

JULY 1988 \$3.50 NZ \$4.50 (inc GST)

Electronics



WIN AN EQUALIZER

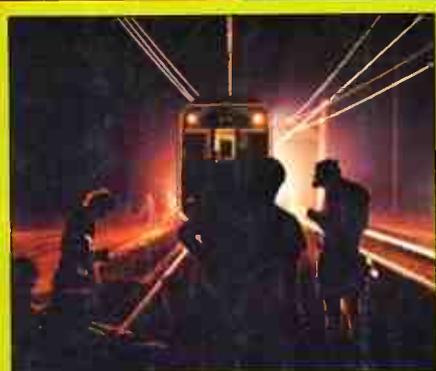
Today

INTERNATIONAL

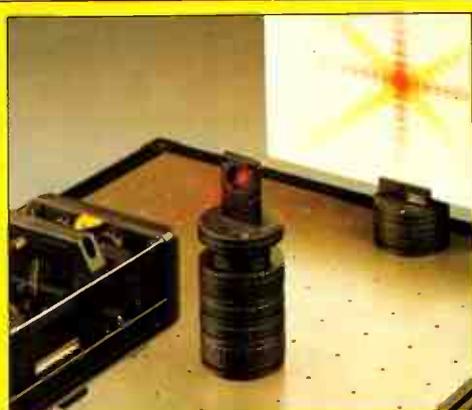
INCLUDING SOUND INSIGHTS

PROJECTS:

- PC BOARD MAKING SYSTEM
- DATA LOGGER • SPEEDO MODULE



ELECTRONICS ON THE NEW SUPER TRAIN



MAKING OPTICAL FIBRES WORK FOR YOU



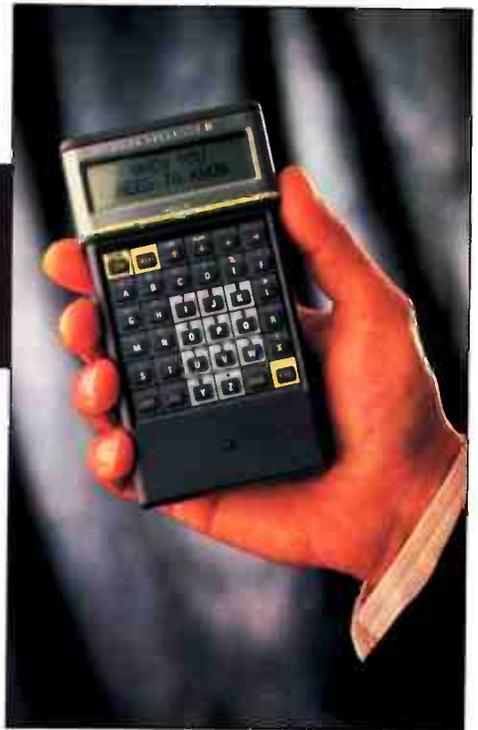
BUILD THESE QUALITY HI-FI SPEAKERS SAVE \$1000

The Power of Choice

When you need to know, keep a PSION handy - \$499

PSION, the world's smallest LOTUS 1-2-3* compatible, is a new dimension of personal computer. Packed with up to 320 K of memory the PSION easily carries an enormous capacity for information in the field. Built-in programs for extensive diary database and a sophisticated calculator are complemented by plug-in peripherals including modem interface.

*LOTUS 1-2-3 is the registered trademark of LOTUS DEVELOPMENT CORPORATION.



PC/XT - \$995 including tax (Turbo option - \$150)

256 K RAM 4.77 MHZ, 1-360 K FDD 'AT'
Keyboard with Amber or Green composite
monitor.

PC/AT - \$2995 including tax

1MB RAM 10 MHZ, 20 MB HDD Extended
Keyboard, 1-1.2 MB Floppy Disk HI RES
TTL, Green or Amber monitor.

HITACHI HL-300 - \$1695 - Exclusive to Blue Chip

HITACHI HL-300, the personal computer that's
truly portable, 512 K memory, twin built-in disk
drives, easy-to-view 11" STN (Super-Twisted
Nematic) LCD screen, detachable keyboard,
modem interface...

The go anywhere communicator from



LOTUS 1-2-3 \$595

Microsoft	
Word V.4	\$675
Mouse PS2/Serial	\$215
Windows 2 (The Clayton's OS/2)	\$155
Excel (Unleashes the power of your 286/386 computer)	\$755
Works (The total solution)	\$295
Quick Basic	\$139
Quick 'C'	\$139

Others

DBase III+ (The market leader)	\$825
Word Perfect (Need we say more?)	\$560
Ventura Publisher (The last word in PC publishing)	\$1435
First Choice (The perfect 'first' package)	\$225
Wordstar 2000+ V.2	\$249
Wordstar 2000+ V.3 (The new generation wordprocessor)	\$465
Q & A (The plain English database)	\$495

Norton

The complete range of Norton guides and utilities are available from every Blue Chip store

Monitors

OMT 5153 RGB	\$550
OMT 5154 EGA	\$750
OMT 5155 MULTISCAN	\$995

Printers

Epson LX 800 (9 pin, 80 col)	\$449
Epson FX 1000 (9 pin, 136 col)	\$1005
Brother 1109 (9 pin, 80 col)	\$425
Brother 1709 (9 pin, 136 col)	\$950
OMT VP1814 (9 pin, 80 col)	\$480
OMT VP1821 (24 pin, 136 col)	\$1185

Attache

Look no further than Attache to solve your
accounting problems. Attache from \$995.

Modems

Interlink 12/75	\$225
Interlink 12/12	\$555
NetComm 123SA	\$850
NetComm 1234SA	\$995
NetComm Pocket	-Call-



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RINGWOOD: 8 Railway Pl. (03) 870 2243. CARLTON:
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(042) 26 3200. CANBERRA: 30 Lyell St. Fyshwick (062) 80 7833.
SURRY HILLS: 90 Foveaux St. (02) 281 1044. PARRAMATTA:
463a Church St. (02) 683 1599. CROWS NEST: 272 Pacific Hwy.
(02) 436 3655. BRISBANE: 55 Little Edward St., Spring Hill.
(07) 832 0408. ADELAIDE: Cnr Wakefield & Poultney Sts.
(08) 223 1962.

Electronics Today

INTERNATIONAL

JULY
1988



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Cover: ETI-1417: Scan Audio's SA100 speakers

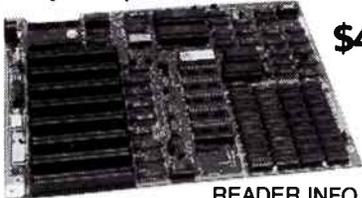
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10MHz TURBO PLUS MOTHERBOARD

This 10MHz, no-wait-state board is a drop-in replacement for the sluggish 4.7MHz PC motherboard.

- 8088-3 running at 10MHz/no wait states
- Turbo/normal selectable
- 4 channel DMA
- 8 expansion slots
- Keyboard port
- 640K RAM fitted



\$475

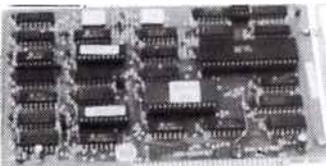
READER INFO No. 70
8MHz Turbo Motherboard still available at new low price. Was \$450.00.

NOW ONLY \$425

1.2MB/360KB FLOPPY CONTROLLER

The perfect answer for backing up hard disks, archiving etc.

- Supports both 1.2MB and 360KB drives
- Fully PC/XT, PC/AT compatible
- For suitable drive see below



\$125

READER INFO No. 71

150W SWITCHING POWER SUPPLY

Drop-in replacement for IBM PC's puny 63W supply.

- Boosts PC to PC/XT specs. Essential to run hard discs and other ad-ons on PC.
- Outputs +5V/15A, -5V/1A, +12V/5A, -12V/1A.
- All cables to disk drives, motherboard etc.

\$148



READER INFO No. 72

AUSTRALIA'S BEST SPEEDUP CARD

Speed up your PC over 7 times with our superb new speed-up card.

- 80286 CPU plus 8088 for complete software compatibility
- Clock rate 6/8MHz (selectable)
- RAM on-board for disk cache
- DMA support
- Socket for 80287 co-processor



\$545
Limited Stock

READER INFO No. 73

You'll always get a better deal at Electronic Solutions

1. Everything we sell comes with our 14 day money-back guarantee.
2. We only sell top quality products. Brands like NEC and Mitsubishi. With Electronic Solutions you know you're getting the best!
3. Massive buying power means our prices are the lowest in Australia for the same quality goods.
4. Our buying team get the latest products sooner. Whether you want an 80386 card, a turbo graphics card or the latest EGA card, we've often got it in stock when our competitors are just thinking about it.

FLOPPY DISK CONTROLLER

Controls up to 4 DS/DD 360K drives.



\$65 READER INFO No. 74

PEGA EGA card – unmatched resolution

Get all the standards with this superb short slot EGA card.

- Supports Monochrome, Hercules, CGA, EGA and Plantronics modes. Fully Auto switchable.
- Supports 132 columns in Symphony, Lotus and WordPerfect
- Automatic monitor detection
- 256K of video memory standard
- Flicker free scrolling

\$495

READER INFO No. 75

DISK DRIVES

40 Track Mitsubishi.

Very fast track-to-track. 360KB DSDD. Lowest price in Australia. **\$245**

1.2MB NEC

Super high density. Superb construction and reliability. Works with 1.2MB floppy controller. **\$275**

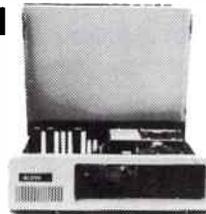
20MB NEC Hard Disk.

Very fast and super reliable. Best price in town. **\$695**
Complete with controller. **\$895**

READER INFO No. 76

XT Style Case with Hinged Lid

Perfect for building your own PC.



\$95 READER INFO No. 77

MEMORY 512K Ram Card – Short Slot

- 512K RAM installed (41256 chips)
- DIP switches to start address

\$195

READER INFO No. 78

640K Ram Card – Short Slot

- 640K memory installed
- User selectable from 64K to 640K
- DIP switches to start address

\$225

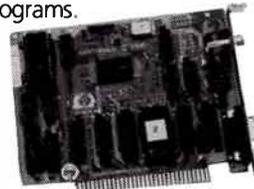
READER INFO No. 79

Colour Graphics/Mono – Short Slot

This amazing new card drives RGB colour, composite colour or a TTL monochrome monitor. And it fits in a short slot. Full CGA support. Can be used as a colour graphics card with a monochrome display and still run all the colour programs.

The card even cures the dread colour graphics "flicker and snow".

\$195



READER INFO No. 80

Colour Graphics Video Card

- Suits RGB and composite colour monitors
- Light pen interface
- Fully CGA compatible
- 40 x 25 & 80 x 25 (text), 640 x 200 (mono) and 320 x 200 (colour)

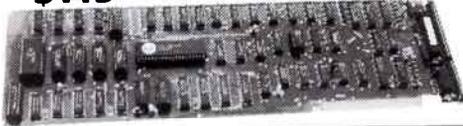
\$115

READER INFO No. 81

Colour Graphics/Printer Adaptor

Attaches to IBM-compatible RGB monitor; provides complete compatibility with IBM Colour Graphics Adaptor. Equivalent to the IBM colour/graphics adaptor with additional printer port to replace the video port originally supplied by IBM.

\$145 READER INFO No. 82



Parallel Printer Card

- Standard TTL level
- Centronics printer port, full IBM, EPSON compatible

\$44

— READER INFO No. 86

Turbo Mono Graphics/Printer – Short Slot

If you want fast, flicker free scrolling and full Hercules compatibility, this is it!

Perfect enhancement for slow scrolling programs like Microsoft Word etc.

The ultimate monochrome graphics card.

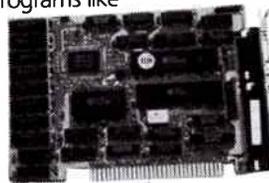
\$175

— READER INFO No. 87

Serial RS-232 Card

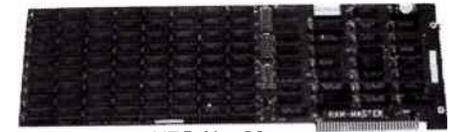
- Independent receive clock input
- 2nd serial port option
- Full buffering eliminates need for precise synchronisation

\$55



2MB EMS Memory Card for PC/XT or AT

An affordable "Above Board" memory card. Fit up to 2MB of high speed RAM (OK fitted). At a low introductory price: **\$495**

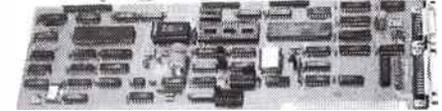


— READER INFO No. 90

Multi I/O Card

- Floppy disk adaptor, 2 drives DS/DD
- 1 serial port, 1 parallel port, 1 joystick port
- Clock/calendar with battery backup

\$175

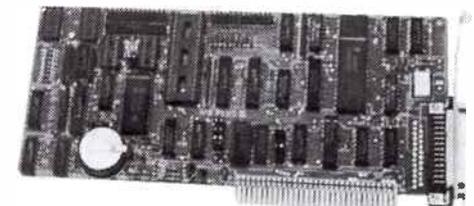


— READER INFO No. 91

I/O Plus Card

- Clock calendar with battery backup
- 1 serial port, 1 parallel port, 1 joystick port

\$136



READER INFO No. 92

NEW PC/XT PRODUCTS the power you're searching for!

2.5MB Multifunction card for PC/AT



Give your AT a big boost with this superb quality, low cost expansion card.

- One RS232C serial port
- One parallel printer port
- Memory expansion to 2.5MB (OK fitted)
- Fully PC/AT compatible

\$495.00 READER INFO No. 83

180W AT Power Supply



Suits all IBM PC/AT compatibles.

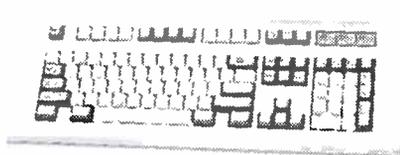
- User selectable 115/230V AC input
- Outputs: +5V/17A, -5V/0.5A, +12V/7A, -12V/0.5A
- Overload protection
- Short circuit protection

\$195.00

- Cooling fan stops when voltage output falls to zero
- Top quality components used throughout

READER INFO No. 84

Enhanced Keyboard suit both PC/AT and XT



The finest keyboard on the market.

- Suits both IBM PC/XT and AT (switchable)
- Full 101 keys with separate cursor and numeric pad
- Superb key action
- Lights for caps, num and scroll lock

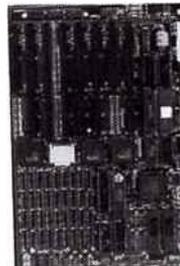
\$145 READER INFO No. 85

10MHz Baby AT Motherboard

Ultra high performance PC/AT motherboard outperforms all the others. Drop it into your existing PC/XT! Up to 1MByte of RAM on-board (640K fitted)

- 80286-8 running at 6/10MHz switchable.
- Speed test 11.7 on Norton Utilities
- 7 channel DMA for disk and special I/O
- 8 expansions slots (6 full AT standard)
- On-board battery backup, real time clock
- Phoenix ROM BIOS

\$945 READER INFO No. 88



Baby AT Case

\$135.00

READER INFO No. 89

Suits "Baby AT" motherboard or 10MHz PC/XT motherboard.

- Hinged cover for easy access
- Keyswitch, reset/turbo buttons, indicators



SUPER SPECIALS

V20 chips	.....	\$29.00
V30 chips	.....	\$49.00
NEC Multisync monitor	...	\$1150.00
TTL Amber Monitor	.....	\$275.00
TTL Green Monitor	.....	\$280.00
256K RAM chips	.....	\$7.00

ELECTRONIC SOLUTIONS

Electronic Solutions

PO Box 426 Gladsville 2111
Phone (02) 427 4422
We accept Bankcard, Mastercard and VISA. Mail orders our speciality. All prices include sales tax.

- All products carry a 14 day money back guarantee
- All products carry a full 3 months warranty
- All cards come with full documentation
- Ring for quantity discounts and tax free prices.
- Freight \$7.50 for first item, then \$2.50 for each extra item.

008 335757 TOLL FREE MAILORDER HOTLINE FOR CREDIT CARD ORDERS!!!

SERIES 5000

INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HI-FI SYSTEM!

By directly importing and a more technically orientated organisation, ROD IRVING ELECTRONICS can bring you these products at lower prices than their competitors. Enjoy the many other advantages of RIE Series 5000 kits such as "Superb Finish" front panels at no extra cost, top quality components supplied throughout. Over 1,500 sold!



POWER AMPLIFIER

WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER

● 1% Metal Film resistors
SPECIAL, ONLY \$399
SAVE \$50

Developed by ROD IRVING ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms (per channel)
POWER AMPLIFIER: 100W RMS into 8 ohms (+5V Supply)
FREQUENCY RESPONSE: 8Hz to 20kHz ±0.1 - 0.4 dB 20kHz to 65kHz, ±0.3 dB
NOTE: These figures are determined solely by passive filters
INPUT SENSITIVITY: 1 V RMS for 100W output
HUM: 100 dB below full output (flat)
NOISE: ±16 dB below full output (flat, 20kHz bandwidth)
2nd HARMONIC DISTORTION: 0.001% at 1 kHz (0.0007% on Prototypes) at 100W output using a +5V SUPPLY rated at 4A continuous - 0.0003% for all frequencies less than 10kHz and all powers below clipping
TOTAL HARMONIC DISTORTION: Determined by 2nd Harmonic Distortion (see above)
INTERMODULATION DISTORTION: 0.003% at 100W (50Hz and 7kHz mixed 4:1)
STABILITY: Unconditional

Cat. K44771 \$449
Assembled and tested \$599
 packing and post \$10



PREAMPLIFIER

THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES PREAMPLIFIER

● 1% Metal Film resistors
SPECIAL, ONLY \$359
SAVE \$40

Believe that dollar for dollar commercial unit available that sounds as

SPECIFICATIONS:
FREQUENCY RESPONSE: High-level input: 15Hz - 130kHz, ±0.1 dB
 Low-Level input: conforms to RIAA equalisation ±0.2 dB
DISTORTION: 1kHz - 0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation)
S/N NOISE: High-Level input, master full, with respect to 300mV input signal at full output (1.2V): 92dB flat - 100dB A-weighted, MM input, master full, with respect to full output (1.2V) at 5mV input 50ohms source resistance connected - 86dB flat/92dB A-weighted MC input, master full, with respect to full output (1.2V) and 200V input signal - 71dB flat - 75dB A-weighted

Cat. K44791 \$399
Assembled and tested \$699
 packing and postage \$10



THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS:
BANDS: 2R Bands
SPECIAL, ONLY \$209
SAVE \$30

Cat. K44590 1 unit: \$239
 2 units: \$429
 packing and postage \$10



DIGITAL CAPACITANCE METER Mk.2

LAB SUPPLY
 Fully variable 0-40V current limited 0-5A supply with both voltage and current metering (two ranges 0-0.5A/0-5A). This employs a conventional series-pass regulator, not a switchmode type with its attendant problems, but dissipation is reduced by unique relay switching system switching between taps on the transformer secondary (ETI May 83) ETI 163
 Cat. K41630 \$249

Updated from the EA March '80 issue, this Digital Capacitance Meter checks capacitor values from 1pF to 99.99uF over three ranges. Its main features include a nulling circuit and a bright 4 digit LED display.
 *Note: The Mk.2 kit contains quality silk screened and prepunched front panel AND an exclusive High Intensity Display! (85csm/a, EA August '85)
 Cat. K85990 \$99.95



3 1/2 DIGIT ECONOMY LCD DPM 50

● Ultra-Low Power
 ● Bandgap Reference
 An ultra-low power, extremely stable LCD DPM suitable for a wide number of different applications. Features: Auto-zero, auto-polarity, 200mV f.s.d. user adjustable Low Battery indication, 12.5mm digit height, programmable decimal point. The OP-5513 has an external bandgap reference for extra temperature stability, with connections brought out, allowing use in single ended, differential or ratiometric mode. The f.s.d. can be easily rescaled by the user to indicate volts, amps, ohms or many other engineering units. Supplied with a bezel mounting clips, connectors and full data sheet
SPECIFICATIONS:
Accuracy: 0.1% ± 1 count
Linearity: ± 1 count
Samples/sec: 3
Temp. Stability: 50 ppm typical
Temp. Range: 0 - 50°C
Supply Voltage: 5 - 15V DC
Supply Current: 200uA typical
Max. DC Input Voltage: ± 20V
 Cat. Q15513 \$89.95



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 lifting bail
 ● Capacitance meter
 ● Instruction manual
 Q91560 Normally \$165
Special, only \$149



VIFA/EM 3 WAY SPEAKER KIT!

This superb 3 way speaker kit competes with systems that cost 2 - 3 times the cost of these units! (Sensitivity may even be using VIFA drivers etc.) Never before has it been possible to get such exceptional value in kit speakers! Call in personally and compare for yourself!

The system comprises...
 2 x D19 dome tweeters
 2 x D75 dome midrange
 2 x P25 woofers
 2 x pre-built quality crossovers
 The cabinet kit consists of 2 knock-down boxes in beautiful black grain look with silver baffles, speaker cloth, innerbond, grill clips, speaker terminals, screws and ports

D19 DOME TWEETER SPEAKER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 2.5 - 20kHz
Free Air Resistance: 1.700Hz
Sensitivity (1W at 1m): 99dB
Nominal Power: 80 Watts (to 5.000Hz, 12dB/oct)
Voice Coil Diameter: 19mm
Voice Coil Resistance: 6.2ohms
Moving Mass (incl. air): 0.2 grams
Weight: 0.28kg

D75 DOME MIDRANGE SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 350 - 5,000Hz
Free Air Resistance: 300Hz
Sensitivity (1W at 1m): 91dB
Nominal Power: 80 Watts (to 500Hz, 12dB/oct)
Voice Coil Diameter: 75mm
Voice Coil Resistance: 7.2ohms
Moving Mass (incl. air): 3.6 grams
Weight: 0.65kg

P25 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 25 - 3,000Hz
Free Air Resistance: 25Hz
Operating Power: 5 watts
Sensitivity (1W at 1m): 89dB
Nominal Power: 60 Watts
Musical Power: 100 Watts
Voice Coil Diameter: 40mm
Voice Coil Resistance: 5.7ohms
Moving Mass (incl. air): 4.4 grams
Weight: 1.95kg

Complete Kit Cat. K16030 \$1,199
Speaker Kit Cat. K16031 \$949
Cabinet Kit Cat. K16032 \$349



MIDRANGE HORNS

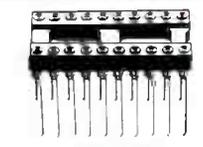
Use these quality, all metal, Piezo tweeters for great top end sound in your band speakers, disco sound system, etc. Rated at 30 watts RMS, in a system they will handle over 100 watts RMS
Two sizes to choose from:
Size: 4" x 10 1/2"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 2kHz - 15 kHz
Dimensions: 102 x 267 x 177mm
 Cat. C92082 Normally \$49.95
This month only \$39.95

Size: 3" x 7"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 2kHz - 15 kHz
Dimensions: 76 x 177 x 145mm
 Cat. C92084 Normally \$29.95
This month only \$24.95
 Dealer, OEM's, etc., phone (03) 543 2166 for wholesale prices



WELLER WTCPN SOLDERING STATION

The WTCPN Features:
 ● Power Unit 240 V AC
 ● Temperature controlled iron, 24 V AC
 ● Flexible silicon lead for ease of use
 ● Can be left on without fear of damaged tips!
 The best is always worth having
 Cat. T12500 R.R.P. \$149
SPECIAL, ONLY \$129



WIRE WRAP IC SOCKETS

These quality 3 level wire wrap sockets are tin-plated phosphor bronze

Cat.No.	Description	1-9	10-14
P10579	8 pin	\$1.50	\$1.40
P10580	14 pin	\$1.85	\$1.70
P10585	16 pin	\$1.95	\$1.80
P10587	18 pin	\$1.95	\$1.80
P10590	20 pin	\$2.95	\$2.70
P10592	22 pin	\$2.95	\$2.70
P10594	24 pin	\$3.95	\$3.50
P10596	28 pin	\$3.95	\$3.50
P10598	40 pin	\$4.95	\$4.50



LOW PROFILE IC SOCKETS

Save a small fortune on these "Direct Import" low profile IC sockets! PCB mounting solder tail. Dual wide. All tin plated phosphor bronze or beryllium and dual wide for reliability

Cat.No.	Description	1-9	10-14
P10550	8 pin	\$0.20	\$0.15
P10550	14 pin	\$0.25	\$0.20
P10565	16 pin	\$0.35	\$0.20
P10567	18 pin	\$0.40	\$0.30
P10568	20 pin	\$0.40	\$0.30
P10569	22 pin	\$0.40	\$0.30
P10570	24 pin	\$0.40	\$0.30
P10572	28 pin	\$0.50	\$0.40
P10575	40 pin	\$0.50	\$0.40

TAKE 25% OFF THESE BREADBOARDS THIS MONTH ONLY!

Cat. No.	Description	Price
P11000	100 Holes	\$ 2.75
P11005	640 Holes	\$10.75
P11007	640 100 Holes	\$14.95
P11009	640 200 Holes	\$17.50
P11010	1280 100 Holes	\$26.95
P11011	1280 300 Holes	\$32.50
P11012	1280 400 Holes	\$39.95
P11015	1920 500 Holes	\$59.95
P11018	2560 700 Holes	\$69.95



METEX 4500H MULTIMETER

10A, 4 1/2 digit multimeter with digital hold, transistor tester and audible continuity tester.

The Metex 4500H is perfect for the technician, engineer or enthusiast who requires the higher accuracy of a 4 1/2 digit multimeter. This meter is exceptionally accurate (just look at the specifications), and yet, still retains an exceptionally low price!
 The Metex 4500H features digital hold which is normally only found on very expensive multimeters. This enables you take a reading and hold that reading on display even after you have removed the probes, simply by pressing the hold button

CHECK THESE FEATURES...
 ● Readout hold
 ● Transistor Tester
 ● 4 1/2 digit x 1/2" LCD
 ● Audible continuity tester
 ● Push-button ON/OFF switch
 ● Quality set of probes
 ● Single function, 30 position easy to use rotary switch for FUNCTION and RANGE selection
 ● Built in lifting bail
 ● Instruction manual
 ● Full overload protection
 ● HFE test
 ● Battery and Spare fuse
 ● Diode Tester
 ● Vinyl case
 Q91560 Normally \$175
Special, only \$159

20% OFF THE PRICE OF SPECTROL MULTIALIDS

MODEL 15-1-11
Number of turns: 10
Minor Scale Division: 1/500 turn
Shaft Bore: 6.35mm (1/4")
Finish: Satin Chrome
Body Size: 25.4 x 4.45mm (1 x 13/16")
Depth: 25.4mm (1")
Weight: 45.4g (1.6oz.)
 Cat. R14405 \$45.95
SPECIAL, \$35.95

MODEL 16-1-11
Number of turns: 15
Minor Scale Division: 1/500 turn
Shaft Bore: 6.35mm (1/4")
Finish: Satin Chrome
Body Size: 22.2mm diameter (875")
Depth: 22.2mm (875")
Weight: 19.8g (0.7oz.)
 Cat. R14400 \$26.95
SPECIAL, \$21.50

MODEL 21-1-11
Number of turns: 15
Minor Scale Division: 1/100 turn
Shaft Bore: 6.35mm (1/4")
Finish: Satin Chrome
Body Size: 46.04mm diameter (1.812")
Depth: 25.4mm (1")
Weight: 85g (3oz.)
 Cat. R14410 \$46.95
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Deicast boxes are excellent for RF shielding, and strength. Screws are provided with each box.

H11451	100 x 50 x 25mm	\$ 5.95
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H11462	188 x 120 x 78mm	\$13.50
H11464	188 x 188 x 64mm	\$29.50



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Plastic boxes with aluminum tops, and available in four sizes. Very popular for projects and very economical!

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H10102	195x113x60mm	\$ 4.50
H10103	130x68x41mm	\$ 2.75
H10105	83x54x28mm	\$ 1.95
H10110	120x65x38mm	\$ 2.95
H10112	120x65x38mm	\$ 2.95

 (Metal top)



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H10384	3 x 4 x 4 inches	\$ 7.50
H10385	3 x 4 x 5 inches	\$ 7.95
H10386	3 x 4 x 6 inches	\$ 8.50
H10387	3 x 4 x 7 inches	\$ 9.50
H10388	3 x 4 x 8 inches	\$10.50
H10389	3 x 4 x 9 inches	\$10.95
H10390	3 x 4 x 10 inches	\$11.95

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Call \$12500	1-9	10-
	1-9	10-
	1-9	25-
	1-9	25-

Normally \$7.95
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- 10 metre length extension cord
 - Features US type plug
 - Use with US Australian adaptor
- Y16043 \$25.95



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Enables a portable CD player or portable TV to be played through any car speaker system by using the cars cassette player. Reduces the risk of theft. Just plug in when required, and remove when you are finished. Hard wiring not needed.

A10011 \$29.95



CD PLAYER ADAPTOR

Many amplifiers have only one auxiliary input. This makes using a compact disc player as well as another auxiliary input inconvenient. Also the majority of CD players have an output voltage of 1.6 or 2 volts whereas the auxiliary input norm is 750mV. This CD adaptor allows dual auxiliary input, and one input has variable gain setting.

SPECIFICATIONS:

- Input 2 sets of 2 x RCA sockets
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- Output 2 x RCA sockets

A11510 \$23.95



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- Strips cable with diameter of 1.6-2.6-3.2mm
 - Fully automatic action. Squeeze grip will simultaneously strip and eject insulation
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- T11532 \$19.95



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Leakproof, long service life batteries ideal for security systems, emergency lighting or as a computer backup power supply etc.

Cat. No. S5029 Normally \$19.95
1-9 \$13.95 10- \$12.95



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P10960 3 PIN LINE MALE	\$3.50
P10962 3 PIN CHASIS MALE	\$3.00
P10964 3 PIN LINE FEMALE	\$4.50
P10966 3 PIN CHASIS FEMALE	\$4.95



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- Charges from 1 to 10 D C AA AAA N, and up to 3 x 9V batteries at the same time
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 - 240V AC 50Hz
 - Approval No. N10637
- Cat. M23525 \$59.95



POCKET SIZE BATTERY TESTER

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 - Requires no power source
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DESOLDERING BRAID

1.5 metres at direct import prices!	
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T11230 \$1.75 \$1.50	



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Low dual cone wide range 200mm (8in) Ideal for public address, background music etc. Tremendous Value at these prices! Cat. C12000
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Erase your EPROMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety, in about 40 minutes (less for less chips). Features include:

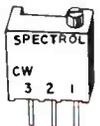
- Chip drawer has conductive foam pad
- Mains powered
- High UV intensity at chip surface ensures EPROMs are thoroughly erased
- Engineered to prevent UV exposure
- Dimensions 217 x 80 x 68mm

WITHOUT TIMER

Cat. X14950 Normally \$97
Special, \$79

WITH BUILT-IN TIMER

Cat. X14955 \$139
Special, \$99



SPECTROL 64Y MULTI TURN TRIMPOTS

Cat No. Description 1-9 10+	
R14700 10R	\$3.50 \$3.20
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R14720 50R	\$3.50 \$3.20
R14730 100R	\$3.50 \$3.20
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Heatsink compound is applied to the base and mounting studs of transistors and diodes. It maintains a positive heatsink seal that improves heat transfer from the device to the heatsink, thus increasing overall efficiency.

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12V DC 2 watt 10 C P S
Cat. Q11300 \$17.95



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1-9 \$4.95 10- \$3.95 100- \$3.75



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H10535 105 x 150mm	\$ 8.90
H10538 105 x 170mm	\$ 9.95
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Socket Cat. P10150 \$2.25

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For the ultimate connection!
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R14055 100R	R14110 10K
R14060 200R	R14120 20K
R14070 500R	R14130 50K
R14080 1K	R14140 100K
R14090 2K	

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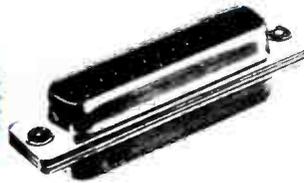
Ferguson 2851 Transformer 150mA/12V CT



\$2

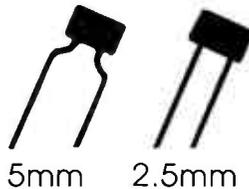
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Monolithic Capacitor

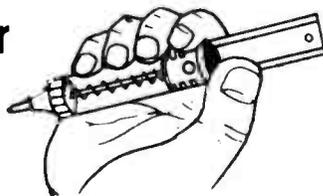


5mm 2.5mm

10c

De Solder Sucker

DT900



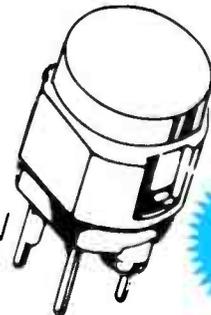
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741
4011
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74HC00
74AC00
74F04
Z80A CPU
2764

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GREEN
YELLOW



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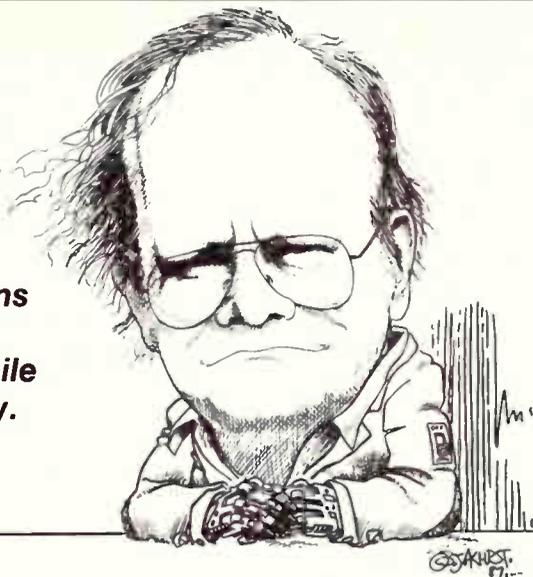
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READER INFO No. 2

“

... it is by no means clear that it's financially worthwhile going to university.

”



A committee headed by the Chairman of the CSIRO, Mr Neville Wran, has recommended that university students should pay for part of their education through a tax surcharge. According to a report in *The Sydney Morning Herald*, the tax would commence once a graduate had reached average income, currently around \$23,500, and would be less than 5%; figures around 1% and 2% have been mentioned.

Wran's announcement is the latest barrage in a battle that has been fought on and off since the government of Mr Whitlam scrapped University fees back in the early seventies. In both cases the main justification for the position was one of equity. Whitlam argued the equity of both the rich and poor having access to education at a tertiary level. A generation on, Wran argues the equity of not making the poor pay for the education of rich children.

For the central, and terribly sad, fact is that the poor have not, by and large, availed themselves of the opportunities given them by Whitlam. The statistics show quite clearly that the social make up of the student body, in terms of parental occupation and income, has shifted scarcely a jot during the last generation. Whether you were a student in 1960, 1970 or 1980, the status of your parents was much the same.

Equity, then, is an argument that cuts both ways. But the argument from equity is not the only, or necessarily the deciding argument. Considerations of the national interest, for instance, must have some force. And surely, the paramount national interest we have at this moment in our history is turning Australia from a primary producer into one where manufacturing and service occupations provide most of its wealth.

The current government has gone a long way down the stony track of restructuring our economy. They deserve more credit for this than they generally get. Part of their strategy has been a recognition that we need to change the composition of our workforce. To create a technology based country, we need more technologists. It is no accident that 90 odd per cent of Japanese have tertiary education, or that engineering is the profession with the highest prestige in Japan.

The national interest then, dictates that we must increase enrolments at tertiary institutions, and particularly in the

Continued overleaf

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INDUSTRY NEWS



Mr Robert A. Curley Kent Instruments (Australia) Pty Ltd.

Kent Instruments has appointed Robert Curley as its new Managing Director. Curley has had vast experience in the industrial instrumentation and Control Field and was previously Manager of the Products Division.

★ ★ ★

NEC Information Systems has announced its financial results, which show a revenue of \$157 million for the 1987 Financial year.

★ ★ ★

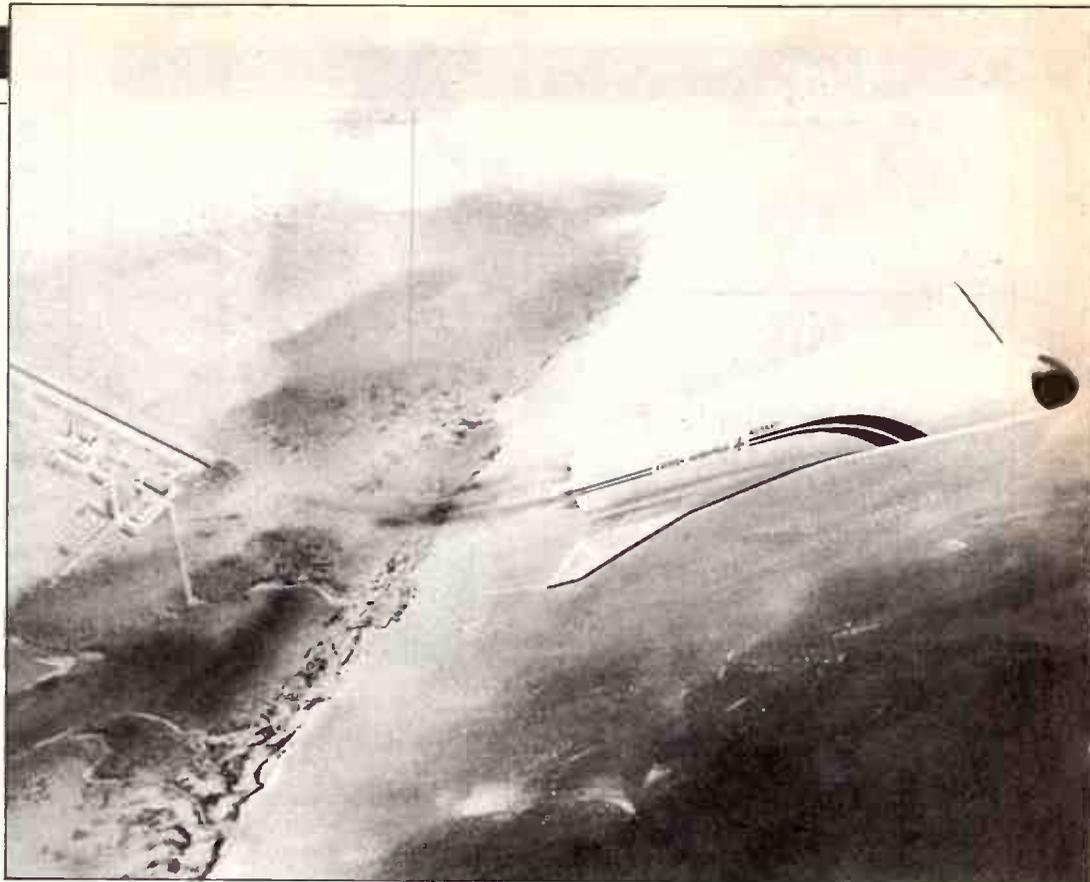
Sydney based Apscore International, the company that developed Cue-Bic has opened an office in Melbourne headed by company chairman, Brian Dean. Mr Dean is former managing director of Ultimate Computer and founder of General Computing Services, the company largely credited with the success of the Pic operating system in Australia. The Melbourne office is located at 2nd floor, 123 Camberwell Road, Hawthorn, Victoria 3122.

★ ★ ★

Hi-Phon has moved its Brisbane office to larger premises. The Brisbane operation, headed by State Sales Manager Derek Naismith is now located at 9 Trout Street, Ashgrove, Qld 4060 (07) 366 6818.

★ ★ ★

In Victoria, Bruce Pascoe has been appointed State Sales manager for Consumer Products.



Hotol carrying a third generation Aussat satellite, lifts off from the Cape York Spaceport. Neither the spaceport, nor Hotol or the satellite, yet exists, but people are working on it.

BAeA shows off

British Aerospace Australia was one of the most bullish participants at the recent "commercialisation of Space" conference held in Brisbane.

With major involvement in the ERS 1 radar satellite, and Aussat's L band downstation technology

(See News Digest, June 1988) the company obviously intends to be closely involved in Australian space activities.

Frequency

productive professions, engineers, architects, management specialists and so on. We need policies that make education for these professions more attractive, and easier to obtain. Unfortunately, this is precisely what we are not doing.

Education is becoming progressively more difficult to get hold of. By reducing the amount it spends on TAFE and universities in real terms, the government is making places harder to get. Its true that the total number of university places will increase over the next few years, with the creation of a new University on the Gold Coast, but only to flood the economy with yet more lawyers, social workers and ac-

countants. So far as this writer is aware, not a single new engineering place will be created in Australian tertiary institutions, at any level, next year. And only band aids are planned for the next ten.

Nor are we making extended education overly attractive. One reason Australian children stay away from universities in droves is that it is by no means clear that it's financially worth while going to university. Depending on how you do the sums, it's quite possible to demonstrate that a bright fifteen year old with a bit of luck and imagination would be better off leaving school, than continuing education for another decade. Consider that

many a fortune has been won in ten years. Many a student is still living in squalid inner city digs worrying about exam marks at age 25. In fact, one could probably argue that it's the mediocre talents that are best served by university. The letters after their name will provide at least a partial shield from the slings and arrows of outrageous fortune.

The argument may be specious; in fact it probably is. But sufficient young people believe it for it to be a problem of such dimensions that it will destroy the whole bright new world Messrs Hawke, Howard, Button and Jones shine before us. If this is not to happen, then we have got to start training

The parent British company has grown by amalgamation of most of the British Aircraft industry to be one of the world's biggest producers of air and spacecraft. It has a track record in the space field as long as any. This year, for instance, BaE is celebrating the tenth year in orbit of its orbital test satellite, OTS, which was launched in May, 1978 to prove the three axis stabilised concept could be applied to geostationary communications satellites.

OTS has 7,200 communications channels through it, and was operated for six years before being retired. It is still being used for experimental and promotional uses. For instance, OTS was used to demonstrate the technique of solar sailing.

Geostationary satellites are affected by pressure from the solar winds, the stream of charged particles which emanate from the sun exerting a force on all objects within its path. If not corrected, this pressure displaces a satellite from its position in orbit. Overcoming this force by use of thrusters uses valuable propellant.

Solar sailing is used to main-

tain on-station position. By positioning the arrays and flaps connected to the solar arrays, the satellite is able to propel itself against the solar wind in the same manner as a sailing ship tacking upwind. This technique considerably prolongs the life of a satellite.

British Aerospace's latest Eurostar family of satellites are equipped with refined solar sailing design features developed from tests on OTS.

Eurostar is being offered to Aussat for the second generation spacecraft and has already gone into service with Inmarsat, the International Maritime Satellite Organisation. Inmarsat has just signed a contract for its fourth Eurostat, to be called F4.

In April 1985, Inmarsat placed an order for three satellites, valued at \$US150 million, with an option to supply a further six. F4 will be launched in 1991.

Inmarsat 2 F4, together with the other three satellites, will comprise Inmarsat's second generation space segment providing a global maritime mobile communications service. Operating at C- and L-band frequencies it will provide important ship-to-shore and shore-to-ship communications.

The other major British Aerospace initiative that has captured the public imagination is Hotol (See ETI, Oct 1986 p104) the space plane. Hypersonic testing in the shock tunnel at the Australian national University has now been completed. However, the funding enabling development of a prototype has yet to be announced. It is most unlikely this would come from the British government, which has shown no great love for scientific projects of any kind. The other likely funding source, the European Space Agency, (ESA) may well save the day, but not at the cost of Hermes, the French mini shuttle. France, which contributes most of ESAs money, would veto any such move.

our people now. Technical education is expensive, but we can't afford not to do it. We have got to start making it more attractive by providing the right financial incentives. We have got to get more women into it and we got to keep the gates open for everyone to have a go.

The last thing we need is yet another disincentive to education. If Wran's proposal becomes law, the message the government will send to the next generation of engineers will come through loud and clear: become a real estate salesman. This worries me. We can only afford one Allan Bond.

Now . . . a literate disc

Tandy Computer in the US has announced the existence of a CD compatible optical disc that can both read and write.

Tandy has not yet revealed the method used to write to the disc, however, the company has confirmed that it follows the conventions established for audio. CD and CD ROM, so that conventional CD players will be able to decode it.

According to Robert McClure of Tandy, the first commercial release of the system will be in an audio application, where it may be expected to compete with Digital Audio Tape for the high end audiophile market. In any such battle, a recordable CD would have a distinct advantage over DAT, because of the huge amount of software available.

A data storage device for computers is still a little way down the track, although most of the technical bugs appear to

have been ironed out of the system. A recordable CD would change the nature of the disk market overnight because of its huge storage area, several gigabytes. In fact, it would change the basic architecture of computers themselves.

Currently, optical storage is available in the so called WORM drives (Write once read many). As their name suggests, these are drives that can be written to once, but not subsequently erased. Thus they form a valuable permanent data recording device in many mainframe applications. However, this inflexibility and their enormous price has kept them out of the PC market.

Optical CD-ROM drives already exist for PCs, and in fact, are price and size competitive with conventional disc drives. The first application of the new technology then, will most likely be in the PC area.

Higher and Higher

The record of high-temperature super-conductivity has been broken yet again. Dr Paul Grant of the IBM research laboratory in Almaden, California has announced the attainment of zero resistance at 125 K in a thallium-barium-calcium-copper oxide. At the time of the announcement, this represented an increase of over 20 degrees on the highest published zero-resistance temperature.

Grant was speaking at an evening session of the week-long International Conference on High-Temperature Superconductivity and Materials and Mechanisms of Superconductivity, which brought 1200 people from 36 countries to Interlaken, mostly to hear reports of the latest research on the high-temperature oxide superconductors. Of the 800 talks and posters, more than 750 reported work on the oxide materials.

Most of the excitement was generated by reports on the new rare-earth-free bismuth and thallium superconductors. Superconductivity at over 100 K in bismuth-strontium-calcium-copper oxide had been reported by Hiroshi Maeda less than six weeks before the conference began, yet more than 30 speakers were able to report results on this system. Only a few had had time to work on the thallium system, discovered by Z.Z. Sheng and A.M. Hermann of the University of Arkansas only in mid-February, but by the end of the week Z. Zhao of the Institute of Physics in Beijing was able to announce that his group had measured zero resistance at 120 K, almost equalling Grant's record. The frenetic pace at which work is proceeding around the world was evident as speakers presented data that were only hours old, hot off the facsimile machine.

INDUSTRY NEWS



Teknis Chairman, Mr Bob Stevens (right) and IBM's Government Affairs Manager, Mr Bob Galloway.

Teknis, the Adelaide-based manufacturer of printed circuit boards, has won a contract to supply IBM Australia with parts for use in the production of personal computers at its Wangaratta, Victoria, plant.

Teknis executive Bob Stevens said the contract was worth a potential \$13 million to Teknis over five years. Teknis is one of the first vendors to be approved by IBM for the supply of locally manufactured products to IBM specifications.

★ ★ ★

The R&D Corporation has signed a licence agreement to commercialise a software program called the Computerised Meatworks Information which it has funded for the past five years.

The agreement between the directors of the company, Graeme Wood and Hing Chua, and the R&D Corporation was signed in Sydney recently. The agreement will ensure that the R&D Corporation gets royalties on all sales of the package.

The Computerised Meatworks Information System (CMIS) is an integrated computer software package designed to meet the needs of the Australian meat industry. It uses the latest bar coding technology to provide extensive control for boning room production, inventory management and shipping operations. It will soon have the capabilities to support or interface with accounting, sales, marketing and carcass handling operations.

ISDN Update

Telecom gave seminars in Sydney and Melbourne recently on the technical aspects of the Integrated Services Digital Network (ISDN) which will come into operation for large customers in May 1989. Attendance at the seminars far exceeded Telecom's expectations. There were 150 people in Sydney. The seminars were pitched at a highly technical level, but many of the attendees appeared to be more interested in the more general strategic im-

plications of ISDN. ISDN will give large organisations access to digital links into their PABX systems at 64 kilobits/sec with a range of additional network features accessible through a separate signalling channel. The services will be extended to smaller business users in 1990 and eventually to domestic subscribers.

Telecom will not release tariffs for ISDN until July. When this happens, communications planners will start doing their sums to see where and how ISDN can save them money. ISDN marketing Manager

Norm Gale, said that Telecom will supply a software package to run on a PC which will enable customers to compare the costs for different networks implemented in ISDN and using existing digital and analogue services.

Reagans Space Program

In a final attempt to reverse the desperate plight of US industry in the face of attack from both Europe and Japan, President Ronald Reagan has used his last state of the union address to announce major new non defence research initiatives to guide US industry over the coming decade.

Central to his plans is a commitment to the Ride report, a paper authored by astronaut Sally Ride which argues the case of a US moon base and a Mars mission. According to Ride both projects could have similar implications for US business as the 1970's Apollo program which gave us integrated circuits and Teflon.

The President seems finally to be convinced that the present level of military funding, which has sapped civilian funds over the last five years, is not sustainable.

For instance, he has ruled that military authorities must drop their objections to the sale of high-quality photographs of the Earth, so that American companies can rival French and Soviet competitors.

The change of heart is not before time. The Soviet Union has announced bold plans to send a probe to the Martian moon Phobos, to land a Balloon on Mars in 1992, and to bring back samples from Mars by robot by 1996. With every new record set by orbit-

ing Soviet cosmonauts, anxieties in the American space community escalated.

Closer to home, NASA's promise to help companies exploit space for profit ran into trouble at the Pentagon. Demand for images of Earth for mineral exploration, agriculture and military planning had drawn European and Soviet space merchants into the marketplace. But the Pentagon forbade companies such as EOSAT, which sells photos taken by the two American Landsat satellites, from offering images with a resolution of better than 10 metres.

Now, the Soviet Union is promising to sell images of 5-metre resolution, and Spot Image, a French organisation, already offers 10-metre resolution. When the nuclear reactor at Chernobyl blew up, the first images seen by American viewers were taken from a satellite.

Finally, the NASA advisory council has warned the agency that "undue obsession over preventing the transfer of technology . . . will weaken the US's ability" to cooperate with other countries or to compete commercially in space.

The news will be appreciated by a number of Australian businessmen, who have been prevented from selling Australian designed products behind the iron curtain by the infamous COCOM agreement, by

which the US government sought to prevent allies from transferring technology to the Soviets.

Stringent budgets for the near future may derail lunar and Martian exploration. Nonetheless, NASA has already begun to plan its voyages. The agency has a new office of exploration that will ask for \$20 million in next year's budget to design a lunar base and a flight to Mars.

In addition, NASA is pushing to get \$1 billion over the coming years for its Pathfinder programme, which has yet to be formally announced. According to officials at NASA's astronautics division, Pathfinder will focus on new technologies for planetary exploration. These will include a robotically controlled "rover" for collecting material from the Martian surface.

NASA also will study aerobraking, which engineers at NASA describe as something like skimming a flat rock across a pond. An aerobraking spacecraft skims a planet's atmosphere to slow down, instead of firing retrorockets. It thereby reduces its need for fuel. Also, engineers must design new propulsion systems and methods for reproducing gravity for astronauts who will make the two-year round-trip journey to Mars.

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.

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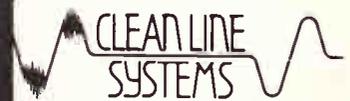
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INDUSTRY NEWS



Mr Richard Benfatto, Field Sales Engineer of Texas Instruments Australia Ltd.

Texas Instruments has appointed Richard Benfatto its new Field Sales Engineer in Semi-Conductor Components. Benfatto brings considerable experience in the field of semi-conductors, having held posts overseas as well as in Australia. Prior to joining Texas Instruments in February this year, Mr Benfatto worked in AWA's Micro-Electronics Division.

★ ★ ★

ESD of Melbourne has been appointed a distributor of Saratoga Semiconductors.

Saratoga, from California, make a series of low power ECL, Static RAMs, a FIFO and a Cache TAG RAM.

★ ★ ★

Autodesk Australia has appointed a new Managing Director, Mike Davidge.

Davidge sports a successful consumer products marketing background, most recently with ICI Australia and formerly with Cadbury Schweppes and Unilever.

★ ★ ★

Following the acquisition of Fairchild by National Semiconductor Corp, IRH Components has been appointed Australian and New Zealand distributor of the Fairchild range of semiconductors.

The Fairchild range includes FACT and FAST logic families, Zener diodes, signal diodes, voltage regulators, op-amps and transistors.

\$50m Smartcard Plant for Australia

Schlumberger, the world's largest manufacturer of smartcards, plans to set up a factory to manufacture the cards in Australia for Australian and Asian markets, including Japan.

The \$20 million factory, in a location yet to be announced, is a joint venture between Schlumberger and its local distributor, Electronic Transactions, Electronic Transactions will have a controlling interest in the project. The factory will have initial capacity of 400,000 cards per month, according to Electronic Transaction's general manager, Robert Bader.

The company claims the plant will give Australia "a first class microprocessor design and manufacturing facility," and says it expects to invest a further \$30 million in the facilities over the next few years.

The cards initially manufactured will be the relatively simple M29 and F256 models. These are used around the world for prepayment of telephone calls, cinema seats,

parking, for access control and electronic payment. They are disposable.

Electronic Transactions managing director, Alain Gottesman, claims smartcard payphones offer considerable advantages over coin or credit card operated models, and the company is discussing with Telecom their introduction into Australia.

In France smartcard operated public telephones were introduced in 1976, there are now over 11,000 of these and very few coin operated payphones, according to Gottesman. He claimed the move to smartcards had cut telephone vandalism by over 90 percent. An additional advantage was that smartcard payphones removed the requirement for coin collection and the possibility of pilfering by coin collectors.

The telephone smartcards can be programmed from the telephone with up to 10 frequently used numbers which could then be dialed using a single button. Each smartcard

has a serial number and if the card was stolen the number could be downloaded into every payphone on the network from a central computer making the stolen card worthless.

Telecom Australia has introduced a payphone by standard credit cards, but this is not a general purpose payphone as there is a minimum fee of \$1.20. However, Telecom was recently reported to be planning the installation of 2500 credit card payphones by 1990. There are only about 150 at present.

Schlumberger's most sophisticated smartcard, the M64K has more processing power and memory than personal computers of 10 years ago. It incorporates a microprocessor, 256 bytes of Random access memory, 4 kilobytes of program storage and 8 kilobytes of programmable read only memory where pin codes, access keys and account details are stored.

New O/sets Policy

Commonwealth and State Governments have launched a revamped civil offsets program that is designed to bring increased benefits to Australian industry and boost its international competitiveness.

In announcing the launch, the Minister for Industry, Technology and Commerce, Senator John Button, said: "The new program will make it easier for Australian firms to win offsets work and for overseas companies to fulfil their offsets obligations. In the first 12 months the program will be worth up to \$300 million to local industry."

Under the new program, foreign companies selling to Federal Government departments or agencies will be required to source goods, services or transfer technology to 30 per cent of the value of the contract. In

the past, companies have also been required to fulfil similar obligations when selling to each State Government or its agencies. This had led to fragmentation of industry.

With the new agreement, the Commonwealth Government, in close consultation the the States, will negotiate offsets agreements for all Commonwealth civil purchases and State purchases of information technology products.

The new policy is the latest of many different offset arrangements tried by the government. None have been particularly successful in generating increased manufacturing, and sustainable R & D has been almost totally absent.

