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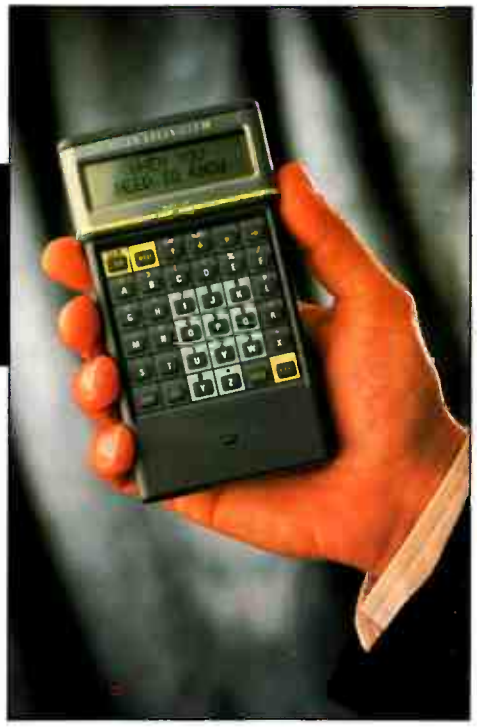

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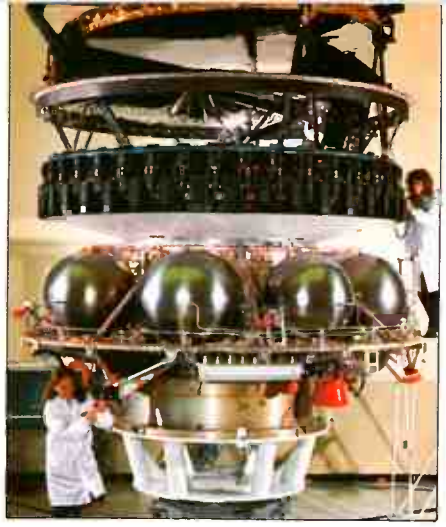

Cover:
Technicians at Hughes Aircraft Company's El Segundo, California plant, check JCSAT, Japan's first commercial communications satellite, after its two major subsections were mated for the first time. Hughes is building two satellites — both HS393 wide body models operating on the Ku band frequency — for Japan Communications Satellite Company, a joint venture between Hughes and its Japanese partners, C. Itoh & Company and Mitsui & Company. The first spacecraft is expected to be launched into orbit around March 1989.

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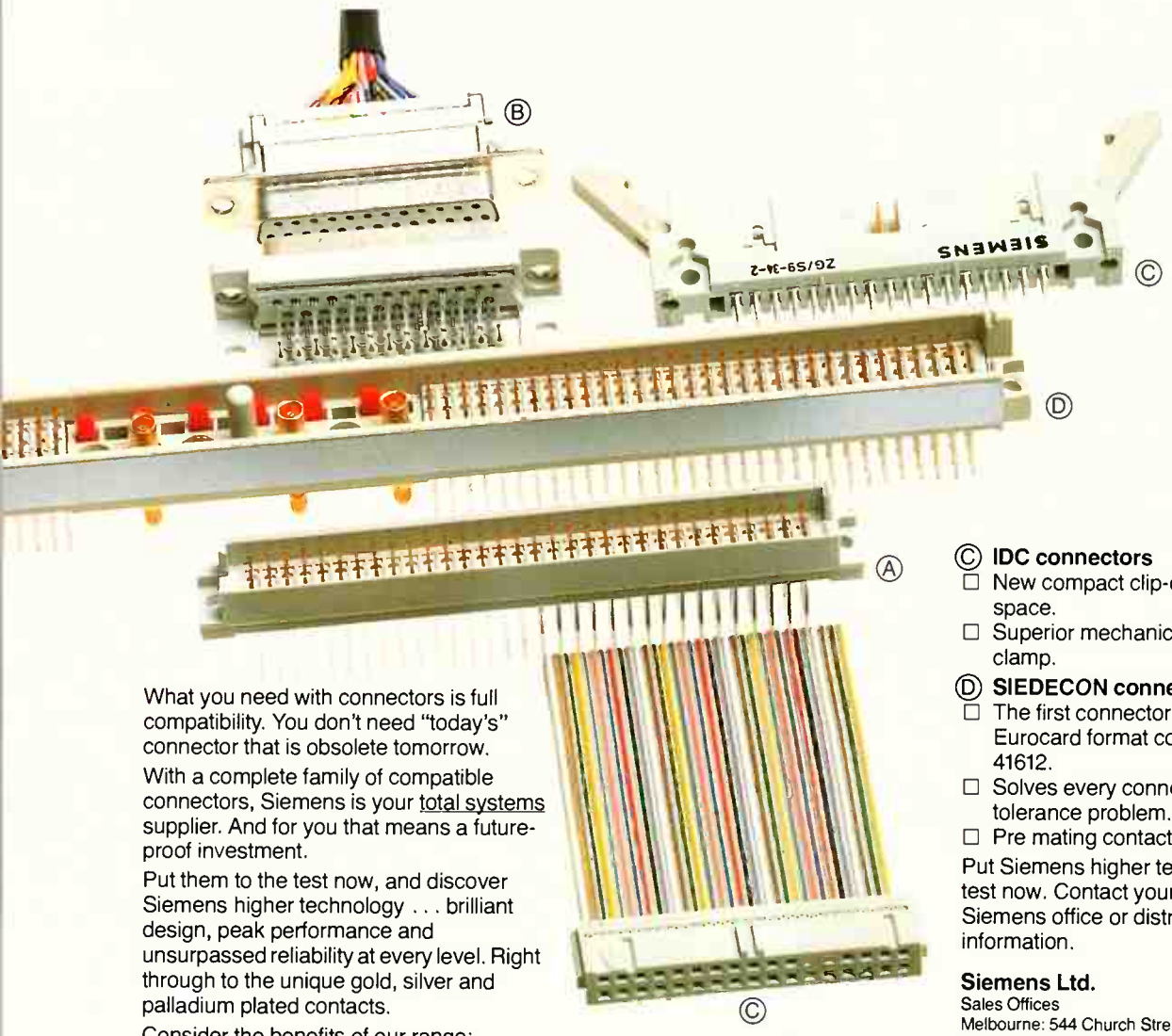
At last ... a complete range of future-proof connectors



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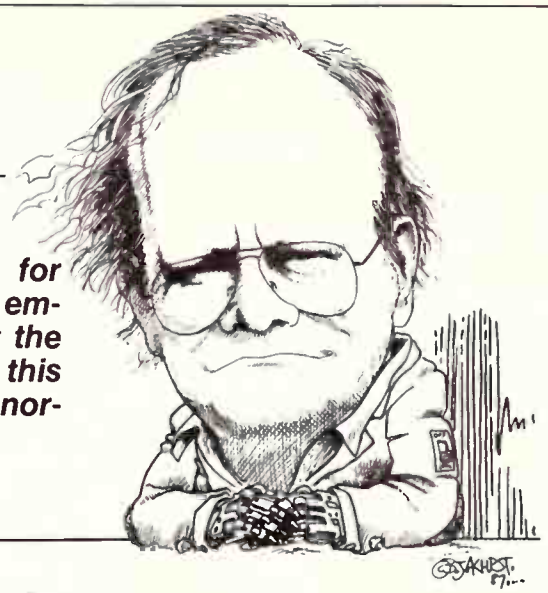

> ***"The consequences for wealth creation and employment of being at the cutting edge of this technology are enormous."***

Aussat is forging ahead with its plans for L band mobile satellite services. (See News Digest, p 8).

The news is exciting for a number of reasons. Foremost, because with mobile radio, satellite broadcasting will finally realise its potential as a communications medium. Arthur C. Clarke's vision of satellites linking together the countries of the world has collapsed in the face of communications economics: the price of launches and satellites is going up, while the price of optical fibres is coming down. Instead, we confront the era of Dick Tracy; communications on the move. Cellular radio sized downstations with roof mounted pancake aerials are already on the drawing board. Just over the horizon, surely, is the wrist watch sized device that will allow you to call the world from your front yard, the top of Uluru, or indeed, the middle of the Pacific Ocean.

Over short distances, cellular phones have shown the way. Even with Telecom charging outrageous prices, demand continues to outstrip supply. No wonder Aussat, who will be able to sell a similar service, but over the whole of Australia, is keen to get into the act.

Secondly, the news is exciting because Aussat is moving to set up its standards at about the same time as similar operators overseas, and working hard to ensure that the Australian system is aligned with the international market place. Consumers in this country will be receiving services as fast as, or faster than, consumers anywhere else in the world. In view of their enthusiasm for the technology that is not altogether surprising.

Thirdly, and most importantly, it seems that Australian industry is actually prepared to gird up its loins and run with this one, instead of adopting its usual chicken hearted "make it elsewhere" mentality. When market leaders like AWA and British Aerospace Australia start setting up joint ventures to table L band technology, we can expect the smaller fish who cruise in their wake to get into the swim. The consequences for wealth creation and employment of being at the cutting edge of this technology are enormous. It goes without saying that the risks are great, too.

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World Radio History

INDUSTRY NEWS

Burgeoning demand for its software here and overseas has prompted Australian Pick Systems to restructure, changing its name to Apscore International, and to take on John Winters as General Manager for Asia and the Pacific.

Winters, formerly General Manager of Attaché Software, said a major international order for Cue-Bic, the company's chief software product was likely to be announced at the SPECTRUM Pick users exhibition in Anaheim, Los Angeles later this month.

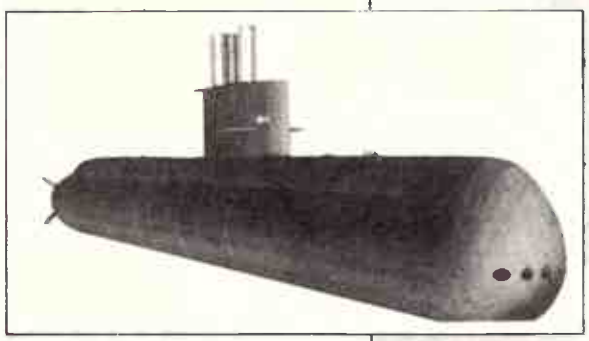
★ ★ ★

Daniella McKenzie has been appointed Group Financial Controller at Voicecall, the business communications company. She was previously with Wang.

★ ★ ★

EMI Records' David Hudson has joined Amber Technology as Marketing Manager reporting to the General Manager, Karl Seglins.

Before coming to Australia, he worked at BC Tel in Vancouver on mf, hf and cellular mobile radiotelephone systems.

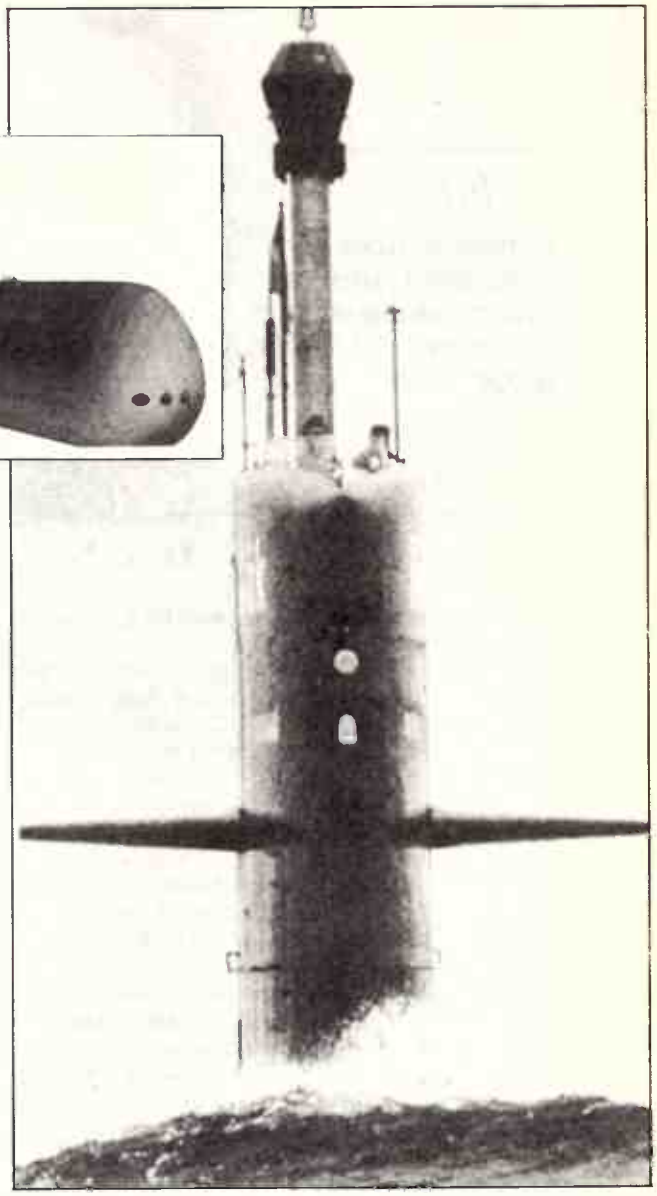


The Silent Subs

Work is proceeding apace on the $4 billion dollar submarine project for the RAN. New facilities are being built at Port Adelaide where the final assembly of the submarines is to take place.

In line with the governments 'Technology Transfer' requirements, some 30 Australian engineers and technicians are currently being trained in the Kockums shipyards in Malmo Sweden. As readers of ETI will recall Kockums headed the consortium which won the lucrative subs contract some months ago.

The first of the six new subs is expected to be launched in 1993 followed by subsequent boats at yearly intervals.



Kodak's Research

Recently the US Department of Commerce awarded a contract to Kodak Research to advise the government on future policy for procuring remote-sensing satellites.

The policy on space commerce was prompted by the belief in the US that the country was falling behind its competitors. Spot Image in France, for example, is aggressively marketing the products of its remote-sensing satellite. In the US, Congress and the Department of Commerce have criticised Eosat, the company set up to sell the data from landsat satellites, for not developing markets. this criticism prompted the current study by Kodak Research.

Kodak's contract is one result of the emphasis put on turning space into a commercial proposition that was highlighted in President Reagan's new space plan, published on February 11. Since the report was published, NASA has set up an advisory group for the commercial development of space,and invited proposals from industry for a privately funded space carrier. The government says that it will pay up to $700 million to lease room on this carrier, which must be ready for launch by 1993. The idea is to tempt investors into the project.

On the same day that the space plan was released, the Economic Policy Council within the White House published a 15-point plan stating policy on commercial space operations for remote sensing, processing materials in space and the development of private launch services.

World Radio History

New Physical Effect in Semi conductors

A new effect has been discovered in semiconductors . The phenomenon occurs at very low temperatures in a thin semiconductor layer where electrons can move more freely in it than is normally the case. It has been established that the resistance of a narrow connection between two areas in such a layer does not change uniformly as the width of the contact decreases, as might be expected, but in extremely regular steps. The size of the steps depends only on fundamental physical constants and not on material properties or the shape of the connection.

The research was carried out by researchers at Philips in the Nettlelads, Delf University and at Cambridge University.

The measurements were made on gallium arsenide, to which very pure aluminium gallium arsenide had been applied very thinly. A thin layer of highly mobile electrons exists at the boundary between the two compounds. At temperatures just above absolute zero (about -272°) the 'mean free path' in the layer, i.e. the distance between collisions in the material, is many microns. Such a thin layer of highly mobile electroncs is termed a two-dimensional electron gas.

Two insulated metal electrodes were applied on the aluminium gallium arsenide, with a narrow space (0.25 mm) between them. A voltage applied to these electrodes influences the electron gas below. At a negative voltage of -0, 6 v there should no longer be any electrons below the electrodes. When the voltage is reduced even further the 'depopulated' area will also spread beyond the electrodes. In this way a controllable, almost point-like connection between the electron-gas on the two sides is obtained. The work showed that electrodes with such small spacings could be made successfully and that the width of the connection could be varied. In measurements of the conductivity of such a contract it was found that with a gradual reduction of the width of the connection the conductivity decreased in steps, with the wavelength of electrons in a semiconductor. These techniques are derived from the techniques used in making solid-state diode lasers and the latest integrated circuits.

Data Disc Release

The Australian Bureau of Statistics has released preliminary labour force data on floppy disk for the first time.

The information will be issued monthly on 5¼" disks compatible with IBM PCs. The date files, in delimited ASCII format, can easily be loaded into most popular spreadsheet packages. This allows quick analysis of trends in labour force data by selectively looking at major labour force aggregates.

The disks cost $50 each for most users, with a substantial discount on annual subscriptions. There is a separate scale of charges for data agencies that want the disks for manipulation and resale.

For more information or to obtain an order form, phone ABS Labour Household Surveys Section on (062) 52-6683.

Cape York Spaceport

There are other proposals to construct spaceports in the Pacific Basin and these represent strong competition to current Australian moves, insofar as it is doubtful that more than one such facility in the region would be economically feasible.

Indonesia is assessing Gag Island (130°E 1°S) in the North Moluccas as a possible site, while the Japanese are looking into the possibility of establishing a site on Kirabati. The Chinese who, like the Japanese, already have a more northerly launch site, are investigating establishment of a second facility, on Hainan Island (110°E 18°N).

There is also competition from the facility recently established by Brazil at Alcantara, just 1400 km south-east of the French launch site at Kourou in French Guyana.

In terms of economic and political stability, local technology base, and capacity to rapidly develop the infrastructure required, Australia would seem to be in a good position to solicit support from international agencies and companies in the satellite launch business, should all sectors here agree to piress ahead with the development of the Cape York site.

Commonwealth Reaction

"The Commonwealth Government fully supports the Queensland Government's efforts to develop a commercial spaceport at Cape York," the Minister for Industry, Technology and Commerce, Senator John Button, said recently.

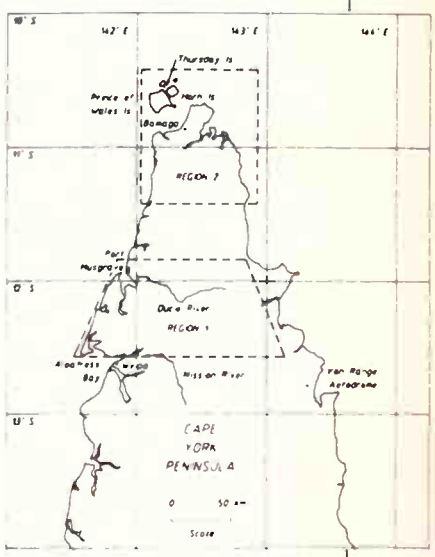
Senator Button has been appointed by the Prime Minister, Mr Hawke, to co-ordinate the Commonwealth's role in the current detailed feasibility studies.

The Minister also said that there was intense interest all around the world in the spaceport concept. "This was particularly evident in my recent trip to China. The technical advantages of a launch site near the equator, the wide international acceptance of Australia by other nations, and the growing trends towards fully commercial space launch activities, all combined to produce a strong case for an international launch facility at Cape York."

The Minister said he would be speaking about the spaceport with the Queensland Premier, Mr Ahern, to enable the Commonwealth and Queensland Governments to establish sound working relationships and a unity of purpose towards the project. Senator Button also announced that he was writing to all Commonwealth Ministers seeking that they identify all issues raised by the spaceport proposal, and that they set in train appropriate and timely processes for resolving such issues.

The Australian Space Board, which advises the Government on space industry matters, will be asked to provide advice on the industrial opportunities which may arise from the spaceport development and appropriate arrangements by which maximum benefits can be achieved.

The Australian Space Office within the Department of Industry, Technology and Commerce, will have day-to-day responsibility for co-ordinating the Federal Government's activities in relation to the spaceport.



Cape York, the projected launch sites

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Voice Coil Diameter: 19mm
Voice Coil Resistance: 6.2 ohms
Moving Mass: 0.2 grams
Weight: 0.28kg
Cat C10301 $38

C20 WOOFER SPECIFICATIONS:
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Frequency Range: 35 - 6.000Hz
Resonance Frequency: 39Hz
Sensitivity 1W at 1m: 90dB
Nominal Power: 50 Watts (12dB/oct)
Voice Coil Diameter: 25mm
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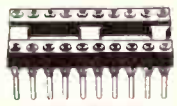

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METEX 4500H MULTIMETER

10A, 4½ digit multimeter with digital hold, transistor tester and audible continuity tester.

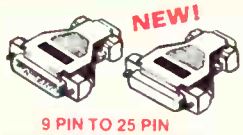
The Metex 4500H is perfect for the technician, engineer or enthusiast who requires the higher accuracy of a 4½ digit multimeter. This meter is exceptionally accurate, (just look at the specifications), and yet, still retains an exceptionally low price!

The Metex 4500H features digital hold which is normally only found on very expensive multimeters. This enables you take a reading and hold that reading on display even after you have removed the probes simply by pressing the hold button.

CHECK THESE FEATURES...

- Readout hold
- Transistor Tester
- 4½ digit x ½"(H) LCD
- Audible continuity tester
- Push-button ON/OFF switch
- Quality set of probes
- Single function, 30 position easy to use rotary switch for FUNCTION and RANGE selection
- Built in tilting bail
- Instruction manual
- Full overload protection
- hFE test
- Battery and Spare fuse
- Diode Tester
- Vinyl case

Q91560 .... Normally $175
Special, only $159



NEW!

9 PIN TO 25 PIN CONNECTOR ADAPTORS

NEW! The ideal solution! Features gold plated pins.

X15668 DB9 Plug to DB25 Socket
X15669 DB9 Socket to DB25 Plug
each $10.95

★★★★★★★★

10mm JUMBO LED's

Z10155	Red	$1.00	$0.90
Z10156	Green	$1.00	$0.90
Z10167	Yellow	$1.00	$0.90

★★★★★★★★

QUALITY 3mm LEDS

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

QUALITY 5mm LEDS

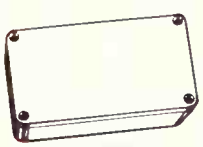
Cat. No. Col.	1-9	10+	100+
Z10150 Red	$0.10	$0.09	$0.08
Z10151 Grn	$0.15	$0.12	$0.10
Z10152 Ylw	$0.15	$0.12	$0.10

P.I.R. SENTRY

FEATURES:

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

S $175



DIECAST BOXES

Diecast boxes are excellent for RF shielding, and strength.
Screws are provided with each box.

H11451	100 x 50 x 25mm	$ 5.95
H11452	110 x 60 x 30mm	$ 6.50
H11453	120 x 65 x 40mm	$ 6.95
H11461	120 x 94 x 53mm	$11.50
H11462	188 x 120 x 78mm	$13.50
H11464	188 x 188 x 64mm	$29.50

12 WAY TERMINAL BLOCKS

P18050 240V 10AMP $1.95
P18052 240V 15AMP $1.95

STEREO WIRELESS TRANSMITTER

This unit was developed to allow portable compact disc players to be used in cars by transmitting the headphone output signal directly in to your stereo FM car radio. It will also transmit any mono/stereo signal from any headphone output to any FM receiver.

SPECIFICATIONS:

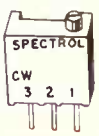
- Input 3.5mm stereo phone plug impedance 32 ohm
- Mono/stereo switch has plug mounting clip
- FM Transmission approx 90.35MHz (Tuneable 89-91MHz)
- Range 15 metres (below 15mV/m at 100 metres)
- Power 1.5V AAA size batteries (100 hours continuous use)
- Size 72 x 38 x 21mm

A16100 ..... $69.95

AUTOMATIC CABLE STRIPPER

- Strips cable with diameter of 1.16 2.26 3.2mm
- Fully automatic action. Squeeze grip will simultaneously strip and eject insulation
- Length 160mm (7")

T11532 ..... $19.95



SPECTROL 64Y MULTI TURN TRIMPOTS

Cat No	Description	1-9	10+
R14700	10R	$3.50	$3.20
R14710	20R	$3.50	$3.20
R14720	50R	$3.50	$3.20
R14730	100R	$3.50	$3.20
R14740	200R	$3.50	$3.20
R14750	500R	$3.50	$3.20
R14760	1K	$3.50	$3.20
R14770	2K	$3.50	$3.20
R14780	5K	$3.50	$3.20
R14790	10K	$3.50	$3.20
R14800	20K	$3.50	$3.20
R14810	50K	$3.50	$3.20
R14820	100K	$3.50	$3.20
R14830	200K	$3.50	$3.20
R14840	500K	$3.50	$3.20
R14850	1M	$3.50	$3.20

ARLEC "DISCO LITE" CONTROLLER

Give your parties a professional touch with the arlec "Disco Lite". Simply plug your light(s) into the "Disco Lite" and you've instant party life!

3 DIFFERENT MODES!
Music Mode: Place the "Disco Lite" in range of the speakers and it flashes the lights to the beat of the music!
Strobe Mode: Simply adjust to desired speed! Great for mime or theatre! The christmas season or advertising!
Dim Mode: Allows you to dim the lights to create moods, effects etc.

Cat M22003 $69.50

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

World Radio History

ROD IRVING ELECTRONICS!

RED HOT BUYS

KEY SWITCHES

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

NICADS!

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

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

10W HORN SPEAKERS

White durable plastic, 8 ohms

Cat C12010 Normally $11.95

SPECIAL, ONLY $9.95

ELECTRET MIC INSERTS

With pins for easy board insertion

Cat C10170

1-9	10+	100+
$1.20	$1.00	$0.90

THIS MONTH ONLY!

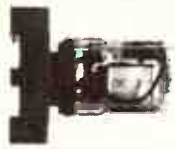
CAR ANTENNA BOOSTER

- In-line installation
- 12V boosts 100%

Cat A12073 **$7.95**

DB25 CONNECTOR SPECIALS!

P10884	DE9P R.A. Plug	$3.65
P10885	DE9S R.A. Skt	$4.25
P10890	DA15P Male	$2.10
P10891	DA15S Female	$2.25
P10892	DA15C Cover	$1.25
P10894	DA15P R.A. Plug	$4.25
P10895	DA15S R.A. Skt	$5.00
P10900	DB25P Male	$1.00
P10901	DB25S Female	$1.20
P10902	DB25C Cover	$1.25
P10904	DB25P R.A. Plug	$4.50
P10905	DB25S R.A. Skt	$5.95



RELAY AND BASE

Can carry 10A at 28V DC or 5A at 240V AC. Supplies with Chassis Mounting Socket with screw terminals. Great for school projects and demonstrations, switching DC power supplies, central circuits and with contacts parallel up to 20A can be switched

Cat S14074 Normally $8.95

SPECIAL $6.95

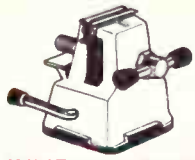
PUSH BUTTON DIALLERS

Tired of old fashion dialling and re-dialling engaged numbers? These convenient push button dialliers include last number redial (up to 16 digits) and instructions for an easy changeover

Cat A12030 Normally $19.95

SPECIAL, ONLY $14.95

(Note: Not Telecom approved)



MINIATURE HOBBY VICE

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

Cat.T12458 ... **only $5.45**

10 AMP RELAY

S P D T 12V Coil 240V (S14114)

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

HIGH INTENSITY RED LED BAR GRAPH

Dimensions:
Overall 63mm across, 5mm high
LEDs 10 x 5mm x 1mm

Cat No	1-9	10+
Z10180	$2.95	$2.75

NEW COLOUR KNOBS!

Standard metric fluted shaft with black dot marker and available in six different colours!

Dimensions 17.2mm high
12.8mm top diameter,
17mm bottom diameter

Cat.No.	Colour	1-9	10+
H10070	Black	$0.75	$0.65
H10071	Blue	$0.75	$0.65
H10072	Green	$0.75	$0.65
H10073	Grey	$0.75	$0.65
H10074	Red	$0.75	$0.65
H10075	Yellow	$0.75	$0.65

UV EPROM ERASER

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

Features include

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

WITHOUT TIMER

Cat X14950 Normally $97

Special, $79

WITH BUILT-IN TIMER

Cat X14955 $139

Special, $99

BRAND NEW FANS

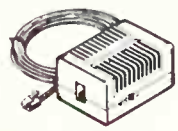
Quality, new fans for use in power amps, computers, hotspot cooling etc. Anywhere you need plenty of air

240V	4 5/8"	Cat T12461	$14.95
115V	4 5/8"	Cat T12463	$14.95
240V	3 1/2"	Cat T12465	$14.95
115V	3 1/2"	Cat T12467	$14.95

10+ fans (mixed) only $10 each!

FAN GUARDS TO SUIT

4 5/8"	Cat	T12471	$3.95
3 1/2"	Cat	T12475	$3.95



TELEPHONE EXTENSION BELL

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

Y16043 ..... **$25.95**

1/2" HIGH INTENSITY RED LED DISPLAYS

(Available in Common Cathode and Common Anode)

Dimensions:
Overall 12.7mm across, 19mm high
Display 12.7mm(H) x 7.3mm(W)
Segment Width 1.2mm
Brightness 3400 ucd I_F 10mA

COMMON CATHODE:

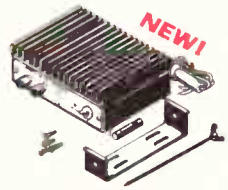
Pin 1	Segment E	Pin 6	Segment B
Pin 2	Segment D	Pin 7	Segment A
Pin 3	CC	Pin 8	CC
Pin 4	Segment C	Pin 9	Segment F
Pin 5	Segment Dp	Pin 10	Segment G

Cat No	1-9	10+	100+
Z10190	$1.95	$1.75	$1.50

COMMON ANODE:

Pin 1	Segment E	Pin 6	Segment B
Pin 2	Segment D	Pin 7	Segment A
Pin 3	CA	Pin 8	CA
Pin 4	Segment C	Pin 9	Segment F
Pin 5	Segment Dp	Pin 10	Segment G

Cat No	1-9	10+	100+
Z10191	$1.95	$1.75	$1.50



STEP DOWN CONVERTER DC-DC

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

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

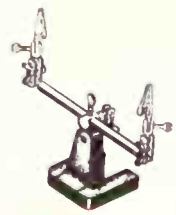
A16155 ..... **$99.95**

10A STEP DOWN CONVERTER DC-DC

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

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

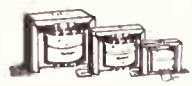
A16160 ..... **$119.95**



PC BOARD HOLDER

Better than an extra pair of hands! A must for all PCB work

Cat T12444 ..... $9.95



ECONOMY TRANSFORMERS

		1-9	10+
2155	240V 6-15V 1A		
Cat M12155		$9.95	$8.95
2156	240V 6-15V 2A		
Cat M12156		$14.95	$13.95
2840	240V 9V CT		
Cat M12840		$5.95	$4.95
2851	240V 12-6V CT 150mA		
Cat M12851		$5.95	$5.50
2860	240V 15V CT 250mA		
Cat M12860		$5.95	$4.95
6672	240V 15-30V 1A tapped		
Cat M16672		$14.95	$13.95

RECHARGEABLE 12V GELL BATTERIES

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

Cat S15029	12V 1.2 AH	$17.50
Cat S15031	12V 2.6 AH	$32.50
Cat S15033	12V 4.5 AH	$39.50

RS232 FAST CABLER

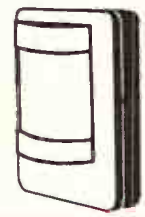
Makes RS232 interface configuring fast and simple. 3 slide switches enable line swapping functions, positive and negative voltages are displayed on 6 tricolour LED's

SPECIFICATIONS:
Connector: DB25 [illegible] on 100mm cable and DB25 [illegible] set on 100mm cable
Indicators: Tricolour LED's for pins 2(TD), 3(RD), 4(RTS), 5(CTS), 6(DSR), 20(DTR)
Switches: 3 Slide switches to swap leads
Power: Interface power
Enclosure: Black, high impact plastic
Dimensions: 85 x 95 x 30mm

X15710 ..... **$145**

ECONOMY ROTARY SWITCHES

Cat. No.	Description	Price
S13021	1 pol 2-12 pos	$1.95
S13022	2 pol 2-6 pos	$1.95
S13033	4 pol 2-3 pos	$1.95
S13035	3 pol 2-4 pos	$1.95

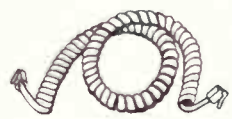


PASSIVE INFRA-RED DETECTOR

FEATURES:

- Walk test LED indicator
- Wall/corner ceiling mount
- Micro switch tamper proof protection
- 24 detection beams in 3 different ranges
- N.C. silent S.P.S.T. dry relay contact output
- Alarm auto reset approximately 3 seconds after triggered
- Superior RFI immunity protection
- Extremely low power consumption
- Adjustable mounting bracket
- Easy installation, easy adjustment
- Dual element, low noise, high signal to noise ratio pyroelectric
- Detection degree indicator
- D.C. 8-16V power operating

S15079 ..... **$89.95**



TELEPHONE CURL CORD

- U.S. plug to U.S. plug
- Replacement hand set cord
- Length 4.5 metres

Cat Y16023 **$7.95**

DIODE SPECIALS

We have millions of diodes in stock!

1-99	100+	1000+
IN4148 Small signal Cat Z10135		
3¢	2 1/2¢	2¢
IN4004 400V 1A Cat Z10107		
4¢	3 1/2¢	3¢

BIG MOUTH CAR ALARM

FEATURES....

- Easy installation
- Automatic on/off
- Loud alarm signal
- Auto reset
- Low Price!

SPECIFICATIONS:
Power: DC 12V battery
Current Consumption: 10mA at 12V DC
Dimensions: 139 x 165 x 136mm
Exit Delay: 60 seconds approx
Entry Delay: 12 seconds approx
Auto reset: 90 Seconds approx

S15048 ..... **$39.95**

U.S. TO AUSTRALIAN TELEPHONE ADAPTOR

- Australian plug to U.S. socket

Y16008 ..... **$8.95**

Rod Irving Electronics

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NORTHCOTE 425 High St
Phone (03) 489 8866

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Electronic Discounters P/L
305 Morphett St. ADELAIDE
Phone (08) 212 1799
NOTE: [illegible]

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All Inquiries (03) 543 7877

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POSTAGE RATES

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

The above postage rates are for basic postage only. Road Freight bulky and fragile items will be charged at different rates.

All sales tax exempt orders and wholesale inquiries to RITRONICS WHOLESALE 56 Renver Rd. Clayton Ph. (03) 543 2166 (3 lines)

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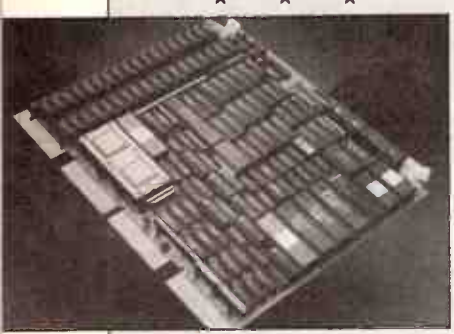
World Radio History

INDUSTRY NEWS

In a move that will boost the Australian electronics industry, the Honourable Barry Jones, Minister for Science and Small Business, opened the new Mitsubishi Electric Australia Manufacturing Centre in Rydalmere, Sydney, on 11/2/88.

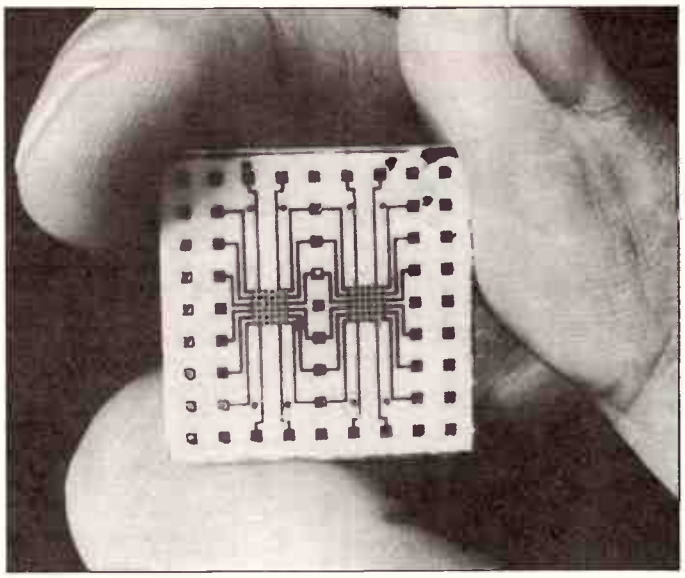
The new factory contains equipment for working with advanced "surface mounted" electronic devices, and although it will initially focus on the manufacture of cellular mobile telephones, there are plans to introduce other communications and electronic products in the near future. A "clean room" in the factory provides conditions suitable for the manufacture of spacecraft components.

★ ★ ★



Negotiations between Webster Computer Corporation and Mentec Computer Systems Limited have resulted in Webster's appointment as exclusive Australian distributor of Mentec's SBC (Single board Computer) modules.

Mentec, a private high technology company, was established in 1978. As a DEC OEM since 1979, Mentec has specialised in developing its software and systems expertise on DEC equipment. In addition to the manufacture of SBC modules, Industrial I/O Termination Modules and Outstations, Mentec provides complete software solutions for commercial and industrial applications, C.A.D., financial modelling and word processing and develops specific software applications according to customer requirements.



Closeup of a ceramic substrate patterned with high-temperature superconducting wires made with a new IBM plasma spray technique. Such wires might be used to connect logic and memory chips in computers. The ability to make sure wiring patterns from high-temperature superconducting material is an important step toward adapting the material for possible future use in computers.

FRAM Available Soon

The Queensland based company Ramtron has announced that it has licenced Ramax in Melbourne to begin manufacture of its FRAM devices.

Ferroelectric Read Only Memory (FRAM) is a nonvolatile memory technology which stores information using the residual polarisation on a ferroelectric capacitor rather than storing a charge, as in conventional memory.

The ferroelectric polarisation remains when power is switched off, making FRAM a direct competitor for EPROM and battery-backed RAM.

FRAM was originally devised by a team at the University of Colorado. Ramtron bought the licence and continued to invest in its development, in spite of industry pessimism at the possibilities claim for it.

However, in February, Ramtron released details of its technology at the International Solid State Circuits Conference in San Francisco.

A market report completed by US market researcher Dataquest in January predicts a market for FRAM in excess of $350 million by 1992. Also in the race to release FRAM products to the market is a US company, Krysalis.

Ramax recently received a grant of $6 million from the Victorian Government to put FRAM into production locally and expects to be marketing devices within 12 to 18 months.

At the heart of FRAM is a ferroelectric capacitor, which stores logic states. The dielectric of the capacitor is a polar material, which retains permanent polarisation in the absence of an applied electric field. This polarisation is caused by asymmetry within the crystal cellular structure.

Although the term ferroelectric is used to describe the technology, there is no iron involved. There is little in common with ferromagnetics except a similarity in hysteresis characteristics.

Materials which exhibit the retention of polarisation have been known of for some time, and were in the past considered as possible replacements for magnetic core memory. However, the technology has not been commecialised before due to fatigue of the dielectric due to cycling caused eventual loss of data.

Ramtron's approach to this problem has been to use the ferroelectric cells as shadow memory for transistor memory cells. The transistors isolate the ferroelectric mateial and thus extend the life of the cells.

Ramtron's rival Krysalis, also has plans to bring a device to the market in the near future. Krysalis, however, uses a different approach to Ramtron, writing directly to the FRAM capacitor cell, whereas Ramtron is manufacturing its FRAM as a shadow memory.

The Ramtron device is fabricated using a thin film PZT (lead zirconate titanate) sandwiched between two metal electrodes to form a non-linear capacitor. This can be built above existing circuitry, allowing the device to be integrated with standard CMOS circuitry.

With production expected within 18 months, Ramtron is optimistic about the prospects for the technology. Dataquest's prediction for a $350 million market for FRAM by 1992 is based on estimates that predict it taking over more than half the EEPROM market when in full production.

Should ferroelectrics prove viable in main memory applications, the market could exceed this prediction. A report from the US Naval Surface Weapons Centre forecasts FRAM as taking over several sectors of the semiconductor memory market. In fact, the military is extremely interested in the technology.

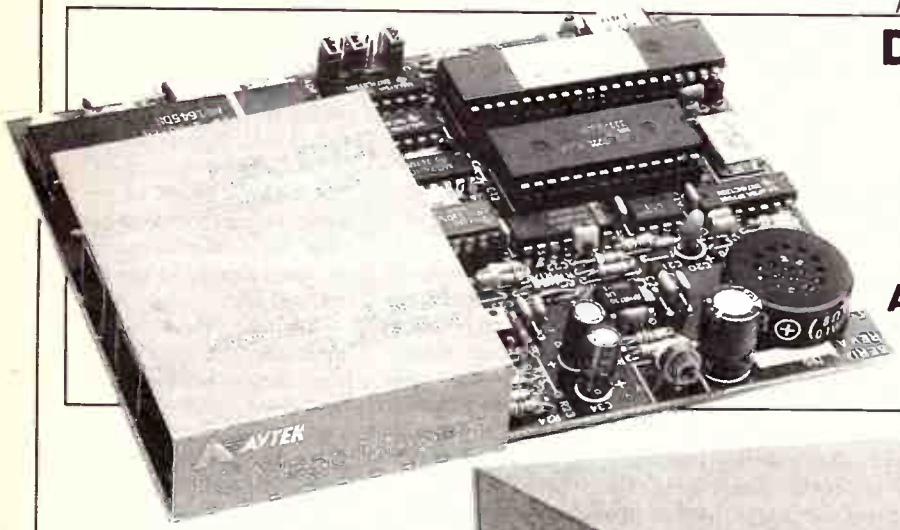
FRAM also has inherent radiation hardness, giving it strong military potential.

Retention of data has been observed at temperatures from below −100°C to over +300°C. In addition, the dielectric qualities of PZT give FRAM an inherent radiation hardness.

Another interested industry is the automative sector. Currently, the extreme ambient temperature inside motor cars degrades the performance of the electronics considerably. FRAM could charge that.

World Radio History

MODEMS *for Australia*



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MEGAMODEMS 12/123

The Avtek Megamodems provide Australia's best value communications products, with a range of fully automatic, autodialling modems. Megamodems are suitable for data transfer from personal computers, terminals, mainframes and mini host computers and for all videotex services such as Viatel. The use of the latest technology has enabled us to make the Megamodem more compact and reliable than any other modem. Price is very competitive and reflects efficiencies incorporated in the design. The Megamodems are locally designed and built. Service, support and specialist R&D for the Megamodem range is all based in Australia. Available either as a standalone RS232 model or as a plug in 1/2 card for IBM PCs and compatibles. The Megamodem range of modems are Telecom authorised.

Automatic Dial, Answer, and Disconnect: The Megamodems will automatically answer an incoming call and connect the computer to the line. When originating a call it will then dial out the required number and auto-connect to the computer at the other end. It will then "hang-up" at the end of a communications session. Both pulse and tone dialling are supported. The modem is compatible with new Telecom exchanges and modern PABXs and can handle high speed tone dialling.

Fully Hayes AT Smartmodem Compatible: The Megamodems are industry standard "HAYES SMARTMODEM "compatible which means they can take advantage of all the communications facilities of packages such as Crosstalk, Open Access, Symphony and Multicom. All communications parameters such as baud rate, parity and number of stop bits are set up automatically by the software and the Megamodem. Using appropriate software data can be sent and received while the Megamodem is unattended.

Specifications

Data Standards	CCITTV21, Bell 103, CCITT V22 Bell 212. (123 model only CCITT V23)
Data Rates	300/300, 1200/1200 (123 model only 1200/75, 75/1200)

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INDUSTRY NEWS

Publicly listed data-communications specialist, Datacraft has purchased 49 per cent of the equity in the Sydney-based Summit Group of Companies. Datacraft has the opportunity under the agreement to increase its shareholding to at least 51 per cent at a later date.

Summit, which is expected to have an annual turnover of around $15m by the next financial year, is a specialist designer and manufacturer of data-communications equipment and will add significant strength to the Datacraft group.

★ ★ ★

Located in Spectrum at 220 Pacific Highway, Crows Nest, Sydney, RVB Products distributors of National Relays have increased their office accommodation and showroom space while providing easier access for visiting clients.

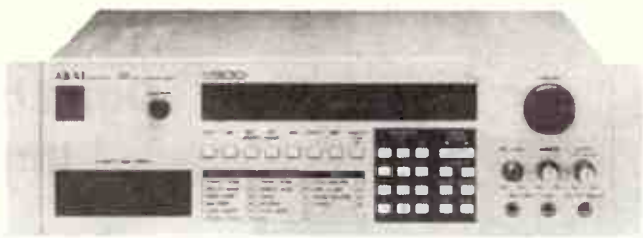
★ ★ ★

The military computer contractor, CSA, has snitched one of the RANs top elecronics experts. Robert Spencer joins a growing list of high level defence force personnel seeking better jobs in industry. Spencer will head up the Major Naval Programmes Department of CSA. The department has just been created by CSA, and reflects the growing amount of business the company is doing with the armed services.

★ ★ ★

Brian Currie, 43, has been named vice president of marketing and sales for SEEQ Technology. He will report directly to J. Daniel McCraine, SEEQ president and CEO.

Brian Currie replaces Michael Villott who has been promoted to vice president and general manager of the FLASH™ division. In his new position, Villott will have responsibility for all operations related to SEEQ's expanding product line of FLASH EEPROMs.



Samples of Trouble

Lawyers round the world are set to make enormous fees from musicians who are exploiting new technology.

This technology referred to lets musicians take electrical "samples" of each other's work and use them to build new musical performances. Sometimes the new music is then sampled by another musician to create something different again, often without permission. Despite many legal threats, there are still no legal precedents concerning this new kind of plagiarism.

There are two quite different kinds of sampling. A DJ can create a performance by mixing together short segments of commercially available recordings,m sometimes talking over the top. Alternatively, musicians can use digital recording equipment to capture brief snatches of an instrumental sound.

The record companies however, are much more concerned with mix sampling as are the various musicians' unions.

Despite this concern however, mix sampling is now a thriving trade. It grew out of the technique used by disc jockeys when they play records on radio stations and in night clubs. They have two gramophone turntables, and wear headphones to cue the start of one record while the other is finishing. DJs then started using the Technics SL 1200 gramophone turntable, which has a quartz-locked electronic control that can vary the speed of the motor by 16 per cent. This lets the CJ match both the tempo and pitch of successive records, to create a natural transition.

Adventurous DJs found that although the SL 1200 motor has high torque when running free, the torque falls to zero as soon as a DJ touches the turntable. The DJ can then turn the turntable by hand, slowly or fast, backwards or forwards, to create odd "scratch" sound effects. DJs then started building up a musical performance, from snatches of music mixed rapidly between their two turntables, at different speeds and pitches.

The bands such as *Beastie Boys* have been accused of using snatches from an old recording by Jimmy Caster.

While the mix sampling craze is likely to fade away, the practice of electronic sampling is more insidious. Electronic synthesizers incorporate solid-state memory. To sample sound, the analogue signal from a microphone or tape recorder is converted into digital code, similar to that used on compact disc. This code is stored in the synthesizer's memory, where it serves as a digital snapshot of the tonal quality of the original instrument.

Only the code for a few notes need be stored, because if the code is read out at different speed, the pitch of the sound is changed. This builds up a whole music scale, controlled by an electronic keyboard. If one snapshot of a trumpet is sampled, notes played on the synthesizer keyboard by a musician will emerge as notes played by the sampled trumpet. But then there is no evidence of where the original sound came from.

Although the solid-state memory of a sampling synthesizer can store only around 20 seconds of high-quality snapshots, it is easy to dump these samples onto magnetic tape or disc for bulk storage. Most engineers working in recording studios have their own "sample reel" which is a tape library of favourite instrument sounds. They ask a musician in the studio to play a few solo notes, supposedly to help set up the microphone levels before a routine recording session. The solo sound is, however, also recorded, sampled and stored for future use.

Centres of Excellence

Australia is to open seven new "centres of excellence", bringing the total to fifteen.

The new institutions are intended to focus new institutions on research with potential economic benefit. $3.6 million will be spent on the centres this year. Among the recipients are Jack Pettigrew, who will head Queensland's first centre, for vision, touch and hearing. pettigrew has been successful in exploiting basic research on animals to develop a new binaural hearing aid.

Other centres are for human communication (Graeme Clark, Melbourne), protein and enzyme technology (Richard Wetterall and Robert Scopes, La Trobe), electronic structure of materials (Ian McCarthy and Erich Weigold, Flinders), lasers (James Piper, Macquarie), membrane and separation technology (Christopher Fell and Hans Coster, New South Wales), and industrial control science (Graham Goodwin, Newcastle).

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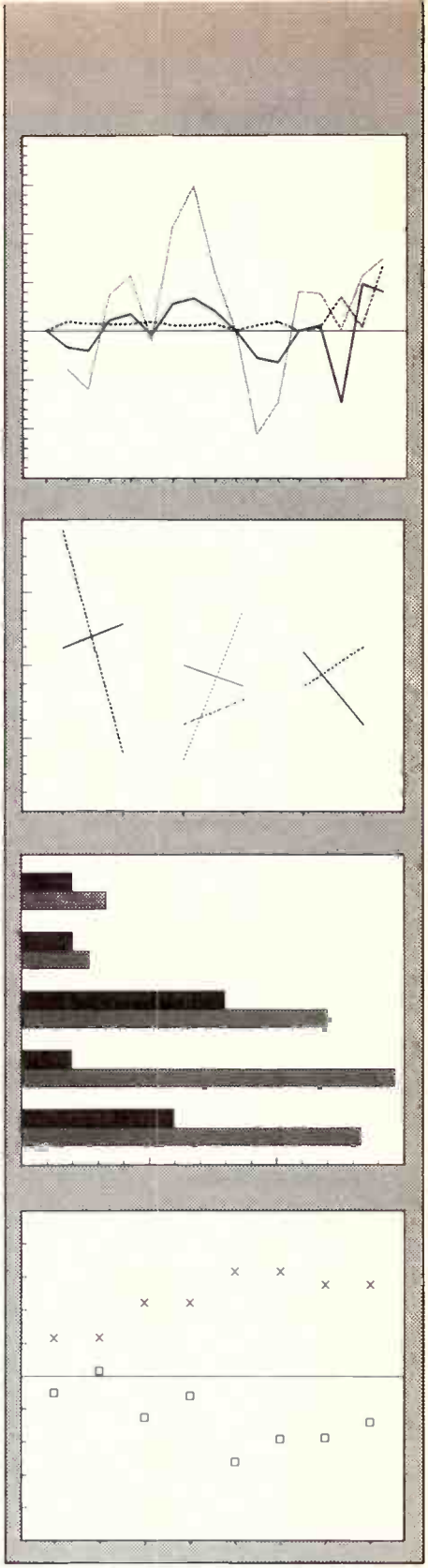
	CSS	SPSS/pc+
MAXIMUM SIZE OF DATA FILES	As large as DOS allows	As large as DOS allows
GRAPHICS	Large selection of colour, hi-res, quality graphs, very flexible interface between numbers and graphics (all CSS output can be converted into a variety of graphs; also, user selected results from different CSS analyses can be easily combined in a single graph).	Limited character based graphs, rigid interface between numbers and graphics.
USER INTERFACE	Fast hierarchical menus; the entire user interface is optimised to limit the number of keystrokes necessary to perform an analysis, fast selection of individual variables or lists of variables; previous variable selections are "remembered" (and can be edited) across consecutive analyses; batch processing is also supported.	Command language, some commands are several lines long (in case of a typo, e.g., a misspelled variable label, the entire command has to be re-typed), commands can also be submitted via batch files.
PROCESSING LISTS OF VARIABLES	Supported by all procedures (where applicable, lists of dependent variables can be automatically processed with the same design, e.g., in t-tests, Crosstabulations, ANOVA, Regression, etc.)	Supported by all procedures (where applicable, lists of dependent variables can be automatically processed with the same design, e.g., in t-tests, Crosstabulations, ANOVA, Regression, etc.)
SELECTION OF SUBSETS OF CASES FOR ANALYSES	Yes (on line selection of cases via "include if" or "exclude if" selection conditions that remain in effect for the entire CSS session or until cancelled; the selection conditions can be saved for repeated use)	Yes (via logical "select if" conditions
SCREEN DISPLAY OF OUTPUT	All CSS output is displayed via Scrollsheets. These are dynamic, scrollable, user controllable, multi-layered tables with cells expandable into pop-up windows. All numbers and labels (or selected subsets) in Scrollsheets can be instantly converted into a variety of presentation quality graphs. The contents of different Scrollsheets can be instantly aggregated, combined, compared, plotted, printed, or saved.	Output scrolls across the screen (a "MORE ..." prompt appears when the screen is full
DISPLAY FORMATS FOR NUMBERS	Flexible; all display formats are dynamically adjusted to yield maximum display precision while preserving compatibility of formats within columns of numbers; special extended formats are available where applicable (B-weight = .094027563759532)	Fixed, regardless of value (e.g., if values are very small, SPSS cannot display them with sufficient precision)
PRINTING	Selective printing or saving of results (e.g., only specified tables with results, or subsets of tables); all results can also be automatically printed (or saved) in formatted reports; graphics can be printed on all plotters, dot matrix, colour, and laser printers. (including printers supporting PostScript)	Only via dumping all screen output from an analysis to the printer or file; hi-res graphics are not available.
ACCESS TO INDUSTRY STANDARD FILE FORMATS	Intelligent read/write interface to (unlimited size) Lotus, dBII, dBIII+, DIF, SYLK, and a variety of formatted and unformatted ASCII files, CSS imports not only data values but also formats, labels, headers, logical variables, missing data codes, etc.	No (only ASCII; an optional file conversion package is available)
SUBMITTING OUTPUT FROM ONE ANALYSIS AS INPUT FOR ANOTHER	In addition to matrices (corr., cov., etc.) and scores that are calculated for each case (e.g., residuals, factor scores), all other numbers generated with CSS analyses can be converted into the CSS data file format.	Only matrices (corr., cov., etc.) and scores that are calculated for each case (e.g., residuals)



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Stuart Corner examines Aussat's new satellite plans and Queenslands "intelligent electricity supply" in this month's Communication News

Communication News

Aussat gears up for Mobile L. Band Services

If Aussat's second generation satellite plans come to fruition, Australia will be one of the first nations in the world to boast a domestic satellite based mobile communications system. Such a system will provide two way data links for paging, navigation and remote monitoring as well as voice telephony. Aussat has been conducting extensive market research into mobile services for some time and estimates that it will have 50,000 mobile terminals in use by the end of the next decade.

