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Australia's Top Selling Electronics Magazine

Electronics Australia

July 1985
Aust $2.60
NZ $3.50

Tandy Model 1000 PC Reviewed

Infrared REMOTE CONTROL for the Teletext Decoder

Weather radio for pilots

All about surface mounting components

Portable 1000V Megohm Meter

Luxman L-215 stereo amplifier reviewed!

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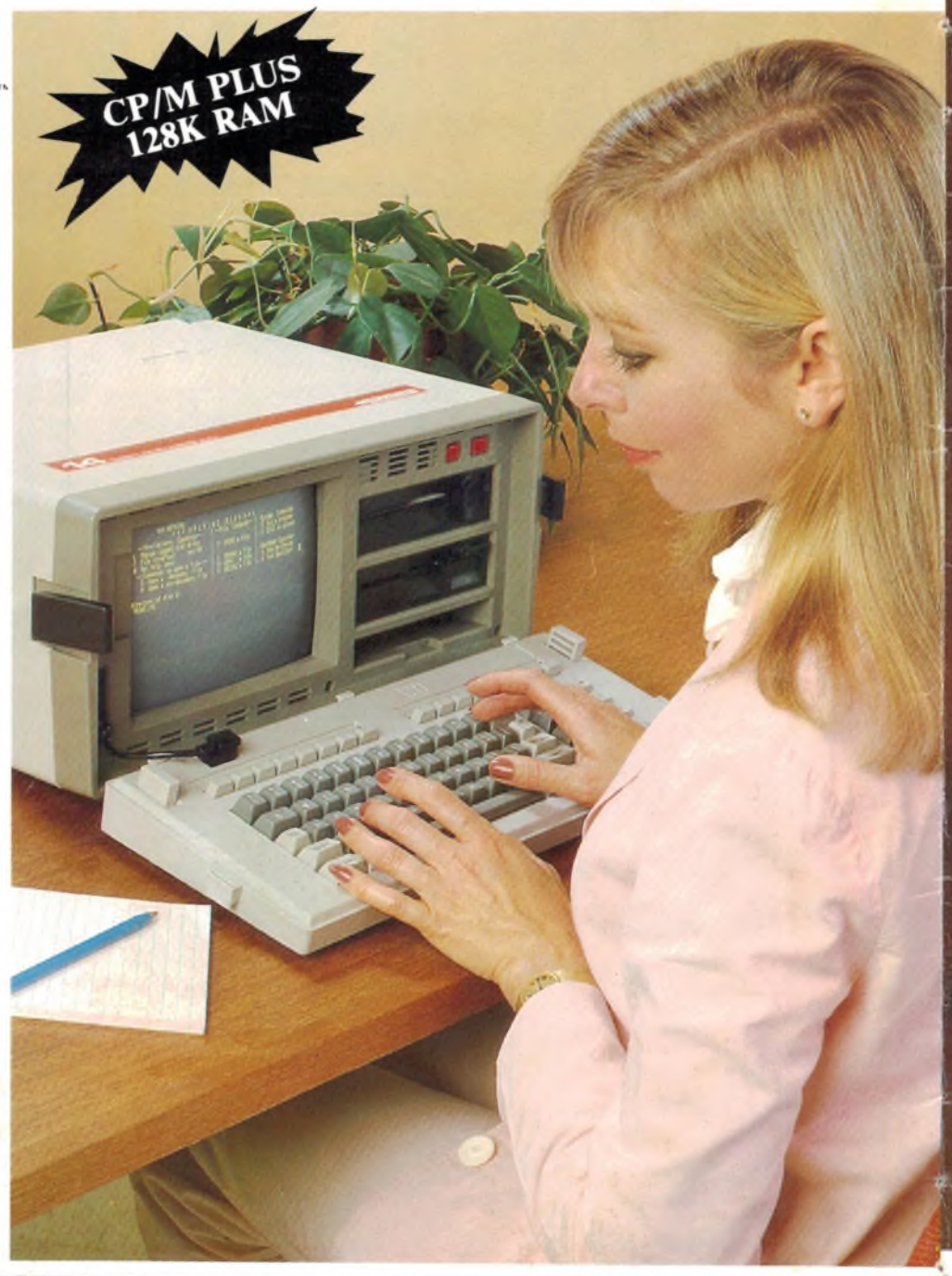

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Volume 47, No. 17

Electronics Australia

July 1985

THIS MONTH'S COVER

The Model 1000 personal computer is Tandy's first real entry into the PC-compatible market. We put the new machine through its paces and report our findings on page 90.

Features

Hifi, Video and Reviews

Projects and Circuits

Personal Computers

Columns

Departments

Infrared remote control

This infrared remote control for the Teletext Decoder duplicates all the control keys on the original wired unit. It requires only a handful of parts and is easy to build. Details page 58.

Build this megohm meter

Featuring an in-built inverter power supply, this Megohm Meter tests at 1000V and covers the range from 2MΩ to 2000MΩ. Construction begins on page 30.

NOW PIONEER PUTS TWICE AS MUCH STEREO FUN IN YOUR CAR.