The States will take a leading role in the negotiation of offsets proposals involving local companies in the Program and

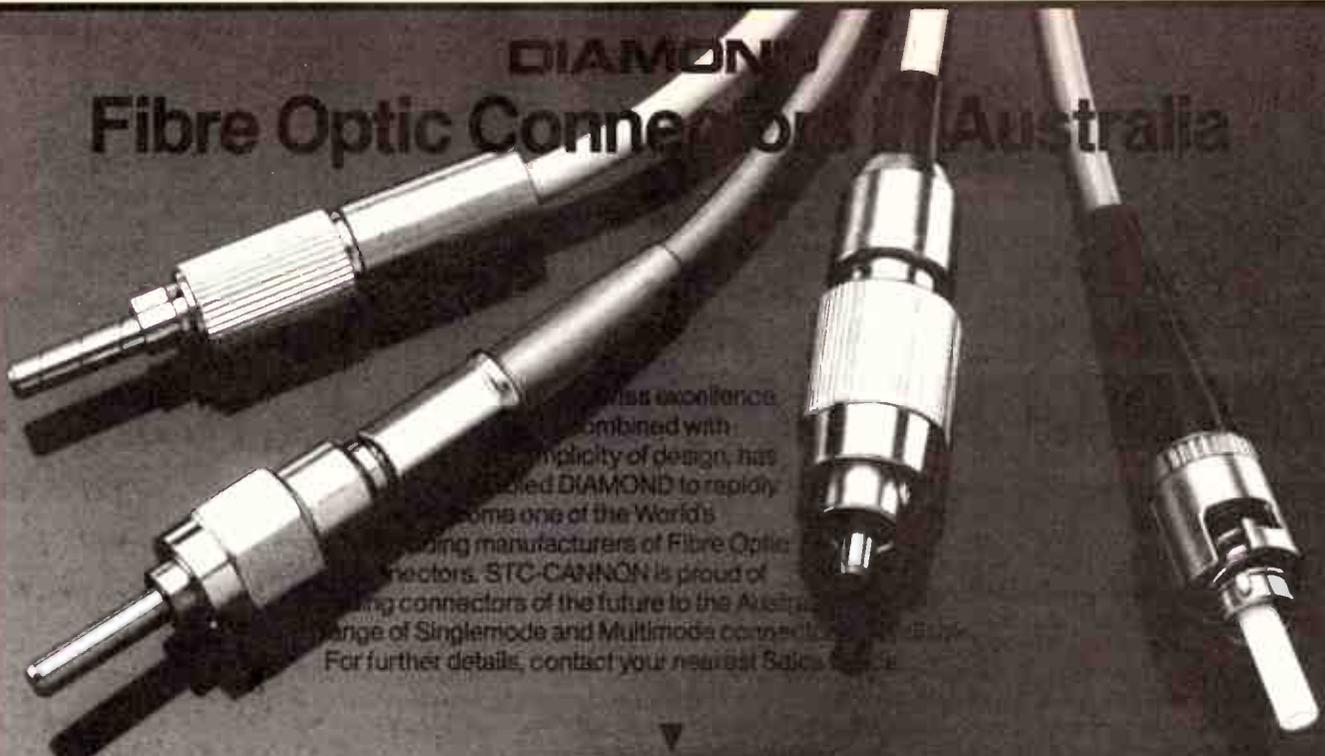
will continue to arrange other offsets obligations in regard to State purchases other than information technology. State offsets outside the scope of the national program will be undertaken in harmony with the national policy.

Under the old system, companies had to cope with separate and different Commonwealth and State offsets programs. Now an overseas firm incurring offsets obligations to a State Government can undertake the work in any State.

The government hopes the new policy will be more attractive to foreign corporations.

"This is a clear signal to transnational corporations that Australia wants to remove unnecessary regulations impeding their productive activities in Australia," Button said.

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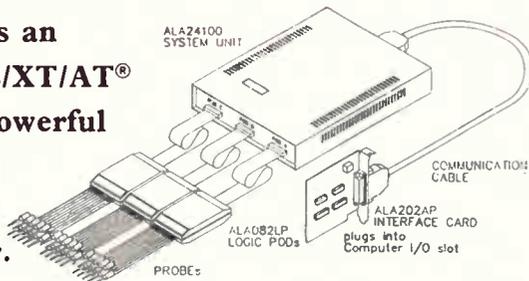
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READER INFO No. 6

AXELEN PC BASED LOGIC ANALYSER

Converts an IBM-PC/XT/AT® into a powerful 24 CH, 100MHz analyser.



The Axelen ALA24100 is essentially an adaptor that turns an IBM-PC/XT/AT® or compatible into a high performance, user friendly logic analyser, at a much reduced cost compared to a stand-alone instrument.

All that is required with the ALA24100 is a PC with one floppy disk drive, 256kB memory and any graphics display card. The configuration overview chart on the right lists the system acquisition specification limits.

The powerful multi-level, multi-command sequential triggering ensures that you can specify

complex events precisely and so, capture and record the required information. Furthermore, Data Qualification can be enabled to achieve optimum use of memory, as this will ensure the ALA24100 only records events of interest.

Most importantly, the driving software is elegantly written, making operation logical and trouble free. A fast, comprehensive HELP feature is available at all times, so there is no need to memorise commands or refer to the manual. In normal operation there are four basic modes: FORMAT, to set up all parameters; TIMING, for display and analysis of timing diagrams; LIST, for display and analysis of state diagrams (BIN, HEX, ASCII, OCT), DOS, to manipulate data files and add/edit comments for future reference.

CONFIGURATION OVERVIEW

	INT at 100MHz	INT at 50MHz	INT or EXT = < 25MHz	
			Nonqualified	Qualified
Data Channels	8	16	24	16
Trigger Words	1	2	4	4
Trigger Levels	1	2	4	4
Memory Depth	8176/CH	4088/CH	2044/CH	2044/CH



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 Nortek Townsville. Phone 79 8600

WA Henco Engineering Pty Ltd Perth. Phone 381 4477

ACT Electronic Components Pty Ltd Fyshwick
 Phone 80 4653

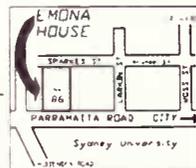
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Phone (02) 519 3933
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TAS George Harvey Electronics Hobart
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READER INFO No. 7

ETI July 1988 — 15



Communication News

Information services by Microwave to start this year

The federal government is planning to licence a range of information providers for Video and Audio Entertainment and Information Services (VAEIS) to be carried over microwave Multipoint Distribution Systems (MDS). VAEIS can also be carried by satellite. An example is the Sky Channel TV service which is beamed into hotels and clubs around Australia via the Aussat satellite.

The plan was announced by the Minister for Transport and Communications, Senator Gareth Evans, in his opening address to the Australian Telecommunications Users Group Conference, AUTUG'88, in Melbourne on April 19th. Speaking by video link from Canberra, Evans said that the plan was designed to cope with the flood of applications for such services received in October 1986 when the Government first invited expressions of interest.

In MDS information is distributed by omnidirectional microwave antennas on high points in metropolitan areas and received by small dish antennas located on office buildings. The target for services distributed by MDS is commercial rather than domestic. Where necessary repeaters can be installed to fill in shadow zones created by tall buildings. Each building is wired with coaxial cable to carry the signal to individual subscribers.

An MDS system is already in operation in Sydney. It is run by AAP Reuters Communications for its parent company AAP Information Services and

distributes all AAP's news wire and financial information services. The central transmitter is located on the top of Centrepoint tower and gives coverage as far out as the Blue Mountains.

The frequencies licenced under the 1983 Radiocommunications Act for MDS allow for a total of 19 7MHz channels five in the 2076 to 2111 GHz band and 14 in the 2300 to 2400 GHz band. These will be available in any capital or regional city where there is sufficient demand for services. The initial problem arose because several hundred applicants expressed interest in providing VAEIS over MDS. Each channel can carry one TV channel or a mixture of voice, data, text and image. In a text only application each channel can carry 4 million words per minute.

Under the Government's new licencing plan, a priority will be assigned to licences depending on the type of information service to be offered. The priority is as follows:

- (1) text and graphics,
- (2) text, graphics and still pictures,
- (3) text, graphics, still pictures and sound,
- (4) non-entertainment video,
- (5) entertainment video which may include pay TV.

Pay TV services have been under a moratorium since 1986. The Minister announced in the same address that these will be the subject of a separate review. Licences for services in category five will not be issued until 1990 when the pay TV moratorium has expired. Six of the 19 channels have been reserved for such services.

If there are still more applicants than available channels,

then those services which offer time sensitive information will be given priority, the Minister said. The first licences should be issued in June or July this year.

Typical services which the Government expects to be offered over MDS include: stock and commodity exchange prices distributed to brokers, fund managers and the like; real estate information to agents; general information and news relating to emergency service to be directed to services such as police, fire and ambulance.

Organisations granted and MDS licence may contract the provision of transmission and receiving equipment to a third party and AAP Communications hopes to pick up a large slice of this business. General Manager Barney Blundell claimed the company is the largest operator of MDS services anywhere in the world. It presently operates these for its parent, AAP Information Services and has MDS receiving antennas and cabling in over 750 buildings in metropolitan areas around Australia. Blundell said the company was already negotiating with Australian manufacturers to meet the anticipated demand for equipment once new VAEIS licences are granted.

Pay TV for Telecom

The review of pay tv policy announced in April by the Minister for Transport and Communications, Senator Gareth Evans, leads to several scenarios for the distribution of these services which could have a major impact on the Australian telecommunications industry.

Evans' predecessor, Michael Duffy, imposed a four year

moratorium on pay TV in 1986 "to allow recent upheavals in the industry to subside before another change was wrought." One of the problems with pay TV services is that they represent a "misfit between the legislative framework and the relevant technologies," according to Senator Evans. "Pay TV is neither broadcasting nor radiocommunications nor telecommunications as defined in our legislation," he said. "The term pay TV is about form and content, our legislation is mostly about carriage. Although Telecom acts in conformity with Government policy, there is no legal impediment to its allowing pay TV at all."

Evans review will initially be conducted "by a small departmental group charged with identifying policy options for Government consideration."

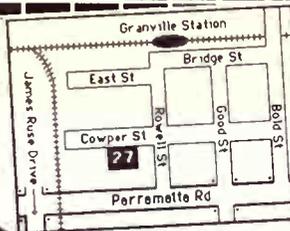
There will be no public enquiry, Evans said, but "an exercise in correlating information already available in contentious issues, such as the number and range of services that can be provided, the likely effects on the broadcasting and telecommunication systems and the Australian film industry and regulation of the industry."

A key issue will be the means of distribution of pay TV services. There are several options: direct broadcast by satellite, broadcast by UHF/VHF signals, dedicated coaxial or fibre optic cable forming part of the overall telecommunications network.

This last scenario could see Telecom Australia as the major carrier of pay TV Services in the future. Many will resent this concentration of power in the already powerful monopoly, but it would allow Tele-

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com to provide high capacity links into the homes of domestic subscribers and amortise the cost over a greater range of services.

According to Allan Locke, General Manager of Austral Standard Cables, one of the country's largest manufacturers of optical fibre cables, such a move would also provide a substantial boost to Australia's optical fibre cable industry which will be faced with the problem of overcapacity after 1992 when Telecom completes its ambitious project to ring Australia with high capacity fibre optic links.

Telecom will be well placed to offer transmission services for pay TV as it will be gearing up to introduce broadband communications carriers into subscriber premises by the mid 1990s. In a number of European countries and the USA, pay TV has been operating since the 1950s, the number of domestic premises equipped to receive pay TV recently passed the 50 percent mark. Belgium has over 90 percent of homes equipped to receive pay TV yet is embarking on a telecommunications strategy which will see the telecommunications network also able to provide carriage of pay TV signals within a few years. These countries will not find it so easy to build a single broadband network for voice, data, image and TV services.

Telecom is not blind to the opportunities and is already researching the technologies it will use to deliver TV signals to subscribers as part of an overall broadband communications network. Harry Wragge, director of Telecom's Research Laboratories said "I've been attempting to position the Laboratories so that if Telecom is in that field we'll be there with the best technology available." This strategy, Wragge said, included very fast packet switching technologies now under development by the Research Laboratories for the main network switches, the QPSX metropolitan area network to meet the needs of corporate customers and the Multiple Access Customer Network (MAC-

NET) to serve the domestic market.

Macnet was conceived by the Research Laboratories in 1985 and is now the subject of several worldwide Telecom patents. Macnet allows a number of customers to share a single optical fibre link to the local exchange. Only in the vicinity of the customer premises is the cable split into individual fibre pairs for each customer using a passive splitter. Information on Macnet is time division multiplexed with address information added for each customer. A prototype Macnet has been developed for Telecom by Alcatel-STC and Australian Optical Fibre Research Pty Ltd. It is now undergoing field trials in Melbourne and Sydney. Telecom's aim, Wragge said, was to keep electronics out of Macnet to keep connection costs as low as possible. Macnet will ultimately support high definition Television which will require a bandwidth of 150 Megabits per channel.

Philips Launches New ISDN PABX

Philips Communications new PABX, the Sopho-S, made its debut at the telecommunications exhibition held in conjunction with the ATUG'88 conference in Melbourne last month. The Sopho-S is designed for use on the integrated Services Digital Network (ISDN) which Telecom will introduce next year. Philips has already installed six of the systems in Australia under the restricted authority to supply which Telecom imposes on all new PABX systems.

According to Philips, the Sopho-S can be configured for any number from 20 to 20,000 extensions. The Sopho-S is one of the first PABX to support the CCITT standard S interface on its extension ports. Most ISDN PABX use a proprietary interface for the extensions. This means that customers must buy terminals from the PABX supplier, or buy adaptors to connect standard ISDN terminals to the PABX. The S interface allows each terminal to be located up to 2 kilome-

tres from the PABX and carry voice and data at 64 kilobits per second over a single pair of wires.

As part of the ISDN, Telecom has developed a proprietary protocol for signaling between PABX systems. Telecom claims the protocol, known as Telinc, is at least a year ahead of similar developments elsewhere in the world. A common standard for signaling between PABX systems from different manufacturers is essential if ISDN is to replace the concept of the private network. Companies with offices around the country are setting up networks of PABX systems interlinked by leased lines. The facilities of the modern PABX allow these networks to appear to users as one PABX with extensions in all offices. These facilities are achieved by signals sent over leased lines. Unfortunately these signaling schemes are proprietary, so all PABX in the network must be the same.

However, no PABX vendor has yet committed to supporting Telinc which Telecom says it has spent over \$1 million developing. Trevor Jordan, supervising engineer technical support PABX engineering, described vendors' reaction to Telinc as varying from "hostile to very positive". He did say the PABX which Telecom will sell will support Telinc. In spite of strong rumours that it will be the Siemens Hicom, Telecom has still not confirmed this.

Jordan said that work in the CCIT on private network signaling had come to an abrupt halt. The work had been vetoed by the US on the grounds that it was not the prerogative of the CCITT to set standards for these services.

Another feature of the Telecom ISDN which represents a departure from CCITT Standards by Telecom will be a user configurable semipermanent 64 kilobit/sec service, known as Timelink. Timelink will differ from a normal dial-up circuit by having a higher flag fall fee and lower time charge. Telecom has not said over what period Timelink will become cheaper than a normal call.

Telecom says Timelink has

been introduced to meet the needs of private networks operating in ISDN. However, users will still have the option of ordering a permanent leased circuit in ISDN in the same way that they order leased lines today. Telecom's main aim for ISDN in the early stages is to reverse the trend to private leased line networks. The more services that can be retained in and controlled by Telecom in the public network, the stronger is Telecom's position in the event of future deregulation and the greater its revenue potential.

Primary Rate ISDN services, which will give large organisations 20 x 64 kilobit/sec channels over a 2 megabit/sec link into their PABX systems will be supplied with an automatic backup facility. Each link between the subscribers premises and the exchange will be monitored continuously for errors. If the error rate exceeds a preset limit, the entire Primary Rate service will be switched over to a standby. The change-over will be 'barely detectable' to customers, according to Telecom.

Second Generation Office Automation Products

Greg Smith, a consultant with the National Protocol Support Centre, predicts that work being carried out on the Open Systems Interconnection (OSI) standards would lead in a few years to a new generation of office products that would demand the high data rate capabilities of ISDN.

File Transfer and Management (FTAM) protocols now under development as part of the OSI would make it possible for files to be distributed on different computer systems anywhere in a network. The OSI's Office Document Architecture (ODA) would when finalised allow for the transfer and manipulation of documents between different wordprocessing systems, pushing up the demand for switched high speed communications links. Smith said.

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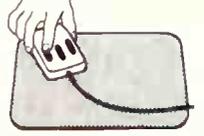
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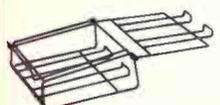
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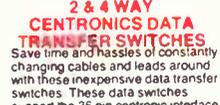
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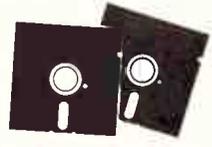
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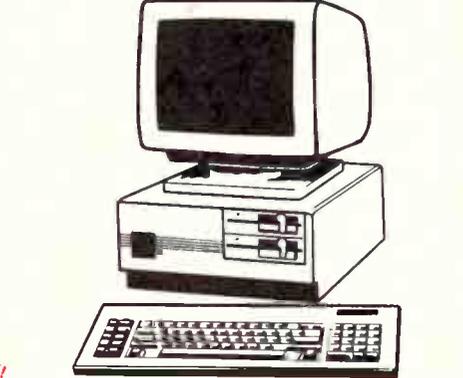
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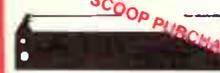
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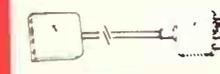
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Paul Budde reports on the international position of videotex services.

This item was contributed by Paul Budde Communications, PO Box 372, Roseville, NSW 2069

Videotex News

Digital Still Leader in Corporate Videotex

Digital Equipment Corporation has sold more than 600 corporate videotex systems in the US alone, thus becoming the dominant factor in in-house videotex. Moreover, most companies that have adopted in-house videotex systems are integrating them into their existing office automation activities — a process that reflects DEC's approach to videotex marketing.

Penetration Teletext

6% of all European households can now receive teletext (the one-way broadcast videotex service). This will grow to 20 million by 1990. Leaders are the UK with 16% penetration, followed by Switzerland and the Netherlands each with 14%.

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.

Courtlink on trial in the UK

The first trial, instituted a year ago, operates in London. Clerks of each of the four courts involved, transmit daily updates of court listings which are then available for access by Prestel users by early afternoon of the day before the court case.

The second part of the trial involves the Oxford and Midlands Circuit; that is, Birmingham, Warwick and Worcester Crown Courts and offers computerised court listings via Network for Law. Using PCs, court staff put all the listing records onto a hard disc and then compile the updated lists from that record. End users simply log into Network for Law at their convenience and refer to their mailbox, where they will find an updated list of the cases to be heard. Future enhancements will enable the recipients to specify the particular cases they are interested in, so they will not need to scan through all the cases.

Push For Videotex in US

Regional Bell Operating Companies (RBOC's) are accelerating their efforts to establish beachheads in online informa-

tion services. In separate proposals for information gateway systems Ameritech and Bell-South stress their commitments to systems that will encourage and assist independent information and service providers' participation.

Videotex veterans from the American Newspaper Publishers Association, after a junket to France, suggest that a telecommunication entity may play a key online services role, but US publishers still want to limit RBOC's roles in developing a full-scale Minitel model in the US.

US Congress will issue new rulings on changes in Modified Final Judgement restrictions by fall, probably giving RBOC's only a small dollop of the freedom they seek. Coming up during the 1988 Washington political season, are further congressional inquiries into RBOC's role in competitive services plus the eagerly awaited examination of Open Network Architecture which is intended to assure equal access for everyone in information services.

Telebank success story — US

Harbinger Computer Services a small business telebanking service, is growing at the rate of 10% per month; the sales surge has been accompanied by growth in the size of checking account balances customers maintain at the banks offering Harbinger's InTouch cash management system. All six banks that are rolling out InTouch, say that 10% of the customers signing up for the system are new customers for the bank, in line with previous studies on

the "crossover" effect for banks that pioneer telebanking within a market. Harbinger's research on usage indicates that more than 75% of the funds transferred through InTouch are for intrabank payments; on the other hand, most of the interbank transfers flow into the bank that offers InTouch.

Separately, Harbinger's "The Promise" home banking service, which has not been heavily promoted, also continues its slow growth. Fulton Federal Savings, the Atlanta thrift that pioneered the service, has had a less than 10% churn rate during the two years it has offered The Promise.

Reorganisation Prestel — UK

British Telecom's Prestel service has been reorganised into four divisions.

1. The lightly used consumer services segment of Prestel is now grouped with Micronet 800, the PC-oriented on-line service;
2. Messaging and electronic services have been incorporated into the Telecom Gold division;
3. Electronic publishing is being expanded to include a new hotline database;
4. A fourth division will manage the computer centres and network services involved with Telecom Gold, Prestel and a message handling service.

AESIS on CLIRS

The Australian Earth Sciences Information System is now available on CLIRS as part of ARID (Australian Resources Industry Database).

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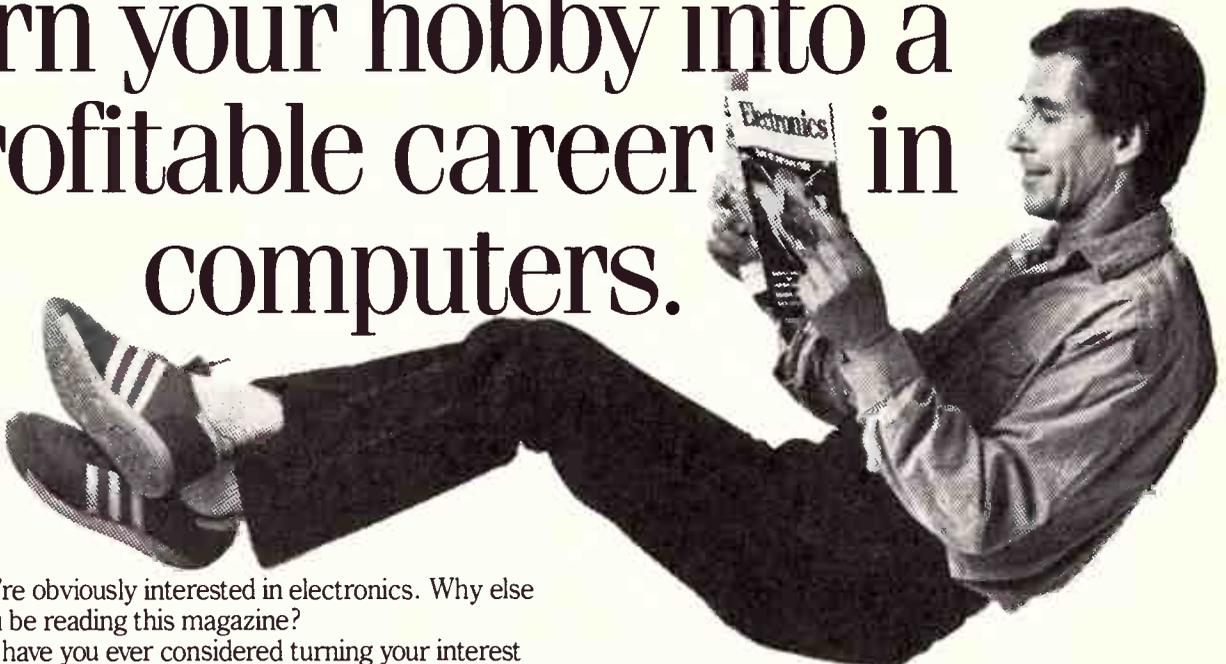
The JAX-110/120 Mobile Facsimile System is a very compact Facsimile Transmitter-Receiver which is designed to connect to an existing mobile radio system and provide Facsimile transmissions with Error Correction.



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ETI July 1988 — 21

Videotex News

source industry oriented data bases which includes Minfinder and Corefinder from the NSW Department of Mineral Resources, and SAMREF from the South Australian Department of Mines and Energy. Minfinder and Samref contain mostly open-file exploration reports held by the respective departments and Corefinder covers 120,000 boxes of diamond drill core held by the NSW DMR.

Judge Wants Views on Minitel Set-up in US

Should the US have a Minitel-type home electronic information system, and if so, what role should the Regional Bell Companies (RBOCs) play in developing such services? And how will telephone companies, if unleashed from restrictions, compete with publishers?

Judge Harold Greene, who oversees the Bell System breakup, put those issues in the spotlight by calling for oral arguments about the Justice Department's proposals to remove or modify restrictions on the RBOCs. By their existence, the two questions on information services pinpoint Greene's interest in the home information issue. One question is a five-parter.

In order to achieve an information system similar to the French Teletel system:

- Is integration required or would co-location be sufficient?
- What type of system do the RBOCs envision if they were permitted to enter this market?
- Is operation of such a system feasible without a government or other subsidy?
- At what cost to the subscribers would the RBOCs, or others, be prepared to provide such subscribers with Minitel-type terminals?
- Could such systems be established in such a way as to remove the ability for discrimination or must the RBOCs be restricted to the transmission of information generated

by others?

The other information services question seeks views on "What anticompetitive activities, if any, would the RBOCs be likely to engage in with respect to competing publishers if the information services restriction were removed?"

New Data Bases on AUSTRALIS

INROADS is produced by the Australian Road Research Board (ARRB). This data base is composed of bibliographic references, research in progress, ARRB library catalogue records from January 1984, and includes a complete record for all ARRB publications. It combines two data bases which were previously on Ausinet: ARRD and ROAD (then a private data base), with some additional records this data base is an excellent source of information on all aspects of roads and traffic in Australia but more importantly it also contains overseas information which is held in the ARRB library collection.

ENGINE: Australian Engineering Data Base is approximately the same file as was once on Ausinet. ENGINE indexes the publications of the Institution of Engineers, Australia.

Free Videotex Terminals In Japan?

the Ministry of Posts and Telecommunications continues to try to make CAPTAIN — Character and Pattern Telephone Access Information Network — videotex systems attractive, this time with a version to be called CAPTEL, touted as a potential AUS\$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 AUS\$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 promotion.

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.

Artificial Intelligence Available On French Videotex

The AI service called "Carl", is specifically designed to help small business owners and entrepreneurs.

"Carl" has been created to offer advice to managers and future entrepreneurs on the 250 most often faced problems and questions in the start-up, or early phase, of a new business. Users are guided to information on financial advantages, subsidies, loans and employment possibilities. "Carl" then sorts the users answers through a system inquiry system which searches for the pertinent judicial, social and financial rules in its memory and gives the user a relevant answer to whatever problem was posed.

Top Suppliers in the US of Electronic Services

The total number of suppliers to the US electronic information market is 1500 with a total turnover of US\$1.6 million. The annual growth is 10-15%.

Five years ago, the market

potential for 1990 was estimated on US\$16 billion with an average growth between 25-30%. This of course was a gross overestimation of this market.

Information market shares:

Organisation	Turnover electr. services	% total turnover	Type of application
Reuters	US\$505	80	Raw materials & and share market/News services
Dun & Bradstreet	US\$325	12	Credit and Busin. Information
Quotron	US\$187	91	Share Information
TRW	US\$160	3	Credit Informat.
Mead	US\$154	6	Legal and general information
Telerate	US\$149	100	Raw materials/ share market
McGraw-Hill	US\$120	8	Financial Inform.
Dow Jones	US\$100	10	Share market/ general business

One million CDs

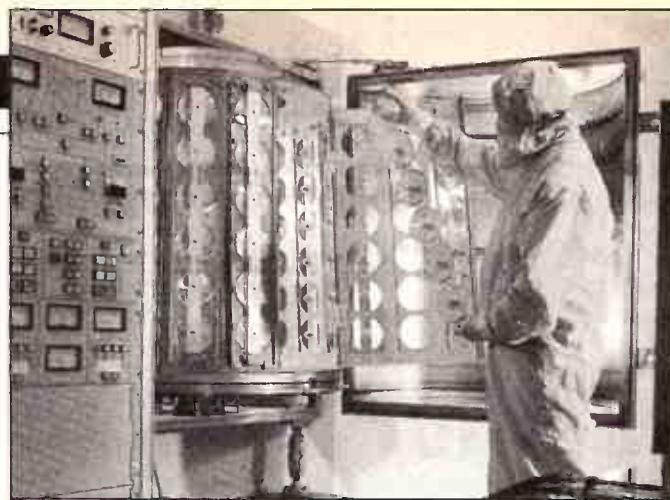
Disctronics — Australia's Only compact disc manufacturer — presented the millionth Australian-made CD for an Australian record company to Festival Records. A special run of the Rock and Roll group Icehouse's "Man Of Colours" celebrates its status as a Gold CD (35,000 units) as well as the album selling 500,000 locally. Festival Records is the distributor of Icehouse's label, Regular Records.

The Icehouse compact disc also has the distinction of being the first four colour print run for Australia with a special process developed by Disctronics

that allows detailed full colour printing featuring the three flowers from the front cover of the "Man Of Colours" album.

The presentation of the special commemorative black compact disc with its colourful printing was made at the Disctronics Melbourne factory to Festival Chairman Allan Hely and Managing Director Jim White by Disctronics Australian General Manager Doug Bell.

Disctronics normally exports about 85 per cent of its output. However, Disctronics estimates that it now produces 30 per cent of the CDs sold in Australia,



lia, manufacturing a consistent weekly average of 18 out of the top 50 selling album titles.

This particular project signifies an important stage of Disctronics growth within the Australian industry and shows the

excellent support the company has been receiving from major local record companies such as Festival, WEA and BMG/RCA as well as the independents such as Regular, Wheatley and Mushroom.

COMING EVENTS

JUNE

21-24: Sound Vision '88. Sydney Showground conference and exhibition. Information: Roger Bunch on (02) 439-5299.

23-24: Australian Transputer and Occam User Group, Conference and Exhibition. Details, contact the Conference Convenor, Mr John Hulskamp, Department of Communication and Electronic Engineering, RMIT, GPO Box 2476V, Melbourne 3001, or on (03) 660-2453/2090.

24: Defence Science and Technology Organisation Hilton Int Melbourne. Commercial Application of DSTOs Innovations and Capabilities. For further information call Mr Cohen on (062) 95-9668. Mr Ian Ridgway of DSTO (062) 66-4336 is also available to answer queries.

JULY

12-14: Fourth National Space Engineering Symposium, Adelaide. The Institution of Engineers, Australia, 11 National Circuit, Barton, ACT 2600. Telex: AA62758.

13-17: The 10th Perth Electronics Show will be held at Claremont, Perth. Contact the manager's office, 94 Hat Street, Subiaco, WA 2008. Phone (09) 382-3122.

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.

AUGUST

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.

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.

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.

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.

10-13: HOTEX The Australian International Hotel, Accommodation and Retail Food Equipment Exhibition. Royal Exhibition Building, Melbourne. Details from Aust Exhibition Services P/L. (03) 267-4500.

10-13: AIFE 88 The 3rd Australian International Food & Drink Exhibition. Royal Exhibition Building, Melbourne. Details from Aust Exhibition Services P/L. (03) 267-4500.

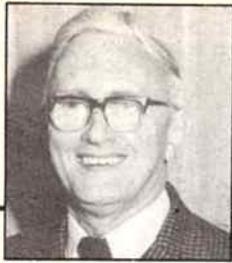
30-Nov 3: 9th International Conference on Computer Communication will be held at the Hilton Hotel, Tel Aviv. For more information contact Dr J. Raviv, Secretariat, ICCC'88, PO Box 50006. Tel Aviv 61500, Israel.

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.

T.B.A. Fifth Australian Remote Sensing Conference. Details H. J. Houghton, PO Box 1215, West Perth, WA 6005.

NOVEMBER

7-10 The International Robot Show. Contact Australian Exhibition Services, 242 St Kilda Road, Melbourne, Vic 3004. Phone (03) 267-4500.



Frequency sharing has led to chaos on the airwaves according to Arthur Cushen.

Kilohertz Comment

Frequency Sharing a Shamble

During the past few weeks there has been chaos on the shortwave bands with international broadcasters conflicting with one another on the same frequency.

Radio Japan decided to use 11955 kHz for the General Service (0700-0900UTC), which is the same channel used by the BBC World Service from Singapore for reception in Australia and New Zealand. This frequency move by Radio Japan caused severe interference to the BBC programme and attempts have been made to get Tokyo to find another channel.

Radio Nederland proposed to use 9685 kHz for transmissions from Bonaire (1030-1125UTC), a channel already used by Radio Moscow Asian Service to South East Asia. It was expected that Radio Moscow would drop this frequency but this did not happen and so a new channel was requested and 9675 kHz proposed.

The Voice of America with its relay from the Philippines to Australia extended its service from 1100 to sign on at 1000UTC on 11715 kHz. Formerly this frequency was used from 1100UTC, which gave good reception. The new sign on time has resulted in interference from Radio Havana, Cuba and the VOA's own Portuguese service to Latin America. A new frequency was requested for one of those transmissions and as 11720 kHz appeared to be the only clear channel at 1000UTC, the Portuguese Service from VOA was moved to that frequency.

The broadcast from Radio

Finland, Helsinki on 17795 kHz has run into interference from Radio France International from 0915UTC. Radio France International is decreasing its English broadcasts and is now heard at 0315UTC on 9790, 11670 and 11700 kHz; at 1245UTC on 11670, 15145 and 21645; at 1600 UTC on 6175 with the programme now titled "Paris Calling the World."

New Relay Base

Radio Australia's fourth relay base is at Brandon and is expected to operate this month. Brandon is in Northern Queensland, 15 kilometres south of Townsville. The ABC also chose Brandon for one of its mediumwave transmitters 4QN which has the power of 50 kW. Last year when Lyndhurst closed down three of its 10kW transmitters were taken to Brandon, where they now are installed with the mediumwave transmitter.

The intention of Radio Australia is to improve the signal into Papua New Guinea and into the Solomon Islands. Shepparton provides a good signal into these areas, but it was recognised that in the evening hours a closer site would provide a stronger signal. That is why Brandon is chosen as it is close to the target areas. The building at Brandon is able to house additional transmitters, while there is plenty of area for the expansion of aerials including the new log periodic and the four curtain arrays. According to a Telecom spokesman the transmitters will not be very effective, but this will be overcome by the installation of 100 kW transmitters which will provide a superb signal.

The delay in receiving the curtain arrays from the USA has been overcome by the temporary use of a log periodic aerial that has been taken from Lyndhurst which will provide a service until the curtain array has arrived. It will be used as a back-up aerial.

The languages to be carried at the Brandon site are French, English and Pidgin. The signal will be heard further afield than the target areas, but the new curtain arrays are not designed for long distance reception.

And Elsewhere . . .

ALASKA: KNLS from May to September 24 has English 0800-0900 11860; 1500-1700 9750; 1800-1900 11700.

BELGIUM: Brussels broadcasting in English to September 24 to Australia 0800-0825 11695, 15510 Monday-Friday; to North America 2330-2355 on 9925 and 11695 kHz. The Home Programme is relayed 0500-0555 on 9860 and 11985 kHz to Europe, 0600-0625 on 6035 and 9860 kHz.

FINLAND: The schedule to September 24 English to Australasia 0800-0825 17795, 21550 kHz; to the Far East 0830-0855 15245, 17795 kHz.

MOROCCO: Additional frequencies are being used for Radiodiffusion Television Marocaine which include broadcasts in English and French. The transmissions are in English 1630-1700 on 17595 kHz and 1700-1800 on 17815 kHz, and the programmes include news at 1630 and 1700-1710UTC. Transmissions in French are carried on the same frequency from 1800-1900UTC and from 1900 an alternative

frequency of 11920 kHz is used. these frequencies were formerly used by Radio Morocco to carry Arabic broadcasts.

SAIPAN: KUOI now carries programmes via satellite from WCSN Boston. KUOI is on 15405 kHz 2200-0200 and then moves to 17780 kHz from 0200. Between 2200-2300 there is a relay of the news and "Monitor" and after that recorded music with news on the hour and half hour.

SYRIA: Radio Damascus has changed frequency to 12085 kHz for its transmission from 2005UTC. This channel is not as strong as the old 9950 kHz frequency, but nevertheless provides an hour of news, comment and music which is received at fair strength.

USA: "KUSW from the West to the World", Salt Lake City 15580 kHz heard closing 0000 at strong strength, then moves to 11665 kHz where it is much weaker and suffers interference.

USSR: Radio Vilnius in Lithuania uses 15180 kHz for a daily English transmission at 2200UTC. On Sunday letters from listeners particularly from Europe are answered and the programme also includes an English Lithuanian language lesson.

This item was contributed by Arthur Cushen, 212 Earn St., 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.

ASIC FABRICATION

Need five integrated circuits, or maybe a few hundred? A new Swiss process makes it possible.

Brian Dance

The demand for Application Specific Integrated Circuits (ASICs) is one of the most rapidly growing areas in the whole of the current microelectronics market. Manufacturers are becoming increasingly aware of the advantages of having ICs especially custom designed for their own individual applications.

The use of ASICs places more of the chip design capability directly in the hands of the design engineers employed by the equipment manufacturer. When compared with systems using standard components, ASICs offer the advantages of performance improvements in systems of smaller size, weight and power consumption with a reduced number of components.

ASICs, which are difficult to copy, also provide manufacturers with a higher degree of confidentiality by keeping the entire design process inhouse.

The growing importance of ASICs can be seen from the conclusion of a Dataquest survey which estimates that ASICs will command at least a 50% share of the whole of the IC market by the early 1990's. They offer independence from the business cycles and delivery schedules of the standard device manufacturers.

Unfortunately the development of a new IC solely for a specific application can be an expensive proposition which may also involve a considerable delay. The delay may extend to many months if, as is often the case, the design fails to meet engineering requirements and must be repeated. These factors have limited the rate of growth of the ASIC market.

The use of ASICs has therefore been economically viable only when the product volumes have been large enough to cover the high cost of developing the circuits and of producing the masks for circuit fabrication. In some cases cost benefits through the use of ASICs instead of standard components cannot be achieved for volumes of less than 10,000 pieces. Many of the more specialised applications have not therefore been able to benefit from the use of ASICs.

Laser System

In order to overcome these problems, the Swiss company Lasarray S.A. of Brugg/Biel has introduced a rapid inhouse, cost-effective system for the design and production of silicon ASICs. This

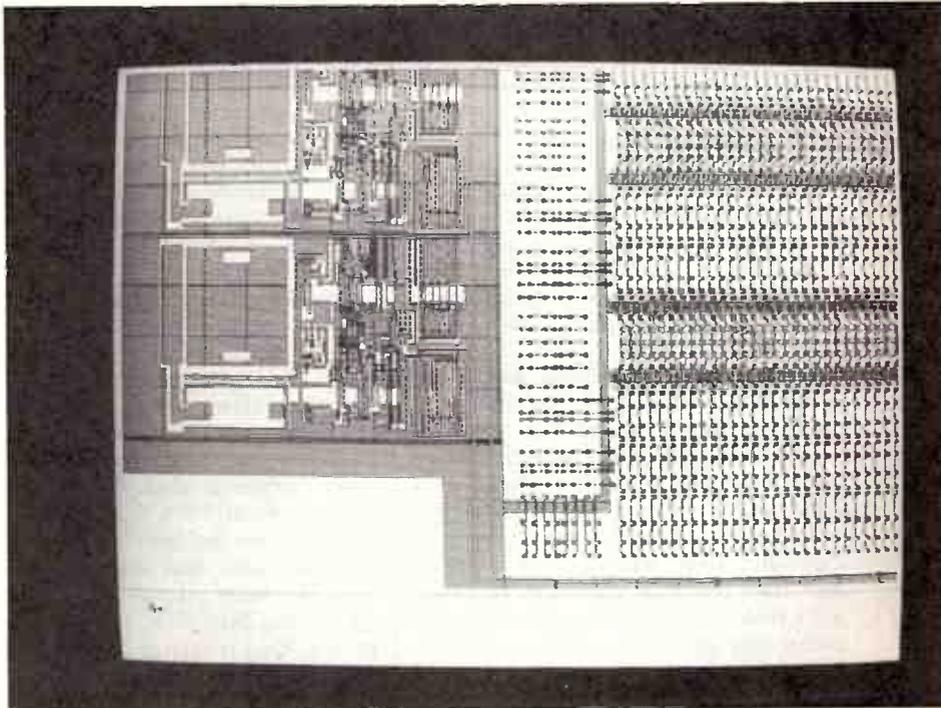
two-stage system approach has been developed by Lasarray in collaboration with Swiss industry and universities. It is mainly intended for volumes of 20-2000 pieces, although it can be economical even for volumes as low as 5 devices. A company intending to use this Lasarray system must first make an investment of some US\$31,000 for PC-based ASIC design equipment and a short course of employee training. The design system is used to transform ordinary circuit schematic functional diagrams into ASIC designs which the computer understands. A silicon compiler translates the complex system logic descriptions into the hardware description language. The programming is performed in MODEL (Microelectronic Design Language), a highly structured language similar to PASCAL. This system can also simulate the behaviour of the devices for testing purposes.

A further investment must be made in an ASIC fabrication unit if the chips are to be produced on the system manufacturer's premises. This unit uses the chip design information to produce fully encapsulated and tested ASICs. The user company staff require a training period of a



The LASARRAY Design System allows the easy development of customized chips. The design data are directly used as input for the Direct-Write Laser in the LASARRAY Processing System.
Photo: LASARRAY

The screen of the design system shows the layout of a gate array developed and produced with the LASARRAY method.
Photo: LASARRAY



ASIC Fabrication

few weeks before they can operate the self-contained unit, but it is claimed that this system can cut the total cost per typical ASIC chip from about US\$220 to about US\$70 for a volume of 10,000 devices per annum.

A unique feature of the Lasarray ASIC fabrication unit is the optical recognition system. This uses a red He:Ne laser to scan the surface of prestructured silicon gate array base wafers of up to 300 chips which are coated with a 1.1 micron layer of a positive photoresist. These chips are prepared with parallel tracks of etched pits for controlling the writing process with the required positioning accuracy. The red laser recognises structures already on the wafer without exposing the photoresist.

Direct Write

A blue He:Cd Liconix direct write laser (DWL) emitting 10 mW at 442 nm is used to expose the positive photoresist on a complete wafer. The power level delivered to the wafer surface is about 0.5 mW. After the CAD program has been loaded into the laser processor, the beam raster-scans the wafer at speeds of up to 300 mm/sec horizontally. The scanning is completed by stepping the precision mechanical stage vertically so that the beam exposes the photoresist on the surface of the wafer in a linear raster pattern to produce the required final gate patterns.

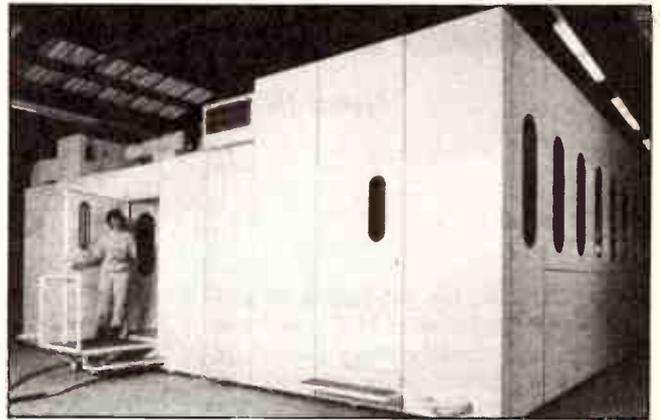
The DWL is switched on and off at up to 20 kHz by an acousto-optical modulator which is controlled using the data which was stored in the silicon compiler during the design stage. The DWL writes the ASIC design onto the photoresist-coated silicon gate array wafers, linking the gates in the desired manner. The wafer does not stop moving during this "flying exposure" process.

The two lasers share a common optical system held stationary above the moving stage. Accuracy is of the order of 0.5 micron at a scanning speed of 300 mm/sec. The system is monitored by closed circuit television. The final gate patterns are produced by chemical processing within the fabrication unit. The device yields of some 50% are limited by unavoidable defects present in the material of the silicon wafer.

The photochemical process with a low power laser followed by chemical resist processing avoids the heat problems associated with other laser systems. In the latter the intense heat concentrated on a small spot is used to remove metal, but can adversely affect the characteristics of the wafer base material. The Lasarray dual laser technique eliminates expensive mask making which is a limiting factor for prototyping and small volume production. Prototypes can thus be produced in small volume quantities. The current system is

The LASARRAY Processing System consists of three clean room containers. They are fully equipped for rapid turnaround ASIC production.

Photo: LASARRAY



optimised for a 2400 gate CMOS base array and 2 micron gate double layer technology.

ASIC device design may take a few days using a Lasarray CAD/CAE hard and software package based on a silicon compiler. This compiler translates complex system logic descriptions into simple three-dimensional chip structure information. The DWL can then program a 100 mm wafer of over 200 chips in about two hours with up to four chip designs produced simultaneously on the singler wafer. The beam sweep can be confined to a single quadrant of the wafer, so up to 16 different chip designs have been programmed on a single wafer. It is the speed and the flexibility of the DWL system which facilitates breadboarding directly onto silicon.

Fully functional and tested ASICs in HCMOS double metal technology can be produced in batches of 20 to 2000 within 24 working hours of the completion of a successful design. This enables equipment manufacturers to adapt electronic products to a customer's specification very quickly and to market new designs with minimum delay. The writing time is not dependent on the number of chips on the wafer, but on the traversing speed, the metal pitch and the dwell time. The typical test duration is about 30 min per wafer (typically less than 15 sec per device) with a test capacity of some hundreds of packaged devices per hour.

The semicustom design can be simply transformed into full custom design to achieve optimum silicon utilization and cost benefit. All unused active and inactive silicon areas are thereby eliminated.

A small plant houses all of the necessary equipment in three transportable clean room containers which can be joined to measure about 7.5 x 9 x 3.6 m. One of these includes the laser pattern generator and a proximity mask aligner in a Class 10 area. The wafer processing (resist processing, plasma deposition, nitride passivation etching, etc.) is carried out in a Class 100 area in the same container.

The second container has a Class 10000

area for wafer sawing, die attach, bonding, packaging and testing, while the third container comprises the service area for air conditioning, gas handling, and electrical power distribution. The plant has a capacity of 12 wafers per 24 hour day with an average daily production (35% yield) of 1000 ASICs.

Installation of the system takes 2-6 weeks for turn-key operation and Lasarray plans to delivery 100 systems by the end of 1989. When an ASIC device design has been finalised, the system can produce thousands of chips economically.

Analogue

The present Lasarray system cannot be used for analogue products, but the company is to collaborate with Delft Integrated Circuit Engineering BV (DICE) of Delft, The Netherlands, in the Eureka EU222 fast prototypable analogue transistor array program. An analogue ASIC will be developed which is prototypable by DWL to ensure extremely short prototype and production turn-around times. In comparison with existing analogue transistor arrays, the layout will provide for much decreased layout times, more effective use of standard analogue cell libraries, and better use of the silicon area. Thus chip development times will be reduced as well as the production costs reduced for both small and large production volumes. The analogue transistor array is to be developed in the Netherlands with prototyping by third parties at any location, and test and evaluation both in the Netherlands and in Switzerland. Both parties will be involved in marketing. The collaboration of Centre Suisse d'Electronique et de Microtechnique S.A., Neuchatel, Switzerland, is being sought as a partner. Commercialisation is expected to the end of the 16 month project with ownership equally divided between the two participants.

For further information please contact: LASARRAY S.A. Dr. Rolf H. Sigg, Gottstattstrasse 24, CH-2504 Biel. Phone 4152 41 0841.

Telex 9 31 452 las ch. Fax 41 32 41 28 28.

GNAT'S WHISKER TECHNOLOGY

Fibre optics need special methods of handling and a whole new complement of components because of its small size and wide bandwidth.

The diagram illustrates the energy levels and transitions in a Helium-Neon laser. Helium levels are shown as $3S_1$, $2s$, and $1s$. Neon levels are shown as $2p$, $1s$, and 10 . Transitions include 'Spont. Emission' from $2s$ to $1s$ and 'Recombination' from $1s$ to $2p$. The photograph shows the Spindler & Hoyer ML 500 laser, a rectangular metal enclosure with a fiber optic cable connected to the front.

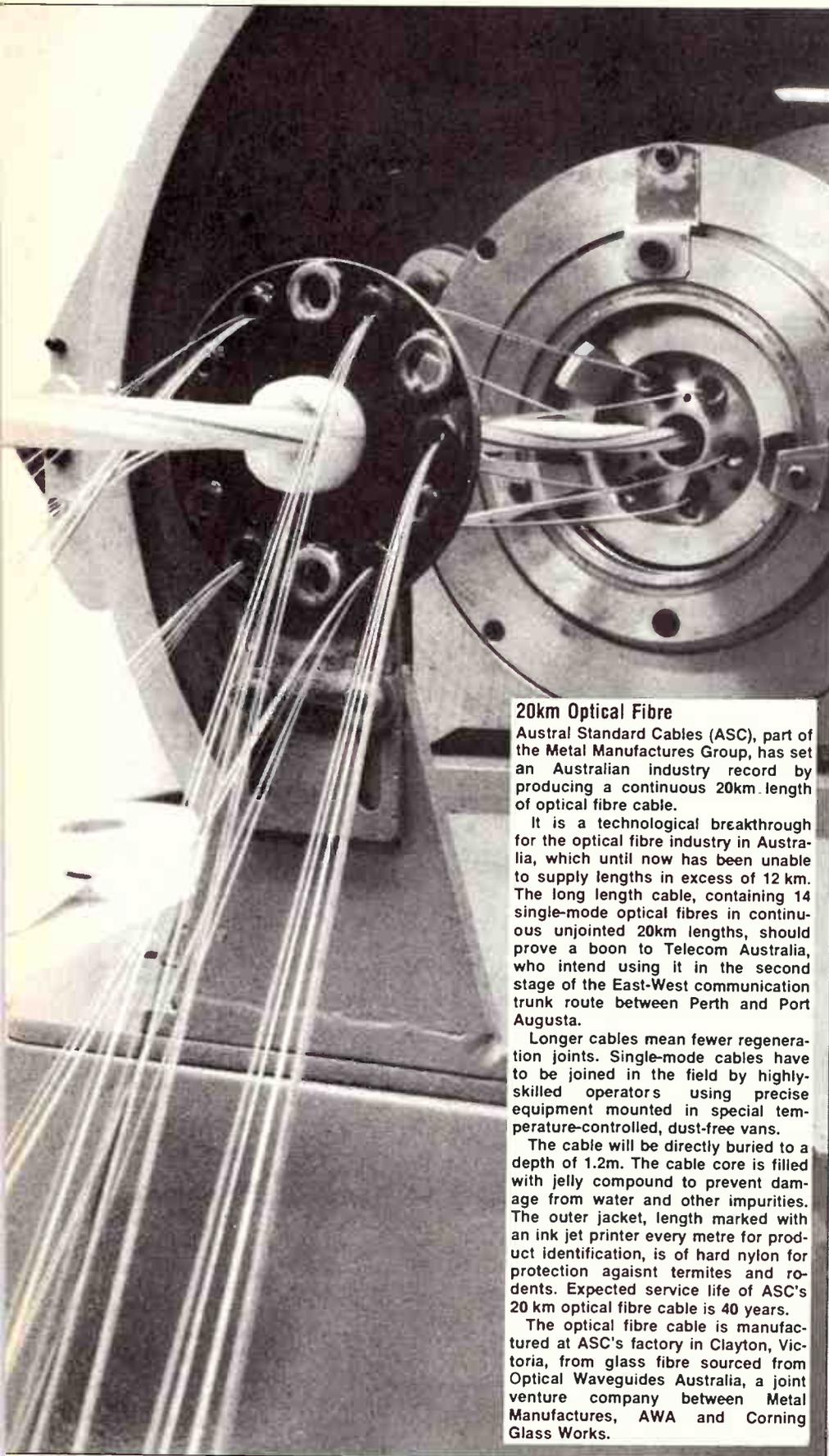
The newly developed Spindler & Hoyer ML 500 offers 14 laser lines from a single laser in the range 611 to 1523 nm. The ML 500 is the first commercial laser where a birefringent filter has been used as a tuning element. This single tuning element covers the entire spectral range. The filter is made from optically birefringent natural crystal quartz, and has a far greater resolution than conventional dispersion prism configurations. The output powers per wavelength vary from 0.1 mW (1523.1 nm) to 5 mW at 632.7 nm. For more information contact Rolfin, (03) 580-0802.

Eli Whitney (1765-1825), the American inventor of the cotton gin, a machine that could separate cotton seeds from their fibres, is generally credited with the first successful use of manufacturing standards and interchangeable parts. This occurred around 1798 when he was unable to secure protection for the cotton gin and so turned to supplying the US government with 10,000 muskets. Little could he have

realised the extent to which his principles of standardised parts would be carried.

Standardised parts made possible modern manufacturing. In electronics, issues of standardisation are often the first, and the most important, matters that need to be discussed. Think about Sony and its Beta VCR standard for a textbook illustration of the way the game should not be played.

Standardisation issues have hounded the fibre optic industry, and in fact impeded its progress from the laboratory to the factory floor for a number of years. Everyone knows how fibres work, but until there is a standard to say how thick they should be, or at what frequency they should operate, it's difficult to design a practical system around them. In any event, such issues have been finalised, and



20km Optical Fibre

Austral Standard Cables (ASC), part of the Metal Manufactures Group, has set an Australian industry record by producing a continuous 20km length of optical fibre cable.

It is a technological breakthrough for the optical fibre industry in Australia, which until now has been unable to supply lengths in excess of 12 km. The long length cable, containing 14 single-mode optical fibres in continuous unjointed 20km lengths, should prove a boon to Telecom Australia, who intend using it in the second stage of the East-West communication trunk route between Perth and Port Augusta.

Longer cables mean fewer regeneration joints. Single-mode cables have to be joined in the field by highly-skilled operators using precise equipment mounted in special temperature-controlled, dust-free vans.

The cable will be directly buried to a depth of 1.2m. The cable core is filled with jelly compound to prevent damage from water and other impurities. The outer jacket, length marked with an ink jet printer every metre for product identification, is of hard nylon for protection against termites and rodents. Expected service life of ASC's 20 km optical fibre cable is 40 years.

The optical fibre cable is manufactured at ASC's factory in Clayton, Victoria, from glass fibre sourced from Optical Waveguides Australia, a joint venture company between Metal Manufactures, AWA and Corning Glass Works.

the result has been the creation of a new industry; new handling methods, new components, new test gear.

To put the matter into perspective, some simple comparisons might be helpful.

A man's facial whisker averages about 120 microns (ie, 120 millionths of a metre). A child's hair is in the order of 60 microns. The core of the current single mode fibres which is the part that carries most of the light signal, is only 9 microns diameter. (Perhaps the diameter of the proverbial 'gnat's whisker'?

Another way of comprehending the size, is that the thickness of the page you are now reading is more than 8 times the core diameter.

Of course, given modern materials handling technology, there is nothing unusual in these dimensions. They are part of the magic of modern technology. However, these small measurements do pose all sorts of problems when it comes to handling optical fibres in the field. How do you lay

What you can do with optical fibre

Australian Optical Fibre Research, a wholly owned subsidiary of Wormald was established in 1984 to develop optical fibre sensor technology. Initial funding was provided by the Australian Government through a Public Interest Contract with the Department of Industry, Technology and Commerce.

Industrial processes, mining installations and area management make extensive use of multi-sensor systems with centralised monitoring stations. AOFR is in the final stages of developing a system using fibre optic sensing, communications and networking technology to implement a multi-sensor system which solves many of the problems faced by conventional monitoring systems.

While the control room of an industrial plant or mine is usually a benign environment, the sensors providing the data, and the cabling to them, must of necessity operate reliably under a wide range of conditions. Conventional sensors are typically connected to the control station via individual copper wire pairs. The sensor can be powered via the connecting pair if necessary and the sensor analogue signal is communicated by a current in the range 4 to 20mA.

When the sensor or cable environment is potentially explosive or electrically noisy, significant cost penalties are incurred in the sensor installation. electromagnetic shielding adds to the cost and weight of the cable and the bulk increases the cost of support structures and installation labour. Additionally, future changes to the

them, cut them, connect them to each other, terminate them in equipment modules? Anyone with practical experience in electronics will know how to do it with ordinary copper cable. How does it work when you have to do all the same sorts of things, but to tolerances measures in microns?

The problems of actually handling optical fibre in the field are significant, but they are by no means the only problem imposed by the technology. Equally important are problems of interfacing into lower frequency electrical equipment, and designing networks with junctions and nodes.

These are the practical problems that confront anyone trying to implement a fibre system in the real world. Predictably, it has led to the creation of joining equipment, connectors of various sorts, test and measuring instruments and so on. In fact, the industry which now supports the fibre industry in this way is much bigger and a lot more significant in employment and

probably money terms than the more flamboyant industry actually producing the fibres.

The fibres

First, a look inside the fibre. It consists of a number of different layers. At the centre is the core, through which light actually propagates.

A series of coatings are applied to the core for optical and mechanical reasons. The first is a 125 micron outside diameter glass cladding of lower refractive index than the core, to produce the internal reflection effect used to transmit the light down the core.

This is followed by a thin soft primary or buffer coating and then a secondary coating of 900 microns outside diameter of nylon. Over this is placed a tensioning strengthening member of kevlar fibres and finally an outer sheath of flame retardant PVC.

Splices

In some applications fibres can be fused together under heat or stuck with glues. Many proprietary methods have been tried with greater or lesser degrees of success. There are two basic types. One involves placing the bare ends of the fibre in a vice, so the two ends of the fibre can be moved relative to one another rather precisely. The usual practice is for the operator to view the ends through a magnifying glass while moving one end by spinning a wheel that moves the fibre fractions of a micron per revolution. When the ends are in position, they can be bonded, either with glue or by welding. Using such methods, it is possible to position the ends sufficiently accurately to reduce losses to less than a few tenths of a dB.

Another method of making joints in the field is to use some form of centering jig and glue. (See box). These systems are somewhat more expensive, especially if you have a lot of joints to do, but they are capable of extremely good results. Ac-

plant may make the existing shielding arrangements inadequate.

For explosive environments all sensor cabling must be "intrinsically safe" i.e. incapable of causing ignition if the circuit is broken. In practice, this means that added cost and space are required for isolating circuits for each cable connection at the control station end and often, explosion proof or flame proof housings are needed for the sensors and cable joints.