Should Aussat's predictions be correct, there will be a huge market for Australian manufaturers who will be well placed to compete for export markets. Australia will be ahead of most other countries in mobile communications services. Already well over 100 companies have expressed interest in tendering to provide equipment to operate mobile services. Aussat plans to release draft specifications for equipment later this year. These will be followed, in about July next year, by a request for tenders for hub facilities and up to 1000 terminals in readiness to start services in January 1992, shortly after the launch of the first of the second generation of satellites.

During the course of this year, Aussat will attempt to seek out a guaranteed market and establish strategic and synergistic relationships with other organisations in the provision of services.

The products and services which are likely to appear include Australia-wide satellite paging services. The pagers will communicate directly with the satellite, and vehicle navigation systems using an omnidrectional rooftop antenna the size of a dinner plate. These navigation systems may be linked to onboard CD ROM systems storing digitised maps so that the vehicle's position is constantly updated on a visual display in true James Bond style.

These mobile services will operate in the L-Band (1.5 to 1.6 Gigahertz). Aussat's first generation of satellites does not provide these frequencies. So Aussat plans to use a Japanese satellite (ETS-V) to carry out tests of L Band services prior to the launch of the second generation of satellites. Uplinks from base stations to the satellite will, however, use Ku Band as do all earth stations for Aussat's present satellites.

Areas of particular concern in technology developments include the design of small antennas, fixed omnidirectional, and steerable systems, voice codecs (compression and decompression) units able to provide high quality voice in digital bandwidths as low as 4800 bits per second. Aussat says this has already been achieved in 9500 bits per second. The public telephone network digitises a 3.1 kilohertz analogue bandwidth into 6.4 kilobits per second.

Other products which will be required include digital modems, and radio frequency components. Low cost, compactness and rugged construction will be important considerations for mobile equipment.

Problems

Aussat does not plan to complete with Telecom's Cellular mobile network, Mobilenet, but to complement it. Aussat's Mobilesat services will have nowhere near the capacity of Mobilenet. It will have at most 1000 telephone channels and these will work poorly in built-up areas because of the shielding effect of tall buildings. Aussat does hope to offer telephone services to remote areas which Mobilenet will never reach. Aussat estimates terminals will cost about $5000 with call changes about 50 precent higher than today STD rates.

One hurdle which Aussat faces in the long term with its L-Band plans is the shortage of spectrum allocation within the Band and the conflicting demands from other communications satellite operators for acces to this scarce global resource.

Other organisations are already experimenting with L-Band services. These include Inmarsat, the international maritime satellite cooperative, Telesat of Canada and USAMC in the US. Inmarsat estimates that it will be able to provide data terminals for as little as $US2000 by the mid 1990s. These will be cheap enough to create a "robust market, numbering tens of thousands of terminals worldwide" according to director general Olaf Lundberg, speaking at Telecom '87 in Geneva last October. Lundberg continued "no one believes that there is a sufficient amount of currently allocated spectrum within the L-Band to satisfy the demands of the maritime, aviation and land mobile markets. "The international aviation community has claimed that it will need all the currently allocated L-Band capacity and more within the next five to ten years.

The International Telecommunications Union's (ITU), World Administrative Radio Conference (WARC), is responsible for international agreements on frequency allocations. It met in Geneva last September, but did not have the authority on that occasion to rule on L-Band allocations. Another WARC is scheduled for 1992 to discuss these issues. In the meantime, Lundberg expressed the hope that the few countries which are able to offer domestic L-Band service do not let their partisan interests override their obligations as ITU signatories. "Those planning domestic mobile satellite systems will need to exercise a considerble amount of co-operation in trying to resolve the vexatious problem of how to share the orbital arc and the extremely limited amount of L-Band spectrum now available for mobile satellite services," he said.

Queensland tests herald the intelligent electricity supply

Electricity, like STD telephone calls, airline tickets and train trips cost less when there is less demand. Substantial off-peak discounts are offered on all these services. Unfortunately, in the case of electricity, the options for off-peak services are very limited because off-peak electricity must have a separate meter in each house to measure consumption. The off-peak supply is usually switched by signals transmitted over the power lines.

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Phosphor: Available in Green or Amber
Video input signal: Composite Signal
Polarity: Negative Sync
Level: 0 5-2 0Vp-p
Impedance: 75ohm
Scanning frequency:
Horizontal: 15 734 KHz ± 0 1%
Vertical: 50-60Hz
Video bandwidth: 20MHz
Active display area:
216(H) x 160(V)mm
Display character:
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Input terminal: RCA Phono Jack
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Weight: 8 1 Kg
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Cat No	Description	Price
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X14512	AMBER	only $199

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- High resolution, 80 or 40 character display

SPECIFICATIONS....
Picture tube: 12" diagonal and 90° deflection
Phosphor: Available in Green (P39) or Amber
Video input signal: Composite Signal
Polarity: Negative Sync
Level: 0 5V-2 0Vp-p
Scanning frequency:
Horizontal: 15 734 KHz ± 0 1%
Vertical: 60Hz
Video bandwidth: 20MHz
Active display area:
216(H) x 160(V)mm
Display character:
80 characters x 25 rows
Input terminal: RCA Phono Jack
Controls:
Outside: Power Switch, Contrast Brightness, H-Shift, V-Size
Inside: H-Width, H/V hold H/V linearity, Focus
Power supply: 110-120V 60Hz 220-240V 50Hz
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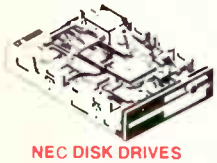

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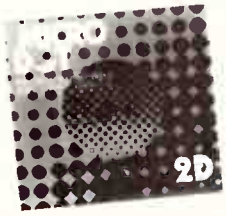

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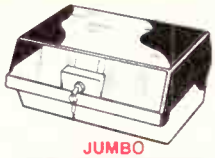

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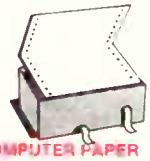

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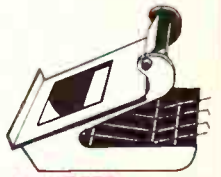

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they want to use high price power at peak times or cheap rate off-peak electricity. For example, if they decide they want to use the electric cooker at peak times, they simply press a button on the box, and electricity charged at the peak rate will be supplied to the cooker.

These facilities could eventually be provided by a new energy management system, developed by Alcatel STC and now undergoing trials with the South East Queensland Electricity Board (SEQEB).

The system uses a small energy management terminal located in the consumers premises connected via the normal telephone line to equipment. This central unit is then connected to SEQEB's computer system by dedicated line. The terminal does not interfere with use of the customer's telephone for normal calls. It provides continuous meter reading information to the central computer and can be controlled by the central computer so that appliances supplied with electricity at off-peak rates can be disconnected.

For the electricity generating industry there are potentially huge savings to be made. Power stations require massive investment. Yet the pattern of demand, with large peaks at certain times of day, means that much of this generating capacity stands idle for most of the time. If the demand for electricity could be spread more evenly throughout a 24 hour period fewer generating stations would be required. The savings to consumers could also be substantial. The SEQEB trial will offer electricity at only one tenth the price of peak rate tariff.

For Telecom energy management offers the attraction of a new market accessible through its present customer access network, the 'local loop' which connects each subscriber to the telephone exchange. This network represents by far the largest portion of Telecom's capital assets. Any means of using it for additional revenue earning services is therefore very attractive, especially as some of Telecom's traditional revenue sources, such as the first phone monopoly, are threatened by deregulation.

The electricity management service, which Telecom has named Emtel, is likely to be a joint operation with Alcatel STC which has licenced the underlying technology designed for building surveillance, from the US. Details of how Telecom and STC would work together in a commercial partnership have not yet been finalised.

Energy management is only one of a whole host of services which will be available on the telecommunications network in a few years time. Another service, Securitel, recently launched by Telecom, provides monitoring of fire and burglar alarms.

The STC technology which underpins Emtel is the basis of Telecom's Securitel service. There are now about 1500 premises in Sydney and Melbourne being monitored by Securitel for about 10 security companies, according to Gerry Johnston, Telecom's national product manager, alarm and telemetry services. He said the number of premises connected to the network was doubling every 12 months. The service presently operates only in Sydney and Melbourne, but will soon be offered in other centres probably first on the Gold Coast.

Telecom has come in for criticism over Securitel for a number of reasons. Security companies previously used leased lines to provide building monitoring services. Telecom has been progressively increasing the cost of these lines to move customers on the Securitel. Johnston said that the dedicated use of a line was an inefficient use of a scarce resource, and Telecom saw no reason why lines should be leased for security surveillance at less cost than other services.

Telecom is also trying to get fire brigades around the country, the largest users of leased premises monitoring, onto Securitel. They are resisting because they claim that its response time is not fast enough. There can be a 30 seconds delay before an alarm is received at the monitoring centre.

Telemetry services over the public phone network are also planned as part of the Integrated Services Digital Network, ISDN, which Telecom will offer to large customers in capital cities from the middle of next year and to smaller business customers around mid 1990.

ISON will eventually provide two digital links operating at 64 kilobit/sec (B Channels) and one 16 kilobit/second channel (D Channel). Over the same pair of wires which now carries only a single voice channel. The B channels will be switchable but the D channel will operate as a continuously connected signalling and data channel. The CCITT is now working on standards for telemetry over the D channel. These will take some years to develop fully and at the present time, according to Johnston, it is not possible to poll terminals through ISDN to provide constant assurance that they are functioning normally, as the Securitel and Emtel networks so. So it will be some years before the ISDN provides an alternative to these networks.

Local area network telephone launched

An Australian designed business telephone system which represents a radical departure from other technologies went on show for the first time at a recent Communications '88 exhibition, held at the new Darling Harbour Exhibition Centre in Sydney.

The Lanx (Local Area Network Exchange) unlike other PABX private automatic branch exchanges) has no central control unit. Each telephone has in-built processing power and is connected to other telephones over a ring of two shielded twisted wire pairs carrying signals at 2.7 Megahertz. Individual telephones connect into the twisted pair ring with simple passive connectors.

Voice is digitised at 64 kilobits using the standard CCITT A-law encoding scheme. These 64 kilobit voice signals are then multiplexed onto the cable using single stage time compression multiplexing techniques. Up to 16 conversations can be carried simultaneously giving the system a capacity of 16 exchange lines and 80 extensions. Voice and control signals are carried on both pairs of wires, but the two pairs are necessary to ensure control and voice functions can operate together.

The Lanx is the result of four years development by Sydney based telephone manufacturer, Tytel Pty Ltd. It is the only Telephone PABX system designed and manufactured by an Australian company.

Tytel at present has only a Restricted Authority to supply from Telecom Australia. This means the company can sell and instal only a limited number of systems until Telecom is satisfied with the system. Telecom controls the maintenance of all PABX systems connected to the public telephone network. Tytel expects to have full authority to supply by June.

The Lanx uses proprietary Tytel designed chips in each telephone. The various features of the telephones are embedded in EPROMs. At present, if users want to make changes to the configuration of a telephone, such as whether it has STD and ISD access, they must contact Tytel which will reprogram an EPROM and go and install it on the customer's telephone. If any telephone fails, according to Tytel, the user can simply unplug it, and replace it with a spare. A small plug in each phone identifies the extension number. So when the user moves to another location in the office, he or she can keep the same telephone number.

According to product manager, Jefferson Lewis, the next stage will to allow the customer to reconfigure some features themselves from a VDU attached to the system. "We are currently negotiating with VDU suppliers." ●

World Radio History

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LIMITED OFFER

World Radio History

This months' Kilohertz Comment examines the state of radio in the far east

Kilohertz Comment

Deutsche Welle Expands Service

The present English language section of Deutsche Welle, the Voice of Germany, at Cologne, is to be amalgamated into one section which will comprise the Asia, Africa and North American services.

Deutsche Welle is also looking at a South East Asia relay base following the uncertainty in Sri Lanka with their new base not being operational. They have overcome this difficulty to some degree by hiring time on Radio Veritas Asia in Manila for broadcast to China, but the service is restricted as there is no beam available into South East Asia.

Papua New Guinea

A report from Gordon Darling in Port Moresby indicates that eleven 10 kW NEC transmitters are being installed at regional stations of the Papua New Guinea Broadcasting Commission. These Japanese transmitters will replace the present 2 kW units at eleven of the regional stations later this year. The transmitters are being supplied as part of Japan's aid to Papua New Guinea.

The stations which will be increased in power rate: Radio East New Britain at Rabaul on 3385 kHz; Radio West Sepik, Vanimo 3205 kHz; Radio Western Highlands at Mount Hagen 3375 kHz; Radio East Sepik at Wewak 3335 kHz; Radio Morobe at Lae 3220 kHz; Radio Western at Daru on 3305 kHz; Radio Enga at Wabag on 2410 kHz; Radio Central at Port Moresby 3290 kHz; Radio Simbu at Kundiawa on 3355 kHz; Radio Madang at Madang on 3260 kHz and Radio Milne Bay at Alotau on 3365 kHz. The first transmitters will be installed around August at Lae, Daru and Vanimo.

Expansion to All India Radio

Rapid expansion of All India Radio has been announced with high powered transmitters being installed at new sites to serve the Asian area.

The expansion plans of All India Radio are being phased over many years with four proposed shortwave facilities according to a "Media Network" report. Of the new sites only three are expected to be in operation before the end of the present five-year plan in 1990. The expansion plans include six 500 kW transmitters at Bangalore. Building of this transmitting station commenced in 1985 and two of the transmitters are expected to begin operation by the end of this year. A 50 kW shortwave transmitter is being installed at Gorakhpur while a further two 250 kW transmitters are to be installed at Delhi, but both of these additional transmitters are not expected to operate until March, 1989. The Bangalore facility is beamed to South Asia and Australia.

It is understood that the Voice of America is upgrading its Sri Lanka transmitters with several 500 kW units and this is believed to have prompted the Indian Government to expand the Bangalore facilities. When all six 500 kW transmitters are commissioned the Bangalore station will be the largest in India.

Kilohertz Comment

ANTARCTICA: Radio Nacional San Gabriel has been heard on 15474 kHz at 2300 UTC. This interesting station located on an Argentine base in Antarctica carries broadcasts in Spanish and is heard under favourable reception conditions.

INTERNATIONAL WATERS: Radio Caroline broadcasting from the South East Coast of England on 6210 kHz has been received around 0700 UTC. At this time there was a short news bulletin and reception is spoilt somewhat from side-band signals from HCJB using 6205 kHz.

ISRAEL: The introduction of summertime in Israel means that English broadcasts are heard one-hour earlier. The news at 0400 UTC in English is on 17620 kHz for reception in Australia, while a new channel 13750 kHz is also providing fair reception. The next transmission in English at 1000 UTC is on 15650 kHz for listeners in the Pacific.

LEBANON: The Voice of Lebanon uses 6550 kHz and has a 10 minute news bulletin at 1815 UTC. At 1825 UTC when the broadcast concludes, listeners are requested to tune in at 11.00am (0900 UTC) the next day for a further session in English. There has been excellent reception of this station in recent weeks, despite the power being only 15 kW.

NEW ZEALAND: Radio New Zealand is using a new frequency for its transmission to the Pacific 1830-2105 UTC. The broadcast is now on 12030 kHz replacing 11780 kHz but early observations show that Radio Moscow World Service is using this frequency at 1900 UTC.

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

World Radio History

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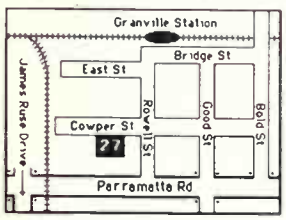

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$10.50 Each

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5" 220V AC
All working but noisy!
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As used on new IBM type computers etc Have 15 pins in 9 pin size connector.

15 PIN Male
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by Toshiba/EMI

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$59 Cat 01-1522

Supplies 3/6/9V dc from lighter skt for CD player or Walkman cassette & inbuilt FM converter transmits sound into car radio for high quality output.

4/6/8" Honeycomb Cone WOOFERS

Reduce cone breakup, excellent bass sound, RMS power ratings
All 8 ohms impedance

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Insert between door switch and light. 15 second delay, 12V dc pos or neg gnd. Cat 01-1522 $14

Nicad Rechargeable NiCad batteries

High quality Japanese nickel cadmium "AA" penlight batteries. each
450mAH Were $3.50 $2.95
Cat 02-1050 10 for $25

STEREO HEADPHONES FOR DIGITAL COMPACT DISC

The difference in bass, treble and sound dynamics is amazing! Clean and crisp with outstanding clarity yet lightweight L/R volume controls, 20-20KHz resp, 100dB at 1KHz sensitivity, normally RRP $44.95, below cost at $20 pr.

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5" Honeycomb Cone Mid-range

25W 325Hz-15KHz
Sealed back, matches all honeycomb cone woofers. Cat 19-6086 $22.50 Each

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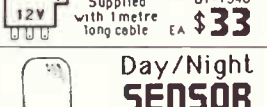
When space is at a premium and you need to switch high currents, this electronic switch is ideal



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Mains powered, charges 6 x AA or AAA batteries in 14-16 hrs, with LED indicators.
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Ideal for CB, car stereo, alarms & battery charger Has LM723 regulator, all parts + instructions $29 Cat 11-1540

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$16 50 Waterproof for outdoors.
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7.2V Nicad Chargers

Fast charge in 15 mins or trickle charge from car battery.

Standard Quick Charger.....$39
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Dual meters, electronic timer control.

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Push ON-Push OFF
Cat 01-0457 each $13.95

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10 Metre lead for remote locations with US type plug Aust plug adapter only $5.52 ea
$22.50 Cat 24-3001

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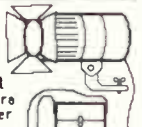
12V 100 Watt



For all video camera lighting with power pack and charger.
$249.00

7.2V Nicad Battery Pack for radio control Tamiya cars etc.

$65 Cat 02-1090

Plug-in replacement is 1300mAH and at this price, you could afford 2 as spares.
Recommended charging 130mA 15hrs.

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Heavy duty professional tool, ni-cad batteries, forward and reverse, 4 tips + charger incl Cat 20-2308

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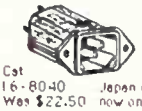

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Was $22.50 now only

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with last number memory re-dial feature. $10 WAS $15
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BANKCARD VISA MASTERCARD AMEX
WANTED: Electronic parts, computers, test equipment, CASH paid.

World Radio History

Paul Budde reports on the international position of videotex services.

Videotex News

NZ Government and Videotex

The New Zealand Government Computer Service is determined to become a player in videotex. In an unexpected flurry of activity earlier this year the Government Computer Service shouldered all the videotex responsibilities of International Computers Ltd.

The New Zealand Computing Service is now positioning itself to offer a turnkey service to its customers including design, consulting and implementation. Indications are that the GCS will work in partnership or joint venture agreements with Information Providers.

The Government Computer Service now hosts the entire TAARIS database for travel agents, previously hosted by ICL. GCS now looks after all elements of this database except for the information provision which is looked after by BPI. At the same time GCS has taken over the Development Finance Corporation videotex system, a comprehensive database of financial services including home banking-style transactional applications.

Electronic Mail Link

An important new link has been developed between Prestel and Telecom Gold, British Telecom's electronic mail system. The new X.29 based gateway is a step towards establishing full interconnection between the two networks.

The link incorporates new software to provide a better display of information sent from a scrolling ASCII-type system to a Prestel terminal. The standard 80 column computer display of information is reformatted in a Prestel page style — 24 lines with 40 characters to a line — and the last two or three lines of the message can be carried forward to the top of the next page for easier reading.

Customers will be able to dial the same number for all customer service enquiries, whether on Prestel or Gold.

Charges for the Gold mailbox and Prestel services will be collated onto the same bill.

UK Controls On Electronic Banking

Recently the British Government ordered an inquiry into electronic banking. This is the frontrunner for new regulations in this field. The British National Consumer Council stated in 1983 that the present legislation covered the users of credit cards and ATM's insufficently.

European Standard for Telebanking

Within 10 years, Europe will have 80 million smart cards and 400,000 ATMS. In order to handle all this financial traffic, the European Commission wants to set guidelines to prevent incompatibility. Also on-line (vidoetex) banking services will be included in this European plan. Both national and private networks will be effected by the new guidelines.

US Videotel to Import 30,000 Minitels

US Videotel (USV) will import up to 30,000 M1B Minitel terminals for a Texas residential videotex services. Services will include home banking, teleshopping, financial services, communications and private business network.

Southwestern Bell Telephone found a back-door approach to the venture by offering to handle market research for USV, thus skirting restrictions on direct telecommunication involvement in information services. Before the commercial launch of the venture late this year, USV, a subsidiary of software developer Encode Internation, will run a three-month, 300-site trial in Houston this summer using Minitel terminals. Customers will be equipped with M1B Minitels that USV calls "Videotels" to access the service. USV won't disclose the unit price of the Minitels, which it is importing from French maker Telic-Alcatel, but experts believe the devices may cost under $US200 each.

Teleshopping Booming in the US

Not videotex but Cable TV has proven to be the key to success in teleshopping. Teleshopping turnover in the US grew from $US20 million in 1985 to $US400 million in 1986. The largest service, Home Shopping Network (HSN), booked for $US3 million a day last December.

HSN is available to 10 million viewers in 26 states in the US. Recently, HSN got competition from a new company called Cable Volume Network, in which 18 cable operators and NuMedia joined forces.

Pharamceutical Network

US data base operator Geiscon, has introduced a range of vertical pharmaceutical information services for hospitals, chemicals, wholesalers and doctors. Drug information, messaging services, price list, trade conditions and order facilities are also available. The annual subscription is $US150 with a monthly fee of $US100 for manufacturers, $US75 for wholesalers and $US1 per minute for the users.

Murdoch Readies On-line Hotel Directory

Murdoch Magazines will launch "Murdoch Travel Systems" (MTS), an on-line and video hotel booking system for travel agents. MTS, the first interactive extension of the company's print publications, will merge the information resources of Murdoch's massive "Hotel Travel Index" directory with the reservations capabilities of Utell, a European-based hotel bookings system recently acquired by Murdoch's parent company.

The Utell relationship gives MTS the immediate ability to book rooms at 3300 hotels in business and vacation cities worldwide. Travel agents, corporate travel offices and other professional users will access the electronic information/reservation system through a special "Jaguar" workstation that Murdoch is developing; the unit will include an on-line system, videodisc and CD-ROM players and a laser printer. Murdoch currently has no plans to offer the information/reservation system to home users.

US Institutions to Launch Telebanking

Seven US financial institutions, that are part of the MAC network automated teller machine system, will introduce "MAC Home and Business Banking".

World Radio History

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Speed Card	$450	233
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Serial Card for XT	$51	236
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Multi I/O and Floppy Controller	$165	238
Multi I/O	$135	239
XT Case	$93	289
XT Hard Disk Controller Card	$185	249
Floppy Controller Card	$62	247
XT Motherboard 4.77MHz/10MHz 0K	$199	274
XT Motherboard 4.77MHz/10MHz 640K	$499	253
AT PERIPHERALS		
AT Floppy & Hard Disk Controller	$319	250
AT Baby Mother Board 640K 10MHz	$940	254
2MB Memory Cards for AT	$399	259
2MB Multi I/O for AT	$450	260
Serial Card for AT	$130	237
AT Baby Case	$125	252
AT Full Sizecase	$165	272
AT Baby 180W Power Supply	$185	241
AT Power Supply 200W	$220	242
PERIPHERALS FOR XT & AT		
Printer Card	$40	235
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Ega Card	$299	244
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HGC and Printer Card	$135	229
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ADI DM-1502 Colour Monitor	$620	201
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World Radio History

The initial offering will involve a joint marketing deal with Source Telecomputing Corp, making The Source on-line information service available to telebanking customers at preferential rates. Philadelphia National Bank, which is a leading bank in th MAC network, is co-ordinating the telebanking project. Telebanking software is based on Manufacturers Hanover Trust (MHT) Corporation's "Excel", which has been adapted for the MAC service. MHT has licensed the telebanking software to MAC.

Reasonable Growth

Apart from France, most public videotex services in Europe have now concentrated on business users.

Country	Public System	1986 (x1000)	1990 (x1000)
Belgium	Videotex	2	10
Denmark	Teledata	2	30
Finland	Telset	2	10
France	Teletel	1200	3000
UK	Prestel	65	250
West Germany	Bildschirmtext	50	150
Italy	Videtel	2	15
N'lands	Viditel	20	25
Norway	Teledata	1	10
Sweden	Datavision	7	30
Switz	Videotex	2	20

US "PC Banking" Finds Bigger Market

Security Pacific National Bank in the US has found unexpected interest in its videotex system "Business Banking" from companies that are larger than the target market for SecPac's newly launched small business telebanking service.

Mid-size organisations (firms with annual sales above $US2$ million) seem to prefer the PC Package to SecPac's "Specifics" cash management product design for them. PC Business banking's most attractive features include the relatively low price ($US50 per month, which includes communication charges) and the balance reporting feature, which is especially useful to some mid-sized companies.

International Network

To combat new competition from private enterprises in the deregulation battles of the national Telecommunications Authorities, European PTT's (Telecoms) have combined forces. They will soon launch an international network for data transmission, information retrieval and value added services not unlike the Australian VASA service.

The network will be fully transparent to the users and all conversions and the standardisation will be done in the network itself. The system will be in operation by late 1988.

Teletext through Aussat

The Australian Teletext Network service is transmitted via satellite through the Australian Television Network, which means it is now available to most television stations across Australia. As more and more stations install the necessary equipment to receive the Aussat signal, it is expected that many of them will also pick up the Teletext signal for broadcast in their areas.

OTC's Australian Database Director

Speaking at the launch of the Australian Database Directory, the Minister for Trade, John Dawkins, targetted the information industry as vital in reversing Australia's trade in services deficit.

The director, compiled and published by OTC, lists over 200 Australian databases and will be distributed overseas through Austrade offices.

"Australia currently imports more information than it exports and OTC, by marketing this directory overseas, has taken the iniatitive to reverse the flow of information" said Dawkins. "Everytime an Australian database is accessed from overseas it creates export revenue.

"30" For Videotex In The US

Newspaper publishers, including the most die-hard ventures, are dropping almost all videotex projects. Cowles Media and Lee Enterprises, two midwest media companies in the US, are the latest to write "30" (newspaper parlance for "end end") to their exploration of on-line and public access videotex systems. They join the New York Times Co, which terminated its New York Pulse service in the beginning of the year. Chronicle Publishing completed its sale of Bay Area Teleguide to GTE of California.

The latest withdrawals leave only a handful of newspaper-oriented companies actively involved in videotex, eg, Dow Jones, Gannett and Tribute and Co (Chicago). All are multifaceted media conglomerates. Dow Jones and Gannett are emphasising business oriented online services while Tribune Media Services and Courier Communications in Louisville are working on specialty kiosks. Several publishers, formerly active in home and kiosk projects (such as Time Mirror, Knight-Ridder, McClatchy and Courer) are now concentrating on electronic publishing for delivery of business-oriented data.

In addition, Southam's Infomart in Canada now produces full-text electronic editions of four Southern newspapers, following its steady retreat from videotex in 1986.

Keyword search on Prestel

The most important service development on the UK Prestel service is clearly Keyword. Access information by a plain English word rather than a page number. Set up your own word to define a particular page you want to access frequently. Reasonably advanced keyword search, with features like acceptance of some mis-spellings and synonyms are included.

Interactive Marketing Network for Tasmania

Applied Video have developed and test marketed since October 1985 an entertainment and promotional machine using interactive video disc technology to attract parents and children (2-10 years) in shopping centres with:

- ★ Simulated rides on go karts, jet boats, etc.
- ★ Interactive cartoons, stories and rhymes.
- ★ Interactive riddles and puzzles.

On all entertainments the computer driven video disc allows the child to interact, making choices, moving graphics, etc, all in video images not computer generated images.

In the Tasmanian Test Market the machines used a generic shape and entertainments. ●

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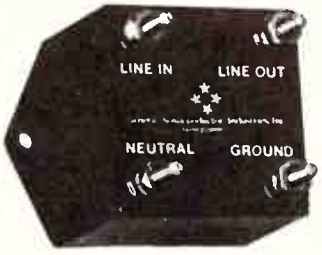

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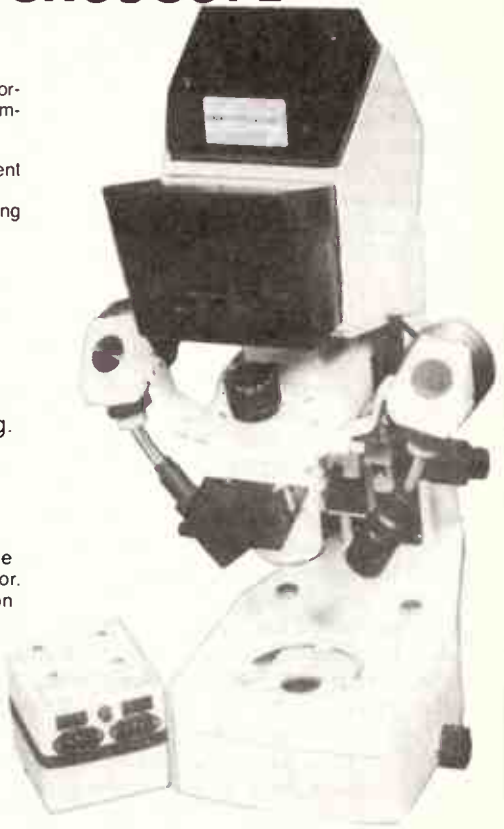

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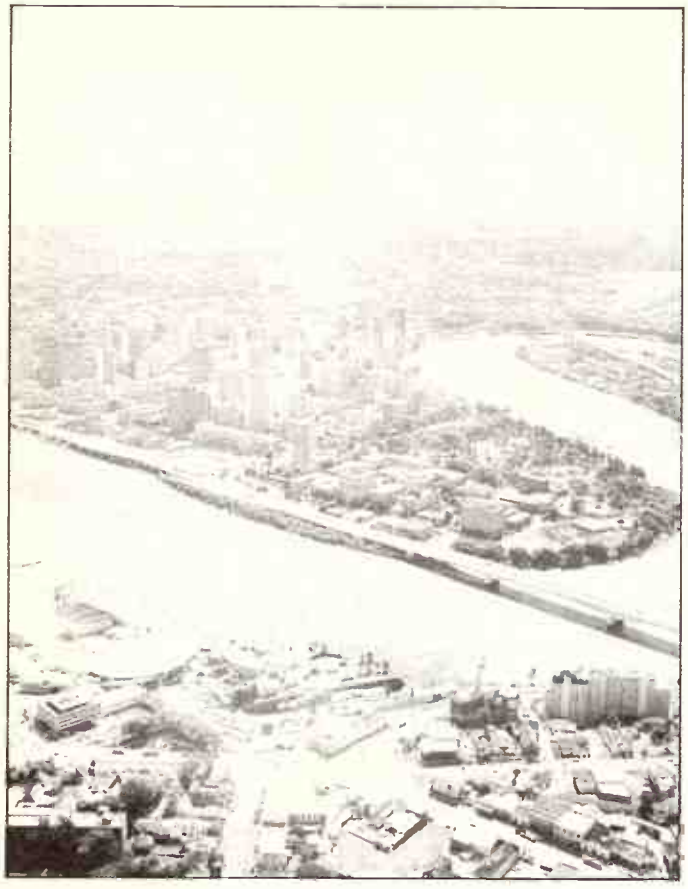

APRIL

Commercial Opportunities from Space Transport and Related Industries Conference will be held in Brisbane over April 26-28. Contact The Secretariat UniQuest Limited University of Queensland, St Lucia, Qld, Australia 4067. Phone (07) 377-2899.

MAY

The Canon Electrathon will take place in the VFL park, Melbourne, on Sunday, May 1. Contact the Co-ordinator, AEVA, P.O. Box 273, Mitcham Victoria 3132. Phone (03) 758-6871.

An International Conference on Environmental Radio-Activity in the Mediterranean area. Contact Mr Alejo Vidal-Quadras Roca, Servicio de Las Radiaciones, Universidad Autonoma De Barcelona, E-08193 Bellaterra, Spain.

An International Aerospace Exhibition is to be held at the Hanover Air Show from May 5-12. For more information contact Deutsche Messe- und Ausstellungs-AG, Abt. 312 Messegelande, D 3000 Hannover 82. Telex: 9-22-728

A Checking the Arms Race Conference will be held at Newport, Sydney, May 13-15, 1988. Enquiries (02) 267-9230.

Microelectronics 88 will be held at Sydney University over May 16-18. All telephone inquiries should ring IREE Australia. (02) 327-4822.

The first Australian FORTH Symposium will be held at the New South Wales University of Technology over May 19-20. Contact Jose Alfonso. NSWUT, PO Box 123, Broadway, NSW 2007. Phone (02) 2-0930.

The Australian Bicentennial International Congress in Mechanical Engineering (Mech 88) will host a Conference on Space Engineering to be held in Brisbane over May 8-13. Contact the Institution of Engineers, Australia, Conference Manager, Mech 88 Conference, 11 National Circuit, Barton, ACT 2600. Telex: AA62758.

JUNE

PC 88 The 11th Australian Personal Computer Show will be held at the Royal Exhibition Building, Melbourne, over June 7-10. Contact Australian Exhibition Services, (03) 269-4500.

International Technology Exhbition will be held in Sydney over June 7-12. Contact Total Concept Exhibitions, PO Box 1227, Crows Nest, NSW 2065.

Infotech Asia '88, The 3rd Asian International Computer, communications and information systems show will be held over June 8-11. Contact AES Suite 33 Illoura Plaza, 424 St Kilda Rd, Melbourne, Vic. 3004. Phone (03) 267-4500.

Sound Vision 99; the 3rd Australian International Conference of the SMPTE, will be held over June 21-24, 1988. (02) 516-1066.

Australian Transputer and Occam User Group Conference and Exhibition will be held in Melbourne over June 23 &24 . Phone John Hulskamp, (03) 660-2453/2090.

The International Audio Video Fair is scheduled to be held in Melbourne from June 30 to July 3. For more information contact Peter Barnes (03) 211-3777/3026.

JULY

Ausgraph 88 The Australasian Computer Graphics Association annual conference and exhibition will be held at the Hyatt on Collins St, Melbourne over July 3-8. Contact ICMS, (03) 387-9955.

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

COMDEX Australia's national and International Computer and Communications Exhibition and Conference will be held in the Darling Harbour area of Sydney from 26-28 July. Potential visitors and exhibitors should ring (02) 959-5555.

AUGUST

The 3rd Regional Convention of the Melbourne Audio Engineering Convention will be held in Melbourne Hilton over August 16-18. Contact the Chairman Brian Horman, PO Box 131, GPO South Melbourne 3205. Phone (03) 329-0162.

SEPTEMBER

The ANZAAS Centenary Congress will be held over 2-6 September 1988 at Sydney University. Contact Mr B. O'Bourke, University of Sydney, NSW 2006 (02) 692-4356.

The Australian Computing Exhibition will be held at Darling Harbour on September 20-22. Contact Michael Fleur (02) 264-1266.

The Fifth Aust.-New Zealand Geomechanics Conference will be held at the Hilton Sydney over 22-24 August. Contact 193 Rouse St., Port Melbourne, Vic. 3207. Phone (03) 646-4044.

OCTOBER

ACCA 88. The Australia Computer Society's Annual Conference will be held over October 1-3 at Darling Harbour in Sydney. Contact ACP Exhibitions Limited, 2/124 Castlereagh Street, Sydney, NSW 2000. Phone (02) 264-1266.

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

NOVEMBER

The International Robot Show will be held from November 7-10. Contact Australian Exhibition services, 242 St. Kilda Rd, Melbourne, Vic 3004. Tel. (03) 267-4500.

DECEMBER

ACSLITE '88 The sixth annual conference on computers in learning and tertiary education will be held in Canberra over December 5-8. Contract Mrs K. Fielden, Canberra CAE, (062) 52-2111.

World Radio History

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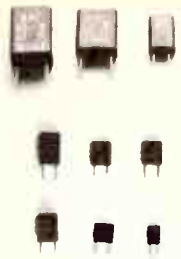

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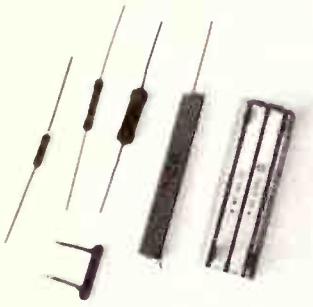

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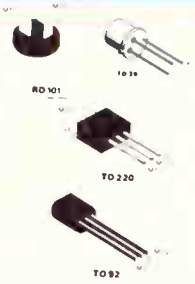

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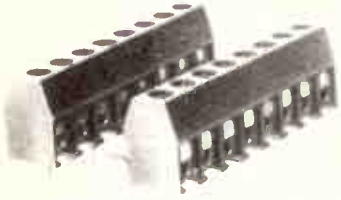

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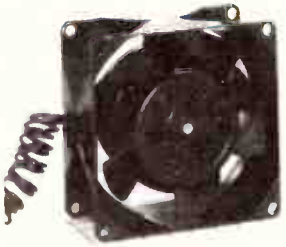

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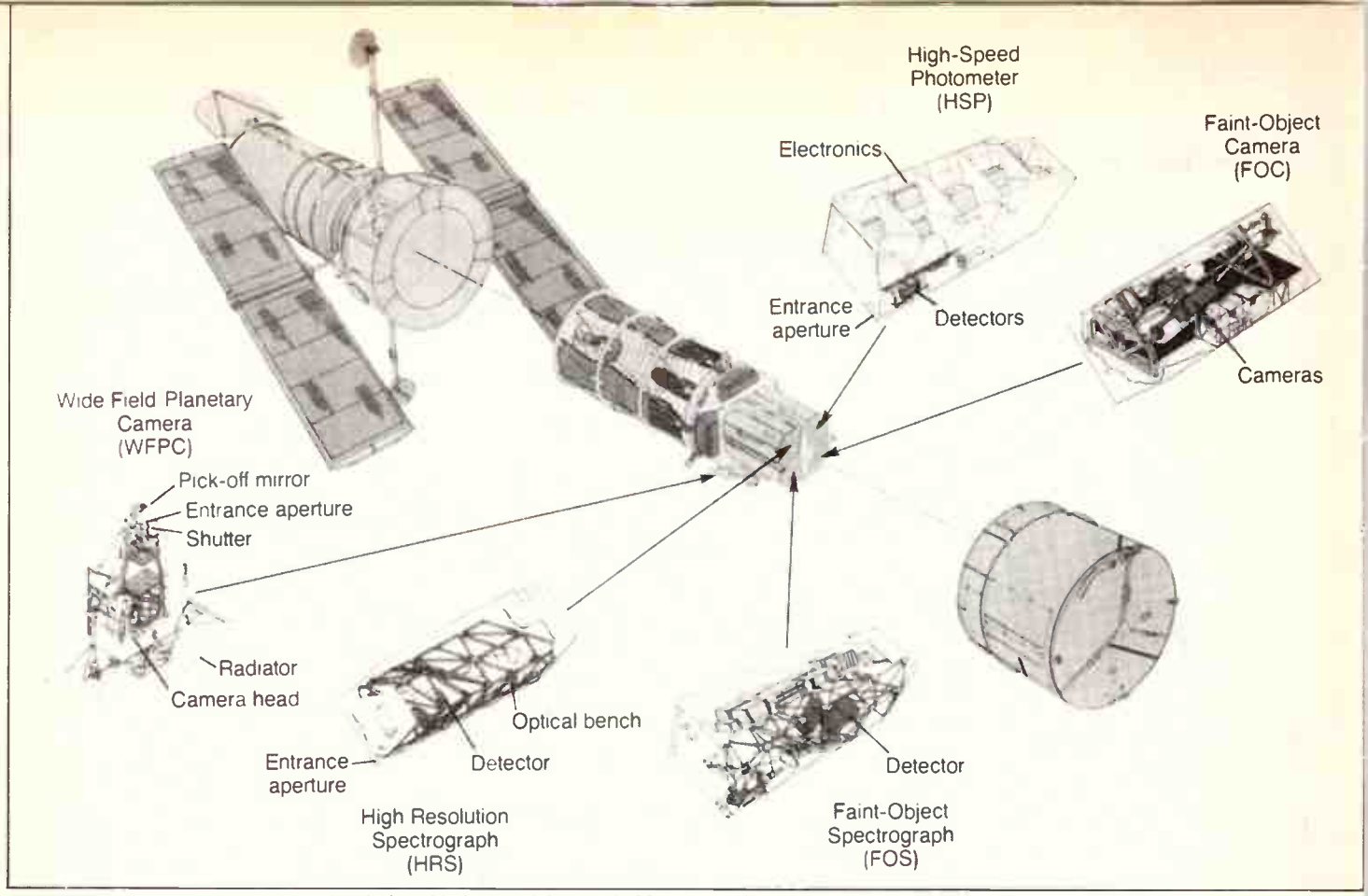


The HST is an immensely complex device designed to be remotely operated for most of its working life. The software to control it requires more lines of code than any other non-military operation in modern research.

TO CREATION AND BACK

The Hubble Space Telescope will see back to the dawn of creation, but only when the shuttle is up and running.

KATHRYN M. DOOLAN

Whenever an astronomer, either professional or amateur, observes the stars, they face an age-old obstruction, the earth's atmosphere, which acts as an effective barrier to an unimpeded view of the universe as a whole. As a result, astronomers have long wanted a vantage point above the atmosphere. Today, it's tantilizingly close.

And yet so far away. For the Hubble Space Telescope is another casualty of the Challenger tragedy. During 1987, when a rare supernova occurred, the perfect means to view it was sitting in a Californian warehouse at the cost of a million dollars a month doing nothing but waiting for the return of shuttle flights. If the shuttle program resumes on schedule in August 1988, the HST should be deployed in either late 1989 or early 1990, some five years later than intended.

The idea of having a large telescope in earth orbit is not a new one. Sixty years ago, German rocket pioneer Hermann Oberth advocated having a telescope in orbit to help solve some of astronomy's greatest mysteries. After World War 2 a Princeton university astronomer, Lyman Spitzer, advanced the idea of having a large space telescope with an aperture of 120 inches in a continuous earth orbit 300 miles above the surface. Spitzer envisioned that the telescope would be larger than ones here on earth and capable of sending data back 24 hours a day to both amateur and professional astronomers for their own research.

With the large budgets of NASA during the sixties, the Large Space Telescope as it was then known, was discussed frequently by the American scientific community. Nothing came of these discussions until 1969, when the Space Science Board of The National Academy of Sciences called for a 120-inch orbiting telescope.

Due to unprecedented lobbying by the astronomical community Congressional approval was granted in 1977 with some restrictions. The aperture was reduced to 94 inches and it was to be known as the Space telescope. It was the first time that the astronomical community had actively lobbied Congress, and with the major success of the Space Telescope under their

World Radio History

belts, active lobbying was commenced for the Galileo probe to Jupiter and a US mission to Halley's Comet.

Mr Hubble

The Hubble Space Telescope is named after Edwin P. Hubble, a noted American astronomer who discovered the galactic red shift and was an advocate of the "Big Bang" theory of universal creation. The Hubble Space Telescope is unique in the fact that it is a "Shuttle shaped" craft which can only be launched by the Space Shuttle because of its size and configuration.

The HST is 43 feet long and 14.1 feet across, with a weight of 25,500 pounds. The HST will orbit 375 miles above the earth with an orbital inclination of 28.8 degrees. The HST has no thrusters of any sort, so the Space Shuttle will be sent up on a periodical basis to service it and if necessary boost it into a higher orbit. With a lifetime of 10 to 15 years the HST was built at a cost of 1.75 billion dollars in 1985 figures, making it almost as expensive as a new Space Shuttle orbiter.

The roles of the HST will be many and varied. Astronomers all over the world are looking forward to the HST answering some of astronomy's more basic questions such as the founding of the universe and life in other galaxies. The HST will be able to look into space to see objects some 14 billion light years from earth, and so enable astronomers to see how galaxies are formed, and perhaps provide the answers to why we are in this particular place in the Universe. The HST will give man superb views of neighbouring planets and the resolution will be amazing, on the ground astronomers will be able to see Jupiter with as much clarity as the Voyager spacecraft provided.

It is expected that the first serious studies of the planet Pluto will be done with the HST. Until now Pluto has only appeared as a small dot on the largest of Earth bound telescopes. Other objects that will be intensively studied by the HST will include pulsars, quasars black holes and comets. It is hoped that the HST will be able to follow Halley's Comet on it's next 76 year journey to the Sun.

Major Systems

The HST comprises three major systems: the Support Systems Module, the Optical Telescope Assembly and the five modular Scientific Instruments.

The Support Systems Module contains the essential instruments to keep the telescope operational. It includes the pointing and stabilization control, thermal controls, data management equipment and communications. Two large solar panels on each side of the telescope will provide electrical power when it is on the Sun side during Earth orbit.

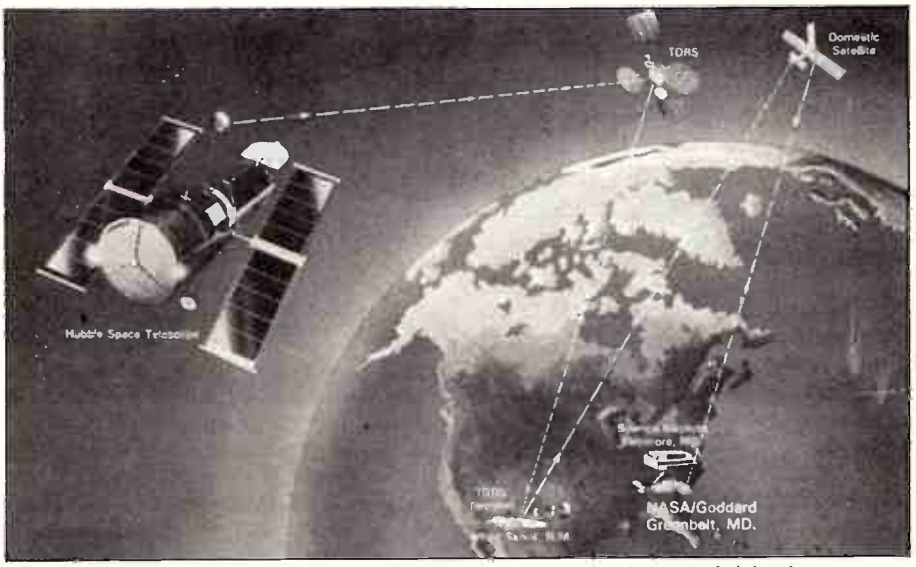
The Optical Telescope Assembly is the most important part of the HST because it provides the means to view the universe. The OTA mounts a 94 inch reflecting telescope. The telescope itself has a Ritchey-Chretien folded optical system with a secondary mirror on the inside of the prime focus. Light enters the front end of the HST, and is then projected from the primary mirror to the secondary mirror and then is directed to a focal plane where the apertures of the scientific instruments are located. The images are then transmitted to the ground by the sophisticated telemetry systems that NASA has made available.

The Scientific Instruments are five different experiments which have various functions. The Faint Object Spectograph will measure wavelengths coming from faint sources to determine their constitutions, physical characteristics and dynamics. The Faint Object Camera will be using the full resolution performance of the HST to photograph stars and other celestial objects that are so faint that it will require cumulative exposures from several orbits to produce an image that can be studied in depth. The High Speed Photometer will be used to obtain precise measurements of constant or time variable intensities that will stretch over broad wave lengths to interpret ultra violet activity. The Wide Field Planetary Camera will be used for either of two different areas of study. The "Wide field" capability will permit the examination of large areas of space allowing accurate measurements of stars, galaxies and quasars. The "Planetary" capability will be used for detailed studies of planets within the Solar System with a special emphasis on the atmospheric compositions of the larger planets (Jupiter, Saturn and Uranus). The High Resolution Spectograph will be able to obtain the composition of ultraviolet regions of different stars with heavy gas clouds (nebulas). This will then help scientists find out what sort of materials make up these mysterious clouds.

Data transmitted back to Earth by the HST will be transmitted to NASA's Spaceflight Tracking And Data Network which includes the Tracking and Data Relay Satellite (TDRS), several ground receiving stations and the NASA Communication Network. This network will then provide the communication links between the HST and ground based systems. Computers will be used to convert the data in to a usable format which will then be relayed to the Space Telescope Institute at John Hopkins University in Maryland.

Overall management for the HST is given by NASA's Office of Space Science located in Washington DC. The Marshall Space Centre in Alabama is responsible for the day to day management of HST, as well as the construction and intergration of the telescope and spacecraft systems. Minor management roles are shared by the Johnson Space Centre in Houston and the Goddard Space Flight Centre in Greenbelt Maryland.

It is a shame to think that when Supernova 1987A made it's appearance the foremost telescope in the world was sitting in a clean room in California awaiting NASA's attention. Once the Shuttle is flying and keeps flying, the deployment of the Hubble Space Telescope will be one of the few positive features in a military dominated civilian space program. ●



The Space Telescope will be operated from stations in the US even when out of sight of North America using the Tracking and Data Relay Satellites (TDRS). All information to and from the telescope will flow along this path.

