

Electronics Today

INTERNATIONAL

INCLUDING SOUND INSIGHTS



\$10,000 OF SONY GEAR TO BE WON

° AUGUST 1988 \$3.50 NZ \$4.50 (inc GST)

NEW 2 TO 48 CHANNEL MIXER

WOOMERA → FINAL LIFT OFF

ALL YOU NEED TO KNOW ABOUT SUBWOOFERS

**BUILD • GUITAR NOTE EXTENDER
• SPEED SENSORS • INSIDE VLSI**

AN OFFER FOR ^{Electronics} Today READERS

"These are NOT . . . Sunglasses!"

Nationally Advertised
Ambervision
Super Fashion
Glasses
For only . . .

\$19.00
(not \$59.95)

AMBERVISION REVOLUTIONIZES EYEWEAR

Not \$100, Not \$59.95 — Incredible Give Away
for only \$19.00

Similar eyeglasses have been advertised by others at \$59.95 each. In fact, you would think that high-techvision revolution Super Fashion Glasses like these would sell for well over \$100.00. But during this publicity campaign, you don't pay \$100.00 — or even \$59.95. You pay an incredible give away price of just \$19.00. But this offer is for a limited time only.

High Technology Disguised as High Fashion

Don't be fooled by the appearance of these glasses! These are not ordinary sunglasses. They may look like high fashion sunglasses (in fact, they are designed after some of the most

expensive brand names on the market today.) Ambervision's scientific design filters out blue and ultraviolet portions of the light spectrum that have been proven harmful to your eyes. By filtering out these dangerous rays, your vision is enhanced to a new level of perceptual eyesight.

A New World Through New Eyes

Just imagine what it would be like to look through glasses that make the world seem sharper, more vibrant, more alive and more cheerful. Slip on a pair of these sleek designer sunglass "look alikes" and you'll notice a marked improvement in your vision. This vision enhancement experience is so incredibly phenomenal that it has been

widely publicised by others as a "Vision Breakthrough". Professional golfers, hunters and skiers have already discovered and reaped the benefits of these indispensable Super Fashion Glasses — now you too can experience the excitement of Ambervision Glasses. Your "Super Glasses" even come complete with a luxurious black suede-like protective pouch. Each pair of Super-Glasses is covered by a full 30 day money-back guarantee.



H032 AMBERVISION GLASSES \$19.00

**PORTABLE USE
ANYWHERE**



**ONLY
\$15.00**



Fabulous New Relief for Drivers WITH ULTRA COMFORTABLE

CONTOURED

'AUTOPAEDIC' CAR SUPPORT CUSHION

WITH POSTURE SUPPORT

Some chairs are so hard they make you squirm and give you unbearable pains in the back. Others are so soft they give you hardly any support. Now this great support cushion gives you comfort and support wherever you sit. It's inflatable — so it contours to your body and provides even support for your lower back and thighs. It's wonderful for those who sit for long periods in the car or office. Just try it, it's heaven for your back!

Think, if you watch sports you can take it with you or take it on the train. If you know someone confined to a wheelchair it would be a Godsend. A little warning. You had better buy more than one because when other members of your family find out how comfortable it is they'll want yours!

J079 SUPPORT CUSHION \$15.00

To order, fill in attached coupon, place in the reply-paid envelope and post. Or if missing, send name, address, telephone no. and cheque, money order or credit card details (card type, number, expiry date and signature) to: FREEPOST No. 4, P.O. Box 227, Waterloo NSW 2017. No stamp required.



FOR AT WORK

FISHING

WATCHING SPORT

CAMPING

AN OFFER FOR **Electronics Today** READERS

THE ULTIMATE WRISTWATCH A MASTERPIECE OF ADVANCED TECHNICAL RESOURCES THE INCREDIBLE CELSIUS 9 CHRONOMETER

- Never needs winding
- Sweep second hand
- Rotating bezel for measuring elapsed time
- Chime alarm for wake-up and appointments
- Luminous numerals
- Tachometer for distance and elevation
- Stopwatch accurate to 1/100th of a second
- 12 and 24 hour time modes
- Tells time in two different time zones simultaneously
- Lights up time in-the dark with photon dispersion beam
- Zero refraction matte black finish chain link adjustable band

BUT IT WON'T COST YOU HUNDREDS
NOT \$300 \$250 \$200

NOW \$49.00
ONLY EXCLUSIVE CLEARANCE SALE PRICE



- Powered by mercury cell (already installed)
- Analog dial plus digital readout
- Water resistant to a depth of 50 metres
- Accurate to within seconds per month
- Scratch resistant mineral glass crystal
- Stainless Steel case back
- Displays month, date and day
- Sonic beep on the hour keeps track of time
- Guaranteed

AN UNEQUALLED ADVENTURE WITH TIME!

Powered by a computer-type chip and precision quartz movement, each "CELSIUS 9" watch is a time-keeping control centre. Its tri-level high tech face includes an analog dial with sweep second hand, a multi-function LCD digital readout that records time in both 12 and 24 hour (civilian and military) modes and a rotating bezel to measure elapsed time.

THE PERFECT PILOT'S WATCH

The ultimate in a man's wristwatch, the "Celsius 9" tells you the time in two time zones (while travelling); chimes the hour to remind you of passing time; keeps track of the day and date; awakens you from sleep and is even water resistant to five atmospheres.

One of the most technologically sophisticated watches ever offered, the "Celsius 9" features a Stopwatch/Chronograph (accurate to 1/100th of a second); a tachymeter that times

THE ULTIMATE IN QUALITY AND RELIABILITY

average vehicle speed over a measured mile and unseen, an amazing photon dispersion beam — smaller than the "eye" of a hornet, which lights up the mineral crystals in the dark.

This handsome high-tech "zero refraction" matte black timepiece is the all purpose watch, smart for everyday wear and perfect for the office. It's a must for sporting events either as a player or spectator and is destined to become the most talked about watch in Australia.

To order, fill in attached coupon, place in the reply-paid envelope and post. Or if missing, send name, address, telephone no. and cheque, money order or credit card details (card type, number, expiry date and signature) to: FREEPOST No. 4, P.O. Box 227, Waterloo NSW 2017. No stamp required.

NO RISK MONEY BACK GUARANTEE

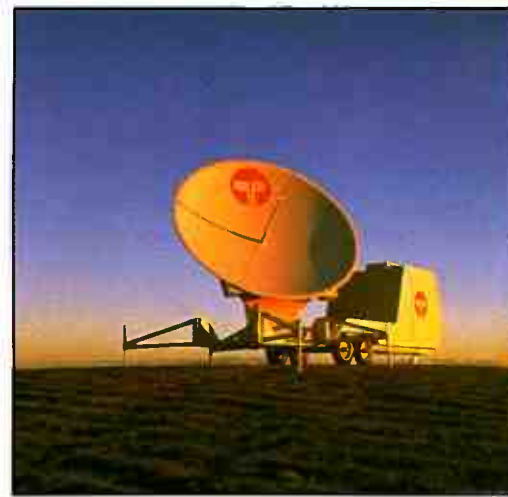
WEAR THE "CELSIUS 9" WATCH FOR 30 DAYS AND IF YOU ARE NOT ABSOLUTELY DELIGHTED SIMPLY RETURN TO US FOR A FULL REFUND OF YOUR PURCHASE PRICE.

Electronics Today

AUGUST
1988

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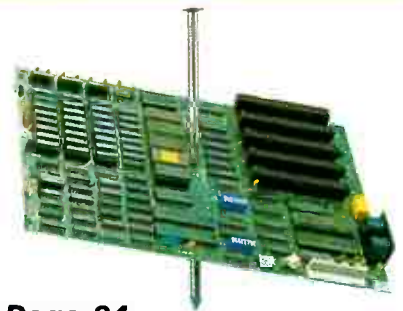
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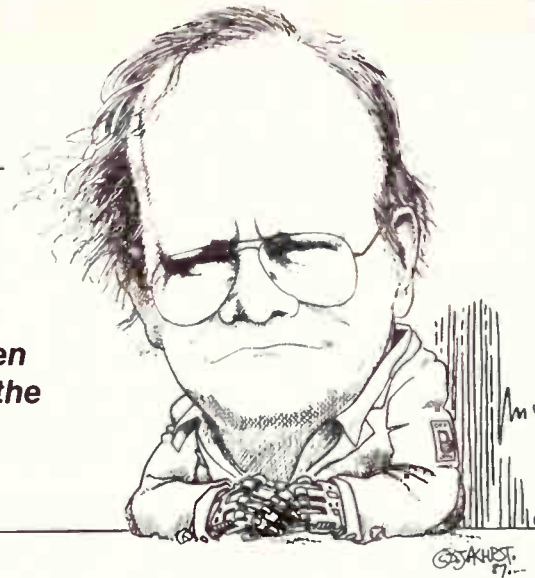
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Cover: The new modular mixer from Applied Audio.



**By and large,
mainstream
electronics has been
totally unmoved by the
R and D windfall**



A new report by the Melbourne based Invertech Operations has revealed that the boards of Australian technology companies know little and cares less about R and D issues. The Invertech study seems to show that industry is replacing long term research with an emphasis on short term objectives. This usually amounts to importing or licencing technology from off shore.

What's going on out there?

Everyone knows that in the late 1970s up to perhaps 1981 the Australian electronics industry suffered a massive lack of confidence in its future, which resulted in the virtual disappearance of R and D activity. The government's response, probably one of the best government responses to any problem faced by Australia since the war, was to allow companies to write off 150% of their R and D expenditure to tax.

Since then, conventional wisdom has it that there has been a research led renaissance in Australian made products. The report seems to throw doubt on that. R and D expenditure claimed under the scheme has increased from 3.1% of total sales to 3.4%. This is a 10% increase, much less than the 50% increase predicted by Senator Button who shepherded the enabling act through parliament. What's more, this increase has been fuelled by a sharp increase in the number of small entrepreneurial companies not a general increase in development activity.

By and large, mainstream electronics in this country has been totally unmoved by the R and D windfall. The report documents a staggering ignorance by board members of the government legislation. In fact, 42% of respondents cited lack of knowledge as the reason they were not more involved. A further 10% didn't bother because of "administrative inconvenience".

One must sympathise with the government. Essentially, the government is offering them money by the bucketload, and it is being turned down. Lesser men than those of the Hawke ministry would throw up their arms in despair before taking up employment growing tomatoes in Spain.

Their response has been somewhat otherwise, (with the exception of Mr John Button, who has taken to berating busi-

Continued on page 9

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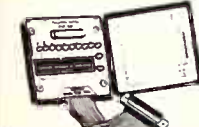
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CRYSTAL LOCKED WIRELESS MICROPHONE AND RECEIVER

MICROPHONE SPECIFICATIONS:
Transmitting Frequency: 37.1MHz
Transmitting System: crystal oscillation
Microphone: Electret condenser
Power Supply: 9V battery
Range: 300 feet in open field
Dimensions: 185 x 27 x 38mm
Weight: 160 grams
RECEIVER SPECIFICATIONS:
Receiving Freq: 37.1MHz
Output Level: 30mV (maximum)
Receiving System: Super heterodyne crystal oscillation
Power Supply: 9V Battery or 9V DC power adapter
Volume control
Turning LED
Dimensions: 115 x 32 x 44mm
Weight: 220 grams
 Cat. A10452 R.R.P. \$113
Our price, \$99



RS232 BREAK OUT BOX

A simple way of monitoring RS232 interface lead activity interface powered, pocket size for circuit testing, monitoring and patching 10 signal powered LEDs and 2 spares. 24 switches enables you to break out circuits or reconfigure and patch any or all the 24 active positions.

SPECIFICATIONS:
Connectors: DB25 plug on 80mm ribbon cable and DB25 socket
Indicators: Tricolour LEDs for TD, RD, RTS, CTS, DSR, CD, TC, RC, DTR (E)TC
Jumper Wires: 20 tinned end pieces
Power: Interface power
Enclosure: Black, high impact plastic
Dimensions: 85 x 95 x 30mm
 X15700 **\$94.95**



P.I.R. SENTRY

FEATURES:
 • 7 LED indicators
 • Passive Infra-red detection radium
 • Built-in piezo siren
 • Rechargeable 12V battery
 • Built-in automatic battery charging system
 • External siren connections
 • External system
 • Terminals for external detection devices
 • Separate digital panel and main unit
 • 3 Function switch delay/off/Instant
 • 3 Adjustable timers
 • 24 Hour loop included
 • Built-in tamper switch
 • Adjustable detection angle
 • LED monitor for walk test
 • R.F. Protection design
 S **\$175**



SCHMIDT 123AT MULTI STANDARD MODEM

• V21 V22 V23 Multi standard modem (300 300 1200 1200 1200 75)
 • Auto dial AT command set (Hayes) compatible
 • Auto answer auto disconnect
 • Auto answerback (Similar to Telex)
 • Auto or manual control
 • Dial-up or leased line operation
 • Pulse or Tone Dialing
 • Automatic speed ranging
 • Speaker for call progress monitoring
 • Baud-rate converter with 48 character buffer (V23)
 • Synchronous or asynchronous operation
 • Fully self contained power supply
 • Low power operation
 • Metal case (R.F. shielded)
 • Visual monitoring of important interface circuits (7 LED's)
 • Full or half duplex (V23)
 • Double adaptor plug to allow use of standard phone (Mode 1.3.5)
 • Telecom Authorised (C87 37 65)
 **\$595**
 *Hayes is a trademark of Hayes Microcomputer Products Inc



COMPUTER CABLE

CIC6 6 conductor computer interface cable Colour coded with braided shield (to IEC22 specifications)
 Copper conductor 6 x 7.0 16mm
 1-9 metres 10+ metres
\$1.90/m \$1.70/m

CIC9 100 9 conductor computer interface cable Colour coded with mylar shielding 9 x 7.0 16mm
 1-9 metres 10+ metres
\$2.50/m \$1.95/m

CIC12 12 conductor computer interface cable Colour coded with mylar shielding 12 x 7.0 16mm
 1-9 metres 10+ metres
\$2.70/m \$2.50/m

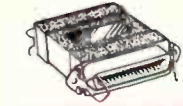
CIC16 16 conductor computer interface cable Colour coded with mylar shielding 16 x 7.0 16mm
 1-9 metres 10+ metres
\$3.90/m \$3.40/m

CIC25 25 conductor computer interface cable Colour coded with mylar shielding 25 x 7.0 16mm
 1-9 metres 10+ metres
\$4.90/m \$4.40/m



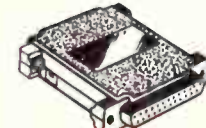
9 PIN TO 25 PIN CONNECTOR ADAPTORS

NEW! The ideal solution! Features gold plated pins
 X15668 DB9 Plug to DB25 Socket
 X15669 DB9 Socket to DB25 Plug
each \$10.95



CENTRONICS GENDER CHANGERS

• Female to Female
 • Saves modifying or replacing non-mating Centronics cables
 • All 36 pins wired straight through
 Cat. X15663 Male to Male
 Cat. X15661 Male to Female
 Cat. X15664 Female to Female
 Normally \$33.95
Only \$24.95



RS232 GENDER CHANGERS

• Saves modifying or replacing non-mating RS232 cables
 • All 25 pins wired straight through
 Cat. X15650 Male to Male
 Cat. X15651 Male to Female
 Cat. X15652 Female to Female
 Normally \$14.95 each
Only \$9.95



DB15 GENDER CHANGERS

• Saves modifying or replacing non-mating DB15 connections
 • All 15 pins wired straight through
 X15645: Male to male
 X15646: Male to Female
 X15647: Female to Female
only \$14.95



DB9 GENDER CHANGERS

• Saves modifying or replacing non-mating DB9 connections
 • All 9 pins wired straight through
 X15640: Male to male
 X15641: Male to Female
 X15642: Female to Female
only \$14.95



ARLEC SUPER TOOL

A versatile 12V electric tool for:
 • Sanding
 • Engraving
 • Grinding
 • Polishing
 • Cutting
 • Drilling
 • Milling
 • Erasing, etc
Features:
 Operates on safe, low 12 volts from mains electricity via AC adaptor (supplied). Light and easy to handle with touch switch and lock for continuous running. High torque motor. 10,000 R.P.M. Can drill 2mm holes in steel. 2 year guarantee
Contents:
 • 12V Super Tool
 • Plugpack AC adaptor
 • 1 spherical milling cutter
 • 1 wire brush
 • 1 grinding wheel
 • 4 drill bits, 0.6, 0.8, 1.0, 1.2mm
 • Set of 5 chuck collets
 • 6 eraser sticks
 • Instruction sheets
 Cat. T12300 **\$59.95**



DIECAST BOXES

Diecast boxes are excellent for RF shielding, and strength
 Screws are provided with each box
 H11451 100 x 50 x 25mm \$ 5.95
 H11452 110 x 60 x 30mm \$ 6.50
 H11453 120 x 65 x 40mm \$ 6.95
 H11461 120 x 94 x 53mm \$11.50
 H11462 188 x 120 x 78mm \$13.50
 H11464 188 x 188 x 64mm \$29.50



PUSH BUTTON DIALLERS

Tired of old fashion dialling and re-dialling engaged numbers? These convenient push button diallers include last number redial (up to 16 digits) and instructions for an easy changeover
 Cat. A12030 Normally \$19.95
SPECIAL, ONLY \$14.95
 (Note: Not Telecom approved)



ULTRASONIC TRANSDUCERS

Designed to transmit at 40kHz (L19990) and receive at 40kHz (L19991) with up to 20V IP on the transmitter. These units can't be heard and so are ideal for TV remote controls, water level detectors, burglar alarms, motion detectors and information carriers as they can be either pulsed or used in the continuous wave mode
 Full specifications below for design purposes
Maximum Input Voltage: 20V rms
Centre Frequency (kHz): 40 ± 1.0
Sound Pressure Level 10V RMS: 110dB min
Sensitivity (dBV/uBar) min.: 65 mm
Bandwidth (kHz):
 Transmit 4.0 (at 100dB)
 Receiver 5.0 (at 73dB)
Impedance:
 Transmit 500
 Receiver 5000
 Cat. L19990 (Transmitter) **\$6.95**
 Cat. L19991 (Receiver) **\$6.95**



DB25 CONNECTOR SPECIALS!

TYPE	1-9	10	100
9P	\$0.70	\$0.60	\$0.50
9S	\$0.70	\$0.60	\$0.50
9C	\$0.60	\$0.50	\$0.40
15C	\$0.70	\$0.65	\$0.60
15S	\$0.70	\$0.65	\$0.60
15C	\$0.70	\$0.60	\$0.50
25P	\$0.70	\$0.60	\$0.50
25S	\$0.75	\$0.65	\$0.60
25C	\$0.70	\$0.60	\$0.50

DB 25 CRIMP SPECIALS!

TYPE	1-9	10	100
Female	\$2.95	\$2.50	\$1.95
Male	\$2.95	\$2.50	\$1.95



CANNON TYPE CONNECTORS

1-9	10
P10960 3 PIN LINE MALE	\$3.90
P10962 3 PIN CHASIS MALE	\$3.00
P10964 3 PIN LINE FEMALE	\$4.50
P10966 3 PIN CHASIS FEMALE	\$4.95



STEREO WIRELESS TRANSMITTER

This unit was developed to allow portable compact disc players to be used in cars by transmitting the headphone output signal directly in to your stereo FM car radio. It will also transmit any mono-stereo signal from any headphone output to any FM receiver
SPECIFICATIONS:
 • Input 3.5mm stereo phone plug
 Impedance 32 ohm
 • Mono-stereo switch has plug mounting clip
 • FM Transmission approx 90-35MHz (Tunable 89-91MHz)
 • Range 15 metres (below 15mV/m at 100 metres)
 • Power 1-5V AAA size batteries (100 hours continuous use)
 • Size 72 x 38 x 21mm
 A16100 **\$69.95**



RECHARGEABLE 12V 1.2AH GELL BATTERY

Leakproof long service life batteries ideal for security systems emergency lighting or as a computer backup power supply, etc
 Cat. S15029 Normally \$19.95
 1-9 **\$13.95**
 10 **\$12.95**



50 W AMPLIFIER MODULE (ETI 480)

Cat. K44880 Normally \$31.80
SPECIAL, \$21.95
 (Heatsink optional extra)
100 W AMPLIFIER MODULE (ETI 480)
 Cat. K44801 Normally \$34.80
SPECIAL, \$28.95
 (Heatsink optional extra)

POWER SUPPLY TO SUIT

Without transformer **\$22.95**



SUPER DELUXE BATTERY CHARGER

• Charges from 1 to 10D C, AA AAA Ni, and up to 3 x 9V batteries at the same time
 • Dual colour LED in first three compartments to designate 1.5V or 9V
 • 240V AC 50Hz
 • Approval No. N10637
 Cat. M23525 **\$59.95**



METEX M-3650 MULTIMETER

20A, 3 1/2 digit frequency counter multimeter with capacitance meter and transistor tester.
 This spectacular, rugged and compact DMM has a bright yellow high impact plastic case. It features a frequency counter (to 200kHz), diode and transistor test continuity (with buzzer), capacitance meter, up to 20 amp current measurement and comprehensive AC/DC voltage, current and resistance ranges.
CHECK THESE FEATURES...
 • Push-button ON/OFF switch
 • Audible continuity test
 • Single function, 30 position easy to use rotary switch for FUNCTION and RANGE selection
 • Transistor test
 • Diode test
 • Quality probes
 • 1/2" high contrast LCD
 • Full overload protection
 • 20 Amp
 • Built-in timing ball
 • Capacitance meter
 • Instruction manual
 Q91550 Normally \$165
Special, only \$149



UHF/VHF MAST HEAD AMPLIFIER

SPECIFICATIONS:
 Gain: 40 ± 160MHz 30dB (reception) 7.5dB at 94MHz)
 170 - 230MHz 40dB
 470 - 900MHz 15dB
 Max Output: 100dB uFV
 • 1 x 75 ohm input
 • 2 x 75 ohm output
 Noise Figure: VHF 6.5dB UHF 7dB
 Input Impedance: VHF (75-300 ohm)
 UHF (75-300 ohm)
 Output Impedance: 75 ohm
 Power Supply: 12V DC 100mA
 Cat. L15046 **\$89.95**



UHF/VHF/FM ANTENNA AMPLIFIER AND 2 WAY SPLITTER.

Covers all Australian frequencies Suitable for use in houses caravans, boats etc
 • 1 x 75 ohm input
 • 2 x 75 ohm output
 • Gain 2 x 6dB
 • Maximum output 2 x 96dBuV
 Cat. L15041 **\$39.95**



METEX 3530 MULTIMETER

This instrument is a compact rugged battery operated hand held 3 1/2 digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode-Capacitance Transistor hFE and Continuity Test. The Dual-slope A/D Converter uses CMOS technology for auto zeroing, polarity selection and over range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, work-shop hobby and home applications.
Features...
 • Push button ON OFF power switch
 • Single 30 position easy to use rotary switch for FUNCTION and RANGE selection
 • 1 1/2" high contrast LCD
 • Automatic over range indication with the 1 displayed
 • Automatic polarity indication on DC ranges
 • All ranges fully protected plus Automatic ZERO of all ranges without short circuit except 200 ohm Range which shows 000 or 001
 • High Surge Voltage protection 1.5 kV 3 kV
 • Capacitance measurements to 1pF
 • Diode testing with 1 mA fixed current
 • Audible Continuity Test
 • Transistor hFE Test
SPECIFICATIONS:
Maximum Display: 1999 counts
 3 1/2 digit type with automatic polarity indication
Indication Method: LCD display
Measuring Method: Dual-slope in A/D converter system
Over-range Indication: 1 Figure only in the display
Temperature Ranges: Operating 0°C to +40°C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)
 Cat. Q91540 Normally \$139
SPECIAL \$109

ROD IRVING ELECTRONICS YOUR COMPLETE ELECTRONICS STORE



QUALITY 3mm LEDs

Cat. No. Col. 1-9 10+ 100-
Z10140 Red \$0.15 \$0.12 \$0.10
Z10141 Grn \$0.20 \$0.15 \$0.12
Z10143 Ylw \$0.20 \$0.15 \$0.12
Z10145 Ora \$0.20 \$0.15 \$0.12

QUALITY 5mm LEDs

Cat. No. Col. 1-9 10+ 100-
Z10150 Red \$0.08 \$0.07 \$0.06
Z10151 Grn \$0.15 \$0.12 \$0.10
Z10152 Ylw \$0.15 \$0.12 \$0.10



30V/1A FULLY PROTECTED POWER SUPPLY

The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0V to 30V and selectable current limit. Both voltage and current metering is provided. (ETI Dec 83) ETI 162 Cat. K41620 Normally \$73.50
SPECIAL, \$63.50



ELECTRONIC MOUSETRAP KIT

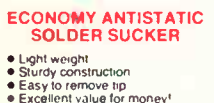
This clever electronic mousetrap disposes of mice instantly and mercifully without 'fall' and resets itself automatically. They'll never get away with the cheese again! (ETI Aug 84) ETI 1524 Cat. K55240 **\$39.95**



ECONOMY SOLDER SUCKER

- Light weight
- Sturdy construction
- Easy to remove tip
- Excellent value for money!

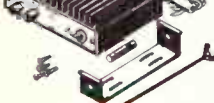
Cat. T11271 **\$11.95**



ECONOMY ANTISTATIC SOLDER SUCKER

- Light weight
- Sturdy construction
- Easy to remove tip
- Excellent value for money!

Cat. T11281 **\$13.95**



STEP DOWN CONVERTER DC-DC

Built around a heavy duty heatsink this unit features the latest transistor switching technology to convert 24V DC to 13.8V DC. Finished in matt black with a unique mounting bracket makes it the best in its class.

SPECIFICATIONS:
Input Voltage: 24V DC
Output Voltage: 13.8V DC
Primary Current: 4.2A (24V input 4A output)
Output Current: 4 Amp continuous rated (5.5A max.)
Size: 125(W) x 50(H) x 90(D)mm
Weight: 450 grams
A16155 **\$99.95**



10A STEP DOWN CONVERTER DC-DC

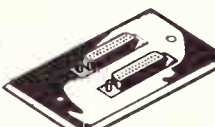
Built around a heavy duty heatsink this unit features the latest transistor switching technology to convert 24V DC to 13.8V DC. Finished in matt black.

SPECIFICATIONS:
Input Voltage: 24V DC
Output Voltage: 13.8V DC
Primary Current: 11A (24V input, 10A output)
Output Current: 8 Amp continuous rated (12A max.)
Size: 125(W) x 50(H) x 175(D)mm
Weight: 900 grams
A16160 **\$119.95**



FM ANTENNA

88-108MHz 75 300 Ohm
Cat. L11015 **\$14.95**



DUAL DB25 SOCKET WALL PLATE

- Fitted with 2 x DB25S sockets (RS232)
- Anodised aluminium plate
- Includes mounting hardware

P10948 **\$19.95**



NEW! TELEPHONE INDUCTION COIL

- For recording or amplification
- 3.5mm plug with 1 metre cord
- Peel-off stick-on adhesive back

A12032 **\$5.95**



10 AMP RELAY

SPDT 12V Coil, 240V (S14114)
1-9 10+ 100-
\$4.95 \$3.95 \$3.75



1W AUDIO AMPLIFIER KIT

A low-cost general-purpose 1 watt audio amplifier suitable for increasing your computers audio level etc. (EA Nov 84)
Cat. T11281 **\$9.95**



MINIATURE HOBBY VICE

- Lever operated suction gnp base for instant mounting and portability
- Mounts on smooth non-porous surfaces
- Ideal for holding components, and other small/light objects

Cat. T12458 **only \$5.45**



CODE KEY PAD

- Telephone type digital keypad
- Four digit, changeable code
- Over 5000 possible combinations
- Power consumption: 5mA standby, 50mA alarm
- Two sector LED and 1 arm LED
- Wrong number lockout
- 12V DC operation
- Relay output
- Panic button
- Normally open tamper switch
- Dimensions 145 x 100 x 37mm
- ACP3 compatible

Cat. A13014 R.R.P. \$79.95
SPECIAL, ONLY \$69.95



MODEM TRANSFORMER

PCB pins spacing 25mm, equipment to line 15mm between equipment pins 25mm between line pins
CAT No. 1-9 10+
M10230 **\$14.95 \$13.95**



NICADS!

Save a fortune on expensive throw away batteries with these quality Nicads and Rechargers!

Size Desc. 1-9 10+ 100-
AA 450 mA H \$2.95 \$2.75 \$2.50
C 1 2 A H \$9.95 \$9.50 \$8.95
D 1 2 A H \$9.95 \$9.50 \$8.95



POCKET SIZE BATTERY TESTER

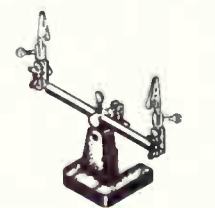
- Tests all 9V to 1.5V batteries including button cells
- Arms extend to various battery sizes
- Easy to read meter
- Requires no power source

M23521 **\$11.95**



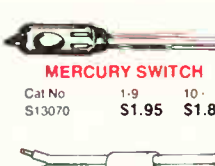
MUSICOLOR IV

Add excitement to parties, card nights and discos with EAs Musicolor IV light show. This is the latest in the famous line of musicolors and it offers features such as four channel 'color organ' plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety. (EA Aug '81) 81MC8
Cat. K81080 **\$114.95**



PC BOARD HOLDER

Better than an extra pair of hands! A must for all PCB work.
Cat. T12444 **\$9.95**



MERCURY SWITCH

Cat No. 1-9 10+
S13070 **\$1.95 \$1.85**



CAR BATTERY ISOLATOR

Designed for car burglar alarm back-up battery. Allows the back-up battery to be charged from the car battery and isolates the back-up battery by not allowing the back-up battery to drain back to the car battery.
A12095 **\$3.20**



RECESSED SPEAKER TERMINAL

Push button red and black terminals
Cat. P10248 **\$1.95**



TELEPHONE EXTENSION BELL

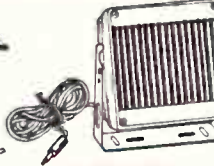
- 10 metre length extension cord
- Features US type plug
- Use with US-Australian adaptor

Y16043 **\$25.95**



NUMERIC KEYPAD

Unencased keypad, 10 digit keys plus two utility keys. Light grey in colour.
OUTPUT ARRANGEMENT:
Output/Pin No. Symbol
1 N/A
2 Shield plate
3 Column 2
4 Column 3
5 Row 1
6 Column 1
7 Row 2
8 Column 2
9 Row 3
10 N/A
Cat. C19030
1-9 10+ 100+
\$2.95 \$2.50 \$1.95



CB SPEAKER

- 10cm (4") speaker
- 3 metre cord with 3.5mm plug
- Impedance 8 ohms
- Power 5 watts
- Complete with mounting bracket

Cat. A12074 **\$24.95**



SPEAKER CONTROLLER (TAA801)

- Enables up to 5 pairs of stereo speakers to be switched on or off in any combination
- Rated at 50 watts continuous per channel
- Stereo headphone socket available for private listening
- Constant minimum load circuit protects amplifier regardless of how many speakers are connected
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Cat. A16054 **\$59.95**



KEY SWITCHES

Cat. S12500 Normally \$7.95
1-9 10+ 25+
\$4.95ea \$4.25ea \$3.95ea



ELECTRIC FENCE CONTROLLER KIT

Restore discipline to the farm or allotment with this new electric fence controller. It features higher output power and lower current drain than the previous design for use in rural areas. (EA Dec 85 85ef11)
Cat. K85110 Normally \$49.95
SPECIAL, \$45.95



FOOT SWITCHES

- Momentary or on/off models to choose from
- Cord length 2.5 metres
- 6.3mm plug

A17000 Momentary operation
A17005 Push-On/Off operation
each **\$19.95**



NEW!
IEC MAINS LEAD
3 pin mains plug to 3 pin IEC plug
1.8 metres long
P10252 **\$5.95**



IEC PLUG
3 pin female line plug 250V 6 Amp
P10251 **\$2.95**

IEC SOCKET
3 pin male chassis socket 250V 6A
P10250 **\$2.50**



INSULATION DISPLACEMENT TYPE HEADER PLUGS

Gold plated ribbon cable plug that plugs directly into PCB mounted IC sockets. All include press-fit cap that fits into bottom half of plug over IDC cable.
Cat. No. Description 1-9 10+
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P12124 24 pin \$2.95 \$2.75
P12140 40 pin \$5.95 \$5.75



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\$500 plus		\$12.50

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Microbee Still Humming

Microbee Systems, makers of the Microbee computer, has escaped death again. The company has lurched from crisis to crisis over the past few years, in spite of technically excellent products and firm contracts from the New South Wales and Swedish education departments.

Microbee was taken over by Impact Systems in a deal that saw Microbee boss Owen Hill relinquish some of his decision making ability last year. However Impact, who rose to fame as an OEM printer maker has had troubles of its own. Now Compumark has stepped in and acquired both companies.

Compumark has bought 4.32 million (20 per cent) Microbee shares for one cent each from the receiver appointed to Impact Systems (Alex MacIntosh of Peat Marwick Hungerfords). It also has issued a Part C takeover with the Sydney Stock Exchange to acquire more Microbee shares at 1½ cents each.

Compumark purchased 5 million options to take up ordinary shares for \$1000 from Impact. These are all the options

that Impact holds.

Impact Systems held 47 per cent of Microbee shares, most of which it acquired from Owen Hill, for \$800,000.

Regulations governing company procedures prevented it from buying more than 20 per cent of these without making a takeover bid.

In addition to selling 20 per cent of Microbee shares to Compumark for \$43,200, the receiver "with the approval of secured lenders," cancelled a debt of \$1.2 million which Microbee owed to Impact Systems.

Microbee, which has been suspended since the resignation of Impact Systems' managing director John Price, was given permission to relist.

Microbee owes Westpac \$1.7 million, the Australian Tax Office \$250,000 and \$700,000 to other creditors, according to a report in Pacific Computer Weekly. The moves have left Hill with only 10 per cent of the 'Bee, but he is still managing director, as well as director of research.

Sarich Engine Study Completed

The Minister for Industry, Technology and Commerce, Senator John Button, announced recently he had received the final report on the potential for the manufacture in Australia of the Sarich two-stroke engine.

The report found that manufacture of the engine in Australia would be feasible provided:

- The development of the engine is successfully completed; and
- a substantial international market is found for the engine.

The most likely end user would be an international vehicle manufacturer wishing to engineer a vehicle around the unique specifications of the Sarich engine.

If development of the engine continues on schedule, it will take about nine months for the preparatory work to be completed. The study found that once the development stage is completed, it could take between five and seven years to progress

the engine to the production stage. This timetable could be reduced depending on the priority given to the project.

The development work of the Orbital Engine Company has involved expenditure of about \$40m over the last 15 years. Originally, it was set up to build a revolutionary rotary engine but development has proven immensely complex. Sarich has been working on the two-stroke for the last few years in an effort to produce a marketable product. Substantial contributions and incentives have been provided by the Federal and West Australian Governments, including funding of this study.

To assist companies genuinely interested in the establishment of such a facility in Australia and to preserve commercial confidentiality, the report and blueprint will be made available through the Automotive Industry Authority in consultation with the Orbital Engine Company.

Chemical Bonds Observed

Using extraordinarily short, strobe-like pulses of laser light, scientists have observed the progress of the fastest chemical reaction ever studied — the kind of reaction that triggers vision.

The laser bursts provide a "slow-motion" measurement of a chemical bond twisting 90 degrees in 100 femtoseconds. A chemical bond is a link between two atoms in a molecule.

The findings are reported (Science, May 1988) by a research team led by Charles Shank, of AT&T and Richard Mathies, of UCLA. The study further reveals that the bond continues to twist another 90 degrees in 400 fsec, completing a 180-degree rotation by the end of the reaction. In the light-sensing rod cells of the

eye, the same kind of reaction starts a cascade of chemical changes that allow the eye to detect light — the basis of vision. The first step reported in the journal, is the only one actually triggered by light.

The laser-aided detection shows for the first time how quickly the first part of this reaction occurs and establishes with certainty that it is indeed the first step in the vital light-sensing process.

In the experiment, the scientists used the laser pulses to measure how light was absorbed by the molecule as the rapid reaction proceeded. Changes in the pattern of the light absorbed provide direct evidence of the shape of the molecule and the progress of the reaction.



Nukes for Canada

The Canadian Navy (RCN) will be allowed to buy British "Trafalgar" class nuclear powered attack submarines. US President Ronald Reagan confirmed this during a meeting with Canadian Prime Minister Mulroney in May. US confirmation was required because the Trafalgar class vessels use American components in their reactors.

In the normal course of events, such a deal between close allies would cause little comment. However, this case is unusual, because the prime motivation for the Canadian deal is to assert Canadian sovereignty over the North West Passage, an icy channel of sometimes open sea between the Atlantic and Pacific oceans across the top of Canada. It is

used regularly by US submarines transiting between two oceans, a practice the Canadians would like to be able to monitor.

The US position is that the North West Passage is an international sea way, and the Canadians have no right to close it off. It's the same argument that the US Navy had with Colonel Gaddafi in Libya last year over the Gulf of Sidra. In the Libyan case, the argument flared into open warfare quickly. The dispute with the Canadians has been settled rather more amicably.

In a recent deal the US agreed to acknowledge the Canadians 'special interest' in the area, and to inform Montreal of its ship movements through the channel. The Canadians agreed to the right of the US to navigate through it. Nevertheless the Canadians are still buying the subs.

Radarsat on hold

Radarsat, the proposed innovative Canadian designed Earth sensing radar satellite, has been



put on hold, following a decision by the British to withdraw from the deal.

The British were forced to pull out of the project when the government slashed funds for space research as part of a review carried out earlier this year. The money will now go into a small number of joint projects with the European Space Association.

The Canadians are busy searching for a new partner. Financial constraints prevent them from going it alone. Most of the Canadian Space budget is taken up with commitments to the American Space station. C\$1200m is currently ear-

marked for the venture, which is seen in Canada as crucial for a number of high technology endeavours currently underway.

In part, Canadian enthusiasm for the space station is fueled by their experience with the Canada Arm, the robot manipulator on the Space Shuttle. Work for this project has spawned a number of companies in Canada that are now doing good business out of experience gained during the project. The Canadian government believes it is essential to keep the association going in order to maintain Canadian pre-eminence in the field.

Frequency

ness gatherings in rather amusing fashion). Treasurer Keating's May mini-budget promised to cut the 150% rebate to 100% in 1990, signalling that government largess, along with government patience, is wearing thin.

This is the wrong response. It is true that the R and D policy has not been the high speed success that the government hoped it would, but a more subtle analysis of the state of the nation would have allowed them to predict that. Essentially, the problem is that the wrong people control this industry, and sit on its senior boards. We need to remember that in a capitalist environment survival belongs to the fittest. "Fittest", (in a rather circular argument) means having those attributes that best lead to survival. By and large, the attributes which until very recently led to survival in Australian manufacturing were extreme fiscal conservatism and chronic lack of technological imagination. It should surprise no one when big Australian companies invest with complete if misplaced confidence in Foreign Exchange dealings while simultaneously failing to invest in new products. They won't spend money on R and D unless the government sets up the lab for them, pays to staff it, and tells them what the product should be. And then they would complain about government interference in the free market.

On the other hand, a new breed of electronic entrepreneur is becoming visible in Australia. They are the people who are making the difference between 3.1% and 3.4%. They are the people who, in 10 years time, will control this industry and reshape it in their own image, and they are the people who are almost totally dependent on the 150% scheme. It is essential they be allowed to succeed.

A new more viable industry in this country will not come easy, nor will it come fast. This government will not live to see the fruit of its action. And there, of course, lies the rub. How does one convince Mr Paul Keating that he should invest in the success of some other treasurer? I do hope that all those flash new entrepreneurs have some good arguments to present to him.

Next Month

If ETI identifies with the entrepreneurial companies of Australia, it's because in our own small way, that's how we like to see ourselves. And our audience is being rather kind to us. As a result, next month, we will be bigger, prettier, look quite a bit different and have more of everything. Look out for it.

The weaker sex?

Ten of the top fourteen medals awarded in 1988 by the University of Technology, Sydney, have been won by women students. Although they make up only 35 per cent of the student body, they have consistently taken out more than their fair share of awards.

UTS, the old New South Wales Institute of Technology, began as an engineering school about thirty years ago, and its student body was almost entirely male dominated. Over the past ten years or so, more faculties have been added, including nursing, law, marketing, and biomedical science which have resulted in a greater female enrolment. At the same time, women have begun enrolling in the engineering faculties as well, currently making up about 4.4 per cent of the student body in these faculties.

Among the medal winners,



Fiona Delmas and Susan Oxborrow.

Leslie Francis won in Computing Science, Susan Haggett and Suzanne McNamee in Applied Science, and Fiona Delmas and Susan Oxborrow in Civil engineering. Men managed to withstand the onslaught in Electrical engineering (Tim Wall), although women took out most of the top places. Women won in Law, Accounting and Marketing, while men held on to Architecture and Mathematics.

Industry Study

The Chairman of the Information Industries Board, Professor Jeremy Davis, has announced that IDC Australia has been awarded the contract to carry out a study into the information and communications services industries.

The study will analyse the structure, strengths and prospects of the Australian industry. It will also seek to identify ways in which industry and government can work together to develop a thriving industry with a significant export base.

The Information Industries Board was established as part of the Information Industries Strategy announced by the Minister for Industry, Technology and Commerce, Senator John Button in September last year.

IDC Australia, as a prime contractor, will be assisted by Strategic Technology Management and Professor Henry Ergas, Visiting Fellow, Monash

Graduate School of Management.

The study sponsored by the Department of Industry, Technology and Commerce and Austrade, is being jointly funded by the Information Industries Board and Austrade.

The study aims to identify the characteristics of Australia's information and communication services, including the international and domestic markets and the actions required by industry and government to enhance Australia's information and communications services both domestically and internationally.

The need for such a study became apparent during the consultative process leading up to the Information Industries Strategy. Industry, unions and the Government representatives concluded that information and communication services have significant potential to contribute to Australia's future.

The Brain Gain

A report from a Department of Industry Trade and Commerce (DITAC) researcher, Dr Glenn Pure, says that Australia is gaining in scientists and engineers, not losing them. It's a brain gain, not a brain drain, contrary to evidence.

The report which covers the period 1983-1987, shows that Australia gained 134 engineers for every 100 it lost. According to Pure most of the gain is due to expatriate engineers returning to Australia. He separated our Australian citizens from migrants and discovered more Australians returning than leaving. On top of this, Pure noted foreign engineers immigrating

under the government's skilled immigration schemes.

The findings would be consistent with suggestions that a nett outflow of engineers occurred up to 1981, when manufacturing, and Australian investment in research both reached rock bottom. As investment has increased, the need for technicians stepped up accordingly.

Pure also divided the engineers by specialisation and found that the biggest growth was in production engineers, up 607 in 1987, and electrical engineers, up 306. The total gain during the year was 1624 plus 686 scientists.

Qubit and the Navy

Australian technology company Qubit has won a \$6.5 million contract with the Royal Australian Navy.

Fremantle-based Qubit, which specialises in marine navigation and defence technology, was awarded the contract ahead of keen international competition.

Equipment and technology supplied by Qubit will be used in the Navy's Hydrographic Data Logging and Processing System, known as HYDLAPS.

Qubit will provide "state of the art" integrated navigation systems for the RAN's hydrographic ships. HMAS Moresby and HMAS Flinders, and their attendant survey boats.

HYDLAPS will replace the Navy's manual system of data collection, which is laborious, time-consuming and prone to human error.

The new equipment will allow data collection at a much faster rate and with greater accuracy.

The Multi-Function-Polis

Australia and Japan are planning to conduct a \$5 million feasibility study into the possibility of building a high-technology city somewhere in Australia. The city population would be 250,000 and would cost at least \$1 billion.

As might be expected the idea originates from the Japanese ministry of international trade and industry (MITI). Technopolises are reasonably common in Japan but none have been built on the scale of the projected Australian model.

All states except Tasmania are falling over themselves to impress the Japanese. Apparently the planners want the city to have a resort-like atmosphere so the Gold Coast is tipped as the most likely contender. Apart from the climate the Japanese are looking at Australia on account of its strong research base and the fact that it is ideally suited to act as a confluence for Japanese, European and American technology.

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SAVE \$206!
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- 120 C P S
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- Print Modes: NLC, Dot Graphics, Proportional Font, Draft
- Proportional Printing
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- Proportional Printing
- Logic Seeking
- 1K Printer Buffer

Cat. C20035 Normally \$595
SAVE \$206, ONLY \$389



PRICE BREAK THROUGH!
20 M/BYTE HARD DISK

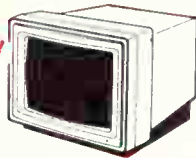
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40 M/BYTE HARD DISK

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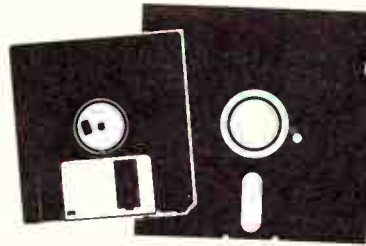


Z-DIN 12" 20MHz COMPOSITE MONITOR

X14514 (GREEN) \$129
X14516 (AMBER) \$129
(10 OR MORE \$119 EACH!)

ZDIN TTL 12" MONITOR

SPECIFICATIONS:
TUBE: "12" 90" non glare dark screen
SIGNAL CONNECTOR: 9 pin D connector
INPUT:
Input signal: Separate signal with intensity
Video Input: 4.0V p-p 1.5V positive going
Horizontal Frequency: 18.44 KHz
EXTERNAL CONTROLS: On Off Brightness Contrast V Size V Hold V-Line
VIDEO
Display Area: 210 x 150mm
Display Format: 25 lines 80 characters per line 9 x 4 dots per character block
Frequency Bandwidth: 22MHz
Resolution: 900 lines at centre 80 characters x 25 lines
POWER
Consumption: 35W
120V AC, 50Hz, 0.15A
DIMENSIONS:
327(W) x 310(D) x 286(H)mm
Cat No Description Price
X14500 (GREEN) \$149
X14502 (AMBER) \$149



CPF CONTINUOUS POWER FILTER SPIKE ARRESTOR

"NO BRAND" DISKS!

Now you can buy absolute top quality disks that are also the cheapest in Australia! They even come with a lifetime warranty, which indicates the quality of these disks. So why pay 2-3 times the price for the same quality?

Packs of 10, D/S D/D without boxes, or brand name, just their white paper jacket, and index labels. (5 1/4" disks includes write protects).

5 1/4" 2S/2D

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10 + DISKS \$7.95^{ea} 100 + DISKS \$7.50^{ea} 1,000 + DISKS \$6.95^{ea}
(ALL PRICES PER 10 DISKS TAX EXEMPT PRICES LESS \$1)

5 1/4" HIGH DENSITY "NO BRAND" DISKS

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PRINTER STANDS

- Restores order to your work area
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- Made of black plastic coated steel
- Suitable for most printers
- Excellent value at these prices!

C21054 (80/132 column) \$26.95



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LQ1000 (C22012)	10	\$27.60	10	\$25.00

NEC DISK DRIVES

3 1/2" DISK DRIVE

- 1 M Byte unformatted (640K formatted)
- Double sided double density
- Access Time 3m sec

Cat. C22055 \$255

5 1/4" SLIMLINE

- Switchable 1.6 M Byte to 1 M Byte unformatted
- 1.2 M Byte to 720K formatted
- Double sided double density
- AT compatible

Cat. C11906 \$269

8" SLIMLINE

- Double sided double density
- 1.6 M Byte unformatted

Cat. C11908 \$785



5 1/4" DISK STORAGE (DD100-L)

Efficient and practical! Protect your disks from being damaged or lost!
Features...

- 100 x 5 1/4" disk capacity
- Smoked plastic hinged lid
- Lockable (2 keys supplied)
- High impact ABS plastic base
- Contemporary design

C16020 **only \$17.95**



JUMBO 5 1/4" DISK STORAGE (DD120-L)

If you have lots of disks you'll appreciate the extra capacity of this disk storage unit when it comes to locating a particular disk.

- 120 x 5 1/4" disk capacity
- Smoked plastic hinged lid
- Lockable (2 keys supplied)
- High impact plastic base

C16028 **only \$22.95**



BABY AT* COMPATIBLE COMPUTER! FROM \$2,295

- Final assembling and testing in Australia!
- 1 M/Byte Main Board
- Switchable 8/10/12 MHz
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- 80286 CPU
- Colour Graphics Display Card
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- Floppy & Hard Disk Controller
- Printer Card and RS232
- Keyboard
- 200W Power Supply
- Manual
- 6 Months Warranty
- Dimensions 360(W) x 175(H) x 405(D)mm

SHORT BABY AT* 512K RAM... \$2,295

STANDARD BABY AT* 640K RAM, hard disk drive...

WITH 20 M/BYTE HARD DISK ... **\$3,295**
WITH 40 M/BYTE HARD DISK ... **\$3,795**
WITH 80 M/BYTE HARD DISK ... **\$4,695**



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All prices 10 disk boxes!

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INDUSTRY NEWS

The Managing Director of the Rakon group of companies, Warren Robinson, has appointed the former NSW sales manager for Unisys Australia, Colin Morris as general manager of Rakon Computers. Robinson said that the early sales experience gained by Morris with Burroughs Australia, in marketing and product design and later as director of corporate communications for the company, established a firm sales and marketing background which combined with his experience at Unisys, would be invaluable to Rakon Computers.

★ ★ ★

Alcatel-STC, the newly formed French multinational which now owns STC, reports a group result for 1987 of \$357.6 million, comparable with the level achieved in 1986. During 1987, Alcatel-STC committed \$250 million for research and development and new laboratory equipment and manufacturing plants for the next five years, and won a \$50 million three-year export contract to supply digital transmission equipment to New Zealand.

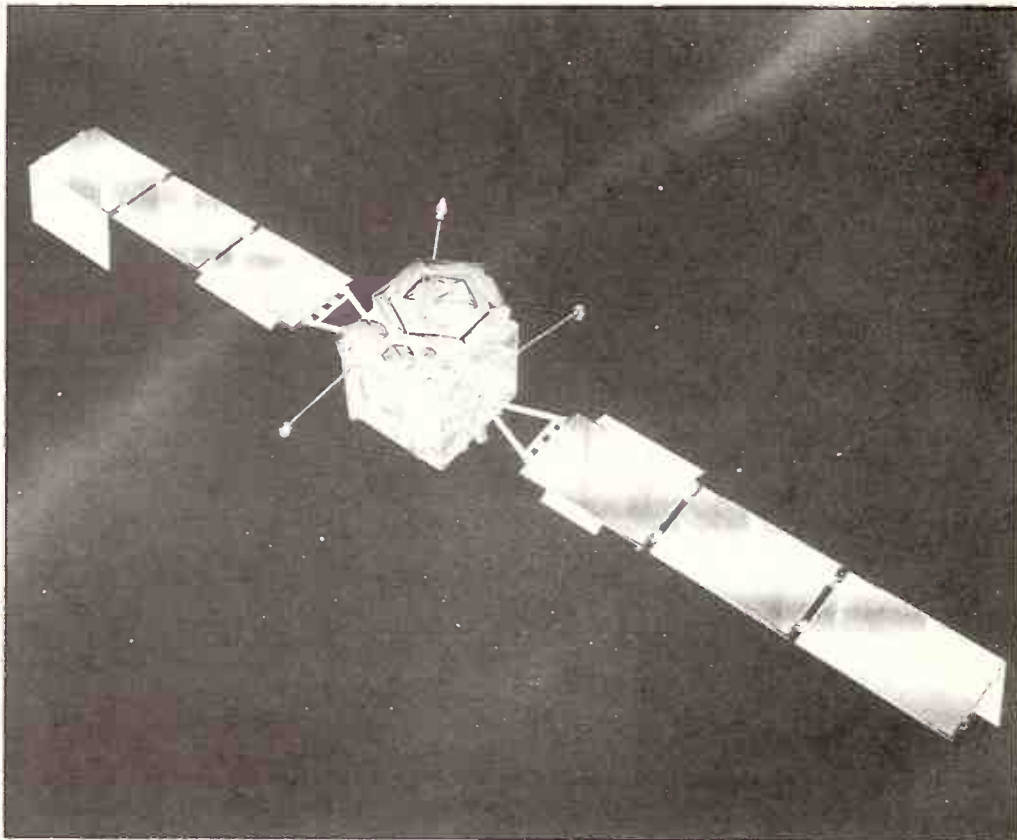
★ ★ ★

Sydney PCB design Bureau, Electri-Board Designs has undergone a major restructure. Managing-Director Deric Netting has bought out former partner Ilmar Timmerman giving him full control of the company.