Optical fibre has obvious advantages for transmission of sensor information as the complete absence of metallic conductors and the negligible average operating power level make it intrinsically safe and electromagnetically immune. An even more attractive feature is that the high signal bandwidth and availability of high performance couplers makes it possible to operate many passive sensors from a single optical source and detector system using a passive branching network which minimises the total length of fibre required. The use of a systems approach in designing the overall network configuration has resulted in the development of an efficient and versatile means of implementing multipoint sensing well-suited to industrial needs.

The fibre network of OSNET is basically a tree structure. The system operates in a manner analogous to optical time domain reflectometry (OTDR). The optical source emits short, high-powered pulses which radiate through the coupler network to all sensors. The sensors reflect a pro-

portion of the incident pulse determined by their measured variables (measurands). The reflected pulses arrive at the detector spaced in time by the differences in round-trip propagation delay to each sensor.

The network uses four-port directional couplers with losses below 0.1dB. The overall attenuation in the path from source to detector via a particular sensor is therefore determined chiefly by the sum of the splitting losses (in dB) for all of the couplers traversed in the round trip. The splitting loss arises purely from the diversion of the optical power entering the coupler at one end between the two fibre ports at the other end. The splitting ratio can be set, at the time of manufacture of the coupler, to suit the application.

The use of concatenated 4-port couplers allows considerable flexibility in network construction. Branching points containing one or more couplers can be located wherever convenient. As these modules are entirely passive they have high reliability and require no more than basic physical protection.

The system currently uses 50/125µm graded index silica fibre and operates in the 800-900nm wavelength range. The combination facilitates the achievement of a large optical loss budget with relatively low-cost sources and detectors.

To interface to the fibre network the sensors must provide an optical reflection ratio which is related in a defined, one to one way to the measur-

and. This characteristic can be achieved in a number of ways. Where the measurand (eg, pressure, mechanical position or liquid level) can be translated into small-scale mechanical movement, the position of an optical reflector relative to the fibre endface can be modulated, varying the portion of incident light coupled back into the connecting fibre.

Other effects such as the temperature dependence of optical absorption or the variation in transmission through crossed polarisers as a function of relative angle can be exploited by placing the components in the optical path between the fibre end and a fixed reflector.

The dual wavelength mode is used when the ratio between reflection ratios at the two wavelengths is well defined. This can lead to considerable increased sensor accuracy by allowing for small, unpredictable loss changes caused by misalignment of sensor components to be compensated. These loss changes tend to be independent of wavelength in the range 800-900nm. In addition to analogue functions a very large number of sensing applications require a binary output only, as would be provided by a conventional electric microswitch. The optical microswitch's state can be determined with high reliability at signal to noise ratios around 10dB (optical). With this reduced S/N ratio requirement the allowable sensor count could be increased by a factor of four over the case of analogue sensors.

Whisker Technology



Sifam's new polariser uses some unique technology developed at the University of Strathclyde to multiplex signals in an optical fibre.

According to distributor Krone Australia, the Lightlinker kit describe in the accompanying box will typically yield results better than 0.2 dB.

Connectors

Once they are joined, a splice can be thrown into the ground and forgotten about. However, there are many applications where this is the last thing we want to do with them. When a connection

needs to be made and broken all the time, there is no substitute for a connector.

There are two problems for the designers of connectors. One is to make losses very low. Secondly, keeping the losses approximately the same every time the connection is made is equally important. To do so components have to be made to fractions of a micron in tolerance to ensure interchangeability. This is also the only way to consistently meet the stringent

low interface loss requirements demanded by system designers.

To obtain the alignment accuracies required, many fibre optic connectors are configured only as plugs. To interface, one is plugged into either end of an alignment sleeve. To ensure the alignment is kept within tolerance, after many interfaces, the connector's ferrule and alignment sleeves are manufactured in tungsten carbide to a tolerance of less than half a micron.

To make these connectors, the ends of the fibre are bared and cleaned, and roughly polished so that the ends are more or less straight. Then the ferrule is placed in a special adjustment tool. Visible light is inserted into the free end of the fibre and a magnified view of the light emitted from the core viewed on TV monitor. By rotating the ferrule 180° the maximum amount of eccentricity can be seen by viewing the light movement on the monitor. A marker, denoting one end of the eccentric movement, is set on the monitor and the ferrule is rotated until the light is at its furthest excursion from this point. An arc shaped V cross sectioned tool is then brought to bear into the primary crimped groove to push the core to the centre.

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READER INFO No. 8

World Radio History

A final fine polishing of the ferrule face then takes place.

Polishing is carried out on a series of automated machines that rotate from the face of the ferrule against an abrasive surface which is backed by an adjustable compliant diaphragm. The pattern of rotation is in the form of a series of eclipses that are generated clockwise, then anti clockwise, then clockwise again in a regular repeatable pattern.

Alcatel STC-Cannon has recently opened a new facility and commenced terminating DIN single mode connectors for Telecom and their suppliers along these lines. Currently, the parts are imported from Diamond SA in Switzerland, but plans are afoot for local manufacture.

Physical fibre contact

As the technology of fibre manufacture produces lower and lower loss fibre, the requirement for lower and lower loss interconnection becomes paramount. Until recently, most fibre optic connectors rarely permitted the actual fibre faces to touch. Either air or a lens filled the void. This produced two effects that reduced the transmission efficiency. Firstly, standing waves are caused between fibre ends of distances of more than one tenth of a

Liquid Light Guides

A rather bizarre variation on the theme has recently been introduced to Australia by the Melbourne-based Rofin company. Liquid light guides consist of a light conducting liquid core within a plastic tubing. Wavelengths between 270-720 nm can be transmitted at higher efficiencies than glass fibre light guides.

A wide range of core diameters 2-20 mm and lengths up to 10 metres are available. Different end fittings and outer coverings as well as twin

branches can be supplied. The high transmission of UVA light make these light guides particularly suitable for UV illumination but at a fraction of the price for fibre bundles. In addition, illumination is uniform over the whole active area. In bending the light guide there is no danger of fibre breakage. The efficiency of transmission at 350 nm over 1.8 metres is 60% compared to only a few percent for glass fibre bundles.

wave length. This causes an increase in insertion loss. As the fibre ends are free, the distance between them can change due to temperature variations, causing large variations in insertion loss. Secondly, an additional loss known as either *return*, *reflection* or *fresnel* loss occurs as the light beam passes through the end of the fibre. A small percentage of the incident light is reflected back because of a phenomenon associated with a step change in refractive index. Both of these losses can be drastically reduced if the fibre ends are firmly butted together.

In the case of a Diamond DIN connec-

tors, the force between the fibre ends is limited by a slip clutch mechanism on the connector tightening nut to 80 Newtons. This force is enough to flatten the convex profile for a diameter of around 200 microns. On releasing the load, the profile returns to its original shape.

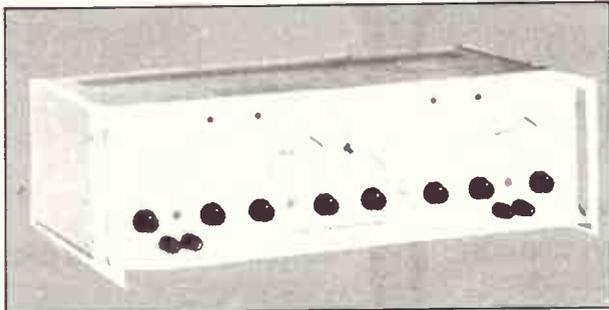
Components

So far we have only considered point-to-point connections. But there are also applications where the information to be transmitted branches out to several receivers, or where several transmitters have information to send to one receiver. In prac-

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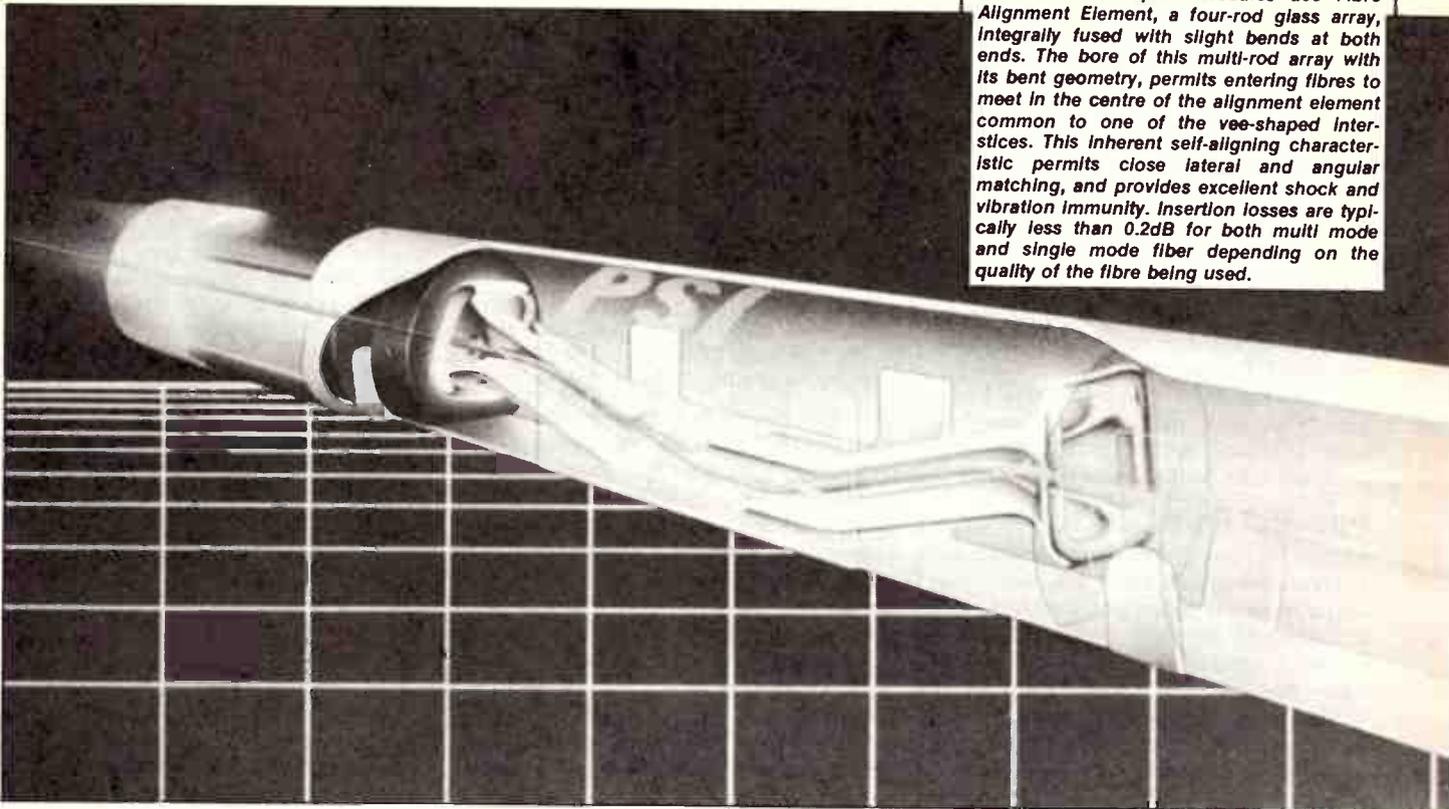


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Whisker Technology

The Lightlinker system is designed to perform fast, low loss, permanent fibre optic field splices on single mode or multi mode fibres. The Lightlinker is based on a splice module. These splice modules use Fibre Alignment Element, a four-rod glass array, integrally fused with slight bends at both ends. The bore of this multi-rod array with its bent geometry, permits entering fibres to meet in the centre of the alignment element common to one of the vee-shaped interstices. This inherent self-aligning characteristic permits close lateral and angular matching, and provides excellent shock and vibration immunity. Insertion losses are typically less than 0.2dB for both multi mode and single mode fiber depending on the quality of the fibre being used.



tice, both possibilities often occur together. Typical examples of this are centralised process monitoring systems with multiprocessing structures. (see box 2)

Bus structures of this type are growing increasingly important. This trend is being reinforced by the advance of integrated circuits, in particular microprocessors. Simple optical branches and complex optical bus structures can be set up with the couplers shown in Figs 1 and 2 from Sie-

mens, or switches like the Dicon Fibre Optic Switch being sold in Australia by Krone. This is a box within which a magnet, controlled electrically from the outside, actually moves the end of the input fibre so that it aligns with one of two output fibres. Dicon claim that the loss across the switch is only 0.6 dB and that it can switch in 5 ms.

Multiplexers

Another interesting component is the

multiplexer, which allows two totally different signals to propagate down the cable, increasing its information carrying capacity tremendously. Multiplexing can be done in either wavelength, time or polarity. Typical of the polarity multiplexer is a new Sifam in-line polarizer which is being sold here by C&K in Sydney.

The unwanted polarisation state is coupled to a plasma wave supported in a thin metal film deposited on the fibre. This

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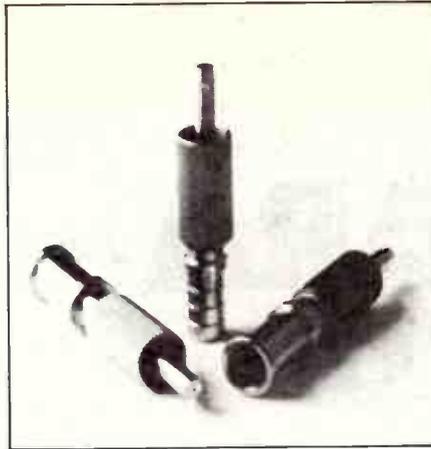
coupling is highly polarisation-selective and the orthogonal state is transmitted with very low insertion loss and high extinction ratio. Typically, insertion losses below 0.5 dB and extinction ratios in excess of 40 dB are attained. The technique can be adopted for all types of single-mode optical fibres.

The Sifam polariser is available in a variety of wavelengths for use in sensors and telecommunications.

An alternative, more traditional method of multiplexing is to use frequency. Typically, this is done using a filter system. For instance, the Bimax WDM being sold here by Rodin in Melbourne is based on a dichroic filter system and is used for two wavelengths (multiples of these two channel wavelengths can be housed in one unit called a multi Bimax).

The WDM uses a diffraction grating based system. A very broad spectral range up to $1.8\mu\text{m}$ is possible with up to 40 channels with different wavelengths available simultaneously. Losses are 0.5-2 dB and cross talk -35 to 45 dB. The device consists of a solid silica block with a spherical mirror and a diffraction grating. The fibres are attached to a microscopic "window" in the centre of the grating.

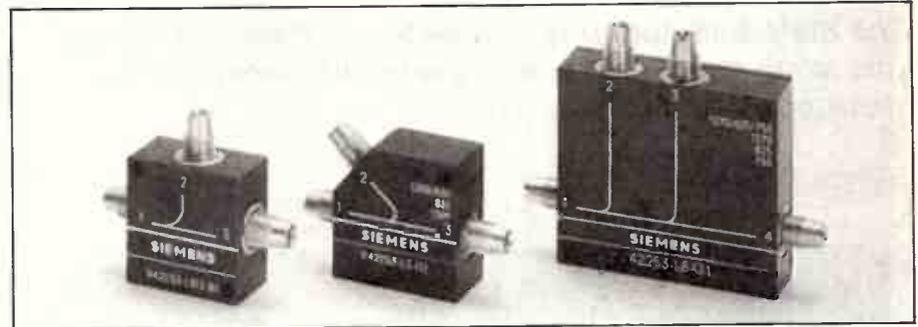
Another very common type of compo-



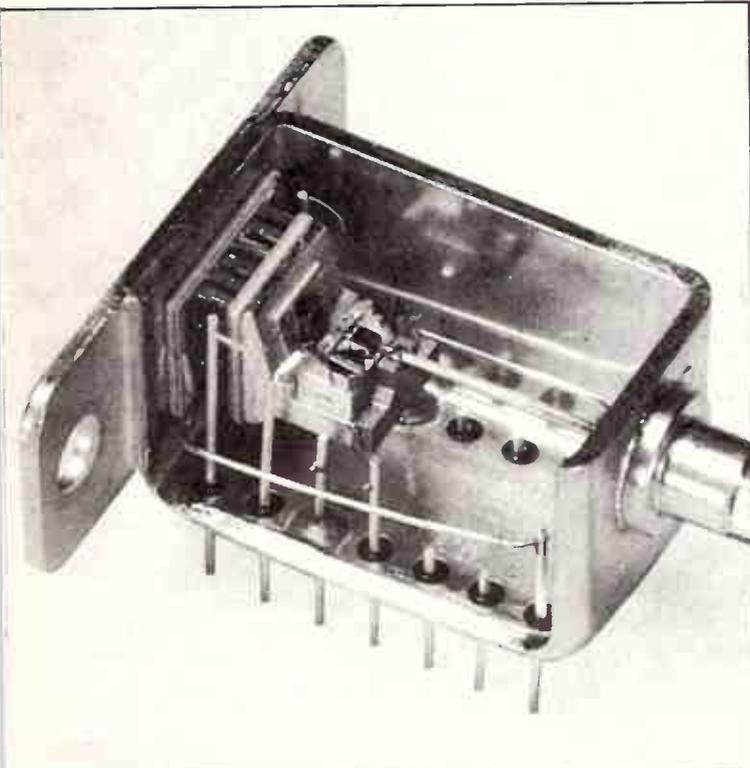
Fibre-optic connectors — a key component in optical system engineering.

nent is the transmitter or receiver used to turn electrical signals into optical ones, and vice versa. Such devices are too numerous to mention, especially as they are tending to all conform to much the same design: a black box with pins on one side, usually for TTL or some other form of logic input, and fibre coming out the other. This means that the designer faces the smallest number of problems in coming to terms with the use of optical fibre. ●

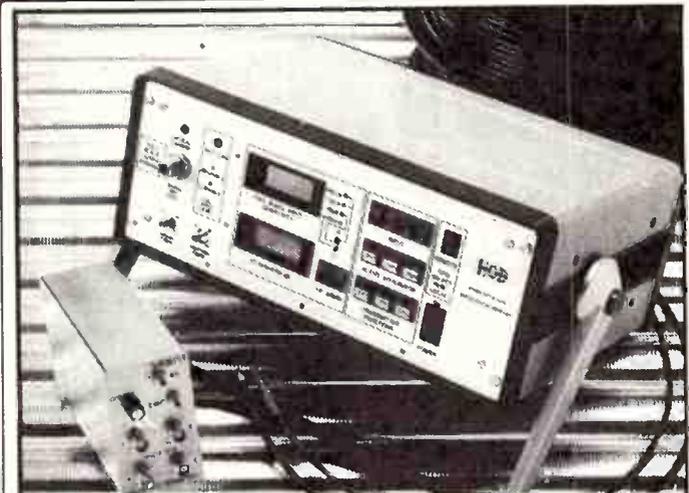
This article is based on material supplied to ETI by people within the fibre optic supply industry. In particular, we would like to thank John Ulph at STC Alcatel, and Geraldine Peel-Baker at Siemens.



Optical triple-gate branch (T-coupler), four-gate branch and wavelength multiplex (right).



Designed to minimize the design effort involved in using a fibre optical system, this module from Siemens mounts on a pc board, and turns an electrical signal into light. The optical source is a semi-conductor laser bonded to the fibre.



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READER INFO No. 13

ETI July 1988 — 33

TANGARA — HI-TECH ON THE RAILS

The State Rail Authority of New South Wales (SRA) has just taken delivery of one of the world's most modern metropolitan commuter trains.

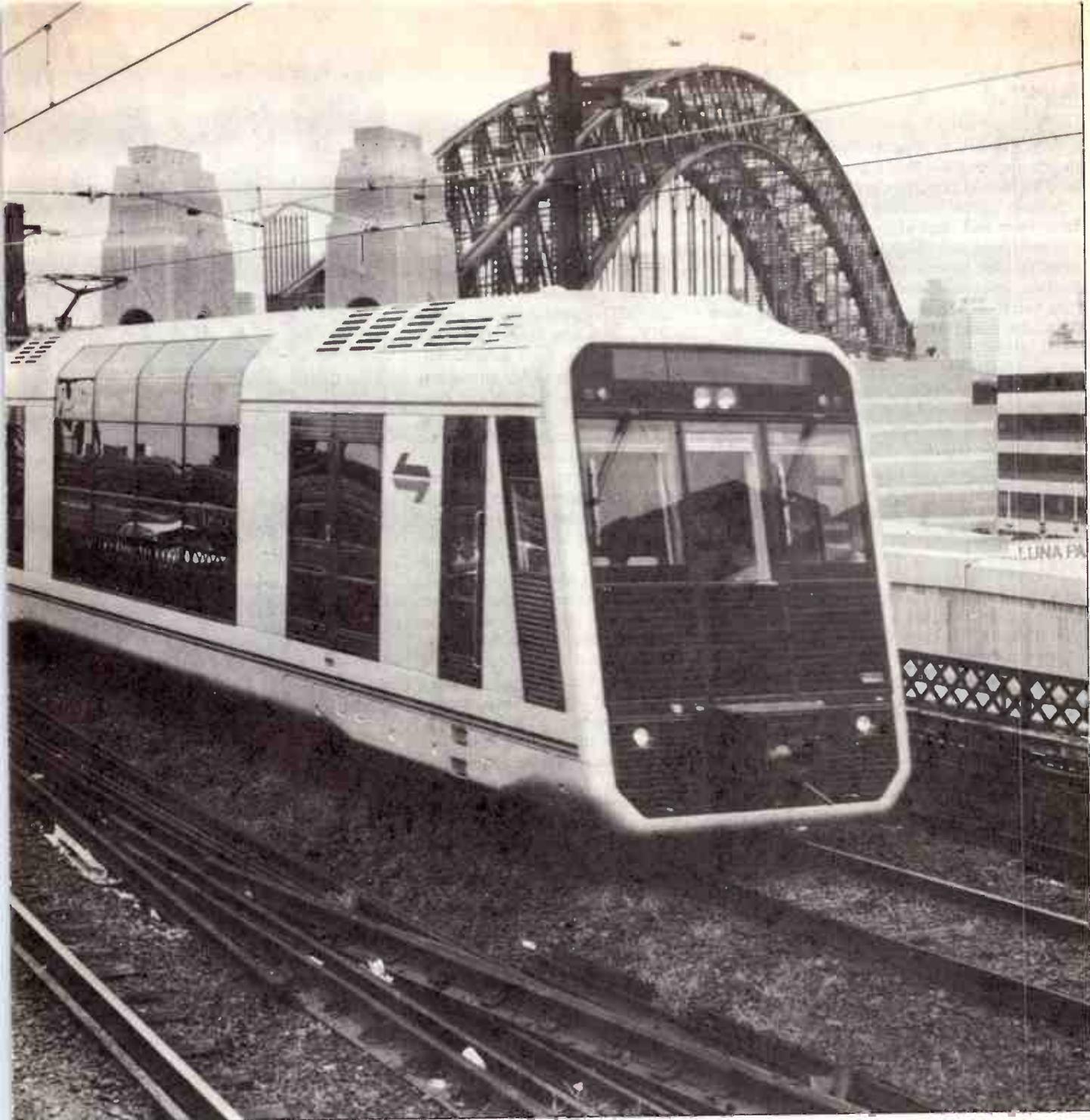
Simon O'Brien



One of the many promises of the Wran Labor Government back in the heady days of the late 1970s was to improve public transport. It was a policy that resulted in a number of measures, not the least of which was a search for a more up to date metropolitan train system for Sydney.

Now, at last, the commuting public will see one of the fruits of those half-forgotten promises. The new Tangara trains are all set to enter services and should offer passengers new levels of comfort as well as decreased trip time.

One of the essentials of the new system was that it had to be new in every respect



not only in terms of technology but also in appearance. Tenders were called and the contract for the design of the train was awarded to the British firm of DCA which, among other things, is closely involved with the Channel tunnel project. The prize contract for building the carriages themselves was awarded to Gonians of Newcastle. For the first time in the State's history the contract was for a complete system of 450 carriages rather than occasional trucks introduced after a long period of time. The total cost, it is thought, will eventually reach six hundred million dollars. The electronic systems which are intended to be the most up to

date available emanate chiefly from Mitsubishi which has had a great deal of experience in this area.

Configuration

One of the first features which makes the Tangara unique is the configuration of each train. The basic unit consists of four carriages consisting of two married pairs, a control trailer car, motor car, motor car and controlled trailer car. The idea of placing the motor car behind the trailer is to ensure that the motor car has optimum adhesion on the rail during powering and electric braking. The trailer car is intended to provide a degree of track conditioning

for the following vehicle.

DCS was largely responsible for the chisel shaped appearance of the train and the huge windows which make the Tangara such an interesting design. Another unusual feature is the shrouding which fits around the bogies of the Tangara. Apart from improving the appearance of the train the tin skirts help suppress the incredible amount of noise so often associated with urban railways. Other singular design features of Tangara are the doors which fit flush with the body of the train. Opening of the doors is both automatic and manual. Passengers will be able to open the doors by simply using the handle

Tangara

but they will get no reaction unless the train is going less than five kilometres per hour. This should hopefully put an end to the present system whereby train doors seem to open and close at random regardless of the speed and which has in the past resulted in some hideous accidents.

Another innovation with a direct bearing on safety is the automatic couplings between the trains. From now on the mechanical, electrical and pneumatic connections will be made automatically. This avoids the need for railway employees to couple the trains by hand, yet another aspect of railway life which resulted in some appalling injuries. These couplers were designed in Germany by the Schakau-Voith Scharfenberg company and reflects the international nature of much of Tangara's technology.

Electrics

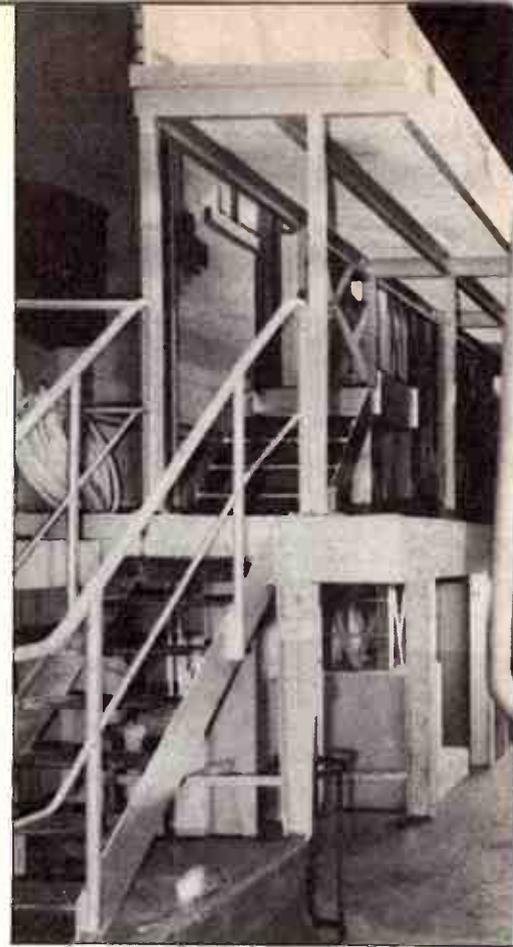
Mitsubishi, which was commissioned to provide and develop the electric systems on the Tangara has been involved in the electric train business since 1905 when the company built Japan's first electric locomotive. The three basic electrical sections of the Tangara consist of the TMS the Train Management System, the Choppers and the Static Inverter. All of these devices have been used before on overseas trains but the Tangara is the first to combine all three systems here in Australia.

The Choppers provide the traction sys-

tem of the Tangara. They consist of the four quadrant high-frequency type and have been used on the Teito private rail system in Tokyo. The choppers take the 1,5 kV dc from the power lines and feed the Clyde traction motors. Choppers have been known since the 1960s but their efficiency has been increased by the appearance of the GTO thyristor, in particular the 4500 PIV, 2000 amp type. The GTO thyristors eliminate the need for commutating capacitors and auxiliary thyristors. The very low minimum value of the conduction ratio allows for higher operating speeds than those attainable with previous equipment. This also removes the need for a main smoothing reactor. Since the maximum gate turn-off current is not effected by line voltage. The motor current need not be reduced when line voltage is low. Good acceleration can thus be maintained over a wide range of line voltages. Previously the traction system relied on the stepped resistance control which was markedly more inefficient than the GTOs. The GTOs are cooled by convection in a Freon-filled tank. This system eliminates the need for fans or other kinds of expensive cooling equipment.

The reference to the four quadrants relates to the functions of forward motoring, forward braking, backward motoring, backward braking all of which are performed by the Mitsubishi choppers.

The advantages of using choppers in-



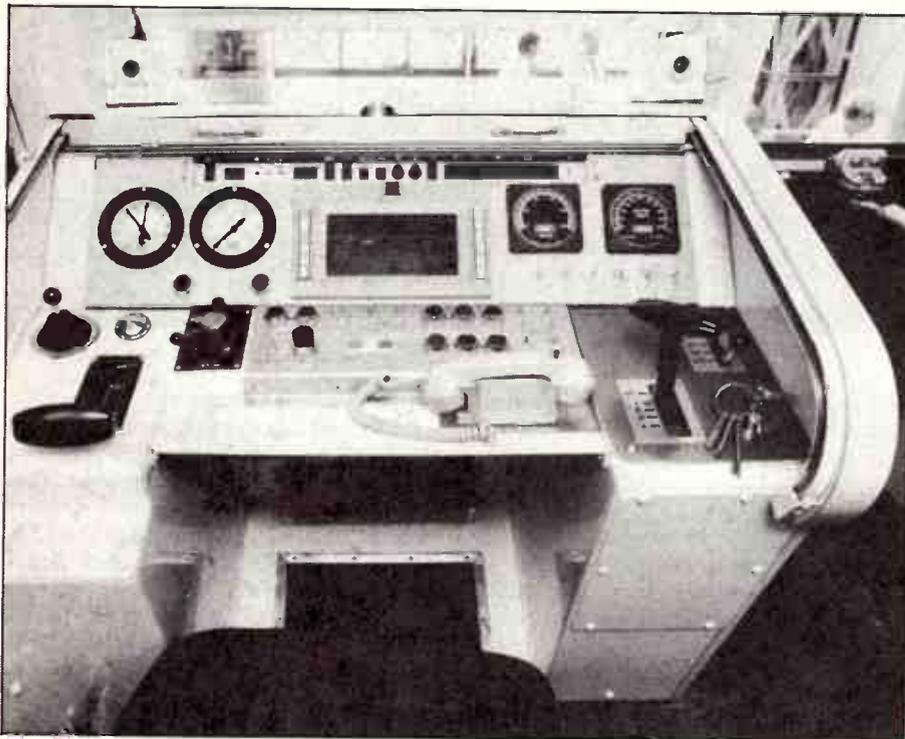
stead of the old stepped resistance control are quite varied. It is estimated that there will be power savings of 29 percent, and lower fault currents due to filter inductance. There will also be an elimination of motor switching transients, local handling of train faults, and a reduction of feeder circuit breaker openings to a lower level if all the fleet is fitted with choppers.

However it won't all be plain sailing. There is a possibility of unfortunate side effects from the chopping frequency and its harmonics on equipment mounted at, or adjacent to, the lines. It is thought that these side effects might range from direct interference with audio-frequency track circuit equipment which share the rails with traction return currents, to noise induced in lineside communications cables and electromagnetic interference to radio services in the nearby area.

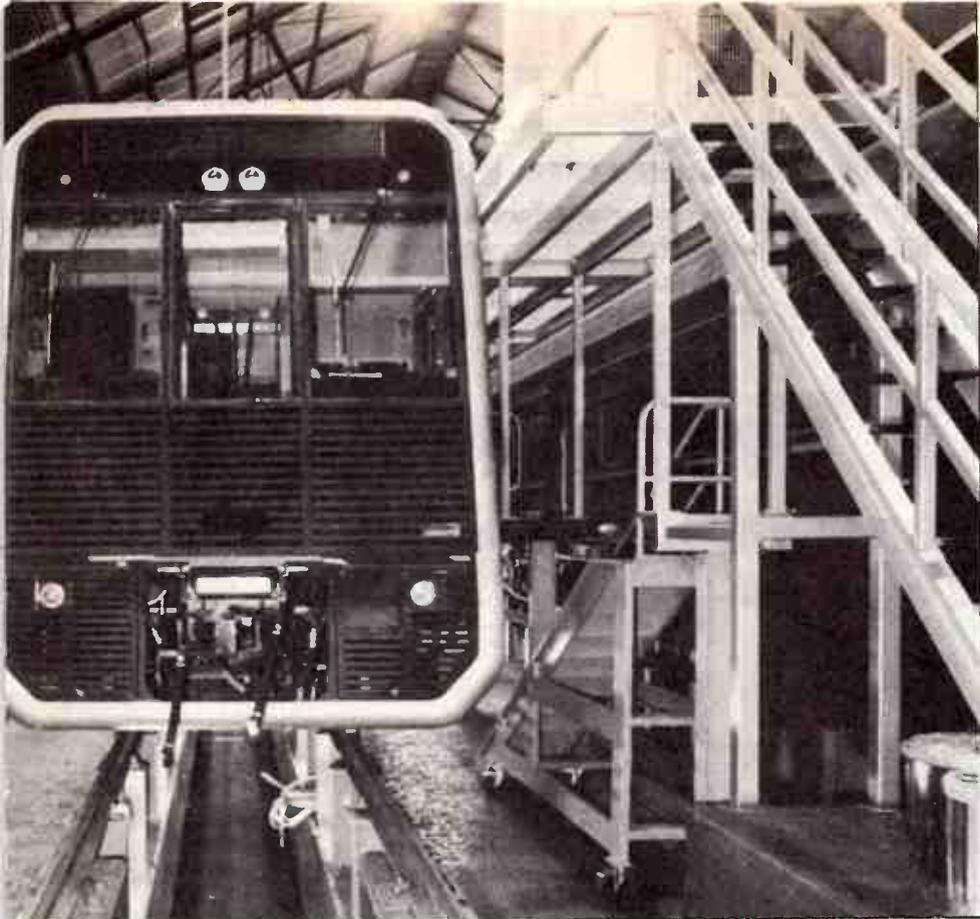
Fortunately these problems have been examined overseas and some answers have emerged. Carefully designed chopper equipment should eliminate most forms of interference. The most difficult area, in terms of safety at least, is the question of track circuit interference at audio frequencies. This can be overcome by selecting chopper frequencies whose harmonics do not appear at significant signal levels within the receiver passbands of the track circuits.

The TMS

If the choppers are one of the more inter-



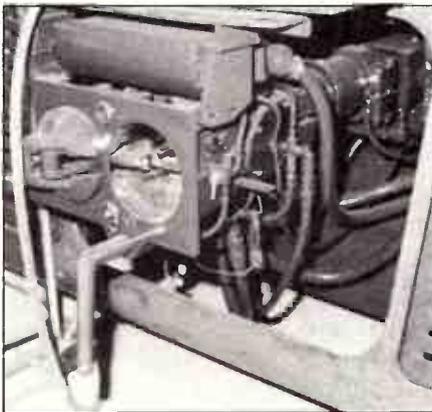
A super-modern driver's console will warn the operator of almost any unforeseen trouble — taking the hitherto guesswork out of train safety. The console complete with TMS screen offering suggested remedies and even a complete shut-down in case of serious malfunction.



The clean lines of the Tangara are shown as it leaves the SRA workshops to take commuters into the 21st century.

esting features of the Tangara trains the actual component which most pleases the SRA is the Train Management System, again designed by Mitsubishi who also wrote the software. The pcbs however were designed by Morris Productions and Printronics. The TMS uses two train wires which closely monitor the train's performance and other features. The information is conveyed in the form of a digitalised code with a unique code for each type of message. At the heart of the system is a 16 bit microprocessor.

From the driver's point of view the TMS appears as a touch screen (which was supplied by the Adelaide firm Teknis) which instantly informs him of any fault in the train, be it an unauthorised entry into another driver's cabin or a major fault in one of the choppers freeon tanks. Aside from informing the driver of any problem the TMS also suggests course of action such as whether the train should continue in service or otherwise. If the fault is particularly serious it recommends that the driver contact the HQ of the SRA's technical trouble shooters. The TMS also allows the driver to isolate any particular fault before it becomes a major problem. As one might have expected this system is proving very popular among the SRA's drivers who were formerly required to guess the state of their trains unless some observant individual had the kindness to inform them.



Automatic mechanical, electrical and pneumatic couplers, designed in Germany, avoid the need for SRA personnel to hand couple while standing between vehicles.



Brake shoes temporarily litter the floor of the passenger compartment while SRA personnel put the finishing touches to the interior.

The TMS also handles such functions as the internal public address system of the Tangara and the locking of the doors. The internal address system is intended to work both ways, the guard, or driver is able to talk to the passengers and they are able to talk to the staff. This, it is hoped, will add greatly to the security of the train though the opportunities for harrassment of guards and drivers by this means seem limitless.

The Static Inverter

The auxilliary power supply aboard the Tangara is provided by a static inverter. this device was originally designed by Toshiba and will replace the existing motor alternator set together with the noise and vibration which came with that system. It is also hoped that the use of the static inverter will involve less maintenance costs than the alternator. As with the choppers the inverter uses GTOs and microprocessor solid state electronics which convert the 15 kVdc overhead supply to a 415 volt 3 phase ac full sinewave output. The inverter is used to provide power for on-board equipment such as air conditioning (a vital necessity on a train with such big windows as the Tangara), battery charging and control circuits.

Finally there is the braking system, one of the most essential components on any public transport system. The brakes on the Tangara use the Clyde traction motors as electric generators. The power reduced in slowing down the vehicle is either returned to the overhead system where it is employed for use on other trains in the area or dissipated by the various resistors. The SRA claims that the electric breaking provides 'a smooth jerk-free retardation' which presumably means that passengers will no longer be thrown off their feet every time the train stops as is the case at present.

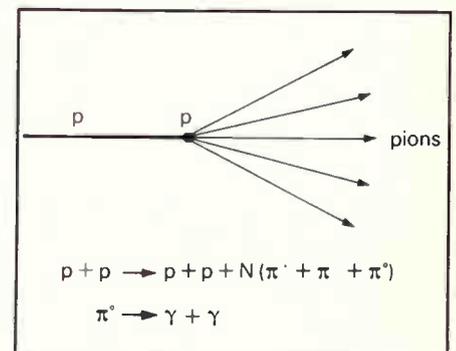
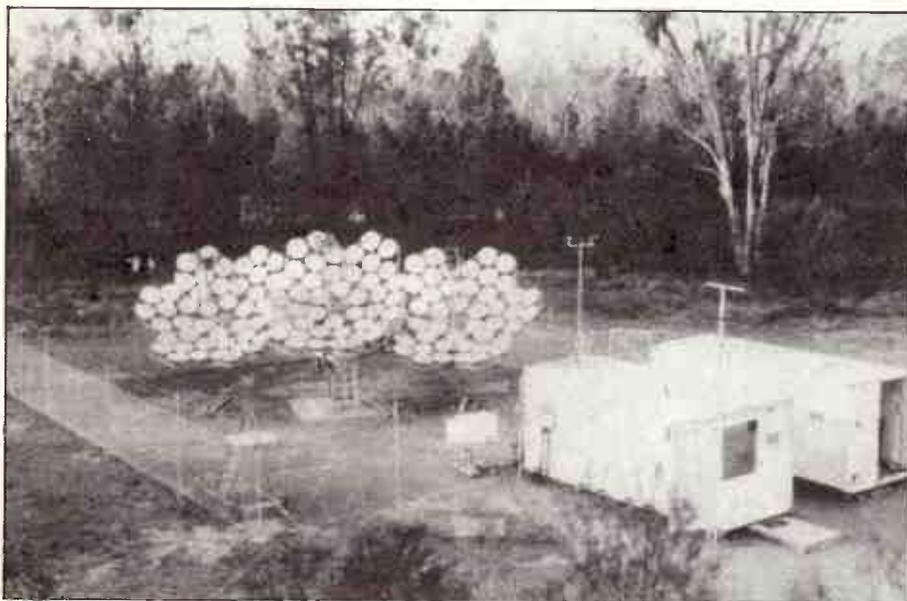
Once again a big plus for the electric braking system is the need for less maintenance. the brakes are fitted with a microprocessor controlled, anti-locking device which monitors each individual axle and reduces the brake force on any axle where wheel slide is detected thus preventing wheel lock-up.

With all the technology and money that has been poured into the Tangara project the central issue now arising is will it be a success? Early indications are quite hopeful, apart from a few small bugs (one of which concerns the electronic display system on the front of the train) the new train seems to be integrating quite smoothly. ●

Earth's atmosphere is continuously being bombarded by high energy particles from outer space called cosmic rays. They were discovered over 75 years ago but direct evidence of their origin has only recently become possible through the study of very high energy gamma ray astronomy. Detectors in New South Wales and at the South Pole aim to settle the long-standing question of how and where they are produced.

SEEKING THE ORIGIN OF COSMIC RAYS

Alan Watson



When a proton (p) with high enough energy strikes another proton a large number of unstable particles called pions are created. Pions with no charge (π^0) are also formed and they decay very rapidly to form two gamma rays, which are very energetic photons.

The Durham University very high energy gamma-ray telescope which recently began operating in Narrabri, in NSW.

While you lie in bed at night over one million charged particles pass through your body. We are biologically adapted to them, so they have an insignificant effect on your well-being. These particles, mainly fast moving electrons and muons (unstable and less familiar particles), are the remnants of a cascade of similar ones created high in the atmosphere by incoming cosmic rays.

Cosmic rays are the nuclei of atoms which have been accelerated to high energies within our Galaxy and elsewhere in the universe. Since their discovery over 75 years ago such rays have fascinated astrophysicists: their energy density is the same as that of starlight and the rarest particles have energies of more than 10 Joules, the kinetic energy of a tennis ball moving at 60 miles/hour.

Cosmic Rays

Cosmic rays are significant in other fields, too. They are a form of background radiation which limits the sensitivity of certain archaeological dating techniques and are a significant nuisance to designers of computer memories for space applications and to astronomers using the latest charge-controlled devices, known as CCDs, for stellar imaging. All ionizing radiations, especially cosmic rays, give rise to biological transitions: during the *Apollo 13* lunar flight the astronauts reported flashes of light in their eyes caused either by cosmic rays exciting the cells in the retina or by the direct production of light by the particles traversing the vitreous humour of the eyeball.

It has proved very hard to discover the source or origin of cosmic rays although

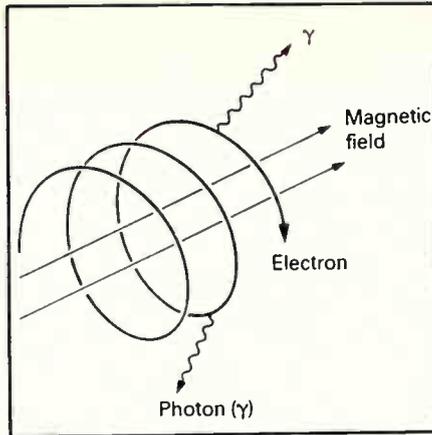
measurements of increasing refinement have been made over the years. We know, for example, that about one per cent of the particles are electrons and we have an accurate knowledge of the abundances of protons, helium and uranium nuclei. Isotopic analysis has also proved possible at certain energies. But this information has not been enough to solve the riddle of cosmic ray origin: the real difficulty is that the Galaxy — the system of 100 billion stars of which the Sun is one — is threaded by a weak magnetic field which bends and twists the paths of the charged cosmic rays. The magnetic field is so extensive and turbulent that it excludes all possibility of tracing the source of a particular particle by following it back along its trajectory. The cosmic ray astronomer is always working under cloudy skies!

Traces of Origin

Unlike charged cosmic rays, electromagnetic radiations travel in straight lines. Hot gas in stars emits photons in the optical part of the electromagnetic spectrum and in the X-ray and infra-red bands as well. But thermal radiation is not the only process which generates photons: many of the objects which are detectable at radio wavelengths, radiate by a process known as synchrotron emission in which an electron, accelerated as it spirals in a magnetic field, transfers some of its energy to a radio photon. In stronger magnetic fields higher energy electrons produce photons of much shorter wavelengths: for example in the *Crab* nebula a great deal of the optical emission comes from electrons of about 10^{11} eV, (electron-volts; this level is comparable with the highest electron energies achieved in a man-made accelerator) spiralling in magnetic fields some hundred times greater than are found in galaxies. So, if electrons can be accelerated to 10^{11} eV, it is conceivable that protons and other nuclei might be accelerated to a similar energy.

Protons do not give rise to synchrotron radiation because they are too heavy, but there is another route by which they can produce photons. This is shown, following the synchrotron process, in the second diagram. When a photon of sufficiently high energy strikes another proton a large number of unstable particles called pions are created. The cloud chamber picture shows the charged pions that are produced. Pions with no charge are also formed and decay very rapidly to form two gamma rays, which are very energetic photons. Detecting them from discrete sources would provide strong evidence for the acceleration site of protons to the energies characteristic of cosmic rays. The protons are not destroyed in the pion-producing processes and, indeed, it is unlikely that all of those accelerated will interact, so gamma ray observations should be able to trace the site of cosmic ray acceleration quite accurately.

To produce gamma rays of energy E requires protons of energy several times larger than E . To study cosmic ray origin at about 10^{13} eV we need to observe gamma rays of 10^{12} eV or so. Using the known flux of protons at Earth and making assumptions about the density of gas in possible source regions, we can estimate the flux of gamma rays that may be expected. This flux estimate turns out to be very small: at 10^{11} eV it is about 30 per square metre per year! Because a typical satellite cannot carry more than a few square metres of detector, it is impractical to observe such gamma rays from space. Fortunately at these energies the Earth's atmosphere, so often a deterrent to astronomy at other than optical wave-



Production of high energy gamma rays by synchrotron radiation.

lengths, actually helps to make detection of these rare, energetic gamma rays possible.

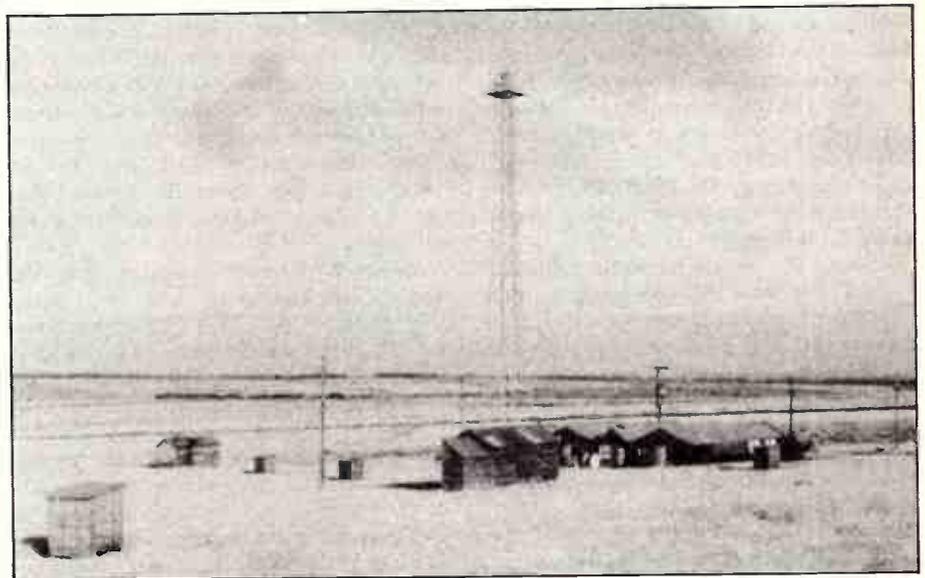
Detecting Cosmic Gamma Rays

When a photon of energy greater than about 1 MeV (twice the mass of an electron) passes through matter it can materialize to form a pair of electrons. This process can take place in the atmosphere and, if the gamma ray energy is high enough, the electrons themselves can make further gamma rays (in a process known as bremsstrahlung). The electrons do not disappear and, if the secondary gamma rays are energetic enough, a further generation of electrons is born which creates more gamma rays. The number of electrons and gamma rays multiplies rapidly and a cascade of electrons and photons is produced. This is sometimes called an extensive air shower. Now, when a charged particle tries to move through any medium at a

speed greater than the velocity of light in that medium, light is produced by the Cerenkov effect, the electromagnetic analogue of the acoustic shock wave produced when an aeroplane flies faster than the speed of sound. The particles in the extensive air shower are so numerous that a flash of Cerenkov light is produced, lasting only about 10 billionths of a second, bright enough to be detected by relatively simple combinations of searchlight mirrors and photomultipliers placed at ground level.

One of the most successful groups in this field is that led by Dr Ted Turver of the University of Durham in England. One of the mirror systems the group has used to observe potential sources of high energy gamma rays is shown in the first photograph. The Cerenkov light photons are produced at a small angle, (about one degree) to the direction of the incoming gamma ray so that, in effect, it produces a pool of light of radius roughly 100 metres at the observation level. Hence a mirror system only a few square metres in surface area behaves as a detector with an area some 10^4 times larger. The rate of detection of gamma ray photons becomes good enough for significant signals to be obtained in only a few tens of hours of observation. Observation periods, however, are restricted to clear moonless nights and the number of sources that have yet been studied in detail is rather small. Britain is, of course, a far from ideal place to make such observations, so the Durham group have had to operate their telescope in the Dugway Desert, Utah, and more recently at Narrabri, in NSW. Similar telescopes are operated in Arizona, Hawaii, the Crimea, India and South Africa.

About 10 objects are now known to emit gamma rays at 10^{12} : among these



The detectors near the centre of the Haverah Park shower array in England. The scintillators are housed in small wooden huts around the central laboratory building. (Photo by Mark Lawrence, Leeds University.)

Cosmic Rays

there are one radio galaxy (*Cen A*) and two isolated pulsars (the *Crab* and *Vela*) while the rest are examples of a class of object known as X-ray binaries, such as *Her X-1* and *Vela X-1*. The isolated pulsars are thought to be rotating neutron stars which are also found in X-ray binary systems. All of these (except *Cen A*) show characteristic periods which help to make their identification more certain, but can we be *sure* that the gamma rays produced by these sources are indeed gamma rays which arise from neutral pion decay? Unfortunately the answer is no. In addition to synchrotron radiation another process involving electrons gives rise to gamma rays in the electromagnetic fields about a neutron star: this is called curvature radiation and arises when a high energy electron moves along a curved magnetic field line. In the case of the *Crab* pulsar the Astronomer Royal, Professor Sir Graham Smith, has shown that the pulsed optical and gamma radiation from this process could explain many observational features so that the discovery of TeV gamma ray emission from this source does not firmly establish it is an emitter of cosmic ray protons.

Cygnus X-3 Cosmic Ray Origin

Among the TeV gamma ray sources is *Cygnus X-3*, one of the most remarkable objects in our Galaxy. It is believed to be a binary system in which a neutron star and another star, perhaps a main sequence star of about one solar mass, co-rotate. Dust clouds lying between the object and Earth prevent detection by optical telescopes but it is known to radiate across band to ultra high energy gamma rays. The source lies about 400,000 light years from Earth and is the most powerful Galactic X-ray source. Moreover, its radio emission occasionally increases some thousand-fold. During some of these outbursts the Jodrell Bank group at Manchester University have used their interlinked radio telescope array, MERLIN, to show that the radio emitting material is ejected in the form of two jets.

Possibly the most remarkable feature of *Cygnus X-3*, and the one which is most important in regard to the origin of cosmic rays, is that it is a source of gamma rays of about 10^{15} eV. Such gamma rays are over one thousand times less common than those of 10^{12} eV so that the Cerenkov light/mirror technique, because of its small on-time, becomes ineffective. Nevertheless, at that energy there are so many particles in the extensive air shower that considerable numbers, about 10^{15} , survive down to sea level and are readily observable with particle detectors such as scintillation counters. The particles move at the



Cloud-chamber photograph showing the interaction of a proton of about 50 GeV energy with a nucleus of argon. The thin tracks leaving the point of interaction are charged pions and the shorter, thicker tracks are fragments of the argon nucleus. The photograph was taken in the 1950s by Dr G R Evans from Edinburgh University using a cloud chamber (at 80 atmospheres) on top of Mount Marmolada in the Dolomites, northern Italy.

velocity of light, in a disk only a few metres thick and about 100 metres in diameter, along the direction of the incoming gamma ray. The direction of the gamma ray can be found within about one degree from the relative arrival times of the disk at detectors spaced a few tens of metres apart. Using this technique a group at Kiel University showed, in 1983, that *Cygnus X-3*, emits gamma rays of about 10^{15} eV. This completely unexpected discovery was confirmed at Leeds University, who used part of the giant (12 km^2) detector at Haverah Park, near Leeds, to show that for the years 1979-83 *Cygnus X-3* did emit gamma rays above 10^{15} eV and that the spectrum of emission terminates above 10^{16} eV.

While it is quite possible that the gamma rays seen at 10^{12} eV from *Cygnus X-3* could arise through synchrotron emission or from curvature radiation, it is most improbable that gamma rays of 10^{16} eV do so too. The point is that such gamma rays could be produced only in a region where the magnetic field is exceptionally strong; the rays would then almost immediately convert their energy into an electron-positron pair through interaction with the magnetic field in which they were produced. Although this process has never been observed in the laboratory, the underlying theory is so firmly based that account

must be taken of it when developing models of how the gamma rays are produced in the source. Some other process must be found to explain the existence of the most energetic photons: the one proposed is the decay of neutral pions. It is supposed that, in the environment of the neutron star, protons can be accelerated to 10^{17} eV and that these protons collide with gas surrounding the binary system to produce sprays of unstable particles in a way that is familiar from lower energy accelerator work. The protons interact far enough from the neutron star for the gamma rays from neutral pion decay to escape freely from the source and travel, relatively unimpeded, through intersellar space to produce the extensive air showers detected at ground level on Earth.

Theoretical work at Leeds has shown that the spectrum of gamma rays from 10^{12} to 10^{16} eV can be explained in this way. While it is far from clear how the accelerator within the binary system operates to produce protons of 10^{17} eV, it is apparent that it is so powerful that *Cygnus X-3* must be a major source of high energy cosmic rays within our Galaxy. Observations show that it radiates nearly 2×10^{30} watts in gamma rays above 10^{15} eV, so some 30 times more energy must be emitted in the form of charged particles; at last a source of high energy cosmic rays may have been discovered.

The establishment of *Cygnus X-3* as a source of ultra high energy gamma rays and so, very probably, of cosmic rays has radically altered views about cosmic ray origin and about the electrodynamics of X-ray binary systems. Only one other source, *Vela X-1*, has so far been observed to emit at 10^{12} and 10^{15} eV but it is expected that others will be found. To this end several groups around the world have built and are operating extensive air shower arrays with greatly improved instrumentation.

A team from the Universities of Leeds in the UK and Delaware in the US has built an extensive air shower array at the US Amundsen-Scott base at the South Pole. It is a unique place for such observations: the high altitude of the site allows gamma rays of lower energy than are detectable at sea level to be observed, while its position on the Earth's rotation axis permits continuous monitoring of all candidate sources. However, one of the candidate objects which will be studied with this array is probably not an X-ray binary system, but the new supernovae *SN1987a* which may be a source of ultra high energy gamma rays and so of cosmic rays. The future of gamma ray astronomy looks very exciting. ●

Professor Watson is with the Department of Physics, University of Leeds

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SOUND INSIGHTS

AUSTRALIA'S HIGHEST CIRCULATING HI-FI MAGAZINE

THE INTERNATIONAL AUDIO-VIDEO FAIR

SPONSORED BY



F M 9 2

S T E R E O

Before you it's best to get

Never before in the history of high fidelity sound has a range of hi-fi equipment received such rave reviews from the world's experts.

NAD, standing for New Acoustic Dimension, is a European company which set the entire hi-fi world on its ear by providing the previously unheard of. Superlative quality sound at a ridiculously low price.

We're not just talking about superior sound performance to competitors in NAD's price bracket, we're talking about superior performance to competitors at any price.

As you can imagine, this really put the woofers amongst the tweeters.

Just how much it did, you can judge from the following:

"Nothing gives us more enjoyment than that rare event of finding a product to rave over and the cheaper the product the bigger the thrill. So when something (like this NAD) comes along that is both ridiculously cheap and ridiculously good, we tend to get rather ridiculous."

HI FI ANSWERS-(U.K.)

"What makes this receiver congenial to knob-shy listeners is that fact that it hides

its sophistication behind a facade of rare simplicity. In welcome contrast to gaudy models speckled with flashing lights that make them seem like refugees from a penny arcade, NAD opts for visual reticence. In terms of audio styling, this is Saville Row. Front panels are dark, matte and muted. Controls are happily kept to an unconfusing minimum but amply serve all normal needs."

NEW YORK TIMES-(U.S.A.)

"All in all, this new NAD compact disc player is an obvious sonic winner. As a further bonus, its front panel controls are a pleasure to use, in contrast to (others, which are) baulky, frustrating and touch sensitive."

I.A.R. HOTLINE-(U.S.A.)

"Clearly the tuner is far above average: indeed there is no other we know of that can match its overall measured performance"

STEREO REVIEW-(U.S.A.)