World Radio History

SPEEDY PCs

Not all IBM clones are alike. Some go faster than others. This article backgrounds the performance of your computer, and shows you what you can do about it.

Jonathon Powers

The history of the PC began in August 1981 when IBM announced the "IBM personal computer" to an impatient world. The processor was an Intel 8088, a new chip with 16 bit internal architecture and an 8 bit external buss. It was a development of the Intel 8088, a genuine 16 bit device, developed to work with the then plentiful industry standard 8 bit chips, but retaining most of the internal advantages of 16 bit operation.

The original PC had a performance measured at about a quarter of a MIPS, i.e: 250000 instructions per second. By the standards of 1981, this was an adequate, but unexciting performance, and so early in the piece, efforts were made to boot it up a little. The first result, from IBM, was the introduction of the XT. This used the same processor, operating at the same speed, but with provision for a hard disc on board. The hard disc, with about five to ten times the access speed of the floppies, dramatically increased the usefulness of the PC, and made many disc intensive programmes a lot faster, but without increasing the processing speed of the machine itself.

In 1983, however, a real change occured when Compaq announced their first machine, the DeskPro, which used the 8086, and thus turned the PC into a genuine 16 bit machine for the first time. The busses on the circuit boards were all 16 bits wide, and all the chips on board ran on a 16 bit basis. The 8086 was almost twice as fast as the 8088, so the DeskPro could trundle along at about 0.5 MIPS. It was a significant development, because it made speed, for the first time, a real issue in comparisons of PC clones.

It also spured on the chip makers to

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come up with faster designs. It had become obvious that there was a market for high speed chips, especially if they could be made downwardly compatible, so that software designed for the slow chips, would run on the fast ones as well. The first result of this trend was the Intel 80186, an example of a new generation of microelectronic technology that allowed many of the peripheral chips that surround the 8086 to be put into the central processor.

Popular chips

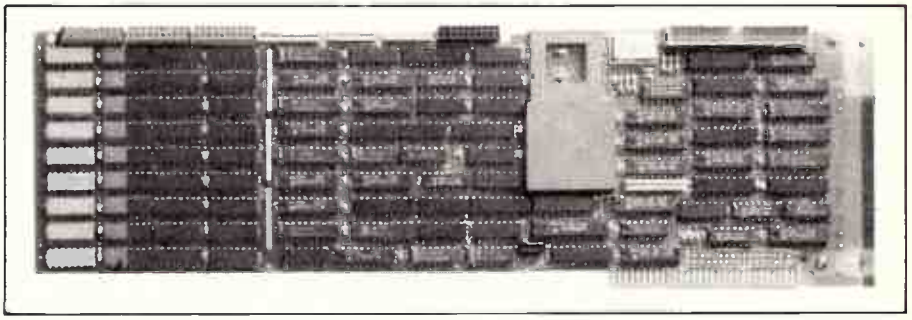
The 80186, however, was not the most popular chip put out by Intel. It was used in a few low selling clones like some of the early Tandy efforts, but generally fell by the wayside. The real advance came in 1985 with the 80286, a complete redesign of the heart of the 8086 together with integration of the core of a small computer. By comparison with the 8086 it fairly screams along, at about 1.5 MIPS. It can add two numbers together about two million times a second, twice as fast as the 8088, and multiply them 300,000 times a second, about seven times faster. The 286 can do a conditional branch 600,000 times a second versus the 500,000 of the 8088. And the beauty of it is that the 80286 will run all the code written for the 8086.

There are two modes of operation of the 80286, real and protected. In the real mode the 80286 acts very much like an 8086. Its fast of course, because it takes less cycles to execute intructions, but otherwise it looks to the software and hardware just like an 8086. The exception to this is that the 286 can also make use of a much faster clock, so that the cycle times themselves are faster. The standard PC with an 8086 runs at 4.77 MHz. The 286 is a standard IBM AT runs at 6 MHz, and clone makers have doubled this, making it effectively about twenty times faster than the ordinary PC at executing instructions.

The other mode, protected mode, does not actually confer any increase in speed, although it may well seem like it does to the user. It adds four new features: protection, which allows DOS to protect parts of the memory; extended memory, which allows up to 16 M to be installed on board (the PC allows only 1 M); virtual memory, which makes it possible for the 286 to juggle the memory allocations in such a way that the PC can appear to have 1 Gbyte; and finally, multi-tasking, which permits the computer to run more than one programme at a time, and swop between them at will. There is only one catch really. While real mode is compatible downwards, so that it will run programmes written for the slow 8086, protected mode is not. To gain any of its advantages your programmes have to be written specifically for it.

Recently, Intel has released a new, even faster version of the 80xxx family, the 80386, a genuine 32 bit high speed chip that races along at extremely high speeds. 16 MHz clocks are common. IBM itself has not used the 386 in any of its machines, having stopped making the PC before the 386 was delivered. However, many of the clone makers have, resulting in PC compatible machines capable of 4 MIPS, some 16 times faster than the original PC.

Another route to higher speeds is the so-called co-processor chip, notably the 8087, for the 86, the 187 for the 186, 287 for the 286, and so on. The 87 chips allow the main processor to offload appropriate number crunching onto the 87 specialty circuits. It can add both speed and accuracy to calculations. Because they specialise in maths functions, the 87s can do some kinds of operations fifty to 100 times faster than the motherchip. In practice, this speed advantage drops down to 5 to 20 times faster because of the overhead involved in using the 87s.



A typical speed up card: Intels Inboard 386. If has over 2m at memory plus the new 80386 chip running at 16 MHz. The empty socket is for the yet to be released 80387.

Incidentally, the 87s also offer significant increases in accuracy. They do all their calculations in a 10 byte format, so that any calculations are done to the highest possible degree of precision. They also have seven special constants 0,1, π, log 2 10, log 2 e, log 10 2, and log e 2.

The trick to the 87 series is that they do not automatically add anything to a programme. The programmer has to invoke the use of the 87 directly, with the result that programmes written without such instructions will run at the same speed whether a co-processor is fitted or not. Secondly, even if the programme is written with the 87 in mind, the speed advantage only becomes apparent when doing calculations. Any other function will be done at the same rate. Thus one would expect that word processors would get little from an 87, while intensive engineering or mathematical calculations will give close to the theoretical maximum speed boost. The result of this is that, while most computers have an 87 slot, few come with the 87 installed. It's just not worth it.

The story of the PC family is one of eight years worth of continual speed improvement while maintaining compatability throughout the range. The consequence has been that the standards, and standard programmes, have been around for long enough for them to become part of office lexicon. Most secretaries, for instance know what Wordstar is. Just about all accountants have heard of Framework. This has had profound consequences for the rate of acceptance of computers in the community. At the same time, speed advances have meant that PC clones can now be found in applications that were unthinkable in 1981. Practical CAD, for instance, or circuit simulation, or real time animation.

The consequence of this has been continuing pressure to update equipment. This could have taken the shape of built in obsolescence, so that one needed a new computer every year, like motor cars. Undoubtedly, the PC makers wish it had gone that way. The problem for them is that a multitude of small pc board level designers have made use of the PCs open architecture to provide an alternative to buying a new computer every time new chips is developed.

For the most part this has taken the shape of speed up boards, cards that plug into a slot on the PC motherboard and carry a fast processor. Typically, an XT owner can remove the 8086, plug in a card carrying an 80286, and instantly enjoy the benefits of an AT. Often, makers take the opportunity to add extra memory to sweeten the pill even further. During the last year, cards carrying the new 80386 have also been available, working on the same basis.

Sometimes, speed up cards take the form of complete drop in motherboards, designed to be bolted into the case in place of the motherboard on the PC. All the existing option cards are then slotted in as before. This option allows the inclusion of large amounts of fast memory and so on. In either case, the result is a cheap alternative to buying a new computer. ●

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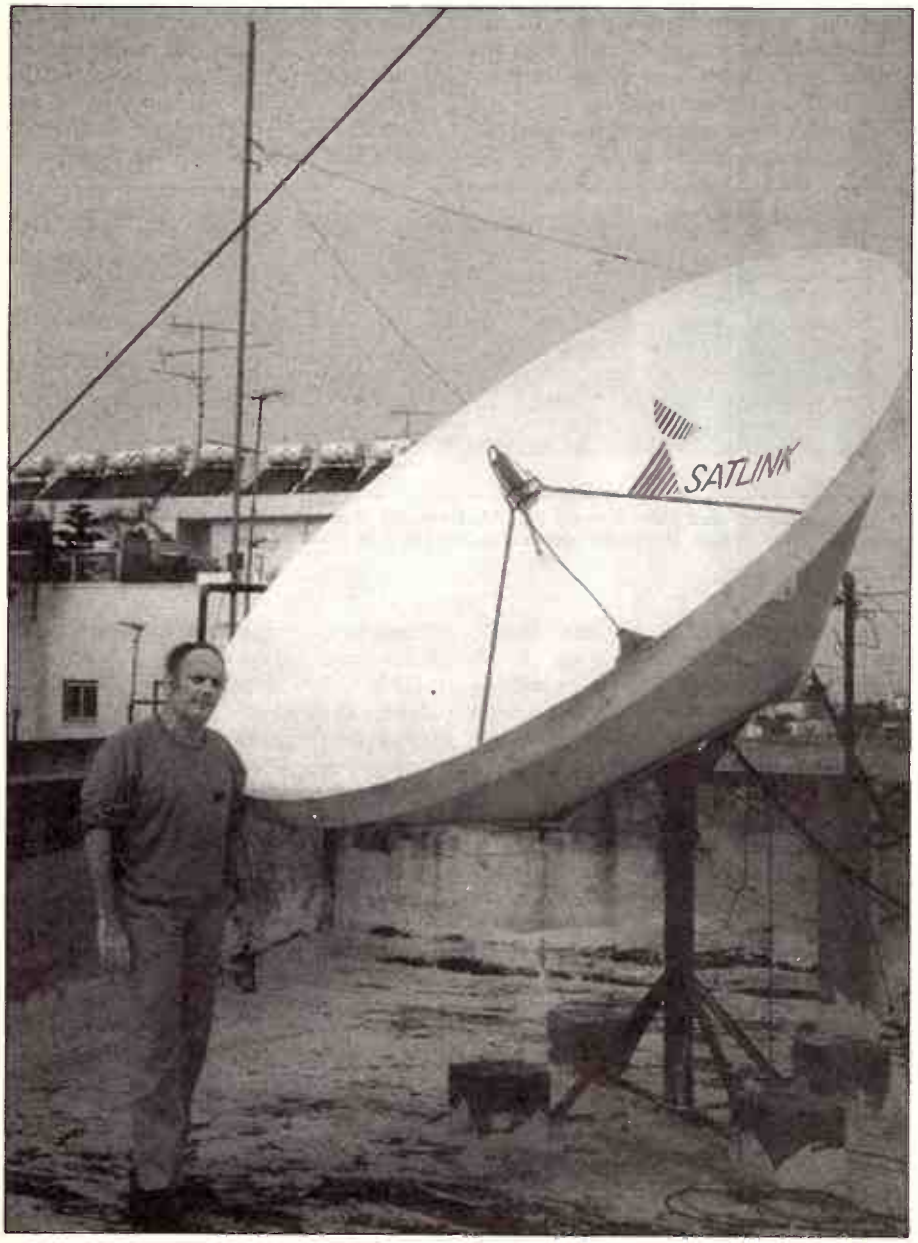
THE WORLD AT HIS FINGERTIPS

Michal Gurdas is the world's foremost monitor of international radio broadcasts

Thomas E. King



International eavesdropper Michal Gurdas with his satellite dish.

In 1974, following a coup in Cyprus, the State Radio announced that President Makarios was dead. In reality, the political and religious leader of the war-torn Mediterrean Island had only fled the capital Nicosia. He made his way to Paphos, a small village in the southern part of Cyprus, and whilst there broadcast a message to his supporters using a small transmitter.

That transmission was monitored and the tape replayed over Israel Radio.Other rebroadcasts from additional shortwave and medium wave outlets followed and were monitored by American and British agencies. Swiftly acting on his appeal they organised a rescue of Makarios and assisted with his eventual return as the head of government.

The man who monitored that inital plea was Michal Gurdus.

When the Iran/Iraq War began, radio transmissions from Syria and Libya co-ordinating the early shipment of weapons to Iran were monitored. After such activities were announced to the world community Iraq severed diplomatic relations with Libya.

The man who monitored those broadcasts was Michal Gurdus.

As a TWA jet was flying over Greece it was hijacked. The man who first monitored the terrorist activity in progress was Michal Gurdus.

While it's impossible for Michal Gurdus to always be at the right place at the right time, his ability to tune into the world and then interpret transmissions is very impressive. And so it should be, because it's his job. He is the ears and eyes of a highly respected and unique communications monitoring service specialising in the Middle East.

His lifestyle would drive lesser men crazy. This Tel Aviv-based Dxer listens to radios — lots of them — and watches several colour monitors for about 16 hours a day, seven days a week. He has equipment to scan the bands from medium wave through

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shortwave to the UHF spectrum. In addition, he has access to a sky full of satellites and the facilities to record everything.

Guided by a stack of confidential frequency lists and a small library of specialised communications-oriented magazines and books, much of his equipment is squelched on fixed frequencies such as 14-.418 MHz, the Kuwait News Agency and 9.117.7 MHz, a popular frequency for aircraft flying over the Persian Gulf. More often than not, however, the sporatic transmissions are purely routine. But when something out of the ordinary happens the communications room in the Gurdus home is crowded with voices from throughout the Middle East.

Centre of Events

He has been involved in much recent history, all of which has made world headlines. He was particularly busy providing information and insight during the Makarios escapade, the early days of Iran versus Iraq, the TWA caper, as well as the American bombing of Libya, the Israel/Lebanon War and the 1980 attempt by the American Air Force to free the hostages in Iran. While all these events are still vivid in his mind, the most "shivering" episode of his career to date was in 1984 when he heard the screams of tortured passengers in an ill-fated Kuwaiti hijack.

A massive number of telephone calls and a large amount of monitoring time these days is devoted to the conflict in Michals own country. Not only does he monitor the broadcasts of Israel Radio but he constantly listens to and watches the events from neighbouring Arab nations.

Michal's university training was in Middle East political science; fluency in Hebrew, Arabic, Polish, Russian, French, English and some knowledge of German coupled with his passion for communications means that he is invaluable to Israel Radio and TV as an authorative news source.

He also works for the US network, NBC. NBC TV values his ability to listen to and understand the Middle East so highly that a telephone 'hot line' was established in 1985. All he need do is pick up the red phone. The company has also provided facilities for direct satellite transmission to New York.

While a situation involving satellite transmission from his home has not yet arisen. Michal is more than familiar with receiving satellite broadcasts.

At present, there are more than 20 different satellites providing viewable signals to Israel. On the eastern footprint of the ECS-1, the European satellite, there's the BBC link between Washington and London. London's ITN TV network uses ECS-1's Bright Star Transponder in the evenings to transmit information to New Zealand. (Australian transmissions, unfortunately, are scrambled). Other ECS-1 transponders relay German and Turkish television signals.

SEB

There are five Russian satellites with portions of footprints over Israel as well as two Intelsats which serve among other nations the communication needs of Gabon and Niger.

SEB is a satellite service for US Forces in Italy. The Arab League has two transponders on its satellite which are frequently used for news feeds throughout the Arab speaking world.

One of Michal's favourite sources of information and entertainment comes from and Intelsat transponder used by the US Armed Forces Television Service. Because of American interest in Johnny Carson and gridiron football Michal is able to keep in touch with these 'cultural contributions' even if it means video taping them for playback the next day.

And what does a super snooper' use to monitor the world around him? Michal is fortunate in having a wider choice available to him than can be found in many retail outlets actually selling communications equipment. Included in the cornucopia of electronic gadgets are four satellite receivers (manufactured by Drake, Anderson and Tracker System); a Sony World Zone portable shortwave receiver; a Collins 51S-1 receiver; a Panasonic RF 2900 receiver; a VHF/UHF tuner; a reel to reel tape recorder next to a Seiko world time clock; controls for the two roof top rotators; two R-2000 receivers from Kenwood; a cassette recorders from Sony, Toshiba and Sharp; a Yaesu FRG-9600 VHF/UHF receiver; a Kenwood R-5000; a Drake R 7 receiver (which is his personal choice as the best receiver of them all); a 5" NTSC Sharp colour monitor and another one from JVC; a Yaesu FRG 7000 receiver next to the older FRG 7; a BARCO professional colour monitor from Belgium; a Brother printer' a Telereader; a 21" BARCO monitor; an AKAI '9 Standard' VCR; a Sony TV and a National video. In the corner (now retired) is an HQ-129X receiver from Hammerland which he used for 27 years, a Collins 51 JX receiver and a Heathkit SB310 bought during an initial trip to the USA over 20 years ago.

With such an assortment of equipment it's quite understandable that a wide variety of antenna accessories is needed. The roof top of his house is filled with an amazing assortment of 'signal grabbers'. Apart from a 5 m dish from the 'C' band and a 3 m dish from the 'KU' band satellites (both of which are instantly rotatable) Michal has installed beams for 7, 13 and 21 MHz; dipoles for 8, 11, 15 and 26 MHz; a long wire for the medium wave bands, a loop antenna; an FM beam and a VHF/UHF beam primarily for aircraft transmissions.

The highest antenna is located some 36 m above the peaceful, tree shaded street in downtown Tel Aviv. This artificial mountain of solid steel towers and masts coupled with the area's slightly elevated position not far from the sea provides for enhanced reception. It's not a place entirely free from noise, Michal noted, but it is just about ideal when the conveniences of a major city are considered.

Even with rows of monitoring equipment in place, more have been ordered. A new satellite receiver is on the way. Offering a 1 db noise figure and a threshold figure of 6, the new satellite receiver will not only provide a better picture on existing signals but it will be sensitive enough to pull in even more stations.

Such a feat will certainly be of assistance when world events demand additional resources, but it won't be needed this coming September and October.

Michal is looking forward to those months because of Olympic actions from Korea. "I'll be able to watch everything from Seoul," he said, "and not just the edited bits that the networks choose to telecast". ●

World Radio History

VIDEO CONFERENCING

Derek J. Powell

The Video conference, with participants in widely scattered locations, has become a reality in Australia.

The development of videoconferencing has proceeded along several strands, each with a slightly different application. Telecom's considerable work in "face to face" videoconferencing in Australia holds enormous promise for a communications revolution that will see video, audio and data transmission unified and facilitated as never before.

Australia Live

The largest scale videoconference events make use of satellite technology in the "Point to Multipoint" mode. This is "Presentation Style" videoconferencing. Large corporations are the typical users of this type of function, for product launches, shareholders meetings and the like.

Arranging a videoconference event requires the co-ordination of many elements: production facilities at the origination site, satellite transponder and terrestrial bearer bookings and video and audio facilities at the presentation sites. Most companies are reluctant to attempt the organisation of an event themselves and prefer to use specialist companies.

Patricia Patterson of Network Technologies, a leading Australian videoconference organiser sees this type of event as on the increase here. "We have had a fantastic number of enquiries since the 'Australia Live' programme on New Years Day.

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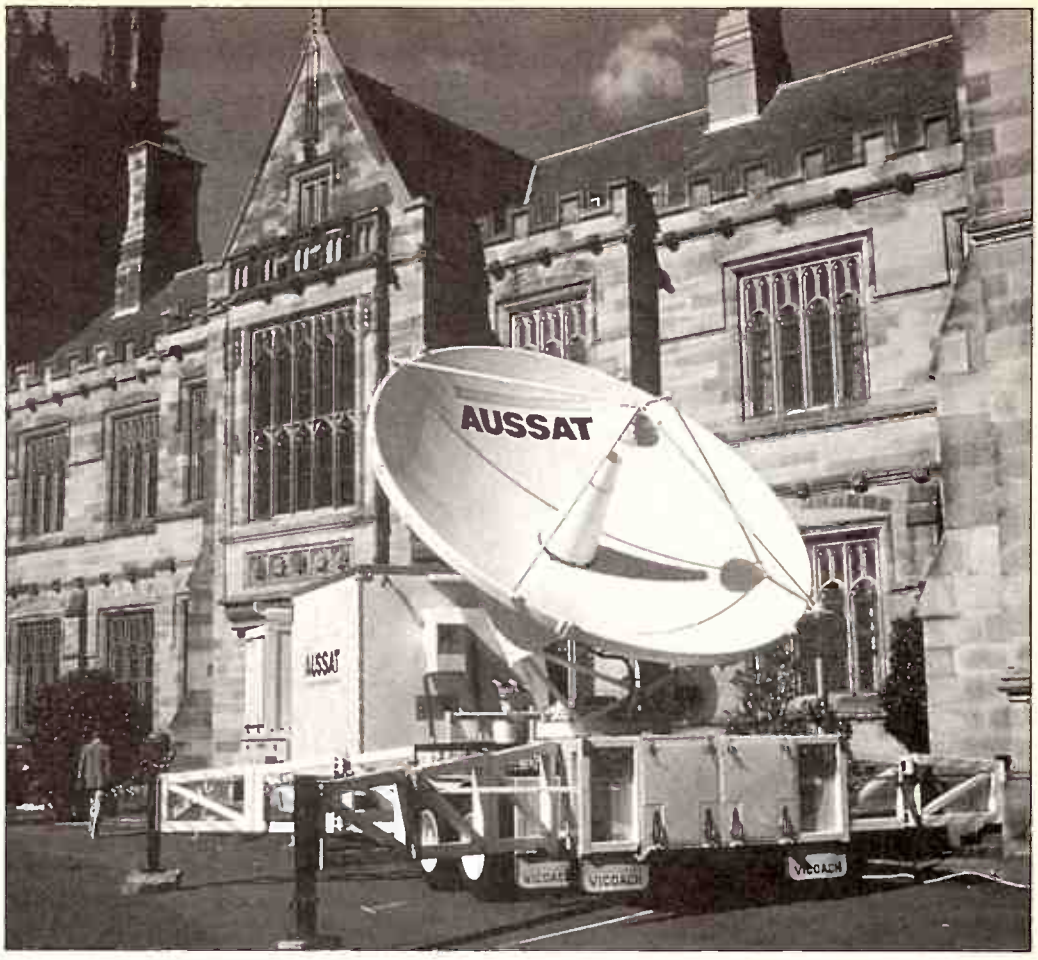
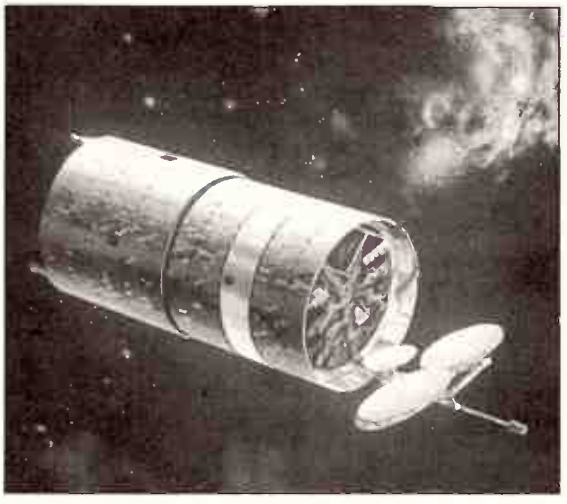
Left: At the remote sites for an 'Event Style' Video-conference video projectors display the pictures from the downlink receiver. Below right: The Aussat satellite makes 'Point of Multipoint' conferencing economically viable in Australia. Right: Transportable Earth Stations can provide 'broadcast quality' Videoconference up and downlinks from any location in Australia.





People are realising the enormous potential of satellite communications to reach a widely scattered audience," she said.

In a typical event, most activity centres on the origination site. This may be a television studio, a convention centre or a major venue like the Sydney Opera House. Here, the main presentation will be given to a local audience and simultaneously shot by a television outside broadcast crew. The video and audio signals are then sent via microwave link to the nearest Aussat uplink point for relay to the satellite. If the origination site is remote, it may be better to use a portable uplink transmitter directly to the satellite.

How It's Done

The uplink uses a large parabolic antenna with a gain of around 60 dB and a carrier power of up to 3 kW in the 6 GHz band. At the spacecraft the received signal is retransmitted as an FM signal on a somewhat lower frequency (between 3.7 and 4.3 GHz) from on board transmitters. One complete receiver/transmitter pair is referred to as a "transponder".

On the Aussat satellites, both low power (12 watt) and high power (30 watt) transponders are available. These may be switched to two different types of directional transmitting antenna. The "national beam" covers the whole of the continent, while "spot beams" are directed at specific areas, covering only two or three states.

This relatively low powered signal has to travel about 37,000 km from the satellite to the receive site. The loss in the down link path is proportional to the square of the receiver to satellite distance and works out to a whopping 200 dB. This results in a signal strength on the ground of around 10^{-20} watts so a large parabolic dish antenna and high gain, low noise head amplifier is essential for a useable signal.

Network Technologies have set the pace in Australia by establishing a chain of receive sites with 3.7 metre antennae at Hilton International Hotels in each capital City. Trailer mounted mobile dishes can be deployed at other sites where there is no permanent receive antenna.

At the presentation site the video and audio signals from the receiver are fed to monitors or a large screen video projector and PA system for the local audience. Each site can participate in the event by

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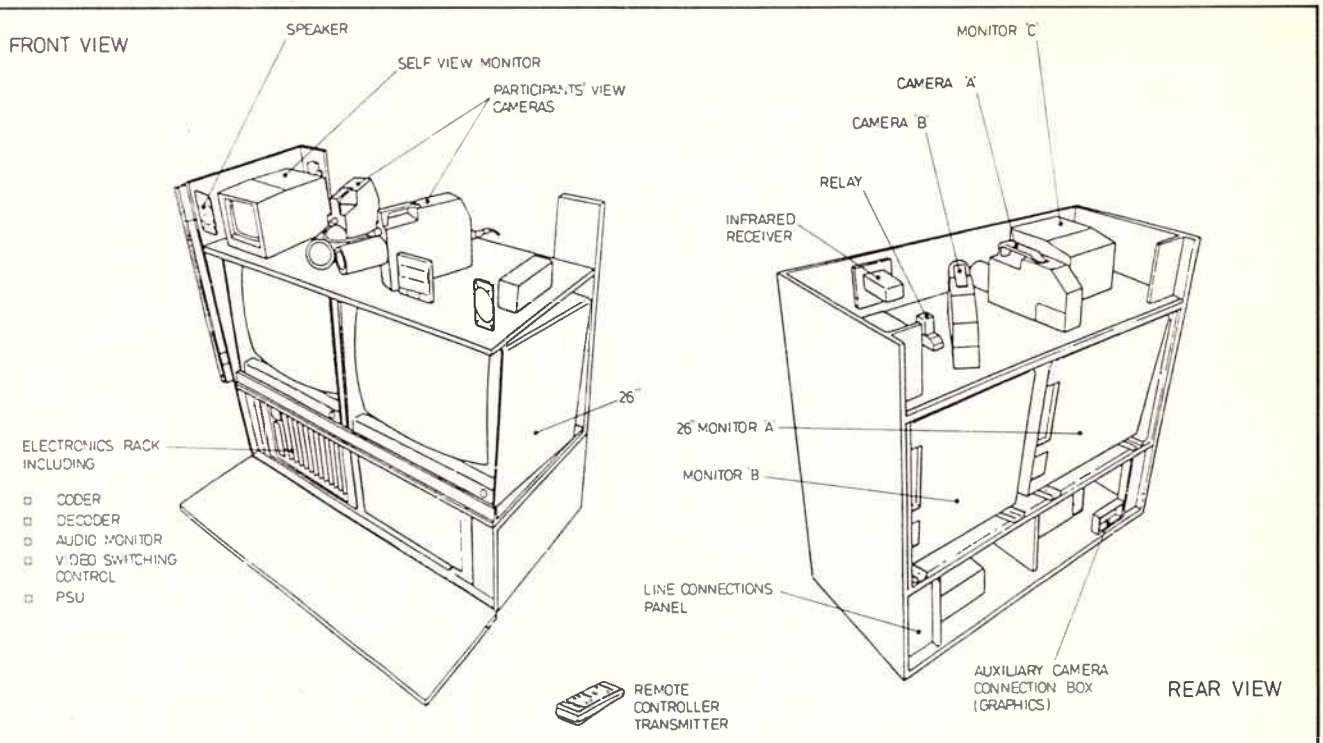

A 'Meeting Style' videoconferencing terminal unit. Two cameras send a split-screen image of participants. The large monitors view incoming vision and graphics, the small monitor is used to check the outgoing signals. (Courtesy SVT Video Systems)

asking questions on a reverse audio link which is usually a telephone or programme line.

Back at the origination site, the incoming audio lines from each of the presentation sites are fed to foldback speakers so that the key presenters can hear and respond to questions from around the country.

Second Style

The second major style of videoconference is the "interactive meeting". Here a small number of people (up to a dozen at each end) can participate in a "face to face" conference with two way vision and sound.

The obvious users of this type of service include executives and engineers from companies with far flung operations, such as oil exploration companies. These type of operations cannot afford to have key personnel away from their posts for days at a time travelling to meetings.

There are other opportunities as well. In the legal field, travelling expenses and lawyers time can be very significant where cases must be presented interstate, for example before the High Court. Whilst full hearings have not yet been conducted via video, legal conferences and certain High Court procedural matters have already made use of this technology here in Australia.

Generally, this type of videoconference does not use satellite communication links. Full two-way vision requires two transponders and two uplinks, this becomes expensive considering the limited number of participants. Security is also a problem with the satellite, unless elaborate encryption methods are used, as the transmisslion can be picked up anywhere in the "footprint" of the transponder.

For these reasons, "face to face" videoconferencing generally makes use of terrestrial video bearers. Full bandwidth broadcast links, via microwave or coaxial cable can of course be used, but big savings can be made by digitalising the video and audio signals and sending them on narrower band (and hence cheaper) data circuits.

Telecom Australia has been in the forefront of both R & D and commercial application of this technology and has since 1974 offered a public Videoconferencing service between centres in Sydney and Melbourne.

Confravision

The opening of the newly refurbished Sydney Confravision centre was the excuse for Mike Richter, Telecom's Videoconferencing Engineering Manager and I, to demonstrate the effectiveness of the system by conducting an interstate meeting.

Conference participants sit at a boardroom table, facing a large screen video display. A camera, unobtrusively recessed above the screen, can be remotely controlled by the chairman to provide a wide shot of all participants or a close up of the current speaker. A monitor to one side allows the chairman to check the camera angle. An automatically switched micrphone system provides exceptionally clean sound, free from any boominess.

The heart of the system is the "Codec" (for video COder/DECoder). This converts the analogue video and audio from the cameras and microphones into an outgoing digital data stream and simultaneously reconverts the incoming data into a PAL video signal and analogue audio.

Full broadcast standard video requires a link with a bandwidth in the order of 5 MHz. Such a link is expensive, so the primary function of Codecs is to compress the bandwitch while maintaining the best possible fidelity.

Some Codecs can be switched to operate on data lines with a transmission rate as lowa s 64 kbits/second, but with these constraints, the best that can be presented is a low resolution freeze frame, updated every 30 seconds or so.

This is a very serious flaw as without a fairly good representation of natural movement it becomes very difficult for participants to concentrate on the content

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of the meeting. The pictures become a distraction, rather than an adjunct to the conference.

Wider Bandwidth

Wider bandwidth links give progressively better results but it is not until we reach a data tranmission line rated at 2 MBit/sec that we find a good compromise between quality and cost, so many Codecs compress to this standard.

There are many different ways of reducing the bit rate required but most are based on the peculiar content of video conference pictures. There are no quick changes of camera angles or different scenes. For most of the time the picture will consist of a head and shoulders shot of two or three people against a static background.

Relatively few of the picture elements will change from frame to frame, perhaps only facial expressions and lip movements. Rather than sending a complete new picture every frame, it will take far less bits if we simply update those picture elements which have changed between frames. Most Codecs use this as the basis of their operation.

Most business meetings require that some form of visuals be presented. The resolution of the full motion Codec is too low for graphic material so a special graphic mode of operation is often provided as an alternative. It can be switched in when required to view documents, plans and so on. The resolution is dramatically increased but each new picture takes from 1.5 to 4 seconds to build up.

The Codec will also provide interfaces for audio, which is PCM encoded, and for other data links such as high speed facimile machines and computer file exchange on the same line.

The Overseas Telecommunications Commission has recognised the opportunity to provide a cost effective overseas videconferencing service by combining CODECs with satellite technology.

OTC will open a public International Conferencing centre in Sydney this month using 2 Mbit CODECs to the CCITT standards. Compatable facilities are available in a number of countries and OTC offers a complete "one stop" organisational service. Clients can make use of the studio facilities or OTC can arrange connection to their own meeting rooms with portable terminal equipment. Other centres will follow, first in Melbourne and then in other states.

Early Predictions

The ultimate in high-tech communications, of course, would have you able to dial up a number of people right from your desk and confer in a multi-way, auto-switched video conference. This particular piece of science-fiction dreaming has just become science-fact, at least on a small scale with the development of the MINX workstation from Datapoint.

Early predictions saw the "picturephone" as a logical developmenet of Mr Bell's telephone. However, the personal computer has opened up a much easier alternative which sees video/voice communications as an extension of the facilities provided by a computer terminal.

With a PC, the high resolution colour monitor, high capacity data communication connection and intelligent switching functions already exist. With the addition of a small video camera and audio facilities plus control software, the system is almost ready to go.

It isn't quite as simple as that of course, and the MINX system is really quite complex, requiring a cluster server to control the switching and a coaxial cable link between workstations. None the less it can readily be implemented as a local area network as is happening at EXPO 88.

Here the MINX will be used to help parents find lost children with a workstation at each of the four information centres and one in the operations office. Three kilometres of video cable have been laid at the site to implement the system. ●

Video Encoding

Typical of units which operate to the COS 211 standard is the Phillips VCD 2M-G. The illustration shows the major steps in reducing a full motion colour picture to a 2 Mbit/sec binary signal.

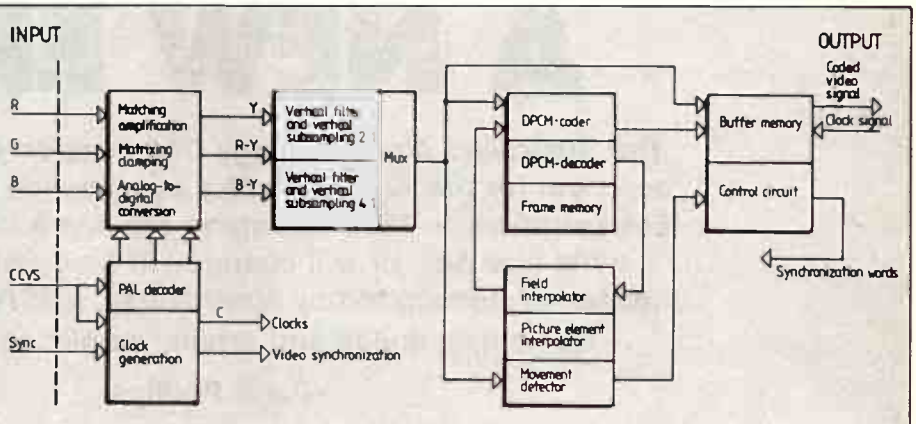
Firstly the incoming video is decodedd and matrixed to a luminance signal (Y) and two colour difference signal (R-Y and B-Y). The luminance is bandlimited to 2.5 MHz and the colour signals to 0.5 MHz. The luminance is then sampled with 8 bit resolution to provide 256 visual picture elements per line. The chrominance sampling results in 52 visible elements per line for R-Y and B-Y which are placed in the horizontal blanking period.

Then follows a 2:1 digital filter which reduces the number of active lines per frame to 286. At this stage, each frame is made up of about 700 kbits. At 25 frames per second this represents a data flow of approximately 18 Mbit/second, still some way from our target of 2 Mbit/sec.

To reduce the bit rate, "Difference Pulse code Modulation" is applied. Here, instead of the value of a picture element, only the difference to a predicted value is transmitted. Typically only four bits are required to encode the prediction error for an eight bit quantised picture element, so the data rate can be reduced by half. Modified Huffman encoding, in which highly probable errors are represented by short codewords and infrequent values by longer words, reduces the data rate even further, to about 7 Mbit/sec.

The big gains are made by "conditional replenishment". Only the elements of the picture which have changed since the previous frame are actually transmitted. The decoder takes the unchanged elements from a frame memory, the contents of which are updated by the changed picture elements. If, on average, only a quarter of the picture elements are changing, then full motion can be encoded with only 2 Mbits/second.

Decoding is essentially the reverse of the coding procedure. A frame memory acts as a buffer between the output of full motion analogue video and the input of the coded changing picture elements. Special circuits interpolate picture elements between those actually transmitted to increase the apparent resolution.



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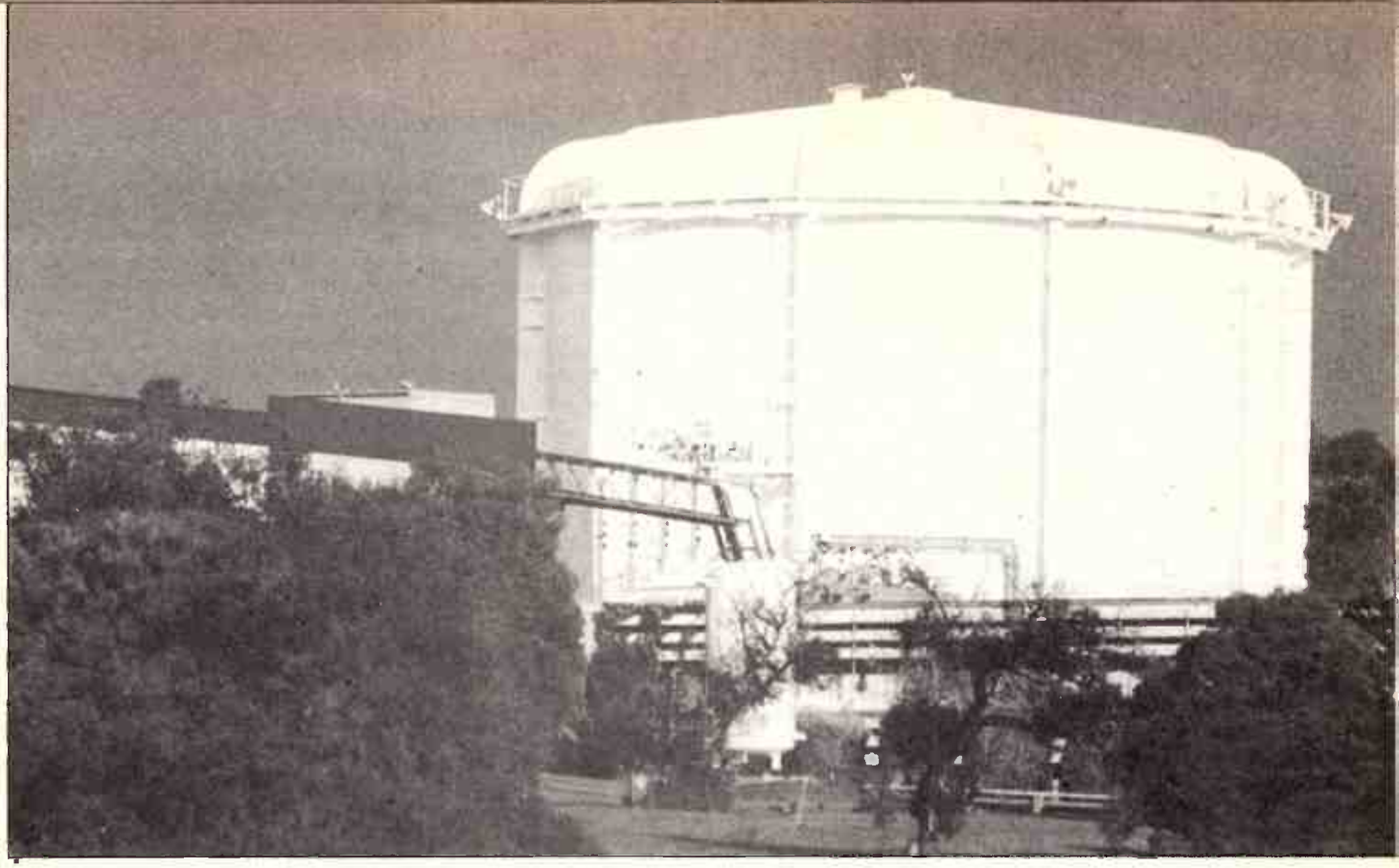

ANSTO
A NEW ERA

The Australian Atomic Energy Commission became ANSTO, acronym for the Australian Nuclear Science and Technology Organisation, in 1987. Changing the name is one thing, but what else has, or will change? In times when the term 'nuclear' is surrounded by controversy, ANSTO is now looking for a new image and greater public acceptance.

Peter Phillips

When the HIFAR reactor first went critical (able to sustain a controlled nuclear reaction) on Australia Day, 1958, it enjoyed relative isolation in the little known Sydney suburb of Lucas Heights. But, the urban sprawl has now caught up with the site, and public opinion, often based more on emotional issues rather than fact, has set into motion various changes that will see a higher public profile and a changed emphasis for ANSTO, previously called the Australian Atomic Energy Commission (AAEC). The name change came into effect on 27th April 1987, along with a new board of directors, new legislation and a change of direction. In 1982 the CSIRO set up a branch of its energy research at the Lucas Heights site, resulting in a more diverse use of the area with the two research organisations retaining their autonomy but enjoying closer links.

Popular Fear

Public acceptance of a nuclear facility within a 1.6km radius of a residential area has by no means arrived however; a fact I can vouch for as a resident of the area. It is often difficult to counter the emotive literature that concerned action groups circulate, as scientific arguments supporting the facility are usually discounted as biased or just plain untrue. Chernobyl certainly didn't help, and the nuclear arms

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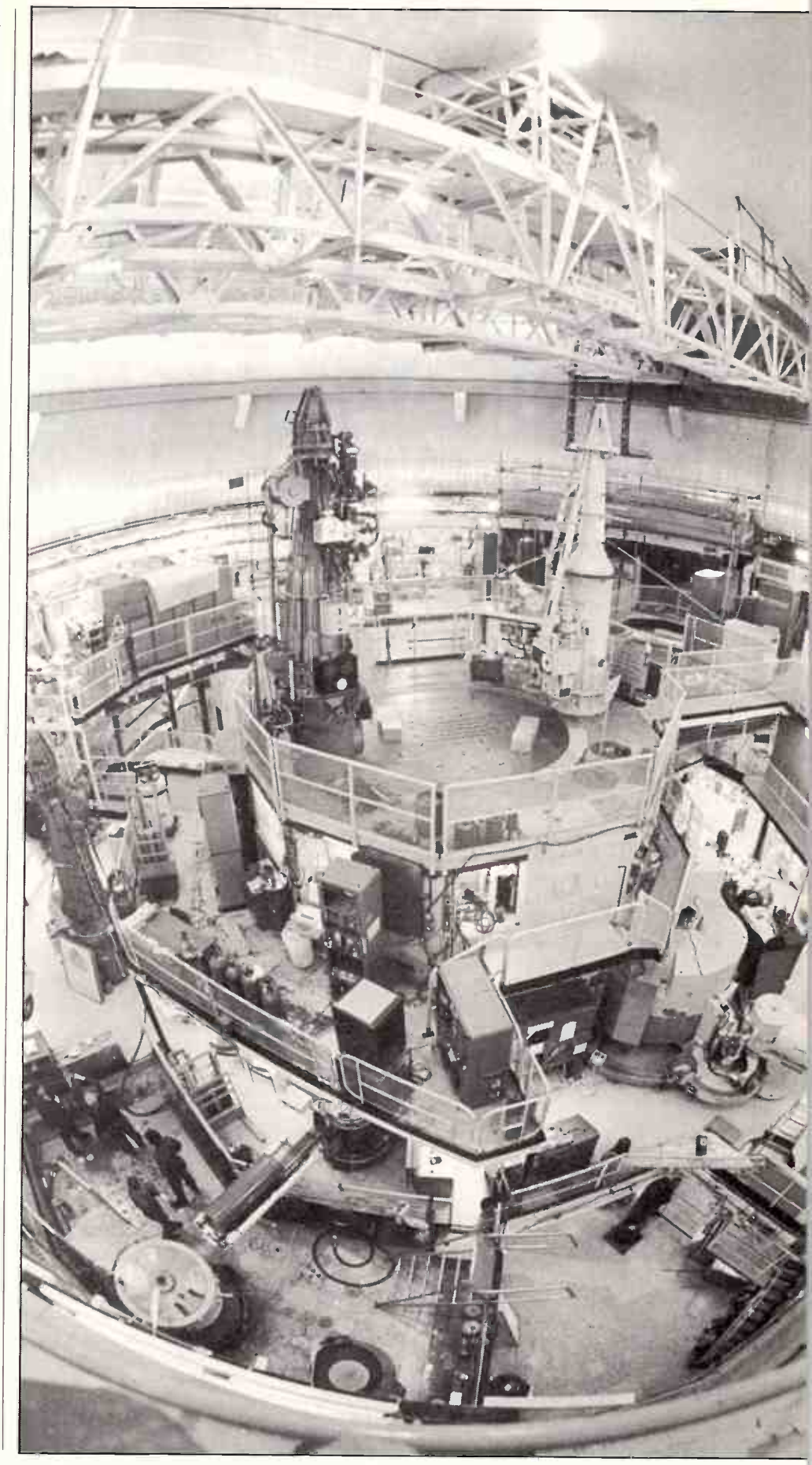
Left, the 20m high x 20m diameter sealed containment building which houses ANSTO's 10MW (thermal) HIFAR research reactor at Lucas Heights. The reactor commenced full power operation in April 1960.
Right, the interior view of the sealec containment building which houses the 10 Megawatt (thermal) research reactor HIFAR (High Flux Australian Reactor). The reactor's 25 uranium fuel elements are located directly below the heavily-shielded circular top plate of the reactor.



race is hardly a cogent reason for HIFAR. In part, it was this climate that set the political wheels in motion to form ANSTO; a name change to herald a new approach for Australia's only nuclear facility. Under the original act, the AAEC had the responsibility to set up Australia's uranium mining and to research the nuclear fuel cycle with a view towards nuclear power.

The allocation of Commonwealth land at Jervis Bay for a proposed nuclear power station was announced in 1969, with little controversy, and much public interest. A subsequent change in Prime Ministership and the discovery of large quantities of coal in the Hunter and MacKay regions brought about a rethink of the project, and it was deferred, pending further investigation. Later it was deferred indefinitely, and now the land has been re-allocated for use by the Navy when it transfers sections of the Garden Island complex. By the mid 1970's, the original legislation under which the AAEC operated was becoming redundant. Public opposition to uranium mining, and the cancelling of the nuclear power station were starting to create an uncertain climate for the AAEC, and it entered fields of research not originally defined in the legislation. In fact, the new legislation formalises the activities that have been under way for some years. However, mention radioactivity in the Sutherland Shire, and you're bound to get an argument. So, what is really going on in the cloistered surrounds of the Lucas Heights Research Laboratories, and in what way will Australians benefit from ANSTO?

The Site

The Lucas Heights site occupies 50 hectares, and its close by the Army's Holsworthy firing range. Other bedfellows include the local tip and new housing developments, where land prices start at around $60,000. Although most of the buildings on the site are now 30 years old, the area is impressive, set in sweeping lawns and landscaped gardens. Already the CSIRO is located here, and plans are underway for the development of a technology centre for the area. (Refer May ETI). The need for 'hard sell' is not just a publicity stunt; it's economic reality, and with the completion of a recent feasibility study, it is probable that the Illawarra Technology

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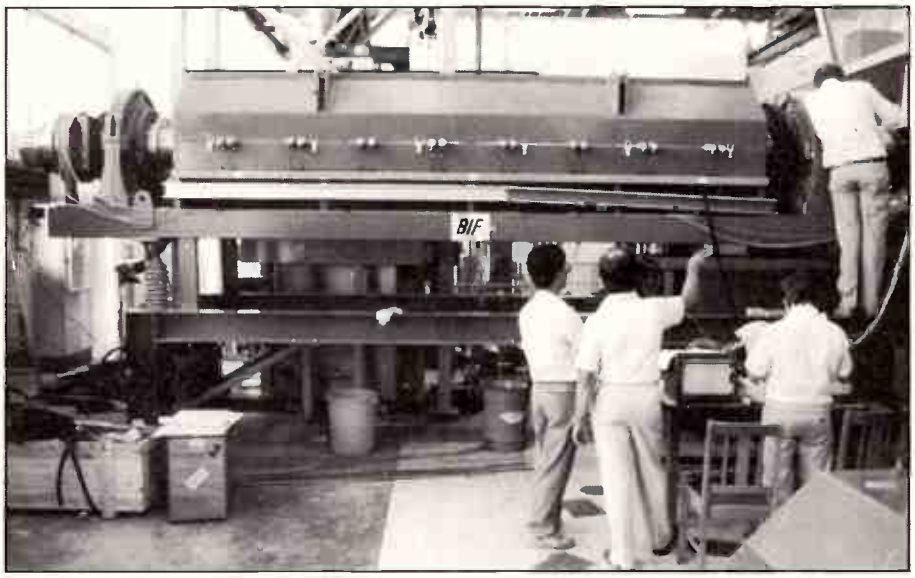

Installation of the high temperature rotary calciner as part of the SYNROC non-radiactive industrial-scale demonstration plant being built at ANSTO's Lucas Heights Research Laboratories.

Centre will now work with ANSTO in setting up the Lucas Heights Technology Park. This centre will be located outside the area used by ANSTO, and will act as the agent for ANSTO and other research centres keen on selling their technology.

For years the AAEC has welcomed visitors, and has a publicity program that emphasises an open-door attitude. Anyone can use the canteen, and tours are easily organised. The Technology Park concept is intended to remove the emphasis of 'nuclear', by putting it into context with all other forms of technology, as well as allowing a closer interaction with private industry. It is also hoped that ANSTO will become more viable economically, to offset the current annual cost of $50 million.

The Changes

ANSTO is still a nuclear research facility. However, the essential changes include its disassociation with mining activities, an entreprenuerial approach and a dedication to using nuclear science for industrial, medical and commerical applications. Included in its Corporate Plan are objectives (or missions) to assist Australian industry to advance its competitive position in the world economy and to protect and improve Australia's environment using nuclear technology. Its overall strategies even include diversification into non-nuclear research where this doesn't duplicate other areas of Commonwealth research being undertaken. A highlight of the corporate plan is the definition of five programs. In effect, these programs define how the resources will be used over the next five years. In summary, these programs are:

Program 1. Industrial Applications. This program aims to collaborate with industry in the exploitation of nuclear technology towards the maximum national benefit. This means ANSTO will develop and exploit the application of radioisotopes and nuclear techniques in the analysis and solving of problems in industry and elsewhere. Included in the list of projects is the development of a SYNROC plant, which has the potential to become an export item of great significance. Another, perhaps more controversial project is the evaluation and development of ionising radiation in applications such as food sterilisation. Another export earner is the expansion of the facilities to produce neutron transmutation doped silicon (NTD silicon), which has wide ranging applications in the electronics industry, as later described.

Program 2. Biomedicine. The production of medical radiosotopes has been going on at the centre for many years, and is considered an essential part of the centre's activities. A medical cyclotron, to be operated by ANSTO is planned, for installation at the Royal Prince Alfred Hospital in Sydney in 1990. Currently, Australia and New Zealand are the only two developed countries in the world without such a device. This cyclotron will be used to produce shortlife tracers to aid investigation in neurological and cardiac disease, cancer and other applications including thyroid, kidney and lung investigations. The cyclotron will not, however, replace the HIFAR reactor, which will still be needed to produce the radioisotopes and to perform the type of research only possible with such a reactor.