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PIO 2018A

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EDITOR
Leo Simpson
B. Bus. (NSWIT)

ASSISTANT EDITOR
Greg Swain, B.Sc. (Hons. Sydney)

EDITORIAL CONSULTANT
Neville Williams
F.I.R.E.E. (Aust.) (VK2XV)

TECHNICAL STAFF
John Clarke, B. E. (Elect. NSWIT)
Colin Dawson
Robert Flynn
Andrew Levido
Louise Upton, B.A. (Hons. Sydney)

ADVERTISING PRODUCTION
Danny Hooper

ART DIRECTOR
Brian Jones

SECRETARIAL
Christine Millar

ADVERTISING MANAGER
Selwyn Sayers

MANAGING EDITOR
Jamieson Rowe

PUBLISHER
Michael Hannan

Editorial and Advertising Office 140 Joynton Avenue (PO Box 227), Waterloo, NSW 2017. Phone: (02) 663 9999. Advertising Sales Manager. Sel Sayers.

Melbourne: 23rd Floor, 150 Lonsdale Street, Melbourne, Vic 3000. Phone (03) 662 1222. Representative: John Oliver.

Adelaide: Charles F. Brown & Assoc. Phone (08) 223 4600. Representative: Sandy Shaw.

Brisbane: Media Services Pty Ltd, 4 Adelaide Terrace, Brisbane 4000. Phone (07) 229 6033. Representative: Fred Maybury.

Perth: Adrep, 62 Wickham Street, East Perth, WA 6000. Phone (09) 325 6395. Representative: Cliff R. Thomas.

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*Recommended and maximum price only.

Editorial Viewpoint

by Leo Simpson

Identity cards for everyone: a good idea!

All Australians should be issued with an identity card. They should show it when applying for a new job, when applying for social security and, in fact, when doing business with any government department. This proposal has been mooted during the current debate on taxation and is very relevant.

The idea is that it will help reduce tax evasion by preventing people from taking jobs under false names and so on. This has caused an outcry from civil libertarians because they can see all sorts of ways in which individual freedoms might be infringed. Well so what? Virtually every development has implications for personal freedom these days, whether it has its origins in high technology or not.

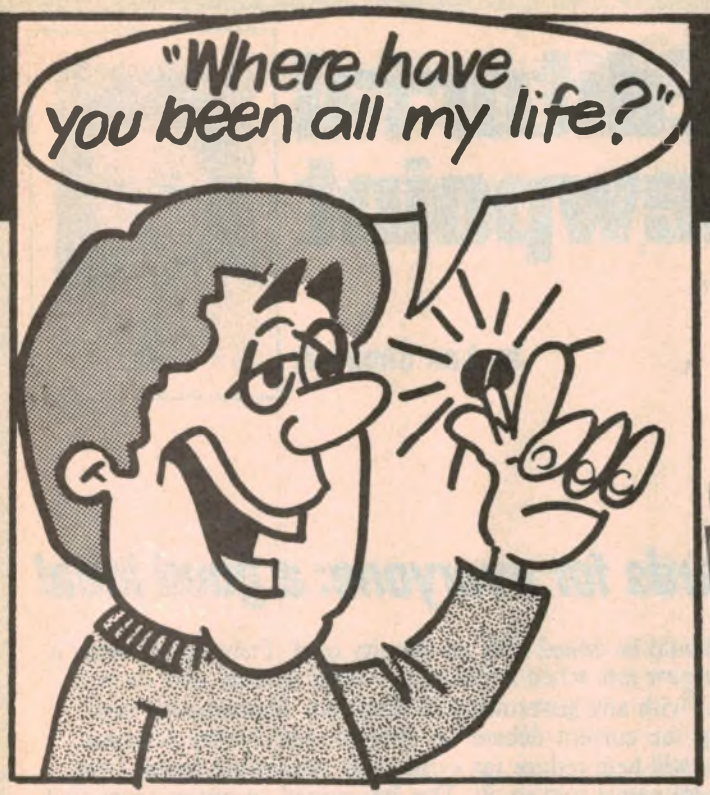
Make no mistake, the idea is made workable by the current state of technology, ie, computers and large databases. The activities of each and every one of us is recorded in many computer databases throughout the country. It is already available to the relevant government departments. We all know this. By identifying every person with a number, all the presently fragmented information could be brought together in a much more organised way.

This would have important ramifications in the fight against crime and in the efficient running of many government departments. I say, "let's do it". We have the technology and it should be used. If it prevents people from dodging tax by holding jobs under false names, if it prevents people defrauding the social security system, if it makes things that much harder for criminals, the government has an obligation to do it.

The problem for government is that as our society becomes more complex, the more ungovernable it becomes. And every time the government brings in a measure which will help society at large, there is an inevitable trade-off in some small reduction in "personal freedom." A good example of this is the legislation to enforce the wearing of seat-belts and motor-cycle helmets. This is a sensible measure which benefits society but which upsets a few rugged individuals. Well, I am certainly willing to give up the "freedom" to be fatally injured on the roads.

The ordinary person has little to fear from the introduction of personal identification cards. The vast majority of us do not abuse the "system" and thus are penalised every time somebody takes advantage of its weaknesses. The civil libertarians should think more about that.

No doubt there will be screams of anguish from those who want to preserve their anonymity. Ultimately, when you think about it, these people don't want to take responsibility for their actions. In today's complex society, we can't afford that. Let us use the technology, for the greater good of the country.