"The NAD 6220 is a new cassette deck on the market and is yet another example of (NAD) putting all of their effort and most of their budget into producing a machine with excellent sound quality performance rather than offering lots of

buy a hi-fi a few quotes.

extra facilities. It is this very excellence of sound quality at a low price that gains this player the winner's prize in the budget category this year (1986)"

WHAT HI FI-(U.K.)

"If you believe that I'm impressed with NAD equipment you're right. In some 25 years of audio experience I have rarely encountered such fine sounding equipment at such realistic prices"

SUNDAY TELEGRAPH-(AUSTRALIA)

"...the NAD 5120 (turntable) stands out for me as the most interesting to listen to. Quite simply it allows you to hear more of the music than any of the other three, (Sansui, Harman/Kardon or B&O)"

POPULAR HI FI-(U.K.)

"In fact, the NAD units had such a good measured performance that no product (of the five) in this group could manage significantly better, which is astonishing (since all were double or triple the price and very highly regarded). It is directly due to the ability of their London based designer Bjorn-Erik Edvardson. As a comparative guide, I have never tested a Japanese amplifier that could match the NAD in this sort of detail!"

NEW HI FI SOUNDS-(U.K.)

"In the case of the NAD 3020, we're dealing with an inexpensive, modest integrated amplifier. Don't let that fool you. It is capable of real-world performance far in excess of what its specifications indicate and cannot be judged by the same standards as other equipment in its price or power class. Quite simply, it's one of the best buys in audio"

STEREO/HI FI EQUIPMENT-(U.S.A.)

Now you've read what the hi-fi critics had to say. (Although you couldn't say they found much to criticise.)

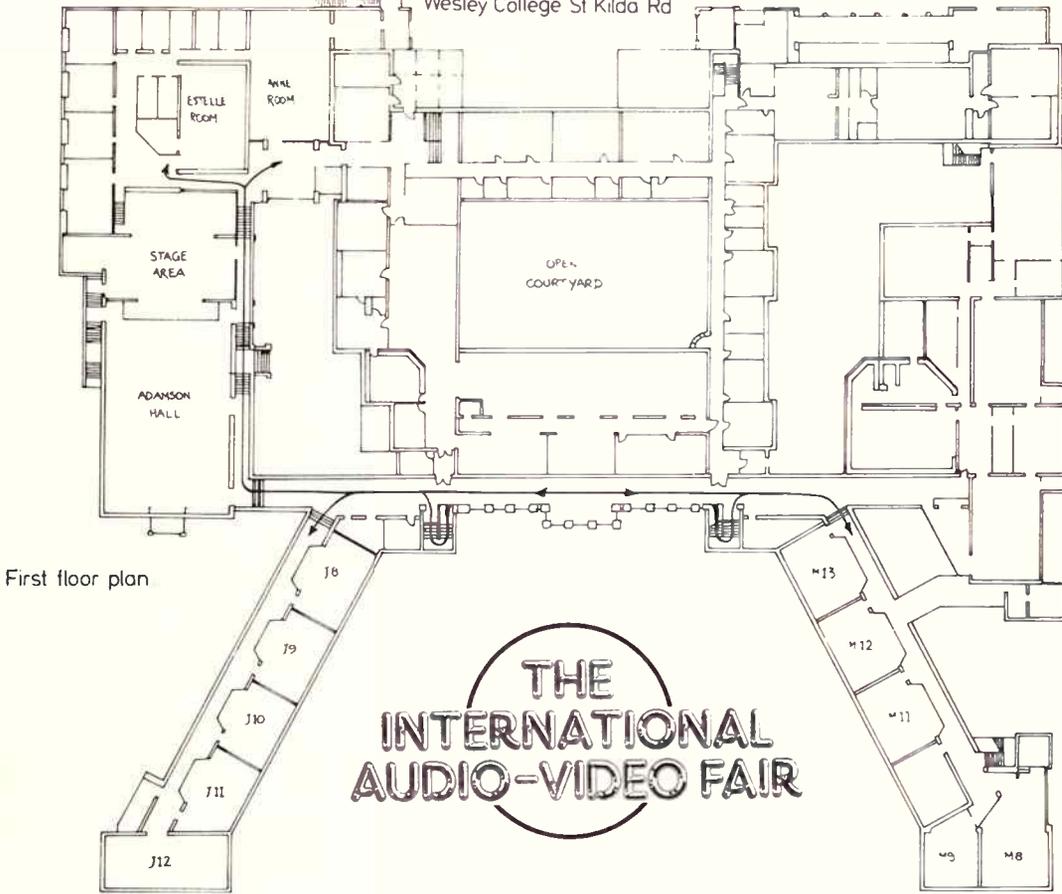
However, if you can hardly believe your eyes at what you've just read, you are cordially invited to visit the specialist NAD dealer near you or phone (02)597 1111 for further information.

We're confident you won't have any trouble believing your ears.



"Ridiculously good.
Ridiculously cheap."

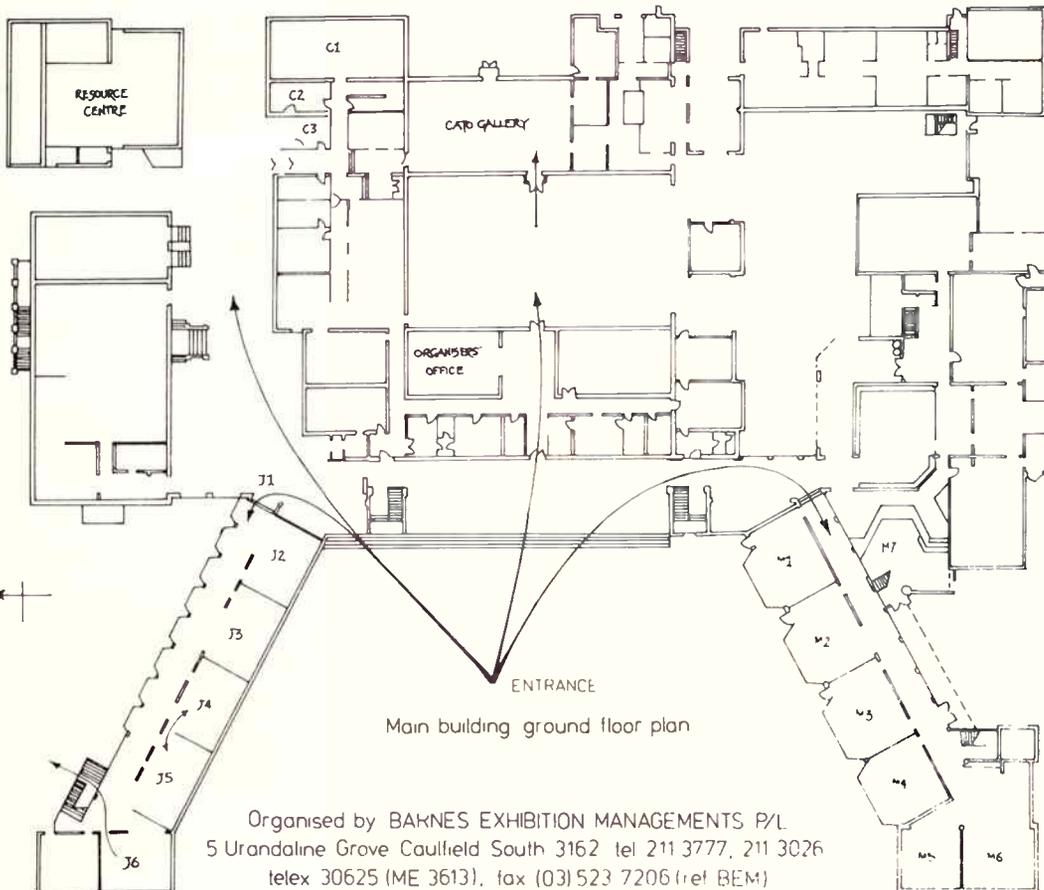
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First floor plan

Opening Times:
Thursday June 30:
 12 noon-10 pm
Friday July 1:
 11 am-10 pm
Saturday July 2:
 10 am-10 pm
Sunday July 3:
 10 am-7 pm

EXHIBITORS	STAND
Atsui	M11
AWA	M12
Convoy	
International	J3
Encel Stereo	Anne Room
Exciting Lighting & Sound	M4
Falk	
Electrosound	M5, M6
Grundig	J9
Haco	M7
Hi-Phon	
Distributors	J5
Kenwood	2A
Marantz	J8
Pioneer	Cato Gallery
Oz-Fi/Richter	
Acoustics	M8, M9
Rookian	
Trading	J6
Scan Audio	M13
Symphonia	J2
Vacuum Tube	Estelle Room
Logic	Estelle Room
Whatmough	Monitors Room
Yamaha	M1



Main building ground floor plan

FAIR PROGRAMME
 CLTV Show presented by Pioneer: Friday July 1, 7.30 pm
 Live Concert presented by Yamaha: Saturday July 2, 7.30 pm
 Hi-Fi Seminar featuring John Dunlavy of Duntech Speakers and Les Cardilini, a regular contributor to ETI: Sunday July 3, 2 pm-4 pm.
 Laser Show by Laser Magic Production Shows: twice daily.
 Also on display are Bob Jane's Nascars.
 All events (excluding Nascars) are on in the Adamson Hall theatre and admission is free.

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Sight and Sound News



Proton Components

The new US-made Proton 200 Series component system consists of an AM/FM stereo

tuner, integrated amplifier and cassette deck.

The AM-200 20 watt per channel integrated amplifier features a bass eq switch to compensate for possible reduced bass from small speakers. It also has adjustable phono capacitance for MM (moving magnet) cartridges. A loudness compensation circuit boosts high and low frequency response at low volume levels.

Frequency response is 20 Hz to 20 kHz, +/-0.2 dB; thd is 0.015%; and SNR is 102 dB (tape play, A-weighted). RRP is \$399.

The AT-200 digital tuner features automatic signal search, 12 station presets and LED signal strength indicator. Specs for the tuner are usable sensitivity of 1.8 mV; thd at 65 dBf

of 0.2% and SNR of 83 dB/74 dB (mono/stereo) at 65 dBf. Stereo separation at 1 kHz is 45 dB. For the AM section, usable sensitivity is 25 mV; AM selectivity is rated at 35 dB +/-10 kHz; and IF rejection is 45 dB. SNR is 45 dB at 10 mV. The AT-200's RRP is \$379.

The cassette deck, the AD-200, with Dolby B and C is rated at 40 Hz to 15 kHz frequency response, +/-3 dB; 0.08% Wrms wow and flutter; and line input sensitivity of 80 mV. SNRs for normal/Cr02/-metal tapes are 58 dB/60 dB/62 dB (Dolby B). For normal tape the thd is less than 1.2% and crosstalk measures 40 dB. RRP is \$349.

READER INFO No. 219

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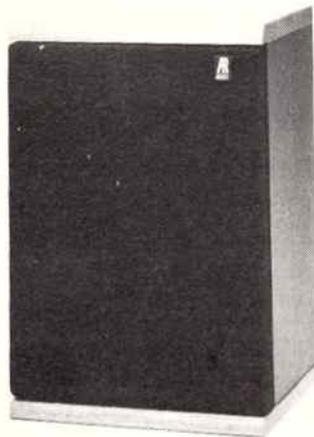
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Active and Passive Speakers

AR has released two new bookshelf speakers, the passive TSW 105 and the TSW 115P.

The TSW 105 uses a 4-inch

woofer of filled polypropylene cone, acoustic suspension shielded; and a 3/4-inch titanium dome, liquid-cooled shielded

tweeter with Tetra-helix mounting plate and acoustic lens.

Frequency response is quoted at 80 Hz to 40 kHz and sensitivity at 87 dB SPL with 2.83 Wrms at 1 metre. Cabinets are American walnut or oak with black vinyl veneer and a black cloth grille.

The 115P active speaker uses the same woofer with electronic bass extension equalisation. The tweeter is the same as for the 105. The speaker is capable of delivering peak sound pressure levels of 105 dB at 1 metre.

The 115P's amplifier produces 16 watts per channel with less than 1% thd, and 50 Hz to 20 kHz frequently response. SNR is quoted as better than 90 dB.

Loudspeaker controls are a power ON/OFF and rotary volume controls.

RRP for the 105 is \$499; for the 115P is \$699.

READER INFO No. 220

A No-bull Speaker

Local Sydney speaker-maker Brad Serhan, who trades under the Orpheus label, has released a new \$1200 speaker. Serhan has named it after the legendary Minotaur, half bull, half human to suggest strength in construction and a sensitivity in sound.

The Minotaur uses the typical Orpheus cabinet construction paying special attention to panel and structural resonances. Tar-pads are fixed to the cabinet and bracing is used to strengthen panels.

Other components in the two-way bass reflex system are the 8-inch (200 mm) bass/mid-range driver with extra large magnet system and polypropylene cone, and the 1-inch (25 mm) metal dome tweeter with aluminium diaphragm. The bass/midrange driver uses

aluminium voice coil formers with copper wire. It is fitted with a special progressive spider to restrict the voice coil amplitude in case of excessive power overload. The tweeter has a soft polamide surround and a voice coil immersed in magnetic oil (ferrofluid).

Manufacturer's specs for the Minotaur are 56 Hz to 20 kHz ± 3 dB frequency response, 86 dB/1 watt at 1 metre sensitivity, 6 ohm nominal impedance and 20 watt to 100 watt power handling. Cabinets are made of 19mm high-density brimsboard, braced and damped with 10 mm tar-pads and finished in Queensland walnut, jarrah, American oak or walnut. Orpheus Speakers is at 7 Ainsworth St, Lilyfield, NSW 2040. (02) 569-9352.

READER INFO No. 221



Power Mic

An interesting series of microphones from Electro-Voice features a new 'supermagnet' made of neodymium alloy with a new structure allowing larger voice coil/diaphragm area. The result has been a markedly more powerful microphone whose increase in power means less power is required at the mixing desk.

EV claims better sensitivity, lower distortion than standard designs, less feedback and less

vulnerability to shock for the N/D Series.

The range of mics includes ones suitable for changing vocal styles, lead and background vocals, live or studio performances and for various instruments. Polar patterns are cardioid, supercardioid and hypercardioid.

Electro-Voice is at 59 Waratah St, Kirrawee, NSW. (02) 521-5322.

READER INFO No. 222

Intelligent Radio on the Move

A new broadcasting service has just begun operation in Britain, using existing signals on the VHF-FM band to transmit data to specially equipped "intelligent" receivers. The new Radio Data System (RDS) has been devised to enable the listener to find his way around the frequency spectrum, the receiver automatically tuning into the best signal or even finding a particular programme; all without the listener having to resort to tables of station frequencies. All the listener does is program the receiver with a set of codes.

The Radio Data System works by using a 57 kHz data subcarrier piggy-backed to the existing VHF-FM service. Using phase shift keying data is encoded onto the signal producing a stream of bits making up a code the receiver can recognise and respond to. For example, a code is transmitted identifying the station; others identify frequencies on which the programme is transmitted in adjacent areas, and another provides information

about other programmes and frequencies of nearby transmitters.

In its development, the first requirement of the system was that, like a TV set it should allow a receiver to display the name of a station or channel being received on rather than its frequency.

Instead of identification being a matter of calibration between dial and receiver, with RDS the station broadcasts a data signal that is displayed on the receiver. Furthermore, the system was designed to tune into the best transmission of the desired programme, something of a problem in Britain where the national broadcaster operates many transmitters with overlapping service areas.

Thus, once the listener has selected his program, the intelligent receiver with the help of the transmitted codes, will display the station identification, automatically search for a better signal if the programme fades and automatically search for the best transmission of another program if requested.

The system is particularly helpful to the mobile listener, but the BBC, which is responsible for implementing the system has ensured that all the services available with RDS are applicable to the stationary listener too. The system has room in the data stream for other applications and some of those mooted are a facility to search for a particular type of program, to record a particular programme, to adjust volume settings and to adjust to appropriate decoders, all triggered by the codes transmitted on the subcarrier.

Another obvious application is the use of RDS for a radiotext type transmission giving newflashes and sports results and designers have not overlooked the possibilities for the downloading of computer information. The equipment being implemented by the BBC adds a date/time clock.

The RDS system has been designed to be compatible with Europe's ARI system which similarly broadcasts traffic information. The signals do not

interfere with each other, however, the RDS system can accommodate traffic information services which may spell the end for ARI.

The new system is expected to boost sales in car audio equipment as new RDS-compatible receivers are required to take advantage of it. Pioneer has already released units in Europe and the BBC move to implement the system, albeit in a very skeletal way (covering the national networks in England only), should stimulate production and consumer interest.

Here in Australia, the Department of Communications is considering the implementation of the system. It is likely to have the same subcarrier and possibly another one. Unlike Britain, Australia has an extensive network of commercial stations. Many local stations presumably means a good deal of negotiation to get the system working maximally and efficiently.

READER INFO No. 223

The DS-77 audio/video surround processor from Sansui—crossing the final gulf to video sound realism

At home you can pop popcorn, dim the lights, settle back in a plush chair, even draw a velvet curtain across your video screen—but if you're expecting to hear the electrifying sound that fills first-run theatres, the element that makes films so riveting—FORGET IT!! Unless, of course, you've got the Sansui DS-77 with its revolutionary cinema surround. Cinema surround will make a storm so thunderous you'll run for cover, a bullet's whine so real you'll duck, the wash of surf so soothing you may doze off.

How does cinema surround do it?

By retrieving all the hidden 'ambience' for surround sound that almost all video soundtracks contain.

Six simple push-button controls allow this affordable achievement:—

Exclusive Cinema Surround—making home video a theatrical event.

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Stereo Hall—capture that elusive concert-hall realism.

Simulated Stereo—enjoy vintage masterpieces in stereo.

Exclusive Super Bass Synthesizer—for chest thumping lows.

Exclusive Peak Attacker—adds shattering sonic impact to your hearing. It can even take advantage of newer films 'dialogue channel', putting voices right on screen. Sansui Cinema Surround—for

compelling moviehouse sound right in your own home.

All this, plus our great 5 year warranty.

DS-77



CINEMA SURROUND



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READER INFO No. 16

Ramsa Rocks The Oz Rock

A new and interesting Audio Visual installation was recently completed at the Oz Rock Hotel (formerly the Kings Cross Hotel) in Sydney's Kings Cross.

The venue has been designed as a total entertainment complex with four floors of different facilities including bars, discos, an exclusive night club. On top of all this is an area in which visiting artists can conduct press conferences while

the general public can see and hear their favourite artist on the first two floors. These floors have various large screen projectors and TV monitors linked via video and audio feeds from the roof. They can also view video clips and even sports presentations.

The new venue caters for the entertainment industry by also providing office and promotional facilities.

The equipment chosen for

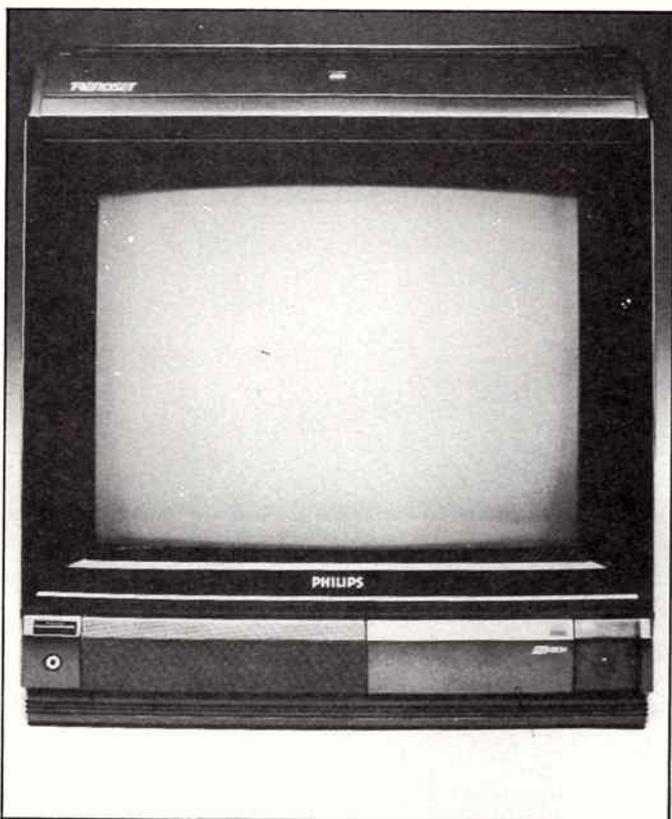
this ambitious complex is all from Panasonic, the audio being their Ramsa sound systems. The site is considered unique because of the integration of mixer, graphic equalisers, compact disc players, cassette decks, AM/FM tuners, microphones, pre-amplifiers and power amplifiers, loudspeakers, turntables, VCRs, cameras, TV monitors and video projectors.

Some idea of the scale of the

system is given by the fact that it uses 43 speaker boxes powered by 8.2 kilowatts.

All this equipment is operated from control centres designed by Freedman Sound which was responsible for the entire design and installation of the sound and video equipment.

READER INFO No. 224



Flat, portable and clever

Philips has released a portable 36 cm flat square tube (FSQ) remote control colour TV, the KH36746R, with all the functions of a larger set.

A built-in timer enables the set to switch itself on or off and the remote control can call up a digital clock onto the screen while a program is on.

The remote control sits neatly in the TV's cabinet, beside a foldable headphone set

with a three-metre cord for private listening. The controls are located behind a soft-eject panel. The set is equipped with RGB and video/audio IN/OUT connectors which allow a personal computer and high fi equipment to be attached. Housed in an anthracite cabinet, the KH3647R retails for \$779 RRP.

READER INFO No. 225

MIDI Effects

Rebel Audio, Sydney, is selling the new Digitech DSP-128 digital effects signal processor which is MIDI-controllable. Some of its range of effects are reverb, chorus, flange and delay. Up to three of the effects can be operated simultaneously.

Seventeen main effect algorithms define possible effects and combinations and their operating parameters may be changed and stored in any of the 128 memory positions.

Programming is done using buttons on the front panel and LED displays show effects and operating parameters. A mas-

ter reset provision brings the settings back to default positions.

Inside the unit 16-bit ADA conversion and a custom 20-bit VLSI DSP engine give the '128 a wide dynamic range and computing power for smooth sounding effects.

The unit is rack mounted with ¼-inch input jacks for right and left input, output, mix output, MIDI in, out and thru connections. RRP is \$999. Rebel Audio is at 286 Gret North Rd, Five Dock, NSW 2046. (02) 713 6866.

READER INFO No. 226

Pay TV by 1990

The Minister for Transport and Communications, Gareth Evans, has announced that the government is looking at the possibility of introducing pay TV after the current moratorium expires in September 1990.

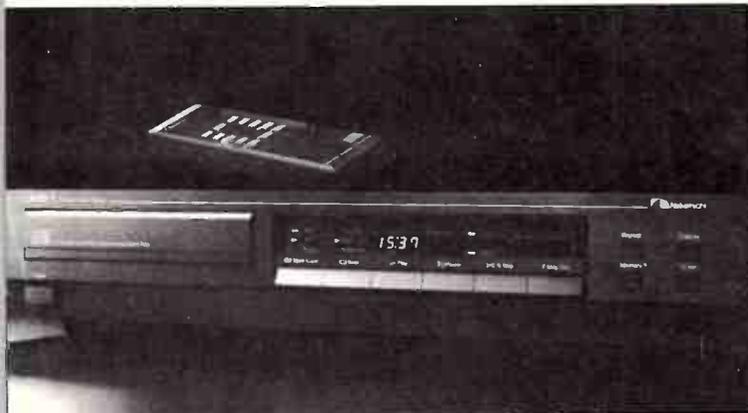
Things under consideration are the legal, social and political implications of pay TV and the technical details. At present the government is undecided on the number and range of services that could be provided, the effects on existing broadcasting, restrictions on licensing and the effects on industry and employment created by the new service.

Options for distribution of

national pay TV services are through satellite, or Telecom bearers, while terrestrial delivery might be over UHF or VHF, via the new Multipoint Distribution Systems or by cable.

The pay TV service has been operating for many years in the US and was introduced more recently in Europe. Subscribers to a channel pay for that service, using special decoding equipment to enable their TV sets to pick up the broadcast. The Opposition has said it would introduce pay TV immediately, and on assuming government that would be about 1989/1990.

READER INFO No. 227



Low Cost NAD

Bottom of the line, ie, most affordable, of the NAD OMS series CD players is the OMS-1, selling for \$795 RRP.

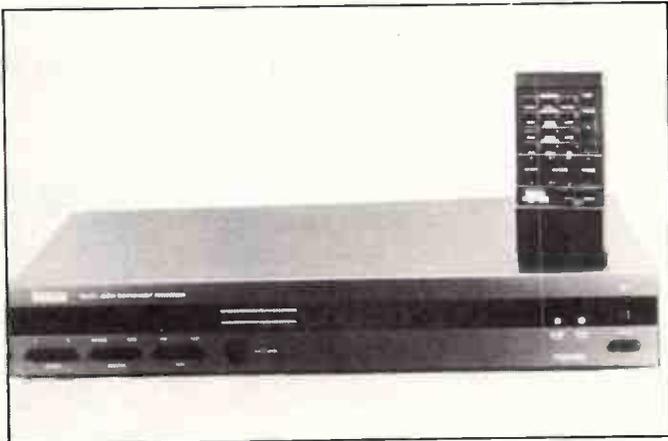
Like its more sophisticated 'siblings' it incorporates over-sampled digital filtering and 16-bit conversion, dual-mono analogue circuitry for channel separation, a three-beam laser and independent digital ana-

logue supplies.

Among its features are a 15-track program memory, bi-directional skip-search, repeat play and audible cueing. It also sports a combined Track/Time/Remaining Time indicator. The deck comes with a remote control unit.

READER INFO No. 229

In brief



DSP for Home

Digital audio signal processing equipment has been very much the stuff of professional sound, but a new unit being distributed by Amber Technology is aimed at the serious home

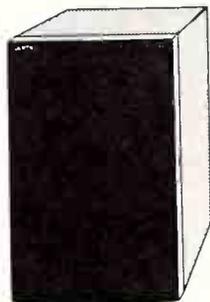
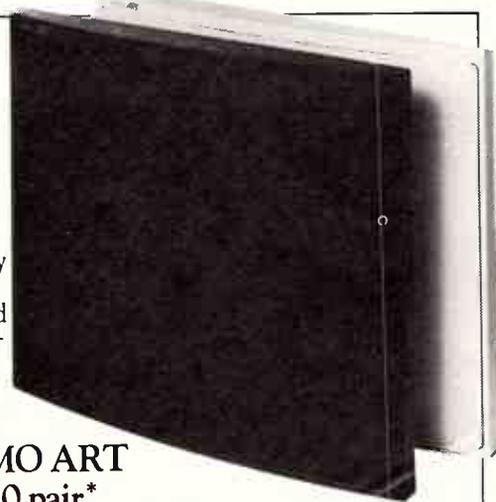
audio enthusiast. The Lexicon CP-1, designed for the home environment, includes 12 programmes for generating reverb, ambience, panorama and surround-sound.

READER INFO No. 230

THE ART OF LISTENING

JAMO ART, a superflat elegant bass reflex loudspeaker designed to be hung on a wall. The unique computer designed slightly curved front panel is a labyrinth of specially formed ribs, giving the ultimate stiffness and yet minimising high frequency diffraction. This newly developed and highly sophisticated JAMO 2-way design utilises a powerful 130mm bass/midrange driver, with high efficiency and low distortion.

A new 25mm impregnated soft textile dome tweeter has smooth performance and great dispersion. The frame of this elegant wall panel is finished in either black or white lacquer to blend perfectly with any decor.



JAMO MONITOR ONE \$650 pair*

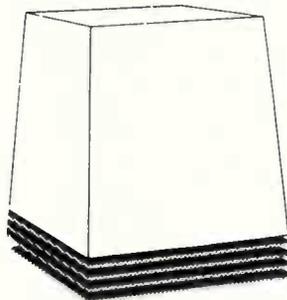
If your decor does not permit a wall panel loudspeaker the new JAMO MONITOR ONE, a bookshelf version of JAMO ART, is highly recommended. White or black lacquer.

*Recommended Retail Price 1/6/88.

For full details see your nearest JAMO dealer or call Sole Australian Distributor:

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JAMO ART \$750 pair*



JAMO SW-50 ACTIVE SUBWOOFER \$950*

The ultimate accessory for both JAMO ART, JAMO MONITOR ONE or any other quality hi-fi loudspeaker. This new active subwoofer is designed to blend discreetly with your decor, yet provide the subtle low frequencies found in today's excellent digital recordings. Black or white lacquer.

Jamo

EXPERIENCE THE TRUE ART OF LISTENING

READER INFO No. 17

SOUND INSIGHTS, JULY '88

9

TRUTH is a very dangerous concept. People's perception of truth is infinitely variable and therefore dangerous. The best example is the prejudice, snobbery and disinformation that surrounds the "Best" in Hi-Fi. How often have you read that the Best in this month's Hi-Fi magazine has already been superseded by another "Best" in the following month? The danger is that the confidence between the customer and the

can quickly turn
customer suspects
behind the

At Symfonia Hi-Fi
the "Best" is defined as being in the Best interest of the customer. We find this out by asking important questions – not by dictating. If you are seriously interested in obtaining advice regarding your Hi-Fi needs, however small or large your budget is, then you owe it to yourself to put Symfonia Hi-Fi to the 'Truth Test'.

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READER INFO No. 20

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AUDIO

**About the Shure
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"Once you have seen and heard a proper Dolby Stereo movie presentation in your own home, you'll never be satisfied with ordinary, garden-vanity television."

(With the Shure HTS 5000) "... the whole effect was overwhelming. Dialog was crisp and clean, and the stereophonic music and special effects were reproduced by the system with stunning clarity and impact."

"You can actually achieve a much higher quality of sound than in most Dolby Stereo theater installations."

Bert Whyte



If you have any doubt about how good Dolby Surround® Sound is with home TV, read these brief comments by independent authorities.

STEREOPHILE

**About the Shure
HTS 5000**

"It is rare in audio to find a clearcut "best" of anything, but in surround decoders, the Shure is the hands-down winner. Simply put, the reason is its superb sound. It has focus, detail, definition and aliveness that I'd not previously heard from any surround decoders or synthesizers..."

"The overall effect is spectacular and authoritative—precisely what one wants from theatrical sound."

Bill Sommerwerck

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SYSTEM**

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GOOD AS
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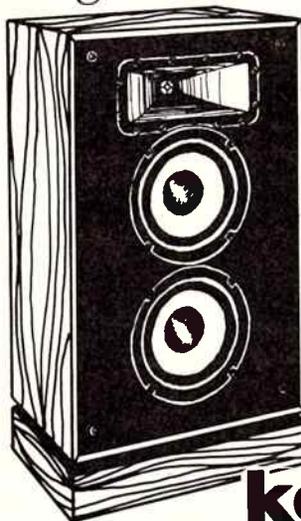
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Today, (40 years on) the KLIPSCHORN is still an industry standard but at \$12,000.00 a pair, a little out of the reach for most.

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READER INFO No. 21

SOUND INSIGHTS, JULY '88 11

The International Audio-Video Fair is something of a new adventure in Australian hi-fi. It has mixed together manufacturers, distributors and retailers with the public, the audiophile and the moderately interested, and it has added a dash of vitality.

From Hi Fi To Laser At Audio-Video Fair



The Kenwood KAC-1020 car audio power amp — quality that until now has belonged only to home audio.

The international audio video fair at Melbourne's Wesley college is the first independent show organised in the eastern states since the debacles of the late seventies. Since that time, the Perth Electronic Show has held sway as the only show of note in the whole of Australia. Now, the electronic shows are coming back, with more razz-a-matazz than ever.

In the Adamson Hall theatre twice daily Melbourne company Laser Magic Productions is mounting a laser show. Bob Jane is showing off his latest racing car sensation from the new Thunderdome, the Nascar and Videoclips. Don't leave the kids at home!

Other events scheduled are Pioneer's CLTV Show (Friday July 1, 7.30 pm) and a live concert presented by Yamaha (Saturday, July 2, 7.30 pm). On the more serious side is the Hi-fi Seminar (Sunday July 3, 2-4 pm) presented by John Dunlavy of Duntech Speakers and Les Cardilini, a familiar contributor to this magazine.

From the point of view of a hi-fi enthusiast, the show should be a winner. Most of the significant companies will be there, together with a wide range of distributors and retail stores. On show will be a repre-

sentative sample of the latest developments from Japan and the rest of the world.

One great trend is the increasing number of local manufacturers. There are some rather interesting high end amplifiers and some exciting speaker designs for the discerning on show.

Below is a list of some of the more interesting stands. The letter and number before each entry is the room number of the exhibitor in the Wesley college building. A map is reprinted on page 4.

EXHIBITION HIGHLIGHTS

M12

AWA

Denon Components Hi-Fi and the fully imported range of Canton loudspeakers from West Germany are what you'll find at the AWA stand.

You can listen to Denon's quality reference compact players including the DCD 3300CD player and sample the Denon DAP 5500 digital preamplifier, recently lauded in *Stereophile* magazine for its improved bass performance, increased dy-

amic range and better imaging. Also on display from Denon are high-power amplifiers, turntables and cassette decks.

The range of Canton speakers includes the popular Plus C subwoofer with a loudspeakers are, according to AWA, bred for speed through a number of design innovations. High-powered barium ferrite magnets, rapid response diaphragms of specially-coated fabric, extreme low mass voice coils, low loss capacitors in the crossover networks are some of their features. The end result is speakers with high impulse accuracy capable of reproducing extremely short rise times, complimented by a superb finish.

J3

Convoy

Convoy was recently appointed distributor of Harmon Kardon products which it has on display.

Three new compact disc players from Harmon Kardon are the HD200 (at \$599)



A pair of KEF 104.2 speakers with attractive woodgrain finish.



The Marantz digital PM.94 amplifier.

and the high-end, remotely-controlled HD400 (at \$699) and HD800 (at \$1100).

All three Harman Kardon units utilise a high-quality three-beam laser pick-up to ensure precise tracking of the digital signals. The HK200 and HD400 employ a 16-bit converter with an 88.2 kHz (two times) sampling rate, and independent left and right channel sample and hold processors, resulting in reduced digital switching noise. The HD800 uses dual 16-bit linear converters with a 176 kHz (four times) sampling rate, to ensure a more detailed sound with less digital noise near the audio band.

To deal with the intermodulation distortion (IM) inherent to the compact disc medium, most manufacturers employ steep multi-steep multi-stage analogue filters with high levels of negative feedback. This can produce severe phase shifts as well as transient intermodulation distortion, TIM. Harman Kardon has developed an analogue output section with, it claims, exceptionally low intermodulation distortion at all frequencies from dc up to 100 kHz. A simple analogue filter was then added to gradually reduce residual ultrasonic signals. In addition, this analogue output section utilises no negative feedback, which also eliminates TIM.

In designing the players, a special circuit layout isolating the analogue section was implemented to keep radiated digital noise at inaudible levels, and three separate power supplies were established between the mechanical, digital and analogue stages.

Two position displays on the HD400 and HD800 include, in the first position, track number, elapsed time, and program number; in the second position, total tracks, total time on disc, and time remaining. Additionally, included on all three models is a fluorescent digital display, 36-track memory, track and index search, audible two-speed cue and review. The HD800 also includes headphone jack and level control.

Also on display is the new range of Har-

mon Kardon integrated amplifiers featuring the high voltage/high current design principle used in HK's earlier Citation Series.

The new Harman Kardon amplifier line-up includes the 45 watts per channel PM640Vxi, retailing at \$599; the PM645-Vxi, with a power rating of 60 watts per channel and retailing at \$799; the PM655-Vxi, delivering 90 watts per channel at \$1299; and the top-of-the-line PM665Vxi with 150 watts per channel and retailing for \$1995.

The High Voltage/High Current design amplifier approach drives speaker systems with a wide variety of nominal impedance ratings more efficiently and effectively than any traditional design. The new Harman Kardon integrates employ a rear panel switch that allows the user to select either a high or low output voltage eight ohm range. The high voltage mode more effectively drives nominal eight ohm loads, while the low voltage mode can better drive lower nominal reactive impedances. Unlike conventional amplifiers, the Harman Kardon Vxi integrated amplifiers have equal power ratings into eight and four ohm distortion, at any frequency

from 20 Hz to 30 kHz. In contrast, most manufacturers only rate their four ohm performance in terms of unclipped 1 kHz tone bursts.

Anne Room Encel Stereo

Who is Encel Stereo? Founded in 1958, Encel Stereo has grown to be, it claims, the largest and longest established quality audio specialist store in Australia.

In keeping with company philosophy, Encel does more than exhibit equipment. Sessions are scheduled to demonstrate equipment from a wide range of categories so that you leave its stand a more enlightened consumer.

Many manufacturers are represented at the Encel stand. Rotel is a hi-fi manufacturer of modestly-priced, quality equipment that has won many awards in Europe and Britain. Luxman, Japan's oldest and one of its most respected audio specialist electronics manufacturers is there as is Counterpoint, highly regarded American hybrid (valves and solid state) amplifier manufacturer. Another amplifier manufacturer is Japanese company Airtight specialising in handmade valve amplifiers.

Cerwin Vega is another American company, specialising in loudspeaker manufac-



Harman/Kardon's PM665 Vxi high voltage — high current integrated amplifier.



A smooth-lined NAD 6300 cassette deck and its remote control.

ture with a strong background in live concert sound. TDI is a loudspeaker manufacturer from Britain. Still on speakers, Encel is exhibiting Australia's Duntech loudspeakers, regarded as the most accurate in the world. Made in Australia they are exported to Europe, Asia and the USA. (Check the events schedule for details of a seminar by John Dunlavy of Duntech.)

M4 **Lighting & Sound**

Exciting Lighting & Sound is a Melbourne company which specialises lighting and sound effects for just about all venues. its services are being used in indoor and outdoor displays, television and film productions, theatres, shopping centres, conventions and as a way of adding some atmosphere to product launches.

Products include mixers, amplifiers, console and speakers, as well as lamps, zoom spots, and lighting controllers. Some of the things you can view at the Audio-Video Fair are a running neon (coloured gas flowing through the tube), plasma globes, fibre optic displays, long life light globes, holograms, dancing lights, and professional sound equipment.

J5 **Hi-Phon Distributors**

On show at the Hi-Phon stand is the latest from the Onkyo range of hi-fi components, the Tannoy Planet Series loudspeakers and Beyerdynamic consumer headphones.

The new line of Onkyo compact disc players includes the Grand Integra-G10, DX5500 and DX7500. In the Receiver line are the Onkyo TX-850 and TX-830. Also on display from Onkyo are the T-4120 tuner and TA-2120 cassette deck.

2A **Kenwood**

Kenwood recently launched the first anti-

theft in-car CD player, the KDC-80. Along with optimum servo control, three-beam laser pickup, double oversampling, electronic preamp and useful driving features like disc replay, the unit incorporates a special theft prevention chassis that allows the owner to remove the player from the car. A handle makes moving it about easier, and the fact that the unit can be used outside the car and features a semi-permanent memory makes it a very attractive unit — though no temptation to thieves.

Showpiece at the Kenwood stand is, however, the combined CD player/receiver the KDC-90R, on public display in Australia for the first time at the Audio-Video Fair. The KDC-90R consists of two modules, the CD player and tuner controls in one unit that fits in a DIN sized hole in the dashboard, and another module housing the amplifier and tuner circuits that can be located anywhere the owner feels is convenient. Like the KDC-80, the KDC-90R uses optimum servo control, three-beam laser pickup, double oversampling and the theft prevention chassis. The unit has a host of control features and displays too numerous to list but one that caught our eye is a selectable illumination colour, green or orange to match the car panel illumination!

The two CD players fit into Kenwood's cassette cradle for portable listening that

allows one to switch from car to boat.

Kenwood has been no slouch on the new product front. In the month April to May, it launched 30 new products, including car speakers which are designed for use with CD players. Kenwood has on display three subwoofers, KFC-W110/W108/W169 designed to be used with the KPX-L100 crossover network. The KFC-M105/105 midranges, KFC-T101 tweeter and KPX-H400 passive crossover network make up the rest of the powerful car Series. And powerful they are, with subwoofers rated at 300 W and 400 W, with 35 ounce and 25 ounce ferrite magnets and a 300 W peak input power tweeter, just to give some indication.

Plenty of power is delivered by the KAC-1020 in-car stereo power amplifier, in fact 640 Wrms, 200 W per channel! This top-of-the-range unit features a bridgeable output which allows it to be used as a single-channel amp, a dynamic linear drive, a voltage interface gate and a multiple independent power supply.

J8 **Marantz**

Two products from Marantz are the PM94 integrated amplifier and CD94 compact disc player.

Known widely for its budget hi-fi, Marantz has come out with a more upmarket product in the PM94 amplifier. It is the first Marantz MOSFET amp. Marantz won acclaim last year in Australia when it won the CESA (Consumer Electronics Suppliers Association) award for amplifiers with its PM6411.

The CD94 CD player features a mixture of the old and the new. Old is its use of parent company Philips' first CDM1 swing-arm single-beam laser assembly. New is the 16-bit, four times oversampling, four independent regulated power supplies, totally separate left and right channel circuits and the diecast transport mechanism. Features include Automatic Music Search, Favourite Track Selection, and an Index Skip function.



The Harman/Kardon HD400 remote controlled compact disc player.



A sample from the range of Richter speakers eliminating shelf space problems.

Cato Gallery Pioneer

Pioneer is promoting the home hi-fi system at its stand. Its new Prologue shelf hi-fi system incorporates turntable, double cassette deck, AM/FM tuner and compact disc player to retail at \$999.

The PD-Z71 CD player features twin D/A converters, digital filter, random play and 20-track programming. The Prologue stereo amplifier has a built-in five-band graphic equaliser and 22 watt per channel power output. The two-way bookshelf-type speaker system features a 16 cm cone woofer and 6 cm cone tweeter. The Prologue double cassette deck with soft-touch mechanism offers normal and high speed

tape copying facility. The belt-driven model with de-servo motor and static balance and straight tone arm.

The system comes with a three-year warranty.

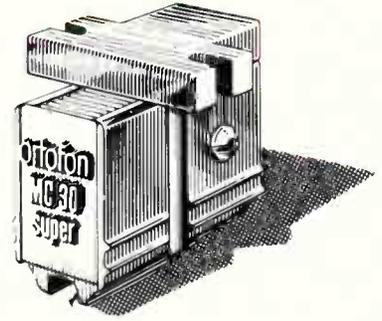
M8, M9 Oz-Fi/Richter Acoustics

Oz-Fi, or the Australian Hi-Fi Manufacturer's Guild as it is more formally known, was formed late last year by a group of Australian hi-fi manufacturers. It began when Ralph Waters of Richter Acoustics contacted other local manufacturers of audio equipment with a view to establishing a guild to set and maintain standards as well as to promote and market Australian products.

Many Australians are surprised to discover that Australia has a well entrenched local hi-fi manufacturing industry, a view that Oz-Fi is trying to confront. Due to its efforts collectively and the efforts of individual members, Australian-designed and built hi-fi components now feature prominently in retail stores which only two or three years ago would have shunned the local product. That fact says something too about the quality of the products. Over the past two years ETI has reviewed speakers from Richter and Orpheus, and the Murray amp, all with very positive comments.

Oz-Fi members include Richter Acoustics, ME Sound, Orpheus Loudspeakers, Etone, Reality Search, Time and Space, GNP Acoustics, Alan Moss ElectroStatics.

'Superlative'



Many people have been mass-marketed into believing that digital 'music' is superior to analogue reproduction. This new ORTOFON MC-30 Super Cartridge will most certainly show you where this theory goes completely wrong! Using pure silver wiring, Ortophase phase/amplitude linearity and a pure platinum damping disc, the ORTOFON MC-30 Super delivers directly to both ears the superior musicality of high-class analogue reproduction. As others have already said:

"... the overall sound is one of extreme clarity which can bear comparison with CD at its best. In fact, unlike CD players, a well designed moving-coil cartridge like this one maintains its response well beyond the 20kHz upper limit."

John Borwick, Gramophone, April 1987.

"The MC-30 Super is a better cartridge than most of its rivals. It's just a thoroughly musical design, and there's little that needs to be added to that bald statement. Go for this cartridge if you want a sharp, incisive sound of real refinement and with explicit stereo."

Avin Gold, HI-FI Answers, April 1987.

"The MC-30 Super ... is the child of a mating of the MC-20 Super and the MC-2000 - both of which I know and adore. Once the cartridge bedded in, it was as sweet as sugar, an MC-2000 without the bite and with most of the detail ... Ortofon has plenty of reasons to believe that a market for high quality cartridges still exists, and this continued support of the LP has resulted in an outstanding transducer."

Ken Kessler, HI-FI News and Record Review, March 1987.

"The MC-30 Super is a superlative tracker ... Highs are gorgeous - smooth, open, and sparkingly crisp ... Low-frequency performance, too, is excellent."

J. Gordon Holt, Stereophile, January 1987.

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SOUND INSIGHTS, JULY '88 15

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READER INFO No. 22

KENWOOD



This car CD player will make you feel right at home!

The KDC-80 seems more like a home audio CD player. It has a high-resolution 3-beam laser pick-up, Optimum Servo Control for scratch resistance, and a double oversampling digital filter for optimum fidelity to the music. Plus a new mechanism that takes no notice of vibration.

Its electronic audio section makes operation incredibly easy. You can even adjust the unit's

angle to your liking. And change the panel illumination colour.

You won't need to worry about losing the KDC-80, either. Because the Theft Prevention Chassis lets you take the unit with you when you leave the car.

So you can enjoy listening to the KDC-80 at home after all.



KDC-80 CD PLAYER: S/N ratio more than 90dB, THD less than 0.005%, Dynamic range over 90dB

KENWOOD CORPORATION

Shionogi Shibuya Building, 17-5, 2-chome Shibuya, Shibuya-ku, Tokyo 150, Japan

KENWOOD ELECTRONICS AUSTRALIA PTY. LTD. (INCORPORATED IN N.S.W.)
4E Woodcock Place, Lane Cove, N.S.W. 2066, Australia

READER INFO No. 24



Coaxial plug WBT-0101 . . . compatible with all "chinch" jacks on the market.

Precision Fidelity, Vacuum State, and associate member, Cabinet Industries.

the Australian loudspeaker industry is best represented at the Oz-Fi stand, with systems from GHP Acoustics, Orpheus and Richter. From the Orpheus range are the four-inch bass driver Minotaur, the larger six-inch bass driver Dolomite and even larger eight-inch bass driver Apollo. GNP Acoustics is a recent member of the fledgling Oz-Fi group, with a range of high end (around \$8000), high efficiency, state-of-the-art speakers.

The latest in the Richter range are the tiny Fairytale and Dreamtime speakers and the radical, new, floor-standing Secret Weapons which feature a chimney port which fires bass notes vertically. A new release for the Audio-Video Fair is the Victor Hercules model, a high efficiency, high powered studio monitor.

The Australian electrostatic speaker manufacturers, Alan Moss and Precision Fidelity are showing their wares. Both manufacturers have been praised for their moderate prices on the notoriously expensive electrostatic speaker. Alan Moss has interestingly developed an electrostatic system in which the bass is handled by a

AUSTRALIAN HI FI
MANUFACTURERS' GUID



oz fi
ENDORSED

The Oz-Fi logo representing music, Australia and high technology. The new logo should become very conspicuous. Oz-Fi plans to tag quality products that measure up to its exacting standards with this logo. Consumers can then identify good audio units, endorsed by Oz-Fi, raising Oz-Fi's profile and providing the consumer with a guide through the hi-fi maze.

separate subwoofer. Precision Fidelity is demonstrating its Stag Electrostatic, a second generation system which designer Vasey Stocks claims has cured all the electrostatic difficulties.

Complementing the speaker products on display are the samples of Space and Time solid core speaker cable range that fit loosely in their jackets to reduce effects of emf interference from twisted cabling. As well Space and Time has a range of interconnects that have proved quite popular overseas.

Need something to house your hi-fi in? Cabinet Industries is showing samples of its quality hi-fi furniture. A new range that it is launching also accommodates the video.

At the heart of the Oz-Fi exhibition, pumping out all the power are a set of high quality, hard working ME Amps. ME Amps has won recognition overseas for its quality products. Quite a tribute is that JBL Vice President in the US uses an ME preamp. ME Sound is launching a new range of quality, affordable, fan-cooled, class A amps at the Audio-Video Fair.

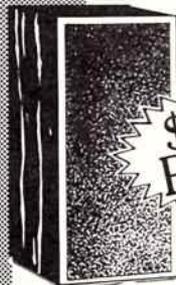
M 13 Scan Audio

Scan's contribution to the show is the new Jamo Art speaker. The bass reflex port has been designed as an integral canal, and the bass reflex opening has been positioned on the rear side of the cabinet so the bass output through the port is further enhanced by the wall itself.

The fine overtones of musical instruments are reproduced precisely and with the greatest dynamics by a new 1" impregnated textile dome tweeter which has a smooth treble with great dispersion. The crossover network which is computer optimised for this system is a 2nd-order type. It used heavy-duty coils of pure copper and low loss capacitors, giving the entire system high power handling capacity and low distortion.

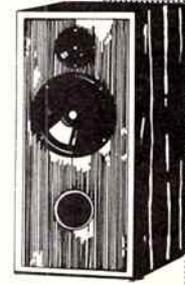
The frame of the front panel has a high gloss, two-component lacquer in either black or white finish to suit any interior decor. The large slightly curved front surface eliminates diffraction from the critical high frequency area.

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READER INFO No. 25

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*Rec. Retail Price

READER INFO No. 26

Directory

The Jamo speakers will be the only ones on display in room M13. Scan's Mike Hendriksen says he wants a very simple display in which people can really listen to the speaker.

This environmentally friendly design is at home connected to a hi-fi system or either side of the stereo television receiver, or anywhere where the ultimate sound quality is required with the minimum of inconvenience. The loudspeaker is rated at 60 watts rms, making it suitable for an amplifier with an output of 30-60 watts rms. The frequency response is an amazing 40-20,000 Hz. This piece of art is available for viewing and listening at the Scan Audio stand. If you miss it there, your local JAMO dealer may be lucky enough to have a masterpiece Jamo Art on his wall which he will be glad to demonstrate.

M1 Yamaha

Yamaha is the first in Australia to release a complete range of compact disc players which offer provision for the new CD single. The CD single is a 3 inch compact disc which has a capacity of around 20 minutes playing time. It is in many ways similar to the EP record. The CD single will be far less expensive than standard compact discs and this will make the compact disc player an even more attractive proposition to the prospective Hi Fi purchaser.

The Flagship of the pre/power amplifier range, the CX1000/MX1000 has been designed not only to provide the highest level of sound quality, but also to offer features which many high quality ampli-

fiers lack, such as an infrared remote control, which not only controls the amplifier itself but also any other Yamaha RS Remote Compatible components that might be partnered with it.

The CX1000 Preamp/ifier also incorporates a Hi Bit, 8 x Oversampling Digital Filter; Hi Bit twin D/A converters and Digital Input which enables D/A conversion and Digital Filtering to occur at the amplifier stage (for any digital source such as CD, CDV or DAT).

The MX1000 power amplifier which boasts 260 Watts per channel, is matched to the CX1000 to present one of the finest pre-power amplifier combinations to be. Yamaha will also be displaying the entire range of new Cassette Decks and Double Decks at the show (ten in all).

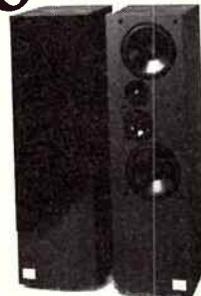
Yamaha has concentrated with this range on improving sound quality and increasing features. It has introduced improved amorphous heads; Playtrim, Bias Adjustment and Dolby HX Pro in most models. Most Yamaha Cassette Decks are equipped with infra red remote controls; RS remote compatibility; Intra Scan; programmable playback; phrase repeat and music search. These are just a few of the features which Yamaha has incorporated into their Cassette Decks for added user convenience.

Something to look out for is the DSP3000, the new top end version of the DSP-1 and what it offers with a number of improvements over its smaller brother. Yamaha has also released a new four channel audio video amplifier, the AVX100 with eight different surround settings. The AVX100 has video enhancements, video title edit, superimposition and infra red remote control. ●



Pioneer's Prologue system, including component CD player.

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The 5" TPX midrange with NORSOLEX suspension is one of the most accurate midrange drivers ever designed, and blends in perfectly with the 1" soft textile dome tweeter directly borrowed from the DALI 40. The cabinet finished in real wood veneer is not only a beautiful piece of furniture, but a result of a new technique called MODAL analysis which eliminates any cabinet distortion.

The result is a performance already highly acclaimed by the hi-fi critics: "Soundstaging was simply breathtaking. The imaging was very close to being the best we've heard - EVER. Bass was truly thunderous... do not commit yourself to anything else before you listen to a pair of these. We can't say more."

Stereo Buyers Guide, 1988.

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DALI

THE Yamaha CDX-1110



READER INFO No. 203

YAMAHA HAVE REALLY set some of their competitors on their ear with the release of their new "Hi-Bit" CD players. It's not too long ago that I was making the somewhat rash statement that the manufacturers of CD players were hard pressed with their publicity campaigns to claim greater perfection when almost true perfection was already within their grasp. Of course, when I made those statements, I did not allow for the clever engineers at Yamaha Corporation in Japan who have developed an astounding range of innovative digital electronics, particularly over the last two years.

One of the most unusual examples of this technical innovation was the development of the "Hi Bit" digital range expansion concept. As most of you are undoubtedly aware, the conventional CD player works on the principal of a 16 bit digital to analogue conversion system which provides a nominal 96 dB dynamic range. This digital format was propounded by Sony and Philips and was standardised in their 'Red Book' about eight or nine years ago. Following the release of that Standard, which is now the basis of the Interna-

tional Electro-Technical Commission (IEC) Standard, the detractors of the CD system (and surprisingly there were and still are many) complained that nothing further could be done to improve the CD player's performance. The detractors also made a strong point of the circuit designers' inability to achieve any real perform-

ance improvements irrespective of however modest they might be.

High Sampling

The Yamaha Research and Development Group obviously decided that such a conclusion was inappropriate and they set out to develop solutions to a number of prob-

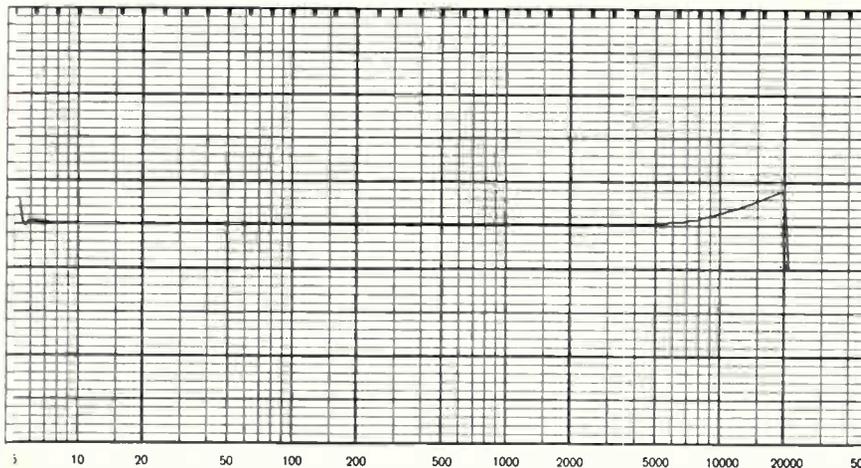


Figure 1: Frequency Response, right channel 5 Hz to 20 kHz.

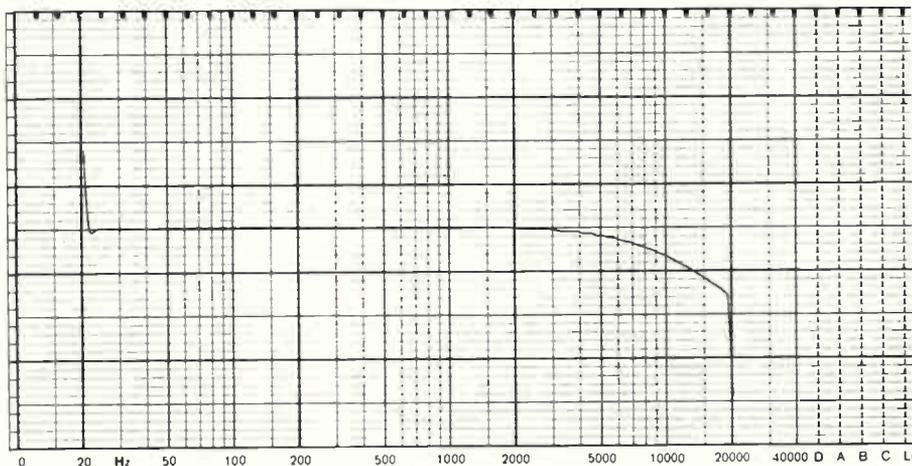


Figure 2: Spot the difference: This is the same test as figure 1, but using a different source disc. Frequency Response, left channel after analogue filter.

lems associated with achieving logical improvements in the CD's digital to analogue data processing format. Since developing their LSI production facility near Hamamatsu on the island of Honshu, Yamaha have been amongst the foremost technical leaders of special integrated circuits for CD based consumer products. Not surprisingly they were amongst the first of the CD manufacturers to introduce the concept of a 'quadruple over-sampling' system which raised the Standard 44.1 kHz sampling frequency which everybody thought was 'etched in blood') to a frequency of 176.4 kHz. Amongst the first of these machines was the CDX 5000 Compact Disc player which until recently was the flagship of the Yamaha CD line. Not satisfied with the performance that CD player provided, Yamaha went one further and offered eight times over-sampling, i.e. a sampling frequency of 352.8 kHz. This extremely high frequency facilitates an even wider filtering separation zone created between the top of the audio-signal spectrum, and the sampling frequency which is almost in the medium frequency radio transmission band.

