Electronics Today

SEPTEMBER 1988
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INNOVATION

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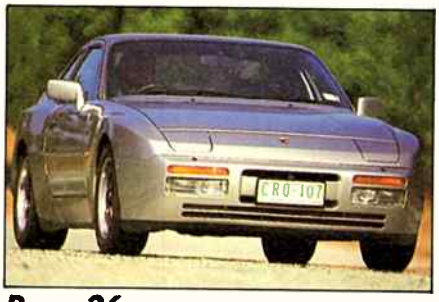

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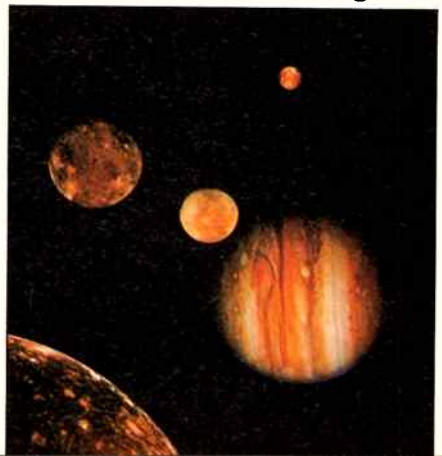

IBM PC/XT/AT BOARDS

8087	8087-2 (8MHz) Co-proc	195 00
ES1004A	Floppy Disc Card, 4 ports	65.00
ES1005	Multi I/O card	175 00
ES1009	Parallel Printer Card	44 00
ES1010	Serial RS-232C card	55 00
ES1010B	Serial RS232C card, 2 ports	79 00
ES1014	I/O Plus II Card	136.00
ES1015	Universal RAM Card, 640K RAM	550.00
ES1015A	Universal RAM Card, 512K RAM	525 00
ES10232A	Colour Graphic/Printer Card	155 00
ES1600E	10MHz XT Motherboard OK*	299 00
ES1611	Serial/Parallel – Keystate	137 00
ES1623	Turbo Colour Graphics Card	165.00
ES1629C	PEGA w/Hurcules Mode	299 00
ES1633	Turbo Mono Graphics Card	165 00
ES1638	Facsimile Card	1249 00
ES2000XT	2MB EMS memory board, 0K RAM*	249 00
ES2210	Serial/Parallel – AGC	137 00
ES2210A	Serial/Parallel – WYSE	137 00
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ES256K15	256K RAM Chip, 150nS	19 90
ES350	Turbo/Mono Printer Card	175 00
ES488	IEEE 488 Interface Card	465 00
ES6210	Hard Disk Controller Card-XT	199 00
ES650	Colour Graphics/Mono card	195 00
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ESCABLE3M	Cable, IBM Printer, 3M	15 00
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ESCONV2	AD/DA dual channel card	599 00
ESEPROM	EPROM writer card	195 00
ESEXTRACHIP	2nd for RS232 board	25 00
ESKEYBOARD	Keyboard, 84 keys XT/AT	125 00
ESKEYBOARDE	Keyboard, 101 keys XT/AT	145 00
ESP9150S	150W Switching PSU – XT	148 00
ESP9180	180W Switching PSU – baby AT	170 00
ESP9180L	180W PSU, Baby AT, L Type	170 00
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ESV20	V20 Chip	29.00
ESV30	10MHz V30 chip	49 00
H452	Co-processor, 80287-6	450 00
H452B	Co-processor, 80287-8	663 00

IBM AT BOARDS

ES1220	1.2M/720K/360K/1.44M Floppy card	145 00
ES2000AT	2MB EMS Memory board, 0K RAM*	249 00
ES2200	FDD/HDD Controller card	493 00
ES2230AT	I/O Plus Card for PC/AT	245 00
ES2230ATB	Multi I/O, 4s, 1P, 1G	399 00
ES2350	3.5MB Multifunc card, 0K RAM*	495 00
ES2401A	10MHz Baby AT Motherb'd, OK*	795 00
ES2403	DTC 5280 FDD/HDD Controller	295 00
ESCASEAT	Case AT – hinged	155 00
ESCASEBABYAT	Case – Baby AT style	135 00
ESP9200	220W Switching PSU – AT	220 00

PRINTERS

P2200	NEC P2200 Printer	695 00
P22CSF	Cut sheet feeder	155 00
RP22	Ribbon, P2200	16 00

PERIPHERALS

ESDRIVE1200	NEC 1.2MB Disc drive	285 00
ESDRIVE360	360K drive, Japanese Mfg	245 00
ESDRIV35	3.5" floppy drive, 720K	255 00
ESHARD10	NEC 10MHz hard disc	395 00
ESHARD20	NEC 20MHz hard disc	549 00
ESHARD40	NEC 40MB hard disc	995 00
ESMS400	14" EGA Colour monitor	845 00
ESMICROCASE	5.25" case for 3.5" drive	30 00
ESMONITORAMB	Monitor, TTL amber	210 00
ESMONITORGRN	Monitor, TTL green	199 00
MULTISYNC2	NEC Multisync II monitor	1249 00

CONSUMABLES

MD1	Diskette, SS SD – (Apple)	25 00
MD2D	Diskette, DS DD – (IBM)	25 00
MD2F	Diskette, DS QD – (NEC)	35 00
MD2HD	Diskette, DS QD – (1.2MB)	49 00

CAD PRODUCTS

CCSDESIGN	CCS Designer & DEXXA Mouse	299 00
CCS SYMBOL	Symbol Libraries	79 00
LOGI	Logi Paint Show	75 00
DR-2A	Designer DR-2A Mouse	99 00

* OK RAM MEANS ZERO RAM FITTED

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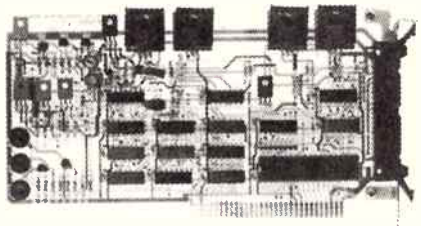
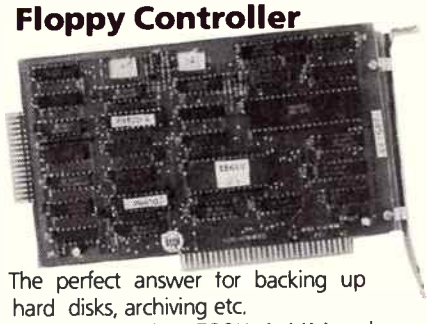
EPROM Programmer Card



This superb EPROM burner comes with a high quality ZIF socket and cabling, with facility to add 3 more sockets if necessary. Facilities include the ability to read, write, copy, compare and erase the contents of EPROMs. It can also verify data and even combine the data in two smaller EPROMs into a larger one.
Compatible EPROMS include: 2716, 2732, 2764, 27128, 27256, 27512, 2804, 2816, 2864, 58064. It comes complete with software and user manual.

READER INFO No. 45 CAT ESEPROM **$195**

1.2M/360K/720K/1.44M Floppy Controller

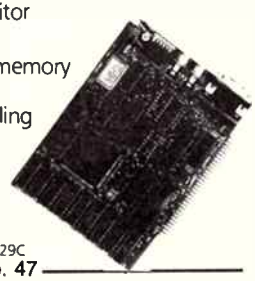


The perfect answer for backing up hard disks, archiving etc.
- Supports 1.2M, 720K, 1.44M and 360K 5¼" and 3½" drives
- Fully PC/XT, PC/AT compatible
- For suitable drive see below

READER INFO No. 46 CAT ES1220 **$145**

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~~

$299.00

CAT ES1629C
READER INFO No. 47

Disk Drives

40 Track – Japanese manufacture. Very fast track-to-track. 360K DSDD. Lowest price in Australia

CAT ESDRIVE360 **$245**

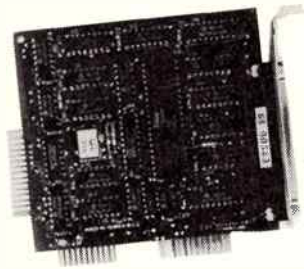
20MB NEC Hard Disk. Very fast and super reliable. Best price in town.

CAT ESHARD20 **$549**

Complete with controller

READER INFO No. 48 CAT ES6210 **$699**

Floppy Disk Controller



- Controls up to 4 DS/DD 360K drives

READER INFO No. 49 CAT ES1004A **$65**

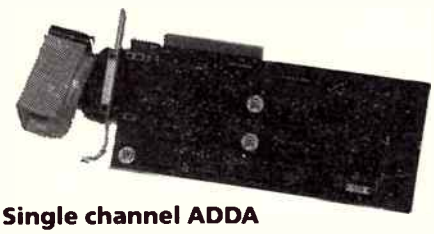
Ours is an open and shut case

Build a PC or AT with one of our sturdy, all steel cases.

XT Style Case with Hinged Lid $95.00
CAT ESCASEXT
AT Case – compact size $135.00
CAT ESCASEBABYAT READER INFO No. 50

AD-DA Conversion Cards

Interface your PC to the real world!!



Single channel ADDA

- 12 bit precision
- Input/Output voltage 0-9V (adjustable)
- Unipolar or bipolar
- Settling time 500nS
- Nonlinearity 0.2%
- Conversion time 60uS

READER INFO No. 51 CAT ESCONV **$215.00**

Dual Channel High-Res card

- 14 bit resolution
- 16 input channels
- Unipolar or bipolar input and output levels
- Conversion time less than 42uS

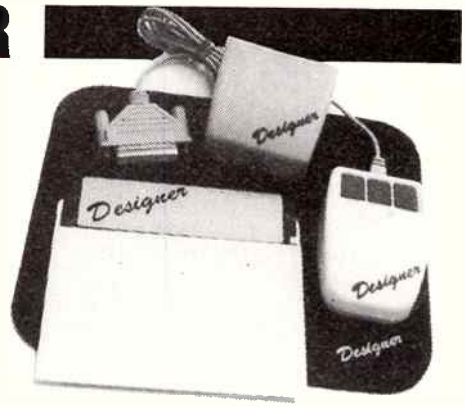
READER INFO No. 52 CAT ESCONV2 **$599.00**

1.2M NEC. Super high density. Superb construction and reliability. Works with 1.2MB floppy controller.

READER INFO No. 53

SPECIAL OFFER

At Last! A High Quality Mouse you can afford!



Electronic Solutions have tracked down a very high performance, industry standard mouse. At $99, it costs around one third the price of lower performance rodents. The mouse is a convenient serial type and comes with software to test, set up and operate.

A major improvement over other mice with the Electronic Solutions mouse is higher resolution and higher tracking speed – up to 600mm/sec.

Features which set it above other mice include:

- Extra high resolution: 290 DPI and up
- Selectable baud rate: 1200, 2400, 4800, 9600
- Optimum mechanism: Ball on centre
- Super tracking speed: 600mm/sec and up.

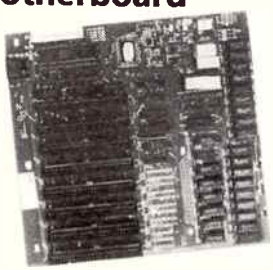
The ES Mouse is compatible with application software supporting Microsoft and Mouse Systems mice. This includes AutoCAD, ClickArt, Desqview, Dr. Halo, GEM, Microsoft Windows, Microsoft Word, Norton Utilities, PageMaker, PC Paintbrush, Personal Editor, Smartwork, TopView, Ventura Publisher and many thousands more.

The mouse includes its own pocket and pad. Introductory price is only

$99.00 inc. tax

9 pin to 25 pin adaptor, suit AT computers **only $10.00** READER INFO No. 54

Give your computer a new motherboard



The best and most cost affective way of upgrading your computer system is by replacing the motherboard on your PC with something faster. You'll get the latest technology without having to sell the computer you've got. Most of the value of your PC is in the hardware – the power supply, case, disk drives etc.

All come with 640K RAM fitted.

Motherboard	Speed	Price
XT (10MHz no-wait state 0K RAM)* CAT ES1600E	x3	$299
AT Turbo (12MHz no wait-state 0K RAM)* CAT ES2401A	x13	$699
386 (16MHz no wait-state 2MB RAM) CAT ES80386	x24	$3500
386 (20MHz no wait-state 2MB RAM) CAT ES8038620	x32	$3995

READER INFO No. 55

Parallel Printer Card

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

READER INFO No. 56 CAT ES1009 **$44**

*0K RAM MEANS NO RAM CHIPS FITTED

Power for those upgrades

If you start adding to your PC, you should consider upgrading your power supply. We have a complete range, for both XT and AT models, suitable for both standard size and "baby AT" cases. All include interference suppression and connectors. Our prices are around half that of the opposition. Buy from Electronic solutions and save!!

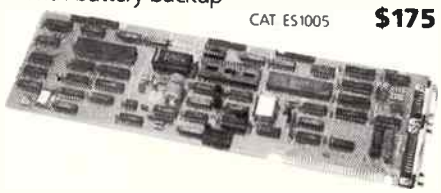
150W, suit XT CAT ESP-9150	$148.00
180W, suit XT, CAT ESP-9180	$170.00
180W, suit AT, baby AT case CAT ESP-9180L	$170.00
220W, suit AT, full size AT case CAT ESP220	$220.00

READER INFO No. 57

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

CAT ES1005 **$175**



READER INFO No. 58

I/O Master – the ultimate communications board

A complete set of fully configurable ports for you IBM PC XT/AT.

- 4 serial ports – full configurable
- 1 parallel port
- 1 games port

$399 CAT ES2230ATB

Complete with all connectors.

READER INFO No. 59

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Note: Products may vary in appearance from those pictured. In all cases they will perform to the same, or better standard.

- 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.

What's the greatest threat facing the computer today?

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

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

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

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

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

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

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

Call us on the number below, or else take your chances with the power threat.

CLEAN LINE SYSTEMS

The ultimate power support systems.

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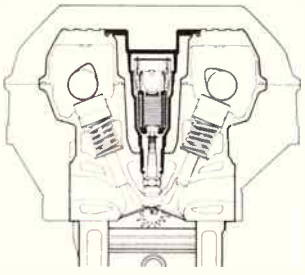
Alexandria NSW 2015
Sydney 698 2277 · Melbourne 51 9167
Brisbane 394 8272 · Adelaide 332 1333

Times are achangin'



Welcome to the new ETI. A brief skim through these pages will show you we have changed our image considerably with this issue, to bring you a brighter, bigger, better magazine.

We will use our new larger format to increase the coverage we currently give to all aspects of technology. We will retain what was good about the old, and give you something new.

Financial, business, educational and political analyses will be regular grist for our new mill, as will coverage of a much wider range of technical developments than has been possible in the past. Regular columns from Canberra, and analyses of overseas events will supply a particular slant to the news you won't get anywhere else. Articles this month on the implications of new government plans for R and D expenditure, and comment on the proposed education funding changes are a case in point.

At the same time, we want to cover all facets of the creation and application of technology. These are exciting times for our industry. For the first time, Australians are taking seriously their own ability to make an impact in technology, and more than any other magazine in the country, we want to reflect that.

A number of new writers will help to increase the amount of information we provide. All have extensive track records as industry observers, and as we get them organised over the next few months, their contributions will enrich the magazine. Peter Brewer's article on under-the-bonnet developments is a case in point, but look out for regular columns on defence, marine and aviation technology. Nor will we shy away from some of the more esoteric, but equally delightful discoveries now being made in diverse fields by scientists. Are you worried by globol warming, the energy crisis, radiation? ETI will tell you whether you should be.

We will continue our extensive coverage of data transfer, communications and shortwave events, and of course, continue to bring you do-it-yourself design ideas, both large and small. Some of the most exciting things to happen to the magazine will be in this area, where we are being really creative in the way we bring you projects. As a result, expect some real leading-edge stuff hovering on the horizon for you. The 12 MHz AT you will find described here is only the beginning.

However, it's worth bearing in mind that this section of the magazine is as good as you let it be. If you have design ideas, get in touch. We're eager to hear your thoughts on our changes, so please drop us a line.

Our aim is to keep you informed on all facets of electronics, the technology it spawns, and the miraculous way it is transforming life.

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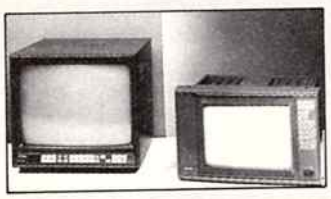
Industry News

Lance Beal

Amber Technology has announced the appointment of LANCE BEAL to head the company's Melbourne office as General Manager, Victoria.

Mr Beal has a background spanning more than 30 years in the broadcast and communications industry. He has held management positions in such companies as Channel 9 in Victoria; the Greater Union Theatre Group in Sydney; and Sony Corporation.

★ ★ ★



The Barco CVS 51 (19V) and CVM 37 (14V) Monitors

Quantum Pacific Pty Ltd has announced its acquisition of the Barco Industries distributorship.

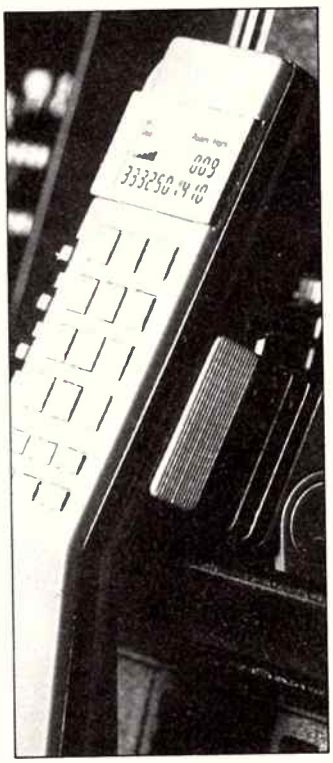
The agreement, names Quantum as exclusive Australasian distributor for the Barco range of professional television monitors.

Barco developed the first micro-processor controlled monitor in 1986, and remains the only manufacturer to offer this technology.

Poor man's mobile telephone

The UK is planning to introduce a variation on the cellular mobile telephone system to provide mobile communications in metropolitan centres at relatively low cost.

The systems, known as Phonepoint, uses base stations connected into the telecommunications network. These communicate with handheld portable units over a range of several hundred metres. The handheld units are not able to receive calls. They will operate in conjunction with pocket pagers. A subscriber would receive a message on a pager, and then have to get within range of a base station to return the call.



Phonepoint is one of several which Telecom is examining to meet future mobile communications needs. The system is seen as a way of reducing the number of payphones needed in public places, with all the attendant costs of theft and vandalism public phones entail.

They will not however replace Telecom's present cellular mobile phone service, Mobilenet, now so popular with busy executives. On present growth rates, Mobilenet will reach capacity in major capital cities by the mid 1990s unless the Department of Transport and Communications is willing to allocate additional spectrum space in the 900 megahertz band to mobile telephones. One of the fastest growth markets for mobile telephone is London where traffic is expected to increase fivefold by the mid 1990s.

MAP/TOP savings claimed

Case studies carried out in the US on factory systems built around the Manufacturers Automation Protocol/Technical Office Protocol (MAP/TOP) show that very large savings in project development time and costs are made possible by adopting communications networks built around these internationals standards.

Financial analysts at Boeing Computer Services predicted that the time required to develop applications in technical and office network sysems could be reduced by up to three years through the use of TOP 3.0, due for release later this year. They also predicted staff requirements for network design, implementation and integration would fall by 30 per cent, and hardware and software cost by 20 per cent.

Similar time savings are expected at General Motors Pontiac Canada plant which recently implemented a factory automation network based on MAP. The time from conception to implementation to projects is expected to halve from two years to one.

The Tennessee plant of Alcoa has installed a MAP based automated materials handling facility which uses PC-ATs as the human/machine interface. It estimated the cost of this network to be half that of other options, mostly because of savings in hardware and software development.

These findings are published in a recent report from the US MAP/TOP Users Group, entitled MAP/TOP a Business view.

Apart from these results, the report says that information on MAP/TOP savings is still scarce. "Many of the most successful implementors are reluctant to share details because of the competitive benefits of their network". The report, however, warns that MAP/TOP is not a 'quick fix'.

A long term commitment to strategy, will also be required. The report warns that there may be some initial increase in project costs associated with a MAP strategy.

The 27 page report is available free by writing to: MAP/TOP Users Group, One SME Drive, PO Box 930, Dearborn, MI 48121, Attention MAP/TOP: A Business Overview.

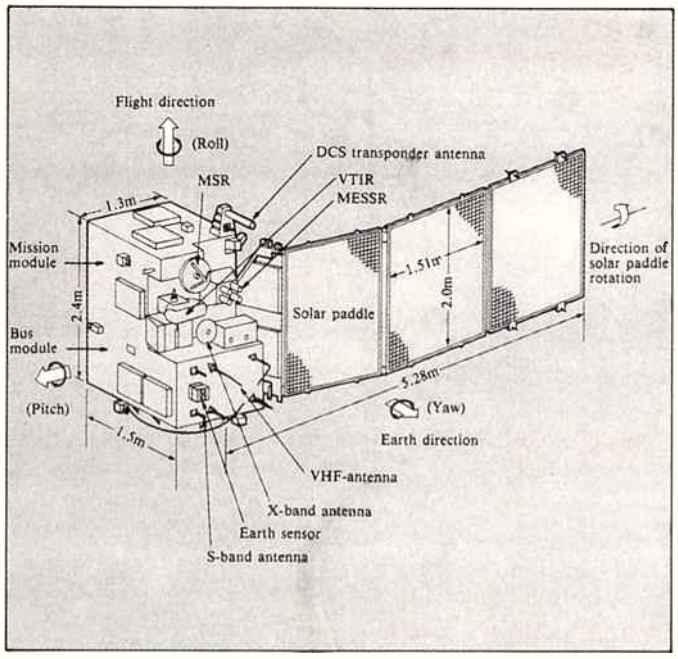


Diagram of MOS-1

First Signals From MOS-1

The Minister for Science, Customs and Small Business, the Hon. Barry Jones, has announced that the first earth-observation images of Australia from the Japanese Marine Observation Satellite (MOS-1) have been successfully received, in an experiment co-ordinated by the CSIRO Office of Space Science and Applications (COSSA).

"The Australian MOS-1 project began with an agreement, signed only in June 1987, between CSIRO, NASDA and the Science and Technology Agency of Japan to receive experimental quantities of MOS-1 data", Mr Jones said. "Since that time, CSIRO scientists and Australian industry have been working together to enable completion of the necessary design and engineering details to allow test reception by the target date of late April. I am pleased to say that this target was achieved."

"I am delighted that this complex project has been completed so quickly, on time, and within budget. It shows what can really be achieved when Australian laboratories, industry and academic institutions co-operate in a professionally managed project. I can see", he said, "that in this area the sleepers are really waking."

The MOS-1 project has involved a number of Australian companies which were contracted to provide hardware and software for the satellite system. Companies involved in the project include Hawker de Havilland, which won the tender for industrial project management, Techsearch (South Australian Institute of Technology) MITEC and Baber Enterprises. The project was funded by COSSA and the Australian Space office.

Advanced ASIC

AWA MicroElectronics (AWAM), the new joint venture company set up to design and manufacture state-of-the-art Application Specific Integrated Circuits (ASICs) in Australia, has been contracted by the Overseas Telecommunications Commission (OTC) to develop a new signal processing chip for use with its international communications systems.

The project is being carried out by AWAM in conjunction with the Laboratory for Communications Science and Engineering of Sydney University (CS&E), which has been working on the design of the specialised signal processor for the past two years and has now proposed a new architecture to OTC. The complex device will process telecommunications signals received from international transmissions, reducing the effects of interference or noise picked up during transmission.

AWA MicroElectronics will develop a single chip implementation of the signal processor which will comprise approximately 100,000 transistors, by far the largest integrated circuit to be designed and manufactured in Australia. The chip will be produced at its new facility at Homebush in West Sydney. AWAM will be responsible for chip level simulation, fault coverage, layout and manufacture of prototypes. It will also act as project manager and will subcontract certain tasks to CS&E, such as the generation and development of a suitable algorithm.

Mr Geoff Brann, Research and Development Program Manager for OTC said that the company had contracted AWA MicroElectronics because of its cost competitiveness, its tie-up with Sydney University and the design and production facilities the compony offerd at its new plant.

Australia Again Exporting Space Hardware

An Australian-built electronics unit for the European Space Agency's ERS-1 satellite will soon become the first major piece of space hardware to leave Australia in 21 years.

The last was the WRESAT satellite, launched from Woomera in 1967.

A digital electronics unit, built by British Aerospace Australia (BAeA) at Salisbury, South Australia, was officially handed over by BAeA to the Executive Director of the Australian Space Office, Dr Bruce Middleton.

The unit is a critical component of an instrument known as the Along Track Scanning Radiometer (ATSR) which will fly on ESA's Earth Resources Satellite ERS-1 in early 1990. It will play a key role in on-board data processing and control of the ATSR and a French supplied microwave sounder.

The Australian Government, through the Australian Space Office, has paid for the $830,000 unit.

Australia is negotiating for access to data from ERS-1 through the Australian Centre for Remote Sensing earth station in Alice Springs.

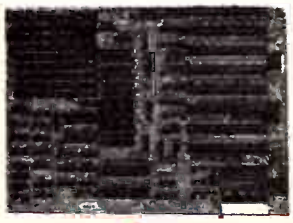
386 TOWER PC

The 386 Tower PC is a high performance system that's IBM*AT* compatible. However, the 386 Tower PC gives you 2-5 times the performance.

FEATURES:

- Intel 80386-20MHz microprocessor
- Switchable 8/16/20 MHz, 8/16/25 MHz, 0 wait state.
- 2 M/Byte fitted. Total memory expandable up to 16 M/Bytes.
- Up to 2 M/Byte or 8 M/Byte RAM modules on system board or on RAM card
- Option for 80287 & 80387 co-processor socket
- Operates in page mode with interleave memory subsystem
- Shadow RAM supported to allow system BIOS to be executed on system memory instead of slower EPROM
- Four 16-bit I/O slot. Three 8-bit I/O slot, and one 32-bit memory slot.
- 8042 keyboard controller interface for 'AT* compatible keyboard
- Seven direct memory access (DMA) channels
- Chips and Technology chip set
- AMI 386 BIOS / Phoenix 386 BIOS / AWARD 386 BIOS (AMI fitted)
- 50 M/Byte Miniscribe hard disk. Fast access. Formatted to 42 M/Byte.
- EGA card

$5,995



XT* TURBO MOTHERBOARD

- 8MHz
- 8088 Processor
- Expandable to 640K on board.
- Provisions for up to 6 x 2732 EPROMs on board
- Keyboard connector
- 8 Expansion slots

X18030 (excl. RAM) **$169**
X18031 (incl. 640K RAM) **$699**

10 MHz XT* TURBO MOTHERBOARD

Increase the performance of your sluggish XT* approximately four times with this super fast motherboard.

- 8088-2 running at 10 MHz, no wait state
- Turbo/Normal selectable
- 640K fitted
- 8 Expansion slots
- 4 Channel DMA
- Keyboard port

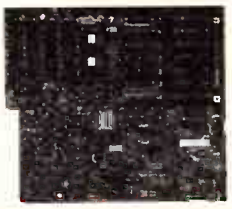
Excluding RAM . **$199**
Including RAM) . **$749**

BABY AT* MOTHERBOARD

(WITHOUT MEMORY)

- 6/10 MHz system clock with sero wait state.
- 80286-10 Microprocessor
- Hardware and software switchable
- Socket for 80287 numeric data co-processor
- 256K, 512K, 640K, or 1,024K RAM
- 64K ROM
- Phoenix BIOS
- 8 Expansion slots

X18200 (excl. RAM) **$689**
X18201 (incl.640K RAM) **$1,299**



6/10 MHz AT* MAIN BOARD

- 6/10 MHz system clock with zero wait state
- Hardware and software switches for alternative system clock.
- Rechargeable battery backup for CMOS configuration table and real time clock.
- 80286-10 microprocessor
- Socket for 80287 numeric data co-processor
- 256KB, 512KB, 640KB, or 1,024KB RAM
- 64KB ROM, expandable to 128KB
- 8 Input/Output slots
- Hardware reset jumper
- Power and turbo LED connector
- Phoenix BIOS

X18100 (Excl. RAM) **$689**

386 MAIN BOARD

- Intel 80386 CPU (16MHz)
- Socket for 80387 Math co-processor
- 32 bit BUS system, 1 M/Byte or 640K on board memory
- Built-in speaker attachment
- Battery backup for CMOS configuration table and real time clock.
- Keyboard controller and attachment
- 7 Channel DMA
- 16 Level interrupts
- 3 Programmable timers
- 8 System expansion I/O slots: 5 with a 36 pin and a 62 pin expansion slot 2 with only the 62 pin expansion slots 1 with two 62 pin expansion slots (32 bit BUS)

X18101 without RAM **$2,489**
X18103 1 M/Byte RAM **$3,495**
X18105 2 M/Byte RAM **$4,495**

MULTI I/O & DISK CONTROLLER CARD

This card will control 2 x double sided, double density drives, and features a serial port, a parallel port, and a joystick port or games port. It also has a clock/calendar generator with battery backup.

Cat. X18040 ..... **$145**

768K MULTIFUNCTION I/O CARD

(Includes cable but not 41256 RAM)

- Serial port
- Parallel port
- Games port
- Clock/Calendar with battery back-up
- provision for second serial port

Cat. X18050 ..... **$194**

MULTI SERIAL CARD

- 4 RS232C asynchronous communication serial ports. One fitted 3 optional.
- NS16450 Asynchronous communication elements (ACE)
- COM1/COM/2 COMPATIBLE
- DTE/DCE Selectable
- Drive support for PC*/AT*, XENIX*
- Interactive installation procedure available.

X18154 ..... **$139**

16 BIT FLOPPY DISK DRIVE CONTROLLER CARD

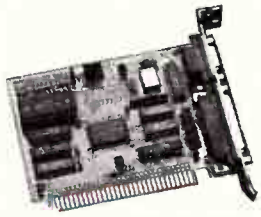
These cards will control up to 2 or 4 double sided 360K IBM* compatible disk drives.

X18005 (2 Drives)...**$52**
X18006 (4 Drives)...**$55**

1·2 M/BYTE/360K FLOPPY CONTROLLER CARD

The ideal solution for backing up hard disk, archiving etc. Suitable for 1·2 M/Byte and 360K drives. XT* and AT* compatible

Cat. X18008 ..... **$124**



GRAPHICS CARD

- Hercules compatible
- Interface to TTL monochrome monitor
- One Centronics parallel printer port
- 2K-Static RAM, 64K Dynamic RAM
- Display Mode: 720 dots x 348 lines

Cat. X18003 ..... **$139**

COLOUR GRAPHICS CARD

This card plugs staight into I/O slot and gives RGB or composite video in monochrome to a monitor.

Colour graphics: 320 dots x 200 lines.
Mono graphics: 640 dots x 200 lines.

Cat. X18002 ..... **$99**

ENHANCED GRAPHICS ADAPTOR CARD

- 256K display RAM
- Handles monochrome, CGA Hercules and E.G.A.
- Paradise* compatible
- Up to 16 colours
- Standards: 320 x 200, 640 x 200, 640 x 348, and 720 x 348.

X18070 ..... **$195**

COLOUR GRAPHICS & PRINTER CARD

This combination card features printer and monitor interface. It has 1 parallel printer port, RGB CTTC outputs.

Colour:
Text Mode: 40 columns x 25 rows.
Graphics: 320 x 200
Monochrome:
Text Mode: 80 columns x 25 rows.
Graphics: 640 x 200

Cat. X18010 ..... **$99**

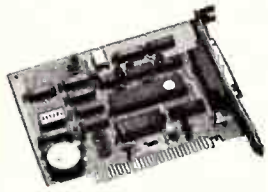
PRINTER CARD

This card features a parallel interface for Centronics printers. Included is printer data port, printer control port, and printer status port

Cat. X18017 ..... **$29**

DTC HARD DISK CONTROLLER CARDS

X18060 (XT) **$190**
X18140 (AT) **$290**



RS232 & CLOCK CARD

(WITHOUT CABLE)

This RS232 card supports 2 asynchronous communication ports. Programmable baud rate generator allows operation from 50 baud to 9600 baud. Fully buffered. Clock includes battery back-up and software.

Cat. X18028 ..... **$89**

RS232 (SERIAL) CARD

(WITHOUT CABLE)

This RS232 card supports 2 asynchronous communication ports. Programmable baud rate generator allows operation from 50 baud to 9600 baud. Fully buffered. Second serial port is optional.

Cat. X18026 ..... **$49**

CLOCK CARD

Complete clock card including battery back-up and software.

Cat. X18024 ..... **$55**

GAMES I/O CARD

Features two joystick ports. (DB15).

Cat. X18019 ..... **$29**

I/O PLUS CARD

Provides a serial port, a parallel port and a joystick port, and even a clock/calendar with battery backup!

Cat. X18045 ..... **$119**

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(TOLL FREE)
LOCAL: 543 7877

512K RAM CARD (SHORT SLOT)

- 512K memory installed
- User selectable from 64K to 512K
- DIP switches to start address

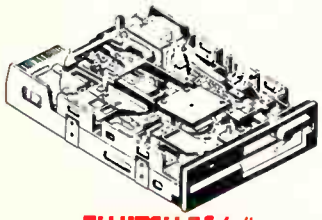
X18013 Without RAM **$99**
X18014 With RAM **$459**

2 M/BYTE RAM CARD

Plugs straight into BUS ports on mother-board. XT* compatible. RAM not included.

X18052 (Excluding RAM) **$194**

PRICE, RANGE AND SERVICE!



FUJITSU 5¼" 1·2 M/BYTE DISK DRIVE

Quality at an affordable price!
5¼" Double sided, double density.
1·2 M/Byte unformatted, 720K formatted.
IBM* AT* compatible.

C11906 .. **ONLY $249**

FUJITSU 3½" DISK DRIVE

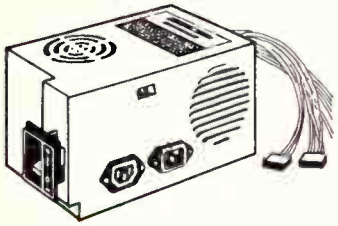
Affordable quality. Double sided, double density drive. 1 M/Byte unformmatted, 640K formatted, Access time 3 m/sec.

C11905 .. **ONLY $255**

MITSUBISHI 4851 DISK DRIVE

Slimline, 500K unformatted, 360K formatted, Double sided, double density

C11901 .. **ONLY $229**



150W SWITCH MODE POWER SUPPLY FOR IBM* PC*/XT* & COMPATIBLE

DC OUTPUT: +5/13A, -5V/0.5A
+12V/4.5A -12V/0.5A

Cat. X11096 ..... **$129**

200W SWITCH MODE POWER SUPPLY FOR IBM* AT* & COMPATIBLE

DC OUTPUT: +5/16A, -5V/0.5A
+12V/5A -12V/0.5A

Cat. X11097 ..... **$199**

180W SWITCH MODE POWER SUPPLY FOR BABY AT* COMPATIBLES

Cat. X11098 ..... **$189**

148 PAGE CATALOGUE FREE WITH EACH ORDER!

"IBM* XT* TYPE" KEYBOARD

- 100% IBM* PC*, XT* compatible,
- 84 keys, including function keys, and a numeric keypad
- low profile keyboard design,
- proper placement of shift keys with large key tops to suit professional typists
- 3 step height/angle adjustment.
- Curl lead plugs straight into IBM* PC/XT
- Status displays, Power, Cap Lock and Numeric Lock

Just like the "real McCoy" only at a fraction of the price! Why pay more?

Cat. X12020 ..... **$89**

IBM* COMPATIBLE EXTENDED KEYBOARD (101 KEYS)

These new keyboards are both XT* and AT* compatible!

- 20 Dedicated function keys
- Enlarged "Return" and "Shift" key
- Positive feel keys
- Low Profile Design, DIN standard
- Separate Numeric and Cursor control keypads
- Additional Functions: Key-in-Lock, Audio Beep, Previous Word, Next Work, Fast Repeat, Line Feed, Pause, Reset, Clear Screen.

Cat.X12022. **only $109**

IBM* XT* COMPATIBLE COMPUTERS FROM $875

Check these features and our prices. They're exceptional value for money!

- Final assembling and testing in Australia!
- Fast 8MHz TURBO Motherboard
- AT* style keyboard
- Tested by us for 24 hours prior to delivery!
- 8 Slot motherboard
- 12 months warranty!
- 150W power supply

* $875 COMPATIBLE COMPUTER

256K RAM Single Drive, Graphics and Disk Controller Card. **$875**

256K RAM COMPATIBLE COMPUTER

2 x 360K Disk Drives, Multifunction Card, Colour Graphics, Disk Controller, 1 Parallel Port. (Includes Timer Disk) **$1,045**

640K RAM TURBO COMPATIBLE COMPUTER

2 x 360K Disk Drives, Multifunction Card, Colour Graphics, Disk Controller, 1 Serial, Parallel Port. (Includes Timer Disk). **$1,175**

WITH 20 M/BYTE HARD DISK:
& single 360K Floppy Disk Drive...**$1,775**
& dual 360K Floppy Disk Drives....**$1,975**

WITH 40 M/BYTE HARD DISK:
& single 360K Floppy Disk Drive...**$2,475**
& dual 360K Floppy Disk Drives....**$2,675**

BABY AT* COMPATIBLE COMPUTER! FROM $2,295

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

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

STANDARD BABY AT* 640K RAM, hard disk drive....
WITH 20 M/BYTE HARD DISK . $3,295
WITH 40 M/BYTE HARD DISK . $3,795

20 M/BYTE HARD DISK

Tandon, including DTC controller card, 12 month warranty. IBM* compatible.

X20010 .. **ONLY $549**

50 M/BYTE HARD DISK

Miniscribe, 12 month warranty. IBM* compatible. 42 M/Byte formatted.

EXCLUDING CONTROLLER . **$649**

80 M/BYTE HARD DISK

Seagate, 12 month warranty. IBM* compatible.

EXCLUDING CONTROLLER **$2,490**

VERBATIM HARD DISK CARD

Available 20 or 30 M/Byte! IBM* compatible, plugs straight in to your computers bus connectors!

X20020 20 M/Byte **$695**
X20030 30 M/Byte **$895**

IBM* XT* COMPATIBLE CASE AT* STYLING

Now you can have the latest AT* styling in a XT* size case. Features security key switch, 8 slots, and mounting accessories.
Size: 490(W) x 145(H) x 400(D)

Cat. X11091 ..... **$99**

"IBM AT* TYPE" COMPUTER CASING

Features security key switch, 8 slots, and mounting accessories etc.
Size: 534(W) x 163(H) x 426(D)

Cat. X11092 ..... **$139**

BABY AT* STYLE COMPUTER CASING

Our latest computer casing, featuring security key switch, 8 slots, and mounting accessories etc.
Size: 360(W) x 175(H) x 405(D)

Cat. X11093 ..... **$189**

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Prices and specifications subject to change.

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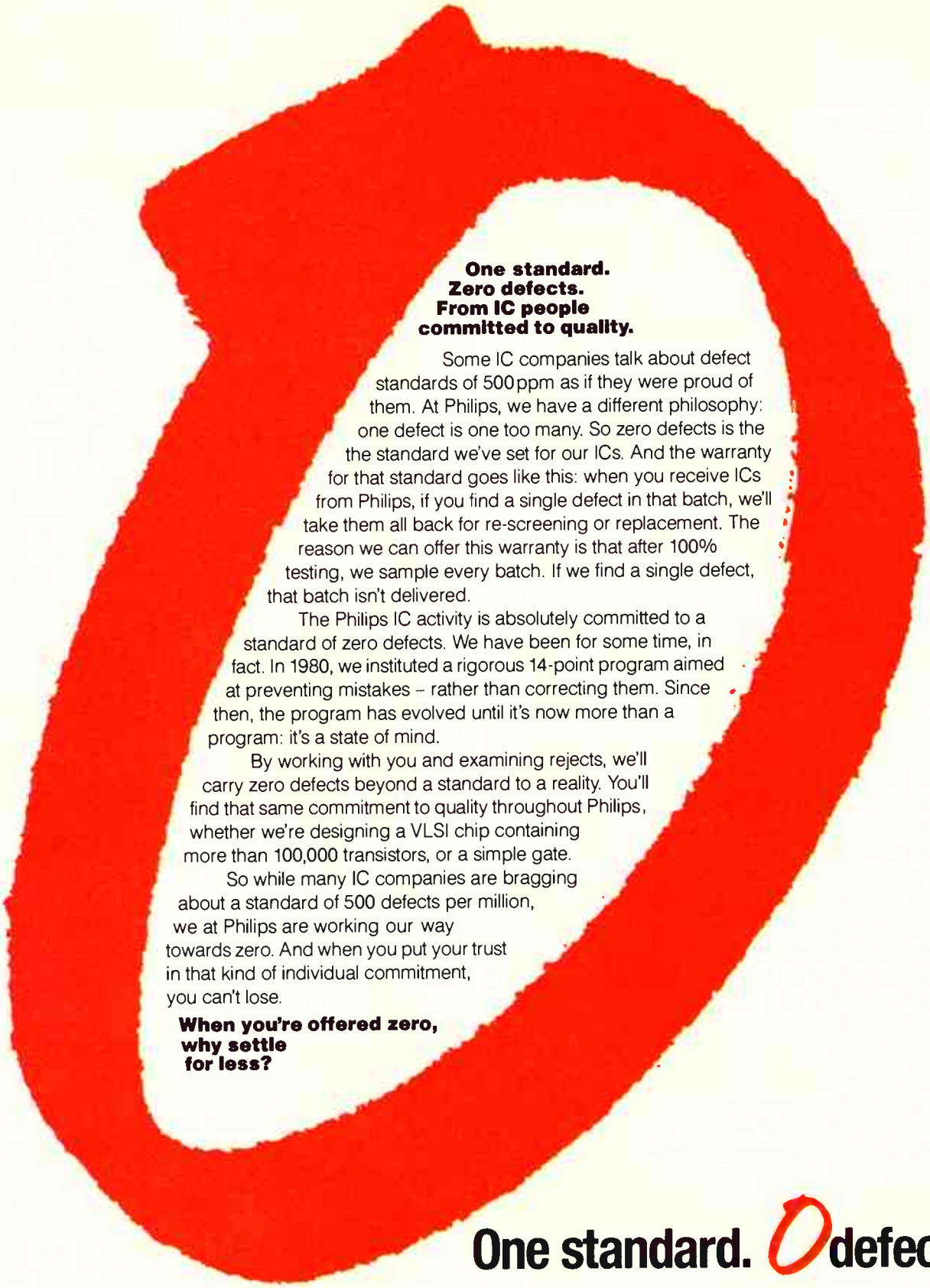

One standard.
Zero defects.
From IC people committed to quality.

Some IC companies talk about defect standards of 500 ppm as if they were proud of them. At Philips, we have a different philosophy: one defect is one too many. So zero defects is the the standard we've set for our ICs. And the warranty for that standard goes like this: when you receive ICs from Philips, if you find a single defect in that batch, we'll take them all back for re-screening or replacement. The reason we can offer this warranty is that after 100% testing, we sample every batch. If we find a single defect, that batch isn't delivered.

The Philips IC activity is absolutely committed to a standard of zero defects. We have been for some time, in fact. In 1980, we instituted a rigorous 14-point program aimed at preventing mistakes – rather than correcting them. Since then, the program has evolved until it's now more than a program: it's a state of mind.

By working with you and examining rejects, we'll carry zero defects beyond a standard to a reality. You'll find that same commitment to quality throughout Philips, whether we're designing a VLSI chip containing more than 100,000 transistors, or a simple gate.

So while many IC companies are bragging about a standard of 500 defects per million, we at Philips are working our way towards zero. And when you put your trust in that kind of individual commitment, you can't lose.

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PHILIPS Electronic Components and Materials

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Industry News

Paula Kirwan

BIS Banking Systems Pty Limited has made two senior appointments to its consultancy staff in Sydney.

Ms Paula Kirwan joins the company as a Banking Consultant from the Australian branch of the Bank of Montreal where she was responsible for user education and liaison on Midas, BIS's wholesale banking system while Mr Mukhtiar Singh joins BIS as a Banking Consultant from the Group's Head Office in London where he was involved with Midas project work. he was previously with the Bank of India in Singapore.

★ ★ ★

Matt Singleton

The NSW Minister for Administrative Services, Matt Singleton, today announced the formation of a private company, Search Tech Pty Limited, which will market the laser video disc image system developed by the Govertnment Printing Office of New South Wales.

Search Tech is a joint venture between the NSW Government Printing Office and the NSW Investment Corporation with the support of Infolink Group Limited providing the necessary input from the private sector.

TV stations challenge tribunal

The commercial television industry has placed further restrictions on violent, threatening and suggestive material in program promotions shown in early evening.

Announcing a new industry code which took effect in June, the Federal Director of the Federation of Australian Commercial Television Stations (FACTS), Mr David Morgan, said that the industry was responding to community concern about promotions for adult programs shown earlier in the evening, when many younger children are watching.

"These promotions already have to meet all the censorship requirements applying to early evening programs. However, many parents obviously believe that the short excerpts shown in promotions should be even more carefully regulated. We have come up with a set of rules that will do this most effectively — for example, by banning any use or threatened use of guns, other weapons or dangerous objects of any kind in promotions shown in early evening for parental guidance or adults only programs."

"There will also be greater restrictions during the parental guidance period up to 8.30 pm, and in any "G" classified programs that extend beyond 8.30 pm. This means that during family movies like "The Sound of Music" only program promotions suited for early evening viewing can now be shown."

Mr Morgan noted that the Australian Broadcasting Tribunal had planned to introduce restrictions on program promotions after a recent inquiry. These had been delayed because television stations were contesting the legality of part of the Tribunal's ruling in the Federal Court. The commercial television industry had decided to adopt its own restrictions while the Tribunal's plans were held up by the Court Action.

Military Electro-Optics

Current US military budget cutbacks, coupled with the relaxation of superpower tensions brought about by Glasnost, point to some lean years ahead for US defence suppliers. The fast-moving electro-optic sector of the military market, however, will be somewhat cushioned from the effects of this downturn and will be in the vanguard of the next cyclical upturn in military spending. According to a new 233-poge research report from International Resource Development Inc., the military electro-optics market will rise to more than $8 billion in 1995, from the current level of $6.5 billion. Certain sub-sectors of the market will display much faster growth rates; major increases are expected in spending on laser-protective goggles, visors and clothing, and on high-energy defensive and offensive lasers.

The IRD report notes that some critics of the "Star Wars" Strategic Defence Initiative (which is heavily based upon the use of various electro-optic technologies) see SDI funding drying up soon. These SDI critics are speculating that after the Reagan administration ends, support for SDI will rapidly dwindle among every major group in the new President's administration.

While the US politicians argue over Strategic Defence Initiative, the conventional weapon scene is being rapidly changed as new electro-optic technologies are implemented. From laser protective goggles for individual soldiers to heads-up displays for pilots, new technologies coming on line in the late 1980s and early 1990s will irrevocably change the way people experience warfare.

Sonics Contest

Robert van der Vlies (left), Queensland State Manager for Amber Technology, congratulates Ranier Guth, band member of Strangelife — the Brisbane rock band that won the top prize in the recent competition run by Sonics Magazine. Among Strangelife's $50,000 prize bononza was a Soundtracs PC-Midi console donated by Amber Technology, the major sponsor of the competition.

New European Satellite TV Standard

The major representatives of Europe's consumer electronics industry have unanimously agreed on the specification for the 'Eurocrypt' Scrambling and Conditional Access System for satellite transmissions using the MAC packet family.

The agreement was reached after many months of intensive negotiations between two major industry associations — the 'Anglo-Nordic' and 'Euromac' groups — and took into account the work done by the European Broadcasting Union — EBU.

With the backing of more than 75 per cent of European industry, 'Eurocrypt' is assured of success. It demonstrates clearly the TV industry's commitment to 1992 — a single Scrambling and Conditional Access System for a single Europe.

The final 'Eurocrypt' functional specification has been issued with the release of the detailed technical specifications following in a few months. Volume delivery of products to the market should then start from mid-1989 onwards, on time for Pay TV services on the new medium and High-Power Satellites.

All parties involved with satellite TV need a single scambling and conditional access system to ensure acceptable consumer prices, mass audiences and guaranteed incomes for program providers. 'Eurocrypt' is the complete answer.

Under the new regime, viewers will need only a single satellite receiver to view programs from all the new European satellites. Program providers will see both their investments and their critical customer data protected.

With The 'Eurocrypt' specification agreed, the consumer electronics industry has decided to work together on a single Subscriber Management System for Europe.

eti
TECHNOLOGY + INNOVATION

Rocky winner

The winner of the Daihatsu Rocky valued at over $27,000 from Theiss Toyota of the NT is Mr Ken Brown of Stuart Park, Darwin. Ken was the lucky subscriber who entered the competition run from October to December last year in ETI. Congratulations!

Datasat winners

The following readers have won modems in the ETI/Datasat competition which appeared in the May-July issues of Electronics Today International.

The lucky ones were earlier informed by mail of the results.

Bill Barbas, 64 Gladstone Avenue, Wollongong 2500.
W. J. Laurie, 100 Bellevue Terrace, Clayfield 4011.
T. Gibson, 31 Turriell Bay Road, Caringbah 2229.
D. Luff, 76 Kingstown Rood, Woodberry 2322.
J. C. Murphy, P.O. Box 258, Belmont 2280.
P. Coulter, 8/42 Sir Thomas Mitchell Rd., Bondi 2026.
R. Silberer, 7/13 Edwin St., Fairlight 2094.
Frank Malcolm, 62 Campbell Street, Balmain 2041.
Peter Hunt, 12 Niddrie Drive, Toowoomba 4350.
N. Rogers, 5 Analese Street, Sunnybank Hills, Brisbane 4109.

Congratulations!

KRYS WAREING

GRADUATE TAX

Tip of the iceberg

The Australian government has proposed to fund tertiary education (among other systems) via a graduate tax. Krys Wareing studies the options and who pays in the long term.

When CSIRO chairman Neville Wran suggested that students might pay for their university eduation, he opened a pandora's box. Questions now in the melting pot include: who pays, who studies, and what do they study. Recent figures show Australia's output of engineering graduates is low compared with overseas, and our high-school students are performing badly in traditional skills such as mathematics.

Under the Federal Government's proposals for higher education, of which the graduate tax is one, 37,000 extra places would be created at tertiary institutes by 2001. There are at present 88,000 tertiary students. The scheme, called ACCESS (Australian Contribution to the Cost of Education for Students Scheme), was proposed by a committee headed by ex-Premier of New South Wales Neville Wran. It appears, however, that there is no guarantee within the proposals that the extra places will be filled by scientists or engineers.

With five job vacancies for each postgraduate chemical engineer, and 1.2 jobs for each graduate, a professional skills shortage already puts Australia in danger of becoming a "technological banana republic", said David Trimm, professor of chemical engineering at the University of New South Wales, recently.

According to Dr David Widdup, executive director of the Federation of Scientific and Technological Societies, Australia had only 4000 electronic engineers, with only 500 or so graduating each year.

Furthermore the Australian Science and Technology Council found recently that Australia trained only 19 engineers per 100,000 population in 1985, whereas Singapore and France trained 23, Sweden 25, Britain 26.5, Israel 29, West Germany 30.5, the US 31, Canada 32, Korea 49 and Japan 59. Allowing for natural attrition and such, it seems Australia does little more than replace its engineering professionals.

That students are moving away from studying mathematics at high school is shown clearly by the figures on students who graduate with honours in mathematics — the number has fallen by one-third — since 1974.

There is a decline in all science subjects taken in Year 12, and only 19 per cent of Australian schoolchildren were studying advanced mathematics in Year 12 in 1985, compared with 40 per cent in 1964, the science and technology council committee has found.

Teachers under the microscope

The government is moving to address some of the problems in the secondary sphere. John Dawkins, Federal Minister for Education, Employment and Training has foreshadowed the need to restructure teaching and has announced a three-member committee to review teacher education in mathematics and science. The review, which is part of Mr Dawkin's proposed national schools plan, was signalled in the Government's Green Paper on higher education funding.

It covers the teaching of those subjects at early childhood, primary and secondary levels. A 10-member steering committee of academics, business and union representatives will support the committee's findings.

"(The Commonwealth Government) recognises . . . the important place of teacher education programmes in these subjects in the process of preparing young men and women to enter tertiary courses in fields such as engineerings, science and technology which are so relevant to Australia's future economic development," Mr Dawkins said when the establishment of the committee was announced.

Only time will tell if the review, due for submission in late 1989, leads to constructive action by Mr Dawkins and the Federal Government. Teacher education is but part of the problem. Students must be disciplined to return to the study of mathematics and science.

Flat charge option

In the wake of the ALP National Conference in June, the Government is examining an alternative to the Wran scheme's three-tier tax rates. Under the Wran scheme, tertiary students would return 20 per cent of their course costs through a 2 per cent levy imposed on average salary earnings of $21,500 or above. Arts and law students would pay about $1500 a year; engineering and science students about $2500 and students in medicine, dentistry and agriculture would pay up to $3000.

If the government opts for a "flat charge" instead, students would probably pay more than $1500 a year for their courses.

But should students pay at all? Wran argues students won't opt out of higher education if it "costs" them. At most, the system would lose students who have a low commitment to tertiary study, and students who attend tertiary institutes for years without taking a qualification.

Even when the Whitlam Labor Government abolished fees in 1974, there was no upsurge in students from the lower socio-economic ranks — the government's intended aim of equity. Abolishing fees created a negligible difference in the make-up of the student population. But then, only 20 per cent of students were full-fee paying; most were on Commonwealth Scholarships.

According to Mr Wran re-

'If we had only spent $600 million on our new Parliament House, we would have had the funds for an extra 10,000 tertiary students a year till eternity.'

cently, the Australian taxpayer meets more than 85 per cent of the costs of higher education and every Australian pays 47c a day each year to meet the costs of higher education. But only 7 per cent of the total population over 15 years, has ever used the system to obtain a degree or higher qualification.

"The unacceptable inequity in the arrangements is that the small and privileged group which has had such access, pays no direct contribution to the cost of tuition — though in recent times an administrative charge has been levied," Mr Wran said.

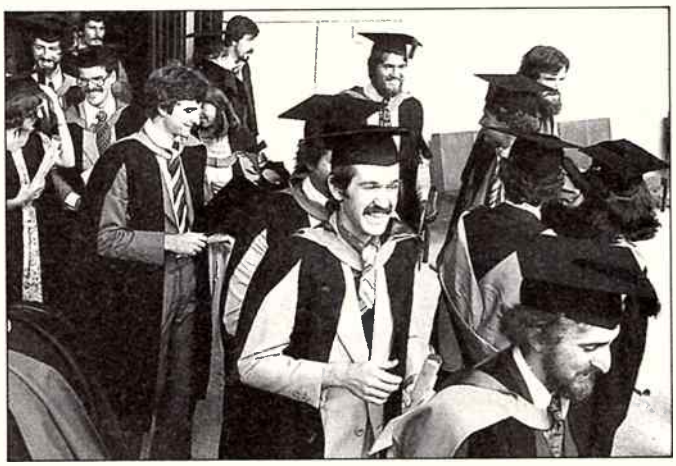
Employers, the Commonwealth and individuals should contribute to a "funding" partnership, according to Mr Wran. The President of the Australian Confederation of Trade Unions, Mr Simon Crean, also suggested industry should pay its dues — by corporate tax.

Levy will rest with consumer

It is hardly surprising that the Business Council of Australia and the Confederation of Australian Industry have slammed the proposal for a levy on employers. A BCA paper says "If such a levy were to be applied to all businesses, then it would simply become a means of increasing corporate taxes.

Both the BCA and the ACTU support the introduction of partial fees for students but preferably combined with loans or scholarships. An "imbolance" in the funding arrangements currently, where the Commonwealth Government foots most of the bill, could be "readily restored if the individual beneficiaries . . . the students themselves contribute", the BCA paper added.

Mr Dawkins will present the final composition of the proposals on higher education to



Cabinet for approval, in time for the August Budget. However, there is one final twist to the tale. The current focus on the cost of education has also focussed attention not only on where the money comes from, but also where it is going to. There is considerable evidence that both the education departments and the universities are not spending as efficiently as they might. There are also questions of priorities.

As Professor Sam Ball, chairman of the University of Sydney Academic Board told the *Sydney Morning Herald* recently, "If we had only spent $600 million on our new Parliament House, we would have had the funds for an extra 10,000 tertiary students a year till eternity."

ARTHUR CUSHEN

PROGRAM PLANNING

Listeners asked to promote programme planning

International broadcasters have been appealing to radio listeners to be more critical and forthcoming in their reception reports, and to look at the programme content as well as giving technical information.

At the recent meeting of the European DX Council in Antwerp, Belgium, many of those speaking on behalf of international broadcasters appealed to the radio listening audience to be more critical or complimentary on shortwave programming. In the past most radio listeners have provided reports of a technical nature but now many stations have established paid monitors in various parts of the world strategically placed to ensure a good global coverage, so that the spasmodic technical reports are less essential. The programme material being broadcast is now under review.

Most international broadcasters feel that the radio listener writing for a verification of his reception does not want to be critical of the programmes in case he offends the station and may not receive confirmation of his reception.

Swiss involvement

Swiss Radio International has been the forerunner of this new look at radio reception reports and the Finnish DX Club has recently designed a new report form which gives space for programme comment. Broadcasters feel that listeners are always complimentary and as the reception reports and mail from listeners worldwide are their only contact with their audience, the radio hobbyist can well provide the broadcaster with some views on the type of programme they wish to listen to.

Too often a reception report is basically just that. The listener does not feel he is conversant enough with the programming of the station to suggest changes, alternatives or deletions of the programme which he likes or dislikes. Broadcasters are now making it well known that this is what they want to hear. They cannot serve the worldwide audience with so many different tastes in entertainment without the input which the radio listeners can give. It is hoped that in the future when radio listeners write to international broadcasters who are trying to serve their information and entertainment tastes, they will take time to comment on the programme content.

International broadcasting is a costly business and to be able to show governments that the programmes have a wide following, are appreciated and are meeting the needs of the listening audience, is one area on which the broadcaster can base his appeal for additional funds to extend the international service.

Many listeners have their favourite sessions. They may only listen to Radio Japan for the "DX Corner" and not listen to the balance of the programme. They may tune to London for financial news, cricket and other sports and are not interested in the popular music or serious music programmes, or they may be a fan of Radio Australia and find their international news and current affairs the main items on their daily listening menu. Therefore, even comment on these programmes which may be their favourites can improve and alter the contents if listeners would be a little more informative in their mail to the international broadcasters.

Around the globe . . .

BULGARIA: Radio Sofia broadcasts in English 0300-0400 on 11750 kHz up to September 25 when Bulgaria returns to Standart Time and broadcasts will be heard one hour later. The session for the Pacific area 0630-0700 is on 9700 and 11720 kHz. There is a DX session in the Friday transmission.

CANADA: Radio Canada International, Montreal, has an hour news service 0500-0600 UTC Monday to Friday. This is broadcast with French 0500 and 0530 and the 15 minutes of English news at 0515 and 0545. Many frequencies carry this transmission with 6050, 6140 and 9750 kHZ providing the best reception.