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74LS21	Dual 4-input positive AND gate	Z-4924	.95	.90
74LS123	Dual monostable multivibrator	Z-5310	$1.30	$1.15
74LS153	Dual 4-input multiplexer	Z-5315	$1.10	$1.00
74LS157	Quad 2-input multiplexer	Z-5287	$1.15	$1.05
74LS190	Up/down decade counter	Z-4999	$1.60	$1.50
74LS191	Up/down binary counter	Z-5000	$1.50	$1.40
74LS221	Dual monostable multivibrators (schmitt-trigger)	Z-5296	$2.25	$2.00
74LS240	Octal buffer/line driver	Z-5298	$2.20	$2.00
74LS241	Octal buffer/line driver	Z-5293	$2.50	$2.25
74LS244	Octal buffer/line driver	Z-5294	$2.40	$2.20
74LS245	Octal bus transceiver	Z-5299	$2.20	$2.00
74LS374	Octal D-type flip flop	Z-5297	$2.00	$1.90
74C Series CMOS				
74C74	Dual D-type edge triggered flip flop	Z-5372	$1.30	$1.20
74C157	Quad 2-input multiplexer	Z-5374	$4.50	$4.05
74C173	4 Bit D-type register	Z-5376	$2.95	$2.70
74C221	Dual monostable multivibrators (schmitt-trigger)	Z-5378	$4.10	$3.80
74C922	16 Key encoder	Z-5380	$9.50	$9.00
4000 Series CMOS				
4044	Quad 3-state NAND RS latch	Z-4370	$1.65	$1.55
4528	Dual monostable	Z-4366	$2.45	$2.20

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LM335H	Precision temperature sensor (TO-46)	Z-6050	$4.00	$3.60
LM35Z	Precision temperature sensor (TO-92)	Z-6051	$2.40	$2.20
LM336AZ2-5	2.5V Reference source	Z-6036	$4.95	$4.70
LM336BZ5-0	2.5V Reference source	Z-6037	$4.95	$4.70
LM1871N	RC encoder	Z-6103	$6.95	$6.30
LM1872N	RC decoder	Z-6104	$7.95	$7.20
LM3046N	NPN Transistor array	Z-6107	$1.85	$1.75
LM10CLN	Op amp/voltage reference	Z-6084	$6.95	$6.30
LM13080N	Programmable power op amp	Z-6106	$2.50	$2.25
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LM78L05CZ	3-Terminal 5V 100mA positive regulator	Z-6108	.60	.55
LM78L12ACZ	3-Terminal 12V 100mA positive regulator	Z-6110	.60	.55
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ADC0802LCN	8-Bit A to D converter (error+.5% LSB)	Z-6833	$14.95	$13.50
DAC0800LCN	8-Bit D to A converter (non linearity + 0.19%FS)	Z-6834	$4.80	$4.40
LM1458N	Dual Bipolar Op Amp	Z-6028	.95	.85
SN76604N	Servo Amplifier (RC)	Z-6835	$5.25	$4.75
SC141D	400V/6A economy triac	Z-4510	$1.60	$1.50
BC327	100MHz 0.8W PNP Amplifier	Z-2240	.35	.30
MJE340	20W NPN High Voltage Amp	Z-2010	$1.20	$1.10
2N3904N	200MHz PNP Gen Purp Amp	Z-2070	.20	.18
2N3905A	200MHz NPN Gen Purp Amp	Z-2071	.20	.18
2N3460	N Channel J-FET	Z-2072	$2.60	$2.45
2N5486	N Channel J-FET	Z-2073	.70	.65
PN4360	P Channel J-FET	Z-2074	.85	.80
74HC00	Quad 2-input NAND gate	Z-5800	.90	.80
74HC02	Quad 2-input NOR gate	Z-5802	.90	.80
74HC04	Hex inverter	Z-5804	.90	.80
74HC08	Quad 2-input AND gate	Z-5808	$1.10	$1.00
74HC11N	Triple 3-input	Z-5811	$1.10	$1.00
74HC14	Hex Schmitt-Trigger	Z-5814	$2.10	$2.00
74HC27	Dual J-K flip flop	Z-5827	$1.10	$1.00
74HC30	8 input NAND gate	Z-5830	$1.10	$1.00
74HC32	Quad 2-input OR gate	Z-5832	$1.10	$1.00
74HC74	Dual D-type edge triggered flip flop	Z-5874	$1.30	$1.10
74HC76	Dual J-K master/slave flip flop	Z-5876	$1.30	$1.10
74HC85	4 Bit magnitude comparator	Z-5885	$1.80	$1.65
74HC86	Quad 2-input EXCLUSIVE OR gate	Z-5886	$1.30	$1.10
74HC123	Dual re-triggerable monostable	Z-5910	$1.80	$1.65
74HC138	Expandable 3/8 decoder	Z-5915	$1.80	$1.65
74HC139	1 of 8 decoder/multiplexer	Z-5920	$1.80	$1.65
74HC157	Quad 2-input multiplexer	Z-5925	$1.80	$1.65
74HC165	Par load 8-bit shift register	Z-5930	$3.50	$3.25
74HC174	Hex D-type flip flop	Z-5935	$1.80	$1.65
74HC221	Dual monostable multivibrators (schmitt-trigger)	Z-5940	$3.95	$3.65
74HC240	Octal buffer/line driver	Z-5945	$3.50	$3.15
74HC244	Octal buffer/line driver	Z-5950	$3.50	$3.15
74HC245	Octal bus transceiver	Z-5955	$4.95	$4.50
74HC367	Hex bus driver & 3 state o/p	Z-5960	$1.95	$1.80
74HC373	Octal 3 state latch	Z-5965	$4.10	$3.80

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Size	Cat No.	Size	Cat No.
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2.7pF	R-2421	100pF	R-2485
3.3pF	R-2423	150pF	R-2489
5.6pF	R-2429	220pF	R-2493
15pF	R-2439	270pF	R-2495
18pF	R-2441	330pF	R-2496
27pF	R-2445	560pF	R-2501

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And for really high voltages:
.001uF, (Cat R-2740) 1600V DC 80¢ ea (75¢ ea 10 up)

Big Savings on Cable Connectors

Genuine 3M Scotchlok® brand connectors Type UG. They're the ones used by Telecom! Now at a BARGAIN price! Cat J-1020

PACK OF 10 ONLY **$1.99**

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Circuit included.