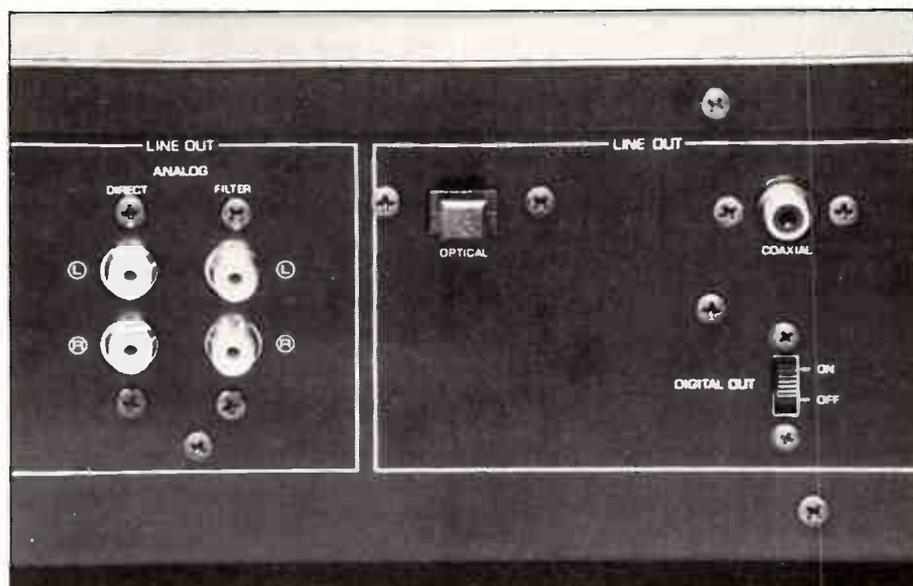
The major advantage that such a high sampling frequency offers, when compared with a simple 44.1 kHz sampling frequency, relates to the nasty characteristics of the simple digital filters. These filters produce significant phase non-linearity and a readily audible stridency in the decoded audible signal. Many reviewers and purchasers of first generation CD players complained about this problem, especially

when comparing the same programme content when played from a record on a quality high fidelity system. I was acutely aware of this problem with my original first generation CD player and at the first opportunity I changed it to a second generation player which offered double over-sampling coupled with the more gentle characteristics of an analogue filter. Now by providing maximum separation between the sampling frequency and the 20 kHz nominal upper limit of the recorded audible spectrum, the digital filter can be replaced by an analogue filter

which avoids most of the nasty phase characteristics. By utilising a four times over-sampling frequency 176.4 kHz the increased separation makes it possible to utilise an even gentler (and simpler) filter.

By doubling that sampling frequency once more, the designers can make the analogue filter even better. This is in fact what Yamaha have done in the CDX-1110. What their literature does not say is of course that by going to an eight times over-sampling the complexity of the digital circuitry is complicated to the point where they had to develop a completely new generation of LSI's, and a number of new circuits which have to fill in the missing bits between the data contained in a signal sampled at 44 kHz and the new signal which they are generating at 352.8 kHz.

Because of the need to introduce a supplementary set of data samples each additional value of which has to be computed on the basis of the values contained in the 44.1 kHz samples (on the disc) it becomes readily possible to generate additional numerical values which provides two possible additional benefits. The first of these relates to "2 extra bits" of data which can be utilised to reduce quantisation error noise whilst the second is the potential to reduce the distortion in the audio band width by a factor of at least four times. As it transpires the "Hi-Bit" filters in the previous generation of four times over-



Back panel of the CDX-1110.

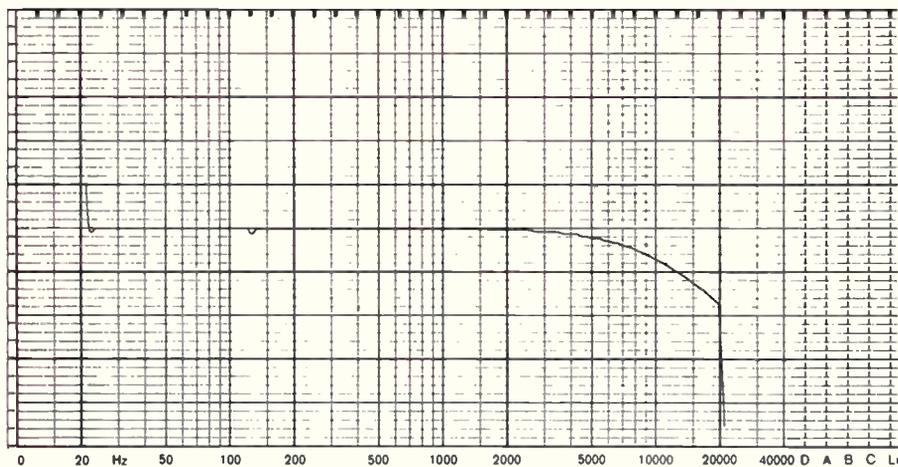


Figure 3: Frequency response up to 20 kHz with the analogue filter switched in. The little notch at 130 Hz is probably a test artifact.

sampling Yamaha CD players operated with 32 bit co-efficients and a 26 bit accumulator to perform the calculations with a 40 bit accuracy. Those filter performed 192 additions and 192 multiplications for each of the 44,100 CD samples input in each second at a clock rate of 16.93 megahertz. A total of four eighteen bit digital output values is generated for each CD sample. Yamaha believe that when the music is being played at high level, and you have 16 bits of data to play around with, you have enough dynamic range and resolution to cope with almost anything that is required of the system.

However, as our measurements have shown over the last six years, the distortion jumps up dramatically, the non-linearity in the coding systems is readily measurable, and the quality of the audible signal (especially after amplification) at the bottom of the dynamic range can be both numerically and on occasions subjectively disturbing.

Features

As well as providing this innovative approach, the CDX-1110 also offers a wide range of other attractive operational features which make the player easier to use as well as 'playing the bells and blowing the whistles'. The first of these is a 44 key wireless remote control unit which allows the user to do almost everything except load and change discs. The first feature that I noticed was the presence of a 24 key numeric key pad which provides direct access to any track on a normal disc with full programming capabilities, repeat play, time display modes, random play, index search, auto space insert, disc skip and scan controls.

One very important attribute is the

provision of a pair of switches which provide up/down volume control functions which are integrated into the remote control and similarly incorporated on the front panel of the CD player. This volume control utilises a 20 bit digital volume control which makes it possible to provide more than adequate volume control capabilities without the nasty sharp steps that many rotary attenuators provide.

With one touch of the RANDOM PLAY key a random playback sequence of all the tracks on the disc are generated by the player and the playing of the disc begins automatically. The 8 digit fluorescent display panel provides comprehensive information on the disc material, the player operation status, programming and time. The 8 digit display also provides a concurrent read-out of track number and disc time selectable between total time, elapsed and remaining time as well as index numbers and program track numbers. The position of the laser optical sys-

tem (and thus the amount of elapsed playing time) is indicated directly on a graduated scale on the bottom of the primary display which fulfills the role of an analogue meter supplementing the precise data in the section of the display immediately above which shows the number of tracks actually on the disc and where the playing cycle actually is through a series of little red arrows over the tops of the track playing and the remaining tracks on the disc. The position of the digital attenuator is also displayed on the right-hand side of the player's main display. This shows the top 50dB of the available dynamic range with 2dB steps to assist in setting the CD player's volume control and more importantly the potential risk of blowing up your speakers.

Another innovative feature on both the remote control and the front panel is the 4 way repeat play which provides repeat play of the entire disc, a single selection, a memory program sequence and any A-B segment on the disc as required. In keeping with other manufacturers, the player provides the opportunity to insert a manual space of 3 seconds delay between individual tracks for smooth and even spacing during playback and/or convenient (if illegal) disc to tape dubbing. I am sure this feature contravenes The Australian Recording Industry Association requirements (as obviously do all the other CD players that provide a similar capability).

The front panel of the CDX-1110 tends to be an understatement of its potential through the use of grey lettering on a polished black satin anodised front panel. The player's 14kg weight is even more impressive and with this weight the CDX1110 must undoubtedly be amongst the heavyweights in the CD player league.

At the lower edge of the front panel is a large power on/off switch and adjacent to this are minor controls for SPACE IN-

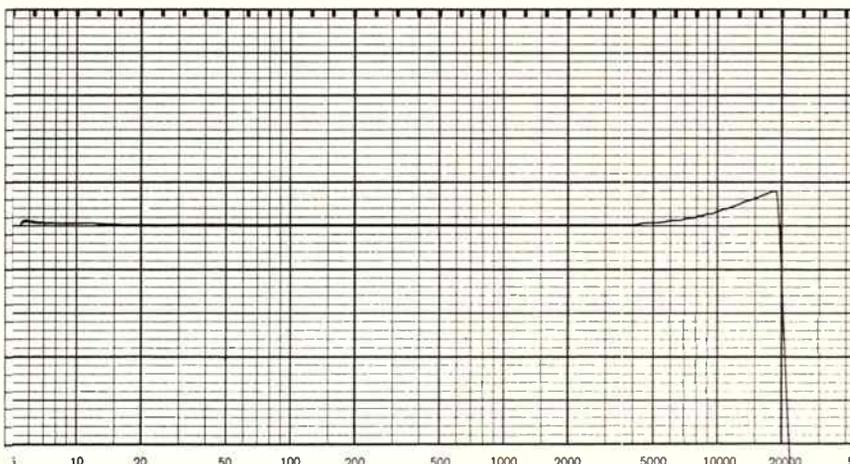


Figure 4: Left channel response, 5 Hz to 20 kHz.

SERT, INDEX, RANDOM PLAY, REPEAT with two buttons providing the SINGLE FULL or OFF functions and A-B respectively. Three buttons are provided for DELETE, SET CHECK AND CANCEL. Below the main display are ten push buttons to provide direct selection of the first ten tracks together with a +10 button which provides increments of 10 thereafter. As well as the normal standard lever key push buttons the only other controls are the output levels UP/DOWN buttons and the time display over the gold plated tip ring and sleeve headphone socket.

On the back of the player are line output controls for gold plated line out phono sockets, a co-axial output providing digital output and an optical output socket that provides an optical glass fibre output signal for as yet unreleased equipment. After removing the unit's cover the first thing that impressed me was the power supply in which the pair of power transformers serving the two separate circuits are labelled as "massive power supply". The main circuit boards feature a relatively small number of LSI chips which obviously make it feasible to utilise smaller, neater and more compact circuitry than many of the previous generation CD players which I have dis-assembled to examine.

These circuits are mounted on heavy copper-plated heat sinks which provide electrical and thermal screening. The amount of inter-wiring by both ribbon cable, and to a lesser extent, conventional screened or twisted pair wiring is far more than I would have expected and on closer examination I noted that there are other circuit boards located below the laser disc player mechanism. The designers have resorted to the use of high frequency ferrite bead chokes on co-axial cables and other techniques which are obviously essential in order to achieve the high signal to noise ratios in conjunction with the high operating frequencies which this player has been designed to provide. I was also intrigued to note that the optical fibre signal output port utilises a transducer mounted immediately behind the back panel. The major impression that one gets is that the unit's electronics and mechanical components have been carefully designed to achieve a rugged, durable and precise performance.

The first significant difference I noted between this CD player and others was the difference measured frequency response using various test discs. One set of discs exhibited a nominal 0.8dB rise in frequency response over the range 5 kHz to 22 kHz. A second test disc, with either

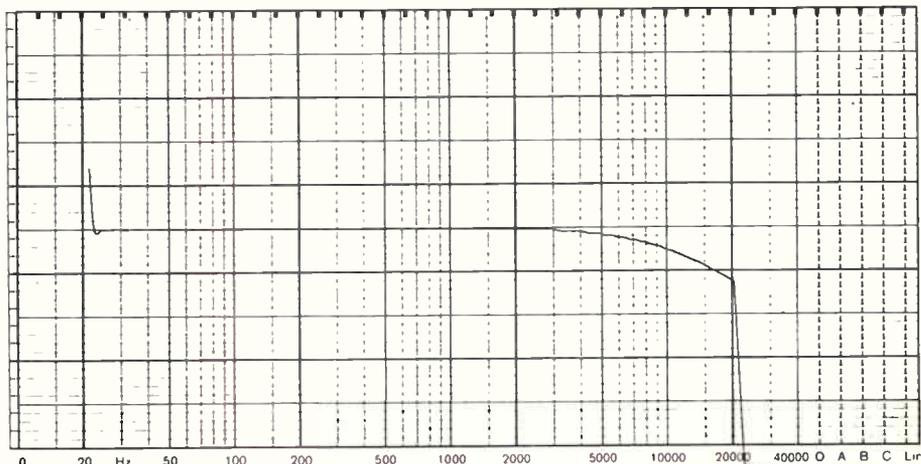


Figure 5: The same problem is visible on the left channel. Match this with figure 4.

analogue filter output or the direct filter output displayed a modest high frequency droop of approximately 1.5dB at 20 kHz and with a very smooth and extremely gentle curve which extends from 3 kHz through to the upper limit of the test disc. Of the two results I tend to believe the latter, but the alternative result is equally believable.

Linearity of the CDX-1110 differed slightly between the left and right channels and the results are as close to perfect as you would hope to achieve from a piece of consumer equipment. The right channel is within the range zero to -1 dB all the way down to -7 dB, is $+0.5$ dB at -80 dB and is -0.2 dB at -90 dB. The left channel is equally precise to -70 dB, exhibits zero error at -80 dB and is 1.4dB high at -90 dB. These results are extremely good and would it appear the best I have yet recorded for any player irrespective of price.

Obviously the tracking between the 2 digital to analogue converters can not be precisely the same, especially at the very bottom of their dynamic range where differences in non-linearity can be expected to show up. The channel separation on the CDX-1110 is much better than recorded on any other CD player other than the Micro Seiki (September 1987), but is nonetheless extremely good. The channel separations were better than 82dB at 100 Hz, better than 99.6dB at 1 kHz, better 100dB at 10kHz and better than 96.7dB at 20 kHz.

The distortion characteristics of the CD player are nearly twice as good as guaranteed all the way down to -50 dB, and very nearly as good as the Micro Seiki's figures which it equals at that point. By the time the signal level is down to -70 dB the distortion is only 1.45% whilst the Micro Seiki went up to 4.1%. At -80 dB the Yamaha produces 6.5% whilst the Micro Seiki produced 23%. At -90 dB the

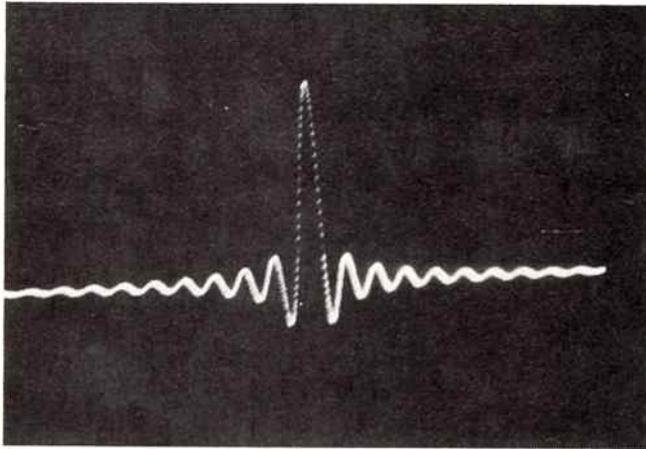
Yamaha produces 27.68% whilst the Micro Seiki produced 100% distortion.

Now whilst I would have expected a quasi 18 bit machine to produce lower distortions at low levels (when compared with a conventional machine), the big question is whether the distortion at these low levels is comparable with other machines other than say the Micro Seiki. In order to assess this question, I compared the distortion figures with a number of other CD players which we tested over the last 2 years and noted with interest that, whilst the results were better than most, even the Yamaha YCD-1000 car CD player displayed lower distortions at -70 , -80 and -90 dB. That tended to confirm that whilst the quasi 18 bit performance offers superior linearity, markedly superior signal to noise figures, it achieves very little by way of tangible results in terms of reduced distortion.

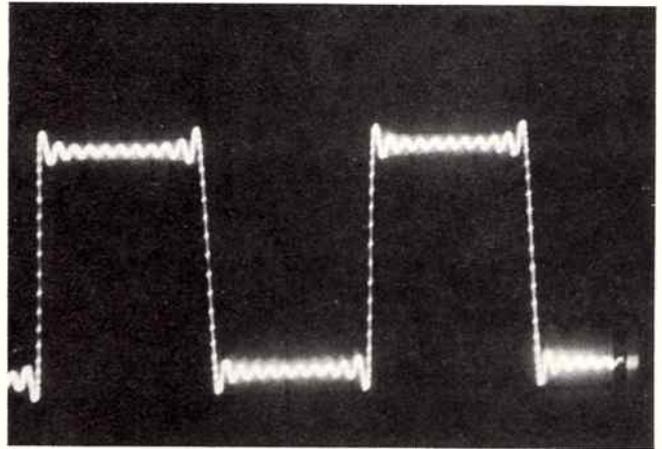
The emphasis characteristics of the CDX-1110 are close enough to perfect to warrant no further comment, whilst the signal to noise ratio performance of this CD player without emphasis is excellent in the left channel and truly outstanding in the right providing 114.1dB(A) without emphasis and 120dB(a) with emphasis. This order of performance puts it marginally in front of the Micro Seiki, which I had previously regarded as the yardstick for comparison. These signal to noise figures are unquestionably the best figures that we have yet recorded and will prove particularly hard to beat.

The frequency accuracy of the CDX-1110 is as close as perfect as you can get with only 0.1 Hz error for the 20 kHz test signal. As the photos of the square wave responses and impulse response show they are exemplary as would be expected for a machine utilising an analogue filter circuit following an 8 x sampling frequency characteristic. The CDX-1110 can track all

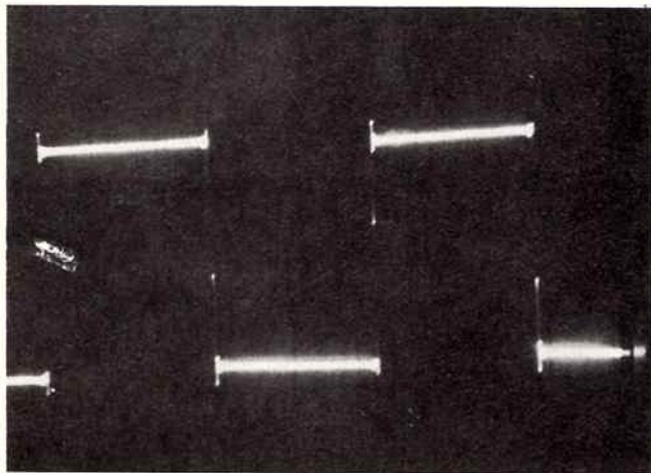
Yamaha CDX-1110



Impulse Response



1 kHz Square Wave



100 Hz Square Wave

DIMENSIONS

Width	435mm
Height	120.5mm
Depth	418mm
Weight	14.2 kg
RRP	\$1899

Knud Vad in a J.S. Bach Organ Concert at the Organ of Marcussen/Andersen Church in Denmark playing a series of eight organ pieces, most of which are well known and well loved. Denon 33C0-1590. The music and the performance was electrifying. I compared the performance with another CD player which provides four times over-sampling and was pleased that I could hear a difference, and much preferred the CDX-1110. The second piece I played was a new piece by Jorge Bolet and Charles Dutoit with the Montreal Symphony Orchestra playing Tchaikovsky's Piano Concerto No. 1 and Rachmaninov's Piano Concerto No. 2 Decca 421 181-2.

Jorge Bolet is superb whilst Dutoit and the Montreal Symphony Orchestra provide a truly memorable performance. I expect that Charles Dutoit will be equally as exciting during his forthcoming Australian tour.

The third disc set I played is Mahler's 7th Symphony with Elisha Inbal with the Frankfurt Radio Symphony Orchestra (Denon 60C0-1553-54). This set of discs is one of the most outstanding I have heard of Mahler's work, notwithstanding the seemingly incongruous combination of an Israeli Conductor leading a German Symphony Orchestra. This is a wonderful and moving set of discs which I believe every Mahler lover will want to hear.

Although I could not hear the difference, I was disappointed that the distortion at low levels were not better than achieved, if for the only reason, that a theoretical assessment indicated that they should be. At a recommended retail price of \$1899 this player still offers outstanding value for money, particularly when compared with the price of the Micro Seiki and other premium performance disc players in Australia at this point of time. ●

of the test discs incorporating interruption in information layer, black dot distortion on the readout side and black stripe tests for trackability in the presence of fault characteristics. As I discovered, it also tracks all of my nastiest faulty discs includ-

ing those with excentric centres.

Subjective View

I spent considerable time playing a series of new software including the following exciting discs. The first of these were

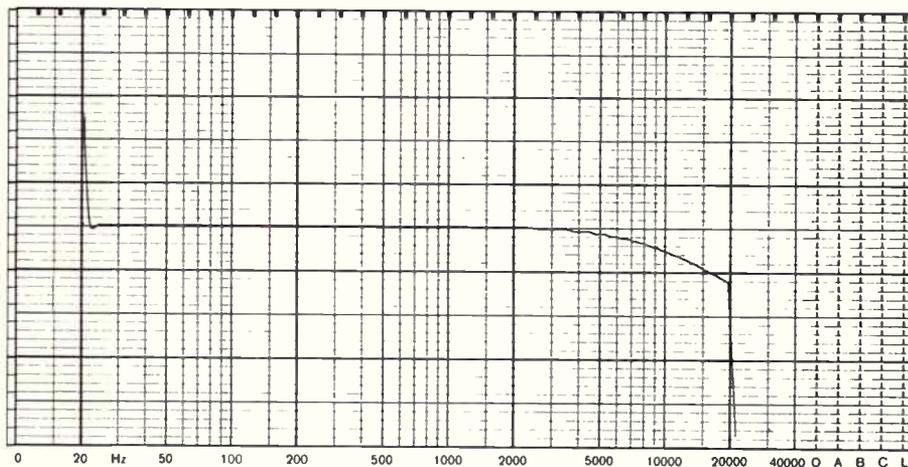


Figure 6: Left channel response with the analogue filter switched in.

MEASURED PERFORMANCE OF YAMAHA

MODEL NO. CDX-1110 PLUS REMOTE CONTROL TRANSMITTER CDX1110
SERIAL NO. MOI0200 7UX

1. **FREQUENCY RESPONSE** 20 Hz to 20 kHz ± 1.5 dB
5 Hz to 22.05 kHz ± 0.8 dB*
* See Text

LINEARITY (@ 1kHz)	NOMINAL LEVEL	LEFT OUTPUT	RIGHT OUTPUT
	0 dB	0.0	0.0
	-1.0	-1.0	-1.0
	-3.0	-3.0	-3.0
	-6.0	-6.0	-6.0
	-10.0	-10.0	-10.0
	-20.0	-20.0	-20.0
	-30.0	-30.0	-30.0
	-40.0	-39.9	-39.9
	-50.0	-49.9	-49.9
	-60.0	-59.9	-59.9
	-70.0	-69.9	-70.1
	-80.0	-80.0	-80.5
	-90.0	-88.6	-89.8

CHANNEL SEPARATION	FREQUENCY	RIGHT INTO LEFT dB	LEFT INTO RIGHT dB
	100Hz	-82.7	-82.0
	1kHz	-105.9	-99.6
	10kHz	-100.4	-103.8
	20kHz	-96.7	-107.5

Level	DISTORTION (@ 1kHz)					THD%
	2nd	3rd	4th	5th		
0	-	108.4	-	103.7	0.0012	
-1.0	-	105.5	-	101.5	0.0015	
-3.0	114.9	102.6	110.2	102.5	0.0019	
-6.0	112.0	110.1	108.6	94.6	0.0028	
-10	-	98.3	-	104.2	0.0025	
-20	103.5	97.6	99.6	92.5	0.0049	
-30	-	95.1	84.3	92.6	0.011	
-40	81.1	-	92.5	87.2	0.027	
-50	75.6	-	68.6	74.1	0.081	
-60	68.9	58.3	56.8	64.0	0.35	
-70	-	-	-	-	1.45	
-80	-	-	-	-	6.54	
-90	-	-	-	-	27.68	

(@ 100 Hz)					
0	113.4	111.1	112.7	101.9	0.0014
-20	103.8	96.0	99.1	93.8	0.0049
-40	79.7	83.3	94.4	88.4	0.034
-60	72.4	61.1	56.6	-	0.29

(@ 6.3 kHz)					
0	110.3	102.5	114.7	-	0.0017

5. EMPHASIS			
Frequency	Recorded Level	Output Level (L)	Output Level (R)
1 kHz	-0.37 dB	-0.3	-0.3
5 kHz	-4.53 dB	-4.2	-4.1
16 kHz	-9.04 dB	-8.5	-8.5

6. SIGNAL TO NOISE RATIO		
Without Emphasis	102.4 (Lin)	114.4 dB(A)
With Emphasis	114.0 (Lin)	120.0 dB(A)

7. **FREQUENCY ACCURACY**
(19.999 kHz) - 0.1 Hz for 20kHz test signal

8. **SQUARE WAVE RESPONSE**
(See attached photos)

9. **IMPULSE TEST**
(See attached photo)

10. **INTERRUPTION IN INFORMATION LAYER**

400 micrometer ;	Passed
500 micrometer ;	Passed
600 micrometer ;	Passed
700 micrometer ;	Passed
800 micrometer ;	Passed
900 micrometer ;	Passed

11. **BLACK DOT AT READ OUT SIDE**

300 micrometer ;	Passed
500 micrometer ;	Passed
600 micrometer ;	Passed
800 micrometer ;	Passed

12. **BLACK STRIPE TEST** (passed)

13. **SKREW TRACKING TEST**
Test Disc Skew angle 2° skew passed.

14. **VIBRATION OR DISPLACEMENT TEST**
Acceleration level 1.5 g^{rms} passed
Displacement test 150 mm @ 7.5 Hz excitation passed

15. **ACOUSTIC EXCITATION TEST**
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ETI JULY '88

Around the world, makers of video and audio tape are reporting problems. Profits are falling. In the US, the world's largest market, the result is a stagnant market, but there is an aggressive new player in the field. A special Sound Insights look at a dynamic market.

Tape Wars

KOREA is emerging as one of the dominant forces in the tape market. In the past few years some huge conglomerates have been formed to take on the world. There are four videotape companies: GoldStar, Saehan Media, SKC and Kolon — and four audiotape producers — Sunkyong Magnetic, GoldStar, Saehan Media and Sun Electronics. More than 90 percent of their total output is exported. In audiotape, more than 80 per cent of output is exported.

Meanwhile in the US, industry leaders continue to bewail the state of the art.

Characteristics of the blank tape market in the United States this year are broader distribution, intense competition along with profitability problems and continued technological development. Many market leaders in the US believe that the industry needs to raise prices on videotape but that stiff competition makes an increase difficult. Rebates are expected to end in the second half of the year in part because of announcements by major mass merchandisers that they will not handle any more rebates in their stores.

Blank tape distribution is extending to "everywhere there is a cash register" to make it convenient for shoppers to buy.

The same trends will probably be observed in the smaller Australian market.

In contrast to the gloomy outlook in the US, the Koreans are unbelievably bullish. Along with the rapid growth of VCRs on the world market, demand for videotape is rising constantly. The total estimated world wide demand for videotape this year is 0.9 billion cassettes, and Korean tape manufacturers expect to cover about 40 percent of the world market. As for audiotape, world market demand is estimated at nearly 1.2 billion cassettes this year and growth is steady. Korean makers expect their share of the world supply to be around 30 percent.

In order to accelerate their growth and to maintain an acceptable level of profitability with all the increased material costs and the appreciation of the won, Korean tape makers are expanding production facilities and promoting their own brand names to gain worldwide public awareness. They are developing innovative



More than 80 per cent of Korean output is exported, mainly to the US.

package designs that appeal to different countries' consumers. They are also investing in R&D to localise material production as well as to improve mixing and coating technology.

The 4 big names.

GoldStar, which has gained public attention in the world market as a hardware manufacturer, intends to plant the GoldStar brand in the field of magnetic products. With the recent completion of a second factory in Chongju the company is placing more emphasis on videotape than on audiotape. The first plant produces 15 million videocassette tapes, up to 18 million floppy disks and 50 million audiocassette tapes per year. The second plant, which specialises in videotape, has an annual production capacity of 80 million videocassettes.

The company's marketing policy is focused on establishing the GoldStar name as a tape maker. To improve its brand image in the world market, the company is participating in exhibitions and electronics Show in Chicago, the Cologne Elec-

tronics Show and the Leningrad Electronics Show, for it intends to enter the Russian tape market.

One of the world's largest videocassette producing companies, Saehan Media, is part of the Samsung Group. The company planned to expand capacity from the present monthly production of 15 million videocassette tapes to 20 million by the end of this year, however, in March a fire at the company's Chongju plant destroyed two-thirds of Saehan's total tape production capacity. It is expected to take more than six months to reconstruct the facilities. The company also will shortly start renovating a factory in Sligo, Ireland where it will establish a monthly output of five million pieces by early next year. This product will meet the demands of the European market and nearby African countries.

Saehan's policy is to expand production for OEM supply rather than emphasising its original brand name in the world market. However, in Africa, Saehan is currently exporting products under its own Sensus and Media brands. In the U.S.

market the company plans to sell its product under the Samsung brand, thanks to the public recognition of Samsung as a hardware maker, along with OEM business. Saehan had expected to supply 13 percent of the U.S. videotape market this year.

SKCZ, which changed its name from Sunkyong Chemical last year, produces polyester film, videotape cassettes and floppy disks. The company's Suwon plant is for the production of polyester film and the Chonan plant is for magnetic tape, with the annual production of 150 million videocassettes and 20 million floppy disks.

The company is concentrating on exporting its products under the SKC brand. In order to firmly establish its brand image, the company is pushing SKC brand in advertising and through other dynamic marketing programs according to the different local trends. Also, the company plans to develop a new design for SKC brand products in time for the Seoul Olympic Games.

SKC offers a wide-ranging product lineup for both VHS and Beta including standard, high and professional grades and 8mm videotapes. The company forecasts growing demand for S-VHS, VHS C and 8mm tape as consumers look for higher resolution and image quality. SKC plans

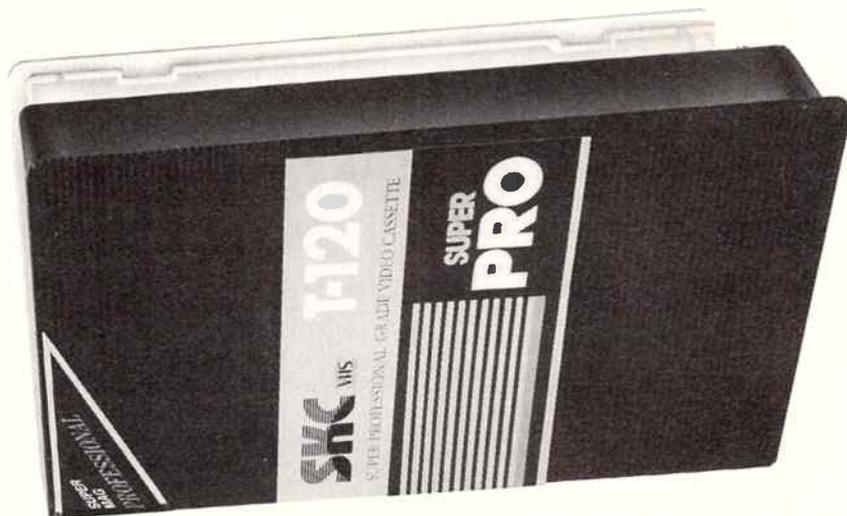
to emphasise value-added items such as VHS-C, 8 mm and digital audio tape.

Audiotape

Sunkyong Magnetic, a specialised audiotape manufacturing arm of the Sunkyong Group recorded 36 percent growth in calendar year 1987 over the previous year. For this year, the company has set its sales target 43 percent higher than last year.

Sunkyong is placing more emphasis on high-end markets such as the United States and Europe with the SKC brand audiocassette. In the United States, Sunkyong is supplying around 20 percent of the blank duplication tape to the professional market, in an effort to boost its share in the consumer line. The company currently prepares various package designs according to different local markets. Specifically, Sunkyong Audio Tape Division in Los Angeles, California is kicking off a powerful sales promotion for this year with a high-impact marketing program including special promotions, strategic distribution and a dealer profit program.

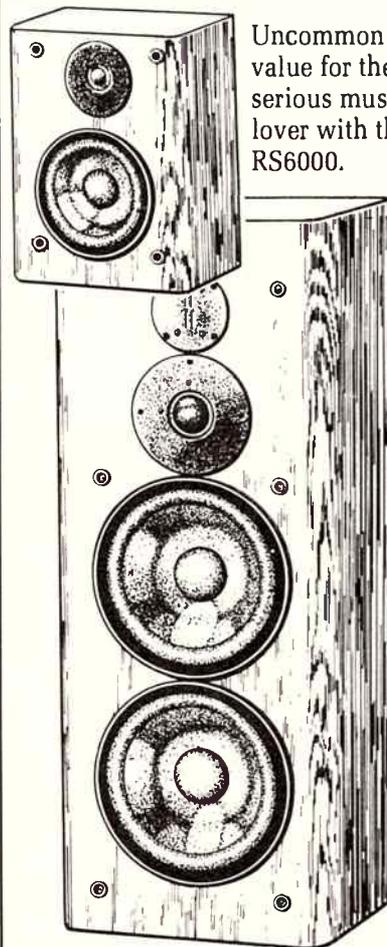
In the Communist bloc audiotape market, Sunkyong is concentrating on Hungary and Poland as the most strategic areas for both SMAT and SKC marketing.



Korean VCR tape will soon be widely available in Australia. If overseas experience is a guide, they will be aggressively priced.

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READER INFO No. 28
SOUND INSIGHTS, JULY '88

27

Tomorrow's Electronic Technology is Here Today

Rising Stars of Domestic Electronics

OBSERVERS are fond of noting that "a week is a long time in politics". The same time span and sentiment applies equally to the domestic electronics scene. These days, it seems that hardly a week goes by without some announcement about a new electronic invention which promises to change our lives, some improvement which guarantees to make life easier or a new application which pledges to become an integral part of our lifestyle.

Belt driven turntables, mantle radios, cordless telephones, pocket TVs, personal computers, portable cassette players, 45 rpm records, FM radio, infrared remote control . . . all these inventions and refinements of the electronic age and a whole host of others, once newsmakers, are now taken for granted. The past may be history but yesterday does perhaps give us a guide to the rising stars of domestic electronics that, at least for a few brief shining moments are the newsmakers of today . . . or will be tomorrow.

New TV

While the humble television set is hardly a newsmaker, what's happening to it certainly is. Stereo transmission and improved speaker fidelity have already revolutionised TV's audio system. And digital signal processing is set to do the same for video.

Imagine being able to watch a TV program and a video movie at the same time and on the same screen. Or think about freezing live sports action or scanning all available TV stations on the same screen. These innovations are not some pencil doodles on a design board. They are part of tomorrow's TV technology, available today.

Sanyo's VHR D500 was the first digital video recorder in Australia. Released earlier this year it, like other DVRs now available, stores an incoming signal in memory, then manipulates the digitised data to improve picture quality or create special effects.

For instance, the electronic image from DVR can appear as a small insert in a corner of the screen superimposed on the main video display. The \$1499 VHR D500 goes one step beyond this with its cycle



Peter Barker, Manager of Janaco P/L, launched the first truly portable FAX machine at the recent Australian Telecommunications Users Group exhibition in Melbourne.

memory-still. Using this technique the centre of the screen displays the normal program while 8 surrounding segments are frozen in sequence enabling the viewer to analyse fast moving scenes.

In addition, Sanyo's first DVR has multi-TV programme scan which permits rapid selection of all on-air TV channels by showing stills from all channels in succession. (It works by showing a multi-screen display of still pictures from preset TV channels shown nine at a time up to a maximum of 32 stations.) As well, the DHR D500 has a multi index scan facility which gives a 5 second preview of the contents of a tape containing a number of different recordings. Further features include a unique zoom which enlarges the centre of the screen 4, 9 or 16 times or any quarter of the screen four times. All this and considerable more video wizardry is programmed by remote control.

CD Video

The CD format has been modified so that the pictures as well as sound can be stored. CD has really taken off in Australia. Is CDV about to do the same thing?

Philips certainly hopes so as the Dutch company is preparing to attract a second generation of home entertainment buffs here and overseas with an audio and video playback system of very high fidelity.

Somewhat of a hybrid between the compact disc and LaserVision, CD-Video player (which will be available in NTSC

and PAL formats) will be able to 'play' — using laser tracking — conventional CD discs; gold tinted 12 cm CDV-singles with 6 minutes of video material and 20 minutes of audio material; and 30 cm CDV's (CDV-LP) with 60 minutes a side.

The first Philips machine, certain to be under some European Christmas trees this year, will be able to play 30 cm LaserVision video discs, as well. (The extended play of this format is particularly good for feature films and classical music concerts.) A portable CDV-single player with an LCD screen, capable of playing CD-Audio and CDV-singles is planned for a later introduction.

Although it seems unlikely at this early stage that CDV-single players will replace cassette recorders there's no doubting the potential is staggering particularly in the pop music market where each digital music track can have its own digital video image.

CD-V and the planned CDV-single formats are in direct competition with digital audio tape (DAT). But DAT, another innovation in home entertainment, has one distinct advantage: it can be reused like conventional magnetic tape, but several disadvantages including no fast scanning. This means the user can't program track sequences in any desired order without long delays between selections. It also means the unit is susceptible to head wear.

The new audio medium uses cassettes



'Speak and the words appear on a computer screen' is the principle Jon Marks expounds with the Kurzweil voice recognition system.



Continued product development has led to a number of music refinements such as the CD player and infrared remote control found on Sanyo's top of the line stereo midi systems.

Thomas E. King

which resemble conventional ones. However, any comparison between the two technologies ends there. Twice as thick as conventional cassettes, the single sided DAT cassette provides up to two hours of playing time. In the DAT player a pair of recording/playback heads is mounted on a tilted spinning drum which moves diagonally across the width of the moving tape. Similar to technology used in VCRs, this method enables denser encoding of data than available using the stationary heads found in analogue audio recorders.

Communications

Telephones are also big business. While Telecom will continue to sell the plain old phone, retail outlets will sell an increasingly diverse range of products that use the telephone lines.

A sign of the times: there were 70 exhibitors at the largest display of communications equipment ever assembled in Australia. Organised by the Australian Telecommunications Users Group (ATUG), in conjunction with Riddell Exhibition Promotions, the Fifth Australian Telecommunications Exhibition and Conference held at Melbourne's Royal Exhibition Building in late April displayed a wide spectrum of communications equipment, including a perfected voice recognition system, an image phone using yet unavailable ISDN technology and the first portable facsimile machine.

Take, for instance, the Courier 53. It is described as the first go-anywhere fax with capability to send or receive documents from the hotel room, office, phone booth, car or plane.

"Because of its size and light 3 kg weight," said Peter Barker, Manager of Janaco, the Melbourne based distributor of the Courier 53, "this innovation, which fits into a conventional briefcase can be interfaced, at this stage, to NEC and Philips mobile phones for use in the cellular area of metropolitan centres or acoustically coupled to any telephone system." The \$2722 device which doubles as a photocopier operates from a rechargeable Nicad battery pack, any 240 Vac supply or the 12 Vdc vehicle electrical system.

Voice recognition products manufac-

tured by the American Kurzweil Applied Intelligence, were also a big hit. Providing accurate recognition of up to 1000 words or phrases (without switching 1000 word block vocabularies) the KVS is the first speech recogniser with sufficient vocabulary to allow direct voice control and voice input for many industrial and business systems such as data base enquiries and data entry. Apart from a larger vocabulary, KVS has greater accuracy and more flexibility than any previous voice recognition systems, according to Jon Marks, Sales Manager for DBE, Australia, Priced around \$13,000 (not including the PC) KVS applications include communications with the handicapped and, in conjunction with an optional software package, rapid medical reports of radiology, cardiology and pathology tests.

Another product is the Kurzweil Voice-works, which effectively automates the creation of printed or written text. Marks said this new product would be ideal for anyone without keyboard or computer skills or secretarial resources needing to rapidly produce documents or contracts such as those required by solicitors and estate agents.

Priced around the \$30,000 mark (without the PC) the KVV provides accurate recognition of up to 20,000 words or phrases. KVV uses the Word Perfect word processing package and drives it by voice input. Users can not only compose text by speaking but can also display, edit, process, store and print documents by speaking the appropriate commands. Input capability is about 60 — 65 spoken words per minute.



The new Fujitsu Image Station at Melbourne's communication exhibition is another product of the future available today. Unfortunately communications technology (specifically ISDN) is not yet available to make use of the integrated voice, text, graphics and data capabilities of this 'electronic notebook'.

"Such a simplified term," said Mr Barty, Marketing Manager, of Fujitsu Communications Group, "does little to explain an entirely new concept in business communications. Designed for simultaneous verbal and visual communications, Image Station can create drawings and text documents on screen with an electronic pen, keyboard of document scanner. Then, during a voice conversion the contents on one Image Station screen can be transmitted to another screen, discussed, edited, stored on a built-in 600 K 3" floppy disk, printed out and/or sent to yet another Image Station.

Fujitsu provided terminals, transmission systems and digital switching systems for the world's first full-scale test of ISDN conducted in Singapore in 1985. Further field tests have been held in Japan, the UK, Europe and the USA.

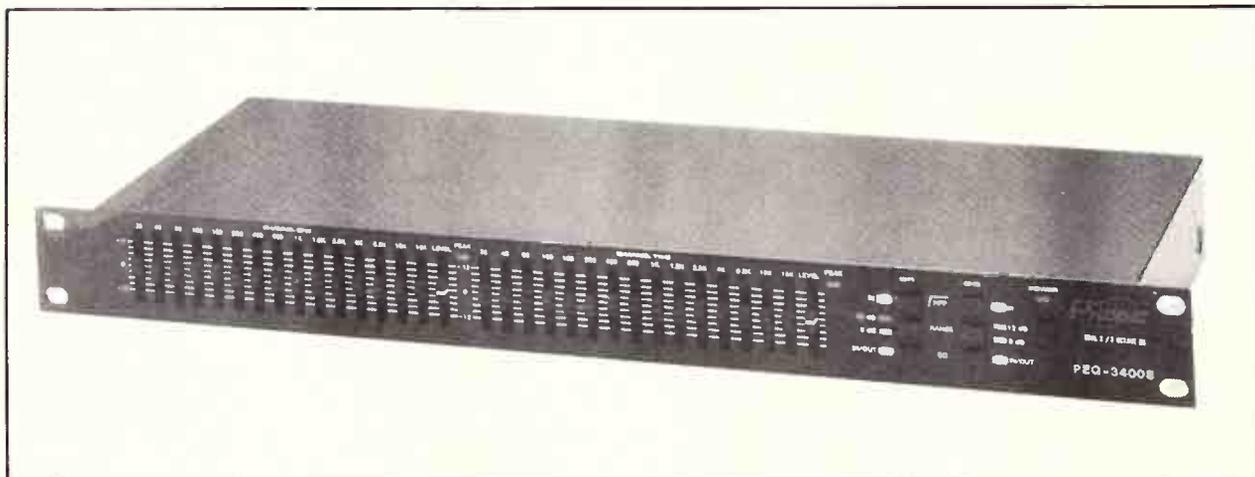
Telecom plans a soft launch of basic rate access ISDN in May 1989. But it's likely that any sophisticated end user such as Fujitsu and its high speed multi media business communications system will only be able to fully come on-line in the first half of 1990 when the supplementary second phase basic rate service of ISDN is commissioned. At that time, even though a few other countries may have limited ISDN facilities, Telecom's goal is to be operating the world's first fully integrated national service.

But an even greater market exists for this sophisticated multipurpose information exchange system. Undoubtedly Fujitsu engineers are well aware of the general acceptance of new technology 'down under'. Their development of a domestic-use ISDN terminal could easily be the next rising electronic star for the Australian consumer.

Consumer and business telecommunications equipment with multi line facilities and large memories demonstrated by Ross Makris of Dallas Delta Corporation.

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Enter this contest sponsored by Freedman Sound and you could win your choice of a PEQ-3300M mono or PEQ-3400S stereo graphic equalizer. Both graphic equalizers have just been released. Aimed at the professional or serious amateur they are both 19" rack mount models, incorporating many desirable features.

Both models are available from Freedman Sound, 91A Liverpool Rd., Summer Hill, NSW 2130. Phone (02) 797 0986 for only \$395 inc. tax.

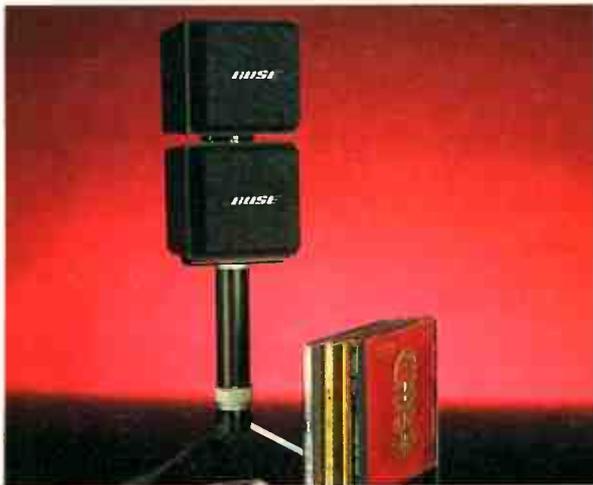
To enter this contest put your name, address and whether you would prefer the mono or stereo model on the back of an envelope, enclose

the ETI logo at the bottom and send it to ETI Freedman Sound Competition, PO Box 227, Waterloo 2015.

This contest will be drawn on August 12 and the three winners will be notified then and announced in September ETI.



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READER INFO No. 29

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 where each letter is a different color.

5 YEAR WARRANTY.

```

10 REM#DISINTEGRATOR#
20 MODE(0):CLS:COLOR,0
30 POKE30862,B0:POKE30863,52
40 GOSUB900
50 GOSUB800
100 'START FRAME
110 CLS:POKE30744,1:D=16:N=3:U=0
120 FORL=29152TO29183
130 POKEL,255:NEXT
140 M=D+16:P=0
150 PRINT@0,"  CHAMP:T$:PRINT@17,"PLAYER$: "U$
160 PRINT@32,"HI SCORE:T:PRINT@49,"SCORE:"U
170 PRINT@64,"  BOMBS:M:PRINT@81,"CRAFT:"N
180 FORL=29121TO29151STEP2
190 K=(RND(5)-1)*16+172
200 H=RND(7)*32:P=P+H
210 FORX=HTOOSTEP-32
220 POKEL-X,K
230 NEXT:NEXT
240 PRINT@139,"<S>=START"
250 A$=INKEY$:A$=INKEY$:IFA$=""S"THEN250
260 PRINT@139,"      ":SOUND31,1
270 L=28767:C=253.5:Z=.5:B=2
300 'MOVE CRAFT
310 A$=INKEY$
320 POKEL,32:L=L+1:POKEL,C+Z
330 IFRND(10)>5THENX=USR(X)
340 Z=-Z:FORI=OTOD*2:NEXT
350 IFB<2THEN370
360 IFA$="" ANDM>OTHEN400
370 B=B+1
390 IFPEEK(L+1)<>32THEN600
395 GOTO310
400 'DROP BOMB
410 SOUND20,1:M=M-1:F=L+32:B=0
420 PRINT@73,M
430 IFPEEK(F+32)=255THENSOUND10,1:POKEF,32:GOTO460
440 POKEF,32:F=F+32:POKEF,243
450 X=USR(X):GOTO430
460 FORY=29089TO29119STEP2
470 IFPEEK(Y)<>32THEN310
480 NEXT
500 'COLLECT POINTS
510 SOUND31,1;31,1
520 IFD>OTHEND=D-2
530 M=M*(2000-(D*100))
540 IFD=OTHENM=5000
550 U=U+M+P:POKEL,32:GOTO140
600 'WIPEOUT
610 SOUND15,1
620 COLOR,1:POKE30744,0
630 FORI=1TO50:NEXT:SOUND5,1
640 POKE30744,1:COLOR,0

```

```

650 N=N-1:M=(32-M)*10:U=U+M
660 FORL=28864TO29151
670 POKEL,32:NEXT
680 IFN=0THEN700
690 GOTO140
700 'END ROUND
710 IFU$=T$THEN730
720 IFU=TTHEM$="A DRAW"
730 IFU>TTHEM$=U:T$=U$
740 PRINT@9,"      "
745 PRINT@9,T$:PRINT@88,N
750 PRINT@41,T:PRINT@56,U
760 PRINT@96,"<T>TRY AGAIN <N>NEW GAME <E>END"
765 PRINT@170,"#GAME OVER##"
770 A$=INKEY$
775 A$=INKEY$:IFA$="" THEN770
780 IFA$="T"THEN100
785 IFA$="N"THEN50
790 IFA$="E"THENCLS:END
795 GOTO770
800 'INITIAL
810 CLS:POKE30744,0
830 PRINT"PLAYER,PLEASE INPUT YOUR NAME"
840 PRINT"  NO MORE THAN SEVEN LETTERS"
850 PRINT:INPUTU$
860 S=LEN(U$)
870 IFS<10RS>7THEN840
880 RETURN
900 'INSTRUCT
905 CLS:PRINTTAB(8);"#DISINTEGRATOR#"
910 PRINTTAB(7);"(BY ALAN STIBBARD)"
915 PRINT"YOU ARE IN A CRAFT WHICH HOVERS"
920 PRINT"OVER TALL STRUCTURES.YOUR TASK"
925 PRINT"IS TO DESTROY THESE BY DROPPING"
930 PRINT"BOMBS DOWN ON TO THEM BEFORE"
935 PRINT"YOUR ALTITUDE GETS TOO LOW AND"
940 PRINT"YOU CRASH INTO ONE OF THEM."
945 PRINT"THE GAME BECOME'S MORE DIFFICULT";
950 PRINT"AS YOU SUCCEED EACH FRAME.THE"
955 PRINT"NUMBER OF BOMBS WILL DECREASE:"
960 PRINT"AND THE SPEED OF THE CRAFT WILL"
965 PRINT"INCREASE.HIGHEST SCORER WINS!."
970 PRINT"*BOMBS NOT DROPPED ARE A BONUS."
975 PRINT"*THE <SPACE> KEY DROPS THE BOMBS";
980 PRINT"  HIT RETURN KEY TO CONTINUE";:INPUTS$
985 RETURN

```

Disintegrator

This game is run on the VZ-200 or 300. All the instructions

and comments are explained in the program.

A. Stibbard
Stanmore NSW

```

0 REM *****
1 REM ***** 3-D PLANET MAKER *****
2 REM ***** BY BRAD MARSHALL *****
3 REM ***** 3 - MARCH - 1987 *****
4 REM *****
10 : R=100:XC=160:YC=100
20 : GRAPHIC1,1:COLOR1,2
30 : FORY=-RTOR
40 : X1=INT(SQR(R*(R-Y*Y)))
50 : FORX=-X1TOX1
60 : N=INT(RND(1)*X1*2)+1
70 : IFN<X1+XTHENDRAW1,X+XC,Y+YC
80 : NEXT X
90 : NEXT Y

```

READY.

3-D Planet Design

This program is designed to make a 3-dimensional picture of a planet or moon. It gets the 3D effect by using Dot Distribution. This is random to a certain degree; dots to the left of the centre are more likely to be turned on than ones to the right.

The result is quite stunning. It uses the hi-res 320 by 200 bit map mode. This is an excellent example of how a very small program can produce a great output.

Unfortunately it is not in machine code, so a full size planet (which is default values) takes about 28 minutes to display. This is because of the slowness of BASIC. The program could be transferred to machine code, for any of those interested.

The radius of the planet is defined by R in line 10. The X and Y axes are determined by XC and YC in line 10 also.

Brad Marshal
Manjimup WA

READY.

```

10 REM 3-D SURFACE PLOTTER FOR I28
20 REM ORIGINAL PROGRAM FOR THE MICROBEE BY JOHN MC CORMACK
30 REM CONVERSION BY NICHOLAS SCULL
130 PRINT "I":
140 INPUT "HOW MANY LINES RESOLUTION(X-AXIS)?:":N
150 INPUT "HOW MANY LINES RESOLUTION(Y-AXIS)?:":M
160 INPUT "WHAT IS THE DOMAIN OF X(MIN,MAX)?:":X0,X1
170 INPUT "WHAT IS THE DOMAIN OF Y(MIN,MAX)?:":Y0,Y1
175 INPUT "DO YOU WANT A PRINTOUT(Y,N)?:":P$
180 PRINT "I":GRAPHIC1:SCALE1:SCNCLR
200 NO=(X1-X0)/N:MO=(Y1-Y0)/M
210 A=512:B=512
215 A1=2.17993878:SI=SIN(A1):CI=COS(A1)
220 FOR Y2=Y0 TO Y1 STEP MO
230 FOR X2=X0 TO X1
240 GOSUB 1000
250 GOSUB 2000
260 DRAW 1,A*U,B*V/2
270 NEXT X2:NEXT Y2
290 FOR X2=X0 TO X1 STEP NO
300 FOR Y2=Y0 TO Y1
310 GOSUB 1000
320 GOSUB 2000
330 DRAW 1,A*U,B*V/2
340 NEXT Y2:NEXT X2
350 IF P$="Y" THEN GOSUB 60000 ELSE T60
360 GET A$:IF A$="" THEN 360:GRAPHIC0:PRINT "":END
370 GRAPHIC0:PRINT "":END
1000 REM THIS GENERATES THE EQUATION
1010 REM
1020 Z2=300/((X2*X2/1000)+(Y2*Y2/500)+1):Z2=Z2*(-1)
1030 RETURN
2000 REM THIS CONVERTS 3-D INTO PERSPECTIVE 2-D
2010 REM
2020 REM
2030 U1=X2-Y2+C1
2040 V1=Z2+Y2+S1
2050 U=INT(U1)
2060 V=INT(V1)
2070 RETURN
60000 SOUND 1,40960,60
60001 GET T$:IF T$="" THEN 60001
60005 SL=B192:REM START OF HI-RES SCREEN
60010 DIMSC(127),A1(25,40):FOR I=0 TO 127:READSC(I):T=T+SC(I):NEXT
60020 IFT=24512 THEN GRAPHIC0:PRINT "ERROR IN DATA STATEMENTS":STOP
60030 DATA 128,192,160,224,144,208,176,240,128,200,168,232,152,216,184,248,132
60040 DATA 196,164,228,148,212,180,244,140,204,172,276,156,220,188,252,130,194
60050 DATA 162,226,146,210,178,242,158,202,170,234,154,218,186,250,174,198,166
60060 DATA 230,150,214,182,246,142,206,174,278,158,222,190,254,128,192,162,225
60070 DATA 145,209,177,241,137,201,169,233,151,217,185,249,135,197,165,229,149
60080 DATA 213,181,245,141,205,173,237,157,221,189,253,131,195,163,227,147,211
60090 DATA 179,243,139,203,171,235,155,219,187,251,135,199,167,271,151,215,183
60100 DATA 247,143,207,175,239,159,223,191,255
60110 OPEN#4:FOR I=7680:SLTO7992:SLSTEP8:M=(I-7680-SL)/8+1
60120 FOR J=1-7680:DISTEP20:N=(I-J)/320+1:FOR K=J+7:DIJSTEP-1:X=PEEK(K)
60130 IF X=127 THEN X=64:GOTO60130
60140 IF K=J+7 THEN A1(N,M)=A1(N,M)+CHR$(SC(XANDPEEK(K-1)+128)):GOTO60140
60150 A$(N,M)=A1(N,M)+CHR$(SC(X))
60160 NEXT J:NEXT I:FOR L=1 TO 25:PRINT#4,CHR$(B)$(A$(L,M)):NEXT PRINT#4,CHR$(B):NEXT
60170 PRINT#4:CLOSE#4
60180 RETURN
    
```

3-D Plotter

This is a conversion to C128 basic of a program originally published in the April '84 issue of ETI. The domains of X and Y must be about -300 to 300 at most, and there should be a fairly large number of lines

each way, but apart from that, the program is fairly similar apart from the screen dump routine at line 60000 to 60180

**Nicholas Scull
Mount Lawley
WA**

Minimart

FOR SALE: Applix 1616 computer consisting of 2 x 3.5" Chicon drives. Disk/coprocessor board. Samsung monitor (new). New keyboard. Power supply with mains filter. Genuine (expensive) case. Cassette deck. Joystick. It is very well built (machined IC sockets and 4 x expansion sockets). Jeremy Ellis, 10 Mercedes Crt., Rosanna 3084. (03) 459-5698.

