It is not often necessary to type in a complete phrase. Forty eight commonly used phrases and part phrases are listed, together with associated coded abbreviations, on the bottom cover of the unit. These save a great deal of time especially once they are remembered.

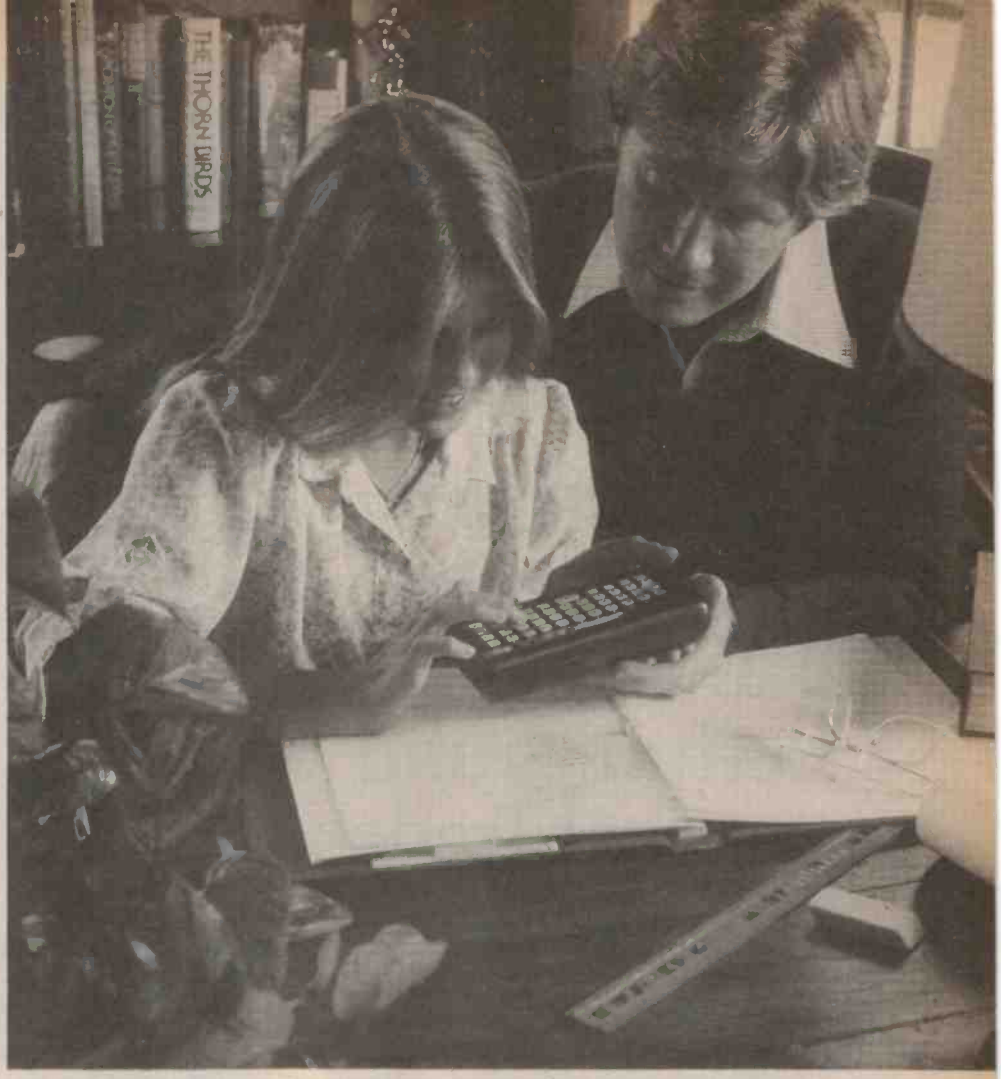
A very common useage of a coded abbreviation is when showing the person you are trying to communicate with how to use the machine. For this there is the code 'O'. All one does is press keys PHR and the letter 'O'. The display will then read PRESS LETTERS TO SPELL WORDS AND PRESS SPACE KEY AFTER EACH WORD. Subsequently pressing keys L2 and L3 will cause this phrase to be displayed in the language you have selected.

One can also combine a partial phrase or sentence such as 'Can you recommend' (letter 'Q') with your own final words. Thus 'Can you recommend a doctor' is achieved by entering (PHR)(PHR) 'Q' (A)(SPACE)(D)(O)(C)(T)(O)(R)(?). It's very much quicker to do than to type!

If the phrase or sentence you need is not included in the coded listing then you just type in what you want to say.

There are a number of rules which you must follow. You must keep your grammar as simple as possible using the singular form and the present tense. Pick out only the key words that you want to communicate – for example if you want to communicate 'I am going to buy some books' you simply enter 'I buy books'.

You must also pause before entering the first letter of a new word to allow the unit to verify the spelling of the previous word. If a word is misspelt the unit cannot understand it and will display '????'. Pressing the (SCH) key will cause the unit to display alternative spellings or words with similar spellings.



The Craig Translator has much potential as a teaching aid as it indicates misspelt words, multiple meanings, incorporates a range of partial phrases and can display words by category or frequency.

Most languages have words that are spelled in the same way but have different meanings. In normal communication the meaning implied is gathered from the overall context in which the word is used. The M100 is not capable of this and must be told which meaning is intended. It does however spot most double or multiple meanings and when such words are used it displays '????'.

For example if you wanted to translate 'Watch the movie' the M100 will know that 'Watch' has more than one meaning so will indicate WATCH????. The next step is to press the (SCH) key which will cause the unit to search its memory for alternative meanings of 'Watch'. The display will indicate WATCH (CLOCK), WATCH (SEE). In this instance the meaning (SEE) is required. One now presses the (SPACE) key whilst (SEE) is displayed and proceeds with the rest of the entry which now becomes WATCH (SEE) THE MOVIE. When the translate key is pressed this reads (in French say) as REGARDER L'CINEMA. C'est clever n'est pas?

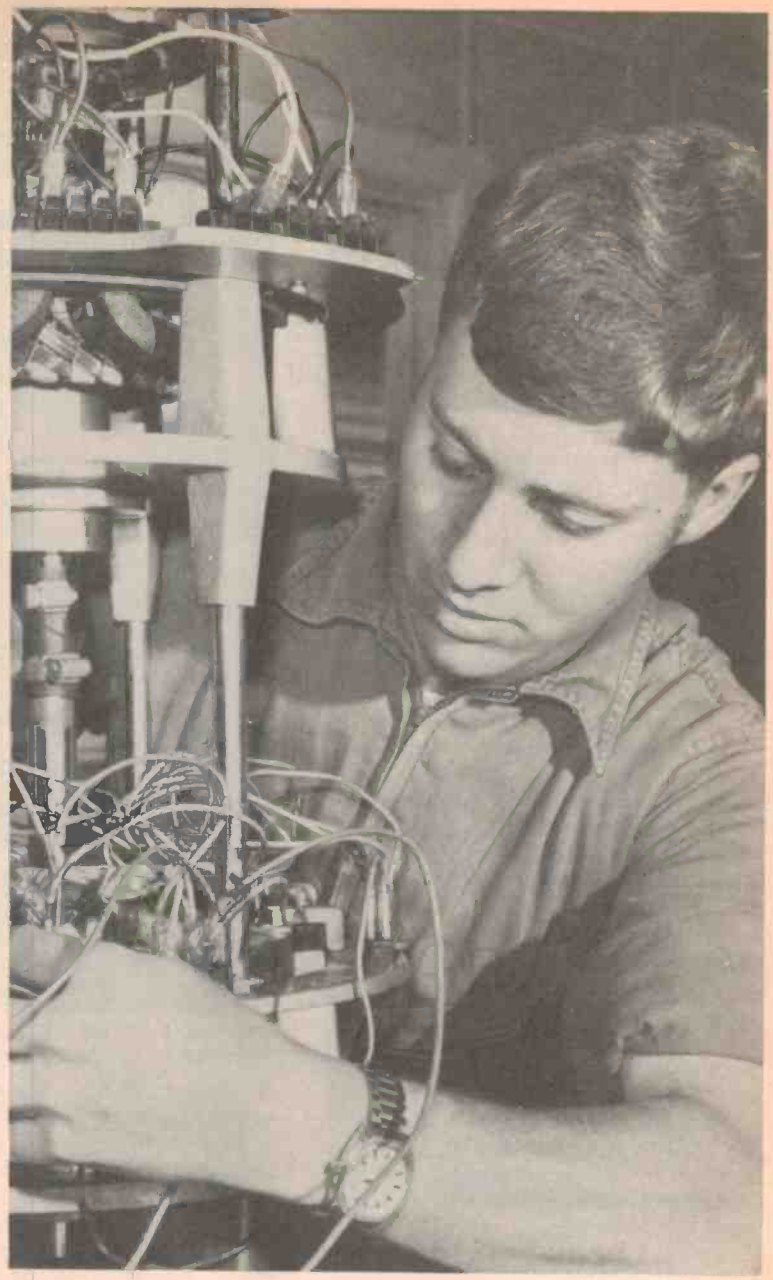
There will always be some word combinations that the M100 cannot adequately handle. The linguists' famous 'Time flies like an arrow' is one example – this phrase can be understood in very many different ways. Any of the first ▶

The Caldor Corporation in Melbourne have arranged to import 5000 of these units – apparently that's their entire allocation for the whole of Australia for one year!

Just how big the demand will be no-one really knows – except that they've taken off like wildfire in the USA! Caldor feel that many ETI readers would like to have a chance to reserve one of these units before they are advertised more generally. Those interested please see page 33

Army Apprenticeships

Opportunities for young men (15-17*) in the Electronics and Electrical Trades.



ELECTRONIC TRADESMEN • ELECTRICAL MECHANICS • ELECTRICAL FITTERS

The Army wants young men to enlist as Army Apprentices to be trained as

- Electronic Tradesmen in the field of electronic communications.
- Electrical Mechanics in the field of high and low voltage electrical generation, reticulation and distribution systems.
- Electrical Fitters in the fields of electronic devices, electrical control equipment and domestic electrical systems.

The 9 years enlistment period will include a 4 years apprenticeship at the Army Apprentice School at Balcombe in Victoria and in Army technical units (leading to civilian trade qualifications) and 5 years further training in the Army corps of Signals, Electrical and Mechanical Engineers or Engineers as appropriate.

Applicants should be successfully studying English (or its equivalent), Higher Maths, Science and at least 2 other subjects at Year 10 or 11 School level. They will be required to present documentary evidence of successful results of their previous completed School year at formal application.

It is important to understand that the number of applications that can be accepted is very limited. If you're interested, don't wait or you will miss out. Fill in this coupon or phone an Army Apprenticeship Counsellor.

Brisbane 226 2626; Townsville 71 6784; Sydney 212 1011; Newcastle 2 5476 or 2 4728; Wollongong 28 6492; Canberra 82 2333; Melbourne 61 3731; Adelaide 223 2891; Perth 325 6222; Hobart 34 7077.

**Applicants must be at least 15 years old but still under 17 years old on January 1, 1980. If you are over 17 years you may apply to join the Army Adult Tradesman Scheme as an Electronic Tradesman trainee.*

Authorised by the Director General of Recruiting, Dept. of Defence

For further information, post this coupon.
To: Army Apprenticeships Counsellor, G.P.O. Box XYZ
(insert name of your nearest capital city and postcode)
Please send me details of ☐ Army Electronic and Electrical Trades Apprenticeships ☐ Adult Electronic Tradesman Trainee.

NAME: _____

DATE OF BIRTH: _____

ADDRESS: _____

_____ POST-CODE: _____

Join the Army

We're looking for more good men.

AAE40.FP.19

Translator

three words may be taken as a verb for example. (If you don't immediately see 'like' as a verb consider the phrase as expressing the tastes of a particular rare species of fly).

Essentially, the M100 causes one to think quite hard about one's own language and its peculiarities. Ned Rorem summed this up very well in his column 'Random Notes from a Diary'. He said, "the art of translation lies less in knowing the other language than in knowing your own".

The Craig M100 has several other inbuilt clevernesses. It can for example sort through its 4500 word vocabularly displaying words sequentially under selected subject categories – operating as a sort of electronic thesaurus. Entering 'FAMILY' then (LRN) will cause the unit sequentially to display 'FAMILY, PARENTS, FATHER, MOTHER, HUSBAND, WIFE' etc, etc. Any or all of these words may be immediately translated simply by pressing the appropriate key (I2 or L3).

A program built into the fourth (permanently installed) capsule enables the M100 to display metric conversion factors. Sixteen such conversions are held in memory. Once the required factor has been obtained, the calculator section may then be used to work out the required conversion/s.

The calculator functions are conventional. The unit can add, subtract, divide, multiply, square, and perform chain calculations.

The unit is powered by four inexpensive alkaline penlight batteries. These are readily obtainable and take only a few seconds to replace.

All in all Craig's M100 Translator is a fascinating and remarkably effective device. It's not perfect but nor is the science of automatic language translation.

Perhaps the most extraordinary aspect is the sheer amount of technology that has been packaged in such a small space at such low cost. The unit will sell for around A$250. Seven years ago it was unlikely that it could have been produced for less than 100 times that figure – if indeed at all.

One thing puzzles us – the manufacturers do not appear to have seen a very obvious use for their translator. For older members of migrant families who do not speak the language of their adopted country, this device would be a godsend. ●

The plug-in memory capsules each contain the translation information for a specific language. Others available include a 'phonetic' unit, calorie counter and even a bar guide!

Craig Translator . . .

THE DEMAND for the Craig language translator is expected to be very high indeed – and only 5000 units have been made available to the importers (Caldor Corporation).
However, Electronics Today has arranged for Caldor to supply our readers on a preferential basis until stocks run out.
As the unit is not yet on sale in Australia, we cannot state a normal selling price for comparison – but we reasonably expect that most outlets handling the unit will price it at least as high as Caldor's price to our readers – $249.95 (post free). The English language capsule is supplied as standard and is included within the selling price. Additional capsules are available at $34.95 each. Please state language/s required. Units should be available as from the 26th of April – the offer remains open until 16th June (or sooner if stocks are exhausted before June 16).

This offer is made by the Caldor Corporation and this magazine is acting as a clearing office for orders only. Cheques should be made out to 'Craig Offer' and sent, together with the order, to 'Craig Offer' Electronics Today International, 15 Boundary St, Rushcutters Bay, NSW 2011. ETI will process orders and send them on to Caldor who will send goods out by certified mail. Please allow at least five weeks for delivery.

WARRANTY: The Craig Translator is guaranteed by Caldor for a period of twelve months including parts and labour. In the event of the unit not working please return direct to the Caldor Corporation, 12 Terra Cotta Drive, Blackburn, Vic. 3130 NOT to ETI.

Reserve your unit now!

CRAIG TRANSLATOR, c/o Electronics Today International, 15 Boundary St, Rushcutters Bay, NSW. 2011.

Please reserve me . . .(Qty) Craig M100 Translator(s) at $249.95 each. Postage and packing free.
Plus the following language capsule(s) at $34.95 each.
Tick language(s) required.

French ☐ Spanish ☐ Italian ☐ German ☐ Japanese ☐

I enclose cheque/postal note for $ . . . . . .

Name .....

Address .....

.....

Postcode .....

Please make cheques/postal notes payable to 'Craig Offer' and post together with order to Electronics Today International.

CONTINENTAL SPECIALTIES CORPORATION CSC

LOGIC PROBES & DIGITAL PULSER

LP-1. Hand-held, instant reading of logic levels for TTL, DTL, HTL or CMOS

LP-2. The economy version of LP-1. Safer than voltmeter. More accurate than scope

LP-3. High-speed logic probe captures pulses as short as 10ns

DP-1. Completely automatic, pencil-size lab/field pulse generator. Pulse any family of digital circuits.

	LP-1	LP-2	LP-3	DP-1
Input Impedance	100,000 ohms	300,000 ohms	500,000 ohms	Output Tri State
Minimum Detectable Pulse	50ns	300ns	10ns	Autopolarity Pulse Sensing
Max. Input Signal (Freq.)	10 MHz	1.5 MHz	50 MHz	Sink and Source 100 ma

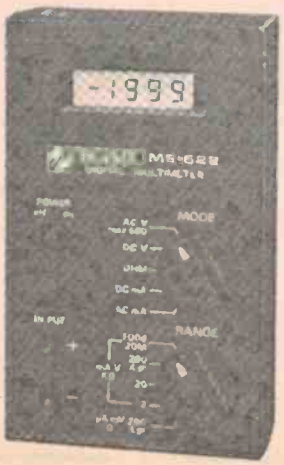
Reliable SOAR Digital Multimeters

ME SERIES

ME-521 DX
3½ digit LED display

ME-523
3½ digit ¾" high LCD with mode display

Digital Multimeter at an analog price! Send for detailed specifications and compare before buying.



ME-522
3½ digit LCD display

Available from:

NSW: David Reid Electronics, 516-3544. Radio Despatch Service, 211-0191. Electronics (Distributors), 636-6052. Martin De Launay, 29-5834.
VIC: Radio Parts, 329-7888. Stewart Electronics, 543-3733. Arlin Instruments, 569-6984. Ellistronics, 602-3282
S. AUST: Protronics, 212-3111.
W. AUST: Reserve Electronics, 328-3116.
QLD: Wilber Sales, 391-5136.

What's this `ear?

Anyone who has ever designed a synthesiser or other electronic musical instrument will, no doubt, have at some time cursed our remarkable sense of pitch, which puts so many design constraints on the oscillator system. Dr. R A Henson of The London Hospital explains just how the human sense of pitch works and turns up quite a few interesting pieces of information.

THE PITCH of a sound means its position on a scale of frequencies. Pitch sense is involved in perceiving all complex sounds: for example human speech has its set of pitches. In this article, I consider the way pitch relates to music.

In general, the pitch of a tone depends on its fundamental frequency, which determines whether it stands high or low on the musical scale. We tell one tone from another by their different fundamentals. Music is made up of a succession of tones and combinations of tones that are perceived, analysed and coded by the nervous system in ways to be explored, but questions of tuning and scales and how well we can hear them must be dealt with first.

Orchestral pitch is agreed nowadays as 440 Hz for A', that is, the note A above middle C. It became necessary to agree this internationally because different pitches were used in different places and because a progressive heightening of pitch in the 19th century led to A' as high as 461 Hz in some places. Musical scales are sets of pitches arranged in such a way that they contain a maximum of consonances, where various tones tend to blend pleasingly, and a minumum of dissonances, where they do not. Tuning in 'equal temperament' has held the field in western music for three centuries because, unlike the earlier 'perfect temperament', it makes possible the use of all 24 keys (C major, C minor, C sharp and so on) without retuning. In equal temperament the octave is divided into 12 logarithmically equal steps of frequency, each to a frequency 5.9 per cent greater than the step below. The steps, called semitones, are each divided into 100 further equal steps or cents, and an octave covers 1 200 cents. This method of tuning is imperfect and less accurate than the earlier forms. As Balbour, the eminent American composer and organist wrote, "all players and singers are playing false most of the time . . . these are errors of equal temperament."

Have we an inbuilt tuning system? Training and early exposure to musical stimuli make this question impossible to answer with any assurance. However, we can say that the western musician's internal pitch scale corresponds to equal temperament but with a slight tendency to sharpen all notes relevant to the tonic or keynote; the target pitch for notation is a shade sharper than equal temperament.

Normal Capability

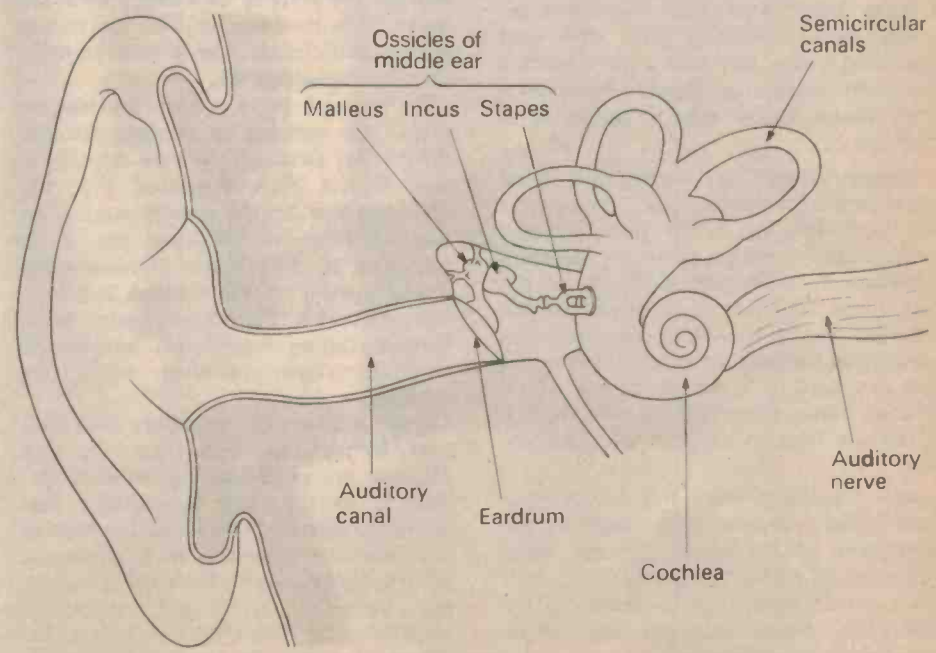
How much of the normal range of frequencies is actually heard depends on the age of the hearer and also on what is meant by 'hearing' a frequency.

Some organ pipes are felt rather than heard.

The figures commonly given are 16 – 20 000 Hz for young people and 20 – 16 000 Hz for adults. Hearing is most sensitive for frequencies between 1000 and 3000 Hz, being much reduced in the extreme lower and higher ranges. People's ability to discriminate in pitch ranges from those who are tune- or tone- deaf to those with absolute pitch sense. Though it is highly developed in some, there is no experimental evidence that they can do better than discriminate between quarter tone intervals consistently. The ability to detect small changes of frequency diminishes sharply above 4000 Hz.

A sense of relative pitch is necessary for hearing or singing a simple tune. Most of us perceive and remember music in terms of changing sequences of notes rather than in orchestral or other pitch vlaues. Absolute or perfect pitch is the ability to name a sounded note or identify its frequency, or to do both this and to sing a given note accurately straight off.

Possessors of absolute pitch appear to have an inbuilt pitch grid against which to measure the incoming sounds. ▶



Sound waves are transmitted via the ear drum and the ossicles of the middle ear to the round window membrane, which sets up pressure changes in the cochlear fluids of the middle ear.

What's this 'ear?

There has been a prolonged debate about whether absolute pitch is innate or acquired, but the present majority view is that both heredity and environment play their parts. Absolute pitch may be the normal manner in which we deal with frequency, but this is trained out of us by our musical environment, which depends on relative pitch. Certainly, absolute pitch can be learned in early childhood, but while pitch perception can be improved in adults by training, no-one has been able to train adolescents and older people who had little original ability in pitch naming. It is likely that highly developed pitch naming almost always derives from reinforcement of a child's behaviour by an adult.

Perfect pitch is an advantage in some aspects of practical musicianship, but it also carries handicaps. For example, a singer has to transpose consciously when a key is changed. Interestingly, all normal people can retain information on absolute pitch for periods ranging from ten seconds to a few minutes, but the information is then discarded.

The Peripheral Analyser

The capacity of the human ear to analyse sound waves is truly remarkable. Perception of musical sounds depends on several factors, including identification of the pitch, duration, intensity and rhythm of a series of tones, and this requires an efficient peripheral analyser of the sound waves produced. Here we are concerned solely with the problem of pitch perception.

Many theories of pitch discrimination have been advanced over the past hundred years, but even now a unified solution escapes us. Current knowledge and views appear to add up to what follows . . .

Sound waves are transmitted from outside via the ear drum and the ossicles of the middle ear to the round window membrane, which sets up pressure changes in the cochlear fluids of the inner ear. The sound receptors of the cochlea are the inner hair cells, disposed along the basilar membrane. These cells are activated by a travelling wave which always passes throughout the membrane from the base to the apex of the cochlea.

The travelling wave has its greatest amplitude at a point determined by the frequency of the sound stimulus. High frequencies cause vibrations in a small part of the base of the cochlear partition; low frequencies set the whole membrane into vibration.

The place where the inner hair cells are activated may well account for the perception of high frequencies, and this idea is supported by the fact that people with disease at the base of the cochlea are deaf to high tones. But this theory does not explain how we perceive low tones, and it has been suggested that low frequencies are represented by the rate of nerve impulses engendered by the stimulus.

The cochlear nerve fibres, which join the ear to the brainstem, cannot carry more than 500 to 600 Hz, and this led to the 'volley' theory. This was that groups of fibres could carry frequency information, so that the stimulus frequency is represented in the combined pattern of nerve impulses produced.

This idea is acceptable in a general sense, but there are objections to it on physiological grounds, especially where frequencies over 3 kHz are concerned. Perhaps the place and frequency patterns in time all play their parts in pitch perception. Harmonics may help in identifying the fundamental lower tones, for if a set of overtones is sounded, without the fundamental, the listener's ear supplies it and he hears it just the same.

Second Mechanism

This first stage of analysis by the basilar membrane is not enough to account for the fine degree of pitch discrimination achieved by the human ear. Studies on the mechanical tuning of the basilar membrane have shown that it acts as a heavily damped, broadly tuned structure; on the other hand, recent recordings of the activity of a single auditory nerve fibre have shown that the tuning here is sufficiently fine to meet psychophysical requirements.

There must be a second mechanism inside the cochlea to account for the differences between the two structures, and it has been suggested that the olivocochlear bundle, which runs from the brainstem to the inner ear, is involved in it. With higher intensities the neural tuning of the cochlea is broad, and it seems that there must be a further tuning mechnaism within the nervous system to deal with loud sounds.

Single auditory neurons have their own best frequencies, but they can also respond to neighbouring frequencies: that is to say, the frequencies that neurons respond to overlap. Looking at how the system works, an arrangement of this type would be essential to ensure the transition from one sound to another that listening to music demands; it would also contribute towards the appreciation of loudness.

Psychophysical studies suggest the frequency selectivity is achieved in man by the equivalent of a bank of overlapping filters, a system that would separate the individual components of a complex signal for analysis. Psychophysical measurements, known as critical bands, have been used to find the effective bandwidths of the human auditory system. It appears that these critical bands range from 200 Hz wide at 1 kHz to 2 kHz wide at 10 kHz.

Such a mechanism could explain why we hear the normal differences in tuning or sounding instruments or voices as the same note or tone. Tonal material that is not relevent to the task on hand is inhibited, a process called tuning or sharpening. The exquisite sensitivity of the human ear is shown by the way in which we can separate simultaneously-heard tones with shared harmonics. So far we have been unable to sort out the mechanisms that produce these psychophysical effects.

A central pitch processor should transform incoming nervous impulses bearing information on pitch into patterns, so that all stimuli of the same periodicity are represented in the same way. This would produce individual sensations for different pitches.

We have already seen the need for an auditory system capable of categorical assessment and of dealing with tones of neighbouring frequency or shared harmonics. The nervous system meets this need in ways we do not understand. The auditory system must integrate stimuli presented to both ears, and its ability to do this is shown by the way harmonic components fed simultaneously into both ears combine so that the subject hears the fundamental.

Conventional neuroanatomical and neurophysiological studies have given little information about central pitch processing, although the complex pathways of hearing in the brainstem have been thoroughly investigated. Auditory nerve fibres from both inner ears stream up the brainstem on both sides after their first relay point in the cochlear nuclei. It appears that these fibres relay at four or more points in the brainstem nuclei before they reach the auditory cortex of the brain.

The final relay is in the thalmus, and from it auditory information flows to the auditory cortex. Apart from the complexity of the nuclei and linking tracts, investigations are made difficult because if anaesthetics are used, then evoked auditory responses in man and experimental animals are not normal, but, of course, more of these abnormal responses are obtained under anaesthesia. than otherwise.

EMONA *enterprises*

ROOM 208/661 GEORGE ST, SYDNEY.
PH: 212-4815, 211-3038

P.O. Box 188, COOGEE. NSW. 2034.

FOR PROMPT MAIL ORDER SERVICE!

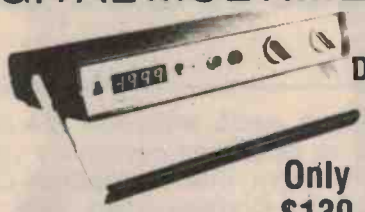
sinclair DIGITAL MULTIMETERS

Exclusive Sinclair 12 months guarantee!

PDM35
Only $55
(plus 15 percent S/T.)

Now everyone can afford to own a digital multimeter

A digital multimeter used to mean an expensive, bulky piece of equipment. The Sinclair PDM35 changes that. It's got all the functions and features you want in a digital multimeter, yet they're neatly packaged in a rugged but light pocket-sized case, ready to go anywhere. **Features:** 3½ digit resolution reading to plus/minus 1999. Automatic polarity selection. 10M ohm input impedance. Full multimeter facilities. Resolution of 1mV and 0.1nA. Semiconductor junction test facility. 1 percent of reading accuracy. Genuine pocket format. **Ranges:** DC volts; 1mV to 1000V. AC volts: 1V to 500V. DC current; 1nA to 200mA. Resistance; 1 ohm to 20M ohms. **Contents:** PDM35; test leads with probes; owner's operating manual — protective carrying pouch. **Power Requirements:** 9 volt transistor radio battery or 9 volt approved AC adaptor.



DM235
Only $130
(plus 15 percent sales tax)

Features:

• 3½ digit resolution • Large, bright, wide angle LED display reading to ± 1999 • Automatic polarity selection • Industry standard 10M ohms input impedance • 0.5 percent of reading basic accuracy • Full multimeter facilities including AC current • Resistance measurement up to 20M ohms. • Direct reading of semi-conductor forward voltages at 5 different currents • Simple, unambiguous controls with readings always in volts, mA or k ohms. • Selection of all functions from a single input terminal pair • Automatic overrange indication • Automatic decimal point placement • Operation from disposable or rechargeable cells, or from AC adapter/charger • Facility for battery condition test.

INTRODUCING THE

SINCLAIR DM350

Introductory price only

$190 Plus 15 percent S/T.

Features:

The DM350 is a laboratory quality digital multimeter. The large LED display has an exceptionally wide viewing angle and a variable brightness control. Measures AC volts, DC volts, AC current, DC current, resistance and diode volts in a total of 34 ranges. Special features include ultra wide current handling from 1uA up to 10 amps, and very high input impedance on the 2000mV range (in excess of 1000 M ohm). The DM350 will operate from low cost disposable cells or from an optional AC adaptor. This adaptor also serves as a charger when the rechargeable battery pack is fitted.

SINCLAIR PRODUCTS also available in: NEWCASTLE Martin de Launay Pty. Ltd. King & Darby Sts. Tel: (049) 2-4741 CANBERRA: ORANGE: WOLLONGONG:

COMMUNICATION RECEIVERS

YAESU FRG-7000
General Coverage Receiver
Only $595

• Triple-conversion superhet receiver • All solid state • Digital frequency display p 24 hour digital clock for local and GMT • Receives 0.25 MHz to 29.9 MHz • Built-in AC power supply • Plug-in circuit boards.

FRG-7
General Coverage Communications RX
Only $315

DR-48
NEW AM-SSB-FM Digital Communications Receiver
Only $476

CALCULATORS

SINCLAIR Enterprise — Programmable!

• Real computing power.
• A comprehensive program library: General, Finance, Statistics, Mathematics, Physics, Engineering and Electronics.
(For more details see Sept. '78 ETI)

Excl. S/Tax **$69.50** Inc. S/Tax **$79.95**

TEXAS INSTRUMENTS

	Excl. S. Tax	Incl. S. Tax
T.I.-25	$32.00	$35.00
T.I.-30 Student Pack	23.00	25.00
S.R.-40	28.00	32.00
T.I.-50	36.00	40.00
T.I.-55	53.00	59.00
T.I.-57	74.00	85.10
T.I.-58	109.00	120.50
T.I.-59	247.00	275.00
T.I.-5050M	81.00	90.00
Little Professor	16.00	17.90
Data Man	23.00	25.00
T.I. First watch	20.00	22.00
T.I. Speak and Spell	45.00	50.00
T.I. Spelling Bee	28.00	31.00
T.I.-Business Analyst	33.00	37.95
T.I.-Business Analyst 11	39.50	43.00
T.I.-MBA	75.00	87.40
T. I. Programmer	53.00	59.00
T.I.-MM Money Manager	21.00	23.50
PC-100A Printer	213.00	236.00
T.I. 5025 H/held printer	77.00	85.00
Library Modules for T.I.-58/59	31.00	35.00
Blank Mag. Cards for T.I.-59	14.00	16.10
Programming Forms — Pads	2.20	2.80
TP-30250 (3 rolls of paper, PC100A)	10.00	11.50

	Excl. S/T	Incl. S/T
NS-108	$40.00	$46.00
NS-100A	$16.95	$19.50
Raymax Minicard	$25.22	$29.00

NEW WORLD TIME CLOCK

EMONA 103A
$75
12-month guarantee

Battery operated. One 1.5V operates the clock for one year. Aluminium dial, cross brushed, silver plated. Crystal-clear heavy acrylic case. Size: 19cm x 21cm.

BUSINESS MACHINES

• **CORONA AD7802** — Auto Telephone Dialler — **$325** (incl. S/T)

• **BIE JOTTO 10 & STENO 30** — Mini cassette recorder & transcriber complete with h/phones & foot switch Package deal special — **$199** (incl. S/T)

• **BMC 1212PD** — 12 digit, green display & printer — **$125** (incl. S/T)

WATCHES: Digital and Quartz Analogue.

NOTE: P&P for all goods: NSW $2, Interstate $3 (up to $50 value). NSW $3, Interstate $4 (up to $100 value). Goods valued over $100 delivered by carrier — freight paid by receiver.

To: EMONA ENTERPRISES
PO Box 188, Coogee, NSW. 2034.

Please send me .....

I am enclosing cheque ☐ money order ☐

or debit my Bankcard, Number .....

Signature .....

Name .....

Address .....

P/code .....

WRITE OR PHONE FOR FURTHER DETAILS. TRADE ENQUIRIES WELCOME

Amplifiers and Transient Intermodulation Distortion

These days, total harmonic distortion (THD) in audio amplifiers is a parameter of minor importance – rendered so by design techniques developed over many years. What occupies the thoughts of audiophiles these days is Transient Intermodulation Distortion (TID or TIM) – a dynamic performance characteristic. Correspondent Wally Parsons discusses traditional design techniques and the modern approach to reducing TID.

WE KNEW ABOUT Transient Intermodulation Distortion in the '50.s – but we didn't call it that. Fortunately our technology was in some respects too advanced, and in others too primitive for the phenomenon to occur very often!

Valves in use then could handle high voltage outputs – so there was no excuse for an amplifier whose early stages overloaded. At the same time, the use of output transformers, good as many of them were, rendered absurd the idea of 40-60 dB feedback. A great deal of attention went into designing high performance into *each* amplifier stage, and into developing stabilizing feedback circuits – techniques still used in transistor amplifiers today.

Distortion

The transistor eliminated some problems (mostly those caused by the output transformers) but brought others of its own.

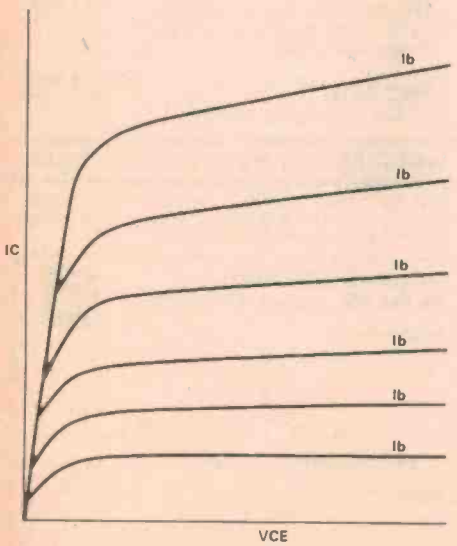


Fig. 1. Non-linear characteristics of a typical bi-polar transistor. Non-linearity causes large amounts of harmonic distortion.

The first and greatest of these is distortion. The bipolar transistor is inherently non-linear: (Fig 1.) put a signal in and out comes the original signal plus lots of harmonics. Plus intermodulation products of all these signals. Very dirty. Secondly, the transistor is very sensitive to changes in operating conditions: small shifts result in major changes in linearity, and temperature changes affect even its fundamental characteristics.

Capacitance Effects

In its simplest form, the bipolar transistor is a sandwich of three pieces of semiconductor. The centre piece is of opposite "polarity" to the outers, and acts as the control device. Application of voltages to these three pieces produces a charged region on either side of each junction. This charge behaves like a capacitance. Thus a transistor in a circuit looks like a complex circuit which includes capacitance between the electrodes (fig 2). Since a capacitor takes finite time to charge and discharge, a time delay occurs between the application of a signal to the input and its appearance at the output. If the signal is ac, the time delay is manifest as a phase delay which increases with frequency, reaching a maximum of 90°, and producing an attenuation of 6 dB per octave (Fig 3, Ref 1).

There is a very simple solution to the first problem of distortion, until we run afoul of the capacitance effects, which seems easy enough to overcome. Therein lies the trap.

Standard Design Practices

The obvious solution to the problems of non-linearity and unstable operating characteristics is negative feedback, right? Where we run into trouble is in what is called "phase margin". Remember the capacitances associated with *each* transistor in the circuit? Each produces a phase shift of 90°. At some frequency the phase will have shifted by 180° or more. This, combined with the 180° phase reversal in the negative feedback loop results in the feedback being 360° "out of phase" with the input. In other words, the feedback is positive.

If the loop gain . . . . . that is, the product of the forward gain of the amplifier, (which is usually less than one . . . . is greater than unity, we have an oscillator instead of an amplifier!

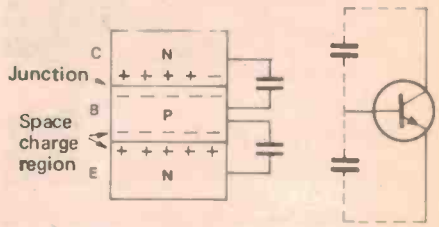


Fig. 2. Capacitance occurs across transistor junctions.

Even if this condition does not occur, but phase is *almost* 360° and/or gain is close to unity, there will be a rise in response, and ringing. Since the capacitances producing phase shift also produce a roll-off in high-frequency response, it is quite possible and desirable, to control both characteristics so that this condition doesn't occur.

This usually means putting additional lump capacitance somewhere within the loop to roll off response and bring it below unity at the 180° shift frequency. This works because attenuation occurs at a continuous rate of 6 dB/octave, but phase shift cannot exceed 90° for a single pole.

There is one major and several minor flaws with this arrangement.

Feedback Variation

If the forward gain of an amplifier is reduced, while the feedback factor (i.e: the fraction of the output signal which is fed back) remains constant,

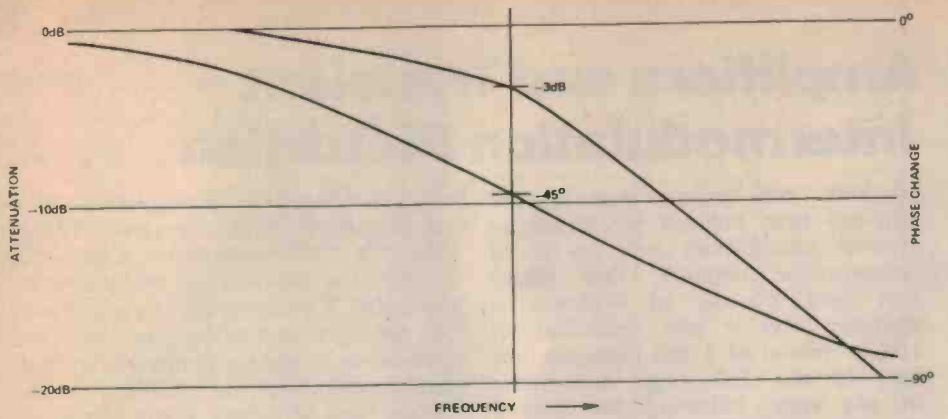


Fig. 3. Graph showing phase change and attenuation, resulting from junction capacitance, plotted against frequency.

it can be shown that the loop gains is reduced by an amount equal to the product of the forward gain reduction and the feedback factor, so that overall gain is almost unchanged. *But the actual amount of feedback is considerably reduced.*

You might say that feedback has been used up in flattening response. As a result, less feedback is available for other things, including *cleaning up distortion.* Remember, feedback does nothing unless it is actually applied. The importance of this apparently obvious fact will shortly become clear.

Figure 4 shows how negative feedback reduces distortion and flattens frequency response. A signal applied to the input really consists of an infinite series of changes in input voltage level. An instantaneous change in input is amplified and appears at the output at a larger magnitude than the input.

Suppose that an input change V, appears at the input and is amplified by a factor, A. If the next incremental change is represented as V+1 then the output should equal (V+1)x A. If a fraction of the output is fed back out of phase with the input, the input level will be reduced by an amount proportional to the signal fed back. But suppose that for a change in input of V+1, the gain of the amplifier was some other value than A, while for input V it remained A. The result is a different input/output ratio and a different ratio of input to feedback. The effective input level change now differs from the applied input.

The result is an input waveform distortion opposite to that produced by the amplifier. Since this now passes through the distorting amplifier the distortion component is cancelled out by an amount dependent on the amount of feedback.

Similarly, if gain remains constant throughout the waveform, but changes with frequency, the amount of signal available for feedback purposes changes and the effective input level changes in a complementary fashion.

Limitations

The greater the amount of feedback applied, the greater the correction of any deviations from linearity. Therefore it would appear that forward linearity, i.e. distortion and frequency response, needn't concern us too much because we can always use buckets of feedback to clean things up.

Much conventional design work seems to proceed along these lines, with impressive specifications — but poor performance as the result!

Phase Effects

Each capacitance in the circuit introduces a roll-off of 6 dB/octave, and a phase shift which is almost 90° at the point where response is down 20 dB. Two such poles introduce almost 180° and three introduce almost 270°. At some frequency there will be a shift of exactly 180° and if we feed back enough signal the amplifier will oscillate at that frequency (fig 5).

The usual remedy is to lower the turnover frequency of one of the poles by introducing *additional* capacitance in the circuit. This changes the amplitude/phase characteristic, and if done properly allows even greater feedback to be applied. But there is still a limit. Unfortunately, this roll-off often occurs within or just above the audio band.

The trouble is, that the actual feedback is reduced as frequency rises. But most transistors, especially power devices, show an *increase* in distortion with rising frequency. In addition, class B amplifiers show a rise in distortion as level is reduced. The only solution is to use whopping amounts of feedback in order to get acceptable performance at high frequencies. This also produces very impressive specs in the mid-range (which some manufacturers emphasise in their advertising). And this is where the fun and games really begin.

Overload

Suppose such an amplifier were driven with a continuous tone sufficient to drive it to full output at, say 1 kHz; distortion somewhere around .001% Suppose, further, that this was achieved with 60 dB feedback, a high figure and pretty impressive, one suggesting an open loop distortion of 1% (pretty low). Finally, suppose that full output is achieved with an input of 1 volt. This represents a gain reduction due to feedback of 1000/1, reducing the 1 volt to 1 mV. What do you suppose would happen if we removed the feedback loop without changing the input signal?

Well, now with the full 1 volt applied we have an overload factor of 1000. Anybody for distortion? — because that's about all that will come out.

Now, let's shift frequency to ▶

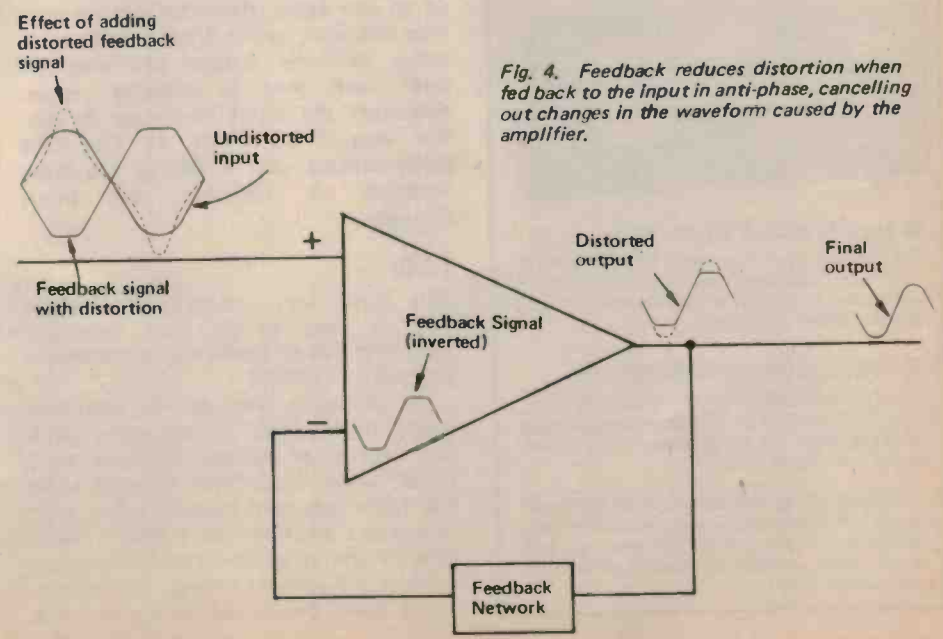
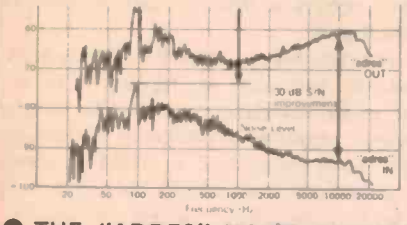


Fig. 4. Feedback reduces distortion when fed back to the input in anti-phase, cancelling out changes in the waveform caused by the amplifier.

NEXT MONTH in ETI

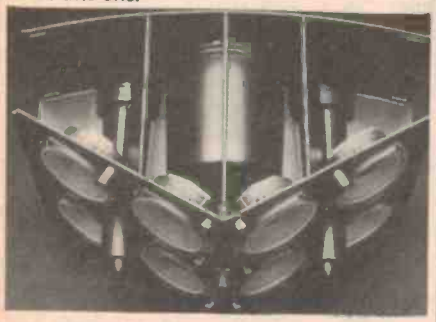


● THE "ADRES" NOISE REDUCTION SYSTEM.

Claimed to rival the Dolby system — we examine the technique in depth.

● TOSHIBA'S ADRES CASSETTE DECK REVIEWED.

Our Audio Consultant, Louis Challis, has tested the first piece of equipment to include this noise reduction system — don't miss this one.



● LOOKING AT LOUDSPEAKERS.

A guided tour through the Loudspeaker 'jungle'.

● SHORTWAVE RECEIVER

We review the Standard C6500 general coverage receiver, designed for those interested in joining the upsurge in interest on shortwave listening.

● STEREO PREAMP TO BUILD

This superb project matches our 60 watt, low TID module in this issue and permits the construction of a magnificent stereo amplifier. Don't miss it!

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

Amplifiers and Transient Intermodulation Distortion

10 kHz, and assume that forward gain has been reduced by 20 dB by internal capacitances and the phase compensation network. That means that only 40 dB of feedback is available, and a gain reduction of 100/1. Instead of 1 mV input we now have 10 mV. This might not matter at any stage following the stage(s) at which roll-off occurs, but every previous stage must be capable of handling a signal level ten times the magnitude imposed at 1 kHz. If it can't, then distortion will be introduced in these early stages. These distortion components will be passed on to the output stages at high level, possibly a higher level than they can handle without generating their own distortion and overheating.

Shifting Operating Points

We cannot assume that an input waveform, or the waveform which results from distortion is symmetrical. If it is not, then it can be shown that such a waveform contains a dc component, the presence of which shifts the operating point of the stage to which it is applied. Since such waveforms occur naturally, any good amplifier must be capable of coping with them, but if distortion adds an additional component we have another source of distortion.

High feedback amplifiers generally show low levels of distortion up to the clipping point, at which point the onset of distortion is sudden and severe. This should come as no surprise. When a waveform is presented to any stage, its instantaneous level may continue to rise from zero to peak value, and the output will also rise until such time as clipping occurs. Although the input continues to rise, the output does not. In fact, the instantaneous gain is *falling*. No more feedback is available and input *increases*.

T.I.D.

This is all very interesting but what does it have to do with Transient Intermodulation Distortion or whatever you want to call it?

So far we've been dealing with sine waves or (at least) simple waveforms. Let's see what happens if we apply a signal whose wave-front shows a rapid rise from zero to maximum value, such as a sharp transient, or a square wave. One of the characteristics of a square wave is the sudden change in instantaneous level. The other is the fact that it is produced by the presence of a large number of odd harmonics. This is also true of the wave-front of a transient.

Not too far back we saw that if an amplifier is designed with large amounts of feedback and heavy phase compensation, especially lag compensation, high frequency distortion is likely to be fairly high. Moreover, if the compensation roll-off occurs at a late stage there is a good possibility of overloading early stages.

This is only the start of our problems. Reference was made to lag compensation. This is so-called because output phase lags input. Phase lag means phase delay which also means time delay. A delay of 90° at 5 kHz represents a time delay of 1/20000 second. This is the amount of delay between the time the signal is applied to the input and its appearance at the output. This delay applies to *all* parts of the waveform. It also means that, for this period of time *no feedback of any kind* is applied to the input. In the amplifier described earlier, enormous distortion levels will occur due to overload unless the internal stages can handle this increase in input level. This might not be too much of a problem with simple wave-forms because some feedback will have appeared before the peak is reached. But the transient or square wave may have components at frequencies ten times the fundamental, and *they will* reach their peak before feedback is applied.

As if this weren't enough, should the overload cause major shifts in the operating conditions of any stages, high internal distortions can be generated even after feedback has been applied. In Fig. 6 we see a square wave with a much higher frequency superimposed. Notice how part of the higher frequency signal has been eliminated due to overload caused by the lower frequency.

Solutions

One outstanding characteristic of any amplifier exhibiting low T.I.M. must obviously be very wide frequency response. Moreover, it will exhibit wide response even without feedback. Therefore, such an amplifier will have very little phase compensation, and that which is used will be of the lead variety, producing a forward shift (2). It will also exhibit this wide response at full power. This in turn results in a high slew rate, that is,

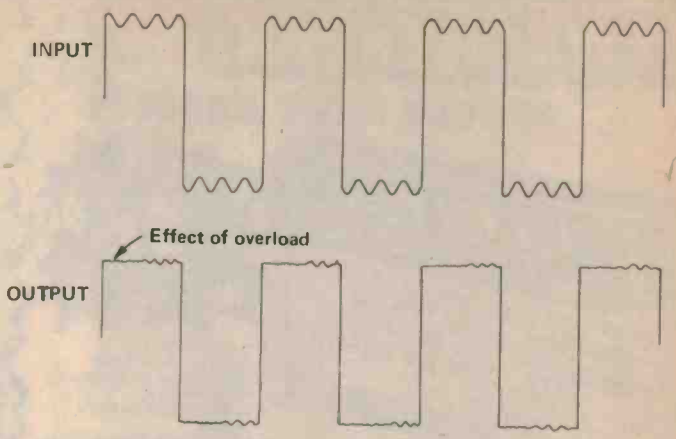


Fig. 5. Overload caused by the lower frequency square wave signal results in any higher frequency information being lost.

the rate at which a change in instantaneous input level will be tracked at the output. The wide open loop response implies the use of relatively small amounts of feedback. To do this, and still achieve low steady state distortion levels, requires that each stage be designed for low distortion, which means the use of very linear devices combined with local loop feedback, to produce low open loop distortion so that low overall feedback levels are required to obtain a respectable figure.

One more requirement: we cannot eliminate phase shift and high frequency roll-off completely, we can only minimize them. Therefore, to avoid overload in any stage, each stage must have a band-width equal to or greater than the one preceding it. This even applies to the input. If necessary, the input signal should be filtered to prevent an input rise which exceeds the amplifier's ability to track. We can only apply local feedback to an output stage if it operates in class A, or is a compound such as a Darlington. If no local feedback is available during part of a cycle, and since any really practical and useful feedback network would have to include the driver which, in turn, normally operates class A, the amount of distortion generated during a portion of the cycle would be considerable. This leaves only the voltage amplification stages, and since feedback increases bandwidth, then either some degree of roll-off must go, and/or we must aim for a very high f_t in the output stages. Practical designs usually employ series emitter resistors in these stages — sometimes with compensation.

• **See our 60 watt, low TID amplifier module project on page 45.**

REFERENCES

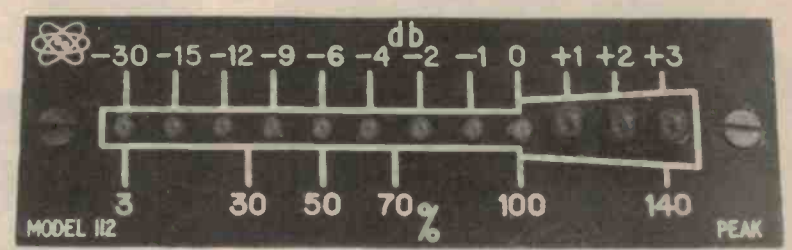
1. *"V-FETs for Everyone", W Parsons, ETI January 1978.*
2. *"An Audio Amplifier for Ultimate Quality Requirements", Lohstroh and Otala, IEEE Transactions on Audio and Electro-Acoustics Vol AU-21, No.6.*

Professional Audio Products

Peak Programme Meter 112

The advent of audio level measuring meters with opto-electronic indication has radically changed the art of peak level monitoring. Studio Electronics has recently developed a versatile meter which displays the amplitude of sound signals by means of a column of light-emitting diodes, this secures level recognition above 100 per cent due to vivid colour change to intensive red and lowest possible eye fatigue with this novel indication principle. **MODEL 112** will for the first time offer a low priced instrument for accurate monitoring of programme levels in recording and broadcasting.

PRICE $58.00



TECHNICAL DATA

Supply voltage	plus/minus 15V dc
Standard scale	minus 30dB to plus 3dB, black, horizontal
Input impedance	greater than 10k ohms
Frequency response	30Hz to 16kHz, plus/minus 0.5dB
Return time	1.5 sec/20dB
Reference level (for "0" indication)	0.775V (adjustable)
Dimensions (mm)	100 x 30 x 60

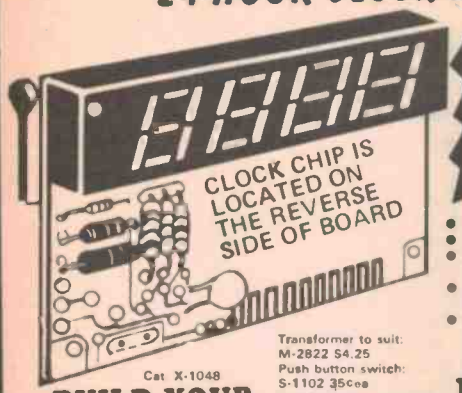
Designed and manufactured in Australia by:

studio electronics pty ltd

PO Box 1055, Burwood North, 2134. Australia.
Phone: (02) 747-5686.
Cable: STUDIOTRON, Sydney.