★ ★ ★

Industry veteran Stuart Wright re-established links dating back nearly 16 years when invited by Peter Stone, Managing Director of RVB Products, to take up the role of National Marketing Manager for the company.

"The choice was easy," said Mr Stone "Stuart pioneered the National Relay product line in Australia and following changes both at RVB and Stuart's former company, Daneva, we felt the time was right to reunite the talent with the product line."



INMARSAT 2 Communications Satellite. The International Maritime Satellite Organisation (Inmarsat) has ordered a fourth INMARSAT 2 communications satellite from British Aerospace. Using the successful 'EUROSTAR' three-axis stabilised platform design, INMARSAT 2 satellites will provide the Inmarsat organisation with its second generation space segment providing a global maritime mobile communications service.

AWA Sales In India

AWA has received a letter of intent to supply air navigation equipment worth \$2.3 million to India and has signed a five-year technological exchange agreement which will open up the Indian aviation equipment market to still more Australian high-tech products.

It is the second export order for Australian air navigation technology in recent weeks. Late in February AWA delivered advanced Doppler VOR (DVOR) equipment to Papua New Guinea under a \$400,000 contract.

"We said then that we expected further overseas sales of this type of equipment, in which AWA is a world leader," said Wes Oke, general manager of the airways and communications systems unit of AWA Defence and Aerospace.

"This latest success shows that we are getting into our stride and we intend to complete on the world stage even more vigorously as time goes on."

Initial sales will be to the Indian National Airports Authority, and will comprise three sets of each of AWA DVOR equipment and Distance Measuring Equipment (DME).

A DVOR unit acts as an omnidirectional radio lighthouse for homing in aircraft to airports where buildings, trees or mountains cause interference to the signals from conventional VOR installations. DME gives the pilot a precise reading on his distance from fixed ground stations. Used together, they give pilots an exact fix on position and direction.

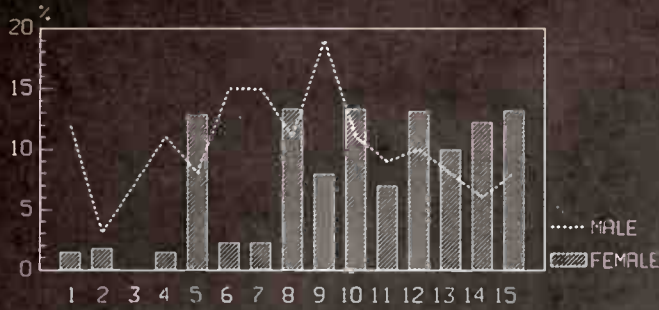
The technology exchange agreement has been signed by

the company and state-owned Gujarat Communications and Electronics Limited of Baroda in Gujarat State. It runs for five years.

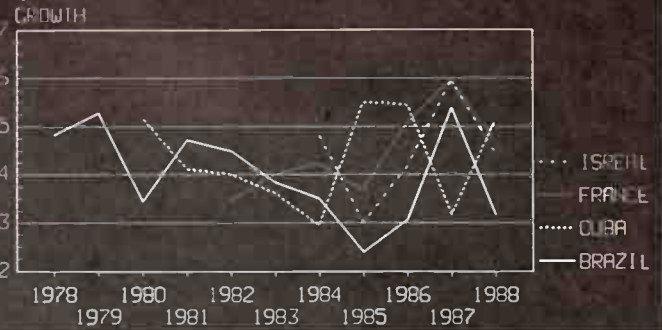
"It is very likely that the Indian authorities will progressively purchase more AWA en route air navigational technology in the years ahead, as they develop the capability to build our equipment locally," said Wes Oke. "It is reasonable to expect contracts worth several millions of dollars."

He added that the Indian agreement could well be extended to cover conventional VOR units, for which the demand in India is expected to exceed 15 sets over the next five years, worth some \$3.5 million. AWA is now completing the development of its own VOR design to meet this need.

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Synroc

Last month it was reported that Neville Wran, the chairman of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), had agreed that the organisation should help the company, Nuclear Waste Management of Adelaide, with its plans to use the locally developed Synroc process to dispose of the waste.

The incident has highlighted the political sensitivities which are holding back the development of a potentially lucrative industry based on the Synroc process. This was invented by Ted Ringwood of the Australian National University and involves the production of a highly stable synthetic rock (Synroc) which traps and immobilises nuclear waste in its crystal lattices. It can withstand extremely high temperatures and pressures.

Nuclear Waste Management had proposed to both Hawke and Wran that a Synroc plant should be set up in either Japan, Europe or Australia. The company's chairman, Sir Ben Dickinson, prefers Australia because of its vast tracts of desert, its non-nuclear status and the fact that the process was initially developed in the country.

Work on Synroc has been under way since 1978: despite Hawke's categorical rejection of its use, the government has so far spent A\$4 million on developing it and has allocated a further A\$6 million over the

next four years. This will be used for further testing of Synroc in a commercial-scale demonstration plant being commissioned by the Australian Nuclear Science and Technology Organisation.

The plant will have a capacity of 10 kilograms an hour and will be used to test the production technology, using non-radioactive samples. Tests on Synroc using radioactive waste are underway in Britain, the US, Canada, Germany and Japan; under a collaborative



Mr Neville Wran

agreement, the UK Atomic Energy Authority has made small samples of Synroc, full loaded with highly active wastes from a commercial power reactor. The tests are proving that Synroc is a potentially excellent storage medium with considerable advantages over the more common borosilicate glass. However the idea that Synroc stored nuclear waste should be placed in Australia is likely to remain politically unfeasible for many years

Transistors Respond to Single Electron

Researchers at AT&T Bell Laboratories have created experimental single-electron transistors — devices so sensitive that just one electron produces changes in the current flowing through them.

The devices are prototypes that operate only at very low temperatures. However, scientists here feel their perform-

ance may foreshadow a generation of all-metal transistors that are extremely fast and small and consume very little power.

The devices work best when composed of superconducting materials. In their present form, they could be used as electrometers in experiments to measure induced charges as small as 1 pc of an electron.

NASA News Updates

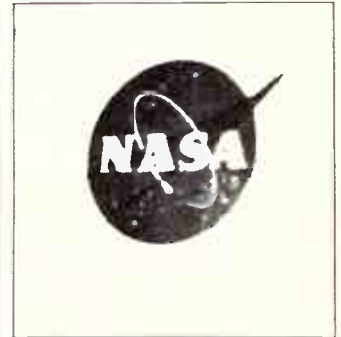
Yet another Space Shuttle delay. NASA have now named the 25th of August as the new launch date for "Discovery". The reason given was difficulties encountered in stacking the solid rocket boosters. The delay now means that the main test firing will be in late July.

Crews have been named for missions up to STS 31. One notable omission from the list is Astronaut John Young who was slated on his command of the Hubble Space Telescope deployment mission. His replacement is Loren Shriver from the Class of '78.

Another Skylab? NASA officials are now starting to worry about the Long Duration Exposure Facility. Launched on mission 41C in 1984, it is scheduled to re-enter the Earth's atmosphere in 1990. It is hoped that the shuttle would have picked it up by then.

Budget woes for NASA continue. To keep the Space Shuttle and the most troubled Space Station afloat all new programs will have to go according to Congressman Ed Boland one of Congress' more influential members.

Former Astronaut Sally Ride



has been appointed to Apple's board of directors. Ride's name has also been mentioned as deputy administrator for NASA after the '88 election.

The National Research Council who have been overseeing NASA's return to flight has announced that there seem to be no major obstacles for the Shuttle launch in August.

In the continuing Soviet custom of launching people from friendly nations into space, a joint Soviet/Afghan flight will take place in August for a duration of a week to ten days.

NASA has announced plans to acquire another 747 aircraft for use as a Shuttle carrier. At the present time there is only one and if it was to crash the shuttle fleet would be grounded. — Kathryn Doolan

Laser cutting

A Brisbane model maker, Peter Sands, is revolutionising production of high quality precision scale architectural models with laser cutting.

He is using a Gold Coast manufactured Laser Dynamics computer controlled laser profiler.

Sands' design and production team can produce scale-perfect models working from architectural sketches, engineering specifications or written details. He bought the \$200,000 LDL laser profiler and associated LDL computer equipment and software last July after a fire destroyed his previous CNC milling machine and computer

equipment.

"I saw many potential benefits in laser cutting and already these are highly evident to our clients," Sands said.

"Among these are cleaner, faster, more accurate cutting of finely detailed model features which can be duplicated with absolute consistency and, most importantly, require no further finishing operation."

Detail which was almost impossible to achieve by previous methods is simply and accurately achieved with the LDL laser. As well, repetitive operations, or the production of duplicates, is substantially faster and easier.

Next
month



A
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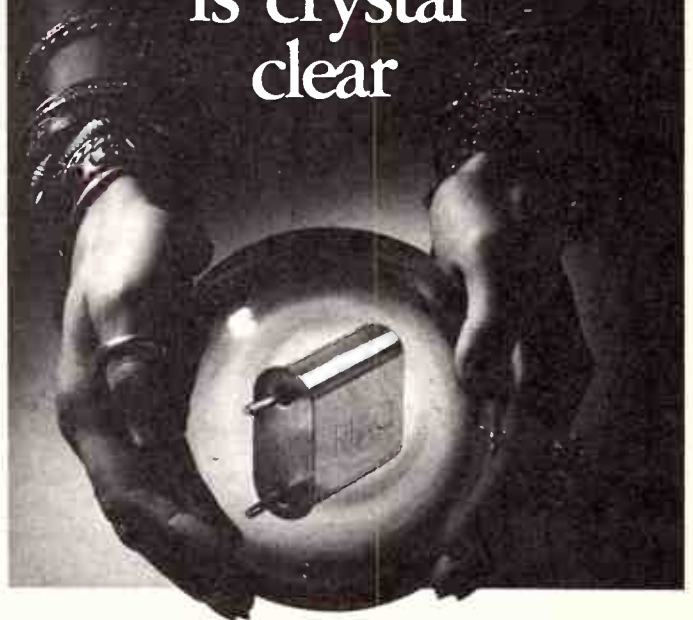
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Government Reviews Policy On Telecommunications

The Minister for Transport and Communications, Senator Gareth Evans announced wide ranging changes to the government's telecommunications policy on May 25. The restructuring, the outcome of a nine month policy review, has been broadly welcomed by the industry and the three state-owned telecommunications carriers. Telecom, Aus-sat and OTC, but heavily criticised by the Telecommunications Union and the Federal Opposition.

Opposition Communications spokesman, Senator Tony Mes-sner, claimed that the government had been "crushed by union pressure" and had "discarded any attempt to deregulate the telecommunications industry". He dismissed the review as "a total farce".

The restructuring will take place on two fronts. Firstly a major revision of the regulatory regime including stripping Telecom of its regulatory powers, an opening of the market in value added services and customer premises equipment, and a more clearly defined and accountable role for Telecom in the provision of community service obligations such as loss making rural telephones and public call boxes. Secondly, there will be substantial changes to the ways in which the three carriers, and Telecom in particular, are managed by and reported to the Federal Government. The new regime for telecommunications services is elaborated in a 230 page book: *Australian Telecommunications Services: a new framework*, obtainable from government bookshops.

Overall, the Government's stated objectives have been:

- ★ to maintain universal access to the standard telephone service,
- ★ to maximises the efficiency of the three carriers,
- ★ to provide the capacity to achieve expansion of the network and the introduction of

a diverse range of new services,

- ★ to enable the Australian telecommunications industry to participate in the rapidly growing Australian and world telecommunications markets,
- ★ to promote the development of other sectors of the economy through a full range of telecommunications services at reasonable prices.

A major aspect of the new regime will be the establishment, in July next year, of an independent regulatory body to take over the regulatory functions of Telecom which has been widely criticised for being both player and referee in the telecommunications marketplace.

The new body, the Australian Telecommunications Authority (Austel), will be a statutory authority reporting to the Minister for Transport and Communications. It is expected to have a staff of 70 and an annual budget of \$5 million.

Assess Standards

Austel will assess and approve the technical and safety standards of all equipment for connection to the telecommunications network. This function is presently performed by Telecom and when a similar structure, Oftel, was set up in the UK, British Telecom continued to perform much of this work on contract as it was the major source of expertise, a similar situation could develop in Australia.

Under the new regime the three carriers, Telecom Aus-sat and OTC, and private industry will all be allowed to offer value-added telecommunications services. Austel will administer the boundary between basic and value-added services and will ensure that the carriers' monopoly over basic services is protected. It will ensure that the carriers maintain separate accounting systems for their value added



Sen. Evans . . . wide ranging changes to policy.

operations and do not unfairly use their monopoly powers against competitors.

Austel will also have to decide exactly where the boundary between basic and value-added lies. This is a problem which is plaguing telecommunications carriers worldwide. Telecom recently made its own judgment in the Value Added Services Policy released last September after much heated argument with industry.

The policy drew a distinction between reserved services (which Telecom will supply exclusively) and value added services. The Government's policy statement has followed this line, stating that "any telecommunication service not explicitly reserved for Telecom, OTC or Ausset will be open to competitive provision". This definition may seem clear cut, but entrepreneurial flair aided and abetted by technological development is certain to create new

service possibilities which will require careful assessment under the new VAS policy.

The services which will continue to be classified as reserved services include public switched data, text and video services, the integrated Services Digital Network (ISDN), leased circuits and mobile telephone services. Austel however is to examine the implications for the licencing of a second cellular mobile telephone operator and report to the Government which will then review the case for licensing such an operator.

To ensure that there will be no attempt to launch a challenge to Telecom's monopolies prior to scheduled deregulations, the Government has hastily amended the Trade practices legislation to give exemption to Telecom and OTC for any of its monopoly services. It has used Section 172 of the Act which gives the Governor General power to exempt from the Act "prescribed conduct engaged in in the course of business carried on by the Commonwealth or a prescribed authority of the Commonwealth."

Speaking at seminar on the new telecommunications policy organised by the Australian Telecommunications Users Group, a lawyer Peter Leonard of Sly and Russell, said that without these regulations, the Trade Practices Act would render illegal "most if not all of the Telecom restrictive practices of which industry and customers currently complain."

According to Leonard, the regulations specifically exempt from any challenge under the Trade Practices Act.

- ★ a refusal by Telecom to grant common interest group status,
- ★ a refusal to grant authority to attach apparatus to the network,
- ★ type approval,
- ★ a refusal by Telecom to allow connection of any non-tele-

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com supplied phone to the networks.

Leonard also claimed that the regulations will give Telecom unchallengeable powers well beyond those intended by the review and will counteract the review's aim to set up "pro-competitive legislation and legislative certainty" with a move back to "justice dispensed at the Minister's discretion."

"Unless the Minister is prepared to actively intervene to support suppliers or users who complain that the existing regulations are not being administered in a pro-competitive manner and in accordance with the Government's reforms, we may be waiting for some time to see the playing field start to level out," he said.

Austel will also monitor the efficiency of the three carriers and in particular will ensure that Telecom fulfils its community service obligations for the provision of non-profitable services. These powers have the potential to be very wide ranging and the reality of the new environment will depend very much on how Austel conducts its activities. There are many unanswered questions such as how Austel will gain access to information on Telecom's efficiency, what criteria it will apply, what mechanisms there will be to effect change in the way Telecom operates.

The government's review has recognised the importance of Telecom's community service activities, but has also insisted that the costs to Telecom of meeting these obligations will need more evident. Telecom has

Rocky Electronics has just opened its new store at 244A Huntingdale Road, Huntingdale (phone 562 8559) previously at 166 Haughton Road, Huntingdale.

The new shop is set up as a wholesale/retail outlet with a large range of electronic components and accessories. It mainly supplies manufacturers, service technicians and R&D personnel.

quoted figures for this cross-subsidy in the region of \$500-\$600 million, but has never been able to provide precise breakdowns.

Breakdowns A Must

Under the new regime these breakdowns must be provided and the Department has decided that the Bureau of Transport and Communications Economics, with assistance from consultants and from Telecom, will undertake an immediate study and prepare a report on the costs and cross subsidies associated with community service obligations. The findings will be available for inclusion in Telecom's corporate plan for the 1989-90 financial year.

The review has not produced any changes to the ownership of Telecom, OTC and Ausset. There was talk at one time that all three would be merged. Aussat's future in particular looked uncertain in view of its lack of profitability to date and the need for a further \$500 million in capital to fund its second generation of satellites. These decisions cannot be delayed. The existing satellites have a finite life of only about seven years before they run out of fuel for their positioning motors and drift out of orbit.

The lack of any decision on Aussat's financing arrangements has been heavily criticised by the telecommunications union ATEA/ATPOA. Federal Secretary, Mick Musumeci, accused the bureaucrats of "dwelling on the price of a \$50 phone rather than addressing Aussat's severe financial problems".

Instead of creating any closer association between the three carriers, the review has set them up in open competition in the provision of value added services, domestically and internationally Aussat will be able to compete with OTC in the provision of international private network services between Australia and those countries within its satellite footprint. These include New Zealand, Papua New Guinea and Fiji. Both OTC and Aussat will be allowed to compete with Telecom in the provi-

sion of value added services within Australia.

None of the carriers have yet said exactly what plans it has. Aussat says it is already looking at several possibilities and Sky-page, a company which provides Australia-wide paging services via Aussat, said earlier this year that it was looking to extend this service to Papua New Guinea and New Zealand if regulations permitted.

There will be significant deregulation of customer premises equipment including the supply and maintenance of PABX, and the installation of premises wiring. Telecom's staunchly defended monopoly over small business telephone systems (the Commander) will go. It is estimated to be worth about \$150 million annually. The much debated first phone monopoly will remain for three years and will be revised in 1991. This monopoly, which is in breach of the Trade Practices Act will be legalised by granting Telecom an exemption from the Act. Telecom will be required to provide a cheaper standard telephone. It's new Touchpone 200 will sell for about \$100, but it is possibly to buy telephones for as little as \$20, and the government suggests that Telecom sets too high a standard.

Scramble For Expertise

Today Telecom provides call-out maintenance on telephone handsets, so reliability is crucial. If cheap telephones become widespread, it may take some time to educate customers so that they do not report faults to Telecom until they have a confirmed that the fault does not lie in their own cheap telephone.

The deregulation of PABX maintenance, from January 1, 1989, could create a scramble for expertise with competent Telecom technicians being lured to the private sector by offers of higher salaries and fringe benefits which Telecom cannot match.

The reshaping of Telecom's role as a government business enterprise will give it greater freedom to set salaries at market

rates, but to single out particular skills for preferential treatment because they are in demand by the private sector could create unrest among other employees not so favoured.

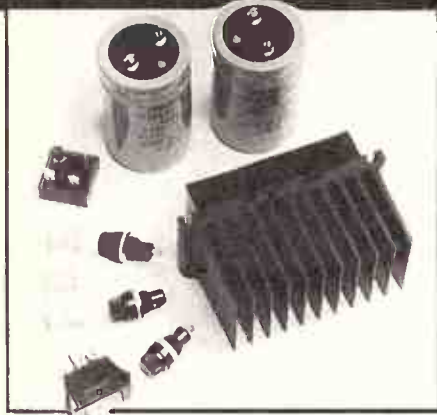
This reshaping will see Telecom liable for all local, state and federal taxes and charges by 1991, starting with payroll tax from this July. The opposition and the union have warned that higher charges are inevitable, accusing the government of using Telecom as another source of tax revenue. Telecom's response to the impost has been very subdued in comparison to the loud protests it voiced when hit with sales tax in the 1987 minibudget. Managing director, Mel Ward, claimed that the imposition would have an "immediate and recurring impact" and would create an "upward pressure on tariffs". He was hopeful that other long term policy changes would lead to greater efficiencies and so keep increases to a minimum.

Overall the Government has had to try and please a large number of parties with divergent views and motives. What it has done has the makings of a very successful compromises, but there are many areas where with one hand the government has bestowed new freedoms on the carriers and the industry, but has inserted provisions for tighter control to be exercised if it sees fit.

The role of Austel will be vital and much is likely to depend on the calibre of the people appointed to this organisation's three executive positions. These will be a full time chairperson, and two full or part-time members selected from people "appropriately qualified in law, economics, business, public administration, consumer affairs, or technology".

Austel appears to have been closely modeled on the UK body, Oftel, with this one notable exception. Oftel's power is invested in a single individual, its executive director. The Australian Government, for whatever reason, has decided to appoint a committee.

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READER INFO No. 3

ETI August 1988 — 19

COMING EVENTS

JULY

- 26-28: COMDEX Australia's National and International Computer and Communications Exhibition and Conference** will be held in the Darling Harbour area of Sydney. Potential visitors and exhibitors should ring (02) 959-5555.
- 18-19: A seminar called Application for Expert Systems**, will be held at the Masonic Centre, Sydney. Contact Gay Gosling (02) 262-2166.
- 25-27: The 6th national conference of the Australian Intergraph Graphics Users Group** at the Sydney Hilton. Contact Intergraph (02) 888-9900.
- 28-29: Computer-Based Training**, a seminar organised by the NSW branch of ACS, will be held at the Masonic Centre in Sydney.

AUGUST

- 1-5: The International Ergonomics Association** is holding its tenth international congress in Sydney. Delegates can register for the week, or for days which interest them. Contact IEA88 secretariat (02) 969-1400.
- 12: A one-day seminar on advances in data security for the DEC VAX/VMS environment** will be held at the Menzies at Rialto in Melbourne. The organiser is Price Waterhouse Urwick. Contact Paula Hough (03) 666-6111.
- 15-17: The Electrical Engineering Foundation** at the University of Sydney is organising a three-day seminar on error control coding. It will be presented by Professor Shu Lin of the University of Hawaii. Contact (02) 692-3659.
- 16-18: The 3rd Regional Convention of the Melbourne Audio Engineering Convention** will be held in Melbourne Hilton. Contact the Chairman Brian Horman, PO Box 131, GPO South Melbourne 3205. Phone (03) 329-0162.
- 18-19: A symposium on knowledge-based systems in civil engineering** will be held at Monash University. Contact (03) 565-4718 or 565-4949.
- 22-24: The Fifth Aust.-New Zealand Geomechanics Conference** will be held at the Hilton Sydney. Contact 193 Rouse Street, Port Melbourne, Vic 3207. Phone (03) 646-4044.
- 23-25: AutoCAD Expo '88, incorporating the Third National AutoCAD Users' Conference**, will be held at Centrepoint in Sydney. The organiser, Autodesk Australia, has called for papers. Contact (03) 429-9888.
- 23-26: A four-day intensive workshop on the effective use of contemporary project management tools** will be held at the Macquarie University Management Centre in Sydney. Contact Wendy Bailey (02) 963-2301.

SEPTEMBER

- 1-2: Symposium on Remote Sensing in Antarctica.** Mr Peter Keage, Antarctic Division, Department of Administrative Services, Channel Highway, Kingston, Tas 7450. Telex: AA57090.
- 5-8: The Third International Technical Innovation and Entrepreneurship Symposium** will be held on the Gold Coast. Contact David Millhouse (07) 377-2899.
- 11-15: International Energy '88. Gold Coast.** Secretariat, International Energy '88. GPO Box 1334, Brisbane, Qld 4001. Telex: AA44587. Attn: H.C.E.

- 20-22: The Australian Computing Exhibition** will be held at Darling Harbour. Contact Michael Fleur (02) 264-1266.
- 21-23: Aust Computer Soc Information Technology** Darling Harbour. Details Miss Karen Hucks, ACS National Secretariat, PO Box 319 Darlinghurst, NSW 2010. Phone (02) 211-5855.

OCTOBER

- 1-3: ACCA 88. The Australia Computer Society's Annual Conference** will be held at Darling Harbour in Sydney. Contact ACP Exhibitions Limited, 2/124 Castlereagh Street, Sydney, NSW 2000. Phone (02) 264-1266.
- 7-8: Contributions are being sought for TAD-SEM '88, a two-day seminar on Computers Serving People with Disabilities**, at Campdown in Sydney. Contact (02) 808-2022.
- 30-Nov 3: 9th International Conference on Computer Communication** will be held at the Hilton Hotel, Tel Aviv. For more information contact Dr J. Raviv, Secretariat, ICC'C'88, PO Box 50006, Tel Aviv 61500, Israel.
- 31: CSIRO Division of Applied Physics Golden Jubilee Symposium and Open Days.** Symposium Oct 31 to Nov 2. Open days Nov 4, 6. Inquiries: J Cook, DAP, PO Box 218, Lindfield 2070. (02) 467-6211.

NOVEMBER

- 7-10 The International Robot Show.** Contact Australian Exhibition Services, 242 St Kilda Road, Melbourne, Vic 3004. Phone (03) 267-4500.
- 6-10: The International Symposium and Exposition on Robots** will be held at the Sydney Hilton and Centrepoint. Contact the Australian Robot Association, GPO Box 1527, Sydney NSW 2001.
- 15-18: AI'88, the Australian Joint Artificial Intelligence Conference**, will be held in Adelaide. Contact (08) 228-5586.
- Next Year*
- 13-17 Feb: The World Conference on Engineering Education for Advancing Technology** will be held at the University of Sydney. Contact the Conference Manager, Institution of Engineers, 11 National Circuit, Barton, ACT 2600.
- 14-17 March biannual: PC89 The 12th Australian Personal Computer Show** at Darling Harbour Sydney. Contact (03) 267-4500.
- 14-17 March annual: ELENEX AUSTRALIA The Australian International Electrical & Electronic Industries Exhibition** at Darling Harbour Sydney on (03) 267-4500.
- 27-27 April: The Institution on Engineers, Australia, has called for papers for a conference on New Business Applications of Information Technology**, to be held in Melbourne. Deadline for receipt of synopses is June 30. Contact (062) 70-6549.
- 6-9 June: PC89 The 13th Australian Personal Computer Show, Communications 89. The 5th Australian International Electronic Communications and Information Technology Exhibition and Office Technology 89. The 4th Australian International Office Technology Exhibition** will be held at Royal Exhibition Building Melbourne. Contact AES or (03) 267-4500.
- August 1991: International Joint Conference on Artificial Intelligence** in Sydney. Contact Lynne Thomson (062) 64-3797.

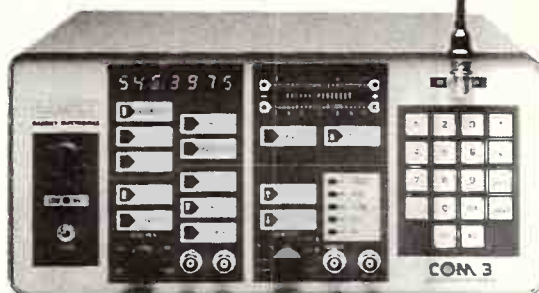
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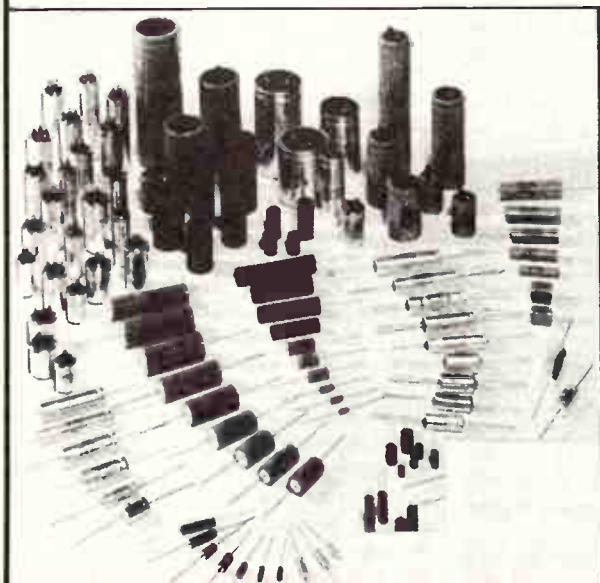


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READER INFO No. 6



Kilohertz Comment takes a look at the BBC's £30m upgrading of their transmitters on the Dorset coast.

Kilohertz Comment

Major BBC Transmitter Overhaul

One of the five BBC transmitting sites in the United Kingdom is being rapidly upgraded.

The site, at Rampisham on the Dorset Coast and has had more than 30 million pounds spent on its new transmitters and aerial systems with the installation of eight 500 kW transmitters and 34 new aerial arrays.

The transmitters are situated in the middle of the building which is 50 metres long, 20 metres wide, 15 metres high. They are in two rows and there are four Telefunken and four Marconi units at this BBC site.

The Rampisham site is 250 km south-west of London and about 15 km from the coast of the English Channel. An area of 70 hectares houses the transmitter building and towers. The building was built in 1941 when four 100 kW Marconi units were installed.

This was one of the war time stations built by the BBC and it operated around the clock.

In 1955 two additional transmitters were added. In 1965 the old 100 kW transmitters were replaced by four 250 Kw units but these were still manually operated. Today Rampisham is the most modern transmitting site anywhere in the world and the final installation will find the station operating with four million watt output completely computerised with automatic program and aerial switching.

The transmitters carry eight program services, many of them in foreign languages. The feed can be checked at any time as they are fed to the transmitters direct from Bush House London.

There is a visible display showing which transmitter is linked to which aerial and in which direction the aerial is being beamed.

High Power

The power for the transmitters is supplied from the National Grid at 33000 volts and is transferred to 11000 volts and fed to the individual transmitters. The power cost is £6

per minute. The transmitter valves are water cooled. The hot water created by cooling the valves is used for other facilities at the station including domestic central heating.

The aerials outside are laid in a semi-circle array targeted in an east and south-east direction. Power is transferred from the transmitters to the aerials on copper pipe, there being 20 km of pipe carrying this power to the various aerial arrays at Rampisham. The towers range in height from 85 to 105 metres targeting many parts of the world.

Answerphone Popular

International broadcasters are making it easier for communication with their audience by installing answerphones which allow the listener to phone-in a request or a question to be answered in a later broadcast. Radio Nederland was first with this service and their answerphone number for the Hilversum studios is 0031-35118700. The questions are generally answered on the Listener Contact Program heard on Saturdays at 0750 and 1050UTC: The first transmission on 9630, 9715 and the second broadcast on 9675 kHz.

Radio Australia Melbourne also has a 24 hour answerphone service which enables listeners to phone-in questions, request the latest program schedule, or comment on transmissions and reception. The Melbourne number is 235-2360.

Radio Moscow World Service is the latest to offer a telephone link with the station, and by phoning Moscow 007-233-6595 one is connected to an answer-phone which will record any questions and comments. Radio Moscow promises to reply within 48 hours, and these answers are carried in the Update program generally broadcast at 0310 and 08180UTC, in the World Service.

Kilohertz Around The Globe

AFGHANISTAN: Radio Afghanistan broadcasts in English 1900-1930UTC on

9655 and 11755 kHz. This English broadcast is preceded with a transmission in German 1830-1900 on the same frequencies.

AUSTRIA: Radio Austria broadcasting to Australia is now using 17870 kHz between 0900-1200UTC. The English transmission is 1130-1200 while the same frequency is used for an earlier broadcast with English at 0730-0800UTC. The frequency of 9875 also carries English 0430-0500 and this channel is in the part of the 31 metre band which is getting very congested with stations moving to the top end of this band.

CUBA: Radio Havana, Cuba in addition to its own English broadcasts relays Radio Moscow into the North American area and in particular has English relays of the World Service 0300-0400 on 9600 and 11710 kHz. English is also carried 1000-1300 on 9600 kHz.

ECUADOR: La Voz del Upano is heard on 1053 with music, and at 1055 the Ecuadorian National Anthem is followed by station identification. Three frequencies carry the transmission, 5040, 5965 and 6000 kHz the latter two being relatively new. The station verifies with a folding card and generally carries a broadcast from Vatican Radio after 1100UTC.

EGYPT: Radio Cairo broadcasts in English to Europe 2030-2200 on 9900 kHz, to North America 0200-0330 on 9475 and 9675 kHz. There is a service to Asia 1215-1330 on 17595 khz.

GERMANY WEST: Radio Deutsche Welle, the Voice of Germany at Cologne is to amalgamate its three English language services into a World Service from September 25. This new World Service will combine the present Asian, African and North American transmissions into a single unit and it is expected that the World Service will operate 24 hours each day.

GERMANY EAST: Radio Berlin International has retimed its transmissions to this area and English is now heard 0515-0600 on 15240 and 17775 kHz, 0745-0830 on 21540 while on Saturday and Sunday additional

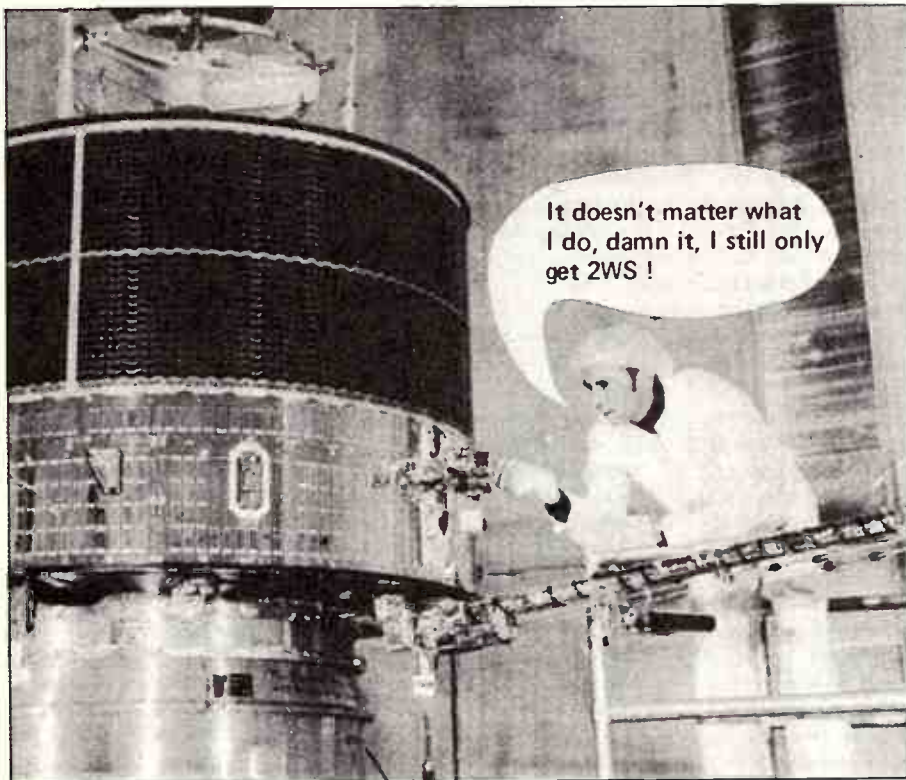
frequencies are 9730 and 21465 kHz.

PHILIPPINES: The Far East Broadcasting Company in Manila has added the new frequency of 15480 kHz for the broadcast in English 0000-0200. The service best received in the Pacific is 0830-0930 on 11850 and 15350 kHz. Another new frequency is 9495 kHz which is operating 1000-1500 with transmission to China.

SWITZERLAND: Swiss Radio International uses 13685 kHz with English 0830-0900 to the Pacific. As well as 9560, 17830 and 21695 kHz also carry this broadcast. The International Committee of the Red Cross, Geneva which uses the facilities of Swiss Radio International is to broadcast on these frequencies on Monday, August 29 and Thursday, September 1 between 0740-0757 UTC.

USA: The Voice of America with its new transmission to Oceania from 1000UTC has included some new programs at a more suitable listening time. One of these is "Communication World" heard at 1010UTC Saturday and in this feature Gene Reich covers many aspects of broadcasting. Reception is best on 5985, while 11715 and 15425 also carry the transmission. ●

This item was contributed by Arthur Cushen, 212 Earn Street, Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT), which is 10 hours behind Australian Eastern Standard Time.



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READER INFO No. 7
ETI August 1988 — 23



In this month's Communication News Stuart Corner examines Telecom's dial-it information services, the help provided to Telecom by geographers and how the Cultural Revolution affects the information revolution.

Communication News

Computerised Dial-it Information Services

Telecom has launched a new system for dial-it information services that will allow information providers to exploit the latest developments in computer-based voice processing technologies. Present dial-it information services such as the weather, road reports, recipes and so on use tape-recorded messages. When the caller dials up, if the service is already in use he or she will pick up in the middle of the information. Also, updating the information is time consuming as the entire tape must be rerecorded. These services are prefixed by a 11 number and are charged at a local call fee, unless accessed from outside the area when the normal STD rates apply.

Services on the new system, prefixed by a 0055 number, will incur the same charge no matter where in Australia they are called from. Telecom and the service provider will share the call revenue on an approximately 50-50 basis.

Messages will be held stored digitally on sophisticated computer systems. These will ensure that each caller hears every message from the beginning. They will also allow the information provider to update only certain parts of the message without affecting the rest.

To prevent abuse of the system, Telecom will not allow any information service to be marketed to children, and has insisted that systems disconnect automatically at the end of every message. Messages are restricted to a maximum length of 10 minutes.

Telephone subscribers will

also be able to have their phones barred to all 0055 numbers on request. The exchange facilities needed to support this barring will mean that only about 50 percent of the population will have access to the 0055 service initially. Telecom says it has no plans at present to discontinue the 11 prefixed dial-it services.

Rates for 0055 calls will vary depending on how valuable the information provider thinks the information is. The maximum charge will be about \$6 for a 10 minute message, and there is a minimum charge of 20 cents. Off peak and night time economy reductions will apply at the same times as STD off peak and economy rates.

The initial service will be a six month trial. Telecom says there are a number of organisations keen to offer services. Two that have been named so far are Intelcom of Sydney, a subsidiary of Consolidated Press, and Link Communications of Melbourne.

The new service represents a significant departure for Telecom in that Telecom will share revenue with service providers and does not intend to operate the computer systems on which the information resides. So long as these meet technical specifications, information providers will be free to set up whatever systems they choose.

Information categories which Telecom has said will be available for the initial 6 month pilot of the service include financial and stock market information, music, health and medical information, veterinary services and horoscopes. Intelcom claims it will be offering a personalised horoscope service which will give each caller a

personal horoscope, developed scientifically!

Geographers To Aid Telecommunications

Studies into the effective use and impact of rapidly evolving telecommunications technologies are lagging far behind developments in the technologies themselves, according to Marina Cavill, a geographer working at the Telecom Research Laboratories.

In a paper presented at the bicentennial Congress of the Australia and New Zealand Association for the Advancement of Science (ANZAAS) in Sydney in May, Cavill said that more research was needed into the effects of non technological factors on customer distribution and use of telecommunications services. Geographic information services, she said could help by providing "a common reference point for information about customers at a particular location".

Anticipating demand for new telecommunications services was becoming increasingly difficult as fibre optic communications and the integrated services digital network were creating a myriad of new services simultaneously about which there was no previous experience on which to draw, Cavill said.

"Deciding which service options to deliver and determining where to build the electronic highways demanded by a society increasingly seeking to take advantage of new technology is a very complex matter. Not only is the technology in a state of flux, but so are the customers that service providers like Telecom have to cater for."

Cavill called for a re-assessment of the traditional methods used to monitor and plan for change, and the skills called upon to carry out the analysis. "New tools and approaches more appropriate to the emerging information age need to be developed. The discipline of geography has much to offer in this area."

Cavill said that new computer systems for handling geographic information, hailed as the "biggest step forward in handling geographic information since the invention of the map," were a powerful new tool to assist telecommunications planners.

"The GIS concept can provide the means for unlocking the power of customer information already or potentially available to a service organisation by using location as the key to link, integrate and present that information."

Standards Association's EDI Committee

The Standards Association is setting up a committee of organisations interested in electronic document interchange (EDI) to help it ensure that standards development in Australia meets the needs of all parties involved.

The Association has written to about 30 organisations, according to Standards Association Executive, Bob Lions. An independent chairman, Michael Baker, has been appointed and the committee will hold its first meeting in mid June.

The EDI Council of Australia was also set up recently to promote the development of EDI in Australia. It comprises

individual users and vendors and will be an independent body with its own full time executive.

EDI replaces the exchange of business documents such as purchase orders and invoices with electronic information conforming to agreed international formats. EDI is claimed to be able to save up to 15 percent of the costs of producing, handling and processing paper-based information. It is already widely used overseas and several services have started in Australia including one for the motor industry operated by Telecom under the name Tradelink, and another by the Coles Myer group for its retail store chain.

IIC's Australian Gathering

The international Information Industry Congress (IIC) will hold its annual congress in Australia for the first time later this year. The organisation is made up of national bodies representing companies in the information industry. Australia's member organisation is the Australian Information Industry Association (AIIA).

The IIC Congress is closed to the public, but AIIA will be holding a one day joint seminar with the IIC in Sydney on November 25, to coincide with its annual general meeting. The seminar will feature a number of prestigious international speakers including New Zealand Finance minister, Roger Douglas, on the benefits of deregulation. IBM's director of security and standards, John Rankine, and a director of Nixdorf Computer will speak on the importance of standards.

OECD professor, Dr Henry Ergas, currently on secondment to Monash University, and William Roelandts vice president of Hewlett Packard's Network Systems Group will speak on telecommunications challenges for the next century. The Global Marketplace in the next century will be the subject of speeches by Pat McGovern, and Philip Hughes chairman of Logica of the UK. McGovern is founder of the International Data Group, the world's largest publisher of newspapers and magazines for the computer and telecommunications industries.

An international speaker will describe the impact of the General Agreement of Trade and Tariffs (GATT) on the information technology industry (see CCITT Congress elsewhere in this issue).

For more information contact the AIIA on (062) 82 4700.

Japan's ISDN Plans Snagged

Japan's national telecommunications carrier, Nippon Telephone and Telegraph (NTT) has hit an embarrassing snag in its plan to start a public integrated services digital network (ISDN). The network will not handle free emergency telephone calls to fire, police, ambulance and so on.

According to the US-based *ISDN Newsletter*, the problem is reported to be a software fault and will take an unspecified time to fix. Meanwhile, ISDN services will be operated on a trial basis, but NTT has not said what services will be available during the trial.

In Australia, Telecom is scheduled to start its ISDN sys-

tem in July next year. The starting date was initially set for late this year, but was put back after problems with software development on the Ericsson AXE exchanges which will form the backbone of the network.

Dial Moscow Direct

That most useful tool of trade of the espionage agent, the miniature camera, looks like being made redundant in the electronic age. If they can get access to secret documents, Russian spies will now be able to pop them into the nearest fax machine and whisk them off direct to the KGB. OTC has just introduced direct dial services to Moscow, the country code is 7. International direct dial services were also announced to Nepal, Burma, Syria and Rwanda in Africa, bringing the number of overseas countries accessible by direct dial from Australia to over 180, more than any other nation.

Telecom Streamlines Fault Reporting

No doubt moving to head off competition from the private sector which will follow as a result of the May 25 telecommunications policy statement, Telecom has streamlined its fault reporting system for large corporate customers. Under the old system, there was a confusing array of numbers depending on the faulty equipment of service: one number for PABX, another for data services and so on. Under the new Corporate Fault Reporting Bureau (CFRB) there will be just one number.

The system relies on IBM

RT PCs linked to applications running on Telecom's Honeywell and Fujitsu mainframes and HP 3000's. The software has been developed in a joint venture between Telecom and BHA Computers of Brisbane. According to BHA, it involves "the creative use of the IBM RT combined with the power of the Ingres relational database."

All You Ever Wanted To Know About . . .

The Australian Telecommunications Users Group (ATUG) has published an international edition of its Telecommunications Users manual. The manual covers the roles of the international standards bodies such as the CCITT, CCIR and ISO, the role of the International Telecommunications Union (ITU) and several other international organisations. It deals with the various standards produced by these bodies and is in loose leaf format for ease of updating.

It costs \$250. Enquiries, tel: (02) 957 1333.

MAP/TOP Guide for Business

The MAP/TOP Users Group has published a free information paper which examines the business issues of computer communications. The 27 page paper discusses the choice of these international protocols as strategic business decisions and provides three case studies. It can be obtained by writing to MAP/TOP users Group, One SME Drive, PO Box 930, Dearborn, MI 48121, Attention MAP/TOP: A Business Overview. ●



Paul Budde reports on the local and international position of Videotex services.

Videotex News

AUSTREAM — New Name for VASAS

Telecom Australia is introducing a new data communications network access service to provide users with low cost access to a range of Value Added Services (VAS) offered by service providers. This new VAS Access Service, called Austream, will be based on the Packet Switching Network (PSN).

The network will provide a range of advanced features and facilities to enable service providers to realise the potential market opportunities arising from the rapidly growing information based society through a cost effective communications infrastructure.

Austream will progressively evolve a number of stages to support access to a wide range of existing and future value added services, including the following:-

- ★ Videotex
- ★ Electronic mail (e.g. X.400) and messaging
- ★ Electronic Directory services
- ★ Electronic Document Interchange (EDI)
- ★ Mediation services
- ★ Software transfer

Subsequent stages of Austream will use the Digital Data Network (DDM) and Integrated Services Digital Network (ISDN) to extend the range of facilities.

Austream would be the perfect vehicle for the recently launched Telebox project that could be put on top of Austream as a marketing layer. It depends however, completely on the willingness of Telecom to co-operate with private industry as to whether a worthwhile mass domestic electronic services network could be established such as Minitel in France. This service now has close to 3.5 million users. Other countries like the US, Canada, Japan and several

European countries are adopting the Telebox-like approach.

It is still unclear whether Viatel will be part of the Austream network. After two successful years, Viatel has grown to 30,000 subscribers but as in all other countries with public videotex services such as Viatel, a drastic change in policy a la France is necessary to secure the growth everybody wants to see — not in thousands of users but in hundreds of thousands of users.

The key to the French success story is:-

- ★ Co-operation between network operators, service providers and hardware manufacturers;
- ★ Integration of services (Austream).
- ★ Low cost hardware.

These elements are also the starting point of the Australian Telebox project.

Electronic Financial Service In New Zealand

New Zealand's leading investment analysis organisation, Datex Services, has applied to the New Zealand Telecom Starnet as the on-line service to transmit to subscribers information about all aspects of New Zealand's listed companies and the sharemarkets, covering:-

- ★ Company announcements;
- ★ Top 20 shareholders;
- ★ Capital and dividend data;
- ★ Financial figures and ratios;
- ★ Company consultants, addresses and data;
- ★ Company directors;
- ★ Sector ratio comparisons and share price data.

Videotex Profit Is In Services

In a recent report from Butler Cox it was stated that videotex is mainly a European activity (Australia was not mentioned),

that protocols, graphics and technology are not important and that videotex is an ideal tool for offering news services. And this is where the money lies. A further spectacular growth is expected for videotex in that area.

Slowly, videotex will become part of an integrated system of electronic services. The revenue for videotex services will grow from \$US500 million in 1986 to \$US1.5 billion in 1991. Two thirds of the total videotex revenue is in services, the rest is hard and software. Last year, these figures were reversed.

Order entry and interactive services are the most favoured among users, followed by telebanking and electronic mail.

Most videotex failures occur because of wrong applications and lack of marketing.

DTX Exit? — A Review Of Videotex Investments

We have been reporting on the rises and falls of the Perth based videotex company DTX (Direlectronics). Despite debts, legal and all sort of other problems, the company has been able to survive for some four years. In all these battles, DTX has not done a lot for the Australian New Media industry. Several clients are disappointed and it will take quite a while before these companies will enter the videotex market again.

It is amazing that DTX has been able to battle on for so long. Their latest struggle involved the establishment of a Malaysia hi-tech factory based on Government funding worth \$3 million!

But the patience of the WA creditors and the Supreme Court ran out. A liquidator is now appointed to wind up the infamous venture. After all their previous failures, we will

still have to wait and see if this really means the end of DTX.

The videotex industry around the world has seen a number of failures, but also some successes. The lesson that can be learnt from this is that large amounts of money are no guarantee for a successful videotex system.

Time Inc. spent \$US40 million, Knightrider \$US60 million but both have failed in establishing a profitable domestic videotex service in the US. Several Australian companies have also stranded in the videotex struggle (Mayne Nickless, Control Data, ICL, and a range of smaller service providers on Viatel).

Success stories are mainly found in France, but Australia's national videotex service Viatel, is among the world leaders, with many worthwhile services. A slow growth with cautious investments, based on a marketing package is the only way to go in a market like Australia, where there is not a large enough terminal population to guarantee profitable large services such as DTX, Afel or others.

Westpac's Handyline Growing

Since its inception in February 1987, Westpac's electronic banking service Handyline has grown spectacularly. Over 15,000 videotex and audiotex terminals are linked to the service. Approximately 70 per cent use the telephone-tone dial (audiotex) service. Most traffic, however, comes from the videotex terminals.

Another unique feature of the service is its kiosks — public access terminals in branch offices. Clients can use the service without being actual subscribers. This service means that much more than 15,000 registered users have access to

Handyline. Recently, Westpac also introduced its electronic banking service in New Zealand.

Communication For Doctors In The Netherlands

More pressure on the financing of the Dutch national health service has urged a further automation of the public sector. Currently there are three such projects, all using the Dutch public videotex service Viditel. The projects are in Haarlem, Rotterdam and Delft. The services are aiming on communication between specialists and laboratories on one side and GPs on the other end. Messages relate to laboratory tests, X-ray results, contra indications, etc.

Talking Yellow Pages in the US

Yellow Pages publisher InfoPlus, which is developing "talking" classified directories, has added sections of Dow Jones' DowPhone audiotex to its electronic package. More than one-third of InfoPlus' yellow pages

advertisers have purchased audiotex supplements to their print advertisements.

Nearly 6500 of InfoPlus' 18,000 directory advertisers have included a four-digit audiotex number in their print display advertisements to steer callers to talking advertisements for additional or updated information. InfoPlus says it receives 1.5 million audiotex calls per month. The firm says it will generate US\$30 million in advertisement revenue (talking and print) this year, up from US\$11 million in 1986. InfoPlus publishes talking yellow pages in Boston, two Boston suburbs, Rhode island and Cape Cod. The company plans to launch service by next year in New Hampshire and in Phoenix, Mesa, Tempe and Tucson, Arizona.

Free Videotex Terminals In Japan?