NEW PRINTER: \$205 — Genuine IBM 8 1/2" Printer, 80 column,

buy own adapters for Apple, Commodore, Atari. Tony Petrovski, 6 Crighton Place, Dapto Heights, NSW 2530.

For Sale: ETI and EA back issues. ETI — 1981-1987. EA — 1982-1987. Phone: Andrew after hours on 371-6336.

WANTED URGENTLY — Circuit diagrams for a Dokorder 1140 & any spare parts. P.O. Box 606, Horhsam, 3400 or Ph. (053) 82 1351 and ask for Steve.

```

10 REM DISK DIRECTORY DUMPER
20 REM "BY G.TUNNY (C) COPYRIGHT 1988"
30 REM*****
40 LPRINTCHR$(27);CHR$(21);:REM SET SINGLE LINE FEED
50 CLS:PRINT"          DISK DUMPER          ":REM INVERSE
60 INPUT"HEADING FOR DISK":H$
70 INPUT"INSERT DISK AND HIT RETURN":XZ$
80 LPRINT"----";H$;"----"
85 LPRINT
90 POKE30876,1
100 STATUS
105 LPRINT
107 POKE30876,1
110 DIR
120 FORI=1 TO LEN(H$)+7
130 LPRINT"-" ; NEXT I
135 LPRINT"-"
140 INPUT"ANOTHER COPY":Y$
150 IF Y$="YES" OR Y$="Y" THEN RUN
    
```

Disk Directory Dumper

This handy little program dumps the disk directory and

the disc status directly on to the printer.

**G. Tunny
Gorokan
NSW**

ERRATA — ETI-1413

Astute readers will have noticed that our presentation of the ETI-1413 (ETI June 1988, p78) was a right royal shambles! What can we say? Even the best run outfit has its off days. As we clean the egg off our faces, please note a new parts list, which overrides both the previous parts list and the values on the original circuit diagram:

Resistors

- R1, 2, 3, 7, 9, 14, 21, 22 10k
- R4, 16, 17, 20 3k9
- R5, 6, 8, 11, 15 100k
- R10 22k
- R12 33R
- R13 390k
- R18, 19 2k2

- RV1 10k twin gang pc board mounting
- RV2 20k twin gang pc board mounting
- RV3 10k log
- RV4, 6, 7 10k
- RV5 20k trim

Capacitors

- C1, 2 33n ceramic
- C3 1µ/50V electro.
- C4, 5 1µ tant.
- C6, 7 1µ/35V tant.
- C8, 9 1000µ/25V electro
- C10, 11 5n6 ceramic

Semiconductors

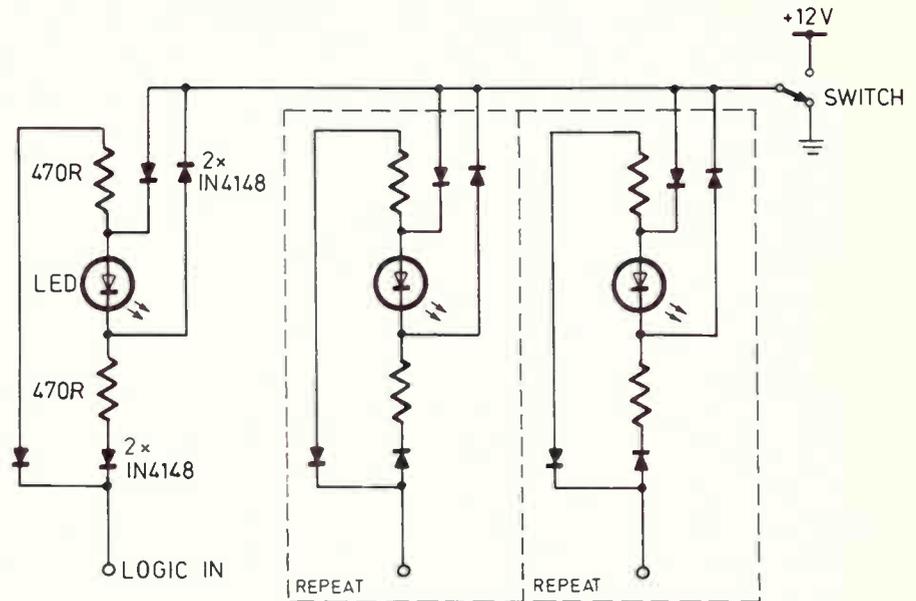
- IC1, 3, 5 TL 072 or equiv.
 - IC2, 4 TL 071 or equiv.
 - IC6 7815
 - IC7 7915
 - DI, 2 IN914 or equiv.
- Note that the ABOVE and BELOW level LEDs are not labeled, and one is shown with the reverse polarity. Also note that C6 and C7 connect to the ground rail in the normal fashion.

Reversible Led Logic Indicators

This circuit is useful for a prototype breadboard. Any number of LED's can be changed from logic "1" indication to logic "0" indication using only one SPDT switch.

If the switch is switched to ground a logic "1" will turn on the LED. If the switch is switched to +ve then a logic "0" will turn on the LED. In either position, with no logic in, the LED will be off.

L. Kafer
Laverton
Vic.



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.



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.

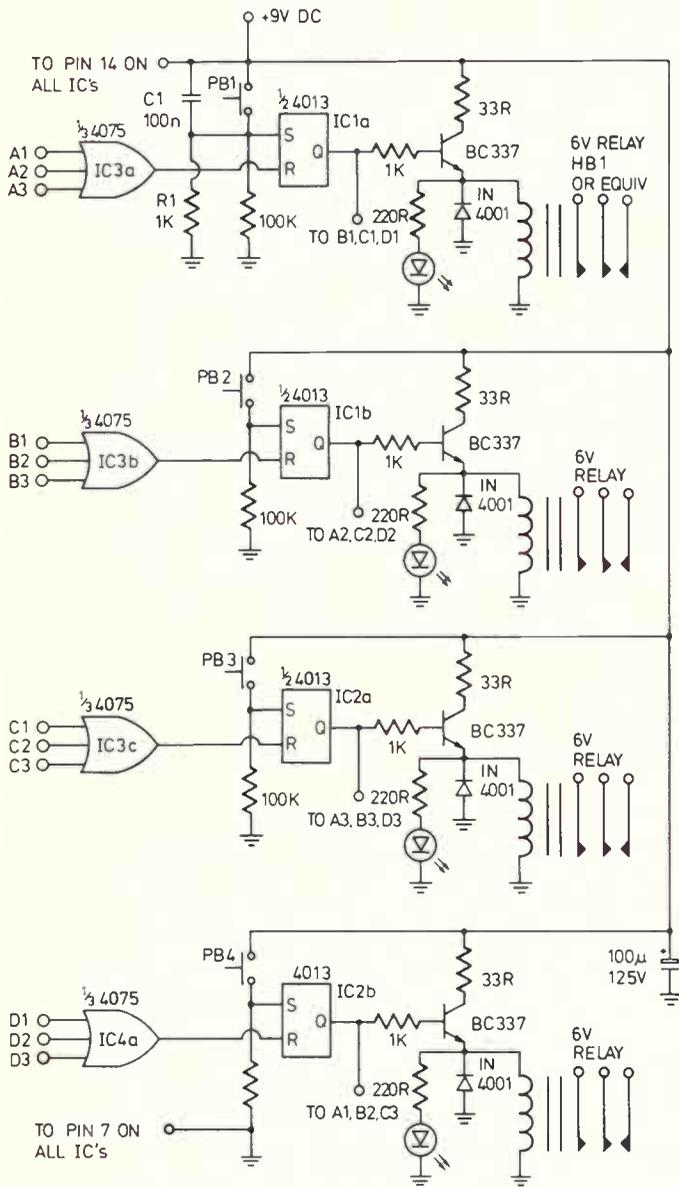
Title of Idea/program

Signature Date

Name

Address

Postcode



Logic Pulsar

This logic pulser is intended to be used with the logic probe published in the March issue. The design allows either a single pulse or a pulse train to be outputted to the circuit under test. I have decided to list the relevant design equations for the readers to make their own calculations on the pulse duration and the frequency of the

pulse train.
 Pulse Duration = $R4C2$
 Pulse Train frequency = $1.44 / (R2 - 2R3)C1$
 Train Pulse Duration = $0.693(R2 + R3)C1$

The pulser draws its power from the circuit under test.

**R. Gill,
 Kippa-Ring
 Qld.**

Ramming It Home

The Psion Organiser II XP has 32KB of Ram. The Eprom Programmes occupy some of this leaving 23.5KB for the user. Unfortunately your article stated the Ram to be 16KB; this was incorrect.

An OPL Procedure can also be accessed through the calculator on the Organiser.

Eg . . .
 FACT: (N)
 IF N=0
 RETURN (1)
 ENDIF
 RETURN (N*FACT:(N-1))
 Can be accessed through the calculator thus.

Calc: 6+5+FACT:(6)+8
 = 739

further you could use this Procedure to achieve higher functions.

Eg. CALC: FACT:
 (6)/FACT' (6-4)
 =360

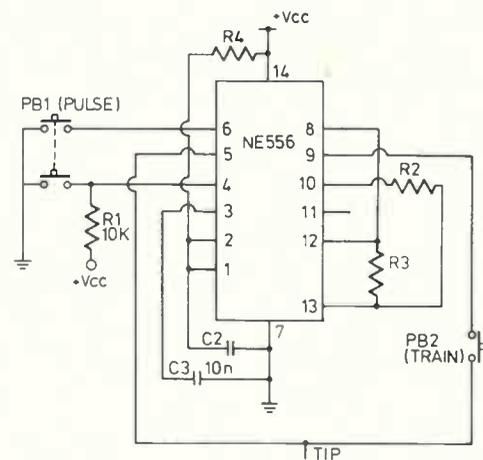
This procedure can be used to calculate permutations and combinations. The procedure can be called within other procedures and used to develop higher functions. Beyond a scientific calculator, the Organiser gives the user Real Computer Power.

PERM: (N,R)
 RETURN FACT:
 (N)/(FACT:(N-R))

Which can then be accessed through the calculator . . . thus

...
 CALC: 6+5+PERM:
 (4,3)-2
 =33

As well as the mathematical, scientific and engineering applications, the organiser also has very strong file handling facilities, allowing up to four files to be opened simultaneously and through the comms-link another file can be opened on a PC.



Electronic SP4T Switch

This circuit is an electronic version of a mechanical SP4T switch with a row of push-buttons which are often found on electronic equipment. Pressing any push-button will cause its corresponding flip-flop to "set" and the corresponding LED and relay to turn on. It will also reset all other flip-flops via the OR gates, thus only the se-

lected switch is activated. On power-up C1 and R1 sets IC1a. The commons on the relays can be connected together to give a true SP4T rotary switch operation or they can remain isolated. The relays used in the prototype 6V at 50mA types.

**B. Hirst
 Northcote
 Vic**

Within the limitations of screen size and memory; the only difference between the organiser and a desktop is that a desktop computer doesn't fit in a pocket.

I use mine to carry my tracker data bases (like a nomad gone walkabout). even without a cellular phone, its invaluable! I also carry the pocket spreadsheet and spell checker because I need them.

I am sorry that your unfamiliarity with the keyboard caused you some difficulty. I suppose as a journalist, you have been very used to the keyboard at your desk. I can assure you that with just a little time you will find yourself becoming almost as quick with the organiser with one hand behind your back and walking down a busy street.

Bryant Bemsteen BAppSc(M/D)
EME Product Manager (Pslon)

Just For Schools

In speaking for the high school population that read your magazine I want to thank you for such great reading material. Would it be possible though to include an article comparing different sound systems ranging from the lower priced range to the expensive such as the Sony FH15A (for us high schoolers).

Ilya Gruzden
Clareville,
Sydney, NSW

Project Please

Keep up "Sound Insights" — it's not bad — how about good medium power guitar amp — 25 watts or so? — haven't had one for a while in the projects section. Also you need more variety in your CD reviews.

J. Kennedy
Condon Hill, Qld.

TVRO On The Go

I refer to the May '88 issue of your magazine and in particular

the article "Australia's number one sky watcher".

I have on several occasions over the past 12-18 months spoken to Vic about my own TVRO station and exchanged ideas with him (Vic) about our own stations! On each occasion Vic has been most helpful and informative with this our interesting "hobby".

While I do not expect the writer to know what goes on in every radio — amateur's backyard through out the country, a quick telephone call or two to suppliers of equipment such as Acesat, Dick Smith Electronics etc, would have revealed that there are other amateurs in this country who have TVRO equipment. I personally knew of 3 others besides Vic!

I have no objections at all with the comment that Vic Barker's station is the best in this country — my discussions with him reveal that he is most competent but I object most strongly with the last paragraph of the article when it states.

... this veteran experimenter finds there is no one else in the country to exchange ideas and information with ...

This is simply not true!

If you the Editor, and the writer of the article (T. E. King) care to speak to Vic about it you too will verify the inaccuracy of such a statement.

Vic Barker does not go it alone!

John E. Dunkley
(VK5JE)
Pooraka SA

Thanks a Million

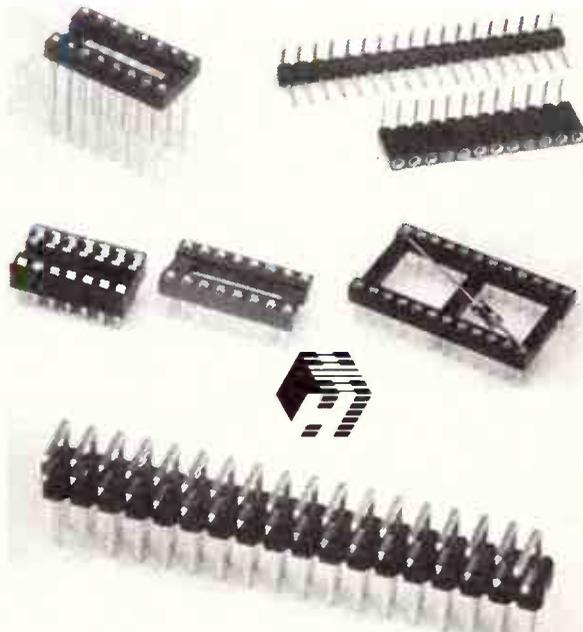
Just a note to say thank you for publishing the announcement of Webster's UK office (May, Industry news, p 10).

Just one thing, I hope our sales are running at more than \$650 p.a.!

— **Gail Phibben**
Webster Corp.

I think we meant \$650m. Mea Culpa — Ed.

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Image Processor For PS2

Imaging Technology has released the industry's first real-time, modular image processor for IBM's Personal System/2. Called the Series 151, the subsystem enables PS/2 users to perform high-performance image processing on the new Micro Channel bus.

The Series 151 image processor can be configured to meet varying applications requirements. Users choose from 11 functional boards — eight for pipeline image processing — to create a cost-effective image processor. Other versions of the Series 151 are compatible with the PC-AT and the VMEbus, including Sun Microsystems workstations.

The Series 151 captures from CCIR, RS-170 and nonstandard video sensors such as line- and area-scan cameras. Once digitised, images are processed in real-time using one or more pipeline image processing boards. Capabilities in the Series 151 product line include real-time averaging, subtracting, convolutions with programmable 8 x 8 kernels, histograms, feature extraction, binary correlation, morphology, and median filtering.

For further information on Series 151, please contact: The Dindima Group on (03) 873-4455.

READER INFO No. 204

High Speed Kookaburra

Sydney based Kookaburra Computers have recognised the move to faster processing by announcing a special price on the Speedplus 286. At \$450 they are expecting stock to go fast.

The Speedplus 286 is an internal option card designed to significantly enhance the performance of the IBM PC, XT or clones thereof. It includes an 80286 16-bit microprocessor to replace the 8088 originally provided. The 80286 processor runs at 7.2 MHZ, as compared to the

8088's speed of 4.77 MHZ.

The Speedplus also includes 8K of cache memory. With cache memory enabled, your software applications can run up to 7.5 times as fast as they do without the Speedplus 286. Even with cache memory disabled, the Speedplus 286 should still at least double the speed of your application programs.

Further information and orders from: Kookaburra Computers on (02) 365-0706.

READER INFO No. 205



New Transceiver

Icom has released a new model, the IC-781. The central feature of the 781, both visually and technically is a large multifunctional cathode ray tube (CRT) providing menu-driven tracking of memory data storage, multiple filter configurations and VFO settings.

The CRT also doubles as a powerful spectra-scope, displaying up to 200 kHz of the spectrum in graphic detail for instant location of interfering signals, close analysis of received transmissions, wide-band DX signal spotting and visual tuning of digital transmissions.

CRT spectra-scope bandwidth is selectable at 50, 100 or 200 kHz, and a highly accurate built-in log amplifier allows accurate measurement of received signals from 0-50 dBu.

Two independent passband tuning (PBT) circuits, one on the 9 MHz second IF and the other on the 455 kHz third IF, electronically narrow the IC-781's bandwidth using computer driven dual rotary encoders,

combined with an IF shift facility, to eliminate adjacent signal interference.

An advanced array of high quality, high shape factor filters in the IC-781, the basis for the twin PBT control, also provide standard 500 Hz CW filtering (250 Hz filter optional), plus 9 MHz and 455 kHz filters at the touch of a button.

A delay-controlled trigger circuit provides the IC-781 noise blanker with the ability to blank repetitive pulsed noise up to a maximum of 15 milliseconds. Together with an MCF filter at the front of the noise amplifier, this allows the IC-781 to fully eliminate OTH radar (Woodpecker) signals, even on adjacent frequencies.

Icom's advanced direct digital synthesis (DDS) frequency locking system, a feature of all new Icom transceivers, provides the IC-781 with frequency stability and the fast lock-up time, making it ideal for high-speed switching applications like AMTOR and Packet Radio.

READER INFO No. 206

Computer Movies

With the computers and display hardware widely available today, animation, when applied intelligently to appropriate problems can be a powerful tool available to comprehend three dimensional structures, evaluate design alternatives, and communicate what is in the designer's mind to the client's eye.

Utilising Autodesk's integrated product range, animation is now an accessible option for the PC-user. AutoCAD allows you to build three dimensional surface models of objects. AutoShade gives you the ability to view the models you create in AutoCAD as realistic pictures, moving from the abstraction of a surface image to the concreteness of a photograph. AutoFlix takes the next step by introducing MOTION into AutoCAD's models and AutoShade's pictures.

AutoFlix makes a movie exactly as a movie camera does, by taking multiple pictures and then presenting them to the eye rapidly enough to create the illusion of motion. Every movie is a collection of "frames". Each frame is simply a still picture which, in AutoFlix, is generated by AutoShade as a rendering or slide file.

In Kinetic Animation, ob-

jects in the model move as well. The camera position can be fixed or moving, but the key "action" in the movie is changes occurring in the model.

You can define a music sound track or "Score" to accompany your "movie". The score is coded from musical notation and can be synchronised with the visual part of the movie. You may also use vector slides generated by AutoCAD, AutoSketch or AutoShade, and simple ASCII text files. You can make your movies interactive, or overlay multiple images (as in double exposure) permitting easy composition of titles. You can even "splice" other movies previously generated with AutoFlix into a movie, allowing you to assemble a complete movie from separately developed scenes.

Hardware requirements for the initial version of AutoFlix (to be released within weeks) include: IBM/PC/XT/AT or compatible, 640 RAM, hard disk, EGA Display Adapter and compatible display monitor and a pointing device (optional).

For further information contact: Debra Donegan, Autodesk Australia (03) 429-9888

READER INFO No. 207

Fast Recovery Rectifiers

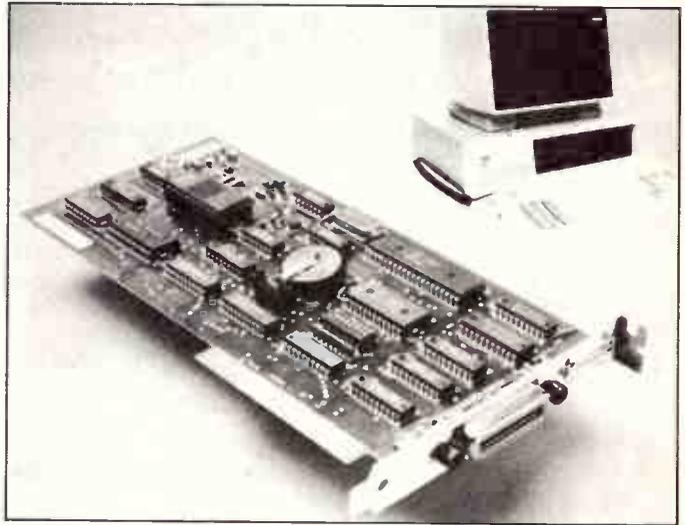
TRW Optoelectronics has just released two new series of extra fast recovery rectifiers.

The first, the DSR3000/DSR5000 series, is an axial lead EFRR (extra fast recovery rectifier) which exhibits the fastest trr available. This speed is coupled with low leakages and low VF. These devices are hard glass sealed for high reliability. The DSR3000/DSR5000 is ideally suited for military programs as well as commercial applications and are also screened to equivalent per JANTX or JANTXV levels upon request.

The second, the HCR3400/HCR31000 series of surface mount EFRR also exhibit the fastest trr available, with low leakage and low VF. These devices are hermetically sealed in a miniature custom surface mount leadless chip carrier. This construction provides for easy handling and mounting, while being rugged enough for medical, military or commercial applications.

For further information, please contact: Total Electronics, 9 Harker Street, Burwood Victoria 3125. Tel: (03) 288-4044.

READER INFO No. 208



The 488PCI generates GPIB from a PC

Making a PC Control Instruments

Scientific Devices (03) 579-3622 is importing a range of plug-in cards for IBM clones which turns them into GPIB controllers, allowing the computers to operate as control station for up to 14 instruments. The units come from ICS in California.

ICS's 488-PCI incorporates all requires software drivers and all GPIB controller functions on the card itself. This means that the 488-PCI is independent of the host computer's RAM or disk. Instead, RAM and disk are used only to store the user's test and measurement programs.

The 488-PCI supplies a battery backed time-of-day clock for precise measurement and control operations as a standard feature. It also permits the user to change the standard mnemonics of the GPIB com-

mand set into words of any programming or spoken language that may be more familiar or convenient.

The standard 488-PCI card supports IBM Basic, BasicA, and compiled Basic; other card versions are available to support a variety of languages including C and Turbo Pascal. It transfers data at speeds of 67 Kbytes/second using program I/O and to 300 Kbytes/second using DMA. The bus drivers meet all IEEE 488 specifications, and the driver routines are stored in a 8K x 8 EPROM; an on-card 2K x 8 SRAM offers the user extra working space. The card accepts standard IEEE 488 cabling; it is powered from its host computer's power supply and draws 600 mA at +5 Vdc.

READER INFO No. 209

Amiga CAD

A new CAD package has been designed in Bendigo for the Amiga. It's called APAL, and claims to revolutionise the CAD scene by allowing even the Amiga 500 to outperform an IBM AT.

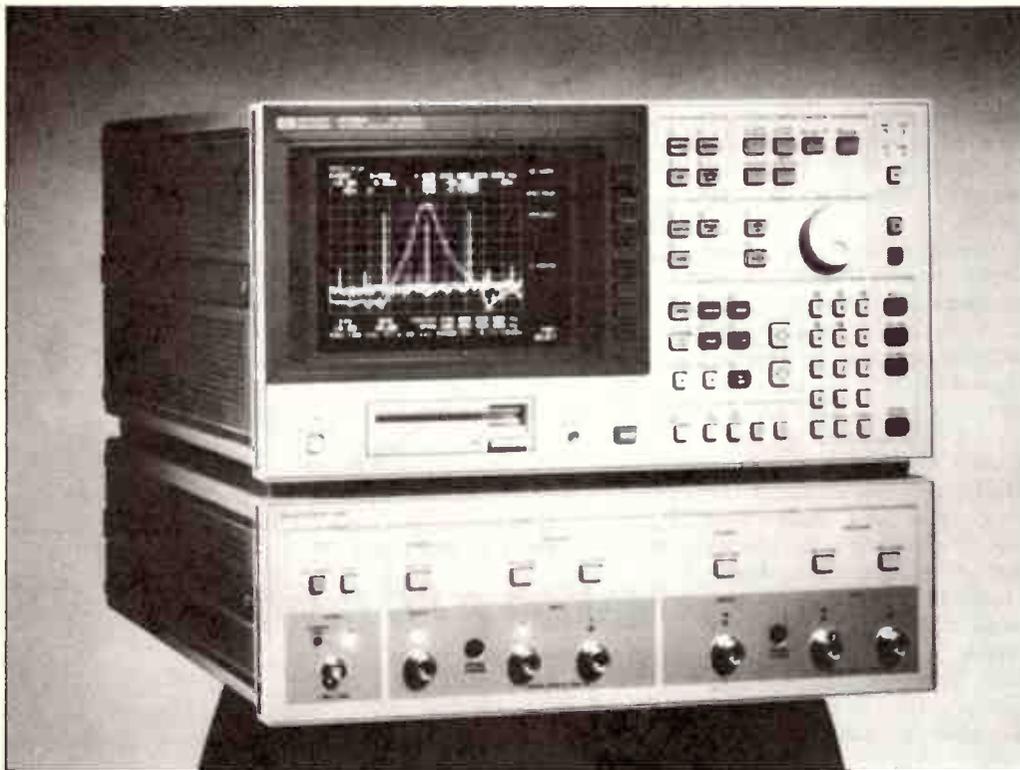
APAL is a true vector based CAD system for fast accurate work. High quality output is provided by either plotters or

printers (including the new 24 pin types). The software is designed and produced in Australia. According to designer Basford Systems, ongoing support is a high priority and is readily available. Training arrangements are being developed. Retail price is currently set at \$199.

For more information phone (054) 43-3349.

READER INFO No. 210

NEW PRODUCTS



The HP4195 network/spectrum analyser from Hewlett-Packard combines vector network and spectrum measurements in one instrument.

BSO — Realtime Craft

BSO (Boston Systems Office) supplier of cross compilers, has released a multitasking operating system for embedded applications running on Motorola M68XXX, Intel 80X86 and National Semiconductors 32000 families.

Why do you need an operating system for a microprocessor? 16 and 32 bit microprocessors

are very powerful, and they are increasingly used in applications demanding realtime responses. The amount of code these processors are running is often more than a megabyte. To make the software easy to develop and maintain an operating system is needed.

The overall code size is small. The executive is only 3Kbytes. The primitives are powerful and

allow all classic needs for a realtime application to be met, eg: mailboxes, semaphores and events. BSO/RC can co-exist with MSDOS in a PC. This mean that the PC becomes a realtime multi-tasking piece of hardware with access to the features of MSDOS.

For more information contact Sea Software on (03) 894-1407.

READER INFO No. 211

Datacraft Releases X.25 Switching Pad

Datacraft Australia has announced the release of a new addition to the Telematics/PCI SmartNet family of X.25 products. Its called the SmartNet 4000 Switching Pad which effectively fills out the mid to lower end of the SmartNed product range which presently consists of the 2000 and 3000 series.

The SmartNet 4000 is an entry level full function async pad-switching pad based on 80186

processor with 512kb DRAM, upgradeable to 1Mb. It provides up to 10 X.25 links and up to 2 X.25 links with 4 to 16 asynchronous channels with speeds up to 9600 bps.

The unit is fully software configurable with an integral 3½" diskette drive. Software architecture and command structure is the same as on the 2000 and 3000 Series.

Network management is pro-

vided by the SmartView NMS package implemented on an IBM PC. SmartView provides a central operator with the ability to monitor network performance and control configurations over the entire range.

The SmartNet 4000 is priced under \$5000 depending on configuration.

For further information phone Datacraft Australia on (03) 727-9111.

READER INFO No. 212



A TI TMS320C25 was flown on board Meteor P2, here being launched from French Guiana to test it for radiation hardness. The flight will last about eight years, during which time TI will collect valuable data on the reliability of its products in space.

New Chips

Several exciting new chips have been released during the month. Intel announced their new generation processor, the 80960 with 32 bit RISC architecture at a press conference in California recently. They are specified to run at 10 million instructions per second. Its just one of 16 ICs to form part of the 960 family. More information is available in Australia from Intel on (02) 957-2744.

The new generation of 1M DRAMS is slowly becoming available. George Brown (03) 329-7500 now have the Samsung KM41C1000 CMOS device on sale. It has fully TTL compatible inputs and outputs. This 100 ns chip uses a common I/O and uses the JEDEC standard pin outs.

Meanwhile SEEQ in the US have released a 512 K Flash EPROM. According to SEEQ publicity, the 48F512 offers twice the density of any EPROM currently on the market. Another unique feature is that it is available as a surface mount device. Erase time in circuit is claimed to be only 7.5 seconds. Write time is one millisecond. SEEQ guarantee the chip for a minimum 100 write erase cycles.

Texas Instruments have also been busy developing 32030 DSP applications. Cross compilers, linkers, simulators and C compilers are now available. However, documentation for the TMS320C30 version is only available under a non disclosure agreement because of patent problems. If you want one, speed to TI on (02) 887-1122.

READER INFO No. 213

OS/2 Apricot Computers

The new OS/2 operating system, from Apricot Computers, will run on any Apricot Xen-i 286 or Xen-i 386 PC system, including those installed or being manufactured now and in the future.

This was stated in Melbourne recently by Mr Julian Barson, Managing director of Barson Computers Australasia, Australasian distributor for Apricot UK Ltd. Mr Barson made the statement to counter reports circulated in the marketplace by rival companies on Apricot compatibility with OS/2.

OS/2, scheduled to be released by the developers, Microsoft, in the first quarter of next year, will also run on the new Apricot PC/S range of five 80286-based PCs and

workstations. Barson pointed out that Apricot systems were fully compatible with the IBM AT and the new PS/2 system.

In the UK, Apricot and Microsoft are jointly developing an enhanced version of Microsoft networks to enable MS-DOS workstations and PCs to exploit the functionality of the MOS OS/2 LAN manager, including its support for applications which use distributed processing.

This will be the first local area networking product to bridge the gap between MS-DOS and OS/2, and is the latest in a series of joint projects with Microsoft in which Apricot's network development resources have been called upon.

READER INFO No. 214

New SIL Resistors

Miniature high density single in line (SIL) thick film resistor networks are now available from Crusader. They are available in combinations of different ohmic values. Epoxy coated packages, with 5 pins to 12 pins in three standard networks complete the series. A (separate), B (com-

mon), and S (series) rated power of the networks is $\frac{1}{8}$ W and maximum working voltage 100 V temperature range -40 to $+125$ deg C.

A free catalogue is available from Crusader Electronic Components on (02) 516-3855.

READER INFO No. 215

Sun control

Using the latest technology in miniature electronic components, Philips engineers at Hendon, South Australia have developed a circuit that will provide the control functions necessary for charging lead acid batteries from solar modules.

The OM1602 thick film hybrid modules measure only 53 x 28 x 5 mm and can control systems of 12 volts to 48 volts.

Charge current flows from the solar array via an external series switching element, to the battery. The series switching element can be a RELAY or a FET, as the OM1602 has been designed to drive either device.

When the voltage across the battery exceeds a level corresponding to full charge, the series switching element is

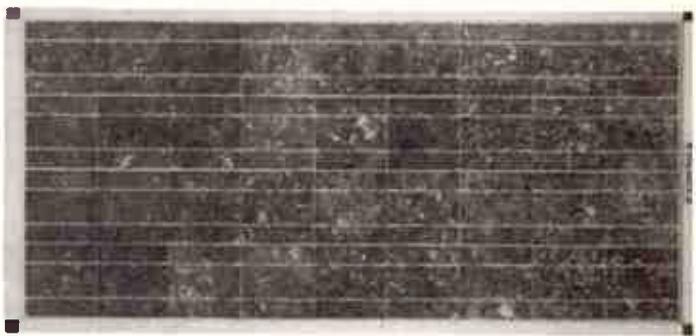
open circuited, allowing the battery voltage to discharge. The voltage will fall until it falls below another preset level at which the series switching element is closed.

These switching levels are factory-preset and require no field adjustment, however provision has been made to allow for slight adjustment if desired.

The only extra components required to make a complete regulator are the isolating diodes for each panel, and the switching element. Having all the control circuitry contained in one module, it is ideal for both large and small installations.

For further information, contact Philips on (02) 434 3322.

READER INFO No. 216



Solar Cells

Sydney based Solarex claim to have produced solar cells with the highest VA rating available.

The new Solarex MEGA series of modules, the MSX58 and MSX54, are a direct result of some 10 years of research and development in semicrystalline silicon casting and enhancement techniques.

The MSX58 and MSX54 produce 3.75 and 3.5 Amps of cur-

rent, at 14 Volts Nominal, with a peak power rating of 58 and 54 watts respectively. The Solarex manufacturing facility at Villawood, NSW has been retrofitted to produce the new MEGA modules and mass production runs are under way. For more information contact Solarex on (02) 727-4455.

READER INFO No. 217

EPROM Programmer

Sydney based Microcontrol has released an EPROM programmer to suit the new generation of one megabit EPROMS.

The programmer features an expansion bus and a modular operating system to safeguard it against obsolescence. Software updates are performed by replacing the control ROM, so that the programmer will be able to accept devices up to 8M bits when they become available.

It can handle 24, 28 and 32 pin EPROMS without personality modules. It can currently program 134 devices from 15 manufacturers from 2716 to 27010/27011.

All programmer software is contained on-board, and the unit is programmed via an RS232C interface, with transmission rates of up to 19200 baud and optional XON/XOFF software handshake. Eight translation formats are supported including Intel, Motorola, Tektronix, ASCII and binary, allowing the programmer to interface with PCs and a wide range of popular development systems.

To prevent damage to the programmer and devices, the programmer carries out extensive hardware and software checks before and during programming, making it virtually impossible to damage the programmer with a faulty device.

Microcontrol has also designed the MA1000 to be used in a stand-alone mode, allowing the user to initiate common operations such as duplicate EPROM, blank test or verify data, and an optional RS232C hand terminal is also available.

With a possible export market for the MA1000 in mind, the company has designed the unit to be operated from a 12V dc plug-in wall adaptor. Eliminating the internal power supply makes the unit better suited for export, since different supply versions do not have to be manufactured.

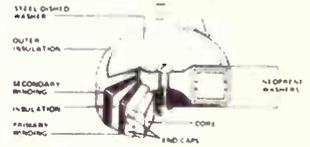
It is currently priced at \$990, which Microcontrol says is about half the cost of similar imported devices. Further information is available from Microcontrol, Unit 11, President Avenue, Monterey 2217.

READER INFO No. 218



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9+9	•	•	•	•	•	•	•	•	•	•
12+12	•	•	•	•	•	•	•	•	•	•
15+15	•	•	•	•	•	•	•	•	•	•
18+18	•	•	•	•	•	•	•	•	•	•
22+22	•	•	•	•	•	•	•	•	•	•
25+25	•	•	•	•	•	•	•	•	•	•
30+30	•	•	•	•	•	•	•	•	•	•
35+35	•	•	•	•	•	•	•	•	•	•
40+40	•	•	•	•	•	•	•	•	•	•
45+45	•	•	•	•	•	•	•	•	•	•
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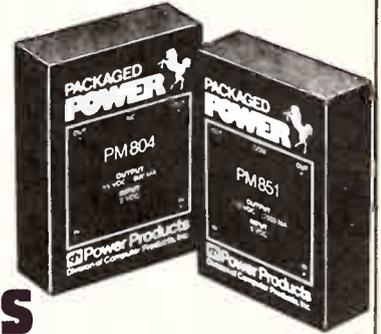
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2.5 3W	5 12 15 VDC	18 26 36 72 VDC	24 Pin Hybrid DIP	DR
3 6W	5 6 12 15 VDC	5 12 24 28 48 VDC	High Performance	F PM EM
5W	5 VDC	17 32 VDC	Non Isolated	WF
6W	5 12 VDC	5 12 24 28 48 VDC	Unregulated	K
10 60W	5 12 15 VDC	5 12 24 28 48 VDC	High Performance	LPS M PM
DUAL OUTPUT MODELS				
1.1 8W	± 12 ± 15 VDC	5 12 VDC	22 Pin DIP	PM EM A
1.5 18W	± 12 ± 15 VDC	5 12 24 28 48 VDC	High Performance	A
2.5 3W	± 5 ± 12 ± 15 VDC	18 36 36 72 VDC	24 Pin Hybrid DIP	DR
3 30W	± 12 ± 15 VDC	5 12 24 28 48 VDC	High Performance	PM A J EM, BA, N
55 60W	5 & 5 5 & 12 12 & 12 15 & 15 VDC	12 24 48 VDC	High Performance	WRK
TRIPLE OUTPUT MODELS				
9W	± 12 & 5 ± 15 & 5 VDC	5 12 24 28 48 VDC	High Performance	C
15W	± 12 & 5 ± 15 & 5 ± 5 & 12 VDC	9 18 18 36 36 72 VDC	Economy	ES
25W	± 12 & 5 ± 15 & 5 VDC	12 24 28 48 VDC	High Performance	S
55 60W	± 12 & 5 ± 15 & 5 ± 5 & 12 ± 5 & 15 VDC	12 24 48 VDC	High Performance	WRK

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READER INFO No. 34

PLOTTERS IN ADELAIDE

Jon Fairall

Strictly by coincidence, two interesting new plotters have been developed in Adelaide within the past few months, and both seem set to achieve some popularity in the marketplace, if only because they have sufficient unusual features to make an impression.

First up is an A1 sized pen plotter being constructed by Barrington Corporation. According to Barry Liston it is the least expensive flat bed A1 (big) plotter on the market, and at \$4600 he is not far wrong. A smaller A2 sized version is for sale for \$3.3k, and a bigger A0 one for \$6.8k. All versions have the same electronic features.

The basic mechanism, including most of the control circuitry, the motors and the pen head are made in the US and imported into the country in kit form. An electrostatic hold down system and an 88 k buffer are added here. The electrostatic hold down is generated using interleaved combs of copper sheeting laid under the plotter bed. One comb has a potential of +3.5 kV and the other, -3.5 kV, giving a potential between them of 7 kV. This is enough to generate sufficient hold down to keep a sheet of A1 paper in position even when used in the vertical position. The 88 k of memory added into the system in Adelaide is a considerable boom for operators, since it makes it possible to load a reasonably sized drawing into memory, thus freeing up the host computer for different tasks.

Liston claims that he already has outstanding orders for 50 plotters, and is expecting more. He also wants to re-export his improvements to the plotter

The QED 300 plotter will take up to A3 sized light-sensitive paper which can be handled in daylight.

back to the parent company in the US.

The second plotter represents the culmination of a few years work by academics at RMIT, who have designed a small solid state light source into the structure of a conventional plotter pen. Quest International, a vehicle for David Brown in Melbourne, has got hold of an OEM plotter, put the light pen and the electronics necessary to drive it inside, put a light proof lid on the outside, and is now flogging it as the world's first PC based photoplotter. It works; what's more, it works extremely well if the artwork I saw in Adelaide is anything to go by.

Although the process is simple in theory, there have been a number of development problems along the way, not least being the design of an optical system which can make a track to a precisely defined

width. Quest engineers are a bit coy about explaining exactly how the system works, but clearly there has to be an algorithm in the software to match the light intensity to the speed at which the head is moving. The lightpen-carrying head can travel as fast as the mechanism will allow, typically four times faster than with a pen, but even so, it needs to start slowly and stop slowly to prevent any bounce in the head. During these times the exposure needs to be reduced to avoid over-exposing the film.

The track width created by the pen can't be varied, so to achieve different sized tracks, different pens need to be used, thus each plotter comes with eight. Pads can be made to a variety of different sizes however, by using a technique known as flashing. The pad is drawn by taking the pen to the appropriate spot and then puls-



The Barrington Corporation's flat bed A1 plotter suitable for wall mounting.



ing the light on and off. The size of the pad depends on the strength and length of the pulse.

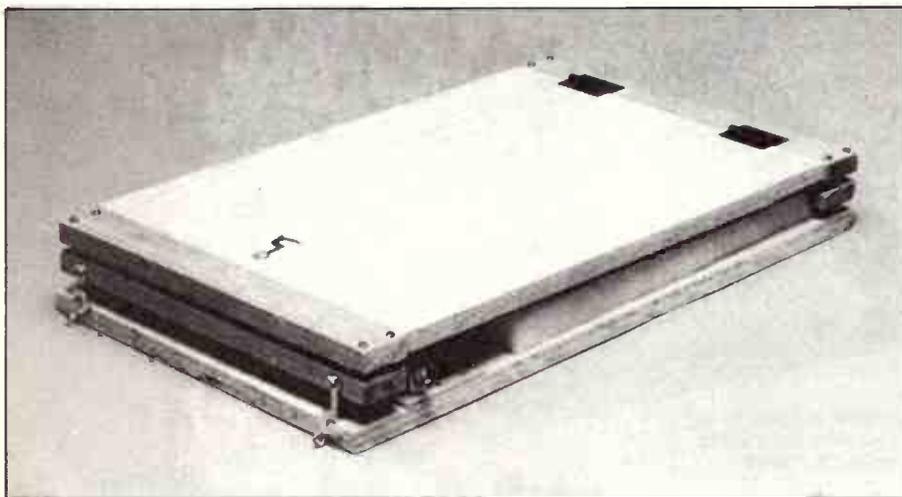
The device being released in Adelaide is the Quest QED300 which will take up to A3 sized paper, but developments are a planned up to size A0. Quest is selling a system that allows the light sensitive paper to be handled in daylight even up to these sizes. All the developing and other film processing can also be done in normal light through the use of light tight containers.

Will it sell? Brown needs to convince the market that there are advantages to be gained by drawing directly onto film. It's quicker, and probably of better quality than most commercial artwork, but it is more messy, because it needs all the developing chemicals with it. At least you have the choice. ●

ETI-188 PCB EXPOSURE UNIT

Utilising the natural radiation of the sun, this project makes printed circuit board exposure easy and inexpensive.

Glen Thurecht



THE MOST COMMON method of producing printed circuit boards for small production runs, prototypes, or one offs is through the use of boards with an ultra violet (UV) light sensitive surface onto which the circuit pattern is imaged. This imaging is generally achieved by passing the UV light through a negative of the circuit pattern. Anywhere that the etchant resist surface is exposed will "harden" and not be washed away when placed in the developer solution.

Mostly the UV light source is obtained through special filament lamps or Phillips TLA-5 Actinic blue fluorescent tubes. The aim of this project was to remove three of the biggest problems in using these light sources:

1. **COST** — UV light sources are relatively expensive.
2. **SIZE** — The maximum size of the board that can be exposed is limited.
3. **NON EVEN LIGHT DISTRIBUTION** — artificial light sources tend to have "hot spots" where the UV light is more concentrated thereby leading to boards that are overexposed in some places

and underexposed in others.

One easy solution to all the above problems is to use a commonly available source — the sun! It is free (ie. low cost), PCB area is limited only by your imagination and parallel light rays means that exposure is completely even across the whole board surface. Hence this project describes the construction of a unit which holds the printed circuit board negative, and times the exposure to the sun.

The board holder also has the important task of keeping the board and the negative tightly squashed together so that the image is accurately transferred without undercutting or "bubbles". The design that was adopted is shown in Figure 1. It is made up of two hinged sections with a glass sheet and foam pad in between. The first section opens via two fish hook latches at the side. This gives access to the foam pad upon which the board is laid with photo sensitive surface upward. The negative is then placed on top of the board and the glass sheet pressed down and latched with the hooks. As the glass is latched the foam compresses and firmly

couple the board and negative together. The second hinged section is the light cover or hood. This is placed over the glass sheet and is removed when the exposure is to commence. When the buzzer of the electronic timer sounds the cover is then placed back over the glass to prevent further exposure to UV light.

The electronics are housed under the glass sheet and have a light sensitive phototransistor which senses the amount of light that is incident upon the unit. Ultimately the output of the sensor is a current, I , shown in the circuit diagram. This current is integrated and switches a comparator when the accumulated light is correct for proper exposure. The comparator then makes a buzzer sound to indicate the "cover up time". The electronics is powered by a 9 Volt battery to allow for complete portability.

Although the photosensor is measuring incident light across a frequency spectrum that is not just ultra violet, experimental results have shown that the output of the sensor is fairly reliable as an indicator of the amount of UV present in sunlight.

The ability for the circuit to integrate the light levels is needed so that factors such as clouds passing overhead can be compensated for. It also means that different light sensitivities on different days will not produce different results.

Construction

The printed circuit board is single sided and fairly easy to construct. Firstly, check the board for solder bridges or breaks between tracks. Assuming all is well, proceed by inserting the lowest profile components first and working up to the highest. Solder the four wire links, then the zener diode (checking for correct orientation), resistors, integrated circuits, etc. The switch is printed circuit mounting to reduce wiring and is the last component to be soldered into place. The phototransistor should be placed well up off the board

Printed Circuit Board Exposure Unit

so that it will not be affected by the shadows of the other components or the foam that will be placed around it.

The only wiring that is needed is for the buzzer and the 9 Volt battery clip. When wiring the battery clip cut off all but 5 cm of the lead length. This will allow the battery to sit neatly beside the board when the unit is fully constructed.

When all is finished do a final check to make sure everything is OK. Check that pin 1 of all the ICs are in the correct place, the two electrolytic capacitors have the positive terminal connected the right way round, both transistors are inserted properly, and that the two diodes are orientated correctly. Last of all, flip the board over and look at the soldering, touching up any suspect joints.

Now being no master carpenter, here comes the tricky part. Firstly, cut the wood to the size you wish. The example shown in Figure 1 is just what I have decided upon but it can be any size you wish. The bottom and top panels are cut from plywood whereas the glass holders were dressed timber to provide a tighter fit on the glass. The glass sheet can be obtained from any glazier and should be

6mm thick to stop flexing. All edges should be properly finished to prevent injuries to users.

Attach the dressed timber pieces to the glass by 3mm bolts drilled through their ends, two bolts on either side allow for a good fit. The glass is then sandwiched between the two pieces of wood and the bolts tightened.

The bottom and top panels are joined to the assembly with the hinges as shown in the diagram. Next the fish hook latches are screwed in.

The foam pad is then cut to size. The thickness should be greater than the thickness of the dressed timber pieces so that it has to compress when the unit is fully closed. Cut a rectangle out of one end of the foam for where the printed circuit board is to be mounted. The PCB is positioned so that the switch and the calibration potentiometer are accessible when the assembly is fully closed and is bolted down through the bottom plywood panel.

Testing

When the electronics has been carefully inspected, the battery may be connected. Slowly turn RV1 until the buzzer sounds. Rotate the trim pot the other way and it

should turn off. Now return it to its central position, turn the switch off and then on again to discharge C. Shine a bright light onto the phototransistor and time how long it takes to buzz. Switch the unit on and then off again now keeping the sensor covered. The time that it takes the buzzer to sound should be much longer.

If the circuit does not pass these initial tests we must do some troubleshooting. Again check the orientation of the ICs, transistors, capacitors and diodes against the component overlay. Ensure that the black and red wires from the battery clip are going into the board in the right places.

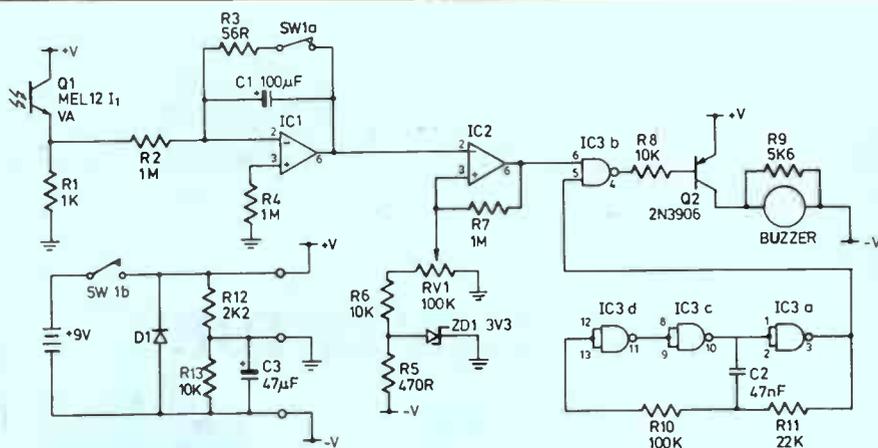
With a fresh battery, measure the voltage between common and the -ve and +ve rails. The magnitude of these should be around 4.5 volts \pm 1.5 volts. If it is not, check for places in which large currents can be drawn on the rail with the smallest voltages. Q1 can be checked for correct operation by measuring the voltage at VA. As the incident light is changed on the sensor, the voltage should change. If this is not the case there is something wrong with the phototransistor or associated circuitry. If the buzzer is not sound-

HOW IT WORKS ETI-188

Incident photons on the light sensitive base of the phototransistor Q1 give rise to an emitter current. This emitter current develops a voltage, VA, across the parallel combination of R1 and R2 since the negative terminal of the operational amplifier, IC1, is a virtual earth point. The input impedance of the LF356 is approximately 10 ohms hence the input current I₁ (which is VA/R2) charges up the capacitor C1. Since the positive terminal of C1 is held at 0V (a virtual earth) the output of IC1 must start going negative to allow for the voltage across the capacitor due to the integrating of the current I₁. R4 is used to reduce output drift due to the input bias currents of the operational amplifier.

IC2 is configured as a comparator with a small amount of positive feedback via R7 to provide hysteresis. This hysteresis stops the output from jittering due to noise when the input approaches the reference or switching voltage VB. Jittering is partially a problem with slowly varying input voltages such as in this design. The reference voltage, VB, is formed by the network R5, ZD1, R6 and RV1. The zener diode, ZD1, is used to stabilise the reference voltage as the battery voltage varies as it is discharged.

The output of IC2 is then used to gate the audio tone generator signal formed by the NAND gate oscillator IC3d, IC3c, IC3a, C2, R12, and R11.



The frequency of oscillation of this circuit is given by the equation:

$$f = \frac{1}{2 R_{11} \left(\frac{0.405 R_{10}}{R_{10} + R_{11}} + 0.693 \right)}$$

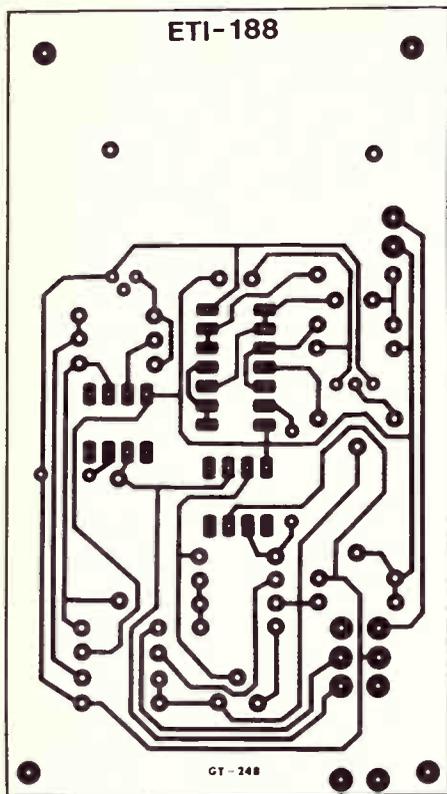
The frequency of operation with R10 = 100K, R11 = 22K and C2 = 47nF is around 470 Hz. If a different frequency is desired a simple change of circuit components can be calculated using the above equation.

When the output of IC2 goes high the gate, IC3d passes the audio signal into the driving transistor, via a base current limiting resistor R8 and then drives the piezo electric buzzer. R9 provides a dc load for Q2.

Power is provided by a 9 volt bat-

tery and the split supply rails for the operational amplifiers are formed by the network of R12, R13 and C3. D1 is used to protect the circuitry from accidental reversal of the battery which may damage the operational amplifiers. Note that the protection diode is placed in parallel with the battery. This has the advantage of increasing battery life by removing the 0.7 volt drop across a series protection diode but it has the disadvantage of creating a large discharge current if the battery is inadvertently reversed.

SW1 has two functions; to turn power on the circuit; and to discharge C, so that the integration always starts with no charge on the capacitor. R3 is used to limit the surge current from C, when SW1a is first closed.



ing check that the comparator (IC2) is switching by looking at its output with a multimeter and rotating RV1 back and forth. Also measure the voltage at pin 3 of IC3. If it reads 0V or 9V then the oscillator is not operating.

Making Printed Circuit Boards

Since we are constructing a project used in the fabrication of boards a brief guide to the processes will be given:

1. **ARTWORK PRODUCTION** — the artwork is laid out using artwork tape or a computer aided design package. Typically it is produced at 4:1, 2:1 or 1:1 scales and then photographically converted to 1:1 when the negative is being made.
2. **NEGATIVE PRODUCTION** — the artwork is photographed to produce a negative of the original. This can be done at many professional photographic stores at a reasonable cost. Alternatively a negative may be contact printed from 1:1 artwork using a "Scotchcal" type process.
3. **BOARD EXPOSURE** — the UV sensitive PCB is then exposed to UV light for a set period of time through the negative which is placed firmly on the top of the board. After

exposure the plastic film over the photoresist surface is removed.

4. **DEVELOPING** — the photoresist surface is then developed in a developer solution which washes away the resist anywhere it has not been exposed to the UV light.
5. **ETCHING** — the board is then etched in a solution which eats away at the copper surface. Typical etching compounds are Ammonium Persulphate or Ferric Chloride.
6. **STRIPPING** — the photoresist over the copper tracks that have not been etched away is then removed with a stripper solution.
7. **DRILLING** — all the holes for the components are then drilled at high speed to allow components to be placed on the finished board.

This finishes the board production although many other steps are possible — such as tinning, solder resist layers, and component overlay silk screening.

Using It

The unit is extremely simple to operate. Firstly, in a dark room, the bottom section is opened and the unexposed board and negative placed on the foam. The glass is then pressed down and latched and the top cover closed to prevent light from reaching the board until you are ready. Now take the sealed unit out into the sun and well away from any shadows which would cause uneven exposure. When all is settled switch the electronics on and then lift the top cover. Sit back, twiddle your thumbs and wait for the buzzer to sound. Close the cover again, walk back to your dark room and develop the board.

ETI-188 Parts List	
Resistors 5% metal film all ¼ watt unless otherwise stated	
R1	1K
R2, R4, R7	1M
R3	56K
R5	470
R6, R8, R13	10K
R9	5K6
R10	100K
R11	22K
R12	2K
RV1	100K
CAPACITORS	
C1	100uF 16V electrolytic
C2	47nF green cap
C3	47uF 16V electrolytic
SEMICONDUCTORS	
Q1	MEL 12
Q2	2N3906
D1	1N4004
ZD1	3.3 Volt zener
IC1, IC2	LF356, YL-071, etc.
IC3	4011
MISCELLANEOUS	
PCB mounting switch, 9V battery clip, buzzer, nuts, bolts, glass sheet, wood hinges, fish hook latches, PCB.	