NEW LOWER PRICE

24 HOUR CLOCK MODULE



4 DIGIT **$6.90** WAS $13.50

- 0.5" HIGH LED
- BUILT-IN RED FILTER
- MM5386 24 HOUR MULTI-FUNCTION CHIP
- COMPLETE WITH DATA SHEET.
- REQUIRES ONLY 6 FUNCTION SWITCHES FOR ITEMS LIKE ALARM DISPLAY, SECONDS DISPLAY, RADIO OUTPUT etc

Cat X-1048

BUILD YOUR OWN CLOCK

Transformer to suit: M-2822 $4.25
Push button switch: S-1102 35c ea
Toggle switch: S-1173 $1.20
P&P all items $1.00

DIRECT IMPORT

ZAPP!! ZAPP!! ZIPPY BOX TIME

- Very tough ● Moulded corner posts take self tappers ● Complete with covers ● 4 different sizes ● Ideal for projects

150x90x60mm H-2751 **$2.50**
196x113x60mm H-2752 **$3.75**
130x68x41mm H-2753 **$1.95**
83x54x28mm H-2755 **$1.50**

SUPER VALUE BARGAINS

$49.50

SPRAYS FOR ALL!!

- Dick Smith FREON ● The complete cleaner ● Degreaser ● Moisture removing ● Use on most cleaning jobs e.g. jewellery, cameras, electronic circuits etc.

N-1051 **$3.00**

- Dick Smith ACRYLIC spray ● Ideal for protecting front panels, lettering, chrome, etc. ● Gives weatherproof finish, use it on outside TV antenna terminals for example.

N-1011 **$2.25**

RACK MOUNTING BOX

TOP VALUE

- Fits standard 19" rack ● Comes as a flat pack ready to assemble ● Heavy guage chassis ● Front panel has heavy chromed handles ● Professional quality ● Has hundreds of uses. H-2480

RESISTOR AND CAPACITOR PACKS

SPECIAL SAVE

ONLY $5.90 R-7010

- 300 Resistors ● 60 values ● ¼ watt ● 5% tolerance ● LESS THAN 2c EACH ● Stock up your depleted resistors today!

ONLY $6.50 R-7030

- 55 Quality Electrolytics ● Single ended ● Contains most used values ● SAVE $10.00 (approx.) on normal 1 off purchase price ● Top value

ONLY $6.50 R-7040

- 60 Greencaps ● 100V ● 10% tolerance ● No weird values - all useable.

ONLY $4.50 R-7050

- 60 Ceramic Disc Capacitors ● None less than 50VW many at 630VW ● Common values.

ONLY $4.75 R-7060

- 50 Tag Tantalums ● High Grade ● Varied voltage values ● Common capacitances in a small package ● Ideal for many projects.

YES! We do stock the normal AC items that every home needs.

● 3 Pin Plug	P-5400	55c
● 3 Pin Side Entry Plug	P-5402	60c
● 3 Pin Plug Piggy Back	P-5405	95c
● 3 Pin Line Socket	P-5410	$1.15
● 3 Pin Surface Socket	P-5415	80c
● Plastic Child Proof Plug	P-5420	30c
● 3 Pin Suppressor Plug	P-5425	$3.40
● Double Adapter	P-5440	$1.10
● Socket Line Type	P-5510	70c
● Inline 240V Switch	P-5515	$1.85
● Wall Board Clip	P-5530	30c
● Double Outlet & TV Socket	P-5540	$6.50
● Outlet With Safety Shutter	P-5550	$2.40
● Double Outlet	P-5560	$4.40
● Architrave Switch	P-5570	$1.20
● Delay Switch	P-5580	$5.40
● Extension Cord 3 Metres	P-5590	$2.85
● 10 Metre Cord Extension Reeler	P-5600	$12.00
● Powerpack - 4 Power Outlets	P-5610	$16.50

TV STUNT CYCLE GAME KIT

- Superb value ● Superb fun ● Easy to build ● Every TV should have one!!

$29.50

SAVE K-3474 $3.00

DESIGN BREAD-BOARD

- Design breadboard ● .1" spacings ● size of board 80x127mm ● ideal for project designers ● accepts 8, 14, 16, 24, 28, 36, and 40 pin DIL ● over 500 holes ● in-built bus bars

$1.90 H-5606

HEADPHONE MIC BOOM SET

$29.50

- Ideal for mobile use ● CB'ers should use this ● Use with virtually any transceiver ● All cable & speaker plug but no mic. plug supplied. C-1120

FANTASTIC

POP RIVETER

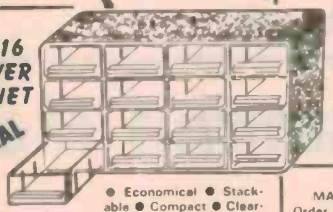
- Very versatile ● 4 hardened heads ● Quality tool.

$17.50 T-5665.

RIVETS: 3mm dia., 3mm grip T-5670 $2.10
3mm dia., 6.5mm grip T-5680 $2.30

12 & 16 DRAWER CABINET

SPECIAL



- Economical ● Stackable ● Compact ● Clear-view drawers ● 12 & 16 drawer units measure overall 300(W)x180(H)x140(D)mm.

H-2586 12 unit **$11.95**
H-2588 16 unit **$13.50**

STACKABLE

40 PIECE SOCKET SET

$16.50 T-4670

- Both inch and metric sizes
- Quality drop forged steel
- All you need for car repairs etc.

NIBBLING TOOL

- Cut any shape opening ● Steel up to 0.6mm thick ● Light alloy 1.5mm thick ● Curved or straight lines.

T-4940 **$12.50**

VIBROSCOPE

- Etches into metal ● Operates on 2.5 to 6.3v AC or DC ● No skill required ● Use it like a pencil.

T-1710 **$19.50**

FANTASTIC

MAIL ORDER P&P

Order Value	P&P
$5 - $9.99	$1.00
$10 - $24.99	$2.00
$25 - $49.99	$3.00
$50 - $99.99	$4.00
$100 or more	$4.50

HIGH EFFICIENCY HEAT SINK

- Thick base ● Radial fan design dissipates masses of heat ● Ideal for projects ● Available in two lengths

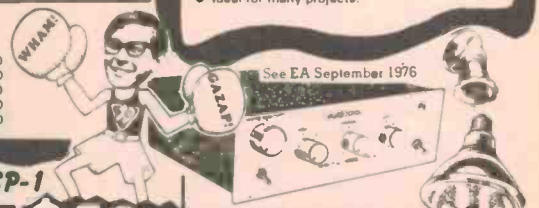
75mm H-3422 **$3.00**
225mm H-3426 **$8.50**

LOGIC TRAINER SPECIAL

This superb Logic Trainer Kit is now available in short form (i.e. without case) at a very special price. All you have to do is provide your own box and we will provide you with a fantastic saving.

100 Kits Only! K-3010

SPECIAL $10 OFF NOW ONLY $69 EA!!



See EA September 1976

WELLER TCP-1 HEAT AT YOUR FINGERTIPS

$58.50

- Temperature controlled ● Complete system with bench transformer/stand in modern design ● Wiping station for tips ● Change iron temperature by using different tips ● Silicon rubber non-burn cord ● Removable plug for safety.

IDEAL FOR THE SERVICEMAN, HOBBYIST, MODEL MAKER

T-1000

MUSICOLOR KIT

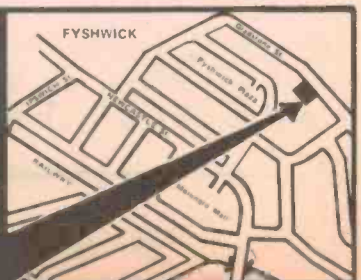
- Easy to build ● 16 page and construction manual ● Connects to your amplifier speaker output ● 3 channels for 3 colours ● Lights pulse to the frequency of your music.
- Lampholder screw mounts to your wall ● Base swivels ● 3 colours available in the 100 watt floods - Red, Yellow and Blue.

Musicolor Kit K-3140 **$65.00**
Lampholder P-5620 **$3.50**
100 watt floods
Yellow S-3850
Red S-3852
Blue S-3854
ALL $7.95

IT'S DISCO TIME WITH THE MUSICOLOR

NOW OPEN IN CANBERRA

YES! Dick now has a store located in the nations capital. Over 250,000 lucky people now have the chance to shop at Dick's new store! Located at 96 - 98 Gladstone Street, Fyshwick — Why not pop in and meet the manager - Owen Jones and his staff for fast and efficient service.



SOON TO OPEN IN PERTH

REAR WINDSCREEN WIPER KIT

SPECIAL IMPORT

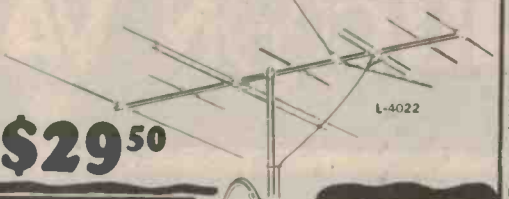
$39.95

A-8505

For the driver who requires good rear vision, without having to peer through dirty windows. A simple to install kit complete with all wiring and a switch plus complete instructions and a full scale plan. Works on all 12V DC vehicles and features AUTO PARK when turned off. Ideal for boats using 12V DC system - keeps the salt off the windows. If safety is your main concern then you NEED this rear windscreen wiper kit.

DICK'S OWN "GOLDEN ROD" TV ANTENNA

A maximum gain antenna on channels 0-2-7-9 and 10. If you live in the metropolitan area or even a fringe area, then this is the antenna for you - it will give excellent results. Antenna termination impedance 300 ohms. Complete with pole mounting bracket and GOLD ANODISED for long life from the 'elements'.



L-4022

TOP PERFORMER **$29.50**

WAS $49.95 SAVE $10 ONLY **$39.95**

A-4050

MINI CASSETTE RECORDER

● High quality sound ● Uses standard cassettes ● Push button control ● Can be held and used in one hand ● Uses 4 standard penlight batteries, not supplied (Cat. S-3001 @ 15¢ea) ● Ideal for students, lawyers, business men, in fact any person requiring a small personal cassette recorder

WATCH THIS SPACE

AND FIND OUT WHAT YOU MISSED

Each month all of our stores feature an outstanding special which is actually BELOW COST! N.B. Specials are strictly while store stocks last. Don't miss out!

LAST MONTH:

LIGHT DIMMER

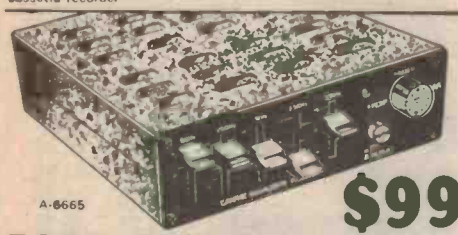
Was $6.90 — now $4.20

SAVING $2.70

L-5090

SIMPLE CAR PROTECTION **$49.50**

● 12V DC negative earth cars ● Senses current drops to sound alarm ● Siren horn with alarm module built onto the back ● Install the alrm in your boot or engine compartment ● Very simple installation ● Special connection for protection of CB or stereo units ● Recommended quality product from Dick



A-6665

$99

BOOST THE POWER — CONTROL THE TONE

A car stereo booster/equalizer

● 25 PLUS 25 watts stereo booster/graphic equalizer ● Provision for four speakers with fader control in-built ● Has 5 frequency controls - makes you the controller of your in car sound ● Use with 12V DC negative earth vehicles ● Simply connect to your existing stereo car system ● Put your living room sound right there in your car!!

DYNAMIC CARDIOID MIC

● Professional quality ● Complete with 7m cord and standard Cannon plug ● Heavy cast construction ● 50k impedance ● Weight 350 gram ● 50mm (dia) x 170mm (l) ● Response 50-15000Hz

C-1050

$49.50

'SHOTGUN' ELECTRET MIC.

● Highly directional - use it like a rifle ● Complete with windshield & 6m cord ● Use it to record plays (from the back stalls), nature, conversations etc. ● Impedance 600 ohms ● Response 40-18000Hz.

C-1069

AVAILABLE LATE MAY

$59.50

5 YEAR WARRANTY ON TRANSISTORS!!!

Yes, thats right. We have arranged for a large US owned manufacturer to produce high quality transistors with LOWER NOISE figures than the original European specs. Standard TO-92 case PLUS lead terminations clearly marked.

PLUS - PLUS A FIVE YEAR WARRANTY (if used within specs.)

DS547	Z-1300	25¢
DS548	Z-1308	25¢
DS549	Z-1319	27¢
DS557	Z-1340	33¢
DS558	Z-1348	33¢

BUY IN BULK AND SAVE!!

TRANSISTOR SPECIAL

TOP POWER

BOOST CAR STEREO SOUND

● 30 watts maximum power to each channel ● Easily connected to your car stereo ● Huge heatsinks for heat dissipation ● Works on any 12V DC negative earth car ● Small size 118(W)x40(H)x165(D)mm ● Contains 4 IC's - all solid state.

ONLY **$49.95**

A-6660

SEND FOR OUR FREE COLOUR KIT CATALOGUE

VISITING THE EAST?

Dick's new Hong Kong store is NOW OPEN! Duty free prices plus AUSTRALIAN Guarantees. Send for your FREE duty free buyers guide!

PARTS FOR NEW KITS

INTERSIL LCD EVALUATION KIT (See Feb EA)

As used in the EA digital voltmeter	Cat. K-3450 $39.50

WHISTLE FILTER (See Feb EA)

Complete kit, including instructions	Cat. K-3496 $19.75

6 DIGIT CLOCK (See Feb EA)

Complete kit, including instructions	Cat. K-3495 $19.75
Case with mounting bracket and bezel	Cat. H-3194 $3.60
AC Mains adaptor	Cat. M-9514 $5.95

PLAYMASTER AM/FM TUNER (See Nov/Dec EA)

Complete kit, including instructions	Cat. K-3494 $129.50
SEPARATE PARTS	
Pre-wired and aligned tuner module	Cat. F-4610 $59.00
Set of 4 PC boards	Cat. H-8357 $9.75
Signal strength meter	Cat. Q-2100 $4.95
Tuning meter - centre zero	Cat. Q-2095 $4.95

Most other electronic parts for this project in stock

MODEL TRAIN CONTROLLER (See Oct EA)

Not produced as a kit - all parts available from stock

PCB only	Cat. H-8355 $3.75
Zippy box	Cat. H-2752 $3.75
2N3055 transistor	Cat. Z-2145 $0.95
2N3053 transistor	Cat. Z-2130 $0.80

FET INPUT AC-DC VOLTMETER (See Sept EA)

Not produced as a kit - all parts available from stock

PC board only	Cat. H-8353 $2.75
1mA MRA-658 panel meter	Cat. Q-2060 $12.50
Fabricate your own meter scale using Scotchcal 8005 black Scotchcal photo-sensitive aluminium	Cat. H-5694 $6.00
CA-3140 FET op-amp	Cat. Z-5417 $2.50

VARI WIPER Mk2 (See Sept EA)

Not produced as a kit - most parts available from stock

Relay	Cat. S-7125 $4.80
C106Y1 SCR	Cat. Z-4315 $1.00
2N2646 (DS2646) unijunction	Cat. Z-1786 $1.20

UPGRADED 40/200MHz FREQUENCY COUNTER (See Aug EA)

Same as previous kit but new circuitry means it is easier to build, set up and is more sensitive. Basic counter is 40MHz — by adding a single 95H90 IC the range is extended to 200MHz

Complete kit for 40MHz, including instructions	Cat. K-3437 $99.50
96H90 IC to extend range to 200MHz	Cat. Z-5360 $12.50
SEPARATE PARTS	
PC boards (set of two high quality boards)	Cat. H-8346 $8.50
MC-10116 IC (triple differential amplifier)	Cat. Z-5415 $1.95
MM-5369M IC (oscillator - divider)	Cat. Z-5781 $2.50
74C926 IC (4 digit counter)	Cat. Z-5414 $6.50
3.579545MHz crystal	Cat. K-6031 $3.00
LT-303 7 segment display	Cat. Z-4103 $1.50

All other components are normal stock lines at all of our stores.

PHOTO TACHOMETER (See Aug EA)

Although we do not produce a full kit for this project, all parts are normal stock lines:

PCB (only)	Cat. H-8352 $1.80
FPT 100 phototransistor	Cat. Z-1950 $2.00

PLAYMASTER STEREO EQUALIZER (See EA May)

Complete kit including instructions	Cat. K-3500 $99.50
UA4136 Quad Op Amp	Cat. Z-6105 $1.95
PC Boards (set of 3 high quality boards)	Cat. H-8360 $12.95

MAJOR DICK SMITH RESELLERS

Listed below are the names and addresses of resellers who stock a large range of our products, however we cannot guarantee that they will have all items in stock and at the prices advertised.

Aero Electronics,
123A Bathurst St, Hobart, Tasmania Ph. 348232
Brian Bambach Electronics,
68, William St, Gosford, NSW Ph. 247246
Coastal Electronics,
Unit 11, Commercial Centre, Ford St, Moruya, NSW Ph. 742545
Crystal TV Rentals Pty. Ltd.,
66 Crystal St, Broken Hill, NSW Ph. 6897
Elektron 2000,
44 Brown Rd, Broadmeadow, Newcastle NSW Ph. 691222
Hutchesson's Communications,
8 Elizabeth St, Mt. Gambier, SA Ph. 256404
Keller Electronics,
218 Adelaide St, Maryborough, Q'ld Ph. 214559
Lismore Kitronics,
Cnr. Magellan St. & Bruxner Hwy, Lismore, NSW Ph. 214137
M & W Electronics,
99 Fitzmaurice St, Wagga, NSW Ph. 213044
G.M. Electronics,
M & W Electronics,
48 McNamara St, Orange NSW Ph. 626491
G.M. Electronics,
99 Fitzmaurice St, Wagga NSW Ph. 213044
Sumner Electronics,
95 Mitchell St, Bendigo Vic. Ph. 431977
Sound Components,
78 Brisbane St, Tamworth NSW Ph. 661363
Advanced Electronics,
5A The Quadrant, Launceston, Tasmania Ph. 317075
Trilogy Electronic Supplies,
40 Princes Hwy, Fairy Meadow, Wollongong NSW Ph. 831219
Tropical TV Services,
249 Fulham Rd, Vincent, Townsville, Q'ld Ph. 791421
Variety Discounts,
113 Horton St, Port Macquarie NSW Ph. 831911
A & M Electronics,
7A High St, Wodonga Vic. Ph. 244588

DICK SMITH ELECTRONICS

bankcard welcome here

SYDNEY	125 York Street, SYDNEY. Ph 290 3377	MELBOURNE	399 Lonsdale Street, MELBOURNE. Ph 67 9834
	147 Hume Hwy, CHULLORA. Ph 642 8922		656 Bridge Road, RICHMOND. Ph 428 1614
	162 Pacific Hwy, GORE HILL. Ph 439 5311	BRISBANE	166 Logan Road, BURANDA. Ph 391 6233
	30 Grose Street, PARRAMATTA. Ph 683 1133		
CANBERRA	96-98 Gladstone Street, FYSHWICK. Ph 80 4944	ADELAIDE	203 Wright Street, ADELAIDE. Ph 212 1962

MAIL ORDERS PO Box 747, CROWS NEST, NSW. 2065. Post and packing extra. Dealers across Australia.

SHOPS OPEN 9AM to 5:30PM (Saturday 9am to 12 noon) BRISBANE ½ hour earlier.

*ANY TERMS OFFERED ARE TO APPROVED APPLICANTS ONLY

Many lines are available from the Dick Smith Electronics Centres at

GRACE BROS

★ CHATSWOOD ★ LIVERPOOL ★ ★ MIRANDA ★ PARRAMATTA ★ ★ ROSELANDS ★

PRICES CORRECT AND STOCK AVAILABLE AT PRESS TIME

DSE532

STOP

NEW FOR 79'

silicON valley®

C & K SWITCHES

MODEL	KEY WAY	KEY WAY	KEY WAY	PRICE	+ TAX
SPDT	ON	NONE	ON	1.43	0.15
7101	ON	NONE	ON	1.43	0.15
7103	ON	OFF	ON	1.70	0.18
DPDT	ON	NONE	ON	2.00	0.21
7201	ON	NONE	ON	2.00	0.21
7203	ON	OFF	ON	2.30	0.24
3PDT	ON	NONE	ON	3.80	0.40
7301	ON	NONE	ON	3.80	0.40
4PDT	ON	NONE	ON	4.75	0.50
7401	ON	NONE	ON	4.75	0.50

WIRE - WRAP

Part No	Description	Bag	Price
WSU30M	Modified Wire Wrap Tool	1	9.50
WW50R	Wire Wraping Wire Red	50ft	2.60
WW50B	Wire Wraping Wire Blue	50ft	2.60
WW50Y	Wire Wraping Wire Yellow	50ft	2.60
3WW5	Wire Wraping Wire Length 3.5 inches	100	1.63
5WW	Wire Wraping Wire Length 5 inches	100	1.84

CALCULATORS

	Price	+ Tax
TI-25	$32.00	$4.12
TI-30	$19.00	$2.28
TI-30 Student Pack	$23.00	$2.75
TI-57	$74.00	$10.00
TI-58	$109.00	$15.30
TI-59	$263.00	$36.97
PC-100 A/C Printer	$213.00	$29.33
TI-MBA	$75.00	$10.40
TI-PG Programmer	$53.00	$7.06
Library Modules TI-58/59	$31.00	$4.00
Blank Mag Cards TI-59	$14.00	$2.10
TP-30250 (3 Rolls Paper PC-100)	$10.00	$1.50
TI-1750 Pocket Calculator	$23.50	$2.75
TI-1790 Pocket Calc with Clock & Stop Watch	$39.95	$5.48
TI-LP The Little Prof	$16.00	$2.06
TI-DM The Data Man	$23.00	$2.94
TI-SB The Spelling Bee	$28.00	$3.89
TI-SAS Speak and Spell	$45.00	$6.75

TRANSFORMERS

	Price	Tax
240 Volt Prim 6-0-6 Volt Sec 5VA P.C. Mount	4.50	1.12
240 Volt Prim 15-0-15 Volt Sec. 5VA P.C. Mount	4.50	1.12
240 Volt Prim 9-0-9 Volt Sec 20VA	6.05	1.50
240 Volt Prim 6-0-6 Volt Sec 40VA	7.40	1.83
240 Volt Prim 15-0-15 Volt Sec 40VA	7.40	1.83
240 Volt Prim Has 15-0-15 and 9 Volts Sec. designed for M.P.U. Type Application	12.50	1.69

SYDNEY: 23 CHANDOS STREET, ST. LEONARDS
TELEPHONE: (02) 439 2965

BRISBANE: 22 ROSS STREET, NEWSTEAD
TELEPHONE: (07) 52 1339

AUCKLAND: 7-9 KIRK STREET, GREY LYNN
TELEPHONE: 76 1169

MELBOURNE: 308 WHITEHORSE ROAD, BLACKBURN
TELEPHONE: (03) 877 5311

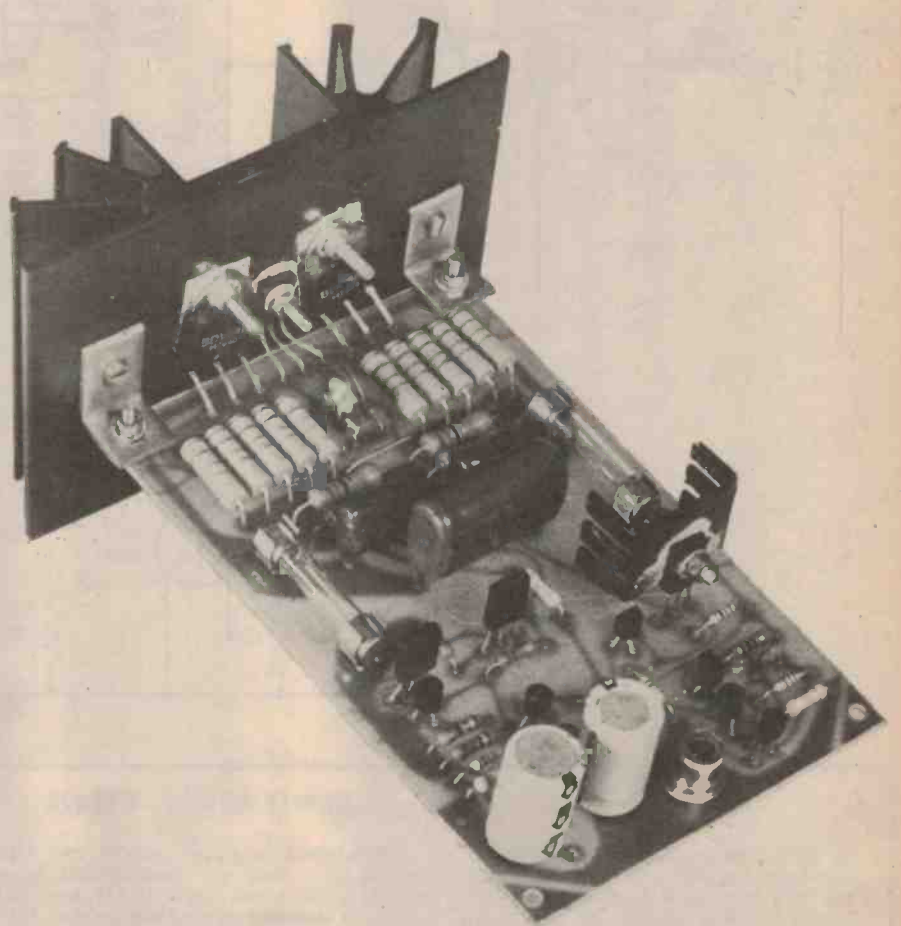
308 BRIDGE ROAD, RICHMOND
TELEPHONE: (03) 429 4780

ADELAIDE: 170 STURT STREET, ADELAIDE
TELEPHONE: (08) 51 4080

MAIL ORDER: P.O. BOX 898, CROWS NEST 2065
N.S.W. AUSTRALIA
TELEPHONE: (02) 439 2965
TELEX: AA22846

SIMPLE 60W LOW DISTORTION AMPLIFIER MODULE

The popularity of our first 50 W 'universal' amplifier modules has been very high since they were published two and a half years ago. Since that time the state of the art has moved on. This project, designed by Phil Wait from an original circuit by Trevor Marshall, is intended to replace the ETI 480 and features simpler mechanical construction, low distortion (particularly TID) and generally better performance.



MANY DIFFERENT amplifier circuits have appeared in popular electronics magazines over the years. The most popular audio projects we have ever published were the 100 watt guitar amp. (ETI 413, published in December 72 and still going strong!), the 422 amp. and the 480 series of power amp. modules.

While these seemed to have satisfied a large demand, our attention has been drawn to the need for something a 'step up' from there – something that approaches the current 'state of the art' for hi-fi equipment. Lower distortion than previously obtained, better bass performance and flexibility was the message we received from reader's letters and kit and component suppliers ("Why don't you . . .", "What I'd like to see . . .", "I need a . . .", etc.).

Late last year we set in motion the 'wheels' necessary to bring this project into fruition. Our major design hurdles were cleared with room to spare with the assistance of talented West Australian designer, Trevor Marshall.

A great many factors place sometimes quite severe constraints on project design – particularly component availability and ease of construction; not forgetting that this design had to perform significantly better than those that came before it.

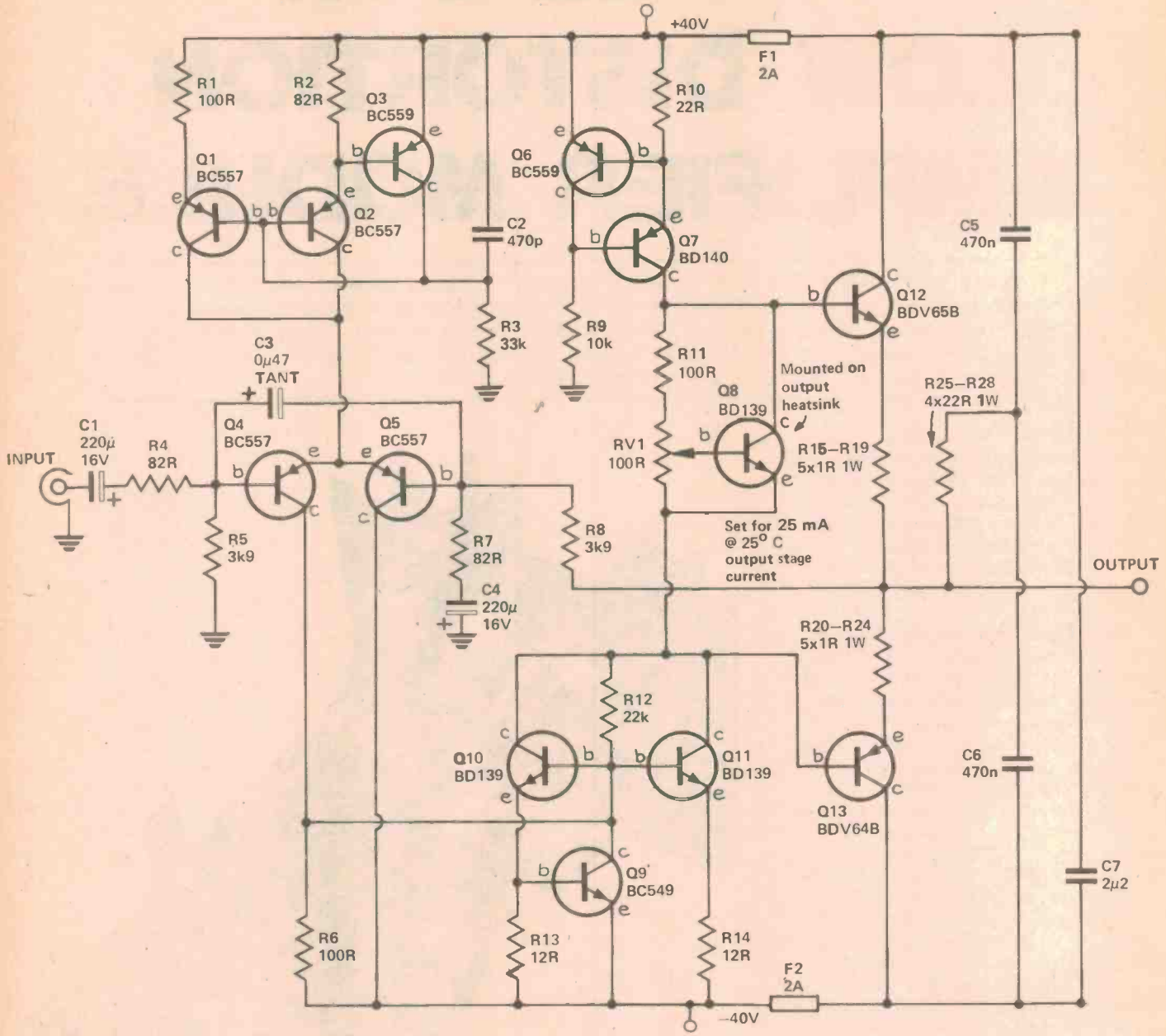
There is clearly little point in describing a project that includes components that are impossible to get or one that is difficult to construct.

A strong point that came across to us from reader feedback and from the popularity of our 480 series of amplifiers was that constructors favoured a modular concept. It seems that the days of the single-board stereo amplifier project have come and gone.

This power amplifier offers a significant improvement in specifications and ease of construction over most kit amplifiers offered to date. It has been designed particularly with low transient intermodulation distortion in mind.

Although a difficult parameter to measure, transient intermodulation distortion is an inherent characteristic of many amplifier designs – especially those which incorporate large amounts of feedback to even out frequency response and reduce harmonic distortion. The heavy feedback 'school' of design produces an impressive list of specifications – but the difference *to the ear* between such an amplifier and one designed for low TID has to be heard to be believed.

60W AMPLIFIER MODULE



HOW IT WORKS – ETI 470

The input stage of the amplifier consists of an emitter coupled differential pair (Q4, Q5) with a constant current source (Q1, Q2 and Q3). The use of a constant current source reduces distortion, as well as the possibility of high frequency oscillation and prevents any ripple on the positive supply from unduly affecting the input stage. Unequal emitter resistors (R1, R2) allow the currents in Q4 and Q5 to be optimised. Input lag compensation is provided by C3, limiting the slew rate of the amplifier to reduce high frequency intermodulation. The gain of the differential pair, driving Q10 and Q11, is very low.

Almost all the gain of the amplifier is obtained from the parallel pair Q10 and Q11. They are operated with series (R13, R14) and shunt (R12) feedback, and a constant current source (Q6, Q7). This results in a highly linear stage.

Q9 protects Q10 and Q11 from high peak currents or damage should a fault occur. When the current through R13 exceeds the safe limit, Q9 conducts and shorts out the drive to Q10 and Q11.

Bias from the output stage is set by RV1 and a shunt regulator (Q8). Q8 is mounted on the same heatsink as the output stages and stabilises the output bias current against heatsink temperature rise. Resistors R15-R24 in the emitters of the output Darlingtons, Q12 and Q13, maintain operation in their safe region as well as reducing the chance of thermal run away.

Protection against ultrasonic oscillation is provided by C7 and the network consisting of R25-R28 and C5, C6.

Both DC and AC feedback is taken from the output, via R8, to the negative input of the differential pair, the amount of feedback being set by the ratio of R8 to R7. C4 increases the feedback, and therefore decreases the overall gain, at very low frequencies. The feedback also automatically holds the DC output voltage at close to zero volts.

Choice of Power Supply

The design of the power supply can mean the success or failure of an otherwise well-designed amplifier. The supply voltage should be well-regulated, varying less than 10% from no load to full load, and be able to supply high peak currents.

However, if a voltage regulator is employed it too must be capable of delivering the very high peak currents occasionally demanded. This necessitates an expensive regulator device and large, expensive filter capacitors.

The alternative is to use a fairly large transformer and large value filter capacitors on a capacitor-input bridge rectifier. This is what we chose.

The circuit given here shows a power supply suitable for supplying a stereo amplifier using two of these modules. The filter capacitors C8 and C9 consist of two 2500 uF, 50 volt electrolytic capacitors connected in parallel. This is the minimum we would recommend.

In general, the largest value filter capacitor one can afford is a good rule of thumb! *It has been suggested to us that values as high as 20 000 to 50 000 uF makes an audible difference in performance.* (Watch the rectifier specifications though!).

Improved performance can be obtained for a modest increase in cost by having a separate supply for each channel module. This improves the regulation, reduces crosstalk and increases the amount of power available before output clipping commences.

The choice of transformer will determine power output. A 28-0-28 volt, 2 A transformer (Ferguson PF3577 or similar) will power a module to 60 watts (RMS) power output, while a 26-0-26 volt, 2 A type (e.g. Dick Smith M-0148 C-core) will permit 40 watts.

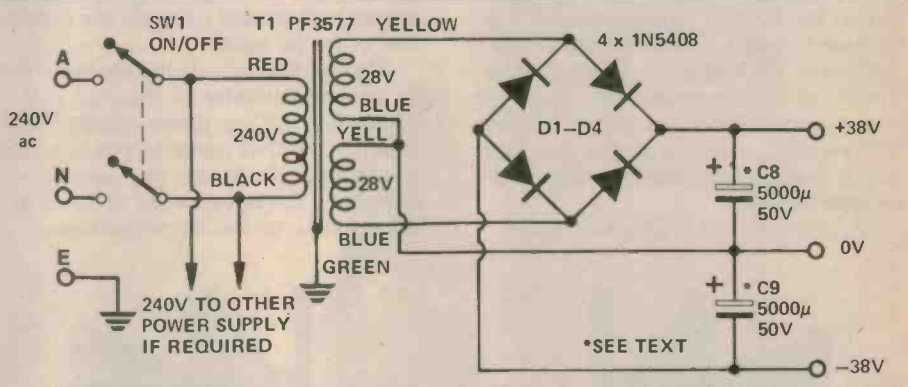
The power supply output should be limited to a peak DC voltage of about 40 volts (for 60 W output). A C-core transformer will generally improve the hum and noise output figures apart from having a reduced field, thereby reducing possible hum pickup problems.

If the amplifier module is to be used with a 4-ohm speaker system the supply voltage must be limited to about 30 volts maximum, otherwise the output devices will attempt to deliver over 100 watts followed by rapid self destruction!

Adventurous constructors may wish to try adding a second set of Darlington output devices, with their own emitter resistors as per the circuit, connected in parallel with the original pair. This combination may supply 100 watts or more into a four ohm speaker load. This technique is also recommended if you are contemplating driving highly ▶

ETI 470 SPECIFICATIONS

Power Output	60 watts into 8 ohms (∓40V supply)
Frequency Response	10 Hz to 100 kHz ∓0.5 dB
Input Sensitivity	500 mV rms for 60 W output
Hum and Noise	better than −110 dB on full output (dependent on power supply)
Feedback Ratio	35 dB
Distortion	at 1 kHz, 30 V p-p output into 8 ohms, Closed Loop 0.04 % (open loop 1 %)
Stability:	The amplifier was found to be completely stable when operated into reactive loads consisting of R + C, L + C and pure L
Intermodulation (calculated values)	at 1kHz, 30 V p-p output into 8 ohms, 3rd order less than 0.015 %, 5th order less than 0.0023 % (Intermodulation reduces with reduced power)



WHY LOW TID?

Looking at the circuit and a quick glance at the specifications, there's little in the circuit that looks outstandingly different from others. So what makes this amplifier special?

The difference in concept that makes this amplifier unique is the use of a very linear, high gain driver stage (Q10, Q11), with a constant current source (Q6, Q7), so that the gain of *this* stage is dependent upon the input impedance of the output transistors. However, *their* input impedance is dependent upon their gain, and therefore *the gain of the amplifier stage is dependent solely upon the characteristics of the output devices.*

Series and shunt feedback is used with Q10 and Q11 which results in a highly linear stage with a very low input impedance (about 28 ohms). The gain of the differential pair when fed into this low impedance is close to unity, so almost all the gain of the amplifier is concentrated in Q10 and Q11.

Provided the phase shifts in the differential pair and the gain stage are negligible the feedback loop is unconditionally stable.

There are two other design features which result in low TID.

The total open loop (feedback disconnected) distortion is only 1% at 30 V p-p output. So, very little feedback is necessary to reduce this to an acceptable level.

Protection of the output transistors is done by fuses, rather than electronically, and very high transient currents can be fed to the speaker without being affected by the (inevitably) non-linear impedance of an electronic protection circuit.

reactive loads such as electrostatic loudspeakers.

Construction

All components are mounted on a pc board – including the output devices. This method of construction is recommended. The module has been designed so that it is mechanically simple to assemble, much simpler than our ETI 480 module. Wiring errors are also avoided when a pc board is used.

Firstly, assemble and solder all the components on to the printed circuit board with the exception of Q12, Q13 (the output Darlingtons) and Q8. Carefully observe the polarity of all the electrolytic capacitors and orientation of the transistors.

The board is then mounted hard against the heatsink using small right-angle brackets. Be careful to avoid shorting the ends of the one ohm emitter resistors, R15-19 and R20-24, to the brackets.

If the module is to be mounted in a chassis the bottom (copper) side of the pc board should be 25 mm above the bottom of the heatsink. This will allow the use of 25 mm spacers to support the 'input' end of the board (furthest from the heatsink). It is expected that kits will include pre-drilled heatsinks and suitable brackets.

Once the board is attached to the heatsink the output Darlingtons, Q12 and 13, and Q8 may be mounted. Insert them in the pc board and then press them back against the heatsink to form their leads to the right shape. Do not solder their leads yet.

Smear heat conducting compound on either side of the mica insulators (don't use too much though) and insert these between the devices and the heatsink.

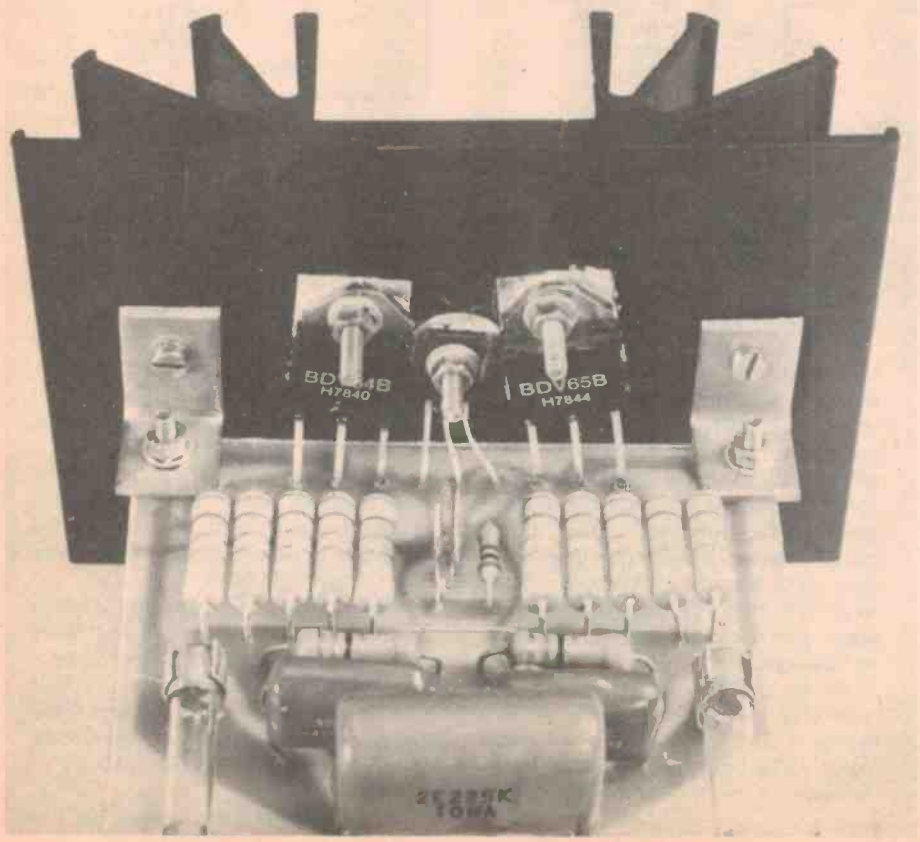
Assemble the washers and mounting bolts for these, finally checking with an ohm meter that there is not a short circuit between the metal tags (collectors) of the devices and the heatsink.

The input connection to the module is via a single-hole mounting RCA socket. This is mounted directly on the pc board. The centre pin connects to C1 via a short length of tinned copper wire.

If this facility is not required the RCA socket may be omitted and a length of shielded cable soldered directly between C1 and the pc board common.

The power supply and speaker connections are soldered directly to the appropriate copper lands on the underside of the pc board.

The 'earthy' side of the speaker must be returned directly to the zero volt connection of the power supply, as close to the filter capacitors as possible (preferably direct to the negative terminal). Do not connect this side of the speaker to the amplifier board.



Left: closeup view of the output stage showing how the Darlington transistors are mounted and how the pc board attaches to the heatsink

PARTS LIST - ETI 470

Resistors all ¼W, 5%, except R15-R28

R1	100R
R2	82R
R3	33k
R4	82R
R5	3k9
R6	100R
R7	82R
R8	3k9
R9	10k
R10	22R
R11	100R
R12	22k
R13, 14	12R
R15–R24	1R 1 watt
R25–R28	22R 1 watt

Potentiometer

RV1	100R mini trimpot (vertical)

Capacitors

C1	220µ 16V electro
C2	470p ceramic
C3	0µ47 35V tant
C4	220µ 16V electro
C5, 6	470n greencap
C7	2µ2 greencap

Semiconductors

Q1, 2	BC557, DS557
Q3	BC559, DS559
Q4, 5	BC557, DS557
Q6	BC559, DS559
Q7	BD140
Q8	BD139
Q9	BC549, DS549
Q10, 11	BD139
Q12	BDV65B
Q13	BDV64B

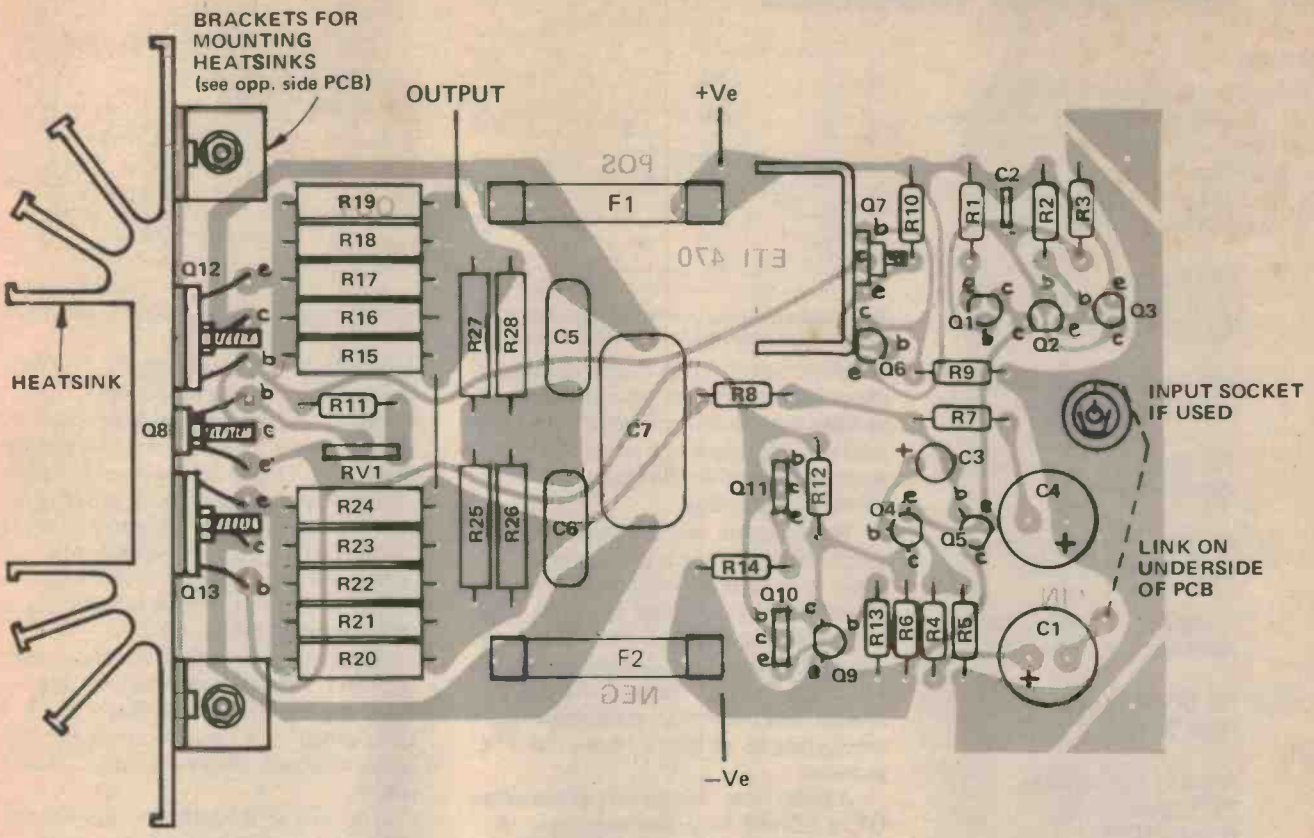
Miscellaneous

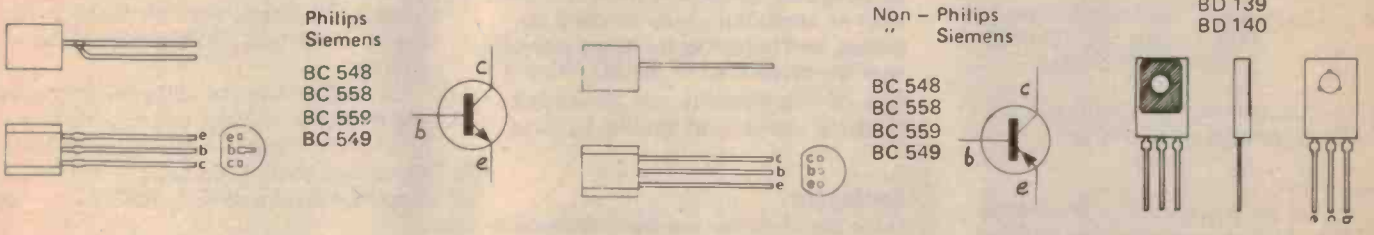
SK1	single hole, panel mounting RCA socket.
F1, F2	2 Amp 3AG Fuses.

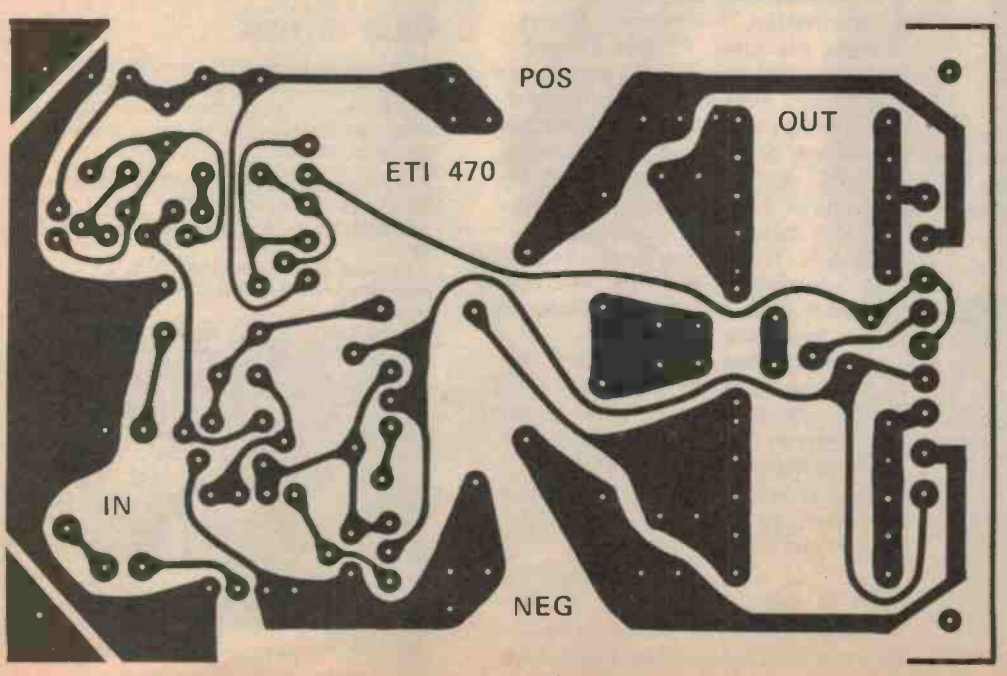
Fuse holders, heatsink for Q7, mica insulating kits (for Q8, Q12 and Q13), flat sided heatsink (75mm x 110mm), angle brackets, ETI 470 pcb.

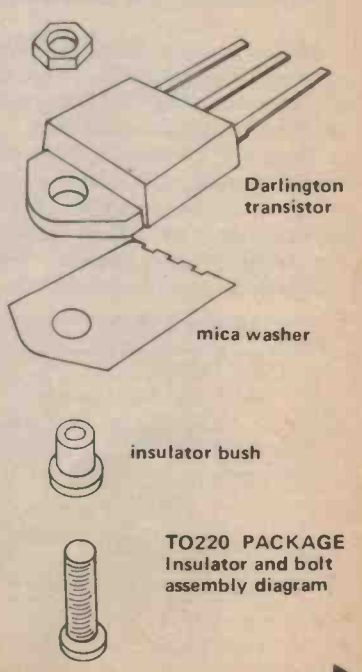
Parts List for Power Supply

D1–D4	IN5404 or sim
C8, 9	5000µ 50V electro (see text)
SW1	240V Dpdt switch
T1	28V-0V-28V, 2 amp transformer Ferguson type PF3577 or similar (see text)


BRACKETS FOR MOUNTING HEATSINKS (see opp. side PCB)
OUTPUT
+Ve
HEATSINK
INPUT SOCKET IF USED
LINK ON UNDERSIDE OF PCB
F1
F2
–Ve
R19
R18
R17
R16
R15
R11
RV1
R24
R23
R22
R21
R20
R27
R28
R25
R26
C5
C6
C7
R8
R14
R12
R10
R1
R2
R3
C2
R9
R7
C3
C4
C1
R13
R6
R4
R5
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13


Philips
Siemens
BC 548
BC 558
BC 559
BC 549
Non – Philips
" Siemens
BC 548
BC 558
BC 559
BC 549
BD 139
BD 140


POS
OUT
ETI 470
IN
NEG


Darlington transistor
mica washer
insulator bush
TO220 PACKAGE
Insulator and bolt assembly diagram

60W AMPLIFIER MODULE

Components

The Darlington output transistors are the only 'special' components, all others are generally available from kit and component suppliers.

The Darlington transistors are available through Silicon Valley stores at:

23 Chandos St., St. Leonards, NSW;
(02) 439 2965.

380 Bridge Rd., Richmond, VIC; (03) 429 4780.

170 Sturt St., Adelaide, SA (08) 51 4080.

22 Ross St., Newstead, QLD; (07) 52 1339.

7 – 9 Kirk St., Grey Linn, Aukland, NZ; 76 11 69.

Mail Order PO Box 898, Crows Nest, NSW 2065.

Or from:

Applied Technology, 7a Pattison Ave., Waitara NSW. (02) 487 2711.

Radio Despatch Service, 869 George St., Sydney, NSW; (02) 211 0816.

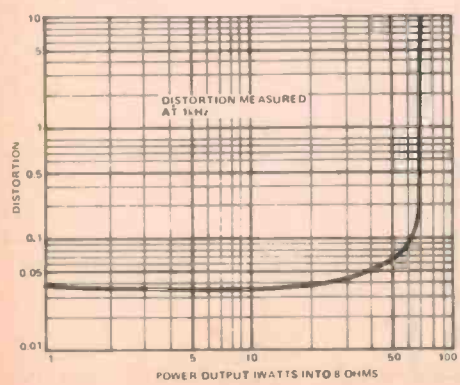
It is expected that kits will also be available through these outlets.

Heatsinks

Heatsinks on any amplifier are a compromise between cost and temperature rise.

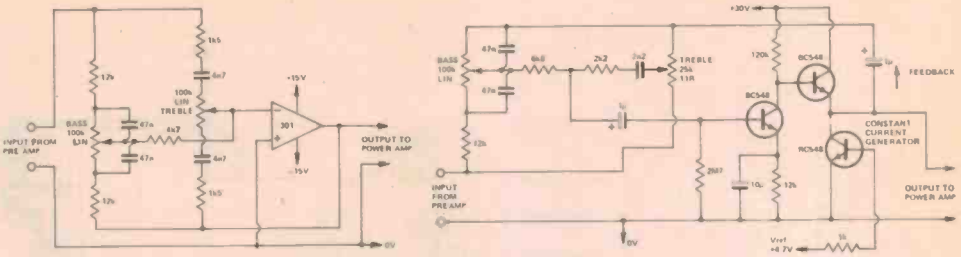
Unless you are going to play long passages of organ music, or run a disco, you will probably find that relatively small heatsinks run quite cool.

However, Darlington transistors are hard to temperature stabilise and should be run as cool as possible. This is why we have opted for a fairly large heatsink compared to other designs. The transistors should be bolted directly to the heatsink, not through a steel chassis. A slit could be cut in a chassis large enough to slide the assembled amplifier through the rear. Heatsink fins should always be vertical to provide the most efficient convection cooling.



The heatsink recommended for the output devices in this project is a flat-sided type with radial fins, 75 mm in length. Other flat-sided types are available with straight fins, and these too would be suitable. A similar length should be used. In general the heatsink should have a thermal resistance, mounting surface to ambient, of around 1° C per watt.

A small 'flag' heatsink is attached to Q7, a BD140 flatpack transistor. A commercial heatsink may be employed (they're only about 60 cents) or a small strip of aluminium may be bent up, drilled, and bolted to the transistor. See that the metal area of the BD140 and a face of this heatsink are in contact. Heatsink compound should be used.



Two suggested tone control circuits for a preamp to suit this module. Low output impedance is an important consideration. Choice of discrete or IC circuitry is given.