GERMANY: On September 25 Deutsche Welle reschedules all its English transmissions and creates a World Service. Up to that date English to Australia is carried 0900-0950 on 9720, 11945, 15510, 17780, 17875, 21650 and 21680 kHz. The second transmission 2100-2150 is on 7130 and 9765.

ISRAEL: The Voice of America is constructing a modern relay station in the Arava to carry not only Voice of America programmes, but those of Radio Free Europe and Radio Liberty to Eastern Europe. In the laying of the foundation stone of the building the US Ambassador in Israel Thomas Pickering said that the new station served the interests of Israel and the United States, while the Voice of America Director/General defined the objects of the station, which is one of the largest used by the VOA. It is understood that there will be sixteen 500 kW transmitters on this site and programmes will be beamed into the USSR down through the Middle East to Iraq and Iran.

PHILIPPINES: The Far East Broadcasting Company, Manila with its broadcast in English to Australia is now using 15100 kHz replacing 15350 kHz for the broadcast 0830-0930. The alternative frequency of 11850 kHz still provides the stronger signal.

Promoting Listening

There is a world wide lack of knowledge in the retail trade about radio listening and shortwave reception, and most retailers while being conversant with videos, computers and the like, have little knowledge of the shortwave bands. There are of course some specialists stores handling communications equipment and they are able to provide the necessary information to help getting started in radio listening.

In New Zealand the importers of the FRG8800, AWA (New Zealand) Limited are aware of the fact that not all retailers are conversant with the equipment and are now supplying the purchasers with a copy of Arthur Cushen's Radio Listeners Guide. The national promotion has been through American Express card and so all those who purchase this high quality communication receiver will be now equipped with a companion publication that gives them all the background information which will introduce them to the fascinating world of shortwave and the multitude of programmes and languages available on the higher frequencies.

Arthur Cushen, 212 Ern St., Invercargill, New Zealand also contributes Kilohertz Comment and 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 EST.

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TECHNOLOGY

SECOND GENERATION AUSSAT FOR HUGHES

Artist's impression of Australia's next generation Aussat B satellite, the HS601.

Aussat has chosen the Hughes HS601 as its second generation satellite. Two HS601s, designated Aussat B1 and B2, will be launched in 1992 and 1993 to replace the first two Aussat A series, also supplied by Hughes. These are due to come to the end of their lives when they run out of fuel for positioning motors.

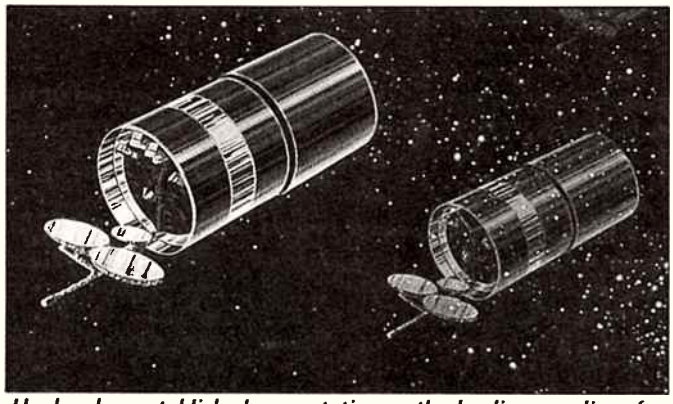
Hughes Aircraft Corporation beat Ford Aerospace, and two consortia: General Electric/Mitsubishi, and British Aerospace with Matra for the contract. It was one of two major satellite tenders each in the region of $500 million dollars announced within hours of each other. Intelsat, the international satellite co-operative, named Ford Aerospace as the successful bidder for its seventh generation of satellites. Intelsat will commence contract negotiations with Ford. If these are unsuccessful, Matra will be the second choice.

Hughes vice president, Steve Dorfman, said his company had believed it could not win both the Aussat and Intelsat tenders and had concentrated its efforts on the Aussat bid.

For Aussat, there is still a degree of uncertainty as to how the satellites will be launched. Aussat's tender, drawn up a time when a string of failures had dogged the world's satellite launchers, specifided in-orbit delivery: the successful bidder had to carry the risk of failure and include the cost of this risk in the bid.

Hughes winning proposal specifies a launch on the Chinese Long March Rocket, and will cost a total of $440 million with associated ground facilities. However, the use of Long March is subject to approval from the US Government's Co-ordinating Committee for Export Control (COCOM). If COCOM does not allow Long March, the cost could be as high as $645 for the two satellites.

There have been suggestions that Aussat has violated the terms of its tender because the launch vehicle will not be confirmed until September. However, Aussat managing director, Graham Gosewinckel, claimed that if COCOM were to veto the use of Long March by Hughes, the veto would apply to all other bidders. Gosewinckel described the Hughes proposal as a clear winner and the best technical choice. It is believed to have been significantly cheaper than other bids, but not to have had the highest local content.



Hughes has established a reputation as the leading supplier of Australian satellites, based on the performance of the first generation Aussats which were also supplied by Hughes.

Both Aussat and Hughes say there is no possibility of the Chinese gaining any access to satellite technology as a result of launching the satellite. Pointing to a table-top model of the HS601, Dorfman said: "They will see about as much as you can on this."

Economic sensitivities

There are also economic sensitivities. Some in the US claim the Chinese are indulging in predatory pricing by offering launches at subsidised unprofitable rates. However, NASA and Arianespace adopted the same strategy. Aussat took full advantage of Arianespace's half price introductory launch for Aussat A3.

Hughes has already sought advice from US officials on the possibility of using Long March and on the basis of this initial advice proposed Long March to Aussat. Now, if authorisation is ultimately refused, it will be a matter for the Australian and US Governments to resolve. Unless there is strong evidence that the Chinese could gain access to sensitive technology, it seems likely that a Chinese Launch will go ahead. Any ban on Long March could benefit the US at the expense of Australia, to the tune of $200 million.

Dorfman estimated Hughes will spend $A32 million with Australian companies on components for Aussat B series. He said Hughes had "tentatively selected" British Aerospace Australia, The Microwave Technology Development Centre, NEC Australia, Philips Communications Systems, and Alcatel-STC, which fabricated the wiring harnesses for the first generation. Dorfman said Australian built hardware was already in use on eight Hughes satellites.

Local components

Components which Hughes expects to manufacture in Australia include Ku band communictions equipment, L-Band solid state power amplifiers, a Ka band beacon, digital electronics and composite structural material. The CSIRO will also assist with antenna design.

With the contract Hughes takes on offset commitments of $A100 million. Dorfman said Hughes would meet or exceed these. He claimed that the $57 million offset commitment from the first generation would be met by 1989, three years ahead of schedule.

Each Aussat B series satellite will have 15, 50 Watt Ku band transponders and one 150 Watt L Band transponder 8 of the 50 watt transpoders will be switchable to provide domestic coverage of Australia or New Zealand, or an international service between the two countries. Switchable spot beams will cover Western Australia, South Australia and the Northern Territory, Queensland, and NSW, Victoria and Tasmania. The L Band transponder will provide mobile communications for land, air and marine vehicles. (ETI June 1988). There will also be a 28 GHz Ka Band beacon for experimental purposes. The design life of the satellites is 15 years.

There is an option in the contract for Aussat to acquire a third B series satellite. Aussat's third satellite (A3) is due to cease service in 1997 and there are plans for further second generation satellite to be known as C1. This may be of the same or different design as the B series satellites.

Aussat originally planned to use A3 as in-orbit backup. This is not now the case, all three are in use. Aussat would not give details of contingency plans for in-orbit failure of any part of the second generation of satellites. Gosewinckel would only say that backup capacity was "adequate".

STUART CORNER

SATELLITES THREATENED BY ISDN

Intelsat, the international satellite co-operative believes it is under threat from emerging ISDN standards which will penalise satellite services. Addressing a seminar on ISDN for satellite communications held at Intelsat headquarters in Washington DC recently, Intelsat deputy director general, John Hampton, claimed that "efforts to create certain types of ISDN standards are potential problems. These proposed ISDN standards . . . should be viewed as a potential dangerous obstacle to the growth and development of satellite communications."

Hampton claimed that there was a calculated campaign by new telecommunictions organisation to use fibre optics as a strategic weapon against telecommunications systems which are microwave or satellite based.

"In advertisements in magazines and journals and even on television in the US, there have been three basic messages all of which favour fibre optic cable and detract from satellite:

★ Fibre optic is the transmission medium for ISDN and advanced packet switching services.
★ Satellite's role in ISDN will be limited to back up and restoration and to thin route services.
★ Fibre optics are the only way in the future age of ISDN to achieve low cost, reliable and effective data services."

In addition, Hampton claimed that there had been attempts within standards bodies to create different ISDN standards for satellite and terrestrial links. Such initiatives, he said, would make restoration of terrestrial services by satellite "difficult if not impossible".

To add to these woes, he claimed manufacturers were designing digital switches, modems and PABX systems with delay characteristics less than 400 milliseconds, insufficient for use on satellite links. "The result may well be equipment that is satellite incompatible," he warned.

To combat this three pronged attack, satellite operators, manufacturers and users formed the Satellite Coalitioin for ISDN in 1986. The coalition now has 20 members. One of its functions has been to create a series of demonstrations of ISDN communications via satellite.

Robert Waldron of Hughes Communications told the seminar that satellite based ISDN services could now be demonstrated in over 170 countries via Intelsat. He said a start had already been made with demonstrations in six countries.

ISDN communications via satellite were first publicly demonstrated by Comsat, the US Intelsat signatory, at he ICA'87 convention in New Orleans last year. A Plessey System X ISDN telephone exchange was used to provide the link between a variety of ISDN terminals at the convention into a satellite earth station over a 2.048 megabit/sec link. This data stream was carried via an Intelsat V satellite into the UK's public digital network.

A much more ambitious demonstration was staged at the Telecom '87 exhibition in Geneva last October. Intelsat satellites linked ISDN terminals in Comsat's US headquarters, the British and US Telecom '87 pavilions and British Telecom's demonstration centres via US, Swiss and British national networks.

New cable factory

The NSW Minister for State Development, Wal Murray, last month broke the ground for the Tasman Cable Company's new $80 million submarine optical fibre cable factory at Port Botany. It will manufacture cable for the Tasman 2 cable to link Australia and New Zealand in 1991, for which the Tasman Cable Company was awarded the contract last December.

The contract will mean 300 new jobs, 35 of them in research and development. The Tasman Cable Company is a joint venture of two subisidiaries of the multinational Alcatel group, Submarcon of France and STC Pty Ltd of Australia. There are expected to be about 30 cable contracts let in the Pacific region over the next 10 years. The factory will be one of only five in the world capable of producing this cable and the only one in the Southern Hemisphere.

Concurrent dial up access for five

Dial up data communications took a great step forward in June with the launch by Telecom of its X.32 dial in/dial out service. The service provides 2400 bits per second synchronous X.25 communications capability over dial up telephone lines. Austpoc subscribers can now dial in to X.32 and dial out again to any computer connected to public switched telephone network. Up to five sessions can be in progress simultaneously.

X.32 dial in/dial out is now available to all holders of a Network User identification (NUI) for the standard Austpac charges. Dial in costs 19 cents and $4.20 per hour. Dial in and dial out costs 38 cents and $7.20 per hour.

Communications hardware and software for personal computers to support X.32, and multiple sessions, is already available from a number of suppliers including JN Almgren, Case and Datacraft.

On the day of launch, June 27, Telecom described the response as "very encouraging". A spokesman said several major clients were interested in using the service as a backup to leased line networks. X.32 dial in/dial out is also available internationally to those countries which support similar services.

Communications seminar

A seminar jointly organised by the Australian Telecommunication and Electronic Research Board and the Electrical Engineering Foundation of Sydney University hopes to get Australian groups together to develop products for the growth markets of video and image communications. Video and image terminals equipment will become increasingly popular with the advent of the ISDN next year.

One of the organisers of the Workshop, Trevor Cole, professor of Electrical Engineering at Sydney University, believes there are ample opportunities for Australian companies: in custom chip design, and in systems for compression and decompression of video images. Standards for these are still in the evolutionary stage and he hoped that Australian organisations would be able to contribute to the final CCITT recommendations which should come out later.

High speed, high resolution Fax machines are likely to be the first of many new devices for video and image communication which will come on to the market. There are also already a number of videophones designed to operate over the ISDN telephone network. The Japanese presently lead the field in many aspects of video and image communication.

The Workshop will be held at the University on September 2 and authors are invited to submit papers on variety of topics. Further details can be obtained from either Professor Cole on (02) 692-2682, or John Ellershaw of Telecom Research Laboratories on (03) 541-6655.

The official Alcatel-TCC (Tasman Cable Company) groundbreaking ceremony at Port Botany, NSW. Left to right: George Maltby, Managing Director, OTC: The Honorable Wal Murray, Deputy Premier, Minister for State Development, Minister for Public Works; Bill Page-Hanify, Chairman and Managing Director, Alcatel-STC.

Model of Alcatel-TCC factory at Port Botany, NSW.

PAUL BUDDE

VIATEL STANDS THE TEST

Telecom's VIATEL has celebrated its third anniversary — it has come a long way since its launch in what was then a sceptical marketplace.

Not only has VIATEL established itself as a leading electronic information service in Australia, but it is also a recognised provider of information to the international market.

The facility now has users from more than 16 countries, including Sweden, Canada, Germany and Argentina, as well as the Asia/Pacific region," said David King, Telecom's manager for Viatel.

"In fact, videotex services in the United Kingdom, France and New Zealand have menus allowing customers from these countries direct access to Viatel and its services.

"UK travel agents have the facility to book directly on Travtel (Viatel's travel information and booking service) and there is a reciprocal agreement for Australia's travel agents to use the British Telecom Travel Service. "Viatel is also about to launch an international Telex service at the end of March. Some travel agents have been using the facility in a trial basis since late 1987."

The system has more than 30,000 customers and, in the past 12 months, 100 million information frames were accessed on the service, and 1.5 m messages were sent. There are about 150,000 information frames in use.

It has established itself as an essential tool for Australian businesses. Business subscribers to Viatel now use it on an average about 12 minutes a day, compared to 9 minutes a day a year ago," David King said.

Continued Growth

"It indicates there will be continued growth and development of Viatel and its key service providers resulting in significant benefits for its customers."

VIATEL's Marketing Manager, Mouli Ganguly, said that the vision of Viatel being capable of delivering complex data processing applications in an easy to use manner had been achieved. New services coming available on Viatel can utilise the Data Processing Gateway which enables external computers to connect to Viatel without running videotex software. Viatel was also about to release proprietory software for IBM PCs and compatibles.

"We are proud of the fact that the products for such interconnections have been designed by Australian companies with the active co-operation and assistance of Telecom," Mouli Ganguly said. "And the products have substantial export potential."

Several key interactive applications have been developed and launched on Viatel in the post 12 months. Some of these have been used to meet the need of corporate or in-house users rather than the public. For instance:

- ★ AGC agents, including automotive dealers can sell finance packages to a prospective client and can seek approval for loans at any time. The system interfaces with data from several computers. It provides competitive advantages to AGC agents by reducing paperwork and allowing quick decisions to be made.
- ★ Transport technology offers an on-line/real time booking system for Ansett Pioneer and Greyhound coaches and is directed toward travel agents.
- ★ TROL (Tender Requests On Line) provides access to tender information from Defence contracting organisations. Through a data processing gateway, users can search for specific areas of interest.
- ★ The Victorian Road Transport Authority provides access to the Vehicles Security Register which records all outstanding financial arrangements on motor vehicles, motor cycles, caravans and trailers. The service is of particular interest to car dealers, financiers and intending purchasers and reduces demand on the already overstretched enquiry service within the RTA.

> *"We are pleased with the progress of VIATEL and excited about its potential for profit growth."*
>
> *David King, Telecom's Viatel Manager*

"In the past year, we have also launched Travtel and Viaship to address the needs of the travel and shipping industries," Mouli Ganguly said.

Travtel was developed from the original Mayne Nickless "Aftel" service and has grown substantially, delivering interactive booking services to travel agents, whilst Viaship is a joint venture between ANL, P&O and Telecom. Development of the system is continuing to ensure the service meets the information needs of the shore based components of the shipping industry.

Viatel plans to launch srvices to effectively meet the needs of users in new vertical markets.

To make it easier for potential customers to subscribe, Viatel is about to release proprietary software for IBM PCs and compatibles and has entered into an arrangement for the supply of low-cost modems by an Australian manufacturer.

Viatel plans to launch Viacorp to better serve the needs of the corporate videotex market. Several corporate videotex applications are already running on Viatel.

"We are pleased with the progress of Viatel and excited about its potential for profit growth," David King said.

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.

Totalnet

The Dutch government is supporting the implementation of Totalnet, a videotex and pay TV service that will run on the cable TV network (CATV) in the province of South Limburg (The Netherlands). Totalnet will be accessible in three cities in this province where the market potential is about 90,000 households. The initial capacity of the system will be 25,000 subscribers, upgradable to 90,000. In this hybrid cable TV-videotex service, signals are sent via the telephone line and sent back via the cable TV network. A DFL60.5 million subsidy was granted by the government for the network facilities. Marketing efforts will be supported by the participants themselves.

Totalnet will offer a variety of facilities ranging from pay per view to interactive videotex services. In addition, picture data bases will also be accessible at very fast transmission rates thanks to the coaxial TV cables: 100 pictures per second.

Totalnet will start this year with Filmnet, a pay TV service. Users will need no additional decoders for this since a switching facility is installed at the network end.

PETER BREWER

The Wheel Thing

AUTOMOTIVE IGNITION

Peter Brewer reports on the march of technology and the way the microprocessor has changed our motor cars forever.

You only have to look under the bonnet of any 1988 model car to gauge the rush of technology which has turned the once-humble family hack into a plethora of plastic pipes, wires, plugs and connections.

There's no stepping back to the days of engine simplicity — and dare I say, design elegance ? — again.

No, it would take a dramatic break-through — something which reaches into the bosic principles of our inefficient four cycle combustion process and turns them inside out — to change the path of the engine development which car manufacturers have set in gear the world over.

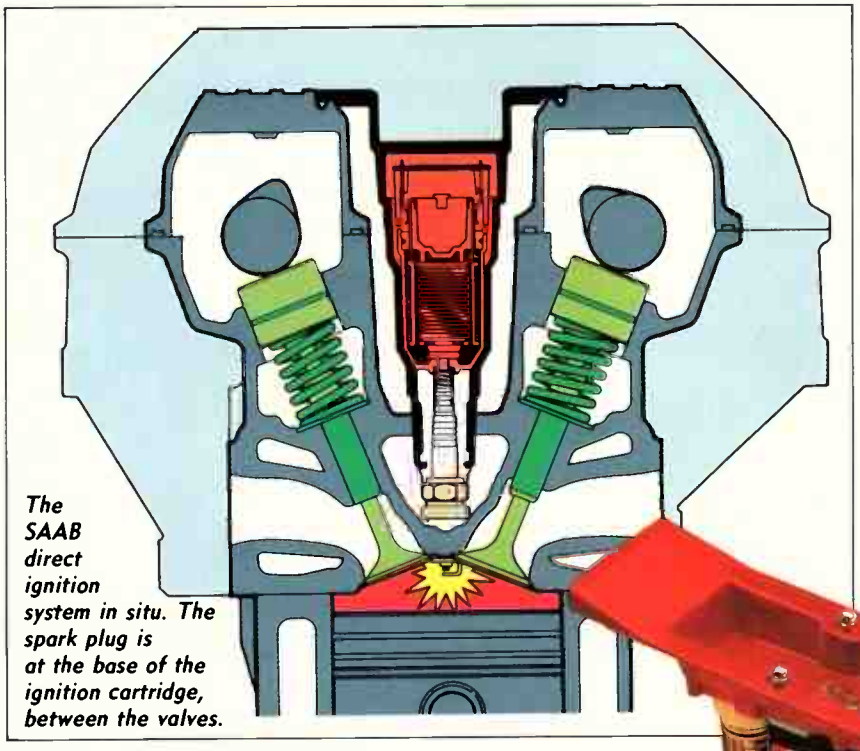
Deviating from the path with some new concept, no matter how worthwhile, costs hundreds of millions of dollars in establishment, machinery, tooling, and training. Large carmakers, despite their loud protestations to the contrary, are as conservative as a banker's pin-striped blue suit. Slow, steady development of an existing engine line provides great economies of scale. It keeps the current plant and machinery ticking over, requires little in the way of new capital investment, yet still ensures the marketing and sales people have an engineering development to crow about when new model time rolls around.

That's not to say, however, that within this broad canvas — where the brush-strokes are controlled by accountants — there is engineering research and development underway ranging in scope from the most prosaic to the utterly preposterous.

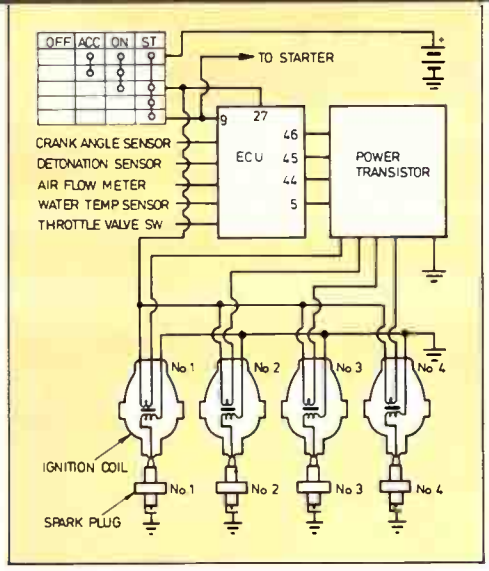
"No more replacement of pitted points, worn-out rotor buttons and high tension leads, and forget any problems with cold weather starting."

Marriage of Old and New

On of the most interesting of these areas, at least in electronics terms, is the work being done on ignition systems. This is a part of the modern motor car which, in recent years, has seen the marriage of old technology with new: the combination of an engine management computer with a conventional distributor, coil and spark plugs — all the trappings of an



The SAAB direct ignition system in situ. The spark plug is at the base of the ignition cartridge, between the valves.



Above: The basic plug firing circuit in the Nissan EXA. The Engine Control Unit takes input from various sensors which detect the configuration of the engine, and outputs to the power transistor unit, which sends a low voltage signal to the ignition coils.

Below: The cover conceals the wiring and controls for each unit.

The new Nissan. Below the bonnet, it's radically different from previous models.

Saab and Bosch co-operated to produce SDI. It's tailor-made to the harsh Scandinavian climate, but won't arrive in Australia until 1989.

inductive ignition system.

For those of us whose teenage years were often spend fumbling under the bonnet of a car, the loss of the "dizzy" to the intricacies of the electronic age will be disappointing.

When you come from a cold, damp place like Tasmania, the first thing you learn about cars is how to dry out the ignition system and reset the points with nothing more than a clean cloth, a matchbox, and a screwdriver.

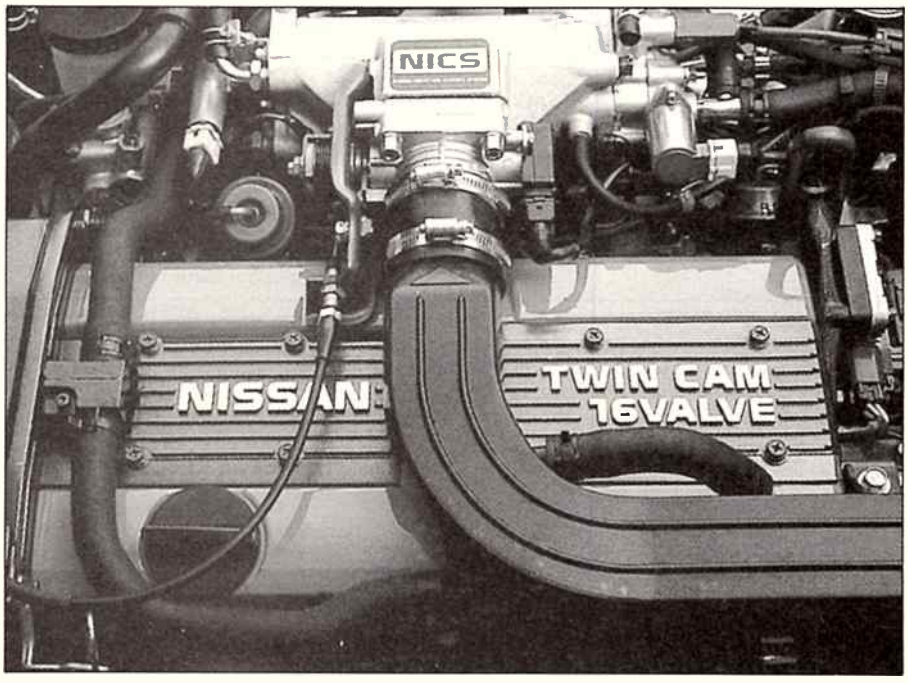
But even back then, the inherent problems and inefficiences of a mechanical distributor were obvious to our untrained eyes and clumsy hands.

The conventional ignition system has the battery feeding a 12 volt charge to the ignition coil which transformed the output into 25 kV. This power is conducted to the distributor and then through high tension leads to the individual spork plugs. The timing of the charge to each plug is controlled by the advancing or retarding of the distributor.

It's a slow process — it takes around 20 microseconds for an inductive system to build up the charge — and each of the ports involved is often subject to failure or loss of efficiency. Current can leak out through poor connections, a cracked distributor cap, faulty or aging cables plus a myriad of other potential problem areas, causing misfiring, reluctant starting and higher fuel consumption.

Solution to Nightmare

Robert Bosch, the West German electronics and engineering giant, has made major strides in this area but one of the most significant — and workable — solutions to the ignition system



Multi-spark: Zapping the engine to life

A conventional engine with dirty, wet or sooty spark plugs won't fire properly, so the only answer is to remove each plug manually for cleaning or replacement.

But with the programmed "multi-spark" function of DI, cleaning plugs becomes just a memory.

Each time the car is started, the DI system is programmed to supply a number of 40 kV sparks — around 50 in a fraction of a second — to the next spark plug in the firing order.

This intensive jolt effectively burns away moisture, soot and other coatings from the plug's electrodes and insulators.

As soon as the engine starts and engine speed exceeds 600 rpm, the DI system switches automatically to its normal ignition mode.

If the engine still fails to start, the DI has another trick left in its microchips: when the driver releases the ignition key from the "start" position, the DI sends a massive jolt — about 1000 sparks — simultaneously to every cylinder.

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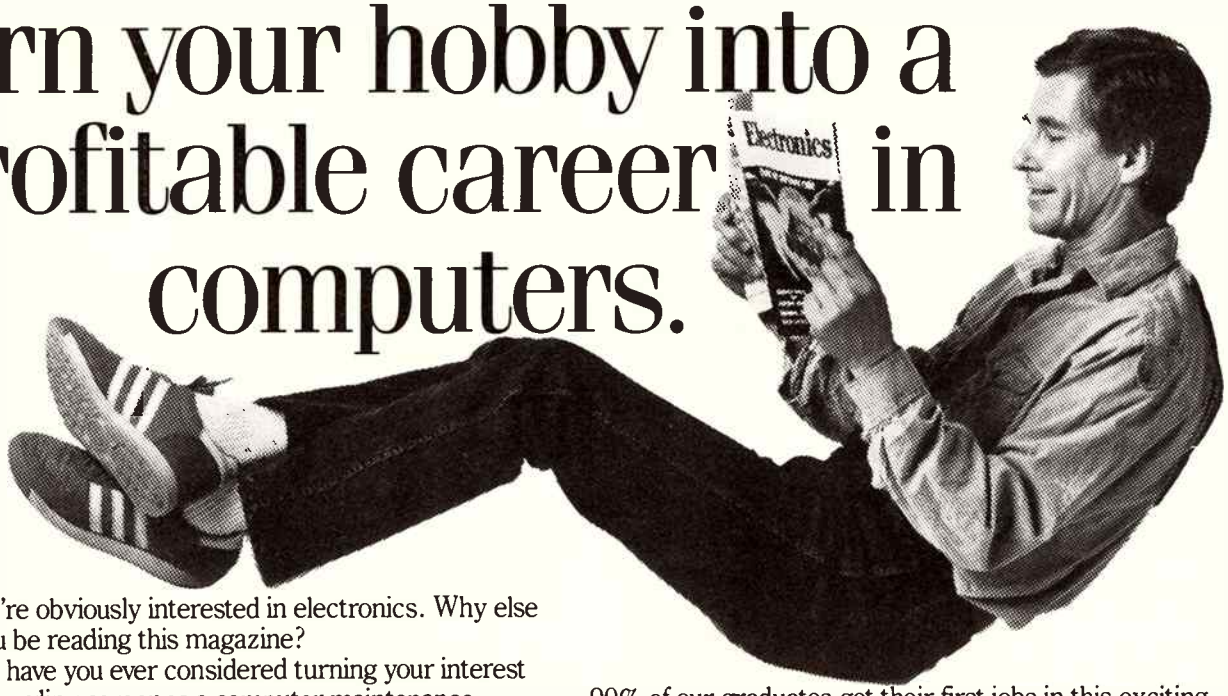

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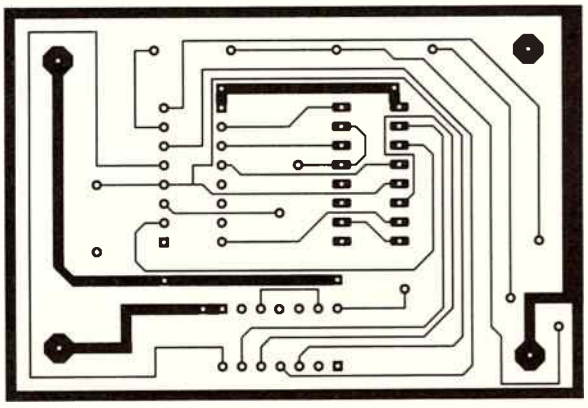

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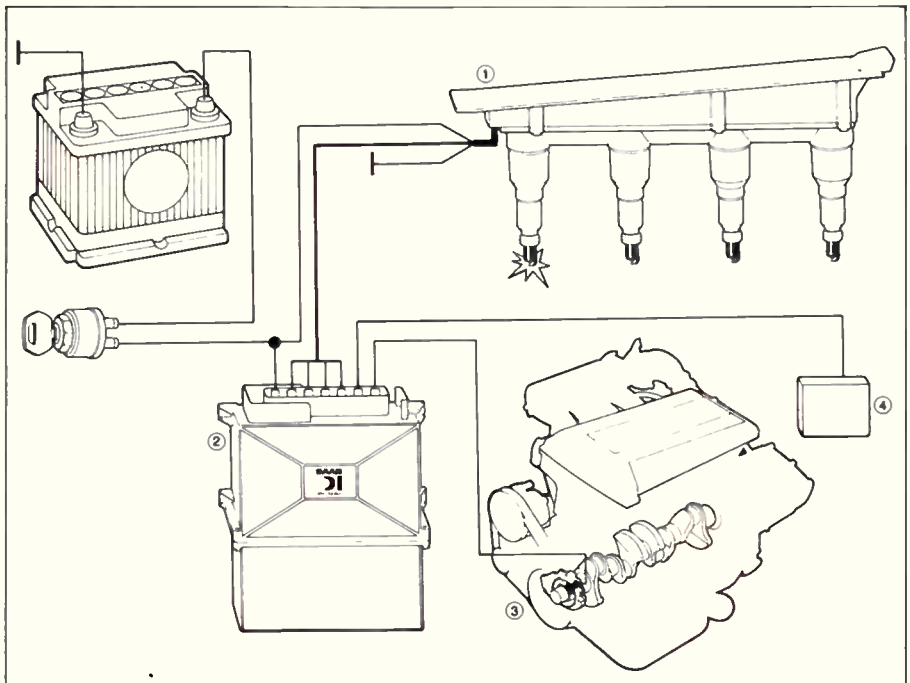


Inside the Saab DI system. The plugs and ignition coils are contained in the ignition unit (1), and controlled from the control unit (2), which gets its instructions from various transducers in the car (3 and 4).

nightmare comes from Swedish car and aircraft manufacturers Saab-Scania.

The inhospitable Scandinavian winter's toll on conventional ignition systems was most likely the impetus behind the development of the Saab Direct Ignition (SDI). With SDI, the major problem sources within conventional ignition systems — the coil, the distributor and the leads — are eliminated.

Fed with inputs from a pressure sensor and another which measures the rotation of the engine crankshaft, an electronic control unit regulates the firing pulse with extreme sensitivity. The single coil is replaced with four separate units of quite advanced design, individually located over the spark plugs in a cartridge.

While the voltage to the coils is quite low — about 400 V — they are capable of boosting this to 40 kV, with the final transformation not occuring until the moment of firing. Spark plug life is increased threefold, according to Saab's engineering data, and aside from these rare plug changes, the system is maintenance-free and self-adjusting. The mini-coils, they say, should last indefinitely.

No more replacement of pitted points, worn-out rotor buttons and high tension leads, and forget any problems with cold weather starting.

Interesting Possibilities

The coils' direct contact with the spark plug also opens other interesting possibilities, as the plug can become a measuring probe to monitor the efficiency of the combustion process.

Pre-detonation or "pinking" can be detected by electronically measuring the level of ionisation over the spark plug gaps, and the electronic control unit can then take steps — such as enriching the air-fuel mixture to cool the cylinders — accordingly. The ignition timing is adjusted for each individual cylinder — a system also used by Bosch for the Porsche 944 Turbo.

This is a particularly desirable feature for turbocharged cars because it allows reliability and maximum engine performance despite varying load conditions and inconsistent fuel quality. While the Saab system won't be seen in Australia until 1989, and the Porsche is virtually unaffordable, Nissan offers its advanced version of thie direct ignition process on a model which is much more readily accessible — its twin-cam EXA.

There's more to this fully-imported 1.8 litre two-door car than just its clever snap-on snap-off targa roof panels and hatchback. The Nissan EXA's "mini-coil" direct ignition system is linked to a engine management system which monitors its own performance by comparing fuel-air mixture ratios in its engine with those stored in its memory.

If, for instance, the EXA owner lives in a mountainous area wherer the air is thinner, the engine management unit adjusts for those conditions by rewriting its own fuel injection control data. When it detects a change in its environment, it rewrites the data again. This is a step forward from conventional management systems which, when the engine is shut down and restarted, return automatically to the settings programmed in at the factory.

Nissan has maximised the low-maintenance benefits of its DI system by fitting platinum inserts to both the centre and ground electrodes on the spark plugs, increasing their service life to 100,000 kms.

DI reliability and safety

The canventional petral engine ignition system has endured because of its low cost and simplicity, but its time is rapidly running out. Problems with voltage loss, radio intereference, and the safety risk of accidental exposure to voltages as high as 40 kV — a jolt strong enough to kill someone with a weak heart — means inductive ignition has no place in the high-tech cars of tomorrow.

The Saab's ignition "mini-coils' and components are enclosed in a patented metal cassette which can be touched without risk. It's a clever design as the cassette shields radio disturbances yet allows the rubber sleeve around each spark plug insulator to open whenever the cassette is removed.

If a fault occurs in the microcomputer, a bypass circuit allaws the crankshaft sensor to take direct control over the plug firing. This also occurs if battery voltage falls too low far the computer to operate properly.

And, unlike a conventional system which breaks down when the single cail malfunctions, if one of the DI's "mini-coils" fails, the car can still be driven on the three cylinders.

The spark plug gap on a conventional engine is limited to between 0.6 mm and 0.8 mm. Any wider and the engine has cold start problems or becomes inefficient under light loads.

The powerful spark generated by the DI system allows the gap to be much greater — between 0.9 mm and 1.5 mm — so the operating "life" of the plug is greatly enhanced.

JOHN COWARD

SYNDICATED R&D FUNDING

Board approves first fund

Research and development sources are running dry. The Federal Government's announcement regarding dispensations to syndicated R&D projects offers a viable alternative. John Coward reports on the possibilities of the scheme.

With the difficulties being experienced by Australia's Second Boards as a viable source of long-term funds and the recent contraction in global equities markets, new companies involved in research and development are having to seek out alternatives to their funding dilemmas.

Funds that were once available through MICs and other venture capitalists have become more difficult to obtain. The MIC's have made only a small number of "new" investments in 1988 and non-grant funding for research and development projects has become extremely difficult.

In line with the Federal Government's recent announcements as to the dispensations that will be offered to syndicated R&D projects, the first syndicated R&D fund has now been approved by the IR&D Board (prior to 30 June, 1988). The syndicate approved was the Pac Rio Research and Development Syndicate which was formed by the Sydney company Pacific Biotechnology Limited, which specialises in Biopharmaceutical research and development. The Australian Taxation Office issued a ruling in relation to this syndicate structure.

There is a range of important structuring and taxation issues to be considered in relation to the establishment of any such syndicates. Such syndicates can be contemplated by technology and research companies or organisations in any fields of operation, with certain provisions outlined by the IR&D Board.

Additionally, the IR&D Board must be approached with full documentation, not only of the structure, but also the fund raising documents and details of the research and development projects being considered in order for the Board to review and approve each syndicate.

> *'A potential source of funds in the current difficult climate'*

As the 150% taxation concession is still in force until June 1991 there is an opportunity for Australian companies to consider structuring such syndicates in order for contributions to such syndicates to benefit from the taxation concession available.

There is a range of matters that need to be considered in the structuring of such syndicates which include the following important issues:

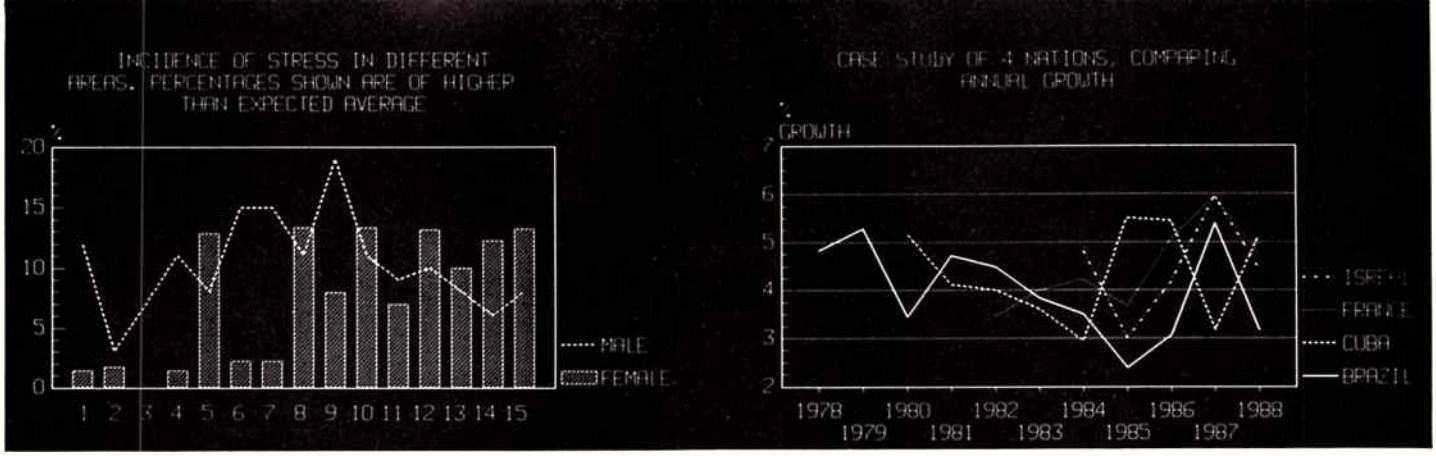
- ★ the contributors (i.e. investors) must be protected; One method of protecting such interests is the appointment of an independent management committee to oversee the research and development activities;
- ★ the management committee may comprise members of the research body undertaking the research, but at all times it should be controlled by the independent members;
- ★ this management committee needs to review and approve each research and development project;
- ★ legal agreements need to be developed binding the contributors and the research organisation;
- ★ as an added incentive to contributors, consideration can be given to the research organisation providing a guarantee repurchase arrangement. In an agreement like this, the organisation must repurchase the contributors' interest at an agreed value if a majority votes to do so. This matter must be carefully considered as in a number of cases the research organisation may not be in a position to make such an offer.
- ★ the contributors at all times must retain ownership and control over the assets generated as a result of the research and development projects;
- ★ the research organisation, in addition to deriving a normal commercial profit margin on the research and development undertaken on behalf of the syndicate, may also obtain a certain proportion of any royalty (or up-front payments or other remuneration received by the investors) in the commercialisation of any assets generated by the research;
- ★ the structure of the commercialisation vehicle needs to be considered. It needs to be flexible so that the management committee keeps its options open.

> *'As the 150% tax concession is still in force until June '91 there is an opportunity . . .'*

The new dispensations available to such syndicates in relation to the 150% taxation concession should result in the receipt in advance of the 150% concession. However, this will be for only 12 months of budgeted R&D expenditure rather than a 150% concession for the total amount initially contributed. This is likely to be an important issue when funds are raised for projects whose duration exceeds one year.

The establishment of these syndicates takes some months due to the preparation of the appropriate documentation, submission to the authorities for approval and other related matters.

With the 150% taxation concession still available until June 1991, these syndicates provide a potential source of raising of funds in the current difficult climate for consideration by Australian technology companies.



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A CRYSTAL BALL LOOK AT TELEVISION

New technologies waiting in the wings will make TV sets bigger and smaller, lighter and brighter, but not necessarily cheaper. Derek J. Powell takes a look at what's in store for the future.

AUSTRALIANS as a whole are quick to take up new developments in home entertainment. Over the next few years, we should be in for a buying splurge of unequalled proportions, because a kaleidoscope of new technology is set to change the way we watch TV.

Products ranging from pocket sized colour receivers "to" Digital VCRs, are already here. The next wave, High Definition TV, flat screens and the integration of the TV as a domestic control centre will be based on already existing technology.

Digital Television

The first really successful digital consumer entertainment product has been the Compact Disc. Its immediate acceptance and rocketing sales have tended to overshadow the amazing potential of digitally processed television pictures.

The circuitry of a Digital Television Receiver makes it a closer relative to the Personal Computer than to the black and white TV of the past. Indeed, digital sets have been described as "simply a microcomputer that emphasises the video display". Their emergence, and the parallel development of the "digital" VCR, has been made possible by the rapid drop in cost of computer memory.

To perform any significant digital manipulations on a television signal, you need to be able to operate on a complete video frame (or at the least one of the two interlaced fields). The incoming analogue video signals are sampled and converted to digital values which are read into a buffer. This buffer memory must have a capacity sufficient to store the values of all the pixels in a frame of 625 scanning lines.

When the first digital video processors were developed, less than ten years ago, they took up an entire equipment rack and cost up to a half a million dollars. Now, due mainly to the development and refinement of VLSI techniques, many of the same features are available within domestic digital TVs and VCRs for only a few hundred dollars more than an analogue unit.

In Australia, the marketing of digital TV receivers has been pre-empted by the digital VCR. Note that the actual transmission and recording processes are still analogue. The digital circuits, with their special effects and enhancements, are used to enhance tape replay or off air signals from the VCR tuner. After the digital processing stage, an analogue RF or Video signal is provided to feed a conventional receiver or monitor.

Digital processing provides benefits in two main areas. The first is an enhanced perceived picture resolution.

Once the signal is in the digital domain, a variety of processing techniques can ignore inherent signal noise, filter out wanted information and reduce "ghosting" and other defects. Improved picture detail results from edge enhancement and noise reduction techniques. Also digital receivers cope well with signal strength variations.

However it is the digital "Special Effects" which have captured most attention. Features like Mosaic, and Posterisation colour effects, still frame and strobe virtually allow the viewer to become his own video editor in an unprecedented way.

All of the digital effects are created by either manipulating the digitising process or altering the sequence in which the memory is read out.

The "Mosaic Tile" effect for example, deliberately reduces the resolution to give the same impression as a patterned mosaic floor. The information in a single pixel is read out repeatedly to extend it horizontally, then that pixel is used again at the same position on the next few scanning lines to create a block or tile effect.

Incoming luminance and chrominance information is quantised into a grey scale of up to 256 levels. By suitably biasing the incoming level, however, a grey scale (or colour scale) of only a few, quite distinct, levels can be created. This gives a "posterised" effect resembling a painting more than live video.

High quality digital freeze frames are achieved by not updating the contents of the buffer memory, while a strobe effect can be created by updating the memory only a few times per second, instead of every frame.

The PIP Effect

The most compelling (and useful) function made possible by the digital technology is the ability to display one still or moving picture within another video frame producing a "picture-in-picture" (PIP) effect.

Receivers or VCRs with PIP capabilities allow viewers to watch from two to nine video sources at once depending on the model. Pictures can be displayed as corner insets or in a variety of split-screen or multisegment formats. The inset video segments generally won't have accompanying audio, though sometimes pushbutton selection of audio from main programme or inset is provided.

Using a PIP set, viewers can watch scenes from two video sources simultaneously. It's possible for instance to watch a prerecorded movie while simultaneously following the progress of the cricket as a corner inset. A push of the remote button exchanges the main and inset pictures instantly if, say, a batsman is caught out.

The multisegment format allows all the available viewing choices to be presented on screen at once so a choice can be made without resort to the programme guides or channel jumping.

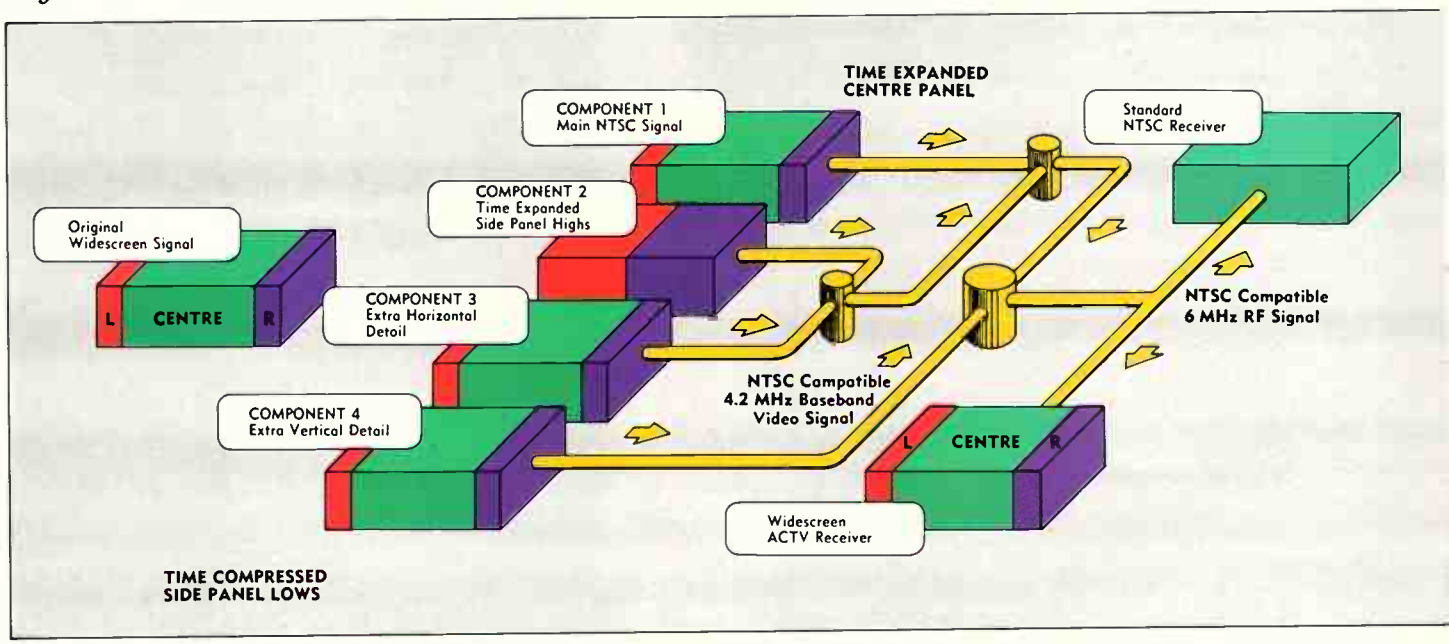
Hooked into a home closed-circuit camera, an appropriate PIP system could allow viewers to monitor the kids in the backyard pool or front door visitors while watching a programme.

So how is the PIP technology implemented? The key again is digitisation and the frame memory.

In simplified terms, if you select every fourth pixel from every fourth line of a video source it is possible to create a quarter sized video image. these pixels can be held in a memory which is updated every frame to give a moving, small sized image.

A block of pixels from another video source can then be deleted and replaced by those of our quarter sized picture. The two video sources do not need

Crystal ball on TV



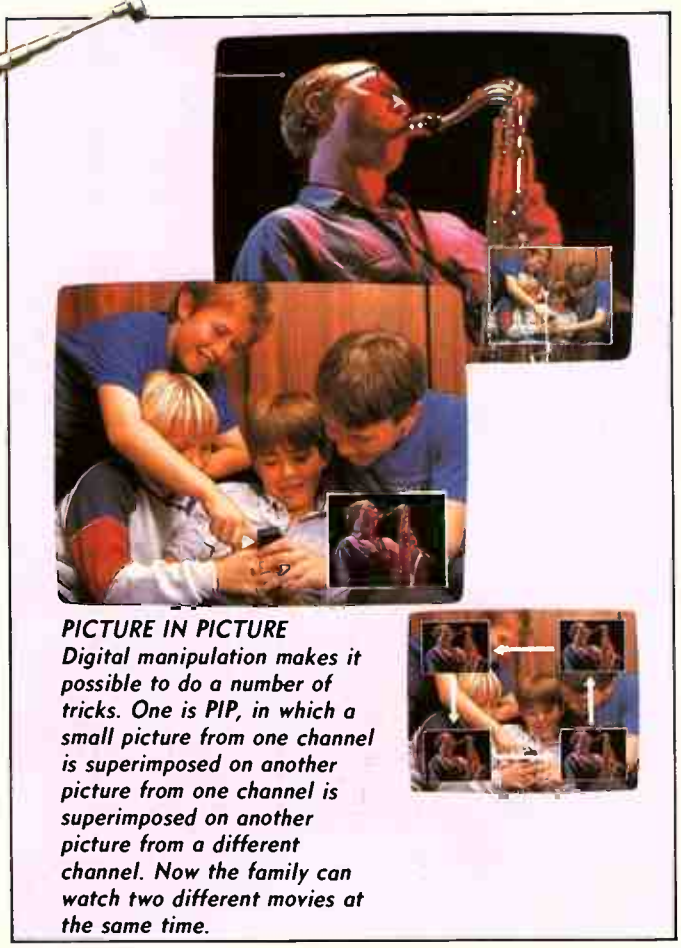
to be synchronous because the output of the combined picture is taken from memory. The pixels are simply read into memory as they arrive, then clocked out from the appropriate memory locations when required to reassemble the composite picture.

High Definition Television

Only one thing can be said for sure about HDTV at the moment: everyone agrees that it will be a good thing if and when everyone agrees on a system. Regrettably, it seems likely that the opportunity to create a universally accepted worldwide system for High Definition Television will be lost amid continuing bickering between proponents of the various (incompatible) systems.

The major enhancements proposed by HDTV are a wider screen picture

The TV 400 from Casio features one-touch auto tuning, a built-in backlight for brighter pictures, a 4-way choice of power supply and car adaptor



PICTURE IN PICTURE
Digital manipulation makes it possible to do a number of tricks. One is PIP, in which a small picture from one channel is superimposed on another picture from one channel is superimposed on another picture from a different channel. Now the family can watch two different movies at the same time.

The problem facing HDTV is whether it should be made compatible with existing PAL standards. One method, shown left, that has been proposed is to broadcast the conventional PAL signal with extra information for the left and right of the screen transmitted seperately. This means a conventional set will receive a picture from an HDTV transmitter, but like current cinemascope pictures on TV, you will only see the central bit.

Casio's TV 200 started the craze for supersmall TVs. It has a supersmall LCD screen with limited resolution in Black and White. But new technology waiting in the wings will make small solid state TVs with high resolution screens light cheap and popular.

(aspect ratio of 5:3 or 16:9 vs the current 4:3 PAL standard) and greatly increased resolution (1126 or 1250 lines vs 625 lines in PAL).

HDTV hardware, in several formats, has been available to programme makers for some years now and several features have been produced using the equipment but unfortunately, not transmitted or received

The prime difficulty is in agreeing on a format. This extends not just to specifications for the picture, but also to bandwidth and delivery method.

By its nature high definition signals will require greater bandwidth to transmit, pasing enormous difficulties to broadcasters where the RF spectrum is already overcrowded.

Other choices to overcome transmission bandwidth limitations include programme distribution via cable or optical fibre, direct broadcast satellites, new video tape systems like S-VHS and Video Disc.

Even when the optimum method of delivery is defined, the question of compatibility will remain. At the moment the industry is wrestling with problems like whether HDTV needs to be compatible with existing transmitted standards. If it is incompatible, there will be enormous resistance to its introduction. But many fear that tying HDTV to existing PAL or NTSC formats might emasculate it totally. The "best guess" of industry pundits suggests that implementation of HDTV is unlikely before the late 1990s.

Size and Shape

Fascinating developments have been taking place in large screen, small screen and flat screen technology. Solid state displays, in the form of LCD panels, are now a serious contender for both colour and black and white applications but the CRT is far from being replaced in large screen sizes as we shall see.

At the top end of the scale, video projection systems continue to improve in both brightness, contrast and sharpness. There are two major types available in Australia. Single piece, rear projection units with translucent screens display video images projected from within the cabinet. Two piece units have a separate screen and projector unit, with the latter often ceiling mounted or disguised as a coffee table. The two-piece projectors usually have no signal source built in and need to be connected to a separate tuner or VCR.

"The truly stimulating part of all this crystal ball gazing is the way all the various technological advances interact to shape our future."

Both types use three special high brightness cathode ray tubes of about five inches (12 cm) diagonal, one with a red, one a blue and one with a green phospar coating. The tubes are liquid cooled and optically coupled to three lenses which focus geometry controls for each channel must be quite elaborate to allow for the accurate overlaying (convergence) of the three images and initial set-up requires adjustment of 60 or more controls.

Video Projectors are not as bright as conventional direct-view sets and usually require the room to be darkened for acceptable viewing. The impact of a picture that is up to three metres wide is sensational, however, it does require a large room for best effect. The cost of these devices has restricted their use to commercial applications but cheaper versions are being actively marketed for domestic use in Japan and the USA and we may expect a similar trend here.

Meanwhile, improvements in CRT design and manufacturing have overcome the technical limitations of glass size and weight to allow screen sizes of "direct view" sets to increase. Mitsubishi's 37 inch unit was a dramatic demonstration of what is now possible, even though the price and weight of the unit is similarly dramatic. Many manufacturers are now offering 28, 30 and even 33 inch models in place of the once ubiquitous 26 inch screen.

At the other end of the scale, tiny "pocketable" TVs may finally be coming into their own. Self contained battery powered black and white models with two to four inch screens have been around for three or four years now without generating much in the way of sales, at least in Australia. Now, however, a range of tiny colour sets from half a dozen top manufacturers is set to change all that.

There are two distinct technological camps in the packet TV stakes. Those sets (like the Sony) which still use CRTs give reasonable resolution but are easily washed out by strong light outdoors. The other contenders use colour Liquid Crystal Displays which do have problems with resolution and low contrast indoors but which really shine in sunlight.

Crystal ball on TV

Given the fact that the major uses of such ultra portables is likely to be outdoors, especially at televised sporting events where the close-ups and instant replay can supplement the live action, LCD sets would have to be the favourites in this race.

It is hardly surprising that some of the leading companies in the field are Seiko, Casio and Citizen, perhaps better known for their calculators and wristwatches. Some of these companies have invested over US$100 million in research and development of LCD displays to date.

Developments in LCD technology, such as the "active matrix" where each LCD pixel is turned on and off by its own transparent transistor mounted right on the display are producing considerably higher contrast pictures.

Proponenets of LCD technology also forecast a wide variety of uses for slightly larger flat panel screen TVs because of their ease of storage, lightweight and relative rebustness. Thin, wide screen LCD TVs could be easily moved from room to room or wall to wall and would be ideal for use in cars, buses and boats.

Playback Systems

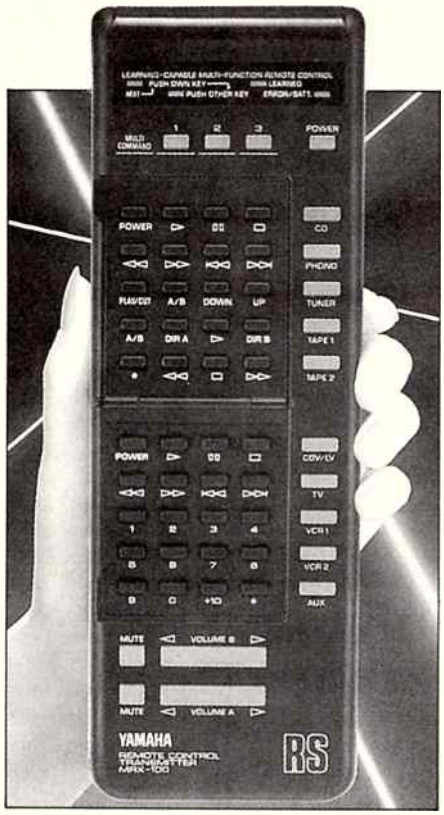
Manufacturers are starting to reassess their policies of constant change in the light of marked consumer preference to stick with a known, universal format. Pundits who forecast the replacement of VHS by 8 mm and other systems have been surprised by buyer resistance to change away from the VHS standard.

Eight millimetre systems have found a niche in the home movie market but it appears that, with the emergence of Super VHS, change in video recording and replay systems will be evolutionary rather than revolutionary. As if to clinch that argument Sony have recently announced "Extended Definition" Beta, even though that format seems to be in its death throes and the industry has recently agreed to a standard for "high band" 8 mm which will provide superior performance.

Laser Video Disc has yet to realise its mass market potential although it has quickly and enthusiastically been taken up for educational and industrial use, especially in computer controlled interactive mode. If the public acceptance of CD carries over into the new CD-V formats which combine video and digital audio, then products like the combined CD/Laser Video players may signal a rebirth of this high quality video replay system.

Infra-Red Remote Controls

Can you imagine picking up your TV remote control in the lounge and getting on screen confirmation as you turn off an air-conditioner in the bedroom, or command the microwave oven to start heating up dinner? Such devices are now actively under development.



A SMALL REMOTE.
This device can be made to learn the codes used on all your different remotes, and then replace them all so that you only need this one, not one each for the stereo, TV, VCR and CD player. This technology is possible because all the manufacturers have standardised on infra red frequencies.

Remote control has evolved from a luxury toy to a common modern convenience. Indeed their proliferation sometimes becomes an embarrassment with separate remote transmitters for VCR, TV, Cassett deck, CD and stereo all competing for space on the coffee table.

Early remotes used UHF radio signals. they were unreliable and prone to interfere with other remote controlled equipment in the same room, or even in your neighbour's flat! Now with those problems cured by the almost universal adoption of transmitters using pulsed Infra-Red radiation, engineers are turning their attention to combining control functions for different equipment into a central, universal controller.

Several companies are offering "smart" or universal remote controllers which can operate a variety of equipment from different manufacturers. They contain a microprocessor and memory which can "learn" and "remember" the control codes used by different equipment and reproduce them on command.

An extension of this system is an inter-room remote command system termed the "home bus". The idea is to develop a universal interface to allow all electronic devices in the house, including heating, cooling and security as well as entertainment devices, to communicate. Command signals would be coded and modulated onto the mains power circuits, obviating the need for special wiring.