The Ministry of Posts and Telecommunications continues to try to make CAPTAIN — Character and Pattern Telephone Access Information Net-

work — videotex systems attractive, this time with a version to be called CAPTEL, touted as a potential AU\$3 billion market.

The CAPTEL is all-in-one terminal, cheaper and smaller than a CAPTAIN terminal. The efforts of manufacturers have been solicited with the exhortation to make terminals smaller and less expensive, in order to activate Japan's videotex business.

The Postal Ministry is very optimistic about the CAPTEL idea, anticipating distribution of 5 million terminals over the next three years — either at AU\$150, half their original price, or by giving them away. The idea is to sign up 30 million paying customers by the fiscal year 1995.

The Postal Ministry first tried the promotion of CAPTAIN in 1984, but even with a heavy promotional fanfare, the system drew only 26,000 terminal sales. NTT, Japan's largest communication service company, however, expects to have 100,000 sets in use within this fiscal year with enough promo-

tion.

Having already struck out with previous promotional projects for CAPTAIN, there is an opinion in the Ministry that raised considerable scepticism about another try.

E-Mail Crosses Channel

Electronic mail facilities are to be established in May, 1988 between the UK and France. The new service follows an agreement between Mercury link 7500, Mercury Communication's electronic mail division and a recently created French company called RCI-Calvacom which offers an international network of value added telecommunication services. Although the French DGT and British Telecom together offer datacom services between the two countries, there has so far been no value-added electronic mail interconnection.

These items are contributed by Paul Budde Communications, PO Box 372, Roseville, NSW 2069.

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16	41	66	91	116	141	166	191	216	241	266	291	316	341
17	42	67	92	117	142	167	192	217	242	267	292	317	342
18	43	68	93	118	143	168	193	218	243	268	293	318	343
19	44	69	94	119	144	169	194	219	244	269	294	319	344
20	45	70	95	120	145	170	195	220	245	270	295	320	345
21	46	71	96	121	146	171	196	221	246	271	296	321	346
22	47	72	97	122	147	172	197	222	247	272	297	322	347
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AUSTRALIA HOSTS GLOBAL CUSTODIANS

The International Telephone and Telegraph Consultative Committee (CCITT) will attempt to uphold the 123-year-old tradition of co-operation that has created the world-wide telephone network at a conference in Melbourne. It will not be easy.

Stuart Corner

In the face of rapid technological change and increasingly sophisticated technology, enormous demands are placed on those responsible for the creation of international technical telecommunication standards. Their task is to guide an industry that has become an essential and ever-growing component of international trade.

The prime purpose of the world gathering is to thrash out the international agreements which will underpin the evolution of this system well into the next century.

Conference members will hold CCITT's quadrennial Plenary. It will be followed by the World Administrative Telephone and Telegraph Conference (WATTC'88). Both meetings will be held under the auspices of the International Telecommunications Union (ITU). The ITU was founded in 1863, as the International Telegraph Union. It changed its name in 1932 and became an agency of the United Nations in 1948. It now has a membership of 164 nations and a notable record of achieving international consensus on telecommunications development.

The CCITT Plenary should hold few surprises. The issues with which it deals are so technological complex that all the key decisions have already been thrashed

out in numerous international meetings. However it is likely to see a restructuring of the CCITT to enable it to better cope with the challenge of standardising future technologies.

On the other hand, WATTC'88 has the makings of a very contentious meeting indeed. Its purpose is to draw up a basic framework of international telecommunications regulations applicable up to the early part of the next century.

The present regulations were drawn up in 1973 when only a limited number of services were offered by telecommunications administrations: services such as telex and the telephone which were closely linked to the basic network. These regulations are no longer adequate when the boundaries between computers and telecommunications are breaking down rapidly, making the telecommunications network the vehicle for a vast range of information services, many of them highly profitable.

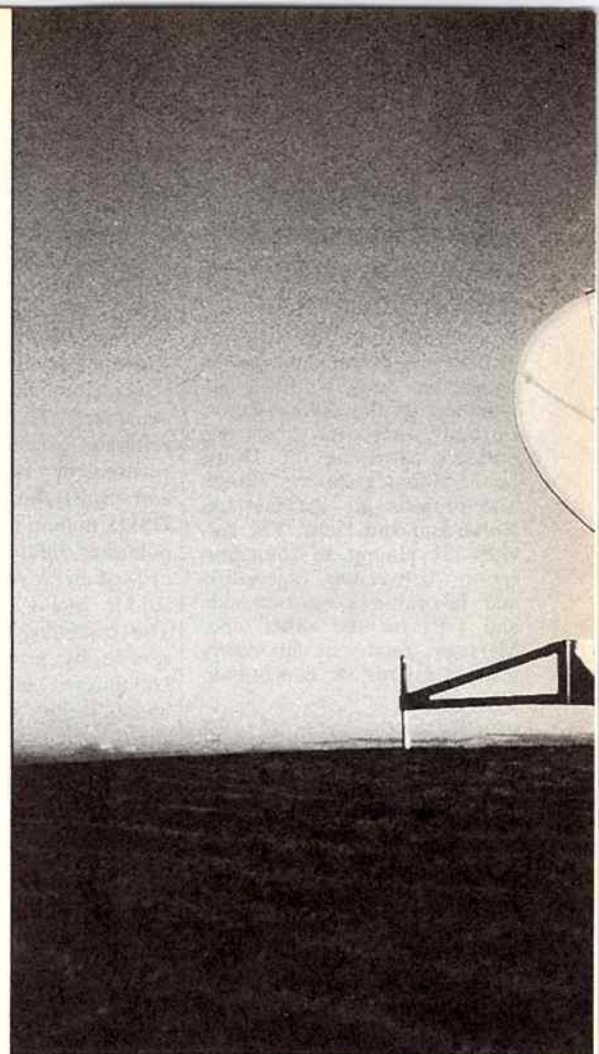
The starting point for the Melbourne meeting will be a set of draft regulations drawn up at a preliminary meeting (PC/WATTC) in Geneva just over a year ago. They were, according to one observer, "hammered out in the last afternoon of the meeting" and are "remarkable for their brevity and controversial content."

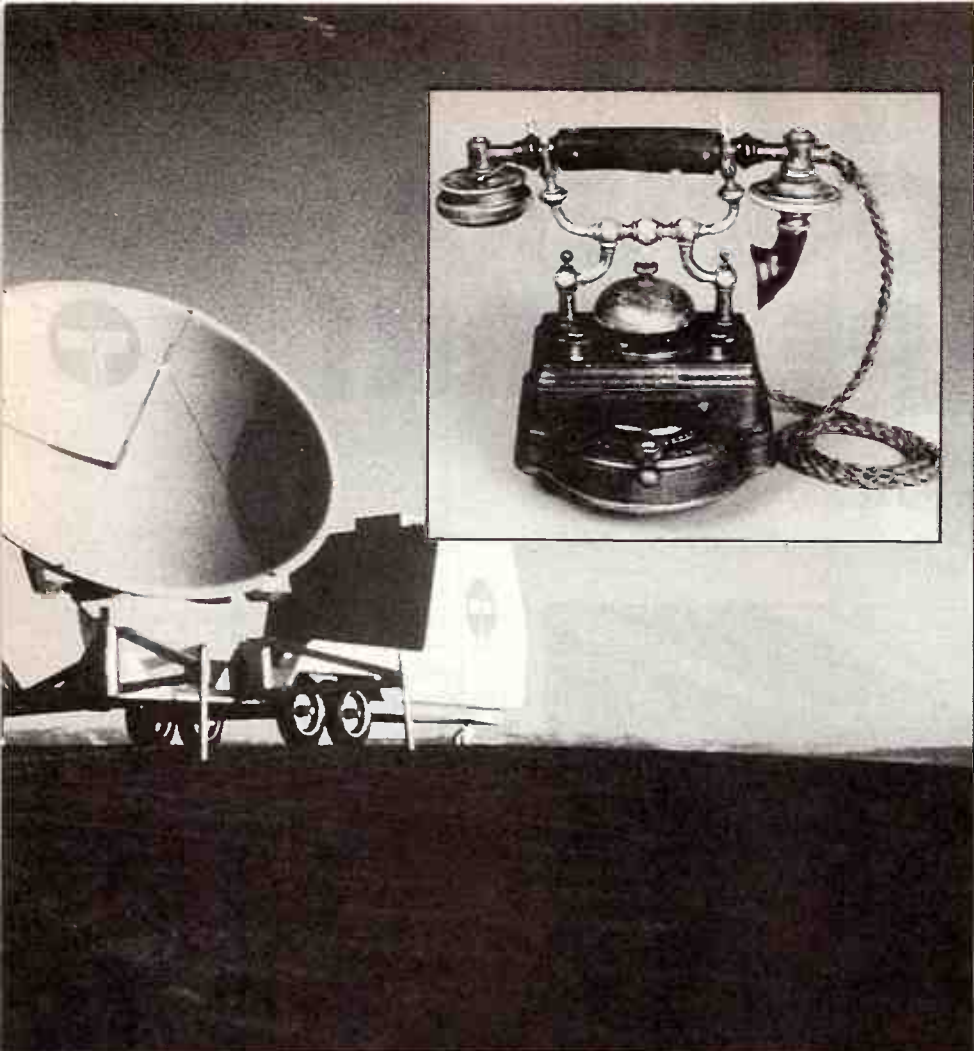
The draft regulations have created a divide between those administrations which favour a tightly regulated global system, and those who feel that any regulation will hamper the development of global information services.

The crux of the contentious draft is Article one. According to one legal commentator it will regulate "any company using the international telecommunications network to provide any telecommunications service to any third party. Member countries will be forced to regulate along lines demanded by the ITU.

The principal concern of the ITU is the maintenance and development of basic telecommunications services on a world wide scale. "The world wide impact of international economic development policies, the permeability of national borders for international economic transactions, capital and data flows, the legitimate expectations spread by modern communications make it catastrophic for any nation or group of nations to pursue successfully national or regional interests without regard for the legitimate interests of other nations."²

In a nutshell, the whole debate is a rerun on a global scale of the basic versus value-added services argument and the need for a universal basic service which





Telecom's Transportable Iterra Network Earth Station (TINES).

has been running in Australia for years. Issues which, incidentally, the new regulations have done nothing to resolve. They have simply reassigned the decision making to an independent body.

As there is no universally agreed definition as to where the boundary between basic and value added telecommunications services lies, it is difficult to see how any regulations which rely on such a distinction can work, and it may be for this reason that the PC/WATTC adopted the controversial step of recommending that the regulations apply to all services.

It is quite clear from the fever of opposition to this draft, that there is very little chance that it will be accepted in Melbourne.

If this were not problem enough for the ITU, it is also faced with another. Services, including value added telecommunications services, constitute a means of trade between nations, and a growing portion at that. It is estimated that trade in services now constitutes 20-25 percent of all international trade. Telecommunications is essential to support most of this trade in services, and will increasingly become the principal vehicle for such trade.

In recognition of the importance of international trade in services, the General Agreement Trade and Tariffs (GATT) has

decided to include these in its discussions. GATT is a multilateral agreement which governs the trade of member countries and the conduct of their trade relations with one another. It contains contractual obligations which are binding on its members.

The latest round of multilateral trade negotiations was launched in Uruguay in September 1986 and for the first time trade in services was included. The Uruguay meeting concluded that merging telecommunications and dataprocessing technologies were being developed and implemented on a global scale with little respect for national boundaries and that an increasing amount of information and knowledge was moving across borders and thus making service transactions more significant, internationally as well as nationally. "This makes a multilateral agreement on the liberalisation of the international service market very urgent."

The GATT declaration drew up a number of elements for consideration in this agreement. These included: "rights of market access including the right of access to distribution systems such as basic telecommunications services, and free access to value added services, with minimal exceptions in cases of privacy and national security."

It is quite obvious that neither of these international bodies will be able to reach any binding agreement in isolation from the other. It is also likely that the large and powerful developed nations pushing for minimum regulation will support GATT as the forum for the debate rather than the ITU as GATT is more oriented to free trade. GATT also is able to embrace all the issues of trade in services, not only those of telecommunications.

The developing nations were initially loath to bring services on to the GATT agenda, but eventually capitulated.

ITU Secretary Richard Butler, addressing a conference on global telecommunications issues in Paris recently, said the ITU "would follow closely the service negotiations between GATT contracting parties in order to avoid duplication or conflict of potentially related international treaty legislation, for the preservation of worldwide interconnectivity is fundamental."

World wide connectivity will be hard fought for. The gulf created at PC/WATTC was wide. A further meeting was called by Butler in Geneva in March to attempt to achieve some closer consensus. He told the writer in an interview in Sydney in May that some concensus had been achieved and he was hopeful of a successful outcome for WATTC'88. However, another European commentator, on a visit to Sydney, expressed the position rather differently, accusing Butler of siding with the US and affectively adopting a "suicide position" on the issues.

The developing nations may ultimately be able to do little to sway the course of events except voice their concerns. Ruth Sitati, the Secretary of Kenyo's PTT spoke for many when she said: "deregulation (of international telecommunications) will enable the developed countries to dominate the market for international services, a development which will only further the imbalance in telecommunications facilities.

A compromise is needed that allows freedom in the development of new information services but ensures that this imbalance does not grow. As Richard Butler said: "The shock waves of inadequate policy and planning decisions could ring around the world telecommunications networks for years, maybe decades." ●

Stuart Corner is a freelance writer specialising in information technology.

1. P. M. Nugent, legal Council Electronic Data Systems, (USA) Forum '87 Geneva.
2. Richard Butler Secretary General of the ITU.

VALE WOOMERA — HAIL CAPE YORK!

Just as a new role is being debated in the far North, an old role is slowly fading away in the south.

Jon Fairall



Rear view of the Skylark 7

Forty thousand years ago, the Aboriginal tribes who colonised the great stony wastelands to the North of the Spencer Gulf in South Australia armed their spears with slivers of delicately cut rock. It was a mighty technological achievement. First the rock needed to be cut to a fine edge. Then it needed to be set into the shaft of the spear so that it could withstand the impact of animal flesh. Aided by that magnificent example of lateral thinking, the woomera, this technology of stone, allowed the first Australians to dominate the continent.

Yet, when the first white man came to interrupt the dream time, this stone age technology had been forgotten. Aboriginals 200 years ago merely cut straight sticks to a point, and hardened the end in a fire. The only legacy of the older time is the shards of stone, still visible among the rocks lying on the red earth.

Why was such an eminently successful technology forgotten? It's a question that must intrigue the modern visitor to Woomera for modern Australians are in the process of repeating the same trick, although we do in years what it took them

centuries to achieve. Once again we are forgetting how to make our spears, and once again, woomera will not help us.

Woomera

Like many small Australian towns in the outback, there seems no reason for Woomera to exist. It has that uneasy feeling, a bit of big city suburbia tossed down casually in the bush. There always is a reason, of course, although sometimes you need to search to find it. In the case of Woomera, you drive for half an hour along a narrow strip of tar through the red earth and the army road blocks until a huddle of white buildings break the monotony of the horizon.

At their centre: a flat bed of concrete, like an altar in the desert. In the 1950s, this remote place was one of the most important sites for the development of rocketry. Today it is like a mausoleum to the pioneers; it has a past, but not much of a future.

Woomera village itself is far from dead. Plutonium warriors from the American spy base at Nurrungar, just around the corner, do a tour of duty here, in this re-

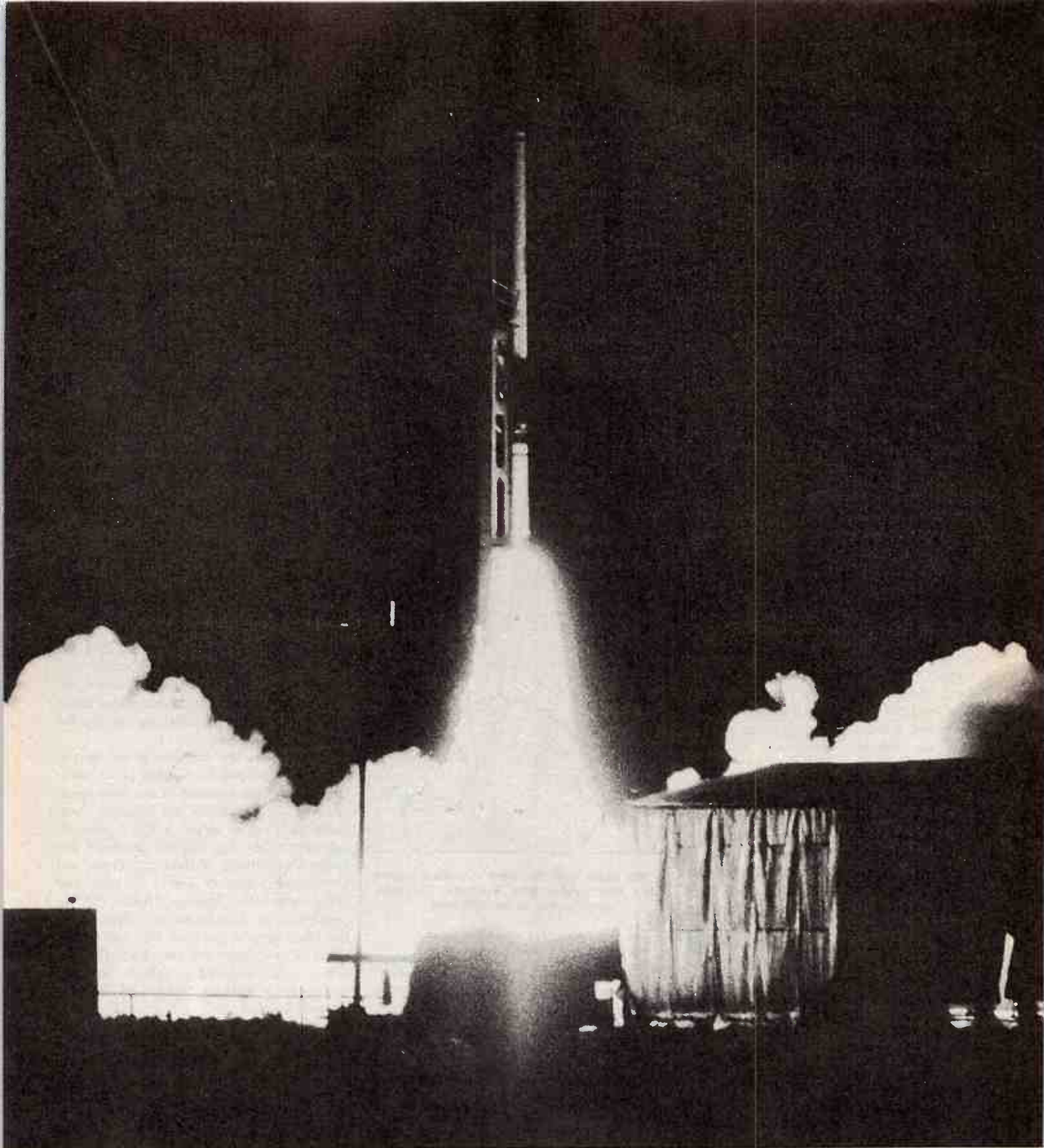
mote outpost of their empire, and our own military come here for exercises — thousands of square kilometres of land on which tanks can do wheelies in the sand and F111 pilots out for a spin from Amberley can drop bombs to their hearts' content. It's an excuse, though, not a reason.

Woomera was set up in 1946, when the British determined to match the Americans with a new generation of weapons. It was an era when Anglo Australian co-operation in the defence field was unquestioned, so there was little problem in sitting a rocket range across the middle of the country.

Over the next 20 years, the British tested all their new guided weapons here; the surface-to-air Bloodhound, the ship launched Sea Cat, an entire generation of air-to-air missiles. On occasion, the Americans were here too, with their Redstone rockets. Woomera had two great advantages. Firstly, it was over land, so the bits and pieces could be picked up after a firing, sometimes a handy clue as to what had gone wrong. Secondly, it was safe. Unlike other bases in the Northern hemisphere, Woomera is about 400 km from the sea, thus 400 km from prying eyes. The Russian fisherman with big field glasses and lots of radio antennae on his boat never posed a security hazard out here.

The 1960s were the heyday of Woomera rocketry. In the 1950s, the British had attempted to develop their own ICBM, to allow them to attack the Russians independently of the US. It became apparent sometime in the late 1950s that this was too expensive an undertaking, so the project was cancelled. However, it led to the start of Pan European interest in space, and a combined European attempt to launch a satellite was made.

The ELDO (European Launcher Development Organisation) rocket consisted of a modified British ICBM as its first stage, a French second stage, a West German third stage and an Italian satellite. It flew



Skylark rocket blast-off

eight times, recording three successful flights into orbit.

However, as a gateway to the stars, Woomera has some disadvantages. Its remoteness makes transport a problem. The British had to bring their Blue Steel first

stage rockets out in ships to Adelaide, and then transfer them to road transport for the final trip to the launch site. It was not an easy thing to do, given the fragility of the thing. It arrived as a great quivering blamange, kept inflated by compressed

gas. The skin was so light, therefore so weak, that it couldn't support its own weight. It was only on the launch pad, pumped full of liquid oxygen and hydrogen, that the power of the beast was revealed.

Woomera

French Sealed Fate

More important, however, was its remoteness from the Equator. An equatorial site is important for access for earth orbit, because the extra bulge of the earth adds many thousands of kilometres per hour to the speed of the launching platform. This translates into payload capability, and the penalty is significant. The fate of Woomera was sealed when the French figured out that moving the European launch operations to the equatorial site in (co-incidentally) French Guiana, would increase payload by 20%.

At the same time political and technical changes made the British military look to a base close to home, and by the late 1960s they had transferred all their defence work back to the UK. Since then, Woomera has been used exclusively by the Australian defence forces and, on very rare occasions, by scientists launching small experimental packages.

Benefits

The benefits of the Anglo-Australian agreement did not all accrue to the British. Woomera started a high technology culture in Adelaide that lasts to this day. To service the rocket range a large number of people were required, and it was impractical to house them all out in the desert. As a result, the Weapons Research Establishment (WRE) was set up in Salisbury, in the Northern suburbs of Adelaide. Over the years, it has been involved in a number of notable projects, including WRESAT, the first Australian satellite, in the mid sixties. It is a measure of the Australian position in space research then that the flight of WRESAT made us only the third country in the world to launch a satellite from its own territory.

Today, several reorganisations later, the WRE is called the Defence Research Centre, Salisbury (DCRS). It still provides the expertise for the range at Woomera, but this is small beer in the overall scheme of things. DCRS is probably the largest concentration of scientists and engineers in Australia, with the exception of the large CSIRO organisations, and has a host of different fish to fry.

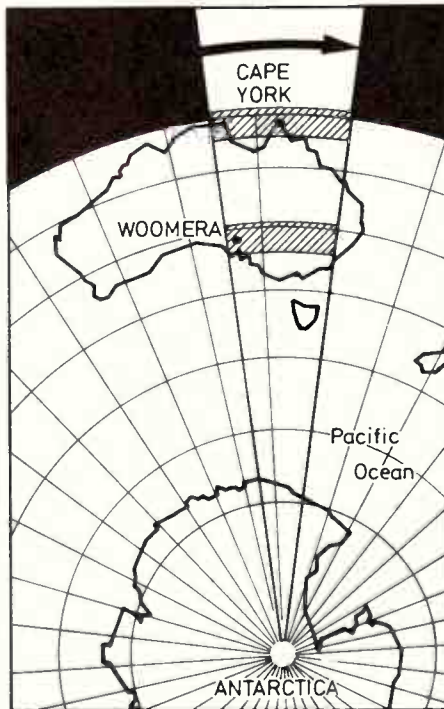
Nor is DCRS the only Adelaide company with links back to the rocket range. Fairey Australia and British Aerospace Australia, among others, both started out to provide an industrial base for Woomera. Today, both companies are heavily involved in the electronics industry, although BAeA still has an interest in space activities. For instance, currently it is building the Along Track Scanning Radar, ATSR, for the European Remote Sensing Satellite ERS-1.

The 1980s

The biggest rockets to lift off from Woomera

this decade have been sub-orbital vehicles-sounding rockets. A sounding rocket is designed to take a small package up several hundred kilometres, and then to bring it straight back down again. During the three or four minutes spent outside the atmosphere, the package conducts whatever experiments it is designed for, before deploying a parachute and returning to the recovery site.

The recent explosion of supernova 1987A (See ETI July 1987) was the occasion of a sudden flurry of launches from



In the same time the earth's rotation carries Cape York further than Woomera. The extra speed makes all the difference.

Woomera, as NASA and the West German Space Research Agency launched a string of telescopes above the atmosphere to detect emissions coming from the star. NASA is due back early in 1989 to check on the progress of the supernova. Apart from this, however, no large rockets have gone up from South Australia for the past eight years, and none are planned.

As a result, Woomera is slowly winding down. The decay is not physical. The entire site is beautifully maintained, ready and waiting for a rocket. In fact, you could launch one tomorrow. The main instrumentation facility a large two-storey building a few hundred metres from the launch pad, is all ready and waiting.

What is slowly wasting away is the expertise necessary to run the range. Men

and women who operated it during the fifties and sixties are now reaching retirement age and there is precious little reason why a young person would want to get involved. The action is elsewhere.

Cape York

It is ironic. Just as the Woomera range closes down, it looks as if Australia might re-enter the space business on a far more commercial level than was ever considered for Woomera. The idea of putting a space port on Cape York was originally merely a bee in the fertile bonnet of then premier Joh Bjelke Petersen. However, much to the surprise of most people in the industry, it looks as if it has a real chance of succeeding. Russians, Americans, Chinese; all have flocked to Queensland to look at the site, and talk to Federal and State officials. The Russians and Chinese in particular both like the idea. It may well represent a way of evading US COCOM rulings which prohibit American-made components being used in Russian or Chinese launched satellites.

Economic studies seem to show that the number of launches in the world will rise to a peak in the early 1990s and then sink to a steady average of less than a hundred a year, mostly communications and remote sensing work. If a reasonable percentage of those were launched from Cape York, it could provide the economic rationalisation for the opening up of the far north of Queensland.

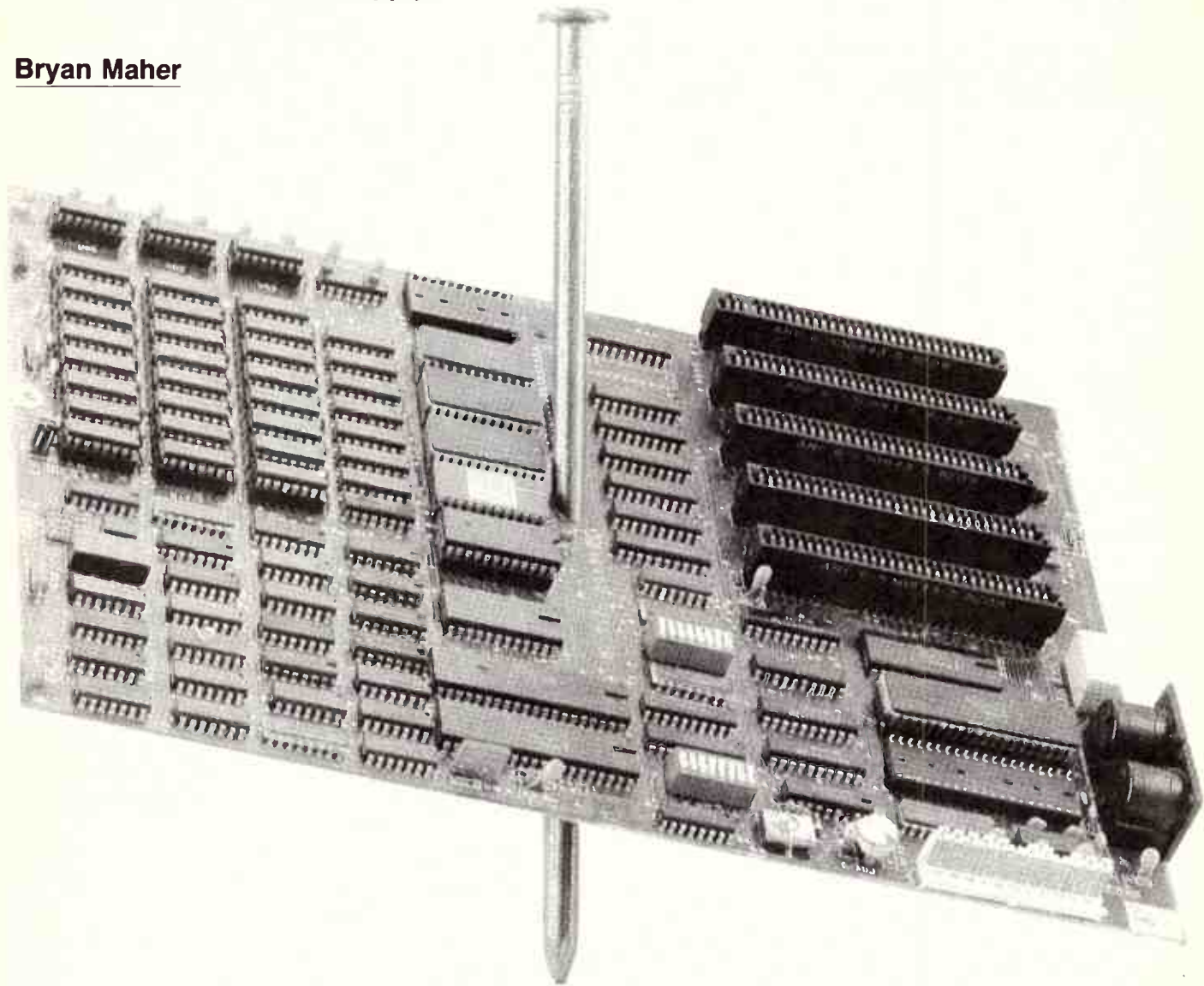
In addition, the impetus given by the Cape York proposal has made other countries show some interest in our new space capacity. In December, for instance, Australia and Russia signed a space research agreement. Among matters discussed between Department of Industry, Trade and Commerce secretary David Charles and Glavkosmos vice chairman Dukov was the possibility of Australian participation in the Mars programme (See ETI September 1987; Russia goes to the Red Planet). Other topics included a flight by an Australian in a Russian flight, and Remote Sensing Technology.

One of the fundamental problems the government of the day will face is: who will run the site. Already there are two consortiums in the race, and in all likelihood, the government will choose one of these. It has already decided against a public equity in the operation, so at least we can be sure that private enterprise will run it. The next question, of course, is who will man the site, actually do the donkeywork. If Cape York had been on the agenda 10 years ago, there is little doubt that the range operators from Woomera would have been able to move north and start again. As it is, it's too late, and we will have to begin again, from scratch. ●

A SPIKE ON THE LINE

Computers and modern electronic equipment, being predominantly microprocessor controlled, can easily be corrupted or "killed" by short-term variations in the 240 volt supply.

Bryan Maher



Our computers, video recorders, printers, terminals, telephone exchanges, modems, TVs, microwave ovens and hi-fi's operating from the 240 Vrms 50 Hz mains are all at some risk of malfunction and/or permanent damage due to variations in the voltage on the 240V mains.

Electricity Supply Authorities aim to

maintain the mains voltage at 240 V rms +/- 5 per cent. However, this goal is not achieved all the time.

Voltage Variations

The causes of variations in the supply voltage may be predictable or random:

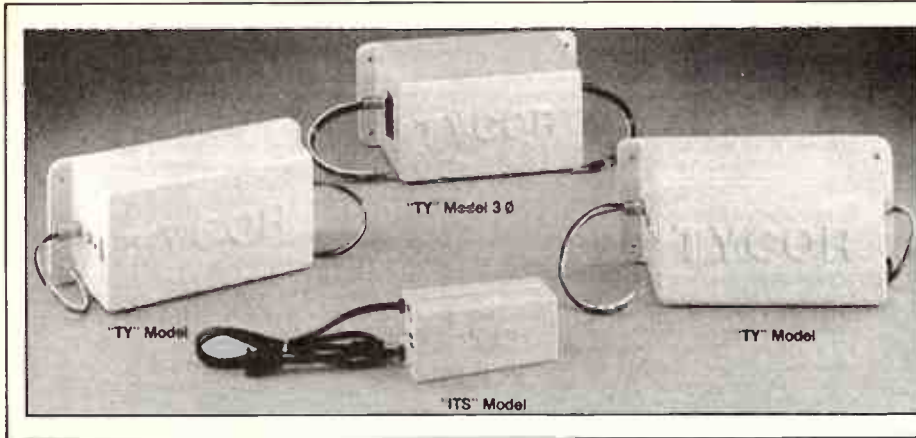
1. Switching on or off high voltage power

lines, large loads, like motors or so on.

2. Random accidental occurrences, such as lightning strikes, failure of high voltage power lines, broken cables, shorted transformer windings or lightning arrestors, blown high voltage fuses or the tripping of automatic high voltage circuit breakers.

3. Interference voltages caused by arcing

A spike on the line



Line conditioners come in a variety of shapes and sizes, from diodes to great floor mounted cabinets. These little blocks from Tycor are power line filters, dedicated to keeping the 50 Hz ac true. They are designed to withstand 6000 volts peak at 2000A, and according to the maker, will attenuate a 5000 V, 4usec pulse with a 200 ns rise time by 60 dB. Contact Electro-mark on (02) 570-7287 for further information.

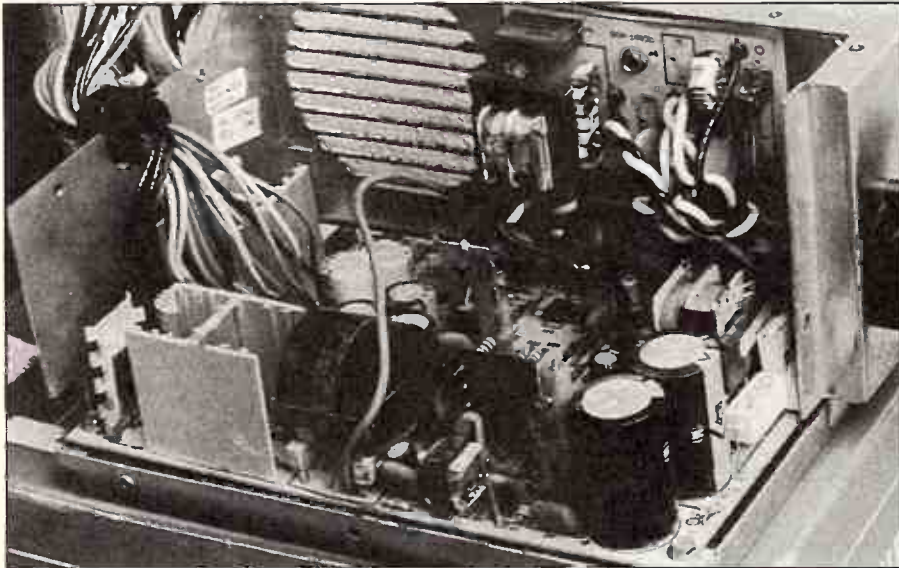
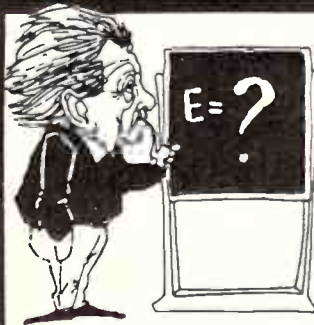


Figure 1
This switching power supply from a personal computer will operate on a wide range of input voltage and frequency; 180 V to 260 V and 40 to 60 Hz.

- contacts such as crane or lift motor contactors, or large oven thermostats.
4. Radiation of spurious large signals from electric welding and other arcs, arcing commutators in electric hand tools, or electrostatic voltage discharges. Such disturbances are radiated as radio frequency interference (RFI) by many sources and received by the 240 V mains.
 5. Large harmonic rf signals received by the 240 V mains; Only significant in 240 V mains within the close field of radio, TV or radar transmitters, or some TV receivers or computer terminals.
- Each of the above can cause malfunction of your electronic equipment.

Frequency Variations

Voltage is not the only variable. There are deviations in the frequency of the supply.



If your Transceiver uses Micro Logic Components, then we recommend

PRIMARY POWER PROTECTION

... protects your transceivers memory against spikes, glitches, lightning, on-off switches, electric motors etc. Max. peak surge current up to 4500 amps; transient energy absorption up to 75 joules.



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W.A.: Geo Moss P/L. Tel: (09) 446 8844.



PIF3-1A	1AMP	2STAGE +E.L.C.
PIF3-3A	3AMPS	2STAGE +E.L.C.
PIF3-6A	6AMPS	2STAGE +E.L.C.
PIF3-10A	10AMPS	2STAGE +E.L.C.

WS 25/M

READER INFO No. 10

Nominally 50 Hz, most bulk supplies in Australia maintain an excellent average frequency, accurate to a few parts per million when averaged over a 24 hour period. This is why synchronous clocks in most cities maintain accurate time.

However on any power supply system, every time a large motor is started there is a sudden demand for energy. Despite the sophistication of the voltage regulators in the power stations, there is only one energy storage source in any ac power system, namely the mechanical rotational kinetic energy of the high speed rotors of the power station alternators and their driving turbines.

This is known as the "spinning reserve" of energy.

Sudden withdrawal of spinning reserve to supply the extra electrical load can only mean a drop in rotor speed, until the control system can react and open the steam valves further to admit more steam to the turbines to recover the correct speed of 3000 rpm.

Such a temporary drop in rotor rotational speed causes a corresponding short time drop in the electrical system ac frequency. Similarly when a heavy electrical load is suddenly removed from the alternators, their rotational speed and hence ac frequency must increase for a short time until again controlled back to the correct values.

For example in Queensland, alternator rotor speed and hence ac system frequency are at any time within the range (50; +0.2; -0.3) Hz, often slowly cycling up and down over about 2 seconds periods.

In all states, large power generation systems involve many alternators, all synchronised, running in parallel. Their speed control systems exist in a state of dynamic equilibrium, meaning that automatic gov-

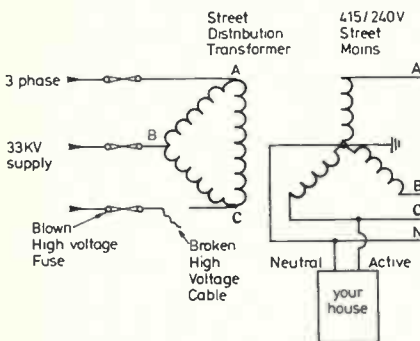


Figure 2
Two causes for the classic "brown-out". Interruption of one high voltage phase leaves the street distribution transformer yielding about 170 Vrms to your home.

ernors are continually correcting turbine speed as load is switched on or off out in the system, and the alternators must adjust their load share.

While these small changes in frequency have no effect whatever on power supplies of electronic equipment, any departure from 50 Hz can upset tuned ac line conditioners.

Causes And Effects

Consider in turn the causes of upsets in the 240 V supply and the effects of each on the operation of computers and other electronic apparatus:—

1. Complete Blackout

Most of us with personal computers or VCRs etc just heave a sigh when the power goes right off, grin and bear it or go for a long walk. We might as well, as the poor computer is somewhat useless without power.

Vital computer systems may have an expensive battery back-up, with a dc/ac inverter system, or (for important, very large users) a diesel driven alternator set.

If you consider purchasing a battery-ac/dc inverter back-up supply, we suggest you check to see if it produces a 240 Vac sine or square wave. (Many converters on the market give square waves!) The actual frequency value, 50 Hz, is not critical.

The computer switch-mode power supply in our photo, figure 1, (from an IBM-PC), will accept a wide range of voltage and frequency, 180 V-260 V; 40-60 Hz. However the waveform of the ac supply to a switch mode power supply is important.



Maitec's Linx uses MOSFETs instead of traditional ferroresonant thyristors technologies to produce an uninterruptible power supply. It is designed to provide full power in the event of a breakdown in supply from in-built batteries, and to act as a line conditioner during periods when the supply is at

normal levels. According to Maitec. The Linx will deliver an output that is within one percent of the nominal value of the mains supply irrespective of the size of the load. It will even withstand a continuous short circuit. For more enquiries contact the manufacturers on (02) 634-6211.

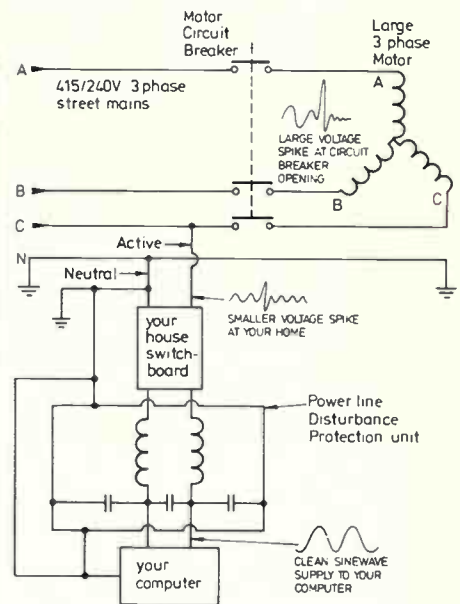


Figure 3
When the large motor down the street is switched off, its inductance produces a very large voltage spike. On the street side of the circuit breaker a smaller voltage spike rides on top of the 240 V supply to your house. You need a protection unit in the 240 V line close to your computer.

They are designed for sine wave supply and will malfunction if supplied by 240 Vac square-waveform.

2. Brownout

Figure 2 shows the cause of "brownout"

A spike on the line

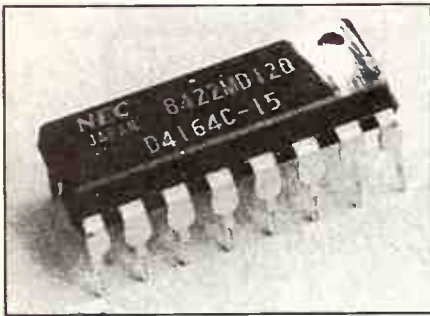


Figure 4
This 64 K memory chip type D4164C was "killed" by a voltage pulse on the dc supply rail. Now this chip is short-circuited from rail terminal to ground terminal.

in single phase domestic ac supply. Most suburbs and towns are supplied by 3-phase high voltage mains to street distribution transformers.

As the circuit diagram shows a break in one phase of the high voltage line (blown fuse or broken conductor) leaves the street distribution transformer with full power to the transformer winding between phases A and B, but much reduced current in the other two windings A-C-B.

The effect on the secondary circuit feeding your house supply is a drop from 240 Vac to approximately 170 Vac, though the frequency is not affected.

While computer switch-mode power supplies are very versatile in being rated to work correctly on reduced supply voltage down as low as 180 Vac, the effect of 170 Vac supply is too much. You will have reduced voltage on the 5 volt rails, resulting in uncertain computer operation and probably corruption of data written to memory or disk. Your TV receiver will give you half-size picture while your radio

may become distorted.

The biggest danger to your computer in a brownout is the violent voltage disturbance occurring at both the onset of the fault on the high voltage line and the eventual restoration of supply.

Automatic Tap-changing Transformers

Should the expense be warranted, a computer user could purchase an automatic motor-driven tap-changing transformer, installed in the supply line to lift the depressed voltage back up to 240 volts. The biggest danger will occur when the fault is fixed and supply returns to 240 volts. If the transformer is still set at the wrong ratio (170:240), it will give 339 Vrms output until the motor resets the taps to the correct 1:1 ratio.

Voltage Disturbances Under 600 Volts

There are frequent voltage disturbances on the 240 volt line, from a multitude of causes. These short-time over-voltages may cause the 240 Vac line to rise as high as 600 volts peak and/or fall by large increments.

Figure 3 shows a possible situation in your street. Every time that large motor is switched on and accelerates its load, the street line voltage feeding your house may drop 30 volts or 40 volts ac for a few cycles, until it recovers.

Again when that motor is shut down, (depending on what point of the current cycle was interrupted by the circuit breaker), the collapsing magnetic field of the motor will produce a high back-voltage across the arc on the circuit breaker contacts (while in the act of opening).

This back voltage can easily be a few kilovolts on the motor side of the circuit breaker, and may readily produce voltage disturbances up to 500 or 600 volts on your side of those opening contacts.

The event will usually be all over in a millisecond or so, but the fast-rising voltage waveform has a very great voltage-rate-of-change. Therefore the disturbance will readily couple by stray capacitance right through your switch-mode or other power supply, to appear as a short sharp high voltage pulse on your +5 V computer supply rail.

Experience has shown microprocessor chips to be remarkably tolerant in surviving such overvoltage, but memory chips, figure 4, have a bad history of breaking down, leaving them shorted from the +5 volt rail to ground. We then depend on the power supply to (hopefully) shut itself down to avoid power supply burnout by being short circuited.

Aerial Versus Underground Mains

Such over-voltage events are not at all



This is a Topaz Distribution box, which doubles as a distribution system for computer supplies. It is an extremely efficient unit, essentially just a one to one transformer. However, the output is multitapped, and during power surges or brown out, it switches taps. Special circuitry inside ensures the switching occurs at zero crossing points, so as to minimize the stress on the power supplies of the computers. This is the ideal way to protect against low voltage variations, but of course it does nothing for fast transient irregularities. These are managed by a noise suppressor which is claimed to give 120 dB attenuation. For further information see the Australian distributor: Online control on (02 436-1313).

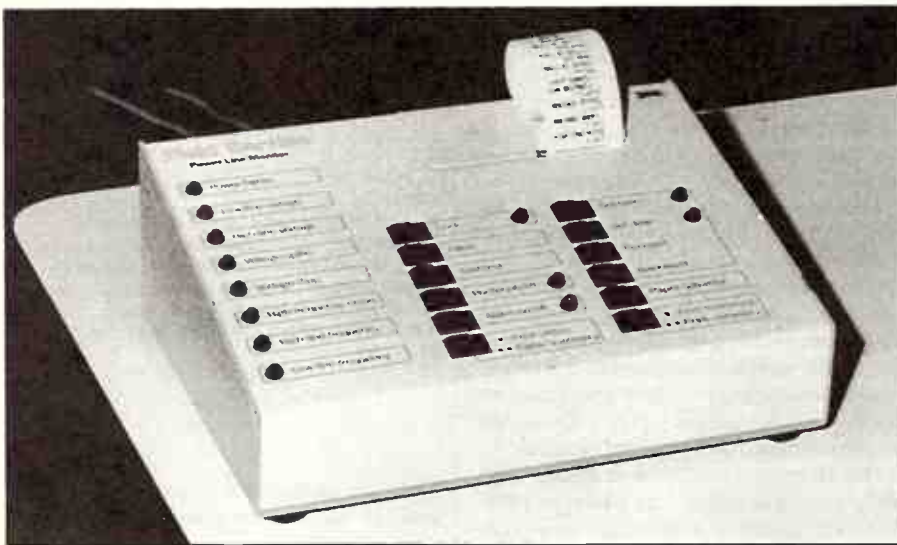


Figure 5
This power line monitoring instrument continuously monitors and records over-voltage spikes, low and high Vrms values, and frequency.

PWR LINE MONITOR SUMMARY	PWR LINE MONITOR SUMMARY
FROM 03:00PM MAY 5 TO MIDNTE MAY 6	FROM 10:20PM MAY 7 TO 11:50PM MAY 7
MAX RMS VOLTS 250V RMS	MAX RMS VOLTS 246V RMS
MIN RMS VOLTS 202V RMS	MIN RMS VOLTS 214V RMS
MAX AC SPIKE 66V PEAK	MAX AC SPIKE 62V PEAK
LOW RMS VOLTS BELOW 226VRMS: 3	LOW RMS VOLTS BELOW 226VRMS: 1
BELOW 180VRMS: 1	BELOW 180VRMS: 1
VOLTAGE SPIKES SINE + >50VPK: 35	VOLTAGE SPIKES SINE + >50VPK: 2

Figure 6
At left, part of power line monitor record taken on the Gold Coast. In a 90-minute period at night; twice the voltage rose in a spike more than 50 V above the sine wave peak, once the voltage fell below 226 Vrms and once the voltage fell below 180 V. Similar tests on one occasion at another substation recorded a spike of 5000 volts between 240 V active and ground. On the right is part of a printout tape from a power line monitor, showing a 33-hour period. Though the rms voltage remained within the limits 202 V-250 V, on thirty-five occasions the voltage rose more than 50 volts above the sine wave peak, i.e: more than 290 volt peaks.

rare, in fact they are all too common, with smaller over-voltages up to 400 or 420 volts peak occurring almost continually, as our test sample, figure 4(b), shows. Larger peaks occur daily in large industrial environments.

Even in domestic suburbs where all 240 volt supplies are run as aerial mains, over-voltage surges up to 500-800 volts occur too often. It seems that suburbs where all 415/240 Vac supply mains are underground suffer less from over-voltage peaks, as the capacitance to ground of kilometers of buried cable forms a natural low-pass filter, attenuating these fast over-voltage pulses.

Nevertheless it is strongly recommended that all computer installations be fed via a filter in the 240 volt line installed as close as possible to the computer, as in our picture. Every home should have one (or more).

Filters

Such a filter may take one of a number of forms, one such is shown in figure 7. Filter types may be either:—

(a) Simple L-C Filter

A simple L-C filter as in figure 8, where two inductances L are used so that both common mode and differential mode over-voltage may be attenuated. The best that

STAL RANGE

The Stal range of uninterruptable power supplies. They deliver between one and 5 kilowatts for up to 15 minutes in the event of power failure. For more information, contact Imuneclec Australia, 21 Orchard Road, Brookvale, NSW. (02) 938 5737.

can be hoped for with this type filter is a reduction in the height of short sharp over-voltage pulse.

(b) L + R filters

A combined L + R impedance with shunt semiconductor double-ended diodes which clamp voltage at a particular peak level. Though simple and effective on slowly rising overvoltages, these avalanche diodes unfortunately may take microseconds to change from the normal to the "clamp" state.

During that time lag, very fast large

Possible Interference waveforms superimposed on nominal 240 Vrms supply.

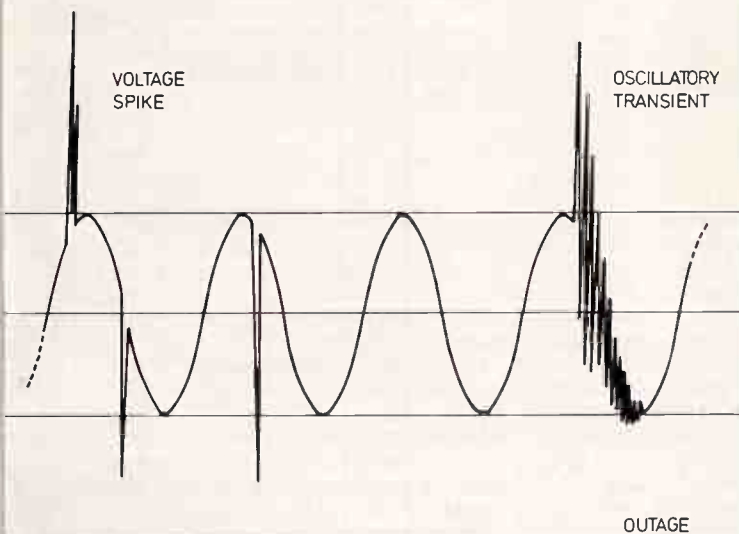


Figure by courtesy Tycor Ltd.

TYCOR® AC POWER LINE FILTERS

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- Improved customer Relations
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A spike on the line

over-voltage spikes pass through the filter without attenuation, to the detriment of the electronic equipment it is meant to protect. A type of voltage-dependent resistor marketed as "varistors" may be used instead of diodes as clamps, usually clamping the line to a peak voltage ± 400 volts, but these too have a reaction time, typically 35 nanoseconds, during which the following electronic equipment is unprotected.