Setting Up

Once the amplifier has been assembled and carefully checked, the bias current for the output devices must be set. Remove the fuses, F1 and F2 and connect a 100 ohm resistor across each fuse holder. Remove any input signal. Connect the power supplies and measure the voltage drop across each of these resistors. Adjust the trim pot RV1 for a reading of 2.5 volts across each resistor. This corresponds to a bias current of 25 mA. The reading should be nearly the same across each resistor. Next check that there is no DC voltage across the output terminals.

If the reading across each of the resistors cannot be adjusted, or if there is a DC voltage across the output greater than one volt then there is a fault and the fuses should not be inserted.

If all is well, remove the two resistors and insert the fuses. Connect the speaker and away you go.

Preamp Considerations

The input impedance of this amplifier is relatively low, falling at very high frequencies. Consequently, it must be fed from a low impedance source.

When driving the amplifier with a preamp-tone control unit, the output is best taken from an emitter follower circuit (to provide the required low source impedance) or directly from the output of an operational amplifier. In either case, it *must* be taken from the point where the output is fed back to the tone control circuitry.

Two suggested tone control circuits suitable for the application are illustrated in Figure 5. Both use a 'Baxandall' type tone control network with feedback derived from the output point.

The circuit at right uses discrete components which may suit some constructors better. The left circuit, using a commonly available op-amp, has higher distortion than the discrete circuit.

A preamp-control unit project to suit the amplifier module will be described in a forthcoming issue along with details of how to construct a complete stereo amplifier system of high quality. ●

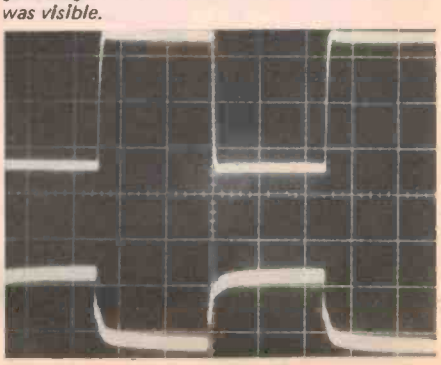
PULSE TESTING

Operation into severely reactive loads was examined by looking at the ac component of the Vbe of Q10 as a measure of the 'overshoot' of the loop and to see if transient overload occured.

f = 1 kHz. CRO is 0.2 mS/div. Output is 30 V into 8 ohms.

Upper trace 10 V/div. Output into 8 ohms.

Lower trace 10 mV/div. Vbe of BD139 gain stage. *No evidence of transient overload was visible.*



ROD IRVING ELECTRONICS

FANTASTIC QUANTITY DISCOUNTS

10	TIP 32B	6.50
10	TIB31B	6.50
10	FND357	12.90
10	FND500	12.90
10	RED LEDS	1.50
100	RED LEDS	13.00
1000	RED LEDS	110.00
10	7805	8.50
10	7812	8.50
10	BC547	1.20
100	BC547	10.00
100	IN4003	6.90
100	IN4004	7.00
10	4016	4.50
100	4016	42.00
6	LUGTAG STRIPS	.05
2	LM309K	3.00
10	GREEN LEDS	2.90
100	GREEN LEDS	25.00
10	YELLOW LEDS	2.90
100	YELLOW LEDS	26.00
10	4011	2.20
10	4001	2.20
10	7400	2.00
10	7410	2.00
10	7490	3.50
10	uA301	3.30
10	723	4.50
LED CLIPS ea.		.02
100	LED CLIPS	1.50
100	MOLEX PINS	1.80
500	MOLEX PINS	8.50
1000	MOLEX PINS	16.00
20	BD139	9.00
20	BD140	8.00
10	BC548	1.40
10	BC549	1.40
10	BC557	1.80
10	BC558	1.80
10	BC559	1.90
10	2102LP 450nS	15.00
2650	CPU ea	21.50
8080A	CPU ea	11.90
10	555 Timers	2.80
20	555 Timers	5.10
10	741 m DIP	2.80
20	741 m DIP	5.10
10	8 pin DIL	2.30
10	14 pin DIL	2.50
10	16 pin DIL	3.00
100	IN4148	4.00
1000	IN4148	35.00
2708	EPROM ea.	13.25
10 2708	EPROM ea.	125.00
2114	(450nS) ea.	7.50
8	2114 (450nS)	57.00
16	2114 (450nS)	112.00
32 2114	(450nS)	199.00
10	2N3055	7.00
10	SC 141D	12.00
10	SC151D	21.00

LARGE ELECTROLYTICS

Lug Mounting Cans

90uF	450V	$3.90	2500uF	80V	$5.90
100uF	200V	$1.90	2500uF	100V	$8.90
100uF	350V	$3.70	3300uF	75V	$4.90
150uF	200V	$2.50	4000uF	15V	$2.30
220uF	350V	$6.90	4000uF	75V	$6.30
300uF	200V	$3.50	4700uF	35V	$2.90
1000uF	63V	$2.90	4700uF	100V	$9.50
1000uF	100V	$3.70	5600uF	40V	$1.90
1000uF	160V	$6.50			PCB
2500uF	35V	$2.90	6800uF	50V	$4.80
2500uF	63V	$2.60	8000uF	75V	$7.90

MULTIPLE CAPACITORS

4X22uF	400V	$2.90	100 + 50	300V	$6.90
40 + 40	350V	$2.75	150 + 100		
50 + 50	350V	$3.50	+ 100	315V	$9.90
40 + 80	300V	$4.30	200 + 60	275V	$4.90
			200 + 100	350V	$7.90

COMPUTER GAME ELECTROS

2900F	40V	$5.90	15,000uF	25V	$10.30
6800uF	16V	$5.75	22,000uF	25V	$12.00
10,000uF	16V	$8.00	22,000uF	40V	$20.50
10,000uF	25V	$9.00	27,000uF	35V	$21.70
10,000uF	40V	$11.50	68,000uF	10V	$19.50

SOCKETS

10	8 PIN	$2.30	100	14 PIN	$23.00
100	8 PIN	$20.00	10	16 PIN	$2.80
10	14 PIN	$2.50	100	16 PIN	$25.00

KITS

ETI 480 100W Module Kit includes Heat Sink Bracket $19.75

ETI 480 50 W Module Kit includes Heat Sink Bracket $16.00

12 volt Electronic Siren Kits

1. "Whip" $8.00
2. "Wail" $8.00
3. "Flying Saucer" $8.00

Horn Speaker to suit $8.50

ULTRASONIC TRANSDUCERS

as used in ETI 585R/T ultrasonic switch

40T $5.95

40R $5.95

As a pair $11.00

SHOP 499, HIGH STREET, NORTHCOTE, VIC. 3070

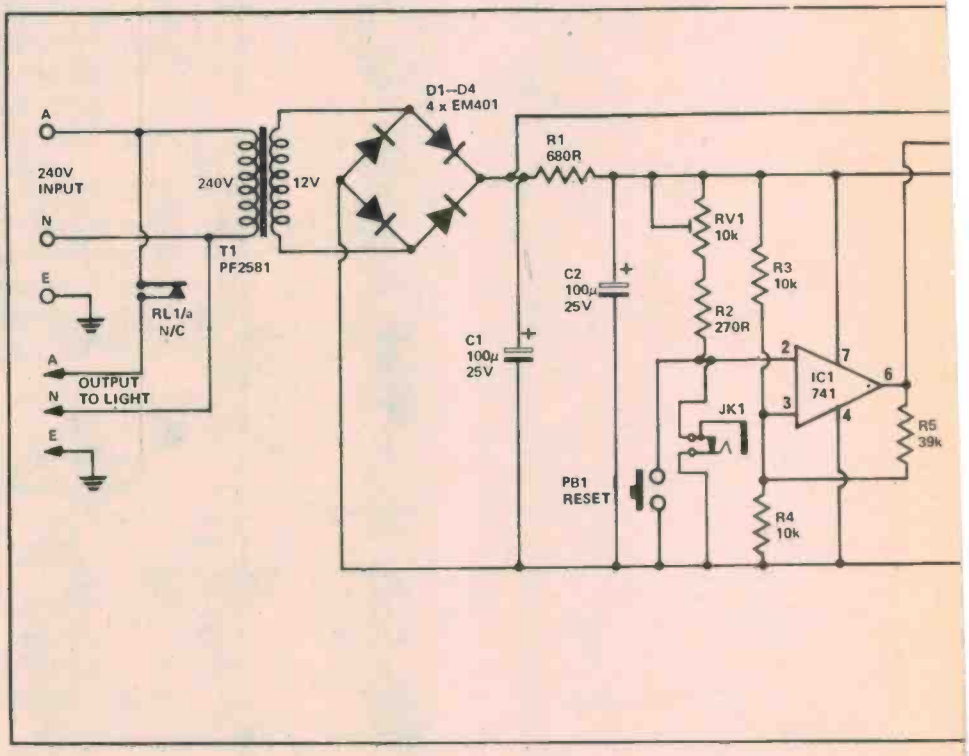
Open: Mon-Thur 8am-5.30pm. Fri 8am-8pm. Sat 8.30am-12.30pm. Mail Orders: PO Box 135, Northcote. Vic. 3070. Minimum 75c post and pack. Send 30c stamp for free condensed catalogue

Project 595

AQUARIUM LAMP CONTROLLER

ORNAMENTAL AQUARIUMS are features of many living rooms. Once these showpieces were only found in the homes of aquatic enthusiasts who lovingly attended to the needs of the watery inmates – checking temperatures, feeding twice a day, cleaning, removing excess algae, adjusting pH and salt contents and so forth.

With the rise in popularity, labour saving devices started to appear on the market. Automatic fish feeders appeared and heaters that cycled themselves on and off reduced the amount of attention the aquarium required. So why shouldn't the lamps do the same?



Desirable Features

The lamps used in over-tank housings are generally of the 'Growplus' type. The manufacturers of these tubes suggest 15-16 hours per day of illumination.

A simple device which turns the lamps on at sun-up and off at sundown would not deliver sufficient illumination. The controller described maintains the aquarium light on for some time after sundown providing adequate illumination, and has the advantage that the tank remains lit into the evening, which is when it looks its best.

In addition, three control functions are made available. Firstly, a reset button is provided to restart the timing period. If guests are expected or if the tank needs to be kept illuminated, irrespective of whether it is on or off, pushing the button recommences the delay period before switch-off. Secondly a winter/summer switch is used to allow selection of the time period after sundown before light-out.

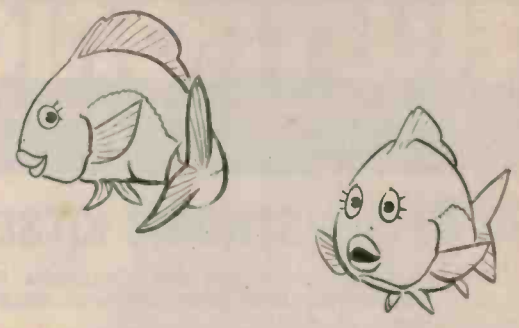
In the middle of winter, when darkness sets in at about 5.30 pm a four hour delay gives a suitable light period. In summer, with Daylight Saving, 1½ hours is quite adequate.

It is also occasionally necessary to inhibit operation altogether – such as when some 'cure' has been placed in the water. Many of these must be used in the absence of lights or aeration. For these reasons an 'off' switch is provided. While it is possible to use the light switch provided on most assemblies this can be inconvenient. For example, if the lamp assembly does not have one itself and the power point is inaccessible, or if the aeration pump has been connected as well (in the interests of a silent night).

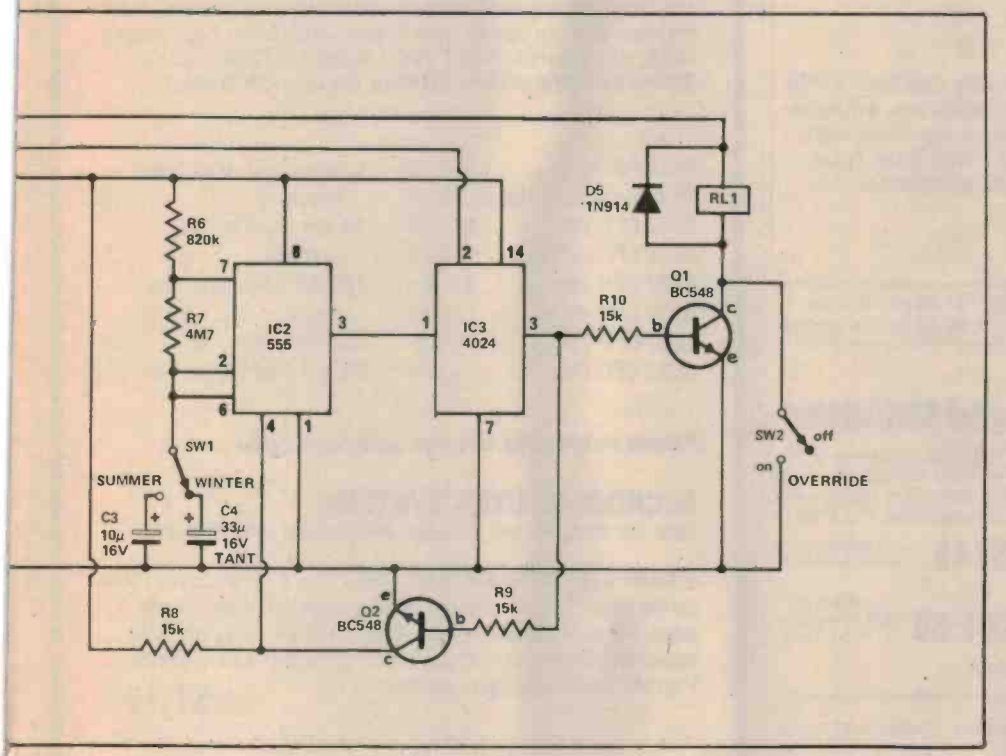
Construction

Construction should be relatively straightforward as there are no serious constraints on layout. If you elect to use the same box and transformer as we did the pc board is a tight fit, but the unit is compact and convenient. Be sure to earth the transformer clamp and the metal parts of the case, and keep the 240 volt wiring a safe distance from low voltage parts.

The first step is to place the major parts in position and mark and drill the mounting holes. Then, following the overlay, assemble the pcb, semiconductors last. Take care with the 4024 as it



An aquarium is undoubtedly a pretty sight in the home. But, some aspects of maintaining it are decidedly a chore. Jonathan Scott decided an electronic controller for his aquarium would make life just that much easier . . .



The circuit is flexible in operation, providing several options, uses readily-available components and is easily set up.

is a CMOS device. Next, wire up the unit as shown in the interconnection diagram leaving adequate lengths of wire between sections to allow convenient mounting.

Finally, fix all the major items in place, mounting the pc board off the case with 13 mm spacers.

Check that there is a high resistance between the transformer primary and secondary. A low resistance indicates a short somewhere. This is necessary to check that the mains wiring is correctly connected.

AQUARIUM LIGHT CONTROLLER

When the illumination on a light sensor exceeds a preset level, say at dawn, the lights are turned on. When the light falls below this level again, at sundown, a delay period is commenced, after which the lights are turned off. The delay can be switched to two convenient values for Summer (with Daylight Saving as well as longer days) or Winter, or the delay manually restarted when it is desired to keep the aquarium on show late into the evening.

Initially, consider LDR1 to be well illuminated. Its resistance will be quite low; say 1-2k at most. The 741 is connected as a Schmidt trigger with a few percent hysteresis. In the illuminated condition its output holds the contents of the counter (4024) at zero via its reset line. The NE555 is connected as an astable multivibrator and oscillates with a period of 225 secs in winter and 85 secs in summer (approximately). The speed is defined by which capacitor is switched in circuit.

When the amount of light falling on the sensor drops sufficiently to cause the output of the 741 to go low the 555 begins to clock the counter. The counter is a seven-stage ripple counter and so the 64th pulse sets the seventh stage to "1". When this occurs the relay is pulled in and the light goes out. Simultaneously the reset line to the 555 is pulled low and it ceases oscillating. This is a stable condition, and the device remains inactive until the counter is again reset and the cycle recommenced. The reset switch momentarily resets the counter by tripping the Schmidt trigger which re-initiates the delay part of the cycle. The 'off' switch merely forces the relay on, holding the lights off, independent of the daily cycle. Hence, whenever it is released, the controller returns to the correct part of the cycle.

▶

ELLISTRONICS

289 LATROBE STREET, MELBOURNE.
PHONE (03) 602-3282

NEW! ELLISTRONIC KITSETS

Complete with all components and instructions. Instrument cases supplied, except when stated otherwise. Kits are sent by certified mail.

E.K.1. ETI 650 Stac Timer kit..... **$89.50** P/P $4.50
E.K.2. 5V DC, 2.5A Regulated Power Supply kit **$27.50** P/P $4.50.
E.K.3. K.C. Cassette Interface kit (no case)..... **$18.50** P/P $2.50.
E.K.4. EA In-Circuit Transistor Tester..... **$9.50** P/P $2.00.
E.K.5. Morse Code Oscillator (no key or case)..... **$3.50** P/P $1.50.

Kits are supplied with top-grade components including wire and solder.

Now distributors for:

• Continental Logic Probes, Pulsers, Frequency Counters. • PCB Drills and Bits. • Alpha Rainbow Cable and Connectors. • Bourne Trimpots. • Piher Trimpots. • Dil Switches. • Sig. Generators. • CRO's. • Jean Reynaud Switches. • O.K. Wire Wrap Tools. • Kynar Wire. • Adaptive Instrument Cases. • Scotchcal. • Computer Grade Electrolytics.

Special **2114 UCB 450ns,** 16 or $7.25 ea. incl. tax. more $6.30 ea. tax exempt.

NOW AVAILABLE EX-STOCK

The new SINCLAIR DM 235 Digital Multimeter

Large 3½ digit display reading to plus/minus 1999. Six functions in 26 ranges. DC volts, 1mV to 1000V, AC volts, 1mV to 750V, DC current, 1uA to 1A. AC current, 1uA to 1A Resistance, 1 ohm to 20M ohms. Diode test, 0.1uA to 1mA. Impedance, 10M ohms. 12 month guarantee. P & P $2,

ONLY $145 including tax. ($130 tax exempt)

Also available:
The ideal pocket-size digital multimeter, the SINCLAIR PDM 35, for only **$61.50** including tax. ($56 tax exempt) P & P $2.00

We also stock Soar, Sanwa & Arlec multimeters.

• Phillips AD12 K 12 TK3 way 12" 40 watt speaker kits, complete, $279.50 pr inc tax.
• Phillips AD 8K 40 3 way 8" 40 watt speaker kits, complete, $195 pr inc tax.
• Philips AD 8K 30 2 way 8" 30 watt speaker kits, complete, $137.50 pr inc tax.
• Philips AD0 160 T8 stereo tweeter kits incl crossover caps, $26.75 pr inc tax.
• Large range of Phillps, Plessey-Foster and CTS speakers in stock.
• Phillps EUY-10E 023LE Tape Printers, $71.25 plus Tax.
• South West Tech Keyboard kits, $85 ea Inc tax.
• Daneva Keyboards (63 keys) $45 ea inc tax.

WE NOW STOCK a huge range of semiconductors (incl. micro chips) by all leading manufacturers at most competitive prices. Also a full range of capacitors, resistors, plugs, sockets, cables, connectors, instrument cases, transformers, Vero and Blob board, Continental breadboard, ETI and EA project boards, Chart Pack, potentiometers, in fact, just about everything electronic at Melbourne's leading electronic centre.

MAIL ORDERS AVAILABLE. Send 30c stamp for catalogue. All components can be supplied tax exempt through our new wholesale division. Ellistronics Wholesale P/L, 289 Latrobe St, Melb. Vic. 3000.

ECONOMIC DIGITAL CONTROL PTY. LTD.

PO BOX 817,
CROWS NEST, 2065.
SHOWROOM:
Cnr. ATCHISON and
OXLEY STS,
ST. LEONARDS, SYDNEY.
TEL: 439-1220
439-1773
TELEX: AA27901

COMPONENTS, KITS and EQUIPMENT

We are now dealers for Jade Computer Products Inc. Guaranteed factory prime. Delivery normally ex-stock to 3 weeks. Add 1 week for mail orders. Add 15 percent sales tax to all prices. Add $3.50 for postage and handling of mail orders. Wholesale enquiries welcome on headed paper. Discount for quantity orders. Send money with order or use Bankcard (send No, expiry date, signature). Send 20c stamp for Catalogues.
Some sample prices. (Retail on one-off basis)

2114 RAMS	$10.38	63 key ASCII unencoded keyboard	$40
2513 Char Gen. Ucase	$9.40		
2708 EPROMS	$12.50	19 key hexadecimal keypad	$14
2716 EPROMS (TI)	$28		
6502 CPU chip	$10.95	TRS-80 16k memory kit installed	$240
8080 CPU chip	$16		
Z80a CPU chip	$30	16k Static Ram kit	$299
8085 CPU chip	$28	Z80a 4 MgHz board kit	$165

Prices subject to change without notice

MICROCOMPUTER SYSTEMS

Send 20c stamp for our full range of equipment and software

• **COMPUTER WITH 48K RAM,** Z80A, 2 x 8" disk drives (480K single density, 960K double density optional); Terminal 9600 baud, 80 x 24, ASCII keyboard plus numeric keypad; Printer upper and lower case, impact, tractor feed; Debtors, Creditors, Payroll, General Ledger, Utilities. **$7,700**

• **DIABLO PRINTERS,** Axion 801p, Ip.225, Expandor printers, extra disk capacity, additional memory, Database packages available. Send for details.

• **WORD PROCESSORS** starting from $4,600 plus your choice of printer.

• **THE TEACH YOURSELF COMPUTER** soon to be released at $640 retail. This computer will make all computers under $3000 obsolete. Send for details.

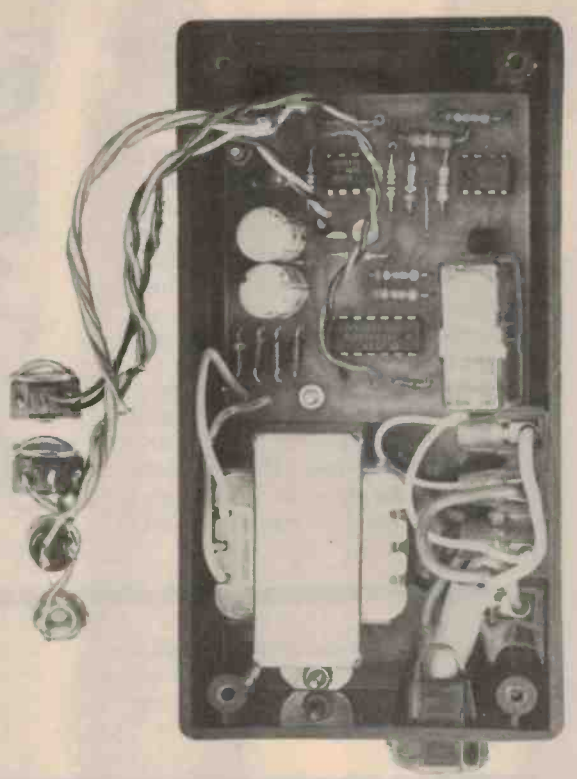
We will be at the

HOME COMPUTER SHOW
MAY 24-27 AT SYDNEY TOWN HALL

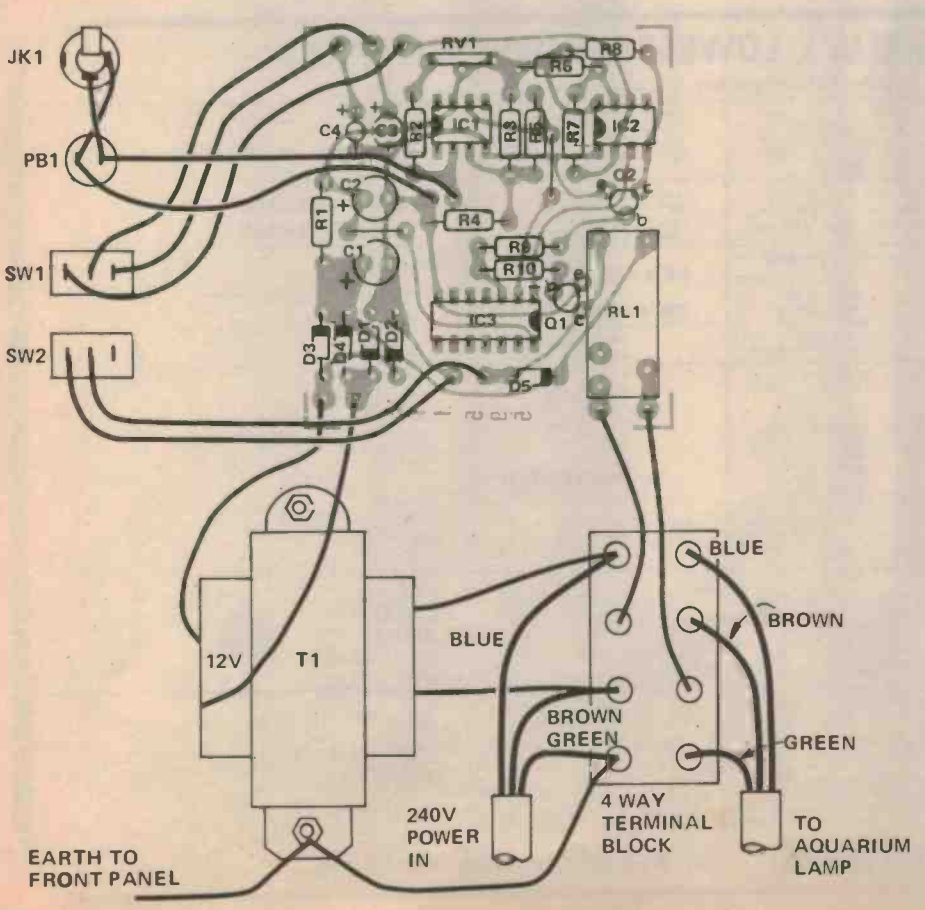
AQUARIUM LAMP CONTROLLER

The controller is constructed in a simple 'Jiffy' box which can be placed in a convenient position. The light sensor may be mounted externally or on a jack plugged into the front panel.

Front panel view at right, internal view left.



Below: the pc overlay and wiring diagram. Take care with the 240 V wiring.



PARTS LIST - ETI 595

Resistors — all ¼W, 5%

R1	680R
R2	270R
R3, 4	10k
R5	39k
R6	820k
R7	4M7
R8, 9, 10	15k

Potentiometers

RV1	10k miniature vertical trimpot.

Capacitors

C1, 2	100µ 25V electro
C3	10µ 25V tantalum
C4	33µ 16V tantalum

Semiconductors

D1–D4	EM401 or similar
D5	IN914
LDR1	ORP12 or similar
Q1, 2	BC548, DS548, BC108 or sim
IC1	741 8 pin miniclip
IC2	555
IC3	4024

Miscellaneous

RL1	miniature 12V single changeover relay 5 Amp pc mounting type.
SW1, 2	miniature SPDT toggle
PB1	miniature momentary pushbutton
P1	3.5 mm jack plug
JK1	3.5 mm jack socket
T1	12 volt, 150 mA transformer

Plastic box to suit, 4 pin 240V plug, 3 pin 240V extention socket, length 240V 3 core cable, cable clamps, ETI 595 pcb.

AQUARIUM LAMP CONTROLLER

Installation

We have made provision in this project for a remote-mounted LDR light sensor as aquariums are usually placed in an area of the house away from direct sunlight. The LDR can be placed near a window or outside the house. A thin gauge twisted pair of wires can be run from the LDR to the jack socket on the front panel of the controller. If mounted outside the terminations of the LDR should be waterproofed with Araldite or Silastic.

Alternatively, the controller can be mounted near a window which receives sunlight all day and the LDR mounted directly on to the jack plug, inserted into the socket. The switched 240 V cable can then be run down to the aquarium.

In either case the unit will be sensitive to even quite small amounts of light and should be installed where it is not influenced unduly by normal house or external lights.

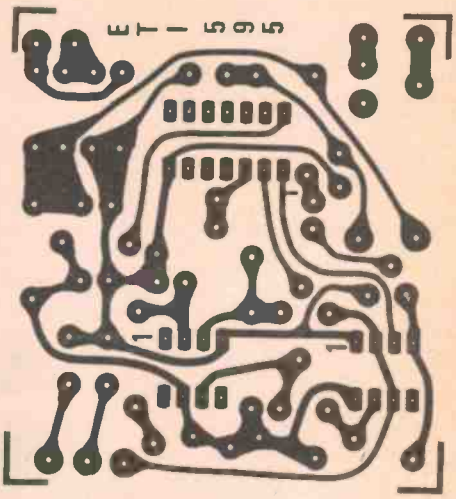
If you live in the vicinity of the Sydney Cricket Ground you may have to build a mask around the LDR sensor to prevent the (infamous) night lights from the SCG upsetting operation of the unit!

Setting Up

Once the unit is installed the sensitivity to light level may be adjusted as follows:

First, you will need a multimeter. The best time to make the adjustment is early morning or dusk, on a cloudy day. This will ensure that the unit will operate correctly over the range of sunlight levels normally received at your location.

Measure the voltage between pins 4 and 6 of IC1 (the 741) with the multimeter. Turn the trimpot, RV1, so that the voltage goes low. Then turn the trimpot in the opposite direction so that the voltage just goes high. This is the correct point.



Remember to check carefully all the 240 V connections. This will ensure that the aquarium lamp lights up but not the fish!

Some of **AUSTRALIA'S LOWEST COMPONENT PRICES**

Note:: Regular Prices not temporary specials — keep us in mind for that next order.

POTS 38c (LINEAR ¼" ALUM. SHAFT) — Linear potentiometers rotary carbon 38c ea. 500 Ohm, 1K, 5K, 10K, 25K, 50K, 100K, 250K, 500K, 1M, 2M.

Quality Large red LEDS well diffused wide viewing angle. 17c each, $1.50 per 10, $110/K. Quality MOUNTING CLIPS 5c ea. $4/100. **LEDS $12 a 100 17c each**

TRIMPOTS 15c (10mm) — Values: 100, 250, 500 Ohm, 1K, 2K, 5K, 10K, 25K, 50K, 100K, 250K, 500K, 1M, 2M

Trade/govt./S.T exempt: welcome. Send for special lists (e.g. $26 a 100 pots and $99 a 1000 LEDs plus tax if applicable. Small quantities also. **TRADE ENTRANCE**

METAL CAN TRANSISTOR **BC 108 - 13c** — 10 for $1.20, 100 for $11

1 Amp. DIODES: 50V 1N4001 - 6c; 100V 1N4002 - 7c; 400V 1N4004 - 8c; 1000V 1N4007 - 12c; 10% off 100 SAME

$4 a 100 SIGNAL DIODE **IN4148** **$30 a 1000 5c each**

ZENER DIODES: 15c each 400 mW 5% E24 values 3V to 33V

5c ELECTROS (UPRIGHT)

(per 100 prices in brackets)

Cap. 0.47 uF thru to	16V all	25V all	50V all
10uF	5c($3½)	6c($3¾)	7c($4)
22uF	6c($3¾)	7c($4)	8c($5)
33uF	8c($4)	9c($5)	10c($6)
47uF	9c($5)	10c($6)	11c($7)
100uF	10c($6)	12c($7)	14c($11)
220uF	12c($8)	16c($10)	35c($17)
470uF	16c($12)	22c($16)	45c($30)
1000uF	22c($18)	30c($25)	75c($50)

1000uF/16V axial — 20c ea. $8 per 50
2200uF/50V PCB — 95c ea. $9 per 10
Full axial price list — SAE

5c POLYESTER FILM CAPS — E12 10% 100V. ALL VALUES .001 to .01 — 5c ea.

.01 — 5c, .012 — 6c, .015 — 6c, .018 — 6c, .022 — 6c, .027 — 6c, .033 — 7c, .039 — 7c, .047 — 7c, .056 — 8c, .068 — 8c, .082 — 9c, 1 — 10c, 12 — 11c, 15 — 12c, 18 — 14c, 22 — 15c, 27 — 16c, 33 — 18c, 39 — 19c, 47 — 20c. All values in uF. 10% off 100 same uF

SCRs C106Y1 40c C122E $1.20

SCRs:
0.8A 30V C103Y — 35
0.8A 200V C103B — 60
4A 30V C106Y1 — 40
4A 400V C106D1 — 75
8A 400V C122D — $1.05
8A 500V C122E — $1.20

TRIACS:
2A 400V ESP240 — 65
6A 400V SC141D — $1.30
10A 400V SC146D — $1.50
DIAC ST2 — 35
Chart to identify leads Plus trigger info. — 10c

25 A 400V **SC260D TRIAC C37D SCR EA. $2.50**

2c RESISTORS ¼w $1.80 per 100 SAME RESISTANCE — Our 3 year old price still current. Opposition hoped we would go broke but our price remains at 2c ea. 1 Ohm to 10 M ¼W 5% E12 carb. film.

APPROX. SIZE: ½W miniature metal glaze. 1 Ohm to 1M 5% E12. 1M2 to 10M carb. film (larger)

RESISTORS 3c $2.50 per 100 SAME RESISTANCE

Keep electronics a hobby and not a luxury, compare our prices and buy from us. Same day turnaround service (unless swamped). All goods top quality and new. No minimum order. One P/P charge of 45c regardless of quantity. Advert current 3 months for late readers. Price list No. 9.

DIGGERMAN ELECTRONICS P.O. BOX 33, CORAMBA, N.S.W. 2466

MAD MAL

Prices so low you can't walk out empty handed

PICK UP A BARGAIN.

AT 10% OFF MAY ONLY

HI-FI SPEAKERS

12"	30W bass driver, 28-3000Hz	$29.80
10"	25W bass driver, 34-6,000Hz	$19.75
8"	20W bass driver, 40-8,000Hz	$11.80
8"	20W dual cone, 40-16,000Hz	$12.95
5"	30W mid-range, 600-8,000Hz	$ 6.95
5¼"	15W mid-range, 800-9,000Hz	$ 4.50
1"	20W dome tweeter, 400-20,000Hz	$ 8.95
1"	50W dome tweeter, 2 - 20 kHz	$11.00
3"	25W cone tweeter, 1 20 kHz	$ 5.50
6" x 3"	30W horn tweeter, 2 - 20 kHz	$10.50

CROSSOVERS

2 Way 30W RMS, 5 kHz, 6dB/Oct	$ 3.95
3 Way 40W RMS, 1 kHz, 6 dB	$ 6.95
3 Way 50W RMS, 600 Hz, 3 kHz, 12 dB	$12.50

SOCKET SPECIAL

14 PIN 5 for $1 | 16 PIN 4 for $1

DIL PLUGS 14 or 16 PIN to suit 10¢

FM WIRELESS MIKE

NEW! 88-106MHz ELECTRET CONDENSER ONLY $23.90 ea

5 Pin DIN → 5 Pin DIN LEAD $2.25 1.3M LONG ea

HOBBY IRON 12V 1.5A SPECIAL *$3.50

MAD LUCKY MAL'S DIP OFFER

10 ASST. SWITCHES D.P.D.T. Toggle, Rotary, Slide, etc.	$2
20 ASST. NEW POTS Incl. ganged, switch, single etc.	$2
40 VARIOUS KNOBS good Assortment, Ideal for Servicemen	$2
50 ASST. TAGSTRIPS Handy for Project Builders	$2
100 ASST. CAPACITORS Ceramic, Poly, Mica, All NEW	$2
200 HARDWARE PACK Nuts, Bolts, Spacers, Clamps etc.	$2
500 ¼W RESISTORS Mixed-up for experimenters	$2
200 1W RESISTORS We don't have time to sort out.	$2
100 CERAMIC CAPS Asst. Values and Voltages etc.	$2
50 HI-STAB RESISTORS 0.5, 1, 2 per cent high grade	$2
40 POWER RESISTORS 2W, 5W, 7W, 10W Asst. Values	$2
25 PRE-SET POTS Mini. Horiz. and Vert. Mtg.	$2
12 SLIDER POTS New, good Quality, Various types etc.	$2
45 ELECTROLYTICS Good variety, PCB & pigtail	$2
20 RF, IF, OSC COILS	$2
20 ASST DIAL LIGHTS	$2

NEW BONANZA PAKS

ASSORTED PARTS — A mixed bag of high quality parts, samples, end-of-line components, specials, manufacturers over-supply etc. including semiconductors etc. MINIMUM 500Gms Wt. $5

13.6V 2.5A POWER SUPPLY KIT

PCB already assembled

$21 Scoop purchase from overstocked manufacturer! Fully electronically protected, assemble in ½ HR.

CHEAPO TRANIES

All New, Aussie Made!

No. 761	6.3v 1a, 31v 1a	$4.90
811	6.3v 1a, 26v 1a	$4.90
831	0-6v-18v 1a	$4.50
791	110v, 6.3v 1a, 16v 1a	$4.90
183	12v 1a, 25v 1a	$3.95
101	50v 1a x 2, 6.3v 2A	$8.00

ELECTROLYTIC CANS

3,300 uF 50vw BRAND NEW! $1.50 SCOOP PURCHASE

BE QUICK FOR THESE!

HEAVY DUTY 12v RELAY

10A CONTACTS

12v DC DPDT Coil 30 ohms $2 EA

TWIN BLOWER

USA made, 110v, use 2 in series, or 240 to 110v transformer $4.90 $18 ea

BARREL FANS

USA made, 110v, use 2 in series or 240 to 110v transformer $4.90 ONLY $12 EA

240v 3 Core MAINS CABLES

2.5M LOOK! $1.25 EA

12 VOLT RELAY

LOOK 10 for $11 ea

12v DC 200Ω 3A ¾ Contacts $1.20

25A RELAY

3¾, Enclosed HEAVY DUTY 25 AMP CONTACTS, ACV- 12, 24, 50, 115, 220, 380 DCV- 12, 24, 48, 110, 220 $4.50 EA TAKE YOUR PICK!

80 WAY EDGE CONNECTORS

You can cutoff to the length $1 EA required.

5M Speaker Cable

5 METRES ONLY 50¢ COLOUR-CODED!

POPULAR REPLACEMENT CERAMIC CARTRIDGES

LOOK! STEREO $2.50 ea OR 5 FOR $10

OVAL SPEAKERS 5"x4" OR 6"x4" $2 Both 15Ω $2.50

2¾ 40Ω ROUND SPEAKERS $1.50

5"x3"27Ω OVAL SPEAKERS $2.50

HIGH OUTPUT BUZZERS

WERE $5.15 NOW $4 BZZZZ 12v 30mA current

Buzzer ONLY 45mA ONLY 12V

VERY HIGH OUTPUT $5

WERE $6.12

$2.90 Relays

OCTAL PLUG-IN AC: 24, 220v WITH DC: 12, 24v SOCKET

Fully encapsulated with 8 pin base. 2% 10A Contacts

220v AC RELAYS

4% Plug-in 10 Amp Contacts SOCKET $1 ea $2.65

PL-259 PLUGS

LOOK with in-built reducer etc NEW, TOP QUALITY 60¢ EA OR 10 for $5

Importer sacrifices stock!

10% OFF

ALL THESE ITEMS

MAD MAL

Drastic reductions... we need more room, new stock coming!

FERRITE ROD AERIALS

A STEAL AT $1.25 EA OR 10 for $10

200mm long x 9mm diam
138mm " x 9mm "
142mm x 16mm x 3mm
126mm x 13mm x 5mm
55mm x 13mm x 5mm
COMPLETE WITH COILS

IC TEST CLIP

INDISPENSABLE FOR ALL SERVICEMEN, HOBBYISTS

Allows easy pin checking of all 14-416 Pin IC's Special at $3.95

10 ASST TRIMMER CAPS	$1.00
20 ASST RADIO KNOBS	75¢
15 ASST VALVE SOCKETS	75¢
100 ¼W RESISTORS SHORT LEADS	75¢
100 1W RESISTORS	$1.00
200 ASST NUTS, BOLTS	$1.00

DC-DC CONVERTOR

Input: 12 Volts
Output: 6V at 100mA, 7.5V at 200mA, 6V at 300mA

$2.50 OR 3 FOR $6

LIGHT DIMMER KITS

or motor speed control

Great Value! 700 WATT Capability, With RFI Suppression $4.95 EA OR 2 for $9

10 WAY COMPARATOR SWITCH

Switches $4.50

10 DPDT contacts, new Isostat push-buttons Suit Intercom, Hi-Fi, P.A. etc

MINI H.D. RELAY

700Ω COIL, 10 AMP CHANGEOVER CONTACTS

$1 ea or 10 for $8

DE-SOLDERING WICK

1.5M NEW EXTRA LONG $2

STEREO CASSETTE TAPE HEADS

Suit Vortex etc, most cassettes $9.95 limited quantity

CASSETTE ERASE HEADS

$4.50 STEREO, SUIT MOST DECKS incl VORTEX etc.

RUBBER DRIVE BELTS

Suit Vortex and Similar cassette tape mechanisms $1.50

NEW 3 DIGIT COUNTER

RESETTABLE MODEL

Suit lap timer, coil winder or tape counter for most cases. $2.50

TELESCOPIC AERIALS

Pivots & swivels Suit portable TVs etc 1.75 SWIVEL TO 180°

LOCK-DOWN CAR AERIAL

A Beauty $4.50 NOW $3

240v LIGHT FLASHERS

Complete, wired with lampholder (no globe) HANDLES 60W GLOBE, UP TO 300W WITH H'SINK

$5.95 EA Ideal for blinking Advertising signs, Discos etc. LOOK!

BEST FUSE Value

2AG 20mm x 5mm: 100mA, 125mA, 160mA, 200mA, 250mA, 500mA, 600mA, 1A, 3A, 5A — 5 for $1

3AG 32mm x 6mm: 250mA, 500mA, 750mA, 1A, 1.5A, 2A, 3A, 5A, 8A, 10A, 15A, 20A, 25A, 30A — 10 for $1

All New SLOW BLOW FUSES

500mA, 600mA, 1A, 1.5A, 2A, 3A Only 45¢ EACH

500mA, 750mA, 1A, 2A, 3A, 5A Only 50¢ EACH

TO-3 MOUNTING KITS 5 for $1

Only

HANDY AMP CABINETS

$3 Last few only 100 left!

Size 16"x9"x 3¾" high New, attractive TEAK woodgrain finish

Jackpot No 3

$10 Hundreds of useful parts, over 2Kgm

A New jackpot box full of 100's of samples, specials, end-of-line specials, manufacturer's overruns

SPECIAL OFFER

MAD MAL % PRE-PAK electronics p/l.
P.O. BOX 43. CROYDON. 2132
718 Parramatta Rd. Croydon NSW
PH: 797-6144

PACK/POST- 50¢ basic PLUS 10% of order value. © 1979

Jaycar New Audio Kits and Components

AUDIO SPECTRUM ANALYSER

The 489 Analyser can be used in conjunction with a Graphic Equaliser to accurately equalise systems for room acoustics.

Features:
- Ten octave spaced displays
- LED readout in 3 dB steps.
- Input sensitivity control.
- Inbuilt pink noise generator.

Complete kit includes matched LEDs, polarised plastic display, complete metalwork, etc.

ONLY $142 plus $3 freight.

100 WATT POWER SLAVE

This rugged, compact amplifier is ideal for PA, disco, foldback or guitar amp use. 2-input Preamp with tone controls or 10-way Equaliser can be built into the same cabinet.

Features:
- Robust construction.
- Handles for portability.
- Cannon mains input, quick connect speaker terminals.
- Attractive finish in light grey.

Complete kit ONLY $105 plus $3.50 freight.
2-input Preamp with front panel $25.
10-way Equaliser with front panel $43.

jaycar PTY LTD **PO Box K39, Haymarket. 2000. 405 Sussex Street, Tel: 211-5077.**

We're the specialists . . .

HI-FI SPEAKER KITS

All Philips speaker kits carried in stock.

THIS MONTH'S KIT SPECIAL
2 Etone 12" bass units.
2 Foster midrange horns.
2 Foster horn tweeters.
2 Etone 3-way crossovers.
PLUS all Innerbond and terminals.
ALL FOR JUST **$189.**

L & G HI-FI SPECIAL

L & G 2600 Amp. 35 plus 35 watts RMS.
ONLY **$155.**

L & G AP 13 semi/auto T/T.
ONLY **$139.**

This month only buy the 2 together and really save. Great value at **$250.**

Available from these two great stores:

Brisbane 293 St. Pauls Terrace Fortitude Valley. Ph: 52-8391.

Sydney 657 Pittwater Road Dee Why. Ph: 982-7500.

David Ryall
hi-fi & electronics

ROD IRVING ELECTRONICS

• TRANSISTORS

AC127	$1.25
AC128	.80
AD149	2.60
BC107	.15
BC318	.15
BC547	.15
BC548	.15
BC549	.15
BC557	.20
BC558	.20
BC559	.20
BD139	.50
BD140	.50
BFX84	.82
BFY50	.80
BFY51	.78
BF115	.66
MJ2955	.90
MJE2955	1.82
MPF102	.45
BF180	.80
TIP31c	.65
TIP32c	.65
2N2219	.45
2N2222a	.40
2N2368	.29
2N2646	1.15
2N2647	1.15
2N2904	.50
2N2905	.50
2N2905A	.50
2N2907	.45
2N3107	1.00
2N3053	.50
2N3054	1.15
2N3055	.85
2N3300	.75
2N3702	.20
2N3740	1.70
3N3904	.29
2N4030	.90
2N4032	.95
2N4033	1.30
2N4036	1.50
2N4037	1.30
2N4231	.98
2N4234	1.80
2N4238	1.65
2N5088	.30
2N5871	1.50
2N5872	2.00
2N5873	1.50
2N5874	1.65
2N6124	.90
2N6126	1.10
2N6129	1.30
2N6130	1.45
2N6132	1.45
2N6134	1.60
MPS3565	.20
MPS3638	.22
PN3565	.18
PN3566	.18
PN3567	.18
PN3568	.18
PN3569	.18
PN3638	.17
PN3638A	.20
PN3641	.20
PN3642	.20
PN3643	.20
PN3644	.20
PN3645	.20
PN3646	.20
PN3693	.29
PN3694	.29
PN4121	.35
PN4248	.22
PN4250	.29
PN4355	.29

• 74LS

74LS00	.22
74LS01	.28
74LS02	.25
74LS03	.25
74LS04	.30
74LS05	.30
74LS08	.25
74LS09	.28
74LS10	.25
74LS11	.28
74LS12	.28
74LS14	.95
74LS20	.28
74LS21	.28
74LS27	.28
74LS28	.40
74LS30	.30
74LS32	.30
74LS37	.38
74LS38	.38
74LS40	.30
74LS42	.95
74LS73	.60
74LS74	.46
74LS75	.55
74LS78	.50
74LS85	1.20
74LS86	.50
74LS90	.70
74LS92	1.10
74LS93	.80
74LS95	1.00
74LS109	.45
74LS113	.50
74LS114	.50
74LS125	.70
74LS133	.30
74LS138	1.10
74LS151	1.15
74LS157	.75
74LS160	.90
74LS163	1.15
74LS164	1.30
74LS165	1.15
74LS169	1.50
74LS174	.70
74LS175	.85
74LS190	1.25
74LS191	1.20
74LS192	1.15
74LS194	1.15
74LS195	1.00
74LS196	1.20
74LS197	1.35
74LS251	.80
74LS253	.80
74LS257	.70
74LS259	3.20
74LS279	.55
74LS290	1.15
74LS365	.70
74LS366	.70
74LS367	.70

• CMOS

4000	.25
4001	.25
4002	.25
4007	.25
4008	1.20
4011	.25
4012	.25
4013	.52
4014	1.30
4015	1.30
4016	.45
4017	1.25
4018	1.20
4020	1.40
4021	1.30
4022	1.30
4023	.25
4024	.90
4025	.35
4026	1.90
4027	.70
4028	.95
4040	1.30
4042	1.10
4043	.95
4044	.95
4046	1.55
4049	.55
4050	.55
4051	1.20
4052	1.20
4053	1.20
4060	2.60
4066	.75
4068	.35
4069	.30
4070	.35
4071	.35
4072	.35
4076	1.75
4077	.35
4078	.35
4081	.35
4082	.35
4093	.70
4441	.95
4502	1.20
4510	1.35
4511	1.30
4518	1.35
4520	1.35
4528	1.20
4553	6.75
4555	1.10
4581	3.00
4582	1.00
4584	.75
74C02	.35
74C08	.40
74C10	.40
74C14	1.60
74C20	.45
74C48	2.40
74C73	1.10
74C76	1.15
74C90	1.50
74C93	1.50
74C175	1.75
74C192	1.85
74C193	1.85

• TTL

7400	.25
7401	.20
7402	.25
7403	.25
7404	.20
7405	.25
7406	.45
7407	.45
7408	.30
7409	.34
7410	.30
7413	.54
7414	.45
7416	.50
7417	.45
7420	.30
7421	.30
7422	.30
7426	.40
7427	.40
7430	.30
7432	.40
7437	.50
7438	.40
7439	.40
7440	.30
7442	.70
7447	.75
7448	.75
7450	.30
7451	.30
7453	.30
7454	.30
7460	.30
7470	.50
7472	.45
7473	.50
7474	.50
7475	.65
7476	.40
7480	.95
7483	1.10
7485	1.40
7486	.50
7489	2.50
7490	.38
7491	1.00
7492	.70
7493	.40
7494	1.05
7495	.92
74100	1.95
74107	.55
74121	.50
74123	.85
74132	1.10
74145	1.80
74150	1.60
74151	1.00
74153	1.00
74154	1.30
74157	1.00
74160	1.25
74172	1.10
74173	2.30
74180	1.10
74192	1.25
74193	1.25
74367	1.00

• VOLT. REGS.

7805	.90
7812	.90
7815	.90
7818	.90
7824	.90
7905	1.40
7912	1.40
7915	1.40
7918	1.40
7924	1.40
78L05	.40
78L12	.40
78L15	.40
78L18	.40
78L24	.40
79L05	.80
79L12	.80
79L15	.80
79L18	.80
79L24	.80
78CB	2.30
723	.50
309K	1.60
317K	2.90

• DIODES

OA90	.15
OA91	.15
1N4002	.8
1N004	.8
1N4007	.16
1N5401	.43
1N5404	.35
1N4148	.6
WO2 BRIDGE	.80
WO4 BRIDGE	.80

• ZENERS

400MW	.19
1 Watt	.30

Same price all voltages.

• SCR's/Triac

C103yy	.90
C106D1	.65
C106Y1	.39
SC141D	1.25

• RESISTORS

½W, E24	.3
1W, E12	.7
5W, W/W	.25
10W, W/W	.50

• LINEAR IC

301	.35
307	.75
308	1.20
311	.75
324	1.25
380 14 PIN	1.40
381	2.00
382	2.00
555	.35
556	.90
565	1.95
567	2.65
741	.30
747	1.15
3900	.90
TL071	.73
TL080	1.15
TL081	.52
TL082	.95
TL084	1.90
CA3140	1.50
CA3130	1.95

• TANTALUMS — TAD 35V

0.1-1uf	.14
2.2uf	.25
3.3uf	.25
6.8uf	.30
15uf	.50
22uf 10V	.40
4.7uf 25V	.25
10uf 25V	.25

• CERAMICS

1pf-0.0047	.5
0.0068-0.01	.8
0.1	.12
0.22	.18
0.47	.24

• SUPP. CAP.

NS5, 0.5uf	.60
NNS30, 3uf	2.00

• CAP. RP can.

2500uf/35V	1.35
5600uf/40V	1.90
RG can type — 6800/50V	4.80

• ELECTRO CAPS PC TYPE

6.3V — 470uf	.20
10V — 4.7uf	.8
22uf	.10
100uf	.12
16V — 10uf	.8
22uf	.12
33uf	.8
47uf	.12
100uf	.15
220uf	.15
470uf	.16
640uf	.42
1000uf	.32
2200uf	.50
2500uf	.62
25V — 1.5uf	.8
2.2uf	.8
3.3uf	.8
4.7uf	.8
10uf	.8
22uf	.8
25uf	.12
33uf	.10
47uf	.10
100uf	.18
220uf	.24
330uf	.24
470uf	.32
1000uf	.48
35V — 2.2uf	.8
3.3uf	.8
10uf	.11
100uf	.18
220uf	.21
1000uf	.53
2000uf	.71
2200uf	.88
50V — 0.47uf	.8
1uf	.6
2.2uf	.8
3.3uf	.6
4.7uf	.6
10uf	.8
22uf	.13
33uf	.15
47uf	.12
100uf	.16
220uf	.23
470uf	.60
63V — 0.47uf	.8
1uf	.8
2.2uf	.8
4.7uf	.10
10uf	.12
25uf	.15
47uf	.16
100uf	.23
220uf	.37
330uf	.40
470uf	.77

• OPTO

9368	1.90
4N28	1.00
FND357	1.35
LED red	.18
LED green	.30
LED yellow	.35
DL747	3.50
FND500	1.58

• MISC.

Speaker Wire, per mt	.17
FUSEHOLDERS, 3AG — Panel Mount	.65
In-line Type	.28
FUSES, 3AG — 0.25A, 0.5A, 0.75A	.16
1A, 1.5A, 2A, 3A, 4A, 5A	.10
TO3 Trans. Sockets	.22
Thermal Grease in Syringe	1.25
MULTIMETERS Arlec YF370	24.30
A&R DMM10	89.00
RELAYS — 12V, coil 220, 1A cont.	4.75
12V, 220 ohm coil, 5A cont.	6.10

SHOP 499, HIGH STREET, NORTHCOTE, VIC. 3070

Open: Mon-Thur 8am-5.30pm. Fri 8am-8pm. Sat 8.30am-12.30pm. Mail Orders: PO Box 135, Northcote. Vic. 3070. Minimum 75c post and pack. Send 30c stamp for free condensed catalogue

Project 722

SIMPLE ANTENNA FOR OUR AIRCRAFT BAND CONVERTER

Our Project 721 has proved quite popular – for many more reasons than we anticipated when the project was conceived. Here is a simple groundplane type antenna that is easy to construct and uses commonly available parts.

THE BEST ANTENNA for monitoring purposes on VHF is one which receives signals equally well from every direction. Such an antenna is actually impossible to build, however, the nearest approach is an 'omnidirectional' antenna. That is, an antenna that responds to signals equally from all directions towards the horizon.

Most transmissions encountered in the 120 MHz band are vertically polarized; the simplest antenna one can construct to receive vertically polarized transmissions from almost any direction is the 'groundplane'.

In this antenna, a vertical, quarter-wavelength long whip (the 'active' part of the antenna) is situated at the centre of two crossed, halfwavelength long metal elements – the groundplane. The centre conductor of a coaxial cable feedline connects to the bottom of the vertical element while the outer conductor (braid) of the coax connects to the junction of the two groundplane elements.

In practice, this antenna will receive signals ranging from very low angles (towards the horizon) to quite high angles, with nearly equal sensitivity.

Construction Comments

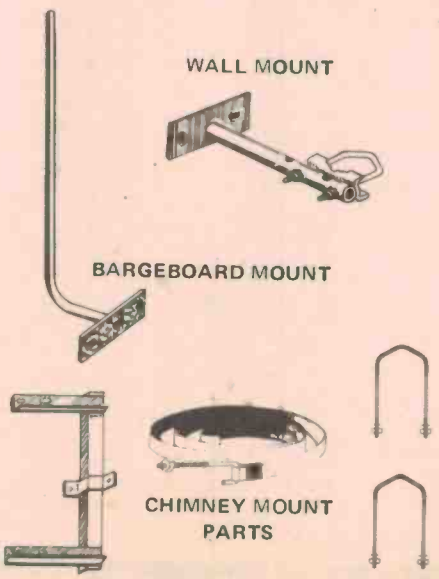
So that this antenna would be easy to build by a majority of interested constructors we have chosen parts which are readily obtainable.