Connecting a home video product to the household power bus system would merely entail plugging it into a standard power socket. A product meant to receive a command would decode appropriate messages, perform its requested task and then transmit a confirmation. As an example, after plugging in a "smart" TV set in the kitchen, you could tell if it was on via a bedroom TV remote control unit. The command execution and confirmation would then appear on the bedroom's TV screen.

Other Services

An ever expanding alphabet soup of services is being offered as "add-on" components to the television signal.

There's SAP (supplementary Audio Program) which is an alternative use of the second audio channel available in stereo receivers. The users of SAP include translation of programmes into a second language and separate novice and professional commentaries during televised sporting events.

The VPS (Video Program System), widely in use in Europe, is a control code inserted onto line 16 in the vertical blanking period. Specially equipped home video recorders can be remotely set-up, started and stopped by the code. In this way, special interest programmes (educational, medical and financial) can be broadcast at varying times during the early hours and automatically recorded for later replay.

Conclusions

The truly stimulating part of all this crystal ball gazing is the way all the various technological advances interact to shape our future.

For example, high definition TV systems coupled with advances in programme distribution will probably first be taken up by industry, medicine, publishing and indeed fabrics. A number of experiments have taken place where fabrics are being designed with HDTV. Just think what may be around the corner as all these new technologies are cross bred.

TECHNOLOGY

Kathryn Doolan looks at a billion dollar probe which will be destroyed after 75 minutes work.

20th CENTURY GALILEO

Discovering Jupiter Again

THE original Galileo was a 17th century mathematics professor. His most notable, but by no means only, claim to fame is that he was the first ever to turn a telescope skywards, the first human to see the moons of Jupiter. Now a new Galileo is once more out to discover Jupiter and its moons.

It's a highly automated robot, one in a series of probes that has opened up the solar system during the past twenty years. Spaceship Galileo will show us a whole new side to the giant of the solar system. But the success of the mission hinges on the success of the space shuttle.

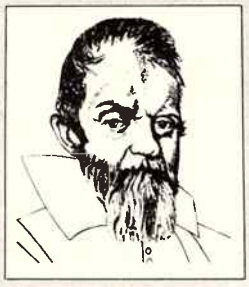
The history of the Jupiter Orbiting Probe (JOP) as it was known in the early 70s was very similar to the Space Telescope. In 1975 NASA had ranked the JOP as its number one priority in planetary missions. A proposed start for the mission would have been contained in the financial year 1978 budget. However the project nearly died in 1977 when the House of Representative's Appropriations Committee recommended against it. The excuse for that action was the start of funding for the Space Telescope. The fight for the funding of the JOP was a turning point for the planetary exploration lobby.

The main concern at NASA was that if funding for the JOP was not approved, 200 jobs at the Jet Propulsion Laboratory would be lost. A frantic lobbying effort was then launched by telephone and mail, to Congress and the White House. Although the scientists did most of the work themselves, they received active help from the emerging pro-space movement including the L-5 Society, Omni magazine and "Star Trek" fans who were contacted at various conventions. This added thousands more letters and telephone calls, which in turn led to a new awareness of space and astronomy on capitol hill.

Additional lobbying was carried out by staff members of the House Science and Technology Committee. In a very unusual political move, they challenged the Appropriations Committee in a floor fight and succeeded in having the funding restored to the project. In 1979, Senator William Proxmire, an avowed hater of all things space, tried to stop funding and was voted down. In 1981 another crisis occurred when the Reagan administration attempted to have the project cancelled but in the end was overruled by a personal appeal to the President by NASA.

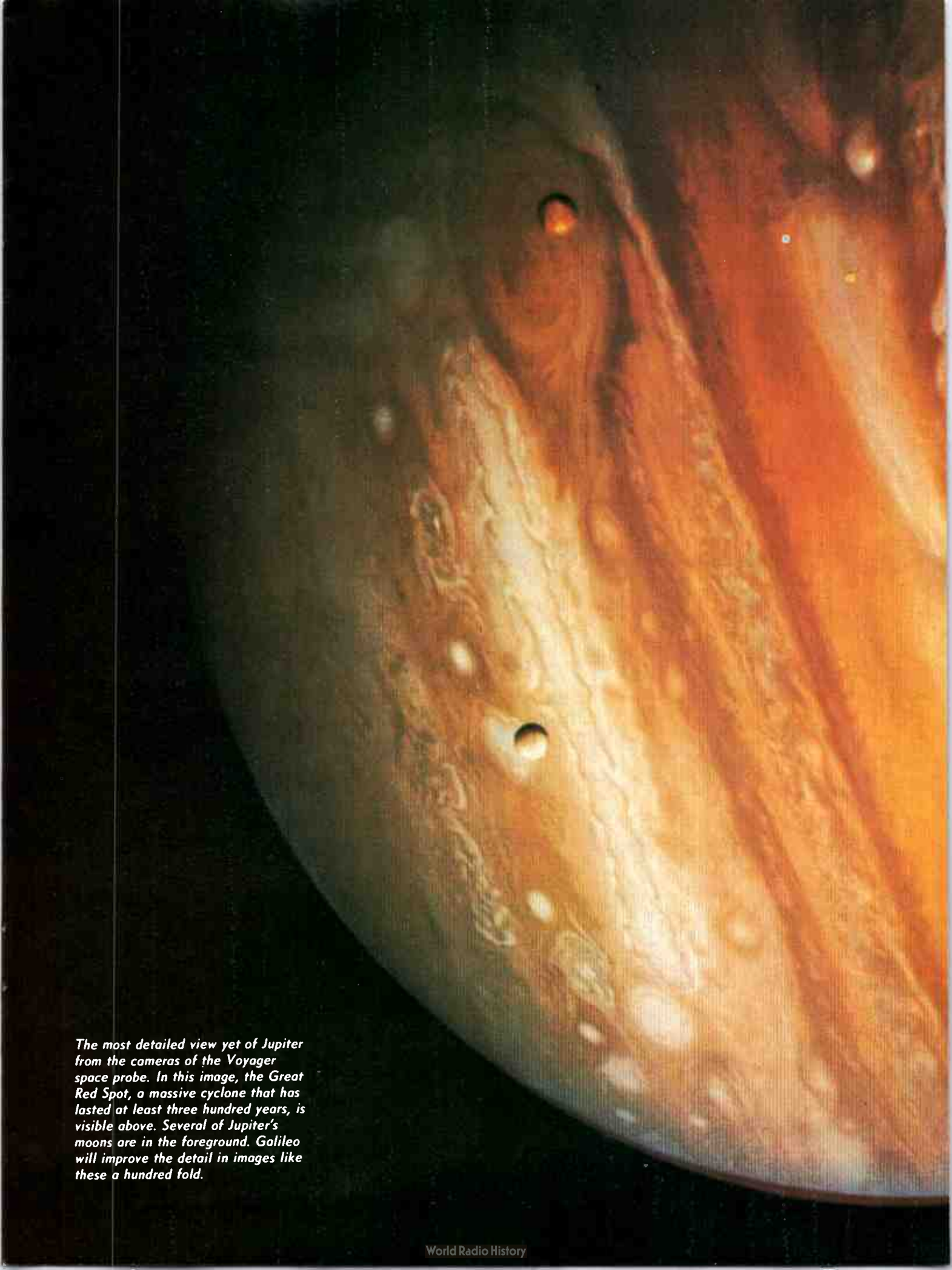
Clouded in Controversy

Originally scheduled to be launched from the Space Shuttle "Atlantis" in May 1986, Galileo has actually been enhanced by the time it has spent waiting for a launch. A typical Space Shuttle mission gets the payload into low earth



"That which will excite the greatest astonishment by far, and which indeed especially moved me to call the attention of all astronomers and philosophers, is this, namely, that I have discovered four planets, neither known or observed by any one of the astronomers before my time."

Galileo Galilei



The most detailed view yet of Jupiter from the cameras of the Voyager space probe. In this image, the Great Red Spot, a massive cyclone that has lasted at least three hundred years, is visible above. Several of Jupiter's moons are in the foreground. Galileo will improve the detail in images like these a hundred fold.

orbit. To go further, the payload must carry its own booster rocket. In May 86 when Galileo was to be launched from the shuttle it was to be sent to Jupiter by a Centaur upper stage. However the Centaur is a cryogenic liquid propellant upper stage which was seen to be a "flying time bomb" by the astronauts. Once NASA became safety conscious after the "Challenger" tragedy, Centaur was cancelled and replaced by the Inertial Upper Stage, a less powerful but safer means of launching satellites and probes from the shuttle.

Now due for launch in October 1989 from the shuttle "Discovery", Galileo will take a fascinating journey to Jupiter using gravity assist from both Earth and Venus to build up speed for the jump to Jupiter.

After launch from the Space Shuttle Galileo will take a flight path that will carry it to Venus rather than heading towards the asteroid belt and Jupiter. In February 1990 Galileo will arrive at Venus. Galileo will whip around the planet at an altitude of 9000 miles and will attempt to confirm data sent back by Pioneer 10 that there are frequent lightning discharges in the atmosphere. As Galileo prepares to return to Earth it's camera systems will produce a time lapse "movie" of the cloud circulation patterns of Venus. Another experiment will involve viewing the planet in spectral ranges which were not available on previous spacecraft. This should yield fresh information on cloud composition which is still a puzzle to space scientists.

In December 1990, Galileo will approach Earth, and for the first time the far side of the Moon will be studied by near infrared cameras. This will result in a complete program of lunar remote sensing which will shed new light on an area of the Moon that was not explored by man or machine in the late 60s and early 70s. Some twenty days after passing around Earth, Galileo will be able to take photographs of the Earth and Moon together in the same frame.

The assistance Galileo will get from the Earth's gravity pull will launch it in to a two year orbit around the sun. The orbit will send Galileo outward to the edges of the asteroid belt, where it will spend 10 months and on October 29, 1991 will pass within 600 miles of the asteroid Gaspra. JPL scientists see no problems with Galileo passing through the asteroid belt and say that the real danger to the mission will be micrometeoroids trapped in Jupiter's orbit.

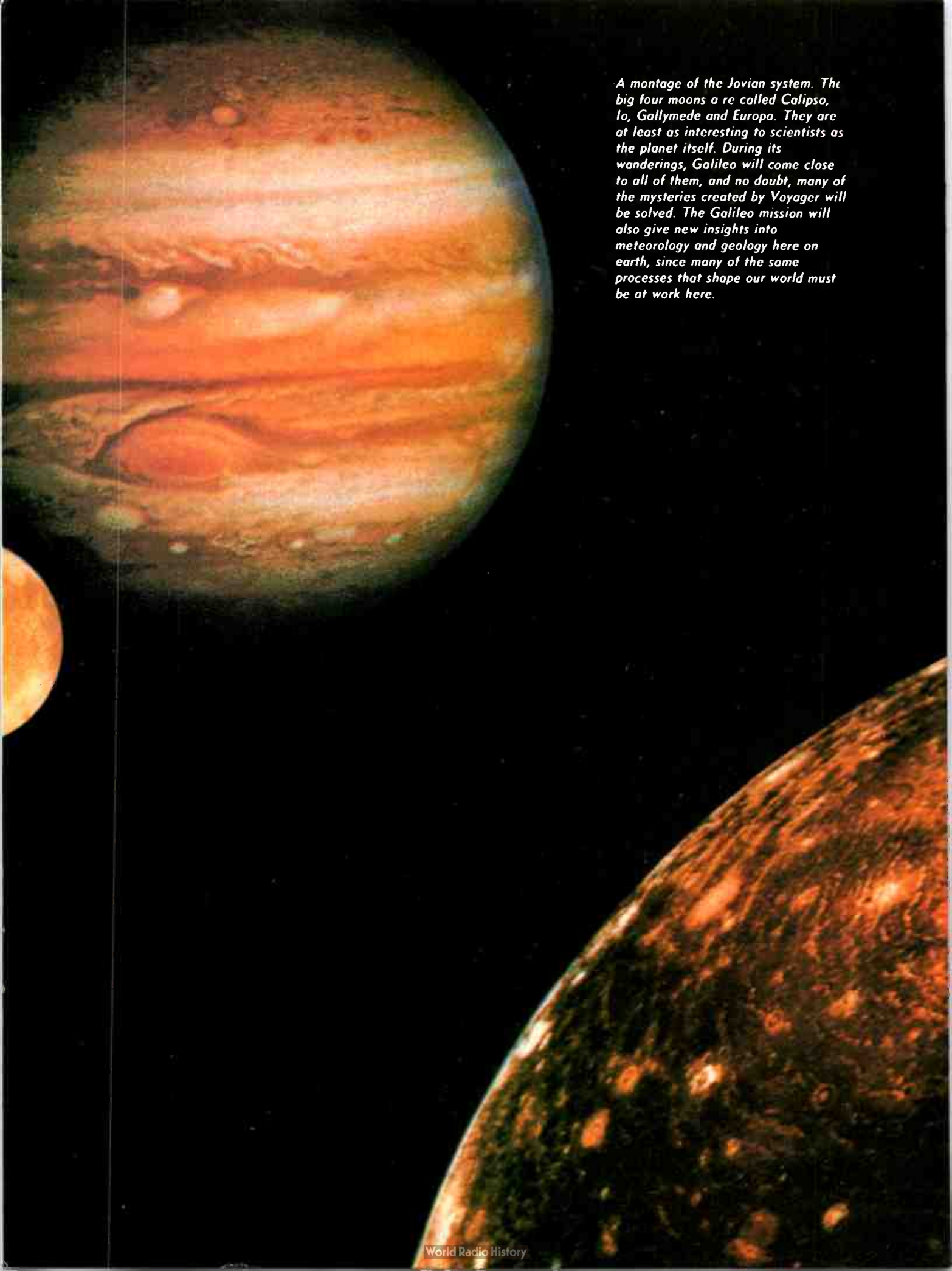
Galileo's second encounter with Earth will occur in December 1992. On the spacecraft's journey to Earth, it will have the opportunity to photograph and take measurements of the North Pole of the Moon. One of the main experiments there will be to determine if water exists in the polar areas. If water or ice is found in those areas it could be used once lunar development and settlement gets underway.

On December 8, 1992 Galileo will swing by Earth to an altitude of 200 miles and with assistance from Earth's gravity Galileo will be flung on a trajectory towards Jupiter. In August 1993 travelling through the asteroid belt Galileo will encounter the asteroid Ida at a range of 600 miles which will assist scientists in determining surface composition and geology.

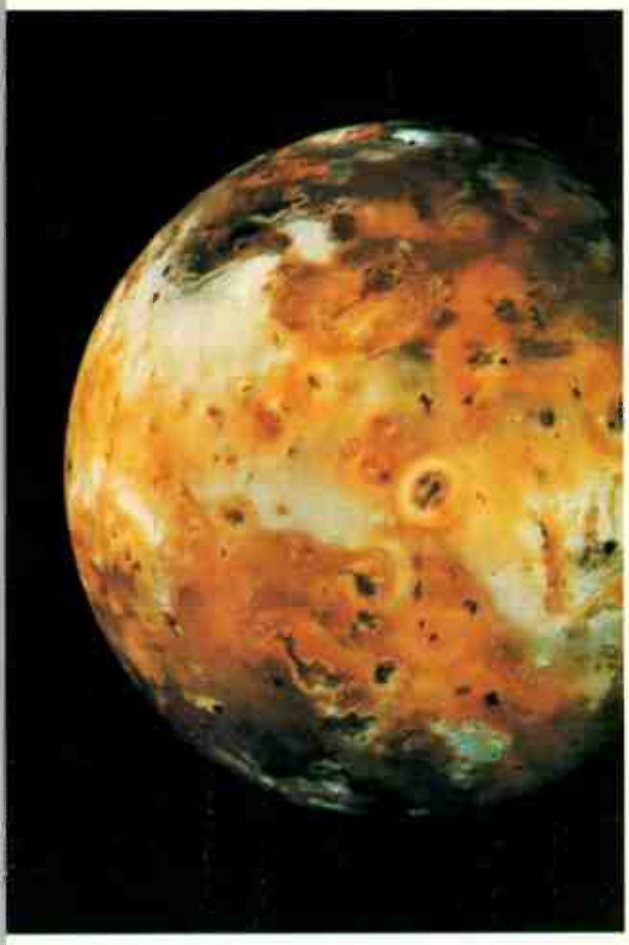
Broadcasting Probe

In July 1995, the atmospheric probe that Galileo carries will be released from the orbiter. Once released the probe will follow a trajectory that will aim it in an area six degrees north of Jupiter's equator. The probe, using parachutes, will descend through Jupiter's atmosphere and then will broadcast data for 75 minutes before being crushed by the atmosphere, or battery power runs out. During this time scientists are hoping to use every moment to discover new details of the composition of the gas giant.

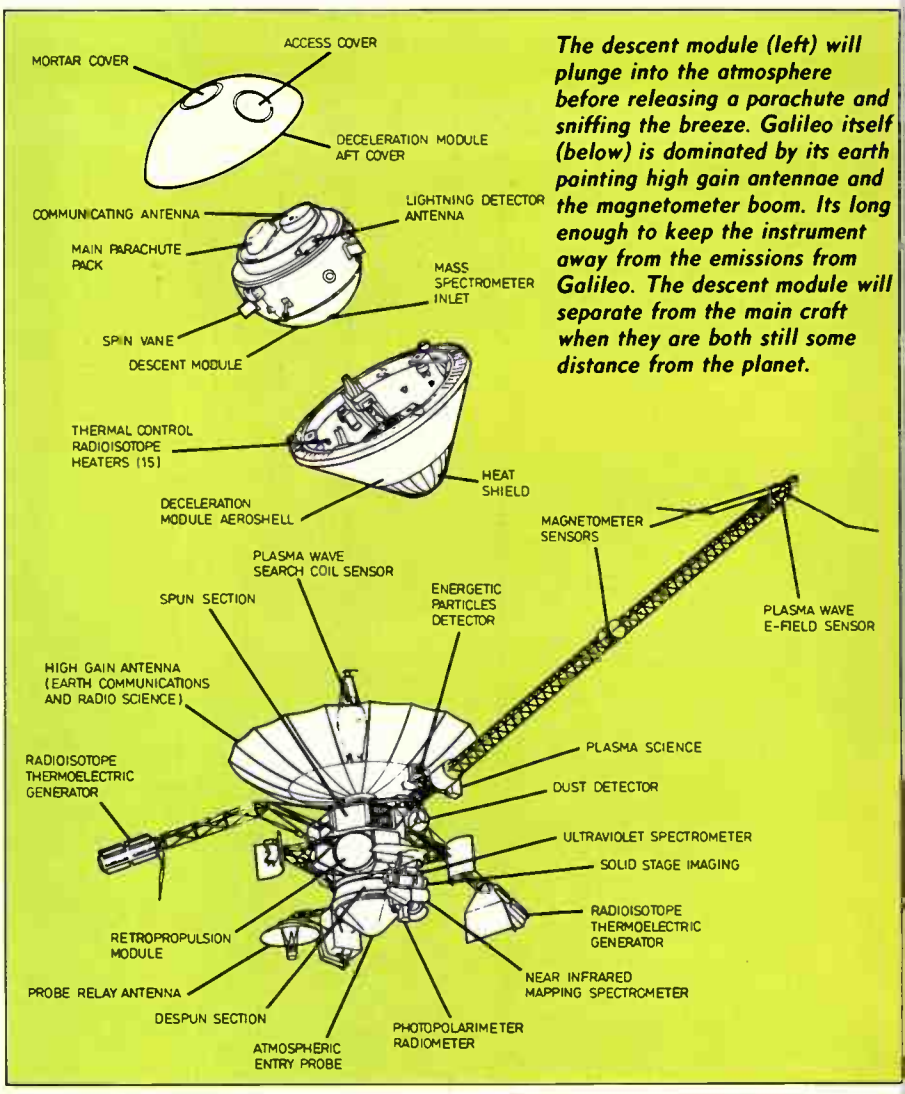
In December 1995, the upper stage of the probe will begin intensive studies of Jupiter, with more detail than the Voyager probes could provide. Towards the end of it's journey to Jupiter, Galileo will make a close flyby of the Jovian moon Io. Io has several active volcanoes and on the Voyager flights, several volcanoes were found to have plumes that shot up 60 to 70 miles into the air. Following orbital insertion, Galileo will



A montage of the Jovian system. The big four moons a re called Calipso, Io, Gallymede and Europa. They are at least as interesting to scientists as the planet itself. During its wanderings, Galileo will come close to all of them, and no doubt, many of the mysteries created by Voyager will be solved. The Galileo mission will also give new insights into meteorology and geology here on earth, since many of the same processes that shape our world must be at work here.



The moon Io. It is as close to hell of one would ever want to go. The biggest volcanos in the solar system spew molten sulphur across its landscape, giving it a baleful, reddy-yellow appearance.



The descent module (left) will plunge into the atmosphere before releasing a parachute and sniffing the breeze. Galileo itself (below) is dominated by its earth pointing high gain antennae and the magnetometer boom. Its long enough to keep the instrument away from the emissions from Galileo. The descent module will separate from the main craft when they are both still some distance from the planet.

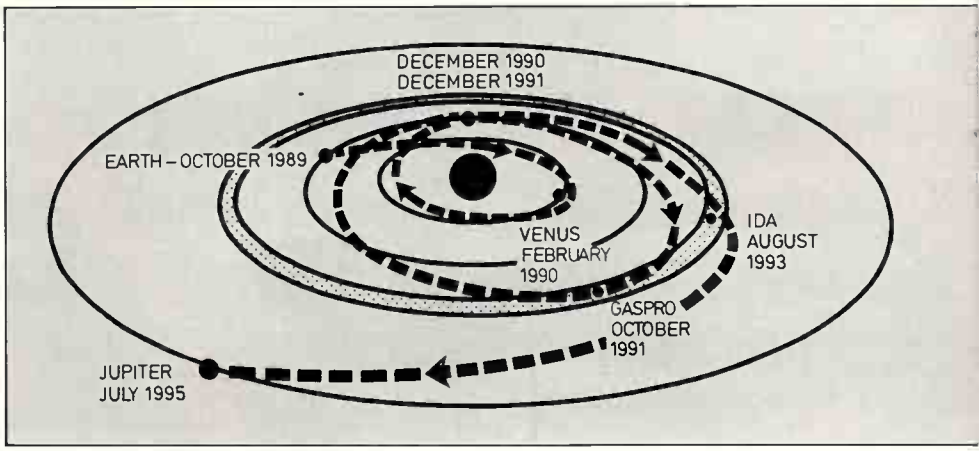
begin an orbital tour of the planet lasting eight months. In this time the orbiter will commence detailed studies of the planet with special emphasis on experiments which will determine the origin of Jupiter and it's composition.

Another area for intensive study will be the four Galilean moons, discovered in 1610 by Galileo. Io also has a strong magnetic field. Callisto is covered by meteor craters, the largest of which is 124 miles across. Scientists think that meteors date bock to great bombardments some four million years ago. Ganymede seems to have both old and new terrain, which contrasts in both light and dark zones, half water and half ice. Europa is a world which scientists describe in jest as a cracked billiard ball. It appears to be covered with an ocean of ice with no discernible features. Each of these moons will be visited by Galileo in the spacecraft's 22 month tour of Jupiter and images sent back to Earth will be 50 to 100 times clearer than ones sent back by the two Voyagers.

Objectives

The three main objectives for Galileo are as follows:

1. Investigate the structure and composition of the atmosphere of Jupiter.
2. Study the surface and chemical properties of the Jovian moons with special emphasis on the Galilean system.



3. Measure the structure and dynamics of the very powerful Jovian magnetic fields.

The spacecraft that has been designed to carry out these goals consists of a 2500 pound orbiter and a 740 pound atmospheric probe. The orbiter was built by the Jet Propulsion Laboratory under contract to NASA, and is divided into spinning and despun sections, a new development for planetary spacecraft. The "upper" section of the orbiter contains a five metre high-gain antenna which spins normally at 3.15 revolutions per minute. The majority of the craft's electronics are located in an eight sided spun bus behind the high gain antenna dish. An 11 metre magnometer boom extends from the spinning section, allowing magnetic field readings in all directions. The electromagnetic instruments must be placed at a distance to prevent interference from the other instruments on the spacecraft. The radioisotope thermoelectric generators (RTG) used as the power supply, are placed at the ends of two five metre long booms because they could create electro magnetic interference. The RTGs can produce 570 watts of power which is used for all altitude control and manoeuvres. The entire system is spun to 10 revolutions per minute for thruster firings as well for the deployment of the atmospheric probe.

The orbiter will carry 10 instruments:

(1) A new camera system which should produce images up to 300 times better than Voyager.

(2) A new infrared mapping spectrometer which will be comparable to Landsat images.

(3) An ultraviolet spectrometer to study Jupiter's atmosphere. 4) A photopolarimeter which will make temperature profiles of the Jovian atmosphere and of the Galilean moons.

(5) A magnometer which will measure magnetic fields and their interaction with the Galilean moons.

(6) A plasma instrument which will yield data on low energy particles and clouds of ionized gas.

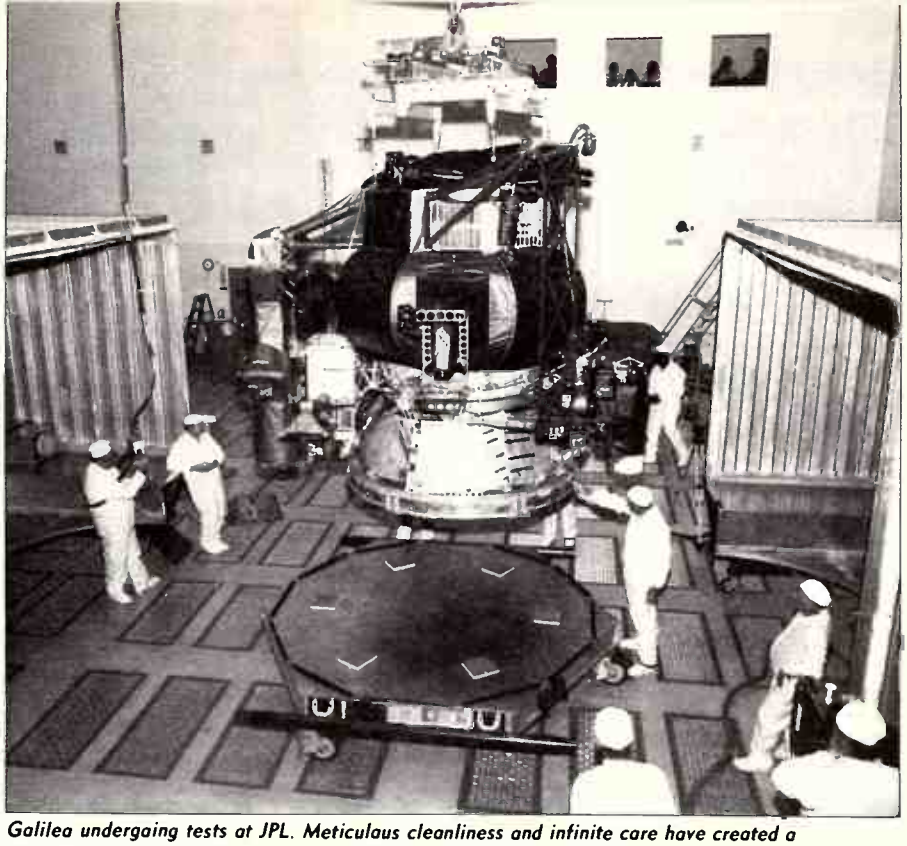
(7) An energy particle detector which will measure high energy particles trapped in Jupiter's magnetic field.

(8) A plasma wave instrument measuring plasma waves generated by lightning.

(9) A dust detector.

(10) Radio science experiments which will use tracking data to measure the gravity field on the two asteroids, Jupiter and it's moons.

The atmospheric probe will consist of five instruments. 1) An atmospheric structure instrument which will measure temperature, density and pressure of the Jovian atmosphere. 2) A helium abundance interferometer which will measure the ratio of helium to hydrogen in the atmosphere. 3) A nephelometer which will determine the locations of cloud layers and the characteristics of cloud particles. 4) A net flux radiometer to detect the energy flow at each level of atmosphere encountered. 5) A lightning and radio emission instrument.



Galilea undergaing tests at JPL. Meticulaus cleanliness and infinite care have created a tradition in US Jupiter-bound space vehicles of unporalleled reliability. Pioneer 11, far instance, is still operating in interstellar space after twenty years. Galilea is only supposed to last eight months at Jupiter, but its designers hope that it, too, will be operating when many of them are gone.

'Once NASA became safety conscious after the Challenger tragedy the initial project was replaced by a less powerful but safer means of launching satellites and probes . . .'

Protection From Sun and Venus

Most of the instruments have been upgraded because of the cancellation of the 1986 mission. Other modifications have included thermal control surfaces, new blankets and heaters because of Galileo's proximity to the Sun. Extra protection has also been added to compensate for the craft's flyby of Venus.

In the possible event that Galileo misses it's launch in 1989, contingency plans have been made to launch it again in July 1991. If this occurs then the flyby of Venus would be cancelled as well as the two asteroid encounters, although a singular flyby may occur from a greater altitude. Further delays would also add to mission costs. For the 1986 launch the cost would have been US$673.5 million in development costs with post launch costs of US$225 million. For the 1989 mission development costs are now $US893 million plus US$500 million for post launch costs.

As these things are measured, the Galileo mission will be money well spent.

The VEEGA (Venus — earth — Earth — Gravity — Assist) orbit. The inertial upper stage is too weak to lift the heavy Galileo package from Earth orbit to Jupiter, so a game of celestial billiards will be set up by controllers at NASA. Each time it approaches the planet, Galileo will increase its momentum. After one Venus and two Earth encounters it will be moving fast enough to fly to Jupiter.

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21	46	71	96	121	146	171	196	221	246	271	296	321	346
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TEXAS INSTRUMENTS
TECHNOLOGY AWARD UPDATE

PARAMETER MODULATION CONCEPTS

In order to create musically interesting sounds it is necessary to have dynamic, time-varying waveforms by modulating the parameters of the FWF generation process. This modulation can be broadly divided into:

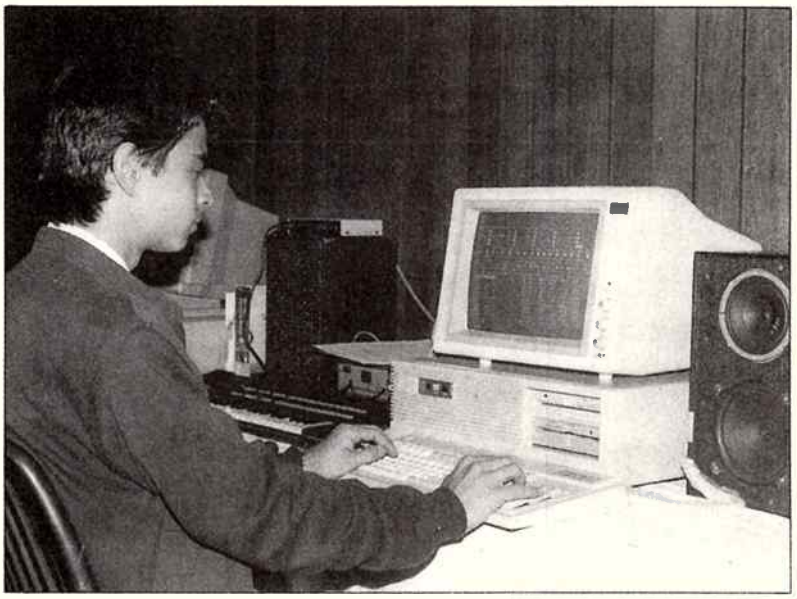
i) time variation of the waveform within the time frame of a single note, and
ii) time variation over the longer time of a musical phrase

The user must be able to control the shape of the generated spectra by

a) specifying the "default" dynamic spectrum for a single note occurrence. This is carried out by programming the parameters of the synthesis process prior to playing the synthesiser and provides the basic timbre, or tone colour, of the synthesiser performance.
b) varying the parameters of the synthesis process at performance time. This will be achieved through the control device (usually a keyboard) the performer is using. Affecting changes in the dynamic spectrum over the length of a musical phrase (if done with skill) provides the musical expressiveness to the performance.

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

In Parallel Processing systems, multiple processors work together either on a common set of data, or multiple sets of data, in order to complete a task much faster than can be achieved by a single processor. In work carried out at the University of Technology, Sydney an initial working prototype was developed of a performance oriented music synthesiser. Ultimately this synthesiser will have multiple processors working in parallel, handling different sections of the synthesis process. This project was the winner of the Parallel Processing section in 1987.

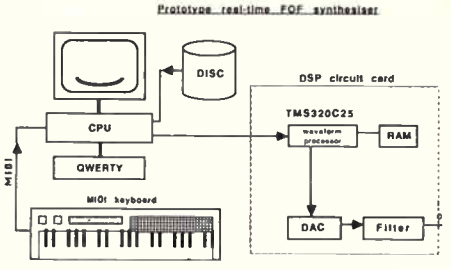


Student: John Reekie
Supervisor: Dr Warren Yates — University of Technology

PRINCIPLE OF OPERATION

This project was motivated by a desire to design a musical synthesiser that allows musical expressiveness of a type that we hear from a saxophone or guitar, but which is sadly lacking in current electronic synthesisers. A performance oriented real-time synthesiser using time-domain Formant Wave Function (FWF) synthesis has a number of advantages over the usual synthesis methods because of it's computational efficiency and the ease with which one can generate complex sounds.

As the first stage of this project a working system was developed using the TMS32020 Digital Signal Processor. Because the parameters of the synthesiser were implemented through software, the system allows different algorithms and configurations to be developed quickly. In order to control the synthesiser, a MIDI (Musical Instrument Digital Interface) compatible keyboard was used, which ensures that the instrument is easy to use, as well as allowing it to be connected to any other MIDI compatible hardware.



TECHNOLOGY

FLIGHT DECK ERGONOMICS

Aircraft pilots are on the cutting edge of the man-machine interface. W M Chapman examines new advances in ergonomics.

A pilot has to monitor a large number of immensely complex systems, analyse faults as they appear and correct them. He also has to do it very fast, and be totally correct. The consequences of getting it wrong can be dire indeed.

As a result of this, aircraft cockpits have become a training ground for ergonomists, those who deal in the science of man-machine interactions, and in particular for those who manage the flow of information and control. The essence of the problem is information flow. It's possible to measure literally thousands of different things in an aircraft. Its possible to design displays to show the information to the pilot. Unfortunately, however, it's not possible to get the pilot to absorb it all, and what's more important, understand it.

To handle all these problems, a number of different routes are being followed. At the most fundamental level, the way in which the information is displayed is under review. Screens are replacing dials, and the entire concept of the dashboard is undergoing modification, with the information being displayed in more convenient positions. Then computers are being used to change the nature of what is displayed. They can now analyse the aircraft situation, and drive the displays with relevant information. Finally, there is growing emphasis on non-visual methods of control.

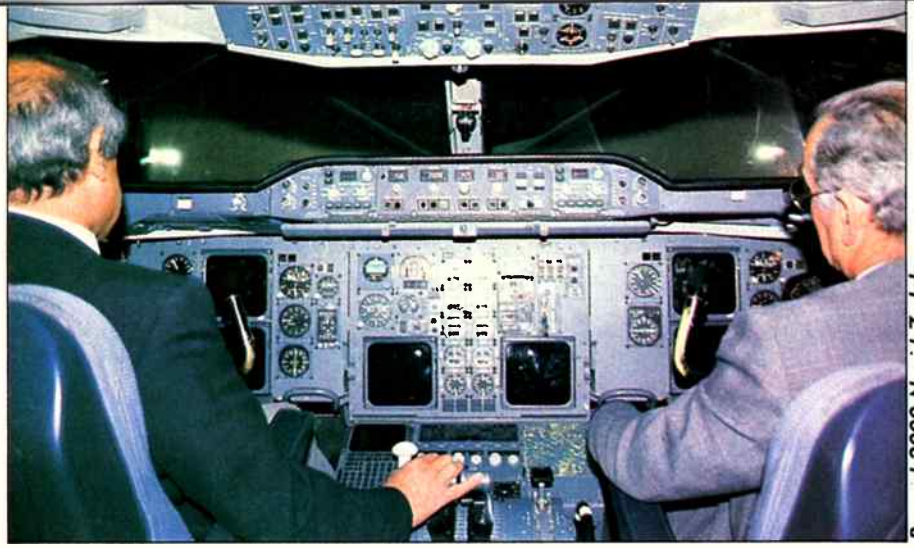
Displays

The initial response to the growing complexity of aircraft was to increase the number of dials. A typical second world war fighter might have had ten guages on the dashboard. The Boeing 707 in the late 1950s had perhaps 50. The 1960s vintage BAC 1-11 had only two engines, but this still needed the pilot to scan 47 dials.

Without some rationalisation of the situation, the current generation of aircraft would have had proportionally more. Something had to give. One method might have been to employ a pilot to do nothing but perpetually scan the instrument panel. Economics, apart from any other inefficiency, rule this out. The chosen method has been to stop using the old mechanical dial technology and start redesigning the displays using the freedom given by mod-

The Airbus A320 is perhaps one of the most sophisticated aircraft ever to fly. Every aspect of its operation is electronically controlled.

In the United States, Boeing has also been using electronics to reduce pilot workload. The B767 uses an integrated computer system to give the pilot the optimum amount of information.



Beyond 2000 Navid Zadeh.

The layout of the new generation of cockpits is the result of much trial and error in simulators. Here, real emergencies can be simulated and the reaction of pilots judged. If nothing else, this work has shown that the way an instrument looks can save life.

ern display technology.

The result is that modern cockpits are no longer dominated by impressive looking banks of mass instruments. Today, colour cathode ray tubes (CRTs) have pride of place. Solid state LED and LCD screens are also common. The advantage of using displays is that one is not limited by the mechanical requirements of a guage. On a CRT, one can display information via a needle, via a bar graph or digitally, or even some combination of these as required. What's more, one can mix and match instruments to present more information, faster, to the pilot.

As an example, consider that traditionally, a flight panel contains five instruments, an airspeed indicator, compass, turn and bank indicator, vertical speed indicator, and artificial horizon. These tell the pilot all that's necessary to know about the orientation of the plane in the air. In the new Airbus A320, all these are grouped together on one screen, dominated with a graphic representation of the horizon. Speed and heading are displayed as digits, other information on bar displays and still more by indicator needles.

However, this is but the first step. The second is to take the display of the dashboard and put it where the pilot is looking. The most common method of doing this is with the HUD, or Heads Up Display. The HUD concept has been around for several years, the basic idea being to project some of the instruments onto the windscreen in front of the pilot, so that the pilot doesn't need to look down to see them.

The design of really practical HUDs has come a long way since they were first suggested. The F18s of the RAAF have the ability to project some of their instrumentation onto the screen, and most of the instruments are arranged in such a way that the pilot has to look a minimum distance to find what he wants anyway. However, the leaders appear to be the French Thomson CSF, who have plans for what they call a "virtual cockpit", a complete set of cockpit instruments focused at infinity, so that the pilot can see them, not only witout moving his eyes from the world outside, but even without focusing.

An enhancement of the HUD is the head mounted display (HMD), in which the display is mounted on the pilots helmet so that he carries some of his instruments with him irrespective of where he looks. At the moment, HMDs are restricted to military use, mainly as weapon sights for aiming, and the amount of information that can be displayed is extremely small. However, advances in miniaturisation and optics may well allow the complete instrument panel to be shown at infinity no matter where the pilot looks.

The A320 is the first airliner to have fly-by-wire side stick controller and fully integrated displays. Each pilot has two similar displays in front, while communications and engine information is on the centre console. However, in an emergency, any display can be switched to any screen.

Computers

All this presupposes that there is a set amount of information, and it must always be available to the pilot. This is obviously not so, and in fact, from the point of view of managing information flow, being able to see it all easily is only the very first step. Having the correct information in front of the pilot is much more important.

Generally, modern instrument displays are organised by a flight management computer. This projects information on the displays as required. One of the most intelligent applications of computers to flight deck management is in the new Boeing 737 model 300. The 737 has been around almost twenty years, but the application of computers has turned an old workhorse into a brand new plane, well fitted to compete in the 1990s.

The flight management system (FMS) allows the pilot to enter the entire flight plan before take off. After take off, the computer takes over flying the plane, while the pilot monitors its performance. In the cockpit, both pilots have access to colour CRTs, and they can, at will, make the CRT display any instrument they want. However, the computer guides the display as well, through the control display unit. At every point in

the flight, certain selected instruments are displayed and not others. This is particularly handy with navigation instruments, where all the facts and figures relevant to a particular leg of the course can be displayed, to be replaced by others on the next leg. Furthermore, markers can be placed on instruments so that they only become visible if they move outside preset parameters.

The function of the FMS is actually much more wide ranging than simply managing the display and acting as an autopilot. It integrates the flight management computer, the flight control system, the autothrottle and the inertial reference system. Between them, these computers fly the aircraft, ensure that it is performing economically, navigate precisely and check themselves. The pilot monitors the system.

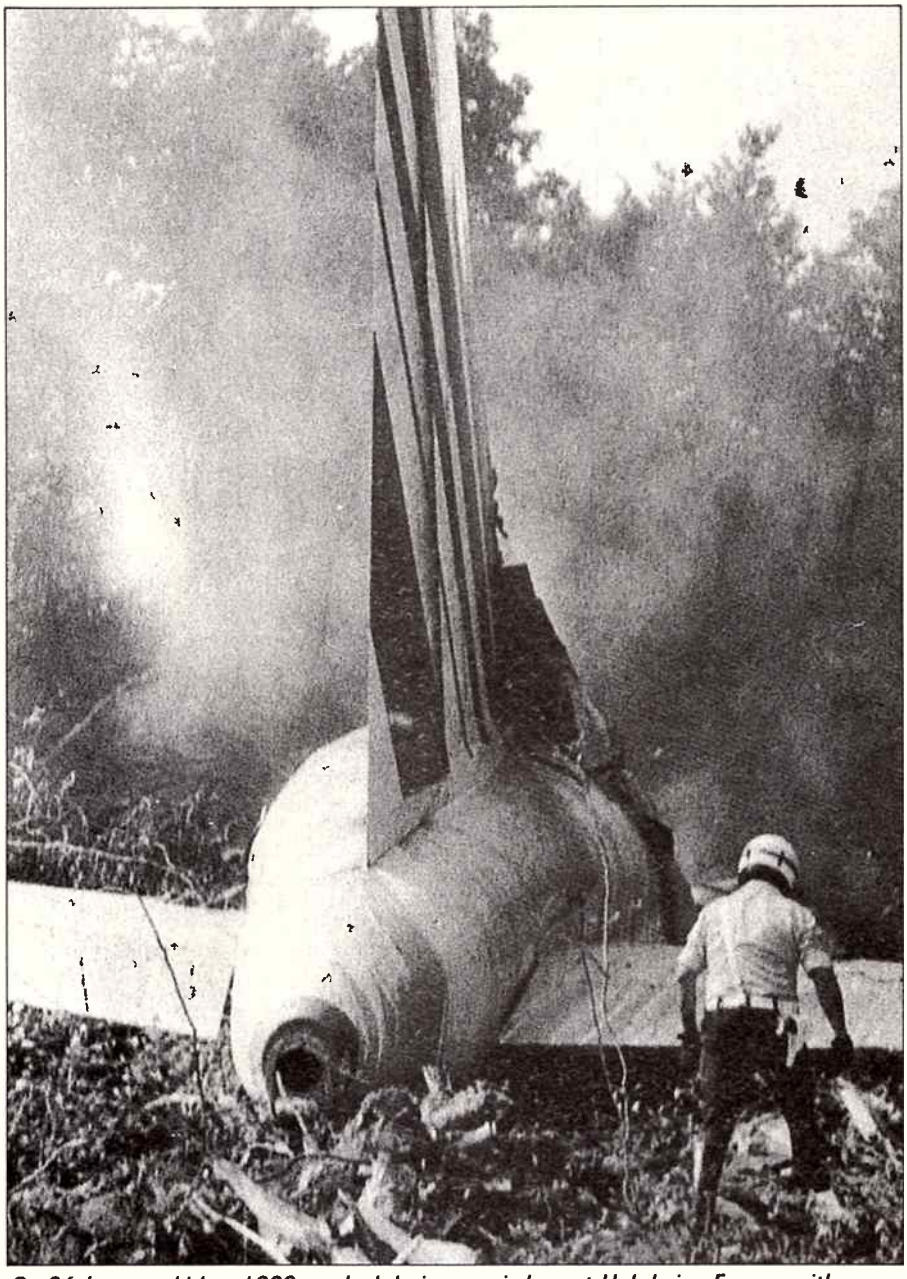
Essentially, except for take off and the final moments of landing, the pilot is redundant. As long as things go well. When things stop going well, the pilot's assessment of the problem and how to fix it are the only thing that will save the day.

Non-visual cues

Currently, aircraft are managed by the pilot visually taking in information, and mechanically outputting control information. Many ergonomists are examining ways of changing this. A number of projects are in the air that will result in pilots being able to talk to planes, or planes being able to talk to pilots. Even more exotic: using the pilots eyes as a control source.

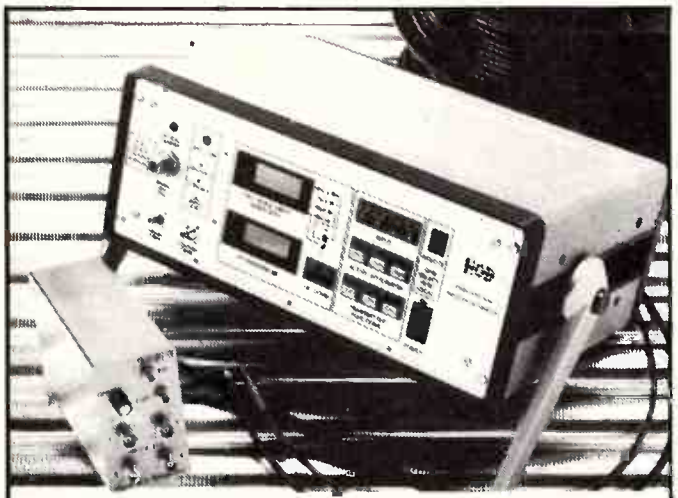
A number of different aircraft now use voice synthesis and recognition as a means of control. It's expensive, and not particularly reliable at this point in time, so the application is almost entirely military, nevertheless it's a pointer to the future. In 1981, for instance, the French Vecsys company won a contract from the French Air Force to build a voice recognition system for the Mirage 2000. It is a learn and tell system, in which the pilot has to say a number of words to the machine, which then records them. Later on, repeating the word will trigger a response. It has taken a while to develop, but today in the Mirage, the pilot can control the display, radar and radio by using some forty different words.

Unfortunately, the French system is restricted to non-critical functions because of its inherent unreliability. A simple template system is totally unintelligent, thus it will always be suseptible to false triggering. The big push now is to develop some kind of intelligence that will make the system respond more predictable.



On 26 June an Airbus A320 crashed during an airshow at Habsheim, France, with 129 people an baard. Miraculausly, anly faur people died. Were the computers respansible? Pilats thraughaut the warld reacted with harrar ta the test pilat's statement immediately after the crash that the an-baard flight camputer had failed ta relay instructians ta baast pawer thraugh ta the engines. The incident has sent camputer pragrammers back ta the drawing baard in a frantic attempt ta demanstrate the reliability af their cade. At the mament the real cause af the crash is nat knawn, but it has made industry peaple just a little mare cautiaus abaut trusting planes ta camputers.

Another exciting technology in cockpit management is the eyegaze monitor. Such systems work by tracking the position of the pilot's eyes. If you look at the radar screen, it turns on. Look at a button, it changes state, and so on. This makes possible a virtually instinctive response to the situation of the machine. This, of course, is the object of all good man-machine interfaces, to make the machine so easy to use it becomes virtually an extension of ones own body. Speech is the instinctive method of control and communications used by humans, so it will probably be the way control techonology will jump.



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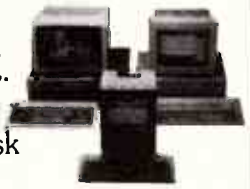

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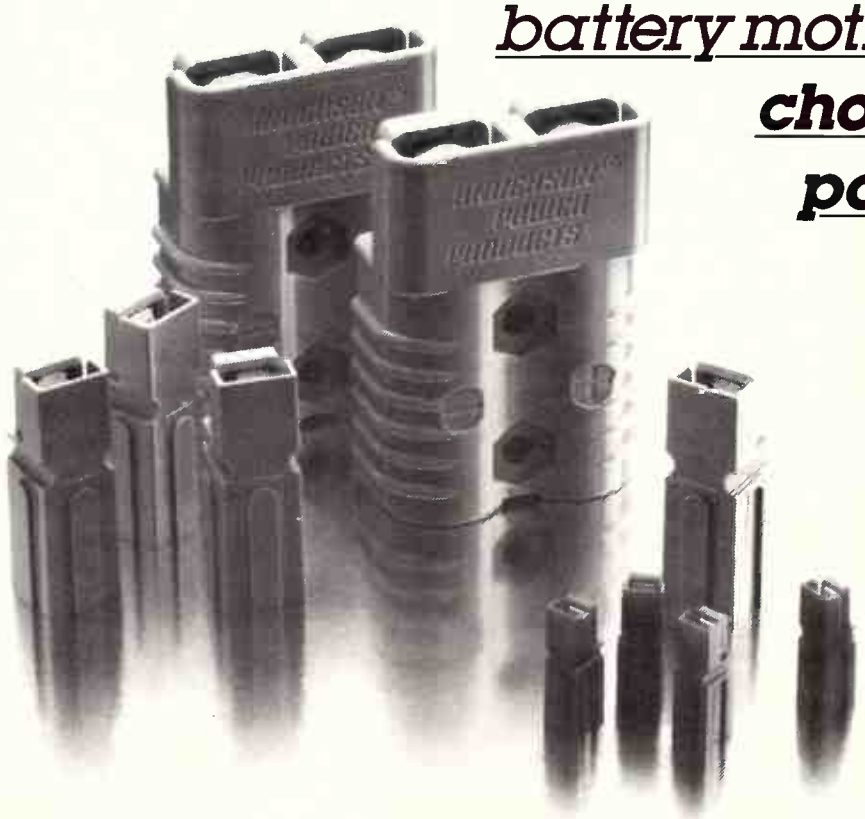

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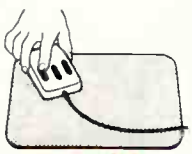

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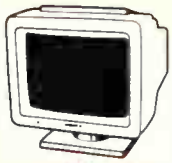

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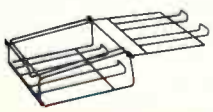

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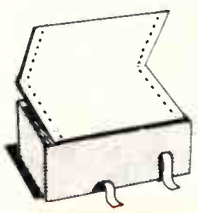

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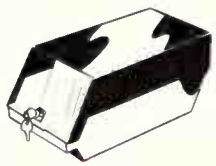

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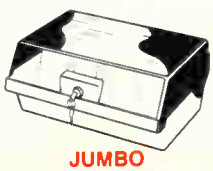

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Each earcup has a twin element driver in it. The mid to high transducer contains a Neodymium magnet with a copper clad, aluminium voice coil. The low frequency driver is a polyester diaphram with exceptionally long travel. There is a first order filter acting as a cross over to link the two together. As a result, Koss claim a frequency response of 10 Hz to 30 kHz.

The connections between the various parts of the unit are made with oxygen free copper cable, which is claimed to minimise resistance. The headband is made of genuine leather and the earcups have a unique contoured shape, all of which is designed to make then comfortable to wear over long periods. It even comes with two detachable extention cables, one 2.4 metres and the other 7.6 metres.

Specifications
Frequency Response 10 Hz-30 kHz
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Sensitivity 300 mV at 100 dBSPL
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READER INFO No. 286

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The PBX4001 digital audio disk is an audio production tool intended to work in a video production environment. A 50 MB Winchester disk drive provides 4.25 minutes of storage of stereo signals.

A 32-bit microprocessor makes format conversion from different digital storage standards possible. An RS422 remote control input is provided enabling the PBX4001 to be interfaced to most edit computers, to which it will appear like a conventional tape player. It's available from Quantum Pacific, Unit B, 5 Skyline Place, Frenchs Forest 2086.

READER INFO No. 285

Psychoacoustic design

Australia's Acoustic Research Laboratories have released another in its recently established Linc line of amplifiers. The Linc 2010 is a 50 W power amp, and while no specifications were available when we went to press, the amp has been designed according to designer Tor Andersen's principles of psychoacoustic design.

Psychoacoustic design doesn't exactly dispense with physical, objective specifications so much as relegates them to the mildly interesting, way behind "sonic characteristics". Reality Search has been researching sonic characteristics, the subjective area of how we physically perceive sound and interact with sonic information on a subconscious level. In terms of designing, this means not only considering the physical characteristics of a component, ie, how many nanofarads, but studying any colouring or less tangible effects a component might have, on its own and in conjunction with other components and materials.

Tor Andersen has been designing amplifiers on a contractual basis for 15 years or so, and is now establishing a range to sell more widely. The range will consist of the aforementioned 2010 power amp for $599 and a matching preamp 2000 for $599; the 2020 100 W power amp for $800-$900; the 2110 50 W integrated amp for $800; and the 2120 100 W integrated amp for $1200.

If this approach interests you and you want to test Reality Search's results, Tor Andersen can be contacted through PO Box 183, Strathfield, 2135, or on (02) 816-1380.

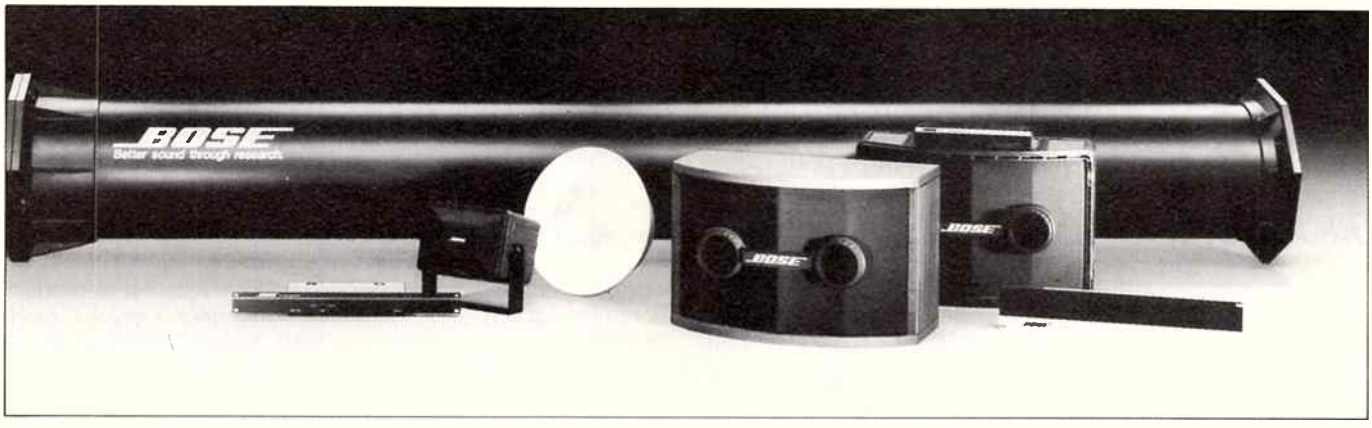
READER INFO No. 287

Microphone for car phones

Audio Engineers has released the Shure Clearvoice, a unidirectional microphone which attaches to the driver's seat belt, and a dual low-noise amplifier system. The idea is to allow clearly understood speech with no compromise in safety while talking on the telephone in a car.

The response curve of the speaker has been designed to enhance the human voice and to suppress unwanted noise at frequencies outside the range of normal conversations. Design considerations include the elimination of vox system cut-off which 'clips' the first syllable of the first word spoken and the 'shock-wave' of car noise each time the driver comes back on line. The mic is available from Audio Engineers, 342 Kent Street, Sydney 2000. (02) 29-6731.

READER INFO No. 289



Customer research

A recent Bose newsletter has some profiles of its customers. They are likely to be 18-34 year olds with high incomes and professional or executive occupations. These descriptions are some of the results of a survey of 3500 Australian hi-fi buyers.

Some other points to emerge are that 46% of people buying hi-fi systems did not previously own one, that 30% had selected a brand before entering the store, that men are more likely to be the decision makers than women or couples (38%, 20% and 18% respectively), and that doctors, electronic enginners, technicians and school teachers figure highly in the occupations of purchasers.

READER INFO No. 290

New Boot-Mounted CD Player

Pioneer's confidence in the future of in-car CD technology is further evidenced by the release of the new CDX-M100 multi-play CD player. The CDX-M100 utilises a six disc magazine (JD-M100), and so provides six hours of uninterrupted music.

Previously, the loading and storage of CDs in the dashboard of the motor car has presented a number of drawbacks, however, the new CDX-M100 is mounted in the boot of the vehicle. The six disc magazine can be pre-programmed with a music selection and loaded into the boot-mounted unit for continuous operation. This architecture is becoming increasingly common with most of the high-end Japanese manufacturers offering a boot-mounted option.

Coupled with the CDX-M100 is the dash-mounted KEX-M700 command unit which, in addition to controlling the CD function, also offers a high quality cassette deck and AM/FM Supertuner. A single DIN-size unit capable of commanding all three sources (cassette, AM/FM tuner and CD), the KEX-M700 is an industry first.

The CDX-M100 and KEX-M700 have been designed with security in mind. The likelihood of theft is reduced with the boot mounting of the CDX-M100 and an anti-theft SECRET CODE on the KEX-M700. It also features the unique remote control unit which improves on safe driving and ensures convenience.

The CDX-M100 includes AMPS (auto magazine program selection), Track Search, Track Scan, Music Power, Program Play and Random Play.

The KEX-M700 cassette deck offers Auto Reverse, Full Logic Control, Music Search and Dolby B&C while the tuner incorporates the latest in convenience features, such as Best Stations Memory for auto station selection. An infra-red remote control is included.

The CDX-M100 mechanism floats on air damper suspension (similar to that utilised on buses) to overcome potential mistracking as a result of uneven road surfaces. Mistracking is still a problem for the car CD, but new technology as well as new cars, is likely to reduce the problem in the future.

READER INFO No. 291

Pioneer's CDX-M100 multi-play conpact disc player.

Remote control for the Pioneer boot mounted CD player.

The CD family

The non-recordable optical disc family seems set to be joined by the recordable disc, CD-RAM, Tandy and CVA Computer and Peripherals (distributor of Maxtor), have both recently promised products for the near future. But while we're waiting, here is a guide to what is presently available in this optical disc medium.

CD: Stores sound signals digitally for replay to a maximum of 74 minutes on a CD player with amplifier and loudspeakers. (Diameter 12 cm and 8 cm.)

CD-ROM: Stores keyboard characters and graphic information for interactive recall using a CD-ROM player and computer. Presently used mainly for on-line databases such as telephone directories, encyclopedias and census directories. Seems set to play a big role in computer memory storage also. (Diameter 12 cm.)

CD graphics: Stores a digital sound and graphic display for replay on a CD player, CD graphic decoder, TV monitor, amplifier and loudspeakers. Would seem to have limited use. (Diameter 12 cm.)