Program 3. Environmental Protection. The aim of this program is to protect and improve Australia's environment. It includes research into the use of isotope techniques to provide information on environmental systems and to study the transport of radioactive pollutants in the environment. Investigation of soil erosion, and the origin and dispersion of pollutants from industrial and mining operations, along with rehabilitation of these sites is one aspect of the program. Another is protection against the impact of uranium mining. Local readers will be aware of ANSTO's role in studying the siltation problems around Port Hacking, which involved the use of isotope tracers.

Program 4. Nuclear Technology. This program includes the maintenance and operation of the HIFAR reactor, as well as the development of a suitable level of expertise in the field of nuclear science. Such expertise is intended to be made available to industry, universities, the community and the government.

Program 5. Support Services. This program aims to streamline the running of the site, by utilising it to the best advantage to serve the outcomes of the first four programs.

So, What's Happening?

Visitors to the centre normally focus their attention on the HIFAR reactor; after all it is the only one of its type in Australia. HIFAR, a DIDO class reactor, is now 30 years old, but its conservative design means there are still many years of life left. It is one of the few high flux reactors operating in the world, and several other reactors of this class in Europe and the UK have since been upgraded from the original 10MW capacity to 25MW. HIFAR was originally intended to be used to study the effects of radiation on materials that would be used in a nuclear power station. It now serves many diverse roles. Its inherent safety was clearly demonstrated in May 1987 when the TV program 'Good Morning Australia' was telecast live inside the reactor's sealed containment building. A problem was how to get the signal out of this all metal building, requiring judicious cable runs through small engineered penetrations in the building from the OB van that had to be accommodated within the sealed building as well.

While there are a lot of projects under research, the following are those that fit the guideline of being interesting to a reader of an electronics magazine.

Synroc

The SYNROC (synthetic rock) project first hit the headlines in 1978 when Professor Ringwood and his colleagues at the Australian National University in Canberra developed the concept of combining

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nuclear waste and three titanate minerals to form a solid, rock-like material that could immobilise the waste for safe disposal in an underground, engineered repository. The idea came from research conducted by Ringwood as to why ordinary rocks retain their radioactivity over millions of years. Currently, a non-radioactive demonstration plant being constructed by ANSTO is nearing completion, and will be on line this year. The plant, when running, will have taken the SYNROC concept from the laboratory phase to an industrial reality.

The brilliance of the research is amply demonstrated by the inherent simplicity of the process. In principle, the nuclear waste is initially liquified by dissolving it in acid, after which it is mixed with the SYNROC minerals which are in powder form. The resultant slurry is then calcined (converted to a powder form by heat) and conveyed into a stainless steel bellows which is then hot pressed to form a cylinder about 400mm in diameter, 200mm high. The cylinders can then be buried and left forever. The plan is to bury the cylinders to a depth of 4kms, with a top covering of at least 1.5kms. A feature of SYNROC is the capability of the product to withstand the high temperatures existing within the earth (and therefore the waste) at these depths, unlike its counterpart developed in France which uses borosilicate glass to contain the radioactivity. Such depths are considered necessary to ensure any leaching of the radioactivity remains out of reach of any groundwater.

After a further three years, the results from the demonstration plant should mean ANSTO will have completed the development of a practical nuclear waste immobilisation method. Export earnings will result from licencing the process to other countries, who will be able to observe the non-radioactive plant in operation at Lucas Heights. The significance of this development will become extreme as the world turns inevitably towards nuclear power generation, and if this outcome is the only one ever developed by ANSTO, surely it will have earned its keep. Extrapolating the concept, some believe Australia could wipe out its foreign debt by simply selling its uranium, then offering a disposal service for the waste. China is now selling space for nuclear waste disposal, in an attempt to increase its export earnings. Imagine the controversy if this became a reality in Australia!

NTD Silicon

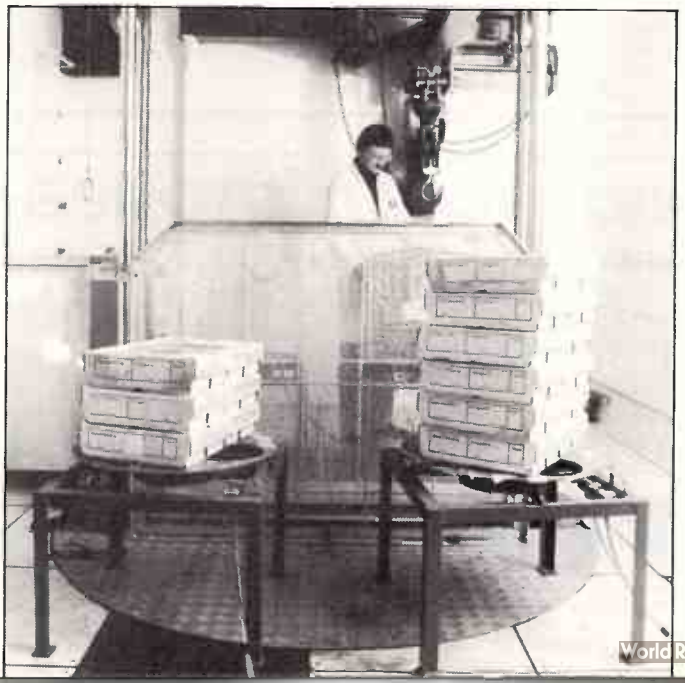
Silicon is the prime example of a semiconductor which has its characteristics altered by the introduction of an electrically active impurity such as phosphorous. This process is known as doping, and the addition of the dopant increases the electrical conductivity of the silicon, producing the well-known semiconductor material that the electronics industry thrives on. The more uniformly distributed the dopant, the more reliable is the electronic device and the better its performance. This improvement in uniformity becomes critical for devices carrying large electrical currents. When an ingot of silicon is subjected to neutron irradiation in a reactor, some of the silicon atoms are changed (or transmuted) into phosphorous atoms. This method of producing doped silicon provides a much more uniformly doped product compared to conventional methods.

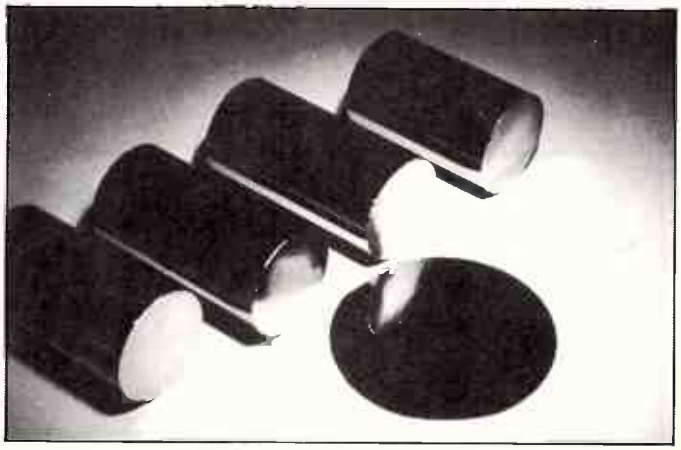
Currently, NTD silicon is being produced for the Japanese semiconductor industry at Lucas Heights by irradiating large single crystals of pure silicon in the HIFAR reactor. It seems that the dearth of high flux reactors has caused worldwide problems in the production of NTD silicon as all such reactors in Europe are currently working to capacity. Although the income earned is not great, the technology has been developed in Australia to the extent that exact levels of doping can be achieved relatively easily. Typically, the silicon is flown in, doped in HIFAR for periods of up to 60 hours, then, within a few days, flown back. If ever Australia enters the semiconductor industry, treatment of the silicon is readily available.

Radioisotopes — Industrial Applications

The use of radioisotopes as tracers to examine the phenomena of such intractable problems as flow in a blast furnace, termite tracing, wear of moving parts, etc, are a few examples of nuclear science being used in industry. None of this is new in fact; industry has been using nuclear science for years in applications ranging from measuring the thickness of paper to any of the aforementioned. The use of irradiation to sterilise medical products is another example not widely known. The message 'sterile till opened' appears on many bandaging products, but few realise the sterilisation is achieved by exposure of the product to a low energy source of gamma rays. Other similarly treated products include wine cask linings and wine corks.

Food irradiation is relatively new, even though the technology has been around since the mid 1940's. Cooking in a microwave oven is a form of food processing using radiation, called non-ionising radiation. Sterilisation is achieved using ionising radiation, in which charged particles are actually formed in the food, even though neutrality is regained following a chemical reaction within the food. Research has shown that irradiating food using gamma rays or electron beams can increase shelf life and kill insects, parasites, moulds and other microbes. According to Pamela Wills, Head of the Irradia-





Above, pure silicon crystals and wafers. Crystals of pure silicon are irradiated by ANSTO to produce neutron transmission doped silicon (NTD silicon) which has precisely specified electrical properties.
Left, the irradiation room of ANSTO's gamma irradiation facility which is used in food irradiation research. The radioactive source is stored in a deep pool below floor level while the food is arranged for the next irradiation experiment. Work on food irradiation commenced at Lucas heights, in 1960.

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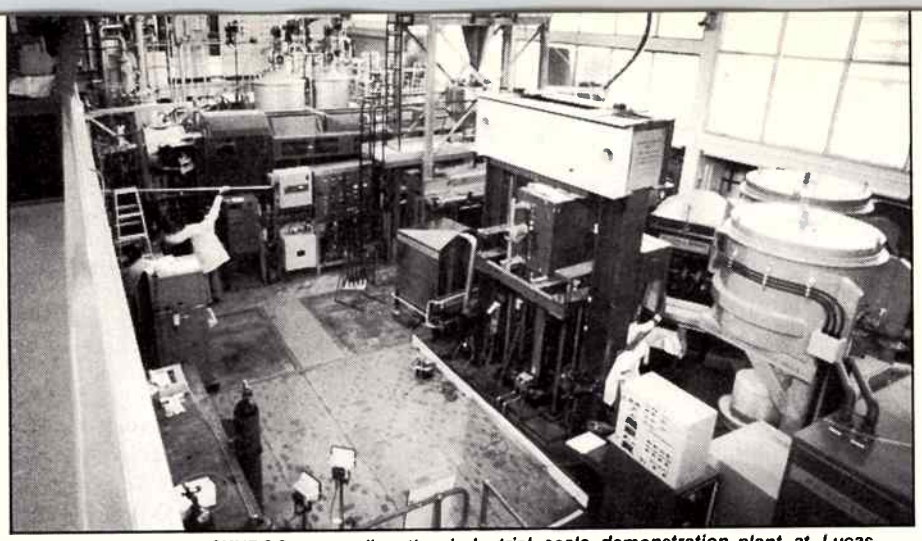
tion Research and Technology Section at Lucas Heights, foodstuffs treated this way do not become radioactive, mainly because the energy levels used are too low. Only certain food items benefit from irradiation, including meat, potatoes, some types of fruits and grains. However, the need for insecticides is reduced, and hygienic standards can be raised.

At Lucas Heights, an experimental irradiation plant is operating, consisting of a rack of Cobalt-60 rods that can be raised or lowered from a pond of water. The products to be exposed are simply arranged in the irradiation room, and the rack raised from its shielding pond for the required time. Naturally, a sealed area is required, will all the safeguards one would expect. A commercial plant uses a more sophisticated conveyor system, arranged to ensure all faces of the product gain equal exposure. Appropriate electronic systems are also needed to ensure human entry is guarded against while the rods are unshielded. Basically, the system is extremely simple, and the research being currently conducted is to gain experience in exposure times (dose) and types of foods that will benefit. Currently, food irradiation is not permitted in Australia, but it is likely we will follow the worldwide trend towards this type of treatment for those foods that benefit. Most major world health organisations have approved, even recommended the use of low energy irradiation for food.

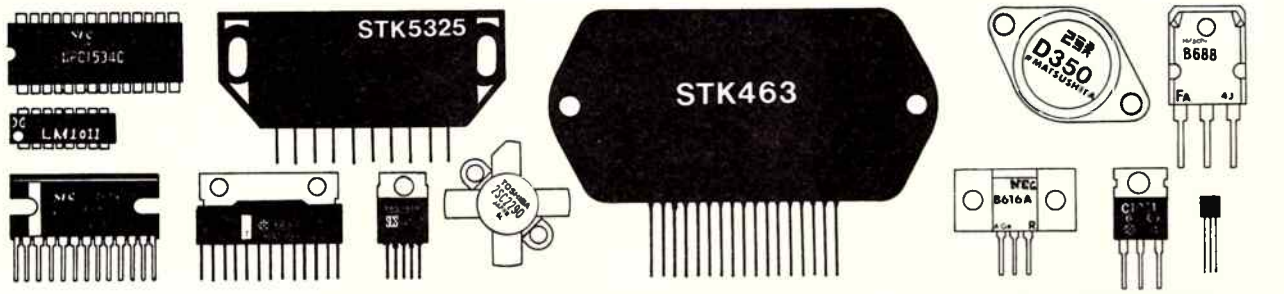


Construction of the SYNROC non-radioactive industrial scale demonstration plant at Lucas Heights which will be used to assess and further develop high-temperature fabrication technology.

The ANSTO/AAEC story is a complex one, surrounded with controversy and only briefly outlined in this article. It is well accepted that all research being conducted is for the peaceful use of nuclear energy; in fact Australia is dependent on a supply of radioisotopes for many applications from Lucas Heights. The fear held by many, however, is the possibility of a major accident. However, after visiting the centre, I am convinced that I should worry more about how to spend my winnings from Lotto. ●

Our thanks to Mr Jack Walker (Head, Media Relations Office) and Mrs June Mead in the preparation of this article.

JAPANESE SEMICONDUCTORS



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Low-cost Nakamichi Cassette Decks

Renowned for its tastefull, if expensive, cassette decks, particularly the magnificent Dragon deck, Nakamichi has released two cheaper cassette systems, the CR-1 and the slightly more sophisticated CR-2. The decks are part of a new range of elegant models of very angular — or oblong — lines which extend up to an expensive $1895.

Both decks feature a microprocessor-controlled silent mechanism transport, independent tape and EQ selection, Dolby B/C with defeatable MPX filter, 37 dB peak-level meters, memory stop, auto repeat, timer record-play, remote control operation and mode indicators along with the usual cassette deck functions. Features specific to the CR-2 only are record mute and bias fine tune.

Manufacturer's specifications promise 20 Hz to 20 kHz frequency response, less than ±0.11 WTD and ± 0.06 WTD rms wow and flutter, better than 64 dB Dolby B and 70 dB Dolby SNR, and less than 10% thd (400 Hz, 0 dB). Fast wind time is approximately 80 seconds for a 60 minute cassette.

Inside the 430x100x265 (mm) boxes are the Nakamichi electronics. The recording amplifiers use high output ICs and Nakamichi Double NF equalisation to eliminate distortion caused by electrolytic capacitors. The playback amplifiers also use Double NF topology but are discretely configured with low noise transistors to match the playback head and ensure maximum signal transfer. The latest Dolby ICs are used in the NR systems.

A bi-polar supply powers the playback amp and eliminates a need for interstage coupling caps. The power transformer is double shielded to prevent hum radiation, and the amp and logic circuits are powered from separate windings to minimise noise. Independent local regulators are used to prevent interstage coupling through ground.

The CR1 retails for $799 and the CR2 for $999.

READER INFO No. 177

Abreast of the Jargon

Consider a most demoralising exercise: sitting a comprehension test on the common hi-fi or video brochure. Overstated, you think? Well, if you don't fall into a dull catatonic state, stumbling over the jargon, puzzling out the acronyms, not to mention sorting out the superlatives, congratulations.

We don't think it's too naive to ask who really knows what a flying erase head is or a winged metal block flying along some pulley system. And what exactly does "independent interpolation" mean . . . some unnatural shenanigans? And, of course, the big one, what are "foot/lamberts"? This unintelligibility is exacerbated by a proliferation of terms as individual manufacturers identify the same features with their own customised labels. They use standard descriptions in their own endearing or not so endearing ways. Beware.

Here's a sample of some of the more puzzling sales terms we've encountered in preparing this issue. The terms are chosen on mere whim, and cover hi-fi, video and related subjects. Strangely, we discovered we're a little in advance of the publicity machine in our selection. A couple of terms, including the intriguing "independent interpolation" we couldn't get any answers on. Apparently they're yet to be assigned meaning in Australia. So, if you know it all, go no further; if you've been faking it all this time read on.

control amplifier: The good old preamplifer.

CRT image deflection: Interference to a television picture caused when a speaker is placed close by so that its mag-

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nets produce an interfering magnetic field, or "gauss" the screen.

degauss: Wiping out residual magnetism from tape heads by alternating the magnetic field.

flying erase head: From the nearly incomprehensible language of video. A special mechanism fixed to the main video head drum which erases slowly frame by frame in a diagonal pattern ensuring clean edits and ridding tapes of the noise and buzz between scenes.

foot/lambert: A unit of surface brightness.

Instant timer recording: Also known as one-touch recording. The button that allows the user to instantly record without the awkward depression of PLAY and RECORD; it works for set intervals per depression, eg, 30 minutes, and avoids adjusting timers.

Midship mount: A Pioneer description to describe a sort of housing of the woofer that avoids screwing the driver to the front of the speaker.

MPX-filter: A filter which eliminates the FM audio carrier noise as it separates L and R components.

ribbon driver: Thin metal conductor acting as speaker diaphragm around which on either side permanent magnets provide magnetic field. Dispenses with cones.

NBS Report on DATs

The US National Bureau of Standards has released its report on the copycode scanner device proposed by CBS Records (which prevents copyright infringement by taping compact discs onto digital audio tape) and has outlined some serious flaws.

The copycode scanner system works by deleting a notch of recorded sound 300 Hz wide around 3.84 kHz. A DAT player equipped with a special chip detects this code and prevents recording, thus also illegal taping.

The faults with the system enumerated by the NBS were that the system worked only half the time and that it was also activitated by music that was not encoded with the notch; the system also caused degradation of the sound and the NBS cited a recording in which a piccolo note dropped right away leaving only the flautist's breath; finally, the NBS report notes that NBS engineers had devised five ways to circumvent the system, each costing an electronics buff less than $US100.

Legislation banning the import of DATs until they could be fitted with the device has been pending in the US Senate and Congress on the outcome of the NBS tests. Japanese exporters have been voluntarily holding back exports until the legal situation is resolved, however, this partial failure of the device may leave the situation right open.

Meanwhile, Philips in the US has apparently put forward a compromise suggestion for software copyright holders and DAT manufacturers. Philips is reported to have developed a system that will allow consumers to make one copy from a CD on to a DAT but will prevent a copy of the copy being made. The system is an alternative to the copycode system developed by CBS that prevents any copying whatsoever, and is designed to appeal to consumers but to also prevent large-scale pirating. However, a representative of the US Recording Industry Association has been reported as rejecting the idea because it would allow people to make more than one copy.

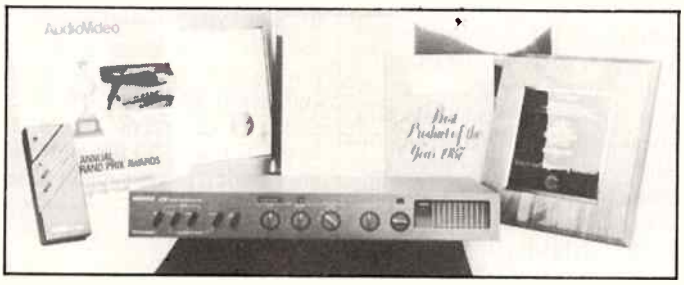
Some small but not insignificant developments have occurred in the slow-moving saga.

On the technical side, Nakamichi, and Sanyo Seiko have devised what they call a FAST, or fast access stationary tape guide transport, which provides extremely quick programme selection, in two seconds time. In fast forward or rewind, the mechanism gives 400 times the normal mode speed.

On the political side, it seems there has been a breaking of ranks amongst the record companies which have up till now solidly rejected issuing their artists on digital audio tape. Three small record companies, two in the US and one in Japan, have been reported selling or intending to sell prerecorded DAT software. Tokyo-based Edison records is selling prerecorded DATs of 300 classical, jazz and new-wave titles that it obtained from Swedish record company BIS.

READER INFO No. 179

Shure Wins at Winter CES



Shure has repeated its 1986 success with the HTS 5000 Home Theatre Sound Audio Processor and won the 1987 "Sound Processor of the Year" award at the ninth annual Audio/Visual International Grand Prix Awards. The awards were run by the US magazine *Video Reviews* during the Winter Consumer Electronics Show in Las Vegas.

The category taken out by Shure is for components with processing as their primary purpose, not as a side effect of recording, playing, amplifying or something else. Shure audio engineers set out to design a decoder that would duplicate the best movie theatre sound for use with the home hi-fi system, TV or video recorder without unnecessary enhancements or tampering, and produced a unit which its US peers are still judging the best. Shure HTS decoders have also won the 1986 and 1987 Consumer Electronic Show Design Awards.

READER INFO No. 180

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New Beta and 8mm formats

Following JVC's announcement to introduce its new Super-VHS video system to countries such as Australia using the PAL broadcasting standard, Sony has announced a PAL/SECAM version of its ED-Beta system.

Like S-VHS, ED-Beta offers a vastly improved picture with better horizontal resolution and a higher signal-to-noise ratio.

Both video formats use similar techniques to achieve improved picture quality, including a higher and wider bandwidth. The Sony ED-Beta system extends the FM signal frequency bandwidth for the luminance signal from 3.8 MHz in the conventional system to 6.8 MHz with a white peak level of 9.3 MHz and frequency deviation of 2.5 MHz. This, Sony claims, give it a 500 line horizontal resolution, 70 or so more than S-VHS offers. The new S-VHS system has shifted the FM luminance carrier from 3.4 MHz to 5.4 MHz and increased the bandwidth from 1 MHZ to 1.6 MHz to increase the horizontal resolution to 430 lines.

As with the S-VHS system, Sony has separated the chrominance and luminance signals in order to eliminate cross colour and dot interference that occurs with a composite signal.

Where the systems do differ is in the choice of tape. Unlike the S-VHS system which stops short of using metal tape, the ED-Beta system uses metal particle tape, allowing high density recording and high frequency recording as well as improved audio recording. However, similar restrictions on the use of the new tape applies. Conventional Beta tape can be used in the new ED-Beta machines but the new ED-Beta tape can only be used in an ED-Beta machine. The new cassettes are equipped with a detection hole that indicates to the ED-Beta machine that the right cassette has been inserted to operate in the new ED-Beta mode.

ED-Beta machines aren't expected in Australia before next year, at a cost of around $3000. And as with S-VHS, to get the full advantage of the new video system a new TV monitor is needed equipped with a special S-connector to accept the separated chrominance/luminance signals. TV sets equipped with RGB inputs and used in conjunction with a special adaptor will also give optimum quality.

Meanwhile, Aiwa, Canon, Fuji, Hitachi, Maxell, Konica, Matsushita, Sanyo, Sony and TDK have announced an agreement on specifications for an 8 mm high resolution "hi-band" VCR recording format. It will be offered as an optional format to the current 8 mm video format, much in the same way that the PCM audio system is offered as an option.

The new system offers either a composite or seperated video signal input/ output with basic specifications for the luminance signal in a PAL standard of 7.7 MHz white peak level, 5.7 MHz carrier and 2.0 MHz frequency deviation.

READER INFO No. 182

Towards the Perfect Stylus

Arista Electronics has made available through must hi-fi shops and Pre-Pak Electronics a new stylus replacement system, paterned as the "Carbo" cantilever system.

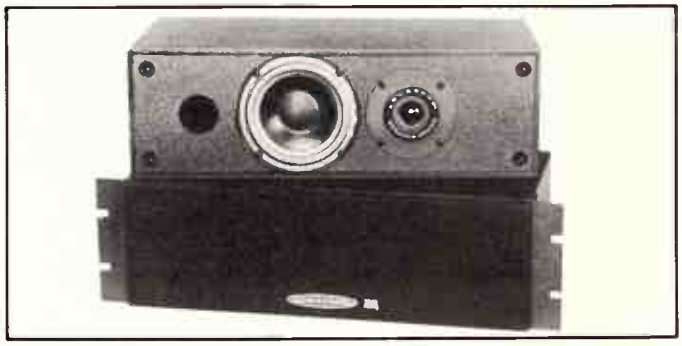
The system involves the totally automated production of a stylus to form a triangular cantilver out of carbon fibre (for strength and low mass) with diamond tip, magnetic poles, striker, iron etc, all forming an integral part of the construction.

The result is, according to Arista, a stylus with a perfectly oriented tip, perfect stability in that each unit is exactly the same as the previous one, optimum 2 g tracking weight for all conical models and optimum 1.5 g tracking weight for all elliptical models and a stronger version of the original stylus for the same cost as a standard replacement. The triangular-shaped carbon cantilever, says Arista, is virtually indestructible under normal use and therefore ideal for backtracking, cueing, disco use, with kids, that is in heavy-use situations. The carbon material is suitable for use with new copper mastered discs now being produced.

READER INFO No. 183

In Brief

Aurotone Studio Monitors



Amber Technology is distributing two new Aurotone professional speakers, suitable for video/broadcast and post production. The RT-V rack, two-way speaker for video/broadcast engineers is a compact unit taking up only 13.7 cm rack space. Frequency response is 70 Hz and a chilled magnet minimises CRT image deflection. Components are on centre axis so the unit can be located left or right in the studio. The RT6-V unit for post production engineers monitors from 35 Hz to 20 kHz and also features a shielded magnetic structure.

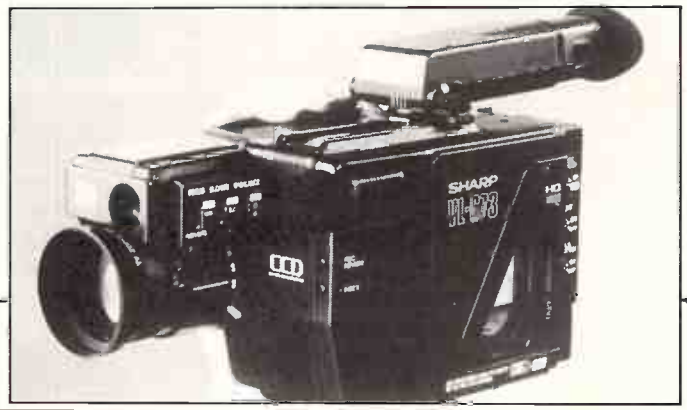
READER INFO No. 184

New Sharp Camcorder

The new Sharp camcorder, VL-C73XA weighs a mere 1.2 kg and features an 8x power zoom with macro function, an electronic high speed shutter, and a background music connection to allow you to add sound effects. Automatic settings are provided for white balance, iris and auto standby. The VL-C73XA will record in light levels as low as 10 lux and produce better picture quality, according to Sharp, thanks to its new higher density CCD image pick-up device.

Other features include playback via the electronic viewfinder, automatic date/clock function which can be marked on recordings, record review of the last few seconds of a scene and an index search for specific scenes. RRP is $3299 with all accessories.

READER INFO No. 185



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**Rec. Retail Price*

READER INFO No. 11

World Radio History

A step by step way to improve your audio pleasures

Optimising Hi-Fi Systems

The world's best, most expensive hi-fi system can be ruined by a poor listening environment. Conversely, the mediocre equipment can be made to sound acceptable if it is treated sympathethically. A certain amount of black magic is inevitable, but you can achieve wonders by following some simple rules.

Les Cardilini

We will start with you the listener. How good are your "specifications"? Many of us are no doubt a little short on dynamic range and bandwidth, and our frequency responses may be a mite bumpy; some of us might even benefit from a bionic balance control to account for differences in sensitivity between our left and right ears. For now, however, we are going to assume that you have average, good hearing, but it is not quite that simple. The question is: Can you hear the difference? How do you tell a good system from a poor one, or more importantly, one that is performing well, from one that is not.

Observing improvements in the quality of sound is not difficult to do although we must be careful not to assume that just because sound is different it is necessarily better. But being able to identify what is missing in the balance of sound, or that something has been added by the system, is not always such an easy matter.

Inexperienced ears can be trained quickly to detect things like wow and flutter, distortion and even discrepancies in the frequency response of a system, with a little practice. Perhaps the best way to begin is to have an assistant adjust various controls on the system while you, relying only on your ears, judge what is happening. For example, wow and flutter is simulated readily by lightly dragging a fingertip against a turntable while a record is playing. Sustained piano notes are particularly susceptible to wow and flutter distortion and make a good test signal for assessing wow and flutter in a turntable and cassette decks, particularly on the lower speeds.

Distortion can be conveniently introduced by tuning a radio slightly off the station. Observing the effect the loudness and tone controls have on different kinds of music should help you to recognise bass and treble imbalance. On a more subtle level shading the mid-range and treble speakers with a newspaper or mat, while playing crisp music or even the noise between stations on the FM stereo band, will give some idea of the contribution each speaker is making to the overall sound. Cupping a hand around each ear will also lift the impression of airiness or spaciousness in a performance.

The Listening Room

Once you know what to listen for then it is time to check and tune the room and the rest of the system for optimum performance.

The listening room should be assessed in terms of residual background noise and how much of the sound in the room is likely to be absorbed by furnishings and decor generally. High frequencies will be absorbed very rapidly in a room with heavily draped walls, carpeted floors and lots of soft furnishings, for example, and will tend to leave the sound very dead and thuddy.

The effect will be more pronounced in smaller rooms than in larger ones. Rapid absorption of sound also means less volume for a given power rating will be suitable in a particular installation. Conversely, of course, rooms which already are a bit "muddy", soundwise, might be enlivened by exposing or installing bare panels around the room to negate the effects of highly absorptive surfaces.

Hotspots and Deadspots

The shape of the room may give rise to hot spots and deadspots of volume due to standing waves at certain frequencies, while bare parallel surfaces will cause higher frequencies to bounce back and fourth between them and ring or flutter momentarily in certain kinds of music. A sharp handclap in different parts of the room will highlight ringing problems. Ideally, no two major dimensions in the room should be the same, and preferably, there should be no parallel surfaces to play ping-pong with the sound, this includes the floor and ceiling. Where parallel surfaces in close proximity cannot be avoided then one of the surfaces should be covered with absorptive material, such as a heavily folded curtain or drape. Alternatively, the sound can be dispersed by convex or angled panels placed on or near the offending wall. Keep in mind that absorption will reduce overall volume in the room.

Room dimensions best avoided would include multiples and sub-multiples of a wavelength of 50 Hertz, the mains frequency, which is about 6.8 metres, or just over 20 feet. Standing waves should be avoided at all frequencies, of course, but 50 Hertz and its multiples are found in power supplies and is the frequency of hum introduced by hum-loops and picked up in un-shielded leads. Fans in air-conditioners and other electrical appliances in the room may also set up standing waves at those frequencies.

Resonances in a room which often cause boominess or ringing, and acoustical feedback to transducers like microphones and turntables, can be subdued by using a graphic equaliser in the system, one with at least octave-band or better, resolution.

Background noise is an important factor and has taken on even greater significance since the arrival of digital audio and the popular, compact disc system and its wide dynamic range, typically 96 decibels. Assuming the volume control on the system had to be turned up in order to seat this dynamic range on top of the background noise, then the loudest sounds would be playing at 136 dB SPL, which is really far too loud for comfort, perhaps ear damaging even for short spells. Accordingly, dynamic range needs to be recovered at the quiet end, by quietening down the room.

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Since we conveniently ignore many of the sounds around us just listening for noises in the room may not prove to be as effective as making a mono microphone recording of the room "silence" and playing it back at a reasonably high volume level. You might be surprised at what you will hear.

The Loudspeakers

When the room considerations are more or less under control it is time to consider perhaps the most important part of the system — the loudspeakers. The sound from the system can not be better than the speakers allow, and it is not unusual to find that more than half the total cost of the system is in the speaker system.

The speakers have been given a single identity in the system because they cannot be separated in terms of performance, especially when used for stereo sound reproduction. It is only by having a pair of speakers matched in all respects, that they can present a sound stage which is stable and does not cause images of instruments to dart about, or the depth of the stage to change fleetingly. For example, it would be most disconcerting to hear a piano playing low notes to the right of centre in the sound stage and diving to the left when certain treble keys were played.

The matching of speakers must also be maintained as they age. The quality control of materials and workmanship naturally influences their initial cost.

A more recent innovation in hi-fi and theatre speaker systems, and one which might be considered for extending down the bass response in a hi-fi system, is the separate sub-woofer or super woofer. The bass sounds in a program tend to be monaural. They play little or no part in stereo imaging and, accordingly, a good sub-woofer can be placed almost anywhere in the room and make a full contribution without affecting or detracting from the stereo image up front. The Bose Acoustimas woofer, for example, can be installed conveniently under a couch of coffee table.

It might also be said that the speakers are the most personal items in the system. Speakers with similar technical specifications can and do sound different and appeal to different personal tastes, respectively. Accordingly, listening tests, preferably in situ, are advisable to find the sound you like.

Specifications are useful, however, for matching the speaker system with the amplifier, as speakers which are more efficient need less driving power to create the same volume. On the other hand, the power handling capabilities of the speakers must not be exceeded or they might be damaged as a result. As well, the proper impedance range must be adhered to so that the amplifier performs within its specifications and is not overloaded.

Speaker specifications usually include a sensitivity figure expressed in decibels of the sound pressure level they will create at a distance of one metre when one watt of electrical input is supplied by the amplifier, e.g., 90 dB SPL at 1 metre, for 1 watt.

Ninety decibels of sound pressure level is generally comfortable but nevertheless fairly loud. Every three decibels of difference of speaker sensitivity is equivalent to doubling the amplifier power, as far as matching the two are concerned. Ten decibels is a power ratio of 10 to 1, (which effectively doubles loudness). Accordingly, a speaker rated at say, 80 dB SPL at one metre for 1 watt, will need ten times the power required by a speaker which delivers 90 dB SPL at 1 metre for 1 watt, to sound as loud. A lower sensitivity, or efficiency, does not necessarily reflect on the quality of a speaker system but nonetheless should be taken into account when matching the speakers with the amplifier rating.

Amplifier Ratings

The power needed in a hi-fi or stereo system is often debated. Some say a higher power is advantageous, even necessary, while others choose lower models. Perhaps two main features of power ratings are worth a mention. One is the headroom or reserve power needed to handle the peaks which occur naturally in music and speech. To handle these without clipping, the amplifier should have almost 20

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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.

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12 month warranty on laser heads.

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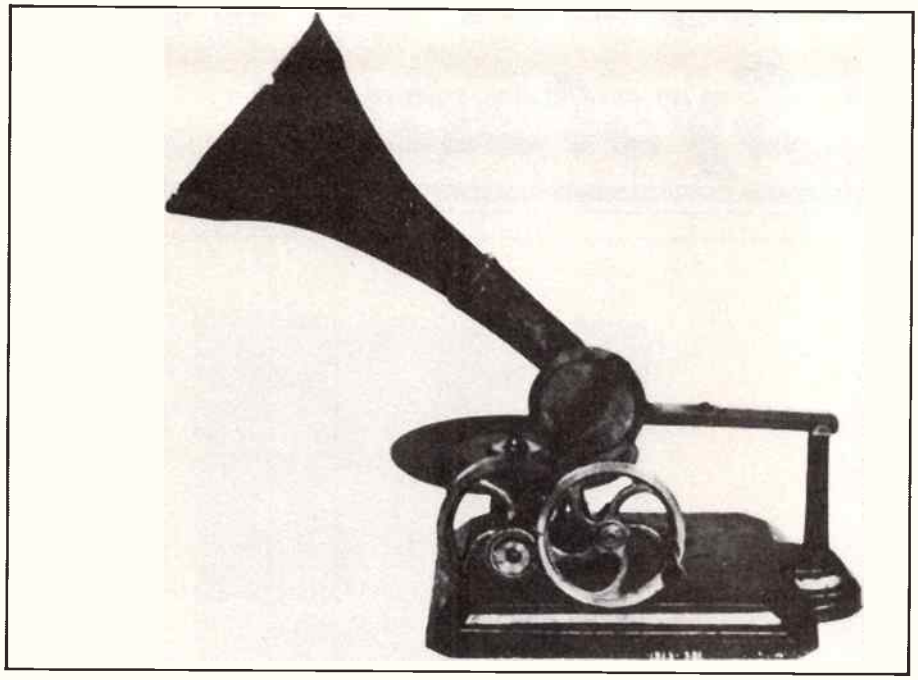

dB of headroom, or power in reserve. This amounts to 100 times the average operating power which creates the perceived, general loudness of the sound. Assuming the amplifier is coasting along creating its 96 dB SL using only one watt of power, the peaks will require 100 watts. On that basis it might seem that the higher the amplifier power the better. But most amplifiers also have generally similar dynamic range and signal to noise specifications. Say for example we compare two amplifiers, one a 10 watt model and the other rated a 100 watts, each with a dynamic range of, say, 96 dB. The dynamic range is relative to operating power in each case, therefore the higher power amplifier will have more residual noise at normal listening levels. In fact the noise level after the volume control is still there even with the volume control turned down. Whatever amplifier power rating you decide upon make sure the amplifier has enough inputs and outputs to cater for the components you plan to include in the system.

These and other factors such as the sensitivity of the speakers and the liveliness of the listening room should all be taken into account when choosing the system power. Other components in the hi-fi system such as cassette decks, turntables, tuners and compact disc players can then be considered in the context of the transparency of the amplifier, speakers and listening room. Naturally, when these items ae optimised one can be and, indeed, has to be, a little more discerning of components upstream. It is suggested that relatively small increases, say 20 percent, in the price of analogue components such as turntables and cassette decks yield noticeable differences in the quality of sound they produce. Changing the cartridge on a turntable, for example, or moving it from a vibrating shelf to reduce acoustic feedback, however slight, can be very rewarding. Compact disc players, on the other hand, can sound the same to many listeners, despite their having a variety of features, laser styles, dual converters and oversampling. Subtle differences in performance when they do exist can only come through wider openings in the performance of the amplifier, speakers and room — and in this instance we should also include, perhaps, the listener.

Tuners

Stereo AM-FM tuners, too, are a popular convenient source of higher fidelity stereo sound. Care should be taken to ensure they are equipped to deliver the goods by connecting suitable antennas respectively to the AM and FM sections. In weaker signals areas a tuner with higher sensitivity will be needed to keep the signal to noise ratio respectable, especially in the stereo modes on both bands. A higher signal strength at the antenna will also enable the tuner to be more frequently used in the higher fidelity, WIDE bandwidth mode, where applicable, on the AM and FM bands. One might feel that in packaged systems the opportunity to tailor the system to personal tastes is removed but there are many combinations and options to choose from. Depending on budget and overall requirements it might be advisable to go for quality instead of quantity in a particular price range, with particular attention paid in the first instance to the amplifier and speakers. Then, options may be considered and compared.

Installation

The system should be installed with optimising its performance in mind. All components should be mounted on sturdy surfaces to minimise feedback and microphony which will tend to blur or smudge transients in the sound. The speakers should be set up, each in similar geometric and material surroundings so that the room does not alter the characteristics in each channel, or pull the stereo image around on different kinds of music. Don't forget, too, that the hi-fi cabinet or the system itself may present a hard reflective surface to upset the acoustic balance of a finely tuned room.

Speakers should be set up facing the prime listening position, unless, of course, they have wide dispersion or characteristics that require their setting up to reflect and disperse sound in ways other than by direct radiations. It would also be wise to keep them out of direct sunlight and possibly rain or mist coming through an open window. Where the speakers are installed in line with other furniture or fittings they should be flush with the other cabinets, and neither recessed nor protruding. Jutting edges and cavities near the speakers will tend to colour the sound.

Budgeting the cost of each item in the system is a very personal task and depends on the size of the system and the affordability of various components. We would all like to have top of the range gear but the pocket can be a very effective handbrake. Also, our individual experiences with sounds means some of us will be more easily satisfied than others. Nevertheless, from the foregoing we might conclude reasonably that about a third of the system cost will be spend on the speakers, perhaps more. Conceivably, another 20 to 30 percent could be apportioned to the amplifier, especially in smaller systems which might be later extended.

This leaves about 30 to 50 percent to spend on other components which, by the way should include a good pair of headphones for personal listening. If you want a compact disc player and a turntable then the allowance for each will need to be reduced accordingly, perhaps in favour of the former. Perhaps, too, we could also apply the "percent cost" philosophy to special leads for the speakers and other interconnecting functions in the system. ●

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Pioneer Model S-55T Speaker System

World Radio History

THE S-55T IS markedly different from the previous Pioneer Speakers in that it would appear that the designers at Pioneer are starting to learn from some of their competitors in England, Germany and Japan. Through this learning process they are now incorporating features which really does put them on a par with, and in some respects in advance of many of their competitors.

The S-55T speaker system is small, and is best described as a "bookshelf" system. The speaker line-up is unusual with a pair of 14 cm diameter low frequency drivers vertically aligned on the face of the cabinet flanking a central 25 mm diameter 'ceramic carbon' dome tweeter.

Parts

The diaphragms of the mid-range/low frequency drivers are fabricated utilising a carbon/graphite composite matrix to achieve extremely high stiffness with low weight. These diaphragms are flexibly supported and are neatly trimmed with a brushed satin anodised aluminium surround. These drivers are retained by an unusual support system which utilises a "mid-ship mounting system" which is attached to the rear face of each of the drivers. This combined stiffening frame come support bracket provides lateral fixing rails which are claimed to reduce driver distortion and cabinet resonance problems. The external surrounds are used to provide positive fixing as well as achieve an exciting appearance which most major speaker manufacturers have now adopted in order to improve the visual impact of their products.

Each of these speaker units incorporates an extremely flexible rolled foam surround and the drivers cones, voice coils and magnetic circuits are designed for long amplitude excursions which are essential if reasonable fidelity is to be achieved at low frequencies. The central dome tweeter is also extremely attractive, but unlike the mid-range/woofer units is mounted on the front of the cabinet and carefully inset into a felt face which is provided to reduce high frequency reflections and dispersion problems whilst simultaneously improving the appearance of the cabinet when the front grille is removed.

The dome tweeter is a Pioneer Model DT-035A which utilises a very unusual magnetic assembly with a rear port in which a spirally wrapped layer of felt is inserted to provide controlled damping for the rear of the tweeter diaphragm. The face of the dome tweeter is cleverly protected by an extremely strong woven heavy black mesh grille behind which a directional spoiler with cruciform supports has been placed in close proximity to the tweeter diaphragm. This directional spoiler is reminiscent of the spoilers developed for the Philips AD 160 Series tweeters which effectively broaden their polar pattern to obviate the high frequency beaming which is otherwise a problem in the 12-20 kHz region. The face of the tweeter has also been very carefully aligned to reduce dispersion and reflection problems all the way up to 20 kHz.

Unusual Features

Removing the tweeter from the cabinet I revealed a number of other unusual features. The first of these was that the diaphragm has been formulated from an unusual combination of carbon and ceramic fibres to provide a very stiff linear piston performance with extremely low weight and inertia. The rear of the tweeter is provided with a very small venting port behind which a roll of felt is inserted to pro-

MEASURED PERFORMANCE OF: PIONEER S-55T

SERIAL NO: PHJ 00833

FREQUENCY RESPONSE: 150* Hz to 20 kHz ± 6dB

* Depends on position of microphone relative to low frequency drivers

CROSSOVER FREQUENCIES: 2.7 kHz

SENSITIVITY:
(for 90 dB average at 1m) 61 VRMS = 6.2 Watts (nominal into 6 ohm)

HARMONIC DISTORTION:
(for indicated level at 1m)

	96dB 100Hz	96dB 1kHz	96dB 6.3kHz	
2nd	-28.2	-58.2	-51.9	dB
3rd	-27.6	-	-59.8	dB
4th	-47.9	-	-61.3	dB
5th	-	-	-	dB
THD	5.7	0.12	0.27	%

INPUT IMPEDANCE

100Hz	28	ohms
1kHz	10.6	ohms
6.3kHz	8.0	ohms
Min at 12kHz	6.4	ohms

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vide supplementary damping.

The rear of the speaker incorporates a large supplementary ferrite ring magnet which has been incorporated to reduce stray flux leakage and allow the speaker to be located in close proximity to either TV sets or other electronic components which require protection from spurious or stray magnetic leakage.

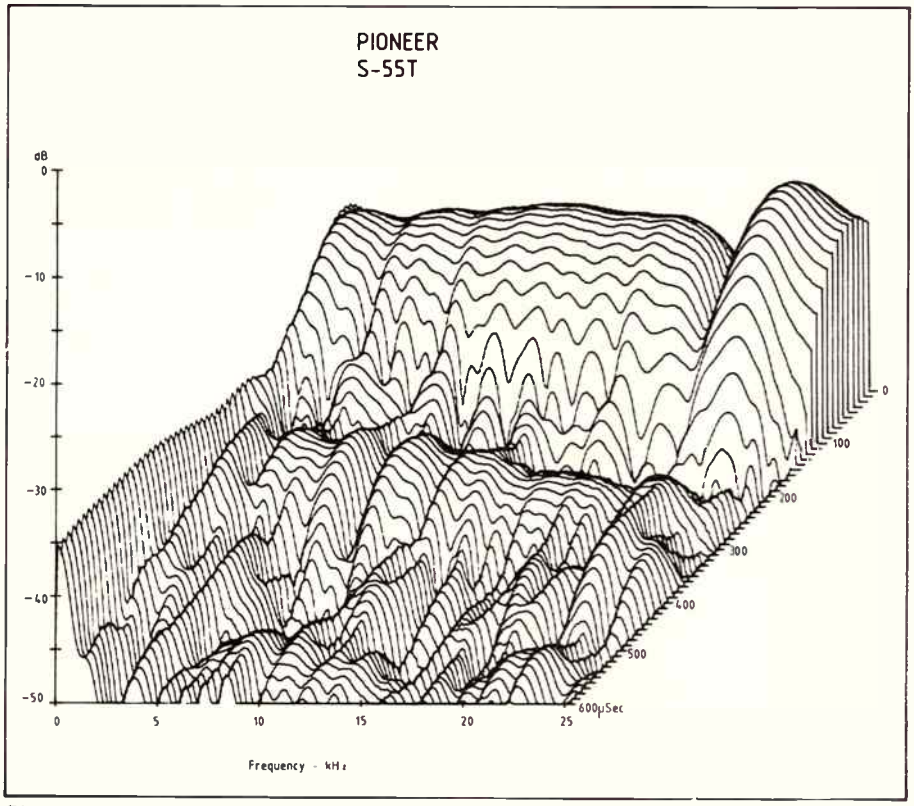
With the tweeter removed from the cabinet it was easy to inspect the 'mid-ship mounting' stiffening frame set behind each of the mid-range/low frequency drivers. These really do increase the overall cabinet stiffness, positively reduce the motion of the drivers under high excitation conditions and dramatically reduce the effects of multiple resonances from the side and rear of the cabinet in the area where these problems are so commonly experienced.

The inside of the cabinet is provided with a large wad of damping felt which is carefully centred by the speaker cables and set well clear of the two (2) loading ports which are inserted in the rear of the cabinet. Now a double load port combination, is I acknowledge unusual, and yet in practical terms it offers a number of potential advantages when compared with a single port which might have been considered in lieu of the double port. The length and dimension of the venting ports have been selected to optimise the frequency response in the 40-100 Hz low frequency region. I suspect that this characteristic has been selected for marketing purposes as much as for audible benefits. Inside the cabinet as well designed crossover with conventional air-cored inductors with polypropylene capacitors have been installed on the removable back panel, whilst at the lower end of the cabinet a well designed pair of color coded Universal terminals have been neatly inserted with terminal edges that ensure that the loose or bare wires can not rotate once they are correctly inserted and clamped.

Externals

The frontal appearance of the S-55T Speakers is enhanced by a well designed removable grille which utilises a neat stiffened perimeter plastic moulding to which the open-weave black cloth is thermally bonded. The plastic moulding also incorporates four neat inserts, which are retained by four matching inserts in the face of the speaker cabinet. The appearance of the speakers is equally attractive with or without the grille and I suspect that many users will opt to leave the grille panel off in order to show the speakers.

The cabinet is veneered with a quality plastic veneer on the face, top, bottom and sides with only the rear panel being provided with a paint finish. The bottom inside of the cabinet has been provided with four captive nut inserts located close to each of the four corners to facilitate the attachment of a supporting floor stand, or alternatively to simplify suspension of the speakers from either a ceiling bracket or a wall bracket, depending on needs.



Phase response

Performance

The on-axis frequency response of the S-55T's is not quite what I would have expected, and depending on where I put my microphone in the vertical plane relative to the pair of primary drivers, I was able to display interference effects between the two main drivers. These interference effects, which also interact with the rear loading ports outputs, was most pronounced between 60 Hz and 180 Hz. By contrast the frequency response from 200 Hz to 19 kHz is particularly smooth, although there is a perceptable rise of the order of 4-5 dB between 600 Hz and 1.5 kHz, which provides a degree of 'mid-range presence'. This same lift in mid-range response also manifests itself in the one third octave band room response which I recorded and which I will comment on further later.

The pronounced dip in the frequency response for the near field measurements close to the drivers which shows up between 60 Hz and 80 Hz intrigued me.

This dip is a direct proximity interference effect which does not show up in the frequency responses at 2m on axis. By the same token the drop in frequency response between 70 Hz and 200 Hz created by the vented rear ports, and which shows up at 2m on axis, does not show up in the near field measurements close to the face of the individual drivers.

The frequency response measured on axis and on 30° to the main axis is exceptionally smooth all the way up to 20 kHz at which point it really takes a dive. The extended frequency responses, which I measured using an alternative swept oscillator over the range 200 Hz to 200 kHz, displays a dramatic rise in response between 21 kHz and 30 kHz. In this region the tweeter actually has a significant resonance whose presence would not have been detected had we not performed a decay response spectra evaluation. This high frequency resonance characteristic is unlikely to be excited by program material on either CD players, record players or tape recorders.