The vertical element (A) is a standard low-band VHF whip sold for mobile applications. It consists of a length of tapered fibreglass covered in copper braid all protected by heatshrink tubing. A plated brass ferrule on the bottom has a tapped hole to mate with a standard mobile antenna mount. The whip as it comes is longer than required for the frequency of interest and is cut to the length indicated (61 cm). This is easily accomplished with a pair of heavy sidecutters.

These whips are obtainable from a number of sources and we have listed them at the end of the article.

The mobile antenna mount is also a 'standard' item, readily available from a variety of sources. There are two choices here – you can either use a 27 MHz CB antenna mount or a special 'VHF/UHF' mobile antenna mount. They are quite similar in construction, however, the VHF/UHF type incorporates a different style of termination for the coaxial cable feedline which provides a better 'match' to the antenna.

Note though, that the VHF/UHF bases available provide a weatherproof termination for the coax feedline. This is a decided advantage.



Commonly available TV antenna mounting components are inexpensive and provide a range of mounting options for the antenna described here.

The groundplane elements are made from standard 9.5 mm (3/8") aluminium tube. This is available quite cheaply in two-metre lengths from hardware stores (such as Pauls in Sydney) or aluminium suppliers. These elements are bolted to a bracket bent up from a small sheet of aluminium, as shown in the assembly diagram.

The aluminium bracket should be drilled before bending. Exact details are not given as mechanical details will vary, depending on the size and spacing of the U-bolt, the mast and the particular antenna base used. The assembly diagram provides a guide. One groundplane element mounts inside the bend, take this into account when marking the bolt holes for drilling. Element bolt holes may be about 30 mm apart.

If you wish, the bracket may simply be screwed to a wooden mast, rather than bolted to a tubing mast as shown in the illustration. There is plenty of scope for different mounting methods, but the basic assembly as shown should be followed.

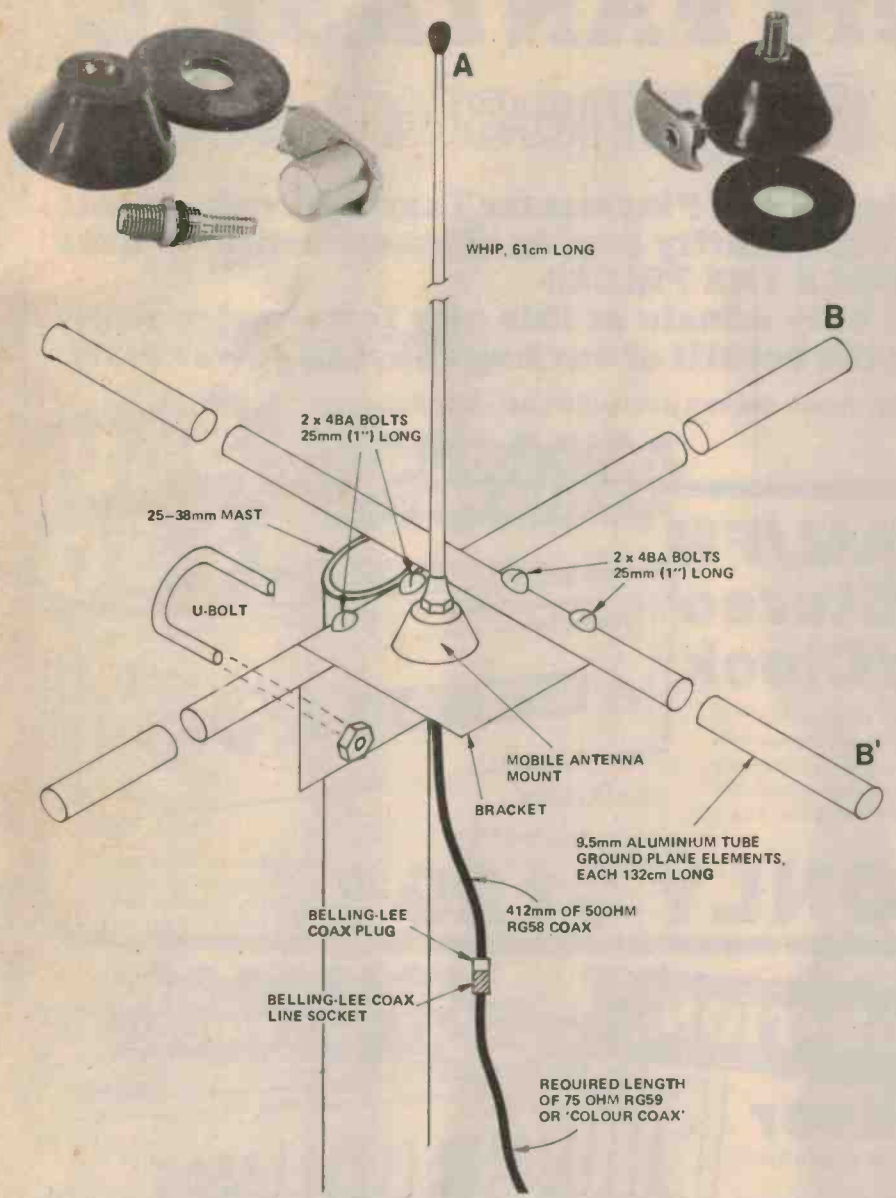
Cut the groundplane elements to length as shown in the illustration. Mark and drill them according to how you have drilled the bracket.

Do not cut the whip to length at this stage.

Assembly

All drilling should be done first. Do an individual trial assembly of the antenna mount and the elements just to see that everything fits without coming afoul of the other parts.

Bend up the bracket and assemble the antenna base, connecting the coax at the same time. Attach the two groundplane elements. Note that one is



Assembly diagram for the antenna. Inset above left shows the solderless Jackson 2-226 antenna mount, inset above right shows Scalar's OB base.

mounted beneath the bracket, in the bend. The other is mounted on top. The bolts go right through bracket and element.

Finally, screw the whip to the mounting base, measure 61 cm up from the bracket and cut the whip at that point.

Mounting Tips

The antenna may be mounted using TV antenna mounting components. These are relatively inexpensive and widely available. Standard wallmounts, bargeboard or chimney mounts and mast sections are ideal.

Mount the antenna as high as practicable and away from other objects for best results.

Coaxial Feedline

Standard 75 ohm coaxial cable is used for the feedline. This is commonly used for colour TV installations.

The impedance of a groundplane antenna of this sort of construction is generally around 35 to 40 ohms. To obtain best performance from the antenna it is necessary to 'match' the feedline impedance to the antenna impedance. Fortunately, there's a very simple way to do this.

A length of coax, one quarterwavelength long, having an impedance equal to the geometric mean of the two different impedances (that is: the square root of the product of the two impedances) will 'transform' between the two impedances. This technique is called the "Q-match transformer" method.

Conveniently for us, the square root of 35 ohms by 75 ohms is very close to 52 ohms. Thus, we can use a piece of RG58 52 ohm coax, cut to an 'electrical' quarter wavelength (to account for the velocity factor of the cable — a wavelength is shorter in coax due to the effect of the cable's dielectric). This is inserted between the antenna and the main feedline as illustrated in the assembly diagram.

The bandwidth of this system, and the whole antenna, is quite adequate for the application.

A standard Belling-Lee coax line plug is attached to the end of the RG58 matching section and a Belling-Lee coax line socket is attached to the end of the 75 ohm feedline. This join should be securely taped with insulation tape, or even covered with heatshrink tubing, to protect the connectors from the effects of the weather. ●

PARTS LIST ETI-722

Whip	Fibreglass quarterwave mobile whip. Obtainable from Mobile One or Scalar (Cat. No: M11).
Base	Mobile antenna base. Obtainable from Mobile One (HF base A), Scalar (type MB or OB) or IFTA (Jackson, model 2-226). The latter is a solderless type.
Bracket	16 or 18 gauge aluminium 75 x 150 mm min size.
Elements	9.5 mm (3/8") dia aluminium tube.
Coax	RG58 (52 ohms) cut to 415mm; RG59 (75 ohms) or similar, length to suit installation.
Connectors	Belling-Lee type, coax plug (e.g.: Dick Smith Cat. No: P-2020) and coax line socket (e.g. DS (e.g. DS Cat No: P-2030).
Miscellaneous	4 BA bolts and nuts, U-bolt to suit mast diameter

Addresses

IFTA 1 Greville St, Randwick 2031 (PO Box 21, Bondi Beach 2026), phone: (02) 665-8211.

Mobile One 17 Sloane St, Marrickville 2204, phone: (02) 516-4500.

Scalar 20 Shelley Ave, Kilsyth 3137, phone: (03) 725-9677.
20 The Strand, Penshurst 2222, phone: (02) 570-1392.
969 Ann St, Fortitude Valley 4006, phone: (07) 52-2594.

These firms should be able to assist with whips and bases to suit the antenna and addresses of nearest suppliers.

Dick offers FANTASTIC Value on Playmaster Kits

YES! Over 500 of these magnificent Playmaster Tuners have been sold. NOW - because of our higher quantity buying of components we have actually been able to REDUCE THE PRICE!! Buy now as the price can only remain at this new lower price while stocks last. Why not reap the benefit of our huge buying power NOW.

NOTE: This special price can only apply to our second production batch of 500 units.

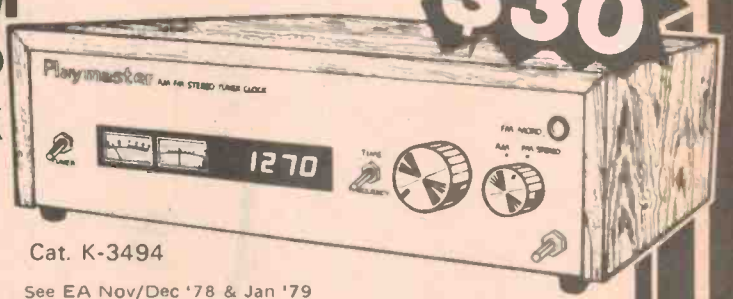
ONLY 500 UNITS AT THIS PRICE!!

SAVE $30

LOWER PRICE

AM/FM Stereo Digital Tuner/Clock

A superb stereo tuner with digital readout for the stations PLUS at the flick of a switch, a built-in digital clock. AM plus FM stereo with an indicator light for stereo broadcasts. The tuner heart comes as a complete, ready built module - no aligning necessary and the extremely well detailed construction manual will make you into a professional kit builder in next to no time.



Cat. K-3494

See EA Nov/Dec '78 & Jan '79

P&P $5.50

NOW ONLY $129.50

TERMS: $13.50 deposit & $11.09 per month over 12 months :- To approved applicants only (not Mail Order).

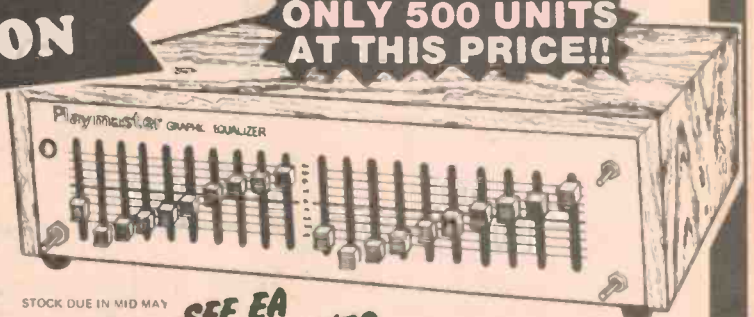
FANTASTIC NEW ADDITION

ONLY 500 UNITS AT THIS PRICE!!

Graphic Equaliser

Improve your Hi Fi sound out of sight with the superb NEW Playmaster Stereo Equaliser Kit.

Ten slider controls per channel enable you to shape the sound of your system to your room acoustics. Connections between the equaliser and your stereo amplifier are very simple, either connect between the pre and main amplifiers or directly through the tape socket. Designed to complement the already famous Playmaster amplifiers and tuner, this unit can be used with any Hi Fi system and comes as a complete kit PLUS detailed construction manual.



STOCK DUE IN MID MAY

Cat. K-3500

SEE EA MAY '79

SPECIAL INTRODUCTORY PRICE $99.50

P&P $4.00

TIMBER DRESS SLEEVE ONLY $8.50

P&P $1.00

Cat. H-3113

The two superb Playmaster units illustrated above are shown with the optional timber dress sleeve. Why not give your kit the professional finish - your friends will never believe that you actually built it!

DICK SMITH ELECTRONICS

bankcard welcome here

SHOPS OPEN 9AM to 5:30PM (Saturday 9am to 12 noon) BRISBANE ½ hour earlier.

*ANY TERMS OFFERED ARE TO APPROVED APPLICANTS ONLY

Many lines are available from the Dick Smith Electronics Centres at

GRACE BROS

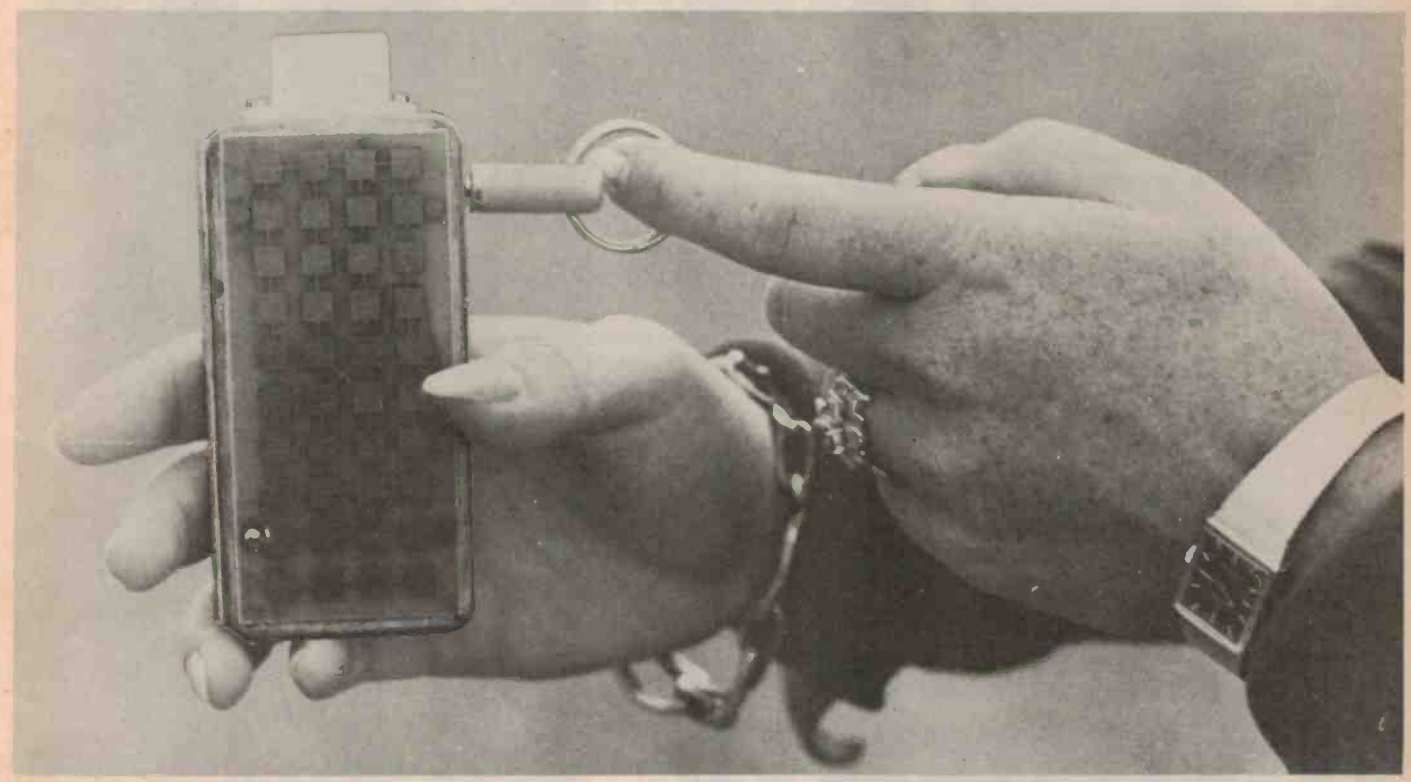
★ MIRANDA ★ LIVERPOOL ★ ROSELANDS ★

SYDNEY	125 York Street, SYDNEY. Ph 290 3377	MELBOURNE	399 Lonsdale Street, MELBOURNE. Ph 67 9834
	147 Hume Hwy, CHULLORA. Ph 642 8922		656 Bridge Road, RICHMOND. Ph 428 1614
	162 Pacific Hwy, GORE HILL. Ph 439 5311	BRISBANE	166 Logan Road, BURANDA. Ph 391 6233
	30 Grose Street, PARRAMATTA. Ph 683 1133	ADELAIDE	203 Wright Street, ADELAIDE. Ph 212 1962
CANBERRA	96-98 Gladstone Street, FYSHWICK. Ph 80 4944		
MAIL ORDERS	PO Box 747, CROWS NEST, NSW. 2065. Post and packing extra. Dealers across Australia.		

DSE533

Play the 'hot potato' game with our Electronic 'Grenade'

We know Christmas comes but once a year . . . and that this is May but we think that you should give your kids (and yourself) a treat and build something with no useful purpose – something just for fun. Designed by Jonathon Scott.

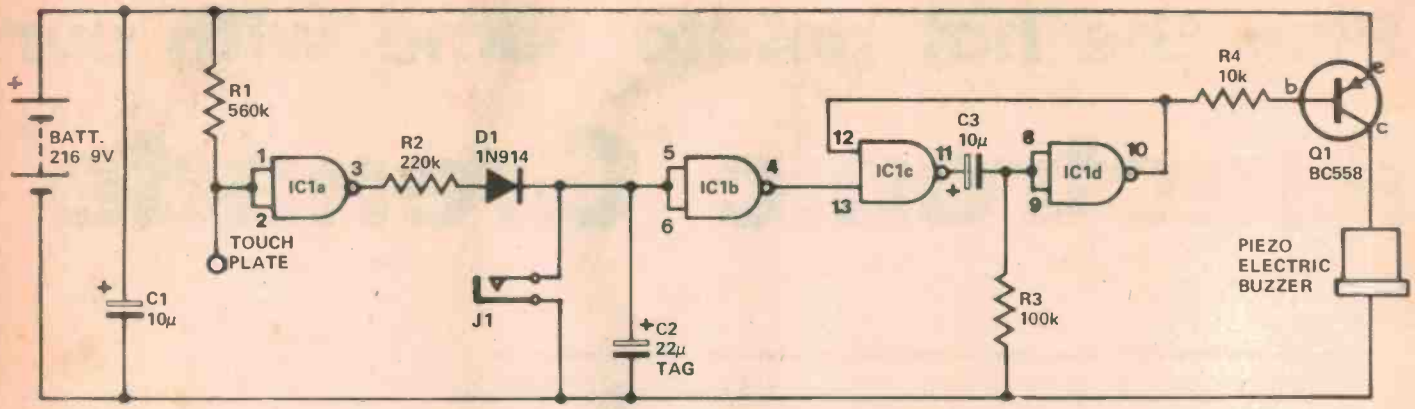


IF YOU HAVE kids (or can borrow some), they make a great excuse for building this project! Don't think that it's purely for children, though – judging from the reactions we saw from adults (especially our staff!), the game is just as good for anyone young at heart.

The basic idea started from the old 'hot potato' game. Some object – the hot potato – is passed from person to person until some cue occurs, such as the music stopping, as in musical chairs. The holder of the object is then out of the game and it proceeds with one less person. Eventually, all but one person is excluded and the remaining person wins the game.

In this new version (which the office wag dubbed "Irish Roulette") the tossed object is a grenade. Once the 'pin' (a shorted 3.5 mm audio plug) is removed, the grenade becomes active. After that, making touch contact between the case and one of the two pc board plates on the outside of the box causes a capacitor to charge. When the capacitor has charged to a preset level, which is the same as saying that the grenade has been handled by the people in the game for the required time, the buzzer goes off.

The grenade will go off while a particular person is holding it. It is highly unlikely to go off in mid-air (though very wet hands can leave enough moisture to set it off). The faster your reaction and the quicker you get rid of the grenade the less likely you are to get "blown up". The grenade times at a rate independent of damp hands or strength of grip, and is reset by putting the pin back in. ▶



PARTS LIST - ETI 253

Resistors — all 5%, ¼W
- R1 . . . . . 560k
- R2 . . . . . 220k
- R3 . . . . . 100k
- R4 . . . . . 10k

Capacitors
- C1. . . . . 10µ 16V electro
- C2. . . . . 22µ 16V Tantalum
- C3. . . . . 10µ 16V electro

Semiconductors
- D1 . . . . . IN914
- Q1 . . . . . BC558, DS558, BC178 or similar
- IC1 4011

Miscellaneous
- BZ1. . . . . piezo electric buzzer
- P1. . . . . 3.5mm audio jack plug
- J1. . . . . 3.5mm audio jack socket

Small diecast alluminium box (100 x 25 x 50 mm), 216 9V battery and battery holder, ETI 253 pcb's (3 in all), curtain ring for "pin".

HOW IT WORKS – ETI 253

The circuit counts the period of time that the grenade is held after the 'pin' has been pulled and operates the buzzer when this period reaches several seconds.

Initially, a shorted plug (the 'pin') is inserted in J1, shorting C2. R1 holds the inputs of IC1a high. Its output is therefore low, so no current flows through R2/D1 (No relation to R2-D2!).

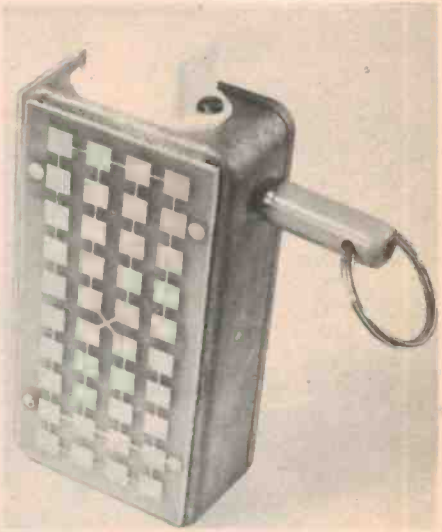
The output of IC1d is high, so that Q1 is biased off and the output of IC1c is held low. Quiescent current flowing in this state is negligible – less than 0.5 µA.

If the device is picked up and the skin resistance of a hand placed across the touch contacts, the output of IC1a goes high and a small current flows through R2, but C2 remains shorted out by the pin.

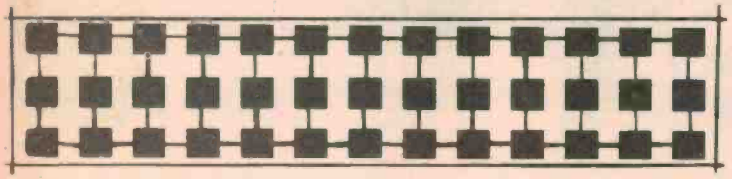
When the pin has been removed, however, holding the device causes C2 to charge. D1 prevents rapid discharging when the touch is removed by preventing current flowing back through R2.

When C2 charges to the threshold of IC1b, its output goes low and a monostable formed by IC1c and IC1d turns Q1, and thus the buzzer, on for about a second.

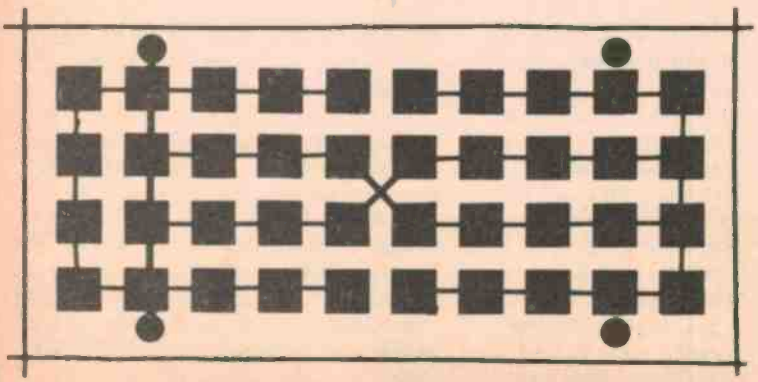
The pin is then replaced to reset the circuit, ready for another attack.

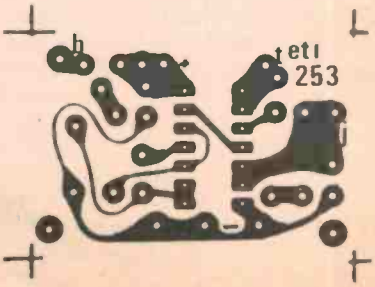


The completed 'grenade'



Touch sensor printed circuit patterns – full size.





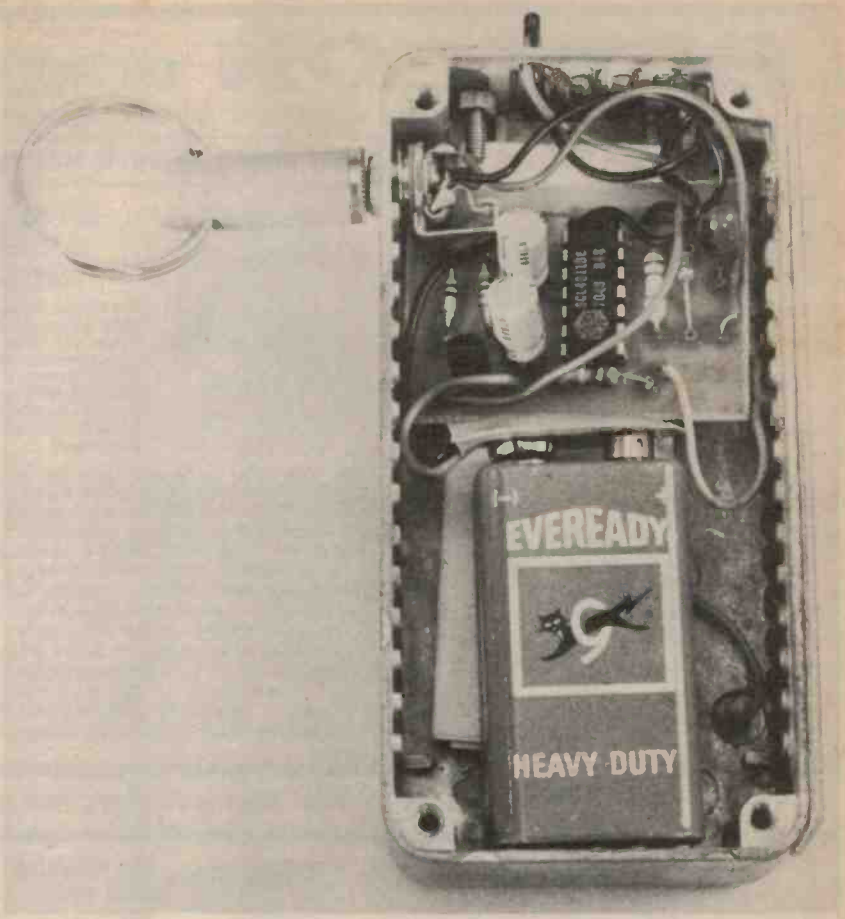
Construction

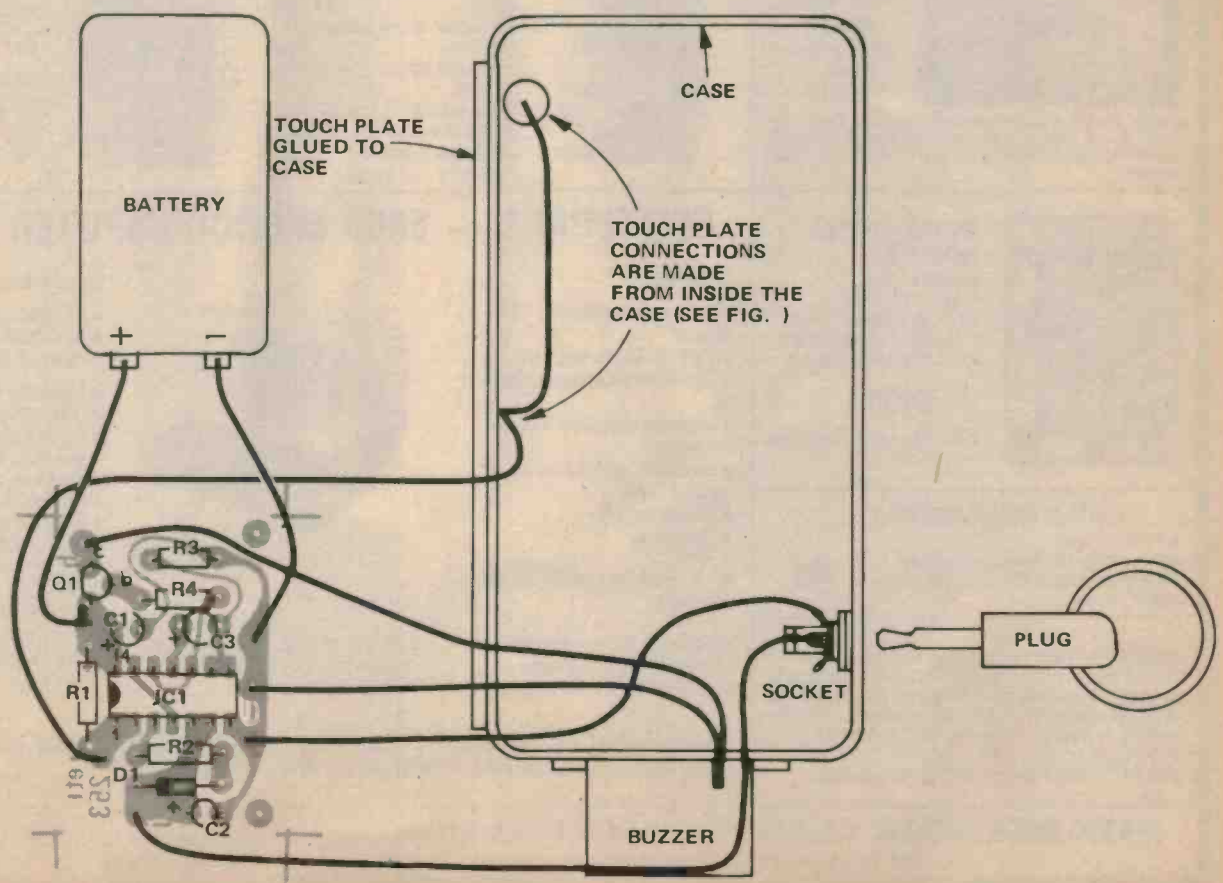
The first thing to do is to mark and drill the diecast box. Drill a 6 mm hole in the box underneath the place where you wish to run the pc board touch sensor wire. It is best to drill the small hole in the sensor pc boards first. This enables you to mark the position of the hole to be made in the box. Also, drill appropriate mounting holes for the buzzer and jack socket.

Next, glue the sensor pc boards in place. Fast setting Araldite is best.

Provision has been made on the component mounting pc board for mounting bolts but we preferred to mount it inside the box by jamming it in with pieces of foam rubber.

Mount all the components on the board first. The IC should be inserted last. Take care that the diode, capacitors, IC and transistor are mounted the right way round (see overlay). Finally, interconnect the board, buzzer, battery and jack (see diagram). Ensure that the end of the jack socket which is in contact with the case is the one which is connected to earth in the circuit diagram, as the case is one of the touch contacts and is connected to the pc board via this socket. Finally, jam the battery in place with some more foam rubber and screw on the lid. ●





SEMCON MICROCOMPUTERS PTY. LTD.

AUSTRALIAN MANUFACTURERS OF MOTOROLA COMPATIBLE PRODUCTS

VISIT OUR STAND AT THE SYDNEY COMPUTER SHOW MAY 24th-27th, SYDNEY LOWER TOWN HALL

7901 Multi Processing CPU Module

- MULTIPROCESSING CAPABILITY: Each module has one 6800 CPU, however bus contention logic allows up to 12 CPU modules to share same bus. Individual modules can then be assigned specific tasks — with this in mind provision is made for a floppy disc controller chip on board.
- MEMORY MANAGEMENT LOGIC — allows address expansion to one megabyte.
- 12K EPROM (2516) 4K STATIC RAM.
- 2516 EPROM PROGRAMMER.
- 3 PROGRAMMABLE TIMERS.
- PRIORITY INTERRUPT LOGIC.
- 2 PARALLEL I/O PORTS.
- 2 ACIA's with RS232 interface.
- Provision for Motorola Floppy Disc Controller.

Please send for details of pricing and availability

CRT-01 VIDEO INTERFACE

$285 PLUS TAX

This powerful unit has been designed to efficiently interface the memory of Motorola compatible systems directly to a CRT display. It is software driven and with appropriate program can be made to emulate the majority of functions of currently available intelligent terminals.

- No page buffer — the card has a line buffer that is continuously refreshed from processor memory on a DMA basis: a) Phase 2 when CPU VMA is low, or, b) Phase one. This is completely transparent to the processor resulting in a flicker free display without halting or slowing processor
- Displays up to 32x2k pages simply by changing contents of 8 bit page register
- Hardware scrolling controlled by scroll register
- Displays full 128 ASCII character set (Control characters optional)
- Inverse video (may be mixed with normal video)
- Coarse graphics
- Link programmable character/line (48, 64, 80)
- Link programmable lines/page (20,22,24)
- Additional line at bottom of page for status information — unaffected by scrolling
- Dot rate controlled by phase locked loop — automatically adjusts to different formats.

32K STATIC RAM: $569 KIT

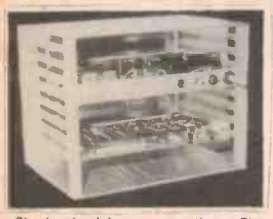
- Page mode operation — allows system expansion to 1 Megabyte
- Quality PCB with solder resist
- Motorola Bus compatible
- Low power — 2.5 Amps
- 300nS access
- Fully static operation
- Buffered address, data and control lines
- Power rails in grid network for improved noise immunity
- 4 x 8K blocks — individually addressable — each write protectable — may be removed from address space if not required
- Multi-phase operation — the module allows access during phase one and phase two — ideal for multiprocessing or DMA channels

	KIT	ASSEM.
32K	$569	$599
24K	469	499
16K	359	389
8K	249	275
No Rams	145	—

2516: plus 5V 2k x 8 EPROM $35

2114: 300ns 1k x 4 STATIC RAM $6.99

Hitachi Floppy Disc Controller Chip $85
(equivalent Motorola MC 6843)



SEMCON RACKING SYSTEM $143

($84 for rack without connectors)

- Sturdy aluminium construction
- Blue anodised finish
- Accommodates 8 Motorola Bus compatible cards
- Tin plated backplane with ground plane on one side
- 8 43x2x0.156" edge connectors.

PIA MODULE CMS 9620

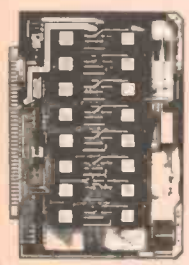
- Motorola Bus
- Up to 8 PIA's allowing 128 I/O lines
- Occupies 32 sequential addresses allowing efficient interrupt handling

$199 without PIA's (price does not include flat ribbon);
$260 fully populated:
6820's — $7.50

ACIA MODULE CMS 9650

- Motorola Bus
- 8 ACIA's
- RS232 interface on each of the eight channels
- 14 baud rates available

$350 assembled
$305 assembled with 2 ACIA's
6850 — $7.50



8K/16K EPROM MODULE

- Motorola Bus
- Up to 16 2708's
- Can be initialised for 8K or 16K of address space
- -5V generated on board

$135

EPROM'S to suit: 1 to 8 $13.50, 9 to 16 $12.50

WIRE WRAP MODULE

- Motorola Bus
- plus/minus 12V distributed on card
- Comprehensively numbered with silk screen overlay

$45

SEMBUG 1: Designed to run in conjunction with the CRT-01 Video Interface Module — displays 256 bytes of program plus contents of MPU registers. Breakpoints can be set and program run at full speed — alternatively single stepping is possible. Memory can be modified under cursor controls. The user can see all the above, dynamically on the vido display. Send for more details.

SEMTERM 1 — 6800 MICROCOMPUTER SYSTEM

Includes:

- Fully populated 7901 CPU Module
- CRT-01 Video Interface
- 32k Static RAM populated with 8k
- Injection moulded plastic housing
- Keyboard with numeric and control pads
- Power supply
- Card rack
- Fan
- 12" monitor (green phosphor optional)
- Software for: Intelligent terminal; FDOS; software development and debugging.

Addition of disc drive & printer required for complete stand-alone system.

Features:

- 80 characters x 24 lines
- Additional status line at bottom of page
- Up/Down Scrolling
- Insert/Delete character
- Insert/Delete line
- Graphics capabilities
- Transmit command
- Print command
- Enter program
- Run program
- 12k EPROM
- 12k RAM
- EPROM Programmer
- 3 programmable counters
- Floppy disc controller — runs up to 4 double-sided drives.

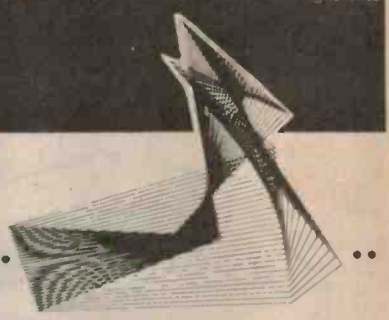
THIS SYSTEM IS AVAILABLE IN A NUMBER OF CHEAPER FORMS — PRICE ON APPLICATION. IT IS ALSO AVAILABLE AS A DEDICATED INTELLIGENT TERMINAL

SEMCON MICROCOMPUTERS PO Box 61, Pennant Hills, 2120. Tel (02) 848-0800

Add 15 percent tax where applicable. P&P: $2.50 Sydney Area. $3.50 elsewhere

PRINTOUT

ETI's COMPUTER SECTION



NEWS

compiled by Les Bell

IBM Offers Braille Program

A new program released by IBM enables their large System/370 computers to print Braille characters on specially modified impact printers. This enables visually impaired workers to access computer printout information.

Micro Trainer

The new Model 5036A Microprocessor Lab from Hewlett-Packard is the first entry-level microprocessor learning program to include three fundamental areas: hardware, software and troubleshooting. The 5036A consists of a 20 lesson textbook/lab manual and microcomputer in a briefcase. It is designed to give 'hands on' experience with the topics covered. The time required to complete the course is typically 50 hours.

Adding the Hewlett-Packard Model 5004A Signature Analyser and the Model 5024A Troubleshooting Kit to the Lab gives the user extensive training in microcomputer fault location. Jumpers are used to introduce faults and program failures into the system. The Models 5004A and 5042A can also be used in lab, production or service departments for troubleshooting a wide variety of digital logic circuitry.

The Microprocessor Lab's main circuit board is laid out like a block diagram with color graphics to highlight components and buses. Data, address, and status lines have individual LED indicators. During single-step execution of a program, the user can see what each signal line is doing during each machine cycle.

Lessons in the course illustrate how keyboards, speakers, switches, LEDs, displays, and other devices operate with microcomputer systems. They clearly show how I/O devices are sent data, and how the processor handles inputs from external devices. The experiments also show the user how to differentiate between a microprocessor and its peripherals when a fault exists in a system.

The board's monitor program includes:

a. Power up-self-test program – checks system operation and displays 'uLAB UP' to indicate the 5036A is ready.
b. Demonstration programs – a series of resident programs used to illustrate microcomputer versatility, including an organ program, a game, and a stopwatch program.
c. Signature Analysis test program – used to exercise all the system's nodes for troubleshooting purposes.

The Microprocessor Lab uses HP's 5004A Signature Analyser as a recommended accessory for the troubleshooting experiments. Signature analysis is a highly accurate data compression technique which provides the user with a four-digit hexadecimal 'fingerprint' unique to each node in a microprocessor system. Signature analysis lets service personnel compare signatures in circuits under repair to documented signatures provided by the manufacturer of the system under test, to verify that the signal on the node is correct.

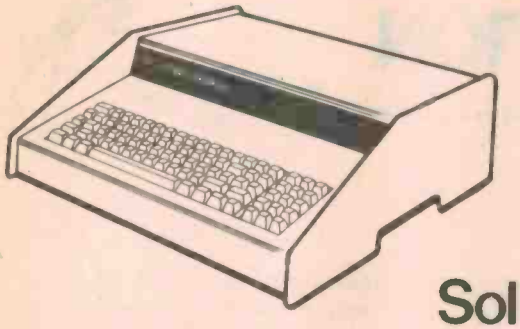
Prices are: 5036A Microprocessor Lab, $800 plus tas. Accessories for troubleshooting experience: HP 5004A Signature Analyser is $990, plus tax, HP5024A Troubleshooting Kit is $625 plus tax, (includes HP 545A Logic Probe, HP 546A Logic Pulser, HP 547A Current Tracer). For further information contact your local HP sales office (in the phone book).

US TV-Viewdata Link

Although the US is a long way from committing itself to any method of transmitting digital text on a TV signal, a US TV station, KSL-TV in Salt Lake City, is planning to write software to link the teletext system

COMPUTER BITS

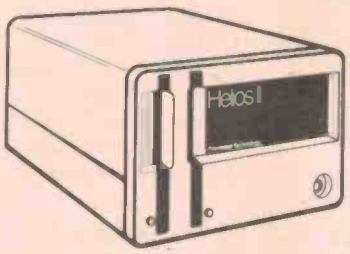
Processor Technology



Sol

Sol Specifications

- Keyboard: 85 key upper/lower case with separate numeric keypad. Upper-case shift, shift-lock, cursor control and repeat keys provided. System reset performed by simultaneous depression of control keys. Indicator lights (LED) for local, upper case and shift.
- Character set: 96 printable ASCII upper and lower case characters plus 32 optionally displayable control characters.
- Cursor: Switch-selectable blinking. Block video inversion. Program controlled positioning standard. Cursors may exist at any or all character locations.
- CPU: 8080A. Uses same machine language as other 8080 systems. 2 MHz clock cycle time. 78 instructions.
- Cassette interface: 120 character per second CUTS format or 30 character per second Kansas City format, selected by software. Uses audio cassette function of microphone start-stop switches. AGC for level insensitivity. Phase-locked data recovery tracks with speed variations. Software performs CRC data integrity check each 256 characters.
- Serial interface: RS-232 and 20 mA current loop. 75 to 9600 baud, asynchronous. 25 pin female "D-type" connector on card.
- Parallel interface: Eight data bits for input and output; output bus is tristate for bidirectional interfaces; levels are standard TTL. 25 pin male "D-type" connector on card.
- External memory: Expandable to 65,536 bytes total ROM, PROM, and RAM. Uses S-100 standard modules.
- Video signal output: 1.0 to 2.5 volts peak-to-peak. Nominal bandwidth is 7 MHz.



Helios II

Your key to effective, economical computer power.

See your Sol dealer for a demonstration.

AUTOMATION STATHAM

PTY. LTD.

47 Birch St, BANKSTOWN. 2200. Phone: 709-4144. Telex: AA 26770.

with the British Post Office-developed Viewdata system, which operates over phone links. The TV station has been cooperating with Texas Instruments in tests since late last year, using six decoders for demonstration purposes.

A UK-Government sponsored software house, Insac, has for some time been negotiating with major US companies for the introduction of teletext and Viewdata to the States – in fact it is surprising that the US have taken as long as they have to pick up on the idea, until one realises that teletext is basically a non-profit making system, and Viewdata is difficult to operate, at least initially. Meanwhile, the French have gotten into the act, attempting to sell the Americans their system, Antiope.

A two-year market study in Salt Lake City has revealed that enough consumer demand exists for the manufacture of TV sets with built-in teletext decoders. Persons earning more than US$15 000 p.a. would be willing to pay as much as $50 more for a new set that has a decoder built in.

More OSI Available

Two new microcomputer systems, the Ohio Scientific C2-4P and C2-8P are now available in Australia. Similar to their "smaller brother", the C1P, they also offer as standard a 6502 microprocessor, 8K BASIC-in-Rom, 512 bytes machine code monitor, a polled keyboard, 4K of RAM and a Kansas City standard cassette interface. Like the C1P they offer memory mapped video, but utilise 2K of display RAM for a full sized 30 x 64 character display of all the ASCII symbols in addition to the full spectrum of gaming and graphics symbols. The larger displays on the C2-4P, C2-8P make them very suitable for business applications (data entry, etc.).

The real strength of these modules lies in their expandibility. Both utilise a Bus architecture – the C2-4P has a 4 slot backplane and the C2-8P has 8 slots. Both use only 2 slots in the basic configuration above, allowing, for the C2-8P, fourfold physical expansion in case by simply plugging in boards. Thus adding a line printer, extra memory, a serial communications facility etc. is simply a matter of "plugging in" the appropriate board.

However, by adding a mini or full size floppy disk drive, these systems really come into their own, as the full range of Ohio software becomes available. This ranges from "PICO-DOS", a 4K experimenters DOS designed to be compatible with BASIC in ROM, right up to 65U V1.1, a 24K business DOS which supports high speed Business BASIC named files with multi-level password protection and ultra fast sequential or random access. Also available are Word Processing discs, a Data Base Management System and general business packages.

The ready availability of system level software (they support four operating systems for the C2-8P!) ready expandibility, and the low baseline price ($718 for the C2-4P, $959 for the C2-8P) make these systems ideal for the serious hobbyist or small business application. For further information on the Ohio product line please contact: Mike Barraclough, Systems Automation Pty. Ltd., 26 Clark Street, Crows Nest, NSW 2065. (02) 439-6477.

IREE Sydney Microprocessor Group

The Institution Of Radio and Electronic Engineers runs this Sydney group, which is going from strength to strength and now boasts 150 paid-up members. They meet on the first Tuesday of the month at 6.30 p.m. at the School of Electrical Engineering, Sydney University. For further details, contact *Dr. Barry Madden,* at the Uni of NSW *on 662 2423* or *Steven Wolkowics on 648 1711.*

12-bit A/D

Intersil, Inc. has announced a new monolithic A/D converter chip which is the industry's first ±12-bit device specifically intended for a wide variety of microprocessor interface applications.

The ICL7109 features a three-state output which enables it to be directly interfaced to virtually any microprocessor data bus which is 8 to 16 bits wide. The device may also be used for remote serial data logging applications.

In the byte-organized parallel mode, the ICL7109 can interface with the data busses of such popular microprocessors as the Intersil 6100, the Motorola MC6800, or the Intel 8080 and 8048. There are 14 data output lines, providing 12 magnitude bits plus polarity and out-of-range bits. The output lines can be grouped in two 8-bit bytes,each activated by its own byte-enable signal, plus a master chip-enable line.

For remote data transmission applications, the ICL7109 has a handshake capability so that it may also be directly interfaced with universal asynchronous receiver/transmitter (UART) logic.

According to Skip Osgood, Data Acquisition Product Manager, the 7109 can either be brought under control of the microprocessor with Start-Convert. Status and Byte Enable lines, or sequence through its two 8-bit bytes either synchronously or on demand from the microprocessor or the UART. "No additional active components are

Word Processing by Memorite

Nobody does it better.

$10,250

Owners are quick to praise Memorite 2 word processing system. And why not? Vector Graphic's Memorite 2 is one of the most modern, powerful and most cost effective word processors in the world.

Its value is just as much a function of its low cost as is its many useful features. Memorite 2 cuts typing time in half and automatically types from memory at a rate of up to 540 error-free words a minute.

Think of the possibilities: contracts, personalized form letters, manuals, catalogs, reports, mailing lists, proposals or other important documents.

See or call your dealer for a demonstration. We think you'll be impressed. Best of all, years later you'll still be impressed.

See a demonstration at the Computer Show
Sydney Town Hall 24th-27th May. Stand B20

MICROCOMPUTER DIVISION
A.J. & J.W. DICKER PTY. LTD.
©VECTOR GRAPHIC INC.
Australian Distributor
24 Woodfied Byde., Caringbah 2229
5245639

needed," Osgood said, "because the device has on-board logic to take control of the microprocessor or the UART. The 7109 is an ideal single-chip solution to design projects involving the logging of temperature, pressure, light intensity, humidity, or any other analog variable."

Osgood said the new A/D converter employs dual-slope integration for good noise rejection (noise is less than 15μV peak-to-peak) and features very low power consumption of less than 20 mW because of CMOS construction. He noted that the low power consumption and low price make the ICL7109 especially attractive for locating near the signal source in one-per-channel A/D systems.

Other features, added Osgood, include true differential signal and reference inputs; zero drift of less than 1 uV/°C; nonlinearity of less than 0.01% and typical input current of 1 pA.

The ICL7109 is available from stock in 40-pin plastic or ceramic dual-in-line packages. Intersil are represented in Australia by *R & D Electronics, 23 Burwood Rd, Burwood 3125.*

COMPUTER CLUB DIRECTORY

Section 1 – arranged by districts

ADELAIDE – ACS Microprocessor Group, c/- Doug Cruikshank, School of Mathematics and Computer Studies, South Australian Institute of Technology, Box 1, Ingle Farm, SA 5098.

ADELAIDE – Wireless Institute Microprocessor Group, c/- Clive Pearson, Wireless Institute of Australia, P.O. Box 1234K, Adelaide 5001 (or Box 207, Gawler, SA).

ARMIDALE – New England Computer Hobbyists Club, c/- Union University of New England, Armidale NSW 2351.

BRISBANE – IREE Microcomputer Interest Group, P.O. Box 81, Albion QLD 4010 (Tel. 356 6176)

CANBERRA – MICSIG, P.O. Box 118, Mawson ACT 2607 (Tel. 72 2237)

HOBART – Tasmanian Amateur Computer Society, meets first and third Tuesdays of the month in the Computer Studies Area of the Rosny Matriculation College, at 7.30 pm. (Tel. Clive Myers, 65 2252)

MELBOURNE – Microcomputer Club of Melbourne (MICOM), P.O. Box 60, Canterbury, VIC 3126. Meets on third Saturday of every month at AMRA Hall, Willis St, Glen Iris, opposite Glen Iris Railway Station, at 2 pm.

MELBOURNE – Monash Personal Computer Club, c/- Union Building, Monash University, Clayton VIC 3168.

NEWCASTLE – Newcastle Microcomputer Club, c/- Dr. Peter Moylan, Dept. of Electrical Engineering, University of Newcastle, Newcastle NSW 2308 (Tel. (049) 68 5256 (office), (049) 52 3267 (home)).

ORANGE – Bruce Carroll, Orange 62 8703 or Neville Wilde, Bathurst 31 5809 or write c/- Box 1117, Orange 2800.

PERTH – Western Australian Computer Enthusiasts Group, c/- R. Langlois, Memrex Pty. Ltd, 49 Hay St, Aubiaco WA 6008. Meets last Monday of each month at 7.30 pm at Taimac Video Corporation, 1st floor, cnr. Newcastle and William Streets, Perth.

SYDNEY – Microcomputer Enthusiasts' Group, P.O. Box 3, St. Leonards, NSW 2065. Meets at WIA Hall, 14 Atchison St., St. Leonards on the first and third Mondays of the month.

SYDNEY – IREE Microprocessor Group, c/- Dr. Barry Madden, School of Chemical Technology, University of NSW, P.O. Box 1, Kensington NSW 2033. (Tel 662 2423)

SYDNEY – Marrickville Microcomputer Society, c/- 26 Malakoff St, Marrickville 2204. (Tel. 569 5689)

WAGGA WAGGA – c/- D. Aleksic, P.O. Box 186, Wagga Wagga NSW 2650.

NEW ZEALAND

AUCKLAND – The N.Z. Microcomputer Club, P.O. Box 6210, Auckland 1, NZ.

CHRISTCHURCH – c/- Paul Campbell, 50 Francis Ave., Christchurch, NZ.

WELLINGTON – Wellington Microcomputer Club, P.O. Box 1581, Wellington, NZ.

Section 2 – arranged by processor or computer

APPLE II – Apple II Users Club, c/- Computerland Australia Pty. Ltd, 55 Clarence St, Sydney 2000.

EXIDY SORCERER – Exidy Sorcerer Users Group, c/- Frank Schuffelen, 66 Porter St, Templestone, VIC 3106.

TI59 – TI59 User Exchange Service, c/- Serge Petelin, 95 Gerler St, Bardon QLD. (Tel. (07) 36 5197)

TMS9900 – TMS9900 User Group, c/- Barry Day, 43A Osborne Rd, Lane Cove NSW 2066.

TRS-80 – TRS-80 Users Group, c/- Les Kinch, VK2BBD, 128A Booralie Rd, Duffys Forest, NSW 2084. (Tel. (02) 450 2026)

2650 – Australian 2650 Users Group, c/- Applied Technology, 1A Paterson Ave, Waitara 2077.

Centaur Industries

"THE S100 SPECIALISTS"

PO Box 37243, Winnellie, N.T. 5789.
29 Meigs Cr. Stuart Park. Ph (089) 81-2505

SEATTLE COMPUTER PRODUCTS, INC.

CLEARANCE SALE

S-100 static RAM. Top quality assembled and tested boards backed by a full year's warranty — will work in any known S-100 system: no clocks, no refresh, no problems with DMA peripherals, no "hidden gotchas"!

16k-250 ns .....$375 16k-450 ns.....$325

GUARANTEED FOR ONE FULL YEAR

S.D. SYSTEMS

Top quality S-100 kits at unbeatable prices (also available assembled and tested). All boards feature sockets for all ICs, and first quality plated-through PCBs.

Z80 STARTER KIT

The ideal choice for the beginner, this is a complete Z80 system on a board. Includes 1k static RAM with sockets for another 1k, powerful 2k ZBUG monitor, extra PROM socket PLUS on-board PROM programmer. There's also a Kansas City standard cassette interface, hex keyboard and six digit display, twelve command keys, four counter/timer channels, two eight-bit parallel I/O ports, and room for you to expand: a generous 2½" x 8" wire-wrap area for custom circuitry AND S-100 INTERFACE WITH POSITIONS FOR TWO S-100 EDGE CONNECTORS ON BOARD.

Comprehensive documentation including full operating and programming guides. Power requirements: +5v at 1A, +25v at 30 ma. (for PROM programming).

ALL THESE FEATURES FOR ONLY.....$249

assembled and tested $399

SBC-100 SINGLE BOARD COMPUTER — much more than just a CPU board, it combines the Z80 CPU with 1k RAM, four PROM sockets for 4k or 8k of ROM storage, fully programmable synchronous/asynchronous serial I/O (RS232 or 20 ma. current loop), parallel input and output ports, 4 counter/timer channels and 4 vectored interrupts.

Replaces 3 or 4 boards in many systems!

PRICES REDUCED: KIT $239

assembled and tested $369

VERSAFLOPPY FLOPPY DISC CONTROLLER — Controls both 8" standard and 5" minifloppies. Directly controls Shugart SA-400, SA-800; Persci 70 and 277; MFE 700/750 and CDC 9404/9406. Listings of control software are included in the price.

THE BEST VALUE IN FLOPPY DISC CONTROLLERS $159

assembled and tested 239

SHUGART FLOPPY DISC DRIVES

SA-400 5" minifloppy .....$379 SA-400 cable.....35
SA-800 8" std. floppy .....575 SA-800 cable.....39

SOFTWARE

CP/M disc operating system — the industry standard, complete with 8080/Z80 assembler and BASIC-E plus editor and utilities, on 5" or 8" floppy disc ...$125
Versafloppy control on 2758 50
SD Monitor on 2716 75
Z80 Disc based assembler 70

NEW RELEASES:

VDB-8024 VIDEO DISPLAY BOARD — Full 80 x 24 character display, complete cursor control, forward and reverse scroll, blinking, underline, reverse and field protect.