CD-I: Stores a 2 to 16-channel digital sound with image or text data for interactive recall on a Laser Vision Disk system. Could be used for education or product demonstration much more than it is. (Diameter 20 cm and 30 cm.)

CD-V: Stores a 20 minute digital sound plus five minutes of digital sound with moving images for replay on a CD-V player, TV monitor, amplifier and loudspeakers. The CD-V player also plays CDs and makes a marvellous jukebox. (Diameter 12 cm.)

READER INFO No. 292

Latest in CD players

Symphonia Hi-Fi in Melbourne have just released the second of Cambridge Audio's CD players, called quite obviously, the CD-2. Like the CD-1, its an unusual mixture of things and has created quite a stir since its release at the Winter CES in Las Vegas.

The front end and laser engine is essential the same as that of the Philips CD660. Cambridge have re-worked the suspension components and played about with earthing paths, but that's all. More importantly, they have completely replaced the power supply, up to a massive 100 VA and also increased the power supply capacitance up to 22 milli Farads.

The main point of interest is in the digital to analogue circuitry. It's so good that the CD2 outputs are connected, more or less directly to the output plugs. There are no output filters or amplifiers at all.

The core of the design is the 16 x 16 decoding system, which is a unique Cambridge Audio development. A 16 bit word length is used for each data sample but after unscrambling and error correction the data is passed through a four times oversampling digital filter from which it is fed to the Cambridge 16 times module. Here four data samples are calculated for each of the original samples. Thus the process is four by four sampling because the process is spread over two circuits but if the whole process took place inside one integrated circuit it would be seen for what it is; 16 times sampling.

Cambridge have packed the circuitry into six Custom ICs and shortly the complete circuit will become available in a 28 pin VLSI custom chip.

The total data rate of the complete system is a staggering 23 M bits per second but this is brought down to a more manageable 5.7 M bits/-sec by the use of four paralleled processing chains. Multiplexed decoding circuitry feeds successive data samples to one of four dual Digital to Analogue Converters (DACs) thus enabling each DAC to work within its maximum allowable operating speed with no loss of accuracy. The outputs of the DACs are summed via 2.2 K resistors to give an output impedance of 550 ohms before being fed to the audio outputs via a 4.7 uF polycarbonate capacitor.

The DACs used are TDA 1541s which are combined in matched sets. All the supply decoupling capacitors used are Siemens Polyester types rather than more common ceramic types.

The Cambridge 16 x 16 allows the conventional low-pass filters, and integrator state (normally needed to smooth out the steps between successive samples) to be completely eliminated by increasing the number of steps to 16 for each of the original data. As a result the analogue waveform is effectively smooth upon reconstruction. The only visible irregularity comes from the residual 705.6 KHz sampling rate; a frequency which can be efficiently attenuated by a simple single pole passive filter. This filter is provided by a small polystyrene capocitor.

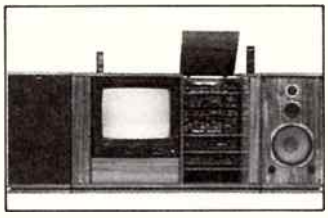
The CD2 is totally manufactured in the new Cambridge Audio facility at St. Ives, Cambridgeshire in the UK and is tested using the latest automatic test equipment. According to Cambridge, all CD2s have undergone a new quality assurance scheme designed to minimise reliability problems. In addition to normal test and inspection stages each CD2 is loaded with a disc and wrapped in a polythene bag before being placed on a burn-in rack. It is then under power for a minimum of 12 hours on a 5 minutes ON; 10 seconds OFF cycle. The player quickly heats up to a case temperature of around 80 degrees celcius ensuring the premature failure of any below standard components or soldered joints. Furthermore after each 10 second OFF period the player resets, its circuitry spins up the disc and reads its table of contents — the sequence where the CD player is most likely to give problems.

READER INFO No. 293

IN BRIEF

Yamaha pros

Yamaha has added to its professional equipment range with a new studio monitor and a series of power amplifiers. The NS40M studio monitor is a compact (598 mm x 293 mm x 312 mm) three-way system, able to handle 100 Wrms. The PC Series amplifiers is available in 240 W, and two 400 W models. They attempt to provide pure, reliable power for critical professional applications.



Audio visual package

Sanyo has released the AV-7000 audio and visual home entertainment system. The system consists of a CD player, double cassette deck, an FM stereo/AM tuner, a semi-automatic belt-drive turntable, a 55 Wrms per channel integrated amplifier, two 3-way speakers and a 63 cm remotely controlled stereo television. The cabinet has glass doors and wood-grain veneer.

New Hi-Fi shop

Leading Edge Audio is Melbourne's newest hi-fi shop aiming to provide custom hi-fi for music lovers. Stock includes Acoustic Research, Vacuum Tube Logic and Australian products from Whatmough Monitors and Orpheus Speakers. The new premises are at 49 Ramsden Street, Clifton Hill 3068. (03) 489-0466.

MARY RENNIE

STOLEN NOTES

Breaches of copyright in the audio industry have been a thorn in the side of manufacturers since the first sound was put to rest on various recording devices. Mary Rennie looks at what's being done to prevent it today.

Digital audio tape (DAT) systems have all the attractive audio qualities now associated with compact disc technology plus the ability to make very high quality copies of copies. Concern over loss of intellectual property rights has produced proposals for legislation requiring that DAT systems sold in the United States be fitted with a copy prevention decoder such that suitably coded material could not be copied by the DAT recorder.

The CBS Records system, the bosis for the proposals, removes a narrow band of frequencies from the audio signal — termed putting a "notch" in the frequency spectrum of the signal.

In considering this proposal, several committees of the Congress asked the National Bureau of Standards (NBS) three questions about the copy prevention system:

1. **Does the copy prevention system achieve its purpose to prevent digital audio taping machines from recording?**
2. **Does the system diminish the quality of the prerecorded material into which the notch is inserted?**
3. **Can the system be bypassed, and if so, how easily?**

The National Bureau of Standards received from CBS Records descriptive material, specifications, circuit diagrams, and operating encoding and recording/decoding devices for the tests. The results and conclusions of the NBS tests apply to these devices. Suggestions for recorded material to be used in listening tests were received from several sources.

NBS conducted a series of laboratory studies to understand the copy prevention system and to exercise it in several ways to obtain answers to question 1 . The NBS also constructed and evaluated several circuits designed to bypass the system (question 3). With the aid of an expert in acoustical evaluations on contract from a university, listening studies were conducted using subjects drawn from the local section of the Audio Engineering Society, NBS staff, and a few local audiophiles and musicians. These listening studies were carried out to answer question 2.

The NBS findings are as follow:

1: **"Does the system achieve its purpose?"**

The system does prevent the copying of notched material much of the time. However, for about half of the recorded tracks studied, the system exhibited *false negatives;* ie, notched material was nonetheless recorded. In addition, the system also exhibited *false positive* behaviour, ie, the system failed to record unnotched material. NBS studied 502 tracks on 54 compact discs and

The new supersmall Casio DA1, not yet available in Australia.

found false positives for 16 tracks on 10 discs.

2: Does the system deminish the quality of the prerecorded material?

NBS concluded: The system's encoder alters the original electrical signal. For some listeners for some selections, this results in a discernible difference between prerecorded notched and unnotched material.

NBS interpreted this question both in terms of objective electrical measurements and in terms of whether or not listeners can detect a difference between notched and unnotched material in carefully controlled listening tests. Electrical measurements showed that the encoded signal is degraded relative to the signal as it was prior to copy prevention coding, degraded in terms of adding a deep notch in signal amplitudes near 3840 Hz. In a double-blind series of listening tests, 87 subjects listened to a prerecorded tape of short selections from 24 different sources; 20 compact discs and four selections produced on a keyboard synthesizer. The results show that, although the effects of the encoder are fairly subtle for some musical selections, there are some selections for which the subjects detected differences between notched and unnotched material.

In a second series, 15 experienced listeners worked with 10 selections presented on porallel tape tracks such that the subject could switch back and forth from notched to unnotched material. For two of the 10 selections the encoded version was correctly identified 12 out of 15 times; these results are statistically significant.

3: Can the system be bypassed, and if so, how easily?

NBS concluded: The copy prevention system can be bypassed easily.

This question was interpreted by NBS as asking whether or not a DAT recorder can be made to record notched prerecorded material. It is not possible to restore all of the actual information removed by the encoding process. NBS engineers designed and constructed several electronic circuits for implementing five different methods to circumvent or defeat the copy prevention system by the use of external signal conditioning. All five methods succeeded in bypassing the copy prevention system. The circuits are simple and easy to construct.

SURROUNDED

Les Cardilini looks inside the Sansui DS-77 surround sound processor, and finds there is more to watching movies than just seeing them.

Does the Earth move for you too?

We have had more than two speakers before. Back in the 'seventies, stereophiles dabbled with quadrasonics, a four channel audio sound system. It never took off.

The problem was in the application. Two channels is enough to give the listener the illusion of full 360° sound information. The movies, however, work to different rules.

In a cinema auditorium, the addition of extra speakers allows off-screen sound effects and so on, which heighten one's sense of reality.

In fact, theatre professionals are more likely to refer to surround sound speakers as "APs", or audience participation speakers and perhaps the term Audience Participation more aptly describes the aural experience created when additional speakers driven by a dedicated surround channel are placed strategically around the regular listening position. After all, in real life we really do participate in all of our sensory perceptions, and hearing should not be an exception. Accordingly, in attempting to faithfully reproduce an acoustic performance, surround sound might be seen to be a logical step forward in improving the fidelity of sound reproduction, in the same way stereo added spice to mono.

There is now a trend, too, to integrate home hi-fi and video systems but TV sets are not renowned for their hi-fi sound, typically. The television system itself is not at fault. It uses frequency modulation, which is traditionally and perhaps inherently a hi-fi medium for sound broadcasting, but TV sets in the main have low power audio systems with small speakers installed where they will fit rather than where they will give the best sound. Conveniently, the hi-fi system is not likely to be needed for other purposes while the family is watching TV and so it seems logical that its full-bodied stereo potential might be utilised to advantage by supplementing the visual action in video movies and other programs where sound is featured.

If you have a stereo TV set, all the better. Many television channels now broadcast in stereo and present popular movies recorded with cinema-stereo soundtracks which with suitable equipment in the home can be decoded to replay full, cinema-type surround sound. It is no wonder then that surround sound is making a big comeback, this time probably to stay.

Surround sound for home audio and video systems comes in a variety of concepts and configurations and in perhaps its most basic form simply provides an ambience or a feeling of spaciousness in the listening area. Because the effect is similar to hearing the program in a larger room or hall, it is often referred to as the Hall Effect, not to be confused with the generation of Hall voltage in transducers.

At a live performance ambience is created by sound waves travelling past a listener and reflecting from the walls beyond, arriving again at the listening position a brief moment later. The effect is to delay the decay or dying away of the sound, which the ear perceives as a sustain, or reverberation. The further away the walls are, the longer the reverberation time becomes. We all know the sensation.

Hearing process

Through listening to a variety of day to day sounds and special events, our hearing process learns to translate the

BY SPEAKERS

nature of the reverberation into an impression of the kind of surroundings in which a performance takes place. Almost everybody could tell whether a recorded conversation took place in a tunnel or an open paddock, for example. Accordingly, the reverberation in reproduced sound will enhance the realism if it matches the reverberation that would be expected or experienced at the live performance. Various techniques such as using interchannel intensity and time delays can be used both at the recording and playback ends of the chain, to optimise reverberation times and the listener's perception of width and depth in a sound stage.

A simple ambience effect can be obtained from stereo programs by connecting a third speaker between the left-positive and right-positive speaker terminals on a stereo system. The connection should be made while the amplifier is switched off, and the existing left and right speaker wires should remain undisturbed. Care must be exercised, too, not to short out the speaker leads or leave any bare wires which may result in damage to the amplifier and speakers should the wires touch while the system is working. The additional third speaker may be mounted centrally, on a shelf or higher up on a wall behind the listening area and positioned for best effect.

Some of the simpler surround sound systems use variations of that third or phantom channel idea, with refinements and controls to adjust the ambience level. Others create two additional sound channels so that the system has its traditional Left and Right front stereo channels and two rear channels combining to reproduce the desired surround effects.

Thus, with speakers to the left and right, and to the front and rear the listener is surrounded by sound sources. Each pair of speakers in the system, in turn sets up apparent sound images in a "solid" field of sound, hence the name surround sound. Where surround systems tend to differ from each other is in the number of channels and the amount of separation, or difference in information coming from each speaker in the system.

One of the most widely known surround sound systems must surely be the Dolby Stereo system used in motion picture soundtracks. Dolby is the trade mark of Dolby Laboratories Incorporated, inventors and licensors of the noise reduction system of the same name used in tape decks. The Dolby Stereo surround sound system encodes the surround information within its regular left and right channel sound tracks and is generally compatible with standard stereo systems. The surround channel is recovered by suitable decoders in the playback gear, if required.

Typically, complex surround sound decoders were at first available only in expensive motion picture theatre projection and professional equipment. It was necessary to attend the cinema to experience the product. More recently, however, Dolby Stereo decoders and compatibility with Dolby soundtracks are features of surround sound equipment priced for domestic consumption. By simply integrating and adding the right equipment to a hi-fi and video system at home it is possible to recover and replay the surround or AP channels. Source material can include off-air transmissions on radio and television, video movies on tape and laser disc, and on audio discs and tapes, provided

they were made from original, Dolby-Stereo soundtracks.

The Dolby Stereo surround sound system provides for a third, Centre-Front channel between the traditional Left and Right speakers in a stereo system. In theatres or in systems where the front speakers are relatively widely spaced, the centre channel helps keep the centre-stage sound located at centre stage where it belongs. In stereo systems where a centre channel is not required it is simply ignored. A centre channel is, however, especially effective for patrons seated to one side or the other of the listening area. Of course, a separate power amplifier is needed for the centre channel. The AP speakers may be any in number and are also driven by a separate, surround channel amplifying system using a signal derived from the tangible, Left and Right sound tracks.

A further, important feature of the Dolby Stereo surround system is a time delay in reproducing the surround channel, compared with the main front channels. The delay is not apparent audibly but, in accordance with the Haas effect, it prevents front sound images being "pulled" fleetingly from the stage when the same sound occurs simultaneously in the surround and centre channel speakers. Without an appropriate delay a listener seated near an AP or surround channel speaker might perceive the sound source as being at that nearer speaker.

Additional amplifiers

An additional amplifier is needed for each additional channel in a surround sound system and may be integrated into a Surround Sound Processor or will have to be provided separately, depending on the model. Of course, a corresponding number of speaker systems are needed, as well. Up to about thirty watts, continuous, seems to be a practical rating for each of the rear channel amplifiers which in most cases only have to supplement the performance of, rather than steal the show from the stereo pair of speakers up-front, in home audio video systems.

At home, surround speakers might be placed one to the Left Rear and one to the Right Rear of the room, typically. A similar speaker layout would also be suitable for matrix and other four-channel sound reproduction from stereo discs and stereo radio broadcasts, and for pseudo-stereo sound created from mono sources, depending on the model processor installed. Stereo effects are also synthesised from mono sound sources such as old movies, for stereo TV transmission.

Most of the facilities outlined are included in the Sansui Audio/Video Surround Sound Processor, Model DS-77, distributed locally by Atsui, in Melbourne.

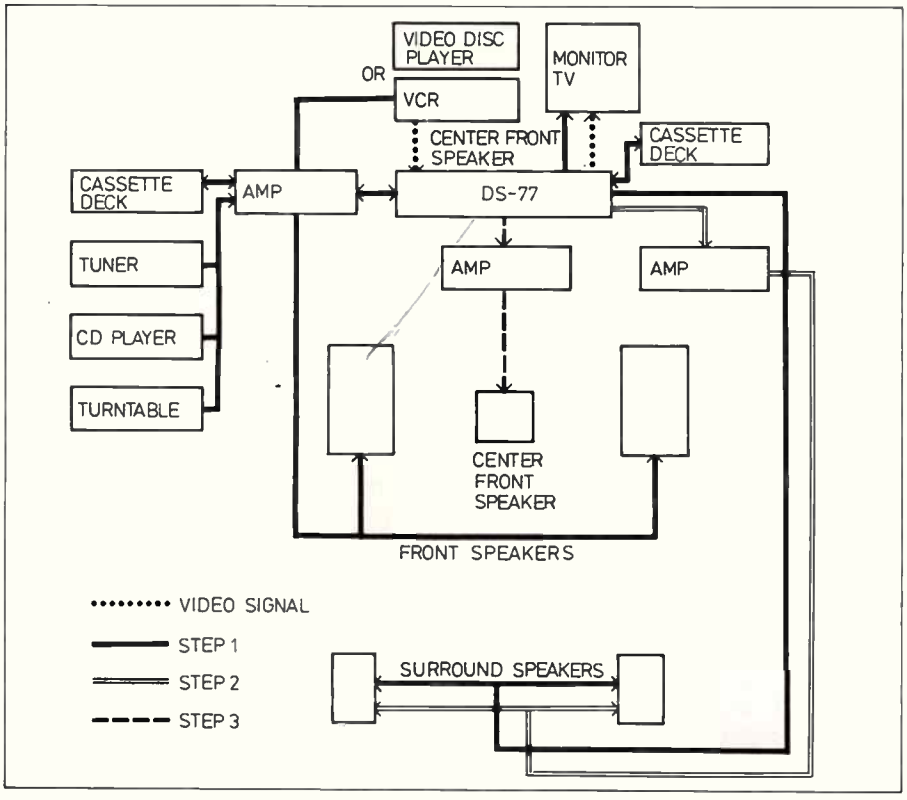
The DS-77 has a Cinema Surround Sound mode "compatible with the Theatre Dolby System". In the Cinema Surround Sound mode the two, conventional, front stereo channels operate normally while the surround channel is created in a matrix circuit which derives a Left minus Right differential signal. The differential signal is delayed by 20 milliseconds and drives two ten watts, continuous power, on-board, amplifiers. Two pairs of surround channel speaker terminals are provided on the rear panel of the component-sized unit and it is recommended that relatively efficient speakers be used in the surround channel. In order to improve signal to noise ratio a companding arrangement is used in the delay circuit designed around an analogue, or bucket brigade device (BBD), delay line.

An optional Centre channel is also decoded in the Cinema Surround Sound mode in the DS-77, and an output to drive an optional external, Centre channel amplifier or the amplifier in a TV monitor, is available on the rear panel of the processor. In smaller systems the centre channel might be considered superfluous but it can be particularly effective for wide screen video shows with stereo sound, or where listeners are unable to take up a "centre seat" in the listening area. Alternatively, the centre channel helps keep in place the centre stage sound should it be desired to move the front speakers further apart, such as in a larger room, for example.

In the QS Surround Sound mode in the DS-77, QS encoded recordings can be decoded creating both ambience and a degree of separation between the Front and Surround channels which enables sound images to appear between the four speakers around the listener. In fact, the major difference between the various Matrix systems such as the QS, is the degree of separation each system provides between Front and Rear, and diagonally opposite channels. Although the QS Surround mode is best exploited when QS encoded material is played a realistic ambience can also be derived from normal stereo recordings played in the QS Surround mode on the DS-77.

Surround sound from stereo

Conventional, two-channel stereo recordings can also be given the sur-



Organising a home surround sound set up is not quite as complex as it looks. The big disadvantage is the requirement for a second amplifier. Still, this can be very small, only 10 or 20 watts and nevertheless be quite effective.

round sound treatment using the Stereo Hall mode on Sansui's DS-77. In this mode a signal which is the difference between the Left and Right channels is played back after a 20 millisecond delay, in the surround channels. The audible effect differs slightly from that in the QS mode and is similar to the reverberation heard in a large hall, creating a sensation of spaciousness in the reproduction. The Stereo Hall mode can be used to enhance the sound of classical and, say, organ music which might be performed in characteristically large venues.

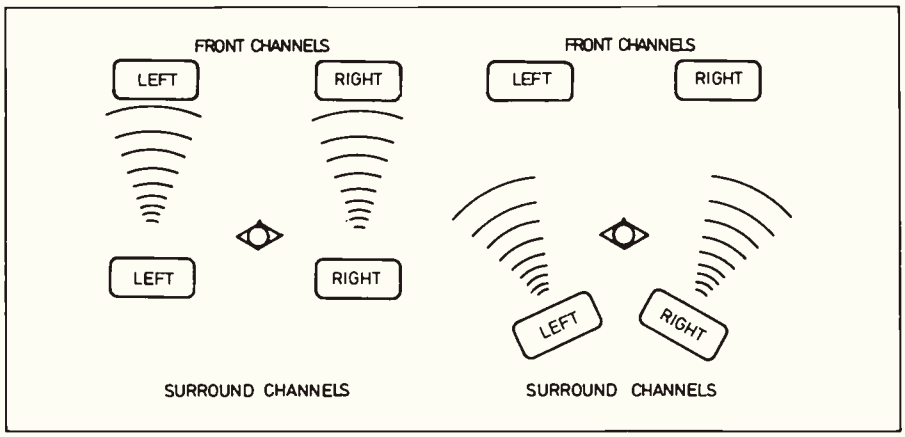
Naturally, since for a mono recording the information is the same in each channel on an otherwise stereo system, the surround signal for a mono recording is theoretically zero. The Stereo Hall effect is therefore most effective on stereo recordings with contrasting signals in the Left and Right channels, that is, when there is plenty of separation.

Of course, after the liveliness of stereo and surround effects mono program sound may tend to sound a little flat and closed in, so, Sansui have included a Simulated Stereo mode on the DS-77. The Simulated Stereo mode may be selected to synthesise a stereo-like sound from mono program material. It adds an impression of width to the otherwise paint source notion that mono sound presents on a standard stereo system. Unlike processors which simply use phase shifts the DS-77 manipulates the mono sound in its bucket brigade device channel to obtain its pseudo-stereo sound, and operates into the Front channel speakers.

Volume and balance controls are provided in each sound channel to trim their respective contributions to the sound field as a whole, and LED bar indicators beside each level control, show which channels are operating and the instantaneous volume and balance conditions in each channel. The individual level controls are subservient to a master volume control which provides single-touch control of the system volume, overall, so that each channel may be trimmed, and the Front and Surround channels balanced without affecting the level in another channel. Conversely, the overall volume of the system can be adjusted at the DS-77 without upsetting the relative level in each channel.

Two additional features complement the surround sound facilities on the DS-77.

A Super Bass Synthesiser can be switched in, to enrich the bass content in a program. Atsui suggests that extreme bass with its typically high energy



Speaker set up of the back speaker is not nearly as critical as front speaker placement. Whatever happens, the screen must be at the centre of the sound stage.

levels is often removed during recording, so as to minimise the risk of saturating tape and overloading other recording equipment, and that the Super Bass Synthesizer can restore some of their exciting impact.

The Super Bass Synthesiser halves frequencies between 50 and 100 Hertz in the program, using a side channel in the system. The extended bass spectrum in the side channel is then recombined with the main signal stream, adding floor-and-body shaking bass energy in the 25 to 50 Hertz range, to suitable soundtracks — provided, of course, the system speakers have the necessary low end response. A LED indicator on the front panel flashes each time the Super Bass Synthesizer circuit is activated by frequencies in its operating range.

> ***'Thus, with speakers to the left and right and to the front and rear, the listener is surrounded by sound sources.'***

Peak attacker

A similar indicator array is provided with the DS-77's Peak Attacker. The Peak Attacker might best be described as a peak unlimiter which restores around six decibels to the peaks of rapid transients in the program sound. Atsui says that, typically, the peaks of these transients would have been limited or clipped in the recording process, again to reduce the likelihood of distortion and signal overload in the soundtrack recording process, and the Peak Attacker restores some if not all of their aural impact. The circuit has an attack time of two to ten milliseconds, releasing in 100 to 600 milliseconds. Attack and release activity displays on the front panel when the Peak Attacker is selected.

The built-in surround sound power amplifiers in the DS-77 are rated at 10 watts, continuous (20Hz-20kHz, 0.1 per cent THD). Stereo pairs of RCA connectors are provided on the rear panel for inputs and output channels, including a Centre Channel and Surround Channel. Quick-connect speaker terminals for the surround speakers are provided. As well, a non-switched Video In-Out loop is available on the set and audio may also be looped directly from the input connectors. Both the Peak Attacker and the Super Bass Synthesiser are adjustable at the front panel, beside their respective LED indicators on the DS-77.

Since the DS-77 pre-empts the Tape connectors on the user's amplifier or receiver, Tape Inputs/Outputs are provided on the processor which also includes a Tape-Monitor switch. A Bypass switch is available to bypass all processor circuits in the DS-77 if required.

The DS-77 may not necessarily be the answer to claustrophobia but it certainly enlivens TV sound and creates a more realistic and open acoustic effect. Given the right movie soundtrack and speaker system, it can also bring some full-bodied, floor-shaking cinema sound into the loungeroom at home. The variety of modes it offers also enables the surround sound effects to be varied from time to time to suit different tastes and kinds of program sound recorded or broadcast in regular stereo. The set has a five year warranty and sells for $899, recommended retail price.

More information: Atsuit, 33 Governor Road, Mordialloc, Victoria 3195, telephone (03) 587 3232.

TECHNOLOGY

THE CELESTION SL700 SPEAKER SYSTEM

Louis Challis reports on a speaker system, the embryo of which emerged from an Atomic Energy Commission research lab . . .

LAST YEAR at the Japanese Fair in Tokyo, I joined one of the queues on animated Japanese Hi-Fi buffs who were waiting to audition the Celestion System 6000. When we finally got into the demonstration suite I was impressed by both the quality of sound and the visual impact of the System 6000. I wasn't surprised when it was awarded the title "Loudspeaker of the Year" by the Federation of British Audio.

Now as it happens the top half of the system 6000 bears more than a passing resemblance to the sealed cabinet of the SL700, and I suspect that the major portion of the electro-acoustic performance of those two systems is also very similar.

The bose elements of the two systems are however entirely different, for whilst the base of the System 6000 employs an attractive and acoustically desirable sub-woofer for its lower half, the SL700 employs a tall and very heavy lead filled die-cast pedestal.

The SL700 is a very unusual speaker system and it owes much of its early developmental work to some very innovative research work conducted at the British Atomic Energy Commission in the late 70s and early 80s — Now who said that the British atomic research project hasn't achieved something worthwhile! That specific research programme centred on the development of a natty two-dimensional (and subsequently three-dimensional) laser interferometer, which was used to evaluate differential motion of speaker transducers under realistic drive conditions. If my memory serves me right, and although the subject is not mentioned, the B & W 801 series monitor loudspeakers were also nurtured by the same research programme . As a consequence there appears to be a link between the Celestion and B & W developmental programme .

New cabinet material

One of the most exciting (and expensive) features of the SL700 is its use of a cabinet material called "Aerolam", which is an aluminium honeycomb with blue bonded sheets of metal on either side. This material is extremely stiff, light, exhibits low resonance and high damping characteristics and is also higly respected by Japanese speaker manufacturers. I noted during my latest visit to Japan that both Matsushita (National) and Sony are currently marketing top line speaker cabinets made from either the same or a similar material. One of the first things I decided to evaluate was how effective this Aerolam material really is, when compared with more conventional particleboard type materials. As you will note from the attached graphs of cabinet sidewall acceleration there is an astounding difference between the two types of material and it would appear that the Aerolam material must perform just about as well as

the B & W matrix system in a cabinet with these dimensions (see Figures 1 and 2).

Rather surprisingly, the Japanese have not been using the Aerolam material for their speaker cabinets, but instead have chosen to use it for the latest flat panel speaker diaphragms that are still very much the vogue in Japan. As a consequence, it looks like Celestion is currently the only manufacturer utilising this material for speaker cabinets.

The other talking point of the SL700 is the speaker stands. They are filled with lead shot, which must cost the importers (and thus the purchaser) an awful lot of money in freight. Each speaker cabinet sits on three conical aluminium points and are held down by two clamping screws to the top of the stand. The composite system then behaves as a solid radiator with reduced spurious sound radiation and a claimed improvement in sonic clarity. The height of the stand has been carefully chosen to ensure that the correct degree of floor boundary layer sound reflection is achieved at low frequencies. I subsequently found these stands achieve a remarkably flat room response in the critical one-third octave bands from 25 Hz to 80 Hz (see Figure 3). The stands provide that very important lift in what would otherwise be a drooping output response around 50 Hz. By increasing the mass of the pedestal to a phenomenal 17.5 kilograms and incorporating spikes in the base the supporting system achieves a dramatic improvement in mechanical stability. It is most effective under the high drive conditions when the sealed cabinet is shaking itself on what turns out to be a very long and slender cantilever. The reduced motion of the enclosure leads to an improvement in sound clarity at low frequencies.

Under partner pressure I baulked at digging eight holes in my polished parquetry floor and was content to remove the spikes and leave the base of the stand sitting on the floor.

Refined Tweeter

Each SL700 cabinet corporates the latest developmental versions of what appear to be two refined and technically advanced conventional drivers. The dome tweeters, in particular utilises a lightweight aluminium dome, which is apparently the same driver that Celestian now uses in its SL6S speaker system. This tweeter has been continually refined over the past five years to the point where it offers excellent sensitivity, extremely low distortion and superb transient performance. The combined mid range low frequency driver also happens to be a well proven unit which has been continually refined over the past five years. Much to my surprise the combined mid range woofer's diaphragm has a diameter of only 143 mm which is really miniscule when you take into account its acoustical output and the low frequencies to which it is capable of operating.

The edge of the diaphram utilises an unusual flexible surround to achieve enhanced travel, good flexure, relatively low distortion and reasonable sensitivity. This particular edge termination is unusually effective in terms of its ability to attenuate standing waves, which are so readily generated in a speaker diaphragm of such small type.

The SL700s are not supplied with a protective front panel with conventional grille cloth, although the tweeter is provided with an external curved slotted grille cover. This protective grating not only provides speaker protection, but also simultaneously fulfils an important acoustical function controlling the dispersion angle of the tweeter.

The passive crossover circuit and the input termination at the rear of the cabinet is unusual, as the designers recommend the use of two separate sets of speaker leads to feed the tweeter and mid range/woofer sections, respectively.

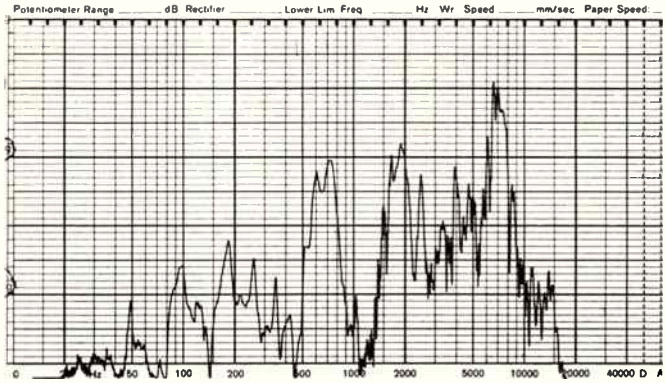


Figure 1: Vibration level on side panel for input level corresponding to a nominal 90 dB at one metre on axis.

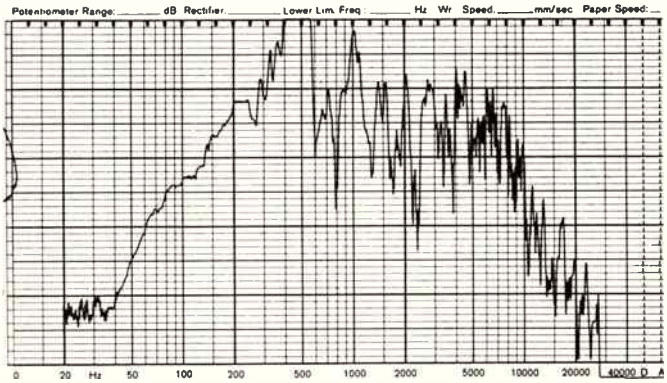


Figure 2: For comparison, a similar exercise to that of figure 1, but carried out on the new B and W DM110s.

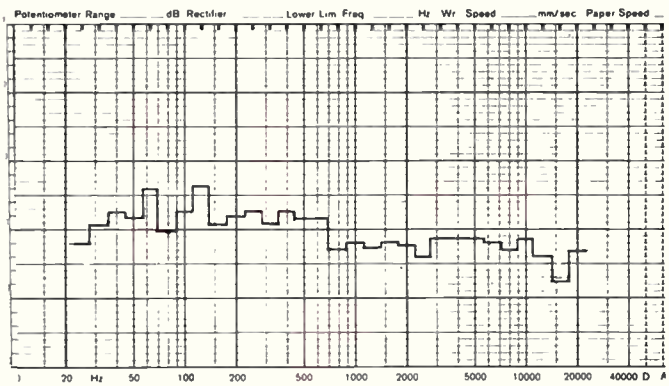


Figure 3: One third octave view of pink noise from the Celestions in a normal listening room.

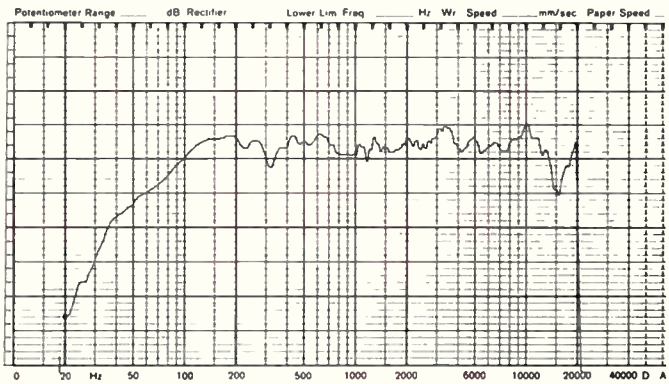


Figure 4: Frequency response at two metres off axis.

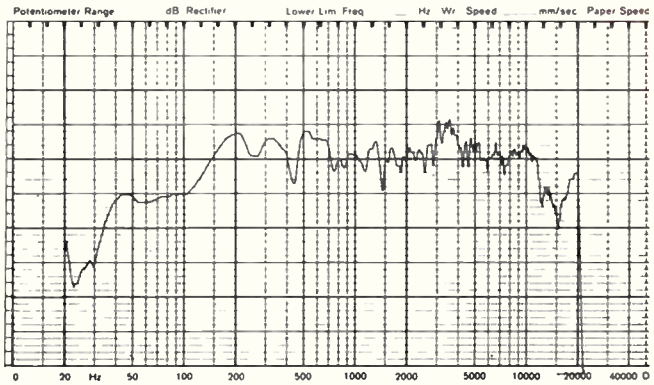


Figure 5: Frequency response measured at two metres 30 degrees off axis.

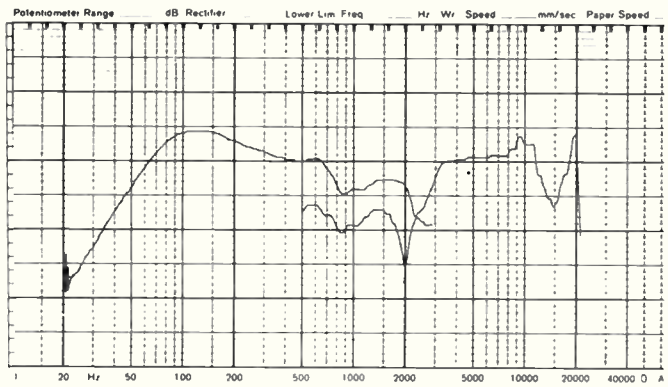


Figure 6: Frequency response measured at 100 mm from tweter and woofer.

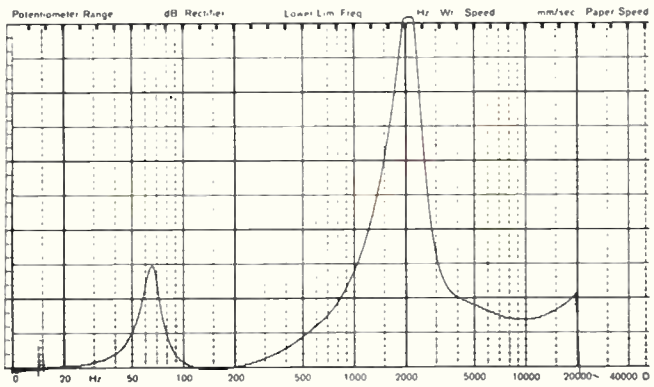


Figure 7: Input impedance varies between six and 88 ohms.

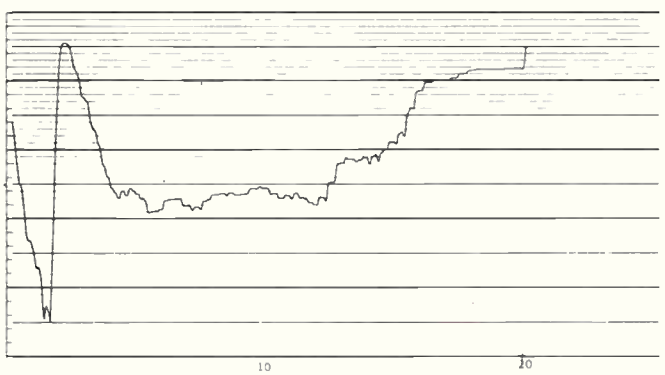


Figure 8: Phase response veers through 360 degrees before becoming linear over the critical mid range frequencies.

These terminals are designed to accept banana plugs and I was provided with two separate Audiolab amplifiers and low impedance Monster cables for this purpose. The crossovers are fairly conventional even though they result in unusually high input impedances within their operating range.

The manufacturers supply a poir of individual frequency response curves measured under anechoic conditions with each set of speakers. Apart from the obvious use of a low 'writing speed' when producing those level recordings, the response appeared to be accurate. When I performed my own set of measurements in our anechoic room, I found that, aport from the minor differences resulting from our use of a faster writing speed, which re-creates all the 'wrinkles and lines', the results are very similar. The most notable differences between the manufacturer's curves and our own, are the extent of the frequency rise at 10 kHz, the depth of the notch between 15 and 16 kHz and the extent of the rise in the frequency response at 20 kHz, which extends to well beyond 25 kHz.

For all that, the free field (or anechoic) frequency response of the SL700s is exceptionally flat within ± 6dB all the way from 50 Hz to 25 kHz (see Figure 4). The response at 30° off axis results in a broadening of the 15 kHz notch by a second notch at 13 kHz, but the response is still within 10 dB all the way up to 25 kHz (see Figure 5). The cross over frequency has been set at 2.5 kHz as you will note from the level recordings produced with the microphone set at 10 cm from each of the drivers (see Figure 6).

Impedance Unusual

The impedance characteristics of the SL700 are unusual and I had to make two attempts to record the full range of the impedance characteristics. At frequencies below the speaker resonance, and again between 100 and 200 Hz, the impedance is down to a relatively low 6 ohms. At 2 kHz, that impedance rises to 88 ohms which is remarkably high. At high frequencies and for the full extent of the tweeters operational range, the input impedance does not drop below 18 ohms. As a consequence, the total power drawn by the tweeter tends to be much less than might otherwise be expected (see Figure 7).

The phase response exhibits a complete 360° phase

LOUDSPEAKER DATA SHEET

Measured Performance of: SL-700
Crossover Frequencies: 2.2 kHz
Sensitivity: 14.5 V rms = 26.3 Watts (nominal into 8 Ohms) (for 96 dB average at 1m)
Harmonic Distortion: (for indicated level at 1m)

	90dB 100Hz	96dB 1kHz	90dB 6.3kHz
2nd	−30.3	−38.2	−61.6
3rd	−45.1	−41.0	−58.3
4th	−54.0	−64.0	−56.6
5th	−42.8	−65.7	
THD	−3.2	1.5	0.21

Input Impedance

100 Hz	8.4	ohms
1 kHz	30	ohms
6.3 kHz	20	ohms
Min at 4 kHz	7.2	ohms

SIZE, WEIGHT & PRICE

Dimensions: 375 mm h × 200 mm × 235 mm (cabinet)
60 mm × 225 mm × 280 mm (stond)
R.R.P. $5,995.00 complete

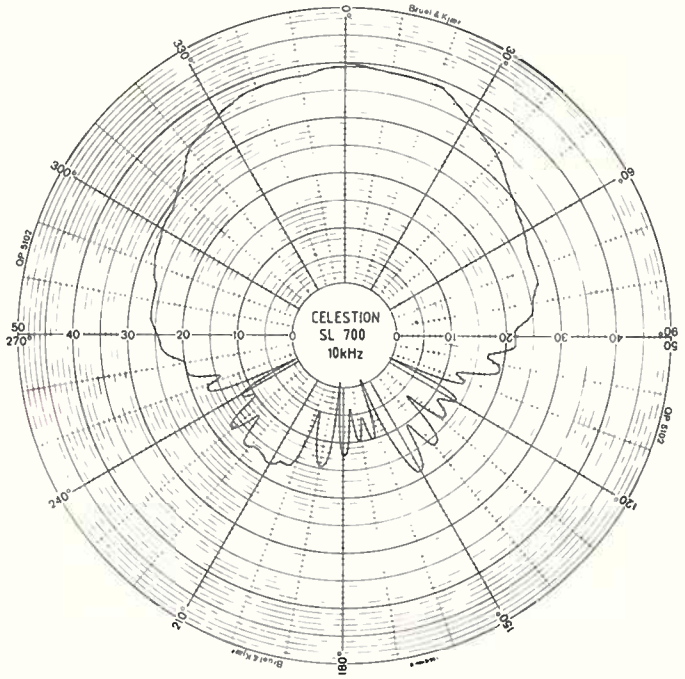


Figure 9: Polar plot at 10 kHz shows significant lobing.

change at 2 kHz, but thereafter is remarkably smooth and really 'phase linear' over the most significant portion of its operating range (see Figure 8).

The speakers exhibit an excellent uniformity of sound dispersion all the way up to 6.3 kHz where it is within ± 3dB over a 120° arc. This dispersion beam width drops fairly rapidly at 10 kHz to only ±30°. At higher frequencies the sound dispersion becomes a relatively narrow beam of sound energy necessiting a listening position fairly close to the direct axis of each speaker for optimum fidelity (see Figure 9).

One of the most outstanding features of the SL700 is the decay response spectra, which is extremely smooth all the way up to 25 kHz, although the droop in frequency response at 15 kHz is quite pronounced (see Figure 10). Notwithstanding the drop in output around the 15 kHz region, the SL700 exhibits minimal signs of frequency colouration, spurious cabinet or speaker resonances, and for that matter, minimal signs of the other nasty physical characteristics which normally show up so clearly in this analytical procedure.

On the basis of the decay response analysis, it is evident that Celestion have achieved remarkable improvements in objective speaker parameters. This is to a large measure the result of their choice of an Aerolam sealed speaker enclosure as much as it is the result of their choice of well designed and carefully chosen drivers. This conclusion was soon reinforced by my subjective assessment which revealed superb stereo imaging, smooth uncoloured sound with virtually all of the programme content to which I listened. I was greatly impressed by the SL700's remarkably faithful reproduction of the human voice, which is among the cleanest and most realistic I have yet heard. I was equally impressed by the performance of the speakers on pink noise which exhibited minimal colouration as they also did with almost every musical instrument which I chose to audition. The only minor exception was the limited output of the speakers in the 15 to 30 Hz region when re-producing bass drums or similarly at very high listening levels when trying to reproduce high outputs at low frequencies.

Summing up

My overall impressions of the Celestion SL700's is that they are capable of providing remarkable fidelity at modest listening levels, exeptionally low sound colouration and superb performance on virtually all of the classical music which I chose for my evaluation. These speakers perform admirably at high listening levels with frequency content above 50 Hz and appear to be primarily designed for classical music, as opposed to rock and pop.

With a selling price of close to $6,000, you will either have to be reasonably affluent or very dedicated to purchase a set of the SL700s. Equally importantly, you will have to be very tolerant to accept the holes that those eight spikes are going to leave in your expensive wooden floors.

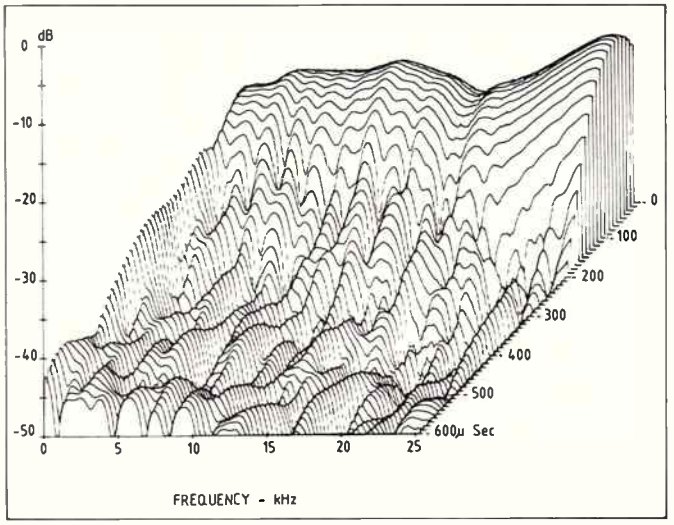
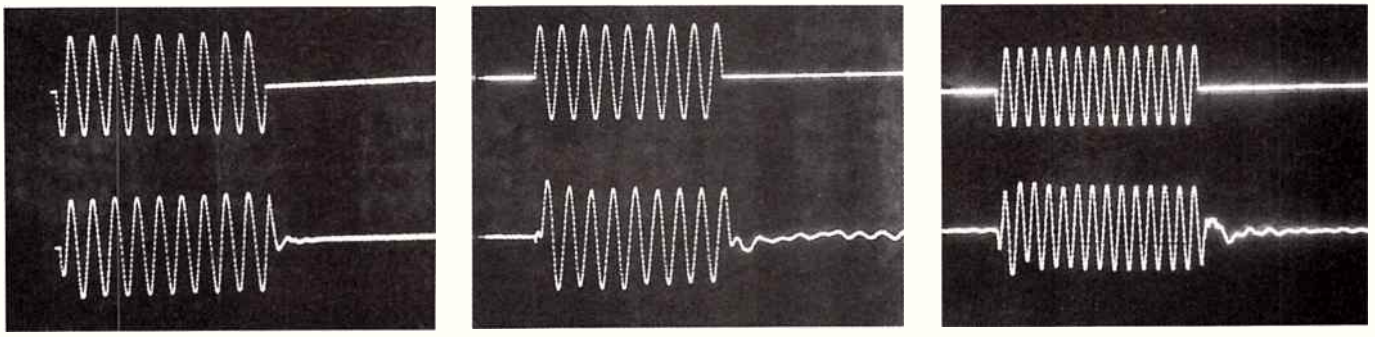


Figure 10: Decay Spectra shows frequency versus amplitude decay with time.



100 Hz *1000 Hz* *6.3 kHz*

Figure 11: Tone burst test. Upper trace is electrical input and lower trace audio output.

A speaker designed to one standard: Live music.

If you have ever heard music live, you can appreciate what's behind the Bose® 901® Series VI Direct/Reflecting® speaker system.

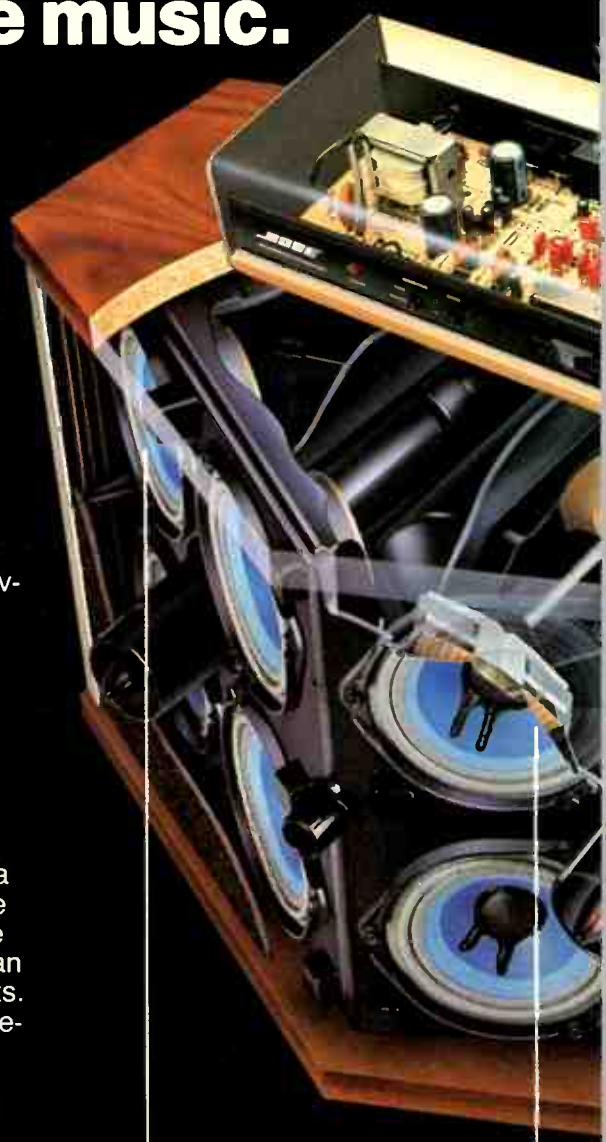
Live music is the complex interaction of direct and reflected sound. Most speakers, however, are not designed with this in mind—which is why they sound more like speakers and less like music.

This was the conclusion reached years ago by a Massachusetts Institute of Technology research team led by Dr. Amar G. Bose. Through extensive research, his team discovered the secret of live music: that it is the precise balance of direct and reflected sound heard during live performances that makes live music sound live. Finally, they designed a product that could put this discovery to work in the living room: the Bose 901 Direct/Reflecting® system.

The Bose 901 Series VI speaker: a system of audio innovations.

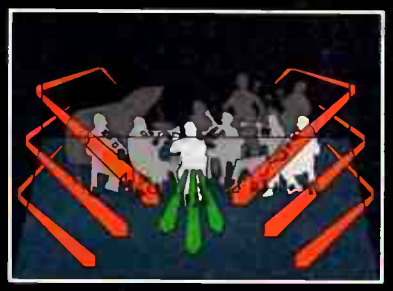
The introduction of the revolutionary Bose 901 system in 1968 redefined the phrase "high fidelity." For the first time, a speaker was capable of reproducing music with much of the impact, clarity and spaciousness of a live performance. The 901 system's concert hall sound and compact size made it an instant success with both audio critics and audio enthusiasts. Today's 901 Series VI system incorporates some 350 improve-

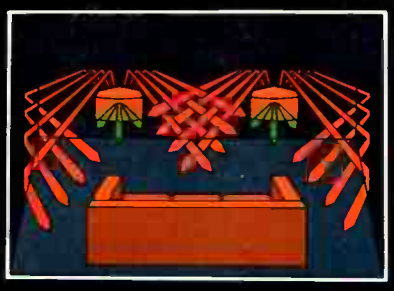
The Bose 901 system's Direct/Reflecting® speaker design turns your listening room into part of your stereo system. You'll hear *full stereo throughout the listening environment*—no matter where you sit or stand.

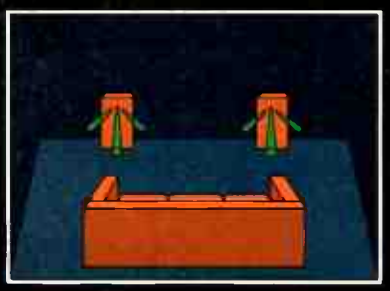


The 901 system's nine full-range HVC drivers are precisely arranged to re-create live music's natural balance of direct and reflected sound. Each driver is matched and tested by the Bose Syncom® II computer.

The Bose-built HVC driver is made out of some of the strongest advanced composite materials available. The heart of the driver is the Helical Voice Coil, *which handles instantaneous peaks of up to 4,000 watts*! Multiple HVC drivers give the 901 system *unlimited power handling* in home applications.

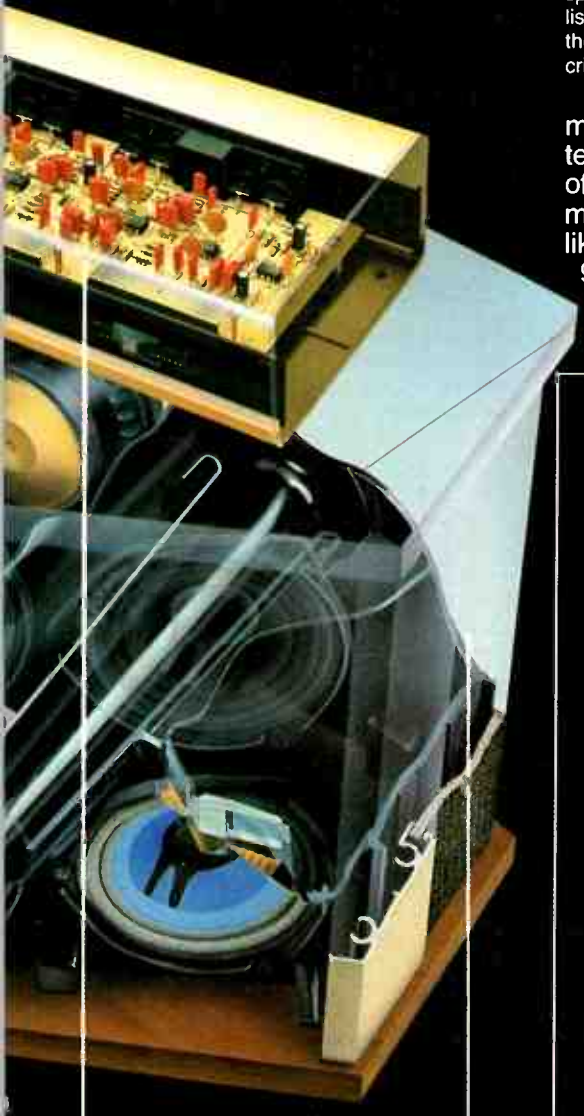






In the concert hall (above left), listeners hear a complex mixture of direct and reflected sounds, arriving from different directions and at different times. Bose Direct/Reflecting® speakers (center) are designed to reproduce music in much the same manner, allowing listeners to hear greater realism and impact. Conventional speakers (above right), on the other hand, reproduce primarily direct sound, causing listeners to miss many of the critical acoustic cues that make live music sound live.

ments over the original. The speaker's innovative audio technology turns your listening room into an essential part of your stereo system. The 901 system works by reflecting most of its sound, instead of aiming all the sound toward you like a conventional speaker. So, anything you listen to over a 901 system picks up a strong sense of concert hall realism, because the system is capable of reproducing the concert hall's natural balance of direct and reflected sound.



The Acoustic Matrix™ enclosure helps the 901 system control sound by precisely controlling air. Made up of 14 separate acoustic regions, it isolates the drivers and regulates internal air flow, resulting in increased bass and lower distortion.

The Bose 901 active equalizer uses low-distortion electronics to control the system's total frequency response, allowing a *compact system* to produce full-frequency sound. Digital Dynamic Range® circuitry makes the entire system ideal for use with the best sources available.

Audition the Bose 901 Series

Audition the Bose 901 Series and judge for yourself. Then take the next step and invite a legend home. There is an entire line of Bose speakers available that incorporate much of the advanced technology developed for the 901 system.

For more information including a copy of Dr. Amar Bose's research paper "Sound Recording and Reproduction" use the Reader Information Service in this magazine or contact Bose (Aust) Inc., 11 Muriel Ave., Rydalmere, N.S.W. 2116 (02) 684 1022.

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". . .the 901s produced one of the most natural sound fields I have heard."

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"The 901 can produce deeper bass than any other speaker I have ever listened to."

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"The Bose 901 may well be the finest speaker in its class."

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"The high efficiency and dynamic range of the Bose 901 will impress even the most sceptical listener."

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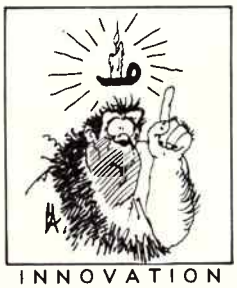


INNOVATION

TWEAKING YOUR SPEAKERS

Part 1: Enclosure Modifications

In this article, the first of several in a series on loudspeakers to be published, Tom Manning describes several improvements which may be effectively applied to the enclosures of many different brands of commercially available loudspeakers.

Speaker modifications can be divided into two groups — those dealing with upgrades retaining the existing driver complement and those which involve driver substitues with the necessary accompanying changes. Since many people will not be inclined to experiment with driver swaps, it's logical to examine the former first. By a great margin, the most common loudspeaker used in domestic environments is of the dynamic moving coil type. This system, employing two or more cone or dome drive units has been widely available for many years, and it will most likely continue to remain so. Although possessed of many shortcomings, which, as we will see, can be addressed and ameliorated, it has endured because it is probably the best compromise between size, price and performance.

There are, of course, several other different types, the most well known of these being of the electrostatic/ribbon/-planar designs, but an in-depth discussion of this exotica is not really practical due to their inherent complexity and delicate construction.

Let's examine the economics involved in loudspeaker production. A speaker is a labour intensive device, and the effort involved in fine tuning a design to extract the maximum available performance is simply not a cost effective exercise. The bulk of the performance of most quality speakers lies in the driver selection and crossover design, which is invariably reflected in the retail price end of the production chain.

All but a few of the world's speaker manufacturers simply don't spend seven hours making and testing each individual speaker, and those that do certainly charge for their efforts! Fortunately, this is not a problem for the home hobbyist, since labour costs you nothing. Additionally, hot-rodding speakers is enjoyable, rewarding, and truly effective when done carefully.

Understanding the enclosure

Where to start? The obvious place to examine is the enclosure itself — this mechanical structure does several important tasks and has an enormous effect on the overall sound of a speaker system. Its main purpose is to control the rear wave radiated by the woofer, or low frequency bass driver.

Since sound consists of minute variations in air pressure, we need a method of controlling the rear wave so that it does not cancel that being radiated by the front of the cone and cause a subsequent loss of pressure. The simplest method of facilitating this would be to place the driver in the centre of a large open board, or baffle, but since low frequencies consist of long wavelengths you would, theoretically, need a baffle 17 metres square to reproduce a 20 Hz signal!

'There is a simple method of measuring how your cabinet is behaving.'

Of course, this is highly impractical, even considering that baffles of much smaller area can provide respectable bass end performance, a much more elegant solution is to "fold" the baffle around itself, forming an enclosure which can either attempt to absorb the rear radiation or make use of it in some way to augment the output from the front of the cone. The various ways in which this can be implemented are beyond the scope of this article, but may form the basis of a future article in ETI.

Shortcomings

Having determined that we need an enclosure, let's look at the inherent shortcomings involved, and what can be done to make these as unobstrusive as possible. A wooden box is a resonant device. If the bass driver in your speakers is coupled mechanically to the cabinet, the whole structure will vibrate at varying levels and frequencies. This is an empirical truism, in contradistinction to many manufacturers' claims. It's also undersirable, for these reasons:

1. As the driver's cone moves outwards, an equal reaction occurs causing an

opposite force to be applied to the frame, and hence to the cabinet. This energy ultimately manifests itself as cabinet reasonances, which radiate energy, resulting in measurable and quite audible distortion.

2. This gives rise to a second problem, occuring if the high frequency drivers are mounted on the same panel as the bass driver(s). The tweeter's signal, which consists of small wavelengths, is modulated in sympathy with the panel movements, causing Doppler distortion and vague stereo imagery. This is also quite audible.