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Quality microswitches with positive switching action ! These are ideal wherever a limited switching movement is required. Don't miss this great deal! SPDT, 5A 12V or 3A 250V rating. Cat J-1004
Genuine Omron brand.

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Famous Brand Swann Switches

Great value press fit mounting Swann switches! 240V, 4Amp. Ideal for that project where appearance is important. DPST Contacts. Cat J-1003

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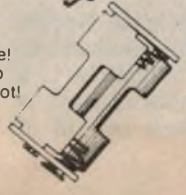
Half Price Battery Holders!



Universal fitting battery holders at an amazing LOW price! Holds 4 'AA' batteries and accepts standard battery snap connector. Grab a few for the junkbox while the bargain's hot! Cat P-6124

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Matte Black Spray Paint

A quick drying matte finish spray. Suitable for giving your project that professional finish. Ideal for spraying heatsinks to increase thermal efficiency. 175 grams. Cat N-1070

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Do it with Diodes

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LT2462-52	Dual Colour LED, Red/Green Cat Z-4070	.60
TL32555	LED 5 × 2mm Rectangular, Yellow Cat Z-4097	.40
FND507	7 segment LED Display Cat Z-4152	$1.65

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A981/SC

See page 81 for address details

News Highlights

You can bet on AWA

An impression of the totalisator screen as it will appear at the Sha Tin racetrack.

Do it yourself satellite receiver

The aggressive Parry group of companies has announced plans to market a do-it-yourself satellite dish to pick up Aussat programs.

Parry's subsidiary group, Communications Technology Corporation, will market a number of new telecommunications devices, with the Homesat satellite dish as the centrepiece. It will be available for Aussat's launching later this year for residents in the outback, and those people not satisfied with conventional transmissions within their range.

The 1.8-metre diameter dish consists of six aluminium segments and a single pole pedestal mount. It can easily be transported in a car and erected by a handyman, with the final alignment and testing preferably carried out by the dealer.

The cost will be between $2000 and $3000.

The company is also about to market other products including commercial 2.8 metre antennas; two-way terminals in digital or analog form, capable of receiving and transmitting voice and data, and receiving video; and a wide range of FM, AM and TV (VHF and UHF) transmitters with power levels from 2W to 2kW for community re-transmission systems.

— The Australian Financial Review.

Australian software finds US markets

In an agreement similar to that drawn up between Attache and IBM in Australia and New Zealand, IBM Canada is to market the Australian-developed accounting software, Attache.

The software will be acquired and distributed under a "vendor logo" agreement. This means that it will be sold using Attache's logo and packaging with IBM Personal Computers.

Meanwhile, the Australian software company, Computer Power, has signed a software agreement with Wang Laboratories. Under this agreement Wang will promote Computer Power's Status information retrieval system throughout the US. The company has also made a similar agreement with Data General.

Computer Power moved into the US market about 18 months ago with the establishment of an office in New York. Since then, the company has sold software to Exxon Corporation and Kodak.

Strong gains for nuclear power

In spite of adverse publicity in recent years, nuclear power continues to gain ground in both developed and developing countries. During 1984, for example, nuclear power stations produced 18% of the electricity used in the OECD countries. By the end of 1984, 264 stations were in use in 13 countries, 21 more than at the close of 1983.

According to the Paris-based Nuclear Energy Agency, electricity produced by nuclear power stations increased by 15% during 1984 to an installed capacity of 182 gigawatts, the highest rate of increase since 1977. There were 86 nuclear installations in operation in the US, 41 in France, 32 in Britain, 31 in Japan, 19 in West Germany, 16 in Canada, 10 in Sweden, seven in Spain, five each in Switzerland and Belgium, four in Finland, three in Italy and two in the Netherlands.

In France, 58.7% of the total electricity supply is now produced by nuclear power stations. The French predict that the total installed nuclear capacity in the West will double by the year 2000, reversing the trend of the late '70s.

A huge electronic totalisator display screen, designed and manufactured by AWA (Australasia), was delivered last May to the Royal Hong Kong Jockey Club.

AWA is the largest totalisator operator in Australia. It has already supplied display systems, wagering computer systems and terminal equipment to a number of race tracks in Australia and Hong Kong. It also supplies most of Australia's TABs with wagering terminals.

The Hong Kong screen measures more than 56 metres in length and six metres in height. It contains 500 display characters, each controlled by its own microprocessor. Also included are some 20,000 integrated circuits and 22,000 light bulbs.

The screen is powered from a 24V DC rail to ensure safety and to avoid problems in selling the design to other countries. The size of the screen could classify it as a building in some countries and thus subject it to local wiring rules for buildings if mains voltages were used.