Controlled by a dedicated on-board Z80, it includes keyboard power and signal interface, plus both composite and separate video and sync.

KIT PRICE.....$319

assembled and tested $369

S-100 EDGE CONNECTORS — Imsai type, gold plated to suit Starter Kit and our motherboards.....$6.00

STARTER KIT MEMORY EXPANSION — set of 8 RAM chips and DIP sockets for lk bytes $20.00

ZILOG CHIPS AND MANUALS

Z80-CPU.....$19.95
Z80A-CPU 29.95
Z80-PIO.....14.95
Z80-CTC 14.95
Z80-DMA 49.95
Z80-SIO 69.50

CPU Tech. manual 11.20
PIO Tech. manual.....7.50
CTC Tech. manual 7.50
SIO Tech. manual 12.50
Assembly prog. manual 15.00

Z80B CPU BOARD $149

assembled and tested $235

EXPANDOPROM BOARD — Takes either 2708 or 2716 EPROMS for up to 32k. Comes complete with all support chips and sockets etc. (EPROMS not included). KIT PRICE $99

assembled and tested 189

EXPANDORAM — High density dynamic RAM, compatible with SD Systems Z80 CPU boards and the Versafloppy controller. Designed to work with 8080 and 8085 CPUs as well, these boards come in 32k and 64k models, which can be purchased partly populated for later expansion if needed.

	32k model (uses 4115 RAM)			64k model (uses 4116 RAM)	
Size	**Kit**	**A&T**	**Size**	**Kit**	**A&T**
8k	$199	$379	16k	$499	$595
16k	299	449	32k	689	849
24k	399	519	48k	869	1099
32k	475	599	64k	1049	1299

MEMTECH CO.

MEMTECH ARITHMETIC PROCESSOR INTERFACE

This unique product brings the number crunching power of the fabulous AM9511 arithmetic processing chip to the S-100 computer user. Full 32 bit floating point multiply in as little as 42 us. — and a full complement of transcendental functions, all far faster than software routines.

Also available is BASIC-M, a modified BASIC-E on CP/M compatible diskette which takes full advantage of the APU performance.

APU interface (without 9511 chip) $159
assembled and tested$179
APU interface with 2 MHz 9511...$385
assembled and tested $399
APU with 4 MHz 9511.....$485
assembled and tested $499
BASIC-M on 8" CP/M format floppy disc $29

Available soon: modified versions of CP/M compatible FORTRAN and PASCAL compilers

CENTAUR INDUSTRIES

CENTAUR S-100 POWER SUPPLY

Professional quality power supply with rugged, generously rated transformer, top grade filter capacitors (the ones NASA use!), fully fused, transient protected, AC line filter — gives+8v at 22A, ±16v at 3A, AND+28v at 3A for floppy discs and/or PROM programming supplies $349

(Power supplies shipped freight collect)

STRUCTURED SYSTEMS GROUP — Quality business-oriented software designed for use under the CP/M operating system.

CBASIC — Runs on any 8080 or Z80 system with 20k or more and CP/M. Powerful disc access features — random and sequential files including variable length records. Enhanced control structures (WHILE . . . WEND, optional ELSE clause and STATEMENT LIST improvements to the IF statement), source library facility, machine language routine linkage, powerful PRINT USING, 14 BCD digit arithmetic for accurate financial calculations, and many more powerful features make this the BASIC for business applications. CBASIC is a compiler, so your programs run faster, use less memory, and are much more secure against software piracy

ON 8" CP/M FORMAT DISKETTE WITH USER MANUAL.....$99.95

QSORT — Runs on any CP/M system. A full disc sort/merge package — easy to use and very flexible.

ON 8" CP/M FORMAT DISKETTE WITH USER MANUAL.....$95

NAD — A complete name and address database system with a number of powerful user options. Requires CP/M, 32k and a 132 column printer — it can select records on any field including a user-definable field — print mailing labels — many powerful uses can be easily programmed.

ON 8" CP/M FORMAT DISKETTE WITH USER MANUAL.....$79

WAMECO, INC: CMB-12 S-100 MOTHERBOARD — 13 slot motherboard complete with all parts and connectors. Features extensive ground plane and termination of all signal lines, I/O area with 3 regulated voltages.

KIT PRICE.....$125

assembled and tested $145

Add 15 percent sales tax where applicable — we pay postage on pre-paid orders — orders accepted pre-paid or COD.

COMMODORE PET

The PET has been hailed as "the layman's computer". Judging by its popularity overseas amongst doctors, solicitors, engineers . . . and hobbyists, it seems set to catch a goodly share of the Australian market. Hanimex obtained the local agency in late March. Our Canadian edition sends us this report.

THE COMMODORE PET started life in the US. It then migrated across the Atlantic to the UK and on to Europe, rousing large-scale interest on the way. It's about to hit Australia.

What makes the PET special is that it's *completely* self-contained. All that is required to begin using it is a mains socket. This may not seem like much of an advantage to all you S-100 boot-strappers but to many people (many more than are at present in the home computer market), it's a gigantic plus. Remember the unit stereo?

What you get for your money is what you see (CRT, cassette mechanism, calculator style keyboard) all packaged in a neatly styled case, plus the innards (6502 microprocessor, 12K of ROM containing all that is necessary to operate the hardware plus a BASIC interpreter, 8K of RAM and other assorted bits).

How Did We Like It

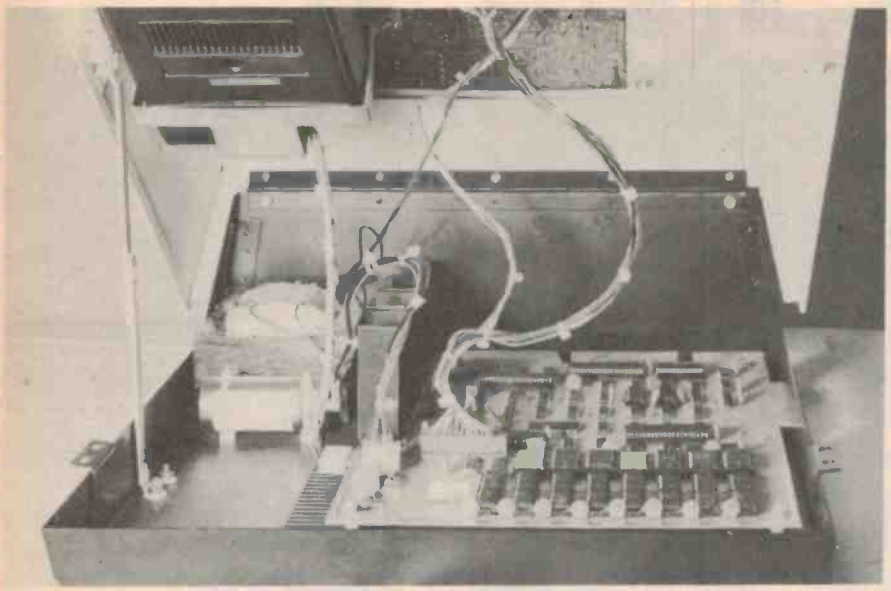
There is no doubt that this package of micro-pieces is well thought out, and designed with the idea that the user needs to know very little about computers to "get into" PET.

First of all there is no wiring up to do. When you plug in and switch on the PET, after only a couple of seconds it's ready for action. No BASIC to load from tape, it's already in there. This is one great headache reliever if the program you've written bombs out and writes all over memory in selected vital (of course) locations. No waiting for a 20 minute BASIC reload. 14K of built-in software is worth ten times its weight in silicon.

So after power-up you can start programming or load from a cassette tape the software you want.

Taped

Upon entering the LOAD instruction, the machine tells you to stick the tape▶



The interior of the PET. Notice the strut which holds the top of the machine out of the way while maintainance is being done. Also notice the cassette mechanism which you can just see at the top of the picture.

in and press the "PLAY" button. Here's where a compromise has been made. Although the PET can switch the transport motor on and off, it tells you to do the muscle work. Commodore have saved money by using a standard (and cheap) cassette recorder, which is sensible for the market they're aiming at.

The cassette feature worked quite well, although a couple of demonstration tapes did not load properly (we suspect a shift in the head alignment from machine to machine). One feature we would have liked which could not have been introduced without heavy cost) would be a fast forward search. Without it the machine took a long time to find a program if the tape was started at the beginning and the program happened to be near the end. For this reason it seems most economical (time wise) to only use C30 cassettes and then record only one or two programs near the start of each side, unless programs are recorded in some long sequence in which they are to be used, or for storage of little-used data.

The keyboard is quite another matter. It looks like a large Commodore calculator keyboard (not surprisingly). The keys are small, have no tactile feedback (they don't click) and are arranged in rows instead of being 'raked' like a typewriter. If you can type, this quickly results in a cramped little finger on the left hand and a very short temper.

Commodore are bringing out another version, with a 'proper' keyboard and an outboard cassette recorder.

The video monitor is rather special. The line and frame waveforms are generated in software, giving an extremely sharp and steady picture. No problems there.

Electronics

For the electronics enthusiasts (well, you are reading this magazine, aren't you?) we've included an interior shot. All the big chips are plugged into sockets, something which is nicé to see, especially for ROM.

The keyboard is accessed via a sixteen line Peripheral Interface Adaptor (6520, like a 6820 for Motorola fans) which we expect uses eight outputs and eight inputs for decoding sixty-four keys and then also a couple of the PIA 'handshaking' lines for the rest of the work. In other words most of the keyboard decoding is done by the software.

The cassette recorder is a standard one with a new pcb inside, full of electronics suitable for data recording. In fact, two cassette interfaces are provided (second cassette recorder available later) with input, output and motor on/off lines for each. This uses six lines of the sixteen on the second 6520 PIA (we assume), leaving ten lines, eight for parallel I/O and two serial, at TTL levels. Both cassettes record at 1 000 baud, but using built-in software any program is recorded twice for reliability, cutting the effective rate to 500 baud. Thus an 8K program takes about two and a half minutes to load.

In addition, the PET is probably the first popular computer to use the IEEE 488 bus, making it compatible with many existing and future digital measuring instruments.

A final note on the hardware. Unlike some of the early hobby computers, the ▶

The PET keyboard. This is the worst keyboard we have ever seen on a hobby computer. The keys are small, don't click and are arranged in straight rows, rather than being 'raked' as a typewriter's keys are. This almost spoiled what is otherwise an excellent design.

TASMAN ELECTRONICS

12 Victoria Street,
COBURG, 3058.
Phone (03) 354-5062.

Open Mon-Thur 9am-5.30pm. Fri 9am-9pm. Sat 9am-12 noon.
Mail Orders – please add 70c minimum post and pack.

• TRANSISTORS

AC127	1.25
AC128	.80
AD149	2.60
BC107	.35
BC108	.35
BC109	.35
BC109C	.40
BC177	.38
BC318	.22
BC319	.22
BC320	.22
BC337	.24
BC338	.24
BC547	.24
BC548	.24
BC549	.24
BC557	.24
BC558	.24
BC559	.24
BD139	.50
BD140	.50
BD262	1.20
BD263	1.20
BFX84	.82
BFY50	.80
BFY51	.80
BF115	.68
MJ2955	.85
MJE2955	1.89
MPF102	.47
TIP31A	.70
TIP31C	.75
TIP32C	.82
2N2219	.46
2N2222A	.40
2N2368	.25
2N2646	1.15
2N2647	1.15
2N2904	.50
2N2905	.50
2N2905A	.50
2N2907	.45
2N3107	1.00
2N3053	.50
2N3054	1.20
2N3055	.75
2N3300	.75
2N3642	.35
2N3702	.16
2N3704	.29
2N3740	1.70
2N3904	.29
2N4030	.92
2N4032	.97
2N4033	1.30
2N4036	1.53
2N4037	1.15
2N4231	.99
2N4234	1.87
2N4238	1.67
2N5088	.30
2N5871	1.53
2N5872	2.05
2N5873	1.53
2N5874	1.67
2N6124	.92
2N6126	1.11
2N6129	1.28
2N6130	1.43
2N6132	1.43
2N6134	1.53
MPS3565	.18
MPS3638	.19
PN3565	.18
PN3566	.18
PN3567	.18
PN3568	.18
PN3569	.18
PN3638	.18
PN3638A	.22
PN3641	.20
PN3642	.20
PN3643	.20
PN3644	.22
PN3645	.22
PN3646	.22
PN3693	.29
PN3694	.29
PN4121	.35
PN4248	.22
PN4250	.29
PN4355	.29

• 74LS

74LS00	.20
74LS01	.30
74LS02	.25
74LS03	.25
74LS04	.20
74LS05	.30
74LS08	.25
74LS09	.30
74LS10	.25
74LS11	.30
74LS12	.30
74LS14	.95
74LS20	.28
74LS21	.30
74LS27	.30
74LS28	.40
74LS30	.30
74LS32	.30
74LS37	.38
74LS38	.38
74LS40	.30
74LS42	.70
74LS73	.60
74LS74	.46
74LS75	.55
74LS78	.50
74LS85	1.40
74LS86	.50
74LS90	.70
74LS92	1.10
74LS93	.80
74LS95	1.00
74LS109	.50
74LS113	.50
74LS114	.50
74LS125	.70
74LS133	.30
74LS138	1.10
74LS151	1.15
74LS157	.75
74LS160	.90
74LS163	1.15
74LS164	1.30
74LS165	1.15
74LS169	1.70
74LS174	.70
74LS175	.85
74LS190	1.25
74LS191	1.20
74LS192	1.15
74LS193	1.00
74LS194	1.15
74LS195	1.00
74LS196	1.20
74LS197	1.50
74LS251	.85
74LS253	.85
74LS257	.75
74LS259	3.30
74LS279	.55
74LS290	1.15
74LS365	.70
74LS366	.70
74LS367	.70

• CMOS

4000	.25
4001	.25
4002	.25
4007	.30
4008	1.20
4011	.25
4012	.25
4013	.52
4014	1.30
4015	1.30
4016	.50
4017	1.30
4018	1.20
4020	1.40
4021	1.30
4022	1.30
4023	.25
4024	.90
4025	.35
4027	.70
4028	.95
4040	1.30
4042	1.10
4043	.95
4044	.95
4046	1.55
4049	.55
4050	.55
4051	1.20
4052	1.20
4053	1.20
4060	2.20
4066	.75
4068	.35
4069	.30
4070	.35
4071	.35
4072	.35
7076	1.75
4077	.35
4078	.35
4081	.35
4082	.35
4093	.70
4441	.95
4502	1.20
4506	.60
4510	1.40
4511	1.30
4518	1.40
4520	1.40
4528	1.20
4553	6.99
4555	1.10
4581	3.00
4582	1.00
4584	.75
40014	.60
40097	.90
40098	.90
74C02	.35
74C04	.40
74C08	.40
74C10	.40
74C14	1.60
74C20	.45
74C48	2.40
74C73	1.10
74C76	1.15
74C90	1.50
74C93	1.50
74C175	1.75
74C192	1.85
74C193	1.85

• TTL

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

• VOLT. REG

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

• DIODES

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

• BRIDGES

W02	.90
VM48dil	1.25
MDA3501	3.40

• ZENERS

½W	.19
1W	.30
2½W	.65

same price, all voltages

• SCR's/TRIAC

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

• LINEAR IC's

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

• MICRO etc

SYP2102A-4	1.90
2708	15.00
93448	10.20
1488	.96

• OPTO

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

• RESISTORS

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

• TANTALUMS

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

• CERAMICS

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

• TRIMMER CAP.

5pf to 65pf	.30

• SUPP. CAP.

NS5, 0.5uf	.60
NNS30, 3uf	2.00

• ELECTRO. CAPS. PC TYPE

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

• ELECTRO. CAPS. CAN TYPE

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

• POLYESTER GREENCAPS

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

• WIRE & CABLE

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

• FUSEHOLDERS 3AG —

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

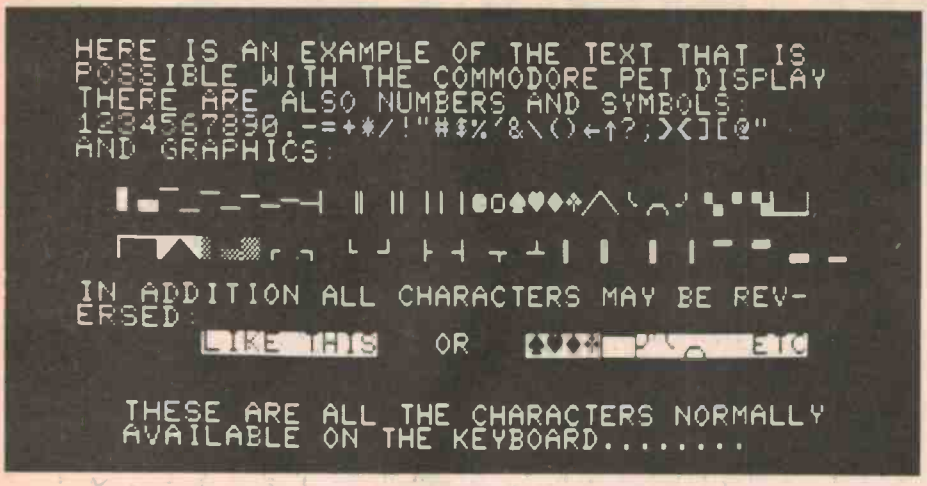
• FUSES, 3AG —

0.25A, 0.5A, 0.75A	.16
1A, 1.5A, 2A, 3A, 4A, 5A	.10
M205 TYPE (20mm) 0.25A, 0.315A, 0.4A, 0.5A	.30
0.63A, 1A, 1.6A, 2A, 3.15A	.20

• RELAYS

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

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



Standard Dartmouth BASIC Statements: LET, READ, PRINT, DATA, IF, THEN, FOR, NEXT, DIM, END, GOTO

Extended BASIC Statements: RESTORE, REM, GET, GOSUB, DEF, RETURN, STOP, STEP, INPUT, FN, ON . . . GOTO, ON . . . GOSUB

Scientific Functions: SGN, INT, ABS, SQR, RND, SIN, COS, TAN, ATN, LOG, EXP

Logical Operators: AND, OR, NOT

Operation Commands: RUN, NEW, CLR, LIST, CONT, FRE

Formatting Functions: TAB, POS, SPC

Machine Level Statements: PEEK, POKE; Allow the user to examine and store at specific memory locations. USR, SYS; Link BASIC to machine language subroutines with parameter passing or developmental subsystems. WAIT; Monitors status of a memory location such as an I/O port until specified bits are set.

String Functions: LEFT$, RIGHT$, MID$: Returns substrings (of specified length and position) of string acted upon. CHR$, ASC: CHR$ returns a character, given a numeric code. ASC returns a numeric code corresponding to a character. LEN: Returns the length of a string. VAL, STR$: Convert decimal values to numeric strings and vice-versa.

Extended I/O Statements: OPEN, CLOSE: Control association of a logical file number to a physical device and, optionally, a file name on the device. SAVE, LOAD, VERIFY: Store and retrieve a program, with optional file name, on a physical device. Load allows for program overlay, VERIFY compares contents of memory to stored program. PRINT#, INPUT#, GET#: Allow communication with logical device numbers other than keyboard or screen. GET# inputs one character. CMD: Permits communication with multiple devices simultaneously.

Variables
TYPES: Real, Integer (%), String ($)
NAMES: Variable names are uniquely given as a letter or a letter followed by a letter or digit.

Special Variables
TI, TI$: Time of day. ST: Status word for I/O operations.

inside of the machine is well laid out and easy to service. The top of the case hinges up and a prop holds it in place while the insides are worked on.

Graphics

We suspect some pretty creative people sat down and worked out the graphic character set on this machine.

The display system is based on 8 x 8 dot units, which may contain 5 x 7 dot upper case letters or assorted symbols which are so designed that they provide very verstile diagram and graphing capabilities. Because the 8 x 8 blocks are contiguous (fit together without gaps), the symbols can be made to run together to form continuous lines and other patterns.

The 'cursor' is a flashing square which can be moved about the screen and normally indicates the next square to be typed in. "RETURN" causes the cursor to move to the first position of the new line, just as a carriage return does on an electric typewriter. Additional cursor controls are useful for editing and correcting programs which are displayed on the screen (the PET has a 'page mode' editing system, which allows you to see what you are doing to the stored program as you do it).

In addition to the normal characters, each may be reversed (black on white) which can be useful for highlighting.

Finally, here's our big surprise! If you've been counting the keyboard characters, you'll notice that there are a lot less than 256 – the normal number found on hobby computers. Quite by accident we found a whole set of lower case letters! Very interesting. We're not quite sure what does it but check the pictures for yourself. That still doesn't add up to 256, so there may be yet more we don't know about. In fact keyboards on earlier prototypes showed a set of graphic symbols which included assorted Greek letters. Could they be inside somewhere as well? We don't know, it all depends on what's in the character generator.

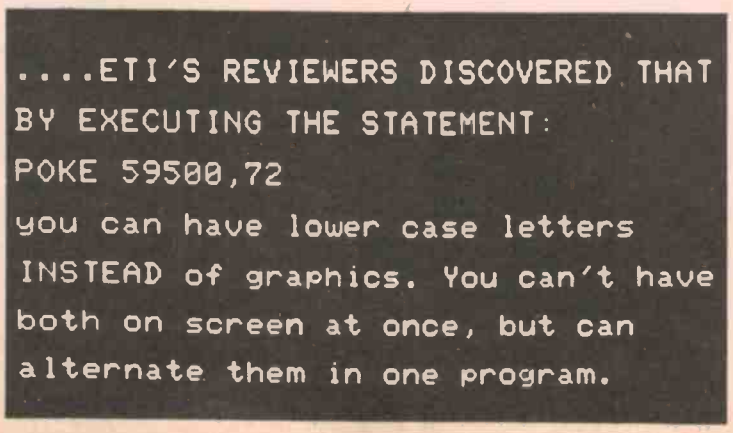
Peripherals

Commodore have come a little unstuck with their planned printer for the PET and in fact haven't produced any peripherals of note so far.

This didn't stop the entrepreneurs.

Several very interesting add-ons, such as a 32K memory board which fits inside the PET and runs off its internal power supply, a dual drive minifloppy and hundreds of programs on cassette are available in the UK, where Commodore found so much demand for the PET that they are setting up a manufacturing facility there. Commodore were selling all the PETs they could get into the UK. And Commodore are a big company.

The PET found a section of the market that the other machines didn't reach. We heard of one machine that was brought back under warranty with a blown fuse in the plug – but that was in the UK. (We trust that's not an Irish joke . . . ED.). ●



ADVANCED COMPUTER PRODUCTS

THE FIRST TO OFFER PRIME PRODUCTS TO THE HOBBYIST AT FAIR PRICES NOW LOWERS PRICES EVEN FURTHER!

1. Proven Quality Factory tested products only, no re-tests or fallouts. Guaranteed money back. We stand behind our products.

2. Same Day Shipment All prepaid orders with cashiers check, money order or charge card will be shipped same day as received.

S100 PRODUCTS

LOGOS I 8K STATIC RAM

- ★ Low Power
- ★ Selectable Memory Protect
- ★ Totally Buffered
- ★ Battery Back-up
- ★ Address on 1K boundary
- ★ Requires no front panel
- ★ No wait states

ASSEMBLED & TESTED

250ns. 199.95
450ns. 179.95

KIT

250ns. 149.95
450ns. 125.95

WE OFFER GROUP DISCOUNTS

Bare PC Board w/Data **$21.95**

Now over 1 year successful field experience "Special Offer" Buy (4) 8K 450ns. Kits $117.00 ea.

IMS 16K STATIC RAM

- ★ Memory mapping
- ★ Phantom
- ★ Address 16K Bound
- ★ Use with or w/o front panel
- ★ Power 2.1 amps typ.
- ★ Uses 2114

ASSEMBLED & TESTED ONLY
450ns. $439.95 250ns. $495.95

S-100 32K STATIC RAM

- ★ Address 32K Boundary
- ★ Power 450ns. 2.8 amps typ.
- ★ No wait states on 2MHz
- ★ Fully Buffered
- ★ Phantom can be added
- ★ 2114/TMS4045 or 9135

ASSEMBLED & TESTED	KIT
250ns. $849.00	250ns. $790.00
450ns. $769.95	450ns. $625.00

Bare PC Board w/Data $59.95

SPECIAL OFFER:
Kit without Memory only $99.95.
Add 2114 Memory for 8 @ $7.50 ea.

PARATRONICS LOGIC ANALYZER KIT

MODEL 100A $219.95
(analyzes any type of digital system)
Trigger Expander Model 10 ..... $229.00
Baseplate 9.95
Model 10 Manual 4.95
Model 150 Bus Grabber Kit 369.00

DC HAYES DATA COMMUNICATIONS ADAPTER

- ★ Telephone/TWX ★ S-100 compatible
- ★ Bell 103 freq. ★ Originate & answer mode

Assembled & Tested $279.95
Bare PC Board w/data ..... $ 49.95

Z-80/Z-80A CPU BOARD

- ★ On board 2708
- ★ Power on jump
- ★ 2708 included (450ns.)
- ★ completely socketed

Assembled and tested $185.00
Kit $129.95
Bare PC Board ..... $ 34.95
★ For 4MHz Speed Add $15.00

MICRODESIGN MR-16 2716 EPROM BOARD (MR-8 Also Available at same price)

- ★ Individual Prom Address
- ★ Uses Low cost 16K TI EPROMS
- ★ Optional 1K RAM ★ Phantom control

Assembled and Tested 174.95
Kit 99.50

SPECIAL SPECIAL SPECIAL

2708-6 Eprom ..... 8 @ $ 5.50 ea.
416 16K Ram ..... 32 @ $16.95 ea.
1771-01 Floppy ..... 5 @ $25.95 ea.
Pet Connector Set ..... 5 @ $ 7.95 ea.

BYTE USER 8K EPROM BOARD

★ Power on Jump ★ Reset Jump

Assembled & Tested 94.95
Kit 64.95
Bare Pc Board 21.95
Special Offer: Buy 4 kits only $59.95 each
NOTE: 2708-6 only $5.95

TARBELL FLOPPY INTERFACE

- ★ S100 Compatible ★ Uses CPM
- ★ Jumper Selectable ★ Persci,Shugart,etc

Assembled and tested $269.95
Kit $179.95
Bare PC Board ..... $ 39.95
NOTE: For CPM Add $70.00
Documentation Add $20.00

TRS 80 UPGRADE KIT

16K Memory with Jumpers and Instructions $159.95
(Specify Level I or Level II)
APPLE II 16K UPGRADE KIT $149.95

PET TO S-100 ADAPTER

Allows Pet to be interfaced to popular S-100 Bus.

Kit $189.95
Assembled $269.95
For Low Cost 8 Slot Bus to expand your Pet only ..... $149.95 Kit

DATABOOKS & MANUALS

NSC TTL Data	3.95	AMI MOS/LSI Data	3.95
NSC Linear Data	4.95	GI MOS/LSI Data	4.95
NSC Linear APP/note I	3.95	Osborne Intro to Micro Vol. 0	7.50
NSC Linear APP/note II	3.95	Osborne Intro to Micro Vol. 1	7.50
NSC CMOS Data	2.95	Osborne Intro to Micro Vol. II	7.50
NSC Audio Data	3.95	Osborne 8080 Programming	7.50
NSC Volt Reg Data	2.95	Osborne 6800 Programming	7.50
NSC Memory Data	3.95	Osborne Z80 Programming	7.50
NSC MOS/LSI Data	3.95	TI Power Semi's Data	7.50
NSC Power Transistors	2.95	TI TTL Data	6.95
Intel Databook	3.95	TI Transistors & Diodes	8.50
Intel MCS85 Manual	7.50	TI Memory Data	3.95
Intel MCS80 Manual	7.95	TI Optoelectronics	3.95
Intel MCS40 Manual	4.95	TI Linear Data	3.95
AMD 8080 Handbook	5.95	TI Bipolar Memory	3.95
AMD Linear Data	4.95	TI Interface Data	4.95
AMD Schottky Data	4.95	Motorola Semi Data 1, 2, 3	9.95
Mot. Vol.4 Mecl Data	3.95		
Mot. Vol. 5 CMOS Data	2.95		
Mot. Vol. 6 Linear Data	3.95		
Mot. Vol. 9 Schottky TTL	2.95		
Mot. MPU Applications	25.00		
Mot. MPU Prog. Ref. Manual	3.95		
Mot. Power Data	2.95		
Mot. Rectifier Data	2.95		
Mot. Switching Trsn.	2.95		
Mot Zeners	2.95		
Basic Software SRI Vol. I or II	24.95		
Basic Software SRI Vol. III	39.95		
Basic Software SRI Vol. IV or V	9.98		
Basic Software SRI Vol. VI	49.95		
Basic Software SRI Vol. VII	39.95		
1978 IC Master	47.50		

DISKETTES

5" MINI
★ Soft Sector
★ 10 Sector
★ 16 Sector

$4.80 each $3.90/10

NORTH STAR MINI
$4.95 each $4.80/10

8" STANDARD
★ Hard
★ Soft

$4.50 each $4.10/10

6800 DESIGNER BOARDS MODULES PROTO BOARDS

★ Motorola Compatible Modules*

MEK 6800 D2 Kit	$235.00
9600 6800 MPU Module	495.00
9601 16 slot Mother Bd.	175.00
9602 16 slot Card Cage	75.00
9603 8 slot Mother Bd.	99.00
9604 System Power Supply	250.00
9610 Prototype Board	36.00
9615 4KEprom Module	250.00
9620 16 port parallel I/O	375.00
9626 8K Static RAM	295.00
9626K 8K Static RAM Kit	225.00
9630 Extender Card	60.00
9640 Multiple Tuner Prog.	395.00
9650 8 port Duplex Asyn. I/O	395.00
Mot 43/86 Connectors w/w or s/t	5.95
AMI EVK 99* 6800 sub Kit	99.00
AMI EVK 200 Kit	249.95
AMI EVK 300 Assembled	275.00
EVK Kluge Board	95.00
EVK 16K Byte Ram Board	75.00
EVK 6 Slot Motherboard	35.00
EVK Extender Board	45.00
EVK Solid Frame Chassis	129.00
EVK Connectors	6.50
AMI 6800 Proto Rom	30.00
AMI 6800 Micro Assembler Rom	30.00
6800 Tiny Basic Paper Tape	20.00
6800 Tiny Basic Eprom	125.00

Hi PLOT LOW COST DIGITAL PLOTTER

- ★ RS 232
- ★ Plot Size 7" x 10"
- ★ Digitizer Avail. Soon
- ★ High Resolution
- ★ 2.4"/sec Plot Speed

NEW
List: $1085.00
OUR
PRICE $999.00

SPECIAL KEYBOARD BUY WHILE THEY LAST

"Clare Pender 62 Key ASCII w/26 Pin & 34 Pin Output Conn." $54.95

SUPPORT DEVICES

AM9511 Arith Processor	$195.00
AM9517 DMA Controller	71.95
AM9519 Universal Interrupt	24.95
3881 (Z80 PIO)	10.45
3881-4 (4MHz)	14.95
3882 (Z-80 CTC)	10.45
3882-4 (4MHz)	14.95
8205/74S138 Decoder	2.95
8212 8 bit I/O	2.80
8214 Priority Int.	6.95
8216 Bus Driver	2.80
8224 Clock Gen.	2.95
8224-4 (4MHz)	9.75
8226 Bus Driver	3.95
8726 Bus Driver	2.39
8228 Sys Control	6.95
8238 Sys Cont.	6.95
8251 Prog. I/O	11.80
8253 Int. Timer	19.50
8255 Prog. I/O	11.50
8257 Prog. DMA	19.50
8259 Prog. Int.	19.50
8275 CRT Controller	74.95
8279 Prog. Keyboard	19.95
6810-1 128 x 8 RAM	4.75
6820 PIA	7.20
6821 PIA	7.25
6828 Priority Int.	11.95
6834-1 512 x 8 Eprom	12.95
6850 ACIA	7.20
6852 Serial Adapter	9.95
6845/HD46505 CRT Contr.	39.95
6860 Modem	14.50
6862 Modulator	14.80
6871A 1.0MHz OSC	25.95
6875	8.25
2350 USRT	9.95
6880 Bus Driver	2.39
1821 SCD 1K RAM	25.00
1822 SCD 256 x 4 RAM	18.95
1824 CD 32 x 8 RAM	9.95
1852 CD 8 bit I/O	10.95
1856 CD I/O	8.95
1857 CD I/O	8.95
6520 PIA	7.50
8522 Mult.	9.95
6530-002	18.80
6530-003	18.80
6530-004	18.80
6530-005	18.80
3851 F8 Prog. Store	14.95
3853 F8 Memory I/O	14.95

PROMS

2708	9.95
2708-6	5.95
1702A	3.95
1702A-6	3.50
2716-5V	44.95
2716-5V, 12V	24.95
2758 5V	25.95
5203AQ	11.95
5204AQ	9.95
6834-1	12.95
M 5610	2.95
82S123	2.95
82S126	4.50
82S129	4.95

RAMS DYN.

4116 16K x 1	17.95
4115 8K x 1	8.80
4050 4K x 1	4.45
4060 4K x 1	4.45
4096 4K x 1	4.25
2104 4K x 1	4.95
2107B-4 4K x 1	4.25
5261	1.95
5262	1.95
5270	4.95
5280	4.95
1103	1.95
4020EL	4.95
TMS4070 16K x 1	19.95
4027-3	4.95
MCM6605 4K x 1	4.95

FLOPPY DISK I/O

1771-01 8" & Minifloppy	27.95
uPd372 Nec Floppy	49.95
1781 Dual Floppy	39.95

CHARACTER GENERATORS

RO32513-001 (5V) Upper	9.80
RO32513-002 (5V) Lower	10.95
RO32513-ADM3 (5V) Lower	14.95
MCM6571	10.75
MCM6571A	10.75
MCM6574	14.80
MCM6575	14.80

KEYBOARD ENCODERS

AY5-2376	13.75
AY5-3600	13.75

UARTS/USRTS

TR1602B (5V, 12V)	3.95
AY51013 (5V, 12V)	5.50
AY51014A/1013 (5-14V)	6.95
AY51015A/1863 (5V)	6.95
TMS 6011 (5V, 12V)	5.50
IM6402	9.95
IM6403	9.95
2350 USRT	9.95
16718 Astros	24.95
SALE TR1472B	9.95

BAUD RATE GENERATORS

MC14411	11.25
4702	14.95
WD1941	9.95

TV CHIPS

MM5320 TV Synch	7.95
MM5369 Prescaler	3.95
LM1889 Modulator	3.95
CW300 Saw Function	1.80
MM57100 Color TV Game	9.95
MM57104 Clock	3.75
AY38500-1 TV Game	5.95
AY38600 Color TV Game	24.95
AY38610 I Color Converter	9.95
AY38700-1 Tank Chip	29.95
RF Modulator with Audio	8.95

A/D CONVERTERS

8700	8 bit Binary	13.50
8701	10 bit Binary	22.00
8702	12 bit Binary	38.95
8705	12 bit TS	42.95
9400	Volt to Freq. Conv.	7.25
8750	3-1/2 Digit BCD	13.95
8038	Multifunction	3.95
14081-6	6 bit	3.85
14081-8	8 bit	5.95
DAC01	A/D	5.95

TV INTERFACES

Pixie-Verter	8.50
TV-1 Video Interface	8.95
Pickles & Trout TV Mod Kit	20.00
Multiverter	35.00
M&R Modulator	35.00

MICROPROCESSORS

Z-80	$19.95
Z-80A	26.95
F-8 (3850)	18.95
2650	24.95
CD1802	19.95
8080A	9.95
SALE 8085	14.95
8035	14.95
2901	21.95
2901A	29.95
TMS 9900JL	69.95
CP1600	39.95
6502	13.95
IM6100	29.95
6800	19.95
6802P	32.95
8038	17.50

SOCKETS

8 Pin W/W	.32	8 Pin S/T	.17
14 Pin W/W	.37	14 Pin S/T	.20
16 Pin W/W	.38	16 Pin S/T	.22
18 Pin W/W	.80	18 Pin S/T	.31
20 Pin W/W	.90	20 Pin S/T	.34
22 Pin W/W	.93	22 Pin S/T	.35
24 Pin W/W	.85	24 Pin S/T	.41
28 Pin W/W	1.15	28 Pin S/T	.49
40 Pin W/W	1.49	40 Pin S/T	.63

CONNECTORS

8 Pin Single S/E	1.49
15/30 Dual S/E	1.95
18/36 Dual S/E	2.35
22/44 Dual S/E	2.95
40/80 W/W	4.95
43/86 Dual W/W/S/T	6.80
50/100 IMSAI W/W	4.75
50/100 IMSAI S/T	4.75
50/100 Altair W/W/S/T	8.95
IMSAI Card Guides	4/1.00

25 Pin D Subminiature

DB25P	3.25
DB25S	3.75
Hood	1.25
Set w/Hood	6.50

NEW CTS DIPSWITCHES

CTS206-4 $1.75 CTS208-8 $1.95
CTS206-6 $1.75 CTS209-9 $1.95
CTS206-8 $1.75 CTS209-10 $1.95
CTS207-7 $1.75

8080 USER'S IT'S HERE

LIVERMORE BASIC

ON 65K ROM
THAT'S RIGHT ON ROM!!
OUR PRICE only $95.00

PCG PROGRAMMABLE CHARACTER GENERATOR

The hottest version of STARWARS available

S-100 Compatible 2MHz Kit with object code on tarbell or cuts $169.95

NAKED PC BOARD SALE S-100

Z-80 CPU (ITHACA)	34.95
Z-80 CPU (TDL comp.)	34.95
8080A CPU	34.95
8K Static Logos	21.95
8K Eprom Byteuser	21.95
32 Static S-100	59.95
Tarbell Floppy I/O	39.95
Tarbell Cassette	29.95
Vector 8800 Proto	19.95
ACP Proto Bd.	27.95
ACP Extender w/apnA	15.95
Realtime Clock	34.95
WMC 13 Slot Mother Bd.	33.00
S-100 8 Slot Mother Bd.	34.95
Vector 8803 11 Slot M. Bd.	29.95
SSM Video I/O	27.95
SSM 102 Parallel I/O	27.95

UV "Eprom" Eraser

Model UV-11E $64.95
Holds 4 Eprom's at a time.
Backed by 45 years UV experience
Model S-52T $219.95
Professional Industrial Model

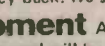
ATTENTION KIM USERS

- Power package supplies 12 games $8.95
- Hobby Editor (w/tape cassette) $8.95
- Hobby Math (w/tape cassette) $8.95
- Hobby Info Retrieval (w/tape cassette) $8.95
- Microchess (cassette) $8.95
- Microsoft Assembler/Debugger (cass) $7.95
- Microsoft Source Listing Statement $7.95
- Tiny Basic for KIM paper tape $9.95

ATTENTION PET USERS

ATTENTION TRS-80 USERS

ATTENTION APPLE II USERS



All Shipments FOB or UPS Orders under $100.00 add 5% handling and postage. Orders over $100.00 add 2.5% handling & postage. Mastercharge/Bankamericard/COD accepted w/25% deposit. California Residents add 6% tax. Foreign Orders add 8% handling. All parts prime factory tested guaranteed. Same day shipments. Add 25 cents for Data.

Retail pricing may vary from Mail Order Pricing

STATIC RAM HEADQUARTERS

	1-24	25-99	100
21L02 450ns	1.30	1.25	1.15
21L02 250ns	1.59	1.55	1.45
2102	1.25	1.15	1.10
91L02APC	1.75	1.65	1.50
2111-1	4.10	3.95	3.75
211-1	3.75	3.65	3.55
21L12-1	4.25	4.10	3.95
2112-1	2.95	2.85	2.65
21L01-1	3.95	3.75	3.65
2101-1	2.90	2.70	2.55
2114-3 300ns	9.95	9.75	8.25
2114-4 450ns	7.95	7.50	5.50
TMS4044	9.95	9.75	8.25
TMS4045	9.95	9.75	8.25
EMM4200A	12.50	11.95	9.95
EMM4402	7.95	7.25	6.25
5101C-E	7.95	7.95	7.25
upd410 (4200)	10.95	10.25	9.25
AMD9140/41	10.95	10.25	9.25
AMD9130/31	12.95	11.95	10.25
FSC 460/46416K CCD Only $18.95 Each			
1101	1.95	1.75	1.25
P2125/93425 (48 ns)	7.95	7.35	7.25
6508 1K x 1 CMOS	7.95	7.95	7.25
6518 1K x 1 CMOS	7.95	7.95	7.25
74S189 64 bit Ram	3.95	3.25	2.80

WAVEFORM GENERATORS

8038 Function Gen.	3.95
MC4024 VCO	2.45
LM566 VCO	1.76
XR2206 Function Generator	5.25

CHARGE COUPLED DEVICES

18K CCD - First time offered Fairchild 480 CCD 16K Memory (how you can experiment with CCD technology at a reasonable price 17 page Application note supplied with each order. Quantity limited)

$18.95 each (reg. 43.00)

CRYSTALS

Microprocessor Timebases TV Game

Frequency	Price	Frequency	Price
1.0MHz	$5.65	6.0MHz	$ 4.95
1.8432	4.95	8.144	4.95
2.0MHz	5.85	8.8536	4.95
2.01MHz	2.95	10.0MHz	4.95
2.097152MHz	5.85	13.0MHz	4.95
2.4576MHz	5.85	14.31818	4.95
3.579545MHz	1.80	18.0MHz	4.95
4.0MHz	4.95	18.432MHz	5.95
4.194304MHz	5.95	20.0MHz	4.95
4.91520MHz	5.95	22.1184MHz	5.95
5.0MHz	4.95	27.0MHz	5.95
5.0688	4.95	36.0MHz	5.95
5.7143MHz	5.95	48.0MHz	5.95
		100KC	12.95

DISPLAYS/OPTO

DL 704/707/CC/CA .300	1.25
FND359 CC .357	.95
FND 500/507/CC/CA .500	1.35
FND 503/510 CC/CA .500	.95
FND 800/807 CC/CA .800	2.50
Bowmar 9 digit bubble	.99
FSC 8024 4 digit CC .800	4.95
HP7340 HEX Display	19.95
TIL 305 5 x 7 Array	4.50
TIL 306 7 seg w/logic	8.95
TIL 308 7 seg w/logic	8.95
TIL 309 7 seg w/logic	7.95
TIL 311 HEX Display	12.95
MA 1003 12 auto clock	17.95
MA 1002 4 digit clock module	9.95
MA 1010 4 digit clock module	9.95
Bezel for above	4.95
NSN 373/374 dual CC/CA .300	2.20
NSN 583/584 dual CC/CA .800	2.80
NSN 783/784 dual CC/CA .100	3.00
4N25 Opto Isolater	1.10
MCT 2 Opto Isolater	.89
4N33 Darlington ISOL	1.75
Red Led's .185 Dia.	5/1.00
Green/Yellow	4/1.00
HP 5082/7731 7 seg	.80

MONTHLY SPECIALS

14 Pin W/W 100 pcs.	19.95
14 Pin S/T sockets 1000 pcs	.10
16 Pin S/T sockets 1000 pcs	.11
22 Pin S/T sockets 1000 pcs	.12
FSC460/464 16K CCD's	16.95
AMD 9140CDC Static Ram	10.95
4118/4116 16K Dynamic Ram's	8 for/149.95
1488 or 1489 RS232 Driver	.99
8T97 Buffer	1.25
8130 or 8131	2.45
8833 or 8835	1.99
74367 or 74368	5/3.00
75451/52/53	10/2.50
8T26 Bus Driver	2.39
78L05 Regulator	2/1.00
MCT2 Optoisolator	.89
2510A Shift Register	2.95
2519A Shift Register	2.95
MM5056 Shift Register	2.95
LM760N-14 Comparitor	1.10
D80025CN Clock Driver	1.49
D50026CN Clock Driver	2.50
8T20 Bidirect oneshot	3.49
1403AN Shift Register	1.80
8098	1.95
Intel 8155 22 I/O w/Ram	17.95
ICL 7107 CPL 3½ Dig. A/D	11.95

NEW
1978 CATALOGUE
SEND 25¢ POSTAGE

DISCOUNT COMPUTER CORNER

	Discount Cash	Computer Credit Card
Apple II/16K	$1125.00	$1155.00
TEI PT20B	4599.00	4699.00
TEI MCS122	450.00	462.00
Cromemco Z-2	536.00	551.00
Cromemco SYS III	5499.00	5561.00
Decimiter II	1478.00	1525.00
Percio 277	1230.00	1265.00
Shugart 800/801	495.00	512.00
Pertec FD200	299.00	319.00
MFE Dual 751	730.00	744.95
Shugart 400	328.00	318.00
Monzon I	1439.00	1479.00
North Star	599.00	617.00
Low Cost S-100 Bus	149.95	155.95
ADM 3 Assem	829.95	865.00
Sorac IO 120	895.00	945.00
Teletype Model 43	1199.00	1230.00
AM100	Contact sales desk	
Imsai w/22 slots	599.00	617.00
Omer 2708-16 Programr.	275.00	288.00
Pennywhistler Modem	129.95	129.95
Cromemco 16K Ram	449.00	462.00
Hazeltine 1500	1175.00	1195.00
Diadata 110 w/TFR5232	1675.00	1705.00
Diadata 22 w/TFR5232	2705.00	2810.00
MEK 6800 D2 Kit	235.00	Same
KIM 1 6502	229.95	Same
Intersept Jr 8100	281.00	Same
Technico 9900 Kit	299.00	Same
RCA VIP Cosmac	249.00	Same
Rockwell AIM	375.00	Same
Synertek VIM 1	269.00	Same

P. O. BOX 17329 Irvine, California 92713 New Phone (714) 558-8813
TWX: 910-595-1565

Retail Store Open Mon. – Sat.
Located at 1310 "B" E. Edinger,
Santa Ana, CA 92705

ETI data sheet

The μA78MG is a 4-Terminal Adjustable Voltage Regulator designed to deliver continuous load currents of up to 500mA with a maximum input voltage of 40V. Ouput current capability can be increased to greater than 10A through use of one or more external transistors. The output voltage range is 5V to 30V. For systems requiring both a positive and negative supply the 78MG and 79MG are excellent for use as a dual tracking regulator.

FEATURES

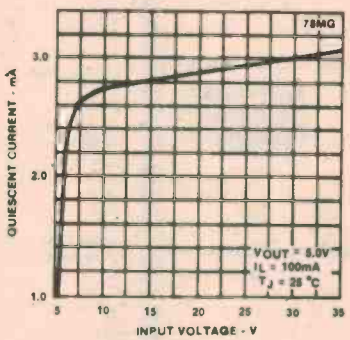
- Output current in excess of 0.5A
- μA78MG positive output voltage 5 to 30V
- Internal thermal overload protection
- Internal short circuit current protection
- Output transistor safe area protection

In many μA78G applications, compensation capacitors may not be required. However, for stable operation of the regulator over all input voltage and output current ranges, bypassing of the input and output (0.33μF and 0.1μF, respectively) is recommended. Input bypassing is necessary if the regulator is located far from the filter capacitor of the power supply. Bypassing the output will improve the transient response of the regulator.

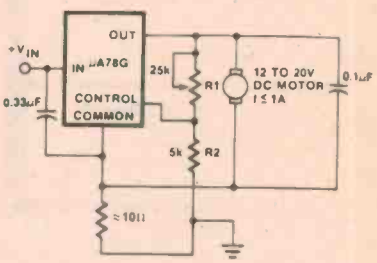
ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING	UNIT
Input voltage		
μA78MG, μA78MGC	40	V
μA79MG, μA79MGC	-40	V
Control pin voltage		
μA78MG, μA78MGC	0 < V < V_{OUT}	
μA79MG, μA79MGC	$-V_{OUT}$ < -V < 0	
Power dissipation	Internally limited	
Operating junction temperature range		
Military (μA78MG, μA79MG)	-55 to 150	°C
Commercial (μA78MGC, μA79MGC)	0 to 150	°C
Storage temperature range		
H	-65 to +150	°C
U1	-55 to +150	°C
Lead temperature		
U1 (soldering, 10s)	230	°C
H (soldering, 60s)	300	°C

QUIESCENT CURRENT AS A FUNCTION OF INPUT VOLTAGE

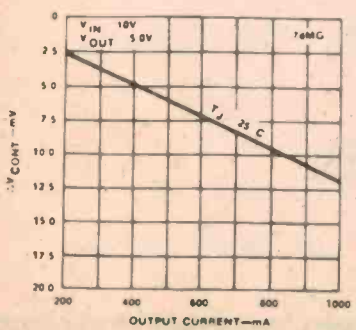


MOTOR SPEED CONTROL

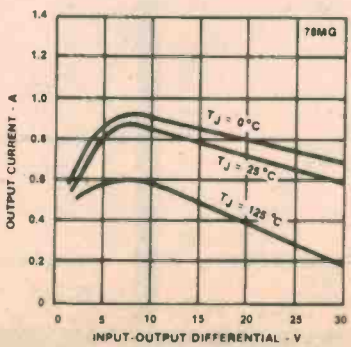


Use flyback diode across motor if necessary.

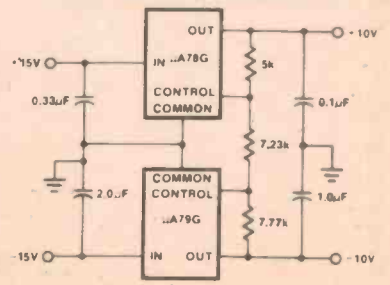
DIFFERENTIAL CONTROL VOLTAGE AS A FUNCTION OF OUTPUT CURRENT



PEAK OUTPUT CURRENT AS A FUNCTION OF INPUT-OUTPUT DIFFERENTIAL VOLTAGE



± 10V, 1.0A DUAL TRACKING REGULATOR



If load is not ground referenced, connect reverse biased diodes from outputs to ground.

DC ELECTRICAL CHARACTERISTICS

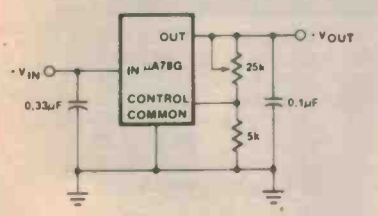
0°C ≤ T_J ≤ 125°C for µA78MGC, -55°C ≤ T_J ≤ 150°C for µA78MG, V_{IN} = 10V, I_{OUT} = 350mA unless otherwise specified.[1,2]

PARAMETER	TEST CONDITIONS[1]	µA78MG			UNIT
		Min	Typ	Max	
Input voltage range	T_J = 25°C	7.5		40	V
Output voltage range	V_{IN} = V_{OUT} + 5V	5.0		30	V
Output voltage tolerance	V_{OUT} + 3V ≤ V_{IN} ≤ V_{OUT} + 15V, T_J = 25°C 5mA ≤ I_{OUT} ≤ 350mA P_D ≤ 5W, V_{INMAX} = 38V			4.0 5.0	%(V_{OUT}) %(V_{OUT})
Line regulation	T_J = 25°C, I_{OUT} = 200mA, V_{OUT} ≤ 10V (V_{OUT} + 2.5V) ≤ V_{IN} ≤ (V_{OUT} + 20V) T_J = 25°C, I_{OUT} = 200mA, V_{OUT} ≥ 10V (V_{OUT} + 3V) ≤ V_{IN} ≤ (V_{OUT} + 15V) (V_{OUT} + 3V) ≤ V_{IN} ≤ (V_{OUT} + 7V)			1.0 0.75 0.67	%(V_{OUT}) %(V_{OUT}) %(V_{OUT})
Load regulation	T_J = 25°C 5mA ≤ I_{OUT} ≤ 500mA, V_{IN} = V_{OUT} + 7V			1.0	%(V_{OUT})
Control pin current	T_J = 25°C		1.0	5.0 8.0	µA µA
Quiescent current	T_J = 25°C		2.8	4.0 5.0	mA mA
Ripple rejection	8V ≤ V_{IN} ≤ 18V, I_{OUT} = 300mA, T_J = 25°C V_{OUT} = 5V, f = 120Hz, I_{OUT} = 100mA	62 62	80		dB dB
Output noise voltage	10Hz ≤ f ≤ 100kHz, V_{OUT} = 5V		25		µV
Dropout voltage[2]	µA78MG µA78MGC			3.0 2.5	V
Short circuit current	V_{IN} = 35V, T_J = 25°C		300		mA
Peak output current	T_J = 25°C		800		mA
Average temperature coefficient of output voltage	V_{OUT} = 5V I_{OUT} = 5mA		-0.5		mV/°C
Control pin voltage (reference)	T_J = 25°C	4.8 4.75	5.0	5.2 5.25	V V

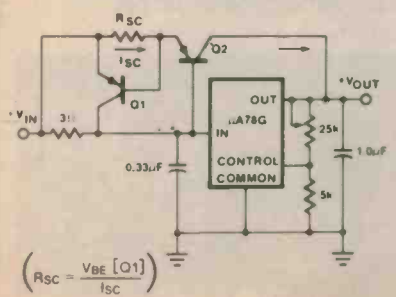
NOTES

1. V_{OUT} is defined for the 78MGC as $V_{OUT} = \frac{R1 + R2}{R2}(5.0)$; The 79MGC as $V_{OUT} = \frac{R1 + R2}{R2}(-2.23)$.
2. Dropout voltage is defined as that input-output voltage differential which causes the output voltage to decrease by 5% of its initial value.

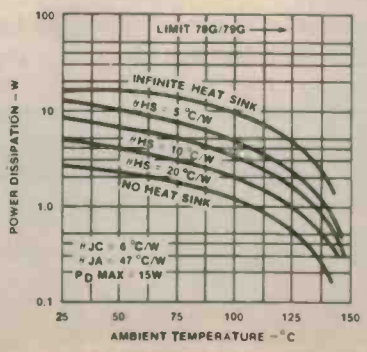
POSITIVE 5 TO 30V ADJUSTABLE REGULATOR



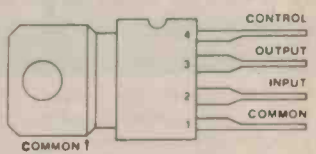
POSITIVE HIGH CURRENT SHORT CIRCUIT PROTECTED REGULATOR



µA78G AND µA79G TO-3 PACKAGE WORST CASE POWER DISSIPATION vs AMBIENT TEMPERATURE



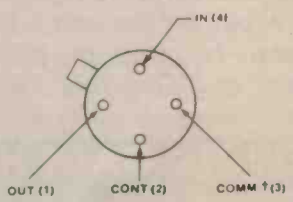
U1 PACKAGE Power Tab



ORDER INFORMATION

TYPE	PART NO.
µA78MGC	µA78MGCU1

H PACKAGE



ORDER INFORMATION

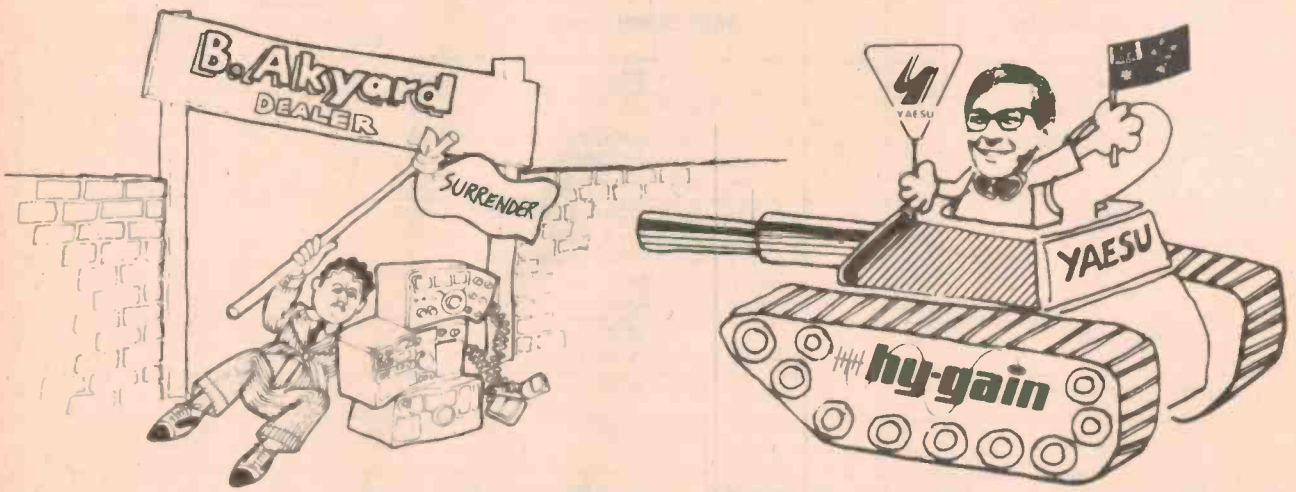
TYPE	PART NO.
µA78MG	µA78MGH
µA78MGC	µA78MGCH

†NOTE

Heat sink tabs connected to common through device substrate

THE WAR CONTINUES

THE BATTLE STILL RAGES WITH YAESU — NOW HY-GAIN ANTENNAS HAVE FALLEN TOO!