Having determined that a problem exists, we can now turn our attention to see what can be done to control it within reasonable limits. The basic aim is to disperse these over a wide frequency range, whilst reducing resonances in level as much as possible.

There is a simple method of "measuring" how your cabinet is behaving, illustrated in figure 1. Set up your box lengthwise, on two narrow supports, mounted as close to the ends as possible. (Don't simply rest the box on a flat surface, this will provide misleading information, since the side remains unsupported during normal use.) You'll need a quantity of clean, dry, fine sand, an audio oscillator and your normal audio amplifier. If you don't have a signal generator, but do have a compact disc player, the pink noise bands on the Denson audio technical test disc are excellent for this purpose and are probably more representative of real musical signals. By sweeping the signal through from a very low frequency upwards, you'll notice several patterns appearing.

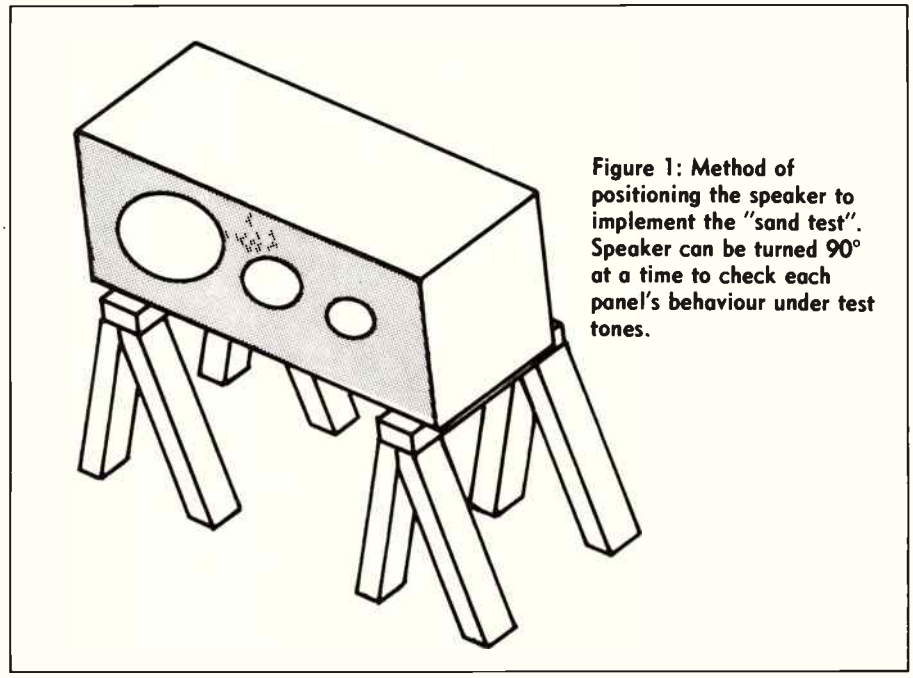


Figure 1: Method of positioning the speaker to implement the "sand test". Speaker can be turned 90° at a time to check each panel's behaviour under test tones.

Where these are most prominent, a pronounced resonance is indicated and should be addressed. For example, if you noticed a sharp increase in the agitation of the sand at 250 Hz, which seems to be fairly uniform across the panel's area, this would suggest that too much unsupported surface is being allowed to vibrate at this frequency.

Suppose we place a rigid mechanical coupling between these sides, just at the position where the level of resonance is highest. We would then have two resonance occurring, each one roughly twice that of the original, but substantially reduced in level.

This is generally desirable, since the most obtrustive resonances lie in the lower midrange region, (about 100 up to 400 hz) where much vocal energy is distributed. Figure 2 shows an easy method of fitting extra bracing to a cabinet without removing any panels.

Before this is attempted, you'll need to remove all the drivers [woofer(s), midrange unit, tweeter] from the cabinet.

It's probably a good idea, at this stage, to remove any soft damping materials from the box. You'll need to cut the bracing piece slightly smaller than the distance to be covered — this will enable you to manoeuvre it with your hands

within the cabinet. Glue the two smaller pieces in first — you may wish to use small wood screws to hold these in place while the glue sets. PVA woodworking glue is quite sufficient for the purpose but epoxy type compound does a superior job of keeping things rigid. Once this has cured, you can fit the main supporting piece in position with screws and plenty of glue.

Improved rigidity

This technique can be applied in several different places within the structure, from both side to side and front to back. Generally it will improve the overall rigidity of the cabinent, but as discussed this will promote several resonances of higher frequencies. Now it becomes desirable to stagger these as much as possible, to ensure that no particular frequency is excited more than once. You can measure this effectively, albeit rather crudely, by applying pressure points manually at various positions on the cabinet whilst you run the 'sand test'.

You'll probably notice that this staggering of resonances can be achieved by installing bracing at points 66 per cent of the length of the panel, both from top to bottom and side to side (see figure 4).

Once you have determined the optimum placement and installed the bracing in position, the final step is to reduce as much as possible any remaining resonances.

You'll need to obtain a can of bitumenous compound, similar to that used to rustproof cars, or some "brushable hydraseal" available from auto body shops and hardware stores. Mix it up with sand into a thick paste, and apply it liberally to all inside surfaces, including the bracing. This excellent product really makes an audible improvement and was used by many of the English manufacturers before widespread cost-cutting measures were implemented in the late 1970s.

For those seeking the ultimate cabinet 'tweak', bitumenous pads can be glued to the inside surfaces in places where any resonances are still obvious. It should be noted however that these chemicals emit fumes capable of breaking down the adhesives used in the construction of many drivers, so newly treated cabinets should be left to 'dry' in an open space for a week or so before any driver refitting is attempted.

Figure 3: The T-nut, this useful and widely available device can be used, mounted from behind, to secure drivers very firmly to the cabinet. It's also the best way to secure spikes to the bottom of the box (see text).

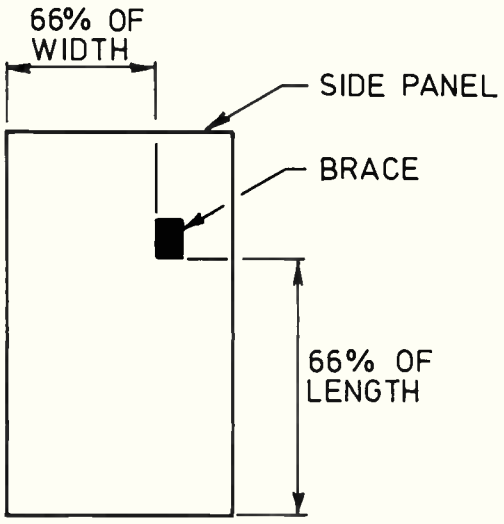


Figure 4: Note the off-set bracing arrangement, designed to stagger resonant frequencies.

Investigate problems

With these steps implemented, your cabinets should now exhibit very low levels of mechanical resonances. Acoustical problems, however, still remain and should be investigated. Most quality loudspeakers are fitted internally with a certain amount of soft damping material, the purpose of which is not to reduce mechanical enclosure resonances, but to control standing wave patterns with the cabinet.

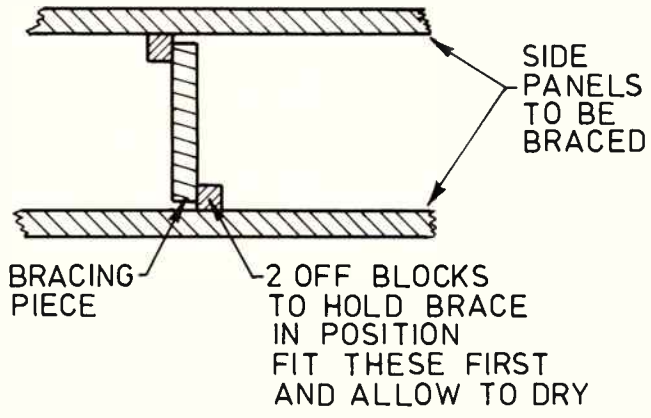
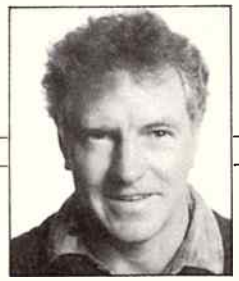


Figure 2: Shows how to instal bracing between panels. Cut the bracing piece slightly smaller than the distance between the sides, this will allow you to manoeuvre it inside the cabinet with the driver removed.

And in the next issue . . .

Next month we will discuss several ways of extracting the maximum performance from your speaker's crossover network, including an analysis of how it functions as a system with the drivers it serves. This will include a detailed discussion on the real life performance of capacitors and inductors, and the inherent shortcomings of these when applied to high level audio signals. We will also give details of the methods involved in winding the ultimate audio inductors.



ANTHONY O'GRADY

THE GODFATHERS

BIRTH, SCHOOL, WORK, DEATH.

(Epic)
Cat No. 460583 2

This is the second album from The Godfathers, a UK group who've topped English Alternative Charts, but the first to be released in Australia.

There's no doubt the group are eclectic, the songs range from revisits to mid-70s London punk, to Beatle pastiches, revamped rockabilly, straight ahead rock, and psychedelic epics with backwards guitar, fuzztone drums and Georgian chants.

The results are ocassionally surprising and invigorating (depending on the listener's tolerance for being subjected to sudden changes of direction) but variety is not always the spice of aural delight. Now that they've shown what they can do, The Godfathers have to answer the question of *who* they are.

JIMMY PAGE

OUTRIDER

(Geffin)
Cat No: 924 188-2

Ironically, Led Zeppelin guitarist Jimmy Page will be competing against CD releases of Zeppelin's catelogue with this, his debut solo album.

Inevitably comparisons will be drawn, particularly as Page and Zeppelin singer Robert Plant re-combine as writers and performers on the song, The Only One.

Unhappily it's no contest, the song itself shows every sign of having been thrown together in the studio — no dynamics, no hookline, not even a grunge guitar riff or cataclysmic scream to rival Zeppelin's glory days. Similarly, Page's collaborations with the veteran English singer John Miles are wearisome efforts, all loud sound with no sensibility.

But pay dirt is finally struck on three songs with eccentric English blues singer Chris Farlow who took time away from his collection of Nazi memorabilia to prove his effortless ability with a slow blues song remains world class.

Page's three non-vocal guitar pieces, to these ears anyway, sound like songs for which no lyrics could be found. Essentially, an album of unco-ordinated bits and pieces that probably won't attract an audience beyond hardcore rock guitar and Zeppelin followers.

MICHAEL BOLTON

THE HUNGER

(CBS)
Cat. No: 4601632

Michael Bolton is a successful American songwriter who, ironically, after clinching his own record deal, had a world wide hit with a cover of Otis Redding's Dock Of The Bay.

To these ears, the cover does the original credit, with the delicately fingered guitar solo by Journey's Neal Schon an outstanding feature.

Journey keyboard player Jonathon Cain (who's also written with and produced Australia's Jimmy Barnes) is involved on four of the nine songs and it's no surprise that the album is in the same ballpark as Journey's American Arena rock sound of beefed up drums, layered guitars and co-ordinating keyboard colouration.

It's proficient, it's commercial, but it's in no way new.

HOTHOUSE FLOWERS

PEOPLE

(London)
Cat. No: 828101-2

One day a band will emerge from Ireland, and make the international charts, *without* an imprimator from U2's Bono Vox and we'll know that Gaelic Rock has at last discovered a self-sufficient identify. Until then, Bono is doing just fine in his attempt to solve Ireland's balance of payment problems with a music-led export drive.

Hothouse Flowers' best strengths are the infectious energy and sunny melodies with which they imbue their folk and blues based repertoire. On occasions they can get darker, with vocalist Liam O Maonlai letting go a particularly desperate howling, screaming vocal on the song Lonely Lane.

More typical is the hit single Don't Go, a beat that sticks steadfastly in the groove and an insouciant vocal that imparts the feeling of good to be alive.

PHILIP GLASS

POWAQQATSI

(Elektra/Nonesuch)
Catalogue No: 979192-2

Philip Glass is a minor player when it comes to chart action, but his ability to invoke atmospheres has consolidated his reputation as one

of the world's best avant garde compasers, while allowing him to escape the commercial constrictions that now burden higher profile artists such as Lauri Anderson.

Powaqqatsi (pronounced: po-wa-KOT-see) is the soundtrack to Godfrey Reggio's documentary of the exploitation of the Third World by industrialised nations. It is the second collaboration for Glass and Reggio, five years ago they won acclaim for Koyaanisqatsi, which examined the plight of the American Red Indian.

The remarkable thing is that both documentaries feature no narration — the music and images aim to form a sensibility that will flood the viewer with emotion.

Reggio says his aim is to send the viewer into a "conscious trance" from which the exploitation of Third World Culture will be felt more profoundly than through rational thought. The downside of this theory is that the message of suffering can be blocked out, as images of horror and discomfort are transformed into a visually stunning ballet.

Certainly the soundtrack, which was compased during editing of the film, is more remarkable for Glass' ability to fuse indiginous music and sounds into a series of uplifting anthems, clattering atmospheres and depictions of tranquil moods. To this end, Powaqqatsi (the music) works just fine as multi-textured mood music, just the thing to soothe away the mental strain of a hard day at the office.

At time of writing there is no indication of when or whether the film will be released in Australia and only a limited stock of the album has been imported.

VARIOUS ARTISTS

ATLANTIC SOUL BALLADS

(Atlantic).
Cat No: 241136-2

"16 tracks and every one a little beauty!!" double emphasises the accompanying blurb for this CD-only compilation. It would be strange if every one wasn't, because Atlantic Records, which this year celebrates its 40th anniversary, owns arguably the world's strongest soul catalogue.

Certainly, from the 60s to early 70s with a roster of artists of the calibre of Otis Redding, Aretha Franklin, The Drifters, Wilson Pickett, Percy Sledge, Solomon Burke, Brook Benton and Ben E. King, Atlantic were the cutting edge of commercial soul.

Not as smilingly slick as Motown, not as gruffly roots R&B as Chess, Atlantic boss Ahmet Ertegun had an uncanny ability to marry great voices with pulsating arrangements and strong songs. Some of the best are present here — Otis Redding's wilfully teasing delivery of Try A Little Tenderness and Aretha Franklin's I Say A Little Prayer, for example.

There are gems that may be more unfamiliar — The Persuaders Thin Line Between Love And Hate. Sam & Dave's Something Wrong With My Baby and Brook Benton's Rainy Night In Georgia.

Inevitably, some selections will not meet with everyone's approval — Clarence Carter's maudlin Patches and Barbara Lewis' lacklustre rendition of Baby I'm Yours, are my picks to be deleted from the programme selection.

Videos

Peter Brown

THE HUNCHBACK OF NOTRE DAME

Distributed by CEL

Rated PG

★★★★ Not quite the classic version of the tale, this lofty mantle being reserved for the original silent version starring Lon Chaney Snr., nevertheless, this effort does fine justice to the Hugo tale. Charles Laughton stars as Quasimodo, and while the purists may object a little to the constant mugging of the star, the power of his portrayal cannot be denied. However, my favourite of the piece is the vicious churchman played by Sir Cedrick Hardwicke. He entertains a passion for Esmeralda, bewitchingly portrayed by Maureen O'Hara and he pursues her to the end. Hardwicke absolutely dominates the screen and his black presence is a constant harbinger of evil. A very young Edmund O'Brien stars as the hero and keep an eye out for Thomas Mitchell, absolutely grand as the king of the thieves. The Parisian sets are massive as is the Notre Dame facade and despite its years, this film is a classic in the true mould.

9½ WEEKS

Distributed by Roadshow

Rated R

★ This was supposed to be one of the entertaining and raunchy films of the decade, that is if you believe all the publicity hype. However, I found it a complete bore. I have yet to be convinced that Kim Bassinger is any sort of actress and she has too much of a load to bear in the lead role of this less than thrilling offering. She stars as a lady utterly bewitched by Mickey Rourke, a ne'er do well if ever there was one. However, what unfolds is a saga of seaminess that irritates to the degree that lassitude and boredom enter the scene. Neither Rourke nor Bassinger are convincing in their roles. And, to be brutally frank, even if they were, who cares anyway? The basic villain in this piece is the total absence of a coherent or interesting storyline. This video is best left on the shelves.

PHILADELPHIA EXPERIMENT

Distributed by Roadshow

Rated PG

★★★ This is a surprisingly good offering, considering the fact that it is semi-science fiction and stars a host of forgettables. The basic premise is an experiment gone horribly wrong when two sailors from a World War II destroyer are suddenly cast into the future. Believable, surprisingly thrilling and fast paced, this film is intriguing, gripping and somewhat galling in that it makes you think of the world of today and the craziness of an experiment gone wrong. Michael Pare and Nancy Allen are the two main stars, she a modern miss cast into the maelstrom of events and he, the poor beleauguered refugee from the past. Recommended for family viewing.

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.

YAMAHA

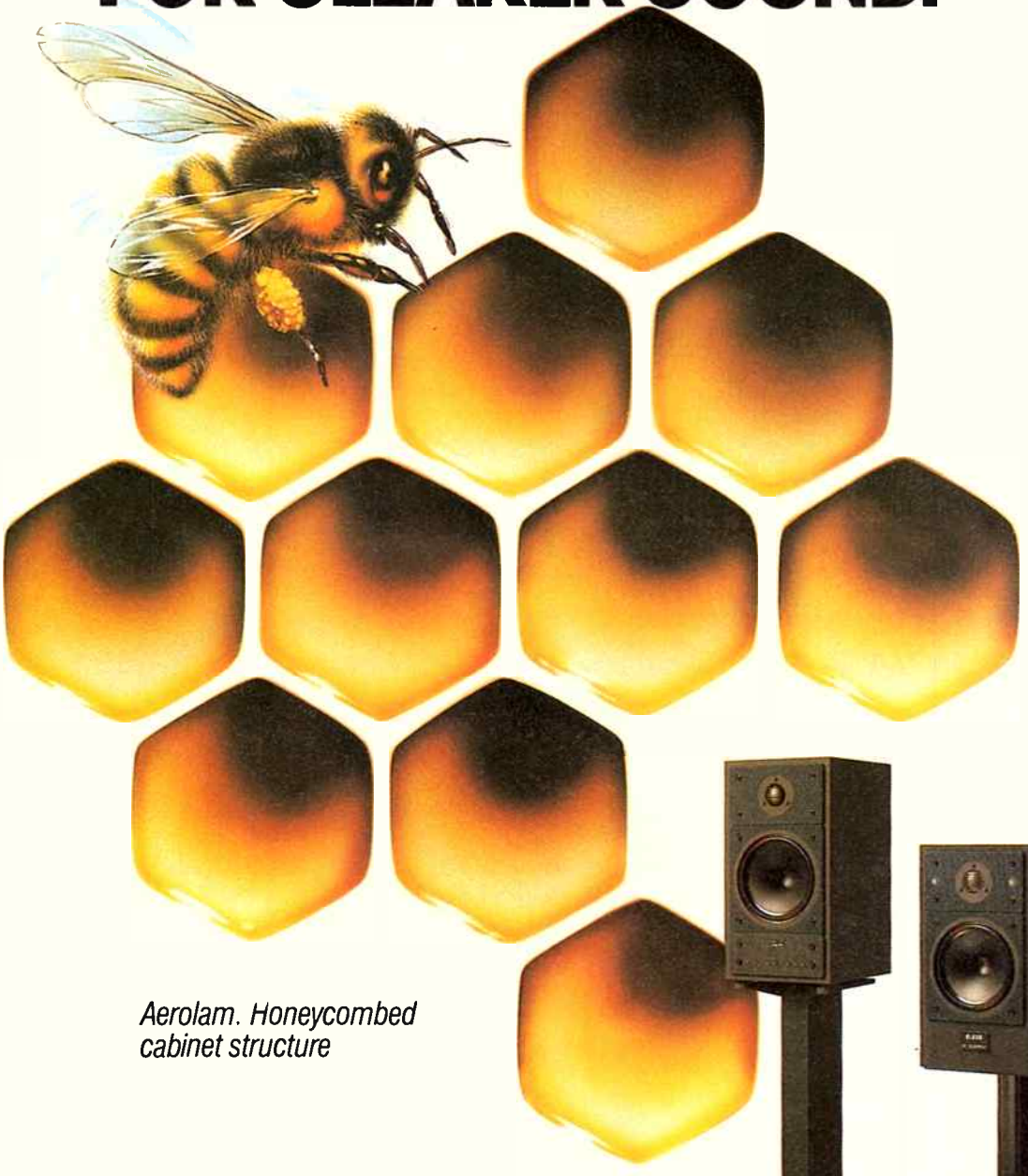
5 YEAR WARRANTY.

12 month warranty on laser heads.

READER INFO No. 19

Saatchi YAM044

WE USED THIS AS THE INSPIRATION FOR CLEARER SOUND.



Aerolam. Honeycombed cabinet structure

The Award Winning SL700 is now the Industry's landmark in speaker design. Prominent critics have quoted — "When sat dead centre, the sound from the SL700's seemed to extend well beyond the speakers. Instrumental definition of complex passages was outstanding."
Julian Hirsch — Stereo Review, Sept. 87

UK — "If the overall performance of the SL700 had to be summed up in just two words they would be 'precision' and 'transparency'."
David Prakel — Hi Fi News, Nov. 87

JAPAN — HI FI VIDEO AND AUDIO AWARD 1988
JAPAN — COMPONENT OF THE YEAR 1988

SL700 **SL600**

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268 Princes Highway, Arncliffe, NSW 2205 Sydney. Australia.
Tel: (02) 597 3683 Facsimile: (02) 597 7241

CELESTION
SL SERIES

READER INFO No. 35

The AT-GPIB from National Instruments — a high-speed IEEE-488 interface.

IEEE-488 Interface for 16-bit IBM PC/AT

Elmeasco Instruments has released a new IEEE-488 interface for the IBM PC/AT. It can connect with up to 13 additional devices or instruments (or more using a National Instruments IEEE-488 extender). A computer configured with the AT-GPIB becomes an IEEE-488 controller.

For further information contact Elmeasco Instruments on (02) 736-2888.

READER INFO No. 267

Portable PROM

The PROMAC 2 is an economical programmer for EPROMs and EEPROMs. It programs all popular 24/28 pin devices up to 512K. With an optional adaptor it can also program a variety of single chip microprocessors. The slimline compact design allows it to be easily slipped into a briefcase or technician's toolkit. An operating voltage range from 85 to 265 Vac lets it be used virtually anywhere.

For further information contact Alfatron Bayswater, Vic. on (03) 720-5411.

READER INFO No. 268

Multigate to Apple

Webster Computer Corporation, has announced multigate, on Ethernet gateway. It was jointly developed by the Department of Computer Science at Melbourne University and Webster Computer Corporation.

Multigate can be used as a gateway between an Ethernet connected host computer running TCP/IP and up to 4 AppleTalk networks. AppleTalk is the networking protocol used by Apple Macintosh computers. Alternatively, Multigate can connect up to 4 AppleTalk networks without the necessity for connection to Ethernet.

Details from: Webster Computer Corporation, (03) 764-1100.

READER INFO No. 269

Webster's Multigate

The Promac 2 programmer from Alfatron in Melbourne.

Voca Communication's ADX37 and ADX17.

A new line on the line

Voca Communications, has introduced its new ADX range of telephone handsets.

All three models come with a 30 number memory, on hook hands-free dialling, three position ringer volume control, two position ringer tone, redial, earth/flash key, electronic hold, tone/pulse, chain dialling to combine multiple memory locations, and a pause button.

Contact: Voca Communications, (03) 697-7000 for more info.

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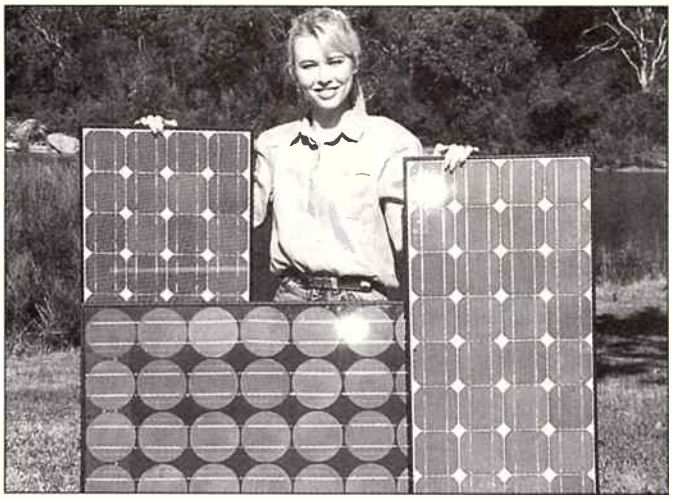


BP's Suntamer solar modules offering a choice of 44, 52, and 58 watts.

Watts under the sun

One of Australia's solar electric companies has released a new range of solar modules designed to reduce the cost of solar installations.

BP Solar Suntamer range features three new modules designed and manufactured in Australia to meet a growing demand for solar electric systems. Modules with outputs of 44, 52 and 58 watts provide greater flexibility and cost effectiveness for a wide range of solar power applications.

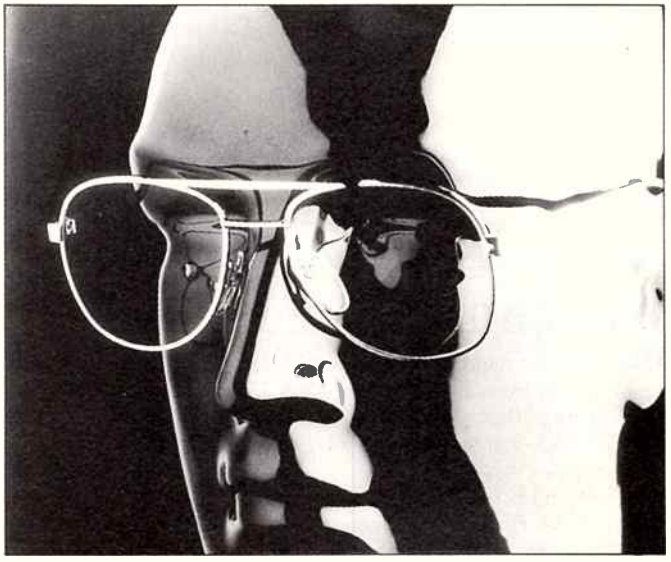
BP Solar Aust. on (02) 938-5111. READER INFO No. 272

Glare ware

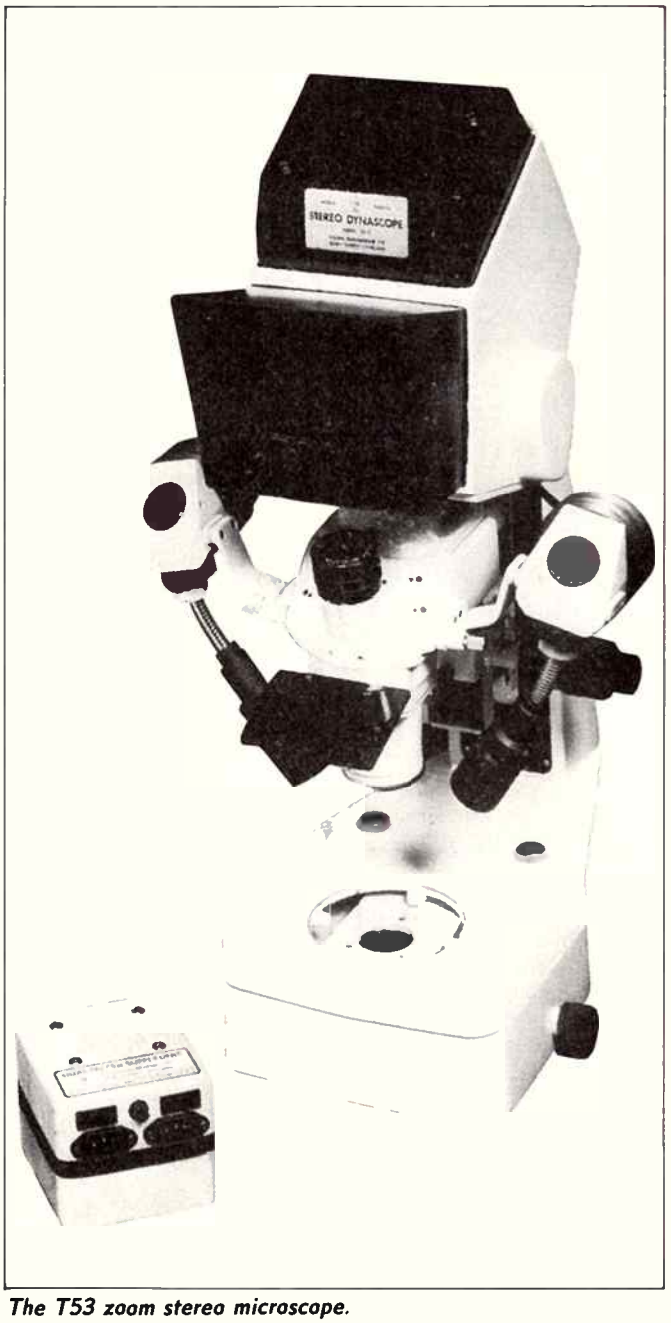
Night driving glasses, from Speed-Safe in Sydey are designed to reduce the glare from on-coming vehicles whilst retaining up to 98 per cent of your natural vision.

They are not sunglasses, in fact they make very little difference at all during the day, and are designed for open road use, not in town where high ambient light limits their benefits.

For more details and orders ring Speed-Safe on (02) 558-4004. READER INFO No. 271



Night driving glasses from Speed-Safe.



The T53 zoom stereo microscope.

User-friendly projection microscope

Dynascope is a projection microscope system from Vision Engineering that displays a genuine 3D stereo image on a screen — essential for inspection and rework of the smaller PC Boards and artwork of the Surface Mount Industry.

Manufactured in England by Vision Engineering, pioneers of this technology, the Dynascope range of microscopes and scanners has found acceptance in Australia.

Call the Penn Central Group, on (02) 648 1661.

Plotting in colour

A new colour thermal transfer plotting system by Benson lends itself ideally for CAD/-CAM and image processing applications that require colour output. The system consists of Benson's Colour Thermal Transfer Plotter and the Colour Image Processor.

An A-size plot can be generated in as little as 45 seconds in draft mode; the maximum timed needed to generate a B-sized, full-screen CRT plot is 180 seconds. The plotter uses a three-pass technique to lay down yellow, magenta, cyan, and black. For more details contact Schlumberger on (03) 560-1166.

Automated videotape library

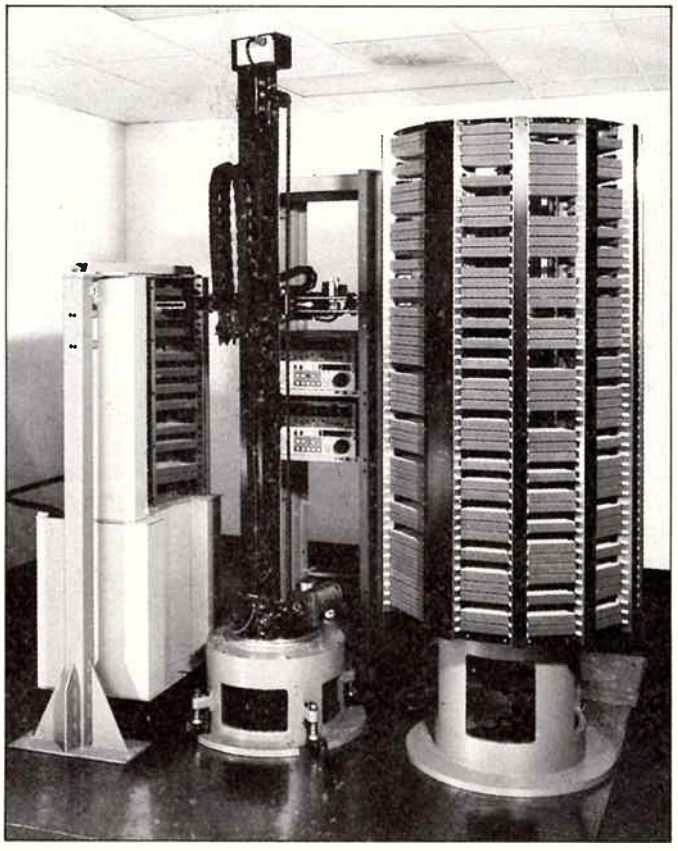
LaKart Corporation has recently released the production version of the LaKart ALS fully automated video tape cassette library system.

The system is expandable in modules of 500 cassettes up to 1500 video tape cassettes on line. The ALS is a total library system and will play tapes on a random access basis.

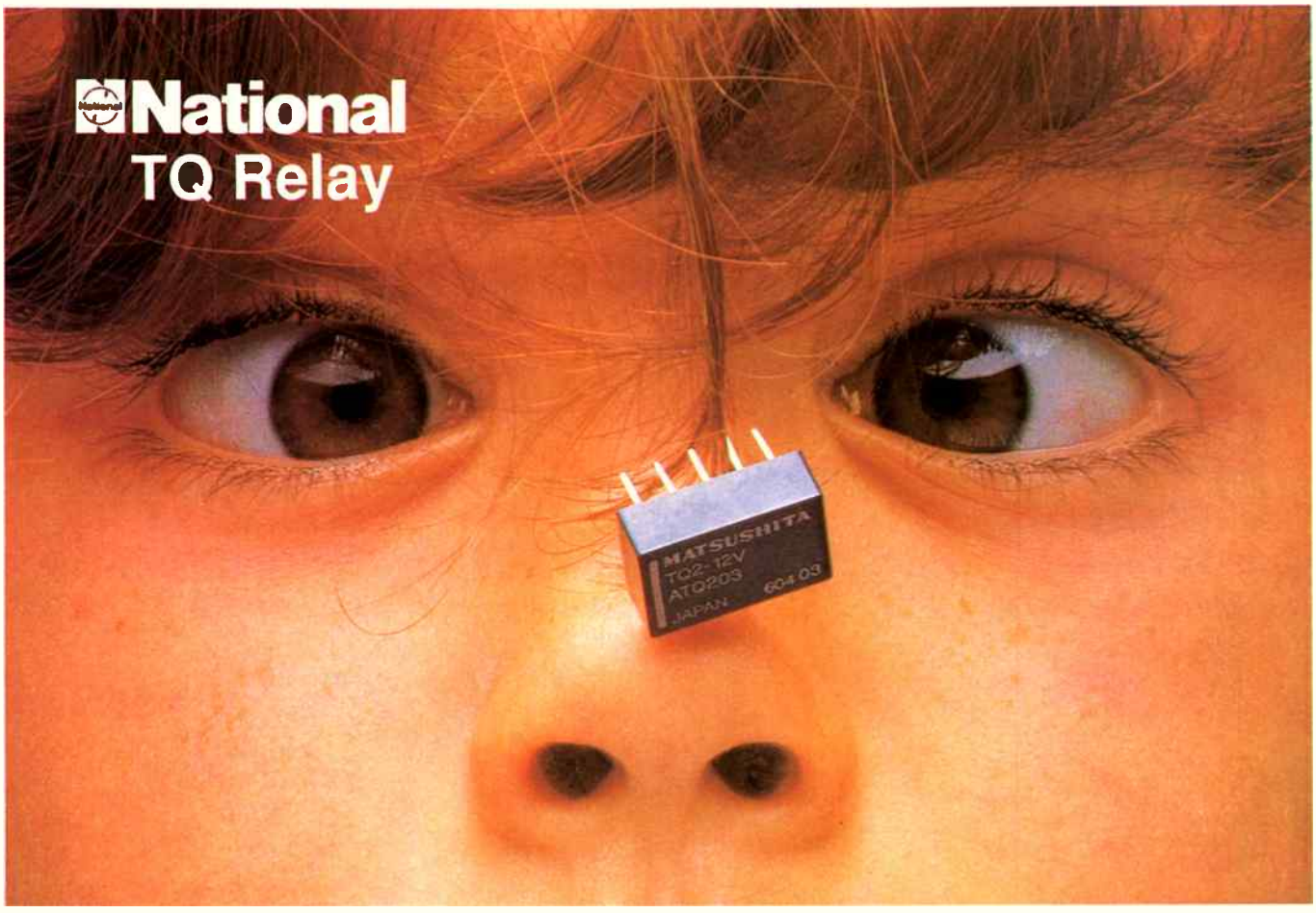
The ALS uses an industrial robot driven by a Motorola 68000 32 bit CDU operating at a 12 MHz clock speed.

The ALS is format flexible and may be implemented in a number of video cassette formats such as Beta, Beta SP, MII, D2, U-Matic and S-VHS,

For more information contact Quantum Pacific, Brookvale, NSW. (02) 975 1323.



The LaKart fully automated videotape cassette library system.



So Tiny....

Is this the world's smallest 2 Form C, sealed, DIL relay in volume production?

Only 5mm. high and weighing 1.5 gram. National's TQ relay sets new standards in small signal switching

Fast! How about 2msec. operate time?

Reliable! TQ's bifurcated gold clad contacts ensure it.

Powerful! 30Watt or 62.5 VA switching puts TQ streets ahead of any DIL reeds.

Sensitive! TQ requires a mere 140 milliwatts drive.

Design Flexibility! Single-side stable, latching, 2 C/o or 4 C/o: - DC to 900Mhz, microvolts to 125Volts - Anywhere you need fast, reliable small signal switching TQ is the answer.

Economical! For around $3.80 ea. at 500 pcs there isn't a relay made that can match TQ spec. for spec., dollar for dollar.

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220 Pacific Highway,
Crows Nest N.S.W.2065
Tel: (02) 957 6385
Fax: (02) 929 5334

RVB - MORE REASONS TO CALL

READER INFO No. 22

Fast Sprint

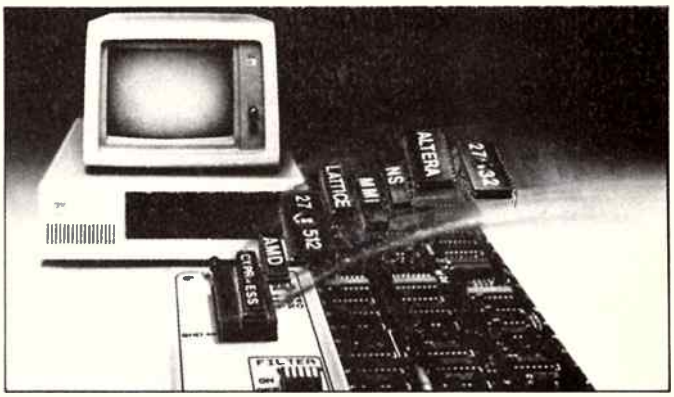
Sprint Plus is a low cost EPLD/EPROM. The system includes 33 PALS and EPLDS from 9 different vendors, and programs 30 types of EPROMS from 14 vendors, plus has a PLD macro assembler while all PROMS and EPLDS from Cypress Semiconductor, are supported.

Sprint turns the IBM and compatible PC/XT/AT range of Microcomputers into a complete development tool for both CMOS and BIPOLAR technologies.

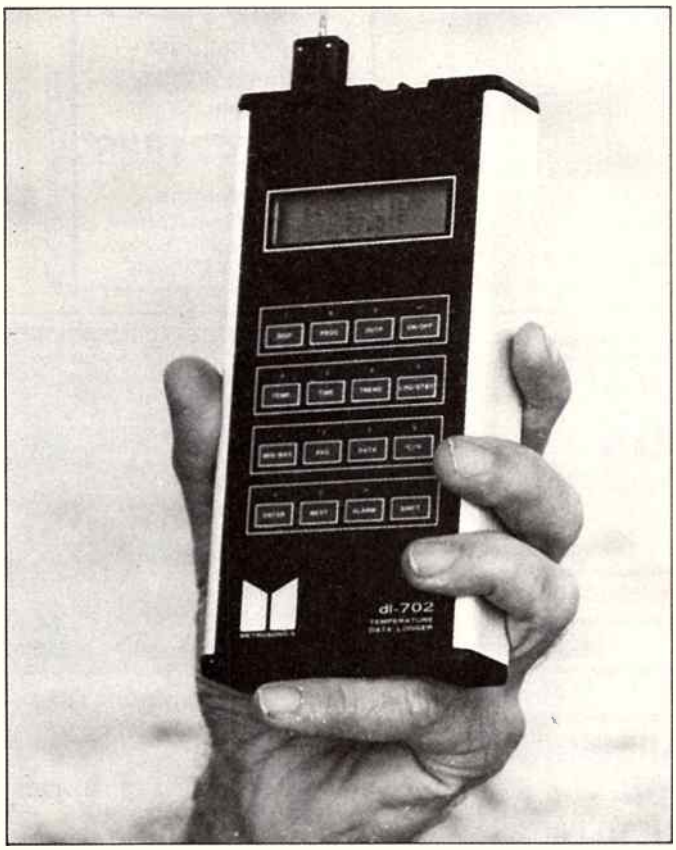
No serial port is required, one long slot and 256 K bytes of RAM are all that are required to interface to a PC. The Megapod allows both 28 and 32 pin devices to be programmed, and all NMOS and CMOS up to 8 megabits will be eventually supported.

Further details: Dynamic Component Sales (03) 873-4755.

READER INFO No. 273



Sprint turns IBM PC type into a development tool for a wide range of technologies.



Point of measurement temperature logger by Metrosonics.

Go-anywhere temperature logger

Australian Metrosonics has released a micro-computer-based temperature logger. The new Model 702 is configured like a hand-held calculator. The Model db 702 performs the combined functions of temperature measurement, display, alarm, data logging, analysis and reduction. For further information: Australian Metrosonics on (03) 233-5889.

READER INFO No. 275

Gates open on energy products

Gates invented and patented the starved-electrolyte recombining sealed-lead battery. One of the two forms this development takes is in the Cyclon wound cells and monobloc batteries.

Cyclon products feature a pure lead grid for long life.

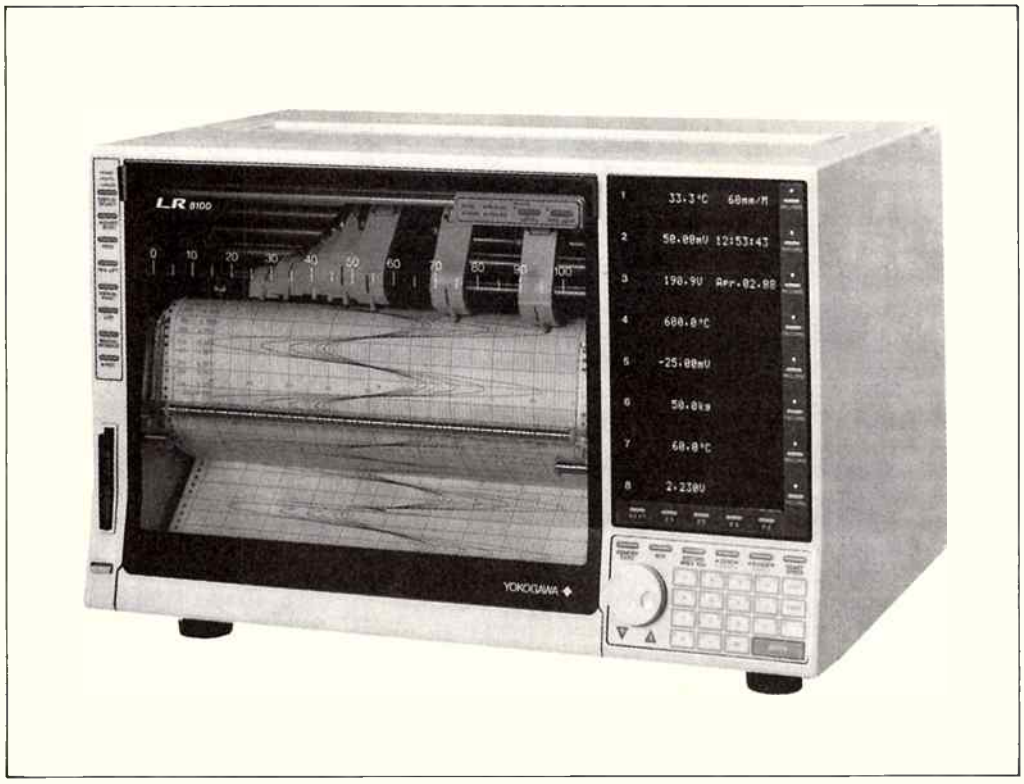
The recombination design eliminates water addition.

Cyclon cells range in size from 2.5-25 amp-hours.

More information from Anitech. (02) 648 1711.

READER INFO No. 274

Gates' energy products — claims to have eliminated leakage.



New recorder series

Parameters has released a new series of Lab pen recorders called the LR8100 series. They go up to eight channels, and a wide range of input configurations. They can be controlled via an RS232 or GPIB interface. Phone (02) 888-8777 for more information.

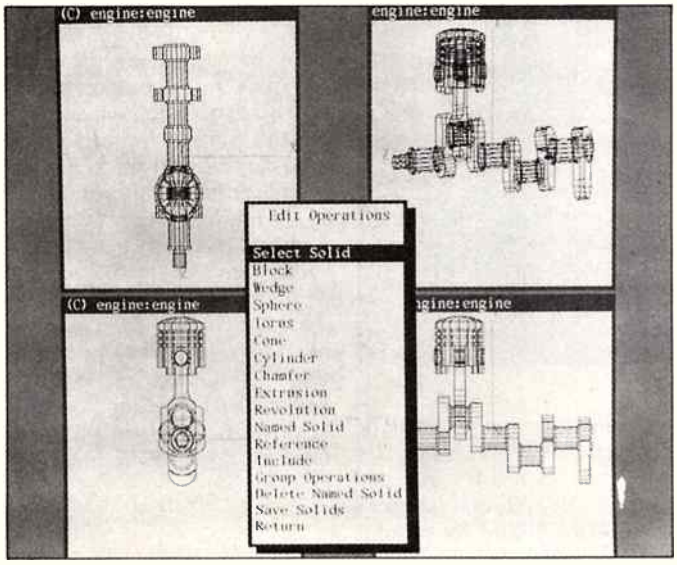
READER INFO No. 276

Parameters' LR8100 recorder.

New desk-top MCAE modeller

Autodesk Australia has announced the introduction of AutoSolid, a solid modelling package. It links to AutoCAD, the world's most widely used CAD package, as well as a wide range of third-party applications for tasks such as analysis engineering and numerical control manufacturing. You may call Autodesk Aust on (03) 429-9888.

READER INFO No. 277



Images created on the Autodesk modeller.

Capacitor catalogue

RIFA have recently released their new 1988 Capacitor Catalogue.

It provides comprehensive data on RIFA's range of Electrolytic, Interference Suppression, Pulse, Power and Precision capacitors as well as detailed design information.

Further information is available from Rifa, Preston, Victoria 3072, phone (03) 480-1211.

READER INFO No. 278

SEMI-CONDUCTOR WATCH

Single chip floating-point processor

Texas Instruments Single Chip Floating-Point Processor, the SN 74ACT8847, per forms high accuracy scientific calculations as part of a customised host processor. The chip can perform 33 million floating-point operations per second (MFLOPS) in single and double precision operations and is particularly suitable to high-level computer systems such as workstations, minicomputers and 32-bit systems or advanced graphic processing, digital signal processing and array processing.

The one-micron EPIC advanced CMOS device combines two 64-bit functions, a floating-point multiplier and a floating-point arithmetic logic unit (ALU). The 8847 is fully compatible with the IEEE 754-1985 standard and supports IEEE single and double-precision formats. It performs fast floating-point addition, subtraction, multiplication, division, square-root and comparison. Chains of sum-of-products and product-of-sums operations are also supported. The device can also function as a numeric processor capable of performing division, square root operations, inter ALU functions and logical operations including logical shifts.

The single-chip, floating point processor

When fully pipelined, the ACT 8847 performs a double-precision floating-point or 32-bit integer operation in 30ns which translates to 33 MFLOPS. With the multiplier and ALU operating in parallel, the 8847 has a performance of over 50 MFLOPS. A double precision IEEE divide can be executed in 11 30 ns cycles.

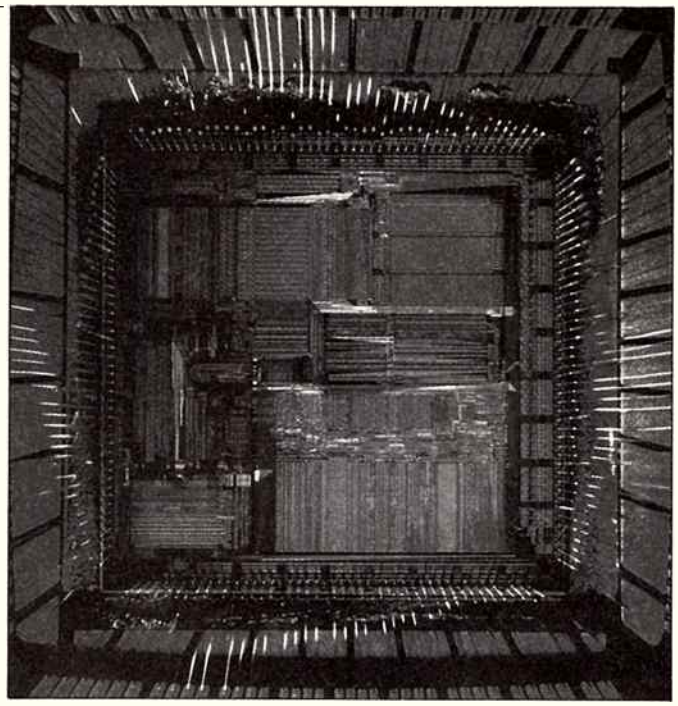
Registers are provided at the inputs, outputs and inside the ALU and multiplier. The device can be completely halted without affecting the data stored in these registers. Four data multipliers are also available on the chip. Power dissipation for the 8847 at 10 MHz is approximately one watt and it operates from a single 5-Volt power supply. The device is packaged in a 209-pin grid array.

For further information contact:—

Texas Instruments Australia on (02) 887 1122 or DWR Communications Group on (02) 909 3188.

New 88000 microprocessor family

Motorola has released details of their new 88000 Reduced Instruction Set Computer (RISC) processor. The Central Processing Unit (CPU), designated the 88100, operates at 10 MHz and delivers 14 to 17 million instructions per second (MIPS). Used in multiprocessing applications, it generates 50 MIPS. By using integer and floating point functions on a single chip, the 88100 sustains 7 to 12 million floating point instructions per second (MFLOPS). Scoreboarding which is a feature taken from mainframe technology allows a number of operations to be managed concurrently. The 88100 can have up to 11 different instructions in process during any clock cycle. The architecture is particularly suitable for the "Supermini-computer" market including multiprocessing and multitasking applications.



Inside the 88100 CPU

The 88200 cache memory chip supports the 88100 and it contains 16 k Bytes of memory as well as a memory management unit (MMU). Multiple 88200's can be used to increase memory and the 88100 can support up to eight 88200 for a total of 128 kBytes of memory.

AT and T will make the applications binary interface (ABI) specifications and associated implementation of UNIX system V release 4.0 and later releases available for the Motorola architecture through it's UNIX software licencing program. The first system V release 4.0 software for the Motorola architecture is expected to be available in late 1989.

A large number of independent software vendors have announced compilers and software applications for the 88000 family. Motorola has also introduced a series of multiprocessing boards called Hypermodules that deliver up to 50 MIPS on a circuit board measuring 3.4 × 8.5 inches. The initial version will be available in the third quarter of 1988 with full shipment in the first quarter of 1989. It will be sold through Motorola's Microprocessor Products Group and Microcomputer Division.

Introducing MAXX™ for your personal computer. The new way to play your games.

Joystick Controllers Available for *IBM XT-AT-386 Up to 16 MHZ

Available for *IBM and *Apple Computers.

Come in for a test flight!

MAXX™ makes sense. Used as a practice tool, even veteran spray pilots can brush up on operations in controlled air space.

MAXX™ means adventure. Ace pilots can touch and go in a variety of aircraft.

MAXX™ makes it easy. Become a MAXXPilot™ and experience the "real" feel of flight at your personal computer.

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*IBM is a registered trademark. *Apple is a registered trademark.

READER INFO No. 30

Hamilton Island

GREAT BARRIER REEF • AUSTRALIA

THE BEST RESORT IN THE WORLD

THE BEST ACTIVITIES

Ride a jet-ski. Hire a catamaran, dinghy, surf ski, canoe or power boat. Water-ski, fish, snorkel or scuba dive. Sailboard, parasail or bushwalk. Try tennis, squash, aerobics or the gym. Or just lie on the beach and soak up the sun.

THE BEST ACCOMMODATION

There are individual "Polynesian-style" Bures, spacious hotel rooms and luxury, self-contained suites with up to three bedrooms. All have king or queen size beds, ceiling fans and spacious balconies and the views are spectacular.

THE BEST FAMILY FACILITIES

As well as their own supervised Kids Club (for those under 12), the children will love meeting the kangaroos, emus, koalas, wallabies, deer and birdlife in our mountain-top Fauna Park. And that's on top of all the other island activities.

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*All prices include return economy airfare and share twin Allamanda or Bure accommodation. Similar savings are available in Bougainvillaea hotel rooms and one and two bedroom apartments. These prices are available April 30 to September 18, 1988.

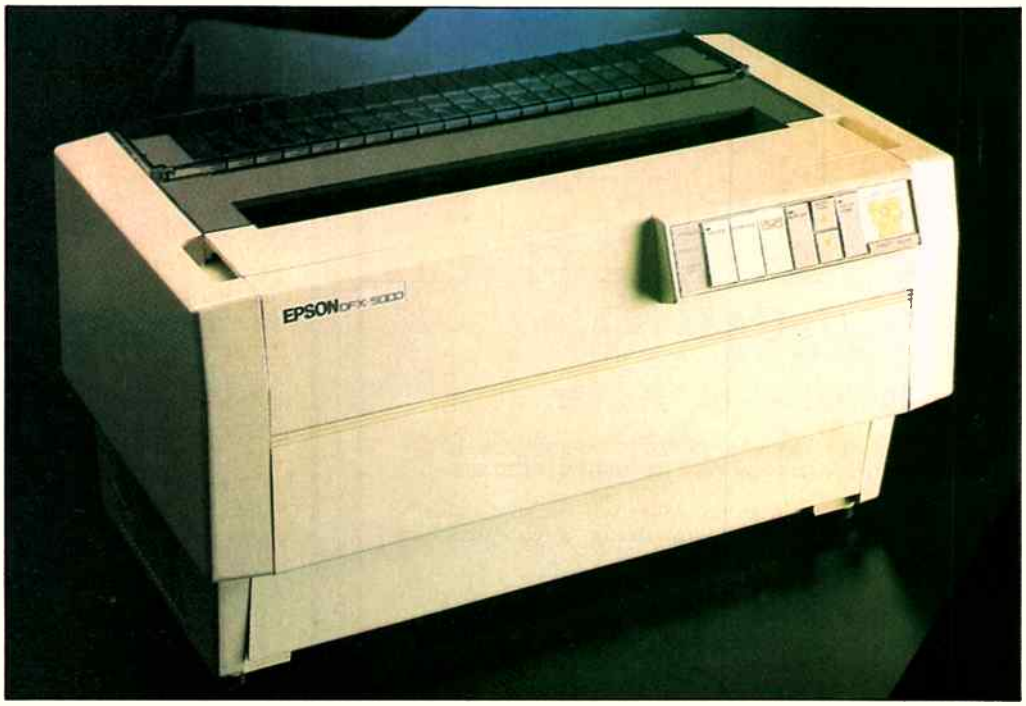
Line printer in the long run

Epson Australia has released the DFX-5000, a high speed, heavy duty printer that has been specifically designed for long print runs.

Filling the gap between high cost line printers and traditional impact dot matrix printers, the DFX-5000 is ideally suited for continuous report generation where speed and continuous use are of paramount importance.

The DFX-5000 prints at 533 cps in high speed draft mode, and the long life print head is capable of printing up to 200 million characters.

READER INFO No. 279



Epson's DFX-5000 9-pin impact dot matrix printer

Adapt, convert and store

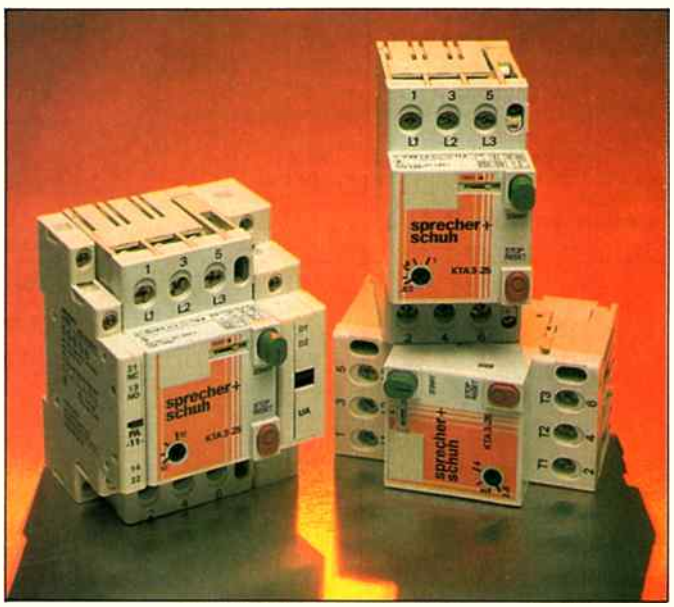
Polar's DS102 oscilloscope converter.

The Polar DS102 is an adaptor that converts a conventional analogue oscilloscope into a fully featured 10 MHz sampling rate digital storage oscilloscope.

It has true dual channel operation using twin flash analogue to digital converters (one per channel), a sampling speed of up to 10 megasamples/second in both single and dual channel modes,. 8 bit vertical resolution, 2048 byte memory per channel, conventional front panel digital storage controols and a simple 3 lead interconnection to the analogue CRO.

More details from Emona on (02) 519 3933.

READER INFO No. 280



Terasaki's Din-T range features 12 arc extinction plates, de-ionising type, designed to break up and dissipate the arc generated during interruption.

Baby breaks the circuit

NHP/Terasaki offers a choice of DIN-rail mounted miniature circuit breakers (MCB's).

This selection is based on the 9kA and 14kA series and the accessories which convert the ranges into a flexible system for protection, control, switching and monitoring.

For more information contact NHP on (03) 429-2999.