For the heck of it, I measured the variation in frequency response of the enclosure with the two rear vented ports blocked off and then super-imposed the two sets of results on one level recording. With the ports blocked off the low fre-

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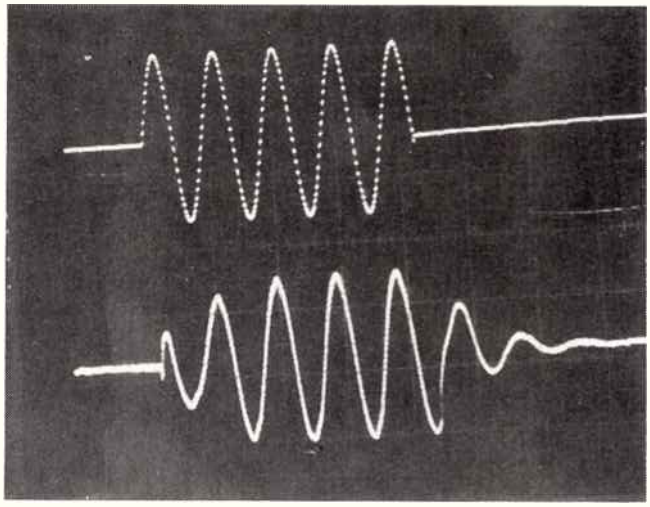

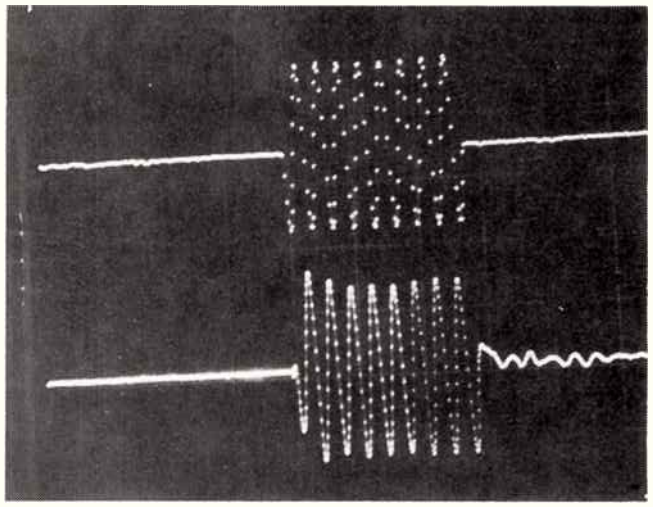

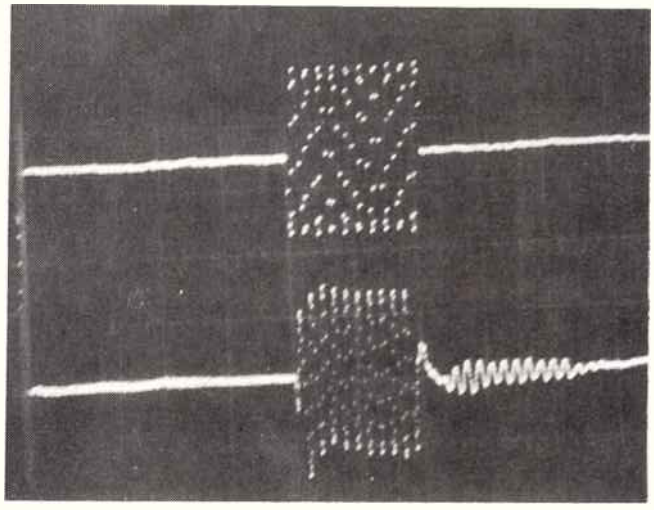

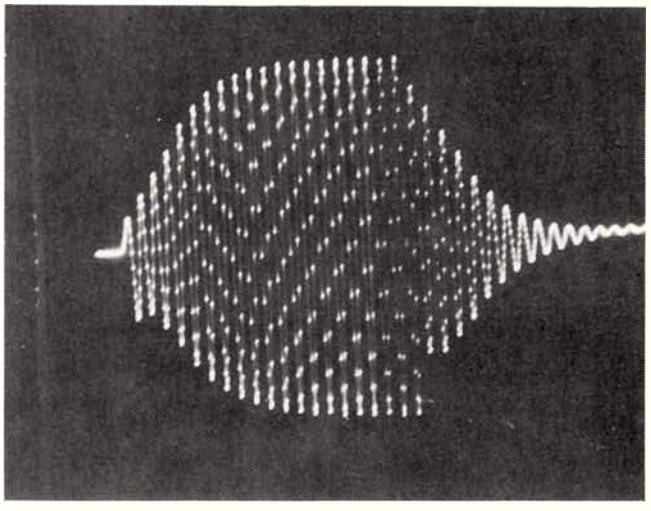

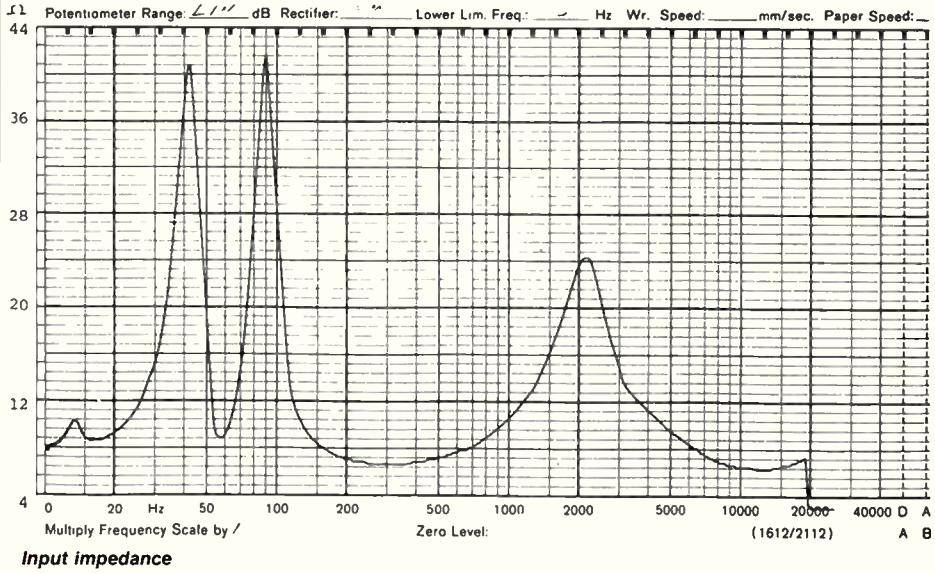

Input impedance

quency response between 30 Hz and 100 Hz drops with an 8 dB droop at 60 Hz. The measurements performed close to the face of each of the drivers revealed that the cross over frequency is approximately 2.7 kHz and that the on axis response from the drivers is exceptionally smooth.

The phase response of the S-55T is equally smooth and typical of a speaker which has been carefully designed for 'true phase linear' characteristics. In keeping with all vented enclosures, the impedance curve displays some very healthy peaks and bumps with two sharp peaks at 42 Hz and 90 Hz, a 6.5 ohm impedance between 200 and 400 Hz and another modest rise to 24 ohms at 2 kHz. Because of these characteristics the S-55T would be classified as a 6 ohms speaker system which

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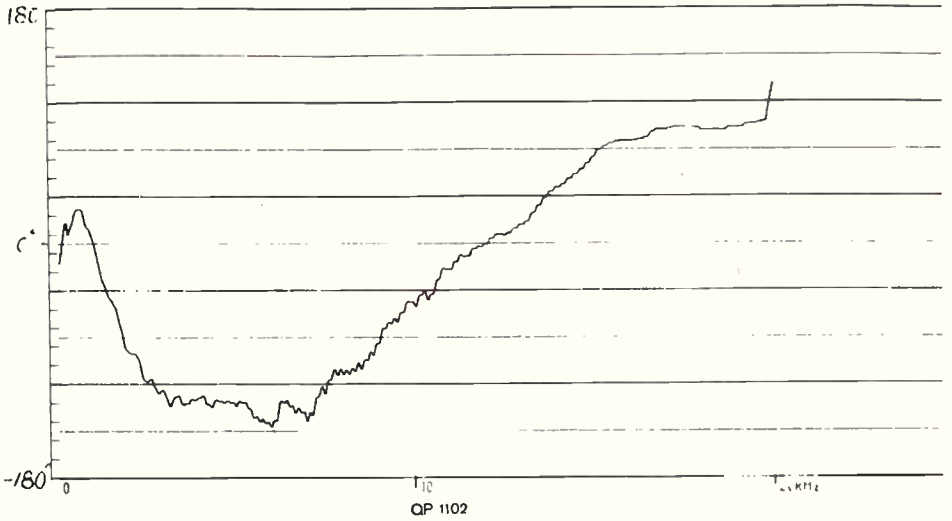
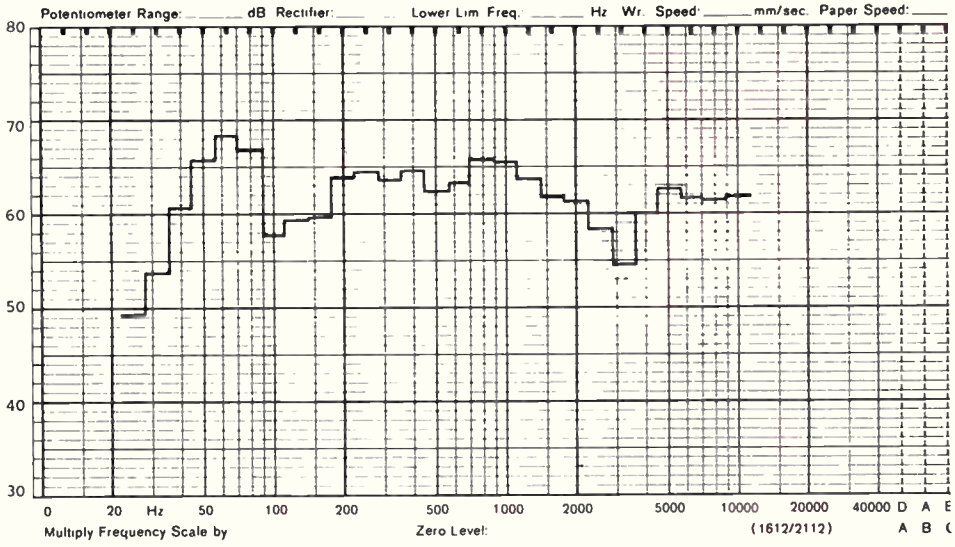


2 m on tweeter axis



Pink noise response in the listening room

could only be paralleled with other speaker systems provided the amplifier is capable of handling impedances of less than 4 ohms.

The polar response of the speakers is exceptionally good with a degree of uniformity which few other speakers in this price range can provide. At 10 kHz the response is only approximately 3 dB down at ± 30° to the main axis and is only 8 dB down at ± 60° to the main axis. At frequencies over 10 kHz the polar response plots tend to exhibit a number of lobes or petal-like responses with off-axis angles greater than 30°, but then so do all the other speakers we have tested. This tendancy is however, less pronounced than most other speakers that we have recently reviewed. The lateral dispersion characteristics of the S-55T speaker system is exceptionally good and must rate amongst the best that we have yet seen.

The tone burst testing displayed some noticable but modest ringing effects over the normal frequency range. This was most noticable at 6.3 kHz, but this characteristic was eclipsed by the spectacular ringing at 21 kHz (see photos appended). I suspect that this ringing characteristic is further exacerbated by the proximity effects of the 'spoiler ring' which is located in front of the tweeter diaphragm.

The decay response spectra confirms how smooth the output is over the range 100 Hz to 20 kHz, confirms the resonance characteristics of the tweeter in the 21-30 kHz region and confirms that the drivers and the cabinet have been very carefully designed and particularly well constructed to minimise spurious reso-

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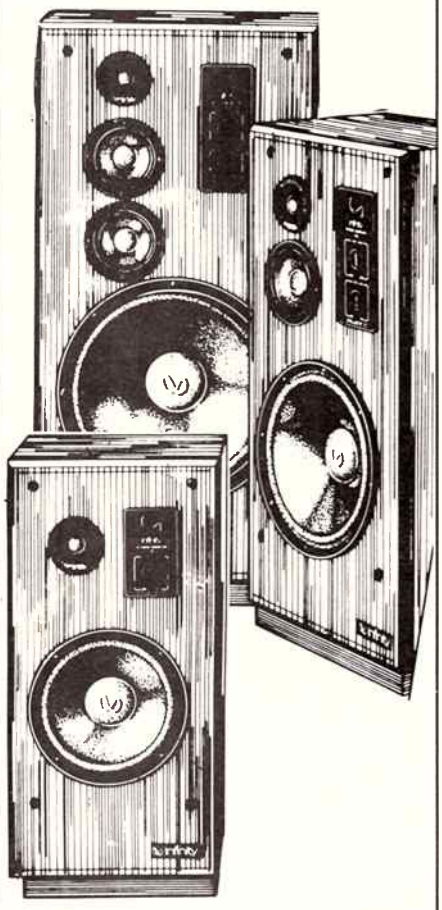

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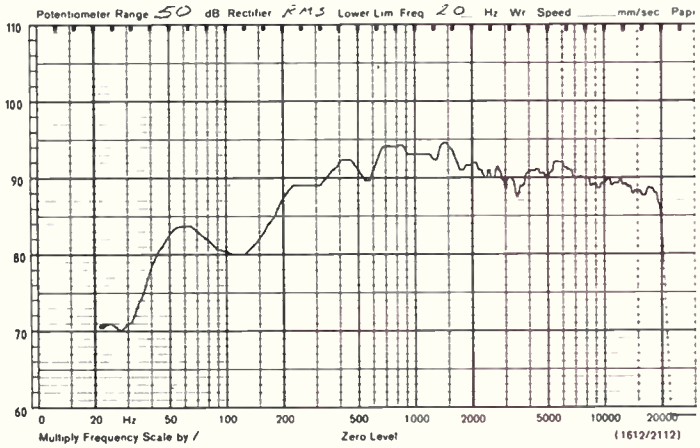
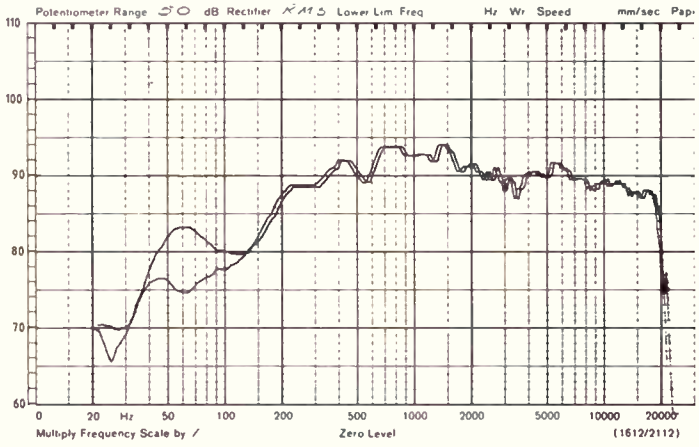
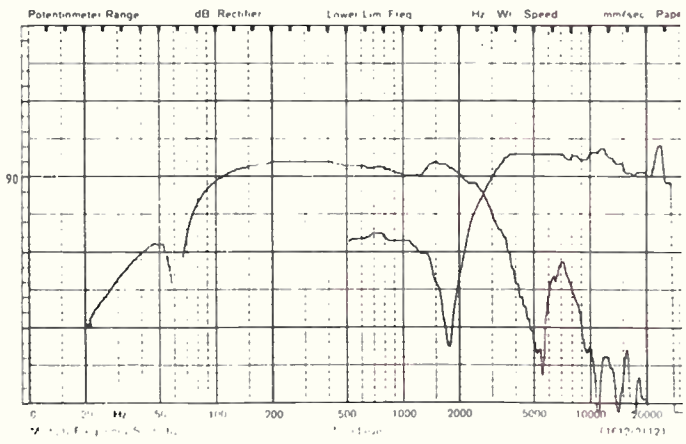


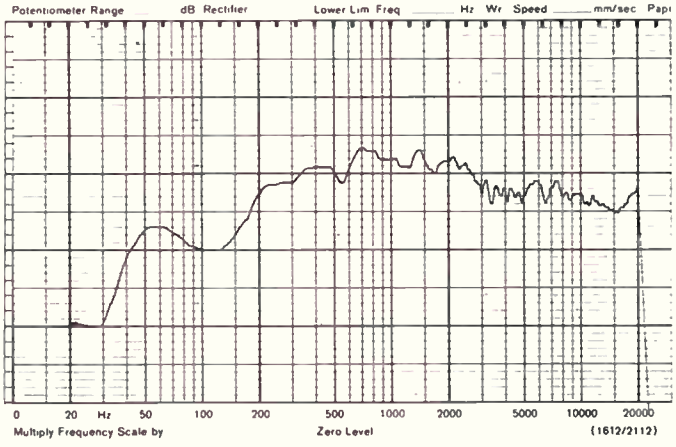
2 m on axis



2 m with bottom port closed



50 mm from drivers



2 m 30 degress off axis

nances from the front, sides and rear of the cabinet. Apart from the sharp resonance at 24 kHz, the decay response spectra exhibits minimal resonance characteristics and these are exceptionally well controlled. Overall the decay response spectra is amongst the best that we have seen from speakers in the under $2,000 category.

The distortion characteristics of the speakers are moderately high at 100 Hz, primarily because of the significant droop in the frequency response resulting from the choice of porting frequency, but exceptionally low at all normal operating frequencies above that point.

These low distortion characteristics were confirmed in the subsequent subjective evaluation which was 'coup-de-grace'.

The last objective test I carried out was with the pair of speakers mounted on their stands in my listening room and fed with pink noise. Under these conditions the frequency response from 40 Hz to 16 kHz was remarkably smooth and there was only a modest dip in the response at 100 kHz, 125 Hz and 160 Hz. Unlike my reference monitors, the S-55T's displayed a trace of mid-frequency colouration, which most purchasers would favour, although I personally prefer to avoid.

Subjective Evaluation

The subjective evaluation of the Pioneer's S-55T was extremely pleasing. I evaluated a number of new CD's including an exciting new release of Mussorgsky's *Pictures at an Exhibition* with the Charles Dutoit with the Montreal Symphony Orchestra (Decca 417 299-2). This is an electrifying rendition in which the speakers revellled and over which I rejoiced. The fidelity, lack of distortion and even the low frequency performance belied the size of the speakers, their cost and their miniscule proportions. The quality of sound was right on par with my reference speakers and I was more than impressed.

The next disc that I utilised was a recent release of Verdi's *Rigoletto* (DGG 423-114-2) which features Carlo Maria Giulini with the Vienna Philharmonic Orchestra originally recorded in 1980. This is an exciting record of a memorable opera and the speakers produce a quality of sound which will gladden the heart of any real opera fan. The feeling of presence, breadth of stereo imagining and quality of

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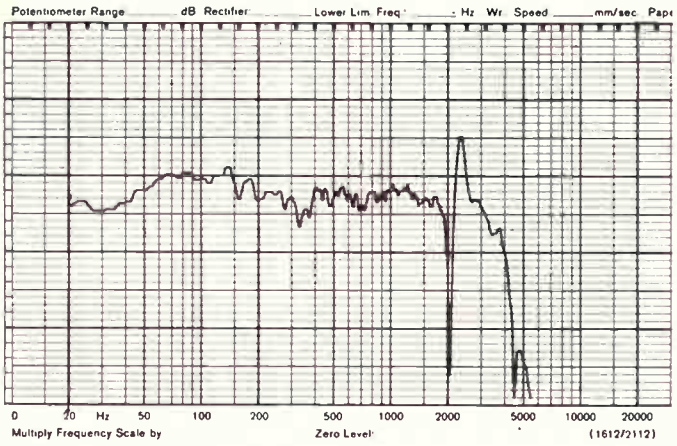

1 m on tweeter axis (200 Hz to 200 kHz)

Frequency response of the S55T displays some peculiar characteristics depending on placement of the input microphone. Note in particular the near field response at 50 mm from the drivers, which disappears completely at one metre. Another interesting feature is the 8 dB drop visible when the bottom port is closed.

sound reproduction were in all respects outstanding.

The third disc which I utilised was a recent release of Mozart's *Clarinet Concerto, Flute & Harp Concerto* from Virgin Records with the City of London Sinfonia, conducted by Richard Hickox (PCD 852) which is a budget priced gem for Mozart lovers.

The fourth disc which I utilised was selected to evaluate the performance of the speakers with a piano and I utilised another budget disc from Virgin Records with Cristina Ortiz in *French Impressionist Piano* (PCD 846). This disc is really "easy listening" classical music at its best and had there been a race, the Pioneer S-55T's would have romped home first.

I tried some Jazz and Pop records and discs all of which were selected because

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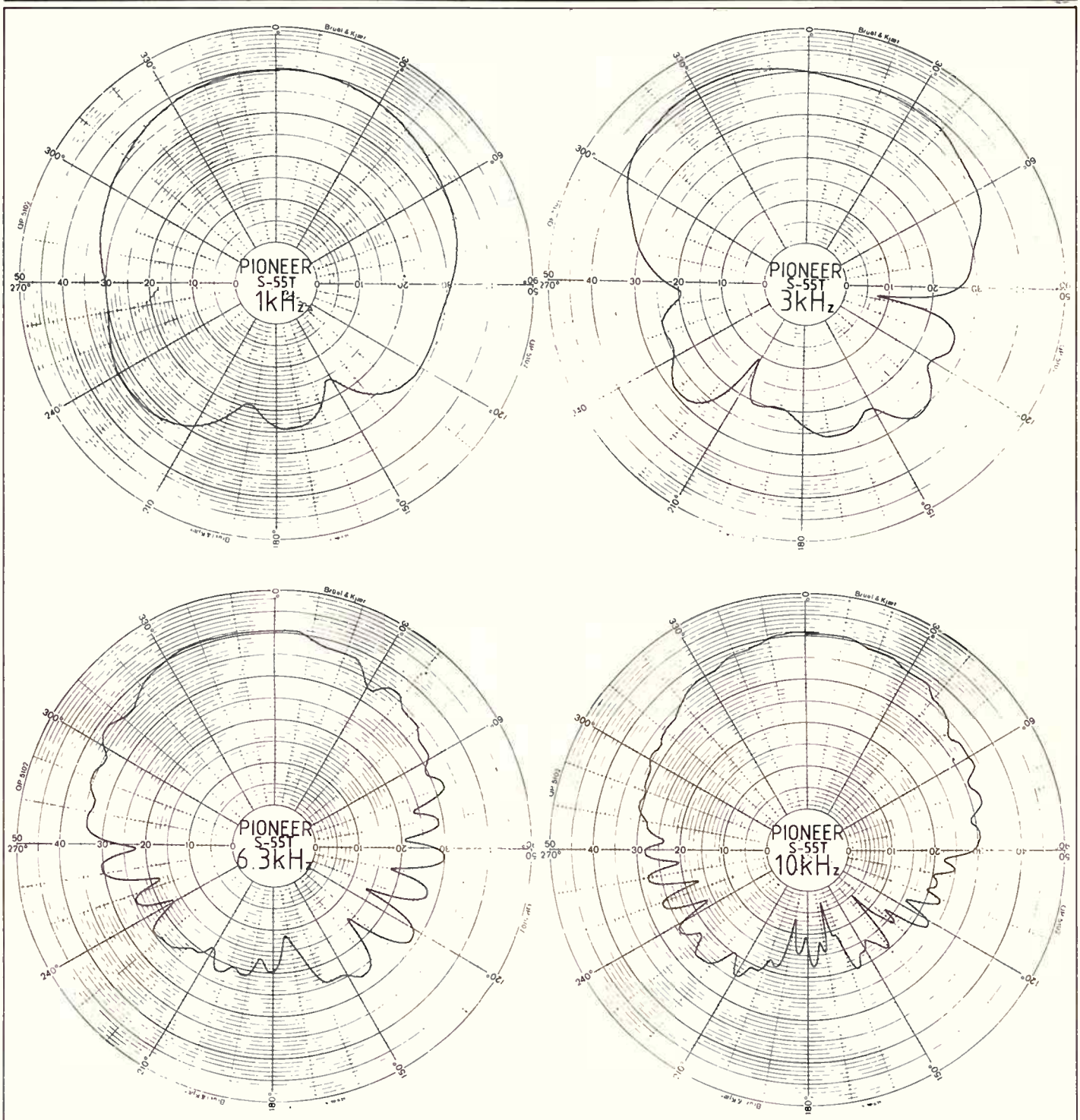

The polar response. Frequencies are shown in the centre of each rose. The lobing effect at higher frequencies is quite typical.

they feature significant low frequency output in the 20-200 Hz region. Although the speakers peformed reasonably well, one had the feeling that a little more output capability in the 80-200 Hz region would have provided a slightly more realistic sound and a decreased distortion in the 100-200 Hz region when played at levels of over 100 decades at the listening position would be even better.

The Pioneer S-55T's are one of the most outstanding bookcase-sized speakers that have been released in Australia and aside from my previous critical comments are undoubtedly one of the most attractive and accurate speaker systems in their size and price range. These speakers produce superb classical music, excellent pop music and almost realistic rock music. You won't have heard them yet because they are too new, but if you are considering new speakers then make the effort to hear the S-55T's as that effort will be worth all the trouble. ●

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Reviews

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VIDEOS

Title: Prizzi's Honor
Rating: M
Standard: ★★★

Put me before a movie starring Jack Nicholson and I'm already half sold. When another part of the combination is legendary director, John Huston, I'm yours for life. Here, Jack plays a Mafia hitman who meets up with another in the same profession, in the person of Kathleen Turner. As ever, Jack exudes a devilish sort of chemistry which lights up on the screen, attesting to his sheer presence as an actor of the first magnitude. Anjelica Huston is nicely cast in a secondary role and she thoroughly deserved her oscar for best supporting actress. Comedy, drama, suspense and reigning above all, the magnitude of Nicholson. One of the five best films of the year and an offering not to be missed.

Peter Brown

Title: Eat And Run
Distributor — Crystal
Length — 80 mins
Rating: M
Standard: ★★★

This may be the "sleeper" comedy of the year. Any movie that has a premise, a 400 pound alien who eats Italian (the people that is, not the food) has got to be off to a good start. When you couple the porcine alien with a wisecracking cop, a half-Jewish judge with a passion for vibrator batteries and a few sideswipes at law and order, drug reform and bad mercery, this film really has something to say.

Best among the stars of this production is the cop (Ron Silver) modelled on the Dragnet model of Joe Friday. However, this gent has a penchant for saying his dialogue on screen, a habit which disturbs all and sundry. A genuine comedy with not the slightest hint of gore, something refreshing when you are dealing with an Italian eating alien. Recommended for a hearty laugh.

Peter Brown

Title: The Yearling
Rating: G
Standard: ★★★★

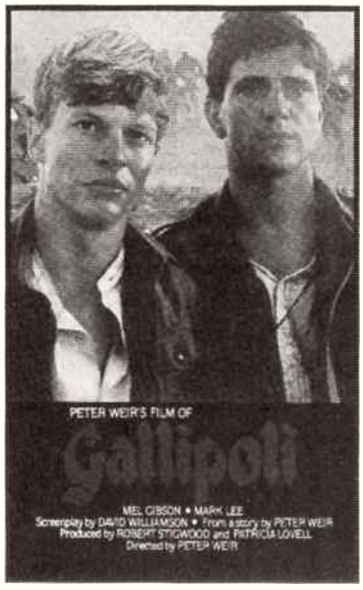
Gregory Peck has never been better than in this paternal role of the eternally struggling sharecropper in the bayous of southern America. Dour wife is played by Jane Wyman, this being her second best role after the classic Johnny Belinda. The story of a boy and his love for a deer is timelessly told and the superb photography always reminds me of the classic George Stevens' Shane. A film not to be missed.

Peter Brown

Title: Beverley Hills Cop II*
Rating: M
Standard: ★

I must be the only person in Australia, perhaps even the Western world who finds the antics of Axel Foley singularly unfunny. Screaming at all and sundry, while masquerading as a cop is a poor excuse for humour, but the queues outside the movie theatres tell a different story. Plainly, the gent is a phenomenon. However, comedy is like travel; purely subjective. I loathe New York, finding it three steps lower than Calcutta, while others constantly praise it to the skies. The same goes for comedy where I abhor Chaplin, Jerry Lewis, Mel Brooks and the aforementioned gent. However, I am in the minority and no apologies are made for my verdict. In this treatment, Axel continues his adventures against the bad guys and after oh so predictable mayhem, good and virtue win through in the end. After all, this is God's Country.

Peter Brown



Title: Gallipoli*
Rating: G
Standard: ★★

For the life of me, I could never see what all the fuss was about when this was first released. The fact that war is hell has been told and retold by the likes of Kubrick with *Paths of War* and Remarque's startling *Western Front*. Yet, here we have the Aussie message, this time incorporating a dash of hatred of the British, a few shots of unconvincing trench warfare and a pyramid or three. Yes, I am the first to admit that like so many other Australian films, this is a good looking effort, but it needed a good script and this is sorely lacking. Two mates, their sprinting abilities and the heights of the Dardanelles were plainly not enough to keep this 'umble reviewer away from the arms of Morpheus.

Peter Brown

Title: From The Hip
Standard: ★★★

Two of the modern day Hollywood Brat Packers star in this offering which details the story of a somewhat unconventional lawyer and his rather bizzare initiation into the profession. Honestly, some of the antics some of these American lawyers get up to would get them turfed out of Yass Petty Sessions, let alone one of the city courts. American law is truly an ass to paraphrase the Great Bard, but this should never stand in the way of a good

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★★★★ Don't miss it ★★ Please miss it
★★★ Value for money ★ Watch the microwave instead

film and this is certainly a good film. Judd Nelson is known as Stormy Weathers and he is certainly stormy in the extreme. Some of his court room inventions would have Clarence Darrow turning in his grave, but the fact of the matter is that the audience is treated to a sometimes serious, sometimes hilarious offering based on the law, ridiculous defences and even more ridiculous matters pertaining to jurisprudence. For the budding barristers, miss this offering by a mile, but the rest of us mere mortals can certainly sit back and enjoy the fun.

Peter Brown

Title — Creepshow 2
Distributor — Roadshow
Length — 92 minutes
Rating — M
Standard — ★★

I have often wondered at those who hire movies for the sheer gore of it. This horror spoof has buckets of gore, but despite the bloodletting, it is slightly disappointing. Perhaps the worst enemy of both comedy and horror is predictability and it wreaks havoc in this epic. The movie is really a toned down Twilight Zone with buckets of innards.

Three stories, one starring George Kennedy and Dorothy Lamour, form the centrepiece of the movie, which is a sad sequel to the original film of the same name. George and Dorothy star as store owners murdered in a particularly nasty fashion, the second tale concerns a swimming adventure gone horribly wrong and the conclusion of the movie is taken up by a seemingly endless tale of a hit and run driver. Plenty of gore for those who love it, but a surprise visit to the abattoir would yield more in the field of blood and guts.

Peter Brown

COMPACT DISCS

Barbara Cook

Title — Carousel
Artist — Various
Label — MCA
Producer — Thomas Shepard
Cat. No. — MCAD 6209

One of the most surprising things about *Carousel* is that it is derived from a Hungarian play set in Budapest. In fact Rogers and Hamerstein were not keen on the play at all and heavy pressure had to be applied before they agreed to write a musical based on it.

Despite their reluctance however *Carousel* became a classic musical and is usually revived at least once every few years. This disc is the latest recording and is the result of collaboration between both English and American artists. Sarah Brightman, who seems to be singing in everything these days, sings the role of Carrie, whilst Barbara Cook sings the role of Julie and Samuel Ramey, Billy. The music is provided by the Royal Philharmonic under the baton of Paul Gemignani.

Whilst the singing and production on this disc are almost faultless one cannot hail this recording as an unqualified success. Too many of the early tracks involve dialogue, which serves to make it painfully clear that good singers are not always the best actors. With that said, this version of *Carousel* is undoubtedly the best currently available.

Simon O'Brien

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World Radio History

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READER INFO No. 17

World Radio History

```
00010 REM MICROBEE BINGO (1987) by G.R.LAMING
00020 REM 17 SALFORD AVE MILE END 5031
00030 REM PH (08) 43 2917
00040 CLS:INPUT"(Y)";CURS25,2:INVERSE:PRINT"MICROBEE BINGO":NORMAL
00050 CURS20,8:PRINT"SELECTING RANDOM NUMBERS"
00060 CURS25,15:PRINT"by  G.R.LAMING"
00070 TURN 1:D90
00080 K=INT(RND*90)+1:IF P(K)<>0 THEN80
00090 P(K)=1:IF N=90:CURS30,9:CLSE:CURS31,9
00100 IF N=90:PRINTINT(90 F I(N))
00110 NEXTN
00120 CURS20,8:PRINTLA24,32):CURS32,9:PRINT" ":CURS27,0:PRINT"EYES  DOWN"
00130 A1$=KEY:IF A1$<>" " THEN130
00140 CURS27,8:PRINTLA10,32):N=N 1
00150 IF N=1:N 1ELS IF N=90:N 90
00160 T P(N)/10:U P(N)-T*10:IF U 0:U 10:T T 1
00170 S=61574+T*64+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:POKES,PEEK(S)+128:POKES+1,PEEK(S+1)+128
00220 FORX 1TO100:NEXTX:GOTO150


                    MICROBEE BINGO


                 SELECTING RANDOM NUMBERS
                          20


                    by  G.R.LAMING


                    MICROBEE BINGO

      1    11    21    31    41    51    61    71    81
      2    12    22    32    42    52    62    72    82
      3    13    23    33    43    53    63    73    83
      4    14    24    34    44    54    64    74    84
      5    15    25    35    45    55    65    75    85
      6    16    26    36    46    56    66    76    86
      7    17    27    37    47    57    67    77    87
      8    18    28    38    48    58    68    78    88
      9    19    29    39    49    59    69    79    89
     10    20    30    40    50    60    70    80    90

                    by  G.R.LAMING
```

Bingo

This short basic program will allow any club, etc to use a microbee as a bingo machine. The 'bee will randomly select 90 numbers and upon pressing the space bar will display each number in turn on a grid allowing the caller to check and verify called numbers from a checker after a bingo call. Each number, as it appears on the screen, will flash on and off to indicate that it was the last number selected. If, however, the caller happens to press when bingo is called, backspace allows him to step back to the bingo number. Upon verification of the numbers the caller, to start another game, presses escape, whereby a new set of random numbers will be generated.

G. R. Laming,
Mile End,
SA

```
00100 REM * * * * * * * * * * * * * * * * * * * * * * * * *
00110 REM *                                                 *
00120 REM *       CASSETTE LABEL/NAME-PLATE MAKER           *
00130 REM *            For the DP-100 Printer               *
00140 REM *                                                 *
00150 REM * * * * * * * * * * * * * * * * * * * * * * * * *
00160 P=0:POKE 220,20
00170 CLS:CUPS 1":UNIDEFLINE:PPINT "CASSETTE LABEL/NAME-PLATE MAKER":NORMAL:CURS
64:PRINT (A64 45)
00180 IF P<>0 THEN 240
00190 PRINT "   This program can be used to produce Cassette Case Labels or "Ca
ssette Name-plates on a Microbee DP-100 printer.It will also"
00200 PRINT "work with minimal alteration on most other dot-matrix printers."\\"
   On the Cassette Case Labels  you can put in a title,print"
00210 PPINT "ruled lines for program names and also print multiple copies."\\"
 Or the Cassette Name-plates you can put in a title and print""multiple copies.
"
00220 P=1:PRINT" "   Hit any key to continue.....":GOSUB 950
00230 CURS 128:FOR E=1 TO 12:PPINT (A64 32):::NEXT E
00240 CURS 192:FPINT "Please choose the option you require:":CURS332:PRINT "1-Pr
int Cassette case labels":CUPS 396:FPINT "2-Print Cassette name-plates":CURS 460
:PRINT "3-Quit"
00250 CUPS 524:FRINT "4-Return to title screen"
00260 GOSUB 950
00270 S=INT(VAL(A0$))
00280 IF S<1 OR S>4 THEN 260
00290 ON S GOTO 310,630,880,960
00300 REM ### THIS SECTION DETERMINES CASSETTE CASE LABEL FORMAT ###
00310 CURS 128:FOR E=1 TO 10:PRINT (A64 32):::NEXT E
00320 POKE 220,96:CUPS 192:PRINT "Enter a title suitable for the spine of the ca
ssette(maximum":PPINT "18 characters)  _________________":CUPS 15,5:INPUT N1$:P
OKE 220,20
00330 IF LEN(N1$)>18 THEN CURS 192:PRINT (A170 32):CURS 200:PRINT"NAME TOO LONG'
'':PLAY 24,7:CUPS 199:PRINT (A20 32):GOTO 320
00340 IF LEN(N1$)=0 THEN LET N1$="  "
00350 PPINT\ "Do you want ruled lines for program names(Y/N)?"
00360 A1$=KEY:IF A1$="" THEN 360
00370 IF A1$<>"Y" AND A1$<>"y" AND A1$<>"N" AND A1$<>"n" THEN 360
00380 PRINT
00390 POKE 220,96:INPUT "How many copies do you wish to make(maximum of 4)?"C:PO
KE 220,20
00400 IF C=0 THEN GOTO 230
00410 IF C<1 OR C>4 THEN CURS 119:PRINT (A60 32):PLAY 24:CURS 1,9:GOTO 390
00420 PRINT\\TAB(11) "Hit any key when your printer is ready.....":GOSUB 950
00430 REM ### THIS SECTION PRINTS THE LABELS ###
00440 CURS 192:FOR E=1 TO 11:PRINT (A64 32):::NEXT E
00450 T=LEN(N1$)*2
00460 CURS 476:PRINT "PRINTING"
00470 FOR I=1 TO C
00480 LPRINT (A40 95)
00490 GOSUB 910
00500 IF A1$="n" OR A1$="N" THEN 550
00510 LPRINT\ "; TITLE ;TP; S ; F ;: TITLE ;TP; S ; F ;"
00520 FOR J=1 TO 11
00530 LPRINT "|_______|__|___|___|:|_______|__|___|___|"
00540 NEXT J:GOTO 560
00550 LPRINT (A12 10)
00560 LPRINT (A40 95)
00570 GOSUB 910
00580 LPRINT (A40 95)\ (A4 10)\ (A40 95)
00590 IF FRACT(FLT(I)/2)<>0 THEN 610
00600 LPRINT:NEXT I:PLAY 24:GOTO 830
00620 REM ### THIS SECTION DETERMINES NAME-PLATE FORMAT ###
00630 CURS 128:FOR E=1 TO 10:PRINT (A64 32):::NEXT E
00640 POKE 220,96:CURS 192:PRINT "Enter a title suitable for the side of a casse
tte(maximum 14"\"characters)  _____________":CURS 12,5:INPUT N1$:POKE 220,20
00650 IF LEN(N1$)>14 THEN CURS 192:PRINT (A170 32):CURS 200:PRINT"NAME TOO LONG'
'':PLAY 24,7:CURS 199:PRINT (A20 32):GOTO 640
00660 IF LEN(N1$)=0 THEN LET N1$="  "
00670 PRINT
00680 POKE 220,96:INPUT "How many copies do you wish to make(maximum of 10)?"C:P
OKE 220,20
00690 IF C=0 THEN GOTO 230
00700 IF C<1 OR C>10 THEN CURS 1,7:PRINT (A60 32):PLAY 24:CURS 1,7:GOTO 680
00710 PRINT\\\ TAB(11)"Hit any key when your printer is ready.....":GOSUB 950
00720 REM ### THIS SECTION PRINTS THE NAME-PLATES ###
00730 CURS 192:FOR E=1 TO 11:PPINT (A64 32):::NEXT E
00740 T=LEN(N1$)*2
00750 CURS 476:PPINT "PRINTING"
00760 FOR I=1 TO C
00770 LPRINT (A32 95)
00780 LPRINT\ TAB(32-T)/2;
00790 LPRINT CHR(14);N1$
00800 LPRINT (A32 95);CHR(18)
00810 NEXT I
00820 REM ### CONTINUE OPTION ###
00830 CURS 476:PRINT (A8 32):PLAY 24:CURS 192:PRINT "   Do you want to print som
e more labels/name-plates(Y/N)?"
00840 GOSUB 950
00850 IF A0$="N" OR A0$="n" THEN 930
00860 IF A0$="Y" OR A0$="y" THEN 170
00870 GOTO 840
00880 P=1:CURS 192:FOR E=1 TO 10:PRINT (A60 32):::NE T E:CURS 252:PRINT "Are you
sure?":PLAY24,4:GOSUB 950
00890 IF A0$ "Y" AND A0$  "y" THEN GOTO 230 ELSE POKE 220,111:CLS:PRINT "Ready"
:END
00900 REM ### ROUTINE TO PRINT ENLARGED LABEL TITLE ###
00910 LPRINT" TAB(40-T)/2;
00920 :PRINT CHR(14);N1$;:REM ### PRINT ENLARGED TITLE ###
00930 RETURN
00940 REM ### WAIT FOR KEYBOARD SUBROUTINE ###
00950 A0$=KE :IF A0$="" THEN 950 ELSE RETURN
00960 PLAYCURS 192:FOR E=1 TO 10:PRINT (A64 32):::NE T E:CURS 125:GOTO 190
00970 END
```

Cassette label and name-plate maker

This is a program I wrote to print labels and name-plates for my cassette library. Using the program you can create labels for the cassette cases (with or without ruled lines for program names) and name-plates to attach to the sides of the actual cassettes.

When the program runs initially, the user is presented with a screen containing brief details of what the program does. The next screen is the main menu, and this is where the required option is chosen. The user may:

1 — Print cassette case labels,

2 — Print cassette name-plates,

3 — Quit,

4 — Return to the title screen.

With each of the options one and two, the user may elect to include a title on the label or name-plate, and with option 1; rule lines for writing program names, lengths and types on may also be specified.

The labels simulate the cardboard labels provided with most pre-recorded music cassettes, and have fold lines printed on them. The name-plates are stuck on the side of the actual cassette in the blank space between the tape reels nd the top of the cassette.

Comprehensive error detection is built in, so the program should not die if you enter wrong information. To escape from option 1 or 2 back to the main menu simply enter a 0 when you are prompted for the number of copies to be printed.

C. Dewick,
Cronulla,
NSW

World Radio History

```
ADDR   CODE    LINE    LABEL   MNEM    OPERAND

                00100 ;**************************************
                00110 ;**              OLD                 **
                00120 ;**          JANUARY 1983            **
                00130 ;**      BY GARY R. LAMING           **
                00140 ;** 1/3A LACHIN AVE MILE END **
                00150 ;** S.A 5031   PH (08)42 3912 **
                00160 ;**************************************
2D00                    ORG     2D00H
2D00 217F7C     00180           LD      HL,7C7FH
2D03 22A000     00190           LD      (00A0H),HL
2D06 210009     00200           LD      HL,0900H
2D09 3600       00210           LD      (HL),00H
2D0B 23         00220           INC     HL
2D0C 3601       00230           LD      (HL),01H
2D0E 23         00240 NXTBYT    INC     HL
2D0F 7E         00250           LD      A,(HL)
2D10 EE00       00260           OR      00H
2D12 20FA       00270           JR      NZ,NXTBYT
2D14 23         00280           INC     HL
2D15 7E         00290           LD      A,(HL)
2D16 EE00       00300           OR      00H
2D18 20F4       00310           JR      NZ,NXTBYT
2D1A 22D2D0     00320           LD      (00D2H),HL
2D1D 23         00330           INC     HL
2D1E 22DB03     00340           LD      (03DBH),HL
2D21 CD1B33     00350           CALL    331BH
0000            00360           END
00000 total errors

NXTBYT  2D0E

00100 REM BASIC LOADER FOR "OLD" PROGRAM
00110 CLEAR200,32000:CLS:?"
00120 READA:POKE2,A:SUMX=X
00130 DATA 255,
00140 DATA
00150 DATA
00160 DATA
```

Old

This short utility program will resurrect a basic program after the command NEW has been executed which places a FF FF at location 0900H and changes the end of program pointer at location 08D2H to 0901H. The utility calls the first program line 00001. then searches for FF FF which marks the end of the program and places this location value at 08D2H and then renumbers the lines. The utility is called from basic with the command USR (32000) and is relocatable as it only uses one relative jump.

```
00010 REM -              -=*  BOXGRF.MWB  *=-
00020 REM -          Written by O.Jackson 10 / 87
00030 REM -       Produces box graphics characters
00040 REM -             Characters 129 ==> 168
00050 REM
00100 POKE 220,16
00110 OUT#0 OFF
00120 HIRES
00130 REM            -=*  SINGLE  LINE  *=-
00140 PLOT 3,0 TO 3,40 TO 19,40 TO 19,8
00150 PLOT 27,31 TO 27,8 TO 11,8 TO 11,24
00160 PLOT 3,24 TO 27,24
00170 REM            -=*  DOUBLE  LINE  *=-
00180 PLOT 34,0 TO 34,41 TO 53,41 TO 53,25 TO 58,25 TO 58,31
00190 PLOT 37,0 TO 37,23 TO 42,23 TO 42,7 TO 61,7 TO 61,31
00200 PLOT 37,39 TO 37,25 TO 50,25 TO 50,39 TO 37,39
00210 PLOT 45,23 TO 45,9 TO 50,9 TO 50,23 TO 45,23
00220 PLOT 53,23 TO 53,9 TO 58,9 TO 58,23 TO 53,23
00230 REM    -=*  SINGLE HORIZ. ; DOUBLE VERT.  *=-
00240 PLOT 66,8 TO 66,40 TO 85,40 TO 85,8 TO 66,8
00250 PLOT 69,40 TO 69,8
00260 PLOT 74,40 TO 74,8
00270 PLOT 77,40 TO 77,8
00280 PLOT 82,40 TO 82,8
00290 PLOT 69,24 TO 74,24
00300 PLOT 77,24 TO 82,24
00310 REM    -=*  DOUBLE HORIZ. ; SINGLE VERT.  *=-
00320 PLOT 91,0 TO 91,7 TO 107,7 TO 107,25 TO 91,25 TO 91,7
00330 PLOT 91,9 TO 107,9
00340 PLOT 91,23 TO 107,23
00350 PLOT 99,23 TO 99,9
00360 PLOT 99,25 TO 99,39
00370 PLOT 107,25 TO 107,41 TO 91,41
00380 PLOT 91,47 TO 91,39 TO 107,39
00390 OUT#0
00400 CLS
00410 CURS 0
00420 PRINT CHR(153)[A62 131]CHR(154)
00430 FOR X=2 TO 14
00440     CURS 1,X:PRINT CHR(146)
00450     CURS 17,X:PRINT CHR(129)
00460     CURS 33,X:PRINT CHR(129)
00470     CURS 49,X:PRINT CHR(129)
00480     CURS 64,X:PRINT CHR(146)
00490 NEXT X
00500 CURS 1,15
00510 PRINT CHR(151)[A62 131]CHR(156);
00520 FOR X=129 TO 139
00530     IF FRACT(FLT(X)/2)=0 THEN CURS 5,X-126 ELSE CURS 4,X-126
00540     GOSUB 710
00550 NEXT X
00560 FOR X=140 TO 150
00570     IF FRACT(FLT(X)/2)=0 THEN CURS 20,X-137 ELSE CURS 21,X-137
00580     GOSUB 710
00590 NEXT X
00600 FOR X=151 TO 159
00610     IF FRACT(FLT(X)/2)=0 THEN CURS 37,X-148 ELSE CURS 36,X-148
00620     GOSUB 710
00630 NEXT X
00640 FOR X=160 TO 168
00650     IF FRACT(FLT(X)/2)=0 THEN CURS 52,X-157 ELSE CURS 53,X-157
00660     GOSUB 710
00670 NEXT X
00680 U=USR(32774)
00690 POKE 220,111
00700 END
00710 PRINT "CHR"[I4 X]" "CHR(X):RETURN
```

CHR 129 ┤ CHR 130 ┐ CHR 131 ─ CHR 132 ┐ CHR 133 └ CHR 134 ┘ CHR 135 └ CHR 136 ┬ CHR 137 ├ CHR 138 ┼ CHR 139 ┤

CHR 140 ╢ CHR 141 ╖ CHR 142 = CHR 143 ╖ CHR 144 ╓ CHR 145 ╢ CHR 146 ╢ CHR 147 ╖ CHR 148 ╙ CHR 149 ╜ CHR 150 ╝

CHR 151 ╙ CHR 152 ╥ CHR 153 ╖ CHR 154 ╖ CHR 155 ╟ CHR 156 ╙ CHR 157 ╟ CHR 158 ╙ CHR 159 ╟

CHR 160 ├ CHR 161 ┴ CHR 162 ┘ CHR 163 ┤ CHR 164 ┴ CHR 165 ┌ CHR 166 ┬ CHR 167 ┐ CHR 168 └

Box Graphics

This program uses a series of plot statements to produce PCG graphics characters borders around the screen. The plot routine takes about two seconds to produce 40 characters consisting of single line. double line. double vertical with single horizontal. and single vertical with double horizontal. The last half of the program provides a list of all the characters along with their appropriate numbers.

O. Jackson,
Devonport,
Tas

Minimart

For Sale "Two 40W RMS Magnavox 10" Speakers. Perfect condition. Superb bass and treble response. Huge Magnets. Will haggle — $100. Kealon. (045) 66-4491."

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For Sale. Quad II value power amplifiers, $300 pair, quad 22 value pre-amp $70, Teak value pre-amp $40. Goodmans audio M 15 inch, 50 watt woofer $160 pair, Grace 707 tone arm $90, 5ME-3009 tone arm $60. Sydney (02) 488-8184.

For Sale. Tektronix 545A 30MHz oscilloscope, dual trace complete with manuals: $340. Tektronix 221 portable oscilloscope, mint condition, 10 MHz $320. Sydney (02) 488-8184.

World Radio History

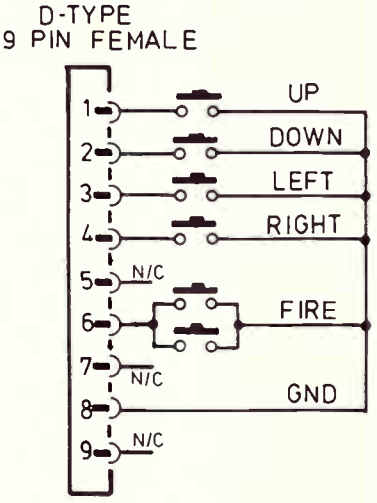
Push button Joystick

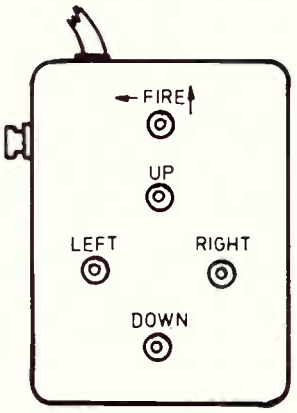
This circuit for a push button joystick was designed to do more precision work with joystick driven graphics software packages on the Commodore 64. It is also compatible with the Commodore 128, Vic 20 and most Atari computers.

The push button joystick basically works on the principle of joining the common group of a C64s joystick with a direction from the computer (either up, down, left, right or fire). By using normally on push button switches to switch directions, the user can obain greater accuracy with their work than with a conventional joystick.

To cater for everybody's needs more than one fire button can be fitted, as long as it is mounted in parallel with the first one. The constructor can decide where to mount the switches and my suggested layout is shown.

Ian Ross
Lower Templestowe
Vic



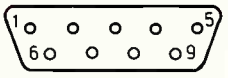


PORT 1-

PIN	TYPE	NOTE
1	JOYA0	
2	JOYA1	
3	JOYA2	
4	JOYA3	
5	POTAY	
6	BUTTON A/LP	
7	+5v	Max 100mA
8	GND	
9	POTAx	

PORT 2-

PIN	TYPE	NOTE
1	JOYB0	
2	JOYB1	
3	JOYB2	
4	JOYB3	
5	POTBY	
6	BUTTON B	
7	+5v	Max 100mA
8	GND	
9	POTBx	



D-TYPE
9 PIN MALE
(FRONT VIEW)

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

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

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

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

'Idea of the month' contest

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

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

RULES

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

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

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

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

COUPON

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

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

Title of idea/program .....

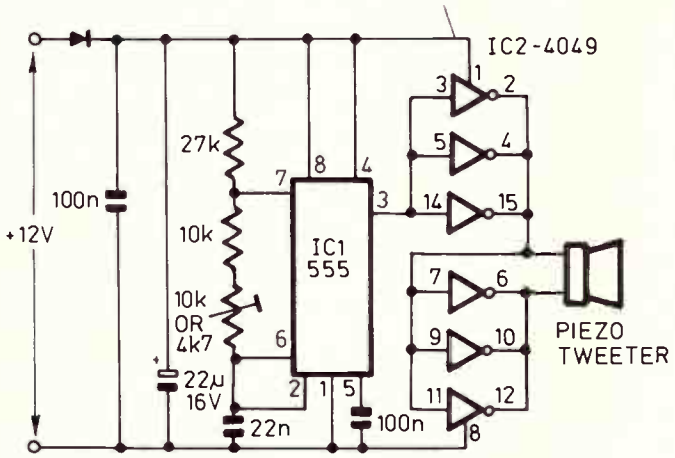
Signature ..... **Date** .....

Name .....

Address .....

..... **Postcode** .....

World Radio History



Screamer

This device was designed to make an awful noise. It consists of two spaced super-tweeters to make a noise like a cicada. Two separate oscillators and speakers were used to produce two sound sources that are approximately 4 Hz apart.

The circuit consists of a fairly standard 555 oscillator followed by multiple cmos buffers connected to drive the speaker in a voltage doubling arrangement. Two separate circuits are made, one with a trimpot and one with a fixed resistor.