You must have heard about the Yaesu price war – Dick Smith will better any genuine price offered by anyone on Yaesu products . . . We've received such a tremendous response from the Amateurs of Australia that we've decided to reduce the price of Hy-gain HF antennas. So now you can buy your complete amateur station from Dick at a real bargain price.

YOU REAP THE BENEFIT!

And you'll be buying from a fully Australian owned company – your one stop electronics shop who actively supports amateur radio!

HERE ARE OUR YAESU PRICES: (and we'll send them anywhere in Australia for just $6.00 extra – We even lose money on this 'below cost' freight offer!)

FT-101E 80-10m HF transceiver	Cat D-2860	$789.00	FT-101Z New HF transceiver	Cat D-2862	$775.00
FT-301 Solid State HF transceiver	Cat D-2870	$795.00	FT-901D Top class HF transceiver	Cat D-2854	$1349.00
FT-7 Mobile HF transceiver	Cat D-2866	$375.00	FT-227RA 2m FM scanning transc.	Cat D-2891	$379.00
FT-227 2m FM transc with memor	Cat D-2890	$379.00	CPU-2500 computerised 2m transc.	Cat D-2889	$549.00
FC-301 Antenna tuning unit	Cat D-2896	$219.00	FC-901 antenna tuning unit	Cat. D-2855	$249.00
FL-2100B 1.2kW linear amplifier	Cat D-2546	$529.00	FL-110 200W linear amplifier	Cat D-2884	$189.00
FRG-7 Solid State HF Rcvr	Cat D-2850	$319.00	FRG-7000 Digital HF rcvr	Cat D-2848	$599.00
FP-301 13.8V/20A supply	Cat D-2872	$169.00	YC-500S 500MHz Freq. Counter	Cat D-2892	$475.00

We believe that the prices above are better than any supplier in Australia. If you find someone cheaper for the same goods, tell us!
For us to better any price, simply show as the advertisement from any Australian company. After checking that they have stocks available at that price we will sell for a lower price. Offer remains open while present stocks last (approx. $250,000 worth).

NEW HY-GAIN HF ANTENNA PRICES:

SUPER SPECIAL:
TH6 DXX SLASHED BY $104.00 TO ONLY
$295.00 WHILE STOCKS LAST
Cat D-4308

TH3Mk3 BEAM:
Save $50.00 . . .
$249.00
Cat D-4306

TH3JR BEAM:
$20.50 off!
$199.00
Cat D-4304

18AVT VERTICAL
SAVE $14.50
$135.00
Cat D-4302

HY-GAIN VHF ANTENNAS ALSO IN STOCK. ASK OUR PRICE!

FT-901DM Transceiver

This transceiver is Yaesu's market leader, featuring virtually all-mode, all-band (HF) operation along with some sophisticated speech processing and Tx/Rx control functions. Top performance is Yaesu's claim — Roger Harrison sees how it matches up . . .

THE FT-901D, as the handbook says, ". . . is a precision engineered, high performance HF transceiver of advanced design, providing all-band coverage (160 — 10 m) on all modes . . . LSB, USB, CW, FSK, AM, and FM."

Among the advanced features Yaesu have included in this transceiver are: phase-locked loop frequency derivation, digital plus analogue frequency readout, 'memory' frequency control circuitry (for split-frequency working) and a 'Curtis' electronic keyer. Along with these features comes 'state-of-the-art' receiver performance, the receiver featuring variable IF bandwidth tuning, a tunable rejection notch filter, audio peak frequency (APF) tuning for improved CW performance, and a 20 dB RF attenuator for protection against front-end overload.

The transmitter features 6146B output valves (180 W input), semi-break-in CW operation with sidetone, VOX operation built-in, an RF speech processor to improve average talk power and time-limit protection on tune-up to prevent damage to the output valves.

All circuitry is solid state with the exception of the transmitter driver and final.

The FT-901 is made in four 'options': the FT-901D, the FT901SD (low Tx power), FT-901DE and FT-901DM (memory). Dick Smith Electronics, who supplied the unit for test, have available the FT901D and DM models. Both have all-band operation (inc. all of 10 m), VOX and 25 kHz marker, the FM unit, RF speech processor and cooling fan. The DM model includes the memory unit, keyer and dc-dc converter which the FT-901D does not.

Other available options are an AM filter (6 kHz) and a 600 Hz CW filter.

Dick Smith's Amateur Products manager, John Dennis VK2AJF, (now Duncan Craven) kindly supplied us with an FT-901DM for review.

On the Air

Front panel layout, though of necessity a little cramped, proved easy to 'learn' and operate. The RF gain and Clarifier are piggybacked — something I found a little disconcerting in operating the rig. However, all controls are grouped in a reasonably logical fashion and operating the FT-901 is generally a simple matter.

The combination of both the digital and analogue dial is a big plus — I don't know what it is about 'straight' digital readouts on transceivers, but I never get a 'feel' of where I am in a band. It's a bit like driving on Victorian highways — the roadside distance signs always tell you how far you are from Melbourne but you have only a vague feeling of where you are between your point of departure and your destination! Notice the same thing with digital time pieces?

The receiver was most impressive. The remarkable number of clear, clean weak signals on the crowded 20 m band was astounding. The ability of the receiver to handle weak signals in the presence of a number of local "rock-crushers" amazed me. The test results confirmed it and a look at the circuit shows why — see later. Tuning was smooth and unfussed, no drift is evident▶

SUPERB KITS from DENMARK

Additional high quality kits coming soon!

JOSTYKIT is Europe's leading manufacturer of electronic kits featuring attractively styled boxes of Scandinavian design and high quality electronic components which will satisfy the most demanding kit builder.

JOSTYKIT's staff of qualified electronic engineers and educationalists supply up-to-the-minute, reliable electronic kits, designed around space-age solid state technology, but capable of construction without any great technical know-how or practical experience.

The JOSTYKIT instruction booklets supplied with each kit give clear, precise directions for assembly and testing. For those with special technical interests, each instruction booklet ends up by describing how the kit works. You'll always learn something when you construct a kit from JOSTYKIT.

Audio

AF300 AUDIO AMPLIFIER – 3 WATTS

A real work-horse., this universal power amp has a wide range of applications such as car radio, record players and small receivers. Due to its well designed electronic circuit, the AF300 can be used over wide voltage ranges without deterioration of the specification parameters.

Kit AF300 . . . . . $25.00

AF340 40 WATT AUDIO AMPLIFIER MODULE

High quality 20-20,000 Hz, 37w RMS with low distortion.

Kit AF340 . . . . . $35.00

FM Tuners

HF325-2 QUALITY FM TUNER MODULE

The HF325 is a complete high quality FM tuner of professional standing. The tuner unit is ready-made and pretrimmed, making it child's play to assemble. Tuning range 88-108 MHz, operating voltage 12-55v ac.

Kit HF325 . . . . . $79.00
Stereo decoder HF310 . . . . . $24.00

HF310 FM RECEIVER

The HF310 is a very reasonably priced HF FM tuner. Fully trimmed, the sensitivity according to IHF standards is better than 10uV. Features 60 dB S/N radio and low harmonic distortion.

Kit HF310 . . . . . $49.00

HF330 STEREO DECODER

Gives 40-45 dB channel separation, just add to a good quality FM receiver.

Kit HF330 . . . . . $24.00

Pre-amps (RF)

HF395 RF PREAMPLIFIER

Gain 30 dB to 20 MHz, 10 dB to 100 MHz and 5 dB to 225 MHz. Ideal to boost reception on short-wave receivers.

Kit HF395 . . . . . $6.00

HF385 VHF/UHF ANTENNA PREAMP

Superb quality with two aerial inputs and one down lead which simultaneously supplies current from the power supply. Frequency range 40-250 MHz and 400-820 MHz. Gain 9-18 dB, depending on frequency.

Kit 385 . . . . . $30.00
Box B850 . . . . . $6.00
Optional Power Supply NT410 . . . . . $20.00

Quick assembly kits

JK01	GENERAL PURPOSE AMP 0.5w	$18.00
JK02	MICROPHONE AMPLIFIER	$19.00
JK03	SINE WAVE GENERATOR 20-20,000 Hz	$30.00
JK04	FM TUNER 88-108 MHz	$30.00
JK05	27 MHz RECEIVER	$33.00
JK06	27 MHz TRANSMITTER	$29.00
JK07	DUAL TONE DECODER FOR R/C MODELS	$43.00
JK08	240 Vac LIGHT OPERATED RELAY	$20.00
JK09	SIREN KIT inc. SPEAKER	$19.00
JK10	PHOTOGRAPHIC TIMER 240 Vac	$23.00
JK101	CAR BURGLAR ALARM KIT	$55.00

Light Shows

AT465 LIGHT SHOW

Turn your music into light. Simply connect this 3 channel light show to the audio terminals of your amplifier and this quality kit does the rest for you!

Kit AT465 . . . . . $64.00
Attractive box and knobs B6065 . . . . . $25.00

AT468 4 CHANNEL LIGHT SHOW

This superb kit drives 4 lights (400w per channel) from the audio amplifier output.

Kit AT468 . . . . . $75.00
Attractive box and knobs B3265 . . . . . $48.00

AT365 LIGHT SHOW

This quality kit uses microphone input instead of connection to the audio output. 1500w max.

Kit AT365 . . . . . $69.00
Box and knobs B3265 . . . . . $48.00

FM Transmitter

HF65 FM TRANSMITTER 60-148 MHz

Will run 5w output with heat sink. Ideal for signal testing or for a miniature transmitter which could be received on a standard FM receiver.

Kit HF65 . . . . . $9.00

Ham Converter

HF305 AMATEUR BAND 2m CONVERTER

Converts 2m FM down to the FM band 88-108 MHz.

Kit HF305 . . . . . $28.00

AM Receiver

HF61 MEDIUM WAVE RECEIVER

540-1600 KHz receiver complete with ferrite coil antenna.

Kit HF61 . . . . . $19.00

Power Supplies

NT415 LAB POWER SUPPLY 0-30V

1 amp well-regulated supply for professional use. Complete with box and transformer.

Kit NT415 . . . . . $128.00

NT300 LABORATORY POWER SUPPLY 2-30V

High quality supply, regulated 2-30V dc at 2 amps with overload protection. Complete with box and transformer.

Kit NT300 . . . . . $110.00

AT320 ALL ROUND AC/DC REGULATOR

This kit is a control unit with almost incredible possibilities. Use it as a touch control, burglar alarm, timer, heat/cold regulator. Power supply is built-in.

Kit 320 . . . . . $54.00

Sydney: CUSTOM COMMUNICATIONS, 6 Orchardleigh St, Yennora Ph: 681-3544. Adelaide: HAMTRONICS, Goodwood Rd, Kingspark Ph: 272-8417. Melbourne: EASTERN COMMUNICATIONS, 898 Riversdale Rd, Camberwell Ph: 836-8635. ROD IRVING ELECTRONICS, Shop 499, High St, Northcote Ph: 489-8131. Canberra: DAICOM, Colbee Crt, Phillip Ph: 82-3581.

And all authorised Vicom dealers around Australia and N.Z.

Dealers being appointed in all areas

NEW KITS

MAIL ORDERS enclose $1 for P & P to

Distributed by:

VICOM

68 EASTERN RD,
SOUTH MELBOURNE, VIC. 3205.
PH (03) 699.6700

in the VFO after warmup – again confirmed by measurement. The digital readout can be clearly read from a 'normal' operating position over a wide range of viewing angles.

All controls operate smoothly; the addition of a vernier drive on the preselector being quite an asset. The 20 dB attenuator did its thing – though hardly necessary under Australian conditions, few amateurs live on top of each other here (be useful on field days though!). The IF passband tuning and tunable rejection notch filter are magic! If you've never previously used a receiver with these facilities you'll wonder how you ever coped.

AGC operation was remarkable. Both RF and AF gain controls rarely needed adjustment when we used the set. The S-meter on the particular unit supplied for review needed calibration (see test results), too many signals were S9 or over! Audio quality was quite good on the internal speaker and very pleasant from a baffled external speaker.

Unfortunately we were unable to check the FM or FSK modes of operation.

The transmitter did its job in an unfussed manner – barefoot it more than holds its own amongst the general run of stations on the air. The RF speech processor is certainly an asset. Properly set up (a monitor CRO is necessary) the facility certainly adds 'punch' to the signal without being obtrusive. Distortion is not evident in operation. Make sure your linear can stand the extra average talk power though!

Audio quality reports were very good. The FT-901 certainly sounds quite smooth from an off-air monitor receiver. The Curtis keyer (using an 8043 IC) is a delight to use – according to our 'tame' full call acquaintance.

The TUNE control allows you ten seconds to tune up then returns the rig to receive. No more red faces on the output bottles (or the operator with a propensity to blow finals!).

Tuning and loading is a simple operation, the controls being quite smooth with no 'touchiness', though plate tuning is a little sharp on 15 m.

Memory

Frequency control of the transceiver can be from the internal VFO, an external VFO, the Memory unit or a combination of all three!

There is insufficient space to detail the complete operation of the Memory unit here, but basically, it allows various cunning tricks, such as:

(a) memorizing a fixed channel (your favourite net)
(b) fixing the transmit frequency, allowing VFO control on receive (split frequency working) and vice-versa.
(c) memorizing separate Tx and Rx frequencies (fixed split frequency working)
(d) swapping between memorized channel operation and normal VFO

Working DX pileups, working across sub-bands, 'watching' a net and occasionally tuning a band are very handy features for the keen, active HF operator. However, the handbook notes that after the M button is pushed (to store a frequency in memory), the unit's VCO requires 10 seconds to stabilise on the memorized frequency. If one of the MR buttons is pushed during this period some drifting of the rig may occur. Small point, but watch it.

Overall operation of the transmitter is certainly better than 'run of the mill', as you'd expect of a rig in this class. VOX operation is very good and the addition of a 'mic. squelch' (AMGC) function to prevent the VOX tripping on background noise is an excellent feature. The clarifier can be operated on both transmit and receive – another convenience feature.

The FT-901DM is a well thought-out design, cleverly engineered and executed. Yaesu – you've done it again.

Measured Performance

I can only say that the FT-901D is one of the best solid-state receivers I've ever had the pleasure to use. While working groundwave and ionospheric modes is the "bread and butter" of amateur activity, this transceiver removes any excuse for not attempting some interesting scatter modes on the HF bands – particularly on 28 MHz (Ionoscatter, meteor scatter . . .). Sensitivity, noise figure, dynamic range, AGC and spurious signal performance figures all showed up brilliantly on test. Better receivers *are* available – but at four times this transceiver's price!

The transmitter does the job required of it – nothing special here apart from the speech processor commented on previously. Harmonic emission figures are good, though the first harmonic could be lower – for the sake of comfort, if nothing else. Whilst carrier and unwanted sideband suppression met specification, the in-band distortion products (intermodulation) was high at –24 dB (processor out). This may have been a bias problem with the finals on this particular unit. Overall? – top class.

Commentary

Taken on its own merits, and realising the demands of the amateur market, there's very little to criticize in the FT-901D(M). As Yaesu's "flagship" it should certainly boost their position in the market after something of a slip in the past two years.

I wish more space were available to discuss various aspects of this rig. However, I shall confine discussion to some interesting and critical portions of the circuit.

Receiver performance in any rig stands or falls largely on the front end. ▶

YAESU FT-901D TRANSCEIVER

- **Supplied by –**
  Dick Smith Electronics
  24 Carlotta Street
  ARTARMON, 2065 (02) 439-5311
- **Serial No:** 8F030421
- **Recommended Price:** $1349

MANUFACTURER'S SPECIFICATIONS

Frequency coverage:	All bands, 160–10m plus 5–5.5 MHz WWV
Voltage supply:	AC: 220/234V 50Hz DC: 13.5V, neg. ground
Power consumption	AC: 70W Rx, 320W Tx DC: 5A Rx, 21A Tx
Dimensions:	342 (W) x 154 (H) x 324 (D), mm
Weight:	18 kg
Transmitter	
Emissions:	SSB (A3j), CW (A1), AM (A3h), FSK (F1) FM (F3 . . . optional)
Input power:	180W (A1 and A3j) 80W (A3h, F1, F3)
Carrier suppression:	Better than 40dB
Unwanted sideband suppression:	Better than 40dB @ 1kHz
Spurious emissions:	Better than –40dB
Distortion products:	Better than –31dB
Tx freq. response:	300–2700Hz @ –6dB
Frequency stability:	Less than 300Hz drift from cold start; less than 100Hz over 30 min. period after warmup.
Antenna impedance:	50–75 ohms unbalanced
Mic. input impedance:	500 ohms unbalanced
Receiver	
Sensitivity:	SSB/A1/F1: 0.25uV for 10dB S/N AM: 1uV for 10dB S/N FM: 0.3uV for 20dB quieting
Image rejection:	Better than 60dB, 1.8–21MHz Better than 50dB, 28MHz
Crossmodulation:	Better than 80dB immunity at 14MHz with 20kHz offset, 20dB input
IF rejection:	Better than 70dB
Selectivity:	SSB: –6dB: 2.4kHz, –60dB: 4kHz width control at '0'
Passband tuning:	Continuous, 300Hz to 2.4kHz
Audio filter response:	Within 3dB from 400–900Hz
Audio output:	3W @ 10% THD, or better
Audio input imp.:	4–16 ohms

TEST EQUIPMENT

Hewlett Packard model 8553B spectrum analyser with model 8443A tracking gen./counter.
Hewlett Packard model 8558B signal generator
Hewlett Packard noise and distortion set 334A
Bird Model 43 RF power meter. Sierra 500 W dummy load.

MEASURED PERFORMANCE

Voltage supply:	*240V AC*
Transmitter	
RF power output	
SSB (PEP):	*72W (all bands)*
Harmonic emissions	
1st:	*–42dB*
3rd:	*–60dB*
Carrier suppression:	*–50dB (relative to 2-tone full power output)*
Distortion products:	*–24dB (relative to 2-tone full power output)*
Unwanted sideband suppression:	*–45dB (relative to 2-tone full power output)*
Receiver	
Sensitivity at 10dB (S + N)/N ratio:	*SSB: 0.125uV (–125dBm)* *AM: 1uV (–108dBm)*
Noise floor:	*–140dBm (minimum detectable signal: –137dBm!)*
Selectivity:	*not measured*
Stability:	*+250Hz drift over 30 min. warmup, +220Hz over next 30 min., within 50Hz thereafter.*
Crossmodulation:	*100dB (on 14 MHz)*
Densitization:	*For 20kHz separation, 3dB output compression occurs with unwanted signal 84dB above wanted signal.*
Image rejection:	*14MHz: 73dB* *28MHz: 52dB*
IF rejection:	*81dB*
AGC performance:	*Less than 6dB audio change for 120dB change in signal level*
S-meter:	*S1 = 2uV (–101dBm)* *S9 = 7.1uV (–90dBm)* *+20 = 140uV (–64dBm)*
Audio output:	*2.5W @ 10% THD*

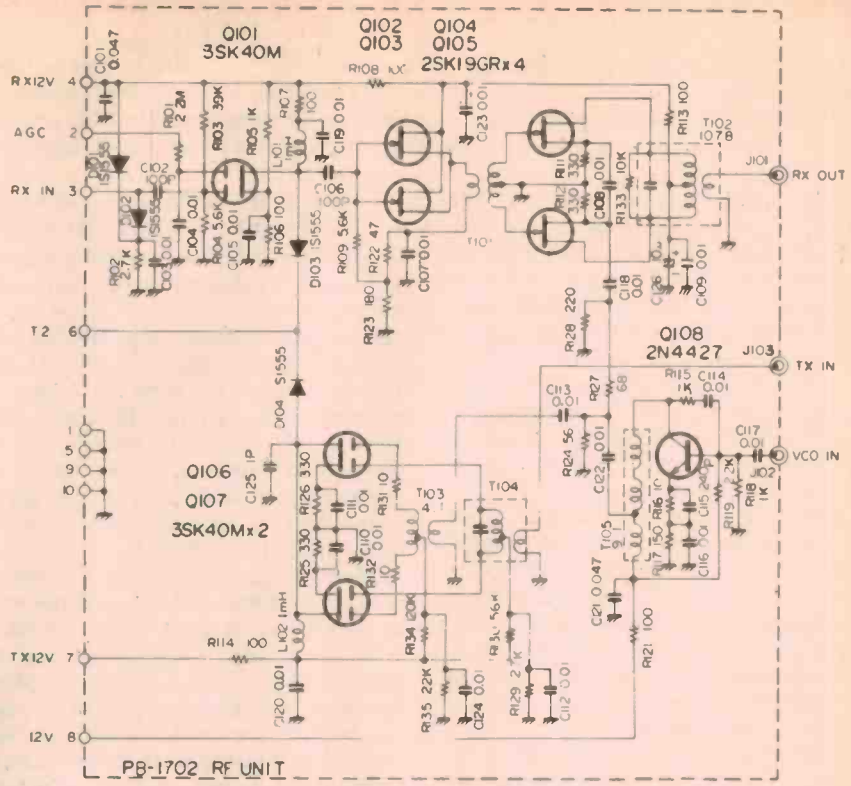
The accompanying circuit, taken straight from the FT-901 manual, gives an insight into why Yaesu have been so successful with this rig.

The dual-gate FET RF amp (Q101) has a broadband drain load and drives the first mixer via a source-follower stage using two JFETs in parallel. The first mixer is a double-balanced type using JFETs, broadband low impedance input, tuned output (8.9 MHz). Incidentally crossmodulation and desense were measured directly at the output of the front end (J101). Local oscillator input to the first mixer is in parallel to the FET sources. Note that two dual-gate FETs are used in the transmit up-mixer (Q106-7).

The following first IF amp uses two JFETs in parallel in ground-gate configuration. All these circuit techniques are in the interest of wide dynamic range — and Yaesu's engineers have certainly been successful.

The sort of solid-state design philosophy embodied in the FT-901 front end is relatively recent and it is heartening to see it used in a recent commercial transceiver.

The memory unit heralds the coming of "dedicated" digital controllers to popular communications equipment. The inclusion of microprocessor technology, controlling many transceiver functions as well as 'housekeeping', is but a small step off (indeed it's here already . . . but that's another story).



Conclusion

The FT-901DM is certainly amongst the vanguard of top-line, top-performance amateur transceivers available today. Undoubtedly it will make its presence felt both in the market place and on the bands. Its capabilities and features will doubtlessly be appreciated by the discerning operator, it seems a pity though that its capabilities in the receiver department seem destined to be rarely exploited in the go-get-'em work-as-many-as-possible atmosphere extant on the HF bands today. But, perhaps it will encourage a few to dabble in the "exotic" propagation modes . . . ●

"THE S100 BUS STOP"

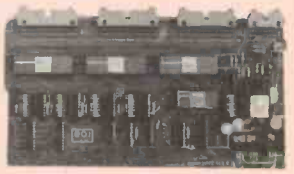
ETI 642 S100 16K RAM

16K, 2114 Low Power chips 1.2 Amps typ. for 16K, 300 or 450 nS, 4K addressing, 4K Write Protect switches, Bank Select, Wait states, plated thru holes, solder mask, see Feb. ETI project for details. **Kit $299 plus $5 P&P. ASSEMBLED & TESTED $366 plus $5 P&P Reg. mail.**

S100/6800 CHASSIS

11 slot backplane, fully card guided, 10 Amp power supply, fan, key switch, bench mount, rack mount, anodised alum. Sent FOB IPEC Transport. **BASIC BENCH MOUNT $189. BASIC RACK MOUNT $166. ACCESSORIES KIT $46. S100 POWER SUPPLY $79. 6800 REGULATED POWER SUPPLY $104.**

S100 I/O PORT BOARD



9 Parallel ports (programable), 1 SERIAL PORT — TTY — RS232 — or TTL, BAUD rate generator 9600 to 75. Fully address decoded. Low Power buffers, Plated thru holes, solder mask. **KIT PRICE $164 P&P $3.**

- S100 16K Eprom board kit..$90 plus $3 P&P
- S100 Z80 CPU board kit...$149 plus $3 P&P
- S100 FLOPPY DISK CONT. kit $159. P&P $3
- S100 ACTIVE TERMINATION BOARD.....$33
- S100 8 slot Backplane.....$22.50
- S100 11 slot Backplane.....$36
- S100 100 way connecter.....$8.00
- S100 WIRE WRAP board.....$28.50
- S100 Extender board kit.....$28.50
- NUMBER CRUNCHER KIT.....$49.50
- PAPER TAPE READER KIT.....$69.50
- FRONT PANEL DISPLAY KIT.....$87.50
- 8080 SINGLE STEP CONTROL.....$21.65

UV EPROM ERASERS

New product range, Model LEE/T 15W tube, 20 min. timer, up to 40 EPROMS, will erase in 10/15 mins. Model MEE/T 8W tube, 20 min. timer, up to 10 EPROMS will erase in 20/30 mins. Model MEE is the same as MEE/T but with no timer. All erasers are fully assembled and have a safety switch. **LEE/T $105, MEE/T $83.47, MEE $73.90**

- **DISK DRIVES**

SHUGART SA400.....$355 P&P $5
SHUGART SA800.....$580 P&P $5

- **6800 PRODUCTS**

6800 Active Termination Board.....$33.00
6800 Extender Board.....$28.50
6800 11 slot backplane.....$36.00
6800 11 slot chassis (basic).....$166.00

- **EPROMS & RAM CHIPS**

2708 450 nS GUARANTEED.....$12.00
2716 450 nS single supply.....$47.50
2114 LOW POWER 450 nS.....$8.50
2114 LOW POWER 300 nS.....$10.00

Send 60c in stamps for COMPUTER PRINTOUT CATALOGUE for more details.

ALL PRODUCTS AUST. MADE AND IN STOCK (ALMOST). DEALER ENQUIRIES WELCOME.

SM ELECTRONICS
MELBOURNE

bankcard welcome here
Give name, no., expiry date & signature for mail order sales.

SM ELECTRONICS
10 Stafford Crt, Doncaster East, Victoria. 3109.
PO Box 19, Doncaster East, 3109. Phone: (03) 842-3950.

BUILT & TESTED POA. ALL PRICES ADD 15 PERCENT S/T IF APPLICABLE.

An Introduction to Medium Wave Dxing

Whoever would have thought there'd be faraway stations to listen for on the medium wave broadcast band between 530 and 1605 kHz? Rob Williams has all the fascinating details . . .

REGULAR READERS of ETI will no doubt be familiar with the short wave reception notes which appear every month. However, there is another aspect of the hobby of DXing which has a relatively small but very keen following. This is medium wave DXing, the observation of the reception of stations on the standard broadcast band between 530 and 1605 kHz. These stations, including Australian and New Zealand stations, will verify correct reports on reception with QSL cards, stickers, and occasionally pennants if one is fortunate enough to hear a Latin American station. It is not necessary to send out reception reports, but most medium wave DXers send reports because they wish to have some kind of proof of reception of the stations which they hear.

The first necessity for a serious medium wave DXer is a reasonable quality receiver, preferably one which has dial readout to at least 10 kHz accuracy. Without this, it is very difficult to determine frequencies with any degree of accuracy, especially since the region below 900 kHz is full of ABC stations, most of them carrying the same programme and giving only sufficient identification to determine the Australian time zone in which they are situated. Even then, this is not an accurate indication, as there are times when the South Australian and Western Australian stations carry the Sydney programmes, complete with time announcements in Eastern Standard Time. Those who have a digital frequency meter would have no problems with frequency measurement.

For good reception with the minimum of overloading and images, a valve type receiver is best, such as the old model Trio or an old domestic receiver. These sets can be used effectively with almost any type of antenna. Of the modern solid state receivers, the Yaesu FRG7, affectionately known as the "Frog", gives fairly good results at a reasonable price. For a top quality receiver such as the Drake SPR4, which is excellent on medium wave, one must be prepared to pay upwards of $800. Obviously there are very few DXers who can afford equipment such as this, so it is necessary to make the most of the equipment which you can afford. A good set which has become available in recent months is the Realistic TRF 12-655 portable which covers medium wave only and operates from mains or batteries. At around $40 it gives surprisingly good reception, although it is not possible to determine frequencies accurately without some kind of logging scale or a frequency meter. Used with the ETI Digital Dial (see September 1978 ETI) it should be ▶

An Introduction to Medium Wave Dxing

an economical way to get started in medium wave DXing and at the same time have a frequency readout to an accuracy of 1 kHz, a facility which was previously available only on the most expensive receivers. The total cost of these two items is less than $100.

In order to hear the maximum number of stations at useable level, it is necessary to have a good antenna. The ideal type of antenna which is very directional seems to be the Beverage if you have room for a straight wire of 300 metres or longer. Some DXers have erected several Beverage antennas of more than 1000 metres length and have received stations which were never possible before. With solid state receivers it is usually necessary to connect the Beverage to the receiver via an attenuator to prevent overloading and still retain an intelligible signal from the required station.

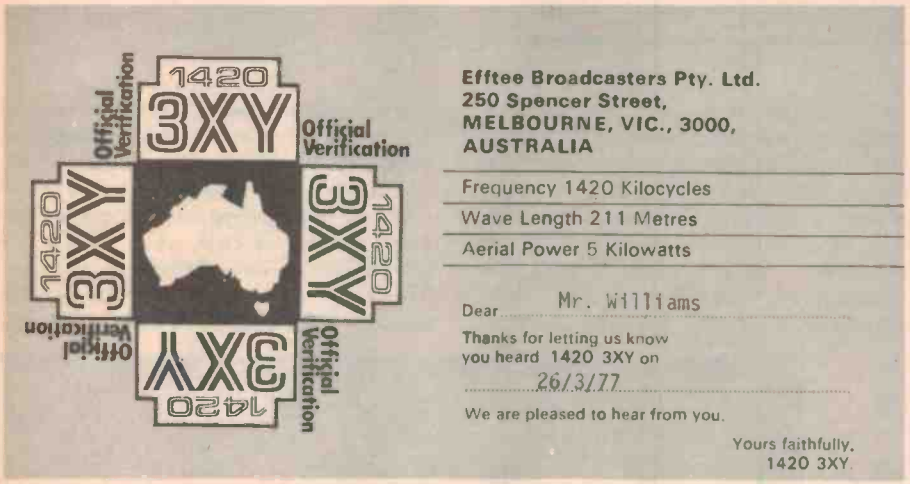
For DXers with limited space to erect an antenna, a loop antenna is the one to use. As an indoors antenna with sides 500-1000 mm long, depending on the design used, it can be rotated to peak or null particular stations and enable you to hear stations which cannot normally be heard with an omni-directional short or long wire. A tuned loop by itself gives fair results, but it is best used with a narrow-band pre-amplifier which can be built for about $10, or less if you have a few parts already in your junk box. Various preamplifier circuits, as well as details of the Beverage and loop antennas, can be found in various electronics publications and DX magazines.

Listening

Now that you have your equipment set up, you can begin listening and sending out reports. It is necessary to have some reference material, the main item being the latest edition of the World Radio TV Handbook. This publication gives frequencies, transmission times and addresses for most stations in the world, except for the low-powered North American stations. As you progress in the hobby, you may like to make various lists of your own according to your needs.

Those who are short wave DXers will already be familiar with the SINPO code for reporting. This was designed for easy reporting of international short wave stations and is not really suitable for medium wave. Unless an amateur or DXer at the station reads your report, or the station has an external service on short wave, or someone at the station has made an effort to find out what it means, the SINPO code means nothing to many, if not most, medium wave stations. A full description in words conveys much more information and is most helpful to the stations. The 5 points signified by the SINPO code should still be given and any other comments on reception quality should be added. In order to clarify this, here is a detailed explanation of what is required.

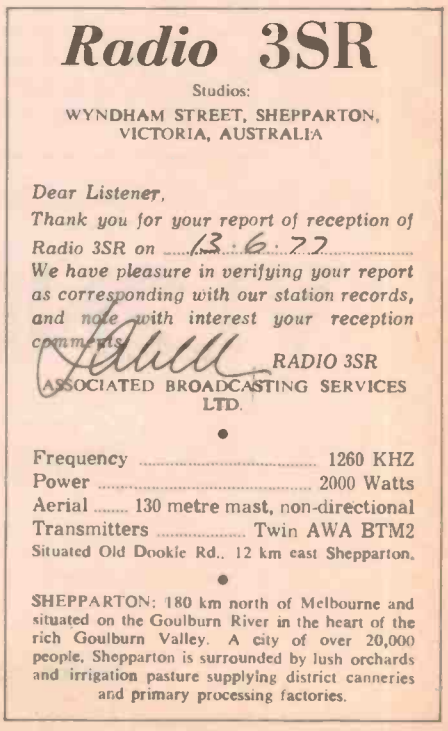
Signal strength: Describe this as fair, good, etc., and state also as a numerical value. For example, "strength 4 on the 1-5 scale" or "strength 7 on the 1-9 scale". Be careful to give the readings according to your 'S' meter or some other accurate method. Many DXers fall into the trap of describing the signal strength as "very good" just because it seems to them to be very good reception for a station in Switzerland, for example, whereas the actual 'S' meter reading shows only fair strength.

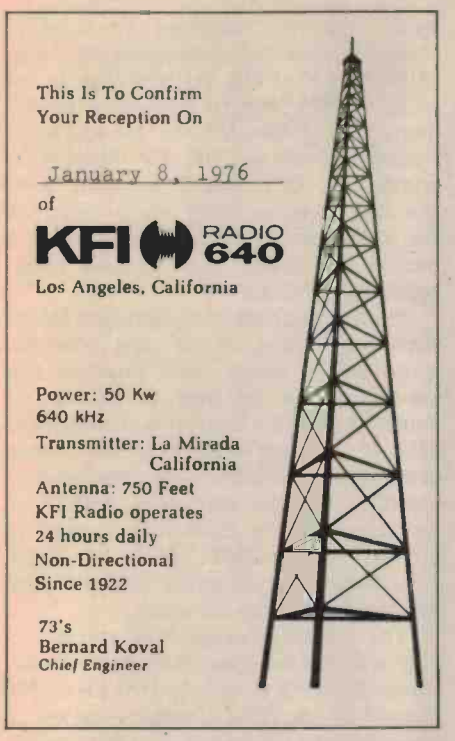


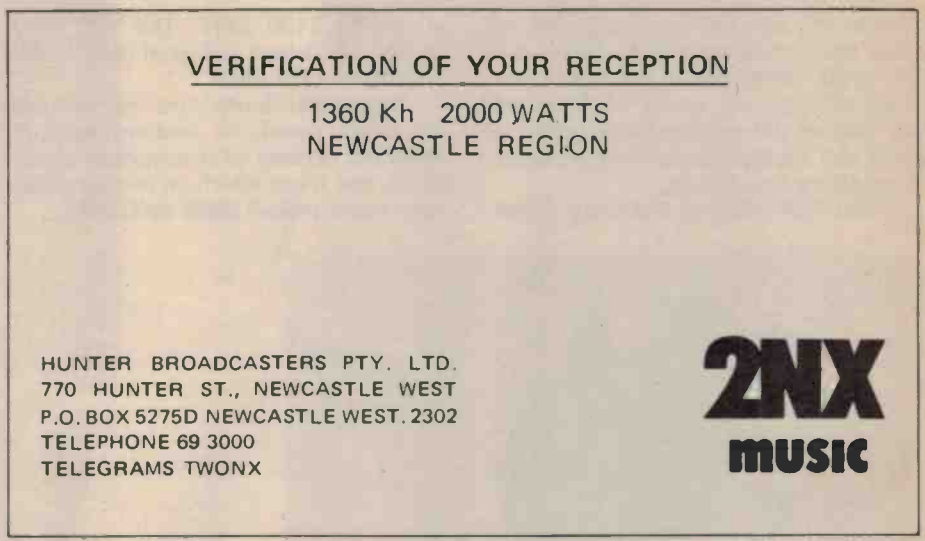
Interference: Give details of all stations which caused interference, the amount of interference from each station, and the variations in the amount of interference. The SINPO code does not adequately cover continual variations in interference due to fading and other disturbances on medium wave unless you give a SINPO reading every two or three minutes during your report. Doing this would obviously take much of the enjoyment out of DXing, so it is best to use words only.

Atmospheric noise: Also referred to as static, this needs no further explanation. However, remember that the relative amount of noise can vary as the station fades and peaks.

Fading: State the number of fades per minute or the number of minutes from peak to peak of each fading cycle. The SINPO code cannot describe this adequately, as the 'P' is usually used to denote frequency of fading. Slight fading, according to the SINPO code, would be no more than about 5 fades per minute and these would usually be only slight fades. One fade in 3 minutes, taking the signal from good to inaudible, obviously cannot be described as slight fading! It is therefore necessary to describe this fully in words in order to give an accurate picture. The details of fading can often be included as part of the description of signal strength.







Overall quality: Taking all the above points into consideration, assess the overall quality of reception. Other points not already covered can be described here also, such as overmodulation, variation between music and voice levels and any other details which you think will help the station.

Details

What program details should be included in a report? This varies between stations, but most stations do not keep a detailed music log, except for Indonesians and a few others. It is therefore necessary to quote advertisements (including the exact times broadcast), station identifications, time checks, station slogans, names of announcers and programs, weather reports, telephone numbers and any other items which the station can positively identify. When a news broadcast is heard it is often helpful to quote items in your report also, especially local news items. In the case of a foreign station which does not give good reception, this could mean the difference between verifying and rejecting your report. Always try to quote identification announcements word for word and quote at least two identification announcements in your report.

Times of reception should be quoted in Greenwich Mean Time and the station's local time. Some countries use daylight saving time, so make it quite clear whether you are quoting the station's standard time or daylight saving time.

When quoting the frequency reported, also give the equivalent in metres. This is found by dividing 300,000 by the frequency. For example, a station on 1200 kHz operates on 250 metres; that is, 300,000 divided by 1200 gives 250. In the case of African stations (and some others) which also have short wave outlets, emphasise that this is *medium wave,* especially with stations like Radio Tanzania who do not seem to believe that anyone outside the country can hear their medium wave stations.

Reports should cover ideally at least 30 minutes of program, and even an hour or two in the case of stations such as those in the Middle East which sometimes broadcast an hour of music and chanting with very few announcements. As far as possible, report in the language used by the station unless you know that there is an English service. The foreign language reporting guides of various DX clubs are very helpful in this respect.

Postage

Return postage is necessary for commercial stations and small stations as well as some others as shown in the World Radio TV Handbook. Stations which do not usually require return postage are the ABC in Australia, NHK in Japan, All India Radio, and stations which are operated by international broadcasting organisations such as the BBC and the Voice of America. Wherever possible, send mint stamps of the country reported. Otherwise, send one or two International Reply Coupons which are available from most post offices.

Always comment on the programs which you heard. Local stations are not usually concerned about whether they are being heard a great distance away, but they *are* concerned about the overall listener response to their programs.

Never demand verification of a reception report. Stations reply out of courtesy to those who report them, so make your letters as polite and informative as possible. Always remember that a station is under no obligation to reply, even when you enclose return postage. In the case of distant and rare stations you can add a few personal details and even a picture postcard. Some stations will even send a postcard or small souvenir in return.

Challenge

Medium wave is a very challenging aspect of the hobby of DXing, much more so than short wave. Whereas a short wave station can be heard on a particular frequency on a daily basis with little variation in reception conditions, one medium wave frequency can produce completely different stations on consecutive days because of much greater differences in propagation conditions.

If this article has aroused your interest in medium wave DXing, you will want to know when to listen for stations in different parts of the world.

Beginning at home, Australian and New Zealand stations can be heard throughout the day and night, depending on your location within these countries. For example, a DXer in Adelaide or Perth will not hear a New Zealand station in the middle of the day, whereas a listener in Sydney could.

After the Australian and New Zealand stations sign off (except for the growing▶

An Introduction to Medium Wave Dxing

number of all-night stations), and in many cases while these stations are still on the air, many foreign stations can be heard while tuning across the band. At this time of the evening, these would be Asian and Pacific stations which can be heard all the year round.

From November to February, some American and Canadian stations can be heard from 1300-1500 GMT (11 p.m.–1 a.m. Eastern Standard Time). With the frequency change to 9 kHz separation which affected all countries except the Americas from November 23rd 1978, it should be possible to hear many North Americans on clear channels from as early as 0900 GMT.

May to September is the season for African DX from around 1500 GMT until daylight. Stations in the north of Africa, such as Egypt, can be heard all the year round.

The best months for European DX are December to February, although there can be a few good openings during our winter months. Try for these from around 1800 GMT until daylight.

Middle East stations are heard all the year round, the earliest ones fading in at around 1430 GMT. The BBC relay on Masirah Island has even been noted as early as 1330 GMT.

Central and South American stations are rarely heard on medium wave in Australia because of propagation difficulties, but those which do reach us have been heard around 0900-1000 GMT.

The reception times given here are for reception in Adelaide and can be taken as a rough guide, but allowance should be made for listening in other parts of Australia and in New Zealand. European stations have been heard in the afternoons occasionally in New Zealand, a phenomenon which is unknown in Australia. The eastern states of Australia are the best locations for North and South American stations, while DXers in Perth have the best reception of Africa, Europe and the Middle East. Listeners in Darwin will find the band covered with Japanese, Philippines and Indonesian stations.

North America

Since the 23rd November 1978 Frequency Plan came into effect, a whole new world for serious MW Dxing has opened up, for the keen Australian based hobbyist wishing to explore reception from North America. Previously reception of NA stations was somewhat limited, due to frequency assignments being the same as for the local Australian stations (ie, for frequencies ending in "0"). Now, however, with the new 9 kHz spacings, the possibilities for reception of NA MW stations are almost boundless, given suitable propagation conditions.

Many channels assigned for North America, ending in "0" are now far more easily tuned, and possibly the easiest station to hear is KDAY, at Santa Monica, in California, using 1580 kHz. It has been heard in Victoria from as early as 0900 GMT during the summer months. Another station is KNEW, at Oakland, also in California, logged at around 1100 GMT. Both of these frequencies are allocated only for MW broadcasting in the Americas.

The easiest foreign MW station to hear is Radio Noumea, in New Caledonia, using 666 kHz (formerly 670 kHz). No Australian or New Zealand station is allocated this frequency, and this French speaking station may be heard from around 0600 GMT, or even earlier for listeners in NSW and Queensland. It signs off at 1100 GMT with the playing of "La Marsellaise".

Other channels which have not been assigned to Australian or New Zealand stations under the new plan include: 909 kHz; 1062 kHz; 1125 kHz; 1305 kHz, these channels are the ones to watch when trying for night-time DX from the Asian countries, and also in the early morning dawn period when European, Middle Eastern, and African transmitters may appear.

One of the easiest European stations to hear is the high powered West German transmitter at Langenburg, now using 1593 kHz (previously it was on 1586 kHz). The best time is just before 1800 GMT before the Australian stations open on the same frequency.

In a further article, we'll offer some detailed information on how to hear various stations in other countries.

The challenge is there, especially to log low-powered foreign stations, and there is always a feeling of elation or triumph in adding another country to your total. By paying careful attention to the guidelines given here, you should easily verify 10 countries, then progress to 25, 50, 75, 100 and even more. Whatever your ultimate goal is, you are sure to get great satisfaction and enjoyment in exploring the world via the airways. ●

CENTURY-21
communications receiver

The CENTURY-21 Receiver provides precision tuning over the short wave spectrum of 0.5 to 30MHz with the capability of reception of AM (amplitude modulation), CW (continuous wave) and SSB (upper and lower single side band) signals.

The CENTURY-21 has a built in telescoping antenna or may be connected to an external antenna for better results. The sensitivity of the receiver is such that it operates near thermal limit and when using the telescoping antenna the performance reaches external noise limits.

Solid state circuitry is utilized throughout the receiver design allowing efficient operation or from an external DC or AC power source.

$325 incl. Tax.

The circuit design of the Century 21 is similar to the Drake SSR1.

bankcard welcome here

ELMEASCO Instruments Pty. Ltd.

SYDNEY
PO Box 30, Concord, NSW 2137
13-15 McDonald St,
Mortlake, NSW, Ph (02) 736 2888.
Telex 25887

MELBOURNE
PO Box 107,
Mt Waverley, Vic 3149.
21-23 Anthony Drive, Mt Waverley, Vic
Ph (03) 233 4044

ADELAIDE
Phone (08) 51 3521
PERTH
Phone (09) 325 3144
BRISBANE
Phone (07) 229 3161

Amateur News

Minister Opens Museum Station

The Minister for Post and Telecommunications, the Hon. A Staley, officially opened the Radio Bay and amateur station VK2BQK of the Sydney Museum of Applied Arts and Sciences on Friday 23rd March.

The recently completed Radio Bay features a display of early photographs and graphic material depicting historical events in radio in Australia. Of particular interest is the material on Charles MacClucan – one of Australia's well-known radio pioneers and an amateur.

A replica of a station typical of the advanced amateur of 1925 of a fascinating feature of the Radio Bay – right down to log book, QSLs, pipe and matches!

Devices illustrating the early technology used in radio transmitting and receiving equipment are also on display.

The station equipment for VK2BQK, donated by Dick Smith, includes an FT-101E transceiver and FRG-7 general coverage receiver as well as 2 m VHF equipment. The NSW division WIA organises volounteers to man the station on weekends.

Following the opening ceremony the Minister made contact via VK2BQK with a group of South Australian school children being introduced to the delights of the hobby – much to their surprise!

The exhibit is certainly worth a visit, it's fascinating and instructive. During school term, special classes may be arranged for secondary school students by contacting the Senior Education Officer on 211 3911.

Record Attendance at Central Coast Club Field Day

The Central Coast Amateur Radio Club's 22nd annual field day, held on Sunday 18th February, was a runaway success. Registered attendance exceeded 820.

The on-air scrambles and various foxhunts were well patronised, overall winner of the day's events being Steve, VK2BGL.

Trade displays this year were generally larger than in previous years, those taking stalls being: Andrews Communications Systems, Australian National Amateur Radio Teleprinter Society, Custom Communications, Central Coast Club's Store, Dick Smith Electronics, Emona, Gilco Amateur Radio Centre, Scalar Industries, Sideband Electronic Sales, Westlakes Radio Club and the NSW WIA Education Service.

The disposals market – always a popular feature of the Gosford Field Day, was jam packed immediately it opened. The trend, noticed over the last few years, to quality equipment being offered through this event at the Field Day was also apparant this year. In all, 50 people provided items (or 'lots') for sale with a total value around $3000. That's an average value of $600 per lot! Much of the equipment offered changed hands on the day.

The Minister signs the log at VK2BQK, watched by Pierce Healey, VK2APQ.

Another popular feature of the Field Day this year was the Equipment Workshop run by Des Clift, VK2AHC. A range of test equipment was available and many people made use of the facilities.

A newcomer to the 'stalls' was the Australian National Amateur Radio Teleprinter Society, ANARTS. Their stall featured a working display of various items of teletype equipment, ancient and modern, illustrating the sort of fun you can have on the air when you attach a keyboard to your rig. An example of their work is shown below.

BRIGITTE BARDOT

Articles of Note

Two pages of Amateur News in the March issue of ETI this year carried an article examining highly unusual 144 MHz propagation across the geomagnetic equator – a further note on this phenomena is included elsewhere in this column. Speaking recently with Dr Leo MacNamara of the Ionospheric Prediction Service I was pleased and excited to hear that he and Matt Heron of James Cook University, Townsville have written a paper proposing a model of the propagation mechanism that supports night-time (or Class II) trans-equatorial propagation. Apparently, large field-aligned 'tubes' or 'bubbles' (Matt Heron suggests 'bananas' . . .) of depleted ionisation form in the equatorial ionosphere after sunset. VHF signals are guided across the equator via these tubes. Significantly, no upper frequency limit is proposed and the predicted properties of the model closely match many of the observed characteristics of night-time TEP. The paper will appear in the May-June issue of "Radio Science" – state and university libraries carry copies.

ETI will publish an article in an upcoming issue shortly.

Narrowband Voice Modulation is here! The December 1977 issue of QST carried an extremely interesting article on a technique for *halving* the bandwidth of voice transmissions – noted in our March 1978 issue in this column. The November and December issues of QST carry a two-part article on this technique titled "A Baseband Communications System". The series covers both theory and practical hardware – circuits included. Recommended reading.

Tram D64 for Amateur Market?

The Tram D64 27 MHz SSB transceiver, imported by Mobile One, is a high quality unit that importers feel will suit amateurs seeking a top performance rig for 28 MHz operation. Novices in particular are paying increasing attention to 28 MHz.

Conversion for the D64 to 28 MHz, to include all the usual features, is reputedly quite simple.

For further information, contact *Mobile One, 17 Sloane Street, Marrickville, 2204, (02) 516-4500.*

144 MHz TEP?

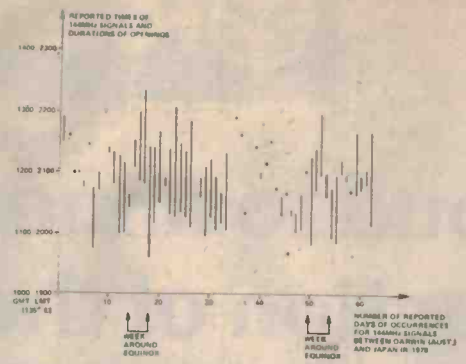
Further to my two-page article in this column in the March issue, I have completed an analysis of the 144 MHz Australia-Japan contacts during 1978 reported by Graham VK8GB and Brian VK8VV. The reports were taken from the column "VHF-UHF An Expanding World" conducted by Eric Jamison VK5LP in the WIA's journal 'Amateur Radio'.

It is a tribute to the meticulous, detailed and accurate accounts that Eric gives in his column that I have been able to do a reasonable analysis and reduction of the data presented. It's a pity more column writers in this field couldn't follow his lead.

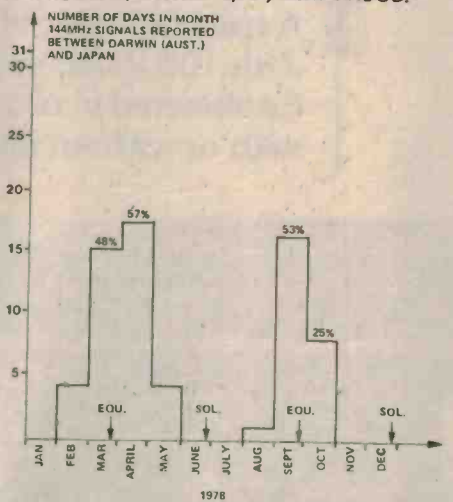
Two graphs are reproduced on this page, one showing occurrence rates over the year, the other showing the diurnal occurrence times reported.

Quite clearly, from the graph of occurrence rates, these contacts between Australia and Japan (Darwin to southern Japan) have a strong equinoctial character. The peaks of the monthly occurrence rates 'lean' towards the mid-year solstice (June 21), an interesting phenomena. Next step is to correlate this with "spread-F" disturbance data from the ionospheric sounder located at Vanimo in Northern New Guinea. This sounder is nearly beneath one of the control points in the ionosphere associated with evening-type transequatorial propagation. Spread-F on ionograms indicates the presence of field-aligned irregularities in the ionosphere.

The graph of diurnal occurrence rates indicates a clear peak between 2000 and 2200 hours local meant time. The longest durations of openings are associated with the week around the equinoxes – again with a tendency towards the mid-year solstice.



Diurnal occurrence pattern of 144 MHz propagation , Darwin-Japan, from VK8GB.



Seasonal occurrence rate of 144 MHz propagation Darwin-Japan during 1978, reported by VK8GB..

An examination of the areas worked from Darwin shows a very narrow strip covering the island of Shikoku and the southern half of Honshu – between geomagnetic latitudes 21 - 22° North. Darwin is at a geomagnetic latitude of 21° South making the path terminals very nearly conjugates.

Unmistakenly, these results accord very closely to the major characteristics of evening-type or Class II TEP.

Sunspot Numbers

The Swiss Federal Observatory, Zurich has issued the Final Smoothed Sunspot Numbers for the 12 months from July 1977 through June 1978. Get out your coloured pencils and plot these on your graph for old Sol's Cycle 21:

July 77	29.0
August 77	33.4
September 77	39.2
October 77	45.6
November 77	51.8
December 77	56.9
January 78	61.3
February 78	64.5
March 78	69.6
April 78	76.9
May 78	83.2
June 78	89.4

Which lot accounts for the quite respectable performance of the HF bands through last year. The rise is quite rapid and maintaining a healthy pace as evidenced by the high activity levels and excellent performance of the upper HF bands these past few months. Apparently the provisional number exceeded 190 in March – creating some excitement on 50 MHz.

The Mean Provisional Sunspot Number for February was 138. A figure of 136 to 150 was predicted.

Latest predictions of the Smoothed Monthly Sunspot Numbers for May to August (from Zurich Sunspot Bulletin No. 2, 1979) are as follows:

May	156
June	159
July	162
August	163

Warm up the linear and stoke up the beam – there's gonna be a hot time on the old bands these nights!

Noise Suppressors

The most annoying aspect of mobile operation is ridding the car's electrical system of the multitude sources of noise that interferes with reception.

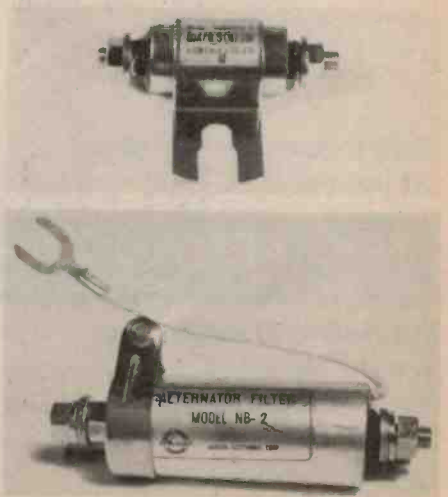
Any amateur worth his license knows the basic solutions – ignition lead suppressors, alternator/generator filters and a copious sprinkling of high-current feed through capacitors in likely places.

That's all very well, but, as the man on the modulated milk bottle raucously said, ". . . where do you get it?".