(c) Saturated Transformer Filter

The saturated transformer type filter as figure 8, in the form of a double wound transformer wherein the core is saturated when on 75 per cent or more of rated full load. As a saturated iron or ferrite core cannot produce any more magnetic flux in response to overvoltage impressed on the primary, no overvoltage can be produced by the secondary.

These filters should protect the following electronic loads from overvoltage, but are non-ideal on three counts:—

1. Stray capacitance from primary to secondary winding can carry fast voltage spikes into the secondary circuit.
2. The saturated core tends to produce square wave output rather than sine wave, to the detriment of switching type power supplies.
3. Unless loaded to 75 per cent or more of rated load, these filter transformers are not in saturation, so are no protection at all.

(d) Tuned Filters

The "tuned filter" type over-voltage protector, which is just a very clever circuit tuned to 50 Hz, follows the supply sine wave up and down through its normal sinusoidal excursions, automatically filling in any gaps or holes in the sine wave voltage, and suppressing any over-voltages.

These are almost ideal in protecting your computer's electronics, but may perhaps have trouble from three causes: —

Telephones

One of the most invidious line problems belongs to Telecom, who must attempt, some how, to protect miles of telephone cable, sometimes strung in the air, from lightning strikes. The consequences for a subscriber in the event of suddenly being connected to a bolt of lightning are dire indeed. Telecom, like most of the world's phone companies, strongly advise against using the phone during a storm if there is electrical activity.

However, they also take considerable steps to protect the lines. This is not only because they want their subscribers to stay alive, but also to protect exchange equipment. The fa-



Figure 7
Your humble author would never switch on the IBM-PC without this power line filter in the 240 V line.

1. Continual small variations in the supply frequency, departing by as much as 0.3 Hz from the nominal 50 Hz (as discussed earlier in this article). Furthermore, tracking measurements show that in any one week period it is highly probable that some fault on the

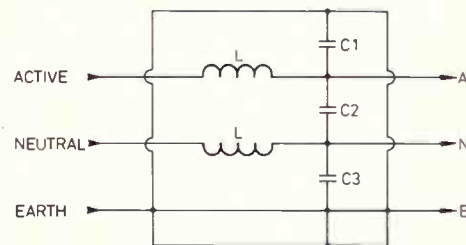


Figure 8
The simplest power line filter, using inductances in both active and neutral lines to protect against both common mode and differential mode high voltage spikes. The inductors must have low self capacitance; and the capacitors, to be fast, must have low self inductance.

voured method of protecting telephone lines is with transient protection diodes. They give extremely fast response to voltage surges, and are cheap enough to be bought in the quantities required.

Semiconductor protectors, of which the most common is probably General Semiconductors Transzorb, work by clamping voltages below a certain critical level after the manner of a zener diode. The Transzorb is a P-N junction avalanche diode, typically connected cathode to cathode across the line so that it provides protection for either polarity. Versions are available that will handle up to 1500 watts.

What's the greatest threat facing the computer today?

Australian and American experts agree on what it is, although their estimates of how much it costs you in downtime varies. Americans believe it accounts for more than 30% of all computer failures. Yet some Australians say their practical experience leads them to believe 70% would be a far more accurate figure.

Surprisingly enough, the greatest threat to your computer is the very power it runs on.

The way to control the power to your computer and avoid these costly breakdowns is with Clean Line Systems. Their power conditioners, uninterruptible power supplies and other products and services can eliminate all disruptive power line disturbances. They provide stable, clean electrical energy. They can combat the damaging effects of lightning and even have inbuilt safety systems to ensure the power to your computer is never cut off unexpectedly.

Clean Line Systems is a wholly Australian-owned company that designs and manufactures its own equipment. They are the people more computer companies choose to protect their corporate computers.

All Clean Line Systems equipment conform with the most stringent specifications here in Australia, America and Europe. It is so advanced that it is half the physical size and weight of most comparable competitive systems. And it outperforms them too!

Clean Line Systems equipment is not noisy, it runs cool and does not emit any damaging magnetic fields. Best of all, it can grow with your computer needs. Plus, if you ever need it, full service back-up is available 24 hours a day, seven days a week.

Clean Line Systems can eliminate the greatest threat to your computer today. You can purchase, lease or rent immediately.

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The logo for 'eti' is a light blue shape resembling a stylized house or a speech bubble with a small notch at the top, containing the lowercase letters 'eti' in a bold, black, sans-serif font.

eti

No 14 \$1.00

Sound insights

AUSTRALIA'S HIGHEST CIRCULATING HI-FI MAGAZINE

A pair of large, rectangular, light-colored wall-mounted speakers with a woven grille, positioned in a room. The background shows a white wall, a window, and a plant.

**NEW
JAMO WALL
SPEAKERS**

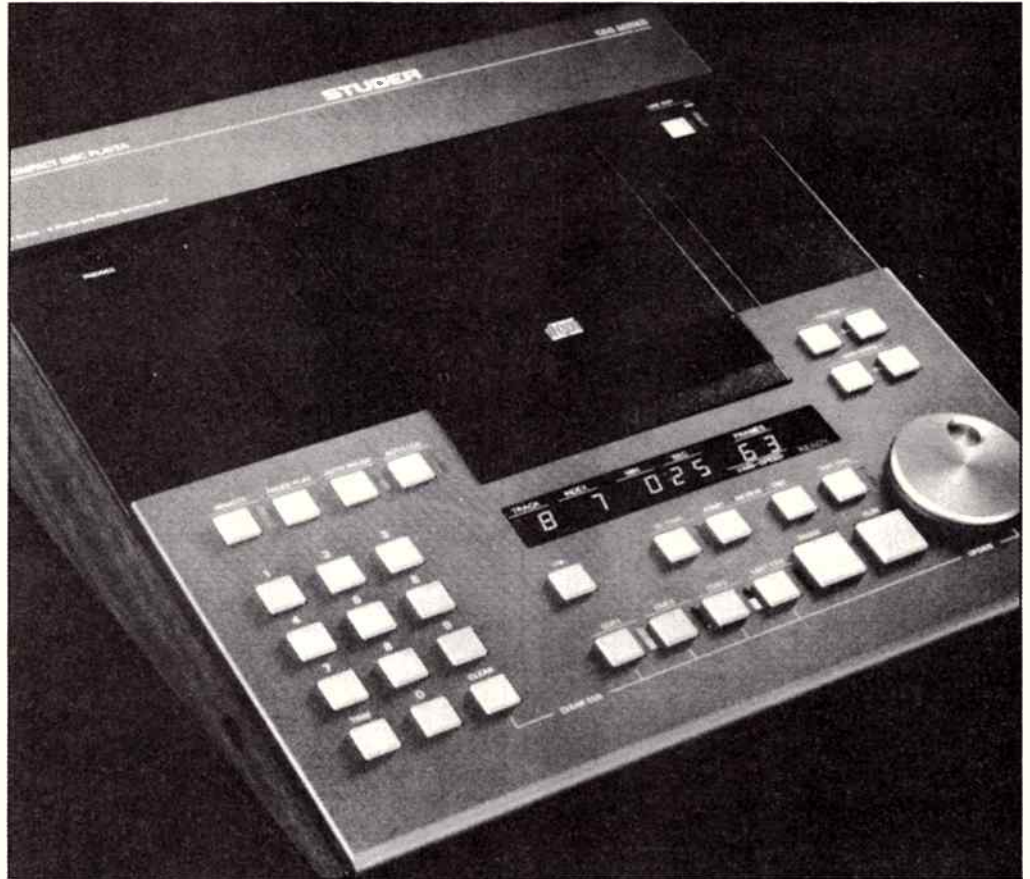
A pair of large, black, rectangular floor-standing speakers with a woven grille, positioned in a room. The background shows a white wall, a window, and a plant.

**NEW TANNOYS
REVIEWED**

Sight and Sound News

New Professional CD Player

Digital recording on an optical medium was introduced in 1982 with the first compact disc player. A new joint venture between Philips and Studer is one of the latest developments in the evolution of the technology. And the first offspring of the new company, Studer and Philips CD Systems AG, is the professional CD player, the Studer A730. The unit incorporates the features of an advanced consumer player such as 16-bit four-way oversampling and high quality DACs, but much of the engineering effort relates to the peculiar requirements of the studio DJ. It is a top-loader model with an ac-



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cessible compartment through which the disc can be placed directly on to the platter. This is so that the CD can be changed quickly and so that the player can be installed flush with the desk top. The player is designed in such a way that the new 8cm CDs can also be played without an adaptor. Apparently the jock has need for

a device which varies the motorspeed by 10 per cent and hence the pitch and rhythm.

A variety of other functions allows the operator to listen silently, cue, select, program, recognise discs, use the player remotely through, say, a mixer and many other actions. The unit includes a RS422 SMPTE/EBU bus allowing it to

function with several units, perhaps controlled by a PC.

The A730 is aimed at studios, discoteques and for audio dubbing applications. It will also be of interest to high-end consumers. It is available from Syntec, 60 Gibbes Street, Chatswood 2067. Phone (02) 406 4700.

READER INFO No. 232

Murray Joins LSE

Murray Amplifiers has merged with LSE Technology, a company which specialises in the design and provision of turnkey communications and broadcasting systems. The joint group will now design, install and commission complete professional sound reinforcement, broadcasting studio and public

address systems in addition to LSE's normal services. Both companies will be located at Frenchs Forest, Sydney.

Murray Amplifier products have been used in some reputable ventures such as by the ABC in its broadcasts of the 1982 Commonwealth Games from Brisbane, in the new

Papua New Guinea Parliament House, and The Sydney Opera House, Cyril Murray was involved in the design and installation of the audio system in our own new Parliament House.

READER INFO No. 234

1988 Audio Forecasts Down

The Consumer Electronics Suppliers Association (CESA), representing the major Australian importers of audio and hi-fi equipment, has released market forecast figures as part of its annual Industry Consensus Market Report for the 1988 market.

The figures in unit quantities are set out in the table and represent total projected sales for the year (January to December) in excess of \$390 million.

Although CESA speaks of an industry confidence about the figures, and certainly the figures are substantial, they show a drop in most categories over last year's forecasts. In actual sales for 1987 the only available figures for comparison were in four categories CD players, amplifier and receiver systems (together), mid size 3-in-1 music centres, amplifier and receiver systems, and full size 3-in-1 music centres.

Comparing the figures, forecast increase is predicted in the sales of CD players in 1988

over 1987, from 127,679 actual units sold in 1987 to 142,000 forecast for 1988. Another increase is expected in amplifiers and receivers, from a combined figure of 38,853 units actually sold in 1987 to a combined figure of 49,000 forecast for 1988. Three-in-one music centres are expected to decline in sales from 163,000 actual sales in 1987 to 154,000 units forecast to sell in 1988. Midi size music centres, amplifiers and receivers (combined figure) are, too, expected to decrease in sales, from 60,960 units sold in 1987 to 58,000 expected to sell in 1988.

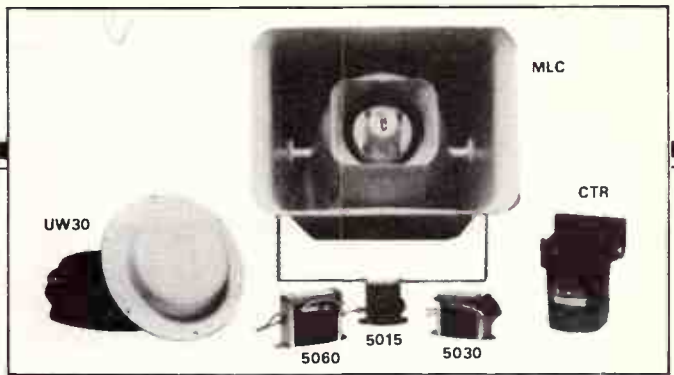
The forecast figures are compiled by Price Waterhouse from estimates supplied by the members of CESA. An "average" is reached by excluding the highest and lowest forecasts. CESA is made up of 11 member and 8 associate member companies representing the main Japanese hi-fi manufacturers as well as Philips and Bose. No Australian manufacturer is represented.

READER INFO No. 235

FORECAST AVERAGE SALES AUDIO AND HI-FI EQUIPMENT IN UNIT QUANTITIES

Category	1988 Forecast	1987 Forecast
radio	353,000	295,000
clock radio	318,000	298,000
players	86,000	95,000
portable stereo radio/ cassette players	470,000	606,000
stereo headset players	479,000	363,000
cassette recorder/player	55,000	62,000
CD players	142,000	131,000
3-in-1 music centres	154,000	150,000
amplifier systems	23,000	34,000
receiver systems	19,000	25,000
midi size*	58,000	58,000
car radio cassette combo units	73,000	90,000
car speakers (flush mount)	205,000	233,000
car speakers (box mount)	14,000	18,000

* Amplifier, receivers and 3-in-1 centres.



Underwater Speakers

University Sound equipment has been around for some time. The US company was founded in 1936 and promotes itself with a litany of firsts in the hi-fi world. Among its claims are that the company produced the first self-centering loudspeaker voice coil and magnetic gap, permitting closer proximity without rubbing, for higher efficiency and more accurate response. Another is that it developed the reflex or folded horn; yet another is its claim for leadership in developing blast-proof speakers.

The company has a range of equipment including mixer/power amps but its speciality is transducers, speakers and microphones. One of its most recent "firsts" is for its commer-

cially accepted underwater loudspeaker.

It may be the wrong time of the year in Australia to talk about underwater speakers but... the UW30 is a single speaker which, the manufacturer claims, efficiently covers a pool with your favourite sound. The speaker can be flush-mounted in a wet-niche (similar to that used with underwater lights) or simply dropped into the water. There are no exposed metal parts to cause corrosion or electrolysis, says the manufacturer.

Specs are 100 to 10 kHz, 30W power handling capacity, 88 dB sound pressure level with 8 ohm voice coil impedance.

READER INFO No. 236



Cassette Deck Piping Up

The cassette deck is not dead yet, although the CESA figures quoted elsewhere might suggest it's in its autumn. Yamaha has released a new range among which is the KX-800U.

The deck is a single cassette player/recorder with a three-head system being 12-layer laminated amorphous recording and play heads, and a double gap ferrite erase head. Other notable features include an Optimum Record Bias Tuning facility which consists of a bias test button and adjustment

control and meter which allows the user to adjust the bias level to individual tapes. The Myriad Dolby varieties it has are HX Pro Dynamic Bias Servo, Double Dolby B and C and Double dbx noise reduction which have been introduced with taping from CDs in mind.

The remote control is an almost daunting 28-key device and the paradoxically named random play feature permits nine or less selections to be programmed into the memory for playback.

READER INFO No. 237



New Celestion Speaker

A new series of speakers from Celestion, the DL Series Two, has been released in Australia. The series is made up of four models, the DL4, DL6, DL8 and DL10. All the speakers except the DL10 are two-way

with fast response base drivers and titanium tweeter domes. The larger DL8 uses special bracing to strengthen the relatively thin side panels. The high power handling DL10 is a three-way system.

READER INFO No. 238



S-VHS from JVC

In London, JVC has announced the world's first Super VHS Euro System VCR — the HR-S5000.

Super VHS delivers more than 400 lines of horizontal resolution, an improvement made possible by recording the luminance signal in a higher and broader carrier frequency band. Another improvement in the signal to noise ratio has been achieved by expanding the frequency deviation and using a non-linear sub-emphasis system.

The development of Super VHS is a direct response to satisfy consumer demand for higher picture quality.

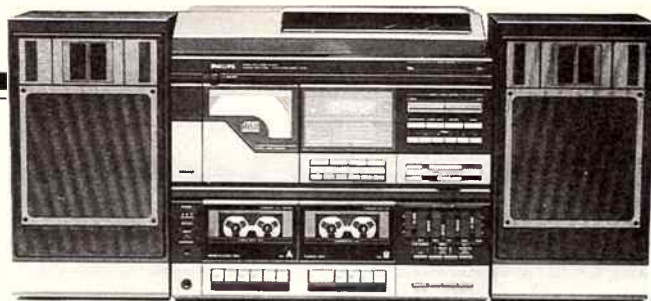
To ensure that none of that Super VHS quality is lost, the

HR-S5000 has a built-in wide bandwidth tuner capable of detecting a much wider range of video signal frequencies than before. To enhance picture quality in both the SP and the LP modes, a Super Double Azimuth 4-Head (Super DA-4) combination video head system — based on JVC's Double Azimuth 4-head (A-4) system — has been incorporated. First rate picture quality in VHS recording and playback is also ensured by picture improvement circuits.

The HR-S5000 will be released in Australia later this year.

For more information contact Hagemeyer on (02) 750-3777.

READER INFO No. 239



Watch The Disc

Philips has released three new "four-play" combination systems, that is CD player, cassette deck, tuner and turntable combinations. They have a novel arrangement of the CD unit, abandoning the horizontal tray system and building in the CD facility vertically, like a cassette deck. This way the disc can be viewed through a front panel.

Each system features 60 watts peak music power, dual

cassette deck with high speed dubbing and five-band graphic equaliser. The CD player has 20-track memory and the digital AM/FM stereo tuner has 12 preset channels. The turntables are belt-driven with magnetic cartridges.

Recommended retail prices range from \$959 for the XC3006B shelf unit, to \$1129 for the CS3115B floor standing system and \$1249 for the SC3149 hickory walnut version.

READER INFO No. 240

More Test Tapes . . .

The AAC9 is an Australian-made test tape for the hi-fi enthusiast and audio tradesman. A range of tests can be performed without other test equipment or technical knowledge, the most useful one being a test of tape speed. The tradesman user is encouraged to use this tape so as not to risk damage of proper alignment and test cassette tapes. The first six minutes of the tape is a 1 kHz sine wave, the next six minutes a 5 kHz sine wave, then a 2.5 kHz sine wave suppressed for 10 seconds every 10 seconds. Cost is \$19.95.

The LC Engineering products are of a more advanced, imported range, aimed at the audio tradesman. Each tape is a master, not a duplicate, and each is individually produced, tested and numbered. There are six models which test head alignment, tape speed, signal-to-noise ratio and wow and flutter. They are priced from \$36 to \$39.95.

There are three video cassette test tapes aimed at the professional. The recent cessation of broadcast test signals has made these even more useful.

The VID50 is designed as a test tape for fault diagnosis so as not to risk damage to a proper alignment tape. It contains a 30 minute colour bar signal at 1 kHz audio tone. Cost is \$49.95.

The VID60 contains everything necessary for video alignment excluding sweep for head alignment. It contains a 20 minute black and white staircase followed by 10 minutes of colour bars with 333 Hz audio tone; then follows a black and white staircase with 6 kHz linear stereo audio tone and a 10 minute colour bar with 333 Hz linear stereo audio tone. Cost is \$89.

Next step up, the VID70 does contain everything necessary for video alignment, including sweep for head alignment. It has an eight minute rf sweep followed by eight minutes of colour bars with a three kHz audio tone, then an eight minute staircase with monochrome 333 Hz audio tone and a six minute crosshatch, testing linearity of input versus output. Cost is \$115.

The tapes are available from Wagner Electronics, 305 Livepool Rd, Ashfield 2131. Phone (02) 798 9233.

READER INFO No. 241

Specialists Label Themselves

SPECIALIST



Hi-Fi
Association

If you see this sign hovering around your local hi-fi dealer, it signifies membership of a new group entitled the Specialist Hi-Fi Association (SHA). The professed aim of this coterie is to, in the words of its president, Gary Sellers, "im-

prove the general understanding and confidence of consumers towards component high-fidelity sound" through the maintenance of high standards and public education.

READER INFO No. 242



VideoMovie Update

The latest in the JVC VideoMovie (video camera) lineup is the GR-45EA. It weighs 1.2 kg, has HQ (high quality) circuitry and a new super high resolution CCD image sensor. Features a manual over-ride auto-focus, variable speed electronic shutter and two-speed 6X power zoom. Its Master Edit Control System allows the user to simultaneously control

both the GR-45 and any JVC deck equipped with a remote pause terminal using the video camera's controls. Other features are a second record start/stop button, selectable date/time recording and a demonstration tape. The GR-45EA is a VHS-C unit compatible for replay with the home VHS system. RRP is \$3099.

READER INFO No. 243

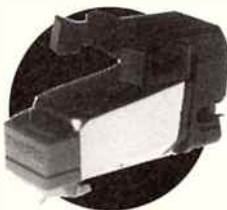
CARTRIDGE OF THE MONTH



ME70B



ME92E



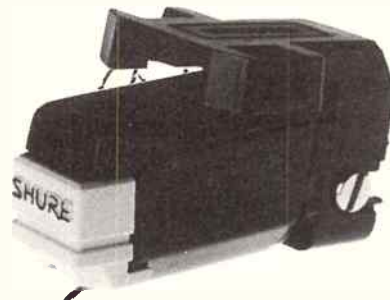
ME99E



ME95E



M104E



M104E

The M104E is ideally suited for the person who needs outstanding sound performance and wants to upgrade their system on a limited budget. This cartridge captures and recreates sound with elliptical shaped diamond stylus tip and an aluminium alloy shank to faithfully reproduce your favourite music.

The M104E cartridge is compatible with 1/2" mount tone arms or most P-mount tone arm systems.

The M104E features a slide-on stylus guard plus a screwdriver and mounting hardware.

You'll find no other cartridge offers so much for so little as the M104E

SPECIFICATIONS

Tracking Force at the Stylus Tip:
Optimum: 12.5 mN (1.25 grams)
Maximum: 15.0 mN (1.5 grams)
Trackability at 12.5 mN (1.25 grams) Tracking Force (Typical in cm/sec peak velocity):
M104E: 400 Hz: 24 cm/sec
Frequency Response: Essentially flat
20-20,000 Hz
Channel Balance: Within 2.0 dB
Channel Separation: 1 kHz: 25 dB typical
Output Voltage (Typical):
M104E: 5.0 mV RMS at 1 kHz at
5 cm/sec peak velocity
Net Weight (with mounting adapter, screw and nut):
M104E: 7.3 grams; also P-mount compatible

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51 Scarborough Beach Rd,
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ShrC14

AE08

READER INFO No. 11

SOUND INSIGHTS, AUGUST '88

5



Hands Free Chatter

A new featherweight (metaphorically speaking) headset providing high audio quality has been released by AKG. The headset is intended for use in verbal communications, eg aircraft cockpits etc, but AKG claims the new Q24 is also suitable for TV and radio production. One or two earpieces can

be used for listening and the mic arm is adjustable. The Q24 comes in two versions: the 24/10 weighing 90 g features a studio quality miniature electret condenser mic; and the 24/20 weighing 100 g with a dynamic noise cancelling, close-talking mini-microphone.

READER INFO No. 244

NAD & KEF Co-operation

The new NAD 8020e small bookshelf speaker system is the result of work conducted by NAD in conjunction with other British speaker manufacturer, KEF. The speaker comes in a

woodgrain finish with a high sensitivity rating of 90 dB and is suitable for use with 10 to 60 watt amps. RRP is an attractive \$499.

READER INFO No. 245

Unsound Enterprises

Bargain hunters beware! Not only do you have to guard against the unscrupulous tape pirate peddling his badly dubbed versions of the greats on cheap and nasty tape, but warnings have been issued to look out for the unscrupulous peddler of cheap and nasty tape dressed up as the real thing. According to TDK,

which spends time and money chasing these things, outfits based in South East Asia are selling fake TDK cassettes. A case to point was the recent raid on Singapore company Sound Enterprises which uncovered 6200 pieces of fake TDK audio tape, 1000 wrappers, 108,000 index cards and 165,000 casings.

READER INFO No. 246

Party Speakers

The new Party Partner speaker released by AR follows on AR's theme speakers, the Powered Partner, Rock Partner and Environmental Partner. The new speaker is a stage style monitor delivering 100 watts in either a bookshelf or floor-standing model. It uses a 10-

inch woofer and 1-1/4 inch liquid cooled cone tweeter in a black vinyl veneer cabinet. Styled in a wedge shape, its specs are 48 Hz to 22 kHz frequency response, and 89 dB SPL with 2.83 Vrms input at 1 meter.

READER INFO No. 247

Harmon Kardon Distributor

Sydney based Convoy International has been appointed distributor of Harmon Kardon products in Australia. Convoy

is at 400 Botany Rd, Alexandria, 2015. (02) 698-7300.

READER INFO No. 248

Early Wireless & Sound Society

Interested and avid followers of early radio and sound systems may shortly get together once a month if a proposal from John Murt, a keen collector of mysterious early relics (early wirelesses and sound systems), is accepted.

Murt presented his proposal to start an amateur society to the members of the Phonograph Society of NSW in February because there is currently no active society in Sydney.

The main objectives of the Society will be to encourage the preservation, restoration and collecting of early radio sets. It is intended that a quarterly newsletter will be published informing members of the history of various aspects of

early radio, availability of parts, films nights, auctions and exhibitions. John added "that I would like the montly meetings to be both educational and entertaining, not just purely exhibiting members' prized objects, but presenting all aspects of the history and technology to do with early wireless."

It is intended that the club hold its first meeting on the fourth Friday evening in June, subject to a suitable venue being found. The Society is open to anyone who shares similar interests is asked to contact John Murt at The Early Wireless & Sound Society of NSW, Post Office Box 623, Lane Cove 2066, or ring (02) 488-8184.

READER INFO No. 249

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Warranty Wisdom

Apart from the manufacturer's warranty, another "statutory" or "implied" warranty exists under the Trade Practices Act . . .

Mary Rennie

Recently Yamaha revoked its well publicised five-year warranty on CD player laser heads, cassette deck record/playback heads, and on goods for commercial use. Reassessing the wear and tear on these items and the heavy use they are put to, Yamaha decided to guarantee them for one year only. This brings it just slightly closer to Yamaha branches worldwide where all Yamaha products are under warranty for just one year.

The five-year warranty Yamaha offers on its goods in Australia is part of a marketing policy devised for the Australian market, and according to spokesman Lindsay Woodland, the cost of extra servicing is easily outweighed by extra sales. Nevertheless, (in a perhaps contradictory statement) Woodland said he did not expect to lose any sales with the reduced warranty periods.

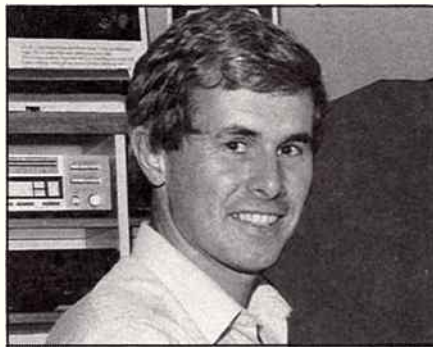
The interesting thing to note in all this is that Yamaha invests quite a bit in the attractiveness to the consumer of a long warranty. It is a factor consumers should not overlook when buying a product in conjunction with the future of the manufacturer or retailer — whether the company will be around in business to honour a warranty should something go wrong.

Noticeable Variation

On hi-fi goods, the warranty period varies noticeably between manufacturers. For example, NEC products are covered for a period of one year while Australia's Orpheus offers a five year warranty. Different products within a company's range may incur different warranty periods. While it behoves the consumer to enquire about warranties and conditions there are some legislative safeguards. Apart from the familiar manufacturer's statement of warranty, another "statutory" or "implied" warranty exists under the Trade Practices Act. The implied warranty means, among other things, that the product must be merchantable. That is, it must

do its job properly for a reasonable period of time (which may well be longer than the manufacturer's warranty period).

If the consumer can show that a fault existed in the product at the time of purchase and that it did not occur due to normal wear and tear, he is entitled to a refund, repair or replacement from the seller or the manufacturer. It is important to note that the legislation holds the seller as well as the manufacturer responsible for making good a faulty product. The seller is entitled to indemnity from the manufacturer, and many retailers will replace or



Mr Len Wallis . . . educating the public to integrate components.

repair a faulty item under warranty then pursue the matter with the manufacturer later.

In this light, it may be wise to buy products of a new manufacturer through an established retailer if you have any doubts about the new company's stability. If both the seller/retailer and the manufacturer close down, the unhappy consumer is unlikely to get any satisfaction.

Small Claims Tribunal

Business and Consumer Affairs is available to help anyone who feels they have a case against a seller or manufacturer regarding faulty products, and the Trade Practices Commission has brochures on the subject available to consumers, retail-

ers and manufacturers. If negotiation with the company is unsuccessful the usual next legal step is to take the case to the Small Claims Tribunal.

Despite the ubiquity of the term, there is no such thing as an unconditional guarantee, express or implied. Manufacturers are very unlikely to refund, repair or replace an item taken to with a sledge hammer. But neither are they unapproachable on faulty goods which might arguably have been caused by the user, although they are, of course, the final arbiters.

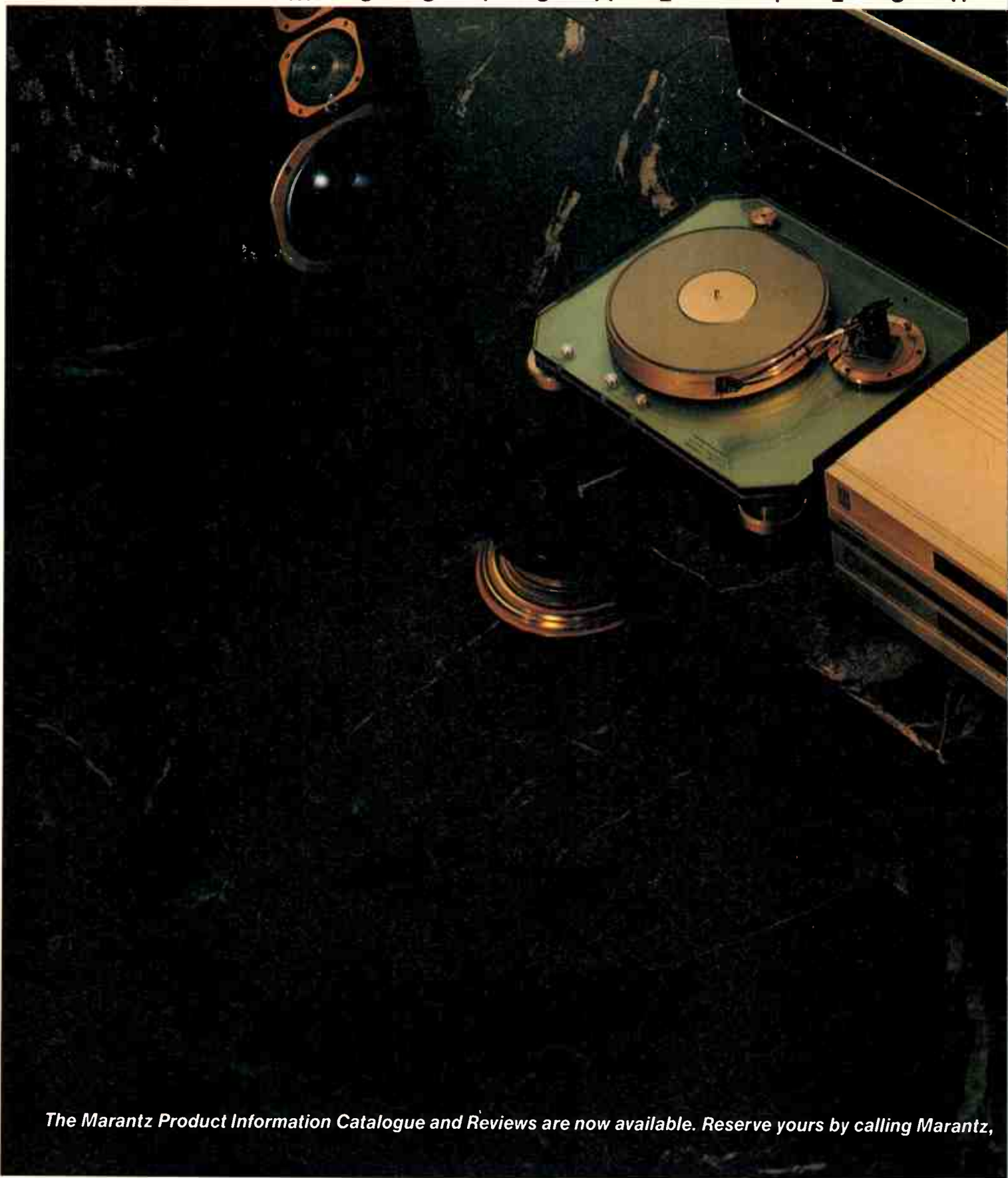
According to Len Wallis of Len Wallis Audio in Sydney, that is not the problem. In fact, many manufacturers will freely service faulty products just out of warranty (which they may be obliged to do under the implied warranty anyway) and they are tolerant of servicing products even if the fault has been caused by user abuse. Rather the problem, according to Len Wallis, is educating the public to integrate and use hi-fi components carefully and appropriately; in particular, to match amps and speakers for power and not to pump up the amp and burn out the drivers. While that is the commonest fault attributable to users, Wallis blamed the industry for not making consumers aware of the dangers of excessive power.

Retailers Bear Brunt

Another criticism Wallis has is for the turnaround time for repairs. According to him customers can expect to wait on an average three weeks for goods under warranty to be serviced, a situation he considers unacceptable. While manufacturers honour their warranty obligations, it is not in their immediate interest to do so hastily or at the expense of other paying customers. Retailers, meanwhile, must answer to the customer. The problem is exacerbated when the warranty is a long one as spare parts become fewer and may need to be shipped in from overseas or substituted.

But Len Wallis' stories are not all bad. In fact, he speaks proudly of an Australian company, Duntech. When a user burnt out his expensive Duntech speakers by overdriving his amp (three times), Duntech not only accepted his claim on warranty, it supplied a handmatched speaker from Adelaide which was installed in the speaker at the owner's Sydney home the next day. ●

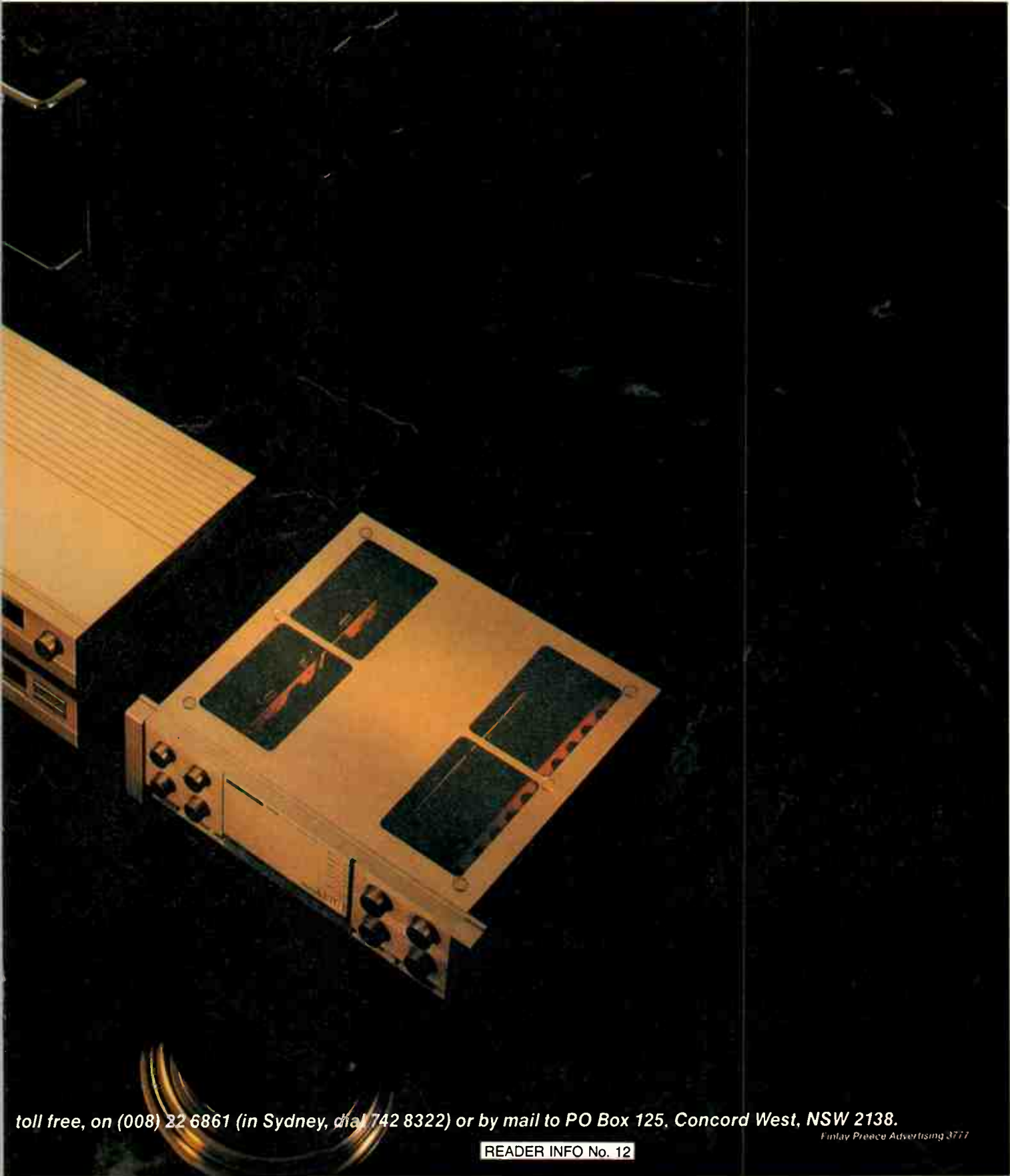
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READER INFO No. 12

FLASH! Strobe Sheds New Light On Fast Motion Cinematography



In film-making, persistence of vision is the key to the illusion of motion. The succession of still pictures shown in the cinema at 24 per second makes a 'movie'. In fact, we actually witness 48 frames of vision — most projectors have twin-bladed shutters, giving each frame of the film two bursts of light. Less than around 45 'pictures' a second, and we see flicker.

In the depiction of motion another factor enters the picture. Until now it has mattered little that the individual frames showed blurred action — it all seemed to add to the movement illusion. Now, even amateur video cam-corders are available with in-built shutters running to 1/4000th of a second with the capacity to record fast action, sports, etc with sharp detail. At normal replay speed the depiction of medium to fast-moving action is improved — and the crispness of image information in each frame allows detail-packed, analytical inspection at slow replay speeds.

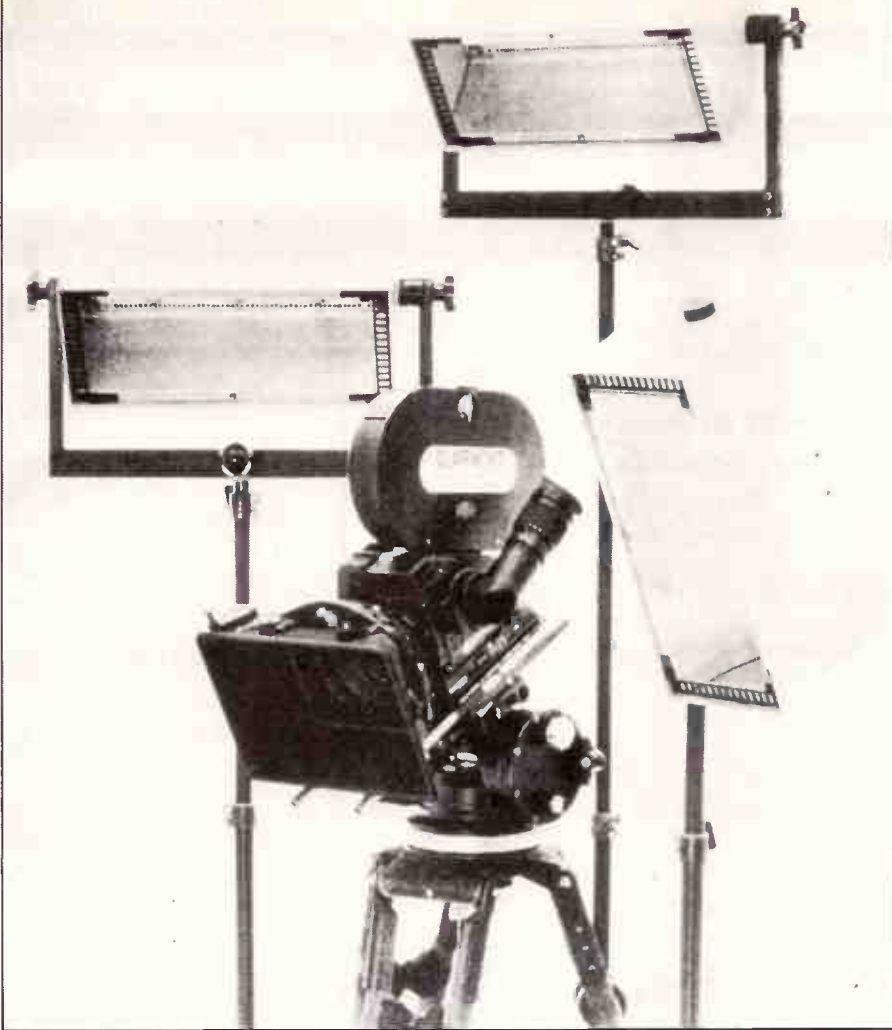
Professional motion picture photography has employed high speed camera photography for decades. In the early days it was probably an impossibility for the poor cameraman to wind any faster than 20 odd frames per second; sound called for electric drive cameras — and opened the way for the technique that has become known as 'slow motion'.

At 24 frames the camera's effective shutter speed is 1/50th of a second, sufficient to capture a sharp image of an object 30 metres from the lens provided it is travelling at less than 8 km/h — walking speed.

A car passing at 80 km/h would call for a shutter speed of 1/500th of a second to capture a sharp frame: and a camera speed of 250 frames per second.

Increasing the number of frames running through the camera in a given period results in 'slow motion' when played back at the normal 24 fps. Most commonly used slow motion speeds in feature film and TV commercial shooting are 80-100 frames per second for actors performing stunts, to 120-150 for animals such as horses on the run. The TV series 'The Bionic Man' was interesting in its use of a camera that had a near instant speed change from the normal sound rate of 24 fps to 400, with automatic compensation for the exposure change.

Photograph by Denis Jobron through the Courtesy of Studio Collections.



Speed Affects Quality

Currently, 35 mm cameras are available which get to 360 fps. Anything faster must be shot on 16 mm, subsequently blowing up the negative to 35. The Bionic Man camera, Photosonics' Action Master 16 mm model, comes in at 500 fps — 'on a good day'. Above this, there are models which accelerate the film's pulldown time by replacing the classic intermittent movement with a rotating prism; adopting this route gets us to around 8,000 fps. But quality descends as the framing rate ascends.

The entertainment industry aside, scientific filming of motion analysis calls for sharp, clearly defined information in each frame. The demands often become difficult to achieve, with speeds of 10,000 frames and upwards necessary. It's mechanically demanding, and calls for massive quantities of film.

High camera speeds call for wider lens apertures, reducing sharpness and depth of focus; or increased shutter angles, diminishing subject sharpness; or additional lighting. Filming at 500 frames calls

for 21 times the light on the subject (or an increase of over $4\frac{1}{2}$ lens stops); a camera speed of 8,000 fps demands 333 times the illumination (or a theoretical, but totally impractical, extra 18 lens stops).

Studio

Filming inside a studio at high camera speeds has, up to now, been a near-impossible chore. Conflicting demands arise between optically unsatisfactory wide lens apertures, and impossibly high levels of illumination. The subject, whether it be an entrapped actor, a prostrate block of chocolate, or tumbling slivers of ice cream, rarely shows the same enthusiasm for high-intensity, high temperature lighting as the imperious director, coolly skulking in the shadows.

Not new to photography, but novel to film-makers is the use of electronic strobe as a light source. Specialist companies in the USA now offer systems that can emit a light source with an exposure duration of $1/50,000$ th of a second, yet the camera need only run at 24 frames per second to improve the clarity and fidelity of motion. Light source and shutter are synchronised,

so the strobe will only fire when the shutter is open.

Clairmont Strobe in California offer one unit capable of interfacing with 16 and 35 mm cameras shooting from 1 to 150 and 120 fps respectively, illuminating each frame with a $1/50,000$ th burst of electronic flash. Additionally, in rotary sequence the equipment can expose every alternate frame, third, etc until it supplies scene illumination for each sixteenth frame.

The system's colour temperature is balanced at 7,000° Kelvin, a little above daylight (5,500°), but considerably above normal film stock's 3,200° — calling for special filtration to avoid colour infidelity. This filtration introduces a slight loss in light intensity, but a penalty considered worthwhile.

In use, the strobe's extremely short burst of light is triggered when the camera's shutter is open at mid point. The result on film is a blur free image that greatly enhances photography of moving objects, irrespective of camera speed. Unlike conventional lighting, once the exposure is determined, the lens aperture remains constant whether the camera speed is 1 or 120 frames per second. The frame rate can even be changed in mid-scene.

Cornflakes and Bubbly

In the USA strobe is used extensively in commercials to enhance the clarity (and appeal) of commercials such as cascading cornflakes, ensuring they look crisp and inviting, with every sliver and crumb razor sharp; champagne gushing from a bottle with each and every bubble having an individual character — naked and clear to the eye.

Consider this example: The camera is running at 24 fps. A hand holding a packet of cornflakes enters frame. Switch framing rate to 120 fps as the cornflakes begin to tumble out. When bowl is full, switch back to 24 fps — exit the hand at normal speed. If you were an ad man I'm sure your mouth would be salivating at the vision.

At normal 120 frames water from a pulsating shower head would be hopelessly blurred; with strobe lighting the same camera speed allows each individual water pulse to be clearly discerned.

Lifting the camera speed to 1,000

frames would make the pulses not only clear, but sharp — too sharp, in fact. The action would be slowed down to such an extent that reality would be lost. The manufacturers make the point that strobe lighting is for 'super sharpness; ultra high speed is for slow motion. They're not the same.'

Science is also finding benefits: The strobe flash is short in duration, and generates no heat. Filming of live specimens at high camera speeds can result in the subject being killed by the high thermal ambience produced by regular tungsten lights — flash avoids this unnecessary mortality.

The electronics are complex, but compact, with each lamphead weighing no more than 5 kg. The current required is low, with the USA system's 110 Volt unit pulling only 13 Amps per unit.

Each lighting fixture is fitted with a 360 mm strobe lamp. Two intake fans keep cool air flowing across the lamp. A power pack supplies a 2,500 Vdc start up charge which strikes the arc. A negative discharge rod is mounted via three insulators in order to bleed off the high voltage.

Any number of lamphead/power pack combinations can be used (typically 2, 3 or

4) and all will fire perfectly in sync. Thus, conventional set lighting techniques can be pursued: key light, back light, fill, etc. Each lamphead delivers 250 foot candles at 1.2 metres.

Whilst lighting and previewing the action to be shot 'Preview mode' is engaged and the strobe units will fire at a 61 flashes per second rate — before the camera is started. At this speed the eye is deceived into thinking the light looks like

**"At 61 flashes
per second . . .
the eye is
deceived . . ."**

the regular 50Hz ac. The cameraman can position and adjust his lights as though they are normal incandescent units.

At this point exposure has to be determined. The company supply a modified Minolta incident light meter solely for this purpose. Additional ambient light, particularly ac, has to be extinguished as it will degrade the clarity of the strobe unit's output — and affect the meter's reading. Once the ASA rating for the filmstock has

been entered into the meter and the light's output measured, the F stop is indicated as a direct reading.

Double Flash

Nearly all modern motion picture cameras utilise rotating mirror shutters, in which the light leaving the lens is shared between the film and the viewfinder. To enable the camera operator to view the action being filmed the strobe system produces a double flash for exposure — one for the camera, another for the viewfinder.

A High Speed Control unit is attached to the camera for strobe work. This unit controls the synchronism between open shutter and strobe triggering. Modern crystal-controlled motion picture cameras allow the systems to sync, at speeds from 1 frame to 120 per second.

Present strobe systems are designed solely for table top work, product shots and the like. The technology has not reached the point where larger scenes can be accommodated. In addition, the strobe units with their fans make a lot of noise, so dialogue can't be recorded on location. But, those who've worked with them are not complaining. ●

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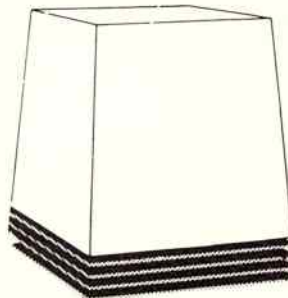
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★★★★ Don't miss it

★★ Please miss it

★★★ Value for money

★ Watch the microwave instead



The Time Machine Distributed by CEL

89 minutes

PG rated

★★ For those faithful readers who actually read this entire column, my mother thanks you. But the other point is that earlier, I decried the run of the mill science fiction feature and this doubtful entry certainly falls into the run-of-the-mill category. Rod (did he ever make a decent movie?) Taylor, one of Australia's most regrettable exports, stars as yet another of those dedicated scientists out to unravel the mysteries of the universe.

What Taylor does to what was originally one of the masterpieces from the pen of H. G. Wells is absolutely unforgivable. Taylor, one of the most promising graduates from the Wooden School of Acting, stumbles his way through this production which is replete with monsters, time travel and yes, even the obligatory love interest. This one film set back the course of science fiction movies an entire decade. Only for the brave, the foolhardy and the three or four Taylor fans out there.

— Peter Brown

Sinbad the Sailor Distributed by CEL

117 minutes

G rated

★★★★ A word of warning. This review is being written by an unabashed Steve Reeves fan, an acolyte of Francis the Talking Mule and a devotee of Ma and

Pa Kettle. Now, the cynical in the audience might decry this Arabian Nights fantasy as just another polyglot of Hollywood hash and of course, they are absolutely correct.

However, for those who like their hokum spread nice and thick, there are few better films than this effort. Douglas Fairbanks Jr, nearly outdoes his famous father in the title role as he prances this way and that. The underestimated villain, Walter Slezak is perfect in the nasty role, Maureen O'Hara supplies the love interest and the astute might even spot former boxer and wrestler, Mike Mazurki in the background.

A superb fantasy replete with trick photography, flashing sabres, genie and everything else to make the juvenile (your 'umble correspondent) slaver at the lips. Highly recommended.

— Peter Brown

Local hero Distributed by Warner Bros.

★★ For a movie supposedly one of the best of the decade, this was a vast disappointment. It is the story of a former Hungarian, sent to Scotland to engineer a large land purchase on behalf of an oil company. Burt Lancaster stars as the eccentric, astronomically minded head of the company and wooden as he is, he remains the star of this production.

Yes, it is a beautiful film, but the story, what little of it there is, dawdles along at an infuriating pace. Twice I fell asleep, only to be prodded by my wife who assured me that something was bound to happen. However, like the Micawber of old, it never did and I was left waiting in Dickensian torpor for the ending of this less than epic effort. A few attempts at humour half-heartedly succeed, but the ending is lachrymose, the plot is underdeveloped and the end result is a sad meander through a rather boring effort. However, the music, courtesy of Mark Knopfler is outstanding.

— Peter Brown

Club Paradise Distributed by EMI

Thom

★★★ This could well be the sleeper of the year. A marvelous and refreshing comedy starring Robin Williams, Twiggy, Peter O'Toole and Jimmy Cliff, of reggae fame. Williams stars as a disenchanted Chicago fireman who has discovered a paradise of sorts in the West Indies. He helps Cliff set up a resort on one of the beaches and the remainder of the film is given over to their collective efforts to establish the resort against some rather startling opposition.