READER INFO No. 281

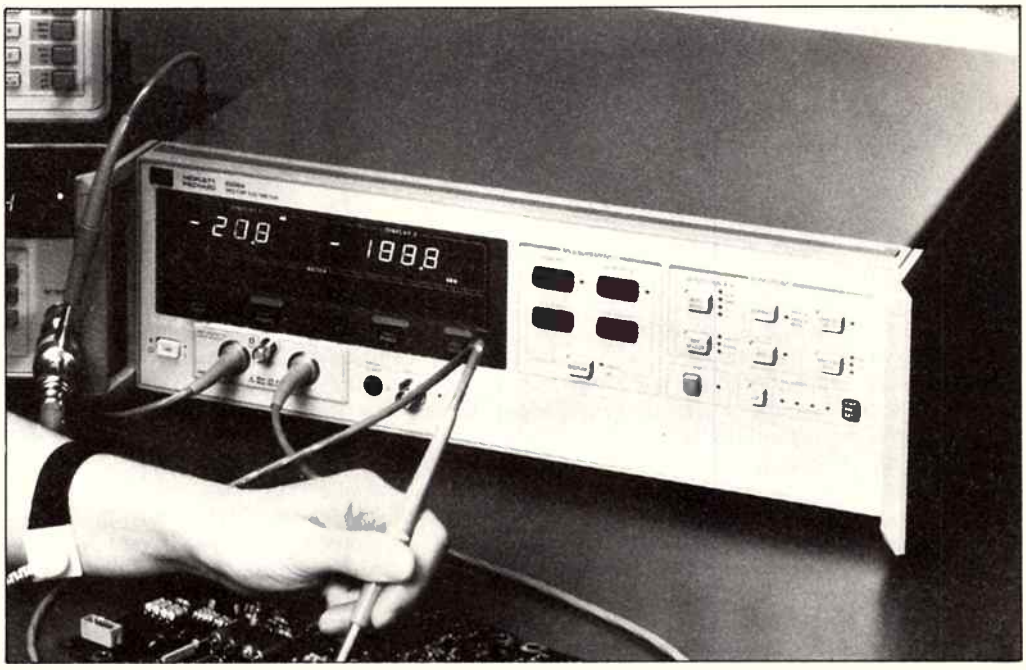
Versatile voltmeter

A new vector voltmeter designed for sensitive rf voltage and phase measurements has been introduced by Hewlett-Packard Australia.

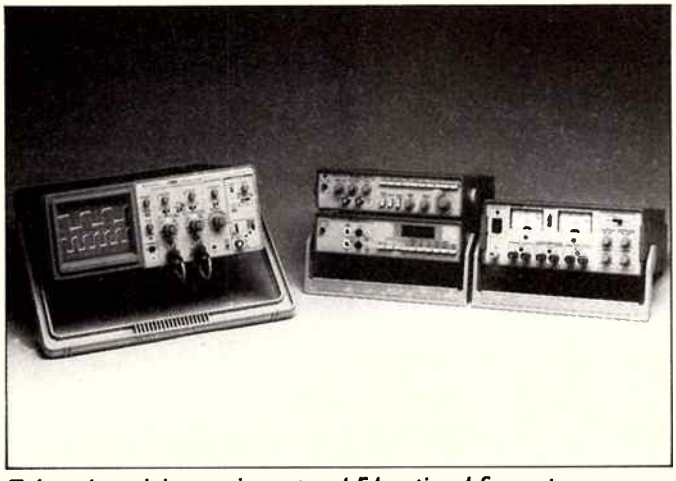
The new HP 8508A can tune across the 100-kHz to 1-GHz or 300 kHz to 2-GHz frequency range. The front end of the vector voltmeter has two channels and is contained in a replaceable module on the front panel. The standard version of the HP 8508A comes with two high-impedance probes.

For further information, contact: Hewlett-Packard Australia (03) 895-2644.

READER INFO No. 282



The HP 8508A vector voltmeter.



Tektronix training equipment and Educational Support comprises Oscilloscopes, Test Materials and Measurement Equipment.

Bench equipment with a touch of class

Tektronix has released its new classroom Series (CRS) laboratory bench equipment for use in colleges and universities, vocational training institutions and secondary schools. The series features lab package pricing and instructional support materials for both digital and analogue equipment.

The Classroom Series includes industrial-quality oscilloscopes, test and measurement equipment, instructional materials and teaching aids in beginning and advanced bench set-ups. More information is available from Tektronix, North Ryde, NSW. (02) 888 7066.

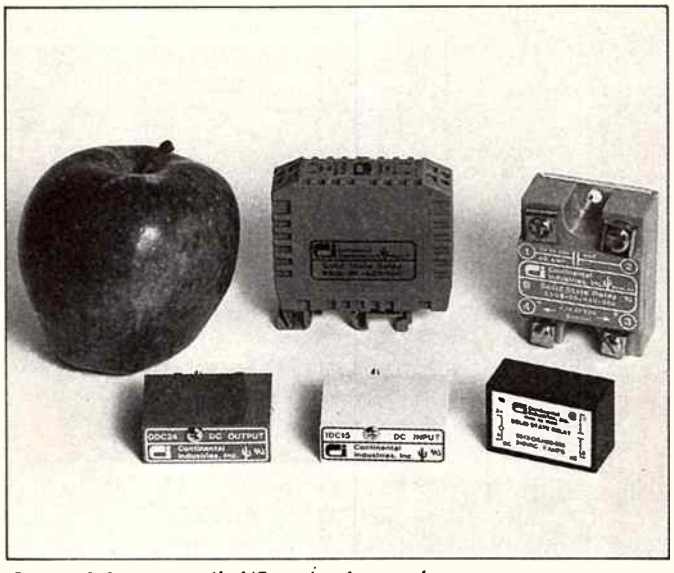
READER INFO No. 284

New local outlet for relay and I/O modules

Amtex is distributing the solid state relay and I/O module range of Continental Industries.

The Continental relays include panel-mounted units for heavier loads and printed circuit and DIN rail mounts for light loads. Featuring 4000 V opto-isolation, the relays have zero voltage turn-on as standard and can be ordered for random turn-on as an option. For more information phone (02) 805 0844.

READER INFO No. 283



Some of Continental's I/O and relay products.

ELECTRONICS
E T I — 6 6 8

EPROM PROGRAMMER

Recently R W Daley, found the need to upgrade his EPROM Programmer.

The changes shown in the enclosed circuit diagram show how the ETI-688 (Feb 1983) may be upgraded to programme EPROMS up to 27512's, using the existing software.

Although the simple approach used in this circuit does not make use of the fast programming algorithms for the latest EPROMS, it can be used with a large number of computers, not just the Microbee as originally described. Many porallel ports are provided by programmable devices such as the Z80 P10,6820/21 and the 6520/21/22 series. Any of these can be used to drive the ETI-668. In addition, the IBM parallel port can be made to drive this programmer by making the port bi-directional, as described by Peter Radcliff (ETI Nov. 1987).

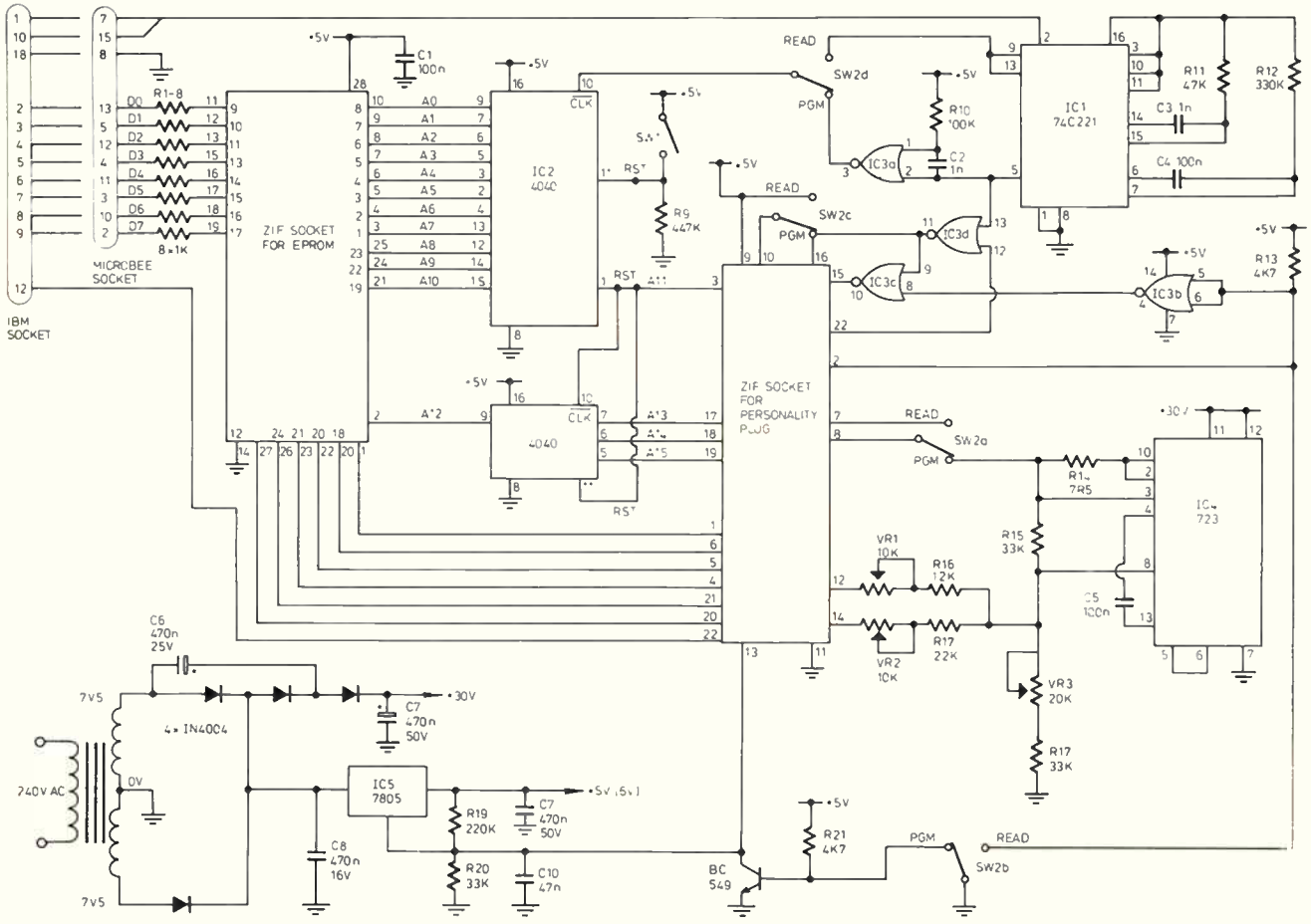
Although the ports of the above devices are programmable as either inputs or outputs, the control lines of most bias the A port to be an input and the B port to be an output. The ETI-668 was originally designed for use with the Microbee and as the Microbee uses the B port, the control lines are programmed as "write handshake" lines. If the A port were used the control lines would have to be programmed for the "read pulse" mode, to generate the clock pulse for the address counter. This applies to most of the devices and must be remembered if the programmer is used with an A port.

Most of the circuit changes from the upgrade published in ETI January 1984 concern increases in address range, Vpp and Vcc. Another was taken directly from the originating trigger pulse which caused the address counter to increment when the programmer was switched from read to programme. I have used the output of the first monostable as the read address clock to prevent this false triggering.

For use with modified IBM clone's an extra control line is extended from the programmer to force the output drives of the IBM clone high impedence in the read mode.

Other than Microbee

As already mentioned this upgraded programmer should still operate on the



existing software, however as the author doesn't run his on a Microbee he can't guarantee this. The only possibility of error is the delay on the clock pulse introduced by the first monostable which may need a software delay for the read mode.

For computers other than the Microbee the software will have to be written specifically for each computer. To assist in this the following algorithms outline the three basic requirements of the programmer.

PROGRAMMING:

1 Request input of source data. (Start and finish addresses)
2 Read and store contents of the Condition Code Register (CCR)
3 Set CCR to generate a clock pulse on the control lines.
4 Set the Data Direction Register (DDR) as an output.
5 Display instructions to switch programmer to program.
6 Output data byte, wait 50 ms.
7 Read the port and discard the result.
8 Increment source data counter.
9 Repeat steps 6, 7 and 8 until complete data is written.
10 Restore CCR. Set DDR as an input.
11 Display instructions to switch to read.

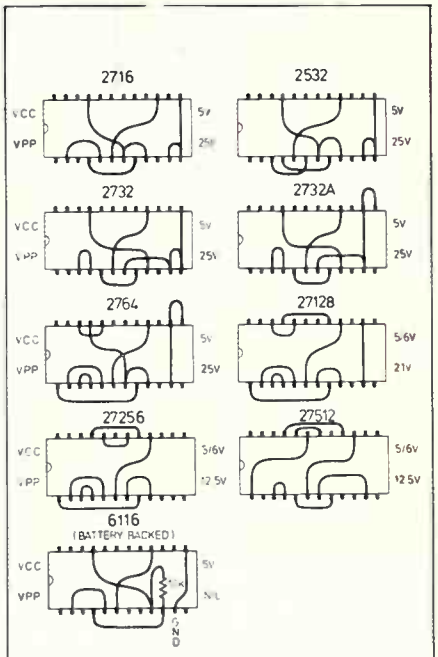
VERIFY:

1 Request input of source data addresses.
2 Read and store contents of CCR.
3 Set CCR.
4 Set DDR as an input.
5 Input data byte and compare with the source data. Print source address, source data dna eprom data if the comparison fails.
6 Output FF (HEX).
7 Increment source data counter.
8 Repeat steps 5, 6 and 7 until last byte has been tested.
5 Restore CCR.

STEP (Advance address counter "N" times)

1 Request number of steps to be advanced. "N"
2 Read and store contents of CCR.
3 Set CCR.
4 Set DDR as an output.
5 Read the port and discard the result.
6 Write FF(HEX) to the port.
7 Action steps a total of "N" times.
8 Restore CCR.

These three algorithms are only the bare bones of the software but should be sufficient to get most people started and are suitable for either A or B ports.



The wiring for the Personality socket is different for each type of EPROM you wish to use. This is a simple but elegant method of reconfiguring the programmer for different pin outs on the EPROMs.

TECHNOLOGY

The Baby AT contains a 80286 processor running at 12 MHz with a processor clock cycle time of 82.5 ns, and an average memory cycle time of 180 ns.

These memory cycles are more than twice as fast as the memory cycle times of an 8 MHz IBM PC/AT running with one wait state.

There is provision for an optional 80287 math coprocessor. The coprocessor runs on a clock that is the same as the processor, and is in the divide by 3 mode. At 12 MHz operation an 8 MHz coprocessor is required.

The ETI-1613 contains space for 36 16-pin DRAMs. when populated with a combination of 256 Ks and/or 64 Ks, the 1613 can support memory maps of 512 K, 640K, or 1 MB. A parity bit for each byte (two additional bits per bank) is provided.

It may be worth noting that VLSI in the US apparently has other boards available that will support the additional memory maps provided for by the CL82CPCAT-compatible chip set of 2 MB and 4 MB when using 1 MBit DRAMs.

For 12 MHz no wait state operation, 80 ns access times are required, and for

In this article the convention —xx is taken to be equivalent to $\overline{xxx}$, meaning that xxx is asserted when logic low.

THE BABY AT:

Feel like speeding up the old PC? Build a high performance AT drop-in board

This is the second article in our series on building a cheap, high performance AT computer. A quick guide to value for money: the unit is being sourced by Energy Control in Brisbane for $499, and features a board with only 18 individual integrated circuits plus the memory, runs at 12 MHz and has zero wait states. That's cheap, easy to build and very, very, quick.

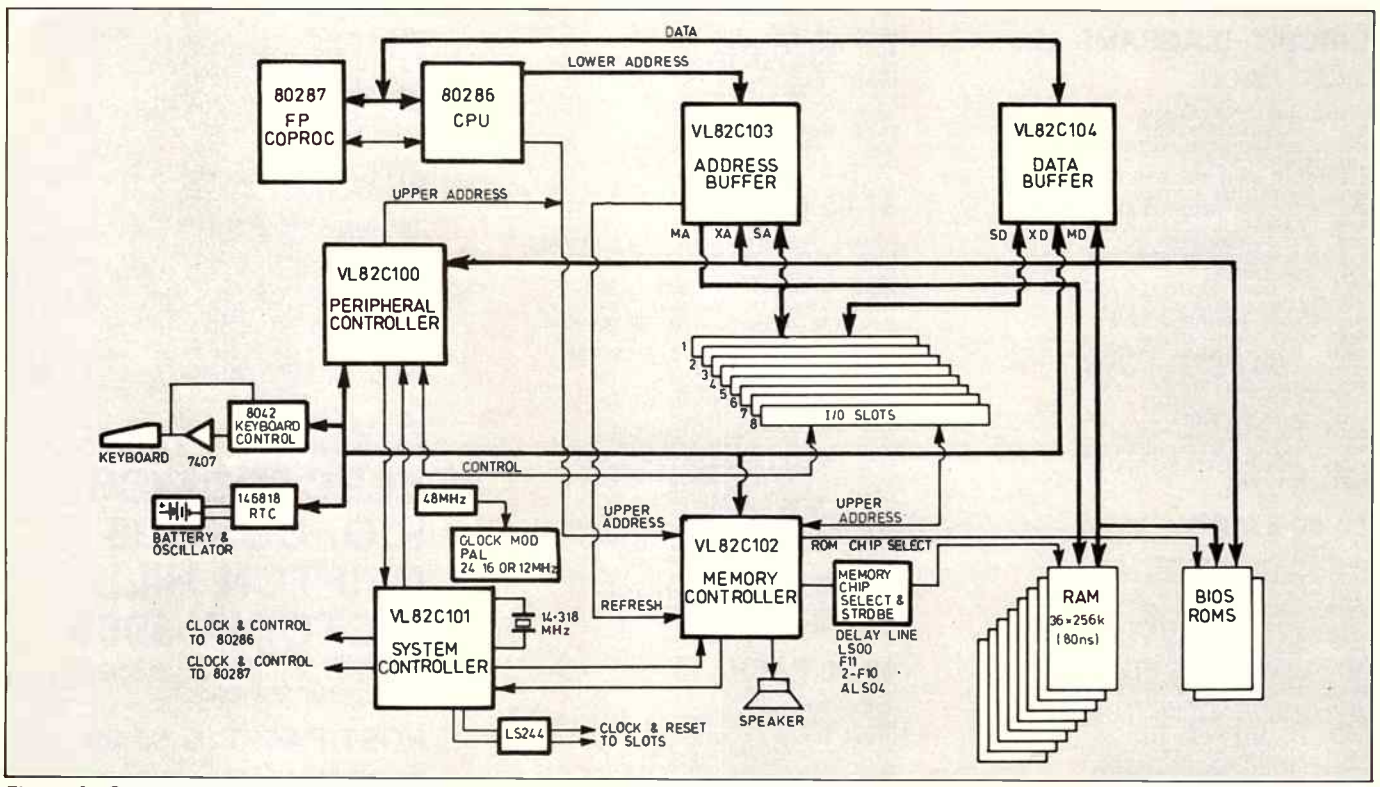


Figure 1: Connections between the chips of the chipset and other components on the board.

12 MHz one wait state operation, 120 ns access times are required.

There is also provision for two BIOS EPROMs that can either be 27128s or 27256s. The access times for the EPROMS can be either 120 ns with one wait state or 200 ns when using two wait state accesses. ROM access cycles are either three or four PROCCLK cycles long. PROCCLK is a 2X clock provided to the processor. In the Baby AT it runs at 24 MHz.

The 1613 provides drive for up to eight XT-compatible cards (six of which can be AT-compatible with the second connector). The bus is directly driven by the chips of the chip set, and can have up to 50 LSTTL loads (drive capability = 20 mA), and 200 pF. The 200 pF is the practical limitation to systems since a conservative rule of thumb is that PC-compatible cards rarely exceed 25 pF per pin. The 200 pF limitation allows for all eight slots to be papulated and not violate any of the driver specifications. For expansion bus access, four wait states are automatically added, thus making reads and writes into six cycle operations.

Although the five chips reduce the complexity of the board considerably, it is quite impractical to either publish a complete circuit diagram, or even give you a complete how it works. We just don't have the space. However, one can get a pretty good idea of what's going on by discussing the internal design of each of the chips in the chip set, and by looking at the pin out descriptions.

As we discussed last month, the ETI-1613 is based on a VLSI Technology chip set. There are five chips in the set, and the way they fit together is shown in the block diagram figure 1. This is not the only way to do it, as demonstrated in the table which shows a comparison of the different chip sets on the market.

This five-device chip set has been designed using the highest integration consistent with economic and reliable system design. The VL82C103 Address Buffer and VL82C104 Data Buffer are offered in separate packages, although their circuitry is relatively small. If they were offered as a single device, the pin count would be extremely high, or some performance degradation would occur.

The devices are manufactured with VLSI's CMOS process and all five are available in a JEDEC-standard 84-pin plastic leaded chip carrier (PLCC) package.

Five chips contain the majority of the circuitry to implement an entire AT.

The Peripheral Controller

The VLC100 Peripheral Controller integrates two 8237 Direct Memory Access (DMA)controllers, two 8259 interrupt controllers, one 8254 counter/timer and a 74LS612 equivalent along with support logic onto a single chip.

The peripheral controller will replace all the logic on the X bus of an AT-compatible design except the keyboard controller and real time clock.

The VL82C100 is broken up into five major subsections. The chip select subsection consists of decodes of the signals —MASTER, CPUHLDA, and the address bus XA9-0. This decode is used to generate the chip select signals to each of the megacells within the VL82C100.

The DMA subsection consists of two 8237 megacells, two 8 bit latches to hold the middle range address bits during the DMA cycle and a 74LS612 equivalent megacell to generate the upper range address bits during a DMA operation. In the PC environment, DMA is the process whereby some parts of the computer, particularly the disc drives, can exchange data directly with the memory, without going through the microprocessor. The 82C100s DMA subsection also has logic to force all DMA cycles to have one wait state inserted and some logic to delay the leading edge of the —XMEMR signal for one DMA clock cycle. These groups of logic are used to maintain AT-compatability. The DMA subsection provides a total of seven external DMA channels. Four of these channels are used for 8 bit I/O adapters and the other three are used for 16 bit I/O adapters. All channels are capable of addressing all memory locations in a 16 megabyte address space.

The interrupt controller subsection consists of two 8259 megacells cascaded together to allow for 15 possible interrupt sources. One of these interrupt request lines is used internally, so there are a total of 14 passible external interrupts.

The counter/timer subsection contains a single 8254 megacell. This megacell has three internal counters. All of the counters run off a common clock input. The output of counter zero is routed to the interrupt controller subsection to be used as interrupt request zero. The out-

put from counter one is routed to the hold request arbiter to initiate refresh cycles. Counter two's output is available as an external pin.

The hold request arbiter and refresh subsection is used to arbitrate between a possible hold request from the DMA subsection or counter two of the counter/timer subsection. This block of logic also controls the —REFRESH output signal.

Address bits XA9-0 are used to generate chip selects for each of the individual megacells.

System Controller

The VLC82C101 chip generates all the major clocks for an AT-compatible system design along with the command and control signals the primary function of the address buffer is to multiplex the address lines to the system, peripheral and memory address buses for both the system and peripheral buses. It interfaces with the CPU to determine the type of bus cycle to execute and generates the — READY signal to indicate that the current bus cycle can be terminated. It also contains logic to make conversions between 16 bit and 8 bit data accesses. Finally, it generates some of the control signals necessary for the 80287 Numerical Processor.

The VL82C101 contains two oscillators to generate the clocks for an AT-compatible design. Both oscillators are designed to use an external, parallel resonant fundamental mode crystal. The first oscillator is used to generate the videa clock output (OSC) and MHZ119 which is the clock for the 8254 time in the VL82C100. A 14.318 MHz crystal is used on this oscillator to maintain compatibility. The OSC output is generated directly from this oscillator for the system bus and the MHZ119 output is derived from the OSC output divided by 12.

The second oscillator is used to generate the system clocks. The crystal frequency for this oscillator is twice the operating frequency of the CPU so, for a 12 MHz system, a 24 MHz oscillator is used. This oscillator is used to generate four clock outputs. PROCCLK is generated directly from the oscillator and will have the same frequency as the crystal input. This input is connected directly to the CPU and Numerical Processors clock inputs. PCLK and —PCLK are used to clock the 8242 Keyboard Con-

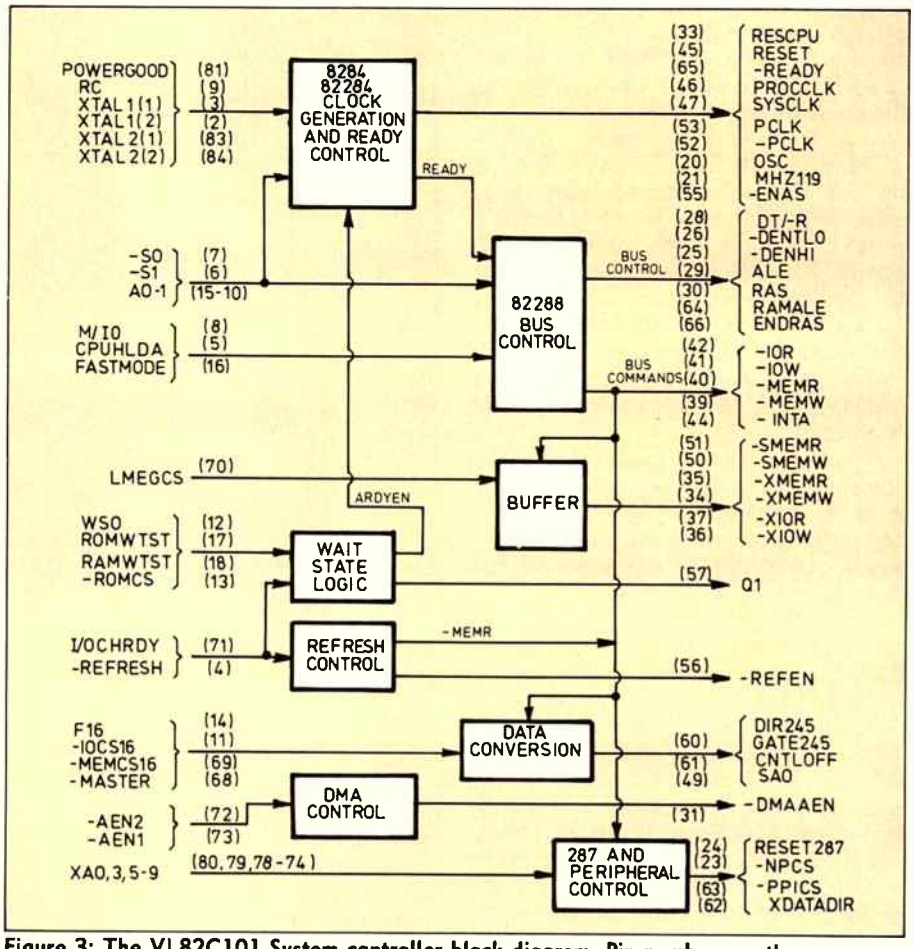


Figure 3: The VL82C101 System controller block diagram. Pin numbers on the package are shown in brackets next to signal names.

PC-AT Chip Set Performance Table

Maker	Custom Chips	PAL's Required	Non Memory IC's	System Clock	Read Waits	Write Waits	Time for 9 reads and one write (ns)	Relative performance
IBM	None	None	88	8.0 MHz	1.0	1.0	3750	1.00
Chips-NEAT	4	None	26	16.0 MHz	0.8	0.8	1750	2.14
Chips 6	6	None	25	12.0 MHz	1.0	1.0	2500	1.50
Zymos 2-16	4	1	39	16.0 MHz	1.0	1.0	1875	2.00
Zymos 2	2	1	39	12.0 MHz	0.0	0.0	1667	2.24
Faraday/WD 4	4	2	26	12.0 MHz	1.0	1.0	2500	1.50
UMC	2	?	53	12.0 MHz	1.0	1.0	2500	1.50
Erso	2	?	53	12.0 MHz	1.0	1.0	2500	1.50
Logicstart	5	None	25	12.0 MHz	1.0	1.0	2500	1.50
G-2 (LSI Logic)	3	2	14	16.0 MHz	1.0	1.0	1875	2.00
VLSI 5-12	5	0/1 (Clock Mod)	17/18 w/clk mod	12.0 MHz	0.0	1.0	1750	2.14

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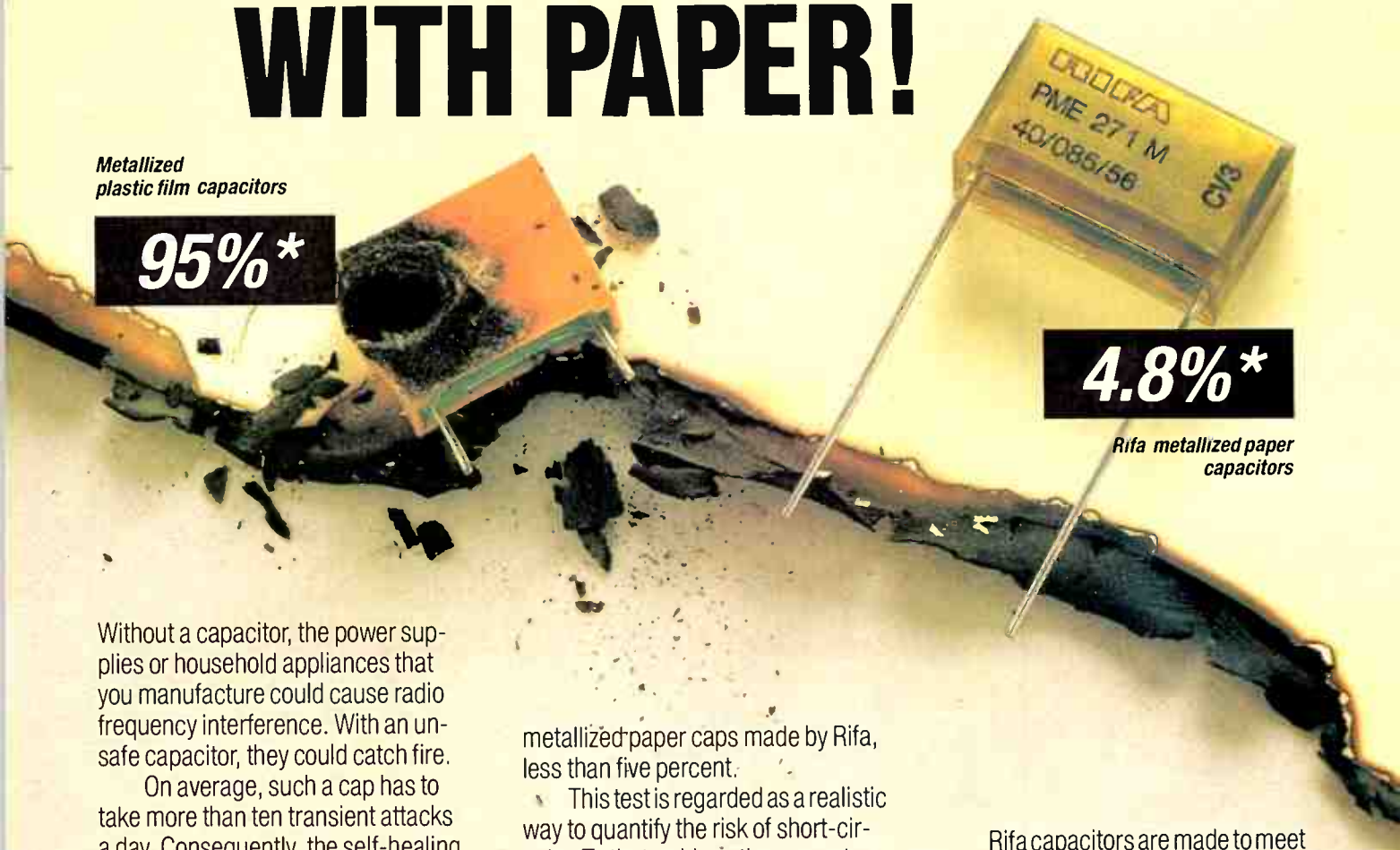

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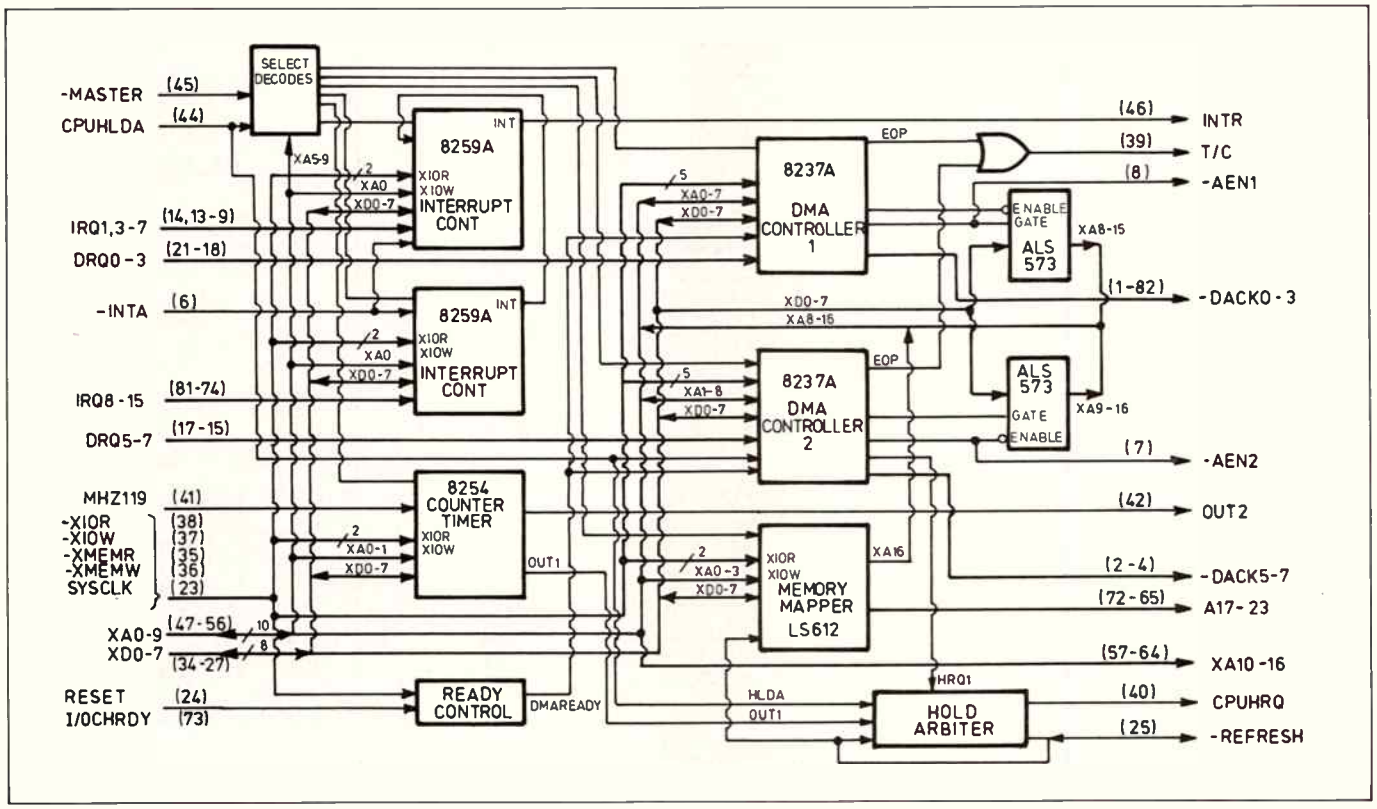


Figure 4: The interior of the VLC100 Peripheral controller block diagram. Pin numbers on the package are shown in brackets next to signal names.

troller. These outputs are free running clock signals with a frequency of half the PROCCLK frequency. The last clock output is SYSCLK. This clock is also at half the PROCCLK frequency, but it will be held low during reset and will not begin running until the first bus cycle is initiated by the CPU. It will then make its first low to high transition on the falling edge of the PROCCLK during the start of the first TC cycle. TC is port of the standard command cycle of the DRAM. This synchronization is done to ensure that the system clock is synchronized with the 80286 internal system clock. The SYSCLK output is used to drive the VL82C100 peripheral controller directly.

The 82284 megacell along with some support logic is used to control the system reset signals and READY signal for the CPU. Two basic reset signals are generated for the system. RESET is the system reset out of the 82284 megacell and is synchronized to PROCCLK. It is generated form the POWERGOOD input signal. RESCPU, the other reset output, is connected to the input on the 80286 processor. RESCPU will be active anytime RESET is active. It can also be generated from two other possible sources. The first is the RC input from the keyboard controller. RESCPU will go active within 4 to 18 PROCCLK cycles after RC is asserted and will go inactive 16 PROCCLK cycles later or 16 PROCCLK cycles after RC is negated. RESCPU will also be generated if a shutdown command cycle is decoded from the CPU. As with the RC input, RESPCU will go active within 4 to 18 PROCCLK cycles of detecting the shutdown command and will be negated 16 PROCCLK cycles later. The POWERGOOD pin has a Schmitt-trigger input so that an RC network can be used to generate the reset signals.

The —READY output is synchronised and controlled by the 82284 megacell. —READY is an open drain output connected directly to the CPU and requires an external pull-up resistor. Bus cycle length is controlled by the —READY output. Bus cycles are lengthened and shortened internally by the VL82C101 depending on the type of bus cycle being executed.

The VL82C101 also contains an 82288 bus controller megacell to generate all the bus command and control signals. The 82288 megacell generates the —MEMR, —MEMW, —IOR and —IOW command signals and the DT/—R control signal. The DEN output from the megacell is split into —DENLO and —DENHI for enables on the upper and lower bytes of the data bus. Internal circuitry is used to insert one PROCCLK cycle of command delay for all I/O cycles and off board 8 bit memory cycles.

The VL82C101 operates in four basic modes. First, and most common, is the CPU mode. This mode is active any time the input CPUHLDA is low. While in CPU mode the VL82C101 will drive both the CMD (—MEMR, —MEMW, —IOR, —IOW) bus and XCMD (—XMEMR, —XMEMW, —XIOR, —XIOW) bus.

The other modes can only be active when CPUHLDA is high. Then the VL82C101 can be in DMA mode, MASTER mode, or REFRESH mode. If the inputs —AEN2 are active, the VL82C101 is in DMA mode and the CMD bus is driven from the intputs on the XCMD bus. If the —MASTER input is active, the VL82C101 is in MASTER mode and the XCMD bus is driven from the inputs on the CMD bus. When the REFRESH mode is active the —MEMR output will be driven to generate the refresh for the DRAMs but —MEMW, —IOR and —IOW will be in a high impedance state. The XCMD pins will be configured as

outputs driving whatever value is on the CMD pins.

A state machine for controlling the conversion between 16 bit data accesses from the CPU and 8 bit peripherals is contained in the VL82C101. This state machine will generate the control signals DIR245, GATE245, and CNTLOFF to the data buffer chip to route the data correctly for both read and write conversions. The conversion logic will signal the wait state logic to hold the CPU and start the read/write of the low data byte. It will then latch the low byte for a read operation, negate the bus control signals, switch SA0 to a high, and then perform the read/write operation for the high data byte. The VL82C101 also uses the DIR245 during 8 bit DMA cycles to route the lower byte on the system data bus to or from the high or low byte of on baard memory.

Memory Controller

The VL82C102 memory Controller provides address buffering for the upper address bits on the system and CPU address buses. It generates chip selects for the two possible RAM banks and the two possible ROM banks. The VL82C102 also contains the Port B register logic to control the Non-Maskable Interrupt signal and the speaker. It generates chip select decodes for the 8042 keyboard controller and MC146818 real time clock.

The upper address bits A23-17 and XA 16 are used to decode chip selects for all on baard memory. The three option inputs RAMSEL2, RAMSEL1, and RAMSEL0 are used to select one of three possible memory mapping options.

The memory mapping options are used to generate the enable signals for the RAS and CAS pulses to the DRAMs. RAS0 and CAS0 are the enables for Bank 0. RAS1 and CAS1 are the enables for Bank 1. These signals will be active anytime the decode on address bits A23-17 fall in the ranges shown in the memory maps. The signals are latched by the input signal RAMALE. The latches will be transparent while RAMALE is high and hold the value in the latch while RAMALE is low. The latch clocks will also be forced high when CPUHLDA is active making the latches transparent during all hold acknowledge operations.

When —REFRESH is active address bits A23-17 are ignored and both RAS0 and RAS1 are forced active (high) while CAS0 and CAS1 are forced inactive (low).

A23-17 are also used to generate four address bits for the upper address bits of the DRAM memory space. These address bits are also latched by the combination of RAMALE and CPUHLDA as described for the RAM Selects. The four latched address bits are then multiplexed out on MA8 and MA9. MA9 is needed only if a memory mapping option using 1M bit DRAMs is selected. REFBIT9 is multiplexed out onto MA8 during refresh cycles.

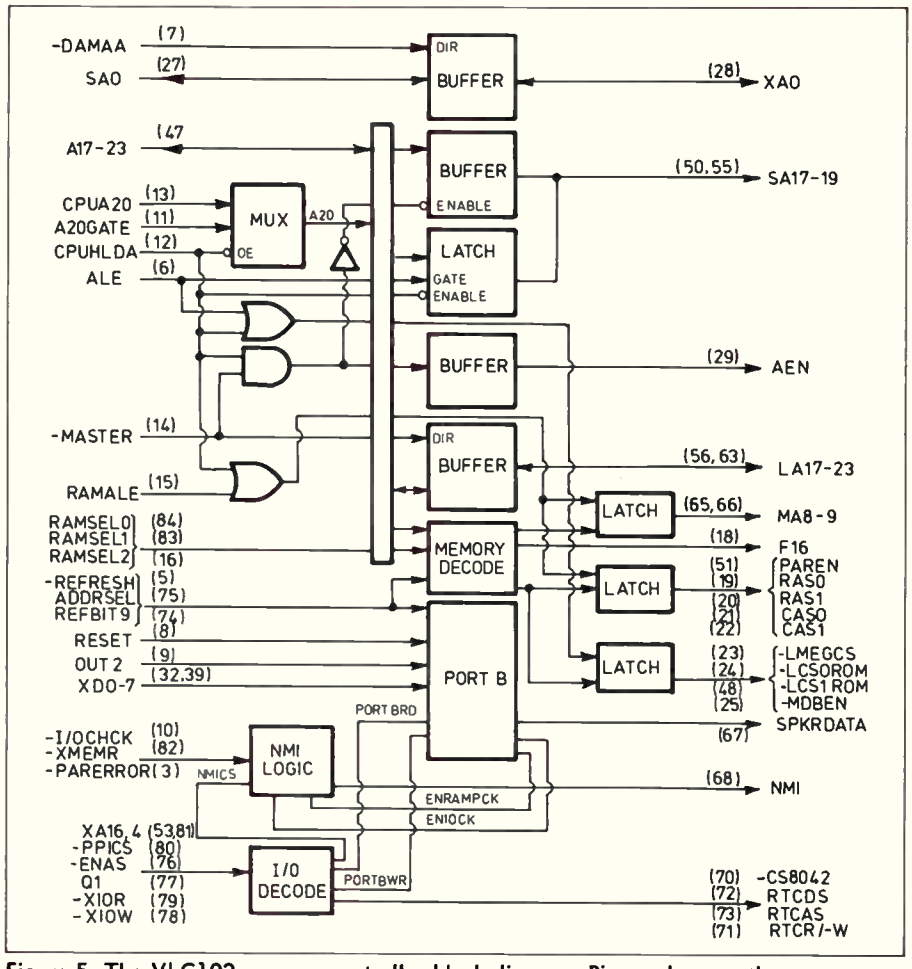


Figure 5: The VLC102 memory controller block diagram. Pin numbers on the package are shown in brackets next to signal names.

The ROM address space is decoded from A23-17 and latched by ALE. These latches are also forced transporent when CPUHLDA is active in the same manner as the latches for the RAM chip selects. This latched value is then split into the two signals —LCSOROM and —LCS1ROM using the XA16 input.

If XA16 is low, —LCSOROM will go active any time the ROM address space is decoded. If XA16 is high, —LCS1ROM is decoded. In this configuration —LCSOROM selects the address space from 0E 0000 to 0E FFFF while Z —LCS1ROM selects the address space oF 0000 to 0F FFFF.

The ROM address space is duplicated at FE FFFF to FF FFFF and the chip selects will go active in the same manner as described above in this address space.

The VL82C102 provides buffer drive capability to drive the card slots on the I/O signals LA23-17 and SA19-17. The values on A23-17 are passed directly through to the LA23-17 outputs if —MASTER is high. If —MASTER is low LA23-17 become inputs and pass the value on those pins to the A23-17 bus.

A19-17 are latched by ALE and driven onto the SA19-17 bus whenever CPUHLDA is low. When CPUHLDA is high and —MASTER is high, the latch is bypassed and A19-17 is driven directly to SA19-17. SA19-17 will be left floating when CPUHLDA is high and —MASTER is low.

Address bit 20 is handled differently to other address bits. The A20 signal will be generated directly from CPUA20 if the input A20GATE is high. If A20-GATE is low, the A20 signal is forced low.

A buffer transceiver between XA0 and SA0 is also provided on the VL82C102. If the input —DMAAEN is

high, signal flow is from SA0 to XA0. If —DMAAEN is high, signal flow is from XA0 to SA0.

The logic necessary to control the Non-Maskable Interrupt (NMI) signal to the processor is contained in the VL82C102. An NMI can be caused by a parity error from the system board DRAM or if an I/O adapter pulls the input I/OCHCK low. At power up time, the NMI signal is masked off. NMI can be masked on by writing to I/O address 070 hex with bit 7 low, or masked off by writing to I/O address 070 hex with bit 7 high.

Address Buffer

The VL82C103 Address Buffer replaces several bus transceivers and address data latches located within the PC/AT-type system. The DRAM refresh circuitry is also located on this device.

The primary function of the Address Buffer is to multiplex the iAPX286 microprocessor address lines (A1-16) to the System Address Bus (SA1-16), the Peripheral Address Bus (XA1-16), and the Memory Address Bus (MA0-7). This is accomplished through two sets of 16 bit wide, positive edge triggered latches and a group of data multiplexors. One set of latches have their output enabled with CPUHLDA and are gated with ALE. This set of latches drive the SA and XA bus outputs. Another parallel set of latches are mux'd into the MA lines and are gated with RAMALE. RAMALE is an early ALE signal which is generated inside the VL82C101 device. When FASTMODE is enabled, RAMALE becomes active as soon as a —MEMR or —MEMW signal is generated (typically one PROCCLK earlier than ALE). This allows more setup time for the address to be mux'd to the DRAMs. If FASTMODE is not enabled, RAMALE and ALE are identical signals.

The device also provides for address flow between the SA, XA, and MA buses and the —XBHE and —SBHE signals. This control flow is arbitrated with the CPUHLDA, — DMAAEN, and — REFEN Inputs.

Memory Addresses are multiplexed from the SA and A bus sources and are controlled via the CPUHLDA, REFRESH, and ADDRSEL inputs.

A 9 bit refresh counter is provided on this device. This allows support for DRAMs of up to 1M bit in size. The refresh counter is clocked on the rising edge of the REFRESH input. A latched register inside the counter latches in the current state of the counter on the falling edge of —REFEN and transfers this value to the internal bus which routes to the SA and MA bus outputs. The SA0 output is provided only for refresh purposes and is driven only during this time. During a refresh the SA and MA bus outputs are driven from the output of the refresh counter latch Q0-8.

Note that all SA bus lines are driven during a refresh cycle. The REFBIT9 signal is the Q8 output of the refresh counter. This is output to the VL82C102 device which controls the upper MA address lines. It is required only for the refresh of 1M bit DRAMs.

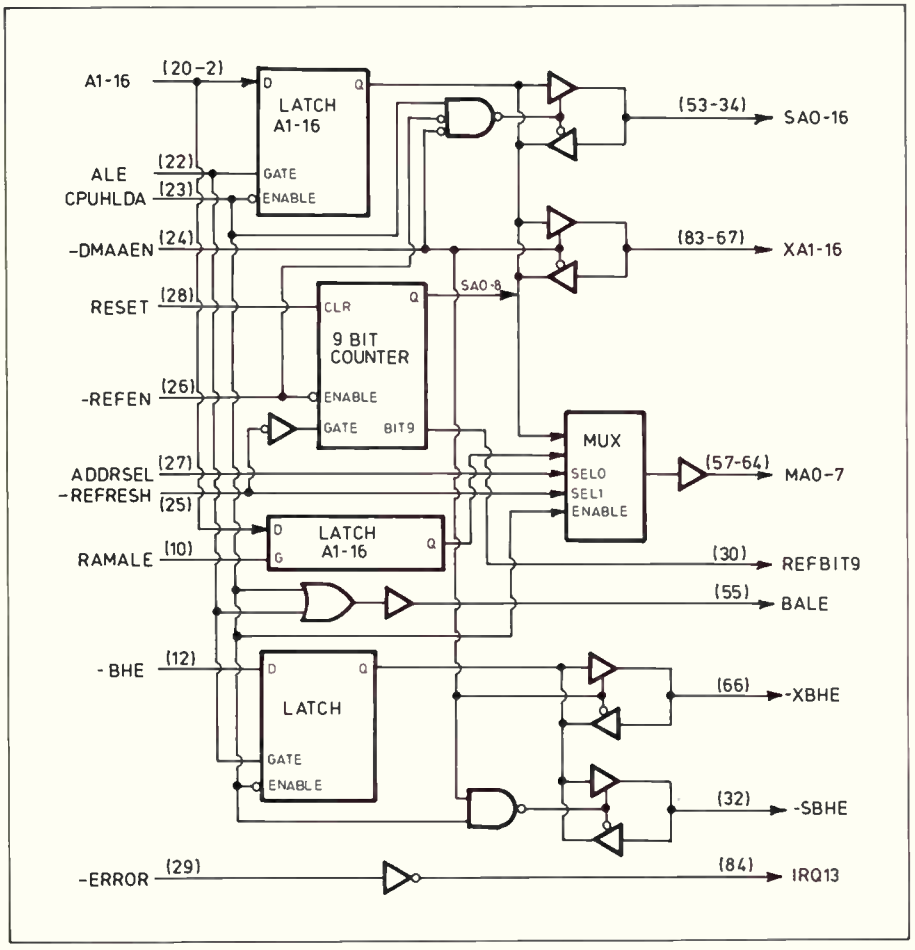


Figure 6: The VL82C103 Address buffer block diagram. Pin numbers on the package are shown in brackets next to signal names.

Data Buffer

The VL82C104 Data Buffer replaces several bus transceivers and a CPU lower byte data latch located within the PC/AT-type system.

The primary function of the Data Buffer is to multiplex the iAPX286 microprocessor data lines D1-15 to the System Data Bus SD1-16, the Peripheral Data Bus XD1-16 and the Memory Data Bus MD0-7. This is accomplished through six sets of 8 bit wide data multiplexors. The lower data byte of the CPU data bus transceiver has a byte wide register which is clocked by the rising edge of CNTLOFF. The data is latched in the direction from the System Data Bus to the CPU Data bus only. XA0 is used to control data flow to the CPU Data Bus.

When XA = 0, real time data is passed to the CPU Data Bus. When XA0 = 1, latched data is passed to the CPU Data Bus. The six groups of transceivers can be seen in the block diagram of the device. The data parity encoder/decoder logic is also located within this device. All data present upon the Memory Data Bus passes through the parity logic. The outputs of the parity encoder/decoders, MDPIN0 and MDPIN1, are enabled via PAREN to prevent decoding a ROM access and are gated with —XMEMR. The —PARERROR signal is fed back to the VL82C102 where it is gated with other logic to produce the NMI signal for the

iAPX286.

The logic controlling the bus tranceivers has been optimized for speed and as such there are not provisions to prevent internal bus collisions. This is not a problem as the control signals which enable the transceivers are decoded in such a fashion as to prevent this from happening.

From the block diagram it can be seen that every bus transceiver has an A and a B I/O port. The DIR input to the transceiver controls the direction of data flow through the transceiver. A high (1) input into the DIR pin causes data to flow from A to B. A low (0) causes data to flow from B to A. All transceiver enables are low true causing the output of the particular transceiver to be active.

Memory Design

When discussing the topic of high performance 80286 based PC/AT-compatible systems, the talk inevitably focuses on the number of clock cycles required to perform the various input/output and memory accesses in the system. In particular, we can define here four separate operations in PC/AT-type systems that are time critical, controlled directly or indirectly by the VLSI chip set, and associated with what has become the taboo term to systems designers around the globe — Wait State.

However harshly wait states are looked upon, they are necessary to match the performance of subsystems to that of the microprocessor. In high performance PC/AT system based on the 80286 microprocessor running at its maximum bus transfer speed, only two system clock cycles would be required for any given byte (8-bit) or word (16-bit) transfer. The problem is that most subsystems cannot keep up with this pace, especially at system speeds exceeding 8 MHz. This implies the need for wait states during some accesses, but the secret to high performance is to eliminate the wait states during the most frequent operations. The four critical operations are:

- System Board DRAM Accesses. These are the most important target for no wait state performance. By far the most common memory or I/O cycle performed by the 80286 in an AT is a memory access to the DRAM on the system motherboard.
- System Board ROM Accesses. System board ROM in an AT system usually implies the BIOS ROMs or EPROMs which contain various system services routines. These memory accesses occur more frequently during power up and much more infrequently during normal operation. Because ROM access times are usually slow compared with RAM access time and because these accesses are infrequent during normal system operation, wait states during these memory cycles can be tolerated without noticeable loss of system performance.
- Expansion Memory Accesses. Because of the increased amount of DRAM memory that is supported on the system board these accesses are not required as often as they used to be. However, these accesses must be supported by the VLSI chip set. The —MEMCS16 input of the VI82C101 controls the number of wait states in an expansion memory access. If the pin is pulled low, one wait state will occur, and if the pin is pulled high, four wait states will occur on these "off board" memory accesses. A slow expansion memory system can take more time, just as any other device on the expansion bus, by driving the —I/OCHRDY line on the expansion bus low until it has completed its operation.
- Expansion Bus I/O Operations. As with ROM and expansion memory accesses, expansion bus I/O operations occur relatively infrequently. The issue with these types of operations in the high performance AT systems centers more around slowing the access down than speeding it up because of the abundance of expansion cards that simply can't keep up with the fast bus timings. The —IOCS16 pin on the VL82C101 controls wait states on the I/O operations just like the —MEMCS16 pin described above (low forces one wait state, and high forces four wait states) with slow peripherals able to fall back on the I/OCHRDY line for more time if needed.

System Board DRAM cycles are impartant because most PC/AT applications spend over 90% of their time executing these types of cycles. Streamlining these cyles is the best way to acheive high performance in a PC/AT-

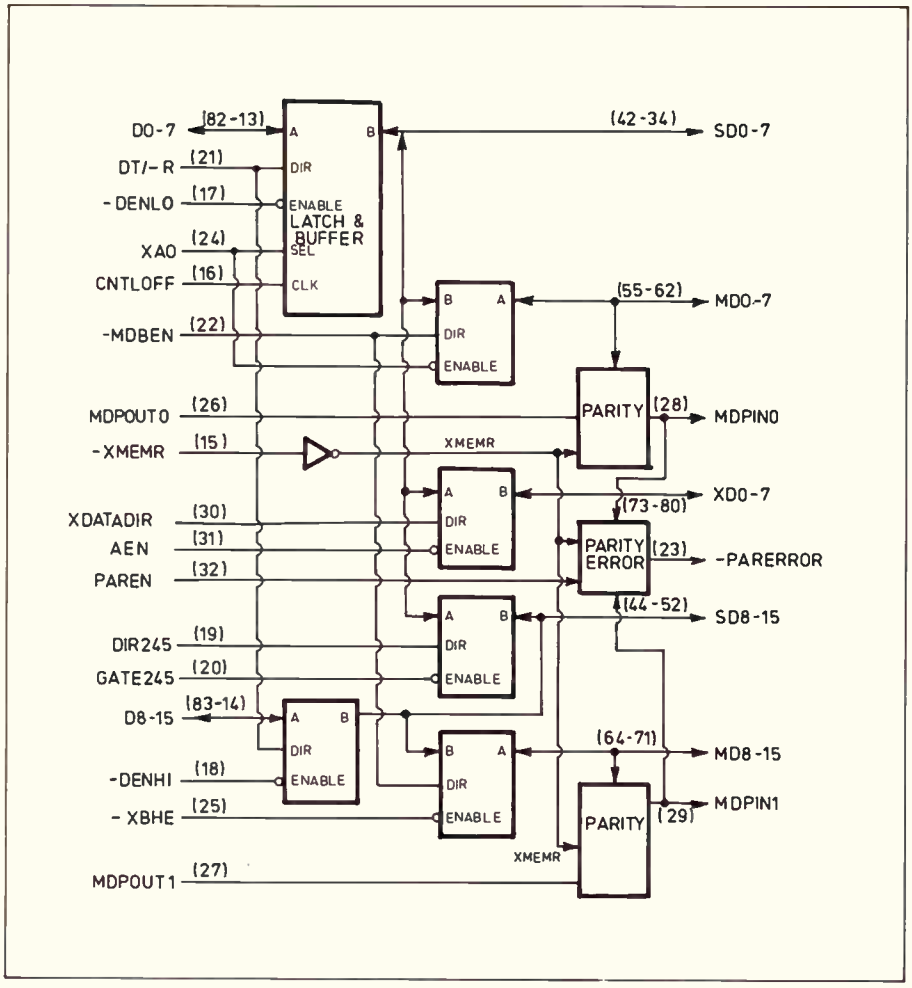


Figure 7: Inside the VLC104 Data buffer. Pin numbers on the package are shown in brackets next to signal names.

compatible system.

A complete, standard DRAM memory cycle with zero wait states consists of one TS (status) cycle followed by one TC (command) cycle, whereas a one wait state memory cycle consists of one TS cycle followed by two TC cycles.

The memory cycle can alternatively be defined with respect to the MEMRAS signal.

With standard memory timing during a zero wait state memory cycle, the MEMRAS signal will be active for two PROCCLKs, through both phases of a single TC cycle. During a one wait state memory cycle, MEMRAS will be active for three PROCCLKs, through an additional TC cycle (wait state).

In both the zero and one wait state standard memory read cycles, the time available to generate the MEMRAS signal, allow for the data access time of the DRAMs, and return the data to the processor, is equal to the number of TC cycles (the 80286 will expect to latch valid data on the falling edge of the final TC cycle). This is because in standard mode we do not start to generate RAS until the end of the TS cycle. For example, in a 10 MHz one wait state system, we have 200 ns.

The way to analyze this critical path is to treat the DRAM RAS to data access time as the unknown and plug-in the rest of the known values in the path:

1) We start with the amount of time we have to perform the access, 200 ns.

2) Subtract the delay in the VL82C101 from the falling edge of PROCCLK at the end of the TS cycle to the rising edge of RAS, 17 ns.

3) Subtract the delay through the external F10 gate that performs the NAND function on RAS and ENDRAS to generate MEMRAS, 6 ns.

4) Leave the DRAM RAS access time as the unknown.

5) Subtract the delay through the VL82C104 from the memory Data Bus to the Data Bus of the 80286, 19 ns.

6) Subtract the Data Set-up time for 10 MHz 80286, 8 ns.

Performing the arithmetic, we find that the maximum RAS access, time that can be tolerated under worst case conditions is 150 ns (200-17-6-19-8).

With standard memory writes, the parameters limiting the type of DRAMs that may be used in the various system configurations are the memory cycle time and RAS precharge time.

The system memory requirements with standard memory timing are governed by the memory read timing. Since the timer of the critical path for memory reads starts "ticking" when we begin to generate RAS, the logical way to get more time to access data is to generate RAS sooner (generate an "early" RAS). It turns out that generating RAS one PROCCLK earlier will allow us to run the system at 12 MHz with no wait states on memory read cycles using a —08 DRAM. However having one wait state on memory write cycles sounds worse than it really is in an AT-type system. It is a fact of computer science that approximately 70% of a conventional microprocessor's time accessing DRAMs is spent on instruction fetches (DRAM reads). It would be conservative to estimate that 2/3 of the remaining 30% of the processor's time is also spent on read cycles because the processor inevitably goes to memory to get two pieces of data before it performs an operation on them and puts back a single answer. This brings us to an estimated 90% of all DRAM cycles being read cycles.