Europe fears Star Wars braindrain

Star Wars defence systems being developed by the US may sap Europe of its best scientists, if the Reagan administration is to have its way.

The $US26 billion defence program wants the cream of Europe's scientists to join its ranks. French President Mitterrand has rejected Washington's invitation to join in the Star Wars research program. Said Mitterand, "the countries of Europe must preserve their skills and grey matter."

Mitterrand wants Europe to support his proposed alternative program, Eureka, which provides for joint research into the non-military aspects of the Star Wars plan. These include high-power computers, artificial intelligence, lasers, sensors and advanced telecommunications.

There is a political advantage inherent in the Eureka project. French officials insist it is not intended for military ends and this shields the participating governments and companies from much of the political fallout of Star Wars.

Many of the European governments view the military implications of Star Wars with reservation because of its potential to exacerbate the arms race.

Further reservations stem from the European realisation that Star Wars research may lead to American dominance in a large range of new technologies. European officials doubted that co-operation in Star Wars would be on an equal footing and fear that European companies would be nothing more than subcontractors with no rights to the complete results of the work in which they were involved.

Above: The liquid crystal colour display screen developed by Matsushita.

Giant-size liquid crystal colour display

The Matsushita group in Japan has developed a giant-size LCD screen for demonstration at the Tsukuba Expo '85.

The product is a second generation version of the slit diffusion LCD screen first developed in October 1983. Improvements on the first generation LCD joint design have made seams between screen panels much less conspicuous although, as the photograph shows, they are still quite visible.

The screen comes in three standard sizes, the largest measuring 3.2 metres high by 4.3 metres wide.

High-tech bans slow Soviet military growth

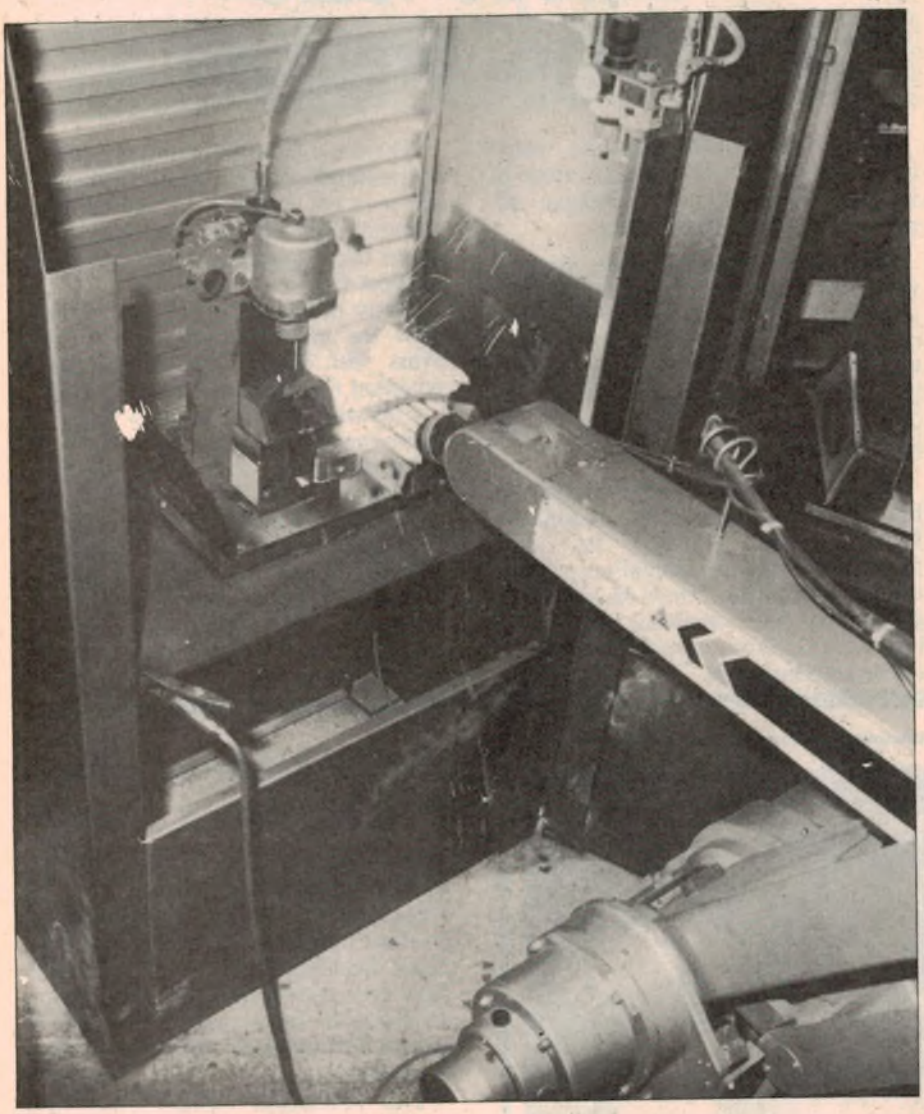
The Reagan crusade to ban shipments of high-technology equipment from the West to the Soviet Bloc is beginning to produce results, according to US officials. Because of the bans, the Russians have been forced to spend more money on research, leaving them with less to plough into the development of military hardware.

The Americans believe that their strategy has paid economic dividends. Pentagon officials claim that the export controls have saved the US between $US14 billion and $US27 billion in additional defence spending. In particular, the Russians could have made dramatic improvements in sensor technology for tracking submarines, and in computers and anti-missile technology involving lasers and particle beams.