The music, courtesy of Cliff is absolutely great, Williams, at last reveals his propensity for zany comedy, O'Toole is fruity and delicious and the film is a rare treat. How this film escaped the big screen is a mystery to this writer as it remains one of that rare and unsullied breed; an uncomplicated comedy with no message, no inner meaning, just a lot of laughs along the way. Highly recommended.

— Peter Brown



The World at War Distributed by CEL

12 volume series

G rated

★★★★ When this series first saw the light of day on ABC I was absolutely enthralled. Coupled with some of the most re-

markable war footage ever assembled, this series of documentaries really brought the war into my lounge. The makers of this series must have scoured the film vaults of the Russians, French, British, Italian, American and German forces to assemble such an impressive array of rarely seen footage. Each of the 12 volumes is now being offered for sale.

Like so many other documentaries, this series can be seen and re-seen. Release dates have been scattered throughout the remainder of the year with the final part of the series hitting the shelves in November. Well worth seeing and one of the few films which all members of the family should compulsorily view.

— Peter Brown

Bye Bye Jimmy Distributed by Macro

63 minutes

PG rated

★★ This is a documentary based on the life of the Great Dribbler, James Dean. For my money, I never could see what all the fuss was about when it came to this alleged star whose brief career came to an end in a much-publicised car crash. I mean, for a bloke who only made three movies, none of them good, he certainly created a sensation. Whether this was because of a general dearth of talent in Hollywood at the time or through marvellous publicity, one could never doubt the impact of Dean.

However, his acting is appalling to say the least, the sentiment is lachrymose, the stars interviewed are predictably fulsome in their praise and the overall impact is a little less than dynamic. This also features the only filmed interview with Dean, if that sets your pulse racing. Also featured are many of the sports cars of the day and of course, close-ups of the fateful death vehicle. To be brutal, Dean wouldn't be half the star he has become if he was still alive today. Extremely missable.

— Peter Brown

Woofers —

sub and super

Solid, chunky bass has always been a favourite. There were times in stereo sound showrooms when customers and salespersons alike would not even switch on a hi-fi system without first turning up the bass, switching on the loudness control and winding up the volume level to flatten the ear's response to those lower frequencies.

JAPANESE LOUDSPEAKERS of the late 'sixties and even into the 'seventies did not do much to help, in fact I can recall sets and tape recorders which tended to hum when headphones or speakers with even moderately extended bass response were fitted to modify some earlier models. The original speakers in some sets attenuated hum more effectively than the capacitors in the power supply; at least it seemed like that at the time. The Japanese manufacturers did, however, get to cater to Australian tastes for bass, in later models.

It would be unfair to blame just the speaker manufacturers, however. Moderately priced amplifiers at the time were ac amplifiers, with their "bottom ends" still well up in the double-figure Hertz region. As well, rumble and warp noise from some turntables and discs were more than competitive with signals of similar frequency range, if they were able to get through the amplifier. Using the loudness and bass boost controls to compensate for poor bass response in the speakers, only robbed the amplifier of valuable headroom, converting the problem of poor bass response into one of clipping and intermodulation distortion (IMD). So, who needed more bass?

Bass Popular As Ever

But, enough cynicism. Bass really is as popular as it ever was, if not more so — listen to the next panel van that stops beside you at the traffic lights.

Theatres have led the way perhaps, with their multi-channel hi-fi and surround sound systems in demonstrating that an added dimension of realism exists in the super-bass region. Movie-goers not only can hear low bass but in suitably equipped theatres they may feel it as well, when the occasion demands. And for the home system, movie sound tracks and other recorded music and effects with frequencies down to just a few Hertz can now be recorded on rumble-free compact discs and CD-Video discs and played back through dc amplifiers.

Their fullest impact is only experienced, however, if the system speakers, too, are up to the task.

The super woofer or sub-woofer is one way of supplementing or extending the bass response of a hi-fi or stereo speaker system, and because pure, low bass is difficult to localise aurally, the ideal sub-woofer can be placed anywhere in the listening area without changing the listener's impression that all of the sound is still coming from the stereo pair of speakers in front. As well, the difficulty of localising pure bass tones also means that they play little or no part in the stereo imaging in the room but rather simply add their strength to the program sound; accordingly, only one sub-woofer is needed in the stereo system. Bass sound from each channel is simply crossed over into, and summed in, the sub-woofer channel. The crossover may be passive, or active with additional amplification, depending on the systems being integrated.

An advantage of having the bass driver(s) in a separate, woofer enclosure, of course, is that the front speaker boxes then will not need to be as large, a feature which in turn may offer greater flexibility in placing the speaker system for better effect in small flats or apartments. For example, the woofer could be placed under — or used as — a coffee table, while a stereo pair of smaller speakers might be mounted, out of the way, on a wall or shelf near the system or on the system, itself. What is more, whereas relatively large speaker boxes tend to dominate the appearance of the typical hi-fi system (and the placement of furniture) smaller front speakers and a concealable woofer assembly can effectively take the speaker system out of sight altogether.

An Example

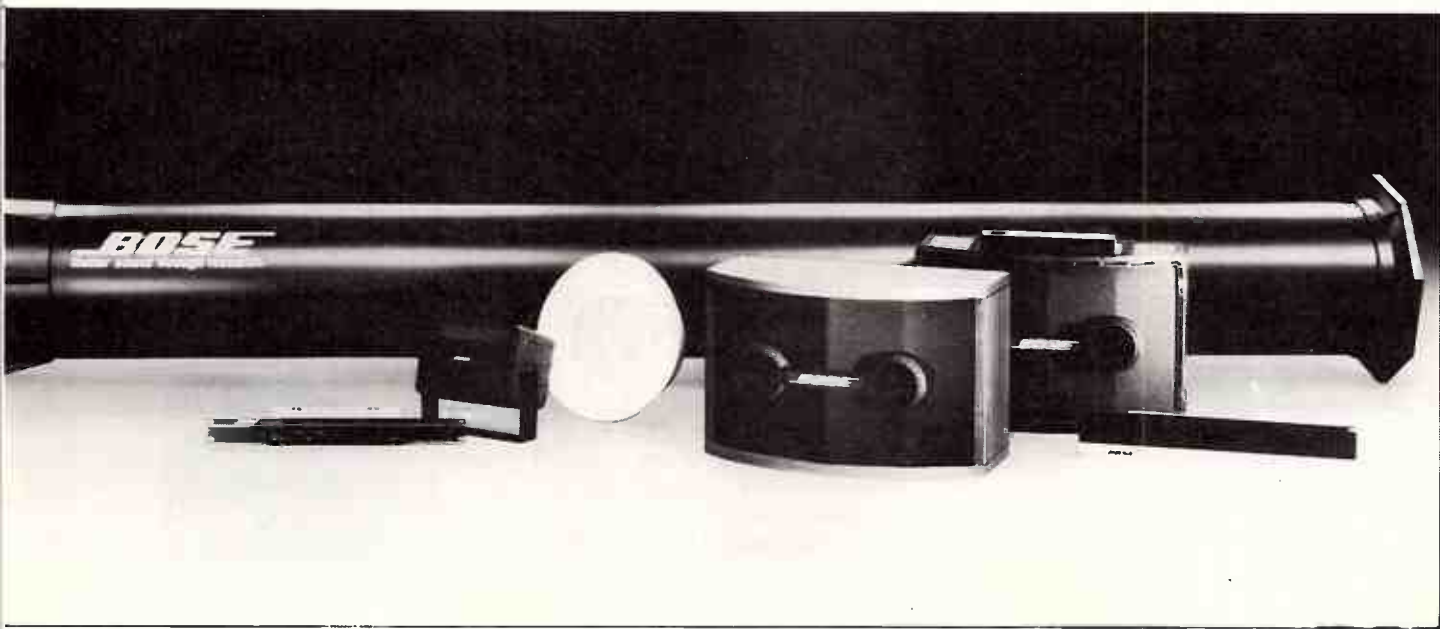
An excellent example of this approach is the popular, Bose Acoustimass System, Model AM-5 which comprises a relatively small woofer assembly which handles those octaves which are difficult to localise, and a



pair of dual, cube speakers to handle the balance of the audio frequency range.

Anyone viewing the Acoustimass woofer for the first time could be forgiven for not realising they were looking at a loudspeaker system. Apart from two, small round holes, or ports through which the bass sound is radiated the Acoustimass simply looks like a very solid, relatively small wooden box. It is only 510 mm high (or long, depending how it is placed) 320 mm wide and 180 mm deep. The enclosure houses two totally concealed 150 mm speakers and a novel, speaker protection system which operates and resets automatically should the speakers be overdriven. Provided the open ports in the box are not obstructed the Acoustimass woofer can be placed just about anywhere in the room, including behind or under furniture, without noticeably affecting or detracting from the front, stereo imaging, according to Dr Amar Bose who designed the system.

One of the potential difficulties with a single conventional woofer placed anywhere but up-front in a stereo system, is harmonic distortion generated mechanically in the speaker itself. While it might be difficult for a listener to determine the whereabouts of a woofer reproducing only pure bass notes harmonic distortion arising in the speaker system will manifest itself higher in the spectrum and provide aural clues for a listener to discern its apparent location. A woofer which produced localisable distort-



tion products would, therefore be better placed centrally between the front, stereo pair.

The Acoustimass woofer system, on the other hand radiates sound, not from the speaker cones inside, but from the air masses moving in tubes mounted behind the ports. The travel of the woofer cones is restricted to only a small fraction of their possible excursion and is, in itself good insurance against distortion arising in the mechanical operation of the speaker, according to Bose. The coupling between the two speakers and their separate, respective environments inside the enclosure establish the system's controlled extended bass response, and further enhance the woofer's non-localisable character by attenuating acoustically post-amplifier and crossover, distortion.

Small But Admirable

The effective invisibility of the woofer in the Bose Acoustimass system is complemented by two pairs of 90 mm (two and a half inch) "cubes" which, despite their diminutive appearance, handle the mid-range and treble reproduction, admirably. Two cubes are used in each channel and they are physically and electrically coupled together in parallel via a six millimetre phone plug.

With a twisting action both cubes can be aligned to face forward in a conventional stereo stance. Alternatively, one can be swivelled to face the rear and bounce sound off

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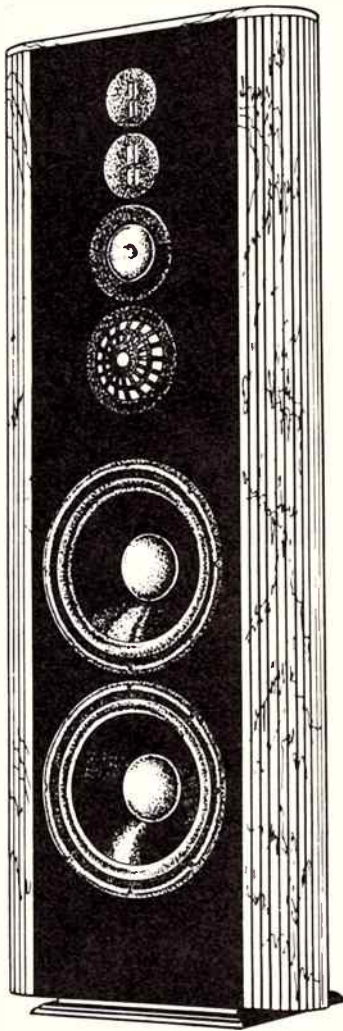
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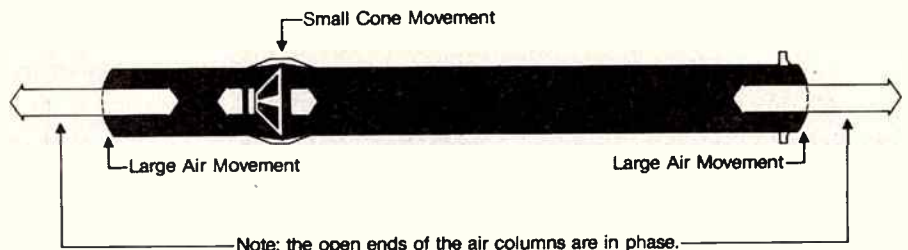
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READER INFO No. 15

Woofers — Sub and Super



Inside Bose's revolutionary Cannon sub woofer.

a wall behind the system in the traditional Bose, direct-reflected philosophy for a more ambient sound, if preferred.

Using a phone plug instead of hard-wiring the two together allows the cubes to be swivelled without fear of twisting and breaking cables. It also facilitates their separation for enlarging the sound stage by placing the four cubes over a wider angle, if desired, or simply adjusting their angle with respect to each other for wider dispersion. Dispersion may also be adjusted by placing the cubes one over the other or side by side. The cubes may be mounted on small tripods which are standard accessories in the system, or they can be attached to the sides of, say, a TV set or system cabinet, using adhesive strips, also supplied. The cubes are magnetically shielded for use with colour TV sets and monitors.

With the Acoustimass woofer tucked under a coffee table, for example, the 90 mm cubes up front for stereo imaging hardly present a formidable furnishing problem and Project X, the Bose nickname for the Model AM-5, should be able to be accommodated readily in large and small rooms, alike. It is rated to handle "nominally 165 watts" and the rated impedance is 4 ohms. Recommended retail price for the Project X speaker system is \$1600 which includes necessary cables stands and fittings for the various installation options. The Acoustimass principle is also used in the Bose Model 303, Compact Acoustimass Sub-Woofer System for professional use.

Acoustic Wave

The Acoustic Wave Cannon is another innovative low frequency acoustic system from Bose. As part of a larger system the Bose Cannon consists of a large barrel or tube-like housing open at both ends. The tube assembled is 3.81 metres long and 266 millimeters in diameter and encloses a 300 millimeter bass driver mounted concentrically in the tube and close to one end. As in the AM-5 woofer, cone movement is restricted to minimise distortion. Sound is radiated in phase from both ends of the Cannon which is rated at 125 watts over the range 25-125 Hertz. If required, bass energy can be raised in the system by stacking Can-



Celestion's System 6000 is another new sub-woofer system. The 600 is on top, with a woofer consisting of two drivers connected out of phase operating face to face below it.

nons into arrays, using interlock kits. An array can then be deployed, out of the way behind the screen, on the floor or fixed to a wall or ceiling as required.

The Bose Cannon is presently aimed at the cinema sound market (pun unintended) and some have already been installed in Australia. It is anticipated that a smaller Cannon about half the length of the cinema version which can be added to existing speaker systems, will be available from Bose next year for use in home stereo systems.

Sub-woofers can also be very practical in car sound systems where it is difficult to effectively baffle the low frequency drivers; such as in thin door linings or where the sound energy created at the back of a dash-mounted speaker, for example, is able to return out of phase from the open area behind the dash and cancel out some of the bass sound in front. A suitably enclosed sub-woofer, on the other hand, could be bolted under the seat in a car and still function efficiently, thus enabling smaller treble and mid-range speakers to be installed and aimed more strategically at ear level for better high frequency performance and stereo imaging.

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READER INFO No. 16

Tannoy Eclipse Speaker System

TANNOY ARE ONE of the oldest speaker manufacturers in England and for that matter one of the oldest in the world. Their reputation was really made in the post-war period when they provided large numbers of monitor speakers to the BBC and as it happens, to the ABC and NZBC as well.

With such an illustrious history, it's not surprising that they have considerable knowledge on the user's functional and performance requirements for quality monitoring and consumer loudspeakers, although I have criticised some of their consumer oriented speakers for performance limitations in the past.

The Eclipse series of bookshelf speakers is Tannoy's latest venture into the consumer market and surprisingly one of the smallest quality speakers Tannoy have yet marketed. It has fewer vices and more attributes than any previous Tannoy speaker I have reviewed in this magazine.

The Eclipse is remarkably small, with a cabinet volume of only 11 litres (less than 0.4 cubic feet) and is almost perfectly sized to fit into any bookshelf, screw to a wall, or use as a mini-monitor, where cost and space are two primary limitations. The sides of the cabinet are solidly made from 15 mm thick particleboard, with a somewhat thinner 12 mm thick particle-

board unobtrusively used for the back panel. The cabinet is only supplied (in this country) with a Black Ash finish, which is basically the same marketing philosophy that Henry Ford offered back in the 20s.

Acoustical Energy

The 'Eclipse' is a two-way speaker system and incorporates a relatively small 165 mm diameter base-mid range driver, which is very well sized for the chosen cabinet volume. The effective piston size of the diaphragm is further reduced as a result of the width of the flexible foam surround that provides its long excursion capability. With such a miniscule woofer it really does become essential to provide the maximum possible linear piston motion in order to be able to impart the maximum possible acoustical energy from the input electrical signal. The smaller the size of the diaphragm the more important this factor becomes, particularly at low frequencies. This becomes even more critical, especially when the driver is called upon to cover such a wide frequency range of 40 Hz to 2.3 kHz. In spite of all these prospective demands, the base-mid range driver has been well chosen and really 'delivers the goods'.

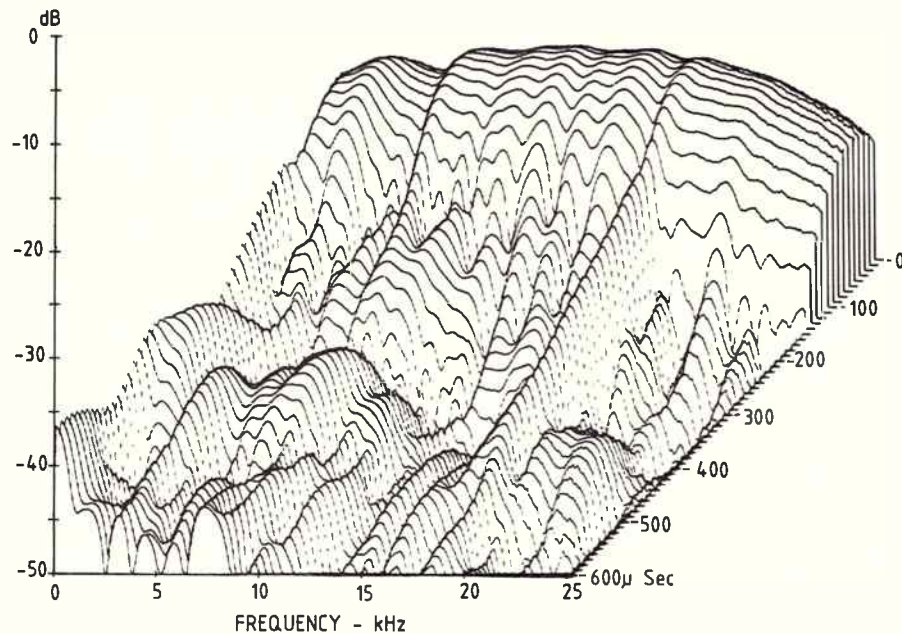
Tannoy's design group has applied just

as much care in the selection of the tweeter to provide maximum possible power handling capacity and specifically the ability to handle input powers as high as 90 watts. This peak power capacity seems very high for a vented enclosure with such miniscule proportions and offering such a high level of electro-acoustical efficiency. The selected tweeter uses a 28 mm diameter polyamide diaphragm, which is relatively stiff and is very cost effective. Its basic performance is dramatically enhanced through the application of a proprietary 'ferro-fluid' in the armature gap, as this enhances the thermal capacity of the magnetic circuit and provides the ability to dissipate the intense heat generated at the 90 watt peak input power level. Without the ferro-fluid, the tweeter's demise would be assured at a much lower power working level.

Tannoy have taken considerable trouble in the design of an asymmetrical mounting plate structure for these tweeters, which is a relatively new twist, particularly when most other manufacturers have adopted a semi-anechoic edge termination procedure based on foams and felts. The Tannoy engineers have sculptured the surface to enhance the sound dispersion characteristics at high frequencies in order to reduce the Fresnel diffraction effects from which most dome tweeters seem to suffer. This approach has proven to be far more effective than I would have expected as my subsequent testing confirmed.

In keeping with the latest (and also a much older trend from the early 50s), the venting port is located at the back of the cabinet. I suspect this approach was adopted to make use of the potential benefits that this location can provide when the speakers are mounted on a bookshelf with the venting port looking at a blank wall with a thin gap then extending outwards to the four faces. My subsequent testing has basically confirmed this attribute in my listening room.

The simple internal cross-over circuit board is hard wired from well selected components, and the inductors in particular, have been designed to handle high signal levels without suffering from current and magnetic saturation. The colour-coded universal terminals on the back of the cabinet have been well conceived and by placing them on the angle I confirmed that



Decay spectra. Resonances are visible at 6 and 16 kHz.



this materially assists in minimising space requirements on a bookshelf.

The open weave black cloth-covered speaker grille neatly chips onto the cabinet and as I subsequently confirmed, results in minimal impact on high frequency dispersion.

Objective

The most striking objective which is its frequency response, which is flat all the way from 150 Hz to 18 kHz. There is a modest 9 dB droop in the 80 Hz to 120 Hz region, with another shallow threshold in the response before rolling off again at 45 Hz. The low frequency output characteristics, measured under anechoic conditions, confirmed how much trouble the Tannoy design group has taken to minimise the limitations in their previous series of consumer speakers.

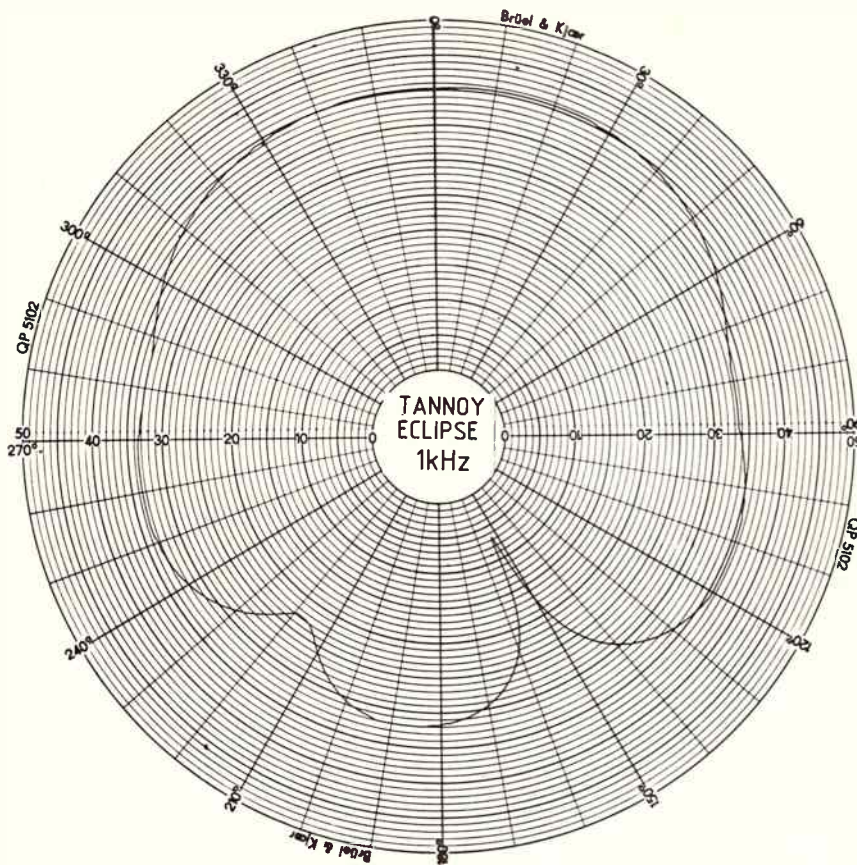
The measured frequency response at 30° off axis, is still exceptionally good, even though there is 5 dB of drop in output at 15 kHz and 10 dB of droop at 18 kHz. The shape of the low frequency response, measured in the anechoic room, exhibited characteristics which seemed to have been optimised to suit the specific conditions which would prevail in a more typical bookshelf mounted operating environment. As it transpires, that simple assessment subsequently proved to be correct. The near field assessment of individual driver output, confirmed that the cross-over had been selected for the relatively high cross-over frequency of 2.3 kHz. This of course means that the base-mid range driver has to cover more than 5 octaves, which is an unusually wide frequency range.

Rather surprisingly, the driver manages to do just that, although the bottom octave is not quite up to the task, which is not surprising when you consider its size. The near field measurements, in front of the tweeter diaphragm, revealed the presence of a significant resonance at about

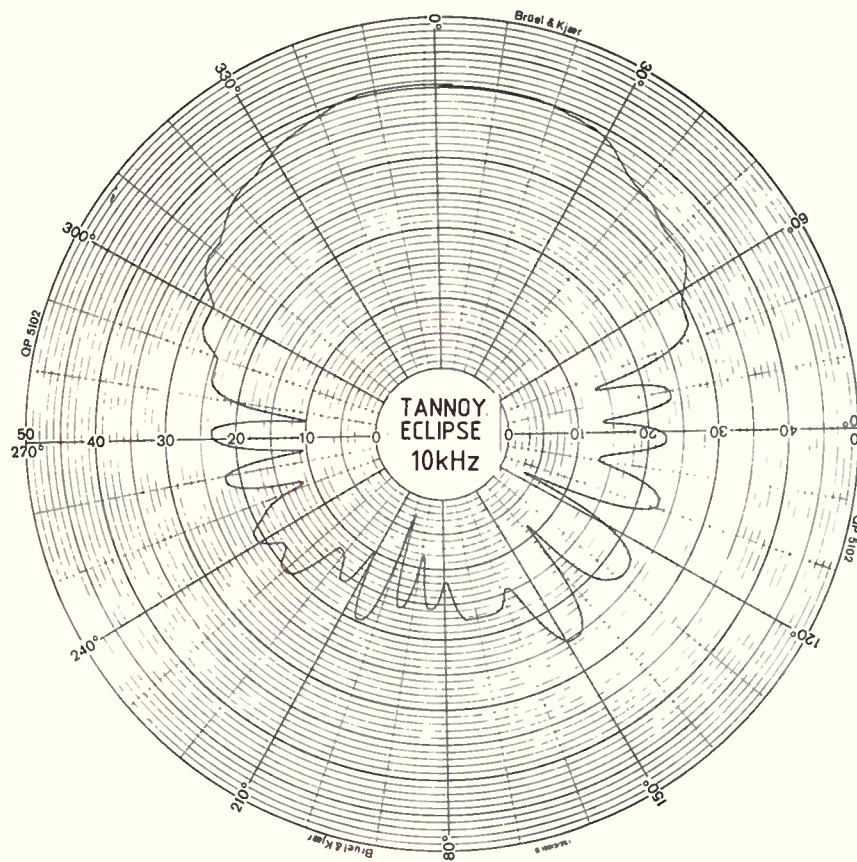
DIMENSIONS

Height	500 mm
Depth	243 mm
Width	445 mm
Weight	5kg ea
RRP	\$499 pr

Tannoy Eclipse



Polar response graphs.



12 kHz, about which I will have more to say later.

The input impedance curve reveals two sharp resonances at 35 Hz and 95 Hz, peaking at 39 ohms and 35 ohms respectively. It drops to 9 ohms between approximately 150 Hz and 300 Hz with a subsequent minimum at 8 ohms between 8 kHz and 11 kHz. The highest impedance manifests itself in the region of the cross-over frequency, where the unusually high impedance of approximately 42 ohms occurs. With this sort of impedance characteristics, you would be unlikely to experience any problems in paralleling the Eclipse with other nominal 8 ohm speaker systems, and by the same token, the speaker impedance characteristics are likely to create some unusual effects with long high impedance speaker leads.

The phase response of the Eclipse exhibits some rather sharp phase non-linearity particularly in the region around the cross-over, although the tweeter itself exhibits excellent phase linearity over its full working range. The Eclipse system does not appear to have been designed with phase linearity as a primary design parameter, and this comment should not be treated as a condemnation of its design.

Tone burst rests on the Eclipse show some unusual ringing, especially at high frequencies, where the number of extra cycles added to the output was very noticeable. This characteristic often tends to be a significant factor, especially in terms of high frequency subjective response. It generally manifests itself as a marked increase in stridency in the frequency region where the ringing occurs.

The measurements of the polar response of the Eclipse in our anechoic room revealed excellent dispersion characteristics, with a dispersion angle of more than 100 degrees at 6.3 kHz and more than 70 degrees dispersion at 10 kHz, for the normal 3 dB drop in signal intensity.

This wide angle dispersion performance is excellent, and in the subsequent testing at higher frequencies I noted that there is no significant reduction in high frequency dispersion until the test frequency exceeds 15 kHz. This confirmed the effectiveness of the tweeter face plate sculpturing and earns full marks for the Tannoy design team.

The distortion characteristics of the Eclipse are reasonably good, although at 100 Hz for 90 dB output at 1 metre, the distortion rises to 5.1 per cent, which is fairly high. By contrast the distortion at 1 kHz and 6.3 kHz are relatively low at the 96 dB signal output level and well within the design limits that most manufacturers would set as a criteria limit for a

speaker system of this size.

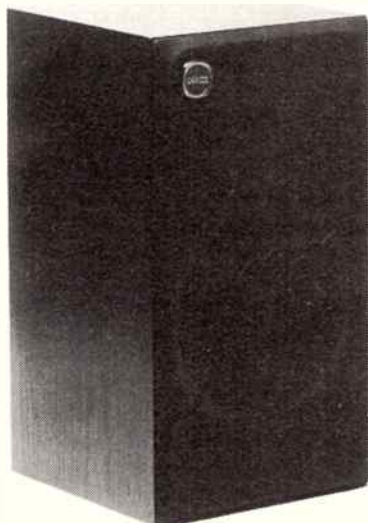
Reassured by the capability of these test results, I proceeded to assess the decay response spectra, which I regard as the most revealing test of all.

The Eclipse provides a relatively smooth output, with only two significant resonances being apparent and a significant rolling decay which I also noted in the tone burst testing at 6.3 kHz. There is also a much stronger rolling decay characteristic readily apparent in the 16 kHz region.

Both these resonance characteristics and the ability of the speaker to regenerate some frequency components and provide significant carry over, when excited at these specific frequencies, was the only real criticism that I could raise in the objective performance of the Eclipse. The decay response spectra confirmed that the speaker cabinet exhibits surprisingly little internal energy reflection and in like manner does not seem to generate any nasty cabinet resonance characteristics.

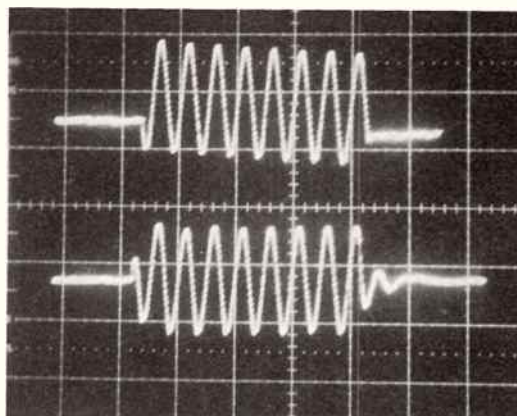
Subjective

The subjective assessment of the Eclipses was carried out with the speakers in a number of positions in my listening room mounted at various heights and at various distances from the rear wall. The speakers seemed to provide the best performance when approximately 900 mm above the floor and relatively close to an absorptive rear wall with curtains interposed between the back of the cabinet and the wall surface.

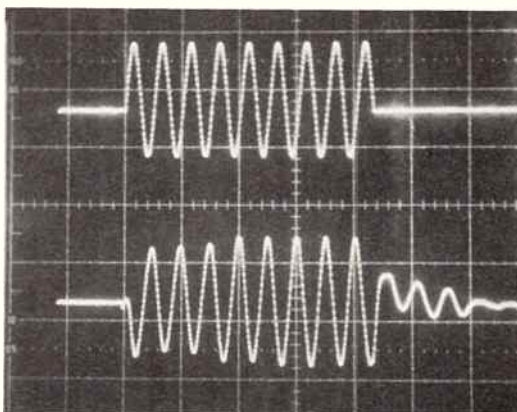


The Eclipse. A port at the back enhances bass response.

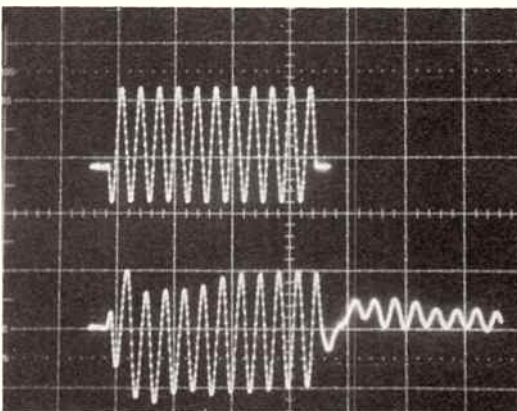
MEASURED PERFORMANCE OF: TANNOY "ECLIPSE" LOUDSPEAKER			
SERIAL NO:			
FREQUENCY RESPONSE:			
CROSSOVER FREQUENCIES: 2.3 kHz			
SENSITIVITY:			
(for 90 dB average at 2m) 102 V r.m.s. = 13 Watts (nominal into 8 Ohms)			
HARMONIC DISTORTION: (for indicated levels at 1m)	90 dB	96 dB	90 dB
	100 Hz	1 kHz	6.3 kHz
2nd	-29.3	-45.7	-57.3 dB
3rd	-78.5	-48.0	-55.9 dB
4th	-57.0	-	- dB
5th	-51.9	-69.2	- dB
THD	5.1	0.65	0.29 %
INPUT IMPEDANCE	100 Hz	32	ohms
	1 kHz	21.6	ohms
	6.3 kHz	8.2	ohms
	Vin at 9.0 kHz	8.0	ohms
Date: 30th April 1988			



100 Hz



1000 Hz



6.3 kHz
Tone burst response of the Eclipse. Upper trace is input, lower trace is output.

Tannoy Eclipse

The first subjective test I performed was with pink noise which confirmed that there was a small degree of enhanced output in the 4 kHz to 6 kHz region which could be removed with a graphic equaliser, but which I declined to do for the subsequent subjective evaluation. The pink noise test is a very effective means of assessing subjective speaker colouration and it was particularly accurate in this case as it revealed the presence of a marked increase in presence in the 4 to 6 kHz region.

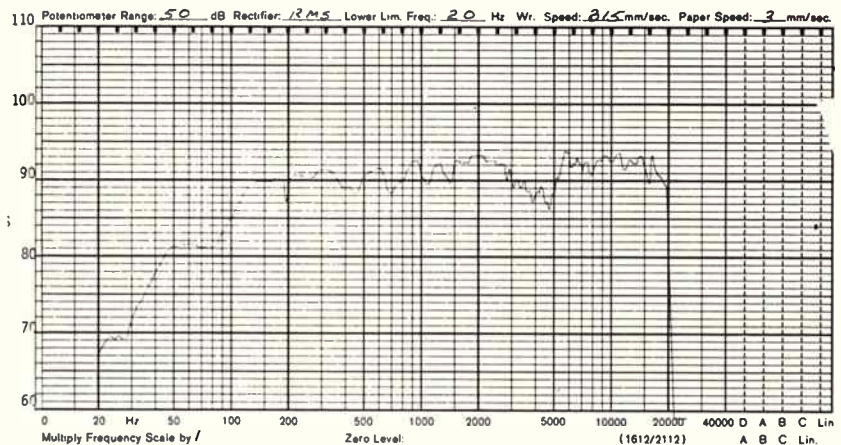
I evaluated the pink noise room response using a real time analyser and I was pleased to note how smooth the response was all the way down to 40 Hz. This test confirmed that the Eclipses are well suited to most residential listening environments and should perform much better than expected in the critical 45 to 180 Hz region (the lowest two octave bands) when correctly positioned relative to the floor, side walls and rear wall in any given room.

I proceeded to evaluate the Eclipses on a wide range of programme content including organ pieces for which the performance was acceptable at levels below 95 dB, on pop music, for which peak levels of up to 110 dB could be safely and satisfyingly generated, on rock music, which was safely, but not always satisfyingly, reproduced at high levels and on classical music, for which the chosen content became the significant factor.

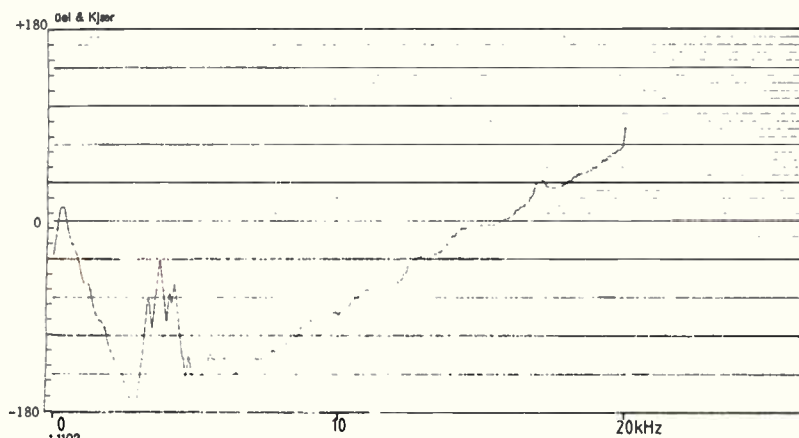
I played many classical pieces including a delightful new disc from Deutsche Grammophon — Joseph Haydn Symphony No 96 "The Miracle" Sinfonia Concertante with Claudio Abbado and the Chamber Orchestra of Europe (423105-2) which is one of the most delightful Haydn Symphony Concerts to be released and in which the Eclipses absolutely revelled. They did however exhibit significant stridency in many passages, particularly with violins and cellos and although the performance was good, I was most often aware of this stridency in specific passages.

The second set of digital discs which I used for the subjective assessment was Richard Meale's Voss produced by the ABC and Philips (420928-2), which is an all digital production with the Sydney Symphony Orchestra and the Australian Chamber Chorus recorded at the Sydney studios of the ABC (whose acoustical performance I have previously evaluated and which I know particularly well).

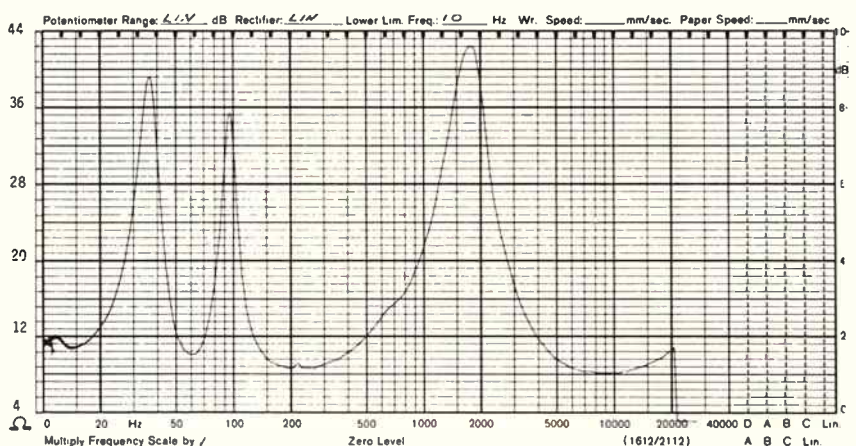
The performance of the Eclipses on this fine Australian opera was exciting, and I enjoyed the music and singing without



Frequency response measured at 2m on the tweeter axis.



Phase response also measured two metres from the tweeter.



Input Impedance.

really being aware of the traces of stridency, which only showed through in some of the other programme material.

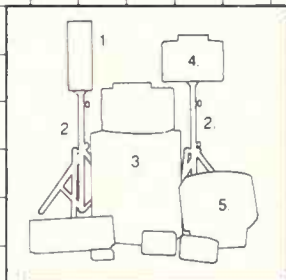
The Tannoy Eclipse mini bookshelf speaker system is a delightful, inexpensive speaker system offering good performance right across the audible spectrum, with adequate efficiency and excellent power

handling capability. They will add lustre to the name of Tannoy and pleasure to your listening, especially when utilised in those space limiting situations in bookshelves and small rooms. They are currently one of the best buys available in the under \$500 bracket and its worth the time and trouble to audition them. ●



The yardstick by which all others are judged

For more than a decade, musicians and performers all over the world have selected Bose professional sound systems to meet their performing needs. Bose professional products produce accurate sound, are simple to set up and are easy to carry around a performance combination that's not easily achieved with conventional equipment.



- 1 Bose 402 Articulated Array Speaker
- 2 SS-5 Stand
- 3 Bose 802/302 Tandem-Tuned Speaker System
- 4 Bose 802 11 Articulated Array Speaker
- 5 Bose 101 Music Monitor

All Bose professional products are designed and built by engineers who work and consult with performers. The result is a line of products designed for the real world of the professional, ideal for use in a multitude of professional applications.

BOSE[®]
Better sound through research.

Enquiries: — Bose Australia Inc. 11 Muriel Avenue
Rydalmere, NSW 2116 (02) 684 1255 — 684 1022
Telex: AA127168

READER INFO No. 17

YAMAHA'S NEW CDX 1110 CD PLAYER OWES ITS BRILLIANCE TO A PIECE OF TWO-BIT TECHNOLOGY.



Until now, CD players were limited to 44.1 kHz and 16 bit technology. Now Yamaha has, as Audio Magazine states, "found a way to improve on perfection". Introducing the world's finest CD player that features 18 shifting bits and 8 times oversampling digital filters. A technological progression that quadruples both sampling frequency and density to produce exquisite wave-form resolution.

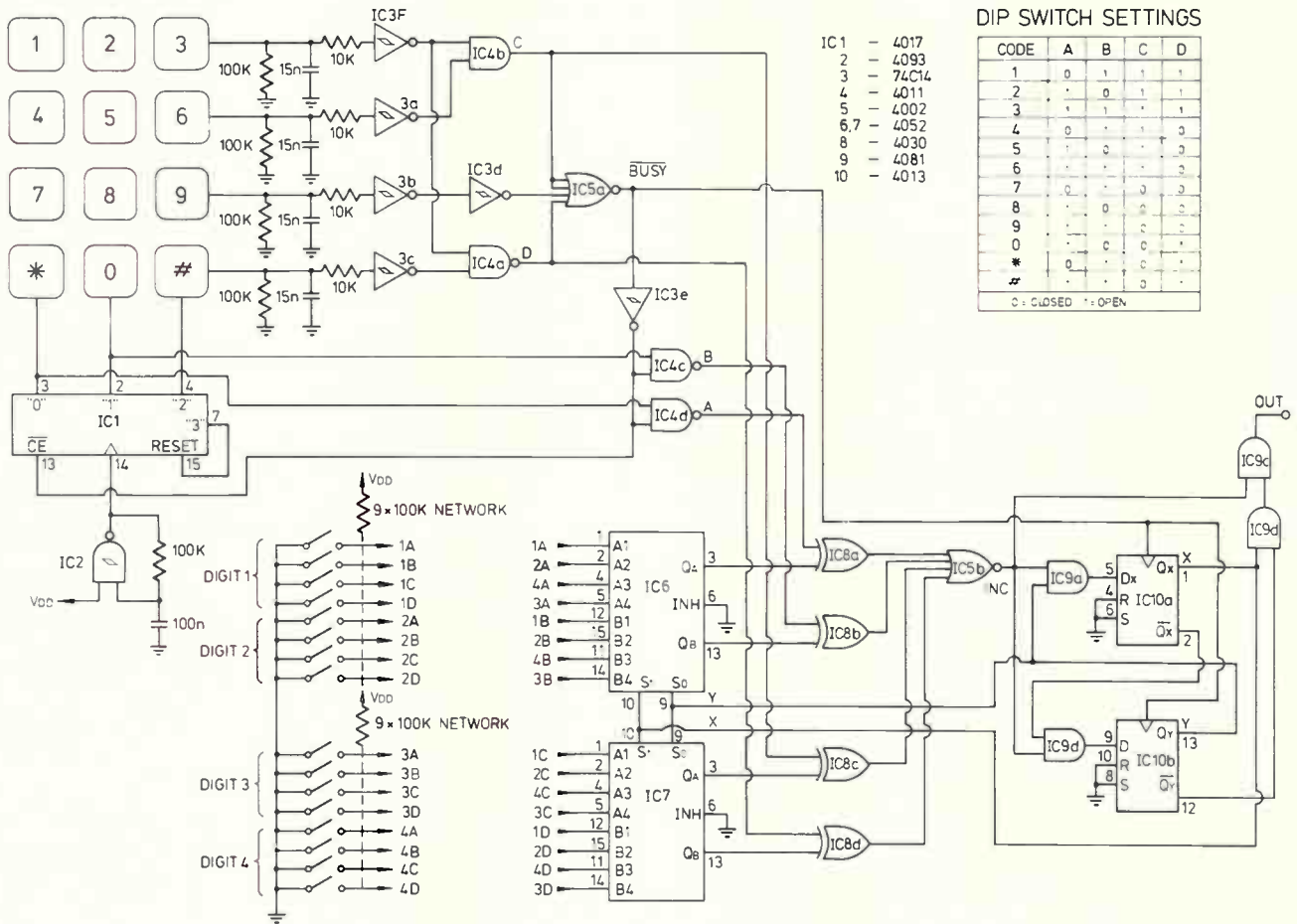
The result is unsurpassed sound quality. We could mention its 44 key wireless remote control, its new 3 beam laser pick-up, its 24 track direct access and random access programmable playback. Or we could compare it to our previous model, the CDX 1100. Of which Audio Magazine said "As to how a CD player is ideally supposed to sound, we do not hesitate to say that it should sound like the

CDX 1100". All of which proves that the new CDX 1110 won't sound one bit better than any other CD player. It'll sound two-bits better. Starting at \$399, our entire CD player range is there for the picking in your local Yamaha Hi-Fi store.

The Yamaha logo, consisting of the word "YAMAHA" in a stylized, multi-colored font (Y is blue, A is red, M is green, A is blue, H is red, A is green) set against a black background.

5 YEAR WARRANTY.

Idea of the Month



Combination lock

A combination lock is only useful as long as its combination remains confidential; with combination in undesirable hands, its function as a lock immediately ceases. Thus criterion number one for a versatile combination lock is that it must have an alterable sequence.

Secondly, it must also have many different combinations to reduce the chance of opening by guessing; more than 1000, preferably 10,000 combinations are desirable.

The third criterion is a matter of ergonomics and appeal; in today's computer age the sight of a keypad instills more confidence in the user than a messy array of switches.

The circuit shown provides in

excess of 20,000 distinct combinations, entered into a 12-digit keypad which is inexpensive and readily available from Dick Smith. Using CMOS technology, the circuit consumes only about 2 mA and is therefore suitable for use in just about any environment. The circuit was originally designed for a car alarm, for which purpose its low power was extremely desirable; furthermore, the supply voltage may vary from 3 to 18 V.

The principle of operation is simple; IC1 scans the keyboard columns sequentially; the rows are monitored and if a key is found to be depressed, counter IC1 is stopped as long as the key remains depressed so that

multiple inputs are avoided. Debouncing is provided on all rows to avoid spurious multiple inputs. IC4 converts the depressed key code into a distinct 4-bit binary number, available at points A, B, C & D. This number, ABCD, is compared by IC8 with a preset number selected from a set of DIP switches by ICs 6 and 7. If the numbers are the same, INC at the output of IC5b goes high. ICs 9 and 10 form a counter, clocked by the keypad BUSY signal, which increments if INC is high but resets to 00 at XY if INC is low. Therefore if the correct digit was entered, data selectors IC 6 and 7 then select the next preset for comparison with the keypad digit. If the

digit was incorrect, the first digit of the sequence will be selected.

When the counter is on its final value and INC goes high, OUT also goes high for as long as the last key of the sequence remains pressed. This pulse may be used to trigger a flip-flop to turn a device on and off alternately, or it has the potential to be interfaced to any type of system required to be locked.

The circuit has proven extremely reliable as a car alarm on/off switch, and removes the fear of not being able to turn the alarm off if one loses one's keys.

J. Schutz
 Camden Park SA

Letters to the Editor

In-flight Physics

"Counting Down to Discovery" (ETI April 1988) was informative but did not mention the fact that the first and only Australian experiment will also be aboard the Discovery flight.

The experiment Aggregation of Red Cells (ARC) will be on its second flight, confirming the results of the first which was hailed an enormous success. The experiment is concerned with one of the most complex branches of physics called rheology, the science of flow and deformation. Dr Dintenfass of the Rachel Forster Hospital, Sydney, is the Principal Investigator.

Steven M. Cherry
St Clair
NSW 2759

Novice In Need

I think that ETI is a great magazine, however, I do not feel that the circuits published

in Feedforward and in your projects are explained well enough for beginners into electronics, such as myself. Apart from this, ETI is excellent, especially Sound Insights and your product reviews.

Benjamin Hoad
Armadale, WA
6112

Metered Calls and Modems

Regarding your recent article on the manufacture of modems in Australia, and how the industry is booming, when Telecom brings in timed or metered local calls, what effect will this have on the private sector of the market? I myself run a 300 Band modem on the MacBoard, usually 5 or 6 times a week, for about 20 minutes or so per call. At 20c per call, that's not really bad, but with metered calls the price will skyrocket. Won't this slow the cur-

rent selling of modems, since the cost of running them will become prohibitive in the long run?

K Bennett
Kew, Vic
3101

Project Request

I like your magazine for its up-to-date info on new products and developments in the electronics industry.

I would be very happy if you were to run a project for a dedicated general purpose micro-processor control board.

D Keller
Techtronix
Ballarat, Vic
3250

Dregs Fan

Thanks for the 'Dregs' column at the end of ETI. May's Dregs column was just hysterical! It's good to see that some people have a sense of humour. Also

as a 1616 user, waiting in anticipation, when will GEM or some similar software be available?

K Newbery
Hawthorn, SA
5062



Feed Forward needs your minds. If you have ideas for circuits that you would like to enter in our idea of the month contest, programs for the computing columns or just want a word with the editor, send your thoughts to:

Feed Forward
ETI, Federal Publishing,
PO Box 227,
Waterloo, NSW 2017

Contributors can look forward to \$20 for each published idea/program which should be submitted with the declaration coupon below.

Programs MUST be in the form of a listing from a printer. You should indicate which computer the program is for. Letters should be typewritten or from a printer, preferably with lines double spaced. Circuits can be drawn roughly, because we have a draughtsman who redraws them anyway, but make sure they are clear enough for us to understand.

'Idea of the month' contest

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month, we will be giving away a Scope Soldering Station (model ETC60L) worth approximately \$191.

Selections will be made at the sole discretion of the editorial staff of ETI Magazine.



PRIZE
WORTH
\$191

RULES

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

The winner will be advised by telegram. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI Magazine.

Contestants must enter their names and addresses where indicated on each coupon. Photostats or clearly written copies will be accepted. You may send as many entries as your wish.