It so happens that an enterprising entrepreneur saw the suffering of mobile enthusiasts and made available some delightful devices through multitudinous outlets the length and breadth of the land.

I.F.T.A. Australia import and distribute a variety of noise suppressor components. Of interest in their range are the model NB-2 Alternator Filter (catalogue No. 11-102) and a 0.5 uF, 60 amp rating feedthrough capacitor (catalogue No. 11-110). The 11-102 sells for a recommended retail price of $7.75, while the 11-110 will set your budget back a mere $3.99. Now that's not bad for the price of peace!

If your local retailer is foolish enough not to keep any in stock you may find out who has them in your area by contacting *I.F.T.A. Australia, P.O. Box 21, Bondi Beach or phone (02) 665-8211.*



KENWOOD

We are proud to announce the introduction of the TS-180S

A truly fantastic HF Transceiver with 100 W RF output power. Engineered in two versions — with or without memory.

Designed for Base Station and Mobile 12 Volt operation or as a permanent Base Station with the PS 30 Power Supply. Has provision for WARC 79.

Ask to see this new range at your nearest Kenwood distributor.

TRIO-KENWOOD (AUSTRALIA) PTY. LTD.
31 Whiting Street, Artarmon, Sydney, N.S.W. 2064. Telephone (02) 438-1277

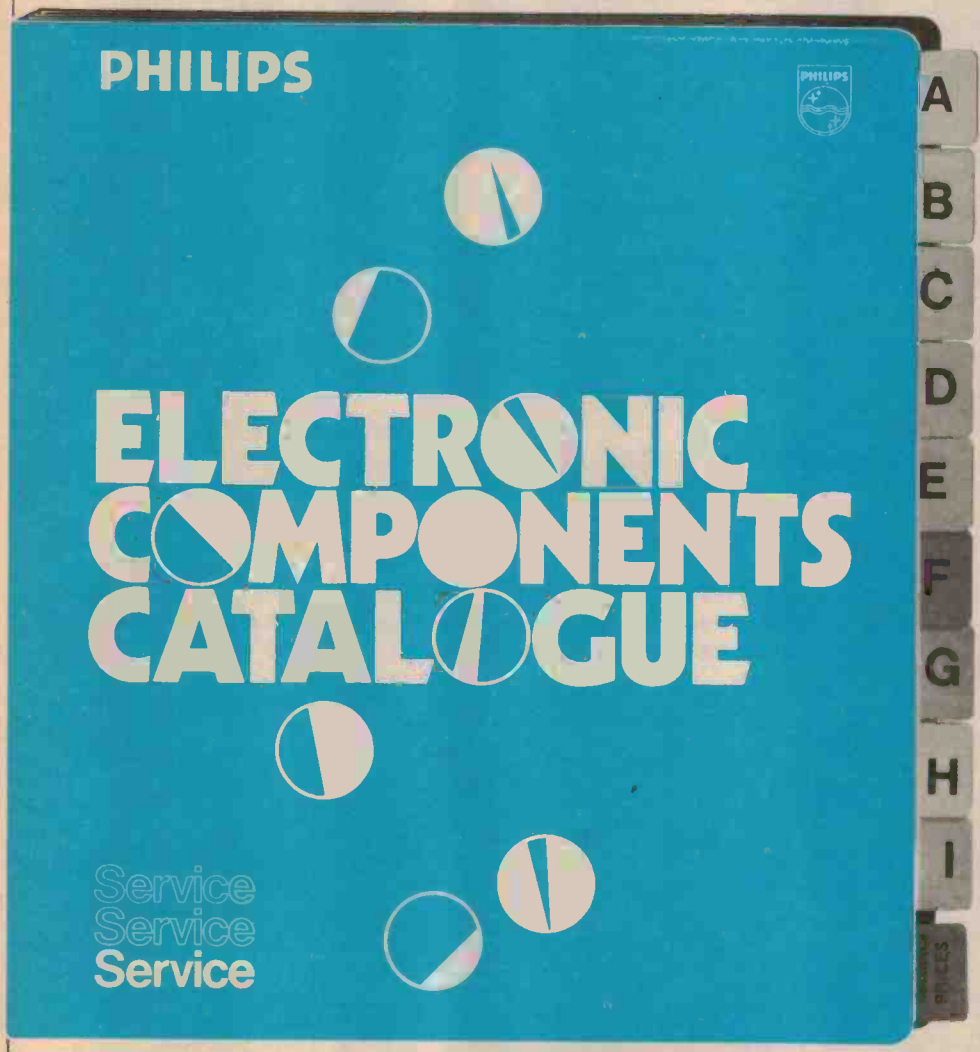
Interstate Distributors:

N.S.W.: SIDE BAND ELECTRONICS SALES. (02) 438-4191 — CUSTOM COMMUNICATIONS. (02) 681-3544 •
VIC.: VICOM IMPORTS PTY. LTD. (03) 699-6700 • **QLD.:** MITCHELL RADIO CO. (07) 57-6830 •
S.A. & N.T.: INTERNATIONAL COMMUNICATIONS SYSTEMS PTY. LTD. (08) 47-3688 •
W.A.: WILLIS TRADING CO. (09) 321-7600 • **TAS.:** ADVANCE ELECTRONICS. (003) 31-5688 •

PLUS MANY OTHER REGIONAL OUTLETS THROUGHOUT AUSTRALIA

ONLY $9-40

FOR THIS COMPREHENSIVE ELECTRONIC COMPONENTS AND ACCESSORIES LOOSE-LEAF CATALOGUE.



- PAGES UPDATED WITH NEW PRODUCTS
- PRICES UPDATED
- REPLACEMENT PAGES AVAILABLE

The new Electronic Components Catalogue from Philips Service is a comprehensive guide to Electronic components and accessories available in Australia.

It is compiled of 350 regularly updated pages complete with an easy-to-follow, alphabetical index system.

The price also includes the updating and page replacement services to keep you informed of current prices and new products.

SEND IN FOR YOUR COPY TODAY.
Or for further enquiries, please telephone:

Sydney 736 1233, Newcastle 61 1631,
Canberra 95 0321, Melbourne 699 2731,
Hobart 28 0121, Brisbane 221 5422,
Townsville 79 7422, Adelaide 223 4735,
Perth 322 4653.

PHILIPS

To: Philips Central Service Division,
443 Concord Road,
RHODES NSW 2138

Please send me ☐ catalogues @ $9.40 each
Cheque/postal order for $ is enclosed.

Name: _____

Position: _____

Company: _____

Address: _____

Telephone: _____

ETI May

McCann 184.0009

SWL News

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

Greece's other transmitter sites

Most shortwave DXers are aware that the Voice of Greece operates two 100 kilowatt transmitters located at Avlis near Athens. But the station also uses transmitters at two further sites, both in northern Greece.

A single 35 kilowatt transmitter located at Salonica, Greece's second city, is used to relay the Home Service program for listeners in Europe and elsewhere. Programmes in Greek are relayed each day from 1000-1430 on 9675, and from 1830-2030 on 9655. On Sundays, the Salonica transmitter is used from 0500-0830 for relays of religious programs, including a Greek Orthodox church service, on 7135.

The other transmitter site is at Kavalla where the Voice of America has a relay station with a number of high power shortwave transmitters. Greece makes use of the Voice of America transmitters for programs to Australia daily 0900-0950 on 9655 and 15160, with further programs for Australia 2100-2150 on 6140, 9640 and 9760, and from 220–2250 on 9640 only.

Reports of reception are welcomed and will be verified by QSL card, and the address is the Voice of Greece, PO Box 19, Aghia Paraskevi, Attikis, Athens.

Voice of Chile changes

The Voice of Chile at Santiago continues to modify its overseas schedule, with announcements from the station now indicating that English programs are broadcast at 0030, 0200, 1100, 1300, 1400 and 1430 each day.

The 1100-1130 English program is the most regular, with best reception currently noted on 15110. Meanwhile, the new outlet of 17800 has also been observed, carrying the 0200-0230 English program.

Denmark makes a move

Radio Denmark, one of the pioneers in the early days of shortwave broadcasting, has for some years operated its aging 50 kilowatt transmitter on just one frequency, 15165. The station has, however, recently introduced the new outlet of 17735 for some services.

Radio Denmark has been using 17735 for the service to Australia and the Far East between 1200 and 1255, for the Southern Europe and Africa service from 1830-1925, and the programs for South America from 1930-2025 daily.

Meanwhile, the old outlet of 15165 will continue to carry Radio Denmark's other services which are scheduled:
0900-0955 to the Middle East and South Asia.
1400-1455 to the Eastern Mediterranean and East Africa;
1600-1655 to the West Mediterranean and West Africa;
1100-1150 and 1730-1800 to the Pacific region;
and to North America from 1300-1355 daily.

All Radio Denmark's programs are in Danish, apart from some sign-on and sign-off announcements and station identification in English. Plans are in hand for the expansion of Denmark's shortwave service. The station hopes to install two 500 kilowatt transmitters by 1984, replacing the current 50kW units.

New publications for DXers.

Just published is the ARDXC's completely updated MEDIUM WAVE GUIDE TO STATIONS IN AUSTRALIA, NZ, PNG AND INDONESIA. This includes frequencies now used by all stations in our area since the implementation of the Geneva Plan for medium wave broadcasting late last year. Details such as transmitter power, operating schedule and transmitter location are listed, and the price is just one dollar from ARDXC.

Many people would have noted the article on UTILITY DXING in a recent issue of ETI. The author of that article, Steve Thurlow, is preparing a new Utility Book for those interested in this fascinating branch of the radio listening hobby. Please write to ARDXC for more information on how to obtain a copy of this book.

The Indian DX Club International (IDXCI) notify us that they have available a DX Annual containing many valuable articles which cover such topics as: Selecting a receiver; Reception Report Writing; Technical aspects of DXing; and Radio Broadcasting in India. If you don't wish to write to India for this book, then you may order via the ARDXC. The price is $1.25 a copy.

Asian signals

Mongolia: A new outlet for Mongolia's home service programs is 4995, which is audible with Mongolian language programs until sign-off each night at 1500. It is believed that the transmitter is located at a site other than Ulan Bator, where, until recently the only shortwave transmitters in Mongolia were located.

New transmitters were reportedly recently installed in the eastern town of Choybalsan, as well as at Altay City in the west of Mongolia.

Meanwhile, the English service from Radio Ulan Bator currently uses 6383 between 1200 and 1250 every evening.

Pakistan: Radio Pakistan's home service is currently heard on 5060 between 1400 and 1600 each evening, with programs in Urdu and minority languages, from a transmitter of 10kW located at Islamabad.

African signals

Angola: Radio Nacional in Luanda has recently returned to 4820 for programs in Portuguese. Currently noted with excellent signals from 1900 until after 2200 each morning. Luanda has recently experimented with different frequencies for the 60 metre band channel, mainly 4790 and 4985.

Mozambique: Radio Mozambique, Maputo, is currently noted on 4925 with good signals 1900 to past 2150, with programs in Portuguese and local languages. The regional station located at Nampula also provides good

reception on 4937 at the same time.

Libya: Tripoli has moved to 7200 (replacing 7120) for Home service programs in Arabic from 1500 nightly.

Somalia: With Tripoli vacating 7120, and Chad's transmitters being currently off the air due to the troubles in that country, Radio Hargeisa in north western Somalia gives good reception on a clear frequency, 7120, with programs in Somali audible between 1400 and 1530.

Latin American signals

As outlined in a recent issue, signals from this area will continue to improve with the approach of the winter months. Signals on the 49 metre band have been prominent, with these stations being regularly audible:

6180: Radio Nacional, Guatemala City, about the best Latin American signal at present, usually signs on at 1100 each night, and plays very pleasant marimba music. Sign on may sometimes be as late as 1200.

6175: Radio Tawantinsuyo at Cuzco in Peru. This station, located at the former Inca capital in the Andes mountains, gives good reception from sign on at 1000, but is quickly over-powered by Malaysia after 1030. Radio Tawantinsuyo plays distinctive Andean guitar and flute music, with occasional announcements in Spanish.

6115: Radio Union in Lima, Peru. Regularly heard from sign on at 1100 in Spanish.

6010: Radio Mil Cuarenta at Merida, Venezuela. Noted on 24 hour schedule currently, with rock music selections, as well as local guitar tunes.

6035: Station TIFC Faro del Caribe in Costa Rica is currently noted from sign-on at 1000 with callsign and frequencies announced. This is a station which was heard regularly some years ago, and is again audible having recently changed frequency for its 49 metre band outlet to a current vacant frequency. The station also has a 60 metre band outlet, 5055, which is not heard at present in east Australia.

Haiti back

This tiny Caribbean country has again a voice on shortwave, with the religious broadcaster 4VEH in Cap Haitien again audible on 11835, with best signals noted in east Australia between 2100 and 2230 each morning.

Programs are in Spanish, with hymns and local songs. The station will QSL reports and the address is Box 1, Cap Haitien.

The station was off the air for most of 1978, but now seems re-established having solved some of the technical troubles it has had with its 2 kW transmitters.

Compiled by the Australian Radio DX Club (ARDXC). Further information about shortwave DXing and ARDXC's activities may be obtained from either PO Box 67 Highett VIC 3190, or from Box 79 Narrabeen, NSW 2101, for a 30c stamp.

DIAL THE BEST RECEPTION FOR YOUR TV, FM, CB.

REMOTE CONTROL ANTENNA ROTATOR

Approved by the Electricity Authority of NSW

Now available in Australia. A simple, no-fuss way to get the very best of your TV, FM or CB.

With Crown's Remote Control Antenna Rotator fitted to your existing antenna, you can tune precisely to the station from the comfort of your armchair.

Just turn the dial until you get the strongest reception. Then sit back and enjoy the best picture, the clearest sound you've ever had.

The Crown Remote Control Antenna Rotator is designed for you to get the best from your equipment in built-up or fringe areas.

And because it comes as a simple, do-it-yourself kit, you save on installation charges.

Price: Remote Control and Power Rotator, complete with installation kit, wiring and instructions, $99.00 including postage and handling.

Trade Enquiries Welcome

We are the experts — 30 years in the antenna business.

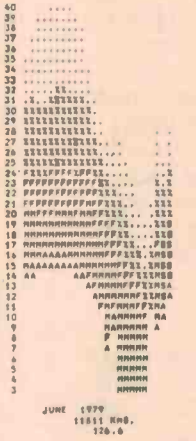
ELECTROCRAFT
PTY. LTD.
68 Whiting Street, Artarmon, 2064
Telephone 438-4308. 438-3266
Open Mon. to Fri. 8-5. Sat. 8.30-12.

predictions for JUNE 1979

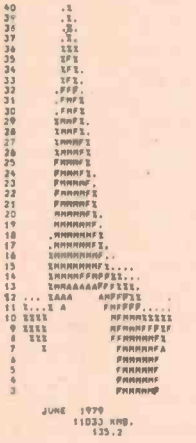
These predictions cover the frequency range between 3 MHz and 40 MHz showing the times propagation is possible over the paths designated for each chart, as well as the probable mode of propagation. For full information on how to use the graphs, refer to ETI issues Nov-Dec '78, Jan-Feb '79 or the ETI/Trio-Kenwood poster given free in the December '78 ETI.

For reliable predictions follow the times and frequencies indicated by the F character on the printouts. Time goes from 0000 UT to 2300 UT, left to right across the graph. These GRAFEX style of computer generated predictions provided courtesy of the Australian Ionospheric Prediction Service.

East Coast — Europe (Short Path)



East Coast — Japan (also serves NE and South Central)



East Coast — South Africa (also serves South Central)

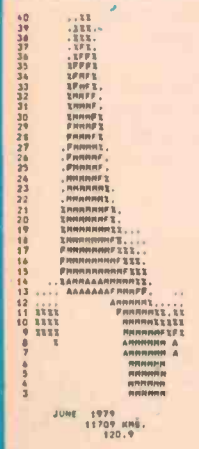
East Coast — North Africa (also serves South Central)

East Coast — South America (also serves South Central)

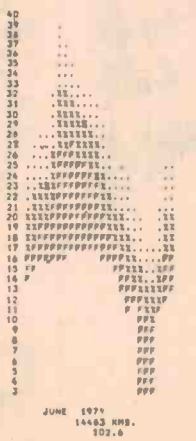
East Coast — North America (also NE and South Central)

East Coast — South Pacific

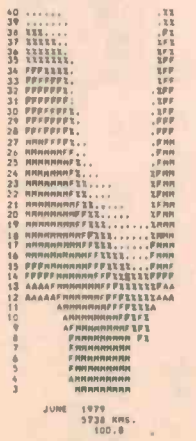
North East — Europe (Short Path)



North East — South Africa

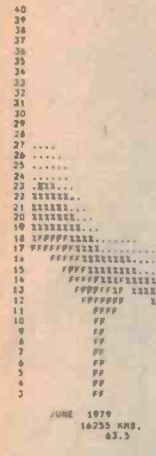


North East — North Africa

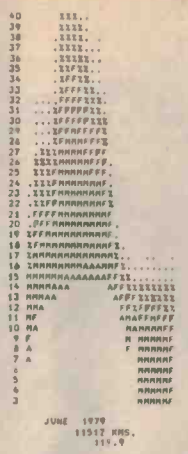


North East — South Pacific (also serves South Central)

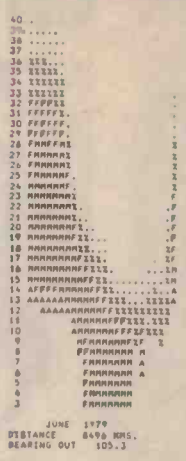
South Central — Europe (Short Path) (also West Coast)



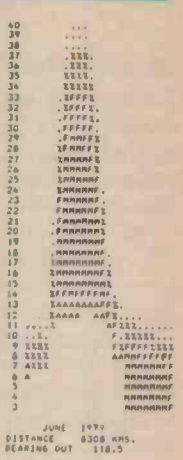
West Coast — North America



West Coast — North Africa



West Coast — Japan



West Coast — South Africa

Top careers in sound production begin here

There is a need for sound production people in TV, recording, theatre, clubs, engineering hit records, designing studios, installing sound reinforcement systems. The Academy of Sound Recording Engineers offers a 3 semester course on audio engineering, production and design. Complete technical knowledge plus practical experience. No wasted time. Additional courses on Music Theory, Effective Communication. *Ring for full details.*

ACADEMY OF SOUND RECORDING ENGINEERS

54-50 Alfred St., Milsons Point, Sydney 922 6301

- **Canberra** 80 4446 • **Melbourne** 95 9510
- **Adelaide** 261 1383 • **Newcastle** 69 4021

John Burnett, Stephen Penning A.S.R.E.

TWO BYTES ARE BETTER THAN ONE

THE TECHNICO T9916 MICROCOMPUTER

Available now from stock, assembled and tested

YOU KNOW the superior quality of the TEXAS INSTRUMENTS 16-bit TMS9900 microprocessor — there is no better microprocessor available.
ADD TO THIS the versatility of the TECHNICO T-6K-SSA board, which is a complete assembled Single-board Stand-alone system, incorporating its own 2708 EPROM programmer, and which can be added to so as to build up a complete minicomputer.
PLUS A LARGE POWER SUPPLY that delivers plenty of power at all the voltages you need (including 27 volts for EPROM programming). PLUS CABLES for power, ground, and terminal connection.
THIS SYSTEM, including all of the above, is normally priced at $998 tax exempt, or $1111 tax included. We have several of these systems, complete with 2K of RAM, 2K of EPROMs and 2K Monitor and Assembler installed, for sale this month at the SPECIAL PRICE of $846 tax exempt or $959 tax included. NOTE: This offer is open for one month only.

I.M.P.A.C.T. Ltd. PO Box 177, Petersham NSW 2049. Ph: 560-7603

Specialists in Technico 16-bit microcomputers and peripherals.

Anything eight can do, this can do better

15

☐ Please send me details of the T-6K-SSA with cables and power supply.

☐ Please send me the T-6K-SSA with cables and power supply. I enclose payment.

Name.....

Address.....

.....

State..... P/code.....

CB News

CB and Cyclone Peter

During early January, the city of Cairns experienced near cyclonic winds and torrential rain as a result of Cyclone Peter which was centred off the coast near Cooktown, just north of Cairns.

Throughout this period, a group of CB operators, known as the Mercury Emergency Service, assisted the local State Emergency Service with support communications.

The SES controllers expressed their gratitude to members of Mercury, and to all CBers who helped during the flooding.

Reports from members as far away as the Upper Barron River (in the Atherton Tablelands, 30km west of Cairns) were greatly appreciated by the SES officials as at that time the telephone lines to the area were in a state of disruption and communication via the SES VHF system (mobile) was not possible.

The Mercury Emergency Service was established at the beginning of 1978 with the idea of providing emergency radio communications back-up for the State Emergency Service using CB.

Shortly after the formation of the club, members were given a full communications course by the SES instructors covering topics such as message handling and voice procedures.

The part played by Mercury liasing with the SES has resulted in diverse activities such as providing communications for a boy scout group climbing a mountain to bush fires in the Cairns area last November.

From left to right receiving the final situation reports of the flooding are: Trevor Chapman - SES Staff Officer, Bert and Jan Hampton - Communications Officers, Bruce Birchall - Local Controller of SES as well as Ron and Dot Eather, Communications Officers for the Mercury Emergency Service.

Donation to CREST

Mobile One recently donated some $6000 worth of equipment to CREST to be distributed nationally amongst new and established CREST bases to assist in the continued operation and improvement of this nation-wide emergency service.

Amongst the equipment donated, courtesy of Mobile One's Director, Greg Ackman, were: 12 three element Wilson beams (for country bases), six Tram XL-5 SSB/AM transceivers and a large quantity of helical whips.

Yooralla Telethon raises $25,000

The annual Yooralla/GTV9 Appeal, held over the weekend of 24–25 February, was assisted by a group of CBer volunteers who managed to raise the princely sum of $25,000.

Yooralla is a special school for handicapped children, located in the Melbourne suburb of Camberwell. Each year television station GTV9 runs a telethon appeal to raise funds for Yooralla, a multitude of the dignified and famous giving of their time – free – for the telethon.

This year a group of Melbourne CBers pitched in to help the fund-raising effort, calling for donations on the air on both the HF and UHF bands.

CREST Director resigns

Bill Payne, National Director of CREST since the 1977 National Convention resigned at the National Council meeting held over 17–21 March.

Bill will remain Regional Director of the Sydney region, their base station at Northpoint serves the Sydney metropolitan area and the coastal region on both HF and UHF.

During his term of office, Bill headed a team that was involved in the setting up of Northpoint – CREST's "prestige" station, negotiated for grants and donations from leading Industry members such as Philips, Communications Power Inc. and President Electronics, established divisions in West Australia, Tasmania, Queensland and the Northern Territory, lobbied heavily with the Minister and his Department, promulgated training schemes for CREST operators and managed to score quite a few publicity 'coups'. Bill was associated with CB Australia (sadly demised . . . RIP) from late 1977 through 1978.

Now with Sydney radio station 2UW, Bill is a programme co-ordinator doing, amongst other things, the station's CB radio community activities.

Bill Payne

Report from "upstairs"

Compiled by Max, VCH 051, who hails from Melbourne. Max has been on the CB scene since the early '60s – spending many years on 27 MHz. Now? Max has 'embraced' (and that's the only word for it) UHF CB. We'll have regular reports. If any readers have something to contribute, address your letter to: **CB Column, ETI, 3rd Floor, 15 Boundary Street, Rushcutters Bay. NSW. 2011.**

UHF CB is very alive and well – particularly in Victoria. At the close of 1978 we had contacts with several

Tasmanian mobiles at good strength and to offer further encouragement, one of the Tassie stations told us that he worked a West Australian station for over an hour up to strength 9!

Look back in shame. One of the great advantages of UHF is the lack of TVI – the curse of 27 megs. Remember the look on the face of the guy next door after you had been hammering away on the mic. for a couple of nights in a row when the skip was in? The writer can vividly recall the evening a neighbour banged on the door complaining that I was coming out of his son's tape recorder in the middle of a French lesson. And the little old lady up the street complaining of the two Japanese voices coming from her new electronic organ, not to mention the morning I overheard an upset housewife in the local Post Office raising her voice to the Post Master and pointing her finger in the direction of my QTH and screaming something like, "that CB fanatic over there ruins my husband's television nearly every night." Naturally I shrank out of the Post Office and bought my stamps for the QSL cards elsewhere. Thank the Almighty and the P & T for UHF/CB for at least I can now eyeball my neighbour without having to approach with cap in hand.

Better than five miles? In a recent article it was stated that the average distance worked on 476 MHz is about 8 km (5 miles). It's the writer's personal experience that something like 30 km is more like the truth. Of course it depends on factors such as antenna height, efficiency of feedlines and the aerial. From my QTH down to the tip of the Mornington Peninsula, which is some 80 km south of Melbourne, we find that the average distance worked is approximately 65 km base to base. Our base to mobile distance is around 25 km.

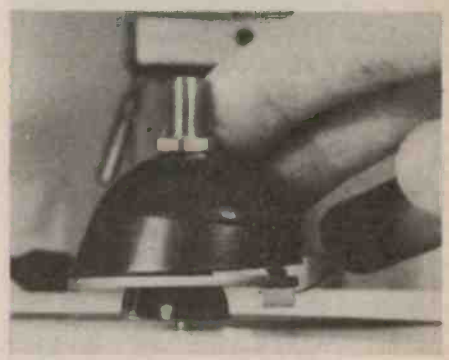
Ships that pass in the night. There is controlled excitement around Melbourn e every other week when Burnie, the TAB 561, steams into Port Phillip Bay from Hobart on the container ship Seaway Prince. Burnie also has another License namely NAE 977 and, as a maritime mobile, be known to many UHF operators on the coast of New South Wales.

Using an omnidirectional aerial strapped to the funnel of the ship, Burnie can hold a signal for up to 120 km with relative ease to base stations around Melbourne and outlying suburbs. Burnie also has 27MHz gear on board but similar contacts have proved scratchy and when one considers that more than twice the power is used on 27MHz it certainly is a feather in the cap of the UHF operators.

The Victorian UHF Club. This club was formed recently to benefit the serious operators of UHF CB. One of the prime objectives of the club is to insist on proper operational proceedures from members and fortunately, the club has several operators with the technical expertise to assist members in most aspects of the UHF scene.

Enquiries for membership should be made by writing to: The Secretary, T.V.U.H.F Club, P.O. Box 151, Preston, Vic. 3072.

Finally, for those UHF stations looking for a spot of 'mini-DX' try channel 20 when those temperature inversions seem evident.



Handy mobile base

Few cars these days have a decent flat surface on which to mount your mobile antenna – barring the roof, and not everybody wants to drill a hole on the roof or bother with magnet mounts. while gutter-grippers are great and trunk-lips terrific, the popular place is a mudguard (or cowl). And they're rarely flat . . . as we said.

The model 2-218 Slopt-Adjustable antenna base from I.F.T.A. is just the thing. It will mount on a sloping surface in the conventional fashion and may be simply adjusted with a spanner so that the whip is vertical for best mobile transmission and reception. The base has a standard 5/16" (8 mm) male fitting which accepts the popular mobile whips.

Available through CB retailers in all states. For more information contact *I.F.T.A. Australia, 1 Greville Street, Randwick 2031 (P.O. Box 21 Bondi Beach 2026). Phone (02) 665 8211.* ●

RAVE
SOUND & LIGHTING
2388 GOLD COAST HWY.
MERMAID BEACH, QLD.
Phone (075) 38-3331

NEW . . . NEW . . .
'SOUND ANIMATOR'
Brings sound sync to 3 inch effects casset tes. Slides into Solar 250 or Lito 250 projectors.

DISCO CONSOLES
CENTAUR GXL 200
- 200 watt stereo
- 4 channel light display on front of console
- Tape-in
- Flexi lites
- Deck start switches
- Voice overide
- Crossfade
- 2 BSR turntables

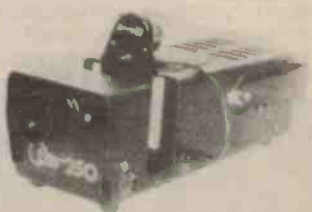
ONLY $998

DJ S77 STEREO DISCOMIXER

SUPERIOR DESIGN
CLEAN, CRISP SOUND REPRODUCTION.

Automatic voice overide • tape-in, tape-out • 2 microphone in • 2 x turntables in • T.T. start buttons • slave out • 2 year guarantee.
Available separate or in console C/W turntables and 200 watt power amp built-in. Mono or stereo. Size (mixer only) 17cm x 86.5cm x 9cm. Weight 4.5kg.

LITO 250 PROFESSIONAL EFFECTS PROJECTOR



• New 250W Quartz Iodine Effects projector for use with effects from spectacular Lightomation range • Lens system totally enclosed to eliminate light spill • Cool, quiet operation, high efficiency tangential air blower • Used free-standing or suspended with adjustable handle • Supplied as "Main-Frame Unit" with 50mm lens, 60, 85 & 100mm avail. • 14 attachments available — changed by slide-in rotator system — wide selection of cassettes & 6" Effect Wheels • Mains voltage selector gives range of 6 input voltages.

• STROBES • SOUND TO LIGHT UNITS • DRY ICE FOG MACHINES • ROPELITES • LIGHTING STANDS • BEACONS • JBL SPEAKERS & CABINETS • Brochures available on request.

BUILD A COMPUTER KIT AND SAVE

KB05 FULLY ENCODED KEYBOARD

Eliminates messy wiring between keyswitches and encoder. The KB05 is a full featured keyboard kit fully encoded for all 128 ASCII characters. Based on a design published in ELEKTOR November, 1978, it is an ideal low cost keyboard for microcomputer use. This clever design uses a single sided PCB to connect the switches and the encoder IC and few links are required. The kit includes 2 spare user definable keys and a metal mounting bracket to hold each switch accurately in place. The switches are supported on this bracket not on the PCB as with inferior designs. Spare mechanisms, cursor option and number pads are available.

KB05 encoded keyboard kit $84.00
KB06 cursor option $4.95
KB07 number pad $11.95

EA2650 STARTERS KIT

Described in EA May, 1978, this is an ideal project ideal for the beginner or educational applications. The kit comes complete with all instructions for assembling and running the 2650 computer, all components including 2650 microprocessor, PIPBUG ROM and 1K of RAM. The kit can be expanded to 4K and requires a serial terminal such as the EA LOW COST VDU detailed below. Sample programs are included for you to run and a cassette interface can be readily added so that programs can be stored on low cost cassettes.

EA2650 starters kit $65.00

EA LOW COST VDU SELLOUT!

This low cost stand alone VDU was described in EA February, 1978. Accepts parallel ASCII input and produces 16 lines with 32 characters per line with onboard sync generation and video driver. Supplies direct video to a converted TV set or to an RF modulator if required. The kit includes sockets for the RAM and character generator IC's, all components plated thru PCB, and step by step instruction manual.

EA VDU sellout (until stocks cleared)
$75.00 save $22.50!!

All prices include sales tax and are subject to change without notice. Our full technical support and service backup is available on all these kits.

Mail Orders: Box 355, P.O. Hornsby 2077. Please allow $2.00 towards post and packing.

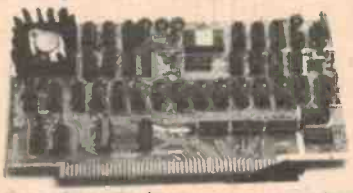
Applied Technology Pty. Ltd.,
1a Pattison Ave., Waitara N.S.W.
(9 to 5 Mon. to Sat.)

DG640 VDU ON S-100 BUS

A most professional unit for serious microcomputer users. Features 16 lines and 64 characters (32 with strap select), upper and lower case with chunky graphics and full S-100 bus standard.

This is not a half kit! The DG640 kit includes:

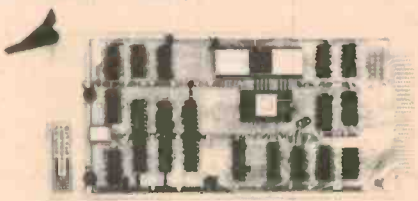
- professional quality plated thru hole PCB with hard gold edge connector.
- all prime quality guaranteed components.
- sockets for all integrated circuits.
- 12,000M/C crystal.
- comprehensive owners manual (54 pages) describing assembly, troubleshooting, and operating software for 2650,Z80,8080,6800.



DG640 kit $149.50 (PCB with manual $35.00)

EUROCARD 2650 SINGLE BOARD EXPANDABLE 2650 COMPUTER

This professionally engineered 2650 single board computer is the answer to all those who want a systematically expandable computer system. The DB1001 uses a simple E58 bus which is readily adapted to S100 and Z80 bus requirements. The DB1001 uses the 2650A chip and has fully buffered address and data lines, on board 1K operating system in Eprom (PIPBUG SUPPLIED but easily reprogrammed), 1K RAM and a crystal controlled clock on a top quality plated thru PCB with hard gold edge connector. Readily expanded on the E58 bus for more memory, I/O and will accept floppy discs and high speed printer. The kit is supplied with all components, owners manual and full service backup. A conversion kit for the EA2650 is available.



DB1001 single board computer $135.00
($35.00 PCB with manual)
DB1001/EA2650 conversion kit $99.00

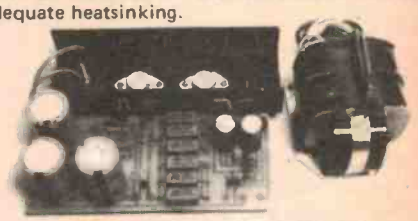
DB1008 8K STATIC 2114 RAM

A very useful add on memory module to support the DB1001 computer on the E58 bus, this 8K RAM is fully buffered and has been arranged as 2 4K blocks with DIP switch address boundary selection. The kit is supplied with all components, sockets for all memory IC's and a plated thru PCB with hard gold edge connectors and full instruction manual.

DB1008 8K memory kit $175.00
($35.00 PCB with manual)

EPS100 ECONOMY POWER SUPPLY

This popular modular power supply kit is ideal for use with micros. Based on the EA "BRUTE" power supply the EPS100 supplies 5V @10A regulated, +,– 12V @1A regulated as well as unregulated 8V,+/–16V for the S100 BUS. The module includes an on board heatsink which must be mounted on a suitable metal case for adequate heatsinking.



EPS100 power supply kit $60.00

ET1632 UART/BAUD RATE GENERATOR

Converts serial to parallel and parallel to serial. This low cost baud rate generator can be set for any speed from 50 to 9600 BAUD (continuously adjustable with multi turn trimpot) and can be set for 5 to 8 bits per character with 1 or 2 length stop bits. Requires +5V, –12V. and kit includes all components and 40 pin socket.

632U with full instructions $18.50

ETI 630 HEX ENCODER/DISPLAY

This simple kit includes a pair of 4 bit encoder/latches driving large .5" digits to display the HEX equivalent of any 8 bit data word. Ideal for troubleshooting and also programming in machine code.

ET1630 HEX DISPLAY $14.50

SECI CASSETTE INTERFACE

This reliable unit is easily aligned without a CRO and is KANSAS CITY STANDARD useable up to 1200 Baud. The SECI uses top quality multiturn trimpots for accurate long-term timing adjustments and is supplied with the clock preset to 4800 Hz. A computer generated test tape is included so that you can readily check the operation at any time. Connects directly to a low cost tape recorder and has TTL level input/output for connection to the microprocessor. Requires +5V and provision for optional regulator has been made on the PCB.

SECI Cassette interface kit $24.50

DB1048 4/8K ROM BOARD WITH HIGH SPEED CASSETTE INTERFACE

This card supports the DB1001 on the E58 bus and has provision for 2708 or 2716 EPROMS. Included on the board is a software controlled cassette interface (300 characters/sec!) controlling two tape recorders with full file handling. The DB1048 is supplied with a preprogrammed EPROM with the tape interface software, a utility tape with useful routines, all components, plated thru PSB and owners manual.

DB1048 ROM Board/Cassette interface $130.00

Internationally acknowledged to be the finest cigarette in the world

dunhill **The most distinguished tobacco house in the world**

PA 5228
CC15/78

Electronic Components and Materials

PHILIPS

Hands-on microprocessor experience from day one...

The Instructor 50.

Learning by doing is still the best method of education. And when it comes to learning about the world of microcomputers, you won't find a better method than the Instructor 50.

It's the fast, ready-to-use learning device that immediately provides "hands on" experience for gaining microprocessor knowledge – in your home, office, or in the classroom.

The Instructor 50 is a COMPLETE package – including a **power supply**, a **LED prompting display**, and both **functional and hexadecimal keyboards.** You also get **S-100 compatibility** for adding memory and other peripherals. This lets you expand the machine's capability – and your microprocessing applications knowledge. Moreover, you can easily build a program library by recording your own audio cassettes.

The Instructor 50 comes complete with a *Users' Guide*, along with step-by-step instructions for those with no previous microprocessor experience.

Signetics offers one of the broadest choices of microprocessors in the industry. This knowledge stands behind the Instructor 50. When you need to learn about microprocessors, start with Signetics. Start with Instructor 50.

*one cassette supplied with each Instructor 50

We can help you understand microprocessors.

signetics

a subsidiary of U.S. Philips Corporation

For more information write to:–
Philips Electronics Components and Materials
P.O. Box 50, LANE COVE N.S.W. 2066.

PHILIPS

We want you to have the best

McCANN 153.0257

SPECIAL READER OFFER!

HOW'S YOUR BLOOD PRESSURE?

Take your own blood pressure quickly and accurately in your own home or office

Introducing the Unitrex Home Blood Pressure Monitoring Kits!

A SPHYGMOMANOMETER can help protect you and your family against one of the most dreaded human killers in the world – heart disease and other illnesses associated with abnormal blood. It is not surprising then that hundreds of thousands of people world-wide are buying their own personal blood pressure monitoring devices – NOT as replacements for regular medical checks. But simply as an extra precaution for peace of mind.

One of the best known home units is the Home Blood Pressure Monitoring Kit from Unitrex. A substantial quantity of these were imported by Australia's Caldor Corporation and sold extensively via chemists – they were also offered via mail order. These units were generally sold at $29.95.

Caldor have a number of these units still available which they are offering to our readers for the very low price of $19.95 – plus $2.50 post and packing. The kit includes the professional blood pressure unit itself, a nurse's stethoscope, a complete instruction book and three month's supply of blood pressure recording forms.

Please note: This offer is made by the Caldor Corporation, 12 Terra Cotta Drive, Blackburn, Vic., 3130. This magazine is acting as a clearing house for orders only. Cheques should be made out to 'Caldor Offer' and sent together with order to 'Caldor Offer', Electronics Today Int., 15 Boundary Street, Rushcutters Bay, NSW, 2011. ETI will process orders and pass them on to Caldor who will then send out the units by certified mail. Please allow approximately four weeks for delivery. Offer closes July 31st 1979.

Caldor Offer

Please send me:

.....Quantity – Unitrex blood pressure monitoring kit/s at $19.95 each	$ .....
plus postage at $2.50 each	$ .....
TOTAL	$

Name .....

Address .....

.....Postcode ...

Please make cheques/postal notes payable to 'Caldor Offer' and send C/- Electronics Today International, 15 Boundary Street, Rushcutters Bay, NSW 2011.

David Reid Electronics Pty Ltd.

104 KING STREET, NEWTOWN, NSW. PO BOX 317. TEL: 519-6361

SAVE $$$ THIS MONTH

All the following Fuller Tools at ½ price, yes ½ price!

Model 7151 Long Nose Cutter
7152 Diagonal Cutter
7153 Needle Nose
7154 Cutting Nipper
7155 Bent Nose
7156 Flat Nose

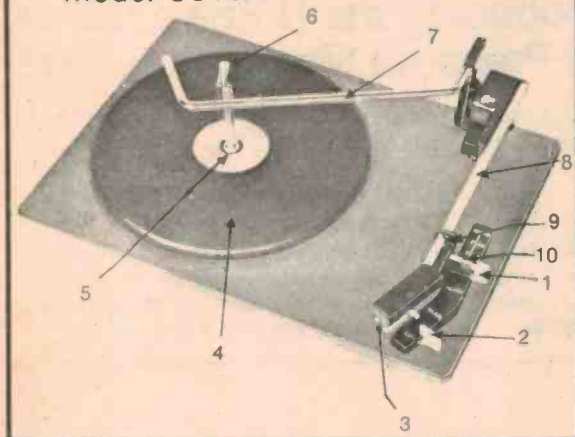
ALL ONE PRICE **$3.50** EACH

Replace that worn-out record deck with a

GARRARD MINI CHANGER

complete with cartridge

Model CC10A **$18**



SEEING IS BELIEVING!

We have one of the largest range of components under one roof in Sydney. Call in and see for yourself, there's plenty of parking. A free gift with every order over $20.00 during May. This also applies to our many mail order customers.

NEW PRODUCTS

12 volt Buzzers **$3.95**

20 Turn Trim Pots
model 90P 50E up to 1 meg. All one price **$1.60**

CMF30 10" 30 watt Woofer Speaker **$28.50**

Piezo Tweeters, 100 watt **$22.50**

Back in stock
6L65C valves **$5.25**
Limit of 4 per order

3 Watt W/W Pots
Normally $2.25
This month only **$1.50**

9-pin Valve Sockets **20c**

POST

Mail Order Instructions: Minimum P&P $1.00. Orders over $9.99 must include additional postal charges (see below).

ORDER VALUE	Charge
$5-$9.99	Nil
$10-$24.99	$0.50
$25-$49.99	$1.50
$50-$99.99	$2.50
$100 or more	$4.00

The following KITS are new to our range:

Kit 43 Burglar Alarm **$13.50**
Kit 81 Decision Maker **$8.25**
Kit 82 Siren **$6.25**
Kit 83 Electronic Organ..... **$9.50**
Kit 89 Flashing Light..... **$7.50**

For the Hobbyist: WELLER SOLDERING IRON

Model SP25DK 25 Watt complete with solder and spare tip
Great value at only $18.95
250 gram 60/40 Solder, 20 gauge and 22 gauge, **$5.25**

Protect your car with a CHUBB CAR ALARM KIT

Complete with instructions.
Limited stock available.
Normally $49.00 **$39**

NOW IN STOCK:
SN76477 T.I. SOUND GENERATING CHIP **$5.35**

NEW SHIPMENT: 3 STYLES

TIME GENTLEMEN PLEASE!
You'll always be on time with our Model LU.010 digital car clock.
0.3" LED display.
Only **$28.45**

We regret that prices are subject to change without notice. E. & O. E.

DON'T MISS THESE GREAT ELECTROBOT SAVINGS

If you're looking to invest in low cost, portable DMMs, you must consider our Model 935. At only $149, it offers features and performance that equal or surpass 3½ digit DMMs costing much more. Features like a lightweight, palm-sized package, 29 pushbutton-selected ranges, including switchable hi- and lo-Ω, and full ½ inch tall low-power liquid crystal display that helps make a 9V battery last up to 200 hours. And the 0.1% basic accuracy of the 935 rivals many bench/lab 3½'s. It's even fully protected against mechanical and electrical abuse, so it will last a long, long time.

MODEL 935. Unmatched performance at an unmatched price: $149.00 *

Available from stock at all Data Precision representatives.

*Plus sales tax.

$149.00*

Good Investment.

DATA PRECISION®
Performance in the field.

Kenelec (Aust.) Pty. Ltd. 142 Highbury Road, Burwood. Victoria. Tel: (03) 288-7100. NSW (02) 439-3954. SA (08) 223-2420. QLD (07) 262-2223. WA (09) 444-5826.

GREEN RISTON PRECOATED LAMINATE

Workshop Pack as March/April

$30.00 + $40.00 P & P

Single Sided Precoated Laminate:
300 x 225 (12" x 9") $7.00 + $1.50 P & P.
150 x 225 (6" x 9") $3.70 + $1.50 P & P.
Double Sided Precoated Laminate:
300 x 225 (12" x 9") $9.00 + $1.50 P & P.
125 x 225 (6" x 9") $4.80 + $1.50 P & P.

Full Range of Sizes of Precoated Laminate Available—Send S.A.E.

SOLID TUNGSTON CARBIDE P.C.B. DRILL BITS

1 mm – $3.00 each
8 mm – $3.00 each

Other Sizes Available

Send S.A.E. with enquiry
80c P & P

PRECISION CRYSTALS

± .002% 25°C Parallel Resonant 20pF.

1 MHz – $8.00 each
2 MHz – $7.00 each
4 MHz – $5.80 each
8 MHz – $5.80 each
10 MHz – $5.80 each
12 MHz – $5.80 each

Other Frequencies and Filters Available. Send S.A.E. with Enquiry. 80c P & P.

2114 SPECIAL

2114 4K STATIC RAMS
450nS max. access time.

Manufactured by SEMI, Inc. prime units

$7.50 each
$6.80 each for 8 or more

80c P & P

MODULAR POWER SUPPLIES

STATRONICS BRAND

STA 53/5 5 Volt 3 Amp $41.00
STA 53/3 2 to 18 Volt Adjustable 3 Amp at 12 Volts $47.00
STA 53/2 ± 2 to 18 Volt Dual Adjustable 1 Amp at ± 12 Volts $47.00

Bench Version $12.00 extra
Pack & Freight $6.00

WRITE FOR O.E.M. QUANTITY DISCOUNTS

TERMS: AUSTRALIAN CURRENCY ONLY. 24 HOUR TURNAROUND ON ORDERS ACCOMPANIED BY BANK CHEQUE, MONEY ORDER OR BUILDING SOCIETY CHEQUE. ALLOW TIME FOR CLEARANCE OF OTHER CHEQUES.

D. BOWEN
P.O. BOX 123,
BEECROFT, N.S.W.
2119

KITS FOR ETI PROJECTS

WE GET MANY enquiries from readers wanting to know where they can get kits for the projects we publish.

We have only listed the projects published in the last two years, with their dates of publication, so this page can also be used as an index, even though kits are not available for some of them (as far as we know). We will repeat a complete list every 6-12 months depending on space limitations. Any companies not included in this list should phone Jan Collins on 33 4282.

Key To Companies

- A Applied Technology Pty Ltd, 1A Paterson Avenue, Waitara, NSW 2077.
- C J R Components, PO Box 128, Eastwood NSW 2122
- D Dick Smith Electronics P/L, PO Box 747, Crows Nest NSW 2065
- E All Electronic Components, 118 Lonsdale Street, Melbourne Vic 3000
- J Jaycar Pty Ltd, PO Box K39, Haymarket, NSW 2000
- K S M Electronics, 10 Stafford Court, Doncaster East, Vic 3109
- M Mode Electronics, PO Box 365, Mascot NSW 2020
- N Nebula Electronics Pty Ltd, 15 Boundary Street, Rushcutters Bay NSW 2011
- O Orbit Electronics, PO Box 7176, Auckland, New Zealand
- P Pre-Pac Electronics, 718 Parramatta Road, Croydon NSW 2132
- R Rod Irving, PO Box 135, Northcote Vic 3070
- T Townsville Electronic Centre, 281E Charters Towers Road, Rising Sun Arcade, Townsville Qld 4812
- V Silicon Valley, 23 Chandos Street, St Leonards NSW 2065

Project Electronics

041. . . . .Continuity Tester . . . . . .T, D
042. . . . .Soil Moisture Indicator. . . . . .T, D
043. . . . .Heads or Tails Circuit . . . .Oct 76. . .T, D, E, A
044. . . . .Two Tone Door Bell . . . . .Oct 76. . .T, D, E, O, A
045. . . . .500 Second Timer . . . . . .T, D, O, A
047. . . . .Morse Practice Set . . . . . .T, D, O, A
048. . . . .Buzz Board . . . . . .T, D, A
061. . . . .Simple Amplifier. . . . . .Oct 76. . .T, D, O, A
062. . . . .Simple AM Tuner . . . . . .Mar 77 . .D, E
063. . . . .Electronic Bongos . . . . . .D, A
064. . . . .Simple Intercom . . . . . .Nov 76 . .T, O, A
065. . . . .Electronic Siren . . . . . .D, O, A
066. . . . .Temperature Alarm . . . . . .Dec 76 . .T, D, E, A
067. . . . .Singing Moisture Meter. . . . . .D
068. . . . .LED Dice Circuit. . . . . .Oct 76. . .T, D, E, A
070. . . . .Electronic Tie Breaker . . . .Jan 77
071. . . . .Tape Noise Limiter . . . . . .Jan 78. . .E
072. . . . .Two-Octave Organ. . . . . .Jun 78. . .D
081. . . . .Tachometer . . . . . .Mar 77 . .T, E, O
082/528 .Intruder Alarm . . . . . .T, E, A
083. . . . .Train Controller
084. . . . .Carl Arm . . . . . .D, A
085. . . . .Over-rev Alarm
086. . . . .FM Antenna
087. . . . .Over-LED
088. . . . .Hi-Fi Speaker

Test Equipment

132. . . . .Experimenter's Power Supply . . . . . .Feb 77 . .E
133. . . . .Phase Meter . . . . . .Apr 77 . .E
134. . . . .Ture RMS Voltmeter . . . . .Aug 77 . .E
135. . . . .Digital Panel Meter . . . . . .Oct 77. . .E
136. . . . .Linear Scale Capacitance Meter . . . . . .Mar 78 . .E
137. . . . .Audio Oscillator . . . . . .May 78 . .E
138. . . . .Audio Wattmeter. . . . . .Nov 78
139. . . . .SWR/Power Meter . . . . . .May 78
140. . . . .1 GHz Frequency Meter-Timer . . . . . .Mar 78 . .C

Simple Projects

243. . . . .Bip Beacon. . . . . .Apr 77
244. . . . .Alarm Alarm . . . . . .Feb 77
245. . . . .White Line Follower . . . . .Nov 77
246. . . . .Rain Alarm . . . . . .Apr 78
248. . . . .Simple 12V to 22V Converter. . . . . .Jul 78

Motorists' Projects

316. . . . .Transistor Assisted Ignition . . . . . .May 77 . .K, O, E
317. . . . .Rev Monitor Counter . . . .Jul 77 . . .E
318. . . . .Digital Car Tacho . . . . . .Jul 78 . . .K, E
319. . . . .Variwiper MK II . . . . . .Sep 78. . .E

Audio Projects

448. . . . .Disco Mixer . . . . . .Nov 76
449. . . . .Balanced Microphone Amp . . . . . .Nov 76 . .J, E
450. . . . .Bucket Brigade Audio Delay Line . . . . . .Dec 77 . .
480. . . . .50-100 Watt Amp Modules. . . . . .Dec 76 . .J,E,D,O,R,A
481. . . . .12 V 100 Watt Audio Amp . . . . . .May 77 . .E
481. . . . .High Power PA/ Guitar Amp . . . . . .Jun 77. . .O
482. . . . .Stereo Amp . . . . . .Jan 77. . .O, E
482. . . . .Stereo Amp Part 2. . . . . .Feb 77 . .O, E
483. . . . .Sound Level Meter. . . . . .Feb 78 . .E
484. . . . .Simple Compressor Expander . . . . . .Jul 77 . .E
485. . . . .Graphic Equalizer . . . . . .Jun 77. . .J, E
486. . . . .Howl-round Stabilizer . . .Nov 77 . .J
487. . . . .Audio Spectrum Analyser . . . . . .Feb 78 . .E
489. . . . .Audio Spectrum Analyser 2 . . . . . .Apr 78 . .J, E
495. . . . .Transmission Line Speakers . . . . . .Aug 77

Miscellaneous

546. . . . .GSR Monitor . . . . . .Mar 77 . .E
547. . . . .Telephone Bell Extender . . . . . .Jun 77. . .E
548. . . . .Photographic Strobe . . . . .May 77 . .E
549. . . . .Induction Balance Metal Detector . . . . . .May 77 . .E
550. . . . .Digital Dial. . . . . .Aug 78 . .E
551. . . . .Light Chaser. . . . . .Sep 78. . .E
552. . . . .LED Pendant . . . . . .Sep 78
553. . . . .Tape/Slide Synchroniser . .Oct 78. . .E
581. . . . .Dual Power Supply . . . . .Jan 77. . .E
582. . . . .House Alarm . . . . . .Jul 77 . . .T, O, E, A
House Alarm – Installation Instructions . .Aug 77
583. . . . .Marine Gas Alarm . . . . . .Aug 77 . .M, E
585. . . . .Ultrasonic Switch . . . . . .Sep 77. . .R, O, E, T
586. . . . .Shutter Speed Timer . . . .Oct 77. . .E
587. . . . .UFO Detector. . . . . .May 78
588. . . . .Theatrical Lighting Controller . . . . . .Dec 77, Nov & Jan & Mar 78 . .N
589. . . . .Digital Temperature Meter (PCB135) . . . . . .Dec 77 . .E
590. . . . .LCD Stopwatch . . . . . .Oct 78. . .N
591. . . . .Up/DownPresettable Counter . . . . . .Jul 78 . . .E
592. . . . .Light Show Controller . . . .Aug 78 . .E

Electronic Music

602. . . . .Mini Organ. . . . . .Aug 76 . .O, E, D,
603. . . . .Sequencer . . . . . .Aug 77
604. . . . .Accentuated Beat Metronome. . . . . .Sep 77. . .E
605. . . . .Temp Stabilized Log-exponential Converter . . .Sep 78

Computer Projects

630. . . . .Hex Display . . . . . .Dec 76 . .E, A
631. . . . .ASCII Keyboard . . . . . .Dec 76 . .O, E, A
631. . . . .Keyboard Encoder. . . . . .Apr 77 . .O, E, A
632. . . . .Video Display Unit . . . . . .Jan- Mar 77 . . .O, A
633. . . . .TV Sync Generator . . . . . .Jan 77. . .E, A
634. . . . .8080 Educational/ Prototyping Interface . . . .Jul, Aug 78
635. . . . .Microcomputer Power Supply. . . . . .Sep 77
637. . . . .Cuts Cassette Interface . . . . . .Jan 78. . .V, O, E, A
638. . . . .Eprom Porgrammer . . . . .Jul 78 . . .E, A
639. . . . .Computerised Musical Doorbell . . . . . .Mar 78 . .A
640. . . . .S100 VDU . . . . . .Apr- Jun 78 . . . .V, O, A
641. . . . .S100 Printer. . . . . .Sep 78
650. . . . .STAC Timer. . . . . .Nov 78

Radio Projects

712. . . . .CB Power Supply . . . . . .Jun 77. . .O, E
713. . . . .Add-on FM Tuner . . . . . .Sep 77
714. . . . .VHF-Log-Periodic Antenna. . . . . .Feb 78 Mar 78
715. . . . .VHF Power Amplifiers . . . .Nov 77
716. . . . .VHF Power Amplifiers . . . .Jan 78 Feb 78
717. . . . .Crosshatch Generator. . . . .May 78 . .E
718. . . . .SW Radio. . . . . .Oct 78. . .E
719. . . . .RF Field Strength Indicator . . . . . .Nov 78

Electronic Games

804. . . . .Selectagame . . . . . .Nov 76 . .O
804. . . . .Selectagame (Rifle Project) . . . . . .Mar 77 . .O
805. . . . .Puzzle fo the Drunken Sailor . . . . . .Oct 77
806. . . . .Skeet . . . . . .Jan 78
810. . . . .Stunt Cycle TV Game . . . .Jun 78. . .O, D
811. . . . .TV Tank Game . . . . . .Oct 78. . .O, E, D

Introducing the 'Versatile' computer.