Power supply bypass capacitors are important as the piezo tweeters are nearly all capacitive and cause the drivers to draw current spikes from the supply. These spikes reduce the output power but more importantly cause the two oscillators to inter-react and lock especially with such a small difference in frequency. The slow beat frequency makes this sound source very noticeable.

The screamer was tuned with three hands, one for the trimmer and one over each ear! The frequency of both oscillators may have to be increased by increasing the 220m capacitors if a different type of superhorn tweeter is required.

L. W. Brown,
Burwood
Vic

Letters

Sound Approaches

I was interested to note your comments in the article on ETI-186 wide range voltmeter, regarding the precision full-wave rectifier. While I cannot say that your arguments are incorrect, I find they are incomplete, and you have rejected at least two fundamentally sound approaches because of (I assume) an incomplete understanding of the principles involved. Let me explain.

1. "A conventional full-wave bridge rectifier drops approximately 1.2 volts across the diodes, which makes it useless for low-level signal rectification."

The conventional full-wave rectifier (bridge) circuit has been used for at least forty years in a simple circuit which gives excellent linearity. To illustrate, consider the circuitry around IC6 in your "How it works" diagram.

Current flows from pin 6 of the amplifier, through R25, through the meter to the inverting input of the amplifier, and thence through RV7 or RV8 to ground. It can be shown that the current in this circuit is equal to the voltage applied at pin 3 of IC6 divided by the resistance of RV7 or 8. The resistance of either R25 is less than the output saturation voltage of the amplifier, and also providing that we don't call for an excessive amount of gain from the amplifier. OK so far and all very simple.

Let us assume that we disconnect the meter, connecting these points in the circuit to the input of a bridge rectifier; let us now connect the output of the rectifier to the meter. Apart from the full-wave rectifying action of the bridge, all we have done is add the output voltage and gain limitations of the amplifier, the meter current is not affected in the least by the extra series resistance. In fact the only factor in this part of the circuit that can vary the meter current is the diode leakage within the bridge, and this is not a problem with modern diodes.

Over forty years ago, this type of circuit was giving excellent results to beyond 50 KHz using copper-oxide rectifiers and two stage valve amplifiers with a gain of about 100 at best. In these days of high-gain, high-slew-rate FET input operational amplifiers, together with fast switching diodes, it should be possible to achieve satisfactory operation down to a few tens of millivolts at frequencies well above 100 KHz.

2. "Figure 3 was then implemented . . . even worse characteristics resulted. The need for exact values of resistors was also a restriction . . ."

A Study of the circuit of figure 3 shows that the gain and balance may be trimmed very simply.

Decreasing R1 or R5, or increasing R2, R4 or R6 will increase the gain during the negative-going half-cycle of the input.

Decreasing R4 or increasing R6 will increase the gain on the positive-going half-cycle.

Thus increasing R6 will increase the gain during both half-cycles by an equal amount; it makes a simple overall sensitivity control.

Increasing R4 will decrease the gain during the positive half-cycle but increase it during the negative half-cycle; this resistor could be used as a "symmetry" control.

The traditional values shown in your figure for R3 and R7 are compromise values to give minimum bias current offset effects, and are in fact wrong! With FET input op-amps, the bias current is negligibly small and the non-inverting inputs can be grounded with no ill effects. If desired (and it may be necessary with a high sensitivity unit) the non-inverting inputs may be fed via 1000:1 voltage dividers from potentiometers across the positive and negative supply, for trimming of the offset voltage of each amplifier.

Far from giving poor performance, I have found this circuit to be a consistent good performer, from DC to several hundreds of KiloHertz. The main limitations seem to come from poor HF gain and/or high bias currents typical of the early op-amps, including the 741.

Name withheld by request

IN REPLY

A wide-range voltmeter, in itself, is technically not difficult, as pointed out by our correspondent. However, combining it with auto-polarity dc and a need to keep complexity and costs down makes things a bit more difficult. The circuit of figure 3 (ETI March 88) is traditional, and is presented in the text IC Op Amp Cookbook by Walter G Jung (1979).

I agree that, in theory, trimming various component values should achieve the required linearity and bandwidth. However, this would have added more variable resistors on an already overcrowded board resulting in a more complex circuit. During the development process (which was lengthy) I aimed for a high performance, low cost circuit — a dichotomy of the most difficult kind. In fact, I tried trimming the values mentioned by the correspondent, but still found the performance characteristics to be worse than those of the final circuit used in the project. If the dc feature was eliminated from the meter, perhaps figure 3 (in modified form) could have been used successfully, as it has been in the past in the manner described by WG Jung and our correspondent. But, after many hours of experiment, I gave up on it.

Peter Phillips

World Radio History

TEXAS INSTRUMENTS
TECHNOLOGY AWARD UPDATE

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

This report details the implementation of machine vision indicating the software and hardware issues associated with a working system. The aim of the project was to be able to recognise simple objects at a speed that is suitable for use in robotics. This involves image processing which depending on system design and technique can be very time consuming. A multi-processor system was proposed for this reason.

Image processing involves the analysis of an image in a quantised or digital form, such that the image can be improved or modified in a way that will improve its information value. Processing of this type includes filtering and labelling of intensity levels within the image according to the grey scale. The grey scale is a spectrum of grey light levels ranging from white to black.

SYSTEM COMPONENTS

The image capture device used is a solid state CCD (charge-coupled device) camera. The image is sent to a PC-addin board which captures and stores the images in a 512x512 format with 256 grey levels (PIP-512). Also housed in the same PC (80286 based) is a software development system for the TMS32020 (digital signal processor). Initially the data from the PIP board was processed by a PC resident program written in the language 'C', however this was found to be too slow. Communications between the PIP board and the SWDS board was then set up via a PC controlling program in order that the image processing could be executed on the TMS32020. The high speed of the DSP chip was used to increase the system throughout.

THE PROCESSING

PRE-PROCESSING

This generally involves filtering and noise removal from the original image to enhance the distinction of objects within the picture. This is done by using a modified histogram. A histogram of an image contains information regarding the grey levels that are contained within the image and the quantity of pixels that are at each grey level. The type of image scanned in this project consisted of different shaped objects on a contrasting background. When a histogram was performed, two peaks generally occur — one for the background and one for the foreground or objects. The peaks are generally fairly distinctive however a moving average is also performed to smooth the curve, so that the peak values can be determined. By modifying the histogram — shifting the peaks to either end of the grey scale — greater contrast and object definition can be obtained (i.e. objects black, background white).

Image Segmentations

This involves isolating and determining the number of objects in the image. This is done on a pixel by pixel basis whereby adjacent pixels of the same grey level are said to be part of the same shape. Each pixel has to be labelled as a particular grey level and depending on the effectiveness of the pre-processing this could be just white and black.

Feature Extraction And Classification

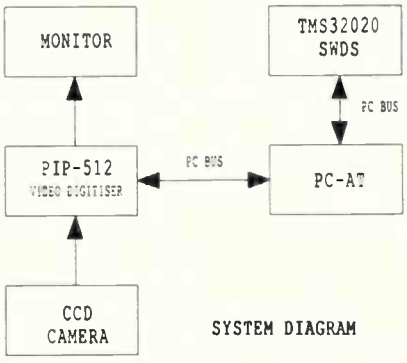
To determine the name of an object, certain parameters of the object are extracted and a lookup table used to label the object as either a square, circle, etc. The parameters are object area, centroid, perimeter, and bounding box (BB) area (this is the smallest box that contains the object). These parameters are worked out by following pixel paths and obtaining lengths and co-ordinates. The following ratios are set up and are used to determine the difference between circles, ellipses, squares, rectangles, and in some cases orientations of the latter.

Object area/BB area

BB width/BB heights

Perimeter^2/Object area

If a vertices count is included, then triangles could also be recognised. From an image consisting of a mixture of 15 shapes, only one object was labelled wrongly — an undefined odd shape was labelled as a rectangle. However, in robot vision applications, the environment is known and undefined objects will not be mistaken.

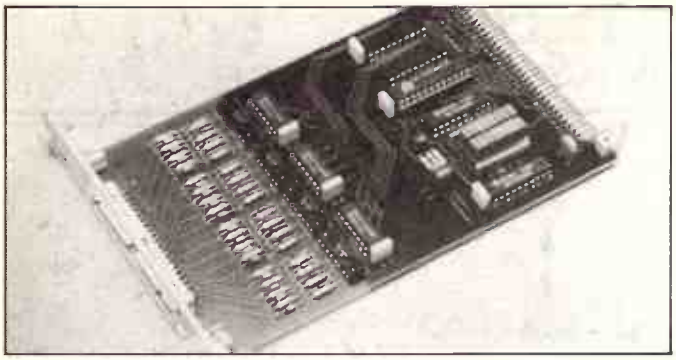


SYSTEM DIAGRAM

TECHNOLOGY AWARD UPDATE
PROJECT: Robotics vision hardware
STUDENT: Richard Delaney
SUPERVISOR: Dr P. M. Nickolls (University of Sydney)

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

World Radio History



Opto-isolated VMEbus Digital Input Module

With the VDIN module, PEP Modular Computers have introduced a new input module for the VMEbus with 16 individual and electrically separated opto-isolated channels.

The module is designed for easy and cost-effective solutions for simple interface applications in industrial control. The opto-isolation offers the highest degree of protection against inversion and over-voltages.

The VDIN module includes 16 opto-isolated inputs with signal and return lines for interconnection. It has the full industrial input voltage range of up to 24 Vdc. Data polling for easy programming and use is also available, as well as an optional LED display for demonstration of the dactual input line status. The single height Eurocard occupies only one slot on the VMEbus system. The module consists of a VMEbus slave interface A16:D16 with standard/short supervisory or non-privileged access. The 40-pin flat cable connector allows quick and easy connections.

The VDIN is available for the industrial temperature range of 0 to 70°C, and also for extended temperature range. For further information, please contact The Dindima Group, P.O. Box 106, Vermont, Vic. 3133.

READER INFO No. 181

MA1000 — EPROM Programmer

The MA1000 programs virtually all 24, 28 and 32-pin MOS/CMOS (E) EPROMs up to 1M bit 27010/27011 without any personality modules.

An expansion bus is provided to accommodate adapters for less common and future programmable devices.

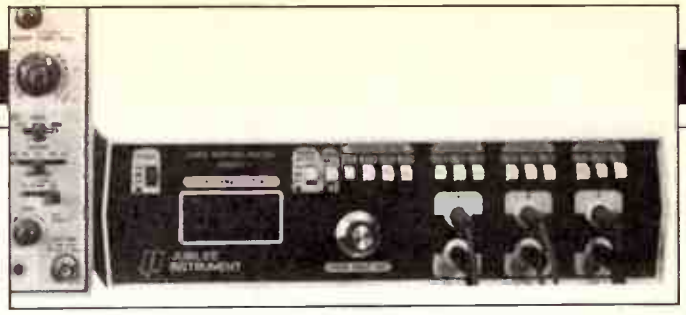
All programmer software is contained on-board and the unit is programmed via an RS-232C interface. Software updating is done simply by replacing the control program PROM.

Transmission rates of up to 19200 bps are available from optional XON/XOFF software handshake. Eight translation formats are supported including Intel, Motorola, Tektronix, ASCII and binary allowing the MA1000 to interface with most development systems and PCs.

The programmer supports standard, intelligent and super-fast programming algorithms like Intel Quick-Pulse.

The programmer split mode supports 16 and 32-bit systems allowing the data to be split into multiple EPROMs. A 128Kbyte (1Mbit) static RAM buffer is included. A non-volatile buffer may be supplied as an option. For more information contact Microcontrol (02) 588 1774.

READER INFO No. 186



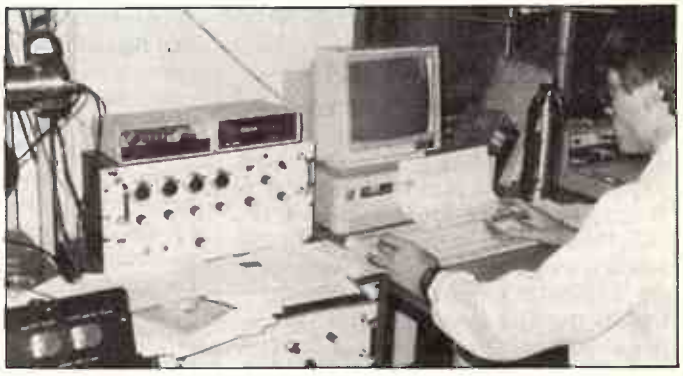
Power Waveform Oscilloscope Adaptor

The Jubilee Instrument's PM-8551 power waveform oscilloscope adaptor provides any general oscilloscope with voltage differential inputs and an inbuilt digital phase meter.

Dedicated to waveform measurements in the fields of power electricity and electronics, the 8551 has three opto-isolated differential inputs that scale and convert the input voltages to single ended BNC outputs, compatible with any conventional oscilloscope.

Under voltage measurement, each amplifier can accommodate a high voltage differential input of up to 1000 V and its sensitivity can extend down to 400mV. The amplifier bandwidth exceeds 2 MHz with 150nsecs rise time. This is adequate for making accurate dv/dt measurements in the fastest switching and commutating circuits with SCRs, thyristors or transistor supplies. Contact Taiwon (02) 308 3774.

READER INFO No. 187



Datataker Aids Chemical Research

At Adelaide University's Department of Chemical Engineering, a PhD student, Mr Andy Zwahlen, is using the Australian-produced logger, the Datataker, to record and control an experiment on the dehydrogenation of isobutane. In the experiment, gaseous isobutane is passed through a heated catalytic reactor. A reaction occurs and the effluent gases are passed through a mass spectrometer linked to a Datataker.

The Datataker records the spectrometer's analysis of the effluent gases and makes the results available to a computer as the experiment proceeds. Since Andy Zwahlen's experiment requires that the rate at which the isobutane reacts remains constant even though the catalysts become less active with use, the Datataker's own output channels are used to control the amount of isobutane being fed into the apparatus. As the catalysts become less active, less isobutane is introduced into the reactor.

For more information on the Datataker contact Data Electronics (03) 227 1277.

READER INFO No. 188

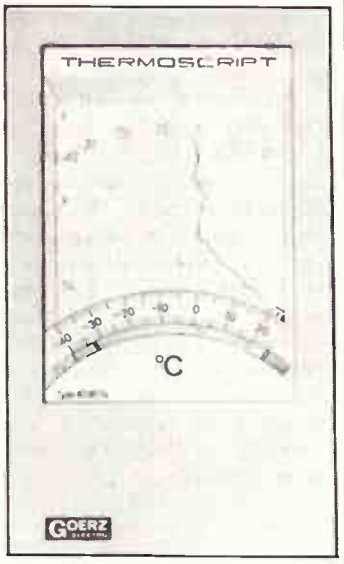
World Radio History

Recorder for Temperature Sensitive Goods

The Thermoscript Temperature Recorder is a small self-contained unit operating without separate probes or power supply. The clockwork chart drive and inkless recording medium provide continuous operation for 8, 16 or 32 days.

The Thermoscript is insensitive to shock allowing its use in vehicles, shipping containers etc.

The recording span is 65°C in the range — 40°C to +65°C with a measurement error max. ±1°C. The unit can be locked or sealed if required to prevent tempering and two telltale pointers provide indication of the maximum and minimum temperatures which have occurred in the course of the recording.



For more information contact Kent Instruments (02) 525 2811.

READER INFO No. 189

Datacraft New Range Of Dial-up Modems

Datacraft has released its new "Craft" series of modems. These products and the supporting marketing campaign focus on the customer's need to easily select a modem based on operating needs rather than technical specification. The "Craft" modems and include a number of new features such as compression and error correction (MNP).

The five products in the series are:

- "MAILCRAFT" a videotex modem with speeds of 300, 1200/75BPS, and 1200 BPS.
- "INFOCRAFT" a 1200BPS, Hayes/Concord Autodial, Auto Answer Modem for general use.
- "QUADCRAFT" a four speed, fully featured modem, operating up to 2400 BPS, with error correction and more.
- "SPEEDCRAFT" a four speed modem like the Quadcraft with the additional feature of data compression allowing it to operate at 4800 BPS asynchronous at little extra cost.
- "PROCRAFT" a high-speed V32 modem operating at 9600 BPS and offering many user-friendly features.

Recommended retail prices (including tax) of the range are: Mailcraft — $488; Infocraft — $750; Quadcraft — $959; Speedcraft — $1439, and Procraft — $4995.

All are now available.

Datacraft will continue to offer other modems outside this range, but a new promotional campaign will be centred around these five core products.

For further information: Barry Lindsey, Marketing Manager. Tel: (03) 727-9111.

READER INFO No. 190

Schmidt Modem

The Schmidt Model 123 AT (3-speed V21, V22, V23) modem claims to give full 3-speed performance for about the same price as most 2-speed modems. Designed and manufactured in Australia by Schmidt Electronics, it comes with a full 5 year warranty. The company bis best known for their range of taximeters. Technical support and service is immediately available. Future upgrading to V22 bis is planned.

For more information contact Schmidt Electronics on (03) 531 8011.

READER INFO No. 191

New CAD software

Intergraph has released a new software package for designing printed circuit boards. Called PCB Engineer, it can handle single layer, two sided and multilayer boards. These can incorporate analogue, digital and high-speed logic along with surface mount devices.

Phil Campbell, Intergraph's general manager says: "It adapts to the way you work. You can place components visually or have them placed automatically. Or, you can use a mixture of the two.

For more information contact Intergraph on (02) 888 9900.

READER INFO No. 192

Use the PS/2 as a Graphic Terminal

Dimension Graphics has released 4107 and 4115 Tektronix terminal emulation software packages that support IBM's high-resolution graphics card and monitor, the 8514A. Dimension Graphics is shipping two different product configurations for TGRAF-07 (Tektronix 4107) and TGRAF-15 (Tektronix 4115) on the 8514A display. The first configuration is a single screen emulation product, both text and graphics appear on the 8514A monitor. The second configuration supports dual screens: the graphics display is on the 8514A screen and alphanumeric (dialogue) is displayed on a VGA monitor.

The IBM graphics display is capable of 1024 x 768 resolution and can display up to 256 colours at one time. The 8514A display is available only for IBM's Model 50, 60, and 80 PS/2s.

Price for TGRAF-07 (Tektronix 4107 emulation for asynchronous environments) is $1803, and the price for Grafpoint's TGRAF-15 (Tektronix 4115 emulation for asynchronous environments is $3835. The price for TNET-07 and TNET-15 (Tektronix emulation for networking environments) is $1803 and $3835 respectively.

Dimension Graphics offers Tektronix graphics terminal emulation software for the IBM PC, XT, AT, PC clones, Macintosh II, and workstations in asynchronous and networking environments. Ph (02) 929 5855.

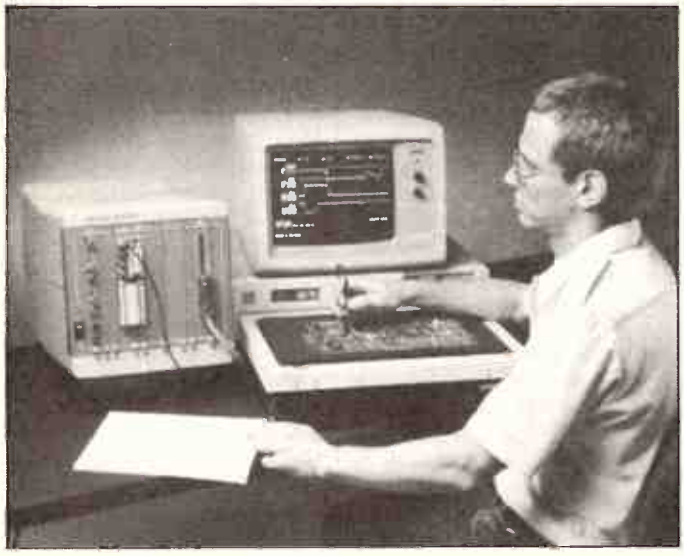
READER INFO No. 193

Optoelectronic Devices

ROHM has just released a number of new products extending their already wide range of optoelectronic devices such us, the SLM23 High Luminance Surface Mounted LED's with Lens ROYG. SLA590/5 5mm Red High Luminance Reflector type (300-3000 mod). LA2216R 57mm high, 7 segment displays. SIM-22ST Infrared LED, and small profile, low power, wide angle.

READER INFO No. 194

World Radio History



Waveform Digitizers

LeCroy Corporation has created a high performance line of automated single channel, waveform digitizers, called the Century Series. The single channel configuration is claimed to provide the industry's best price/performance ratio for high speed waveform measurement and alalysis instrumentation.

Century Series System hardware has been designed to maximise user benefits compared to analogue oscilloscopes and include accurate measurements, extended memory-length waveform recording, both pre- and post-trigger wareform recording, high resolution transient capture, digital signal processing and analysis, and total programmability.

For more information, contact ETP Oxford. (02) 853 5122.

READER INFO No. 195

Two New 100-MHz Analog Oscilloscopes

Philips is introducing two 100-MHz analogue oscilloscopes. Each of the dual-channel, dual-timebase instruments has an integral microcontroller that makes it easy to use (with, for example, an Autoset key), and ensures accurate, error-free measurements. Philips say that new New production techniques have simplified construction and reduced prices, and also make the instruments easy to service and maintain. An IEEE-488 interface allows the PM3065 and PM3070 to be incorporated into automatic test systems, and enables automatic calibration. The basic model is the PM3065; the PM3070 includes a range of cursor control. These instruments are offered alongside Philips' existing PM3050 and PM3055 analogue scopes (which are simultaneously being upgraded from 50 to 60-MHz with no increase in cost).

READER INFO No. 196

Extra Fast Recovery Rectifiers

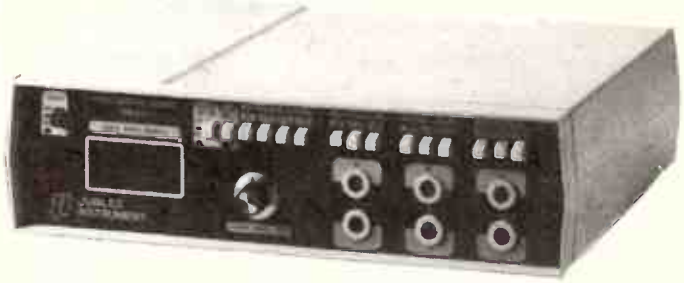
TRW Optoelectronics has just released two new series of extra fast recovery rectifiers.

The first, the DSR3000/DSR5000 series, is an axial lead EFRR (extra fast recovery rectifier) which exhibits the fastest trr available. This speed coupled with low leakages and low VF. These devices are hard glass sealed for high reliability. The DSR3000/DSR5000 is ideally suited for military programs as well as commercial applications and are also screened to equivalent per JANTX or JANTXV levels upon request.

The second, the HCR3400/HCR31000 series of surface mount EFRR also exhibit the fastest trr available, with low leakage and low VF. These devices are hermetically sealed in a miniature custom surface mount leadless chip carrier, this construction provides for easy handling and mounting, while being rugged enough for medical, military or commercial applications.

For further information, please contact: Total Electronics, 9 Harker Street, Burwood Victoria 3125. Tel: (03) 288-4044.

READER INFO No. 197



Power Waveform Monitor

Power Waveform Monitor is a new instrument dedicated to waveform measurement in the field of power electronics. It enables the general Oscilloscope to do the measurement functions of powerscope with much lower cost and high safety. It is a compact portable instrument providing one phase meter and three photo-isolated differential amplifiers.

Each amplifier can accommodate directly a high voltage differential input up to 1000 volt DC, and its sensitivity can extend right down to 400 millivolt. Not only the input range large, the common mode voltage is also large. At 1/20 attenuation, a common signal to both input of each amplifier can be up to 220 volts rms.

The amplifier bandwidth of 2.15 megahetz with 150 nanoseconds rise time is adequate for the fastest switching or commutating circuits in SCR's, thyristor or transistor supplies for accurate dv/dt measurements.

For phase measurement, the power waveform monitor send the modulation signal to the Z-axis input of Oscilloscopes, and then display two bright-up markers, reference marker and phase marker, on the screen of Oscilloscopes. The phase angle between the reference marker and phase marker is read out digitally in 1 degree step from 1 degree to 360 degrees. The phase marker is continually controlled by a knob and the zero reference can be selected by push button switches. This enables rapid comparison to be made of waveforms of two or three phase supplies to detect.

READER INFO No. 198

World Radio History

32 Channel Analysing Recorder

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

It can measure up to 2 channels using its large memory of 10 Mbytes and is widely used in laboratories and equipment/machine testing plants. This recorder digitalises the measuring field of conventional multi-analogue waveform measuring instruments such as electromagnetic oscillographs and recorders, thereby enhancing processing versatility. In addition, in multi-channel measurement, this recorder is used for the measurement of a wide range of physical quantities, and can integrate various input amplifiers according to applications so that no external signal conditioner is required to achieve compact construction.

For more information contact Parameters (02) 88 88 777.

READER INFO No. 199

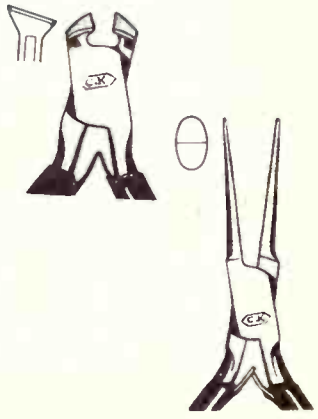
Securitime

Techforce Sales, a division of RCS Design, has released Securitime, a device which will allow companies to check the attendance of staff and all incomings and outgoings.

Securitime is based on a bar code reader combined with a Psion organiser and retails at $990.

READER INFO No. 200

Tools



CK Tools of West Germany has released a set of precision pliers and cutters for use in the electronics industry.

The new tools feature double leaf springs for controlled action, induction hardened cutting edges for soft and hard wires and four different levels on cutting edges to meet all demands.

For more information contact Electratool (03) 848 1045.

READER INFO No. 201

Something Fishy

Keen Irish anglers will soon be able to plug into a computer service which will give full information on how Irish rivers and lakes are fishing, the most effective baits, how recent catches have been and what the weather conditions are likely to be.

Called AIS, Angling Information Service, the system has been developed by Dr Kenneth Whelan of the Central Fisheries Board, who set out to develop a computerised and continuously updated service for fishermen in Ireland and abroad,

The scheme is being part grant aided under an EEC programme for the development of information technology and will be developed by a private compant, SUS Research Limited, in association with the Central Fisheries Board and the Department of Computer Science, Trinity College, Dublin.

World Class Marine Transceiver

The M-700AUS, a 49 channel HF (high frequency) SSB/AM marine transceiver produced specifically for Australian requirements, can transmit and receive on any authorised marine channel from 2 to 23 MHz with up to 150 watts output (selectable at 20, 60 or 150 watts to suit conditions) from a standard 12 Vdc power circuit.

Ideally suited for small ships, the M-700AUS can also be programmed to receive on any frequency from 1.6 to 24 MHz, providing access access to useful services like weather-fax (weather chart fascimile transmissions on 5100 kHz), news broadcasts and international (UTC) time and Pacific area weather broadcasts (5000, 10000 and 15000 kHz). Ph (008) 33 8915.

READER INFO No. 202

World Radio History

Tandy 1400LT Review

Without doubt, journalists are partisan when it comes to laptop computers. For the kind of work we do, the laptop is made to measure. Even admitting to this bias, however, the new generation of laptops are impressive devices, conceding almost nothing to their bigger cousins except price. Screens are brighter than they have ever been, graphics are quiet easily done, keyboards are no better or worse than any other, speed and compatibility assured. As I say, a journalist's dream machine.

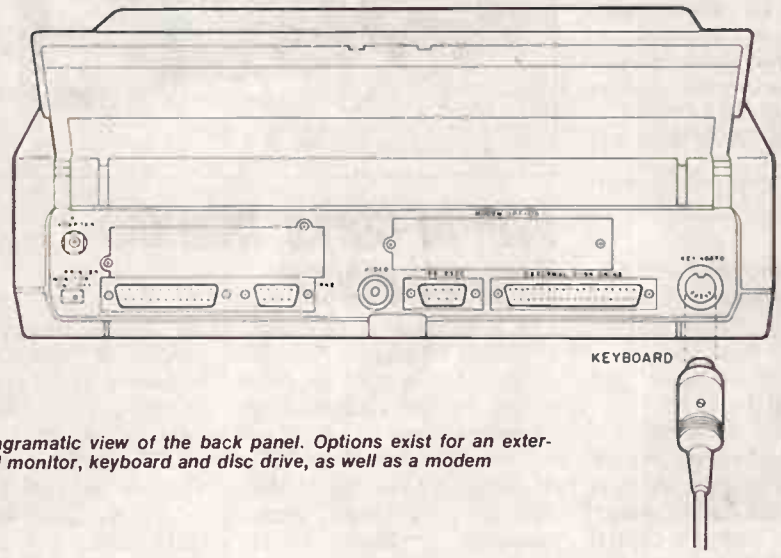
Typical of the new breed is the Tandy 1400LT. Tandy, of course, was the company that started the laptop revolution with the T100, a LCD screened, Z80 based 8K machine with its own peculiar operating system and something that pretended to be a word processor. A few years down the track, and it's clear Tandy has come a long way. The first thing you notice is the screen; a supertwisted blue LCD display with 25 lines and 80 columns in text mode. A conventional LCD display is good for only one angle of viewing. If you move your head too much, the letters disappear. The supertwisted display's viewing angle is such that two or three people can quite easily read the screen at the same time. It's also bright, so the ambient lighting conditions are no longer as important as they were. It's as good as a conventional video screen.

The keyboard is pleasant to use, with a nice positive tactile feel. It's laid out in typical IBM fashion with the function keys across the top, and the usual selection down both sides. The only concession to space it the fact that there is no keypad, so the numbers are doubled up on the letter keys in the right hand side of the keyboard. To access them, one needs to operate the Function and Delete keys together to get into 'Num lock' condition.

Under the keyboard, Tandy have managed to squeeze in 4.77/7.16 MHz, 16 bit V20 processor surrounded by 768 k of system RAM and two 3.5 inch floppies. It runs under MSDOS V 3.2 and the Phoenix BIOS V 2.51. There is also on board circuitry for a serial printer, colour graphics output and an RS232 port. If you are really serious, there is support for a variety of options which fit into cards that slide into panels on the back. For instance, an RGB monitor, external keyboard, an external 5.25 inch drive, an 8087 maths copressor, or a modem.

Tandy claims a high degree of compatibility with the IBM standard, and on the face of it, I found nothing to disuade me from that view; it ran everything I flung at it. The only thing I can find to take issue with is the price, which at $3995 is far too high. Obviously, there is a perception among the manufacturers that the laptop market will bear a price two to three times higher than the regular PC market. The fruit of that policy is a much smaller market that would otherwise be the case. In the case of the 1400LT that really is a pity, because it deserves to be widely owned.

Jon Fairall

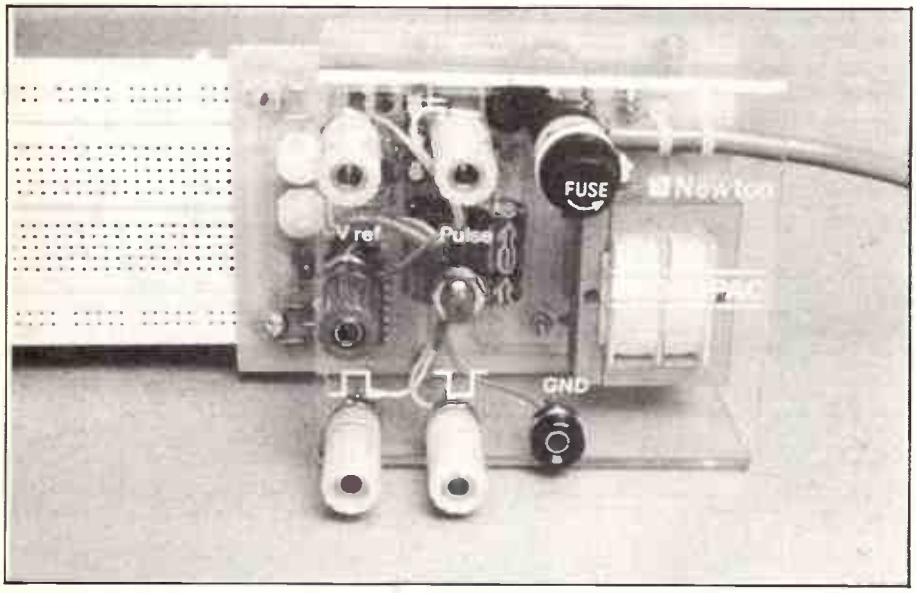


Diagramatic view of the back panel. Options exist for an external monitor, keyboard and disc drive, as well as a modem

World Radio History

ETI-187 PROTOPAC

— A Low Cost Analogue/Digital Protoboard System



THE DEVELOPMENT AND testing of electronic circuits is usually a costly and time consuming business. Firstly, the system needs to be prototyped in one way or another, power supplies connected and test signals applied. Wires dangle around the test bench and connections to the circuit are often far from ideal. In order to simplify the prototyping stage of the design process this low cost protoboard system was developed.

Primarily the project was conceived as a training aid that could help those new to electronics develop the skills required to design and implement both analogue and digital circuits. Since the cost of a development lab is so high it was thought that more may be convinced to try their hand if an economic alternative was available. What better way to do this than constructing your own system, learning in the process, and getting a versatile piece of lab equipment in the end.

Initially the system specifications were developed in consultation with staff members of the electronic engineering section of the School of Information Sciences and Engineering, Canberra College of Advanced Education, and the Advanced Technology and Engineering Centre (ATEC). Their aim was to provide final year engineering students with a low cost system which could be taken home to allow them to develop circuits in their own time.

This meant that the system had to be very versatile and provide facilities for both analogue and digital design. In the end the following features were decided upon:

- — mains operation
- — +5 Volt power supply
- — +12 Volt power supply
- — −12 Volt power supply
- — Variable reference voltage −11 to +11 Volts
- — variable frequency clock with two phase output (180° apart) variable over 2.5 decades
- — debounced pulser providing
  a) normally high output
  b) normally low output
- — +5 or +12 volt operating levels for the clock and pulser, link selectable.
- — power on LED indication

Design Philosophy

The aim of this project was to provide the greatest number of features for the lowest cost. In order to comply with this the construction shown in Figure 1 was chosen. This is a departure from the normal prototyping system in that the electronics is not housed in a box underneath the protoboard. The greatest advantage of this arrangement is that the +5, +12, −12 and ground connections can be made directly from the pc board to the protoboard. This saves the user having to wire power to the board every time it is used, and saves the cost of four extra connectors. A clear perspex cover was developed to house the electronics and hold the connectors. This is available as part of the kit associated with this project.

Although this project was developed for the student or hobbyist, it is such a convenient way to prototype that it has come into general use in our development labs over and above the more expensive "boxed" systems.

Construction

Using the component overlay given, begin with the five links. You will have to decide which level will be needed for the clock and pulser. If you use TTL (5 V), then configure the system for +5 volts by placing link 1 as shown. The long link beside the IC should be insulated to prevent any chance of shorting to the connector wires. Next insert the resistors, then trim-

PARTS LIST — PROTOPAC

Resistors	All ¼ Watt, 2%
R1	680
R2	2.2K
R3,R4	1K
R5,R6	510
R7,R8	10K
RV1	5L trimpot
RV2	200K trimpot
Capacitors	
C1, C2	470µF 25 Volt electrolitic
C3, C4, C8, C10	0.1µF monolithic chip
C5,C6,C7	10µ 16 Volt electrolltic
C9	1nF greencap
Semiconductors	
D1	Red LED
DB1	Bridge rectifier
IC1	µA7812
IC2	µA7912
IC3	µA7805
IC4	4049, Hex CMOS inverter
Q1, Q3, Q4	BC549 or equivalent
Q2	BC557 or equivalent

Miscellaneous

Perspex cover, 500mA fuse, fuse holder, pushbutton switch, power cable, printed circuit board, 240VAC protective cover, nuts and bolts, 5 banana socket terminal posts, heat shrink tubing or fuse boot, breadboard, cable ties, transformer, 4mm socket, piece of ribbon cable, solder 1µg.

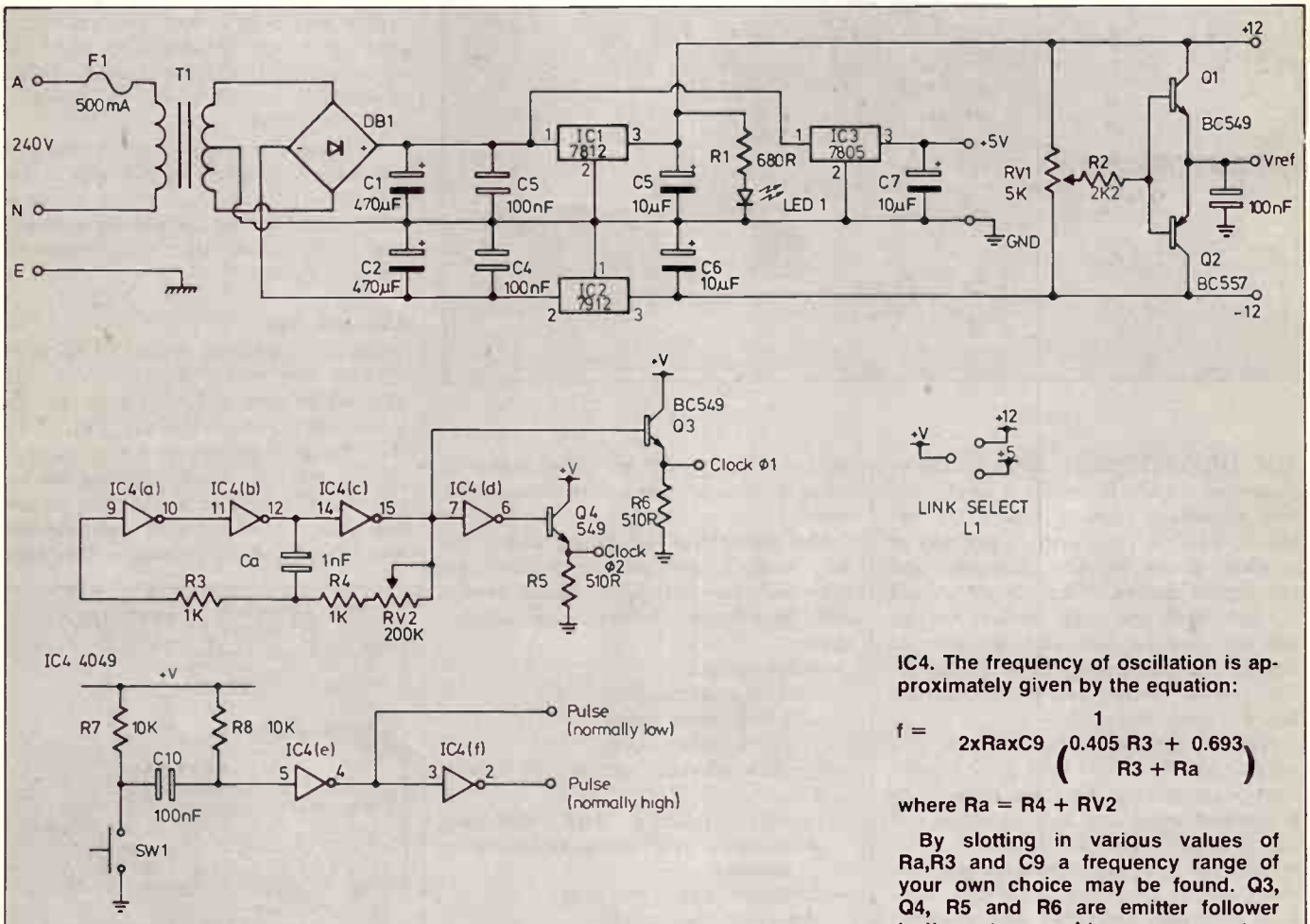
World Radio History

pots, IC, bridge, capacitors, regulators and transistors. This method works on component height above board, allowing each level to be held in place whilst soldering. The IC is CMOS, so take the usual precautions of not charging yourself up before handling it. If you use different transistors to those specified, ensure the E, B and C are as shown. Peel back and strip both ends of the ribbon cable. Insert one end into the eight points on the board. The board is labelled, with P for pulse normally LOW. P for pulse normally HIGH and d01, 02 are the two clock phases. Use four pieces of stiff wire for the power rail connections, and trim them off to about 6mm. These will push into the four power busses on the breadboard. Solder the transformer in and trim the 240 volt pins back.

The next section deals with the 240 volt wiring, so TAKE CARE.

Make sure there are no loose ends or exposed wires. Solder the neutral (blue) to the transformer connection point as shown and trim back. The power cable can be attached to the board using two cable ties. Solder a length of brown power cable to the other connection point. Now liberally coat the entire 240 V section with Silastic Adhesive Sealant (available at hardware stores). Place the protective cover over the sealant and screw down. If sealant does not ooze out everywhere, you have not used enough! The earth lug can be attached to one of the screws, and the earth wire (green) connected. Put the board aside and assemble the cover.

The red binding post should be used for Vref. Insert the fuseholder, switch and other connectors. Now back to the board. Wire each of the eight ribbon wires to their respective connectors, and switch, following the diagram. Slide a piece of heat shrink tubing, or a rubber fuse boot



HOW IT WORKS — PROTOPAC

The mains 240 volts is connected to the transformer with the active through fuse, F1. The output of the transformer is fed to a standard bridge rectifier circuit and capacitors C1 and C2 provide ripple filtering. C3 and C4 are high frequency bypass capacitors (chip monolithic types) to reduce high frequency components entering the regulators. IC1 is a three pin 12 volt regulator, IC2 negative 12 volt and IC3 5 volts. C5, C6, and C7 give additional filtering. The power on LED is driven via the 12 volt supply through current limiting resistor R1.

The variable power supply is made up of RV1, R2, Q1, Q2 and C8. RV1 provides the initial reference voltage and is then buffered through the simple push-pull arrangement which follows. C8 gives additional high frequency filtering.

The clock has been constructed from three cross coupled inverters of IC4. The frequency of oscillation is approximately given by the equation:

$$f = \frac{1}{2 \times Ra \times C9 \left(\frac{0.405\,R3 + 0.693}{R3 + Ra} \right)}$$

where Ra = R4 + RV2

By slotting in various values of Ra,R3 and C9 a frequency range of your own choice may be found. Q3, Q4, R5 and R6 are emitter follower buffers to provide greater output sourcing current.

The pulser is formed with R7, C10, R8, IC4(e) and SW1. The time constant formed by R7-C10, and R8-C10 give charge and discharge times that smooth the voltage applied to the input of OIC4(e) as the switch bounces until the switching threshold of the inverter has been reached. The time constants give an output pulse width of approximately 1ms. IC4(f) inverts the output of IC4(e) to provide a normally high output.

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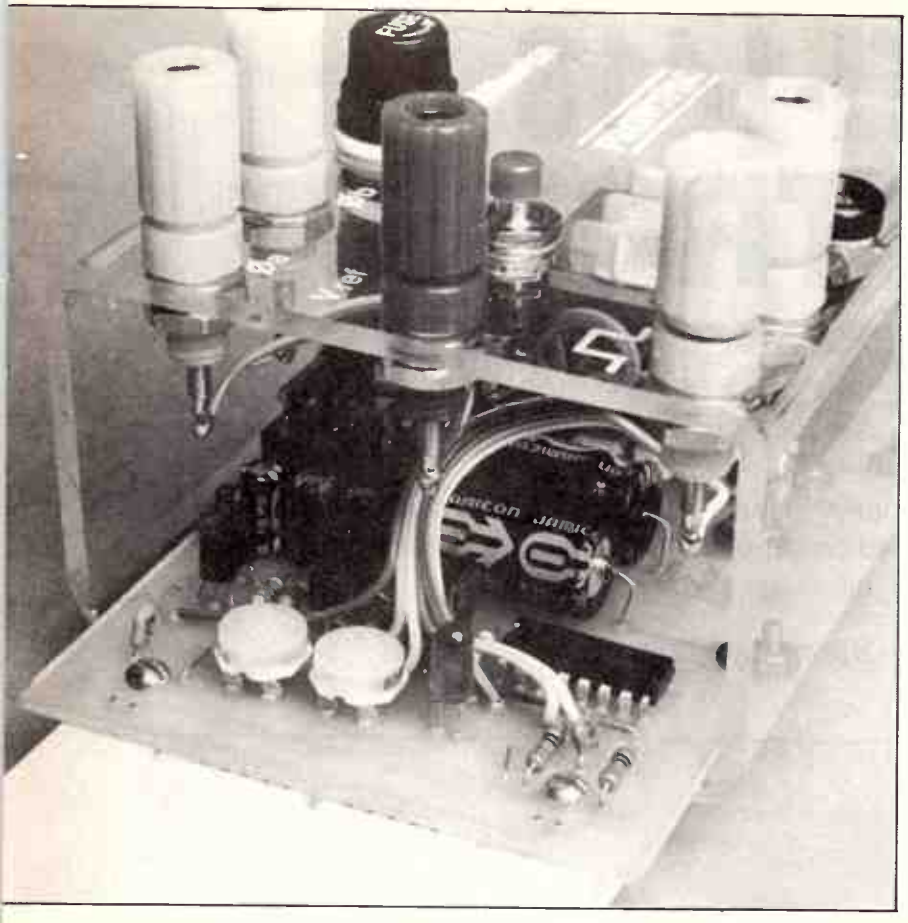
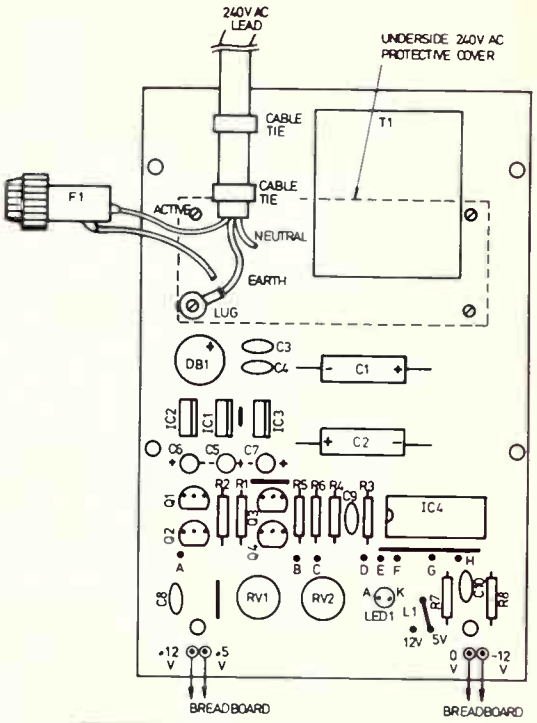




TERMINAL KEY
A — V REFERENCE TERMINAL
B — CLOCK ΦA "
C — CLOCK ΦB "
D — GND "
E — PULSER SWITCH TERMINALS
G — PULSE NORMALLY HIGH TERMINAL
H — PULSE NORMALLY LOW TERMINAL

over the two brown active wires and solder them to the fuse holder. Push the insulator up over the connections and heat or cable-tie in place. Position the board inside the cover and screw the two together. Finally push the Protopac into the breadboard and screw in place.

Testing

Once the circuit has been constructed, give it a careful review. Look for solder bridges and bad joints on the non component side, and loose wires or suspect connection on the component side. Pay strict and careful attention to ALL associated mains wiring, which is potentially lethal.

Examine the orientation of all the semiconductors making sure that the regulators, CMOS IC, transistors, LED and bridge rectifier are all inserted the correct way (as per the overlay diagram).

Make sure the fuse has been inserted and then turn the power on. The LED should then light up. If it doesn't — don't worry, turn the power off and get your multi-meter ready. Measure the voltage across the +12 rail and the ground rail. If it reads +12 volts and the LED still does not light then it is probably placed the wrong way around, so reverse it. If there is no voltage present check that the positive terminal of the bridge rectifier is in the correct position.

Once the power rails have been checked the variable reference voltage can be tested. Simply connect a multimeter to the output terminal and vary the trim potentiometer with a screwdriver. If the output does not vary then check that the transistors are inserted the correct way around.

The clock and pulser sections all run off the one IC. If they are both not operating then IC4 is probably to blame, so check its orientation. If the output from the pulser is OK but the clock output is not running look into the circuitry associated with the output buffers (Q4, Q3, R5 and R6).

Using the system

Using the system is easy. Plug it into the mains socket and power is applied to the board. Note that the power rails need to have wire links placed halfway down the board if you wish to distribute power to the second half.

Electronic components such as integrated circuits, resistors, capacitors, etc can now be plugged directly into the board. Connections between components are made with small pieces of solid core copper insulated wire sometimes called Bell wire to Telephone wire). The best place to get this is, you guessed it, multicore telephone cable. The rest is up to you. Happy developing! ●

WHERE TO BUY THE PROTOBOARD SYSTEM

A complete kit of parts for this project is available only through:

Applied Audio Consultants,
GPO Box 733
CANBERRA CITY 2601
Ph: (062) 43 3345
Fax: (062) 47 0985
KIT PRICE $79
(plus $5 postage and packaging expenses)

The kit comes complete with tinned printed circuit board, breadboard, pre-drilled and screen printed perspex cover, and all components necessary to construct the project. A full set of instructions is also supplied.

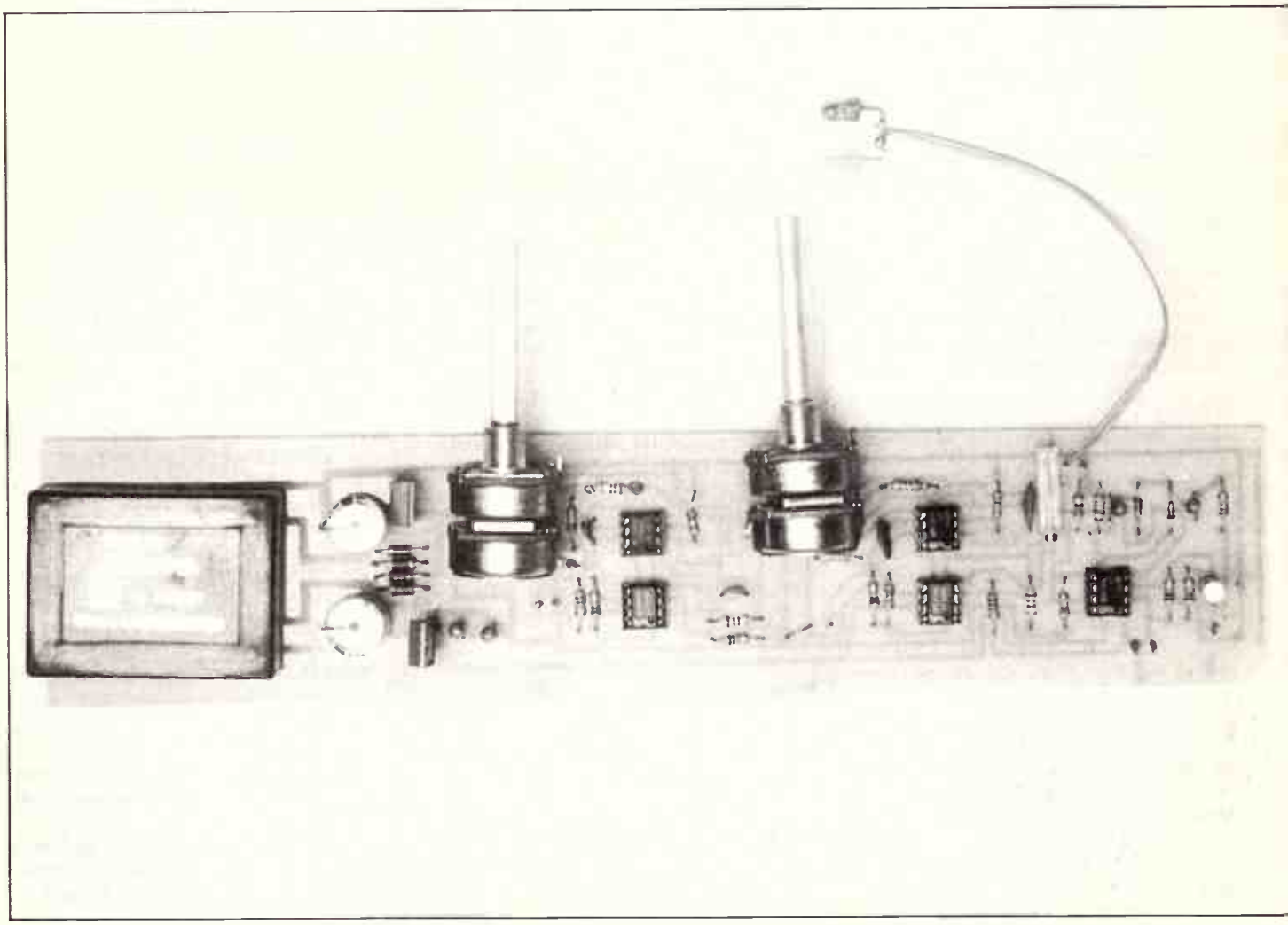
NOTE: The printed circuit board and design are copyright and the property of Applied Audio Consultants and may not be copied or used without permission.