This contest is invalid in states where local laws prohibit entries. Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

COUPON

Cut and send to: **Scope-ETI 'Idea of the Month' Contest/ Computing Column, ETI Magazine, PO Box 227, Waterloo NSW 2017.**

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

Title of Idea/program

Signature Date

Name

Address

Postcode

Six Button Adjudicator

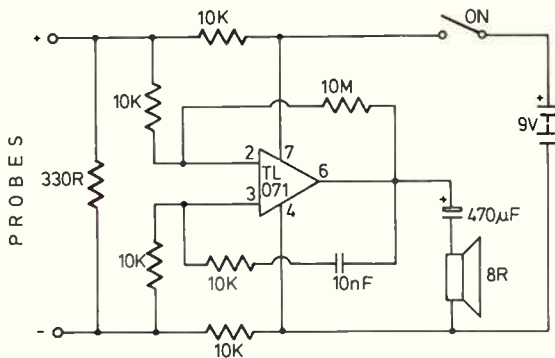
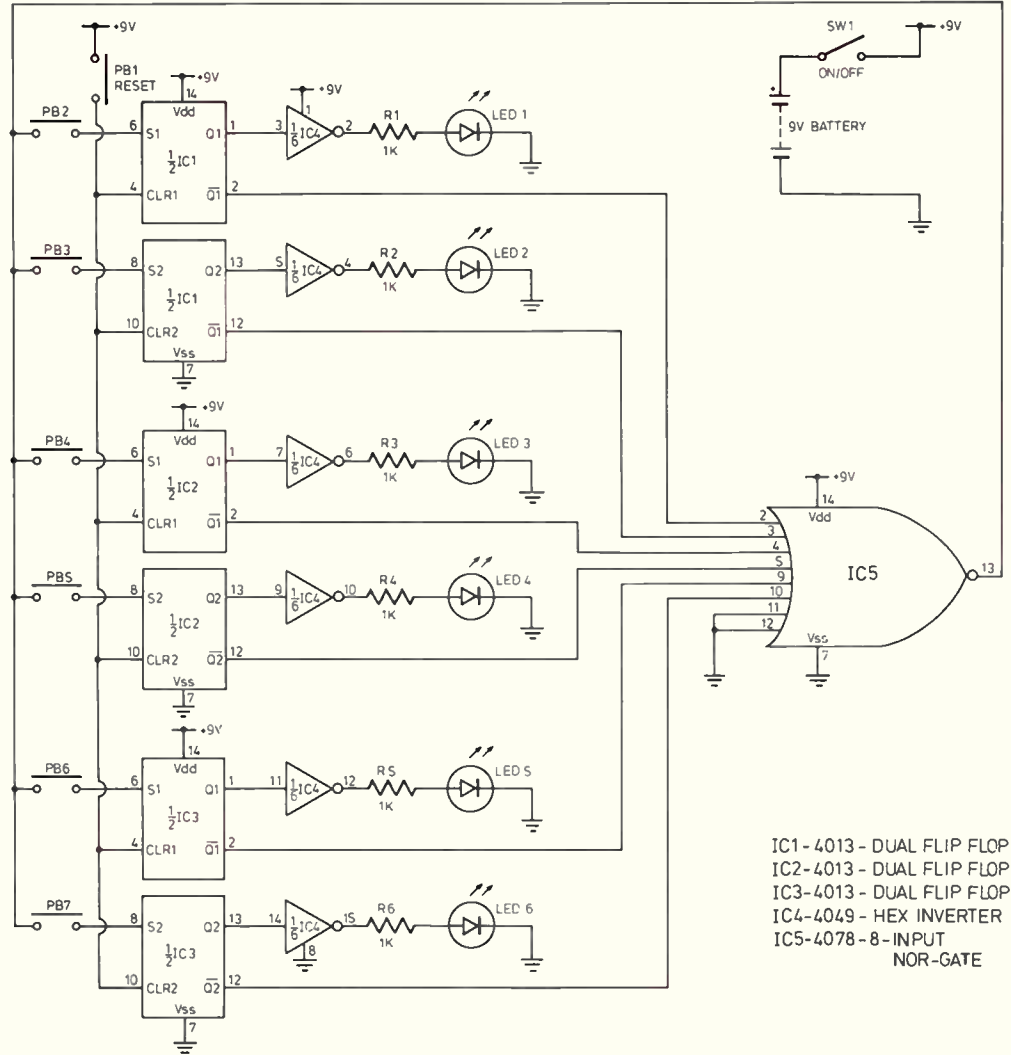
I was faced with a problem. A friend had asked me to find a six button version of the "Sale of the Century" buttons. Alas, I could not. But I failed him not. I designed my own.

The circuit runs off a single 9 volt battery, and uses 5 ICs. IC5 is an 8-input NOR-gate with 2 inputs permanently grounded. With no input, the output is high, and this "powers" the rest of the circuit. When one of the Press-buttons, PB2-7, is pressed, a voltage is applied to the appropriate Flip-Flop, IC 1-3. This applies a low to the adjoining Inverter through Q(1 or 2), which lights the corresponding LED(1-6). Q(1 or 2) then applies a high to the NOR-gate, IC5, leaving the LED on, but not allowing any others to come on as the output of IC5 will be low, preventing any more Flip-Flops to be set.

To reset the Flip-Flops, PB1 is pressed to apply a high to the CLR pins to extinguish the LED and once more apply 8 lows to the inputs of IC5.

**D. Oster
Vista
SA**

SIX BUTTON ADJUDICATOR



Continuity Tester

Most circuits for continuity testers I have seen were either too complex, had high power consumption or a high output voltage across the probes.

This circuit is different in that it has a fast response, low power consumption and a low output voltage. The circuit draws about 2.5 mA of current with the probes open circuited and about 8 mA with the tone activated. The maximum voltage across the test probes is only 150 mV and should not damage any delicate semiconductors. Most importantly the circuit will not respond to the voltage drop across a diode or

resistances greater than about 40 ohms. The output voltage can be altered by decreasing or increasing the value of the 330R resistor. The 10 nF capacitor controls the frequency of the tone. A 2 inch mini speaker produced a good output. Any multimeter leads can be used as the test probes.

**D. Jones
Lethbridge Park
NSW**

TEXAS INSTRUMENTS

TECHNOLOGY AWARD UPDATE

Project: IBM Token-Ring Adapter

Student: Edwin Chong

Supervisor: Dr Ken Sarkies — University of Adelaide

During 1987 Texas Instruments sponsored various final year electrical engineering projects in the fields of Digital Signal Processing, Local Area Networks, and Parallel Processing.

Local Area Networks allow the sharing of resources such as high speed printers, plotters, large disk storage systems, as well as communications between distributed computing devices which may be personal computers, mini-computers, or mainframes. Currently Local Area Networks are nearly always used exclusively for data communications, however in the future we can expect Local Area Networks to handle both voice and data traffic. In this report we highlight work done on a proposed system for integrated voice and data communications using the IBM Token-Ring LAN.

PRINCIPLE OF OPERATION

The project involved preliminary development of an IBM Token-Ring adapter for use as a stand-alone node for interfacing speech and low speed data onto the IEEE 802.5 LAN. The Token-Ring LAN utilised the Texas Instruments TMS380 Adapter Chipset. The adapter was designed, constructed and tested. In the design and testing of the adapter, various hardware and software aspects of the adapter were considered such as initialisation and testing. An interface circuit suitable for a 68000 style system bus was designed, together with interconnect circuitry for the TMS380 chipset to allow the adapter to be connected to the host system. An extensive evaluation of the Direct I/O Interface feature and the DMA capability of the TMS38030 System Interface was undertaken.

TMS38030 Interfacing

The Direct I/O interface provided by the

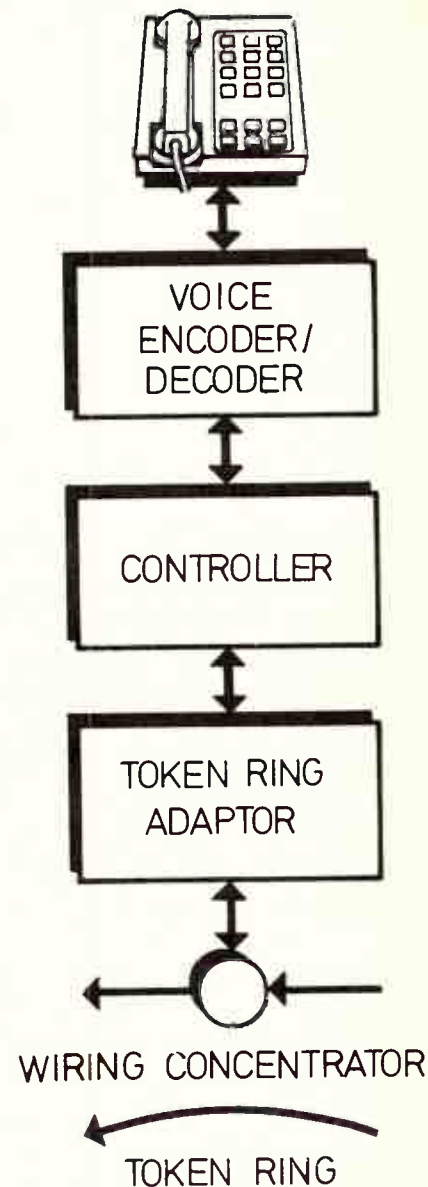
TMS38030 allows the attached system to access a register set within TMS38030 through four word-aligned address locations. The system controls the adapter via these four registers (Interrupt Register, Data Register, Data Register with Auto-Increment, Address Register).

The DMA channel of the TMS38030 provides a full 24 bits of address, and so is potentially capable of accessing up to 16 megabytes of system memory. The TMS38030 also provides parity checking by maintaining a parity bit for each byte of both address and data types. Two modes of DMA may be selected by the attached system: burst mode or cycle-steal mode. The desired mode is selected during the adapter initialisation process.

The software interface with the adapter relies on the hardware interface described above. The adapter is controlled by the attached system through the four registers in the TMS38030 via the Direct I/O interface. Using this interface the system can initialise the adapter, interrupt the adapter (or be interrupted by the adapter), and initiate DMA transfers. The DMA channel enables the attached system to pass commands, parameters and frames to the adapter, and receive completion codes and frames from the adapter.

The Future

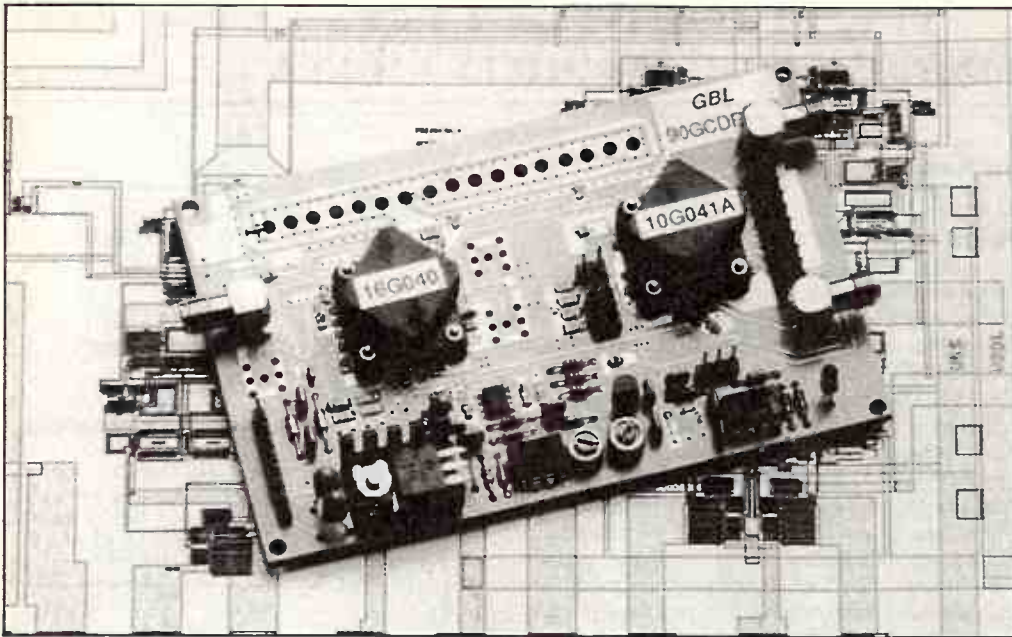
The project as described is intended to function as a testbed for investigating suitable protocols for speech communication. The speech node consists of a voice encoder/decoder, a control unit and an IBM Token-Ring LAN interface (or adapter). Such could well be the indication of what we can expect from LANs in the next few years.



Block diagram of Speech Node



TEXAS INSTRUMENTS AUSTRALIA
SEMICONDUCTOR GROUP
Phone (02) 887-1122



Gigabit — clock IC

GigaBit Logic has announced its 16GO40 Clock & Data Recovery (CDR) circuit and companion 90GCDR-DX evaluation board which enables fibre communications designers to more easily implement a phase locked loop for both clock extraction from high speed data streams as well as data retiming and regeneration.

Unlike conventional clock and data recovery circuits which first filter the clock component from incoming data and then retime the data using the extracted clock, the 16GO40 phase locks an on-chip VCO or external clock source directly to an incoming digital data stream, while simultaneously retiming and regenerating the

data stream. In operation, the 16GO40 IC-based PLL is capable of unaided frequency acquisition, eliminating the need for special circuits to "pull" the loop into lock when the incoming data rate differs from the initial VCO clock frequency.

For further information, contact Gigabit Logic in the US on (805) 499-0610.

READER INFO No. 252

Socket for "SO" Circuits

Utilux is introducing the first true surface mount socket for all "SO" type surface mount integrated circuits seen on the Australian market.

Manufactured by PreciContact of Switzerland the new SMD socket is available with surface mount contacts and is compatible with all SMD integrated circuits in SO packaging, following the IEC standards.

These sockets are available on automatic insertion compatible reels for all pin configurations from 8 through to 28 pins.

Advantages include:

- Zero insertion force
- Contact force 60 grams
- High temperature plastic, compatible with vapour phase soldering techniques

As the IC is not soldered to the pc board it does not suffer from thermal shock.

Possibility to mount SMD components under the IC.

Specifications

For further information contact Utilux, or the company's Electronics Division. Telephone (02) 50-0155.

READER INFO No. 253

10-Bit A/D Converter

Linear Technology Corporation has announced the release of its monolithic LTC1092 10-bit A/D converter, which includes a pin that permits the device to use a reference voltage as low as 200 millivolts as full scale for an input signal.

Fabricated in LTCMOS, the LTC1092 uses switched capacitor technology to perform 10 bit conversions on a differential input pair. The device operates either ratiometrically or with an absolute reference. The LTC1092 is packaged in an 8-pin DIP but incorporates all A/D functions as well as an on-chip sample and hold and a direct 3-wire serial interface capable of talking to shift regis-

ters, most microprocessor serial ports and all MPU parallel ports. The serial interface can present data most-significant bit (MSB) or least significant bit (LSB) first, as required by individual microprocessors.

Conversion time is 20µsec. Total adjusted error from all sources inside the device (offset, linearity and gain errors over temperature with a 5V reference) is ½ LSB for an A grade device. Linearity error typically remains less than ½ LSB with reference down to 200 millivolts.

Further information contact ACD on (02) 534-6200 or (03) 720-2711.

READER INFO No. 254

PAL Programmer

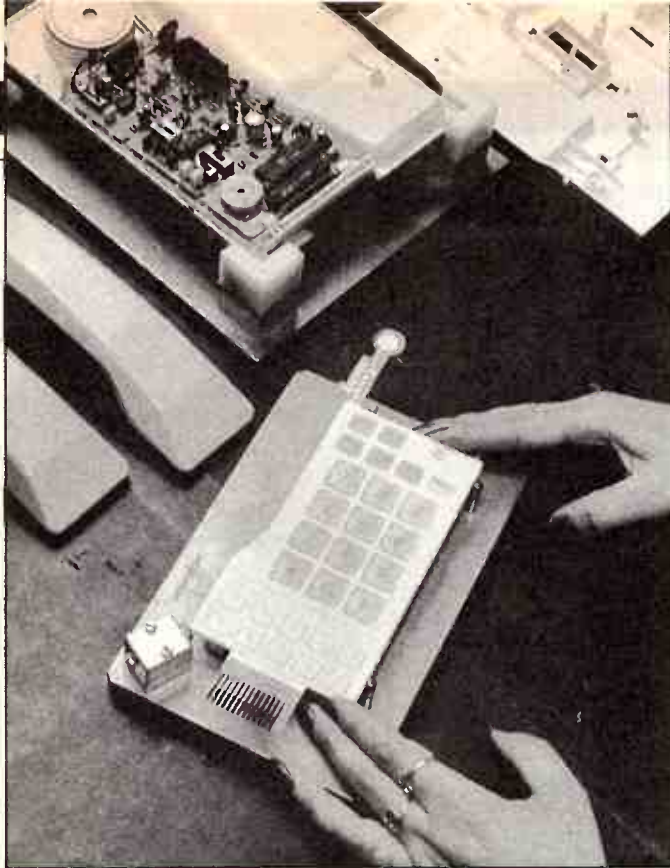
Alfatron has released the Model 11 programmer for PALs, Logic Devices, EPROMs, EEPROMs and bipolar PROMs.

Two serial interfaces are standard and other interfaces may be ordered as options. Full remote control is a standard feature and optional soft-



READER INFO No. 255

ware allows the unit to work with a host computer. Using the PROM module devices from 16Kbit to 1024Kbit may be programmed as well as many different EEPROMs. With the PAL module most modern logic devices may be programmed and the machine



New Telephone

AWA has designed and constructed computer-controlled assembly and testing equipment for Telecom's just-released Touchfone 200.

A joint development between Telecom, AWA and Alcatel STC, the new phone will have many new features including soft touch keypad, 10 stored memory numbers, last number radial and PABX compatibility.

The new standard phone was launched by the Minister for Transport & Communications, Senator Gareth Evans, at Expo 88 in Brisbane.

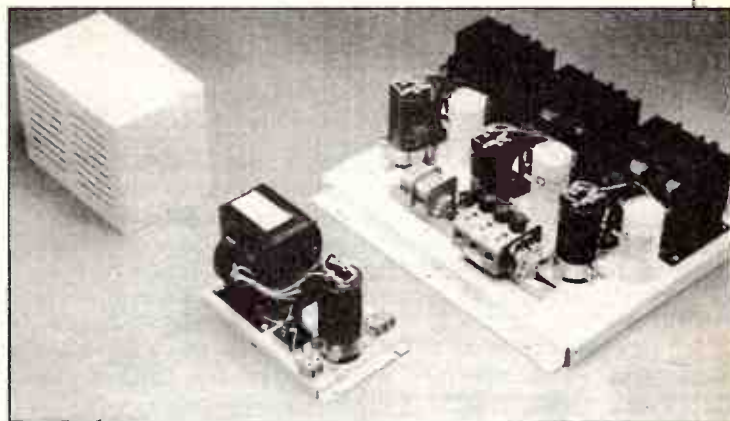
AWA holds a contract from

Telecom Australia to produce 50 per cent of Australia's Touchfone 200 needs. It includes a speech processing circuit that was designed at AWA's micro circuit design centre and will be produced at the company's new \$60 million micro circuit plant at Homebush, NSW.

AWA has designed and installed a series of quality control testbeds that monitor manufacturing and assembly performance at each step.

For information contact AWA on (02) 797-5757.

READER INFO No. 256



New Power Supplies

Sydney-based power supply manufacturer Statronics Power Supplies have released eight new ferro-resonant regulated dc power supplies, bringing the FE range to 15 models. The FE series' supplies are ideally suited to powering PLCs, industrial interfaces, security systems and float-charging lead-acid batteries for uninterruptible power.

There are three new single power supplies with output voltages of 48, 24, and 28 volts and nominal loads of 4 amps, 7 amps and 6 amps.

The new triple models consist essentially of three of these supplies mounted on a single chassis, with the outputs trimmed to match and connected in parallel or series as desired. Inputs can be connected to either single phase or three phase. They are more versatile than the single models and provide improved ripple performance.

There are five triple models

with a range of output voltages from 24 to 48 volts and nominal loads from 12 to 21 amps. The triple models can be rack mounted on a standard 19" rack. In addition the FER 3R model is fitted with high temperature, high reliability filter capacitors which substantially extend the mean time between failure. The FER 3RM model has isolated relay contacts for under and over voltage for each module and for mains failure.

A feature of the FE range is that the voltage regulation is supplied by the transformer. This means that as many FE power supplies as required can be connected in parallel for higher output currents. And three single FE supplies of the same model can be connected in star configuration for three phase operation.

For further information contact Rod Ruson on (02) 476-5714.

READER INFO No. 257

is designed to accept output from various PAL compilers. Over 1000 test vectors can be supported and this may be extended even further as modern devices grow larger. The unit is controlled by a 68000 CPU.

The Model 11 is designed to operate as a fully integrated stand alone programming system that will grow to fill future needs.

Further information: Alfa-tron on (03) 720-5411.

32 Channel Analysing Recorder

Yokogawa have recently released a new 32 channel Analysing Recorder. The Model AR3200 is an all-in-one digital waveform analyser which digitally measures and records waveforms of up to 32 channels.

It can measure up to 2 channels using its large memory of 10 Mbytes and is widely used

in laboratories and equipment/machine testing plants. This recorder digitalises the measuring field of conventional multi-analogue waveform measuring instruments such as electromagnetic oscillographs and recorders, thereby enhancing processing versatility. In addition, in multi-channel measurement, this recorder is used for

the measurement of a wide range of physical quantities, and can integrate various input amplifiers according to applications so that no external signal conditioner is required to achieve compact construction.

For more information contact Parameters, (02) 888-8777.

READER INFO No. 258

Voicecalls turnaround

A substantially improved performance by its radio-paging operation helped business communications group Voicecall Limited to a \$147,000 profit for the six months to December 31, 1987.

The result represents a 568 per cent turnaround, from a \$688,000 trading loss in the corresponding period of 1986, and directors say continuing improvements in overall profitability are expected.

Group member Voicecall Communications has substantially upgraded its national paging network and further improvements are planned.

The company purchased the paging business of Brisbane-based StateWide Communications Pty Limited in December 1987.

READER INFO No. 259

NEC

NEC is establishing a national reseller network through which to market the company's new Unix based Astra XL computers. According to NEC's Keith Shaw, the move will expand opportunities for hardware and software sellers who deal in Unix equipment. Prospective distributors will need to provide professional user support.

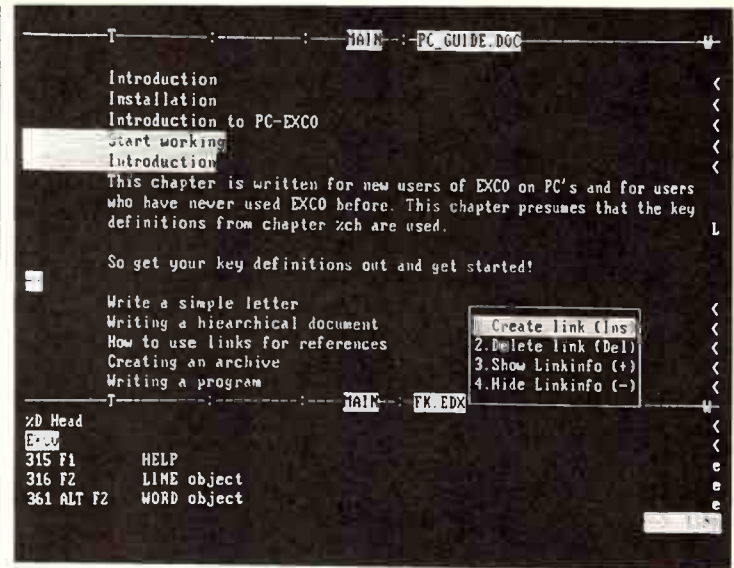
Schmidt Modem

The Schmidt Model 123 AT (3-speed V21, V22, V23) modem claims to give full 3-speed performance for about the same price as most 2-speed modems. Designed and manufactured in Australia by Schmidt Electronics, it comes with a full 5 year warranty. The company is best known for their range of taximeters. Technical support and service is immediately available. Future upgrading to V22 bis is planned.

For more information contact Schmidt Electronics on (03) 531 8011.

READER INFO No. 266

up his own consultancy. Hayden Spike left to prominence a few years ago with the world's first practical microphone worn in the ear. The result was a series of products that could be used for communications in super noisy environments. Now Hayden is setting up a new concern called Vabulit for consultancy work in radio and communications. He will still be associated with Hayden Spike. READER INFO No. 260



New Horizons In WP And Programming

Wide new horizons for word processing, by creating and organising information through hierarchies and links — that's the potential of EXCO word-processing software, now being marketed in Australia by Sea Software.

EXCO has been tested by Scandinavian industry since 1981, and is claimed to be ideally suited to projects from letter writing to highly complex system development.

Initially all properly designed documents have a hierarchical structure, for instance by head-

lines, subheadings, text.

EXCO software gives the writer full command of these functions.

The keys to EXCC are:

- Links: join one document to another.
- Compress: compress any amount of text into just one line. You can now view entire document on the first screen, independent of its size.
- Expand: expand the part of the text you are interested in.

Everything from entire cor-

HP 437B power meter

Hewlett-Packard Australia has introduced the HP 437B power meter, a general-purpose single-channel programmable unit for the rf/microwave market.

It operates with the full HP line of 11 power sensors already available that cover 100 kHz to 50 GHz and +44 to -70 dBm. Three new power sensors were announced, which add high-sensitivity to the 26.5-

to 40 GHz and 33- to 50 GHz waveguide ranges, and provide a coaxial thermocouple sensor for coverage over the entire 50 MHz to 50 GHz with the new 2.4mm connector.

The new power meter, essentially an improved single-channel version of the HP 438A dual-channel power meter, is designed for both manual benchtop as well as ATE applications; its compact front panel is 89 x 213 mm.

For more information contact HP on (03) 895 2895.

READER INFO No. 261



Zilog chip replaces logic packages

Zilog has released the Z84C80/81 General Logic Unit (GLU), a high-integration CMOS multi-purpose interface controller that performs many of the typical logic functions required in a Z80-based microprocessor system design. The GLU operates at clock speeds to 10 MHz, interfaces directly to all Zilog Z80 CPUs and optimises Z80 systems by replacing approximately 100 SSI and MSI packages with a single low-power 44-pin (84C81) or 68-pin (84C80) plastic leaded chip-carrier (PLCC) device.

The Z80 GLU incorporates on a single chip, a clock oscillator and controller (with a power-save monitor), dynamic random access memory (DRAM) interface and refresh controller, a static memory interface, power-on reset and synchronisation circuitry. Additional on-chip functions include eight memory I/O chip selects, a watch-dog timer and five wait-state generators.

Further information: Contact your local George Brown Group office or phone (03) 329-7500.

READER INFO No. 264

porate files to personal documents at home can be organised, modified and edited through EXCO. In implementation, the system offers options of a variety of levels and stages, to be used as appropriate to the application. These include:

Writing sequential documents; Creating cross references, personal files, software products, product versions, etc.

Restructuring a document is

a breeze. When you move a compress line, all underlying text follow.

The links allow you to get page and chapter references that are always correct. You can reuse text from other documents and include postscript graphics for printout. An unlimited number of files can be edited in one session, the writer moves between the files via the links.

The formatter will format

text for printout. Pseudo code is produced for compilation.

ESCO was developed for the Royal Swedish Airforce as a tool for structured programming, but is now available on VAX/VMS, SUN/UNIX and PC/MS/DOS, EXCO can provide a unified editing environment across these computers.

For further details contact Sea Software on (03) 894-1407.

READER INFO No. 262

Hitachi on top

Hitachi claims that its launch of the Hitachi HL300 Laptop Personal Computer through the network of Blue Chip Computer Centres in Sydney and Melbourne at the beginning of March 1988, has been a great success.

The HL300 is an IBM clone with MS DOS twin 720k Disk Drives, 512k RAM as standard, detachable Keyboard, and one of the new generations of bright LCD displays, for \$1695.

No major manufacturer has yet made available such a fully configured quality laptop PC at this price level and it represents a radical departure from the long held view that laptop PCs should be more expensive than Desktop PCs. The closest rival would be the Time Office Kookaburra, a locally made DOS machine without disc drives which sells at a similar price level.

READER INFO No. 263

Hi speed Card

InterTAN Australia (Tandy) has announced the availability of the 286 Express accelerator card for the Tandy 1000 SX and original Tandy 1000 personal computers.

The 286 Express, developed by PC Technologies, increases the performance of the 8088-based 1000 SX and 1000 from 200 to 600 percent — boosting these computers into a speed class comparable to 8 MHz 80286-based computers.

The 286 Express is a half-slot, 80286 accelerator card running at 7.2 MHz. The card features 8 Kb of cache memory, an optional 80287 co-processor and full direct memory access (DMA) compatibility. Users may select either 80286 or 8088 processing modes and enable or disable cache memory from the keyboard without restarting the computer.

READER INFO No. 265



JRC's dashboard mountable fax equipment able to transmit images 104 mm wide puts mobile communications in the forefront.

The JRC Radiofas

IN THE PAST few years, communications on the go has really begun to take off. A new generation of low power, highly integrated designs has meant that sophisticated products can be designed with power requirements low enough to operate off car batteries, and small enough to fit into the dash or boot. Practical mobile phones were the first example of the genre. Then came its computerised, space multiplexed descendant, the cellular phone.

With the establishment of low cost, practical voice communications in major metropolitan areas, the next logical step is the arrival of data transmission facilities. Plans already exist for facsimile, modems and so on to plug into cellular phones.

The potential for this technology is enormous, both in terms of the way it could change people's lives and in terms of the amount of business it will generate. If you think mobile communications is

only for technofreaks, just consider how the cellular phone market has taken off. Mobile computers can have instant access to office-bound mainframes and graphics (of whatever kind) can be sent anywhere. The first example of this type of technology is just beginning to surface here, in the shape of a car mounted facsimile system from the Japan Radio Corporation.

The units consist of the JAX 110 transmitter, and the JAX 120 receiver. Both are dashboard mountable (160 x 200 x 64) and can be used to send an image 104 mm wide and as long as you like, restricted practically only by the receiver paper length of 18 metres. The transmitter reduces the graphics under its input sensor to a 2400 bits per second data stream within the voice band. This then needs to be fed into the microphone input of a radio transmitter. At the other end, a receiver demodulates the signal, and sends the audio through its speaker extension

socket to the JAX 120. The type of radio link is thus not specified by the fax itself, and so considerations of range depend entirely on the power of the transmitter and receiver.

This is not to say that the performance of the unit is independent of the radio path. Obviously, the amount of noise present will determine how well the unit performs, and so error correction mechanisms become of paramount importance. During the time we had the unit for this review, we were unable to do anything quantitative in this area, except show ourselves that the fax will continue to work even when the noise on the channel prohibits audio communications. Exactly how this works is not apparent from the literature, although the manual does say that JRC developed a special error correcting and synchronising circuit for the job. Either way it works.

Operating the unit is quite straightforward, once you have the link established. One but-

ton turns the unit on, insert the paper, push the transmit button, stand back and watch. An automatic tractor winds it through as in a conventional fax, and it drops on the floor. At the receiving end, the radio needs to be switched on and the fax needs to be in standby mode. If it is, everything happens automatically, and the copy of the image falls into your lap. Both units are very neat in an ergonomic sense, quite happy with one finger operation in a moving car.

There is one significant difference of this system over conventional faxes. Because it uses a broadcast system, it is possible to broadcast, i.e.: transmit one signal to many receivers. In some applications this may be advantageous, but equally, it may not. The transmitter has a digital Select-Call facility to make it possible to communicate with designated receivers only.

I can imagine there will be all sorts of people who would find a use for the Radiofas, although I never really got over my feeling that a fax that can only transmit images 104 mm wide is a bit mickey mouse. Having got used to a minimum A4 sized fax, I wonder how people will take to the smaller version. Of course, there is the argument that an A4 fax won't fit into the dash of a car, or even into the boot for that matter, so maybe if we want fax on the road, small size will be essential. It's also a problem that one box can't both transmit and receive. It is perhaps, asking a bit much to shoehorn both functions into such a space, but it will be done, soon.

Even with these caveats however, JRC has every reason to be proud of their work. Both units are nicely constructed to withstand the rigors of a life on the road, and there will no doubt be quite a few punters who will find the ability to transmit graphics worth the asking price.

Jon Fairall

Hung Chang Meter

A budget priced DMM that packs in the features normally reserved for higher priced meters.



This Korean made digital auto-range multimeter (DMM) comes armed with auto ranging, a 20M ohm resistance range, transistor HFE measurements, lo ohm range, memory mode on manual ranging, hold function along with the other essential measurements, but more of that later on.

The HC779 is a hand held DMM measuring 75 x 150 x 34 mm in size and fits comfortably in the hand. The main function selector switch is located slightly off-centre to the left so that it can be switched with the thumb. The unit can also be placed on the bench by pulling out the stand fitted to the back of the plastic box. It comes with a pair of probes and their own insulated crocodile clips that screw on to the tips of the probes.

The 3½ digit liquid crystal display has a maximum reading of 1999 and clearly displays the ranges and functions that have been selected. Along with the standard measurements of ac, dc voltage, current and resistance, there are some features that need to be highlighted.

Extended Resolution

An interesting function of this DMM is the extended resolution obtained in the manual range for current, voltage and resistance measurements. Readings above 1999 are displayed with a blinking '1' as the most significant digit and the three least significant digits display data in the normal way. The resolution increases from 2000 to 3000 counts and in essence, the resolution is increased by one digit. The extended resolution will be displayed until the main significant digit increments to the next higher digit. The ranges are set as shown in the speci-

fication data. As an example, if the dc voltages are recovered in the 20V range then an extended resolution occurs between 20.01 and 29.99 volts. Note that this feature only occurs in the manual mode, except for resistance measurements where it occurs on the 2000k range during auto-range operation.

Lo Ohm

This feature is handy for in-circuit resistance that are shunted by semi-conductor junctions. The probe open circuit voltage is low enough to ensure that the semi-conductor junction is not turned on and upset the measurement.

Mem

Useful for relative measurements where an offset measurement (two least significant digits) can be entered and stored by pressing the MEM button. This value will be subtracted from any future measurements made, very useful for overcoming offset voltage or probe resistance.

Transistor Current Gain

Measurement of transistor HFE is very simple. Simply insert the pnp or npn transistor into their respective sockets, select the HFE position and read off the result.

In Use

The auto ranging mode is enabled as soon as the unit is switched on and is available on all the functions except for the 10A current range. Pressing the Range button brought in the manual mode. At first it was not obvious how to get back to the auto mode, however changing any of the measurement functions (voltage, current or

resistance) or the dc/ac switch reverts it back. The selected range is shown under the decimal point of the display.

Any input overrange condition causes the most significant digit to blink and sets the other 3 digits to zero. Furthermore a buzzer will sound intermittently to draw attention to this condition. In the resistance mode the buzzer sounds continuously when continuity is made.

Conclusion

I found the HC779 extremely easy to use. Most of the functions are self explanatory. At a

recommended retail price of \$119 this budget priced DMM provides auto ranging and other features normally only associated with more expensive DMMs. The HC779 should provide some stiff competition as it does its job very well.

The HC779 is available from Wagner Electronics, 305 Liverpool Road, Ashfield 2131, phone (02) 798 9233.

For further information contact Peter Carlini on (02) 797 9866.

Terry Kee

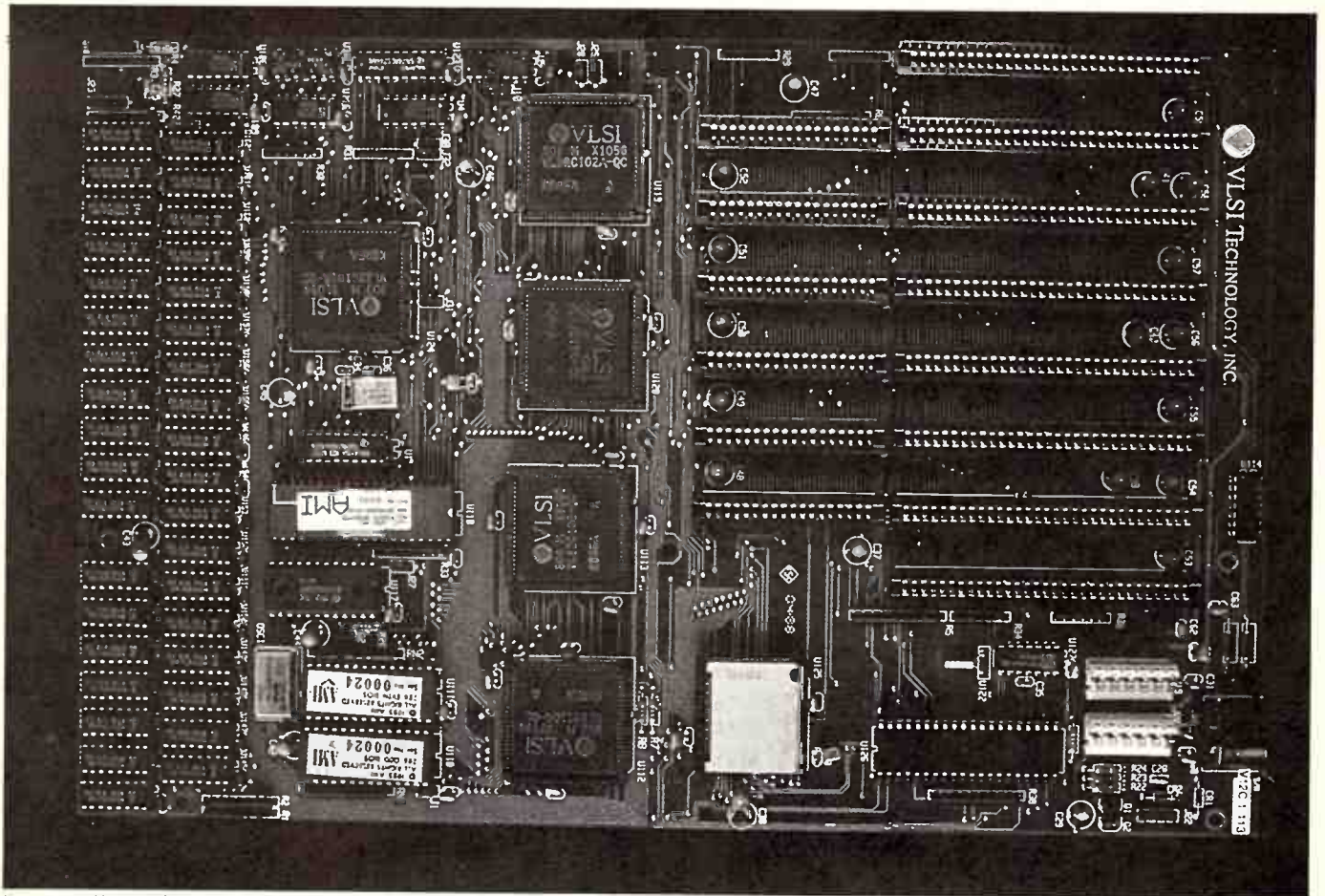
Specifications

DC Voltage	
Ranges	: 5 (200mV, 2V, 20V, 200V, 1000V)
Accuracy	: ± (0.5% + 1dgt.)
Input Impedance	: 100M ohm, 200mV Range 10M ohm, the other Ranges
Overload Protection	: 1100 V dc max. (50 sec) or DC AC peak max.
Resolution	: 100µV
AC Voltage	
Ranges	: 4 (2V, 20V, 200V, 750V)
Accuracy	: ± (0.75% + 5 dgts) (40 Hz to 500 Hz)
Input Impedance	: 10M ohm
Overload Protection	: 1100V dc max. (60 sec.) or DC AC peak max.
Resolution	: 1mV
DC Current	
Ranges	: 200mA, 10A
Accuracy	: 200mA = ± (0.75% + 1 dgt) 10A = ± (1.50% + 5 dgts)
Overload Protection	: 200mA = 0.2A 250V fuse 10A = 12A max. (60 sec.)
Resolution	: 100µA
AC Current	
Ranges	: 200mA, 10A
Accuracy	: 200mA = ± (1% + 5 dgts) (40 Hz to 500 Hz) 10A = ± (2% + 5 dgts)
Overload Protection	: 200mA = 0.2A 250V fuse 10A = 12A max. (60 sec.)
Resolution	: 100µA
Resistance	
Ranges	: Low-power ohms (open circuit V: 450mV approx.) 5 (2K, 20K, 200K, 2M, 20M) Hi-power ohms (open circuit V: 900mV approx.) 6 (200, 2K, 20K, 200K, 2M, 20M)
Accuracy	: Low-power ohms 2K-2M : ± (0.75% + 1 dgt.) 20M : ± (2.0% + 5 dgts) Hi-power ohms 200-2M ± (0.75% + 1 dgt.) 20M : ± (2.0% + 5 dgts)
Overload Protection	: 250 DC or AC rms max.
Resolution	: Low — 1 ohm, High — Vrms 0.1 ohm
Buzzer sounds at	: 19 digits
Memory Mode	: at
Manual Range	: Yes

ETI 1613: THE BABY AT: Part 1 Towards a PC-AT Compatible Board

A look inside the design methods used for Application Specific Integrated Circuits (ASICs).

Jon Fairall



The Baby AT drop-in motherboard will fit into the standard pc case, and may be used as a replacement for an existing board.

THIS IS A MOST unusual project: our first chance to play with a new generation of electronic technology. While we have published a number of articles over the past year that have dealt with ASICs, we haven't been able to really demonstrate the design issues involved, much less bring you circuit diagrams and demonstrate a real live project for you.

However, while we are still playing with 555s, events move on apace. In Brisbane, Ken Curry's Energy Control has acquired the distributorship of the US based semiconductor company VLSI Technology, and Curry has set about spreading the word according to ASIC. This is the first of what he calls "Technology Demonstrations", a way of demonstrating how ASIC design can be made to work for local companies. Naturally, when he suggested that we might like to base an ETI project around such a proposal, we jumped at the chance.

The task: to create a PCAT motherboard that could really be called state-of-the-art without abusing that much abused term. The result: over the next three issues, we will describe a 12 MHz, zero wait state, PCAT drop in motherboard that will require only 16 components plus the memory. An equivalent standard PCAT has 110 parts plus the memory on board. The board that comes with the kit will take one meg of memory.

And the best thing of all: Price. The kit will cost merely \$499 plus tax if applicable, a powerful indication of the significance of ASIC technology in the marketplace. Without doubt, this is the cheapest AT in the country, and should make it possible to put together a high performance AT with enhanced graphics colour monitor, hard and floppy discs for under \$2000, probably a price saving of 50 per cent.

In this article, we will discuss the methods used in putting together a design in ASIC in some detail. Next month we will look at the circuit of the AT chip set and in the October issue detail construction of the kit. If you are prepared to take our word in advance that the price/performance ratio is for real, given Energy Control a ring now and orders yours.

Definitions

There are many terms floating around that describe different ways of building integrated circuits, so some definitions are in order to start with. We are all familiar with the full custom chip: typical logic blocks are of this type. Although they are expensive to design and build, their cost is typically in the order of cents a unit, solely because of economies of scale. Millions are used every day, world wide.

Integrated circuits of this type have their circuit etched in the silicon. Individual tran-

sistors, resistors and so on, will be laid down as discrete units. In the early days this work was done manually. Today it is usually done at least partially with the aid of a computer.

Of course, it is possible to build fully custom chips in very small quantities, and in some applications it might be worthwhile. A spacecraft or military application for instance, might well make it easy to justify the cost. However, in an ordinary commercial setting, there are few applications that could justify the sort of outlay required. As a result, a number of cheaper alternatives have become available.

Historically, the first was the Gate Array. As its name suggests, a Gate Array is an array of logic gates, etched in silicon, and mass produced by the semiconductor vendor with the same sort of economics as his mass produced logic parts. Of course, a bit of silicon with thousands of unconnected gates is perfectly useless. The trick is to connect them all up to perform a specific function. This can be done in one step in the silicon foundry, by putting in a layer of metal interconnects between the cells. This is the only part of the design that needs to be customised, so it is relatively cheap to do even in quite small quantities.

Working with discrete logic gates is still

pretty fundamental circuit design, too fundamental for most applications in fact, so it wasn't long before vendors started to offer custom cells. A custom cell is a whole block of circuitry, typically corresponding to one of the standard logic blocks. It exists as a discrete bit of programme code in the CAD system, so you can call it up as, say, a 7400, but equally, it exists as a discrete bit of circuitry on the silicon, a cell that might be composed of several hundred individual transistors and other components. The silicon of a semi-custom chip may consist of many thousands of these cells joined together in a unique way.

However, as ways of presenting the technology to the user have been developing, on the other side, the ability of the semiconductor fabricators to cram material into their silicon has increased dramatically, so that whereas 10 years ago the smallest feature on a bit of silicon was, say, 10 microns across, it is now less than one in many instances, and mostly less than two. This has made it possible to put more circuitry into the available space, and led directly to the idea of megacells.

Megacells

Megacells are large functional blocks, like processors, which would normally be made up of many smaller cells. Semiconductor vendors found that these were being required so often it made sense to offer them as discrete cells. The result is that it is now possible to specify a megacell on a bit of silicon, and then surround it with other bits and pieces to create a unique device.

Typical applications that can benefit from the use of megacells are those that contain three or four LSI components and a handful of "glue" components. All of these components can be combined into a single component if the functions can be partitioned into logical groups with a reasonable number of Input/Output (I/O) pins. In this type of application, the total pin count might be reduced from 300 pins for a discrete solution to less than 100 pins, and the circuit board area reduced from approximately 20 square inches to 2 square inches.

The power consumption of megacell designs can be very small in comparison with the designs they replace. In addition, because several functions can be put on one piece of silicon, the interconnected capacitance and inductances are minimized, thereby reducing the power to a fraction of what was needed in previous designs.

The reliability of a megacell-based design is typically better than the collection of discrete components it replaces because there are fewer pins, fewer bonding wires and lower total power consumption. In most systems, the largest contributor to reliability problems is IC pin connections, with such other factors as die temperature and die size

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being secondary. Also, the more functional blocks that can be combined on a single piece of silicon, the fewer the number of interconnections that have to be bonded to package pins, resulting in higher overall reliability of the component and system using it.

Structure

The Baby AT is designed using the megacells created by VLSI Technology.

VLSI's megacells are designed to have a fixed height (73 mils) and variable widths, offering the best trade-off between unusable internal space and placement ease. As shown in Figure 1, they can be configured to make a very dense final design with a minimum of wasted silicon real estate.

Of equal importance with the physical layout format of the cells is the structure of the interconnected bus. This was designed so as to be generic enough to allow a wide variety of functions to be connected uniformly and efficiently, and to be fast enough to not itself become a limiting factor as system performance increases.

The internal structure of the bus created by VLSI for use with its megacells contains an m-bit data bus and an n-bit address bus, both of which are expandable in width to accommodate changes in system requirements. The bus operates synchronously at a rate of three million transfers a second, which is equivalent to the performance of a 10 MHz 8086 or 12 MHz 68000 microprocessor. The bus definition allows for internal access times of 50 ns and cycle times in the 200 ns range. With standard pad drivers, external loads can be driven while supporting a 3 MHz bus frequency; faster speeds can be obtained by using faster pad drivers. To create a standard product from a megacell, an interface circuit is incorporated that exactly matches the slower timing of the external bus to the internal bus.

CAD

The key to using megacells, as with using any kind of ASIC, is the Computer Aided Design (CAD) system. This will determine how easy it is to implement a design, and thus how quickly it can be done. All the different vendors have their own particular methodology, but the VLSI system is relatively typical.

The design process is started by using a megacell schematic "icon" as part of the schematic entry of the user's design. Provided with the megacell icon is a data sheet detailing the internal timing requirements of the megacell. The designer works from this data sheet as if using an off-the-shelf standard product, except that the logic and timing of the bus are somewhat easier to use.

When the schematic entry of the design is complete, the designer uses a test language

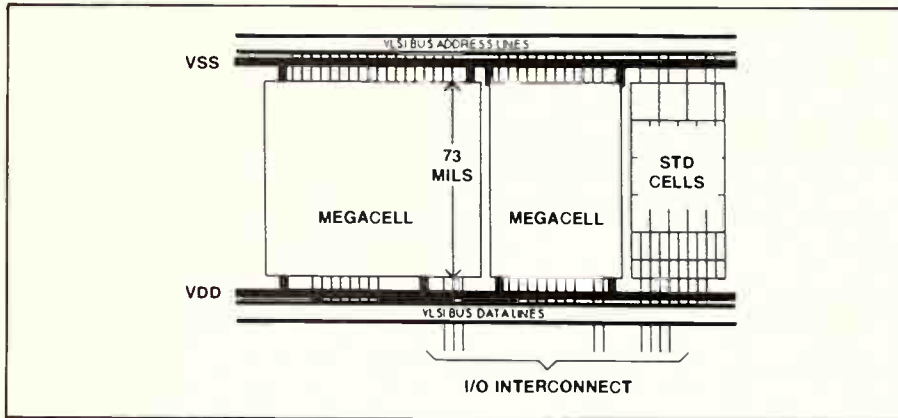


Figure 1: The structure of a bit of silicon from VLSI Technology. The height is 73 mils. The width depends on application.

assistance program (VTItest) to capture a set of simulation vectors that can be used to test the design after the silicon has arrived.

This is of vital importance to the entire design process. There may be gross faults in the product that one can identify right away, as for instance it you short the power rail to earth. Far more likely however, are a collection of subtle bugs. These are of several types. It may be that the circuit designer will not anticipate the circuit getting into a certain configuration, and so an unexpected output might occur which for some reason is not acceptable. Computer design or testing can't help in cases like this, which really are up to the designer to think through. However, it may be that the circuit does not do what it is supposed to do in all the input configurations identified. (Remember that in a complex circuit, like a processor, there might be thousands of different configurations.) In this case a CAD system can assist, by demonstrating all the possible outputs, and recognising that some are illegal. A sophisticated CAD system will have the ability to be instructed to watch out for illegal outputs.

Of course, this means that the methods of testing the unit must be built into the design. In all cases, some additional logic will be necessary to facilities testing the megacells. This additional logic consists of multiplexers on pins to allow all of the connections of the megacells to be accessed from the periphery of the circuit. This dictates that all designs be contained in packages having at least as many pins as the most pin-intensive megacell used internally. To enable the test mode, an illegal condition on the interface is often used, such as Read Strobe and Write Strobe being asserted together while the chip is selected. This would normally never occur in an applications, so it is a safe combination to use. When enabled, the I/O pads of a specific megacell are connected to the I/O pins of the components, and the standard product test pro-

gram run to verify the functionality of the core.

In order to do this for a specific design, software needs to be written to create a test programme, both for the design stage and for actual manufacturing tests, so that its possible to tell the difference between a good unit and a bad one. AT VLSI, the designer works in a test language called VLSI Test Language (VTL), which allows simultaneous development of the circuit design and test program, providing notification early in the design stages of when tester-specific details affect the testability of the design. Through the test language, designers can create a file describing the physical characteristics, timing, stimulus patterns and expected responses of a circuit under development. The remaining software translates the description into commands that run the simulation, verify the expected response, and store requested response values predicted from a simulator. Finally, VLTtest generates a complete test program that includes all specification for the timing generators, strobes, and registers, all pattern loading, requested dc parametric and summary test routines, and the test vectors needed to test the circuit functionality.

Besides identifying tester limitations associated with the test program, the software suggests ways to work around them. In that way, design engineers can become familiar with tester limitations and make the optimum design-vs-testing trade-off. When the testability of a circuit becomes a problem, the design engineer can add additional circuitry to help out. Common practice is to break up long counter strings to reduce the number of states required to exercise each individual stage.

The test vectors generated by the software have a one-to-one correspondence with the vectors used during the simulation, so the information normally lost during post-processing is retained. Another benefit is that, since a tester is not needed to de-

velop the test program and initially debug it, the test system is available for production time and work can be done during the normal hours.

Test engineering effort is still required when using this process, but the time spent can be a matter of only a few weeks, rather than the several-week period traditionally associated with creating a test program for a new product.