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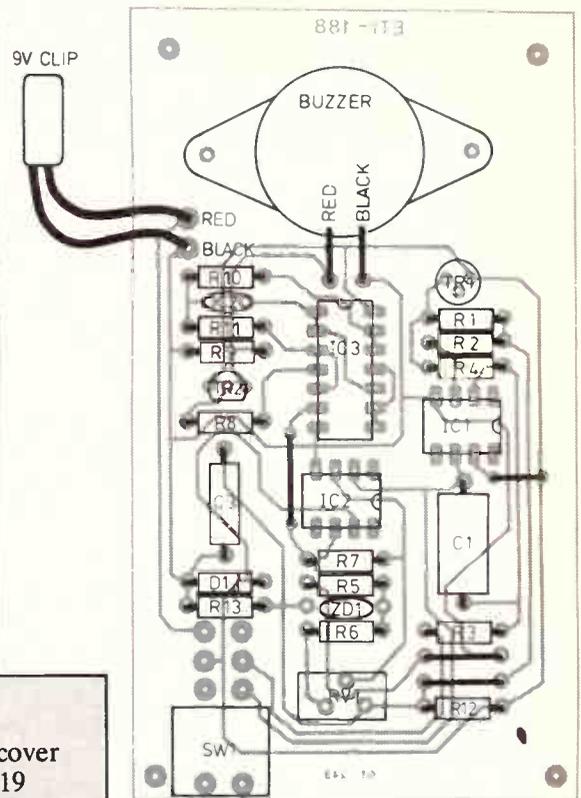
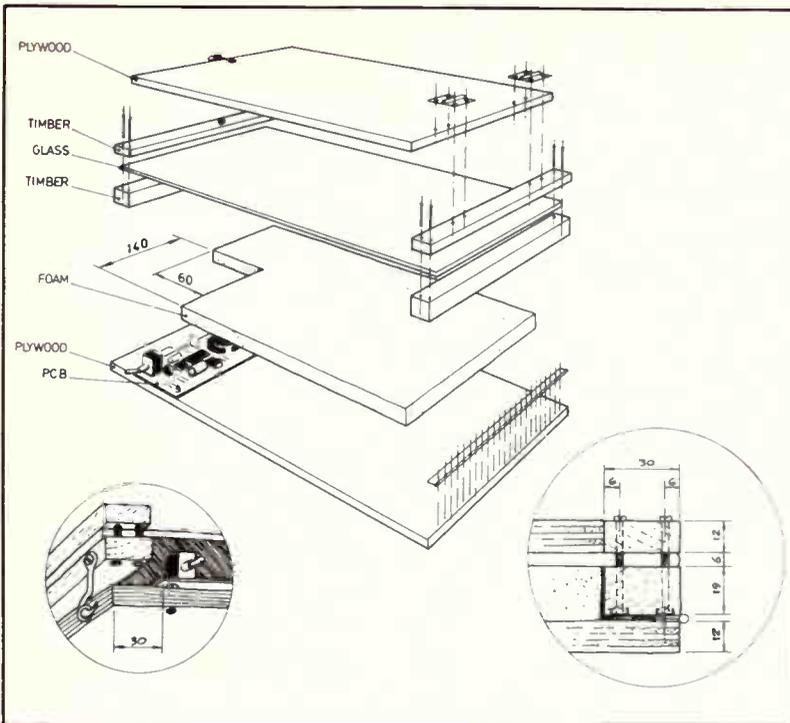


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READER INFO No. 35

Printed Circuit Board Exposure Unit



MATERIALS

12 mm PLYWOOD	350 x 250 top cover; 346 x 250 bottom cover
DRESSED TIMBER	2 PCS 250 x 30 x 12; 2 PCS 250 x 30 x 19
GLASS —	410 x 230 x 6
FOAM —	345 x 230 x 25
PIANO HINGE	Length 220 mm; screws to suit
HINGES TO SUIT	2 off
PCB	60 x 105
FISH HOOK CLIPS	3 off; see note
BOLTS	8 off 2.5 mm; nuts to suit

NOTE:

Readers may care to use a different locking system to the one we used, which is not very robust. A hasp and staple system would probably be a lot better.

A word of caution when waiting for the buzzer — watch your shadow if you are walking around.

Double sided boards can be exposed by doing one side first and then returning to the dark room to flip the board over to do the other side. The foam will be sufficient to stop light from reaching the underside when the top is removed, however a piece of black plastic can be laid underneath if you are worried.

Calibration

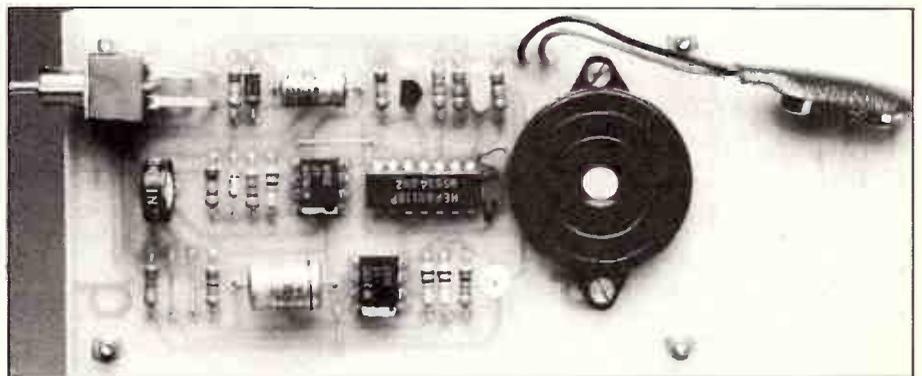
Before PCBs can be exposed with the newly constructed unit it must be calibrated so that the buzzer will sound after the correct amount of light has fallen upon the board. The best way to do this is to do a little experimenting. Take the unit out into the sun and set RV1 so that the buzzer sounds after one minute, thirty sec-

onds. To fine tune the system make a few little test boards that can be exposed through a negative you have handy. The negative should be fairly detailed so that under or overexposure can be more easily

seen. Expose the test pieces one at a time and adjust RV1 so that the best results are obtained.

Once the system has been calibrated it will then automatically compensate for variations in light intensity by increasing or decreasing the exposure times. In general this variation in time is fairly small but will ensure good and repeatable results.

So there we have it, a cheap and accurate board exposure system which should enable a lot more people to become involved in making their own boards and still get a good suntan. ●



ETI-1612

VZ300 Data Logger

For \$60 you can build a box to plug into a VZ300 computer to log up to 8 analogue channels. Data can later be stored on cassette tape.

Bob Sutton



Specifications

Number of channels: 8 analogue (designated 0 through 7).

Channel 7 is used as a counter, being driven from an open collector transistor. Channels to be logged are selected by program.

Voltage Range: +2.5V (count 0) to +3.56V (count 255) with common 0 V.

Range can be hardware modified to any window in the range 0 to +5V.

Sampling Rate: 3 per second.

This is high enough to count up to 1 pulse per second on channel 7.

Calibration: Transducers are calibrated

individually. Every 10 seconds a scan of channels appears on the screen.

Reliability: mainly determined by the reliability of the mains supply.

Power supply: +5V from the VZ300.

Averaging/Counting Interval: 1 hour. This can be changed by program.

Designated RAM Store: 6K bytes. This can be extended; each byte holds one value. 5 channels hours for 51 days fills 6K of RAM.

Digital outputs: There are three digital outputs which could be used for indicators, alarms or control.

THE TASMANIAN BRANCH of the ANZ Solar Energy Society needed a cheap means of recording temperatures and other variables in passively heated solar houses. About 10 days of hourly recording are required to be sure of getting the thermal thumbprint for a house. I thought of designing a battery-powered data logger around the Motorola MC146805 microprocessor but decided instead it would be faster to build an attachment for a cheap, mains-powered microcomputer and to program it in a high level language. Having recently taken a course on the Z-80 microprocessor with Scott Ashton at Elizabeth College I chose the Z-80 based VZ300 which sells for around \$120. Of course a TV screen or monitor plus a cassette recorder are also needed. (This is not the first time a VZ has been used as a data logger: Bruce Baudinet of Sunspot Design built one for the VZ200.)

This article gives sufficient detail to build the box (called the "logger") to collect data, to store the data on cassette tape, to retrieve it and to plot a graph. As examples the logger and programs are for the configuration I use for solar work. The programs deliberately lack refinements so that someone literate in BASIC can modify them readily to suit other requirements. Examples of sensors/transducers and their interfacing are given.

I/O Operation

The VZ300 can transfer data from/to up to 256 input/output ports using the INP and OUT instructions. Data is transferred under the control of the RD, WR and IORQ lines. I have designated the logger to be the vacant port 64. Thus the code Z=INP(64) transfers one byte (8 bits) of data from port 64 to the real variable Z. Likewise OUT 64,Y transfers Y to the logger output latch. Y can be a constant, a real variable, an integer variable or an

Table 1: A/D control

Lower case letters are used to avoid confusion with the VZ300 lines

wr	rd	
1	1	dormant
1	0	offer converted
0	1	start conversion
0	0	forbidden

Table 2: VZ300 output port configuration showing start conversion and offer value instructions for channel 2.

spare	A/D	select	
7 6 5	4 3	2 1 0	LSB
	wr rd	a1 a1 a0	
0 0 0	0 1	0 1 0	start conv= 8+2=19=0AH
0 0 0	1 0	0 1 0	offer value= 16+2=18=12H

expression but it must be an integer in the range 0 to 255.

The latch (IC2) is used to select the analogue channel (lowest 3 bits) and to control the A/D converter (next 2 bits). The highest 3 bits are spare and their contents are irrelevant.

The five steps to collect a sample are:

1. SELECT the analogue input channel;
2. START the A/D conversion;
3. WAIT for completion;
4. OFFER the converted value to the VZ300;
5. INPUT to VZ300.

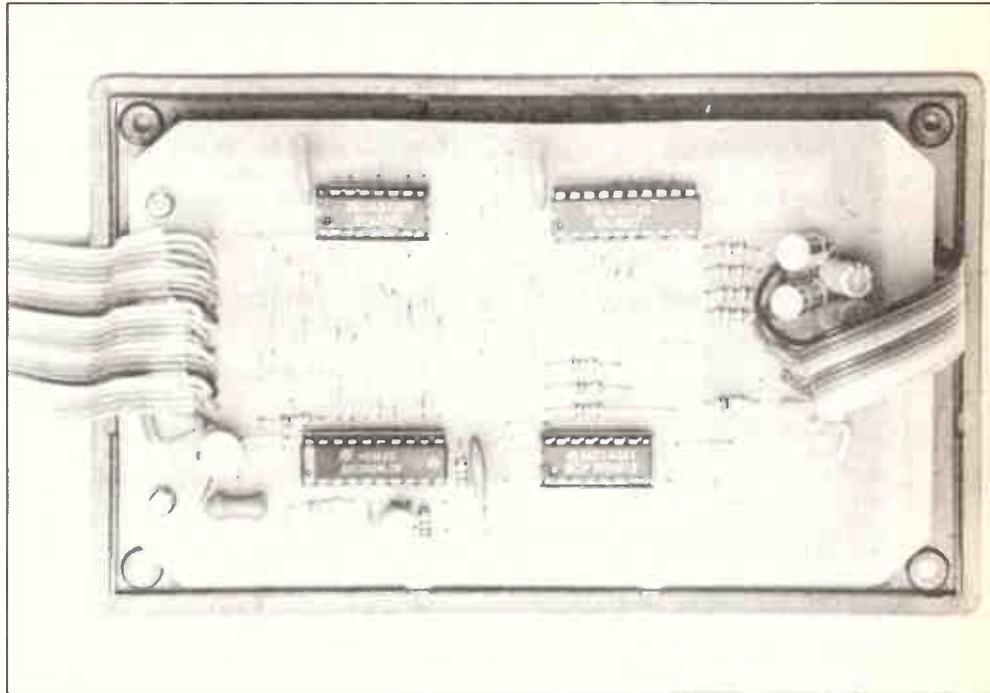
OFFER and SELECT can be combined when treating channels sequentially. Table 1 gives the A/D control and Table 2 gives an example of the START and OFFER patterns. Programs 1, 2 and 3 are suitable for testing.

Cassette Data Storage

The collection program (see box) POKEs data into a 6 K block of unused memory. This data is then stored on cassette tape by making the operating system think it is storing a program. Later the data is recovered by the reverse procedure and then some data processing program is loaded and run.

The following is the procedure to be followed to store and recover all 6 K. The modification for reduced storage is given later.

1. Load and run Program 4.
2. Terminate it at the end of logging by CTRL/BREAK.
3. Then type the following instructions, terminating each with RETURN.
 POKE 30884,254
 POKE 30885,143
 POKE 30969,0
 POKE 30970,168
4. CSAVE"datname" having started the tape recorder before RETURN. 5. Choose your own "datname".



Converting to VZ200 operation

With only program modifications the logger will work with the earlier VZ200. The VZ200 has a 3.58 MHz clock, compared with the VZ300 at 3.54 MHz. Therefore some adjustments may be desired in lines 430 and 470 of Program 4.

The main difference lies in the available storage. The VZ200 has a 6K RAM whereas the VZ300 has 16K. With the following changes the VZ200 will run a program as large as Program 4 in conjunction with a 2K data store:

Program 4: in line 330 put -31232
 in line 840 put -29184
 Immediate POKES: POKE 30884,254
 POKE 30885,133
 POKE 30969,0
 POKE 30970,142

Program 5: in line 30 put 2048 twice
 in line 40 put -31232
 Program 6: in line 70 put -31232

Continue reading this section only if you want to run large processing programs or if you require more than 2K of data store. Refer to the memory maps starting at the RAM. In both computers the program extends above location 31465, first with the BASIC code and then the numeric variables. String variables and the "stacks" extend downwards from the top of store. The spaces between are free for data storage. I started the VZ200 store at location 34304 = 8600H. For POKE and PEEK instructions the locations above 32767 (= 32K -1) are addressed using negative integers (64K being zero). For example 34304 =

-31232. You can search for free space by typing NEW and then using something like Program 5.

As checks of the extents of program and variables it is useful to examine the contents of the address pointers. These two-byte pairs contain the relevant addresses, always starting with the low order byte. For example the BASIC program starts at location 31465 = 7AE9H. Thus from the list of pointers 30884 contains 233=E9H and 30885 contains 122=7AH; this may be verified using PEEKs. At startup, before any program has been entered, the end-of-basic is just two bytes further on at 31467. As program is loaded the end-of-basic advances.

Pointers	Hex	Decimal
End of stack		
(= start of strings)	78A0/1	30880/1
Start of dimensioned variables	78FB/C	30971/2
End of BASIC	78F9/A	30969/70
Start of BASIC	78A4/5	30884/5

The VZ300 is supplied with a 12V battery eliminator instead of a 9V one. The extra voltage drop tends to overheat the VZ300 voltage regulator. With the extra current drawn by the logger this situation is made worse. A high wattage series resistor may fix this. Instead I used a slightly underrated 9V battery eliminator and initially got random variations in A/D conversions due to 100 pps negative bumps on the 5V rail. A capacitor across the 9V leads cured this.

6. Switch the computer off and then on again before reloading data.
7. To reload data and process switch on
 CLOAD"datname"
 NEW
 CLOAD"processprog"
 RUN
 To store less than 6 K, change the 168

in POKE 30970,168 above, to 144 + the number of blocks of 256 bytes (including partly filled blocks). For example if 5 channels were logged hourly for 190 hours then there would be 950 bytes and therefore 4 blocks would be required. Thus the number would be 148 instead of 168.

Analogue Circuits

The ADC0804 A/D converter features

span adjustment and high impedance differential input. The inputs have diode clamps which with high source resistance hold the input voltages in the required range of -0.3 V to +5.3 V.

The span control $V_{ref}/2$ at pin 9 appears from the outside as a 2.5 V source in series with about 1000 ohms. External resistors are added to alter the pin 9 voltage. The span is twice the voltage at pin 9.

The converted count is given by
 $C = (V^+ - V^-) \times 128 / V_{pin\ 9}$

For example when $V^+ = +3.1$, $V^- = +2.5$ and $V_{pin9} = V_{ref}/2 = 0.5$, the count is 153. Out-of-range inputs give counts of 0 or 255.

Transducers

For temperature measurement I mostly use the LM335 sensor. Provided it passes at least 0.5 mA it behaves as a temperature controlled zener diode. The constant is nominally 10 mV/K. Thus at 0°C (=273.2 K) the nominal voltage is 2.73 V and at 30°C it is 3.03 V. The board has

Program 1: I/O Selector Test

```
To pulse low pin 11 of 74LS138
10 Y=INP(64)
20 GO TO 10
```

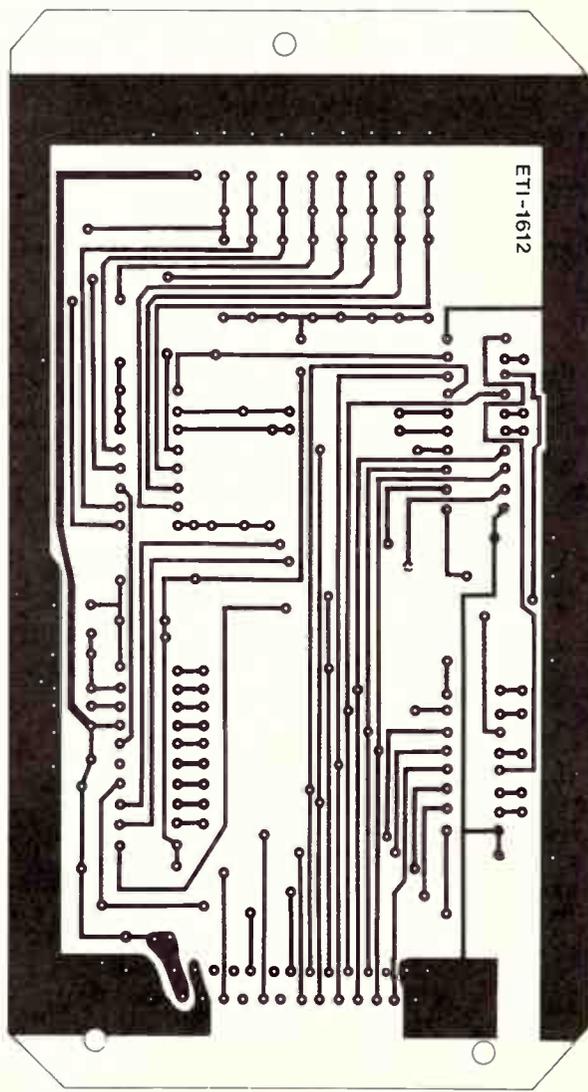
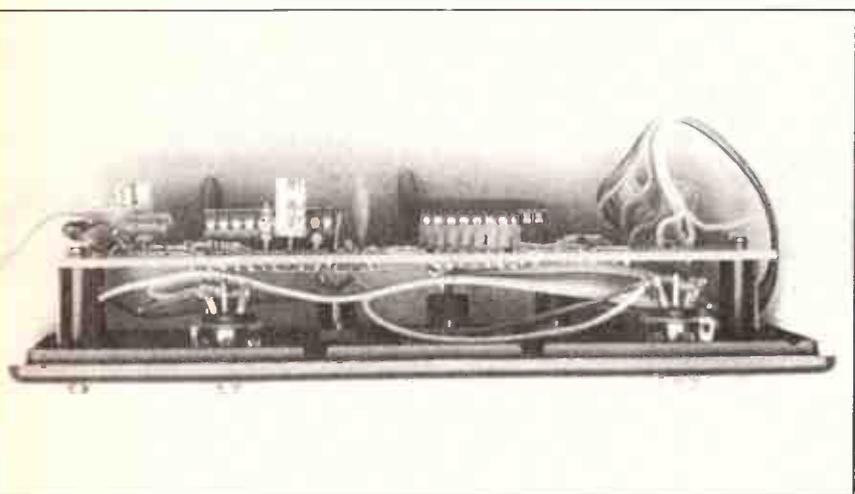
Program 2 Output Latch Test

```
To continually output the number A% to the latch. The lowest 3 bits select the analogue inputs. Pin 13 of 74LS138 pulses low.
10 INPUT"INTEGER IN RANGE 0 TO 255";A%
20 OUT 64,A%
30 REM OPTIONAL DELAY
```

```
40 FOR I=ITO 200:NEXTI
50 GO TO 20
```

PROGRAM 3 SINGLE CHANNEL DISPLAY

```
To display a channel (0 to 7)
10 INPUT"CHN NUM";A%
20 OUT 64,24+A% select channel
30 OUT 64,8+A% start conversion
40 D=INP(64) delay
50 OUT 64,16+A% offer convtd value
60 PRINT INP(64) input & print
70 GO TO 30
```



PROGRAM 5 VIEW DATA

This processing program just displays on the screen, the raw values retrieved from cassette tape.

```
10 INPUT"NUM OF PERIODS";N
20 INPUT"NUM OF ACTIVE CHNS";M
30 IF N<M<6144 THEN M=INT(6144/N)
40 AP=-28672
50 FOR I=1TO N
60 PRINT I:
70 FOR J=1TO M
80 PRINT USING"###";PEEK(AP)
90 AP=AP+1
100 NEXT J
110 PRINT
120 NEXT I
```

PROGRAM 6 PLOT DATA

```
10 CLS:MODE(1):COLOR 4
20 FOR Y=0TO50:SET(10,57-Y):NEXTY
30 FOR Y=0TO50:SET(11,57-Y):NEXTY
40 FOR Y=0TO50:SET(107,57-Y):NEXTY
50 FOR Y=0TO50:SET(106,57-Y):NEXTY
60 FOR X=10TO107:SET(X,57):NEXTX
70 AP=-28672
100 FOR I=101TO150
110 Y0=PEEK(AP+2*I-2)
120 Y0=INT(.34*Y0+10.2+.5)
130 COLOR 4:SET(10+I,57-Y0)
140 Y1=PEEK(AP+2*I-1)
150 Y1=INT(.31*Y1+8.4+.5)
160 COLOR 2:SET(10+I,57-Y1)
190 NEXT I
200 GOTO 200
This is broken by CTRL/BREAK
```

*Program listings
 All the program listings in this article are available on tape from:
 Tasmanian Branch
 ANZ555, PO Box 121,
 Sandy Bay, Tas 7005.
 Send \$10 plus stamped self-addressed envelope.*

provision for pullup/(down) resistors and filter capacitors.

My photovoltaic solar radiation transducer gives about 300 mV full output which is quite compatible with the span for the LM335. The negative wire is simply joined to V⁻ and kept well insulated.

I measure electricity consumption by detecting the mark on the rotating disc of a kWh meter. This is done using a reflective opto switch (RS stock No. 307-913)

costing about \$15. The instrument has LEDs to indicate status to assist in aligning it on the glass in front of the disc. Rubber bands and self adhesive picture hooks are convenient for attachment. A 0.5 second pulse lengthener is required to ensure that a pulse is not missed when the disc is rotating quickly. The program counts pulses by detecting low-to-high transitions for channel 7. Because the IR LED alone draws 40 mA this instrument

should be connected to other than the VZ300 +5 V supply.

Graphs

The VZ300 has two graphics modes: MODE (0) for text — 32 characters wide by 16 down (the default mode) and MODE (1) which is 128 x 64. The rectangle is the only symbol in MODE (1) but variation can be obtained by altering the shading.

The SET(X,Y) instruction in MODE

Program 4 COLLECTION PROGRAM

DATA COLLECTION

```

10 PRINT"DATA COLLECTION PROGRAM"
20 PRINT
30 DIM A(7),B(7),C(7),L%(7),S(7)
100 REM INITIATE CONSTANTS, TIME, DATE
110 PRINT"CHANNELS"
120 PRINT" SLOPE OFFSET IDENT"
130 FOR I=0TO7
140 READ A(I),B(I),C(I)
150 PRINT USING" ###.##"A(I);B(I);
151 PRINT C(I)
160 NEXT I
170 PRINT"IF WRONG THEN BREAK & CHANGE";
171 PRINT" LINES 200-270"
180 PRINT"WRITE DOWN CORRECTED VALUES"
200 DATA 1,0,TEMP
210 DATA 1,0,TEMP
220 DATA 0,0,V
230 DATA 0,0,V
240 DATA 0,0,V
250 DATA 0,0,V
260 DATA 1,0,RAD
270 DATA 1,0,KWH
280 INPUT"NEXT HOUR OF DAY";IH
290 INPUT"DAY OF MONTH";DM
300 PRINT"PRESS S TO START LOGGING"
310 AS=INKEY$
320 IF AS(">")S THEN GO TO 310
330 SH=M:SD%=D%:AP=-28672
335 POKEAP-2,255:POKEAP-1,254
340 IF H<23.5 THEN GO TO 400
350 H=0:D%=D%+1
400 FOR K=1TO360
410 FOR L=1TO30
420 GOSUB600:REM SCAN
430 FOR D=1TO5:NEXT D:REM DELAY
440 NEXT L
450 REM PRINT HOUR & ACTIVE INPUTS
451 GOSUB700
470 FOR D=1TO39:NEXT D:REM FINE DELAY
480 NEXT K
490 REM TRANSFER ACTIVE CHN AVERAGES TO RAM
491 GOSUB800
500 H=H+1
510 GO TO 340

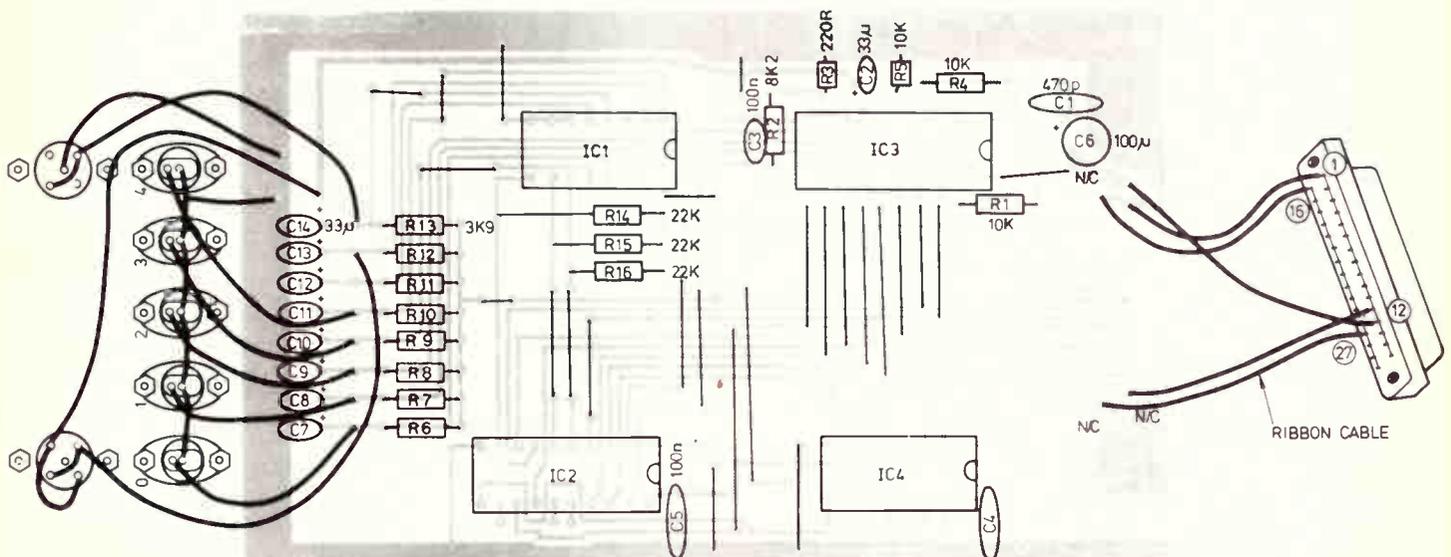
600 REM SUB SCAN
605 OUT64,24
610 FOR I=0TO7
615 OUT64,B+I
620 D=INP(64)
625 OUT64,16+I
630 L%(I)=INP(64)
635 NEXT I
640 FOR I=0TO6
645 S(I)=S(I)+L%(I)
650 NEXT I
655 IF L%(I)>12B THEN NW=1 ELSE NW=0
660 IF NW>0L THEN S(7)=S(7)+1
665 OL=NW:L%(7)=INT(S(7))
670 RETURN

700 REM SUB PRINT LATEST
710 PRINT D%;HI
720 FOR I=0TO7
730 IF C(I)='V' THEN GO TO 750
740 PRINT L%(I);A(I);B(I);
750 NEXT I
760 PRINT
770 RETURN

800 REM SUB STORE
805 FOR I=0TO7
810 IF C(I)='V' THEN GO TO 860
815 XD=S(I)/10800
820 IF I=7 THEN XD=XD*500
825 X%=INT(XD+.5)
830 IF X%>255 THEN X%=255
835 S(I)=0
840 IF AP>=-20480 THEN STOP
845 POKE AP,X%
850 PRINT X%
855 AP=AP+1
860 NEXT I
865 RETURN
    
```

The collection program has the following features:

1. All 8 channels are sampled three times a second. Values from channels 0 through 6 are accumulated to be divided by 10,800 after an hour to give average values. Channel 7 (counter) is accumulated and effectively divided by 21.6 so that it can never overload.
2. Each hour, values for active channels are transferred sequentially to storage in RAM starting at address 36864 = 9000H. An active channel is one without a "V" (for vacant) in lines 200 to 270.
3. At initialisation the user enters the starting hour (integer 0 through 23) and the day of month. Sampling commences when "S" is pressed. The user determines the significance of the hour eg, period starting, or centered on, or finishing.
4. Logging is terminated by CTRL/BREAK or when the store fills. Data for the unfinished hour is lost.
5. Day of month is sequential but does not revert to 1 at any change of month.
6. Every 10 seconds the screen receives the latest day, hour and scaled values for active channels. This is useful for monitoring and calibrating. Scaling is multiplying by the appropriate constant and adding the offset stored in lines 200 to 270.



(1) marks the rectangle at the position X (across), Y (down). To get normal plots with Y positive up the variable effectively becomes 63-Y.

Program 6 draws axes and then plots scaled values of data for two channels for time intervals 101 to 150. Lines 120 and 150 contain the appropriate scaling formulae; the +.5 being for correct rounding. A natural improvement would be to store the scaling constants and list of active channels in arrays as in Program 4; but the aim here is to keep it simple.

Construction

Construction is straightforward and only a logic probe is needed for any trouble shooting.

Decide on your input socket layout and then mount suitable polarised sockets on the lid of the box (We used two pin DIN sockets in the prototype.) To minimise crosstalk, keep the common side resistance low in the cable to the board. Also leave the cable long enough to allow the sections to be separated for testing. Solder the passive components — links, capacitors, resistors and IC sockets. Install plenty of test pins. Finally add the 25 way ribbon and 30 way socket to the VZ300 printer port. Solder the only crossover first (socket pin 12); then solder all other pins sequentially (1, 16, 2, 17, . . .). File

a depression in the box to hold the ribbon firmly with the box shut. Visually and using an ohm meter check for shorts between adjacent tracks.

Testing

ALWAYS SWITCH OFF THE COMPUTER BEFORE PLUGGING/UNPLUGGING THE LOGGER OR ADDING/REMOVING IC'S.

First, with no logger IC's test that the computer keeps working and that the +5 V reaches all sockets. A logic probe would indicate activity on the address and data lines.

Refer to the section on I/O operation.

Second, insert the I/O selector (74LS138), run Programs 1 and 2 and check separately for low pulses on pins 11 and 13. You will need a logic probe to pick up the pulses. If a logic probe is unavailable then proceed anyway.

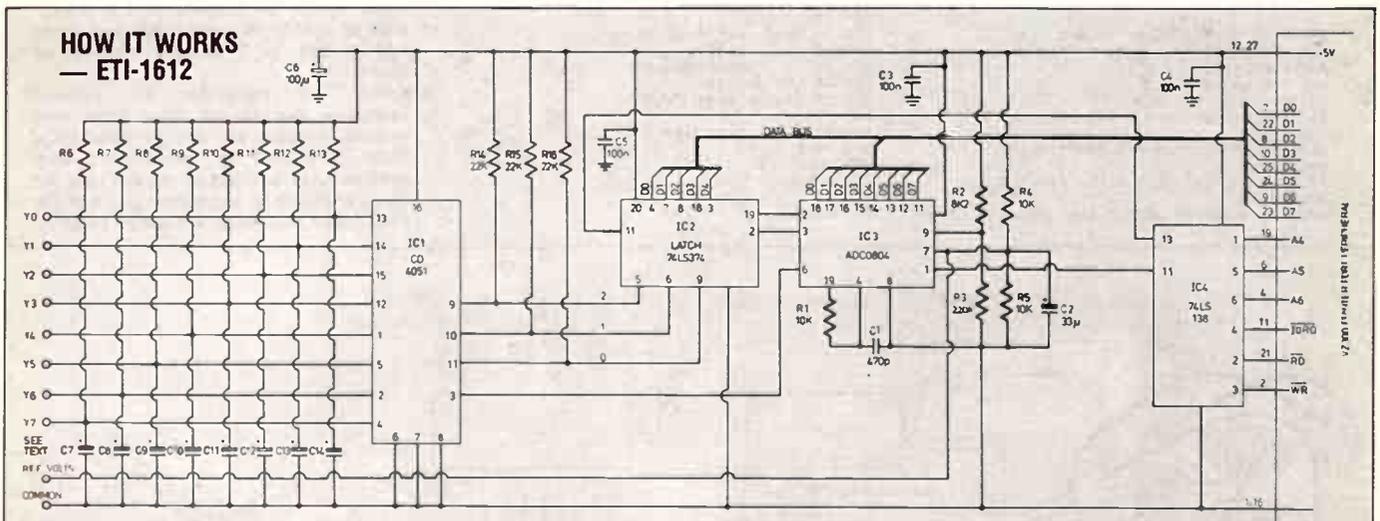
Third, insert the data latch (74LS374) and check that it correctly accepts bit patterns from the computer. A voltmeter can be used.

Fourth, taking the usual precautions to earth yourself and the board, inset the analogue selector (CD4051) and test for the output signal at pin 3. Select channels by program via the latch. The analogue inputs have pullup resistors so operation can be checked by earthing inputs.

PARTS LIST — ETI-1612

Resistors	All 1/4W unless otherwise stated.
R5, R1, R4.....	10k
R2.....	8k2
R3.....	220R
R6-R13.....	see text
R14, R15, R16.....	22k
Capacitors	
C1.....	470p cer
C2.....	33µ/10V
C3, C4, C5.....	100n cer
C6, C13.....	see text
C14.....	33µ electro
Semiconductors	
IC1.....	4051
IC2.....	74LS374
IC3.....	ADC0804
IC4.....	74LS138N
IC5.....	LM335
Miscellaneous	
5 x 2 pin Din, 3 x 5 pin Din sockets, ribbon cable, hook-up wire & box.	

Fifth, again taking care with earthing, insert the analogue-to-digital converter (ADC0804LCN). Check for oscillator action — pin 4. The analogue voltage reference (pin 7) should be around 2.5 V and the span voltage (pin9) around 0.53 V. Run Program 3 to test the logger. Then proceed to full data collection — Program 4. To display scans more frequently than every 10 seconds reduce the 30 in line 410. ●



The logger is controlled from the VZ300 output port. Address lines A4 to A6 select the latch IC4, and the read and write lines drives either pin 11 or pin 13 active. These two outputs are connected to either the latch, IC2 or the converter IC3.

Data comes into the input port from one of seven channels in analogue form. The exact form of the transducer responsible for this is up to you. The input port is connected directly to a 4051 which functions as an analogue

switch, so that it will take the analogue input and place it on the output pin, pin 3. Notice that space is provided for pull up resistors and capacitors on the input lines (Y0-Y6) which should be matched to the transducer. With an LM 335 temperature sensor, a 3.9 k resistor and 33µ capacitor are appropriate.

Which channel is selected depends on the configuration of pins 9, 10 and 11 on IC1. These are derived from IC2, which loads from the VZ 300 data bus when pin 11 is activated by IC4.

the ADC (pin 6, IC3). The ADC is controlled by pins 1, 2 and 3 and eventually the 8 bit converted value is transferred to the VZ 300 data bus, where it is read by the computer. R4, R5 and C2 set up the reference voltage for the ADC, and R2, R3 set the span. R1 and C1 trim the internal oscillator. Note that the reference voltage is available to the external world via the channel seven socket.

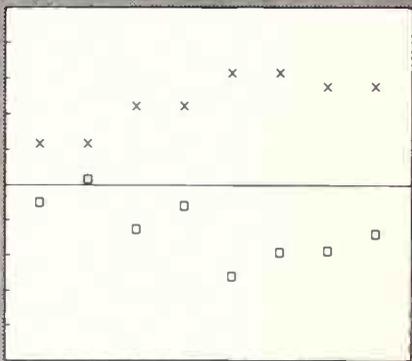
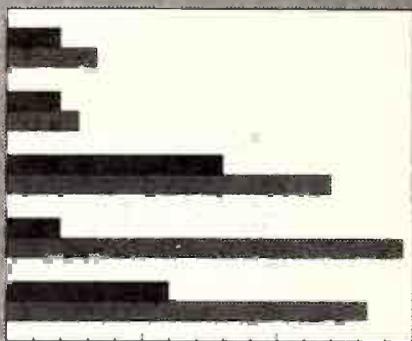
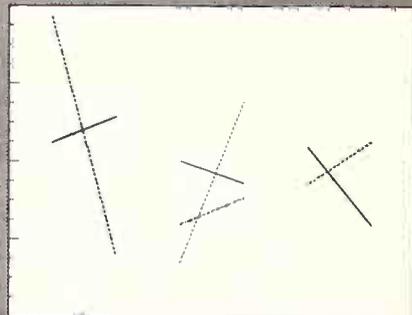
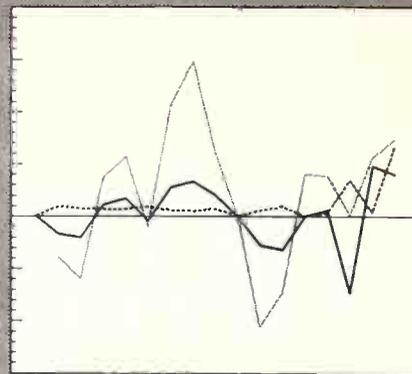
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USER INTERFACE	
CSS: Fast hierarchical menus; the entire user interface is optimised to limit the number of keystrokes necessary to perform an analysis; fast selection of individual variables or lists of variables; previous variable selections are "remembered" (and can be edited) across consecutive analyses; batch processing is also supported.	SPSS/pc+ : Command language; some commands are several lines long (in case of a typo, e.g. a misspelled variable label, the entire command has to be re-typed); commands can also be submitted via batch files
PROCESSING LISTS OF VARIABLES	
CSS: Supported by all procedures (where applicable, lists of dependent variables can be automatically processed with the same design, e.g., in t-tests, Crosstabulations, ANOVA, Regression, etc.)	SPSS/pc+ : Supported by all procedures (where applicable, lists of dependent variables can be automatically processed with the same design, e.g., in t-tests, Crosstabulations, ANOVA, Regression, etc.)
SELECTION OF SUBSETS OF CASES FOR ANALYSES	
CSS: Yes (on line selection of cases via "include if" or "exclude if" selection conditions that remain in effect for the entire CSS session or until cancelled; the selection conditions can be saved for repeated use)	SPSS/pc+ : Yes (via logical "select if" conditions)
SCREEN DISPLAY OF OUTPUT	
CSS: All CSS output is displayed via Scrollsheets. These are dynamic, scrollable, user controllable, multi-layered tables with cells expandable into pop-up windows. All numbers and labels (or selected subsets) in Scrollsheets can be instantly converted into a variety of presentation quality graphs. The contents of different Scrollsheets can be instantly aggregated, combined, compared, plotted, printed, or saved.	SPSS/pc+ : Output scrolls across the screen (a "MORE..." prompt appears when the screen is full).
DISPLAY FORMATS FOR NUMBERS	
CSS: Flexible; all display formats are dynamically adjusted to yield maximum display precision while preserving compatibility of formats within columns of numbers; special extended formats are available where applicable (B-weight = .094027563759532)	SPSS/pc+ : Fixed, regardless of value (e.g., if values are very small, SPSS cannot display them with sufficient precision)
PRINTING	
CSS: Selective printing or saving of results (e.g., only specified tables with results, or subsets of tables); all results can also be automatically printed (or saved) in formatted reports; graphics can be printed on all plotters, dot matrix, colour, and laser printers. (including printers supporting PostScript)	SPSS/pc+ : Only via dumping all screen output from an analysis to the printer or file; hi-res graphics are not available.
ACCESS TO INDUSTRY STANDARD FILE FORMATS	
CSS: Intelligent read/write interface to (unlimited size) Lotus, dBase, dBase III+, DIF, SYLK, and a variety of formatted and unformatted ASCII files; CSS imports not only data values but also formats, labels, headers, logical variables, missing data codes, etc.	SPSS/pc+ : No (only ASCII; an optional file conversion package is available)
SUBMITTING OUTPUT FROM ONE ANALYSIS AS INPUT FOR ANOTHER	
CSS: In addition to matrices (corr., cov., etc.) and scores that are calculated for each case (e.g., residuals, factor scores), all other numbers generated with CSS analyses can be converted into the CSS data file format.	SPSS/pc+ : Only matrices (corr., cov., etc.) and scores that are calculated for each case (e.g., residuals)



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ETI-1417: VIFA SA-100 SPEAKERS

Build these high performance speakers at a low budget price

Tom Manning

THIS IS THE GOLDEN age for the Hi-Fi enthusiast. The recent introduction of sophisticated musical recording and playback technology makes it possible for modern budget equipment to outperform the very best of front ends available just ten years ago. Digital recording techniques, the compact disc, Domestic Digital Audio Tape (DAT) recorders plus an extremely high standard of analogue (via

L.P.) reproduction make a first class audio front end available to many.

However, this performance per dollar factor simply does not, and never has, extended to the loudspeaker — the quality of this electro-mechanical system has always been price proportionate. Today, awareness of the inherent shortcomings of (particularly) low cost speakers is prompting many enthusiasts to seek alternative

ways to achieve high quality sound for a reasonable outlay. Not surprisingly, home built speakers, (very popular some years ago) built from professional designs are enjoying a healthy renaissance. The Melbourne loudspeaker distributor, Scan Audio, has just released a high quality DIY speaker, locally designed using Danish Vifa drivers. This system, the SA-100, loosely based on a much earlier and very popular design using similar components, compliments the SA-70 bookshelf system described last month in ETI.



First Design Considerations

To compliment both the Vifa SA-70 and SA-50 designs (the latter a high quality true miniature speaker) substantial increments in SPL (Sound Pressure Level), bass end performance, and overall efficiency were seen to be both desirable and logical. To achieve a worthwhile increase in bass capability, a proportionate increase in cabinet volume is mandatory — after predicting the performance of many drivers in various enclosures one combination seemed ideal. The Vifa P-21 bass-midrange unit, housed in a 42 litre vented enclosure would give us the desired bass end capability with excellent transient performance and high power handling.

Alignment

It's worthwhile looking at the steps used in determining an "alignment" (suitability of matching a bass driver with a cabinet) — to appreciate this an explanation of some basic parameters will help. The key points are:

1. The free air resonance (F_0), which is the frequency at which the moving system of the driver exhibits the maximum output for the minimum electrical signal.
2. The total Q factor of the driver (Q_t), which is the quality factor at resonance, and which indicates the

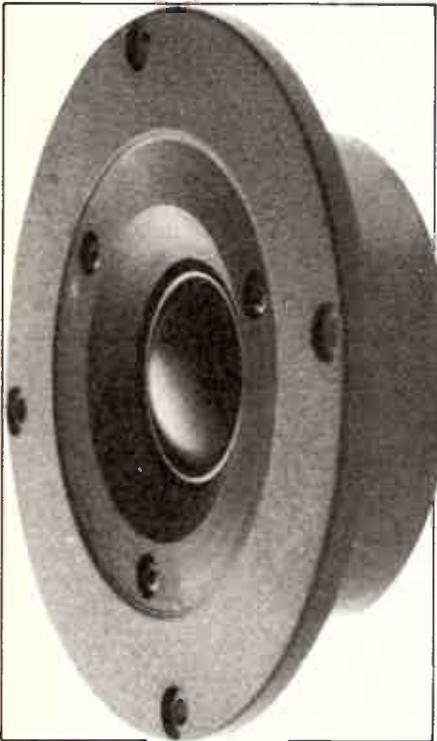
combined effects of the driver's electrical and mechanical damping of the moving system at its free air resonance. 3. The VAS, which is the volume of air in litres need to provide the same restoring force to the cone as does the suspension. Expressed more generally, an indication of the "springiness" of the suspension system.

We can now predict:

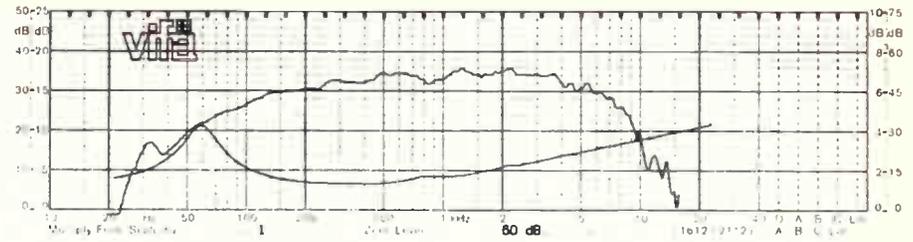
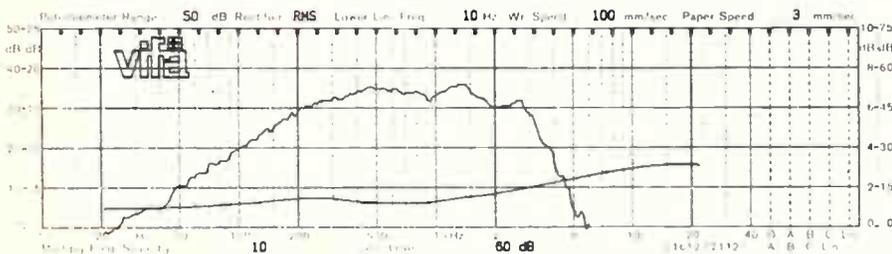
1. V_b , the optimum cabinet volume for any driver,
2. F_b , the frequency at which the reflex port exhibits the maximum output — also known as the box resonance.
3. F_3 , the -3dB point (half output) of the bass response.

Consultation of Thiele's alignment charts indicates that a cabinet volume of 42 litres with a cabinet resonance of 48 Hz and a 3 dB of 43 Hz will be ideal.

These computations, now used worldwide, are the result of some pioneering research by two Australian engineers,



The D25 tweeter frequency response and input impedance curves.



Neville Thiele and Richard Small (now of KEF fame). Begun in the early 1970's by Thiele and later expanded by Small, their work provides designers with a solid grounding on which to model low frequency speaker behaviour.

Midrange Musings

Numbers aside — the bass driver in a two way system such as this is required to reproduce the lion's share of the midrange, and its behaviour in this region will more than anything else determine the overall sonic result. The P-21 features a non-resonant alloy frame, rubber roll outer suspension for good linearity at high excursions, and a thick, rigid polypropylene cone. The latter is particularly important for midrange resolution since the driver must work in a frequency region where the mass of the cone prevents it from moving in unison with the voice coil, causing "wave modes", which are then propagated through the cone and (hopefully!) terminated by the edge suspension. Both the type of material and its construction consistency determine how well this task is accomplished. It is now widely accepted that thick polypropylene is a very suitable material for the purpose.

As the frequency increases, the cone becomes acoustically heavier resulting in a substantial reduction of output. Looking at the frequency response graph of the P-21, there's nothing much useful above the 3 kHz mark, and at this region it is necessary to consider a treble driver capable of covering the remainder of the frequency spectrum.

Tweeter Thoughts

Frequency range is largely a function of size. Just as a 210 mm bass driver cannot perform adequately at high frequencies, a

Frequency response and input impedance of the P21 woofer.



small tweeter has neither the radiating area nor the excursion capabilities to reproduce low frequency energy. Certain compromises must be made to satisfy, partly, conflicting requirements. Choosing a tweeter which will both operate at the 2 to 3 kHz region and extend out to the upper limits of the frequency range while still maintaining good power handling can be problematic, but fortunately Vifa make such a device. The D-25-TG tweeter uses a roll suspension 25 mm polyamide dome, ferrofluid voice coil cooling and an oversized magnetic structure. The low mass diaphragm gives excellent high frequency extension, the ferrofluid filled voice coil gap ensures high power handling and the "suspension" is sufficiently compliant to ensure reliable operation at the 2 to 3 kHz region. In short it is an ideal choice.

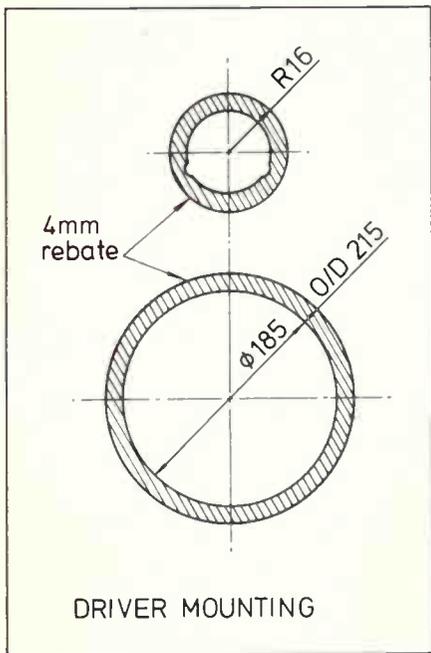
Dividing Decisions

With drivers decided, we were now ready to tackle the crossover — usually the most interesting and always the most complex aspect of speaker design. It is good to start analysing the individual response of

each driver (Figure 1 and 2). A study of the on axis response of the P-21 shows reasonably flat response out to 2 kHz. Shortly after this a fairly fast roll off takes place. This natural roll off, coupled with a first order electrical filter (more on this later) will provide adequate signal attenuation. The treble circuit, however requires a different approach. Just as the woofer has a natural resonant frequency (dis-

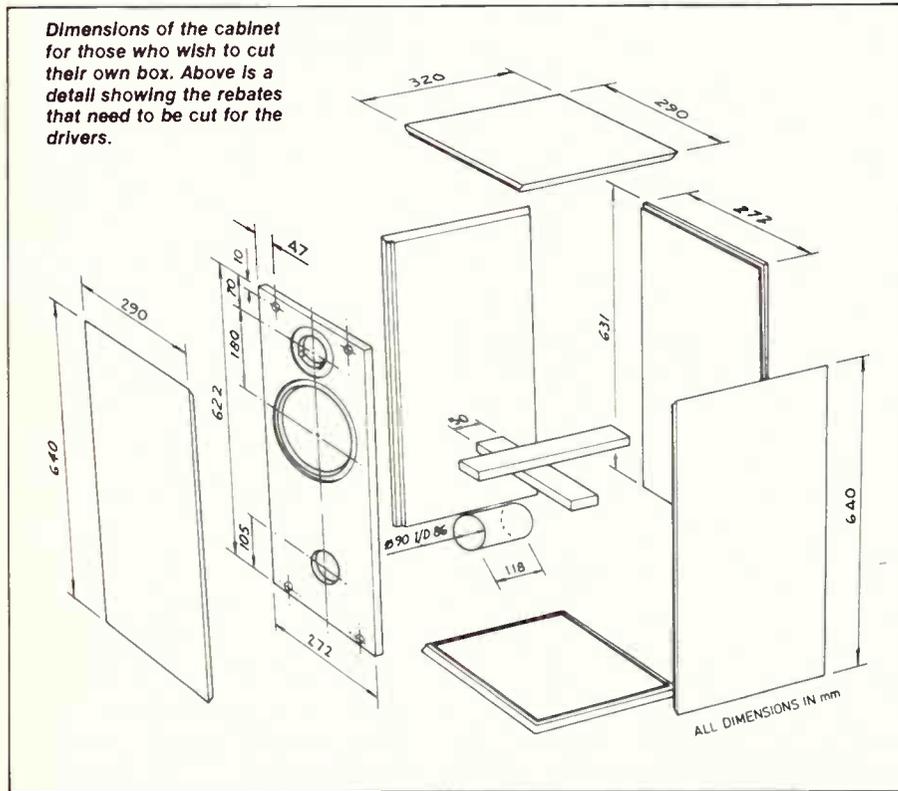
cussed earlier) so too does the tweeter — but here it becomes important since operating the unit at or near this frequency will cause excessive excursion, resulting in definite distortion and possible damage. Since the resonance of the D-25 lies at 1.5 kHz and the crossover frequency at 2.5 kHz, it is essential that the voltage applied to the tweeter at its resonance be substantially lower than that in its operating band. This necessitates a second order slope of 12 dB per octave. C2 and C3 in parallel form the first reactive component (6.9 μ F), with the .28 mH coil, L2, the second. With each of these components contributing 6 dB of attenuation, the result is a rapid electrical roll off ensuring reliable operation. Obviously this is not a problem for the woofer, but a symmetrical crossover function is desirable to achieve a balanced response, and as mentioned earlier, the natural roll off coupled with the previously mentioned first order electrical filter provides us with an overall acoustical attenuation of around 18 dB per octave. The resulting phase error at the crossover frequency is now less than 60 degrees, explaining the in phase connection of the drivers, which, when considered purely in electrical terms would not be logical, since a phase error of 135 degrees (the cumulative result of three reactive components each contributing 45 degrees) would necessitate reversing the tweeter's connections to negate a large acoustical cancellation at the crossover point. The remaining

components in the treble section, R2 and R3 constitute an attenuation pad, reducing the treble level about 2 dB, providing an overall flat response. C1 and R1, connected in series across the woofer, serve as an equalizer, exhibiting an impedance decrease with rising frequency. This compensates for the rise in impedance of the woofer caused by the large self inductance of the four layer voice coil and oversized magnet/pole piece assembly.



DRIVER MOUNTING

Dimensions of the cabinet for those who wish to cut their own box. Above is a detail showing the rebates that need to be cut for the drivers.

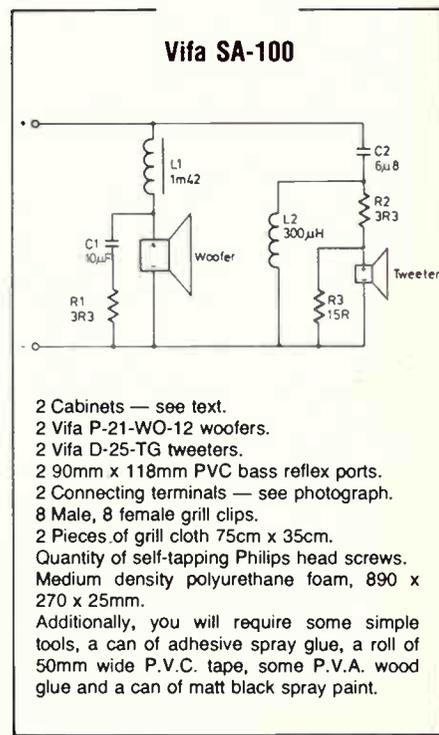


Performance

The subjective performance of the SA-100 is extremely good. The bass seems to extend even deeper than the computer alignment (Figure 3) predicts. This is not surprising, given that the proximity of the floor and walls provide a sizeable increase in output in the low registers. Midrange and treble performance, too is excellent, the speaker having the ability to place various voice and instruments in the sonic soundstage with depth and precision. The speakers are also capable of high sound pressure levels — enough at least to satisfy most aficionados of loud rock music!

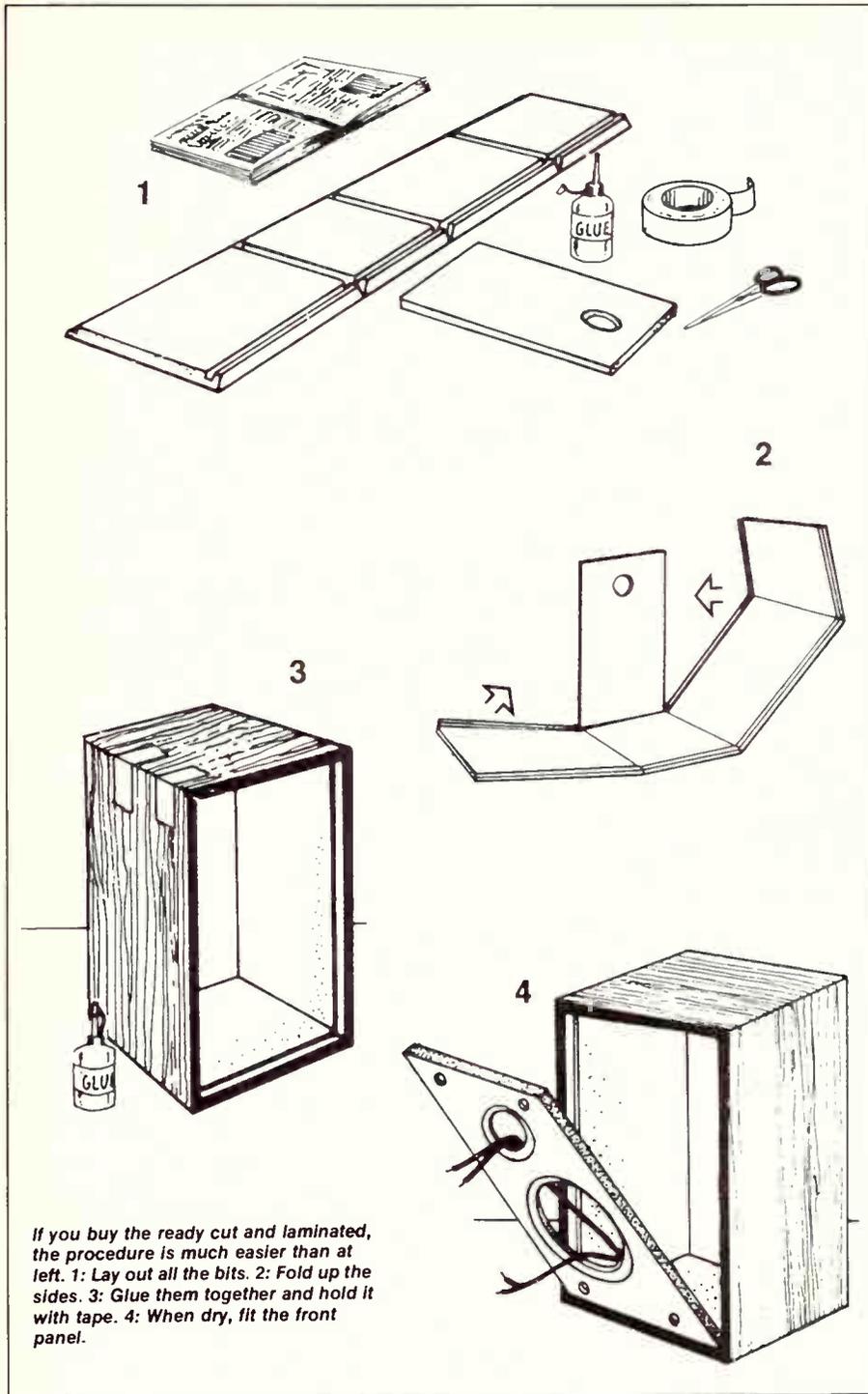
Construction

Scan Audio will be supplying complete kits for the SA-100, however you could save substantially by buying just the drivers and constructing the cabinet yourself. Detailed dimensions are given in the diagram.