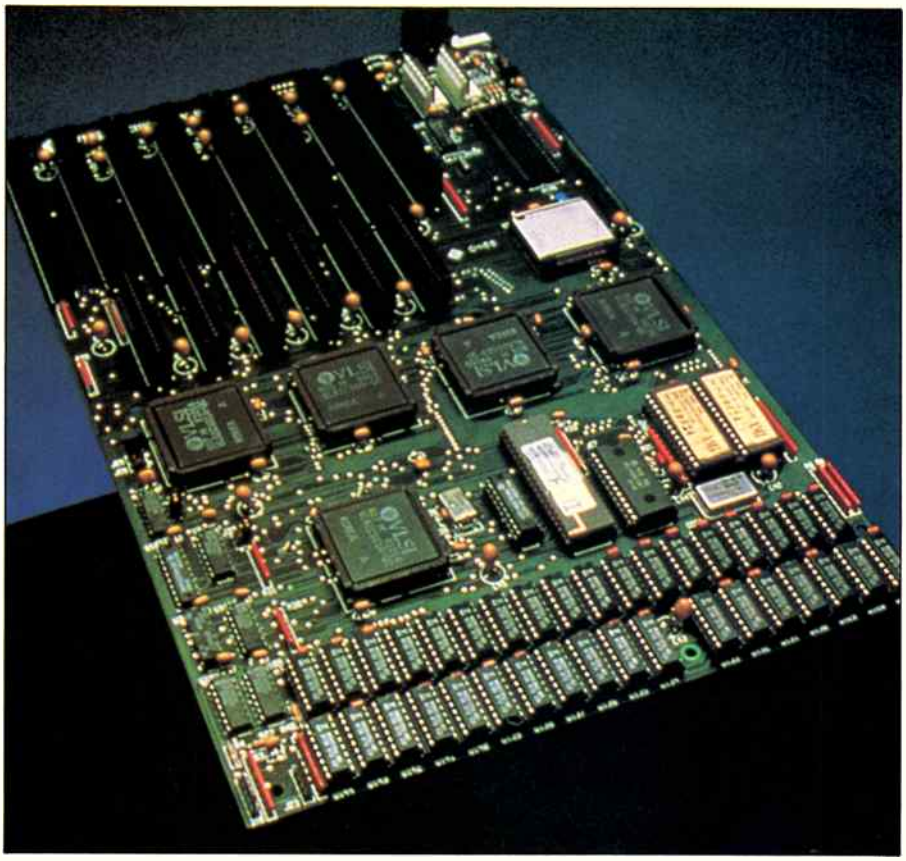


Figure 8: The circuit board supplied by Energy Control in Brisbane. It is available direct from the supplier, together with the chip set. Next month we show you how to put it into an existing PC or XT.

Systems board ROM Accesses are far less complex in the ETI-1613 than DRAM accesses. Since ROM accesses are far less frequent during normal operation of the AT than DRAM accesses, we need not worry so much about elimination of wait states on these types of cycles. However, ROM timing in the VL82CPC/AT can be adjusted to accommodate a variety of ROM access speeds by using the ROMWTST pin of the VL82C101. If this pin is pulled high, the VL82C101 will generate one wait state on ROM accesses. If ROMWTST is pulled low, two wait states will be geneated for ROM accesses.

With the VL82CP/AT chipset, the time between —LCS0ROM or —LCS1ROM becoming asserted and the data from the ROM becoming valid represents the ROM acces time.

Just as we covered the critical path for RAM access, we can perform an analysis for ROM accesses.

In the case of ROM timing, there are actually two critical paths for ROM accesses. We call these paths "fast" ROM timing, and "standard" ROM timing. The difference between the two is simply a matter of whether the system designer "hardwires" the XA16 pin of the VL82C102. This hard wiring will allow faster access to the ROMs, but will limit the ROM address space which will be accessed.

TECHNOLOGY
ETI-1418

EXPANDABLE MIXING CONSOLE:
The Output Module

This is the second part in a three-part series by Andrew Robb and Glen Thurecht on the design and construction of a high quality expandable mixing console.

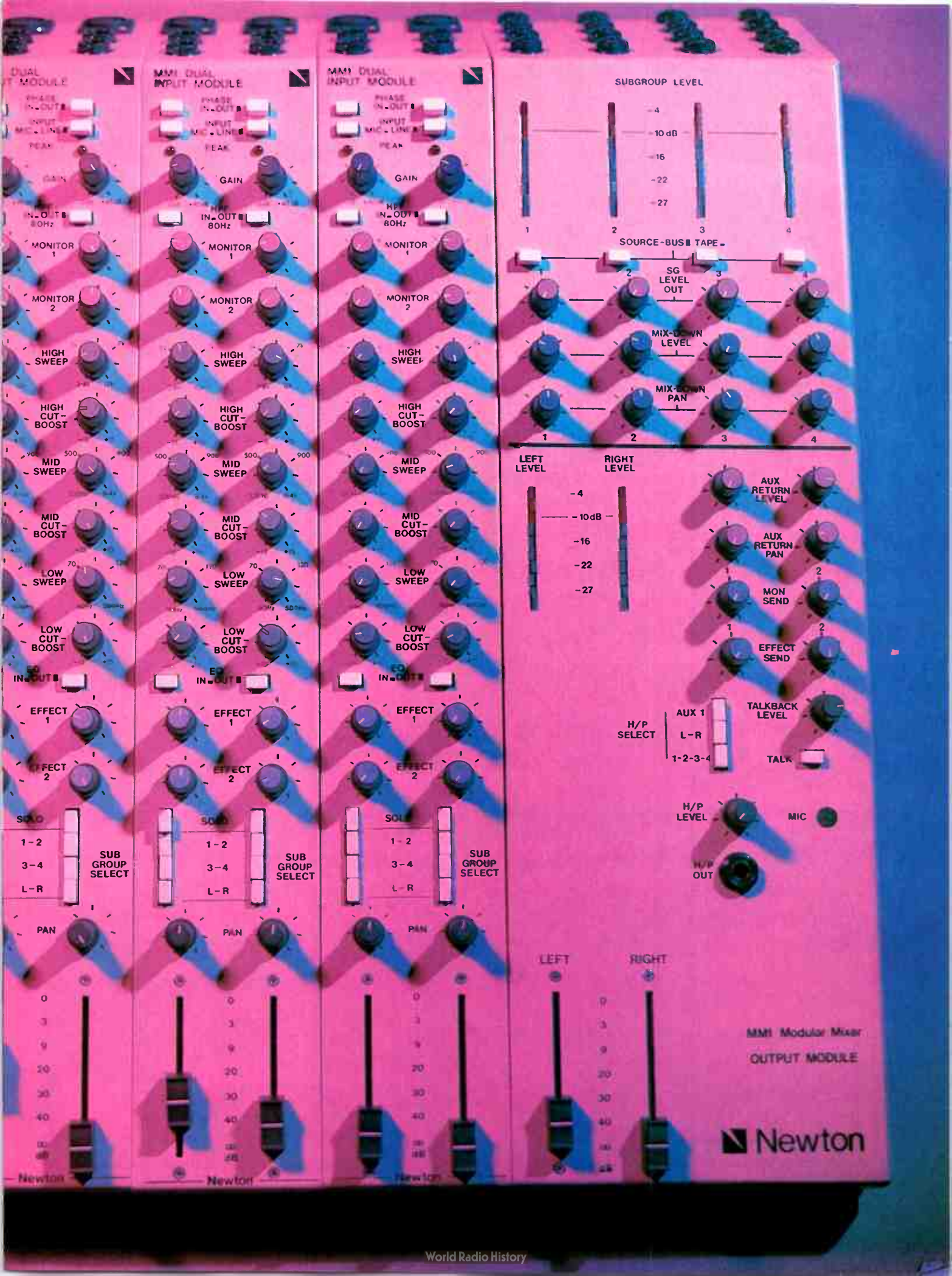
The output module comes as a single block of metalwork in which four printed circuit boards are mounted. They perform all the mixing functions that combine the inputs to form one of the 6 output channels — Subgroups 1-4 and the Left/Right outputs.

Most of the versatility of a good mixer is found in the design of the output section. Flexibility of routing and mixdown facilities are fundamental to a design that will enable a sound engineer to get the most out of the sounds created.

For instance, if a multitrack mixer does not allow direct mixdown to the right and left channels; monitoring the complete sound source can only occur after the recording has been made, which may mean that the recording has to be made again if everything is not up to scratch. So, even though the input sections are responsible for most of the quality of the sound, the output must not be neglected or the utility of the mixer will be reduced.

Again, as in the design of the input channel, the number of active components in the signal path should be kept to an absolute minimum to reduce noise. Parallel signal processing should be used wherever possible instead of serial to prevent noise from each op-amp adding through each stage. Resistance values should be low enough to minimise thermal noise while at the same time not being so low as to excessively load an amplifier hence creating distortion.

This design has kept all the active circuits in the output channels down to the equivalent of two op-amps. The solo circuitry uses a parallel processing and gating system that reduces the number of active circuits usually found in such a



circuit by one. All in all, this will lead to a low noise mixer that will do justice to high quality digital recording systems.

The circuit diagram of the output module is shown broken up into four sections. These sections correspond to the four printed circuit boards that are found in the output module. The circuit diagram is not fully complete, however, since it is too large to fit on one sheet. So the ancillary circuits will be shown on another diagram to be published in next month's issue of ETI.

CONSTRUCTION — COMPLETE OUTPUT MODULE

Prepare the case by attaching the power cable, transformer, switch, fuseholder, bridge rectifier, and two power transistors. The TO 3 transistors must be mounted using the insulating washers and bezels provided. Smear a small amount of heatsink compound on the base of each transistor and the area to which they will be fixed on the case. The transistors mount outside the case, with their leads pointing in. Using a multimeter, check that there is no connection between either transistor case or pins, and the mixer case. Now wire the power supply as shown in the wiring diagram using spagetti to insulate all 240 Vac connections, and the transistor legs. Attach the green earth lead to the case using the lug provided. Scrape some paint off under the lug to ensure a good metal-to-metal earth connection. Leave the eight connecting wires ready for wiring to the AAC-05 PCB when it is completed. Mount the 16 6.35mm connectors on the back panel and, using stiff wire, link the OV pin on the four rows. Mount the two faders as per the input modules.

The AAC-03 board is set up so that a Left or Right channel may be made by the selection of 5 links logically set out directly above the bussing connector. These links select the different bus pins required by the Left and Right channels, thus saving the cost associated with producing a whole new board when there is little difference in the circuitry.

Begin with one of the AAC-03 boards. Insert the links as per the overlay for the LEFT channel version. In this case, keep the links insulated, as they run close to each other. The usual procedure to simplify construction is to start soldering the lowest profile components and work

PARTS LIST — ETI-1418 OUTPUT SECTION

Resistors.....All ¼ watt unless otherwise specified.

R40, R56, R72, R91.....4k5
R41, R42, R43, R44a), R45, R46, R47, R55, R57, R58, R59, R60, R62, R63, R64, R71, R73, R74, R75, R76, R78, R87, R90, R92, R93, R94, R95, R97, R104, R107...8k2
R44, R54, R61, R70, R77, R86, R89, R96, R103, R106.....1k
R48, R50, R65.....5k6
R49, R68.....3k6
R51, R52, R66, R67.....2k2
R53, R69, R79, R81, R83, R84.....3k
R80, R82, R98, R99, R100, R101...1k5
R85, R88, R102, R105.....11k
RV14, RV16, RV19, RV21, RV23, RV25, RV28, RV29, RV30, RV32, RV35, RV36.....10k LOG
RV15, RV20, RV24, RV31.....5k LIN
RV18, RV22.....10k LOG SLIDER
RV26, RV33.....10k LOG DUAL
RV27, RV34.....1k LIN

Capacitors

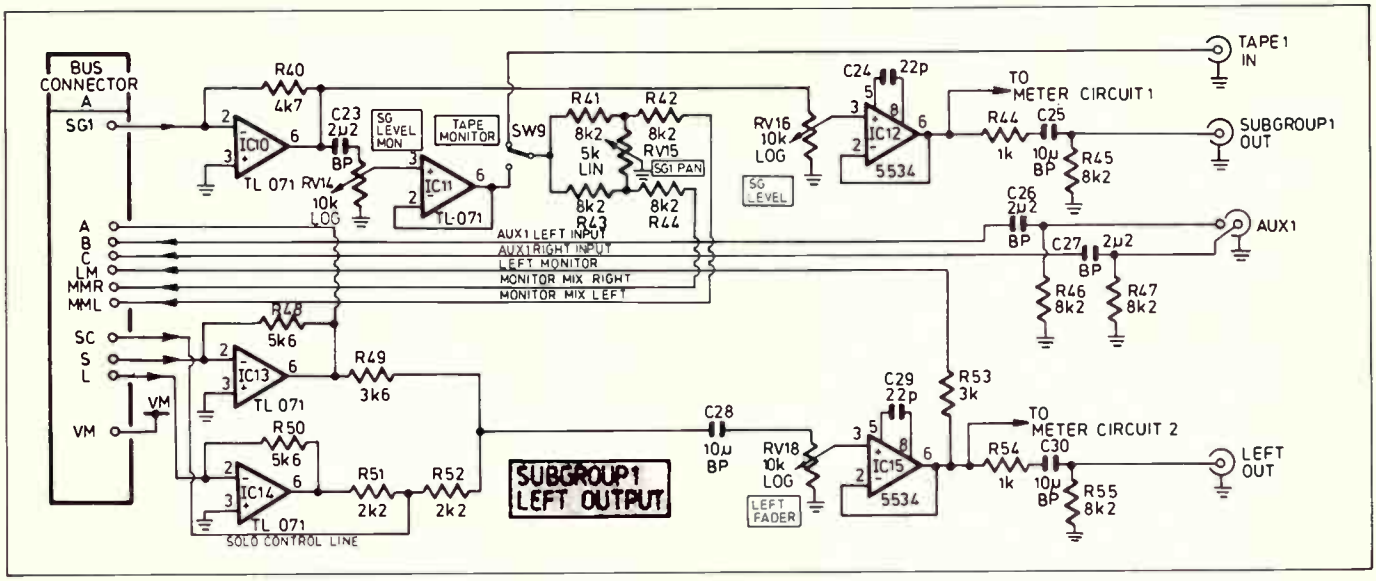
C23, C25, C26, C27, C28, C30, C31, C33, C34, C35, C36, C38, C39, C41, C42, C43, C44, C45, C46, C48, C49, C50, C51, C52.....2.2uF to 10uF Bipolar 50 Volts
C24, C29, C32, C37, C40, C47.....22pF

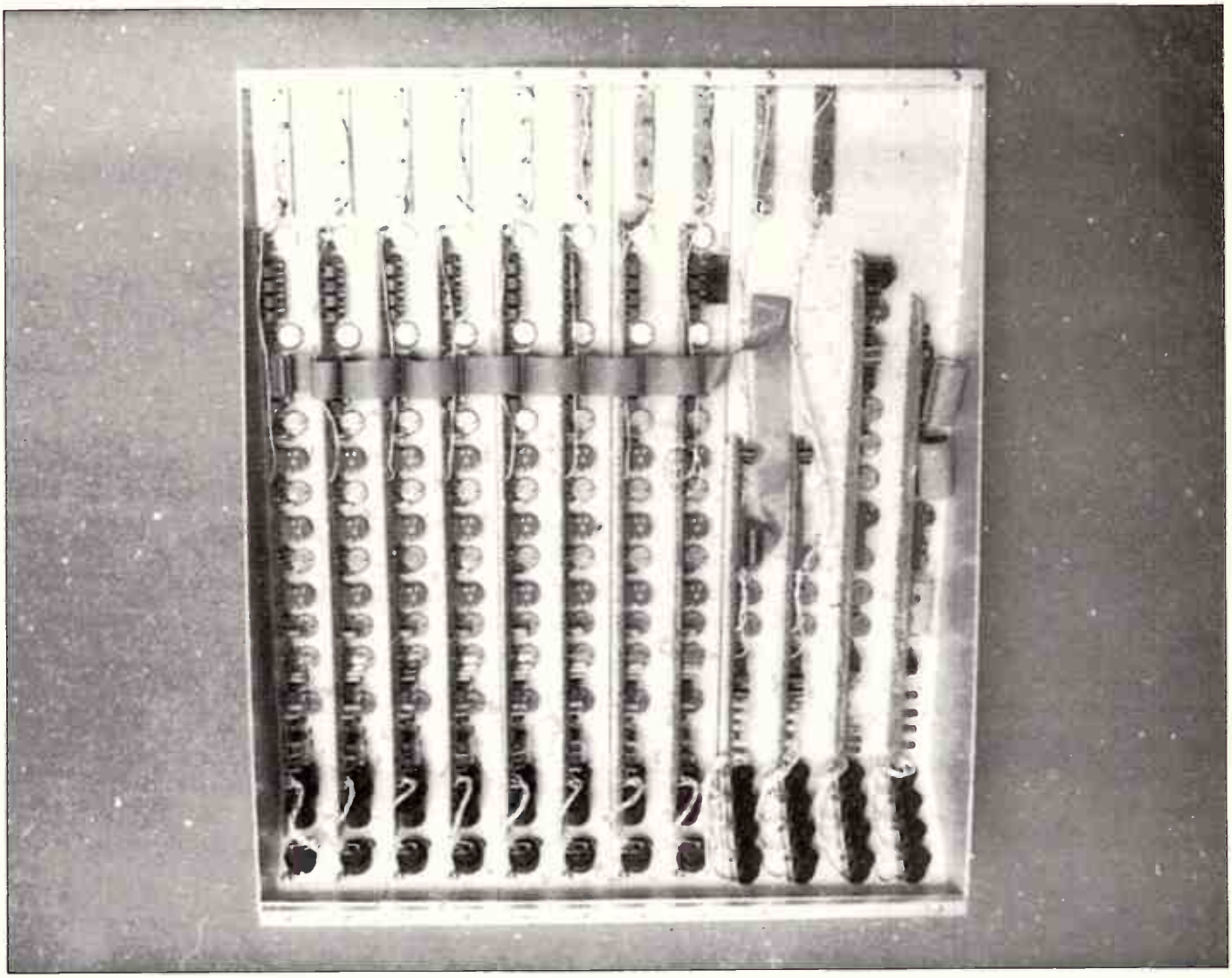
Semiconductors

IC10, IC11, IC13, IC14, IC16, IC17, IC19, IC21, IC22, IC24, IC25, IC26, IC27, IC28, IC29, IC30, IC31, IC33, IC34, IC35, IC36, IC37, IC38.....TL-071
IC12, IC15, IC18, IC20, IC23, IC32....5534

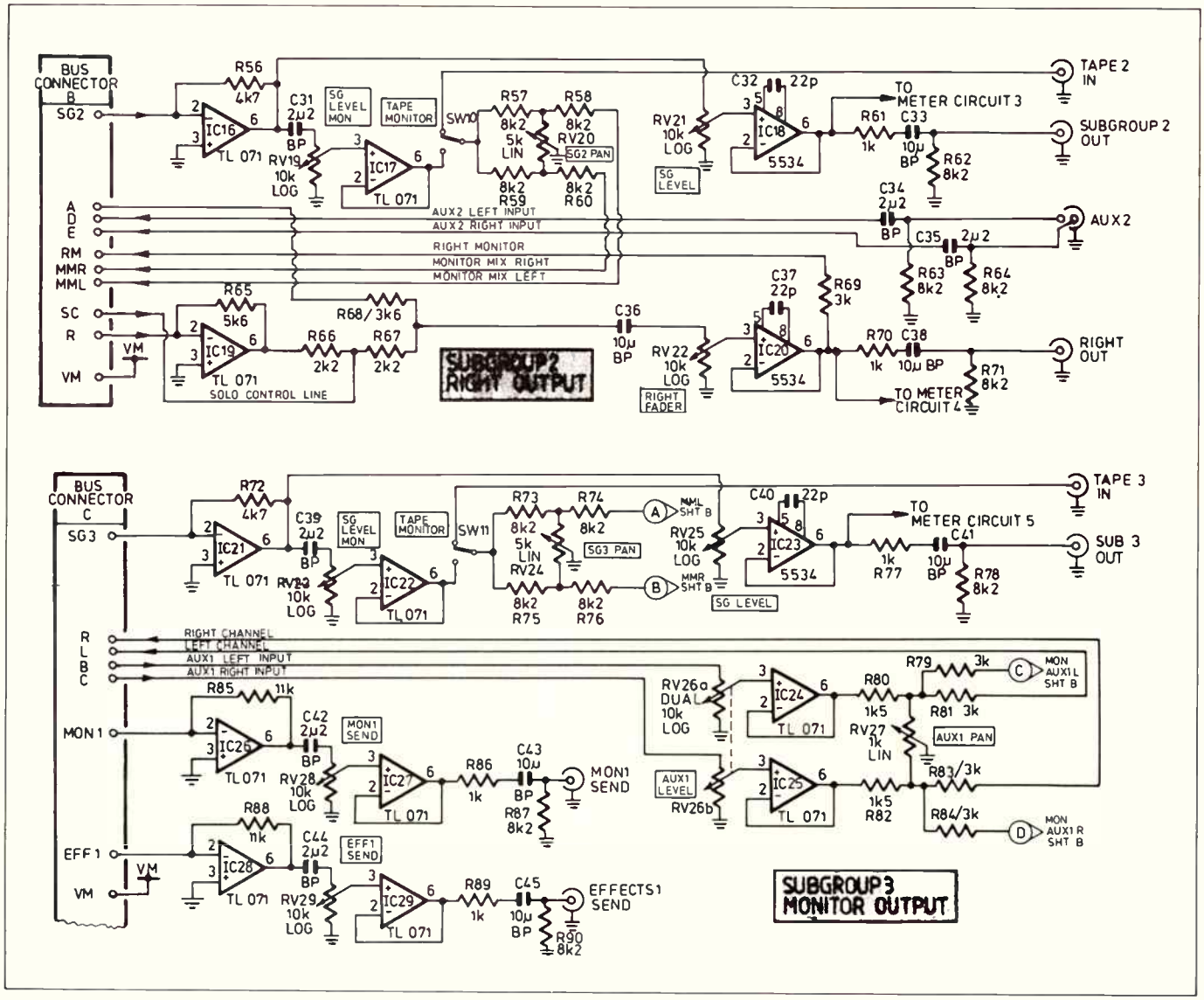
Miscellaneous

6 x Slider knobs, 16 x 6.35mm connectors, output module metalwork, output module baseplate, 20 pin IDC connector, 20 pin IDC header, 4 x 34 pin IDC connectors, 4 x 34 pin headers, wire, 34-way ribbon cable, 2 x PCB AAC-03, PCB AAC-04, PCB AAC-05, 4 x 2P/2P push button switches, 4 x switch knobs.



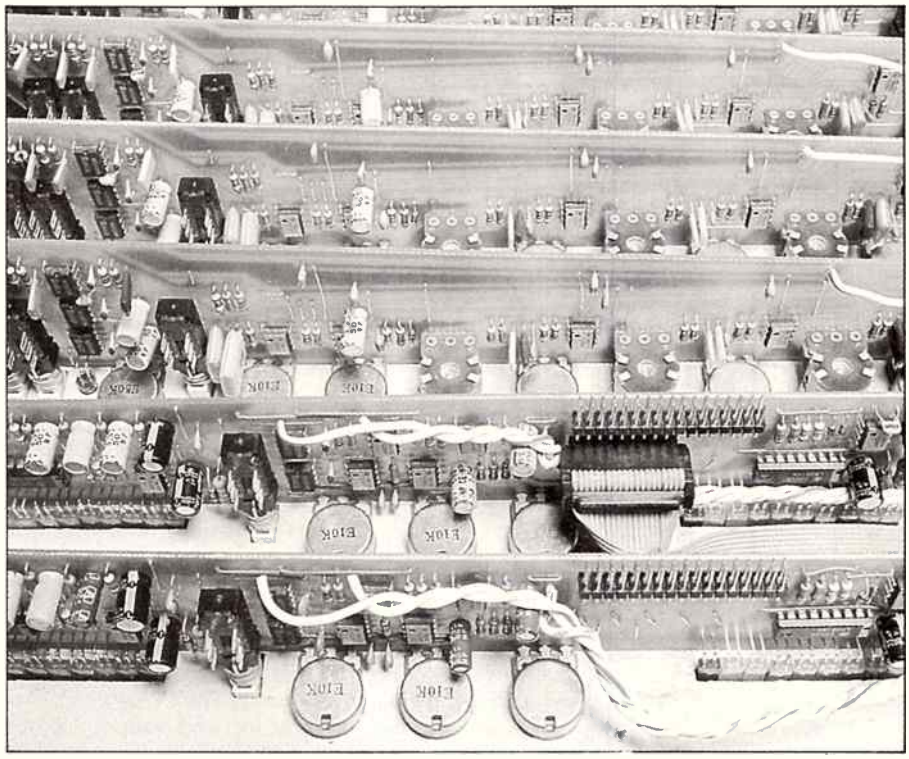


The underside of the complete mixer. The expandible input units are to the left, and the outputs to the right. The power supply has been omitted from this prototype. Expansion of the unit is simply a question of unbolting the rails at top and bottom, and replacing with longer elements.



up to the highest so that the board may be laid faced down for soldering without all the components falling out. So we next insert the resistors and diodes. The zener diode, ZD2, and ½ Watt resistor, R125, should be mounted about 3mm off the board. This assists in airflow cooling, as both these components dissipate considerable power. Now construct the two bargraph displays. Bend the legs of each rectangular LED at about 4mm from the LED body, and solder in place. There are seven green, two orange and one red LED (red at the top). The orientation is important, with the shorter leg being the cathode (K or bar). The body of the LED should sit about 6mm above the board, so that it meets the rectangular hole in the metalwork. Take care to make each LED the same height above the board as this will affect the appearance of the overall bargraph.

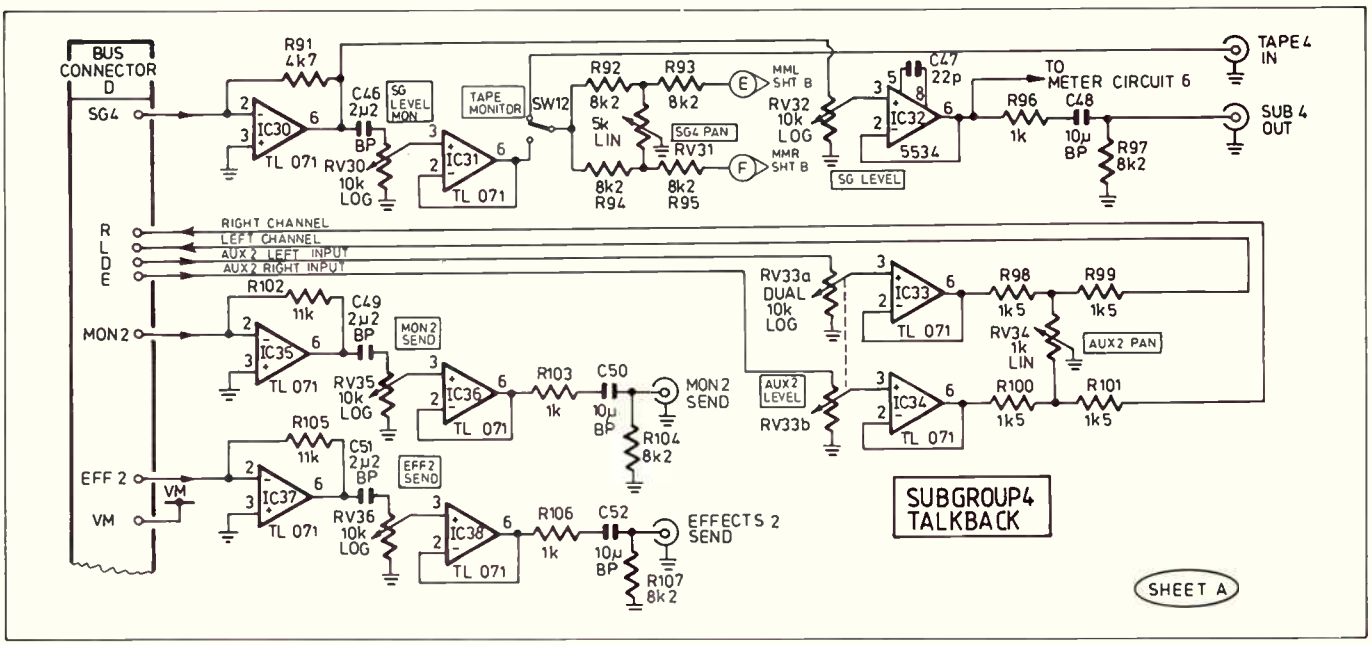
Finally, insert the IC's, capacitors, 34-way connector, 20-way connector, switch and three spots. Solder five lengths of wire (120mm), as shown in the wiring diagram, ready for the 6.35mm connectors, and a twisted three-way piece (400mm) for the fader. The fader and connectors are soldered in once the board has been mounted in the case. Now recheck every component, link and solder joint visually. It is going to be a lot easier to fix any mistakes before mounting the board! Give the board a good brush down to shift any loose solder flakes or wires, then insert into the metal case. Tighten the three pots down, push on the switch cap and knobs and line up the LEDs. Wire up the connectors and faders.



The output boards are in the foreground. The connectors are normally coupled via ribbon cable which forms the only electrical connection between the boards.

Now on to the RIGHT channel board. This is almost identical. The links are in a different position, there is no 20-way connector, and the SOLO summing amplifier is not used on this board (that is IC13 and R48 positions are left without any components).

AAC-04 contains the subgroup 3 circuit plus the headphone monitor circuit. Following the same procedure as previously described, construct the board, starting with the links. Again, because of the close proximity of tracks and pads, take care when soldering. Note that, due to a different designer being used to layout this printed circuit board, the IC's point the opposite way! Mount the LED bargraph zener and resistor off the board as before, and check the orientation of all diodes and the regulator (7805). There is also a 6.35mm stereo connector for the headphones, mounted



on the board. Having rechecked this board for mistakes, shorts and other problems, insert into the case and wire up to the four connectors.

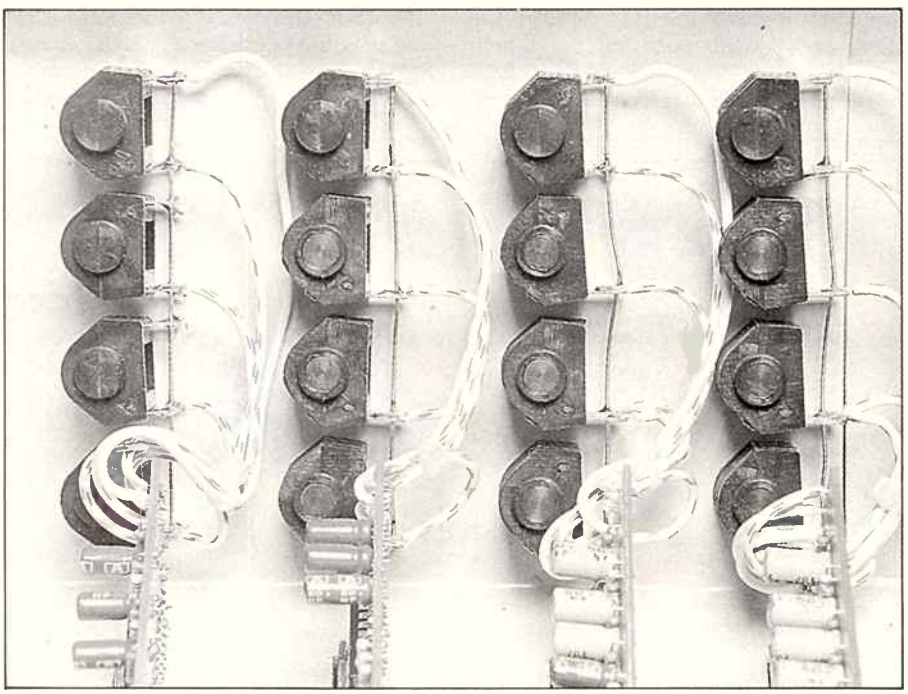
Finally, construct the AAC-05 board, containing the remainder of the power supply, following the usual procedure. Note that there are some links which go under the large capacitors, C65, C69. Mount D4, the LED supply diode, about 3mm off the board, as it also will get warm. Mount the microphone about 13mm off the board, using stiff wire, so that it lines up with the hole. Using a pair of pliers, remove the small metal latching pin from the TALK switch. Solder in the eight wires from the power supply, mount the board and connect the four sockets.

Push one end of the 20-way ribbon cable into the 20-way connector on the LEFT channel board, ready for connection to the input modules. The small raised section on the header (ribbon cable connector) should be facing out towards the monitor board AAC-04. This is critical, as it ensures the orientation of the cable is correct. Do not connect the four output boards together yet as we will follow a power-up procedure in the testing phase.

Having completed the output module construction, you are all ready to put the whole thing together and test it. Until it is fully checked, we suggest the unit should be bolted together without the base plates. This will make it easier to see, pull boards out, or check wiring. To do this, lay the modules out upside down, with the output module on the right, and input module on the left, and all other input modules in between. Attach the rails at top and bottom. Do not connect the input modules using the 20-way cable yet. The power-up procedure for the commissioning will be described in the final article next month in which the input modules will be plugged in one at a time.

Should the mixer need to be expanded at a later date, each input module has provision for a second 20-way connector in parallel with the first. Additional input modules will be supplied with two connectors, and a short ribbon length. This unique procedure allows as many expansions as needed, without any soldering or use of space-wasting blank panels.

Because we cannot discuss testing the mixer until you have seen the complete circuit diagrams and know how the system works, (due to space restrictions, we could not publish them all this issue), we will be covering testing and troubleshooting next month.



The output jock wiring. These ore oll supplied ot 6.35 mm jocks in the kit. There is no reoson why professionol quolity connon connectors could not be used insteod.

ETI — 1418: HOW IT WORKS

The circuit diagram has all the output section electronics except for four ancillary functional blocks which will be described in next month's edition. These four blocks are the monitor output and headphone amplifier, talkback station, LED borgraph circuit, and power supply. The diagram is arranged in four sections that correspond to the four printed circuit boards in the output module.

The Subgroup 1/Left output and the Subgroup 2/Right output boards contain exactly the same circuitry but with different bussing connections, so a description of one will explain both. IC10 (and IC16) is configured as a current summing amplifier which combines the currents injected via bussing point SG1 (SG2). These currents are generated by the input channels that have the correct subgroup select switch activated (i.e. SW6 on the input channel). R40 (R56) is the feedback resistor and sets the gain of the stage in conjunction with R30 (R33) on the input channel. C23 (C31) is a dc blocking capacitor to prevent dc voltages from the input channels accumulating to cause clipping. RV14 (RV19) is the potentiometer that sets the level of the subgroup to be mixed down onto the Left/Right busses for Mixdown monitoring. IC11 (IC17) is a voltage follower which is used for an impedance buffer to the Pan circuit formed by R41, R42, R43, R44, and RV15 (R57, R58, R59, R60, and RV20). The input to the Pan is derived from the output of SW9 (SW10) which selects between the direct mixer subgroup mixdown and mixdown via the output of the four-track recorder itself so that the actual sound being recorded can be monitored. The output of the Pan circuit is injected into Monitor Mix Left (MML) and Monitor Mix Right (MMR), in the ancillary monitor section.

The output of IC10 (IC16) is also sent to the main subgroup output level controls, RV16 (RV21). The signal is then buffered via IC12 (IC18) which is a low noise 5534 op-amp. These amplifiers are used here because the output noise of the subgroup should be very small, even when the output level is extremely small (eg when fading out at the end of a song). C24 (C32) is the unity gain compensation capacitor for the 5534 op-amp. R44 (R61) is a current limiting resistor to prevent damage to the op-amp if the output is shorted to ground. C25 (C33) blocks any dc from being injected into the output stage from an external source and is used in association with R45 (R62) to set the lower frequency break point. The stereo Auxiliary inputs are occupied via C26, R46, C27, and R47 (C34, R63, C35, and R64) onto the bussing connector for use by the Subgroup 3 and 4 boards.

The next part of the diagram is the Left and Right outputs. The circuitry is complicated by the inclusion of the Solo feature. Firstly, the input currents at bussing point L (R) are summed by summing amplifiers formed by IC14 and R50 (IC19 and R65). At the same time the solo bus is summed via IC13 and R48. R51 (R66) is a current limiting resistor that is used to protect the output of IC14 (IC19) when the solo control line is asserted. This control line is grounded when SW8 on any input channel is pressed. This then has the effect of blocking the signal on the left (Right) channel and letting the solo signal through via R49, (R68). R52 (R67) is used so that the solo signal is not blocked off as well when the solo control line is grounded. The values of R49, R51, and R52 (R68, R66, and R67) are such that there is no change of level in the channel being put into solo when the solo is activated. The signal is then sent to the fader (RV18 and RV22) via the ac coupling capacitor C28, (C36) which prevents the fader scratching sound that can occur when dc is present on a pot and its position changed. IC15 (IC20) is an output impedance buffer formed by a low noise 5534 op-amp for the same reasons as explained above. C29 (C37) is the unity gain frequency compensation capacitor. R54 (R70) is the short circuit protection resistor and C30 and R55 (C38 and R71) set the output frequency break point, the output impedance and also prevent dc from returning via the output socket and damaging the op-amp. R53 (R69) are summing resistors that go to the headphone monitor circuit that will be described in the next edition.

The output circuitry for subgroup 3 and subgroup 4 is the same with the addition of two extra resistors on the Auxiliary 1 input pan control so both will be described at the same time.

The electronics for the subgroup 3 and 4 output and monitor is the same as that already discussed for the subgroup 1 and 2 section and so will not be repeated here. The new sections are the Auxiliary, Effects, and Monitor send circuits. IC26 (IC35) is the summing amplifier for the Monitor 1 (2) buss. R85 (R102) sets the gain of the stage. C42 (C49) is a dc blocking capacitor to prevent scratch noise from effecting the RV28 (RV35) master level control for the monitor. The signal is then buffered by IC27 (IC36), current limited by R86 (R103), and output via C43 and R87 (C50 and R104) for dc protection and frequency breakpoint adjustment. The effects send circuitry is the same as the monitor send and is centered around IC28, R88, C44, RV29, IC29, C45, and R90 (IC37, R105, C51, RV36, IC38, R106, C52, and R107).

The stereo input signals terminated on the subgroup 1 and 2 boards are then tapped off the bussing connector and input to the level control formed by the dual potentiometer RV26 (RV33). The signal is then buffered by IC24 and IC25 (IC33 and IC34) and sent to the pon circuit to enable mixdown onto the left and right output channels. The pan of subgroup 7 is formed by R79, R80, R81, R82, R83, R84, and RV27. The output of the pan control goes to two places: R81 and R83 bus directly to the Left and Right output channels and R79 and R84 are used to bus the Aux 1 signal to the headphone monitor amplifier (next month's edition). The Pan of subgroup 4 is formed by R98, R99, R100, R101, and RV34. This is the same as the subgroup 3 except that the output of the Pan only goes to the Left and Right output channels via R99 and R101 and is not routed to the headphone monitor amplifier. The value of the resistors change between the subgroup 3 and 4 channels because, to maintain the correct level in the Pan circuit, the ratio of the summing resistors to that of the Pan pot should stay at about 1.5 as the Pan pot is rotated. Hence for a 1 k Pan pot the resistors should be 1.5 k. Since the subgroup 3 Aux 1 Pan has two outputs, both going to virtual earth points on the summing amplifiers inputs, the two 3 k resistors form a parallel combination to give 1.5 k as is required.

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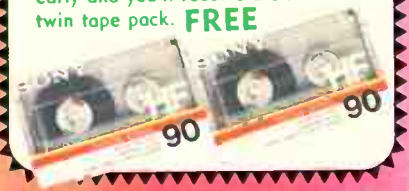

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3 Prizes are not transferrable or exchangeable and may not be converted to cash

4 The judges decision is final and no correspondence will be entered in to

5 Description of the competition and instructions on how to enter form a part of the competition conditions

6 The competition commences on July 20 1988, and closes with last mail on October 31st The draw will take place in Sydney on November 2 and the winner will be notified by telephone and letter The winner will also be announced in The Australian and a later issue of this magazine

7 The prizes are as follows 1st prize — Sony Trimitron + Camcorder $6225 2nd Sony stereo system $1300 3rd Sony Portable compact disc $800 4th 3 x Walkmans $270

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ATWMS

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A BLAST TO BEAT THE PAST

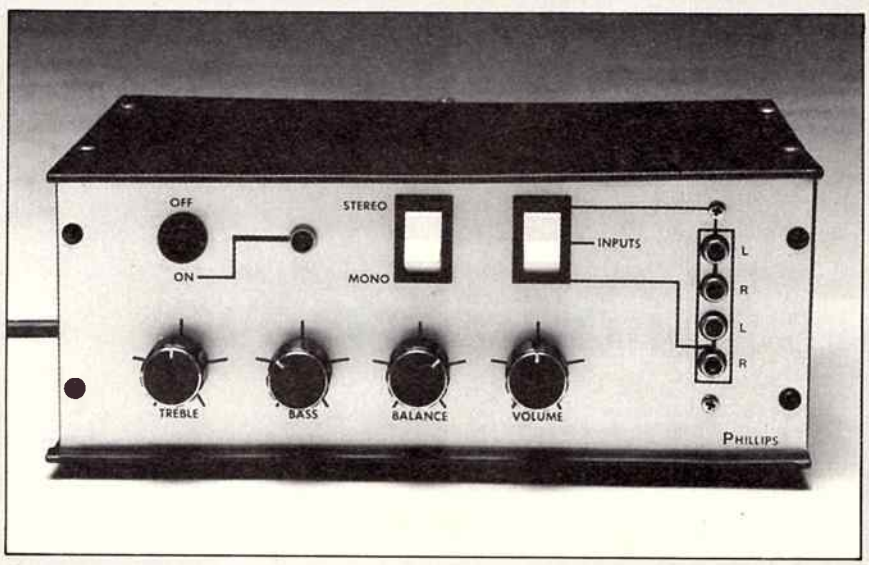
From the workbench of Peter Phillips comes a 10 watt per channel amplifier, costing around $75, which doesn't require a printed circuit board, but has a gut thumping performance that is reminiscent of valve amps.

Like many projects, this one grew from a need, created by a recent re-organisation of my overcrowded workshop. An essential part of any workshop is a sound system, both as a means of entertainment and as part of the test gear. For nearly 25 years (is it that long??) a valve amplifier has faithfully fulfilled this role for my workshop, but, apart from a deteriorating performance, it was taking up too much room. So the search began for a simple, small equivalent. Research showed that a plethora of amplifiers are available — either as kits or as ready built modules. But, I wasn't sure if these amplifiers would have the same sound as the old valve unit. Also, there was no challenge.

Whatever I came up with, costing and performance had to be competitive. After all, re-inventing the wheel is not viewed favourably by either editors or readers, and therein lay the challenge. Slowly some thought crystallised, and further research confirmed that there was a way by using ideas that (as far as I can tell) have been out of fasion for many years. Basically, the design uses three ideas that collectively do not appear to have been integrated before, but which individually are fully tried and tested. The first idea was to use Sanken Power modules as the outputs. These modules have been around for years, and have proven their worth as being both reliable and rugged. The question was, can you still get them? At the time of writing, George Brown confirmed that the type I wanted is currently available for around $20, (10 watt module) and that supply was no problem.

The next two ideas came as a result of the circuit development process. Like most projects, this one had its genesis on a breadboard. Basically, all I had to do was develop a tone control stage, as the Sanken modules had everything else, including sufficient gain to operate directly from a typical signal source. I researched the field to find that contemporary circuits all use an active tone control configuration. This method places the tone control circuitry as part of the feedback around an amplifier, with component values chosen to give the required boost or cut for both treble and bass controls. So, I commenced using a design that borrowed from various ideas, and soon had a circuit up and running. But, no matter what I did, I could not get the sound I wanted. I was able to perform an A — B test with the old valve amplifier, and it always won. Then, with an uncharacteristic burst of insight, I figured that if I wanted the same sound as the valve amp, I should use the same circuit. And that's idea number two.

The third idea grew after all my concentration on valve circuitry. Older readers may recall that in the 'good old days' magazine projects always built the circuit on tag strips or terminal strips — that is, using point to point wiring. While this method is fussy, it meant that anyone could do it. Today, the mini-



Specifications:

Measured using 8 ohm resistive loads.
Output Power = 9.6 W per channel, 1 kHz, 8 ohm load, (both channels driven together).
Input for full output = 1 Vp-p. (Volume control at max)
Frequency Response = 20 Hz to 60 kHz (within 3 db) Tone controls to mid posn, output = 1 watt.
Tone Controls
Bass = +12 db and − 9 db at 40 Hz (boost-cut, compared to 1 kHz)
Treble = +15 db and − 18 db at 10 kHz (boost-cut, compared to 400 Hz)
Output impedance = 0.2 ohm, output = 1 watt
Harmonic distortion at full power = 0.5% max.
Approximate cost = $75.00, including transformer.

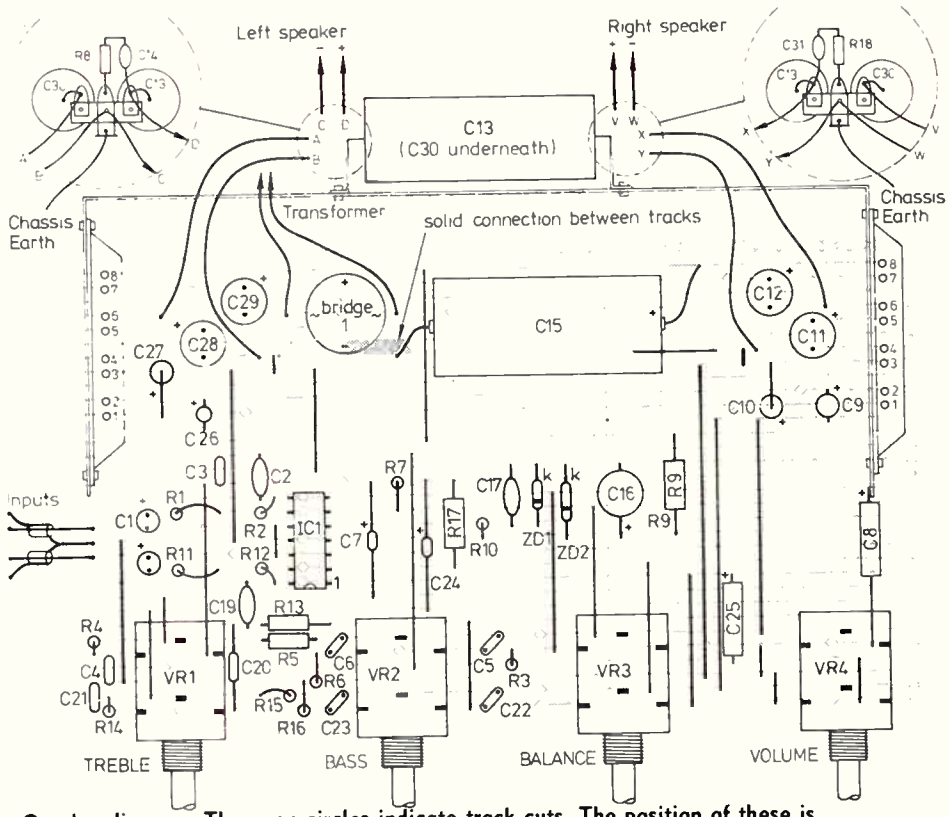
mum requirement for any but the most simple projects is a printed circuit board, which is great if you can make your own, or if it is available as a stock item. Because the circuit for this amplifier is essentially quite simple, I decided to build it all on strip-board (Vero board) and to present it in this form.

So, collectively, the final result is an amplifier that will 'knock your socks off' even though it uses the most basic components and a piece of strip board costing around $4.00. Demonstrations of the unit have resulted in high praise indeed — and I now have no reluctance to pension off the valve amplifier, as this one compares in every way. More importantly, I don't have to update to a more expensive set of speakers, as the boost frequencies from the tone controls compensate admirably.

About The Amplifier

These days, applications for a stereo amplifier that can operate into cheap speakers abound. A tuner, a video recorder, or a second sound system for Mum, (or whoever) are common applications. Other reasons include electronic keyboards, computers (such as the Apple 2GS with its sound synthesiser) and even fully blown hi-fi systems with a room equaliser that requires rear speakers. This amplifier has the right sort of bass and treble boosting compensate for a cheap set of speakers, so you win all round — a cheap amplifier with cheap speakers. Naturally, the amplifier will also perform well with good speakers, as distortion is extremely low, and frequency response very high.

But why does the tone control circuitry of this amplifier have a different sound (a better one, I believe) to other circuits? Certainly, sound quality is a subjective phenomenon, and has been the subject of much debate. The argument of solid-state versus valve amplification often involves reasoning more akin to a witch-doctor's explanation of bone pointing. One dedicated individual of my acquaintance even asserts that 20% carbon resistors are essential for true valve sound. It is probable that most people could not tell the difference between various amplifiers operating under 'flat' conditions, given controlled listening tests. But, fiddle the frequency response by rapping up the bass and treble controls, and each different amplifier will take on a characteristic as easily discernible as one set of speakers to another. The amount of boost, the boost frequencies and the shape of the response curve all contribute to the effect. Of course, purists will by now be shuddering at the very thought of listening to sound that is not 'flat', although it is arguable that most speaker systems exhibit humps and bumps in their response curves.



Overlay diagram. The open circles indicate track cuts. The position of these is not critical provided the components all stay on the correct side.

There are various reasons why boosting both ends of the audio spectrum is desirable. Compensating for speaker deficiencies is the most typical, as is low volume listening. The latter reason is to compensate for the ear, as low volume sound often sounds thin and lifeless. Another reason is to enhance certain effects, a liberty taken by many FM radio stations, particularly those with an emphasis on pop music. So, I reckon, if you are going to take musical license, then do it with the best effect. This amplifier uses high impedance voltage amplification with a passive tone control circuit, giving a close approximation of a solid-state equivalent to the traditional valve pre-amp circuit. As a result, the bass is big and the treble bright. There is a distinct lack of harshness, and distortion seems to be minimal, allowing hours of fatigue free listening. Convinced? Build it and see for yourself — it works!!

> ***"After all, re inventing the wheel is not viewed favourably by either editors or readers, and therein lay the challenge."***

The tone control circuit used in this amplifier is not my design, (I confess), but one that in various forms appeared with many valve amplifier circuits of the 1960s. Because of its losses, it needs amplification both before and after it. The circuit is intended to operate into an impedance of 220k, easily obtained with a valve, but difficult with a transistor amplifier. The solution here was to use operational amplifiers, although the spectre of a dual polarity power supply is consequently raised; a complexity I wanted to avoid. However, by using RC coupling and mid-supply biasing, single supply operation has been achieved.

The Sanken power modules are the real 'guts' of the circuit, as virtually everything else is incorporated within them. Unlike other IC power amplifiers, the Sanken module is a hybrid unit, enclosed in an aluminium housing that allows direct mounting on a heat sink. They are physically large compared to an IC, and require only four externally connected capacitors to become operational. The specifications include 0.5 % distortion at full power, and a power bandwidth of 20 Hz to 20 kHz. However, I found that at a normal listening level, the bandwidth extended up to 60 kHz; impressive by any standards. These modules are available in various power ratings; 10 W, 20 W, 30 W and 50 W. I chose the 10 W size as this keeps things simpler and cheaper, and 10 watts per channel is more than

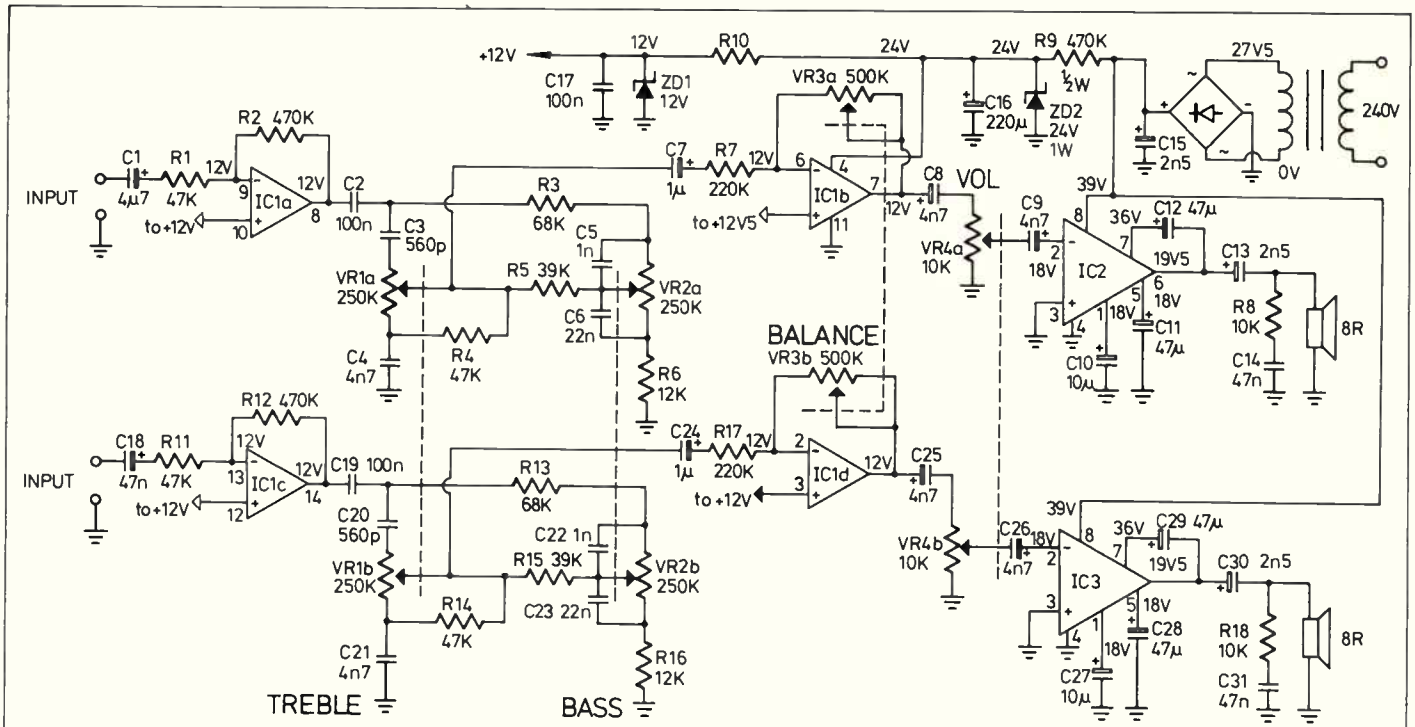
enough for a domestic situation unless you have very inefficient speakers. Readers requiring more power could use the 20 W module, although a power transformer with a higher voltage and VA rating (37 V, 1.5 amp) would also be needed. The higher voltage would require the value of R9 to be raised to around 1k (1 watt minimum, as 0.9 W would be dissipated). Also, the heat sink should be increased if full power applications are envisaged. I have not researched the other higher power modules, but their cost effectiveness may make them less attractive than other currently available circuits.

The whole amplifier in its presented form is basic, but can be extended if required to include input selection and any other sophistication that may be needed. Under normal listening conditions, heat generation is low enough to permit the enclosure to be a plastic case or a timber cabinet, although any suitable size aluminium case is probably the easiest and cheapest. If you intend operating the amplifier at loud volumes for any length of time, the size of the heatsink should be increased or the case incorporated as part of the heatsink. The complete amplifier shown is an example of how I adapted the amplifier module to make a complete unit, and may give some ideas. There are all sorts of ways to make a suitable front panel, including application of press-on lettering direct to the selected front panel, or, as in the example, with Scotchcal aluminium. I suggest the use of a metal front panel, electrically connected to the circuit earth to minimuse hum pick-ups as it earths the casing of each potentiometer.

"A no-frills workhorse, with all the facilities necessary, including the right sound"

Construction

The design is based on the strip-board unit, catalog number H-5612, available from Dick Smith, and features tinned copper strips with an alpha-numeric grid to uniquely identify each location. Any similar board is suitable, and the alpha-



How It Works

IC1 is a quad, FET input op amp, and all four non-inverting inputs are tied to a fixed 12V supply, filtered by C17, and regulated by ZD1 and R10. This sets the quiscent output voltage of all four amplifiers to 12V, in turn making all the inverting inputs equal to 12V. The op amp is supplied by a 24V supply, regulated by ZD2 and R9, filtered by C16. Because of the quiescent dc voltages, RC coupling is used throughout the amplifier. IC1A and IC1C are set to give a gain of 10, with an input impedance of 47K, established by R1 (and R11). The tone control circuit follows, in which RV1 gives treble boost or cut, and RV2 bass boost or cut. If both controls are set to mid position, the frequency response is essentially flat, although a square wave will exhibit slight variations from the ideal at frequencies around 1kHz. The output of the tone control circuit is coupled to the next stage by C7 (and C24), which, because of the high impedances used, need to be tantalum for low leakage. RV3 is the balance control, and operates by varying the gain of IC1B and IC1D from zero to approximately unity in mid position, and 2 for either extreme. If more gain is required from the circuit is intended to operate into an resistance of 220k, and lowering either of these resistor values may affect the operation of the tone control circuit. RV4 is the volume control and supplies signals to the output modules.

The output modules have a gain of approximately 40, with bootstrapping applied via C12 (and C29). The remaining components connect sections of the internal circuit to ground. The network R8 and C14 (R18 and C31) are suggested by Sanken, presumably for stability and transient suppression. The output coupling capacitors, C13 (and C30) can be 1000uF values, as recommended by Sanken, but I used 250uF to get the best low frequency response.

numeric grid can be written on the board as required. If the chosen board is not tinned, clean it thoroughly with steel wool to ensure easy soldering. Commence by marking on the track side each of the 42 track cuts required using the track-cut diagram/listing. Use a 3mm drill bit in a slow speed drill to cut each track and remove any swarf on completion.