There are also significant time savings to be made throughout the design cycle. From the point of view of the individual entrepreneur, this time saving may well be the single most significant benefit of using ASIC technology. Prototyping using breadboards and rats nests can take an awful long time. First circuits almost never work, which means that debugging, redesigning and rewiring are part and parcel of the daily life of a design engineer. All this takes time. By using a CAD system with a simulator and tester, things can be speeded up dramatically. Unlike simulators for pcboard designs, ASIC simulation can be highly precise even when working with high speed logic. This is because the connector lengths, and their associated capacitance and impedance, is known to a high degree of accuracy. Thus, many ASIC vendors, VLSI among them, claim that once the simulation is correct, the design will work.

Some indication of how dramatic this time saving is, can be seen from the length of time it taken to develop this project. The decision to go with a five piece AT compatible chip set was made in February 1987. Just three months later, the design was complete. The first silicon actually appeared in June 1987 and VLSI stepped up its marketing effort. By Christmas, production had begun in earnest and had ramped up to 20,000 sets a month. It is instructive that this chip set was designed in four months, but took a further six to get into products in Asia, and only now, a year later, are we seeing them driving products in the shops. ASIC technology is making the design cycle a trivial part of the entire product cycle.

Meanwhile, VLSI design engineers are back at work on the next round: a 16 MHz version of the baby AT has already seen the light of day in Arizona and a PS2 chip set is on the drawing boards.

The ability to design chip sets this fast, and get them into production, gives companies who use the technology an enormous advantage over those who don't. It makes it easy to see why electronics companies who are still designing with discrete components on pc boards never have world beating products, and ultimately fall by the wayside.

Next month—pulling an AT apart, and putting it back together again.

ETI-1425 GUITAR NOTE EXTENDER

If you want your guitar notes to keep on hanging on cleanly, then the ETI-1425 may be just for you.

Terry Kee

THE INFAMOUS "fuzz box" or distortion box has long been the electric guitar player's most used effect pedal. One of the reasons responsible for this is that the distortion allows the player to sustain the notes much longer than normal and the other is due to the harmonic change generated by the clipping or bending of the guitar signal. It is often difficult to achieve a guitar sound with heaps of sustain and without it being buried in distorted grunge.

The ETI-1425 solves the problem and provides the sustain without the distortion. Using the Note Extender as the first pedal in the effects chain, and there are usually many, can accentuate the effect of other ones, as an example, using it with a distortion unit set to give just a hint of "edge" can fire that guitar solo into life.

The 1425 has a Bypass LED indicator which tells us when the effect is switched in or out. The Input Drive knob is used to set the input gain so as not to overload the unit and it also determines the amount of sustain required. The output level can be varied by the volume knob. The unit is powered by a 9V battery. There is also a dc socket to accept a 9V battery eliminator. The power to the unit is switched on when a jack plug is inserted into the output socket, thus eliminating an on/off switch.

Design Considerations

The Note Extender works on the same principles as the familiar Automatic Level Control circuit found in radio receivers. The heart of such a device is a Voltage Control Amplifier (VCA) and a rectifier

that converts the ac signal into an appropriate dc level to control the VCA and keep the level constant. The time constant of the rectifier filter plays an important role in determining the overall performance of the unit. The attack time has to be fast enough to bring down the gain quickly to stop the transient portion of the guitar signal from being amplified excessively.

Remember that once the guitar note has decayed the system gain will be at its maximum thus making the speed of the attack time even more accurate. The decay time has to be fairly long to smooth out the low frequency that can effectively modulate the VCA and manifests itself as distortion at these frequencies. Furthermore the decay time has to be short enough to follow the envelope of the signal. In a simple RC filter network the fast attack and slow decay requirements are conflicting as the time constants are determined by a single capacitor.

After some experimentation with different time constants and plucking endless guitar notes, I came to the conclusion that a dual time constant rectifier circuit was essential. The compromise between low distortion and a fast response became too critical. Furthermore the results that were obtained were too dependent on guitar playing styles.

Occasionally plucking a note hard and fast allowed a nasty click through to the output as the system was too slow to respond to it. My attention was then drawn to the 572 companding chip which has a separate attack and decay time constant built into the rectifier filter network. The 572 can be configured as a compressor or

an expander circuit hence the name, companding. In the Note Extender the 572 is configured as an Automatic Level Controller (ALC) with the signal input connected to the rectifier input rather than the signal output, which is the compressor configuration. This makes the gain inversely proportional to the input level so a decaying signal level will produce a proportional increase in gain to keep the level constant.

The amplification of the lower levels of the guitar signal does present us with a problem as the level becomes comparable to the guitar pick-up noise and that dreaded hum!

Unfortunately the envelope of a plucked guitar string decays fairly quickly so low level amplification is important to the amount of sustain perceived by the ear. However, there has to be a compromise between the amount of sustain and acceptable noise levels. This compromise is also a function of the type of guitar pick-up to be used with the 1425. The single-coil pick-up as found on Fender Strats are renowned for their ability to pick up hum and to generate noise of their own.

The humbucker is a twin coiled pick-up which cancels out any picked up hum (hence the name). These pick-ups have their own characteristic sound and both are widely used.

Furthermore some guitars are not properly screened which makes them a perfect aerial for hum! To accommodate different types of pick-ups and to obtain the best performance with your guitar a Select On Test resistor is included in the design. A measured SNR of -80dB was obtained



A bass cut is also built into the input amplifier to attenuate low frequency noise and hum. The mid to high frequencies are thus accentuated by the ALC action and this makes the sustain effect more noticeable. The signal is then applied to the heart of the Note Extender which is the gain control section consisting of the 572 Companding ic. The gain cell contained in the 572 is placed in the feedback loop of an op-amp with the input signal connected to the rectifier input.

The 572 thus acts as a varying impedance in the feedback loop that is controlled by the input signal and in turn, varies the voltage gain of the op-amp. When the input amplitude decreases below the cross-over point which is around -30 dBm, the overall system gain increases proportionally to hold the output at a constant amplitude of -30 dBm.

As the input level increases above the cross-over point, the system gain decreases proportionally again holding the output amplitude constant. The amount of ALC action is thus level dependent and the Input Drive control ensures that the input level can be varied to an amplitude comparable to the cross-over point.

A time constant of 68 mS was suitable and produced about 1% distortion at 100 Hz. Note that the 572 is a dual channel device, however only one channel is used.

To reduce the gain at very low levels, R15 supplies an extra current to the rectifier which raises the voltage applied to the gain cell and effectively reduces compression at low levels. The ALC action is further reduced at low input levels by R5 which limits the maximum gain of the circuit.

Unfortunately limiting the low level gain by these methods also affects the amount of gain available at the cross-over point. Hence the trade-off is acceptable noise generated by your particular guitar pick-ups and sustain. I used a Stratocaster guitar with single-coil pick-ups to set up the values of R15 and R5 experimentally.

The procedure to set up the 1425 to work best for your individual guitar is described in the Testing section.

The input jack socket is wired to short out the input when no plug is inserted. The output socket has a switched connection that disconnects the ground connection from the battery or dc power source. The footswitch allows the output to be switched between the output of the Note Extender or the input signal. A LED is also switched on when the unit is in use.

The unit can accept a maximum input level of 10 dBm with the Input Drive set to minimum before clipping commences at an output level of -6 dBm.

Construction

The circuit board is built on a single-sided pc board measuring 90 x 53 mm. Once the pc board is etched and the holes are drilled then start by mounting and soldering in the resistors, capacitors, link and ic sockets (if you have decided to use them). Check the polarity orientation of the electrolytic capacitors by referring to the overlay. Note that C10 is a $470\mu/25V$ capacitor and if you find that the component height is too high to fit in the box, then solder the cap on the solder side. Solder in the diode and transistor, noting again their correct orientation.

The next step before the wiring can commence, is to decide on the type of box you want to use. Since the unit is to be floor mounted, it needs to be rugged and made of metal for screening purposes. I used an aluminium diecast box measuring 150 x 50 x 80 mm, commonly available from electronics stores. The holes on the box need to be marked and drilled out. I did not use a Scotchcal panel as they tend to scratch quite easily and would not survive all that foot pounding! Measure out

with the input short circuited so most of the noise will be generated by the pick-ups.

Circuit Description

The input amplifier IC1a serves to provide a high input impedance of around 90k ohms so as not to load the guitar pick-ups and to provide amplification for those lack-lustre pick-ups. The gain is made variable via the Input Drive pot from 0 dB to a maximum of 20 dBs.

The rectifier in the 572 consists of a full-wave circuit and a buffer amplifier that implements the separate attack and decay filter network. Capacitor C6 and a 10k internal resistor determines the attack time.

In the Note Extender an attack time of 1.5mS was found to be suitable only after extensive plucking of guitar notes and listening carefully to the transient response at the output. The decay time is determined by C7 and another internal 10k resistor.

the holes by dropping in the hardware and checking that everything fits. Do not forget about the 9V battery! Ensure that the marks are neatly aligned before the holes are drilled. I managed to fit everything in the diecast box although it was a tight squeeze.

The pc board was mounted on top of the footswitch and input jack socket and tightened down to the top panel via 2 bolts and spacers. The footswitch contacts were bent down so that the pc board could fit inside the box.

Next comes the spray painting, if you want the unit to look really professional. I coated the box with a metallic blue spray, available from your local car accessory store. Smooth the surface of the box with a small piece of fine wet and dry sandpaper. Wipe it clean and allow it to dry. Spray the box with three light coats of paint, allowing each coat to dry fully. Use some Letraset or something similar to letter the knobs and sockets. Spray the lettering with a clear protective coat to avoid the lettering from being rubbed off.

Once that is done it is time to commence with the wiring. Use screened audio cable for the connections to the jack sockets and footswitch. Note that the connections to the footswitch have the screen cut at the switch end but soldered to ground on the pc board. Sleeve the connection at the switch end to prevent any short circuits to ground. Use hook-up wire for the rest of the wiring keeping the connections to the two pots as short as possible to minimise stray pick-up. Insert the ics into their respective sockets if you have not soldered them in already. Take note of their polarity.

The final stage is to cut a piece of cardboard to insulate the solder side of the pc board from the footswitch and input jack socket. Tighten the nut of the input socket SK1 firmly as it also acts as the ground connection to the metal box.

HOW IT WORKS — ETI 1425

IC1a is configured as a non-inverting amplifier with the gain set by RV1 and R4 to a maximum of 20 dB. R2 and R1 establish the biasing point 4.5V for the op-amp to operate with a 9V supply and sets the input impedance to 90k. The signal is then ac coupled via C3 and C4 to IC1b and the rectifier input of the 572 (IC2). C6 determines the attack time with an internal 10k resistor and sets it to 1.5 mS; C7 sets the decay time to 68mS.

The resistor R5 limits the maximum gain of the circuit to reduce the ALC action at very low input levels. Reducing the value of this resistor reduces the gain and increasing it, increases the ALC action. R15 is connected between pin 2 to 9 V to reduce the gain even further at very low levels.

Resistor R9 is used to bias the output halfway between the supply and ground to obtain the maximum headroom. A value of 22k sets pin 7 of IC1b to 4.5 Vdc feedback is provided by R10 and R11 and C8 ensures that no ac signal is present in this path.

The 572 is placed in the negative feedback loop of IC1b with the output ac coupled via C11 into the input of the gain cell (pin 7). The gain circuit is configured as an inverting amplifier with R7 being the input resistor. The non-inverting input of the op-amp

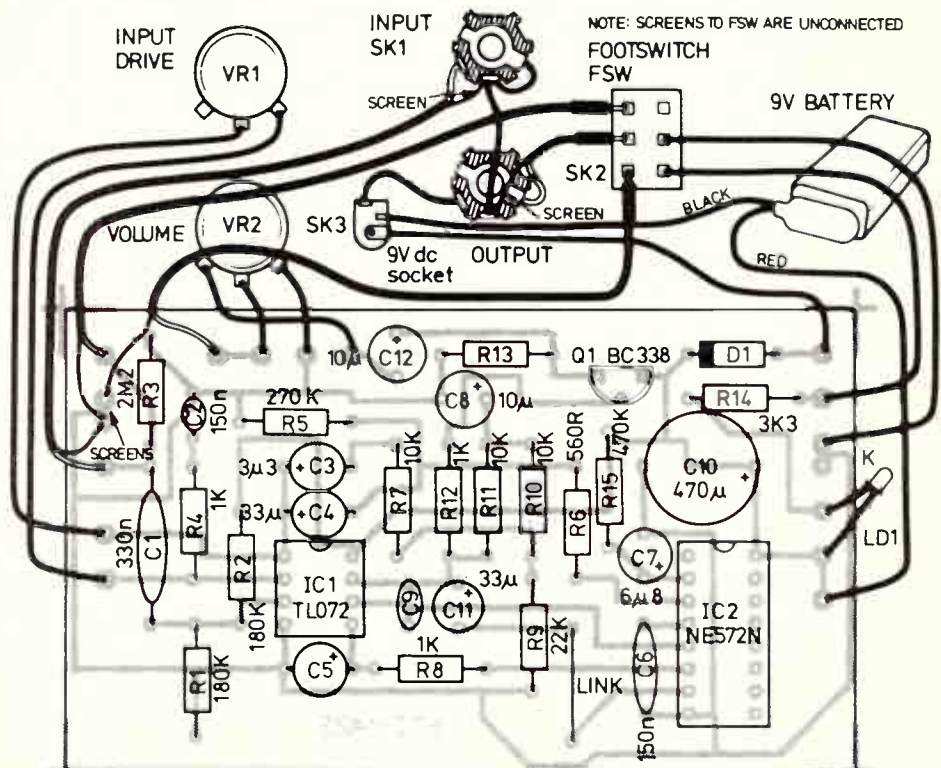
(IC1b) derives its dc bias from pin 6 of the 572. Note that only one half of the 572 is used. The output of the gain control circuit is then buffered by an emitter follower Q1. The output is ac coupled by C12 before being fed to the volume pot (VR2).

The 9V rail is heavily decoupled by C10 which smooths out the glitches generated by the gain control circuitry. The diode D1 provides circuit protection for incorrect supply polarity by becoming reversed bias when the wrong polarity is applied.

Battery switching is arranged so that the ground connection of the battery becomes disconnected when a dc plug is inserted into the dc socket (SK3). The on/off switch is incorporated into the output socket (SK2) where the ground continuity is made as soon as the jack plug is inserted into the socket.

The footswitch is configured to feed the output socket with the input or output signal. At the same time the LED circuit is switched in via the limiting resistor R14 and lights up when the output is selected. The resistor R3 discharges the voltage on any capacitors in preceding units and enables quiet switching to be achieved.

The unit consumes about 9 mA dc current when the unit is switched in.



ETI-1418

EXPANDABLE 4-TRACK RECORDING MIXER

A truly expandable mixing console that can save you thousands of dollars over commercial units and offering features that are usually only to be found on equipment with \$5K plus price tags.

Glen Thurecht and Andrew Robb

both professional and semiprofessional backgrounds. Also the enthusiastic help of the staff of *Sonics* and *ETI* Magazines was invaluable in helping to provide the flexible and multifunctional unit that has been developed.

Expand According To Budget

The mixer is an expandable, X-4-2 console that can have up to 48 input channels. This limit is imposed by the power supply. Each time extra channels are added to the system, the case automatically expands with it, due to a unique mechanical design. This expandability then allows you to increase the capabilities of your recording system as your budget permits or as needs change.

The Newton MM1 mixer kit consists of two parts:

1. Output module — contains the 4 subgroup output channels, the left and right output channels, the headphone monitor station, and talkback station.
2. Dual input channel module — contains two independent input channels per module.

Each kit would contain an output module and as many input modules as you wish (up to a limit of 48 input channels). Construction is relatively simple and a complete self-contained console can be built that looks as good as any factory assembled job.

All components used throughout the mixer are of high quality, maintaining a no-compromise design. Low noise operational amplifiers, low noise metal film resistors, toroidal transformer, etc are used to produce the quality needed in a studio applica-

THIS PROJECT was not conceived for the faint hearted, not because it requires any special skills or techniques, but simply because of the size and cost of the kit. For a mixer configured as an 8-4-2 there are 430 resistors, 307 capacitors, 123 intergrated circuits, 128 potentiometers, 73 switches, and 55 connectors just to mention a few of the components. For an experienced and well organised constructor, it should take around 30 hours to complete.

The aim of the project was the design of a high quality, expandable mixing console that was optimised for 4 track recording but

could equally be used in live sound applications if the need arose. More than this, if the project was to be a success the kit would have to show substantial cost savings on equivalent units on the market. These aims have been achieved in the final design. A high degree of functionality and many operational features have been combined in a basic low noise, low distortion design that can save you literally thousands of dollars compared to a commercially bought built up unit. The specifications and features of this mixer were decided upon with the consultation of experienced sound engineers from

tion especially with the eminent onset of cheap digital recording systems (DAT). Cost savings, which allow the kit to be sold at a reasonable price, were made in ways which will not affect the sound quality. An example of this is the use of single sided printed circuit boards with high component densities. This means that a few links will need to be inserted but the cost saving makes it well worth the effort.

Features

Figures 1 and 2 illustrate the functions that have been included in the Newton MM1 mixer. The input module contains the following features:

- Balanced input:** A low impedance electronically balanced XLR input with radio frequency filtering. Electronically balanced inputs offer better transient response and lower hum pick-up than transformer coupled inputs and are much cheaper to implement.
- Unbalanced input:** A high impedance single ended input using a 6.35 mm phono socket connector. Ultrasonic filtering is also provided to guard against interfering input signals.
- Insert point:** A stereo 6.35 mm phono socket connector is used to conserve cost and panel space. It is used to allow the input channel to be routed to an external signal processing device and then reinserted at the point from which it was taken.
- Phase reversal switch:** Reverses the phase of the balanced input. This has

THE NEWTON MM1 MIXER

The Newton MM1 mixer is available in kit form only from APPLIED AUDIO CONSULTANTS. The kit comes complete with all components, printed circuit boards, metalwork, power supplies, wire, etc. A fully comprehensive construction manual is also supplied which gives a step by step guide through all stages needed to complete the mixer.

Costing of the components is as follows:

- | | |
|---|-------|
| 1. DUAL INPUT CHANNEL MODULE: | \$280 |
| 2. OUTPUT MODULE: | \$490 |
| (including power supply) | |
| 3. 2 SUPPORT RAILS: | \$40 |
| (to enable modules to be bolted together) | |

An example of how to order an 8-4-2 mixer would be:

4 x DUAL INPUT MODULES	4 @ 280 =	1120
1 x OUTPUT MODULE		490
1 x 2 SUPPORT RAILS		40
		<u>\$1650</u>
Shipping and handling		25
		<u>\$1675</u>

All prices include 20% sales tax hence sales tax exempt prices are: \$233.33 for input modules, \$408.33 for output modules, and \$33.33 for the support rails.

Orders may be placed with:
APPLIED AUDIO CONSULTANTS
 PO BOX 733
 CANBERRA CITY 2601

For further information feel free to call **APPLIED AUDIO CONSULTANTS** on (062) 43-3345 or Fax (062) 47-0985. Shipping and handling costs are: \$25

ABOUT THE AUTHORS

Glen Thurecht and Andrew Robb are electronics engineers and principals in Applied Audio Consultants, based in Canberra. They design and manufacture a range of specialist audio equipment, under the NEWTON trade name, in addition to custom design and production. They contribute to ETI and Sonics magazines regularly.

many uses in a studio or live sound allowing microphone in/out phasing techniques to be used.

- Input select switch:** This switches either the balanced or the unbalanced signal through the input channel. Although this function can be implemented using switching on the input connectors them-

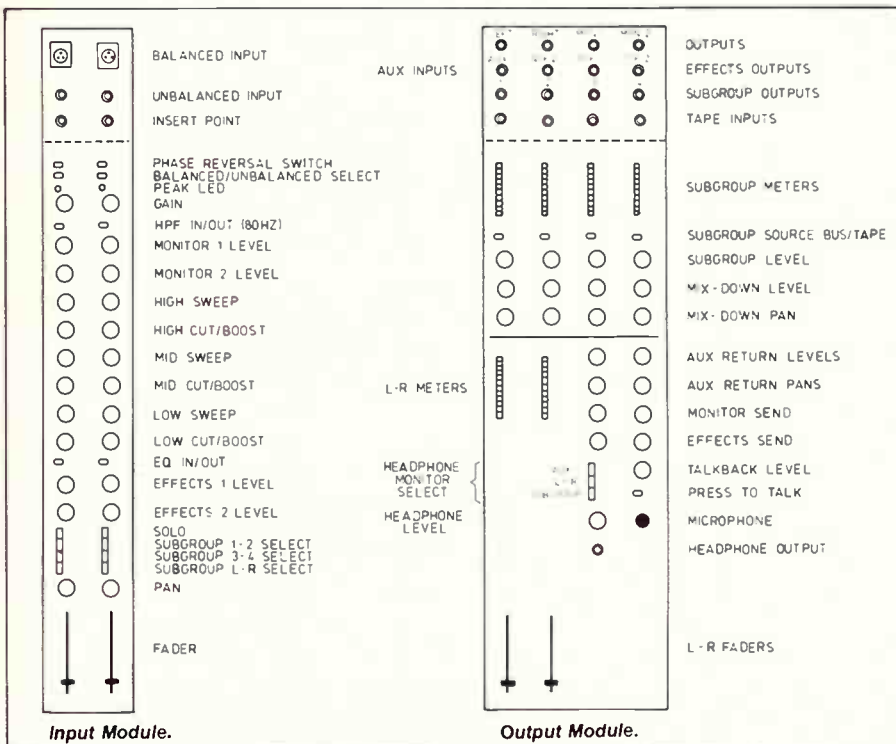
selves, this does not then allow both inputs to be permanently connected to the console, as usual in a studio situation. The switching method does not require one connector to be unplugged to switch the other through.

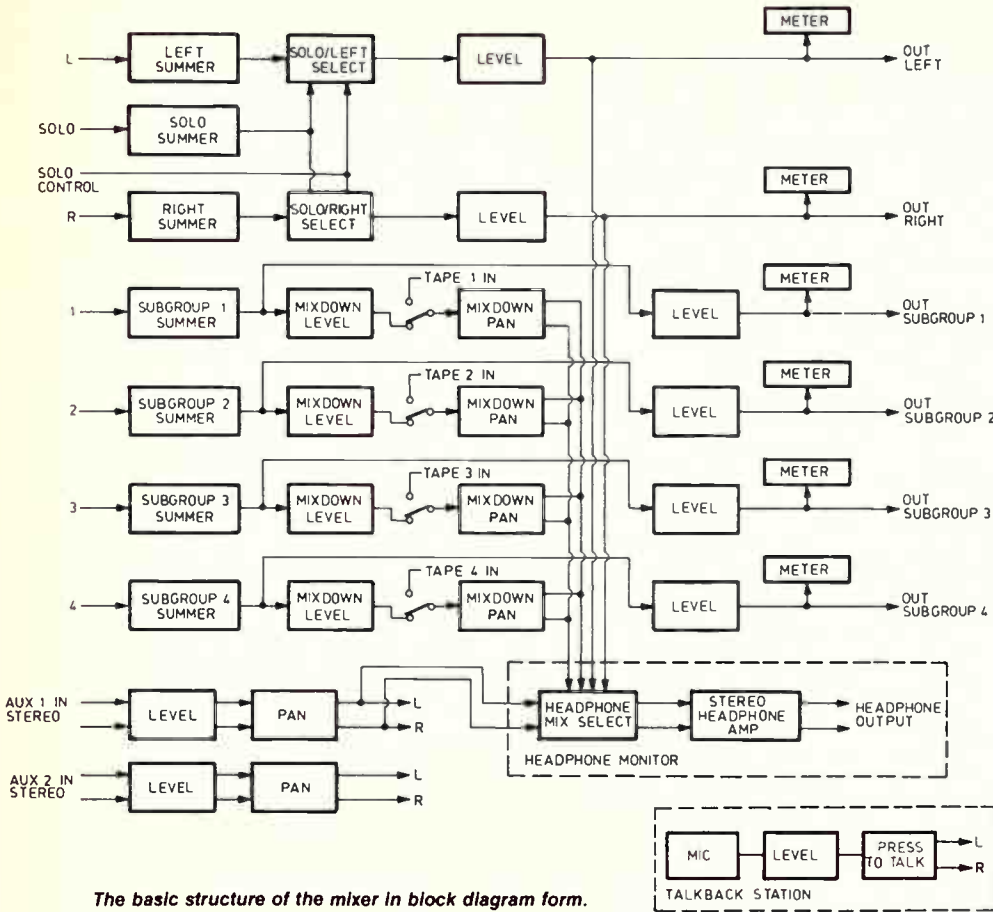
- Peak LED:** Indicates when the input signal is within 6 dB of clipping. Electrically this is connected Post Gain and Post EQ.

- Gain:** Provides system gain from 0 dB to 40 dB. Home studio recording equipment is usually of the semiprofessional variety and these systems run at a nominal -10 dB operating level (i.e. -10 dB = 0 VU), as opposed to the professional level of +4 dB = 0 VU. Hence this control allows inputs in the range of -10 dB to -50 dB to be brought up to the 0 VU operating level.

- HPF in/out:** Inserts or removes the high pass filter from the signal path. This is used to reduce hum and other low frequency signals that may be present on the input signal. The cutoff frequency of the filter is 80 Hz and it is implemented using a Bessel type filter. These filters have the advantage of excellent transient response but have lower attenuation rates than the more common Butterworth filter types. The Bessel filter has the best transient response out of any filter type and was thus chosen for this project.

- Monitors:** Two monitor sends connected Pre-Fade, Post-EQ to give headphone monitor mixes to the musicians



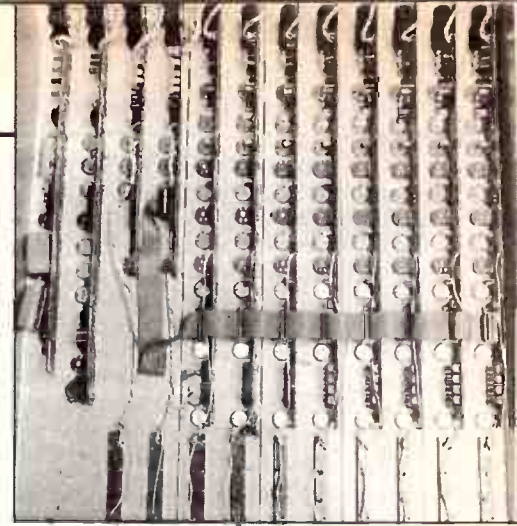


The basic structure of the mixer in block diagram form.

Specifications

INPUTS: BALANCED	—	input impedance	1 k
		nominal input level	-60 dB to -20 dB
		max level before clip	-25 dB to +13 dB
UNBALANCED	—	input impedance	50 k
		nominal input level	-50 dB to -10 dB
		max level before clip	-15 dB to +23 dB
INSERT	—	input impedance	10 k
		nominal input level	-10 dB
		max level before clip	+23 dB
AUX	—	input impedance	4.5 k
		nominal input level	-10 dB
		max level fore clip	+23 dB
TAPE INs	—	Input impedance	>8.2 k
		nominal input level	-10 dB
		max level before clip	+23 dB
OUTPUTS: SUBGROUPS, LEFT, RIGHT	—	output impedance	1 k
		nominal output level	-10 dB
		max level before clip	+23 dB
MONITOR, EFFECTS SENDS	—	output impedance	1 k
		nominal output level	+ 4 dB
HEADPHONE SENDS	—	max level before clip	+23 dB
FREQUENCY RESPONSE:		Stereo 0.5 Watts/channel into 8 ohms	
EQUALISATION:		20 Hz to 20 kHz ±1 dB	
		3 band quasi parametric	
		LOW: Cut/Boost	±15 dB
		Centre frequency	50 Hz to 500 Hz
		MID: Cut/Boost	±15 dB
		Centre frequency	320 Hz to 6.4 kHz
		HIGH: Cut/Boost	±15 dB
		Centre frequency	3.8 kHz to 12 kHz
PEAK LED:		set 6 dB before onset of clipping level of +23 dB	
OUTPUT LED BARS:		10 segment, 3 dB between segments with full scale level of -4 dB	

NOTES: 1. 0 dBm = 1 mW into 600 ohms = 0.775 volts RMS
 2. Specifications subject to change without notice.



in the studio.

10. **3 Band quasi-parametric Eq:** Although fixed frequency shelving EQ is useful in live sound, in the studio it has a number of limitations. Firstly, the clarity of the mix is achieved by applying careful and unique EQ to each individual sound, which shelving EQ does not allow. Secondly, shelving EQ has a tendency to exaggerate tape hiss if high frequency boosting is required on mixdown.

A far better EQ for studio use is a 3 band quasi-parametric, or sweepable type. This is an EQ that has a centre frequency adjust control on each band as well as the normal Cut/Boost control. Bearing in mind that each sound may be processed with EQ twice (record and mixdown) this allows up to 6 variable and unique EQ points.

The sweep ranges of the three bands are:

1. HIGH 3.80kHz to 12 kHz
2. MID 320 Hz to 6.4 kHz
3. LOW 50 Hz to 500 Hz

Note that sufficient overlap has been included to optimise the filtering capabilities.

Cut and Boost it +/- 15 dB on all bands.

11. **EQ in/out:** Allows the EQ to be bypassed if not needed, thus reducing the number of active components in the signal path and reducing total channel noise.
12. **Effects sends:** Two effects sends connected Post-Fade.
13. **Solo:** The solo mutes the output of all other channels, Aux inputs, etc going to the Left and Right outputs and allows the engineer to listen to just the channels that have been put into Solo mode. Very useful in the studio, but disastrous for live sound applications!
14. **Subgroup selects:** Used in conjunction with the pan pot to assign the output of a channel to the desired subgroups.
15. **Pan:** Standard pan arrangement.
16. **Fader:** Final channel level adjustment before mixing at the output module.

Electronically Speaking

The design of a high quality mixer requires a number of fundamental rules to be strictly adhered to. For lowest noise the gain structure of the mixer should provide all gain as

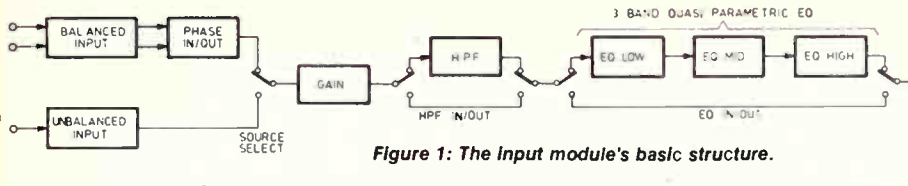


Figure 1: The input module's basic structure.

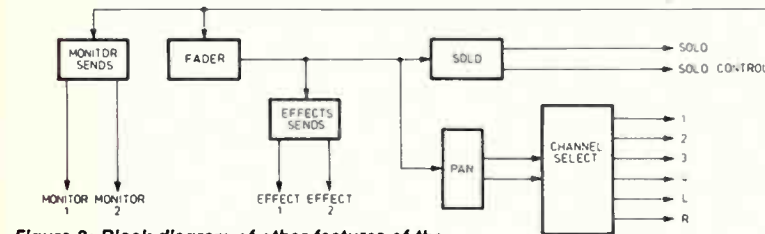


Figure 2: Block diagram of other features of the input module.

close to the input as possible. This is the same principle that applies in communication equipment where a low noise, high gain amplifier (eg a mast head amp) is placed on the front end of the receiver. The gain structure in this mixer has been set up so that all gain is given by IC3 at the front end. This is a low noise 5534, since the noise characteristics of this stage will largely determine the total active noise of the mixer.

The second rule which should be applied is that all active components in the signal path, such as operational amplifiers, should be kept to a minimum. This is done because every amplifier will add extra noise to the system, hence for minimum noise we used the minimum of components. The total noise of this mixer is so low that the effects of Johnson or thermal noise generated in the resistors themselves accounts for a large part of the total noise. The equation for the calculation of thermal noise of a resistor is:

$$V = \sqrt{4kTR(BW)}$$

where k = boltzmanns constant
 $= 1.37 \times 10^{-23} \text{ J/k}$
 T = temperature
 R = resistance
 BW = bandwidth
 $= 20 \text{ kHz}$

Hence to reduce the thermal noise the resistor values were kept as low as possible. Also metal film resistors were used which have an inherently lower noise figure compared to the cheaper carbon film resistors. A trade-off exists, however, in that the lower the resistor values, the lower the noise but the higher the distortion due to the loading of the output stages on the operational amplifiers.

One very nice feature of this design is the equalisation. Traditionally parametric equalisation is achieved through a state variable filter which can use up to four operational amplifiers, increasing cost and greatly increasing noise. The design implemented in this mixer uses only a single op-amp and provides excellent performance

with $\pm 15 \text{ dB}$ cut and boost.

All components in the input module, except for the balanced input connector and the fader, are printed circuit board mounting thereby removing almost all the wiring and saving construction time. The metalwork comes complete with all holes pre-punched, industrial baked enamel powder coated paint work, and silk screened labelling. The panel is constructed from 2.5 mm aluminium sheet making it light and robust.

Construction — Input Channels

The discussion here is limited to construction of the input module. A full description of the construction of the output module will be given in next month's ETI.

Firstly, as always, look carefully at the printed circuit board for any bridges or

breaks in tracks. Starting with a good PCB, we commence soldering, starting with the lowest profile components and working up to the highest. The links are inserted using the tinned wire supplied. Refer to the supplied printed circuit board overlay supplied with the kit when positioning. When all links are soldered in, the resistors and D1 are inserted. Pay strict attention to the correct placement of the components at this stage since it will save a lot of trouble later when trying to fix an error. The IC's are next. Make sure that pin 1 (this position is designated by a small circle indented into the IC package above the pin 1 position) is in the correct place, checking with the overlay. Capacitors now, again using the component overlay. There are no electrolytic capacitors on this board so polarity does not have to be checked.

The two ferrite beads can be prepared. Cut a 100 mm length of the enameled copper wire and thread it through the bead two times. Now scrape off the enamel from the ends and solder into place.

Place the LED in making sure it is the correct way around as per the overlay. Now the switches can be inserted. Make sure that they are sitting flat on the board so that they will all look evenly spaced through the front panel after the knobs are fitted. The potentiometers are now inserted, keeping these mounted flat also. Finally the IDC bussing connector can be

PARTS LIST — ETI-1418 SINGLE INPUT CHANNEL ONLY

Resistors.....all 1/4W metal film unless otherwise state

R1, R2	.....1k
R3, R4	.....3k
R5, R7	.....510
R6	.....51k
R8	.....20k
R9	.....15k
R10, R11, R14,	
R15, R18, R19,	
R22, R23, R24,	
R25	.....2.2k
R12, R35, R39	.....5.1k
R13, R20, R28,	
R29, R30, R31,	
R32, R33, R34	.....4.7k
R16, R17	.....2.7k
R21	.....4.3k
R26, R27	.....1.5k
RV1	.....50k linear
RV2, RV3, RV11,	
RV12	.....10k log
RV4, RV6	.....50k dual linear
RV5, RV7, RV9	.....5k linear
RV8	.....10k dual linear
RV10	.....10k log slider
RV13	.....1k linear

Capacitors

C1, C2, C3	.....1.5nF
C4, C7, C8	.....22pF

C5, C9, C21	.....2.2µF to 10µF Bipolar electro
C6, C17	.....15nF
C10, C11	.....150nF
C12, C15, C18	.....330pF
C13	.....39nF
C14	.....100nF
C16	.....5.6nF
C19	.....1.8nF
C20	.....4.7nF
C22, C23, C24,	
C25, C26, C27,	
C28	.....0.1µF monolithic chip

Semiconductors

IC1, IC2, IC3	.....5534
IC4, IC5, IC6,	
IC7, IC8, IC9	.....TL-071
LED1	.....5mm red
D1	.....1N914, 1N4148, etc

Miscellaneous

SW1, SW2, SW3,	
SW4, SW5, SW6,	
SW7, SW8	.....2P/2P alternate action pushbutton

Two 6.35 mm phono jacks, Female XLR connector, 20 pin IDC connector, 20 pin IDC header, knobs, slider knobs, AAC-02 printed circuit board, 3mm bolts, nuts, washers, 20 way ribbon cable, wire, knobs for switches, Dual input channel metalwork with industrial baked enamel powder coated paint and silk screened labelling, metalwork baseplate, ferrite beads.

soldered in place.

Note that the two 6.35 mm sockets are not yet inserted. This must be done after the board is mounted on the metalwork.

Now before the board is mounted on the metalwork, screw 3 nuts onto the dual pots. These will act as lock nuts to stop the pot from bending in when it is tightened down. Now mount one board on the metalwork. Insert the two 6.35 mm sockets before it is screwed down. Solder the sockets in place and then tighten all the pots down. Next, insert the slider pots and XLR connectors, then begin the wiring as shown in the photograph of the finished unit. This involves cutting an 80 mm piece of the twisted three wire cable soldering to the board and the XLR connector as per the wiring diagram supplied with the kit. Finally wire the slider pot.

Repeat the exercise with the second board of the module. Push all the knobs on and position the coloured cap. You now have a completed input module is waiting to be placed together with other modules to form the complete mixer. The description of the construction of the output module (including power supply) and the method of bolting the modules together will be discussed in next month's issue. A comprehensive troubleshooting guide will also be given.

The output module functions can be seen in the figure 2 panel layout and the block diagram of Figure 4.

1. **In/Out Connectors:** All input and output connectors are located on the sloped rear panel and are 6.35 mm phono sockets. Included are the following:

- the 4 subgroup sends;
- the left and right sends;
- the 2 effects sends;
- the 2 monitor sends;
- the 2 stereo Auxiliary inputs;
- and the 4 tape inputs (which come from the output of the 4 track recorder).

2. **Subgroup Meters:** The meters are 10 segment LED bar graphs which monitor the output of each of the subgroups. The scale is logarithmic with 3 dB increments between LEDs. They are calibrated for a peak full scale range of -4 dB (ie 6 dB above the nominal output level of -10 dB).

3. **Subgroup Source:** This switch allows the selection of either mixer output subgroups or tape recorder inputs. The selected source can then be mixed down onto the left or the right channels or to the headphone monitor. This allows the engineer to monitor via the tape machine (very important in a studio).

4. **Subgroup Level:** To economise on cost

and panel space, rotary subgroup masters are used instead of faders.

5. **Misdown Level And Pan:** These allow the subgroups to be mixed down and monitored on the Left/Right bus and headphone monitor. The mixdown is independent of the subgroup output level which is sent to the recorder inputs. When the subgroup source is switched to select the tape recorder outputs, a direct mix may be made onto the Left/Right channels for recording onto 2 track or cassette tape.

6. **Left/Right Meter And Fader:** For monitoring and control of the stereo bus.

7. **Aux Return Level And Pan:** Level and pan for the stereo Aux returns 1 and 2. The pan pot behaves like a balance control in this application. These stereo INs may also be used as two mono inputs (with the correct lead), in which case the level control will behave as an overall level control for the two sound sources, while the pan pot will alter their respective levels.

8. **Monitor And Effects Send Levels:** Is the master level control for Monitors 1 and 2 and Effects 1 and 2.

9. **Monitor Station:** Three signal sources can be selected by the headphone monitor:

(a) **Aux 1:** used to directly listen to the signal applied to the Aux 1 input, such as the two track, for replaying a mix.

(b) **Left/Right channels:** for monitoring during mixdown on the stereo bus. It can also be used in conjunction with the Solo switch to listen to individual input channels when recording.

(c) **Subgroup mixdown:** for monitoring via the subgroup monitor during recording or upon playback.

The selected signal is then passed on to a headphone amplifier which can drive the headphones directly.

10. **Talkback Station:** A signal from the internal microphone is sent to the left and right bus outputs when the press-to-talk switch is activated. This allows communication between the musicians in the studio and the sound engineer at the console.

The output module panel is constructed in one piece and includes a welded end face to seal the complete unit. All internal bussing is done with press fit connectors making it extremely easy to extend the system since no soldering is required. The output module also contains the power supply and is rated for supplying power for up to 48 input channels as well as the output module. ●

HOW IT WORKS — ETI-1418

The Input from the balanced XLR connector is wired directly to the phase reversal switch, SW1. This switches the inputs from pins 3 and 2 of the connector to different inputs on the differential amplifier (IC1 and associated components) thus creating a phase reversal for the two switch positions. Inputs are passed through the low pass filter formed by the ferrite beads and C1 and C2 to provide radio frequency rejection. The electronically balanced amplifier is formed by the differential amplifier of IC1, R1, R2, R3, and R4. The gain of the amp is set at 3 and is determined by the ratio of $R3/R1 = R4/R2$. C3 is used to provide more high frequency filtering and to increase the stability of the amplifier. C4 is the frequency compensation capacitor.

The unbalanced input comes in via a 6.35 mm connector and is ac coupled via C5 to remove any effects of dc on the input. Interference on the input is reduced by the low pass filter formed from R5 and C6. R6 sets the input impedance to around 50 k. IC2 is a single ended 5534 amplifier, for low noise, in voltage follower configuration with C7 as the unity gain frequency compensation capacitor.

Both the single ended and balanced input signals are presented to SW2 to allow selection of the input to be passed on to the gain stage formed by IC3, R7, RV1, and C8. Gain is calculated from the equation: $\text{Gain} = RV1/R7$ and is variable from 1 to 100 (0 dB to 40 dB). C9 removes any dc on the output of the gain stage due to input offset voltages of the input stages.

The high pass filter is made from the active filter IC4, R8, R9, C10, and C11. This is a Bessel highpass filter with the 3 dB corner frequency set at 80 Hz. The Bessel filter provides optimum phase linearity across the frequency spectrum required and hence provides the best transient response. The filter is bypassed via SW3 when it is not needed.

Equalisation is performed by the three stages based around IC5, IC6, and IC7. Selective frequency response is obtained through the combination of positive and negative feedback adjusted by RV5, RV7, and RV9. Components C13, C19, R12, R13, RV4; C16, C17, RV6; C19, C20, R20, R21, RV8 all affect the frequency mid point of the individual stages. R10, R11, R14, R15, R18, R19 set the gain of the stages to unity when cut/boost is in the centre position. C12, C15, C18 remove any possibility of high frequency oscillation.

The two monitor sends are tapped off from the output of SW4. RV2 and RV3 adjust the level and R22 and R23 are the bussing resistors used to sum the monitor send from the other input channels.

The peak LED detector circuit is formed from D1, R35, R36, and C22. These form a

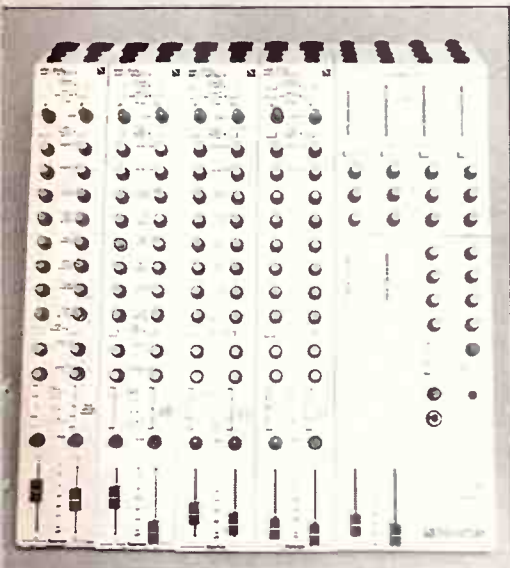
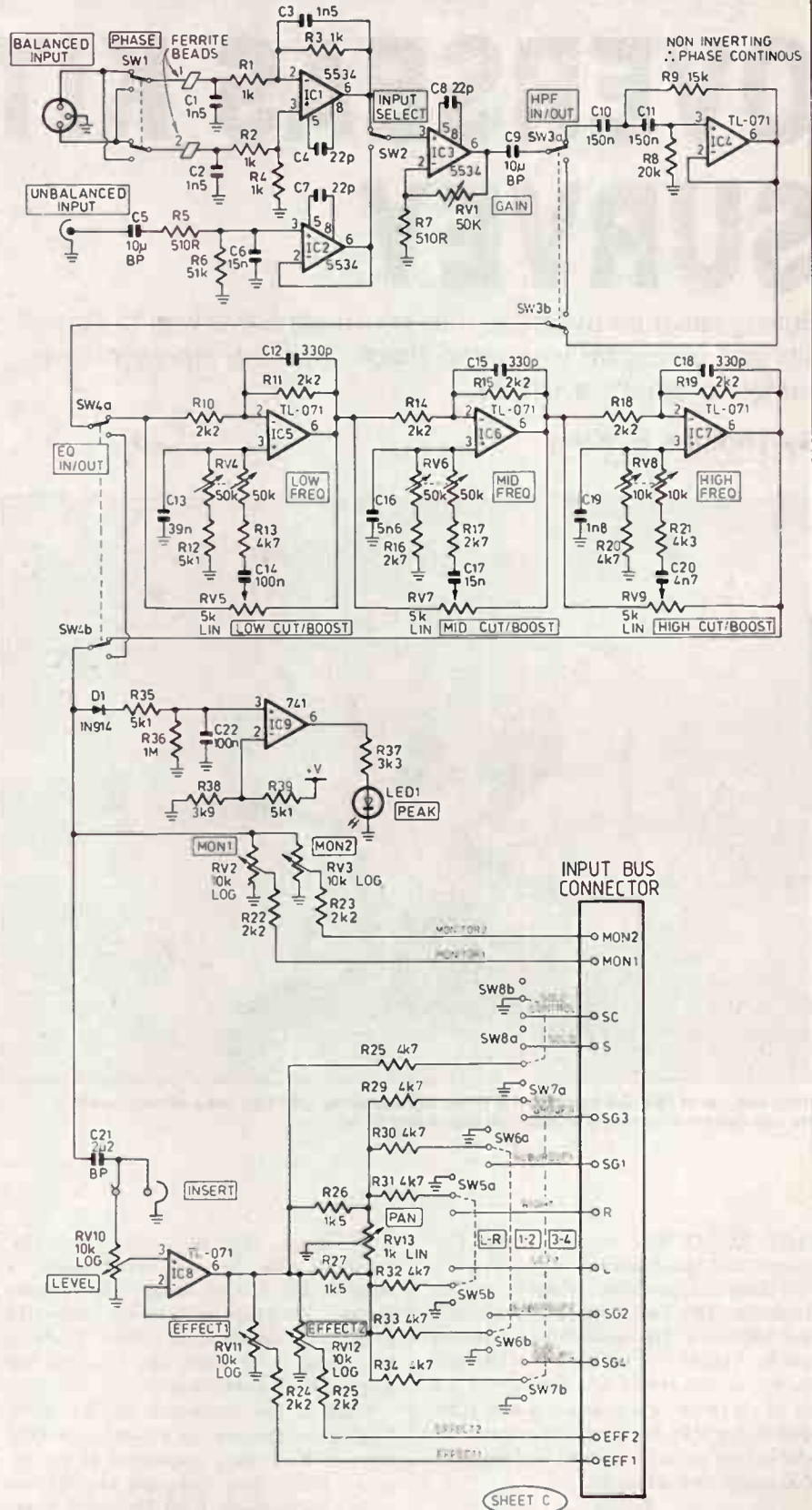
4-Track Recording Mixer

rectifier and filter arrangement which is compared against a reference voltage formed from the divider network of R28 and R39. IC9 is a comparator configuration switching from -VE rail to +VE rail when this reference voltage is exceeded. R37 is the current limiting resistor for LED1.

The output of switch 4 is also sent via the coupling capacitor, C21, to the channel fader or level control. This is done to prevent any scratch noise from the slider as it is varied due to changing dc levels into the voltage follower buffer of IC8. The output of the buffer then feeds the effect send pots RV11 and RV12. R24 and R25 are the bussing resistors for the effects sends.

R28 is associated with the Solo control and is used to route the channel signal to the Solo bus when SW8 is pressed. A Solo control line is also grounded when SW8 is depressed which signals circuitry on the output module that the left and right channel outputs are to go into solo mode. R26, R27, and RV13 form the pan circuit when combined with the bussing resistors for the 4 subgroup channels. R29, R30, R31, R32, R33, and R34 form the bussing resistors for the 4 subgroup channels. SW5, SW6, SW7 are the output channel select switches and ground the bussing resistors when the channel is not selected. This is required so that the output level does not vary as the channels are switched in and out.

All power supplies and bussing lines are wired to a printed circuit board mounting IDC connector to allow signals to be routed to the other input channels and the outputs.



AMATEUR RADIO OVERSEAS KIT SURVEY

Buying kits from overseas may be an attractive way to source bits and pieces for your radio shack. This is a representative sample of what's available.

By **Thomas E. King**



While this line of QRP CW equipment is being superseded by QRP SSB units, Mizuho is still the sole electronic company in Japan manufacturing RF kits.

THIS RUNDOWN on the Radio Frequency and shortwave kit scene looks at the range of products available outside Australia. The June 1987 issue carried a description of kits manufactured and/or sold in Australia. In the nature of the case it's not an exhaustive list, although it is a list of all the kit manufacturers who bothered to reply to our letters of enquiry. So why not sit up late one night and call ISD. You might save a bundle.

Japan

According to the Japan Amateur Radio Industries Association, Mizuho Tsushin of

2-8-6 Morino, Machida — Shi, Tokyo 194, Japan, is now the only manufacturer of amateur HF kits in Japan. The Shimizu Denshi Kenkyujo (Electronic Research Company) also produced these kinds of kits about three years ago but now has stopped their production".

When I last contacted Mizuho about English instructions for a number of their kits Mr T. Takada responded to my enquiry. While these following kits may no longer be available from Mizuho I would be happy to exchange construction and operating notes about:

QP-7 7 MHz transmitter
QP-21 21 MHz transmitter
CW-100 7 MHz receiver
Mod-1 2 W AM modulator

The original price of each of these kits was Yen 3000 — now about \$32 — which makes them excellent value. When writing to enquire about availability of the CW units amateurs may also wish to ask about the kit status for the current range of Mizuho QRP HF SSB equipment. The following are currently being advertised in Japan:

MX-6SR 1 W on 50 MHz
MX-28S 2 W on 28 MHz
MX-21S 2 W on 21 MHz
MX-14S 2 W on 14 MHz
MX-7S 2 W on 7 MHz
MX-3.5S 2 W on 3.5 MHz

All these pieces of equipment are priced at Yen 24,000 or about \$250. A 10 W HF amplifier is available for about \$105 and a power supply for about \$40.

United States

The USA has a number of companies producing amateur radio and shortwave oriented kits including Radio Kit, Box 973, Pelham, NH 03076 (an 80 M transceiver), Heil Ltd, Marissa, Illinois 62257; Communication Concepts Inc, 121 Brown Street, Dayton, Ohio 45402 (35 W and 75 W 2 M FM Amp kits), and Kantronics, 1202 East 23rd Street, Lawrence, Kansas, 68046. Phone 913-842-7745. Kantronics is not currently in the kit market. Although it has been highly successful in selling its 2 W Rockhound QRP 40 and 80 M transmitters and companion receivers, the company is now 'packet' happy.