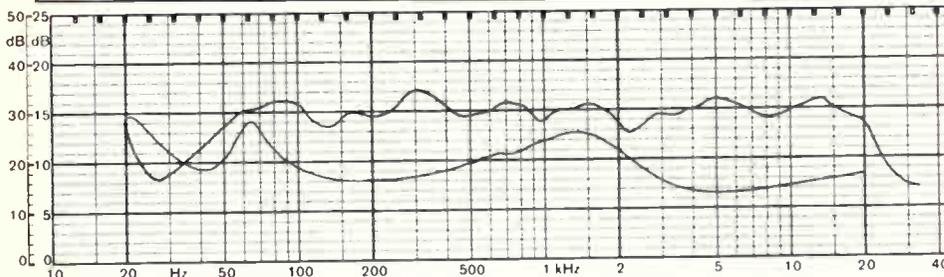


- 2 Cabinets — see text.
- 2 Vifa P-21-WO-12 woofers.
- 2 Vifa D-25-TG tweeters.
- 2 90mm x 118mm PVC bass reflex ports.
- 2 Connecting terminals — see photograph.
- 8 Male, 8 female grill clips.
- 2 Pieces of grill cloth 75cm x 35cm.
- Quantity of self-tapping Philips head screws.
- Medium density polyurethane foam, 890 x 270 x 25mm.
- Additionally, you will require some simple tools, a can of adhesive spray glue, a roll of 50mm wide P.V.C. tape, some P.V.A. wood glue and a can of matt black spray paint.

Vifa SA-100 speakers



If you buy the ready cut and laminated, the procedure is much easier than at left. 1: Lay out all the bits. 2: Fold up the sides. 3: Glue them together and hold it with tape. 4: When dry, fit the front panel.



Combined frequency response and impedance diagram for the SA-100.

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Construction

If you're assembling the speakers from a supplied kit, begin by unpacking the contents of the cabinet pack. This must be done carefully because the top, sides and bottom of each enclosure are in a wrap-around piece and held together by the decorative veneer "hinges" which allow them to be folded. If you are not careful in handling the enclosure in this form you could tear the veneer and spoil the finished result. You should also remove the contents of the box containing the individual drivers, the crossover networks and the other components, and check them against the parts list.

Before starting assembly, it is wise to drill pilot holes for the self-tapping screws, ensuring that they penetrate in a straight line, a 2 mm drill gives a suitable pilot hole. Use the drivers as a template when marking the holes, but take care to avoid damaging them.

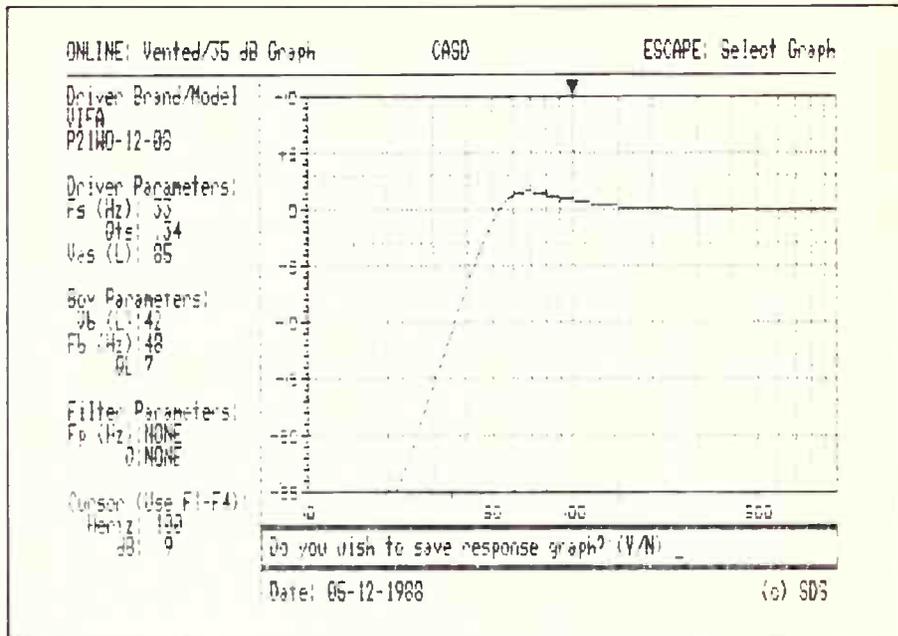
The nickel plated terminal blocks are mounted on the back panel. Each requires four mounting screws for which the pilot holes should also now be drilled.

With all the drilling completed, you can proceed with gluing the enclosures. The wraparound member actually folds around the back panel and has a machined rebate to hold it in place. This gives a rigid structure, even before the glue sets.

The procedure is quite simple. Lay out the continuous side piece on a flat surface such as a floor or large table. The three fold joints should be flexed as little as possible, as noted above. Then run a line of PVA glue into each of the V-cuts for the three fold joints and into the rebate channel. The back panel can now be fitted into the channel of what will become the base panel. Make sure that the terminal block hole is at the bottom; i.e. it corresponds to the join in the veneer which should also be at the bottom. Then it is a matter of carefully wrapping the sides around the back panel, making sure that no stress is placed on any of the three corner joints.

That done, the final corner is held together with strips of packaging tape. Don't worry if a little glue oozes out onto the veneer, it peels away from the plastic quite easily once it is dry. The bass reflex ports should be fitted now. Once they are painted and dry they can be glued from behind with hot melt glue. Leave the assembly for at least 2 hours to allow the glue to set.

Each crossover is preassembled on a piece of chipboard, so that it can be screwed in position on the back of the enclosures. Make a note of the connections for the respective terminals on the crossover; ie, input, bass and treble. Once this



A computer generated prediction of the performance of the ETI 1417.

is done, you can fit the damping material to the back and bottom of the enclosure, stapling or glueing it in place. Do not attempt to line the sides or top of the cabinet. Meanwhile, the grills can be prepared. A framework is supplied over which the screen cloth must be stretched. As each side of the cloth is stretched and folded into position, it can be retained with spray glue and staples.

When the grill cloths are fixed into place, you should trim off the excess. Be sure to uncover the grill mounting holes. There is one in each corner — they are 12 mm in diameter. A special plastic clip is inserted into each, the mating half of each clip being mounted in the front panel of the enclosure. They can be inserted now with a gentle tap from a hammer.

Now that the glue is completely dry, fit the terminal blocks and solder them to the crossovers. This done, you can complete the remainder of the cabinet assembly. The front panel can now be fitted, rather more simply than the back panel — It just slides into the rebated front of the box. Run a bead of glue around the perimeter of the box first, using a generous squirt of glue, enough to give the front panel an airtight seal. Leave the whole enclosure for another hour or so, to let all the glue set.

After the requisite drying time has passed, the drivers can be mounted. Solder their terminals first, paying particular attention to polarity and making sure that you do not transpose the woofer and tweeter connections — if you make a mistake here you will ruin the tweeter.

Then it is a matter of fitting the grills onto the enclosures — just push them on — and you are finished. Connect them up to your amplifier, select some music and settle back to enjoy the sound. ●

Tom Manning is with Scan Audio in Melbourne.

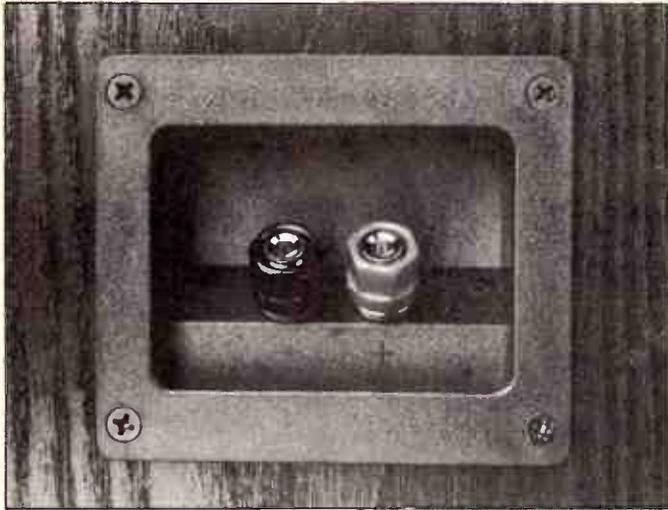
Price List

Components for this project are available from Scan Audio

D25 tweeter	\$74
P21 woofer	\$188
SA100 kit (no cabinet)	\$629
SA100 kit complete	\$799

MODEL:	VIFA SA-100
SYSTEM:	2-way bassreflex
WOOFER:	197 mm (8") VIFA P21W0-12-08
TWEETER:	25 mm dome f.fl. VIFA D25TG-55-06
RATED POWER:	100 Watt peak
IEC POWER:	70 Watt RMS
SENSITIVITY (1W/1m):	91 dB
FREQUENCY RESPONSE:	35-20,000 Hz
CROSS-OVER FREQ'CY:	2200 Hz
TUNING FREQUENCY:	48 Hz
IMPEDANCE:	8 ohms
INTERNAL VOLUME:	42 litres
DIMENSIONS (H x W x D):	64 x 29 x 32 cm
WEIGHT:	15 kgs (approx)
SUITING SPKR. STAND:	VIFA SA-100
PRICE EXCL. CABINETS	\$629.00 pair
PRICE INCL. CABINETS	\$799.00 pair

Vifa SA-100 speakers



The terminal block fits on the bottom of the back panel.

WHERE TO GET THE VIFA SA-100 KIT

ACT

Brashs
168 Melrose Drive
Phillip 2606
(062) 81 5255

NSW

Jaycar Electronics
Cnr Carlingford & Pennant
Hills Rds
Carlingford 2118
(02) 872 4444
115-117 Parramatta Rd
Concord 2137
(02) 747 2022
188 Pacific Hwy
Gore Hill 2065
(02) 439 4799
121 Forest Rd
Hurstville 2220
(02) 570 7000
117 York St
Sydney 2000
(02) 267 1614

NT

Sound Spectrum
51 Stuart Hwy
Darwin 5790
(089) 1 5060

QLD

Queensland Stereovisual
Shop 4, 50 Lutwyche Rd
Lutwyche 4030
(07) 357 7433
Jaycar Electronics
144 Logan Rd
Buranda 4102
(07) 393 0777

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International Sound
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Adelaide 5000
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St Peters 5069
(08) 42 3781
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Unley 5061
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(03) 663 2030

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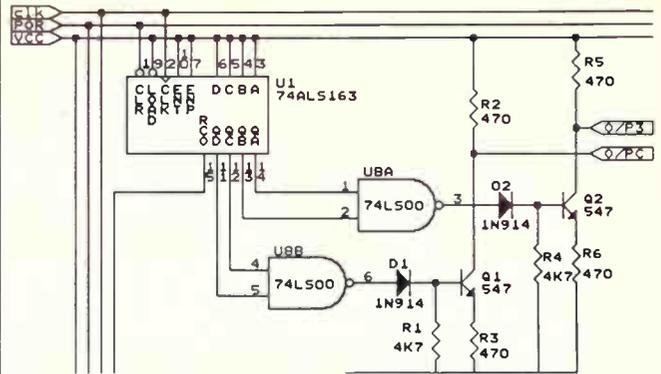
WA

Altronics
174 Roe St
Perth 6000
(09) 328 2199

Alberts Hi-Fi
396 Murray St
Perth 6000
(09) 322 4409

Alberts Hi-Fi
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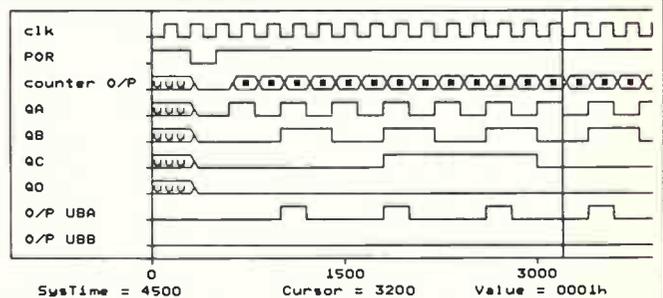
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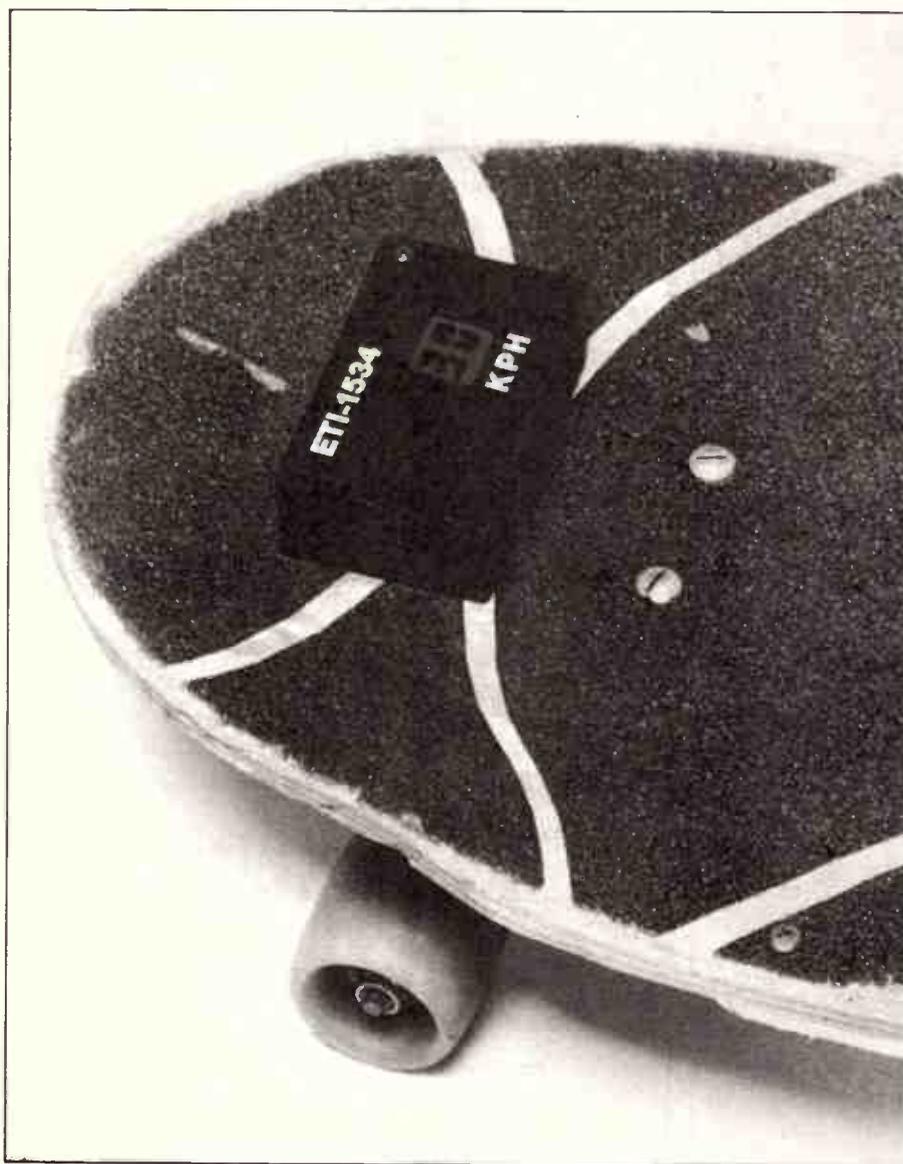
READER INFO No. 36

ETI July 1988 — 99

ETI-1534 Speedometer Module

Build a cheap, easy to implement speedo that can be used on boats, cars or bikes, or to measure engine speed, wind speed, or a hundred and one other applications.

James Twomey



MAN HAS ALWAYS been fascinated by speed. Unfortunately not all modes of transport come with the facility to measure it. Sometimes it's too difficult or expensive. Sometimes its just not possible to get it installed. With this in mind we designed a speedometer which can be adapted to as many applications as ingenuity or imagination will allow.

An important feature in a speed measuring device is the ability to measure speed without affecting it. Direct drive bicycle speedometers, which measure the current flowing from a small dynamo, never caught on because of the extra effort required to drive them. The ETI-1534 measures speed using magnetism, and causes an imperceptible increase in the resistance of the shaft. It uses an LCD display and is battery powered. It is versatile enough to be customised to almost any use. It can be powered from any voltage between 7.5 and 15 V. The leading zero's of the 4½ digit display can be displayed or blanked. A decimal point can even be insulated.

This months article concentrates the workings of the ETI-1534. Next month's issue will give construction details, how to customise the ETI-1534 and details on building projects such as a skateboard speedo or a boat speedo. We are open to suggestions for any other applications you might have.

Operation

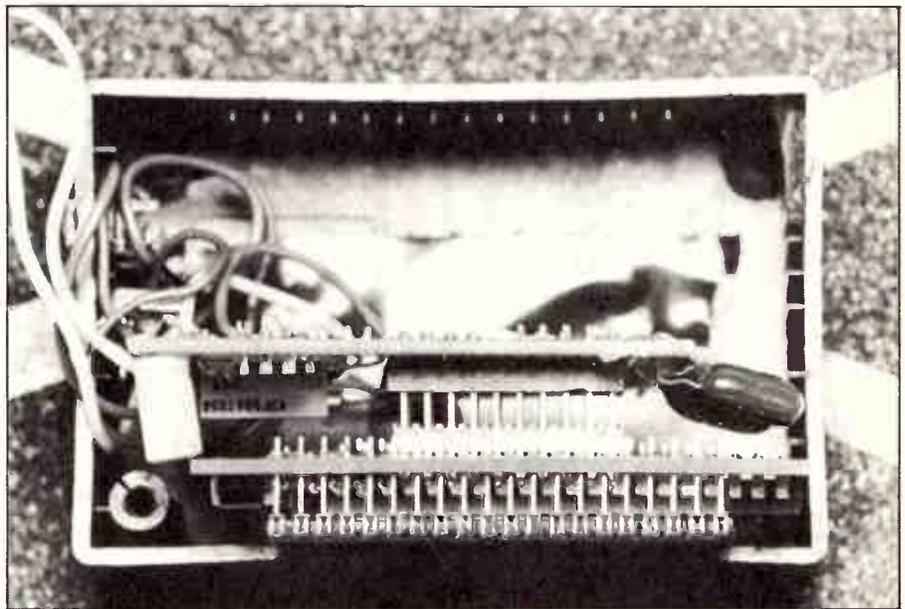
The ETI-1534 operates as follows. A magnet is mounted on a moving part of the vehicle. This could be a wheel or a propeller, or any other device where the rotational speed is linearly dependant on the speed you wish to measure. A magnetic sensing or "Hall Effect" device is mounted on a fixed part of the vehicle in

The ETI 1534 mounted on a skateboard. The sensor is fitted to the wheel.

such a way that it will interact with the magnet once per rotation. The hall effect device then gives a voltage signal for each revolution of the moving part.

The physical relationship between the hall effect device and the magnet is quite critical. The hall effect switch needs to be brought to within 1 to 5mm of the magnet, and virtually at right angles to it, for decent switching. Although this means that you need to consider the mechanical problems of mounting with some care, the switch is actually made quite immune to false triggering. You will not seem to accelerate everytime you go under a power line!

This signal is conditioned and fed into a counter. The counter value is an indication of the number of revolutions of the rotating part and thus of the distance travelled. To turn distance into speed, it is merely necessary to divide by time. So by adding a timebase circuit the speed is measured.



Inside the box, with the boards tilted to show the module plugged into the board.

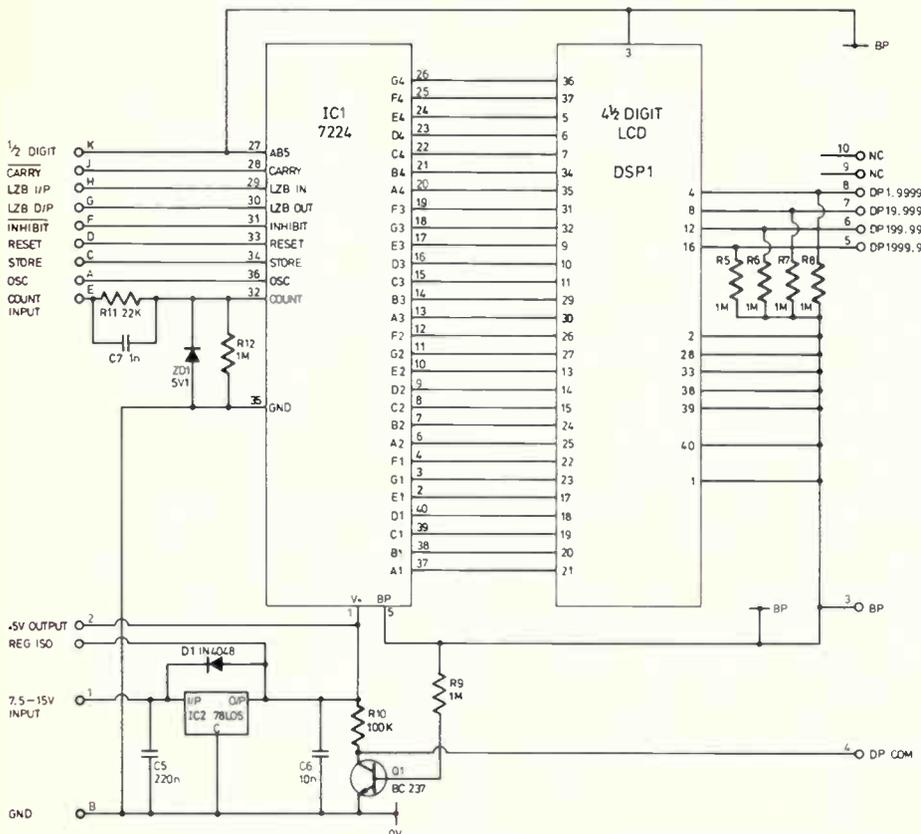


Diagram of the Lascar LCD counter module. Connecting pin 4 to either 5, 6, 7 or 8 positions the decimal point.

Our system is totally flexible in the sense that because you have complete control over the timebase, you can choose to measure in whatever units you wish. All you need to do is change the length of time over which the count occurs.

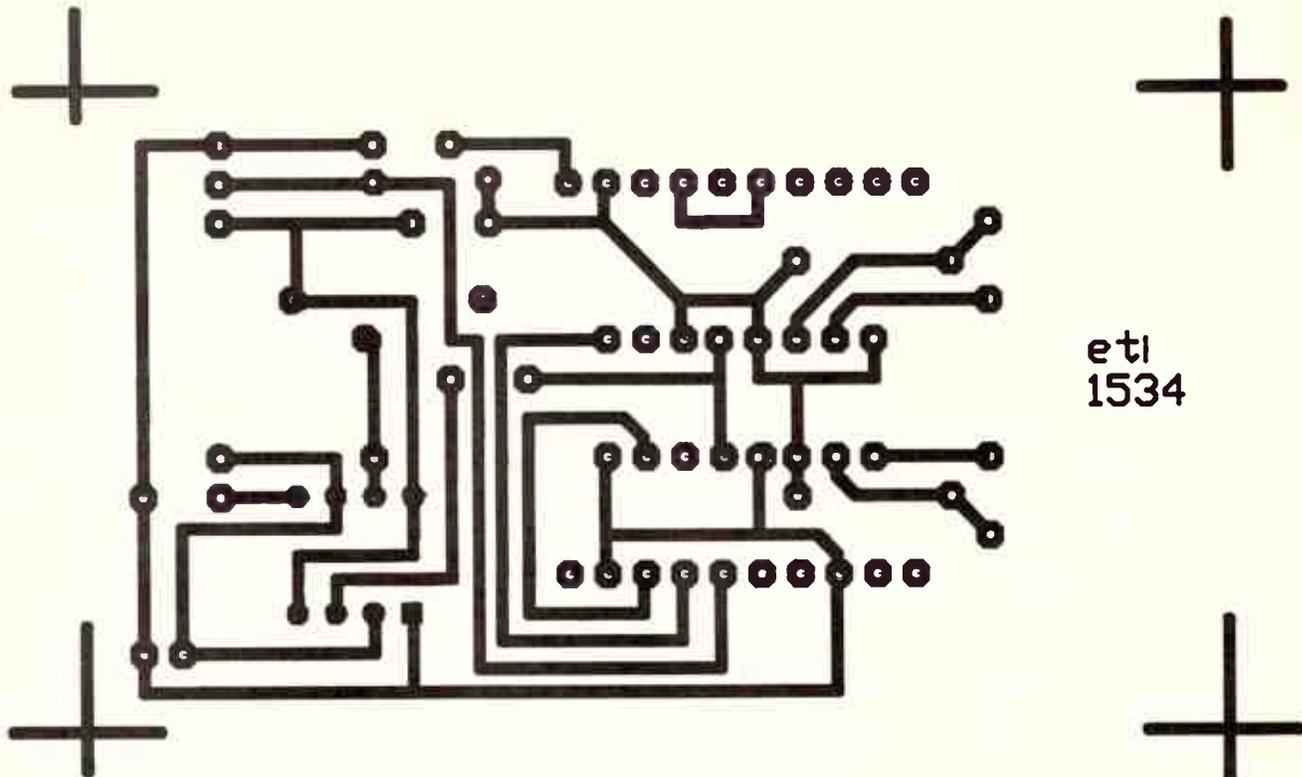
The Hall Effect

A hall effect device is simply a transducer that converts magnetic field intensity into voltage. It is possible to complete these projects without a full understanding of the hall effect, but an explanation is included for those who wish to customise the 1534 to their own ends.

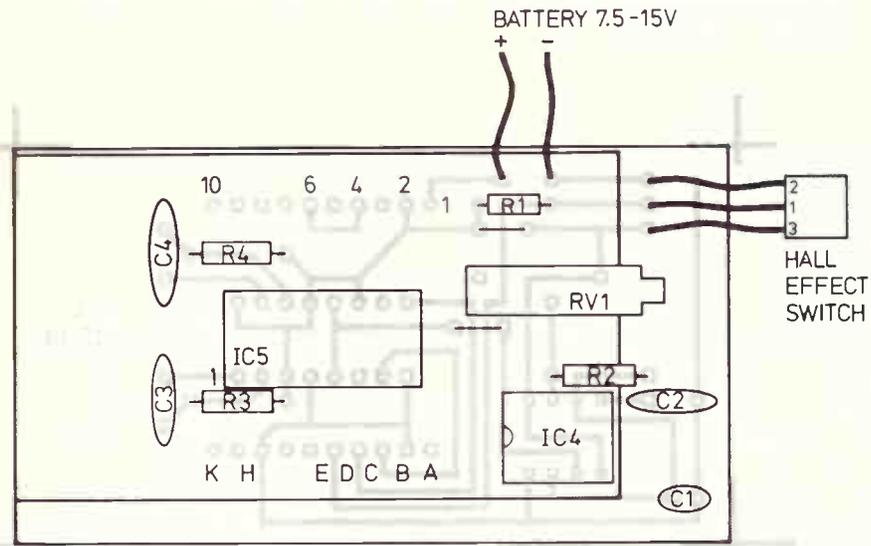
Figure 1 shows a piece of N-type semiconductor with a magnetic field B acting on it and a current I flowing through it. The hall effect results from the force F , with which a magnetic field B acts on a current density J according to the vector product.

$$F = J \times B$$

The force acts on the charge carriers (electrons in this example) moving at a drift velocity v opposite to the convention current direction. The mobile carriers are pushed towards the back. As a result, there is an excess of mobile carriers at the back and a depletion of mobile carriers at the front. As the mobile carriers in figure 1 are electrons, the back of the semicon-



eti
1534



ductor becomes negative with respect to the front. This gives rise to a measurable voltage called the "Hall Voltage" (V_h). If we had chosen P-type semiconductor the polarity of V_h would be reversed.

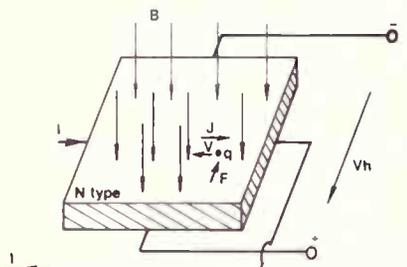
When first discovered by EH Hall in the 1870s, it was believed that the hall effect had no practical value because the hall voltages in metals are small. It came into its own with the advent of semiconductors which have high drift velocities and can produce hall voltages of the order of millivolts with moderate currents.

The hall effect is packaged in an integrated circuit with an amplifier, hysteresis and drive transistor all on one device. This makes it easy to interface to the counter module. To implement a practical switching circuit, a simple pullup resistor is needed.

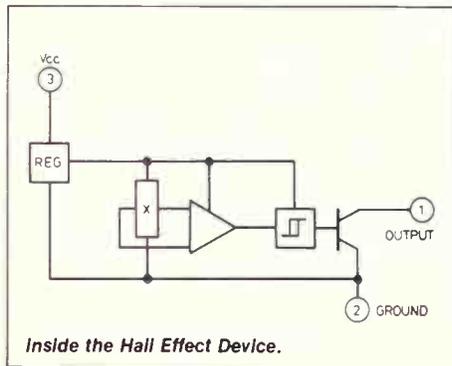
From an operational point of view, the device is simplicity itself. The output transistor in the device is normally off. When the magnetic field perpendicular to the surface of the semiconductor exceeds the threshold or operate point the output transistor turns on. A special hysteresis circuit prevents it from turning back off again so that a fast switching action, without bounce, occurs.

The Counter Module

The heart of the project is the Lascar C7224 LCD module sold in Australia by Jaycar. This module consists of a voltage regulator, counter IC and an LCD display. It is not necessary to use the module. If



The Hall effect. An N-type semiconductor with current density J in a normal magnetic field B . A force F acts on an electron q carrying the current.



Inside the Hall Effect Device.

Speedometer Module

ETI-1534 HOW IT WORKS

The output of the hall effect device IC3 is held at +5V by the 1K pullup resistor, R5. When the magnet passes the device its output transistor turns on. The output goes low presenting a negative going transition to the COUNT input of the 7724, IC1. Lets assume that the STORE input signal is high (active) and the RESET signal is also high (inactive). The 7724 increments its count value by one each time a negative going transition appears at the COUNT input.

At this stage the display will show 0000 (or just the selected decimal point if the leading zeros are blanked). When the STORE signal goes low the counter value is displayed on the LCD. The counter continues to count on each negative transition generated from the hall effect switch. The store signal stays low for such a short time (less than 100mS) that only one counter value is stored in the display.

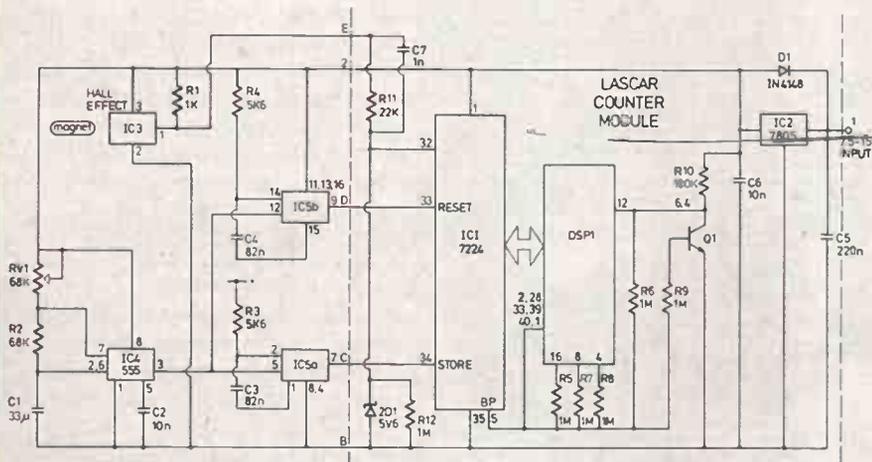
The counter continues counting until the RESET signal goes low (active). When this happens the counter value is reset to zero. The RESET signal immediately goes high and the counter starts counting again. The next time the store signal goes low, a new value is displayed.

The STORE and RESET signals are generated by two IC's, a 555 timer (IC4) and a dual monostable (IC5). When activated it outputs two signals: a pulse and an inverted pulse. The pulse duration is set by external components R4, C4, R3, C3. Monostable 1 (IC1a) is negative edge triggered and its inverted output is used as the STORE signal. Monostable 2 (IC1b) is positive edge triggered and its in-

verted output becomes the RESET signal.

IC4 is in astable mode. Its output is used to drive both monostables via the AND buffers formed by IC6a and IC6b. Its frequency is set by R1, R2, and C1. R1 is variable and used for calibration. The output of IC4 is a rectangular wave. The rising edge of this wave activates monostable 2 and a RESET signal is generated. (Monostable 1 is inactive and the STORE signal is high.) This sets the counter to zero. The counter increments by one on each negative going transition to COUNT. The falling edge of the rectangular wave activates monostable 1 and generates a short negative STORE signal. When the STORE signal goes low the counter value is shown on the display. The time constant of monostable 1 is so short that only one counter value is shown or latched onto the display. The counter continues to be incremented until the next RESET signal. Speed is measured between the rising edge and falling edge signal on the output of IC1.

The frequency of IC1 depends on the application. A high frequency is used where there are a large number of input pulses generated in a short time. It also means that the display is frequently updated. This shows small changes in speed. Lower frequencies of IC1 (eg the skateboard uses a frequency of 2 Hz approximately) must be used where the number of input pulses per second is low. This is usually not a problem. Your average skateboard rider doesn't look at his speed every 5mS nor is he interested in speed accuracy of 0.00001 km/hr.



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ETI July 1988 — 103

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CONDITIONS OF ENTRY

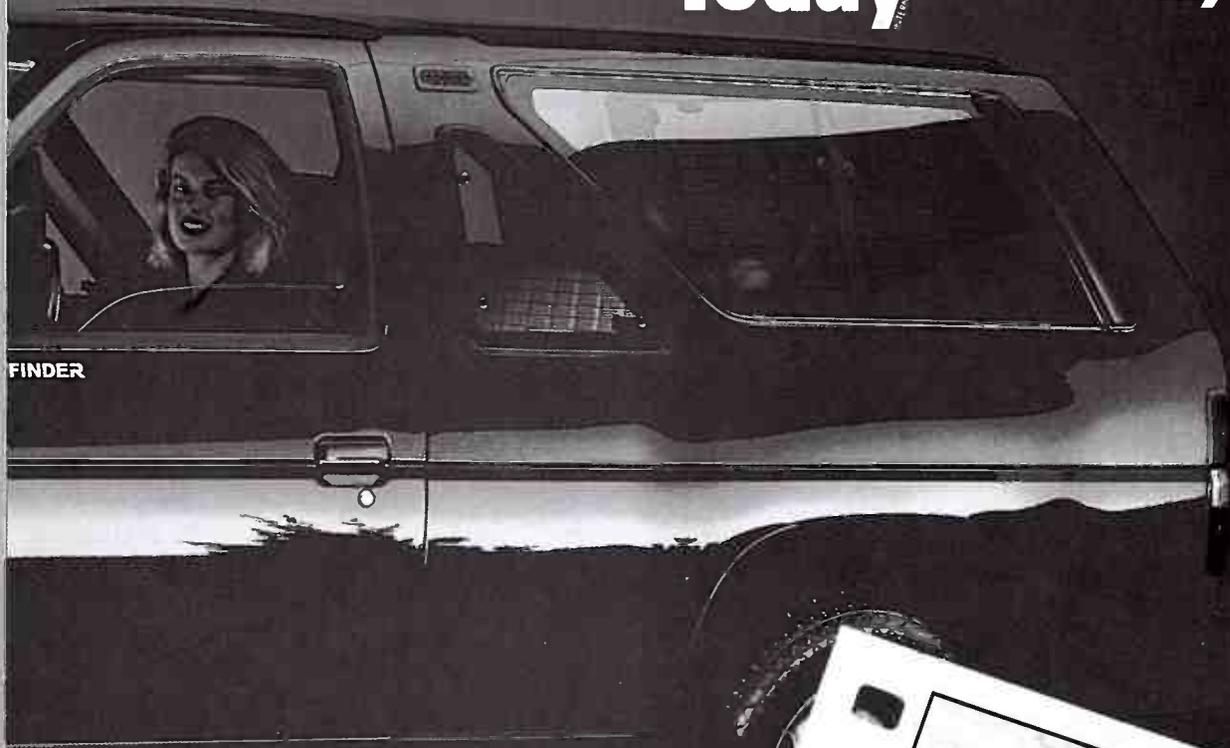
1. The competition is open only to Australian Residents authorising a new renewal subscription before last mail July 31, 1988. Entries received after closing date will not be included. Employees of the Federal Publishing Company, Nissan Australia and their families are not eligible to enter. To be valid for drawing, subscription must be signed against a nominated valid credit card, or, if paid by cheque, cleared for payment.
2. South Australian residents need not purchase a subscription to enter, but may enter only once by submitting their name, address, and a hand-drawn facsimile of the subscription coupon to The Federal Publishing Company, PO Box 227, Waterloo, NSW 2017.
3. Prizes are not transferable or exchangeable and may not be converted to cash.
4. The judges decision is final and no correspondence will be entered into.
5. Description of the competition and instructions on how to enter form a part of the competition conditions.
6. The competition commences on April 1, 1988 and closes with last mail on July 31, 1988. The draw will take place in Sydney on August 8, 1988 and the winner will be notified by telephone and letter. The winner will also be announced in the Australian on August 12, 1988 and a later issue of the magazine.
7. The first prize is a Nissan Pathfinder with Solartint treated windows, Deluxe bullbar, Thomas Electric Winch, Yokohama Super Digger tyres, and includes all on-road costs, third party insurance and registration.
8. The promoter is The Federal Publishing Company, 180 Bourke Road, Alexandria, NSW 2015. Permit No. TC88-319 issued under the Lotteries and Art Unions Act 1901, Raffles and Bingo Permits Board Permit No. 88-189 issued on 12/2/88, ACT Permit No. TP88-108 issued under the Lotteries Ordinance, 1964.

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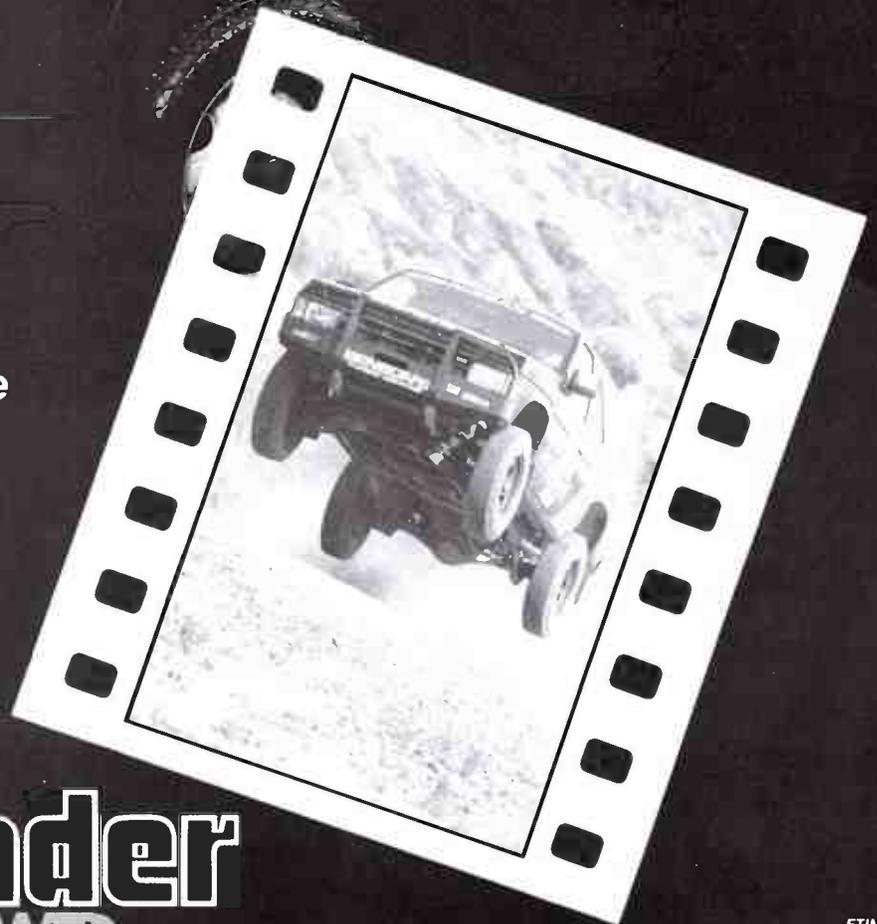
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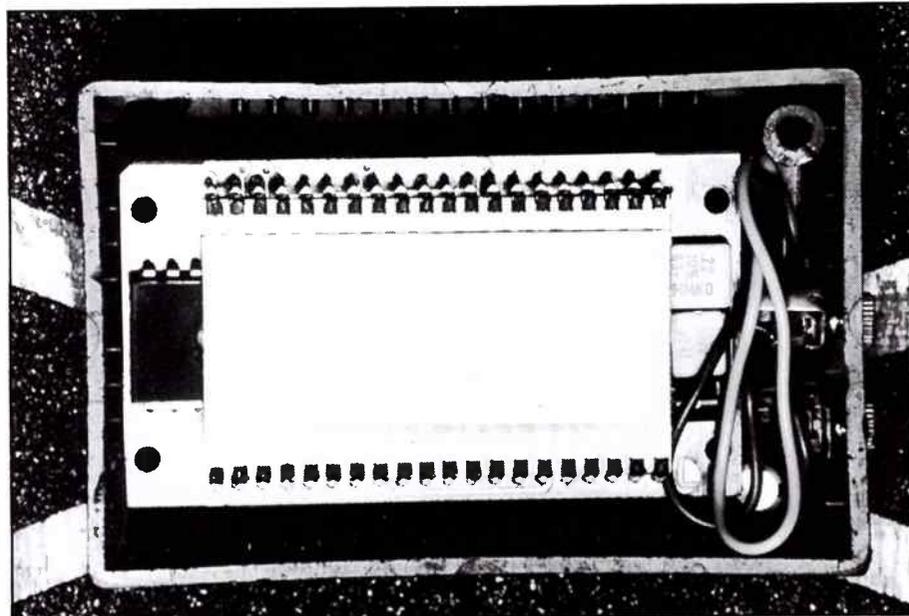
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READER INFO No. 39

ETI-1534

Speedometer Module



Inside the box with the LCD in situ. Note that the battery is mounted externally.

you can get hold of the 7224, an LCD module and the 7805 you can implement the circuit quite easily. However, we used the module since it enabled us to get the circuit up and running quickly. It is simply plugged onto the circuit board via a pc board socket. Should you decide to build The ETI-1534 and use it for more than one application the Lascar module can be plugged in and out of each one necessitating the purchase of only one module.

The Lascar module has a fairly straightforward circuit (Fig 3). A 78L05 voltage regulator regulates the input supply voltage to +5V. This +5V is used in the mod-

ule as well as by any external devices. Input signals are protected by a 5.1V zener. The remaining semiconductors are an NPN transistor and a counter IC which also drives the LCD display. The pin-out functions are as follows (Fig 4).

A OSC Access to the backplane oscillator, not of interest.

B GND Ground

C STORE If this is at +V the display is frozen (the counter continues to count). If it is at 0V the counter value is displayed.

D RESET Resets the counter to zero.

E COUNT The counter is incremented on negative going transitions here.

F INHIBIT Taken to 0V to inhibit the counter. Not of interest.

G LZB o/p Used when cascading modules. Not of interest.

H LZB i/p Held at +V to blank the leading zeros, 0V to display them.

J CARRY Used in a multiple module system.

K ½ DIGIT Not of interest.

1 7.5 – 15 power.

2 +5V Used to power external circuitry.

3 BP Not of interest.

4 DP COM This pin is used to drive the decimal point in any or all of the following positions. DP COM is linked to the appropriate pin to give a decimal point in the appropriate position.

5 DP 1999.9

6 DP 199.99

7 DP 19.999

8 DP 1.9999

9 No connection

10 No connection

Next month we will detail the mechanical problems involved in a number of specific applications of the 1514.

ETI-1534 Parts list

Resistors (all ¼ watt)

R1 1k
R2 68k
R3 5k6
R4 5k6
R5, R6, R7, R8, R9, R12 1M*
R10 100k*
R11 22k*
RV1 68k trim

Capacitors

C1 33u
C2 10n
C3 82n
C4 82n
C5 220n*
C6 10n*

Semiconductors

IC1 7224*
IC2 7805*
IC3 Hall effect switch
IC4 555 timer
IC5 4528 dual monostable
Q1 BC237*
D1 1N4148*
ZD1 5V1 zener*

*These items are included on the Lascar counter module available from Jaycar.

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Next Month

- **ETI-1418**
Build a high quality recording studio mixer
- **Louis Challis** reviews Britain's Tannoy Eclipse speakers
- **The future of Woomera Rocket Range**

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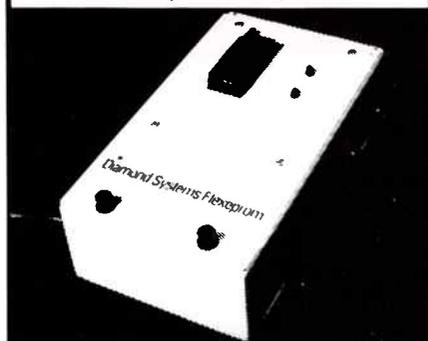
have been sold in all states and may, if proper safety procedures are ignored, constitute a serious risk when constructed, as the power switch supplied with some kits is incompatible with the wiring diagram.

Customers are asked to return this product, whether or not assembled, as a matter of urgency to the nearest Dick Smith Electronics store for immediate attention to the problem.

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TEXAS INSTRUMENTS

TECHNOLOGY AWARD UPDATE

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

Digital Signal Processing (DSP) techniques can now be applied to a wide variety of telecommunications tasks. In this update a method using DSP for speech scrambling is discussed.

Student: Tom Henry.

Supervisor: Alan Bradley — Royal Melbourne Institute of Technology.

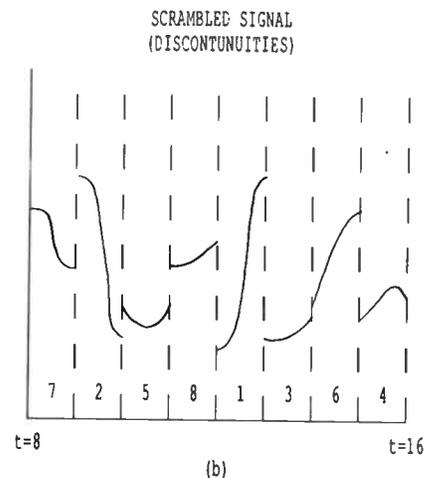
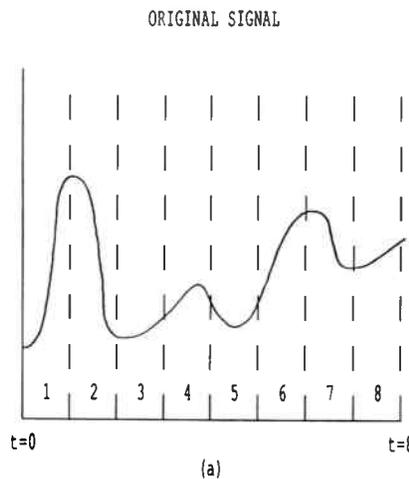
PRINCIPLE OF OPERATION

A Time Domain Medium Security Voice Scrambler was constructed and tested. The results have been tested for both security and voice quality. The security of the current system ranked highly when tested against various methods designed to infiltrate the speech message. Further improvements on voice quality can be made by increasing the bandwidth and sampling rate.

The time domain scrambling used in the system works by dividing the input signal into segments. These segments are stored in the scrambler and then passed to the output, but in a permuted order. The order in which they are output is determined by a scrambling table. This scrambled signal is passed via a voice channel to the receiver where the same process occurs, except the permutation table decodes the speech.

An example of an original signal and its scrambled version is shown in the figure below.

Clearly synchronisation is a key factor in a time domain scrambling system where the receiver has to identify block boundaries and to reconstruct the speech waveform, as well as achieve phase synchronisation between the transmitter and the receiver sampling clocks. These have traditionally been a major stumbling block that has restricted the development of time do-



main scramblers. Digital Signal Processors such as the TMS320 family can efficiently carry out block storage, permutation, and synchronisation procedures thus allowing the construction of low cost, yet efficient speech scrambling systems.

PARALLEL LISTENING

Before tests can begin to be carried out on a security system, it is essential to determine if it can be easily infiltrated. This technique involves summing the total number of segments within a block where the first sample of every segment is added together and used as the new first sample of every segment. This is repeated for

every other sample so that a sum of all the segments is produced and used as every segment. The resulting waveform should contain a reproduction of the original plus a fair amount of noise. The parallel listening test was carried out on a Rectangular Window Scrambler implementation. To test its performance a series of four-digit numbers were played through the scrambler, and a listener had to write down what he believed he heard. From this a percentage of intelligibility could be obtained. The parallel listening signal was less intelligible than the already scrambled signal. The result of this test was zero intelligibility for parallel listening.



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Buck(ing) The Numbers

In a world fast becoming reliant on calculators, seemingly simple mathematical problems can become quite confusing — even with the help of your pocket brain.

ETI offers no prizes but asks you to consider the following:

Three imbibers (yes, they were staff) spent far too long in the bar and managed to quaff thirty bucks worth of amber.

On settling, each of them threw in \$10, being notoriously lousy tipplers to the dismay of the barman.

The same barman, being an honest type, discovered an error and adjusted the bill to \$25.

"Fair enough," decides the trio, "Give us back a dollar each and keep the remaining two bucks for yourself!" — sudden generosity doubtless due to .05 plus!

Thus having each received a one dollar refund on the proffered \$10 they each contributed \$9 plus \$2 to the barman.

Ok: $3 \times 9 = 27$ plus 2 to the barman makes a total of \$29 . . . where's the remaining dollar? See if you Casio can help you now!

Timely Suggestion

Yours truly takes great pride in being employed at ETI even though he has neither the time nor the ante to spend long hours in the local.

He's even more proud to be surrounded by a world of technology and the experts that write its material but he can't help wondering why none of the clocks in the

office manages to show the correct time.

Perhaps if they were digital our boys would know how to deal with them.

Reminds this writer of a yarn in the early days of computers and their logic when someone enquired of a computer which of two time pieces he should buy — one had stopped completely while the other lost some 5 minutes every day

The answer came back smartly: Purchase the one that has stopped completely for it will show the correct time twice in the one day while the other one will only show the correct time every goodness-knows-how-many days.

Stands Corrected

In the early days of computerisation many and varied stories on the infinite "wisdom" of the computer did the rounds.

Those that knew better supplied us with anecdotes to be laughed at and ominous warnings of a big-brother type office machine running our lives.

Some actually believed that the computer had a brain of it's own and would supply us with all types of answers hitherto unheard of.

The following among them: — "This computer can answer any question," boasted the proud owner.

"Ok, ask it where my father is now," suggested the sceptic.

Question duly fed in with the resultant reply: "Your father is teeing off on the 6th hole at the Meadowlands golf course"

"Nonsense," exclaims Mr Sceptic, "My

father has been dead for 4 years!"

Computer owner demands more info for his Pride & Joy toy.

"My father, Gordon Charles Chips, died 4 years ago, where is he now?" is the next question.

Came the smart answer: "Correct. The man who married your mother, Gordon Charles Chips died Jan 22, 1984.

Your father, meantime, got a 2 under-par, on the 6th at Meadowlands golf course!

Sizing Up!

This writer would also like to see some form of standardising being applied to the clothing industry.

Seems that we still do not have our garment sizes nussed out.

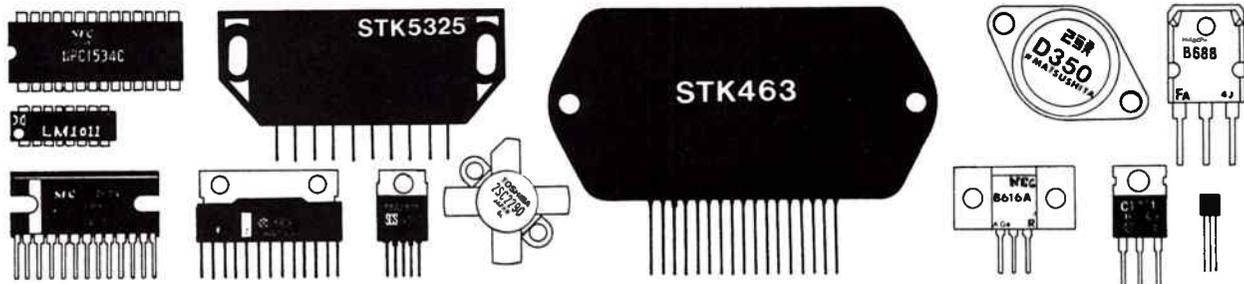
How many of us have bought a shirt or pants after first checking the size in the one we are wearing only to discover that the identically-sized newly purchased item doesn't fit at all.

Worse still — knowing your wife, sweetheart or whatever is a size 12 (again having checked the tags) you buy her the blouse she hinted at only to discover that it's too small.

The mere suggestion that perhaps she's a size 14 doesn't exactly make for a nice evening and is sure to take the shine off the whole idea of buying her a present.

Surely, by now someone can calculate garment sizes to a more accurate minimum/maximum to each size? ●

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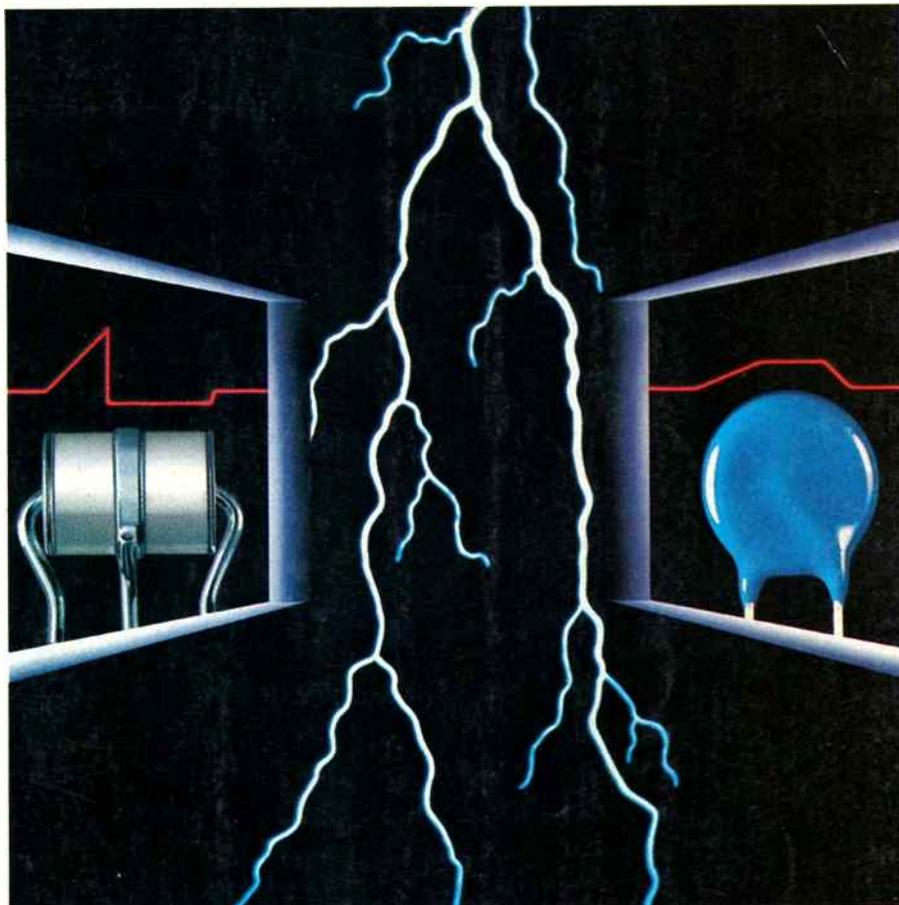
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