But military technology is not the only area of current Soviet difficulty. Russian attempts to mass-produce their own personal computer, the Russian Agat, were not successful, and the Soviets now want western PCs to launch a mass computer literacy program.

If the government can find the money, Soviet schools may soon be shopping for PCs from IBM, Apple and some European suppliers. Some analysts predict that the orders could be the largest from the West since 1979, when the Soviets invaded Afghanistan and trade collapsed.

News Highlights



CIG's robotic welding — cutting assembly time and wastage.

Robotic welding system for CIG

At CIG's plant in Preston, Victoria a Transrobo WS-3000 robotic welding system is being used to manufacture the new Metalcraft electric arc welder. The robot automatically welds transformers, the first such application for a robot in Australia.

CIG introduced the robot to speed up production and to cut costs. Other cost cutting areas included microprocessor-controlled bobbin winding of the transformer and automated computer testing of the assembled product.

The Transrobo is a high speed, five axis, computer controlled robotic welding system. It welds the transformer halves together and then welds the subassembly to the base of the unit. According to CIG, this has considerably cut assembly time and material wastage.

Australia's biennial electronics exhibition

The Institution of Radio and Electronics Engineers convention, IREECON '85, will take place in Melbourne's Royal Exhibition Building from September 30 to October 4. The associated lecture program has attracted papers from authors throughout Australia and around the world.

Exhibitors range from the large to the small and include Telecom, OTC and Aussat.

To mark the 20th IREE Convention and the 150th anniversary of the host state Victoria, the IREE will be sponsoring a number of Student Awards. The theme for IREECON '85 is "The New Era of Communications".

Mr Stephen Strobel shows the device which prevents carburettors from icing up.

Keeping your fuel warm — *electronically*

An electronic device which prevents carburettors in cars from icing up has won its designer an international award for his innovation.

The device is the brainchild of Mr Stephen Strobel, the Engineering Manager of Texas Instruments' manufacturing plant at Elizabeth in South Australia. Mr Strobel's invention takes the form of a "gasket assembly", incorporating a "PTC" ceramic heater, which can be fitted between the inlet mainfold of the engine and the carburettor.

Linked to the motor vehicle's electrical system, the PTC ceramic is electrically heated to a preset temperature. This maintains the carburettor temperature at above freezing point all year round. Texas Instruments has taken out patents on the device in Australia and in other countries.

Speeding train checks track wear — Australian invention to US

A Perth high technology company, Aldetec Pty Ltd, has delivered a $500,000 computer-controlled device for monitoring wear on railway lines to an American railroad company.

Called Liteslice, the device is said to be the only machine of its type available in the world, thereby opening up a huge potential export market for Aldetec.

At present wear on railway lines is checked using a hand-held mechanical device, a difficult and time-consuming task. Using Liteslice, maintenance engineers are able to check the condition of the tracks while travelling at 80km/h.

The device, which is mounted underneath a train carriage, has filtered globes which throw a narrow band of light across the rail. Two cameras mounted at angles record the shape of the rail exposed by the light. This information is then fed into seven DEC LSI-11/73 computer systems in the carriage.

By comparing the computer generated profile of the rail with an onscreen template of the optimum shape, an operator can measure the wear on a rail very accurately and so minimise the possibility of tragic and costly accidents.

According to the managing director of Aldetec, Mr Bill Legge, the company has identified a market potential for at least 20 of the systems in North America over the next two years. China and Europe have also expressed an interest.

Aldetec is also working on an ultrasonic system to detect cracks and flaws in rails, and is conducting a feasibility study for the Department of Defence to examine the possibility of developing an underwater device to check propellers on ships.

— The Australian Financial Review.

DEPEND ON JAYCAR

2nd HAND SURPLUS ☆ BARGAINS ☆

Jaycar does not normally sell 2nd hand surplus goods but this purchase was just TOO GOOD to knock back! We have basically purchased an amount of electronic equipment from a large Australian Banking group. We are offering two items for sale, both absolutely astonishing value for money. We defy you to buy more high quality electronics for less. Both items are in outstanding condition and have not been in service for all that long. They are a distinctive orange colour. Because they are so heavy (compared to their low cost) special P&P conditions apply.

ITEM	NSW	VIC	QLD	SA	NT & WA	TAS
XX 5910	$2.90	$4.60	$6.20	$5.80	$8.20	$5.80
XX 5900	$4.15	$8.00	$12.00	$12.00	$12.00	$12.00

PASSBOOK PRINTER UNIT

This is the familiar unit that prints your deposit balance in your passbook savings account. The unit weighing a massive 12.5kg has a one-line matrix printer, with large gearbox reduced stepping motors for carriage head drive and passbook positioning. We estimate that ONE motor alone would be worth at least $70. Apart from this there are 7 (YES 7) main PCB's all crammed with transistors, passives, edge connectors, gold IC sockets, Cannon subminiatures, not to mention LSI & MSI IC's, heatsinks, power transistors etc. AS WELL AS THIS a massive computer grade power supply is included, which is based on two (YES 2) monstrous double C core transformers! The power supply will provide standard voltages of +5, +12V etc. The equipment is of such recent vintage to use insulation displacement connectors.
We emphasise that the equipment is not new and may not still perform its original function (no problem if you don't own a bank!). We do not have circuit diagrams but they would be meaningless anyway.
They are however, an outstanding opportunity to get hold of hundreds of normally ridiculously expensive components at a fraction of their cost price. We are absolutely convinced that you will be delighted with this purchase.
Size: 345(W) x 310(D) x 215(H)
Cat. XX-5900