Marketing Manager, Lori A. Elliott, said the company's leading unit these days is the Kantronics All Mode Communicator. Retailing at \$US319, the KAM All Mode Packet Radio Controller includes

32 K RAM, WEFAX (weather fax capacity), simultaneous HF/VHF gateways and KA-Node for linked connection of Packets.

India

India has a large and thriving amateur marketplace, with a number of companies in the market. Telectron Industries, 22 Dayalu Nagar, 3rd Street, Near Power House, Kodambakkam, Madras 24, phone 42 8805, is a small all-India company described as "manufacturers and designers of high quality printed circuit boards, electronic kits and dealers in all electronic components". The visitor to India's fourth largest city may have some difficulty in finding the company at its suburban Kodambakkam address but should be able to easily locate its city centre-counter sales outlet called Abirami Electronics at 17 Athipattam Street, Mount Road, Madras.

Most of the 175 different silver plated printed circuit boards made by Telectron as well as some of the kits are available through Abirami Electronics. The boards are supplied with the necessary schematics. (See Box 1.)

Also in Madras is Teltron Electronics, 6 Truspuram, Third Cross, Kodambakkam, Madras 600024. Like Telectron, this Madras-based company has a wide range of boards and kits for applications as diverse as audio, servicing and rf. The PCB I purchased was designed for a 3 to 20 A power supply. (Power handling capabilities depend upon voltage regulator selected.) Designed around a supply published in the May 1985 issue of "Elector India", the PCB came with a full photocopy of the construction article. Teltron has printed a

list of its PCBs and kits.

Still another PCB manufacturer located in Madras is Sundaram Electronics L-5 Intronics Campus, Thiruvanniyur, Madras 600041. This company produces a number of small power supply and power amp PCBs. Depending upon quantity desired they will custom manufacture boards for projects . . . an idea to consider when a radio club has a project in mind for its members.

Over the past five years, the Amateur Radio Association B2/101 Pachim Vihar, New Delhi, India 110063, has trained around 100 residents in the Indian capital. Most of these have gone on to sit for the amateur radio exam.

The ARR is run by Dr Ashutash Singh, who achieved fame in Indian radio circles when he set up communications for one of the early Indian Antarctic expeditions.

The Delhi Radio Club meets from 5-7 pm every Friday, Saturday and Sunday. The hub of amateur activity in the capital is located in the corner of the massive Pragati Maidan Exhibition Grounds nearest Appu Ghar, India's first electronic amusement park.

It may be easier to visit the club and its club room/classroom than to get a reply to any enquiry about the club's VHF and HF projects.

During my visit in 1987 I was shown a very impressive display of totally home built equipment including a 4-band transceiver, 2 W FM transceiver and a frequency counter. Professionally produced PCBs available for these projects have been manufactured in the DRC workshop. Hopefully, the club will answer requests for PCB costs.

Greece

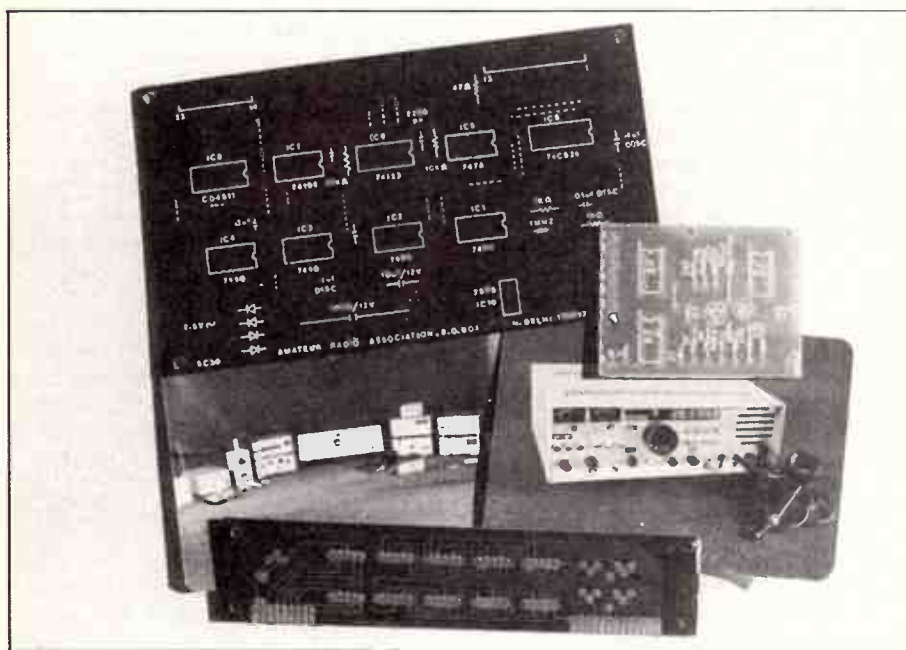
C & A Electronic O.E., PO Box 25070, Athens 10026. Greece. Phone 5242-867. is located within sight of the famous Parthenon. It has the potential to be the amateur radio kit giant of Europe. Headed by Mr Simeon Krizias, an electrical engineer by profession, this is the largest kit company in Greece and one of the largest in Europe. The 11 year old organisation has R&D facilities and manufacturing facilities for its own PCBs.

To date nearly all the 115+ kits have been mass market consumer items, with

Box 1:

A list of the kits available from Telectron Industries. Prices are in A\$, on the assumption that 10 Rupees is one dollar. Confirm this before you send your money.

1. Bel 700 Radio Receiver	.40
3. 3 Band Radio Receiver	.40
4. 3 Band Radio (using TBA 810 ICs)	.40
5. Coilless Radio Receiver	.80
87. TV Booster	.60
88. 4 Stage TV Booster	.80
89. UHF TV Preamp	.60
90. VHF TV Preamp	1.00
91. UHF to VHF TV Converter	1.00
103. 40W Inverter	1.00
104. 100W Inverter	1.50
105. 150W Inverter	1.50
106. Two Station Intercom	.50
107. Automatic Voltage Stabiliser	.60
116. Ni Cad Battery Charger	1.00
123. IC Transmitter	1.00
131. Fault finding probe for microprocessors	.80
134. 3½ digit DVM	2.50
135. Digital LCD Multimeter	4.00
136. Capacitance Meter	1.00
137. Analogue to Digital Converter	1.50
138. Crystal Filter	1.00
139. Scope Calibrator	.50
147. Digital Frequency Meter	4.00
150. Battery Eliminator	.30
151. IC Power Supply	.80
152. 1.5 to 15V Regulated Power Supply	.80
153. 60V/3A Regulated Power Supply	1.00
154. Bench Power Supply 24V/2A	.80
155. Dual Power Supply for Op Amps	1.00
156. Variable Regulated Power Supply	.80
157. Symmetrical Power Supply	.80
159. PCB and Wiring Tester	.50
174. Signal Injector	.50
175. 180W AC/DC Converter	1.00



The Delhi Radio Club in conjunction with the Amateur Radio Association are manufacturing PCBs for a number of homebrew projects including a low power multi band transceiver and various pieces of test equipment.

BOX 2

Some of the kits available from C and A Electrics in Athens. Prices are quoted in British pounds.

No 611	6 channel AM CB receiver. 3 μ V input sensitivity.	£12.07.
No 622	6 channel 4 W B transmitter. Both 611 and 622 operate on 11-14 Vdc and can be combined to create a transceiver for 11M or converted for the 10M amateur band.	£15.78.
No 614	6 channel NBFM VHF receiver. .5 μ V input sensitivity using dual gate MOSFET 3SK88, dual conversion.	£33.17.
No 619A	6 channel 3W NBFM VHF Exciter. Both 614 and 619 operate on 11-14 Vdc and can be combined to create a VHF transceiver.	£23.43.
No 625	115-165 MHz Narrow Band FM VFO Receiver. 1 μ V input sensitivity, dual conversion.	£ P.O.A.
No 626	1 channel 250/750 mW VHF Handtalkie. .25 μ V input sensitivity (20 dB), dual conversion, 400 mW audio output, operation voltage 9 V dc.	£30.
No 630	140-170 MHz RF Amp. 20 W out for 1.5-3 W in, fully protected for antenna mismatching.	£20.



India is highly developed for the kit enthusiast with several companies in the sub continent manufacturing PCBs and supplying components for a wide variety of amateur radio, audio and test equipment projects.

projects still available like 60 W Hi-fi stereo amps, 30 W car stereo boosters, 'bird song' electronic door bells and multi-channel remote control devices. The company also has a wide range of test equipment kits such as a digital frequency counter (0-200 MHz), a digital voltmeter (0-200 Vdc) and a crystal controlled frequency standard.

The greatest interest for amateurs may well be the rapidly expanding range of HF and VHF kits. (See box 2.)

All components are supplied and instructions are in English. C&A welcomes orders from overseas amateurs and will dispatch orders by registered air post for an additional 15 per cent of the total order. They can also supply crystals for the 144-148 MHz amateur band at a cost of about \$A4.

Apart from the above the Athens-based company sells several assembled kits: CA 6149A/3 3 W mobile VHF transceivers, CA 6149A/20 20 W mobile VHF transceivers and CA 6149A/B20 20 W base VHF transceivers. Price is on application.

A number of new kits/assembled kits released this year including a microprocessor controlled general coverage (500 KHz — 30 MHz) shortwave receiver, a 12 V 10 W 80/40/20 M AM/SSB/CW transceiver, an SSTV decoder usable with any amateur receiver, a 6-8 MHz synthesiser useful for 2 M equipment, a 70 cm transverter and a 70 cm fast scan ATV transmitter.

An illustrated catalogue detailing the

full range of C&A kits is available by sending \$A2 or equivalent to cover air mail postage. A short form catalogue and price list accompanies the paper back book size illustrated catalogue.

West Germany

Ironically, the federal amateur radio organisation, Deutscher Amateur Radio (DARC), Postfach 1155, Lindenallee 6, D-3507, Baunatal, in one of the western world's most technologically developed countries is having kit problems. For a number of years the DARC has helped individuals enter the world of amateur radio with its HF transceiver kits. But suppliers are no longer able to provide critical components. It appears that when the few remaining transceiver kits are sold nothing will be available from society headquarters.

Wilfried Spreen, DF6ZE, noted, however, that "cq-DL" often carries construction articles for HF and VHF transmitters, receivers and transceivers. In his response to my request for product information he enclosed photocopied details (in German) and PCB layout for the JF-Serie receiver and JR transceiver, recent "cq-DL" projects.

Unfortunately, the manager of Josef Frank Elektronik, Wasserburger Landstrasse 120, D-8000 Munchen, West Germany did not send details of the company's HF transceiver which would be of interest to all amateurs. Likewise, Nuova Electronica in Bologna, Italy and the

Dutch-based Velleman did not send information on their VHF transceiver kits.

As with the latter, no details about the kit scene in the United Kingdom came from any British companies. All the following information was graciously sent courtesy of George Dobbs, G3RJV, the editor of SPRAT, the journal of the G-QRP Club. This publication (available by contacting George at St Aidan's Vicarage, 498 Manchester Road, Rochdale, Lancs, 01L 11 3HE, telephone 0706 31812) contains a wealth of construction information plus advertisements from companies selling QRP kits and components. The extract of kits were taken from the Spring 1988 issue of SPRAT.

Britain

A total of 19 different kits is available from CM Howes (see box 3). The address is Eydon, Daventry, Northants, NN116PT. Telephone 0327 60178.

The two newest kits from CM Howes

BOX 3

Kits available from C. M. Haines in the UK. All prices are in British pounds.

DcRx20	20 M SSB/CW receiver	£15.30
DcRx40	40 M SSB CW Receiver	£15.30
DcRx80	80 M SSB/CW Receiver	£15.30
DcRx160	160 M SSB/CW Receiver	£15.30
CTX40	40 M CW transmitter	£13.40
CTX80	80 M CW transmitter	£13.40
MTX20	20 M 10 W transmitter	£21.90
CVF20/40/80	VFOs for the above transmitters	£9.90
NC220	2 M to HF transverters 10W output	£52.50
TRF3	Shortwave broadcast receiver	£14.50
CTU30	HF band ATU for receiving on 30 M	£24.90
SWB30	SWR/relative power indicator for 160 to 2 M	£11.90
AP3	Automatic speech Processor	£15.90
ST2	Sine wave/sidetone/practice oscillator	£8.60
XM1	Crystal calibrator with 8 marker intervals	£16.80



Athens-based C & A Electronics are well known in Europe for their quality amateur kits including this very popular 2 M FM hand held transceiver . . .

are 2 M and 6 M converter kits each priced at £17.50. Output is on 20 M. While the CV 220 and CV 620 are designed as companions to the DcRx20 receiver these two converters can be used with any 20 M receiver.

A copy of the Howes catalogue and overseas mail order information is available by contacting the technical manager. Please enclose SASE suitable for Australia.

John Beech, 124 Belgrave Road, Wyken, Coventry CV2 5BH. Phone 0203 617 367, has an audio filtering, sidetone and key click filter. UK price is £55 for the tri-band unit and £40 for a mono bander. Overseas amateurs need to write for a price quote which includes air postage.

The leading, but not only, kit made by Lake Electronics, 7 Middleton Close, Nut-hall, Nottingham NG16 1BX. Phone (0602 382 509 is the 1.5 W DTR3 CW transceiver for 80 M. Featuring direct conversion, sensitivity better than 1 uV and 250 Hz @ 6 dB selectivity, the DTR3 costs £74.25 plus postage. This kit has ready printed front and back panels, a slow motion drive, audio filter and all

parts. Contact Alan G4DVW for export information and details of other Lake Electronics kits.

A number of QRP projects are also available from Harlech Electronics, Noddfa, Lower Road, Harlech, Gwynedd LL46 2UB including a shortwave receiver, DcRx80 or 160 M receiver, CW transceiver, active antenna, preselector, audible signal strength meter, and a power supply suitable powering projects.

Export prices including airmail postage are available from the company.

Kanga Products of 3 Lines Road, Folkestone, Kent CT19 4AU, (the company's logo is a kangaroo with a VHF transceiver!) offers a range of semi-complete kits for the radio amateur and shortwave listener. Kits are supplied complete with the hard-to-get parts leaving out components which are commonly found in any junk box. Dual Band receiver kit £35.95. Single band receiver kit £19.95. VFO £9.95. Oner VFO £6.00. Sidetone £5.95. Digital Dial frequency counter (to 45 MHz) £19.95. Marker Unit £9.95.

A free copy of the 1988 catalogue is available to those sending an SASE. ●

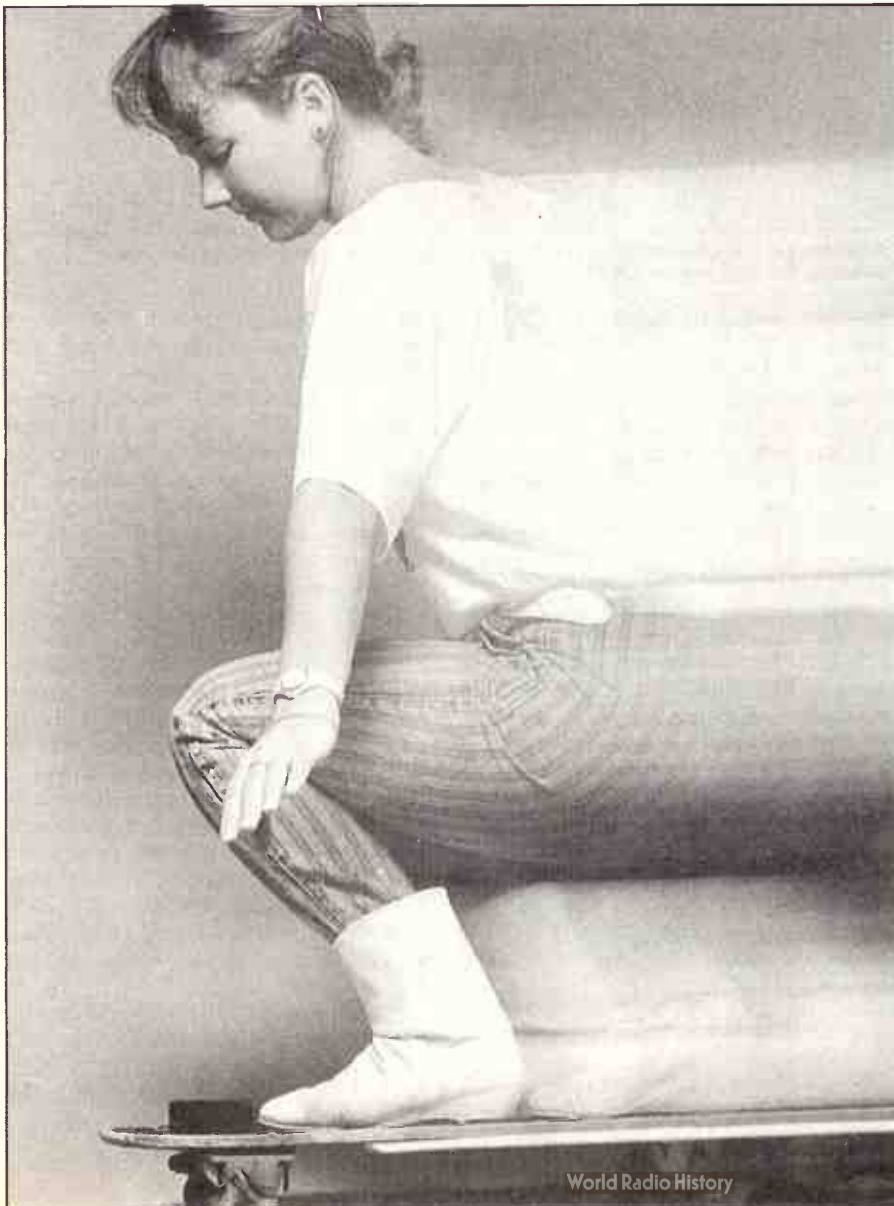
ETI-1534

Speedometer Module

Part 2

Continuing last month's article, we look at construction of the unit, and possible applications for the ETI 1534. This month we concentrate on two: speed measurement on land and in the water.

James Twomey



Construction

The project is built on a single sided printed circuit board. The board is reasonably compact because it is effectively made up of 3 layers. The pc board forms the bottom layer and carries IC5 plus some associated components. The Lascr module is mounted above this. It is effectively made up of two layers: the counter layer, which contains the LCD driver ic, voltage regulator and some associated components, while the LCD display itself forms the top layer. Some readers may be tempted to dispense with the module and build their own by duplicating its functions. This would be much cheaper than buying the module, but a bit more time consuming. If you elect to go this way, it's probably a good idea to stick to the idea of a multilayer construction. It makes things very compact.

Before you begin work, it is a good idea to consider the mechanical problems of your application very carefully indeed, since how you use it will influence the way you want to build it. We had two applications in mind, and the small box you see in the pictures seemed most appropriate for both of them. However, there are a hundred and one different applications where something else would be more suitable.

No matter how you use it, the electronics are going to be pretty much the same. As usual with any project, check the board for track breaks and shorts. If it is an undrilled board, drill out all the pads and trim any excess off the board so that it fits into the plastic box. Cut the 28 pin socket in two to make two 10 pin single in



The skateboard wheel, showing the magnet located in the rubber at top and the Hall Effect Switch mounted on the chip carrier at bottom.

line (SIL) sockets. Each of these is mounted on the board to hold the Lascar Modules.

Next put on the two wire links. Mount all the resistors. Set the large variable resistor RV1 to approximately 22 k and solder it onto the board. Add the remaining capacitors and ICs. Now solder on the flying leads from the hall effect switch to the board and solder in the 9V battery clip.

Testing

Once the unit has been tested and operates correctly, the mechanical construction can commence. The orientation of the magnet with respect to the hall device is important. To get the best results, the magnet needs to be at right angles to the hall effect switch, and they need to be brought to within a millimeter or so of each other. This means that in any practical application, the switch must be held rigidly in position with respect to the shaft, and the magnet must rotate in a precisely defined circle. Its no good hanging it all together with a bit of chewing gum if the first time it gets bumped, or you lean on it, everything goes out of alignment.

The hall effect switch has three legs, which naturally suggests it should be mounted on a piece of circuit board, the board itself then being bolted rigidly to some other assembly which also carries the axle about which the magnet rotates. Of course this is easy to say; achieving it in practice turns out to be rather difficult, especially when one is restricted to the type of tools typically found on an electronics work bench.

Skateboard

Our first application is to provide a speed indication on a skateboard. We felt it was a sufficiently bizarre application which, if successful, would demonstrate the practicality of the project in more mundane applications. The speed is measured from one of the front wheels of the skateboard. The display is mounted on the deck directly above the front wheels. Experts

have advised us that this is the best compromise position. Most manoeuvres on a skateboard do not use the fore-deck, with the exception of "riding the bowl".

The case we used was just large enough to house the circuit without the battery. The battery is clipped onto the underside of the skateboard. It was necessary to remove some of the mounting holes in the case to get those vital extra few millimetres of space.

To start, remove the front wheels (called trucks by the cogniscenti) from the skateboard, and place the project box on the fore deck of the board. Mark off and drill two holes of the same diameter as the truck bolts on the bottom of the project box. Drill a 4 mm diameter hole in the side of the box. This is to allow a screw driver to adjust RV1 without disassembling the whole project. Place the truck bolts through the project box and skateboard deck and secure the trucks exactly as they were originally except that now the truck bolts also hold the project box. One final hole needs to be drilled through both the box and skateboard deck to pass the power lines and hall effect switch lines from the underneath to the upper side of the skateboard. The position of this hole is not critical, although it is important to position it so that the wire can be run from the sensor to the hole tight against the bodywork. If it is loose it will eventually snag on something. Put some plastic insulation tape along the bottom of the project box covering the truck bolts so that they don't short on anything.

Now remove the front left wheel. Select a drill bit with a diameter just smaller than the diameter of the bar magnet. Use this to make a hole 10mm deep on the inside face of the wheel. The hole must be close to the outside circumference of the wheel. Push the magnet into this hole so

that it is flush with the inside of the wheel.

The hall effect device is mounted on the truck so that the magnet passes close to it when the wheel rotates. Remove any cables on the hall effect IC, take a plastic 8 pin IC carrier (any piece of plastic or perspex the right size would do) and drill 3 holes on one face. Place the legs of the hall device through these holes and secure it against the outside face of the carrier. While the unit is still loose, solder the wires to the legs of the hall effect switch. Using Araldyte or other metal and plastic adhesive, glue the chip carrier to the upper left side of the front truck. Before the glue dries replace the wheel to be sure that the hall device and the magnet do line up. They should not touch, but they should come very close.

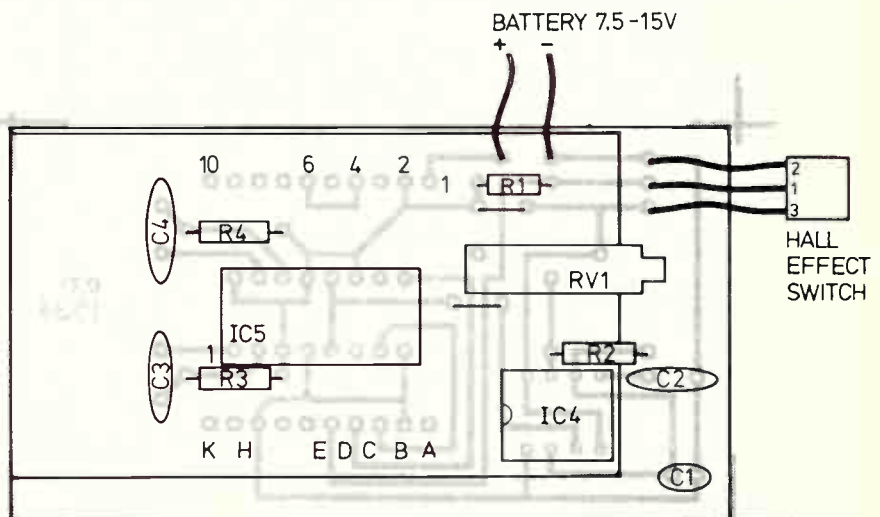
Now disconnect the battery cable from the board. Thread it through the hole in the skateboard, tie a knot in the end to provide strain relief and reconnect it. Thread the remaining cables from the hall effect switch through the holes to the top of the board and solder these onto the pc board.

Finally, place the complete module into the project box and secure the cover. The battery is clipped onto one of the truck bolts using a plastic cable clip and a nut. Mechanically, this construction should be quite sound.

Calibration

Calibration is an interesting problem in almost any application. It may be done on a trial and error basis if you have something to measure speed with, for instance, following a car. More often however, its going to be done by measuring time and distance, and the more carefully you can do this, the better the accuracy of the final unit.

The physical adjustment on the unit is



Overlay diagram. Pin numbers 1-10; A-K are as per the Lascar module.

simplicity itself, just adjust RV1 with a screwdriver inserted in the hole on the side of the box. Specific values are not given for RV1 because each skateboard will have a different wheel circumference depending on age and model.

The circumference of a skateboard wheel is measured by making a mark on the wheel and pushing it for one revolution. The distance travelled is the circumference. The prototype had a circumference of 140 mm. Knowing this, the calculation proceeds as follows: A speed of 10 kmh corresponds to 2777 mm/sec. This is 19.8 revolutions per second, or 10 revs in 504 msec. So RV1 needs to be adjusted such that pin 3 of the 555 stays at a logic high for just over 1/2 second, or alternatively operates at 1.98 Hz.

Note that it is only necessary to do this calculation at one speed. Provided the wheel revolutions are a linear function of speed, a correct calibration at any speed ensures its accuracy at all speeds. It is worth mentioning this because this linearity is not always guaranteed. In our next application, for instance, there could be problems.

Boat Speedo

The most obvious way of measuring water

speed is to measure propeller speed. However, mounting a prop on a boat is not a simple operation. There are two solutions in current vogue. One is to mount the sensor on a rigid shaft cantilevered out from the underside of the boat. This is the neatest way, but it may be impractical on small boats, racing skiffs or surf skis. If the first thing to hit the beach is your prop, its unlikely to last long.

A second alternative, favoured on ocean going ships, is actually to tow the prop on a line behind the ship, well clear of its turbulence effects. This gives the most accurate results, but its operation will be a bit of a problem, since the unit (correctly called a 'drogue') needs to be wound in and out for use.

If you choose the first of these options, then obviously the mechanical arrangement will depend entirely on the position of the sensor, the type of boat and so on. Thus it will need to be customised for every individual application. If you intend building it as a drogue, then the following will give you some ideas on how to approach it.

We developed a unit that would work on a small sailing dingy of the Laser class. A Laser is maybe three metres long, with

a single sail, and a reputation for being both fast and manoeuvrable. We trialed the various prototypes on board a larger sailing boat, a Hood 23, equipped with an outboard motor, which gave us access to both constant speed and an area in which we could work.

The problem was to find a design that could be implemented with the type of materials typically found on an electronics workbench, constrained even further by the mechanical skills of the typical electrical engineer. We went out and bought a small brass propeller from a local hobby shop. It came with a shaft and a sleeve in which the shaft could rotate, also made of brass. The shaft was held in the sleeve with a collar that screwed onto the shaft.

Our first option, following good design practise, was to go for the simplest construction possible. We fixed the sleeve to a bit of circuit board, stuck a magnet to the collar and mounted the hall effect switch on the edge of the board so that the magnet fired it on every rotation. It worked fine from an electrical point of view. The problem was that as soon as boat speed went over two knots the entire assembly skated across the top of the water.

Snap-in circuit protection...



W28 series thermal circuit breakers from Potter & Brumfield snap into standard 5/8" panel cutouts. They occupy about the same amount of space as a fuse holder, but unlike fuses, W28s can be reset by merely pushing a button. Available in ratings from 0.25 through to 15amps, these breakers are offered in a variety of bezel and button colours.

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READER INFO No. 20

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AM/DL01

READER INFO No. 21



Then, getting extremely clever, we applied our somewhat shaky aeronautical knowledge to the problem, and came up with a number of designs of greater and greater sophistication, all involving a number of 'wings' made from strips of printed circuit board soldered together. We tried star shapes, triangles, squares, all to no

avail. Without exception they all proved to be failures. Some depended too strongly on the angle at which the pieces of board met the water flow, and twisted around in the water. Other proved to be unstable and at the first opportunity flipped over on their backs, leaving the prop high and dry.

In the end, we fixed on the design in the diagram. The pc board area is designed to give minimum resistance to the water flow, and minimum lift, so that the prop will stay under water at all times. The prop itself hangs below the pc board, attached to another bit of board so that it is permanently buried in the water, even if the top board comes to the surface.

This design proved quite adequate with a reasonably heavy brass prop hanging underneath it, and at the type of speed a typical sail boat will achieve, say less than ten knots, it stays submerged. It is small and reasonably robust, especially if you don't skimp on the solder that joins the boards together.

The prop shaft is about 150 mm when you buy it. This needs to be cut down to about 30 mm in length, and fixed to a bit of pc board. In our experience, the best way to do this is to drill holes in the board

in the appropriate places, and then thread some wire over the sleeve and through the holes. Pull the wire up really tight, and then apply solder liberally. Firstly solder the wires onto the solder side of the board, so they hold the sleeve in position, then apply solder where the wires cross over the sleeve. This should hold the sleeve in place really rigidly. When you are satisfied that this is the case, cover it with gunge of some kind just as an added strengthener and to protect it from corrosion. One of the drainpipe sealers found in handyman racks at the local hardware store will do the job perfectly.

The next step is to mount the hall effect switch. Score through the copper on the board so as to create three lands you can solder onto, drill three holes and insert the switch. It should wind up as close to the edge of the board as possible. Next the magnet. It is advisable to make sure you have the polarity of the magnet correct before you mount anything. Do this by connecting the switch up to the unit, and waving the magnet in front of the switch. The display will jump to number 1, at least. Remember that the switch will not respond to an incorrectly polarised magnetic field, so it is advisable to get this

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right before going any further.

Once you are satisfied that you have got the polarity right, the next step is to mount it on the collar. We bound the magnet to the collar with a bit of wire, extensively soldered so that the whole edifice was quite firm, then covered it with epoxy resin to keep the water out. Make

sure that the whole thing is aligned in such a way that everything spins freely.

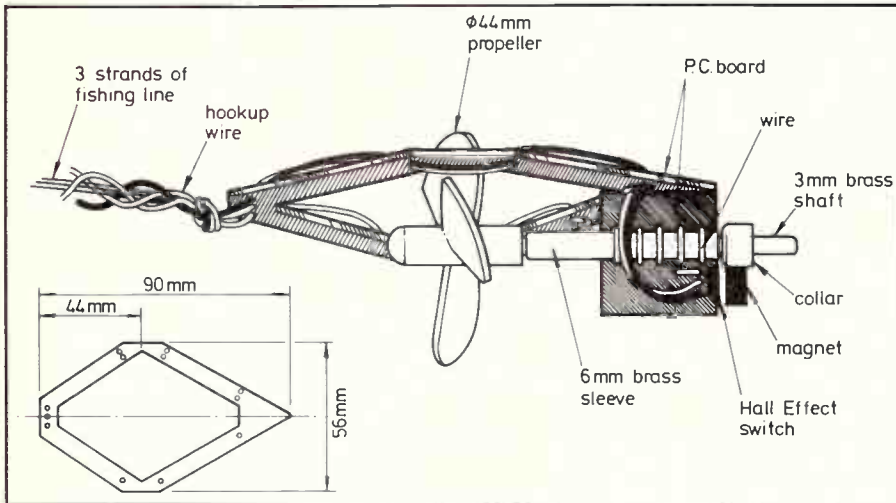
Finally, do the wiring. Solder the three cables to the lands at the switch, and then take the cables through the holes in both pc boards, so that the stress of the cables is spread all over the drogue. Tie thumb knots at every hole so that it can't slip

through in the event that something fails. Then plait up the wire so that its all in one unit, and put a few strands of heavy fishing line up the middle, through the plaits, so as to provide additional security.

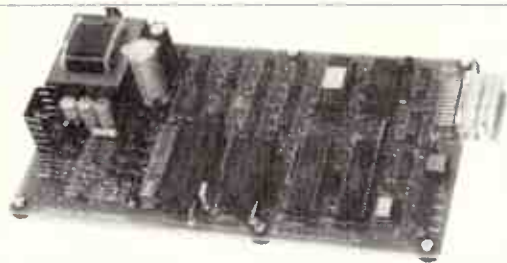
Good nautical sense says the cable should be as short as possible. However, you want it long enough so that the cable has a chance to lay flat in the water before it hits the drogue, and also so that it is outside the immediate turbulence effects of the hull. On the Hood, which is a smallish cabin yacht, three metres of plated cable proved adequate. On the laser, perhaps 500 mm, stapled to the bottom of the rudder, is all that is required.

Problems

While this is the standard method used in commercial units, it is worth while mentioning that there are problems using a simple measuring circuit as we are doing for measuring speed in a fluid (like air or water). The first problem is that there is unlikely to be a linear relationship between the boat speed and the speed of rotation of the prop. Even if the prop itself is well designed, there are still all sorts of problems to do with friction which may mean that at high and low speeds the unit will underread.



The drogue is towed behind a moving boat. The dimensions are taken from the prototype, but are not critical.



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Another problem is that of boundary effects. One can think of this as the ability of the boat moving through the water to drag some of the water with it, so that the water near the hull is actually moving with the boat. Clearly, if your sensor reads this water speed it will significantly underread. Unfortunately, you can't make a simple allowance for this effect, because the boundary effect is most definitely not linear, increasing rapidly with speed. Another part of the same problem is that the boat's passage through the water will cause turbulence, and this turbulent water

will cause all sorts of spurious readings in the prop.

Calibration

The extent to which this is a problem can be determined during calibration of the unit. In a boat there is really only one way to do it, and that is to sail over an accurately determined distance at a constant speed, and consequently work out speed as a function of distance over time. The first requirement is to get a chart, and accurately determine the distance between two points that you can get close to in the boat. Marker buoys are ideal. Secondly, you need a motor, as sail or oar power is likely to be too variable.

As with the land based version, calibration at one speed should give accurate results at all speeds. However, because of the factors mentioned above, it's advisable to check for nonlinearity at speeds above and below the calibration speed. If you find noticeable errors, then you will have to note them, and learn to live with them. Without redesigning the circuit using all sorts of weird and wonderful techniques, there is nothing that can be done about it.

In any event, it is best to calibrate at the most common speed of the boat. Because of the way resistance and energy interact in a boat, it will tend to spend most of the time travelling quite close to one specific speed. Experience shows that the Hood usually does about four knots, over a wide variety of wind speeds. The wind needs to really blow before it goes much faster, and drop away to a light breeze before it goes much slower. I calibrated at that speed, and then went back over my measurement course at two knots (indicated) and eight knots (indicated) and in

each case, the results were correct to within a few percent. This seems to indicate that while these non-linearities are present, they are probably not significant over such a confined speed range. ●

ETI-1534 Parts List

Resistors

RU1.....	500k multitem pot
RU2.....	68k
R1.....	1k
R3.....	5k6
R4.....	5k6

Capacitors

C1.....	33 u 16v electrolytic
C2.....	0.01 uF
C3.....	.82 nF
C4.....	.82 nF

Semiconductors

IC1.....	Lasca counter module
IC3.....	Hall effect switch
IC4.....	LM555
IC5.....	4528 dual monostable

Miscellaneous

Plastic case, Perspex cover, Bar magnet (supplied with IC3), 9V Battery connector and clip, 28 pin DII socket.

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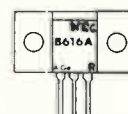
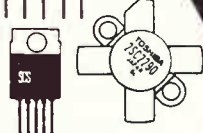
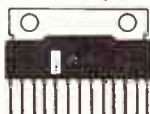
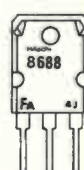
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ETI August 1988 — 99

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6. The competition commences on July 20, 1988, and closes with last mail on October 31st. The draw will take place in Sydney on November 2 and the winner will be notified by telephone and letter. The winner will also be announced in The Australian and a later issue of this magazine.
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Pregnant Apple

Mike Carlton, top rating Sydney breakfast show host, had complained to his listeners that his Apple had refused to release a disk. Carlton had taken his PC for repair 3 times but the repairers had been unable to remove the disk. He sought the advice of his listeners. One caller suggested that the problem arose because Carlton used floppy disks, but then had used a hard disk which made the Apple pregnant.

Stand Up And Be . . . Measured!

According to a recent edition of the US based science magazine, *Omni*, Darell A. Frohrib of the Mechanical Engineering Department at the University of Minnesota in the American mid-west has discovered what he calls 'a provocative engineering problem'. It works like this: A good deal of sexual trauma is caused by the failure of men to get an erection at the appropriate moment. Science would love to help of course, but the problem has been to obtain objective measurement of the problem. Currently, information is almost always qualitative, not quantitative.

The methods used so far have quantified only girth, but Frohrib claims circumference itself is not the best indicator of erection: Rigidity is.

This is where "nonlinear tissue constitutive" laws come into play. In other words, a tumescent member may look erect but not be rigid. According to Frohrib, it's only in the last, almost-undetectable millimeter or two of lengthening that internal penile pressure rises enough to cause stiffness.

To demonstrate this, Frohrib and his colleagues first brought a subject's penis to erection by infusion of drugs and saline solution. Then they carefully rammed a "buckling force gauge" against it and measured "Axial rigidity" by recording the amount of force required to make the penis buckle.

Next, a microprocessor-controlled machine called the Rigiscan measured circumferential pressure — the internal pressure that keeps the penis "inflated," somewhat like air inside a balloon. The machine consists in part of two loops that are slipped around the penile shaft. When the loops detect a one-centimeter increase in girth, they apply ten ounces of squeezing force every ten seconds. The degree to which the loops are able to indent the shaft provides a reliable measure of circumferential rigidity. In this case an IBM PC provided graphic representation of the data.

Frohrib and his group "want to know more about the tissue laws" that underline

erection and "the physical constants of the actual member" in the hope that this knowledge will eventually contribute to the treatment of impotence.

Handy Hints

On a slightly less tacky note, another group of researchers has been tackling a more monumental problem. A paper in the British journal *Nature* (333, p213) suggests that right handers live longer than left handers. A note from Diane Halpern at California State University and Stan Coren of the University of British Columbia records that they analysed all baseball players listed in *The Baseball Encyclopedia* for whom dates of birth and death, as well as throwing and batting hand, are reported. A subject was assigned to a handedness group only when both throwing and batting hand were the same with no indicated change in hand use.

Mean age at death for the 1,472 right-handers was 64.64 years and 236 left-handers was 63.97 years. This difference is difficult so interpret as the range is so large and the distribution is skewed. However, a nonparametric test of group differences indicated that the greater longevity for right-handers is significant. To clarify the pattern of results, they also examined data for the cumulative proportion of individuals surviving at each age, and found that the groups are virtually identical in mortality until the age of 33. From that age onwards about 2 per cent more right-handers than left-handers survive at each age.

Although these data suggest that left-handedness is associated with reduced longevity, they do not provide any direct causal information.

Three factors seem possible. First if prenatal and perinatal birth stressors are more probable in left-handers it may reduce their ability to survive. Second, genetic effects and intrauterine hormones may have reduced the effectiveness of the immune system of left handers, increasing the likelihood of an earlier death. Finally, left-handers may have more accidents in an environment designed for a right-handed majority. This latter is likely to be the cause most favoured by left handed people themselves.

German hacker beats Berkely pros

An account in the May issue of the *Communications of the Association for Computer Machinery*, documents how a US Astronomer working at the Lawrence Berkely Laboratory tracked down a West German hacker who had penetrated into 450 sensitive computer instalations.

The hacker, whose name has not been published, walked free from court because he was not caught in the act. A West German court ruled that the telephone trace was not, of itself, sufficient evidence on which to base a conviction against an individual.

However, the case has worrying implications for computer security, Berkely astronomer Clifford Stoll first detected the intruder in August 1986 when a discrepancy arose in the LBL computer's internal accounting records. Soon afterwards, the National Computer Security Centre at Fort Mead, Maryland, notified LBL that someone using an LBL account had tried to access its computer, and it turned out to be the same person.

LBL is thought to have been the target because of its proximity, in name and location, to Lawrence Livermore Laboratories, where classified defence projects are carried out. LBL does no military research. Stoll, at first believing the intruder to be a Berkeley student, spent ten months tracing the hacker to Hannover, West Germany, in June last year.

The hacker had tried to gain access to about 450 computer systems in the United States, Japan and West Germany, most of them used for military work. Operating systems breached included Unix, VMS and VM-TSO. In total, the intruder breached more than 30 of the systems, but Stoll says that LBL researchers monitored "every keystroke", notifying the violated systems of the intrusions.

The eventual give-away was the communications delay. Working with US and West German authorities, Stoll laid a trap using made-up data about the US Strategic Defense Initiative (SDI). The intruder took the bait in June 1987, staying connected with the LBL computer for over an hour — long enough for the West German authorities to trace and arrest him.

When the case reached court, however, prosecutors faced a serious obstacle. Bremen public prosecutor Hans-Georg von Bock and Polach said that officials' hands were tied because merely entering a computer system is not illegal in West Germany. Authorities could have gained access to data coming over the telephone with a wiretap, but such a procedure would only have been approved if national security — of either West Germany or the United States — had been thought to be at risk.

Stoll says that the implications of the case for open international computer networks are dire, remarking that funding agencies have already eliminated some international links because of break-ins. ●

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018	6.00	247	4.86	445	7.05	562	4.20	670	15.60	1527	18.75	84 PA 11	9.45
019	6.00	249	5.10	446	8.82	563	7.10	671	4.14	1528	30.93	84 MS 10	6.60
021	5.95	250	5.75	447	6.60	564	14.80	672	4.50	1530	4.50	84 FI 10	5.00
022	6.40	251	6.50	448	10.20	566 A	6.50	674	8.20	1531	8.25	84 AU 9	7.40
023	5.60	252	4.10	448 A	4.20	566 B	8.40	675	10.65	1532	7.60	84 SP 4	10.95
026	5.60	254	4.20	449	6.75	567	8.10	676	9.90	1601	5.43	85 TF 10	14.85
029	3.80	255	3.00	450 A	8.05	568	7.92	678	5.70	1602	8.45	85 IT 5	8.15
034	7.40	256	8.10	450 B	7.10	569	7.10	683 A	7.20	1603	21.66	85 PC 1	7.20
037	3.60	257	9.39	451	6.00	570 A	4.05	683 B	4.50	SET		85 TV 4	16.65
043	3.60	259 A	8.60	452	12.60	570 B	6.40	688 A	8.20	1424	18.75	85 IR 2	6.00
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065	5.05	278	8.20	462	14.40	582 B	8.35	707 B	7.60	105	6.00	85 EF 11	11.34
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081	4.05	282	6.36	467	18.30	585 T	6.30	711 A	12.30	111	4.50	85 S 19	7.20
083	5.05	284	4.05	469 A	10.70	586	7.00	711 B	5.60	112	4.50	86 EF 11	4.80
084	5.38	289 A	3.35	470	10.30	587	7.10	711 C	5.10	113	5.50	86 AL 9	6.90
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113	8.20	305	6.15	472	8.20	588	38.30	711 R	6.75	115	5.00	86 AO 11	28.14
114	6.40	312	8.20	473	6.95	588 C	10.80	712	5.20	117	6.10	86 AU 7	6.76
116	7.10	313	4.90	474	3.73	590 A	8.40	713	8.75	120	3.00	86 HR 5	11.07
120	3.75	314	4.65	475	8.85	590 B	8.40	717	8.75	121	6.10	86 DB 8	8.40
121	3.75	316	5.37	476	14.70	591 A	8.25	717	7.20	123	8.10	86 PI 8	15.20
122	11.60	317	7.10	477	15.15	591 B	5.88	718	7.60	126	4.50	86 TS 6	12.40
123 A	5.20	318	6.75	478 MC	7.70	591 C	5.85	724	4.83	129	4.50	86 PC 5	4.95
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130	3.25	322	6.35	478 MM	13.68	599 A	4.50	731	10.20	82 AO 3B	6.42	87 TV 10	18.72
131	7.20	323	5.20	478 MB	38.70	599 B	5.10	733	9.00	82 PT 4	9.20	87 MS 10	5.40
132	6.70	324	10.62	479	8.25	599 C	6.80	735	9.50	82 EG 2	4.50	87 PS 9	8.40
133		325	4.50	480	11.40	599 D	5.90	736 A C & B	6.90	82 LF 2	7.50	87 SC 8	5.91
134	5.10	326	6.45	480 PS	10.20	601 D	4.50	740B	4.56	82 EP 1	27.00	87 BC 2	17.40
135	6.15	327	6.25	481 M	6.90	601 F	5.60	747		82 VC 3	6.96	87 TV 3	7.20
136	3.85	328	3.75	481 PS	10.74	602	28.60	755 A	17.10	82 AL 11	7.10	87 OV 4	6.24
137 A	8.40	329	4.05	482 B	8.10	603	7.10	755 B	6.15	82 PC 11	7.60	87 OM 5	17.70
137 B	6.15	330	6.20	482 R	8.20	604	5.85	755 C	5.70	82 EF 9	9.80	87 C 18	19.84
138	10.25	332	8.70	483	8.10	605	17.40	760	4.60	82 FC 8B	4.50	87 DS 8	27.15
140 A	32.70	333	8.64	484	10.40	606	7.60	780 A	11.60	82 UR 8	9.65	88 PR 5	
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140 D	6.15	335	8.70	486	10.20	609	4.75	810	8.20	82 GA 5	4.65	AEM	Cost \$
141	8.10	336	4.70	487 A	14.60	610	9.90	812	4.85	82 DP 6	6.40	1500	6.18
142 A	22.00	337	7.95	487 B	12.60	611	13.44	813	7.20	82 IV 6	15.75	3500	9.57
142 B	9.75	340 A	7.35	488	12.70	608	30.50	824	2.70	83 PP 5	8.40	3502	9.90
144	8.20	340 B	7.35	489 A	9.50	630	4.50	825	10.00	83 GA 6	17.30	3506	8.86
146	8.30	341	9.54	489 B	7.20	631-2	8.30	1401	9.57	83 PS 5	14.85	4501	20.30
147	6.00	342	8.25	490	9.50	632	21.60	1402	23.40	83 MS 4	6.70	4505	75.60
148	3.75	345	7.10	491	9.70	632 A	7.20	1404	24.75	83 TV 1A	8.15	4601	6.55
149	6.20		18.50	492	7.20	632 B	12.70	1404 PS	7.60	83 TV 1B	4.50	4600	27.21
150	3.40		9.20	494	8.55	632 C	15.60	1405 A	13.20	83 TV 1C	4.95	5502	8.40
151	3.25		47.45	496	17.32	632 M	11.60	1405 B	8.40	83 AL 6	4.50	5503	12.36
152	4.68	412	8.10	498	8.70	632 P	6.10	1406	8.06	83 PC 8	4.95	5504	17.40
156	3.00	413	8.20	499	15.60	632 U	8.60	1410 A	12.39	83 SC 8	7.40	5501 Set	16.75
157	7.80	414 A	8.30	514 B	6.00	633	10.80	1410 B	8.10	83 VE 10	9.00	6010 R	22.50
159	3.70	414 C	10.28	518	6.00	635	8.20	1410 C	8.40	83 MA 11	5.90	6010 F	22.50
161	8.58	414 D	3.70	520 A	8.60	636	28.90	1410 D	14.70	83 PS 12	8.85	6506	25.20
162	9.00	414 E	7.60	520 B	4.50	637	7.20	1410 E	21.93	83 TT 12	7.30	87662 X	6.15
163	18.75	416	12.20	521	10.60	638 A	8.10	1421	7.50	83 MO 9	4.50	87286 A	18.60
162 A	3.60	419	4.70	524	5.25	638 B	6.20	1500	26.92	83 TT 8	4.50	6010 MA	35.00
164	3.50	420 A	4.50	527	5.60	641 B	4.70	1501 A	5.60	83 WM 8	9.45	6010 LL	31.95
166 A	23.50	420 B	6.60	528	3.75	641 F	33.75	1501 B	5.20	83 VA 8	8.10	6005	24.85
166 B	11.10	420 D	6.80	529 A	6.36	649 A	5.20	1501 C	3.75	83 EG 5	21.60	5505	21.45
166 C	7.50	420 E	8.95	529 B	8.55	649 B	5.00	1502	7.60	84 MS 4	9.10	6102	30.00
166 D	8.64	422	10.80	532	7.60	650 A	10.70	1503	9.95	84 MC 2	8.55	6500	14.45
169	15.00	426	2.75	533 A	6.50	650 B	6.60	1506	4.50	84 TP 2	6.75	6501	25.75
170	9.25	427	8.60	533 B	4.50	650 C	5.00	1507	4.50	84 AU 1	4.65	8500	4.50
171	18.20	428	12.90	533 C	4.50	651	11.60	1510 A	5.30	84 BA 5	20.34		
173	8.95	429	6.00	534	5.60	659	7.05	1510 B	4.68	84 US 6	7.35		
174	6.90	438	6.20	539	5.70	660	39.00	1510 C					

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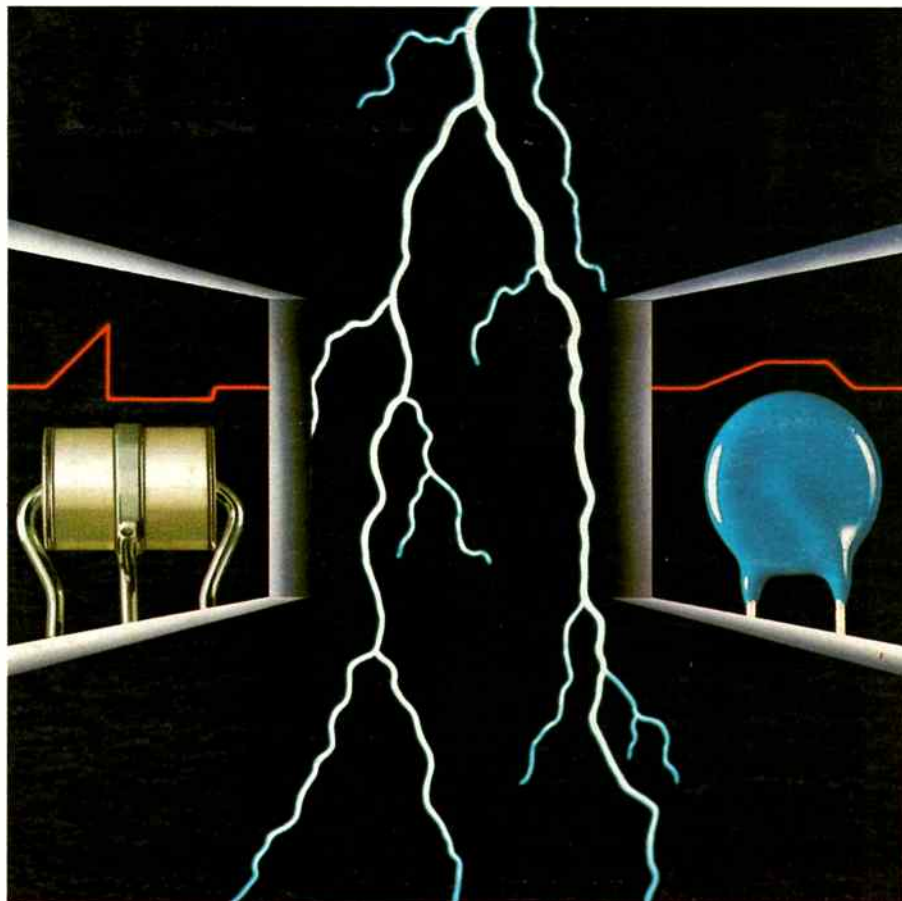
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