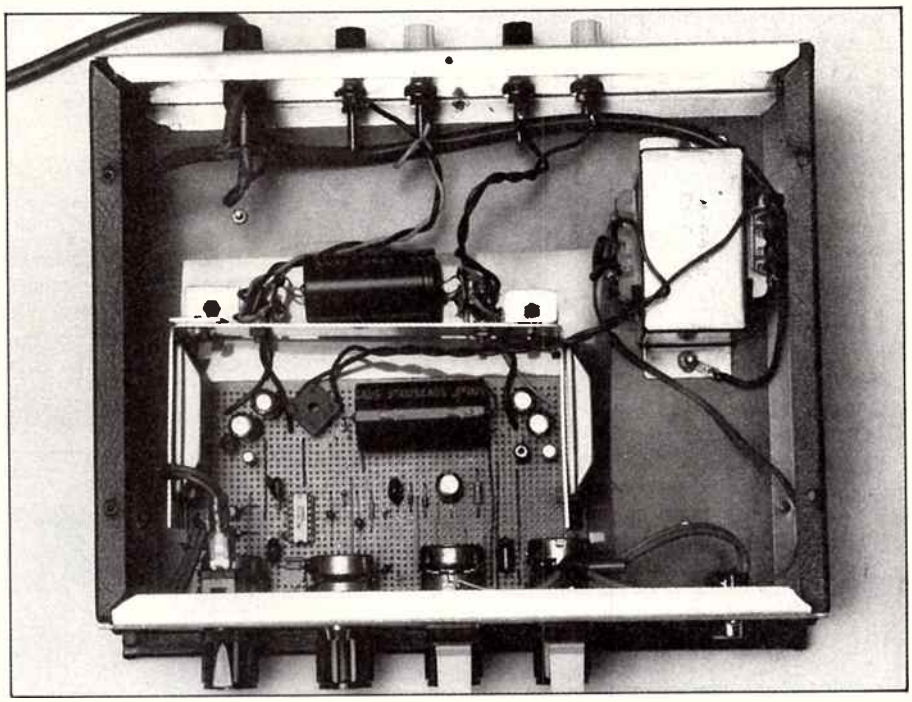
Insert the 23 track links next, using insulated tinned copper wire. It will be useful to write the alpha-numeric grid on the component side of the board to help identifying each point from this side. When fitting each link, bend the excess along the track, rather than sideways before soldering, to minimise adjacent track short-circuits. The diagram showing the links also shows the points for each track cut, this time as viewed from the component side. Check carefully for any misplaced cuts or links, as one error can make life difficult.

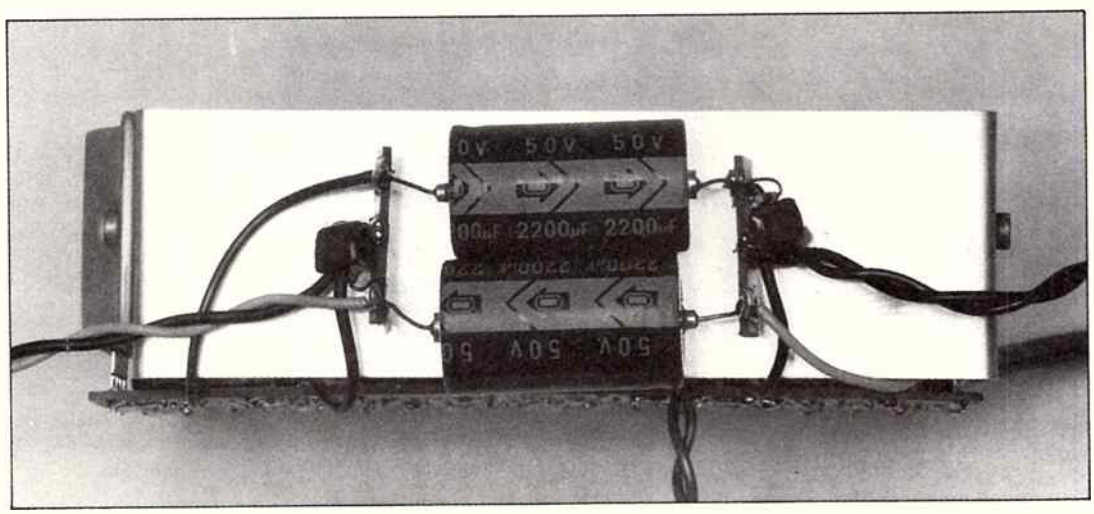
Then mount the resistors, carefully following the layout diagram. Mount them all before soldering, again bending the leads along the track. Once the resistors are soldered in, mount the IC socket and start inserting the capacitors. Fit several before soldering, as this helps to locate them and minimise mistakes. the next task is to fit the potentiometers. Attach 1mm diameter tinned leads to the lugs, and arrange them to fit into the required holes. Mark the holes to ensure all six leads will be correctly located then fit each pot in turn.

At this point, preliminary testing is recommended, as the possibility of error with this kind of construction is more likely than for a pcb. Attach the input shielded leads, then insert the IC. Apply a dc supply (25 V to 40 V) between earth and the top of R9 (end facing the rear of the board), and check that the supply current is around 15 mA to 20 mA. Connect an input signal, preferably from a signal generator, and confirm that signal is present at the volume control. If possible, check that all controls are working by observing the waveform with a CRO, or by listening to the sound with a signal tracer. Confirm that both channels are operating equally, that is the same amount of treble and bass control occurs, and the amplitude of both signals is the same when the balance control is set to its mid position. A square wave set to a frequency of around 400 Hz should exhibit considerable leading edge overshoot for treble boost, and the bass control should alter the slope of the top and bottom of the wave.

With everything working so far, mount the bridge rectifier. Note that tracks Y and Z are earth, and, although already joined at two other points, should now be connected together with a very solid connection between the negative terminal of the rectifier and the negative end of C15. Lay a short piece of wire between the tracks, and run solder to form a continuous connection. This connection minimises hum due to the charge current for C15 taking paths shared by the inputs to the power modules. Next connect the ac supply leads and the output leads checking carefully that there are no adjacent track shorts due to a single strand. It may be necessary to enlarge the holes for these leads with a 1mm drill.

The final task is to mount the power modules and the heatsink. Enlarge, with a 1mm drill, the holes in the strip board





Above: The top view of the amplifier mounted in its case. The transformer is at the bottom left, along with output terminals.

Left: A rear view of the module itself. The power modules are at either end of the aluminium strip, which serves as a heatsink, apart from carrying the power supply capacitors.

required to accept each module, and form the legs of the module to match the hole spacing by bending each odd numbered lead to form a dogleg towards the next even numbered lead. The even numbered leads do not need more than slight reforming. Note particularly that both modules face the same way and the left hand module faces in. Make the heat sink from a strip of aluminium measuring 45mm by 280mm. Bend the strip at right angles 68mm from each end, then drill it to match the holes in each module. Also drill two holes to attach the tag strips required to support the off-board components. Attach the heatsink, then solder the module terminals to their respective tracks, making very certain that no shorts occur between the tracks. The tag strips and their respective components can now be fitted, and the final wiring completed.

PARTS LIST — ETI-1419

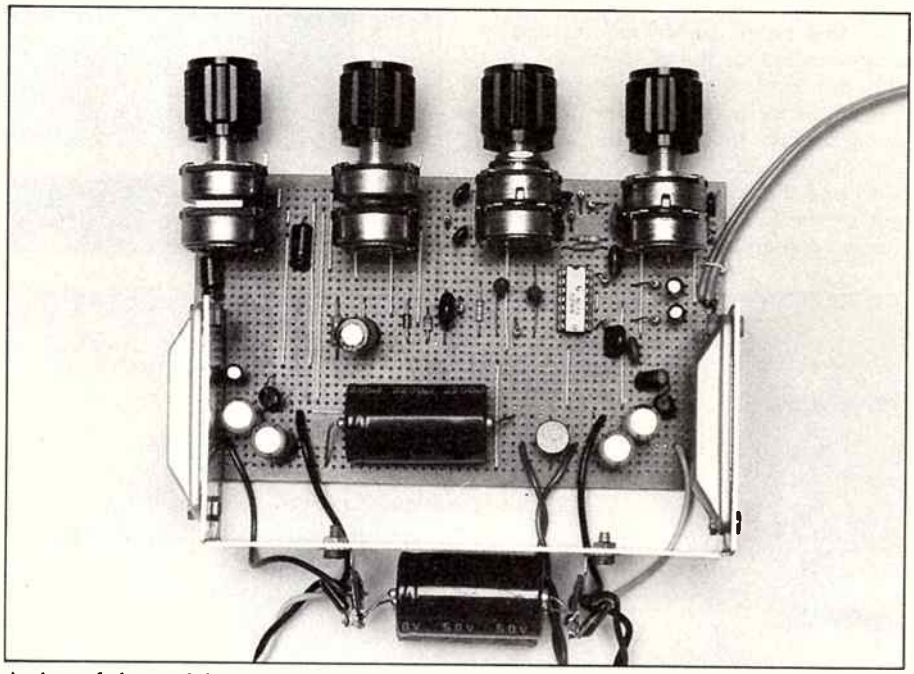
Resistors: .....all ¼ watt unless otherwise stated
R1, R11,R4, R14 ...47k
R2, R12 .....470k
R3, R13 .....68k
R5, R15 .....39k
R6, R16 .....12k
R7, R17 .....220k
R8, R18 10
R9.....470 ohm ½ watt
R10.....2k7
Potentiometers:.....all duel ganged (available from Jaycar)
RV1, RV2 .....250k log (C curve)
RV3 .....500k linear (A curve)
RV4 .....10k log (C curve)
Capacitors: .....All 50V electorlytic, pc mount unless otherwise stated
C1, C9, ...
C18, C26 .....4.7uF
C8, C25 .....4.7uF axial
C2, C17, C19.....40.1uF polyester
C3, C20 .....560pF Ceramic
C4, C21 .....0.0047uF polyester
C6, C23 .....0.022uF polyester
C5, C22 .....0.001uF polyester
C7, C24 .....1uf tantalum
C10, C27 .....10uF axial
C11, C12, C28, C29.....47uF
C13, C30, C15.....2500uF — axial
C14, C31 .....0.047uF polyester
C16.....220uF
Semiconductors
IC1.....TL074 (or uA774)
IC2, IC3 .....SANKEN SI-1010G (available George Brown)
ZD1 .....12 volt, 500mW or greater
ZD2 .....24 volt, 1W
Bridge 1 .....1.2A full wave bridge (WO4 or similar)
Transformer:.....240 to 27.5V, 1A. Type 6672 or similar
Miscellaneous:
Strip board, 90mm × 150mm (Dick Smith — catalog H-5612); thin guage aluminium, 45mm × 280mm; two × 3 lug tag strips; single strand insulated wire; hookup wire.

Before connecting the transformer, verify by measuring the resistance across C15 that there are no shorts between the power supply rail and earth. Also, do a final check that everything is as it should be, then attach the transformer and a pair of speakers and apply power to the unit. If all is well, and the fire extinguisher is not really needed after all, a thump at switch on should indicate both output coupling capacitors charging. Touching both input leads should also give the characteristic hum and the controls should all operate properly. There should be no hum or noise of any kind when the volume control is turned full anticlockwise. The power modules run slightly warm, as does R9. Obviously, if there is a significant rise in temperature of the heat sink, there is something wrong. The voltages shown on the circuit diagram may assist in any fault finding, although correct dc voltages still occur if the fault is an interruption in the signal path.

A Compete Unit

The example shown of a complete unit uses a home made aluminium box, dimensions 95mm × 260mm × 200mm (h × w × d) fitted with a Scotchcal front panel. Because the amplifier is for workshop use, the inputs are on the front panel, with selection of either pair accomplished with a 2 position, 2 pole piano-key toggle switch. A mains on-off switch, a LED power indicator and a stereo-mono switch complete the top row, all located above the amplifier controls. A 1 amp fuse in the mains lead (active), is fitted to the rear panel, along with the speaker output terminals. The box is earthed to the amplifier by having one speaker terminal (the earth of the pair) connected directly to the panel. Although probably unnecessary, I arranged everything so that this was the only earth point to the case to ensure no earth loop currents. Naturally, the box and transformer casing are earthed to the power point in the usual manner. The LED is operated by the transformer using the 27.5 V and 24 V tappings, (to give 3.5 V) with a diode and a 100 ohm resister in series with the LED. The stereo-mono switch simply connects both inputs together, which is somewhat rough, but useful in the planned application. Two brackets from the heat sink to the case bottom support the rear of the amplifier module whilst the front panel supports the controls. A no frills workhorse, with all the facilities necessary, including the right sound.

It is planned to present in a future article a pcb version of the tone control circuit of this amplifier, but integrated with a 4 input mixer. The power output section will be up to the reader, so if a more sophisticated unit is required, keep tuned-in to these pages. Otherwise, enjoy the sound of the 'sixties from this unit.



A view of the module from the top. The pots are conventional panel mounting ones, secured to the board by a bit of stiff wire, (off-cuts from resistor leads work just fine). You can use special circuit board mounting pots if you wish, but there are problems both of supply and price.

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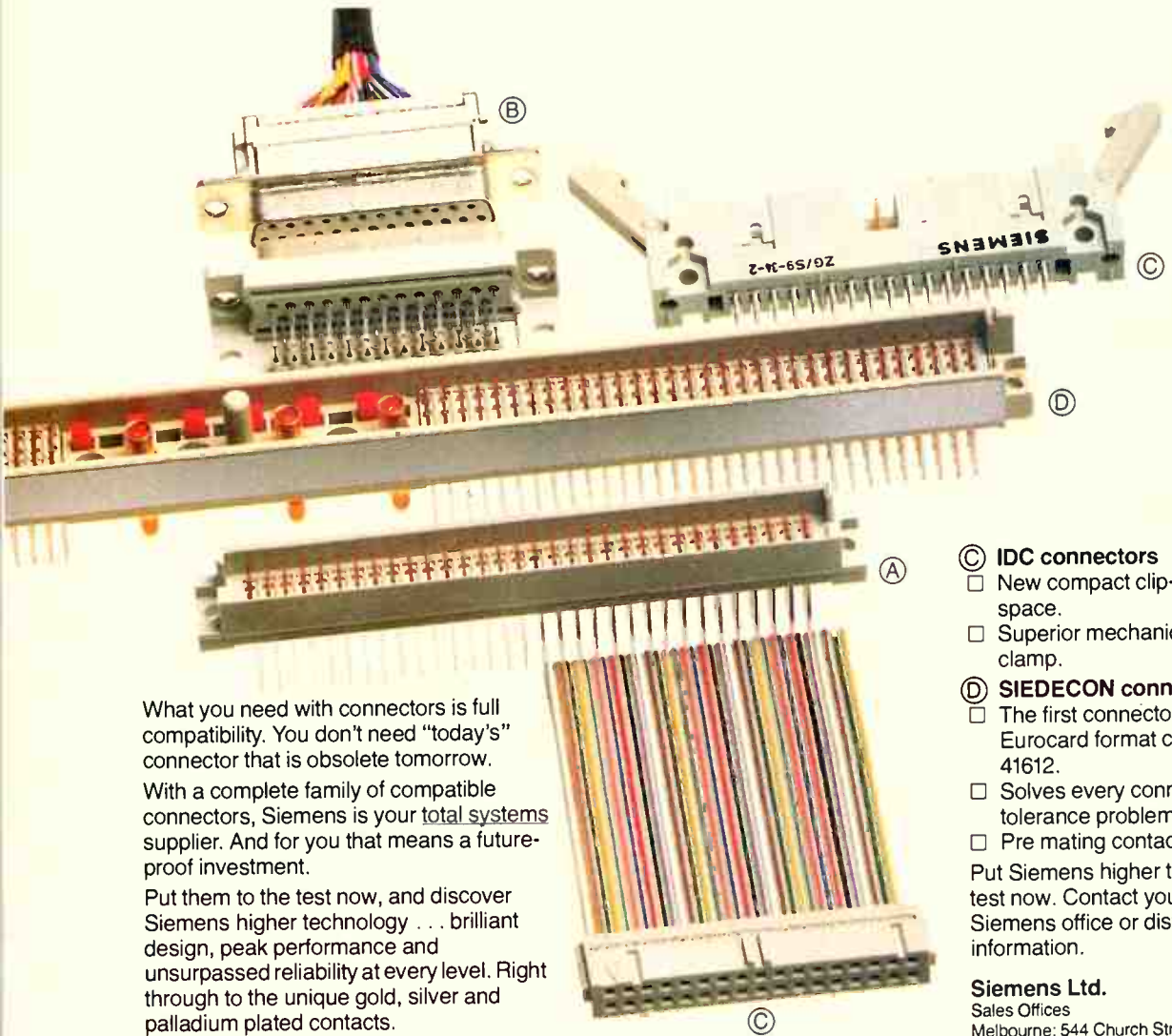

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2. *How many keys on the front panel?*
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P.O. Box 227, Psion Organiser
ETI Competition,
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2 .....
3 .....
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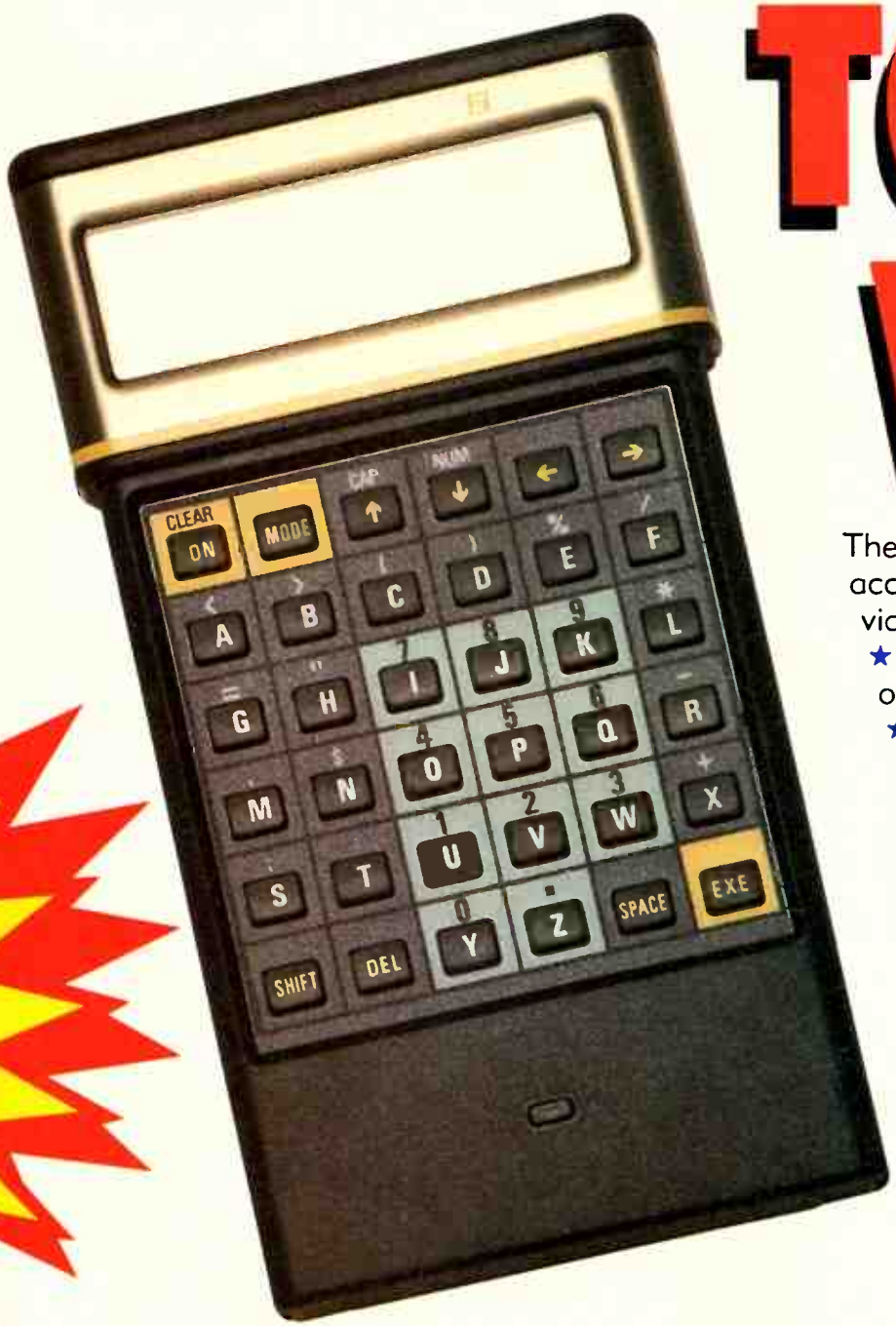
ETI

ORGANISERS TO BE WON



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1. There will be four winners. Eoch winner will receive one Psion Organiser by the most convenient method depending on their location.
2. Prizes are not transferoble or exchangeable and may not be converted to cash.
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4. South Australian residents may enter by completing their answers on a hand drown facsimile of the entry format on this page and posting it to Freepost No 4, Federol Publishing Company, PO Box 227, Psion Orgoniser ETI competition, Woterloo, NSW.
5. Description of the competition and instructions how to enter form a part of the competition conditions.
6. The competition commences on September 1st, 1988 and closes with the last mail on November 7, 1988. The draw will take place in Sydney on November 11, 1988 ond the winners will be notified by telephone and letter. The winners will also be annouced in The Australian on November 14, 1988 and the next avoilable issue of ETI.
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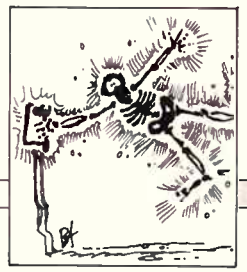
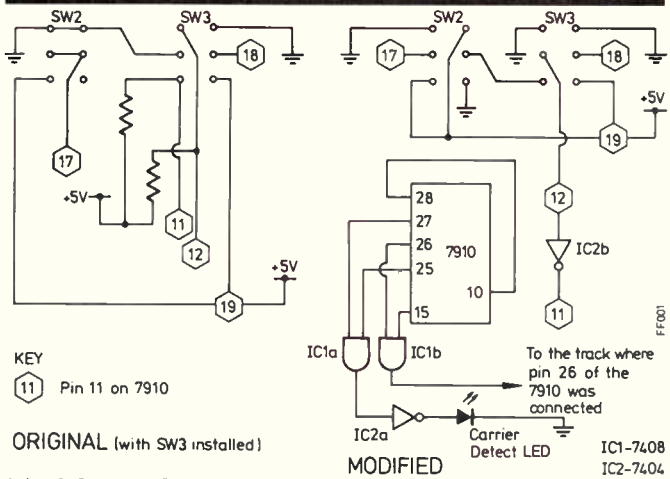


Idea of the month



Modifying the Avtek Minimodem

There are a number of 300 baud modems floating around that have been toppled from their previously safe places alongside their owner's computer in favour of a ritzier version capable of more sophisticated operating modes. Hence, they are secondhand and, usually, quite cheap. Many of these modems are built around the all singing, all dancing world modem chip, one such modem, is the Avtek Minimodem (also sold by Dick Smith as the Dataphone 300). Consequently, this modem, and others built on the 7910 can be modified to perform a variety of new dance steps. For the cost involved of two chips (a 7408 and a 7404), a dpdt switch, a little wire and some time/solder etc the following may be used to modify the Avtek Minimodem/Dick Smith Dataphone 300.

On the original circuit board, there is space for another dpdt switch SW3. Wire links have been soldered into place instead of the switch. Remove these links and install switch 3. Solder a jumper from pin 28 on the 7910 (world modem chip) to pin 10. There will probably already be a track on the board doing just this, but on every minimodem I've seen it has been cut.

That is all you need to operate the modem at 1200Rx/75Tx (i.e. Viatel, some bulletin boards etc). Switch 3 now selects between 300 baud (answer and originate being selected via switch 2) and 1200Rx/75Tx. Note that in 1200/75 mode, the answer/originate switch has no effect.

To convert the modem to 75Rx/1200Tx capability, the forward and back channel receive lines must be ANDed. The carrier detect for the main and back channels must be ANDed together, and cuts and links must be made on the modem board to mimic the change illustrated in the diagrams. I used a 7408 (quad two input AND gates) and a 7404 for the necessary inversions.

Originally the carrier detect was produced via a resistor/-transistor, after the mod's this didn't work anymore so I dispensed with that setup and used the circuit shown to drive the carrier detect led.

A. Kelly
Brampton
SA

Circuits

Minimum component autorepeat circuit

A number of circuits have been produced to add a delayed autorepeat effect to a simple strobe signal. The standard arrangement is to combine an oscillator (at the required autorepeat frequency), with a delay timer, via suitable gating circuitry. The circuit presented here however, exploits the "controllability" of an LM555 oscillator/timer IC and reduces the number of IC's to only one.

The circuit may be simply inserted in series with the original standard strobe line.

Short duration strobe signals are merely reproduced without modification. Strobe signals of long duration produce an initial strobe signal as before, but after a time delay, the output becomes a continuous train of output pulses.

IC101 is an LM555 configured as a square wave oscillator.

The standard strobe signal is applied to IC1's RESET input, pin 4. Its normally low condition forces IC1's output, pin 3, to also go low. At the same time C102 and C103 are held discharged via D101 and D102.

When the original strobe signal goes to its active (high) state, IC1 is freed from its forced reset and commences to oscillate, cyclically charging and discharging (via R101) the capacitor(s) connected at pins 2 and 6.

The initial charging period is lengthened by the presence of C103, causing an extended initial high output state.

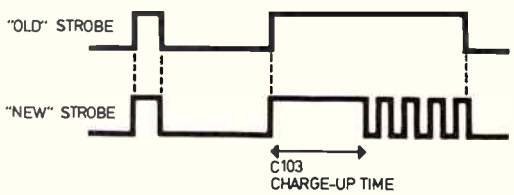
Once initially charged, C103 has no further effect due to the blocking effect of D101, and oscillation then occurs at a frequency largely determined by the values of R101 and C102.

The output of IC101 is used as the new strobe line.

When the original strobe signal reverts to its idle (low) state, IC1 is again forced to reset, and C102/C103 are discharged via D101 and D102 in readiness for a repeat of the sequence.

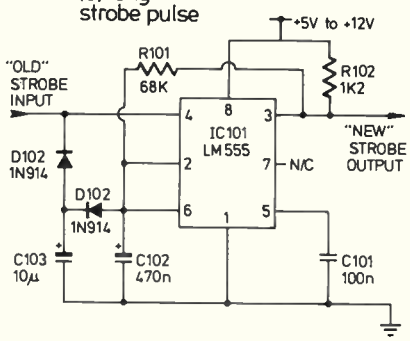
Original and modified strobe signal waveforms are as shown.

R. J. Mortindale
Mill Park
Vic



(a) short strobe pulse

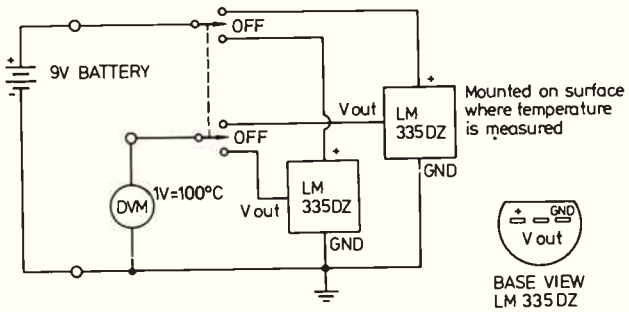
(b) long strobe pulse



DVM temperature measurement adapter

This very simple device was built when I needed to measure a temperature rise between a heatsink and ambient and this was the easiest way to do it. Two LM335 temperature sensors are connected to a 9V battery and the meter input set to measure dc voltage, via a dpdt spring return centre off switch. One of the sensors is placed on the heatsink.

L. W. Brown
Burwood
Vic



Letters

See you there . . .

We would be grateful if you could pass the following information onto your readers.

The MSX and Spectravideo Users Group (Inc.) can be contacted through Mitch Raitt on (03) 438 2687 and meetings are held at the Nunawading Civic Centre on the first Saturday each month, 12 noon to 6 pm.

Hugh M. Raitt,
(President)
Diamond Creek 3089

Review Reviled

I am writing with regard to the ETI-186 Wide Range Voltmeter by Peter Phillips, the article which appeared in two parts in the March and April issues of your magazine this year. It is my considered opinion that, as presented, the device is unlikely to live up to its rated performance. Some simple experiments that I did confirm this.

The first problem is associated with the input protection diodes D1 and D2, two 1N914's. These diodes are unacceptable for this application. Data on the 914's current at 100 mV is not so easy to find which is why I checked it out with prototyping board. The problem occurs mainly on the 1 V range, where the input of IC1 sees a source resistance of around 470 k ohm. The errors caused by the diodes were as high as

---

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:

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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.

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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.*"

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Title of idea/program .....

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13%, considerably greater than the plus or minus 2% as stated on page 82 of the April issue. Even on the 10 V range the diodes contributed significant errors. The effect is twofold: first, the 1 V range will read roughly 10% low when compored to the other ranges, and secondly, there is some nonlinearity throughout the range of the order of the stated accuracy. Neither of these effects are in any way countered in the circuit as published.

Another weakness in the meter's front end is the compensation for stray capacitance. The problem here occurs mainly on the 10 V range. Since there is no compensation it is likely the quoted bandwidth is wrong, at least for the 10 V range and probably also for the 100 V range.

Phil Denniss,
Dept of Plasma Physics
University of Sydney
NSW 2006

In reply

My thanks to Mr Denniss for his comments concerning the front end of the Wide Range Voltmeter published March-April 1988 ETI.

Mr Denniss asserts that the linearity of the meter is more likely to be around 13 per cent, rather than the 2 per cent given as a specification and offers experimental data to support his assertion. Examination of his data in fact confirms the original +/−2 per cent linearity specification stated within the text for the project. The effect of current flow in the diodes is compensated by adjustment (RV7), and the figures provided by the correspondent show that averaging the setting of RV7, as detailed in the original text, will give the specified linearity. The loading caused by the diodes on the input attenuator is easily compensated by adjustment of the resistor values comprising the attenuator, and space is provided on the pcb layout for this. I do not understand his assertion that the input impedence is 470k. It is not. He also writes that the frequency response cannot be as stated for the 10 V and 100 V ranges due to the lack of adequate compensation. I can only reaffirm that the specifications listed are those actually obtained. The circuit was originally developed on a breadboard and was thoroughly tested before a pcb design was made. The eventual prototype was constructed with all new components, giving two working examples of the circuit. The fact that both circuits operated according to the specifications listed is evidence that the design is repeatable, and that component variations have been accounted for. In fact, removing the protection diodes altogether makes little overall difference as any non-linearities within the electronics are likely to be masked by the meter movement anyway. However, I agree that some non-linearity is caused by the diodes, but certainly not to the extent suggested. It may be that the modifications offered by Mr Denniss will improve the linearity, but I stand by the original design.

Peter Phillips

Readers' requests . . .

Would it be possible for ETI to publish a regular feature which will include data sheets and a brief review of new devices.

Alan Dyde,
Perth 6200

Could ETI please refrain from placing entry forms so the articles I wish to keep will not be ruined by cutting them out.

M. May,
Toowoomba 4350

And praise, too!

Great! You're publishing some VZ programmes. Please keep it up.

Mark Tearle,
Busselton 6280

Programmes

Statement printer

```
1 ' ****************************************
2 ' *     Written by Edward Dekkers        *
3 ' *            for IBM                   *
4 ' *              7/5/88                  *
5 ' ****************************************
10 CLS:SCREEN 0:WIDTH 80
20 DIM T$(50),A1$(50),A2$(50),D$(50),P$(50),A(50),B(50),B1(50)
30 INPUT "To who are we sending:";T$
35 IF LEN(T$)< 19 THEN T$=T$ + " ":GOTO 35
40 INPUT "Address:";A1$
45 IF LEN(A1$)< 19 THEN A1$=A1$ + " ":GOTO 45
50 INPUT "Suburb,State:";A2$
55 IF LEN(A2$)< 19 THEN A2$=A2$ + " ":GOTO 55
60 INPUT "How many entries:";M
65 INPUT "Period Ending";DS$
67 IF LEN(DS$)< 18 THEN DS$=DS$ + " ":GOTO 67
68 INPUT "Is there a balance brought forward";I$
70 FOR H=1 TO M
80 INPUT "DATE";D$(H)
85 IF LEN(D$(H))< 8 THEN D$(H)=D$(H) + " ":GOTO 85
87 IF I$="Y" OR I$="y" THEN P$(1)="Balance brought forward                    "
90 IF H > 1 OR I$="N" OR I$="n" THEN INPUT "PARTICULARS";P$(H)
95 IF LEN(P$(H))< 4 THEN P$(H)=P$(H) + " ":GOTO 95
100 INPUT "AMOUNT";A(H)
110 NEXT H
115 FOR Z=1 TO 2
120 PRINT "Please Wait,I am Printing....."
130 LPRINT CHR$(134);STRING$(19,157);CHR$(149)
140 LPRINT CHR$(156);"Eddy's Cactus Farm ";CHR$(156)
150 LPRINT CHR$(156);"Lot 73 The Hoseshoe";CHR$(156)
160 LPRINT CHR$(156);"Wandi W.A.     6167";CHR$(156)
170 LPRINT CHR$(153);STRING$(19,157);CHR$(154)
180 LPRINT "T:"
190 LPRINT CHR$(134);STRING$(19,157);CHR$(149);TAB(60);CHR$(134);STRING$(18,157)
;CHR$(149)
200 LPRINT CHR$(156);T$;CHR$(156);TAB(60);CHR$(156);"     STATEMENT    ";CHR$(15
6)
210 LPRINT CHR$(156);A1$;CHR$(156);TAB(60);CHR$(150);STRING$(18,157);CHR$(151)
220 LPRINT CHR$(156);A2$;CHR$(156);TAB(60);CHR$(156);DS$;CHR$(156)
230 LPRINT CHR$(153);STRING$(19,157);CHR$(154);TAB(60);CHR$(153);STRING$(18,157)
;CHR$(154)
240 LPRINT :LPRINT
250 LPRINT CHR$(134);STRING$(78,157);CHR$(149)
260 LPRINT CHR$(156);"  Date  ";CHR$(156);STRING$(15,32);"Particulars";STRING$(1
6,32);CHR$(156);"  Amount  ";CHR$(156);" Balance       ";CHR$(156)
270 LPRINT CHR$(150);STRING$(8,157);CHR$(159);STRING$(42,157);CHR$(159);STRING$(
30,157);CHR$(159);STRING$(15,157);CHR$(151)
280 FOR X=1 TO M
290 LPRINT CHR$(156);D$(X);CHR$(156);P$(X);CHR$(156);"$";A(X);TAB(64);CHR$(156);
300 B1(X)=A(X) + B1(X-1)
301 T=B1(X)
310 LPRINT "$";B1(X);TAB(80);CHR$(156)
320 NEXT X
330 FOR Y=1 TO 10
340 LPRINT CHR$(156);TAB(10);CHR$(156);TAB(53);CHR$(156);TAB(64);CHR$(156);TAB(8
0);CHR$(156)
350 NEXT Y
352 C=T
353 D=0
354 IF I$="Y" OR I$="y" THEN D=A(1)
355 IF I$="Y" OR I$="y" THEN C=T - A(1)
360 LPRINT CHR$(153);STRING$(29,157);CHR$(152);STRING$(9,157);CHR$(152);STRING$(
10,157);CHR$(152);STRING$(9,157);CHR$(152);STRING$(7,157);CHR$(152);STRING$(9,15
7);CHR$(151)
370 LPRINT TAB(23);"Overdue:";CHR$(156);"$";D;TAB(41);CHR$(156);"Current:";TAB(5
2);CHR$(156);"$";C;TAB(62);CHR$(156);TAB(64);"Total:";CHR$(156);"$";T;TAB(80);CH
R$(156)
380 LPRINT TAB(31);CHR$(153);STRING$(9,157);CHR$(154);TAB(52);CHR$(153);STRING$(
9,157);CHR$(154);TAB(70);CHR$(153);STRING$(9,157);CHR$(154)
390 LPRINT CHR$(12)
392 NEXT Z
395 PRINT "Another(Y/N)?"
400 I$=INKEY$:IF I$=""THEN 400
410 IF I$="Y" OR I$="y" THEN RUN
```

NOTE BELOW:
To print your firm on top of the statement, change line 140, 150 and 160 to read between the quotation marks
(line 140) (Your firm name of 19 characters)
(line 150) (Your first address line of 19 characters)
(line 160) (Your second address line of 19 characters)

This program will produce a statement which automatically adds up Overdue, Current and Total. Enter name and address lines up to 19 characters. Enter date up to 8 characters (dd/mm/yy).

Enter amount without dollar signs.

This program is for an IBM or compatible PC with any dot matrix printer.

E. Dekkers
Wandi
WA

Microbee bingo enhancement

```
00010 REM MICROBEE BINGO (1987) by G.R.LAMING
00020 REM 1/3A FALCON AVE MILE END 5031
00030 REM PH (08) 43 3912
00040 SD14:CLS:DIMP(90) :CURS25,2:INVERSE:PRINT'MICROBEE BINGO':NORMAL
00050 CURS20,8:PRINT'SELECTING RANDOM NUMBERS'
00060 CURS25,15:PRINT'by  G.R.LAMING'
00070 REM ************** Random Number Selector ****************
00075 FORX=0TO89
00080 P(X)=X+1
00085 NEXTX
00090 FORN=89TO1STEP-1
00095 R=INT(RND*FLT(N+1))
00100 T=P(N):P(N)=P(R):P(R)=T:IFN<81:CURS30,9ELSECURS31,9
00105 PRINTINT(90-FLT(N))
00110 NEXTN
00115 REM ************************************************
00120 CURS20,8:PRINTCA24 32):CURS31,9:PRINT'  ':CURS27,8:PRINT'EYES  DOWN'
00130 A1$=KEY:IFA1$<>' 'THEN130
00140 CURS27,8:PRINTCA10 32):N=0
00150 IFN<0:N=0ELSEIFN>89:N=89
00160 T=P(N)/10:U=P(N)-T*10:IFU=0:U=10:T=T-1
00170 S=61574+T*6+U*64:IFU=10:U=0:T=T+1ELSEIFT=0:T=-16
00180 POKES,T+48:POKES+1,U+48:A1$=KEY:IFA1$=' ':N=N+1:GOTO150
00190 IFA1$=CHR(8):POKES,32:POKES+1,32:N=N-1:GOTO150
00200 IFA1$=CHR(27):RUN
00210 FORX=1TO100:NEXTX:IFT  -16:POKES,PEEK(S)+128
00220 POKES+1,PEEK(S+1)+128:FORX=1TO100:NEXTX:GOTO150
```

Just prior to my original Bingo program being published in the June 1988 edition, it was pointed out to me that the program may contravene gaming laws and as such, I contacted the Department of Recreation and Sport, where-upon they informed me that some computers exhibit a tendency to repeat games in a regular pattern and so, if I could prove to them that all numbers have a fair and equal opportunity of being drawn without any pattern evolving, they would accept my program to be used in a gaming environment.

Exhaustive tests proved the former to be the case with the original program and so the following modifications will have to be made before it is used.

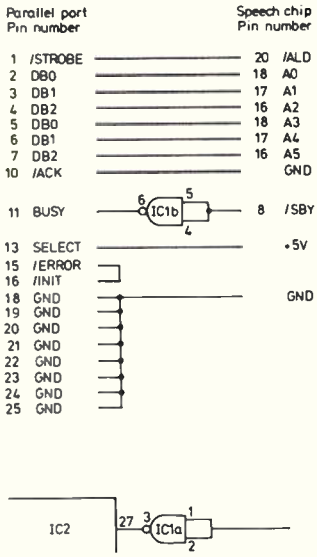
```
In line 00040 add SD14 to the start of the line so the line now reads:
00040 SD14:CLS:DIMP(90):CURS25,2:INVERSE:PRINT'MICROBEE BINGO':NORMAL

Now delete lines 00070 to 00110 inclusive and add these lines:
00070 REM ************** Random Number Selector ****************
00075 FORX=0TO89
00080 P(X)=X+1
00085 NEXTX
00090 FORN=89TO1STEP-1
00095 R=INT(RND*FLT(N+1))
00100 T=P(N):P(N)=P(R):P(R)=T:IFN<81:CURS30,9ELSECURS31,9
00105 PRINTINT(90-FLT(N))
00110 NEXTN
00115 REM ************************************************
```

An added advantage is that the original program slowed down toward the end of the selection process providing a considerable amount of wasted time, but with the modified version it was all over in a matter of seconds.

All will now be well but you may wish to RENUM the lines before saving. The complete program is reproduced here for clarity.

G. R. Laming
Mile End
SA

IBM PC speech chip interface



The 'Commodore 64 Talker' described in ETI May 1987, provides an excellent, low-cost introduction to synthetic speech — provided you own a Commodore. The design can, however, quite easily be altered to interface with almost any computer using the Centronics interface, without the addition of extra components.

The circuit change suggested here utilises the standard 25 pin parallel port of an IBM PC or compatible, which provides most of the signals (Fig. 1). It is necessary to invert the polarity of the standby signal (SBY) from the speech chip to conform with the BUSY signal of the Centronics interface. This can be done by inverter IC1b as shown, which in the original design was used as an extra buffer stage between the oscillator and speech chip, IC2. IC1a pin 3 connects therefore straight to pin 27 of IC2 (Fig. 2).

As for the powering of the speech synthesiser, you may either use the internal power supply of your PC, by taking +5V and GND from one of the free connectors intended for additional floppy drives. Alternatively, you may design your own power supply, by using e.g.: a 9 V wall adapter and a 7805 regulator.

Jørgen Nordqvist,
Rarotonga.
Cook Islands

PRINT Solves Overwrite

```
10 PRINT"Keef NZ"
20 CLS
30 FILES
40 INPUT "WIDTH ";W
50 ON ERROR GOTO 150
60 INPUT "NAME OF FILE TO PRINT ";N$
70 OPEN N$ FOR INPUT AS #1
80 ON ERROR GOTO 170
90 OPEN "COM:" FOR OUTPUT AS #2
100 PRINT#2,CHR$(27)"1"
110 A$=INPUT$(1,#1):IF A$=CHR$(13)THEN C=0
120 C=C+1:IF C<W THEN PRINT#2,A$;:GOTO 110
130 IF A$=" " THEN PRINT#2,A$:C=0 ELSE PRINT#2,A$;
140 GOTO 110
150 CLS:PRINT N$" does not exist..."
160 RESUME 30
170 FOR Q=1 TO 5:PRINT#2,"":NEXT:CLOSE
180 ' uncomment next line to do many copies
190 'RESUME 70
200 RESUME 60
```

PRINT solves a problem with portables that occurs when you wish to "print" a text file to the RS232 port. The lack of Line Feed characters courses overwrite on the same line. It simply lets Basic insert an L/F in the text each time it sees a CR. I have added width control. The program is error driven. That is the end of file and the existence of the file are found by the occurence of an error.

This program should work on any machine with little modifying.

K. Ross
Greymouth
NZ

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COMING EVENTS

AUGUST

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.

22-26: Austcerom Exhibition of Industrial Ceramics together with the International Ceramics Conference. At Darling Harbour, Sydney. Phone (02) 807-0400.

23-25: AutoCAD Expo '88, incorporating the Third National AutoCAD Users' Conference, will be held at Centrepoint in Sydney. The organiser, Autodesk Australia, has called for papers. Contact (03) 429-9888.

23-26: A four-day intensive workshop on the effective use of contemporary project management tools will be held at the Macquarie University Management Centre in Sydney. Contact Wendy Bailey (02) 963-2301.

24-26: Database and Networking Seminar. It costs $795 and is arranged by Hausley Communications. At the Crest International Hotel in Melbourne. Call (02) 498-7877.

SEPTEMBER

1-2: Symposium on Remote Sensing in Antarctica. Mr Peter Keage, Antarctic Division, Department of Administrative Services, Channel Highway, Kingston, Tas 7450. Telex: AA57090.

5-8: The Third International Technical Innovation and Entrepreneurship Symposium will be held on the Gold Coast. Contact David Millhouse (07) 377-2899.

11-15: International Energy '88. Gold Coast. Secretariat, International Energy '88. GPO Box 1334, Brisbane, Qld 4001. Telex: AA44587, Attn: H.C.E.

12-16: Workshop on Surface Mounting in Sydney will be repeated in Melbourne, 19-23. Cost $650. Call (02) 647-1533 or (03) 543-5122 to reserve a place.

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.

30: Australian British Chamber of Commerce closes its **Export Award applications.** Prize awarded to company with biggest increase in UK sales. Call ABCC office in Sydney, or Melbourne.

OCTOBER

1-3: ACCA 88. The Australia Computer Society's Annual Conference will be held at Darling Harbour in Sydney. Contact ACP Exhibitions Limited, 2/124 Castlereagh Street, Sydney, NSW 2000. Phone (02) 264-1266.

7-8: Contributions are being sought for TAD-SEM '88, a two-day seminar on Computers Serving People with Disabilities, at Camperdown in Sydney. Contact (02) 808-2022.

30-Nov 3: 9th International Conference on Computer Communication will be held at the Hilton Hotel, Tel Aviv. For more information contact Dr J. Raviv, Secretariat, 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.

NOVEMBER

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

6-10: The International Symposium and Exposition on Robots will be held at the Sydney Hilton and Centrepoint. Contact the Australian Robot Association, GPO Box 1527, Sydney NSW 2001.

15-18: AI'88, the Australian Joint Artificial Intelligence Conference, will be held in Adelaide. Contact (08) 228-5586.

NEXT YEAR

13-17 Feb: The World Conference on Engineering Education for Advancing Technology will be held at the University of Sydney. Contact the Conference Manager, Institution of Engineers, 11 National Circuit, Barton, ACT 2600.

14-17 March biannual: PC89 The 12th Australian Personal Computer Show at Darling Harbour, Sydney. Contact (03) 267-4500.

14-17 March annual: ELENEX AUSTRALIA The Australian International Electrical & Electronic Industries Exhibition at Darling Harbour Sydney on (03) 267-4500.

27-27 April: The Institution on Engineers, Australia, has called for papers for a conference on New Business Applications of Information Technology, to be held in Melbourne. Deadline for receipt of synopses is June 30. Contact (062) 70-6549.

11-15 Sept: Ireecon '89: IREE has called for papers and is booking exhibition space. The exhibition is being held at the Exhibition Hall, Melbourne. Bookings on (02) 327-4822.

BUFFOONERY
ETI — 0000

Crazies

According to a recent study, nearly one half of the US population believes in one of the two accounts of creation recorded by Genesis, and thus actively discount scientific theories on the origin of life, the universe and everything. Large numbers also believe in healing crystals, harmonic convergence, channellers, Nostradamus and his prophesies and so on. Some people, including one who is extremely well-connected in Washington, even believe in Astrology.

This is, as most scientists and educators in the US readily admit, a pretty depressing state of affairs.

There are a number of reasons why this should be so, according to America watchers. One is a simple reaction against technology. Three-Mile Island, Chernobyl, Bhopal, nuclear deterrence, star-wars, identity cards, phone bugging and so on have given all of us, especially the Americans, plenty of reasons to fear the misuse of technology.

This antipathy to science applies to all the world's citizens, of course. What turns it into criziness in the US is harder to pin down. Many commentators argue that it depends on the mystical strain that has been a constant threat to American life. The current surge in creationist Churches is but part of a long term interest in fundamentalist religion, particularly in the 'bible belt' states of the South.

Another interesting trend, peculiar to the US, although with echoes in Queensland and South Africa, is the way in which the various mystical strins have been hijacked by political extremists. For instance, the creationist Churches are most often identified with ultra-Rightists. At the opposite end of the political spectrum, old 'flower children' from the 1960s, tend to believe in faith healing, oriental religions with odd sounding names and the power of pyramids. Their reaction, motivated by a dislike of the new age of horror weapons, the rape of the environment and the centralising power of technology, is perhaps more forgiveable, even if just as silly.

Whatever the reason, it is pretty depressing to think about how scientificaly illiterate the majority of the population are, given the importance of science in our lives. We are the first society in history to ever really depend on technology, the fruits of science, for our very existence, yet not since the dark ages have so many people wilfully turned their bocks on explanations of why things are as they are.

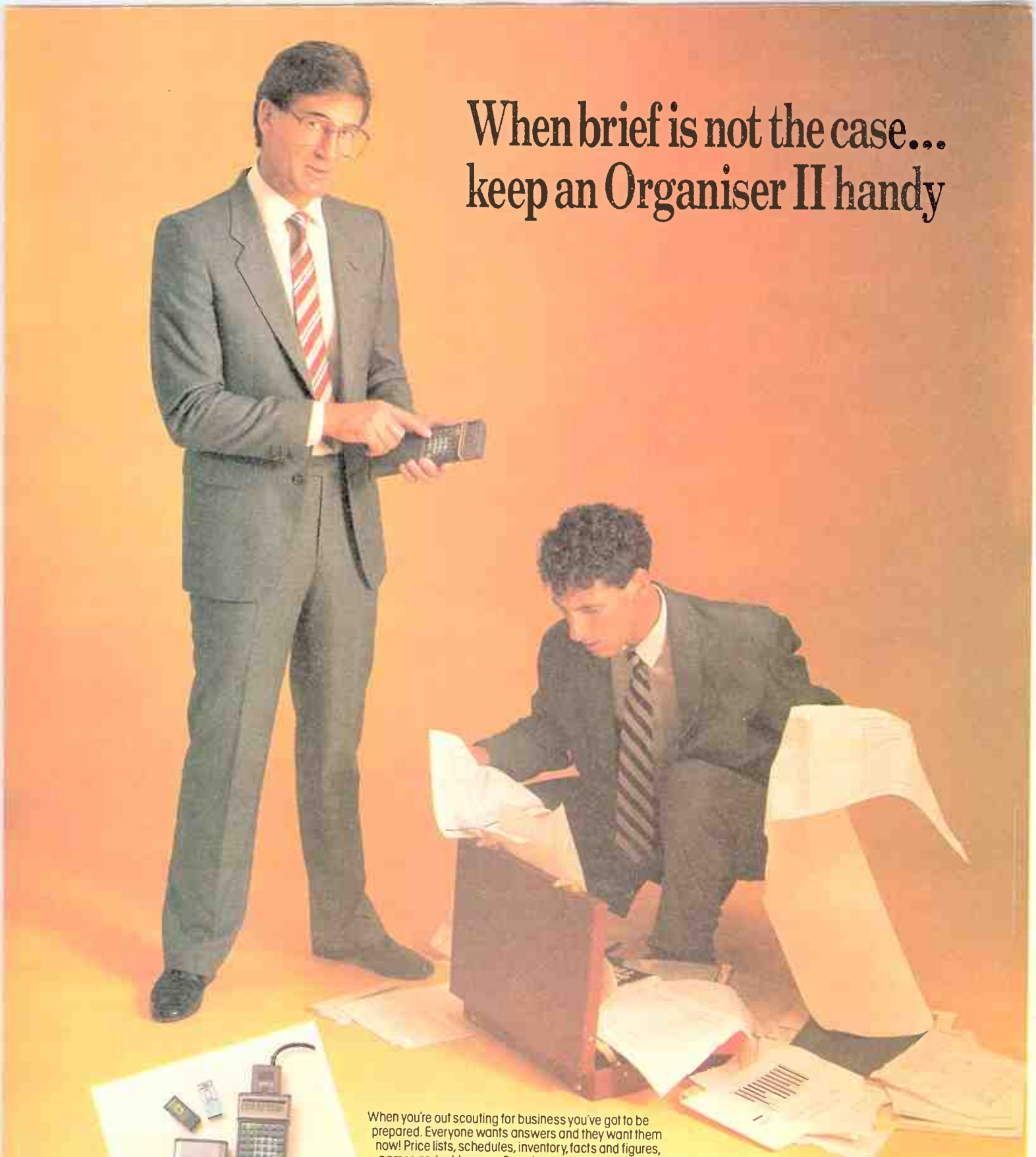
Rats

The article on computers and aircraft might have caught your eye in this issue. It's nice to think of all those error prone pilots being replaced by shiny new IBMs, isn't it?

Consider, if you will, a salutary tale out of India. It appears that rattus rattus, the common household rodent likes electrical cable, especially when its modulated with a bit of digital signal. It also appears that rattus rattus is turning up in increasing numbers as a stowaway on international flights. Put these two items together and you have Indian President Rajiv Ghandi firmly earthbound recently, as first one, then a second plane, was found immobilised by rats gnawing through control cables.

Fair enough: rats chew through the cables while the plane is stationary. Awkward, even embarrassing, but not dangerous. What happens, however, when the rat gets busy at 30,000 feet? Not only does one have the risk associated with loss of control, but also with fire, a nightmare in a sealed-up aircraft. Boeing tell us they have built in redundancy to cover this eventuality. Good.

When brief is not the case... keep an Organiser II handy



When you're out scouting for business you've got to be prepared. Everyone wants answers and they want them now! Price lists, schedules, inventory, facts and figures, names and addresses. Carrying hard copy data stuffed into a brief case used to be your only option. A slow, heavy, clumsy option.

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READER INFO No. 40

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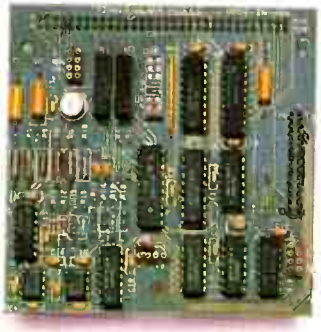
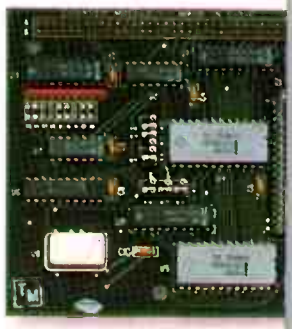
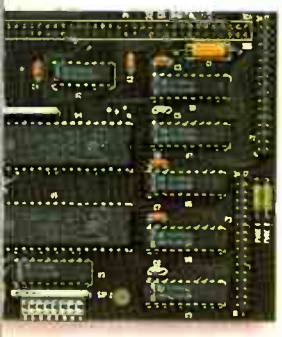


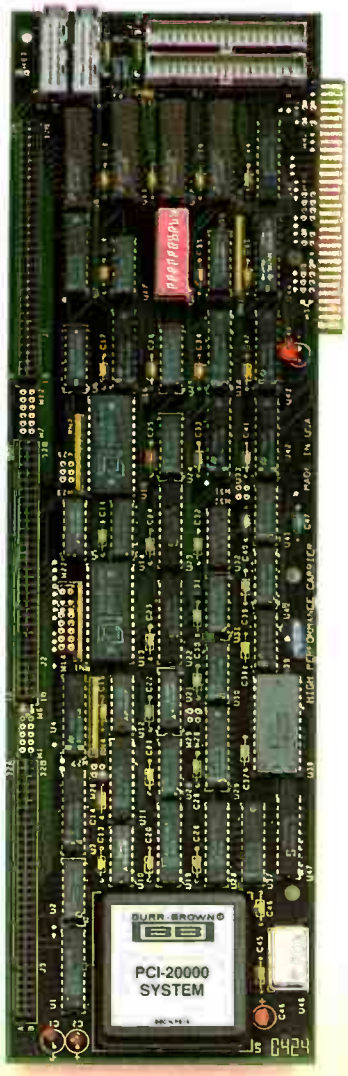
Special function modules: trigger/alarm, simultaneous sample/hold.



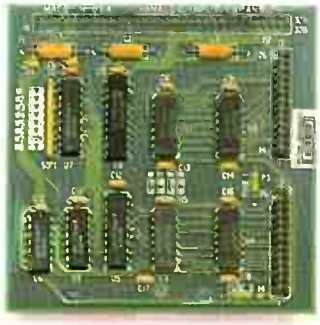
Counter/timer, clock, pulse generator & frequency measurement module.



Expandable digital I/O module (to 128 points per carrier).



DMA carrier board with clock and digital I/O transfers data at 360 kBytes/sec. Holds 3 modules.



Expandable analog input module (to 80 channels per carrier).

The others just grow old.

Some personal computer data I/O systems make you pay for functions you don't need. These same inflexible systems can't be updated—at any price.

The unique PCI-20000 modular system, on the other hand, is easily configured to provide literally thousands of data acquisition, test, measurement and/or control options. Just plug the application-specific modules you need into a carrier board. Then plug the carrier into your IBM/compatible PC. Change or add modules as your needs change. In other words, the PCI-20000 grows up, not old!

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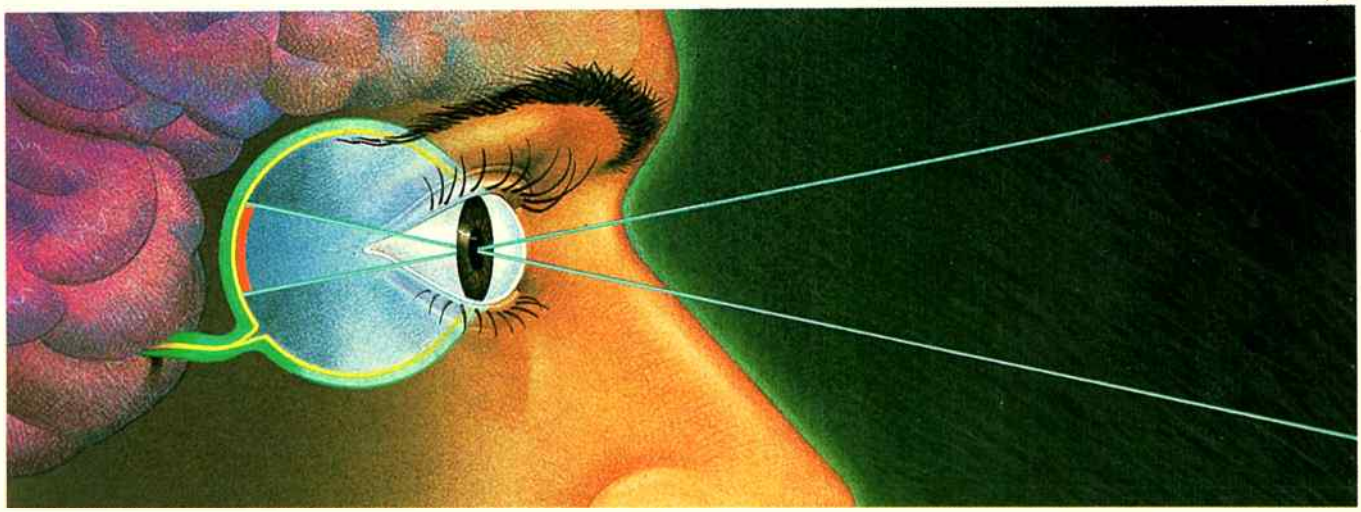
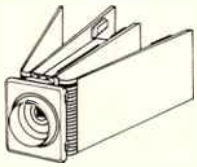
MACHINES THAT SEE



Inside the world's most innovative imaging devices, a miniature solid-state sensor gathers visual data much like the retina of the eye.



Today, Philips is applying the benefits of frame transfer technology to solid-state sensors. With its unique separation of imaging surface from memory, the frame transfer sensor has brought new standards of resolution and sensitivity to imaging applications.

THE IMAGING MODULE

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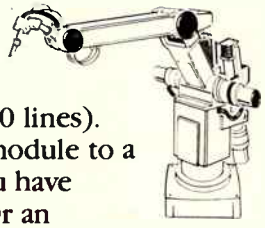

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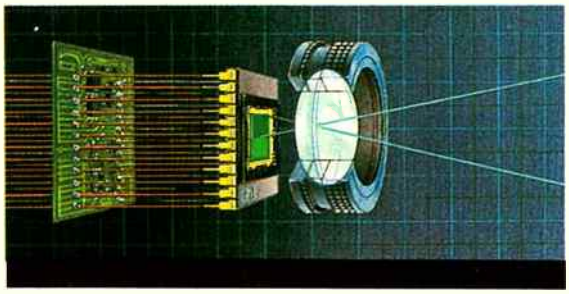

Compared with conventional character recognition systems, the Philips imaging modules offer superior image and reliability.

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- machine vision
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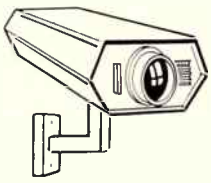

To find out how the Philips Imaging Module can work for you, phone Philips Components on Sydney (02) 439 3322, Melbourne (03) 542 3333, Adelaide (08) 243 0155, Perth (09) 277 4199, Brisbane (07) 844 0191.

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