ONLY $35.00

TELLER UNIT

This unit provides numeric display and data entry facility for bank tellers. As a spare parts bargain, this unit has several features:

- ★ A 12-digit (x7 segment) LED display. Display height 8mm. US made LITRONIX displays.
- ★ Two Hall-Effect keypads, one 13-key pad, one 7 key pad.
- ★ Six PCB's crammed with LED's, IC's, IDC edge connectors, tantalum & other capacitors, resistors etc.
- ★ Two TO-3 voltage regulators, one LM323K & one LM320K5.

This 3.5kg unit is fitted with a 50 way Cannon 'D' plug as well. Once again we are certain that you will be delighted with this purchase.
Dimensions: 210(W) x 300(D) x 150(H)
Cat. XX-5910

ONLY $15.00

Units shown with covers removed.

INFRA RED MOVEMENT DETECTOR

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Cat. LA-5017

$109

MOTOROLA PIEZO TWEETER BARGAIN!

Quite frankly we were staggered when an importer came to us with his dilemma. We couldn't believe our ears when we were told the price of the genuine US-made Motorola brand KSN-1071 high performance tweeter. "With such a strong US dollar" they said the price we offer to you is far below our current replacement cost. This HI-FI high power tweeter is a surface mount, controlled dispersion line source unit that is fitted with its own grille panels. The use of high temperature materials in its construction enables it to be used in automotive applications. Two piezo elements provide a wide (90°) dispersion horizontally with a narrow 30° dispersion vertically. Sensitivity is 98dB @ 2-8V @ ½m. Frequency response easily goes out to 40kHz but this can be limited with external passive components if necessary. A comprehensive data sheet is supplied, which includes frequency response graph, specs, mounting details etc.
The KSN-1071 normally sells for a very reasonable **$24.00** each (pre devaluation). While stocks last, this unit is available from Jaycar for the ridiculously low price of **$12.95 each!** That's right! A high quality, high power HI FI tweeter for a pittance! HURRY!
Cat. CT-1918

ONLY $12.95 each

240V MAINS LEADS - CANNON LNE PLUG

We have a small quantity of moulded 240V plug on a length of 3 wire sheathed cord terminated with a Cannon XLR-LNE-11C line socket (i.e. the STANDARD 240V Cannon line connector). The cord length varies. The XLR-LNE-11C sells normally for **$6.50**, but because these factory-made lead assemblies have been used the WHOLE THING can be bought for **$3!** No cat number - goods at the Concord Salvage Warehouse ONLY. Mail orders O.K. but add $2.00 P&P.

SPECIAL!!

UAA170 LED Bar Display

This device will drive up to 10 LEDs in a bar type display. It will only illuminate the most significant LED and therefore the display will appear as a moving dot. 16 PIN DIL package. Data supplied if asked for.

WORTH $3.50

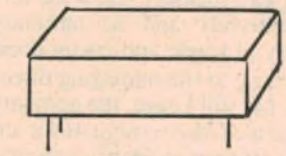
ONLY $2
Cat. ZL-3179

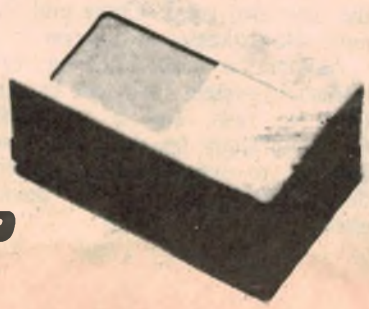
or 10 up $1.50 ea.

RAILWAY MODELLERS NOTE!
NEC Brand Reed Relay

This beautiful little relay measures 29(L) x 12(W) x 8(D). It has 2 separate SPST (i.e. DPST) accessable contacts. The coil is rated at 48V but will operate the dry reeds at a lower voltage. The unit is meant for PCB mounting.
This relay is ideal for railway modellers. It is a very high quality relay.
Cat. SY-4065

ONLY $1.00 each





PLUGPACK BARGAIN

Plug Pack This unit will give a DC output of 1½, 3 or 4½V @ 250mA (max). A switch on the back of the unit changes the voltage. It is also supplied with a 1.6m cord, polarity reversing plug and multiway connecting plug. We have over 500 of them.
This voltage range is fairly useless except for small transistor radios, calculators etc. At this price however, it's worth having one or two for the inevitable occasion when such a power source is required.
Cat. MP-3002

ONLY $2.95
You could pay over $10 elsewhere!

3C-2V 75 Ohm COAX - 7 metres??

Seven metres? Well this is a pack of 7 metres of high quality coax cable. Why seven metres is beyond us except that it was thought to be the most asked for length and why not therefore prepack it? The bean counters got their sums wrong because it did not sell! 7 unterminated metres would normally cost $3.50. Jaycar has a fair quantity of these fairly useful lengths for only $2.00 which amounts to a substantial saving!

ONLY $2.00/7 metres

Cat. HP-1360

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A SCOOP PURCHASE of a high quality modulator that accepts AUDIO & VIDEO inputs. It is very stable & was originally used in a famous brand Teletext Decoder. BRAND NEW - QUANTITIES LIMITED.