Top of its class

Integral printer $1150*

At last a computer that easily adapts to your requirements without being 'strung together'. A computer that is suitable for either business, scientific, educational, or industrial applications. Based on the ever popular S100 bus, it features an **INTEL 8085** processor, 32K of static RAM, and twin **Micropolis** drives giving an amazing 630K bytes of storage. With an interface capable of handling two more drives, Imagine what you can do with 1.2M **BYTES!**

Software is a vital part of any computer, consequently each machine comes with **MDOS** (Disk Operating System), **Extended Basic, Text Editor, 8085 Assembler**, Utility routines, a sample **Business** pak, and several **Games**. You won't have to wait to get the 'Versatile' up and running; **Everything is supplied!** We also have available **CP/M, BEM** (a basic Expansion Module), Mailing List, and a complete set of **Business Programs designed for Australia!**

We even custom design software and hardware to your requirements.

The Integral Printer shown comes loaded with features that others may only be able to offer as options: **Graphics, Enhanced Characters** variable **Characters** per line, selectable **Form Length**, and **more.**

Versatile 4 $5900*

If you need a computer, go to the top of the class. 'Versatile'. Available only from:

MICROPROCESSOR APPLICATIONS
Maskells Hill Road
Selby, 3159 Australia
(03) 754-5108

'Small computers solving large problems'.

*Plus sales tax if applicable.

OVERLOAD 42

ETI DIGITAL FREQUENCY METER KITS

1 GHz .....$179 ($199 including tax)
50 MHz .....$164 ($182 including tax)

Registered post $6. COD $1 extra.

- Prepunched chassis
- Punched and screened, brushed aluminium front panel
- ALL components are supplied and all are high quality and guaranteed
- Fibreglass PCB, pre-tinned
- Instructions included, with notes to assist you to avoid problems

For further information see ETI March 1978

- Service is available
- Tax free prices are available to manufacturers, educational and government institutions and students presenting the appropriate declaration
- Money-back guarantee. If not satisfied return within 7 days, unassembled and in perfect condition, for refund

NZ and PNG customers – tax free price plus $13 for insured airmail

J. R. COMPONENTS

P.O. Box 128, EASTWOOD. NSW. 2122.
Phone (02) 85-3976.

Mini-Mart

send your ad to —
ETI MiniMart,
Modern Magazines,
15 Boundary Street,
Rushcutters Bay,
NSW 2011.

WE'LL PRINT your 24 words (maximum) totally free of charge. Copy must be with us by the 1st of the month preceding the month of issue. Please, please write or preferably type your adverts clearly.

CONDITIONS

Name and address plus phone number (if required) must be included within the 24 words allowed.
Reasonable abbreviations, such as 25 Wrms, count as one word.
Private adverts only will be accepted. Please let us know if you find a commercial enterprise using this service.
Every effort will be made to publish all adverts received — however, no responsibility for so doing is accepted or implied.
Adverts must relate to electronics or audio — general adverts cannot be accepted.

PROGRAMMABLE calculator, Sanyo, incl rechargeable battery, power pack, program library etc, as new in box. Unwanted gift. $49. Bankstown (02) 709.4217 AH or WE.

CROMEMCO microcomputer system, will sell well below cost price, complete or separate boards. Compatible with all S100 systems. Phone for details (02) 709.4217 AH or WE.

SOL software (on cassette) with full documentation, games, languages, business software, utilities, etc. All reasonably priced (02) 709.4217 AH or WE.

ASCII keyboard (new in box) cost $55 sell for $45 (02) 709.4217 AH or WE.

AMI 6800, 4K BASIC tape, EPROM programmer, 48 I/O lines, 2K EPROM, 1K RAM, fully buffered, documentation. $379. 6 x 4K RAM planes $60 each. P Forte, 17 Greta St, Clayton, 3168 (03) 544.9114 Bus.

MIXER 8 in, 4 out. Sony MX20 $700. St Leonards, Sydney (02) 439.4777, ask for Tim Lamble.

ICT flexowriter, similar to Triden flexowriter, suit computer application $40. R Blair, Ivanhoe, 3079. Phone (03) 49.3661 AH.

SELL: Trio 1303 5 MHz scope with X1 and X10 tektronix probes. $200. Signal generator, 300 Hz to 300 MHz, $15, Newcastle (049) 87.3419.

SELL: 1% glass tin oxide Electrosil resistors @ $5 per box. Values 30k, 110k, 160k, 270k, 1M. 58 Underhill Avenue, Indooroopilly, Brisbane.

S100 4K memory board W/250 ns memory, full sockets, memory protect batt. Backup $120, R Pfotenhauer, PO Box 81, Lyneham, 2602.

REWARD given for information on the Memtech Arithmetic Processing Unit and BASIC-M. Does anyone have this board? R Pfotenhauer, PO Box 81, Lyneham, 2602.

FOR sale: BWD 539 C DC-20 MHz dual trace oscilloscope twice used, dustcover, 2 dual probes P 32-X1/X10 probes, in orig box. $500 ONO, with instr handbook and orig invoices.

SELL: Teletype Model RO38 receive only hardcopy terminal, suitable for mini/micro computer. As new condition. Contact Ted Rigby (042) 28.6811, $950.00.

WANTED for Akai 1710 taperecorder (all valve), clear photocopy of circuit diagram. Will pay $2. Brian Connors, 72 View St, Gunnedah, 2380.

WANTED: B41 or similar LF RX covering 15 to 500 kHz. Please write K Anderson, 167 Raglan St, Sale, Vic 3850.

WANTED Teletype ASR 33 with paper tape facility - Barry Griffiths, 93 Glenlyon Drive, Wulguru, 4811, phone (077) 72.2077 or (077) 78.1819 AH.

WANTED transistorised amplifier circuit, Seimens 2000 projector - also Astro Kino colour IV, 1:1.4 35 mm lens. A Schmidt, PO Box 241, Southport, Qld 4215.

WANTED to buy TV service manuals. Colour, black and white. J Ferrie, 5 First Avenue, Lane Cove (02) 427.6767.

AUSTRALIAN Radio DX Club, for shortwave and mediumwave DXers. Monthly magazine published. Write for details, with 20 cent stamp to PO Box 67, Highett, Vic or PO Box 79, Narrabeen, NSW 2101.

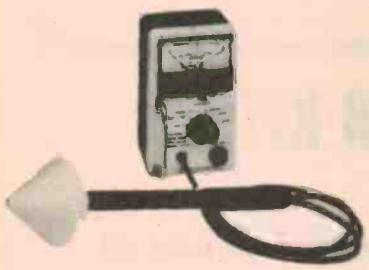
FREE membership, Lakeside QSL Swap Club, send any number your personal QSL cards and 25 cents stamp for equal swaps and free membership registration. PO Box 114, Toukley, NSW 2263.

WANTED CRT monitor - green preferably. Ring AH John Pitman (08) 45.4372 or write 12 Percy Street, Seaton, SA 5023.

ITHACA Audio S100 16K/32K EPROM board using 2708's or 2716's fully assembled less EPROMs $100, R Pfotenhauer, PO Box 81, Lyneham, 2602.

KAWAI E300 organ, hardly used, music books, cassette, 2 years old, must sell $1800. Ring (02) 89.2943.

Microwave Survey Meter Model HI 1501



The HI 1501 is a rugged, compact, portable instrument and is virtually immune to failure caused by excessive fields or physical abuse. It consists of a lightweight instrument package connected to a unique detection probe by a shielded cable.

For additional information call or write:

Reg Geary & Associates

276 Highett Rd, Highett, Vic.
Phone (03) 553-1935

PLEASE USE BLOCK LETTERS			

2650 Mini computer system VDU, encoder, CPU 4K RAM, cassette interface all mounted in single console with room for memory expansion. $600 ONO phone Bert (03) 758.4086 AH.

FOR sale: 16 channel mixer. No metal work - built up in modules, edge connector type, all pots, attenuators, transformer, switches VU meters, LEDs etc., inc. $500 ONO (02) 33.4282 (business), S Bracken.

SELL: KT9500, 2650 RSMB, EPS100, DG640, KB04 Keyboard, ASCII Encoder, 4K RAM, Metalwork. All instructions, cassette interface (partly assembled) $500, AH (03) 386.0674, John Pitcher, 4 Ewan St, Coburg 3058, BH (03) 320.4314.

WANTED: Circuit diagram for 2 channel radio control system. Will pay $1.50. Contact David Rowe, 9 Nelson Ave, Flinders Park, SA, phone 352.2161.

MICROCOMPUTER ICs (new-guaranteed) - 6800 $16.00; 8080A $10.50; 8255 $9.00; 6820 $7.00; 6821 $7.00; 6852 $10.50. Graham, 4 Pryton Court, Balwyn 3103. Phone: AH 89.6918.

SELL: Twin ½" Magnecord tape decks, in 7' high rack, six record amps & power supply (no valves). Good condition. $425 ONO. Jeff Cox, PO Box 104, Bayswater, Vic 3153 or (03) 729.5955.

FOR sale: Blob Board ZB81C new, never used. As used in Digital Electronics by Experiment. ETI April to November 1978. Phone; 451.6113.

NEW computerized language decoder for sale, capable of handling over 250 languages through 600 dialects, contact MBA 21 (05) 122.5110.

KEMTRONIC CB500 AM only $45 ONO. Phone Sean 277.5611 or write to PO Box 111, Parkholme, SA 5043.

ISE CB-345 AM-SSB power supply. Dick Smith TVI filter. All top quality, good price. Phone (08) 295.1270 Adelaide.

GUITAR - PA amplifier, 200 W RMS, four channel, LED VU meter. Very compact $420 ONO. Phone Bert (03) 758.4086 AH.

SELL: Back issues of EA and ETI. Some EA as far back as 1966 and ETI to 1971 - S Redway, C/- PO, Shay Gap, WA 6761.

FOR sale ETI, EA from about 1970 plus others. Best offer. Phone Phil 646.3504, after 6 pm, 66 Sixth Ave, Berala (Sydney).

WANTED: To buy 1 x ETI 448, 2 x ETI 445 NAB, 2 x ETI 445 RIAA, 1 x ETI 448A in suitable case. Will consider ETI 448 only. Phone (02) 708.3359. Ask for Alan, during business hours.

electronics today INTERNATIONAL

Synergistic Beer Drinking

On the second Wednesday of each month, at about 6 p.m., the ETI staff and readers meet at the Bayswater Hotel, in Bayswater Road, Rushcutters Bay, (just up from the Rushcutter Bowl) to discuss electronics (or anything) over a few beers. Why don't you come along?

35 years young

and still on top

for electronic units and all types of mounting...

- Decade Counting Units to 1 Hz.
- Wide Band Amplifier for your counter, 1 MV sensitivity, band width 1-250 MHz.

Manufacturers of

PIEZO ELECTRIC CRYSTALS

Contractors to Federal and State Government Departments.

REPRESENTATIAVES:

NSW: Hose & Equipment Co. P/L, 11 Salisbury St, Botany. 2019. Ph 666-8144.

SA: Rogers Electronics, 65 Magill Rd, Stepney. 5069. Ph (08) 42-6666.

QLD: Fred Hoe & Sons P/L, 246 Evans Rd, Salisbury North. Brisbane. Ph 277-4311.

WA: Westest Electronics, 71 Jean St, Hamilton Hill. 6161. (Mail only) Ph (09) 337-6393.

TAS: Dilmond Instruments, PO Box 219, Bellerive. Hobart. Ph 479-47-9077.

Send SAE for new catalogue or quote for your requirements.

Bright Star Crystals Pty. Ltd.

PO Box 42, Springvale.
Ph (03) 546-5076 Telex AA36004

MOBILE DISCO MIXERS

• • • READY TO GO, with mic, inbuilt 240 watt RMS total Power Amplifiers, 4 stereo inputs all with tone controls, magnetic cartridges, automatic crossfade between turntables and voice over, input and output for tape recorder, output for Musicolor and 2 Column speakers.

$1,900

• • • ALSO AVAILABLE for custom installation, complete mixer wired & tested and assembled to front panel (no case).

$500

• • • MIXER FRONT PANEL ONLY and printed circuit board set (unwired) with VU meters, lights and switches.

$200

Specialists in permanent installations.

LOTSAWATTS

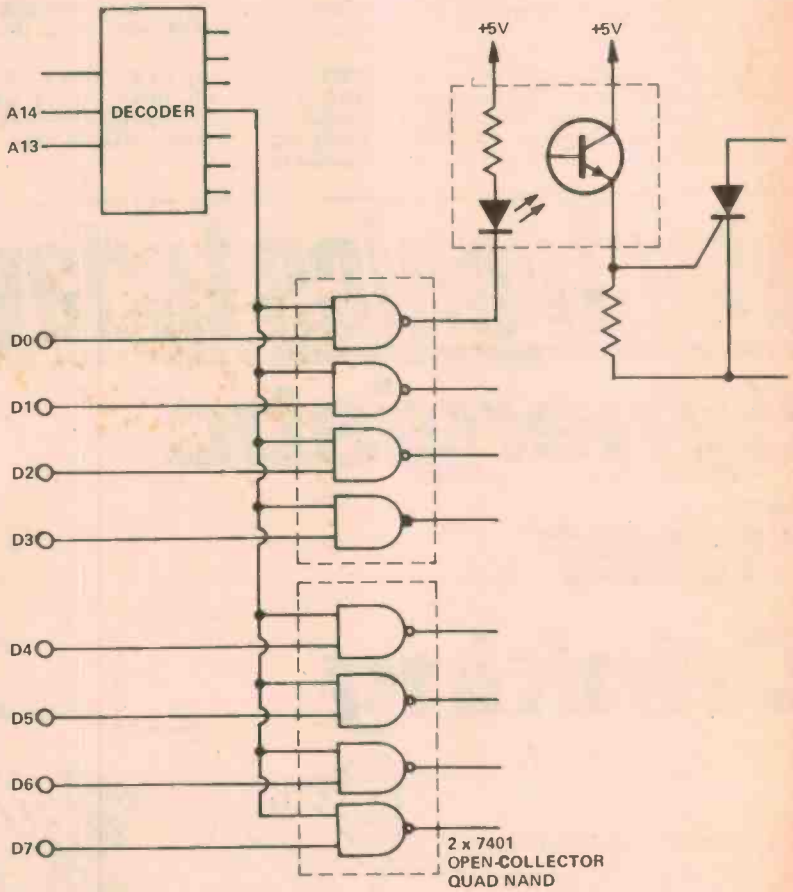
SOUND SYSTEMS of AUSTRALIA

PO Box J97, BRICKFIELD HILL
NSW 2000
Ph: BH 969-5396, AH 922-5257.

• *MAIL ORDERS WELCOME* •

Ideas for experimenters

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.
Electronics Today is always seeking material for these pages. All published material is paid for – generally at a rate of $5 to $7 per item.

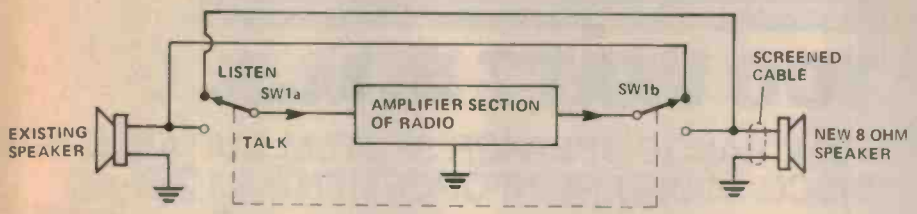


Cheap Micro Output

In simple systems were little of no output bus buffering is needed, users may shy away from using standard TTL due to the drive requirements this places on the μP chip. Where unlatched outputs are acceptable, buffers are often used if standard TTL is to be driven. This is not always necessary.

Looking at the diagram, it *appears* that the micro will have to pull down one TTL load per gate and so many TTL loads if several of these ports are used. This is not so, due to the nature of the input to the gate – once one input is low, only a few μA are required to drive the other and so the bus loading is negligible. Of course, the enable line still needs to be driven from a TTL output but as this is usually derived from a decoder, it should prove no problem.

Ideas for experimenters



Inexpensive Intercom

A small transistor radio can be converted into an intercom by adding a switch, a bit of cable and another speaker.

First, sever the 'tuner' section from the rest of the circuit by cutting the appropriate pc tracks. Then connect a wire to the input of the amplifier section – the wiper of the volume control is the best place. The extra speaker and DPDT switch can then be fitted as shown in the diagram.

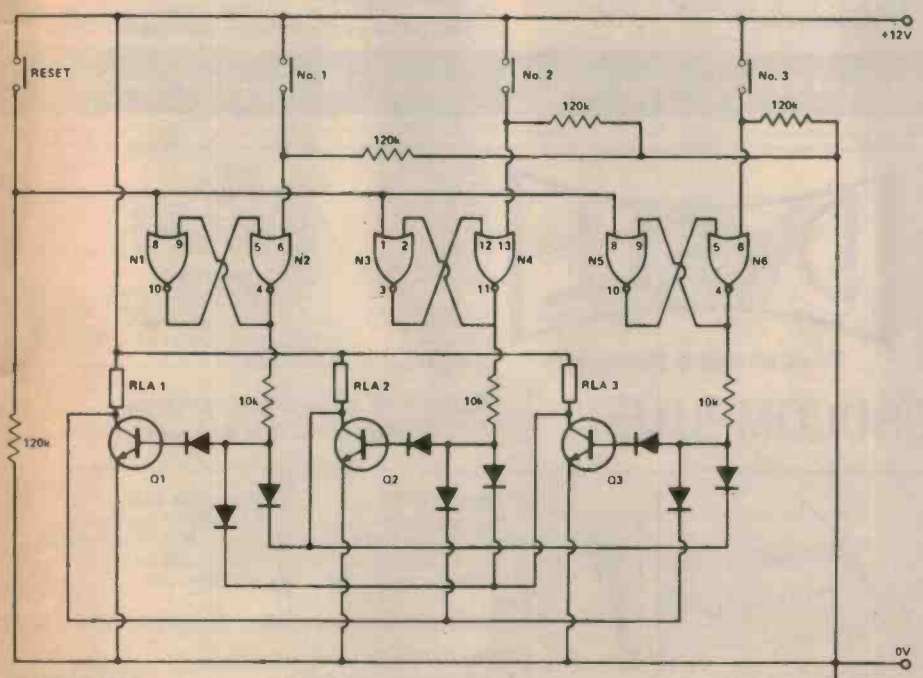
The output of the amplifier section will usually go the the earphone socket and so an earphone may be used in the 'listen' mode.

Push-Button Selector

This circuit was designed to enable three relays to be individually switched by their appropriate buttons such that only one relay can be energised at any one time. When any one relay has been energised the corresponding collector falls to near zero volts, which is connected to the base of the remaining two transistors; now if an attempt is made to energise another relay the base of it's transistor will remain bottomed and keep the relay off. The reset button must be pressed before another relay can be energised. D1 ensures that each transistor is kept off until the voltage applied to the base exceeds 0.6 V.

The Flip-flops and push buttons can of course be replaced with standard switches if momentary action is not required.

The circuit was used to control three radio transmitters where it was important that two should not be switched on at the same time. The circuit lends itself to further applications; for example, switching various inputs into an amplifier, where it can replace the self-cancelling selector buttons.



ALL DIODES 1N4001
Q1,2,3 BFY51
N1 – N4 CD4001
N5, N6 ½CD4001
RELAYS 120R OR ABOVE

RADCOM
constructor components

EVERYTHING FOR THE CONSTRUCTOR AT ONE SHOP AT PRICES TO SUIT YOUR BUDGET

KITS!

We're moving into kits.
Your enquiries are welcome

SILICON VALLEY STOCKISTS

— CAPACITORS —
— RESISTORS —
— POTS —
— SWITCHES —
— PLUGS —
— SOCKETS —
— PANEL LAMPS —
— TRANSISTORS —
— DIODES —
— BOXES —
— LEDS —
— IC's —

Try us for the hard-to-get components

Block Capacitors
Silver Micas
High Voltage
etc, etc

We are now carrying Ferguson Transformers

Cnr. Eldridge & Willfox Rds.
BANKSTOWN, NSW.
709-4706

MATRA

100 WATT R.M.S.

FULL RANGE SPEAKER SYSTEM SUITABLE FOR DISCO/SOUND REINFORCEMENT **$125** each plus freight

FEATURES —

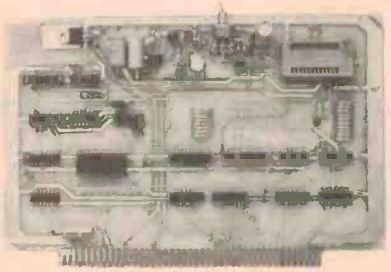
• Carpet covering • Nickle plated corners • Steel mesh grille • 100 watt special design speaker by Etone • ¾" timber construction • 2 x phono sockets • Size: 500mm high, 470mm wide, 260mm deep • Impedance: 8 ohms • 2 year warranty.

Also Complete Sound Systems, Disco Systems, Lighting Control Units, Etone/Matra Speakers, Power Amplifiers, Mixers and associated electronics.

TRADE ENQUIRIES WELCOME ***For further information:***

MATRA MUSICAL INDUSTRIES
3 Staple St, 17 Mile Rocks, Qld. 4073. Ph: (07) 376-4122.

2708 PROM PROGRAMMER

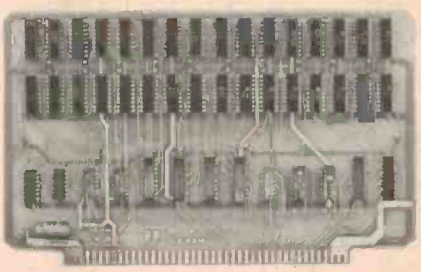


- For 2708's, can adapt to TMS2716.
- PROMS programmed by memory store instructions.
- PROM can be read normally.
- Standard supplies +5 +12 —12.

Assembled & Tested $130.20.
Software drivers available.

ALL CARDS HAVE:
- Motorola Exorcisor Bus as on D2.
- Compatable with most micros.
- PCB's plated through plus resist.

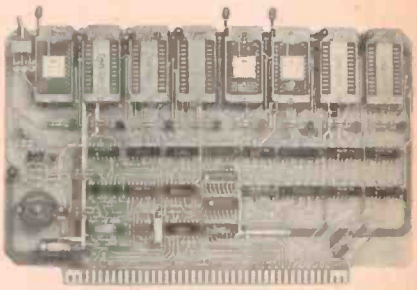
16K STATIC RAM



- Uses 2114L 1K x 4 statics. • Only 1.2A at 5V for 16K.
- 8K blocks switch addressable.

450nS KIT:
4K $153.20; 8K $207.20; 16K $312.60
450nS ASSEMBLED & TESTED:
4K $179.80; 8K $241.35; 16K $359.70
300nS KIT:
4K $161.20; 8K $223.20; 16K $344.60
300nS ASSEMBLED & TESTED:
4K $187.80; 8K $257.35; 16K $391.70.

16K PROM + PROGRAMMER



- For INTEL 2716/TEXAS 2516.
- Single +5V supply, 25V generated.
- Read PROM's and execute programs as for a normal PROM Card.
- Program any location with a single store instruction.
- 8K blocks switch addressable.

Ass. & test. with Low IF skts. $197.30.
Ass. & test. with ZIF skts. $236.20.
Software drivers available.

(Add 15 percent if sales tax applicable. P&P $3)

PP PENNYWISE PERIPHERALS 19 Suemar Street, Mulgrave, Victoria. 3170. Phone (03) 546-0308.

TTL

7400	$0.23	7416	$0.43	7491	$0.95
7401	0.23	7420	0.25	7493	0.65
7402	0.23	7430	0.25	7495	0.95
7403	0.23	7442	0.65	7496	1.15
7404	0.23	7447	1.10	74107	0.50
7405	0.33	7473	0.43	74121	0.55
7408	0.28	7474	0.50	74123	0.85
7410	0.25	7475	0.60	74125	0.95
7413	0.43	7476	0.65	74141	1.25
7414	0.95	7485	1.20	74191	1.35
		7486	0.50	74192	1.10
		7490	0.65	74193	1.65

DWELL
Retail/Wholesale Electronics

REGULATORS

7805	$1.20
LM340T12	1.20
LM340T15	1.20
LM340T24	1.20
LM320K5	2.00
LM320K12	2.00
LM320T15	2.00

EPROM

2708	16.00

DIODES

EM401 1A	$0.12
1N4720R 100PIV 3A	0.36
1N4721R 200PIV 3A	0.40
1N4722R 400PIV 3A	0.47
Bridge Rectifier 25A	2.90

TRANSISTORS

2N2222A NPN 500mW	0.45
2N2907A PNP 400mW	0.45
2N3567 NPN 300mW	0.40
TIP3055 NPN 115W	0.60

CONSIDERING A MICROCOMPUTER?

Come and inspect our range of microcomputers: one will suit you!

Introducing Ohio Scientific
The world's largest full line microcomputer company.
Stocks available soon

- SUPERBOARD 11 (up to 8K RAM)
- CHALLENGER 1P (with mini floppy)
- CHALLENGER 2-4P (with floppy)
- CHALLENGER 2-8P (with floppy)

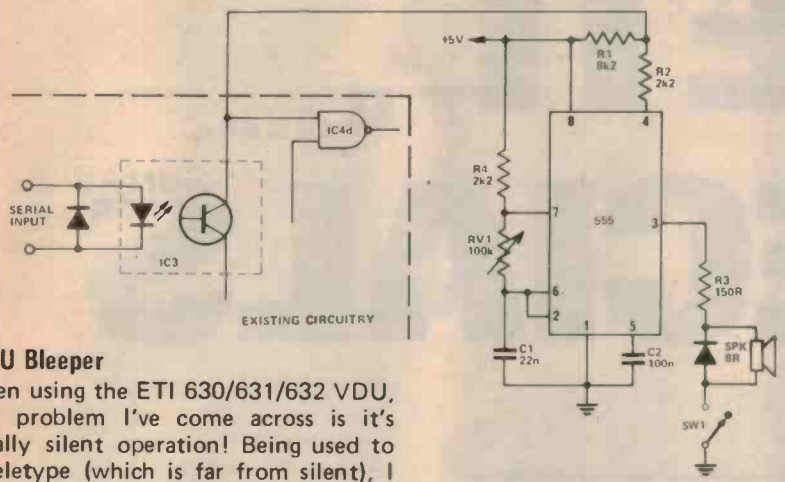
OHIO SCIENTIFIC
CHALLENGER 1P Illustrated

Rockwell AIM 65
Terminal style keyboard, 20 character alpha/numeric display, dot matrix printer, up to 4K RAM . . . all on one board.

Micropolis Discs
Incredible storage capability. From 143K bytes (formatted) to 946K bytes, all on one 5¼" mini floppy disc.

DWELL PTY. LTD. (formerly Dick Woods)
77 Edgeworth David Ave,
HORNSBY, NSW. 2077. Ph. 487-3111.

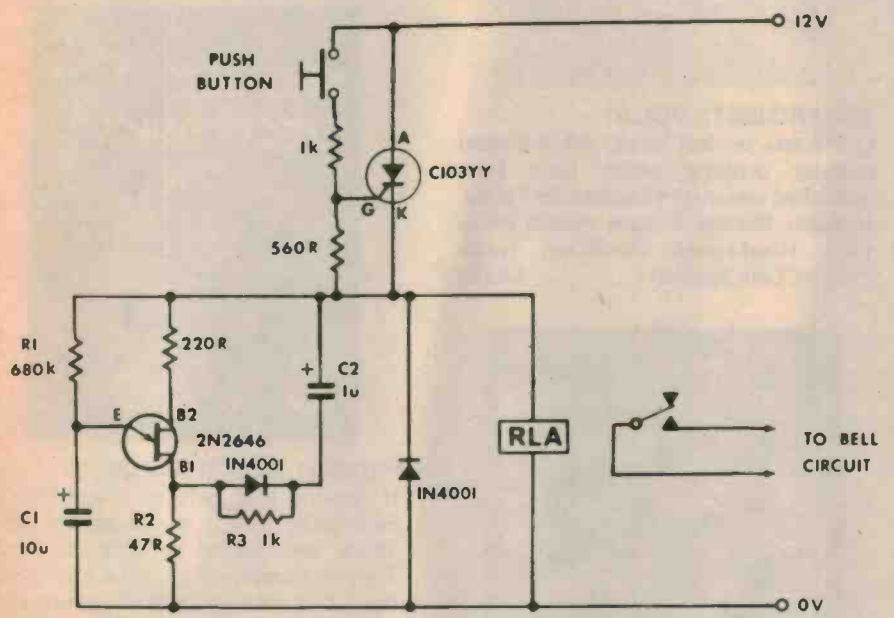
Ideas for experimenters



VDU Bleeper

When using the ETI 630/631/632 VDU, one problem I've come across is it's totally silent operation! Being used to a teletype (which is far from silent), I find that when entering lists of numbers, for instance, it is necessary for me to keep looking at the screen for the processor's 'prompts'. To alleviate this problem, the following circuit modification will produce audible 'bleeps' whenever characters are received from the processor.

The operation of the circuit is fairly straightforward, the reset pin of the 555 being used to gate its oscillation. RV1 sets the frequency (which is largely a matter of personal preferrence) and the switch allows the bleeper to be switched off when dumping onto tape.



Unijunction Pulse Stretcher – Door Bell Extender

The circuit presented is a practical monostable timer which was designed to extend the ringing time of a door bell. It can be useful in cases when the bell push button might not be engaged long enough to attract attention, though it could be used in many other applications.

When the push button is closed the thyristor will switch on delivering power to the unijunction transistor timing circuit and energising the relay, the contacts of which are used to control the bell circuit. At the same time, capacitor C2 quickly charges to the load voltage potential via R3. After a time interval given approximately by 0.8 C1 R1 (about 6 seconds in this case) the unijunction transistor will fire and the corresponding output pulse which is coupled to the cathode of the thyristor via C2 will put the thyristor in reverse bias switching it off. With these values the relay will become energised for at least 6 seconds.

Bill Edge's
ELECTRONIC AGENCIES
115-117 PARRAMATTA ROAD
CONCORD, 2137. Tel: 747-6472
(Near Concord Road)

Playmaster amplifier & tuner kits, Musicolour, drill speed control, CDI kits plus many more. Midland walkie talkies & marine transceivers. Hornet CB's & CB accessories. Fantastic range of technical books, electronic components. "Speak & Spell" calculator on demonstration. Comprehensive range of Myphone intercoms.

BURGLAR ALARM MODULE CPI Only $16

Don't be confused by all the burglar alarms available today. Try this one! Runs on 12V DC. Has 'normally open' & 'normally closed' contacts. Can operate bells or sirens (12V). Other alarm equipment available: window tape $3.60; tape blocks 30c; sirens (hee-haw) $22.50; pressure mats $14.95; small 12V buzzers $1.75.

DIGITAL VOLTMETER DMM 10

Auto decimal point. 9.5mm LED readout. 3 digit display. 7 meg ohm input impedance. 12 separate ranges. Over-range indication. Overload protection. 1 percent accuracy. Re-chargeable ni-cad batteries and adaptor/charger all inclusive.

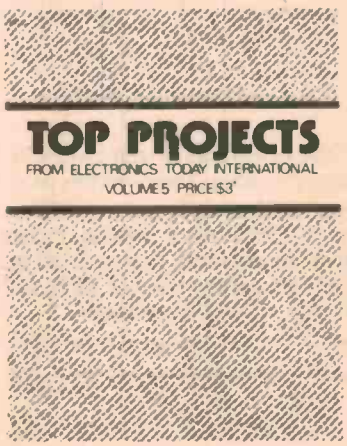
ONLY $89.70 (Trade price)

- Playmaster Forty Forty amplifier kit $129.50
- Playmaster tuner kit 159.50
- BSR belt drive turntable 99.00
- 30 light colour organ 69.00
- AM/FM tuner module 59.00
- Tape recorder switch (dubbing between 2 tape decks and 1 amp) 19.95
- 12 volt mobile PA amp (15 watt) 49.50
- 240V AC/12V PA amp (50 watt) 99.50
- 15 watt 8" x 5" horns (suit above) 22.50
- Full range of microphones and accessories.
- Over 400 different semiconductor devices.
- Rotary, toggle, slider and rocker switches.
- Scope standard super speed iron 17.95
- Miniscope iron 24.50
- Famous Hornet SSB/AM transceiver (27MHz) 199.50
- 13.8 volt 4 amp maximum power supply ..39.50
- Books! Books! Books!
- 100K ohm/volt combined multimeter & transistor checker 54.50

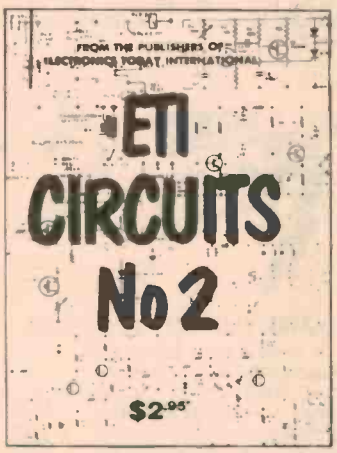
9am-5.30pm weekdays. 9am-noon Saturday. And don't forget OPEN SUNDAYS 10am-2pm.

MAIL ORDER CUSTOMERS
$1 packing plus 5 percent of order value up to $80 and thence a flat $4 for postal items. Carrier — freight on.

ETI SPECIALS



TOP PROJECTS VOL 5
Our latest project book. All the most popular projects which have been published recently in Electronics Today. Includes Bucket Brigade Audio Delay Line, Howl-round Stabilizer, Transmission Line Speakers . . . . . $3.00.



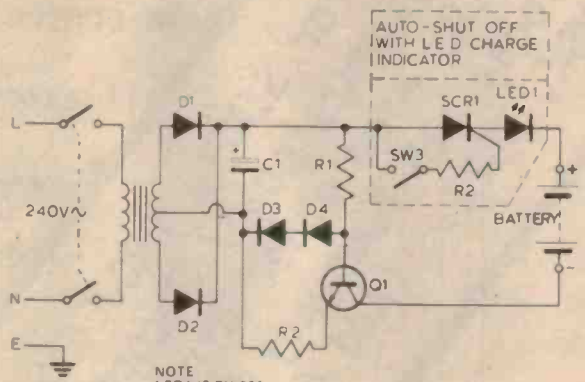
ETI CIRCUITS NO 2
Ideas and data for experimenters. There are about 200 circuit ideas in this book. It's not for the beginner. But someone with a fair bit of experience in electronics will get a lot of use from this book. Invaluable for ideas and inspiration.. . . . . $2.95.

PROJECT ELECTRONICS
If you're just getting interested in electronics this is the book for you. There are lots of projects to build. They're simple, educational and useful too. And there's advice about constructional methods and electronics components . . . . . $4.75.

AUSTRALIAN CB
All about CB. . How to buy and install a rig. How to work interstate on skip. What UHF CB is like. How to build accessories. Australian CB is a thorough, simple yet authoritative guide to CB in Australia 1978 . . . . . $3.95.

If your newsagent has sold out, order directly from us at Modern Magazines, 15 Boundary Street, Rushcutters Bay, 2011.
Just add 45 cents to the price for post and packing

Ideas for experimenters

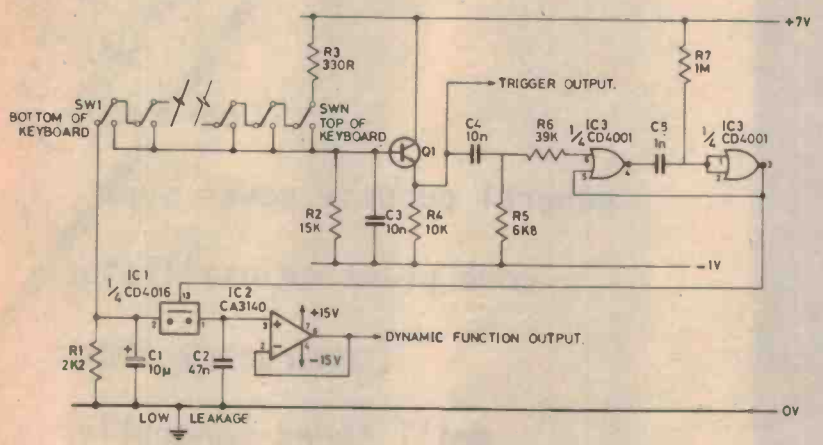


NOTE
LED1 IS TIL209
SCR1 ANY LOW VOLTAGE THYRISTOR
R2 SELECTED TO GIVE ONLY ONE CHARGE RATE OF 45mA INSTEAD OF SIX POSITION RANGE SWITCH GIVEN IN ORIGINAL DESIGN

Ni-Cad Charger Mod.

This modification was made to the ETI 519 Ni-cad charger to protect the cells in case a power cut occurred while the cells were charging. Normally the cells on charge would rapidly discharge through the charging circuitry, causing possible damage.

The modification involved the addition of a low voltage thyristor in series with the battery. If power fails, the battery cannot discharge. When power is reapplied, the battery will not continue to charge until SW3 is closed momentarily.



Touch Keying

A dynamic function (touch sensitivity) greatly increases the flexibility of expression available to the player of a music synthesiser. This circuit achieves the dynamic function by measuring the change over time of the keyboard switches and hence the velocity of the keys.

The circuit is basically composed of three parts: firstly an RC time constant network (R1, C1) controlled by the keyboard switches, a buffer amplifier and monostable (Q1, IC3) and a sample and hold circuit (IC1, C2, IC2).

Normally, C1 is kept charged up to +7V through the chain of closed keyboard switches. When a key is pressed, the chain is broken and C1 discharges through R1. As the key is further depressed, contact is made with the trigger busbar, Q1 is turned on and the monostable triggers. The monostable gives out a 1 millisecond pulse which allows the analogue switch, IC1, to close allowing C2 to charge up to the voltage on C1 at the time. After this, the voltage is stored on C2. Since the input impedance of IC1 is about 1.5 x 10^{12} ohms the delay time of C2 is very long. An output is available from the emitter of Q1 to trigger envelope shapers, etc. To ensure that the response is the same all over the keyboard, the contact wires of the keys should be adjusted to the same spacing.

W Stride

24 HR MAIL ORDER SERVICE!

We guarantee all orders will be despatched within 24 hours of receipt of order

7400 SERIES TTL

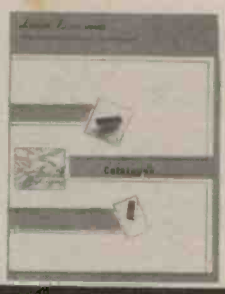
7400	$0.28	7440	0.28	7495	0.90
7401	0.28	7442	0.65	7496	1.00
7402	0.28	7446	1.10	74100	1.50
7403	0.28	7447	1.10	74107	0.50
7404	0.28	7448	1.10	74109	0.55
7405	0.28	7450	0.28	74121	0.55
7406	0.40	7451	0.28	74122	0.60
7407	0.40	7453	0.28	74123	0.90
7408	0.28	7454	0.28	74125	0.70
7409	0.28	7460	0.28	74126	0.70
7410	0.28	7470	0.45	74132	1.10
7411	0.28	7472	0.45	74141	1.25
7412	0.28	7473	0.45	74145	1.10
7413	0.40	7474	0.50	74151	1.10
7414	1.00	7475	0.65	74153	1.10
7416	0.50	7476	0.55	74154	1.50
7417	0.50	7480	0.90	74157	1.00
7420	0.28	7482	1.00	74160	1.20
7421	0.30	7483	1.00	74164	1.50
7423	0.40	7485	1.30	74165	1.50
7425	0.40	7486	0.50	74174	1.50
7426	0.40	7489	2.40	74176	1.20
7427	0.40	7490	0.65	74177	1.20
7430	0.28	7491	0.90	74184	2.20
7432	0.40	7492	0.65	74185	2.20
7437	0.40	7493	0.65	74192	1.20
7438	0.40	7494	0.90		

CMOS 4000 SERIES

4000	$0.30	4020	1.30	4050	0.60
4001	0.30	4021	1.30	4051	1.20
4002	0.30	4022	1.30	4052	1.20
4006	1.35	4023	0.30	4053	1.20
4007	0.30	4024	0.90	4060	1.50
4008	1.20	4025	0.30	4066	0.85
4009	0.70	4027	0.70	4071	0.35
4010	0.70	4028	1.20	4072	0.35
4011	0.30	4029	1.20	4073	0.35
4012	0.30	4030	0.45	4075	0.35
4013	0.55	4035	1.70	4081	0.35
4014	1.20	4040	1.20	4082	0.35
4015	1.15	4042	1.10	4510	1.40
4016	0.50	4043	1.00	4511	1.40
4017	1.20	4044	1.00	4516	1.40
4018	1.20	4046	2.10	4518	1.40
4019	0.45	4049	0.60	4520	1.40

SPECIALS

- 309K 5V 1A Regulator, $1.30
- 555 Timer, 35c
- 723 Regulator 14 DIL, 50c
- IN4148 Diode, 5c
- 230mm x 115mm x 1.5mm F'glass 1oz Cu Single Sided, 50c



FREE! 78/79 CATALOGUE Write for your copy **NOW!**

Pack & Post: 50c minimum, please allow more for heavier items

LINEAR ELECTRONICS
MAIL ORDER ELECTRONIC COMPONENTS
PO Box 254, Punchbowl, NSW. 2196.

SIMPLE PROJECTS

FROM ELECTRONICS TODAY INTERNATIONAL

VOLUME 2 PRICE $2.95*

Look for SIMPLE PROJECTS VOL 2 at your newsagents now! Recommended retail price $2.95 - or order directly from Electronics Today, 15 Boundary Street, Rushcutters Bay, NSW, 2021. (Add 45 cents post and packing).

metal detector

ain controller

ell extender

ic strobe

tester

me

courtesy

rev mon

car

general purpose power supp

code practice oscillator

emergency flash

drill speed controller

three receivers

one transistor radio

ETI mini organ

accentuated beat metronome

active antenna

simple intercoms

DIODES/ZENERS

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

SOCKETS/BRIDGES

QTY.				
8-pin	pcb	.20	ww	.35
14-pin	pcb	.20	ww	.40
16-pin	pcb	.20	ww	.40
18-pin	pcb	.25	ww	.95
20-pin	pcb	.35	ww	.95
22-pin	pcb	.35	ww	.95
24-pin	pcb	.35	ww	.95
28-pin	pcb	.45	ww	1.25
40-pin	pcb	.50	ww	1.25
Molex pins	.01	To-3 Sockets		.25
2 Amp Bridge		100-prv		.95
25 Amp Bridge		200-prv		1.50

TRANSISTORS, LEDS, etc.

QTY.		
2N2222	(2N2222 Plastic .10)	.15
2N2222A		.19
2N2907A	PNP	.19
2N3906	PNP (Plastic Unmarked)	.10
2N3904	NPN (Plastic Unmarked)	.10
2N3054	NPN	.45
2N3055	NPN 15A 60v	.60
T1P125	PNP Darlington	1.95
LED Green,	Red, Clear, Yellow	.15
D.L.747	7 seg 5/8" High com-anode	1.95
MAN72	7 seg com-anode (Red)	1.25
MAN3610	7 seg com-anode (Orange)	1.25
MAN82A	7 seg com-anode (Yellow)	1.25
MAN74	7 seg com-cathode (Red)	1.50
FND359	7 seg com-cathode (Red)	1.25

9000 SERIES

QTY.		QTY.	
9301	.85	9322	.65
9309	.35	9601	.20
9316	1.10	9602	.45

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

QTY.		QTY.	
8T13	1.50	2107B-4	4.95
8T23	1.50	2114	9.50
8T24	2.00	2513	6.25
8T97	1.00	2708	10.50
74S188	3.00	2716 D.S.	34.00
1488	1.25	2716 (5v)	59.00
1489	1.25	2758 (5v)	23.95
1702A	4.50	3242	10.50
AM 9050	4.00	4116	11.50
		6800	13.95
MM 5314	3.00	6850	7.95
MM 5316	3.50	8080	7.50
MM 5387	3.50	8212	2.75
MM 5369	2.95	8214	4.95
TR 1602B	3.95	8216	3.50
UPD 414	4.95	8224	3.25
Z 80 A	22.50	8228	6.00
Z 80	17.50	8251	7.50
Z 80 PIO	10.50	8253	18.50
2102	1.45	8255	8.50
2102L	1.75	TMS 4044	9.95

C MOS

QTY.	
4000	.15
4001	.15
4002	.20
4004	3.95
4006	.95
4007	.20
4008	.75
4009	.35
4010	.35
4011	.20
4012	.20
4013	.40
4014	.75
4015	.75
4016	.35
4017	.75
4018	.75
4019	.35
4020	.85
4021	.75
4022	.75
4023	.20
4024	.75
4025	.20
4026	1.95
4027	.35
4028	.75
4029	1.15
4030	.30
4033	1.50
4034	2.45
4035	.75
4037	1.80
4040	.75
4041	.69
4042	.65
4043	.50
4044	.65
4046	1.25
4048	.95
4049	.45
4050	.45
4052	.75
4053	.75
4066	.55
4069/74C04	.35
4071	.25
4081	.30
4082	.30
4507	.95
4511	.95
4512	1.10
4515	2.95
4519	.85
4522	1.10
4526	.95
4528	1.10
4529	.95
MC 14409	14.50
MC 14419	4.85
74C151	1.50

LINEARS, REGULATORS, etc.

QTY.		QTY.		QTY.	
MCT2	.95	LM323K	5.95	LM380 (8-14 Pin)	1.19
8038	3.95	LM324	1.25	LM709 (8-14 Pin)	.35
LM201	.75	LM339	.75	LM711	.45
LM301	.45	7805 (340T5)	.95	LM723	.40
LM308	.65	LM340T12	.95	LM725	2.50
LM309H	.65	LM340T15	.95	LM739	1.50
LM309K (340K-5)	1.50	LM340T18	.95	LM741 (8-14)	.35
LM310	.85	LM340T24	.95	LM747	1.10
LM311D	.75	LM340K12	1.25	LM1307	1.25
LM318	1.75	LM340K15	1.25	LM1458	.65
LM320H6	.79	LM340K18	1.25	LM3900	.50
LM320H15	.79	LM340K24	1.25	LM75451	.65
LM320H24	.79	LM373	2.95	NE555	.45
7905 (LM320K5)	1.65	LM377	3.95	NE556	.85
LM320K12	1.65	78L05	.75	NE565	.95
LM320K24	1.65	78L12	.75	NE566	1.25
LM320T5	1.65	78L15	.75	NE567	.95
LM320T12	1.65	78M05	.75		
LM320T15	1.65				

— T T L —

QTY.		QTY.		QTY.		QTY.	
7400	.10	7482	.75	74221	1.00	74LS02	.30
7401	.15	7483	.75	74367	.95	74LS04	.30
7402	.15	7485	.55	75108A	.35	74LS05	.35
7403	.15	7486	.25	75491	.50	74LS08	.35
7404	.10	7489	1.05	75492	.50	74LS09	.35
7405	.25	7490	.45	74H00	.15	74LS10	.35
7406	.25	7491	.70	74H01	.20	74LS11	.35
7407	.55	7492	.45	74H04	.20	74LS20	.30
7408	.15	7493	.35	74H05	.20	74LS21	.35
7409	.15	7494	.75	74H08	.35	74LS22	.35
7410	.15	7495	.60	74H10	.35	74LS32	.35
7411	.25	7496	.80	74H11	.25	74LS37	.35
7412	.25	74100	1.15	74H15	.45	74LS38	.45
7413	.25	74107	.25	74H20	.25	74LS40	.40
7414	.75	74121	.35	74H21	.25	74LS42	.75
7416	.25	74122	.55	74H22	.40	74LS51	.45
7417	.40	74123	.35	74H30	.20	74LS74	.45
7420	.15	74125	.45	74H40	.25	74LS76	.50
7426	.25	74126	.35	74H50	.25	74LS86	.45
7427	.25	74132	.75	74H51	.25	74LS90	.65
7430	.15	74141	.90	74H52	.15	74LS93	.65
7432	.20	74150	.85	74H53	.25	74LS107	.50
7437	.20	74151	.65	74H55	.20	74LS123	1.20
7438	.20	74153	.75	74H72	.35	74LS151	.85
7440	.20	74154	.95	74H74	.35	74LS153	.85
7441	1.15	74156	.70	74H101	.75	74LS157	.85
7442	.45	74157	.65	74H103	.55	74LS160	.95
7443	.45	74161	.55	74H106	.95	74LS164	1.20
7444	.45	74163	.85	74L00	.25	74LS193	1.05
7445	.65	74164	.60	74L02	.20	74LS195	.95
7446	.70	74165	1.10	74L03	.25	74LS244	1.70
7447	.70	74166	1.25	74L04	.30	74LS367	.95
7448	.50	74175	.80	74L10	.20	74LS368	.95
7450	.25	74176	.85	74L20	.35	74S00	.35
7451	.25	74180	.55	74L30	.45	74S02	.35
7453	.20	74181	2.25	74L47	1.95	74S03	.25
7454	.25	74182	.75	74L51	.45	74S04	.25
7460	.40	74190	1.25	74L55	.65	74S05	.35
7470	.45	74191	1.25	74L72	.45	74S08	.35
472	.40	74192	.75	74L73	.40	74S10	.35
7473	.25	74193	.85	74L74	.45	74S11	.35
7474	.30	74194	.95	74L75	.85	74S20	.25
7475	.35	74195	.95	74L93	.55	74S40	.20
7476	.40	74196	.95	74L123	.85	74S50	.20
7480	.55	74197	.95	74LS00	.30	74S51	.25
7481	.75	74198	1.45	74LS01	.30	74S64	.15
						74S74	.35
						74S112	.60
						74S114	.65
						74S133	.40
						74S140	.55
						74S151	.30
						74S153	.35
						74S157	.75
						74S158	.30
						74S194	1.05
						74S257 (8123)	1.05
						8131	2.75

CABLE ADDRESS: ICUSD

TELEX #

HOURS: 9 A.M. - 6 P.M. MON. thru SUN.

INTEGRATED CIRCUITS UNLIMITED

7889 Clairemont Mesa Blvd. • San Diego, California 92111 U.S.A.

NO MINIMUM

COMMERCIAL AND MANUFACTURING ACCOUNTS INVITED

ALL PRICES IN U.S. DOLLARS. PLEASE ADD POSTAGE TO COVER METHOD OF SHIPPING.
ORDERS OVER $100 (U.S.) WILL BE SHIPPED AIR NO CHARGE.

PAYMENT SUBMITTED WITH ORDER SHOULD BE IN U.S. DOLLARS.

ALL IC'S PRIME/GUARANTEED ALL ORDERS SHIPPED SAME DAY RECEIVED.

CREDIT CARDS ACCEPTED:

Phone (714) 278-4394 BarclayCard / Access / American Express / BankAmericard / Visa / MasterCharge

SPECIAL DISCOUNTS

Total Order	Deduct
$35-$99	10%
$100-$300	15%
$301-$1000	20%

electronics today SERVICES ADVERTISERS INDEX

READERS' LETTERS

No charge for replies but a foolscap-size stamped addressed envelope must be enclosed. Project queries can only be answered if related to item as published. We cannot assist if project is modified nor if components are otherwise than specified.
We can only answer readers' queries by telephone after 4 p.m.

MICROFILM

Microfiche editions of this publication are available by annual subscription from Microsystems Pty Ltd, PO Box 188, North Sydney, NSW. 2060.

SUBSCRIPTIONS AND BACK ISSUES

ETI subscriptions cost $19.00 per year (inc. postage) within Australia. Cost elsewhere is $24.60 (inc. postage – surface mail). Airmail rates on application.
Back issues cost $1.40 each plus 45 cents post and packing.
We can supply *only* the following issues.
1976: Nov., Dec. 1977: All issues except Jan, Feb, March. 1978: All issues except Sept.
Photostats are available of any article ever published in ETI. We charge a flat $2.00 regardless of page quantity from any one issue of ETI. Thus if the article is in three issues the cost is $6.00. Send orders to the address below.
Binders $4.50 plus 90c post NSW, $2.00 other States.

COPYRIGHT

The contents of Electronics Today International and associated publications is fully protected by the Commonwealth Copyright Act (1968).
Copyright extends to all written material, photographs, drawings, circuit diagrams and printed circuit board. Although any form of reproduction is a breach of copyright, we are not concerned about individuals constructing projects for their own private use, nor by pop groups (for example) constructing one or more items for use in connection with their performances.
Commercial organisations should note that no project or part project described in Electronics Today International or associated publications may be offered for sale, or sold, in substantially or fully assembled form, unless a licence has been specifically obtained so to do from the publishers, Modern Magazines (Holdings) Ltd or from the copyright holders.

LIABILITY

Whilst every effort has been made to ensure that all constructional projects referred to in this edition will operate as indicated efficiently and properly and that all necessary components to manufacture the same will be available, no responsibility whatsoever is accepted in respect of the failure for any reason at all of the project to operate effectively or at all whether due to any fault in design or otherwise and no responsibility is accepted for the failure to obtain any component parts in respect of any such project. Further, no responsibility is accepted in respect of any injury or damage caused by any fault in the design of any such project as aforesaid.

A MODERN MAGAZINES PUBLICATION

Art Director:	Clive Davis
Production Manager:	Bob Izzard
Reader Services:	Jan Collins
Subscriptions & Circulation:	John Oxenford
Acoustical Consultants:	Louis A. Challis & Assoc.

Sydney:	Modern Magazines Bob Taylor (Manager), Geoff Petschler (NSW Manager), 15 Boundary St., Rushcutters Bay 2011. Tel: 33-4282.
Melbourne:	Modern Magazines Tom Bray (Manager), John Colquhoun, Suite 24, 553 St. Kilda Rd, Melbourne. Tel: 51-9836
Brisbane:	Modern Magazines Geoff Horne, 60 Montanus Drive, Bellbowrie, Qld. 4070 Tel: 202-6229.
Adelaide:	The Admedia Group Peter Ryan, 24 Kensington Rd, Rose Park. SA. 5067. Tel: (08) 332-8144 Telex: ADMDIA 82 182
Perth:	Aubrey Barker, 133 St. George's Terrace, Perth. 6000. Tel: 322-3184.
Hobart:	H.W. Lincone, 23 Lord St, Sandy Bay. Tasmania. 7005.
Tokyo:	Genzo Uchida, Bancho Media Service, 15 Sanyeicho, Shintuku-Ku, Tokyo 160.
London:	Electronics Today International 25-27 Oxford St, London WIR 1RF. Tel: 01-434-1781/2.

Electronics Today International is published by Modern Magazines (Holdings) Ltd, 15 Boundary St., Rushcutters Bay, NSW 2011. It is printed (in 1979) by Wilke & Co., Browns Rd, Clayton, Victoria and distributed by Australian Consolidated Press.

ADVERTISERS' INDEX

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

maxell®
simply excellent

For details on all Maxell Recording Tape write to Maxell Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033

WT3/79

TECHNICS DIRECT-DRIVE TRADITION WITH ALL FRONT PANEL CONTROL.

Model SL-3200

Other turntable manufacturers have been chasing our performance specifications since the day we introduced our direct-drive models.

Now Technics introduces a new standard — elegant low-profile styling — with all functions including tonearm cueing controlled from the front panel . . . even with the dust cover down.

The SL-3300 model has fully-automatic tonearm setdown, return and stop, and the memo-repeat control permits up to 6 repeat plays.

The semi-automatic operation of the SL-3200 model provides tonearm return and turntable shut-off.

Choose either turntable and you'll get an S-shaped tonearm with low-friction gimbal suspension, individual pitch controls and an integral base moulded of anti-resonant materials to minimise acoustic feedback.

Speed accuracy is assured with a wow and flutter rating of 0.03% WRMS and rumble is -73dB (DIN B).

See your Technics dealer. He can demonstrate a turntable from the Technics range to suit your hi-fi system and budget.

For a National Technics catalogue, please write to:
National Technics Advisory Service, P.O. Box 278, Kensington, N.S.W. 2033

National Technics hi-fi

T79.27