World Radio History

ETI-1413 ELECTRONIC CROSSOVER

In the Past there have been many Circuits for Audio Electronic crossovers but the one presented here is based on an unusual circuit, is simple, versatile and above all easy to build and use.

Simon Leadley



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ELECTRONIC CROSSOVERS are used to eliminate the need for the inefficient and heavy units that are used in conventional speaker crossovers. They are used to split the audio spectrum into 2,3 and sometimes 4 ranges, which are then fed to a separate amplifier for each speaker. The advantages lie in the fact that the drive to each of the speakers can be adjusted so that the different sensitivities of the drivers match. In an ordinary passive crossover this matching is done by attenuating the drive to the speakers with large wattage resistors which waste power. The passive crossover must be designed with the particular drivers in mind so that it will work properly. Putting a particular passive crossover in a speaker system for which it wasn't designed will result in poor sonic quality unless the drivers are very similar. With an electronic crossover, however, both the crossover frequency and the level of drive to each speaker can be varied, allowing it to compensate for a great range of driver specifications.

Construction:

The whole unit is built on a single board that can be configured 2 ways. As a mono 3-way crossover or as a stereo 2-way. Begin by deciding which version you wish to build and then select the values from the table for the crossover frequency sweep that you desire. Check the circuit board for shorts between tracks and then place all the passive components (take care to orientate the capacitors as in the diagram) Next I suggest that you use IC sockets for all the op amps, it will make testing easier and replacement in case of component failure quicker in the future. (the extra cost is well worth it!) Then place the power supply components, taking care to put the regulators in the correct spot. The power transformer also fits on the board so it may be necessary to drill out the mounting holes to suit. The pots for the frequency adjustment also fit onto the board. Solder short lengths of wire to the six terminals of the pot and then pass these through the board at the correct points and solder them to the board. The two LEDS are soldered together with the Anodes of each connected to the Cathodes of the other. Two flying leads are then taken to the board. (Note: the anode is the longer leg of the LED).

TESTING:

I found it best if the IC's wern't fitted at this point so that you can test if the power supply is functioning correctly. Connect 240v to the transformer input and then use a multimeter to see if the power rails are present at the correct pins of each of the IC sockets. If not, power down (remove the 240 V from the wall socket) and check that the diodes and the regulators are properly orientated. If all is well, power down and insert the IC's (check orientation!) Power up again and feed an audio signal into the input. Using an amplifier you should hear filtered output from each of the outputs. Turning the pots on each channel should sweep the frequency up and down. If not power down and check all connections. Because the two filter blocks are identical, at least one should operate so you can compare them.

Setting the LED threshold will depend on the usage that you have for the unit. Besides providing power on indication, the LED circuitry can be set to indicate that a predetermined input level limit has been reached. In a PA system this might be the 0dB level while in a home Hi-Fi it may indicate onset of clipping in the preamplifier. The multi-turn trim pot is adjusted to give the required point.

Packaging:

If you intend using the unit with a PA system you will probably want to mount the unit into a 19" rack mounting case. The frequency adjust pot will be best mounted on the rear of the unit as they will usually be set once and forgotton, also it is best that they are mounted far from prying hands. The level controls are best mounted on the front panel so that the system can easily be tuned in different rooms. Note that the Level control pots are connected to the outputs with flying leads so that the unit has flexibility in construction.

If, on the other hand the unit is being used with a home Hi-Fi unit then the construction can be more modest. A small instrument case is ideal, since the signal levels are quite high and a fully shielded case therefore unnecessary. Mount the power switch and power cord away from input circuitry to minimise hum pickup.

Filter values

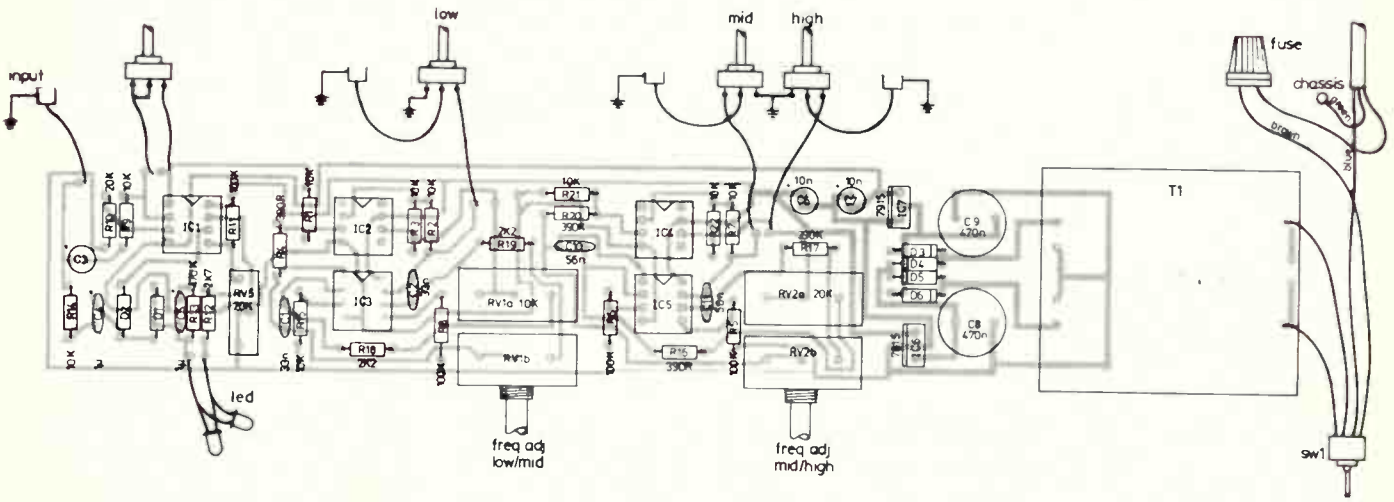
To set the cross-over frequencies, you need to select values for the resistors and capacitors that surround the filter elements. Around IC3a, for instance, we need values for RV1a, R18 and C1. To do this we apply the formula:

$$F = \frac{1}{2 \times 3.14 \times C1 \times (RV1a + R18)}$$

Assuming F for the low to Medium transition is 400 Hz, and we set C1=56n, we discover that (RV1a + R18) equals:

$$\frac{1}{2 \times 3.14 \times 56 \times 10^{-9} \times 400} = 12062 \text{ R}$$

which can satisfactorily be realised with a 10 k pot and a 2.2 k resistor in series.



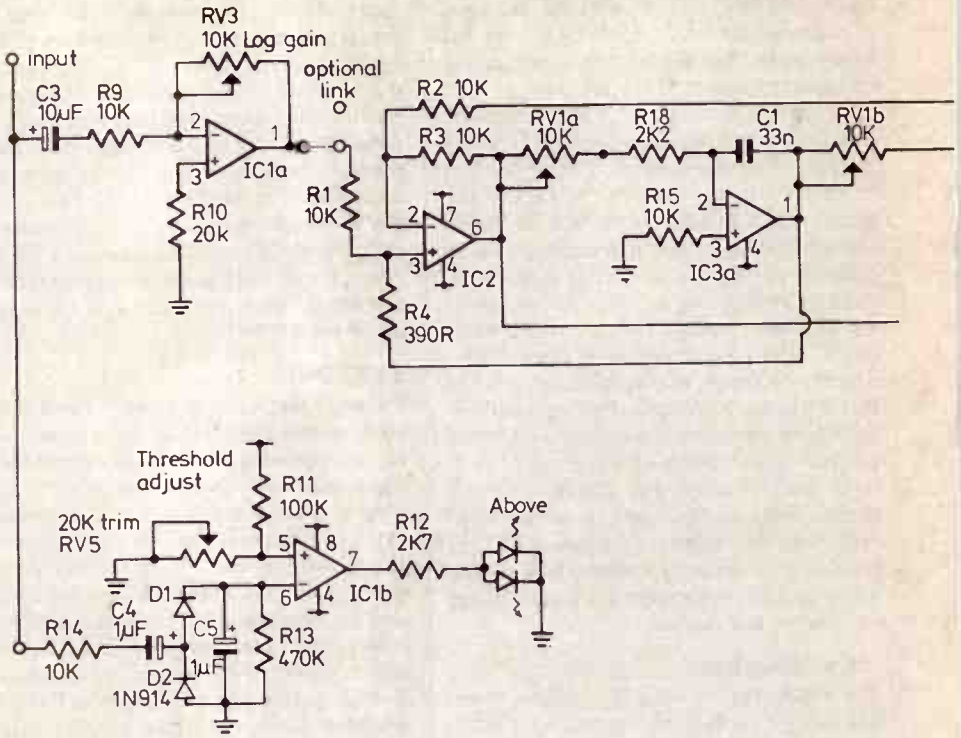
World Radio History

How It Works ETI-1413

The basic design is based on the State Variable Filter technique. The filter used three op-amps (IC2, IC3a and IC3b) to provide high pass and low pass outputs. Centre frequency and Q are independently variable. The circuit is often termed a *Universal Active Filter*. By varying the RC networks (and simplifying the design by allowing C1=C2, C10=C11, & Ra=Rb) then the filter becomes easily turnable.

The input buffer (IC1a) simply provides some gain to offset the loss in filters. If the gain is insufficient merely, change the value of RV3. The threshold indicator (IC1b) is simply a comparator that shows when the rectified input voltage exceeds a certain value. The 1uF cap across the diodes (C5) provides a hold function so that peaks can be detected. The trim pot allows the threshold level to be adjusted over a wide range of values.

To calculate the values for the Cross-over Freq use the above formulas or refer to the values that we have chosen.



The components around IC3b have the same values. Using the components in the circuit gives cross-overs at about 400 Hz and 7 kHz, which seems to be quite satisfactory. However, do not be afraid to select different values to suit your set up, or indeed, the type of music you like to listen too.

In the event that you decide to configure the network as two two-way cross-overs, you will need to make sure that both speakers cross over at the same frequency, so all the components will have the same values. In this configuration, the input buffer and the over range LED circuit can be removed.

ETI-1413 — PARTS LIST

Resistors — all resistors ¼ watt, 1% metal film unless otherwise specified. All values in ohms.

R1, 2, 3, 7, 14, 15, 21	10k
R4, 16, 17, 10	390K
R6, 5, 8, 11	100R
R10	20K
R12,	2K7820R
R13	470K
R18	2K2
R19	2K2

Semiconductors

IC2, 4	TL071
IC3, 5, 1	TL081
IC6	7815
IC7	7915
D1, 2, 3, 4, 5	IN4001
D6	1N4004

Capacitors

C1	33n
C2	33n
C3	10µ
C4	1µ
C5	1µ
C6	10µ
C7	10µ
C8	470µ
C9	470µ
C10	56n
C11	56n

Potentiometers

RV1	10k dual
RV2	20k dual
RV3	10k log
RV4, 6, 7	10k

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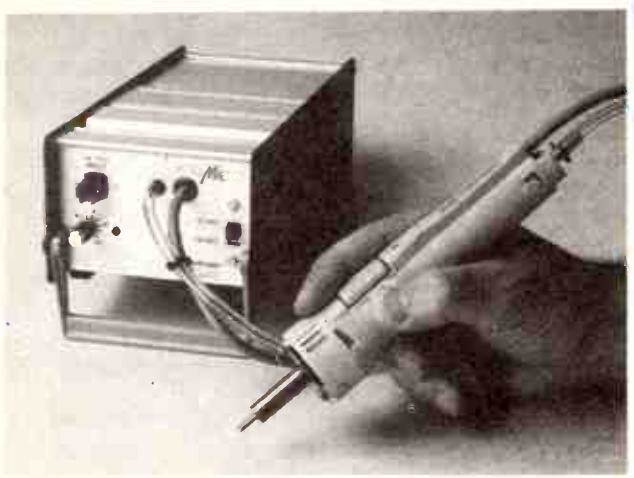

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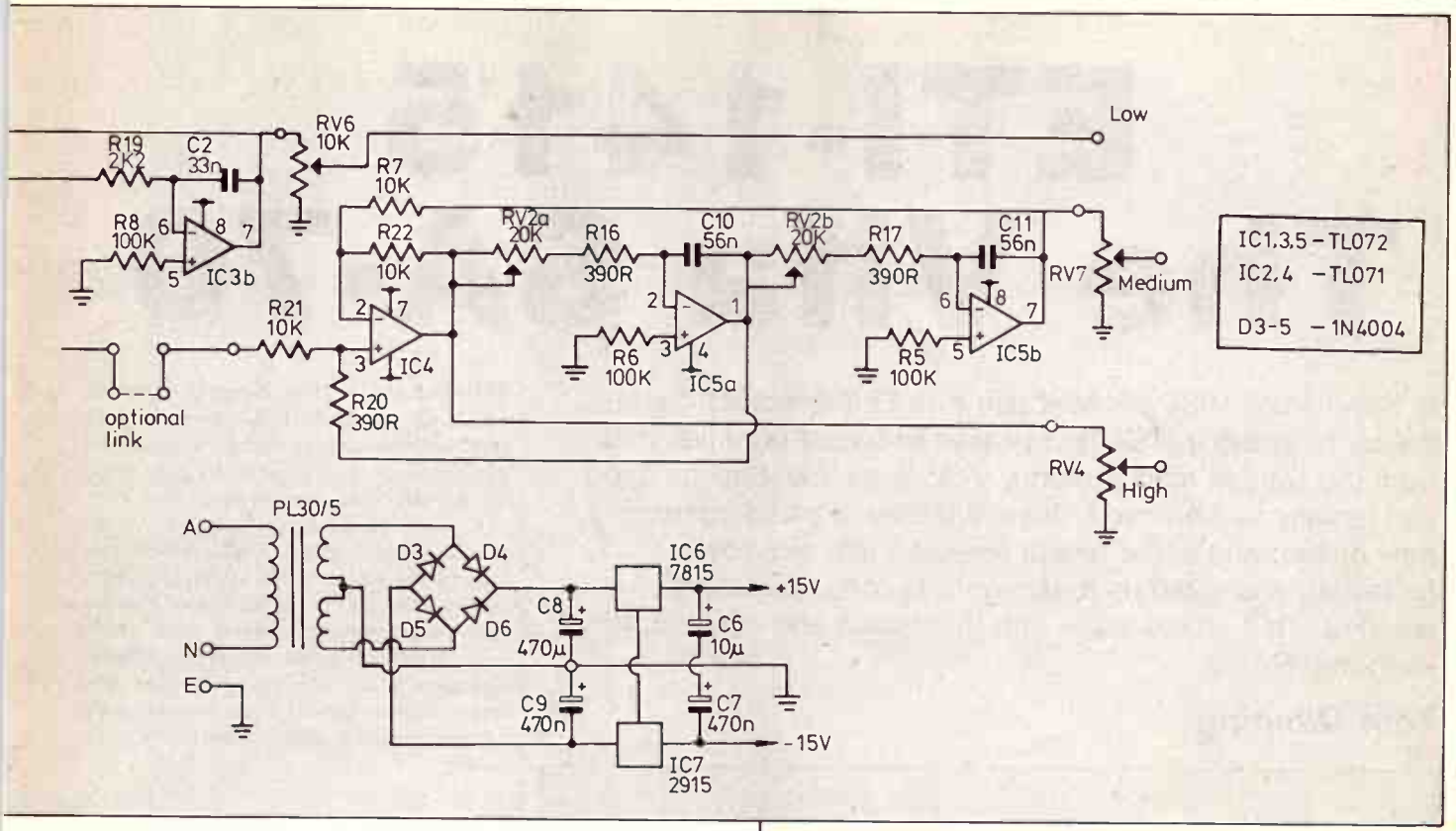
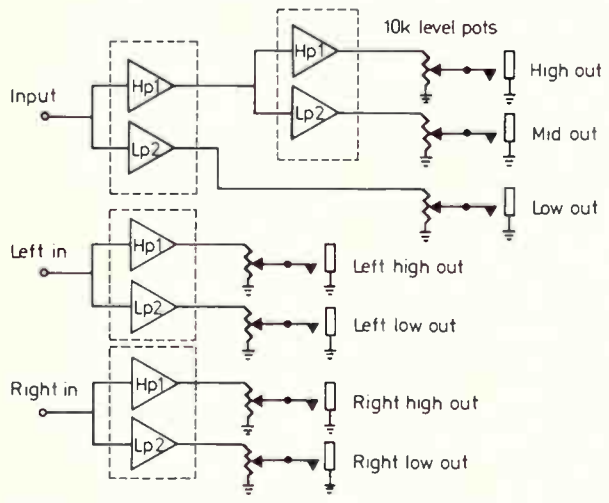
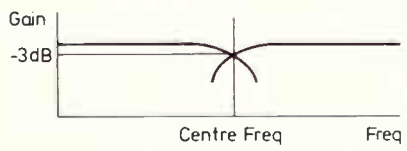




The unit can be configured in two basic ways, to give either a 3 ways or two 2-way systems.



The filters roll off about the centre frequency in the mains shown above.

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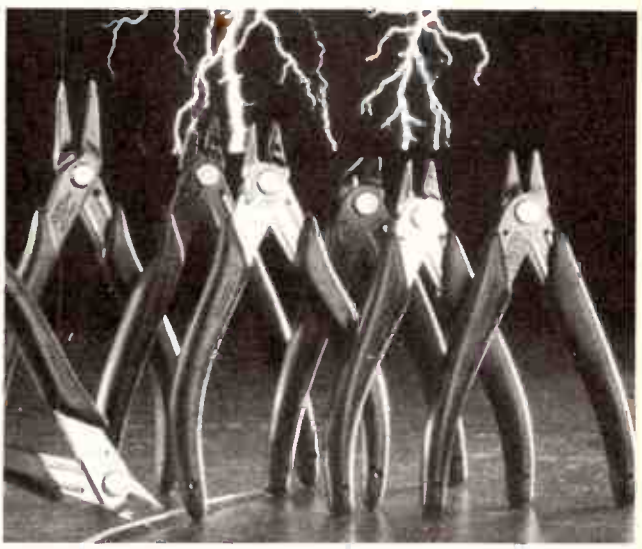

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READER INFO No. 18

World Radio History

ETI-1415
The Vifa SA-70

In September 1986 the Melbourne Hi-Fi distributors, Scan Audio, released the SA-60 speaker kit based on drive units from the Danish manufacturer, Vifa. Since most things good can usually be improved, the availability of some interesting new drivers and some recent research into crossover behaviour prompted us to design a second generation speaker. This article deals with the design and construction of such, the SA-70.

Tom Manning

TO MAKE SUCH a change truly worthwhile, we sought to make several significant improvements whilst keeping the modifications retrofittable so owners of old SA-60s could upgrade at minimal cost.

A word or two on kit speakers — imported systems attract several unfortunate cost hiking factors such as freight, distribution, duty and of course labour charges. By using imported drivers and locally sourced cabinetry and crossovers, substantial savings are available compared with imported speakers of equal quality, many of which employ identical or similar drive units.

Driver Considerations

A new woofer from Vifa sparked the birth of the SA-70 — it's the C20-WG-09 8" driver with some interesting constructional features. A bass-midrange unit must be capable of performing in the dome excursion at the tweeter's resonant frequency. This allows some flexibility with both crossover slope and frequency which would otherwise need to be higher than that which we have chosen.

Crossover Calculations

The wide bandwidth of both drivers allows some manouverability with crossover considerations, and after carefully measuring the impedance and frequency characteristics of both drivers, a second order function at 29 MHz was seen to be ideal.

This is low enough to avoid the erratic response of the woofer at frequencies above this, yet high enough to eliminate potential problems with operating the tweeter close to its natural resonance (17 MHz). In order to ensure that the voltage of both drivers would be quite a few dB down in these troublesome regions, we have used a second order (12 dB/octave) network for both the high and low pass sections. Note the out of phase connections on the drivers — this is done because each reactive component contributes 45 degrees of phase error, therefore the treble leads, and the bass lags the input signal by 90 degrees. The

World Radio History

cumulative effect is a 180 degree phase cancellation at the crossover point — reversing the connections on one driver is the cure and theoretically a perfect response should result.

An examination of the data for any modern woofer will show a set of numbers which critically determine the cabinet volume and tuning for which it is most suited. These are:

1. *The free air resonance* (Fo), which is the frequency at which the moving system of the driver exhibits the maximum output for the minimum electrical signal.
2. *The total Q factor of the driver* (Qt), which is the quality factor at resonance and which indicates the combined effects of the driver's electrical and mechanical damping of the moving system at its free air resonance.
3. The VAS, which is the volume of air in litres needed to provide the same restoring force to the cone as does the suspension. Expressed more generally, an indication of the "springiness" of the suspension system.

In the case of the C20-WG-09, the high Q factor of .78 dictates that a sealed box must be used. Here, the enclosed air is acting as a "spring" on the cone, providing a high degree of mechanical damping, part of which would otherwise be provided electrically by a low Q driver more suited to a vented box. To reduce the total system Q (damping effect) to the ideal value of .8, a small amount of Dacron damping material is stuffed lightly inside the cabinet.

Construction

Only the most basic of tools is required to assemble these loudspeakers. You don't need special clamps or jigs and all timberwork has been precisely machined. You will need to use a soldering iron though, to connect the drivers to the crossover network.

On the other hand, if you are experienced in carpentry, you could make your own enclosures and purchase just the drivers and crossover networks; doing it this way you stand to save quite a bit of money. However this should be balanced against the high quality finish that these pre-cut enclosures will give. They are finished in a very good-looking synthetic black veneer which is a good match for most modern decors.

The baffleboard (on which the speakers are mounted) is also finished in a subdued grey vinyl.

Not supplied in the kit, but nevertheless essential to construction are: (1) a tube of PVA woodworking glue; and (2) a roll of

adhesive foam tape (eg. Engels No. 5 draught exclusion tape). The tape is needed to make airtight gaskets for mounting the drivers on the front baffle.

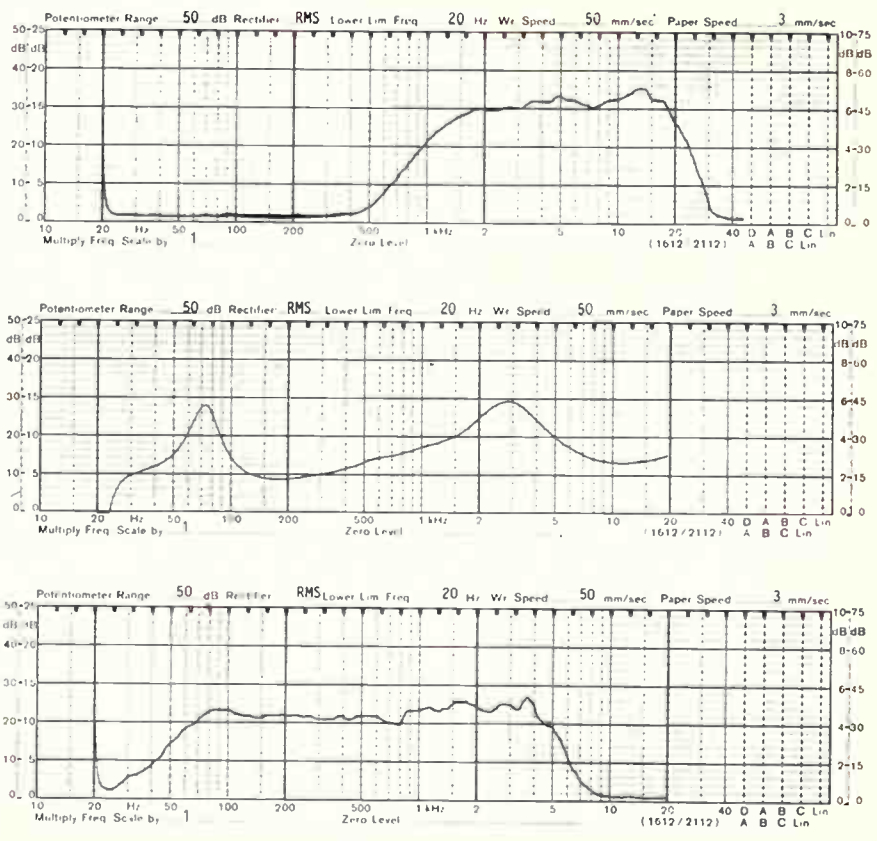
Begin by emptying the contents of the long flat box. This must be done very carefully because the top, sides and bottom of each enclosure are in a wraparound piece and held together only by the decorative veneer "hinges" which allow them to be folded. If you are not careful in handling the enclosure in this form you could tear the veneer and spoil the finished result.

You should also empty the box containing the individual drivers, the crossover networks and the other components, to check that all have been supplied and are in good condition.

Before starting assembly, it is wise to drill pilot holes for the self-tapping screws. This ensures that they penetrate in a straight line and also obviates the possibility of splitting the timber. The screws are supplied and all are the same size; a 2mm drill gives a suitable pilot hole. Use the drivers as a template when marking the holes, but take care to avoid any damage.

Recessed terminal blocks are mounted on the back panel. Each requires four mounting screws for which the pilot holes should also now be drilled.

With all the drilling completed, you can proceed with glueing the enclosures. The wraparound member actually folds around the back panel and has a machined rebate



World Radio History

to hold it in place. This gives a rigid structure, even before the glue sets.

The procedure is quite simple. Lay out the continuous side piece on a flat surface such as the floor or a large table. The three fold joints should be flexed as little as possible, as noted above. Then run a line of PVA glue into each of the V-cuts for the three fold joints and into the rebate channel.

The backpanel can now be fitted in to the channel of what will become the base panel. Make sure that the terminal block hole is at the bottom; ie, it corresponds to the join in the veneer which should also be at the bottom. Then it's a matter of carefully wrapping the sides around the back panel, making sure that no stress is placed on any of the three corner joints.

That done, the final corner is held together with strips of packaging tape. Don't worry if a little glue oozes out onto the veneer, it peels away from the plastic quite easily once it's dry.

Leave the assembly for at least 30 minutes to allow the glue to set and cure.

Each crossover is preassembled on a piece of chipboard, so that they can be glued in position on the bottom of the enclosures. This may as well be done now so that the glue can be drying at the same time as the back panel. Take a note of the connections for the respective terminals on the crossover: ie, input, bass and treble.

Meanwhile, the grills can be prepared. A framework is supplied over which the screen cloth must be stretched. As each side of the cloth is stretched and folded into position, it can be retained with staples.

When the grill cloths are fixed in place, you should trim off the excess. Be sure to uncover the grill mounting holes. There is one in each corner — they are 12mm in diameter. A special plastic clip is inserted into each, the mating half of each clip being mounted in the front panel of the enclosure. They can be inserted now with a gentle tap from a hammer.

Now that the cabinet has been sitting for half an hour or so, fit the terminal blocks and solder them to the crossovers. Dacron filling material has been supplied, enough to half-fill each cabinet. This can now be installed.

The front panel can now be fitted, rather more simply than the back panel. — it just slides into the rebated front of the box. Run a bead of glue around the perimeter of the box first, using a generous squirt of glue, because it has to give the front panel an airtight seal. Leave the whole enclosure for another half hour or so, to let all the glue set.

After the requisite drying time has passed, the drives can be mounted. Solder their terminals first, paying particular attention to polarity and making sure that you don't transpose the woofer and tweeter connections — if you make a mistake here you will ruin the tweeter.

Then it is a matter of fitting the grills onto the enclosures — just push them on — and you are finished. Connect them up to your amplifier, select your program and settle back to enjoy the sound. ●

MODEL:	VIFA SA-50	VIFA SA-70	VIFA SA-100	VIFA SA-130	VIFA SW-1
SYSTEM:	2-way bassreflex	2-way sealed	2-way bassreflex	3-way bassreflex	Stereo Subwoofer
WOOFER:	125 mm (5") VIFA C13WG-08-08	194 mm (8") VIFA C20WG-09-08	197 mm (8") VIFA P21WO-12-08	245 mm (10") VIFA P25WO-00-08	2 x 245 mm (10") VIFA P25WO-00-08
MIDRANGE:				75 mm textile dome VIFA D75MX-30-08	
TWEETER:	19 mm dome f.fl. VIFA D19TD-05-08	19 mm dome f.fl. VIFA D19TD-05-08	25 mm dome f.fl. VIFA D25TG-55-06	19 mm dome f.fl. VIFA D19TD-05-08	
RATED POWER:	50 watt Peak	70 watt Peak	100 watt Peak	130 watt Peak	130 watt Peak
IEC POWER:	30 watt RMS	50 watt RMS	70 watt RMS	90 watt RMS	80 watt RMS
SENSITIVITY (1W/1m):	87 dB	89 dB	91 dB	90 dB	85-88 dB*
FREQUENCY RESPONSE:	60-20,000 Hz	50-20,000 Hz	35-20,000 Hz	28-20,000 Hz	25-88 Hz
CROSS-OVER FREQ'CY:	3500 Hz	2800 Hz	2200 Hz	800 / 3000 Hz	100-150 Hz
SYSTEM RESONANCE:		78 Hz			33 Hz
TUNING REQUENCY:	68 Hz		48 Hz	35 Hz	48 Hz
IMPEDANCE:	8 ohms	8 ohms	8 ohms	8 ohms	8 ohms
INTERNAL VOLUME:	5.3 liters	21 liters	42 liters	60 liters	62 liters
DIMENSIONS (H x W x D):	26 x 17 x 19.5 cm	49 x 26 x 23.5 cm	67 x 29 x 29.5 cm	94 x 30 x 29.5 cm	30.5 x 60 x 41 cm
WEIGHT:	4 kgs	8 kgs	15 kgs	24 kgs	20 kgs
SUITING SPKR.STAND:		SAS-1	VIFA 6102		
PRICE EXCL. CABINETS	$ 319.00 pair	$ 379.00 pair	$ 629.00 pair	$ 929.00 pair	$ 449.00
PRICE INCL. CABINETS	$ 399.00 pair	$ 499.00 pair	$ 799.00 pair	$ 1199.00 pair	$ 699.00**

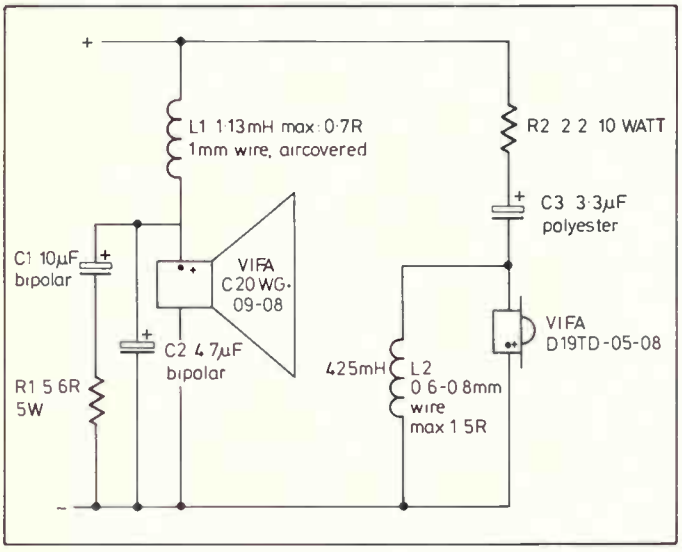
*depends on positioning
**fully built

World Radio History

VIFA SA-70

PRELIMINARY DATA: C20WG-09

NOMINAL IMPEDANCE	:	8 ohms
FREQUENCY RANGE	:	35-6000 Hz
FREE AIR RES.	:	39 Hz
CHAR. SENSITIVITY	:	90 dB/1W/1m
NOM . POWER	:	50 W (DIN 45.500)
MUSIC POWER	:	100 W (DIN 45.500)
VOICE COIL DIAM.	:	25 mm
VOICE COIL HEIGHT	:	12 mm
AIR GAB HEIGHT	:	6 mm
VOICE COIL RES.	:	5.5 ohms
EFF. CONE AREA	:	231 cm^2
MOVING MASS	:	15 g (incl.air)
FORCE FACTOR (B*l)	:	4.5 Tm
THIELE/SMALL PAR.	:	
Qm	:	3.9
Qe	:	1.0
Qt	:	.78
Vas	:	82 ltrs



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- User-Friendly Documentation

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EGA	16/64	640 x 350	Enhanced
EGA	16	320 x 200/640 x 200	Color/Enhanced
CGA	4	320 x 200/640 x 200	Color/Enhanced
Mono	4	640 x 350	Mono/Enhanced
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READER INFO No. 19

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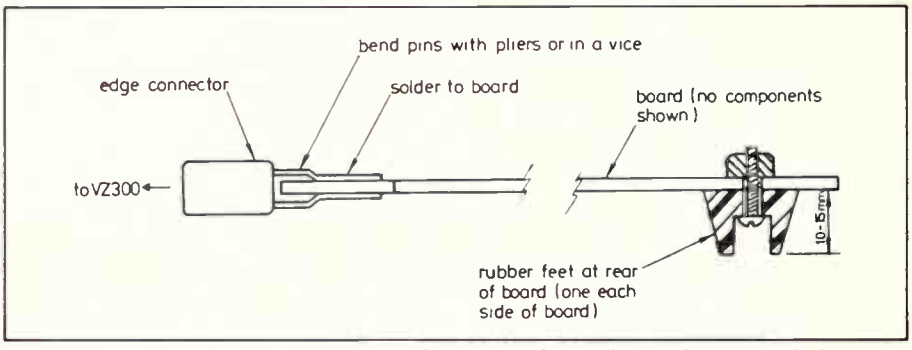
ETI-1611 EPROM programmer

This month part 2 continues with construction, testing and software for the programmer.

Herman Nacinovich

COULD YOU USE a low cost EPROM programmer that will program EPROMs in the popular 2764 to 27256 series? How about one that will also copy from one EPROM to another in seconds? And one which is fully software programmable to cater for EPROMs from different manufacturers, with different programming voltages? How about an EPROM programmer which can double as a memory expansion for a VZ3000 computer when it is not being used for programming EPROMs? Or, one which can load your favourite BASIC program directly from an EPROM into your VZ300 computer in a matter of seconds? This is it!



The bond plugs directly into the VZ300 expansion stat. The foot at right relelves mechanical stress on the connector at left.

Construction

Construction of this project is simplified by the fact that everything goes on a single board and there is no messing about with wires, switches and a box to put everything into. However the usual, if not more, care, should be exercised to ensure that everything is put in the right way around, particularly the IC's, diodes, transistors and electrolytic capacitors. The board uses double sided construction and boards as supplied by kit suppliers will (hopefully) have plated through holes. Although the number of parts on the board is not too great, there are lots of tracks on the board and many of these are very closely spaced. It is strongly recommended that the greatest care be taken in the first instance when examining the board to ensure that there are no bridges or breaks in the board pattern. Never assume that any board, whether you make it yourself or get it in a kit, is free of faults.

It is also important to be careful, when winding the ferrite core transformer, to ensure that the ends of the windings are connected the right way around. If not, the inverter won't work and you might find transistor Q1 getting very hot. The particular ferrite core and former recommended here are made by Neosid, the core and former being very kindly supplied for the prototype by Neosid Limited Australia in Lilyfield, NSW. It is a very easy transformer to wind and the former is of moulded construction with integral pin terminals, virtually guaranteeing success providing that reasonable care is taken in putting the transformer together. One point to watch, however, is that the pin terminals are fairly small and close together. This is no real problem but a steady hand and a pair of long-nosed pliers with very thin, pointed ends do help when trying to twist the wire ends around the pins. When that is done, solder the wire ends to the pins and then fit the transformer onto the board.

A little hint: It is very difficult to scrape the enamel off enamelled winding wire as required when making solder connections. I have found that by burning the wire end with a lighted match and then rubbing lightly with steel-wool, the enamel comes off very easily.

The board is designed so that it can be plugged into a 44-way edge connector, if desired, with a 44-wire ribbon cable going to a second edge connector which plugs into the memory expansion slot of a VZ300. Alternatively, an edge connector of the type with rearwardly extending solder pins can be soldered directly to the tracks on the edge of the board. This avoids the need for a ribbon cable and was the method chosen for the prototype.

One drawback, however, is that you may not be able to plug in a printer or disc drive at the same time because the memory expansion and I/O slots in the back of a VBZ300 are a little too close together. If you anticipate that you will need to plug in a printer or disc drive at the same time as the EPROM programmer then I would recommend that you use a pair of 44-way edge connectors joined by a ribbon cable.

Apart from the ZIF sockets for EPROMs 1 & 2, IC sockets were not used in the prototype. One reason for this was that the prototype board, though of double sided construction, did not have plated through holes and that would have made soldering IC sockets to the board a little tricky (though not impossible). In the case of the ZIF sockets, I could not solder the pins to both sides of the board as required by the double sided board construction. However, I solved the problem by drilling the IC pin holes on the board a little oversize and linking both sides of each solder

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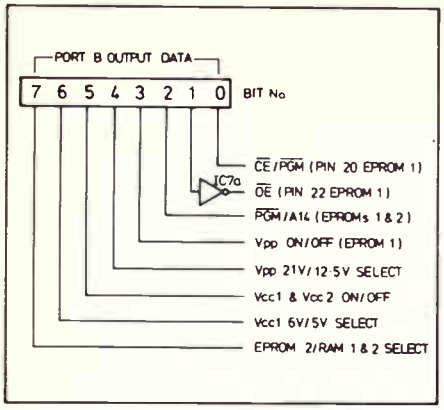


Port B connections

pad, where required, with very fine wire. I would expect boards supplied by kit suppliers to have plated through holes so that, if you choose to use IC sockets, you will find soldering them no more difficult than you would if the board were single sided. One note of advice, however, whether you use IC sockets or not: once you solder an IC or an IC socket, the tracks running underneath the IC or IC socket, on the component side of the board, will no longer be accessible. So, double check for breaks in, or shorts between, tracks underneath each IC before soldering.

On the board there are a number of through-the-board links. Assuming plated-through board construction, these links will be automatically formed in the board as supplied so that there will be need to solder anything to them.

You will notice that there are a couple of trimpots on the board. It may happen that the trimpots supplied with a kit may not quite fit the holes on the board since trimpots come in different sizes with different pin spacings. If you find this to be the case then simply bend the leads (very carefulloy) so that they will fit. Be particularly careful if the trimpots supplied have a ceramic rather than plastic base because the ceramic base is extremely brittle and therefore easily broken.

One last hint: I had a little problem with the locking lever on the ZIF socket being awkward to get at. I solved the problem by bending the lever upwards about a quarter way from its end with a pair of pliers.

Addendum

When you have completed soldering in the components on the board as per the payout given last month, you will have to solder additional resistors R19 and R20 to the reverse side of the board. Solder resistor R19 to pins 24 and 29 of IC4 (Z80 APIO) and resistor R20 directly to pins 1 and 7 of IC7 (74LS05). note: These resistors are not shown in the parts layout published last month.

Testing

Before plugging the board into your VZ300, make one final check over the entire board with a magnifying glass to ensure that there are no breaks in any of the tracks and that there are no solder bridges between tracks. It would also do no harm to check that all the components, particularly IC's diodes, transistors and electrolytics have been soldered in the right way around.

When satisfied that all is OK, plug the board into the VZ300. Do not plug in any EPROM yet. Switch on your monitor and allow it to warm up. Then switch on the VZ300 and observe the display on the screen. If it is the normal display that you get after switch-on then all, so far, is OK. If, however, you get garbage on the screen, or nothing at all, then switch off immediately. In this case there will almost certainly be a fault on the board, either a faulty component or a short circuit between tracks, or a broken track or you may have forgotten to solder one of the components.

Assuming that the display is OK, connect the negative lead of a multimeter (set to read 25 V or more) to a convenient point on the board at 0 V and the positive lead to either end of inductor L1. You should get a reading of around 21 V plus or minus 3 V. If you don't then switch off immediately. Check whether transistor Q1 is hot or cold. If it is hot then most likely one of the windings of transformer T1 has its ends wrongly connected or transposed. If Q1 is cold then possibly the transformer windings are connected to the wrong pins or there is an open circuit somewhere, depriving Q1 of base or collector current. In any case, check the circuit around Q1 and T1 before switching on power again.

Assuming, again, that so far everything is OK the LED should be alright. now, you can check a few voltages on the pins of the EPROM sockets. If these pins are not readily accessible by your multimeter probes, you could plug in a conventional 28-pin IC socket into each ZIF socket. Most ordinary IC sockets have the pin connectors exposed, making access with a probe easy.

At this stage, with the VZ300 switched on, you should be able to measure 5V (plus or minus 0.25V) at pins 1,27 and 28 of both EPROM 1 and EPROM 2 sockets.

Now key in the following: OUT203,7:OUT203,15:OUT201,7:OUT201,143. The LED should light up and you should get the following:

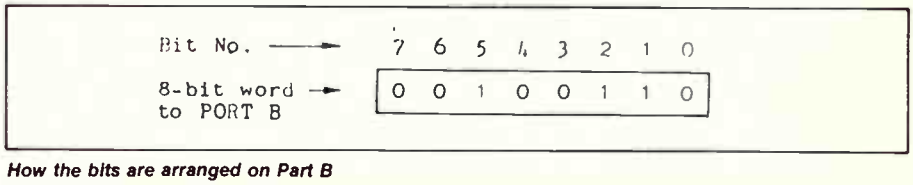
EPROM 1 socket: pin 1: 21 V plus or minus 3V, pin 27: 5 V, pin 20:4 V, pin 22: 0V, pin 28: 6V plus or minus 0.25 V. Adjust RV2 for 21 V at pin 1. Now key in: OUT202,40. You should now get the following voltages at the pins of EPROM 1: pin 1: 12.5 V plus or minus 2 V, pins 20,27: 0V, pin 22: 5 V, pin 28, 5 V. Adjust RV1 for 12.5 V at pin 1.

Now key in: OUT 202,2. The LED should now go out and you should get a reading of 0V at each of pins 1, 20,22,27 and 28.

This completes the preliminary testing of the EPROM programmer and also demonstrates how the various operating voltages and control functions for the EPROMs are software controlled.

The ultimate testing is carried out by loading a suitable program into the VZ300 and running that program with an EPROM plugged in. To save you, dear reader, the rather time consuming task of writing a program, such a program has been developed for you. Unfortunately, this has turned out to be a somewhat lengthy one and space limitations prevent publication here. However, the program is available on EPROM from the author at the address given at the end of this article. Loading the program into the VZ300 involves merely plugging the EPROM into the EPROM 2 socket on the programmer board and keying in a few short instructions in BASIC. The actual loading takes only a few seconds, compared with loading the same program from tape, which would take many minutes. This program will enable you to manually enter machine code into memory, make corrections, if necessary, and then copy into EPROM. The program will also let you check if an EPROM is fully erased and you can copy from one EPROM to another. EPROMs from 2764 to 27256 are catered for.

I would like to express my particular appreciation of Neosid Australia for their assistance. I had a lot of difficulty trying to find a suitable ferrite core from other sources for this project. Neosid came to



How the bits are arranged on Part B

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the rescue with just the right core for the job.

SOFTWARE DESCRIPTION

This programmer board is configured to appear partly as an external memory and partly as an I/O (INPUT/OUTPUT) device to the Z80 microprocessor of a VZ300 computer. There are, therefore, four primary instructions in BASIC which are needed to communicat with and control the programmer. These are:

POKE (write into memory)
OUT (write into I/O)
PEEK (read from memory)
INP (read from I/O)

The VZ300 computer has 16K of internal ROM (Read Only Memory), occupying addresses 0000H (Hex) to 3FFFH and 16K of user accessible RAM (Random Access Memory) occuypying addresses from 7800H to B7FFH. The space occupying addresses B800H to FFFFH (a little over 16K) is vacant in the VZ300 and is available for memory expansion. In addition, the Z80 microprocessor in the VZ300 is capable of addressing up to 256 bytes in I/O space, independently of memory, by an I/O instruction.

The part of the programmer board which appears as external memory comprises up to 4K of optional RAM (RAMs 1 & 2) and up to 32K of optional ROM (EPROM 2). These share the same address space but only one of these can be selected at any one time. Whichever is selected depends on the status of one of the bits of an 8-bit control word contained in an I/O instruction.

In addition, address latches IC1 and IC2 are enabled by any memory read or write instruction to the same address space as occupied by the on-board RAM and ROM. Being 'write only', these latches do not pose any danger of bus conflict but it will be noted that any address stored in the outputs of these latches will be changed to a new address whenever a read or write instruction is sent to either of the external RAMs or ROM. The latched outputs are unaffected by any instruction to an address below B800H. When an address is latched into IC's 1 & 2, this becomes the address for EPROM 1 (the EPROM which is to be programmed).

IC4 provides the I/O interface between the I/O part of the EPROM programmer and the VZ300's internal Z80 microprocessor. As already noted, the Z80 is capable of addressing up to 256 bytes in I/O space (from 00H to FFH). A simple address decoder (IC5a) enables IC4 for I/O instructions to addresses C0H to FFH (192 decimal to 255 decimal). This leaves addresses 00H to VFH availble for other devices (disc, printer, etc) which may be plugged into the I/O expansion slot, next to the memory expansion slot, of a VZ300. IC4 has two 8-bit I/O ports (PORT A and PORT B) which are programmable as either input ports, output ports or as (PORT A only) a bi-directional data transfer between the Z80 microprocessor of a VZ300 and the data pins of EPROM 1. PORT B is used for generating various operating voltages and control signals for EPROMs 1 and 2 and is therefore programmed, in use, as an output port. Programming of these ports consists in sending the following instructions (in BASIC) after power is switched on and prior to using the EPROM programmer:

OUT 203,7: OUT 203,15: OUT 201,7: OUT 201,143.

Note that the order in which these instructions are sent is important. These instructions are necessary to initialise ports A and B. Once the ports are initialised, data may be written into, or read from either port by appropriately addressed OUT and INP instructions, as follows:

INP 202 — read data from PORT B
OUT 200,A — write data (A) to PORT A
INP (200) — read data from PORT A
OUT 202,B — write data (B) to PORT B

Although PORT B data can be read by an IMP instruction, this instruction is not used for PORT B as it is an output port only in this application.

When either PORT A or PORT B is configured as an output port, data, in the form of an 8-bit word addressed to that port by an OUT instruction, will be latched in an internal register for that port in IC4. At the same time, the data will appear at the I/O pins associated with that port and remain there until a new instruction is addressed to that port.

Each bit of an 8-bit word written into PORT B determines a particular operating voltage or control function associated with the operation of the EPROM programmer. The respective bit allocations are shown in the accompanying diagram.

By way of example: Suppose that we want to set up the following conditions: enable RAMs 1 & 2, set Vcc1 to 5V, switch ON power (Vcc1 & Vcc2) to EPROMS 1 & 2, set Vpp to 12.5 V, switch Vpp OFF, set PGM HIGH, bring OE (EPROM 1) LOW, and bring CE (EPROM 1) LOW.

In this case, the required word, in binary form, which we would write into PORT B would look as follows:

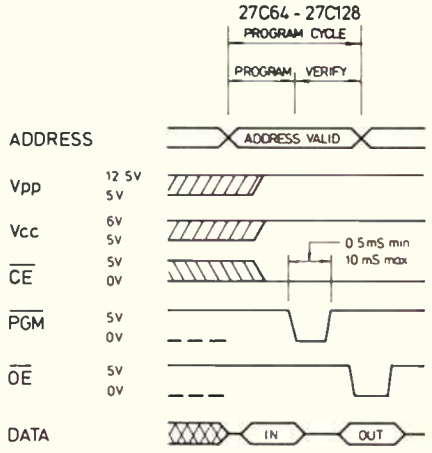
This word corresponds to 26 (hex) or 38 (decimal). The PORT B address is CA (hex) or 202 (decimal). Therefore, to set up PORT B as above, we simply execute the following instruction (in BASIC):

OUT202,38

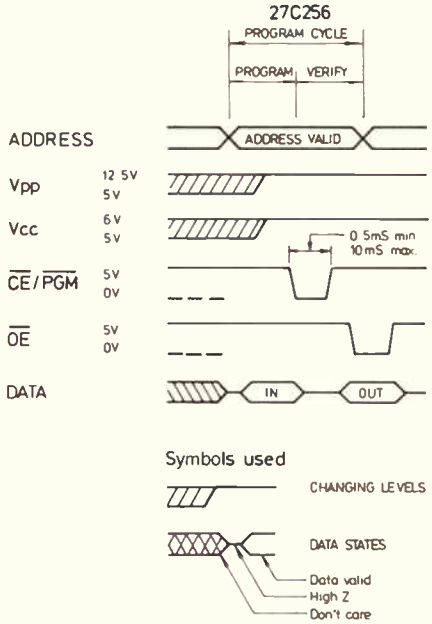
Bit 1, PORT B, determines whether PORT A is an output or an input. When bit 1 is LOW (logic 0), ASTB (pin 16, IC4) is also LOW and PORT A is an output. At the same time OE (pin 22, EPROM 1) is HIGH (logic 1) and any EPROM plugged into the EPROM 1 socket will have its output buffers disabled. That is, data can be written into EPROM 1 via PORT A, as will be the case during an EPROM programming cycle.

When bit 1, PORT B, is HIGH, ASTB goes HIGH and OE goes LOW. Data can now be read from EPROM 1 via PORT A.

An EPROM programming cycle is an operation in which a specified programming voltage (Vpp) and a programming



Waveforms. At top for 2764/128 type devices, at bottom for 256.



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pulse (PGM) of specified duration, together with a desired address and data are applied to the appropriate pins of an EPROM. It is the job of the software to generate the necessary voltages and signals in accordance with the manufacturer's specifications for the EPROM to be programmed. Figure 4 show typical wafeforms for 27C64 to 27C256 type EPROMs as recommended by National Semiconductor.

EPROM manufacturers generally recommend programming algorithms designed to give maximum programming efficiency and speeds when programming their EPROMs. The software developed for this project uses a programming algorithm adapted from one recommended by NATIONAL SEMICONDUCTOR for their CMOS range of EPROMs. This programming algorithm has been found to work well with NMOS EPROMs from other manufacturers. For those interested, a flowchart of the programming algorithm used by the software developed for this project is given in Fig. 5.

It is anticipated that most constructors in this project will take advantage of the software offer made in this article. Space does not permit a full description of the features which this software offers although a brief outline has already been given. A lot of effort has been put into its development to make this EPROM programmer project versatile, easy to use and as foolproof as possible.

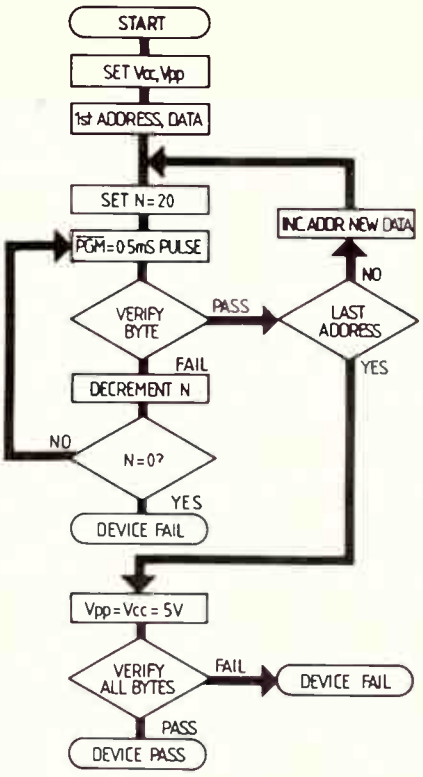
If, however, you choose to develop your own software for this programmer, be careful to ensure that it will generate the correct voltage levels and programming (PGM) pulse widths in accordance with the various EPROM manufacturers' specifications. Some hints for you: write any subroutine for generating the EPROM programming pulses in machine language (for Z80 microprocessors) and ensure that the sub-routine starts with an 'interrupt disable'. If possible, check out all waveforms on a CRO before trying out the programmer on an EPROM.

Whether you purchase the software or write your own, be careful to observe the following precautions:

1. Never insert or remove an EPROM from a socket while power is ON (as indicated by the LED lighting up.

2. Always ensure that the correct programming voltage (Vpp) is selected before programming an EPROM. Different manufacturers specify different programming voltages. The following is a list of EPROM types vs manufacturer and programming voltages derived from information given in the 1987 JAYCAR catalogue and reproduced here with their kind permission (note that ETI cannot accept any responsibility for any errors which may occur in this list) ●

Eproms can be ordered from the author at Beryl Road, Gulgong, NSW 2852.



Software flow chart

EPROM	Manufacturer	programming voltage
2764	Intel, Fairchild, OKI, NEC, TI, Toshiba, AMD, Fujitsu, Hitachi	21V
2764A	Intel, AMD	12.5V
27C64	National	12.5V
27128	Intel, AMD, Fujitsu, NEC, Toshiba, TI, Mitsubishi (M5L27128K & M5M27C128K)	21V
27128	ADC, AMD, NMC27CP128, NMC27C128C (National)	12.5V
27256	Intel, Atmel, NMC27C256 National	12.5V
TMM27256D	Toshiba, Fujitsu (27256 & 27C256)	21V

If in any doubt, always check with the manufacturer.

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THE WONDERS OF ACL

ACL Advanced CMOS Logic lengthens the stride of low-power systems

R CROES and A. DE PAGTER

There's little doubt that CMOS will unseat bipolar technology as the mainstay of integrated commodity logic. Advancing technology is rapidly eliminating the old trade-offs between speed and power dissipation (Fig.1), and problems peculiar to CMOS such as latch-up and ESD sensitivity have already been solved. However, until now, CMOS logic ICs haven't been able to match the high speed and the high current output of TTL technologies which is essential for operation in the bus or transmission-line environment of the fastest logic systems.

The introduction of the Advanced DCMOS Logic (ACL) family of ICs overcomes this hurdle. ACL is fabricated in a 1μm twin-well CMOS process with recessed local oxidation and a titanium disilicide (salicide) layer on the source/drain and gate areas to reduce the contact and interconnect resistance. This, together with oxide gate sidewall spacers for reduced capacitance, leads to increased drive and speed that equals that of the fastest bipolar TTL logic. With an average propagation delay of 3 ns (150 MHz operation) and 24 mA output sink/source capability, ACL supplements the HE4000B and HCMOS logic IC ranges to allow designers to implement the outstanding CMOS benefits of wide and symmetrical noise margins, wide operation temperature range, high reliability, and reduced power dissipation across the whole speed spectrum of logic circuitry.

ACL ICs are fully-buffered, have outputs that are both CMOS and TTL compatible, and have a standard operating temperature range of −40°C to +85°C. A wider temperature range of −55°C to +125°C is available as an option. They're all available in two versions:

— 74AC types with CMOS-compatible input switching levels (typically half V_{cc}) and a supply voltage range of 2 V to 5.5 V for all-CMOs systems.

— 74ACT types with TTL-compatible input switching levels (typically 1.5 V) and a supply voltage range of 5 V ± 10% for interfacing with TTL systems.

The type number nomenclature of these centre supply pin ACL ICs follow that of their bipolar counterparts but consists of a 3-digit function code preceded by the centre supply pin designator 11. For example, the type number of hex inverter '04 with CMOS-compatible input switching levels is 74AC11004.

Since the low power dissipation of ACL ICs makes them ideal for circuitry on densely packed boards in small enclosures, they must be suitable for use with surface mounting technology, which is being increasingly used for automated assembly of electronic equipment to achieve significant reduction of its size and weight. Production quantites of all our ACL ICs are available in DIL packages and in SO (small outlines) packages. The dimensions of the latter were originally developed by us and now form the basis of JEDEC standard publication 95 (also published in IEC standard document 191-2, family A76).

Finally, ACL ICs are completely latch-up free, and have complete protection against electrostatic discharge (ESD) at their inputs and outputs.

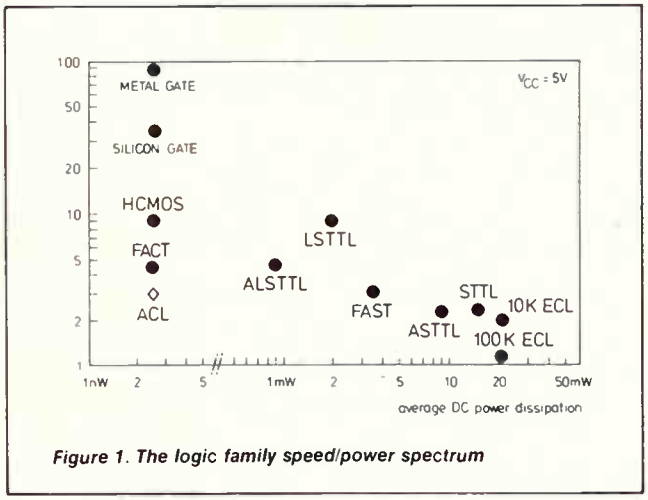

Figure 1. The logic family speed/power spectrum

ACL Features

ACL has all the well-known attributes of our HCMOS family combined with faster operations and increased drive capability. The main outstanding features of the family are:

- A comprehensive type range from simple gates to shift registers and counters.

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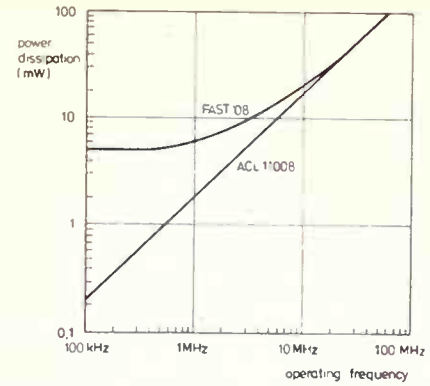

Figure 2. The power dissipation of an ACL quad 2-input AND gate with all outputs switching and with V_{CC}=5V, CL= 50 pF nd T=25°C is considerably lower than that of the fastest TTL circuits.

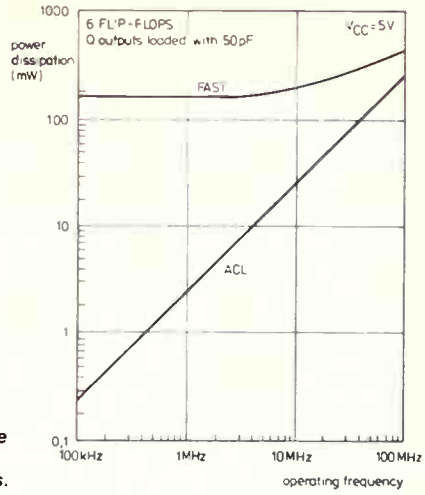

Figure 3. A simulated logic system shows the distinct power saving of ACL at all frequencies.

- Available with specifications valid for an operating temperature range of −40°C to +85°C, with options for −55°C to +125°C operating temperature range and for military processing, both MIL-STD-883 and MIL-M-38510.
- All types available in 74AC versions (CMOs input switching levels) and 74ACT version (TTL input switching levels).
- The input switching threshold level is subject to a variation of only ±60mV over the entire temperature range, much less than the ±300 mV specified for bipolar logic.
- All types available in SO (small outline) and DIL packages.
- Completely latch-up free and guaranteed ESD protection against positive and negative transients up to 2kV (human body model) at all inputs and outputs.
- Low power dissipation. Only a few nW when quiescent, rising to a mere 1.2 mW at 1 MHz.
- Symmetrical 24 mA sink/source current for equal output rise and fall times. For incident wave switching, 50 ohm and 75 ohm loads are permissible.
- More than three times the noise immunity of TTL logic families.
- Wide supply voltage range; 2 V to 5.5 V for 74 AC Ics and 5 V± 10% for 74ACT ICs.
- Average propagation delay for the 74C1100 gate is 3 ns for either high-to-low or low-to-high transitions. Typical operating frequency limit at 25° is 150 MHz.
- Centre supply pins to minimize ground and supply rail glitches during simultaneous switching of multiple outputs. a flow-through architecture to simplify board layout.
- Outputs have edge control circuitry to reduce the effective dv/dt, thereby further reducing switching noise.
- Inputs have a small dc hysteresis to render them less susceptible to slow input edges. Furthermore, clock inputs have additional proprietary dynamic hysteresis which doesn't incur a speed tradeoff.
- Alternate-sourced by TI.

Supply Voltage

ACL ICs with the type number prefix 74AC operate from a supply voltage range of 3 V to 5.5 V, meeting the new industry JEDEC standard No. 8 which specifies 3.3 V ±0.3 V for regulated power supply systems. The internal logic of 74AC ICs will, however, maintain its state with a supply voltage as low as 2 V; this facilitates the use of a lithium battery as a back-up supply. ACL ICs with the type number prefix 74ACT operates from a supply voltage for the TTL logic circuits with which they are intended to interface.

Power Dissipation

One of the most important requirements for any logic system is low power dissipation because it minimises system cost, allows higher packing density and results in improved reliability because of lower operating temperature.

The typical quiescent power dissipation of an ACL gate (2.5 nW) is more than six orders of magnitude less than that of a bipolar TTL gate. This is because, unlike TTL, CMOS logic dissipates only negligible power due to leakage currents when it isn't switching. The maximum quiescent current per ACL package for SSI (40 μA) is less than 1% of that of an equivalent TTL package with 50% of the gates in the HIGH state. As shown in Fig. 2, the typical dynamic power dissipation of ACL gates is also very low. With a 50 pF load and a 5 V supply, it is 0.18 mW at 100 kHz rising to only 180mW at 100 MHz, two-thirds of which is dissipated in the load capacitance. This is considerably lower than that of the fastest TTL logic, particularly at lower frequencies where its high quiescent current predominates over its dynamnic current.

The power merging frequency where ACL and TTL dissipate the same power is about 10 MHz for a gate, and more than 20 MHz for a flip-flop. However, in a practical logic system, only a few of the logic elements operate at the maximum clock frequency, so the average operating frequency is much lower, giving ACL an even greater advantage over advanced TTL. Figure 3 shows that, in a more complex system comprising a divider chain of six flip-flops with their Q outputs loaded with 50 pF, the power merging frequency no longer exists. At 30 MHz, ACL still dissipates only one third of the equivalent advanced TTL dissipation. If the divider chain is lengthened, or the system complexity increased, the power-saving increases yet further.

Propagation Delay

The on-chip propagation delay for a single ACL gate is only 0.5 ns. From input pin to output pin of a 74AC1100 gate with 50 pF load is 3 ns typical for high-to-low or low-to-high transitions. Moreover, propagation delays are specified over the entire operating temperature ranges and at two system supply voltages (3.3 V±0.3 V and 5 V ±0.5 V). For user convenience, the mininium propagation delay is also specified. The specified limits are comparable to those for the fastest TTL logic families. Due to the high drive current capability of the low-impedance ACL outputs, propagation delay variation is a function of load capacitance is much less than that of the other logic ICs. Moreover, unlike the fastest TTL circuits, all ACL ICs have standardised output buffers which allow symmetrical output current sinking and sourc-

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ing to obtain equal rise and fall times (3 ns). This simplfies design and results in optimum limit for ACL is 150 MHz at 25°C and is specified with a 50% duty factor so, unlike with TTL, it's not neccessary to tweak the pulse widths.

Noise Immunity

The input switching levels are between 30% and 70% of V_{CC} for 74AC ICs and between 0.8 V and 2 V for 74ACT ICs. Output swing for both 74AC and 74ACT ICs is from 0.1 V to V_{CC} — 0,1 V with a load of 50μA (fifty CMOS inputs) and from 0.5 V to V_{CC} 8 0. V with a load of ±24mA. For 74AC ICs driving fifty CMOS inputs, the LOW and HIGH-level noise immunity with a 4.5V supply is therfore 28% of V_{CC}. The LOW-level noise immunity of 74ACT ICs with a maximum load of 24 mA matches that of TTL at operating temperatures up to 125°C and exceeds it at 70°C. The HIGH-level noise immunity of 74ACT ICs is three times that of TTL. ACL ICs are therefore ideal for use in electrically noisy environments such as those encountered in industry, telephony and automotive applications.

Drive Capability

ACL ICs have the low input current (only 1μA max. in the high or low state) which is a characteristic of CMOS technology and is essentially zero compared with the input current of TTL technologies. They can, however, sink/source output current of up to 24 mA over the entire operating temperature range whilst still matching or exceeding the noise immunity of TLL logic. The fan-out when driving other CMOS circuits is therefore only limited by load capacitance considerations and not by the available drive power.

In the fastest logic systems, ACL ICs will probably be working in a transmission line environment where their low output resistance (20 ohm max.) is of particular significance for reducing a system's susceptibility to crosstalk and induced noise, and for guaranteeing incident wave switching to optimise system speed. For example, to guarantee incident wave switching over the standard temperature range, the dynamic output current sink/source capability of ACL with a 5.5 V supply is 75 mA at v_O = 1.65 V (Low) or 3.85 V (High) which, allows terminated lines with a characteristic impedance down to 50 ohm to be driven. Over the optional extended temperature range, the dynamic output current sink/source capability is 50 mA at the same output voltage levels, so lines with a characteristic impedance of down to 75 ohm can be driven.

ESD Protection

The ACL input network shown in Fig. 4(a) incorporates reverse-biased diodes between the positive rail, input pins and ground for clamping the input voltage to provide ESD protection and limit the amplitude of ringing. These diodes have typical forward voltage drops of 0.9 V and reverse breakdown voltages of 17 V. ACL inputs can withstand positive and negative ESD transients of up to 2 kV from the 'human body model' (1.5 k ohm, 100pF, 13 ns pulse rise time) shown in Fig. 4(b). This meets MIL-STD-883B, Method 3015.

Large inherent diodes formed by the drain surfaces of ACL output transistors allow positive and negative ESD up to 2 kV to be sustained without damage to outputs.

ACL is Latch-Up Free

Latch-up can be reduced by the use of extensive guard rings, but at the expense of increased chip area. During fabrication of our ACL ICs, a high-resistivety p^- epitaxial layer is grown on a very low-resistivity p^+ substrate. This diverts lateral current flow through the p^+ layer, thereby preventing parasite bipolar transistors from being forward biased. Thus, layout rules and process parameters that further reduce the gain of the parasitic bipolar transistors, means that ACL ICs are completly latch-up free.

ACL ICS have been subjected to the latch-up tests described by JEDEC with ratings far exceeding the maximum limits. In no case did latch-up occur. For example, inputs/outputs can withstand currents as high as 100 mA dc or 650 mA pulsed.

When testing ICL ICs for latch-up initiated by supply overvoltage, the voltage required to cause V_{CC} breakdown far exceeds the maximum V_{CC} rating (6 V). ACL ICs have been subjected to tests to discover the conditions for V_{CC} breakdown and to determine whether or not the supply voltage would snap-back to more than 6 V. The results of the characterisation all concur with the design goals and reveal that a supply voltage of at least 18 V and a current of several tens of milliamps is required to cause the first snap-back (secondary breakdown). Since the snap-back voltage was never less than 10 V, ACL ICs are SCR (Silicon Controlled Rectifier) latch-up free. Since other CMOS logic with a 5V supply goes into SCR latch-up with a snap-back voltage of only 2V, it remains latched-up until the supply is switched off. It should be noted that, during latch-up characterisation, there is a possibility that the IC will become severely overheated. A close eye should therefore be kept on the supply voltage/current product.

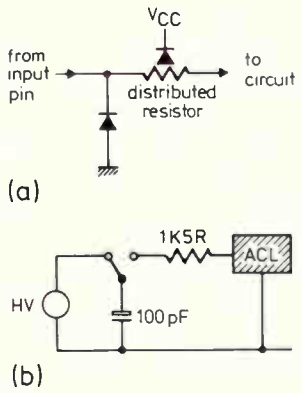

Figure 4. The input of ACL ICs are fully protected against ESD
(a) ACL input protection network
(b) 'human body model' test arrangement.

54/74ACT — For Interfacing With TTL

Since the entire type range of ACL ICs is also available in 74ACT versions, it is easy to drive ACL from ALSTTL, ASTTL or FAST-TTL outputs without using power consuming pull-up resistors at the bipolar logic outputs to maintain adequate noise margins.

All the advantages previously described for 74AC ICs naturally also apply to the 74ACT versions. The only differences are that the propagation delay is slightly longer and the nominal supply voltage and input structure of the 74ACT types have been modified to match TTL characteristics. The modified input structure not only adapts to TTL input switching levels, bu' also reduces power consumption when a minimum TTL high output level of 2.4 V is applied to a 74ACT input. For TTL compatibility, the supply voltage for 74ACT ICS is 5V±10%. Unlike 74AC ICs which have an input switching threshold of 74ACT types is 1.5V, and the inputs switch between the same levels as TTL (V_{IL}max=0.8V H_{III}min=2 V). The temperature sensitivity of the input switching threshold, however, is only ±60 mV over the entire temperature ranges, so the noise margins also remain very stable over the temperature range. With a 4.5 V supply and an output current of 50 μA (50ACL inputs), a 74ACT output swings between 0.1 V and V_{CC}−0.1 V. With the maximum output current of 24 mA, it swings between 0.5 V supply driving fifty ACL inputs, the noise margins are 53% of V_{CC} (HIGH) and 15.5% of V_{CC} (LOW). For a similar TTL IC, they would be only 15% of V_{CC} (high) and 8% of V_{CC} (low). Even when a 74ACT is delivering 24mA, the noise margins are 42% of V_{CC} (HIGH) and 6.6% of V_{CC} (LOW).

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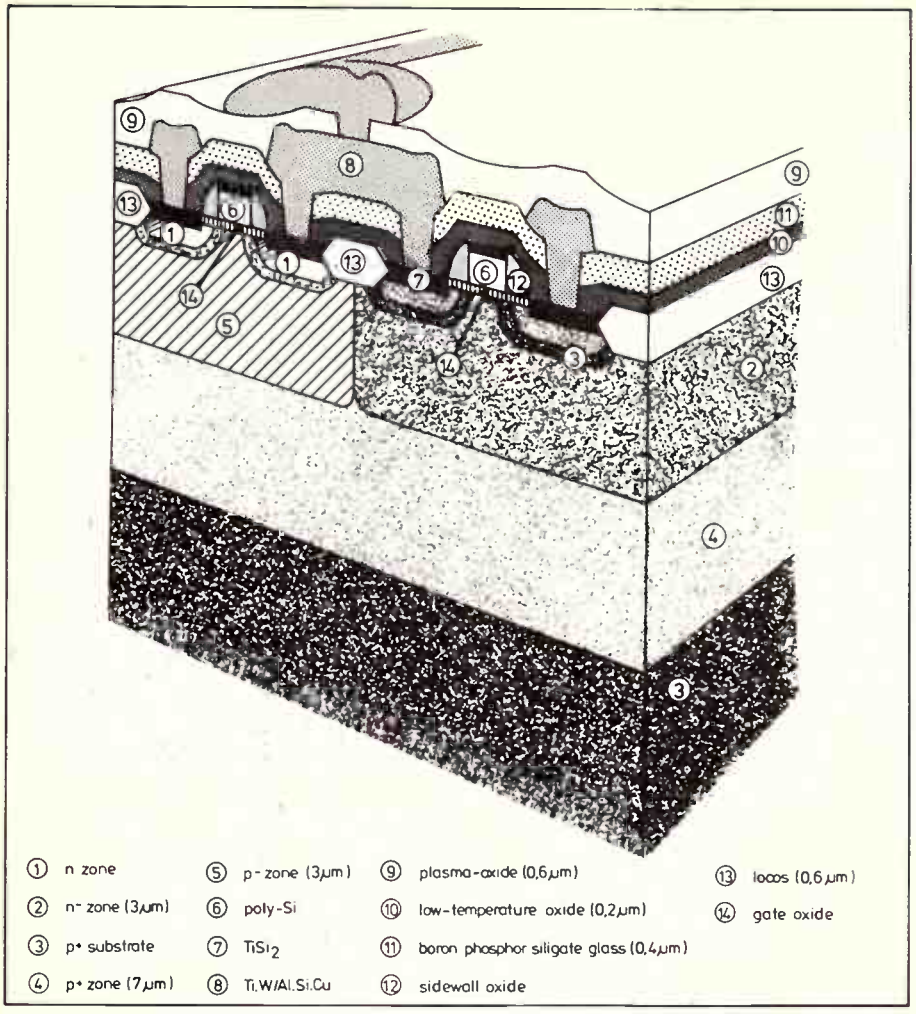

Figure 5. The ACL technology.

Advanced Technology Makes It Possible

The 9-mask ACL construction shown in Fig. 5 is a result of a continuing development programme to enhance the proven polycrystalline silicon (polysilicon) gate CMOS process. It incorporates several technological innovations for increasing packing density, speed, and reliability.

The twin-well P−/N− structure and double-layer metal interconnects allow a high packing density which will also facilitate development of future MSI/LSI circuitry.

Three main features contribute to the exceptionally high speed of ACL. Firstly, the effective length of the transistor gate is only 1µm, resulting in an on-chip propagation delay of only 0.5 ns. Secondly, there is a self-aligned titanium disilicide (salicide) layer on the source/drain and gate to reduce their series resistances and the resistance between the contacts and junctions. Thirdly, gate sidewall spacers minimise the gate/source and gate/drain capacitances.

Electromigration is reduced by using copper-doped aluminium interconnects on a tungsten layer. Furthermore, a − epitaxial layer on a low-resistivity + substrate results in a high degree of latch-up immunity.

New Pinouts For ACL Add Reliability

The fast rise and fall times associated with high speed logic can lead to noise problems when one or more outputs of an IC switch from one logic to another. As shown in Fig. 7, this discharges the load capacitances through the inductance of the internal supply connections, thereby causing a transient that lifts up the on-chip ground and reduces the effective supply voltage to the chip. The problems are particularly severe in CMOS logic because the outputs can switch almost from one supply rail to the other. Referred to as simultaneous switching noise, the transient appears on any unswitched output(s) of the switching IC and has a peak amplitude directly proportioned to the number of outputs simultaneously switched and to the inductance of the internal Ic supply connections. This lifting-up of the chip ground and consequent reduction of supply voltage degrades system reliability by reducing noise margins, reducing speed, causing loss of standard data and causing false switching.

It is a common misconception that supply decoupling capacitors located adjacent to each IC will eliminate simultaneous output switching transients. The output-capacitance discharge noise is related to the absolute inductance of the supply connection between the chip and the IC and the external supply/groundplane. Since multilayer boards provide excellent suply/-groundplanes, improvement can only be achieved by manufacturers taking measures to reduce the supply/ground lead inductance within the IC. Supply line decoupling should be similar to that used for TTL systems operating at comparable speed.

In the early days of integrated logic, manufacturers were forced to position IC

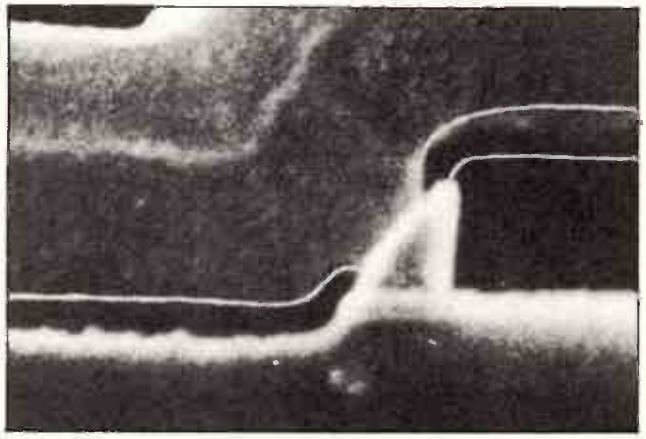

Figure 6. SEMI photograph of a vertical cross-section through part of a salicided ACL transistor. Advanced processing using a salicide technique and gate spacers results in minimal dimensions and excellent electrical properties.

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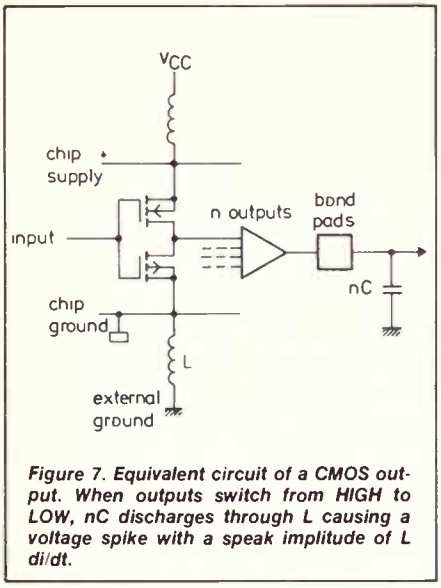

Figure 7. Equivalent circuit of a CMOS output. When outputs switch from HIGH to LOW, nC discharges through L causing a voltage spike with a speak implitude of L di/dt.

supply pins at diagonally opposite corners of the package because of layout restrictions imposed by single-sided print-boards which were in universal use at that time. However, in today's world of double-sided and multilayer print-boards and much faster logic, placing the supply pins at diagonally opposite corners of the package where the long bonding wires and lead frame segments have the maximum inductance can no longer be considered to be good engineering practice. It's the worst possible positioning from the point of view of simultaneous switching noise. So, for ACL ICs, the GND and V_{CC} pins are relocated in the middle of opposite ends of the package where their inductance is minimum. ACL ICs with multiple outputs that can switch simultaneously have multiple supply pins to reduce their inductance yet further.

All ICS with one or two outputs have single GND and V_{CC} pins; 16-pin ICs with 3 or 4 outputs that can switch simultaneously have two GND pins and two Vcc pins; 20, 24 and 28-pins ICs with 3 or more outputs that can switch simultaneously have four GND pins and two V_{CC} pins.

As shown in Fig. 8, tests performed on an octal ACLILC with four centre supply pins reveal that, when seven of the outputs are simultaneously switched from High to Low, the amplitude of simultaneously switched noise on the eighth (Low) output stays well below the maximum Low input switching level and is only about 30% of that for a comparable IC with corner GND and V_{CC} pins. Consequently, the effective reduction of supply voltage to the chip is very small, so signal integrity is maintained and loss of speed is minimal.

The positioning of the I/O and control pinning of ACL ICs has also been rationionised as shown in Fig. 9. All the inputs surrounded the V_{CC} pins(s) on the side of the package with the highest pin numbers, and all the outputs surround the GND pin(s) on the other side of the package. The control pins are strategically placed at the corners of the package. This ACL flow-through architecture, which is used for all ACL ICs in both DIL and SO packages, reduces the total inductance of outputs (bonding wire plus lead frame and output pin) between the chip and the printed wiring tracks. It also facilitates positioning of decoupling components, simplifies peboard design and fault-finding, and decreases the area of print-board required. ●

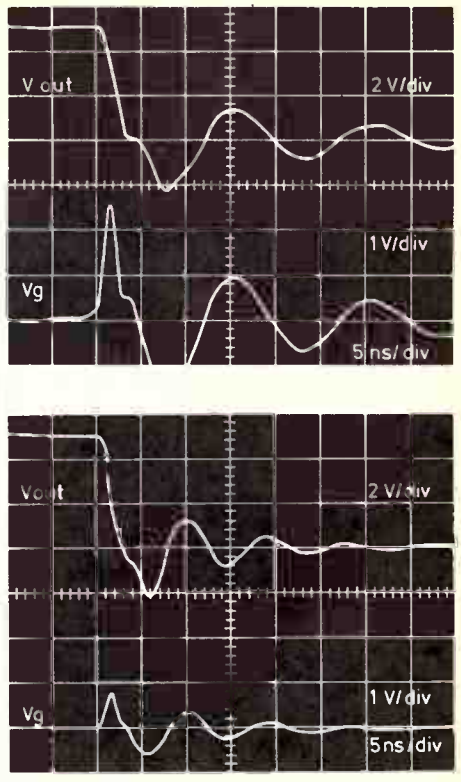

Figure 8 Ground bounces comparison when 7 outputs of octal 74AC240 and 74AC11240 ICs in DIL packages are simultaneously switched (VCC=5VV Tamb=25°C). The bounce is measured on the 8th output which is held LOW. Note that the frequency of the ringing in the upper picture is lower than that in the lower picture due to the higher total inductance of the ground lead.

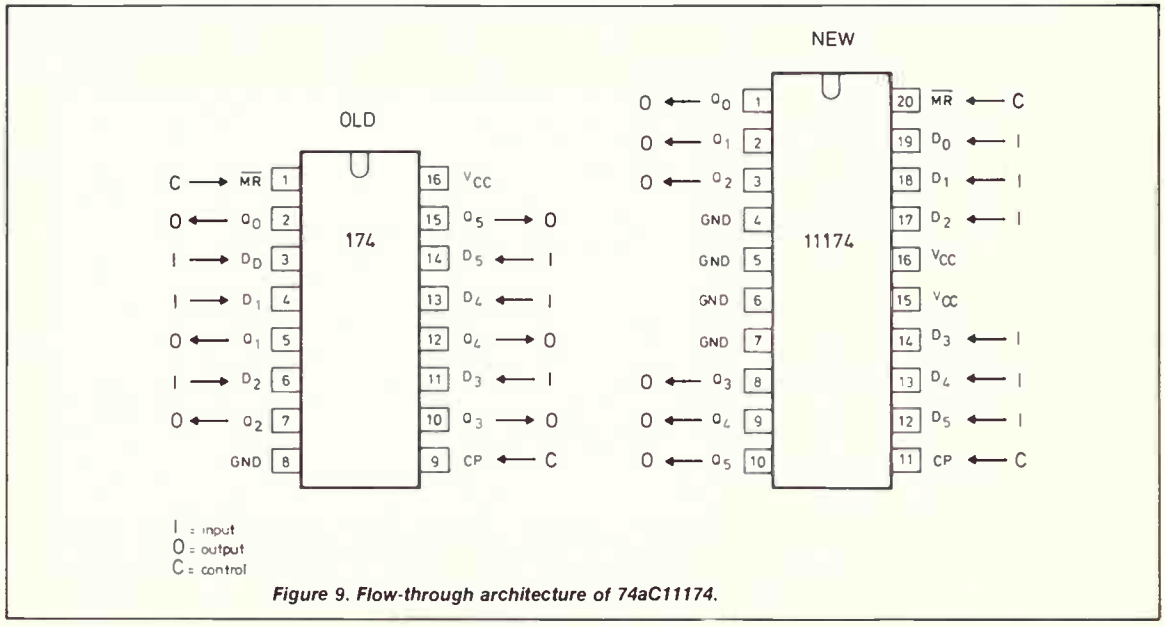

Figure 9. Flow-through architecture of 74aC11174.

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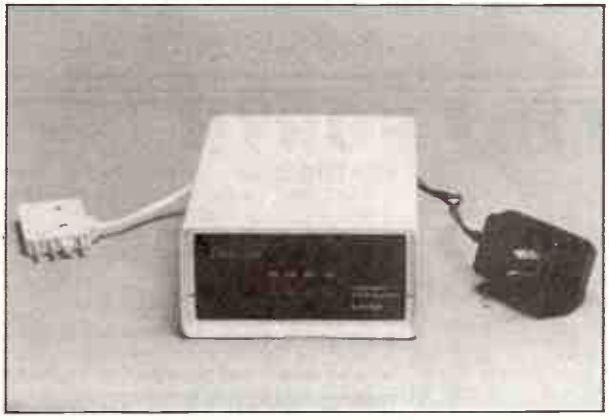

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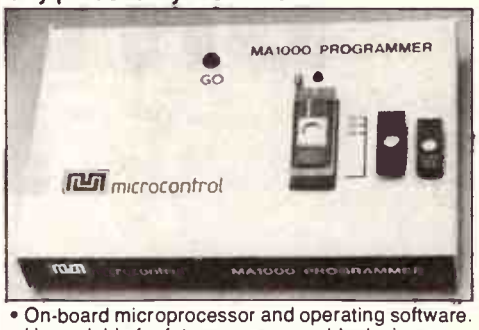

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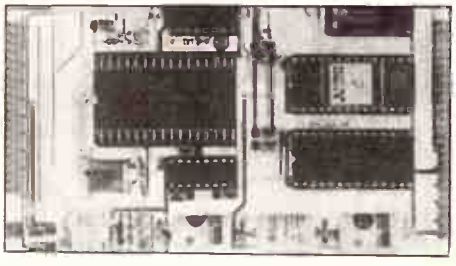

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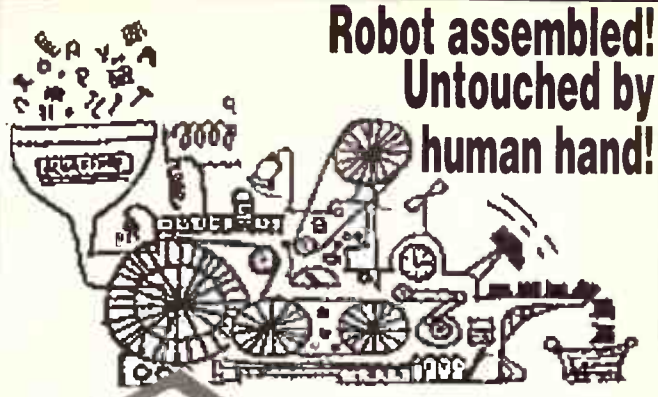

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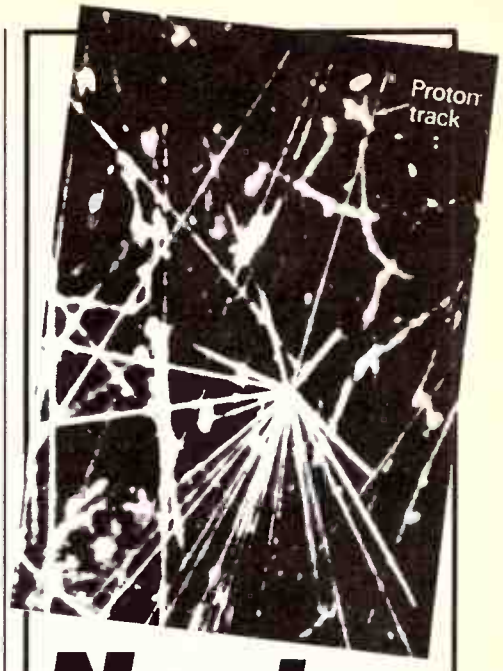

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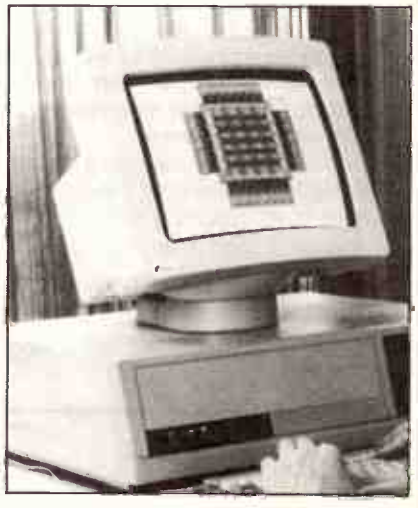

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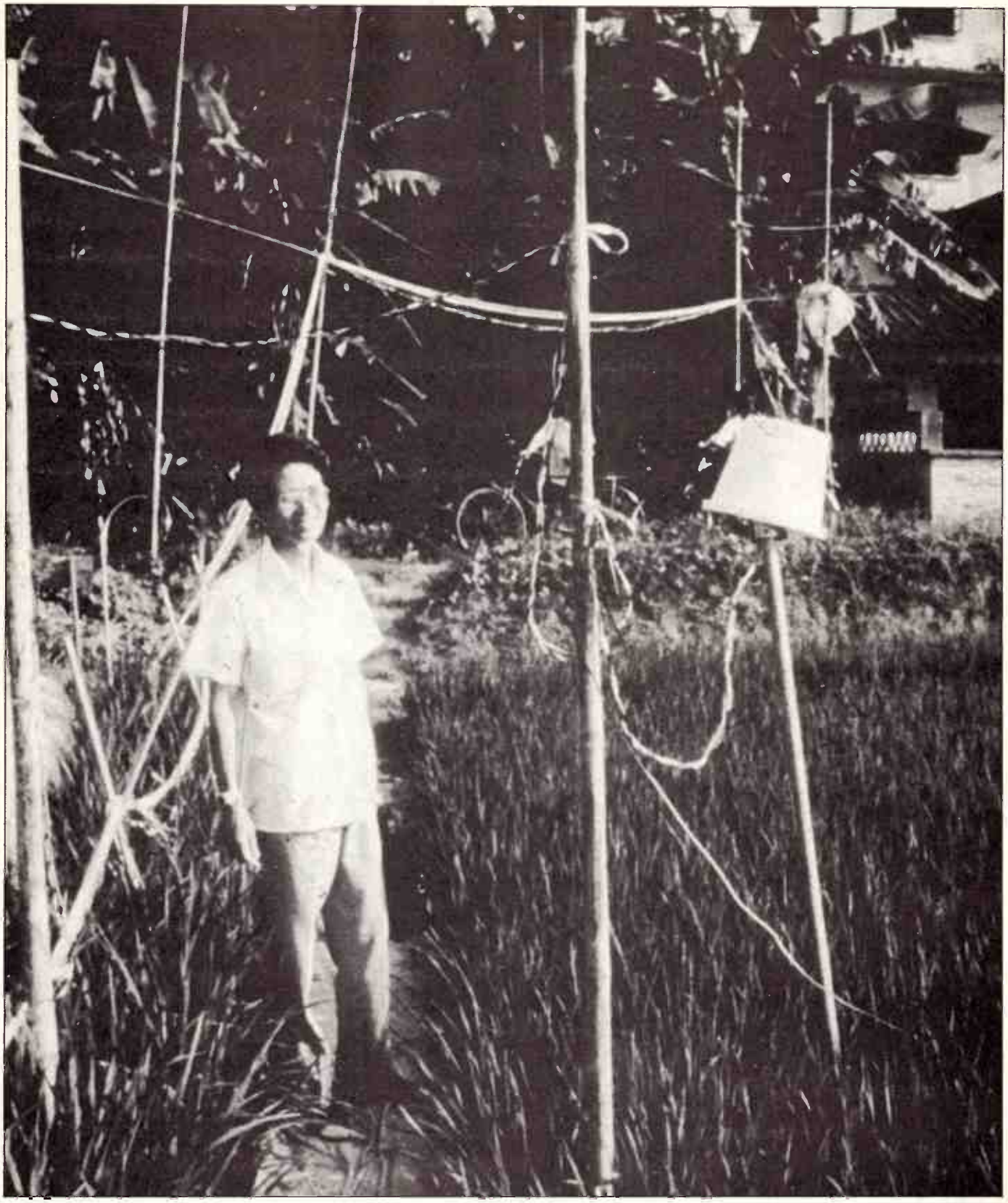

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4. The judges decision is final and no correspondence will be entered into.
5. Description of the competition and instructions on how to enter form a part of the competition conditions.
6. The competition commences on April 1, 1988 and closes with last mail on July 31, 1988. The draw will take place in Sydney on August 8, 1988 and the winner will be notified by telephone and letter. The winner will also be announced in the Australian on August 12, 1988 and a later issue of the magazine.
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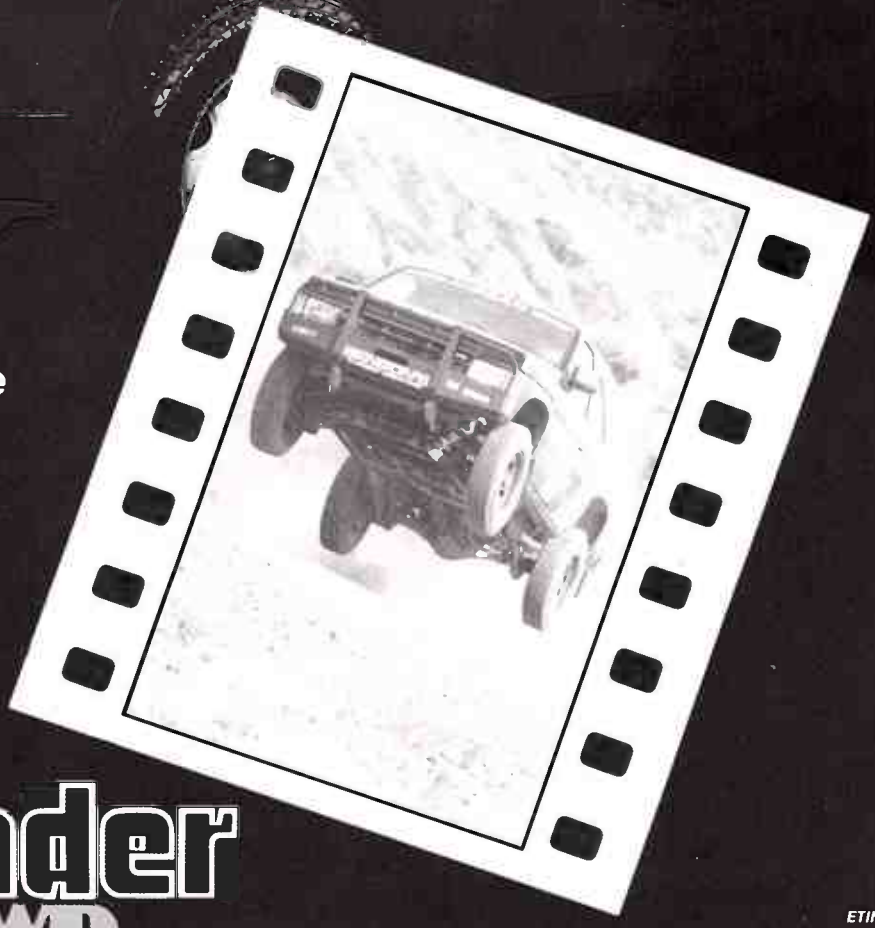

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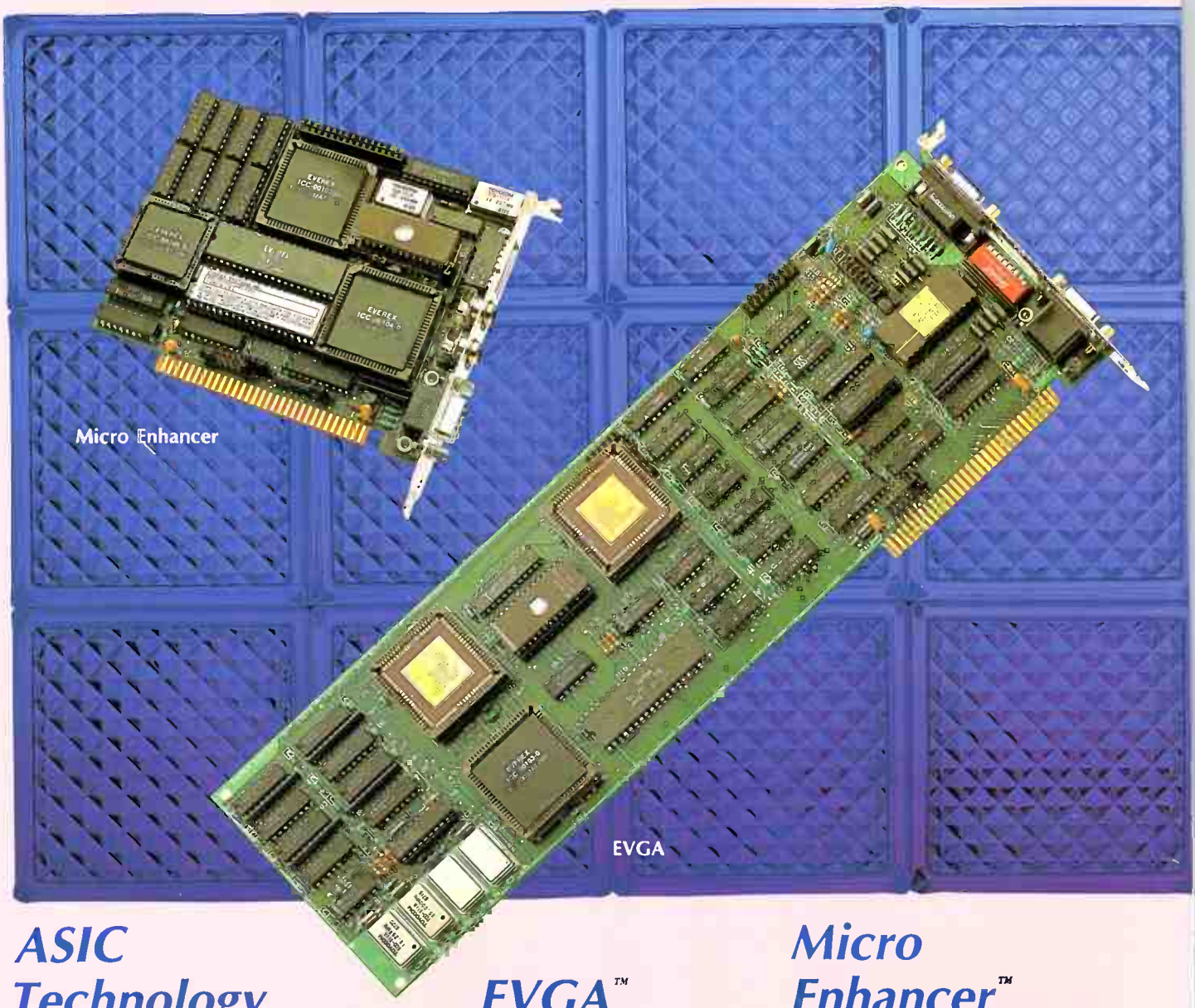

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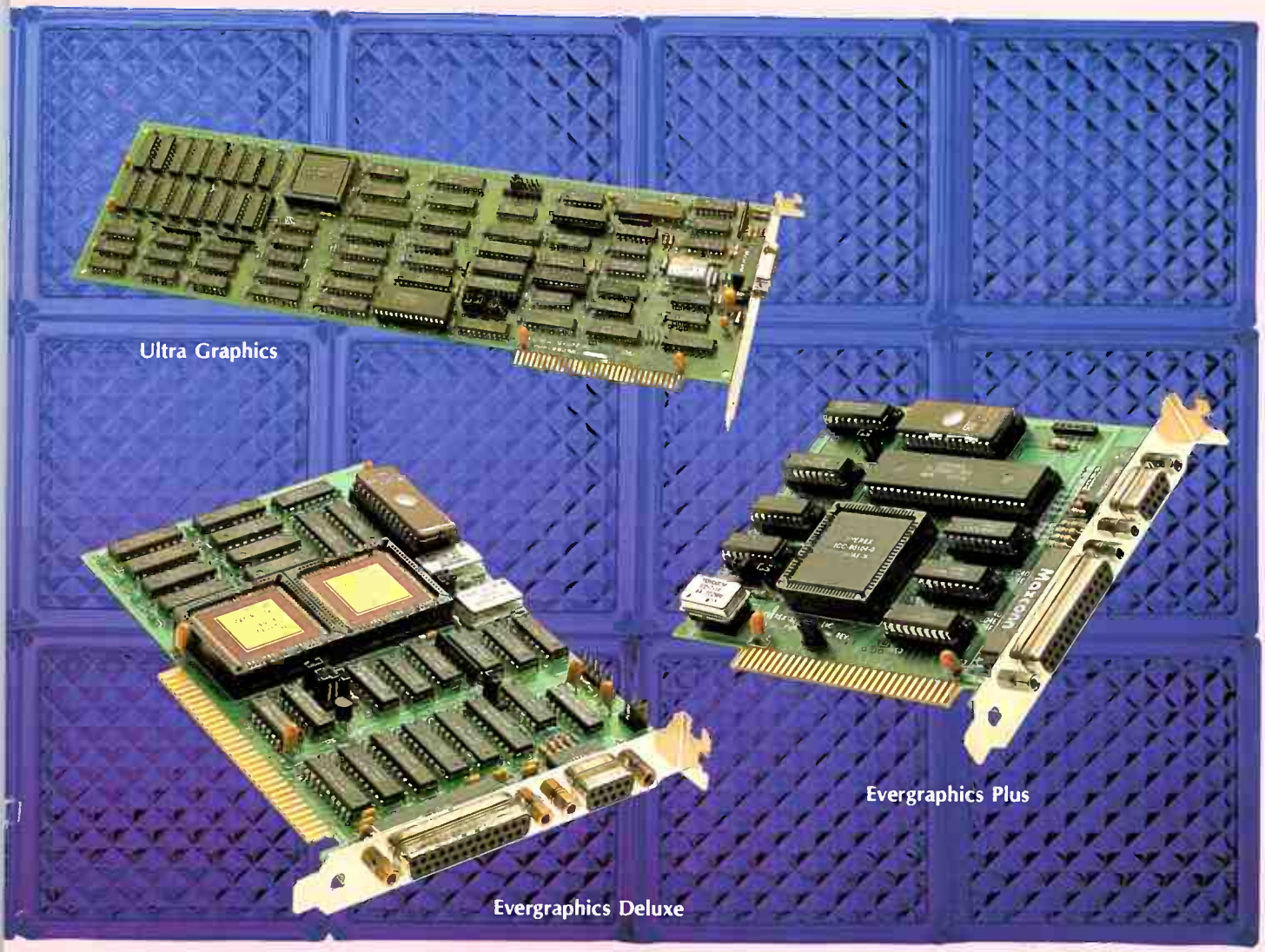

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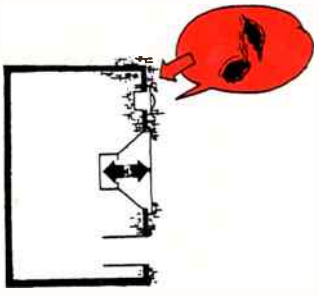
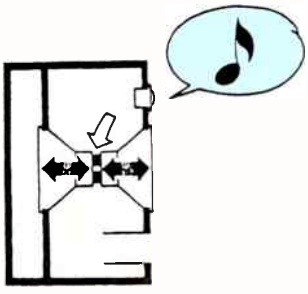


Conventional loudspeaker



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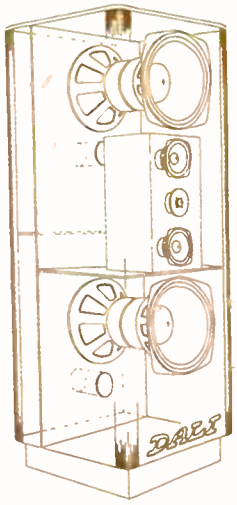

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