Cat. LT-3805 **$7.95**

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SPECIAL ANNOUNCEMENT

We have been very successful in the last few years passing manufacturers distress stock at low prices to you, the customer. On many occasions manufacturers have landed stock in small quantities that has not been sufficient to advertise and distribute through all our stores. Some of the items offered have been unbelievable!!!
We have decided to do something about this dilemma. Jaycar has converted our centrally located Concord store to a

SALVAGE WAREHOUSE

This store will be the ONLY location where you will find incredible bargains in new & used equipment, surplus components and some company stock that is not worthy of repair but valuable in itself.
The Concord store will still carry all the regular Jaycar lines but the surplus will be IN ADDITION to this stock. We will not have the space in our ads to describe the stock there. Many of the specials are in limited quantities as well.
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Cat. AV-6506
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Surface mounted components — the quiet revolution

A quiet revolution has been taking place in electronic components over the last couple of years. More and more equipment is being assembled with surface-mount components. This article tells about these new components, their advantages and the way in which they are used.

by LEO SIMPSON

Electronic components have been shrinking in size ever since the first wireless sets were built. In the valve days, electronic circuits were assembled by point-to-point wiring. The components were literally soldered from tagstrips, to valve sockets and so on. This required componets such as capacitors and resistors to have axial leads.

The point-to-point wiring method is essentially simple but requires a lot of labour. Even so, it is still used today for some high power electronic circuitry.

The next step in the evolution of electronic components was the introduction of the printed circuit board. This occurred at the same time as the first transistor radios appeared but printed boards were also used extensively for valve circuits such as television sets in the late fifties and early sixties.

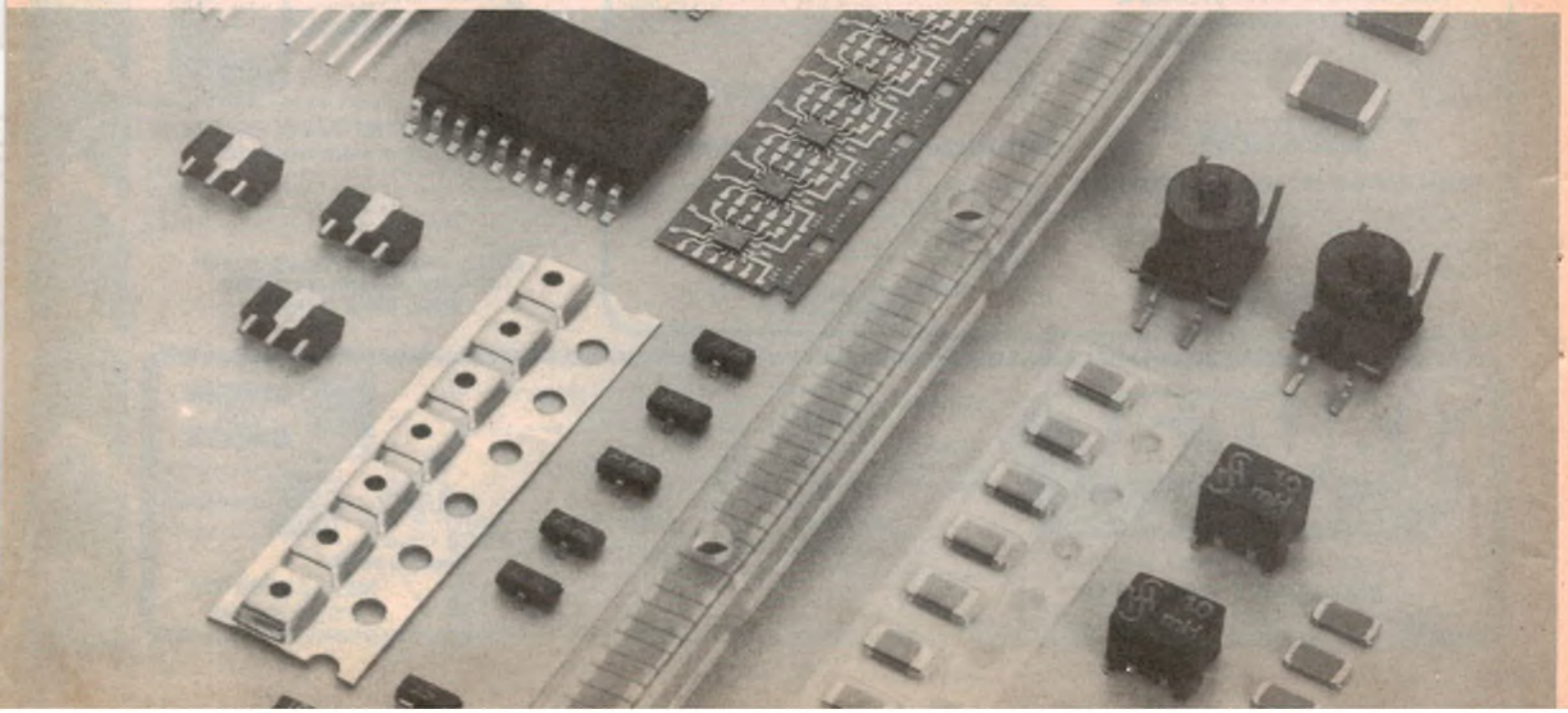
With printed boards, the electronic components no longer had to be individually handled and soldered into circuit (although they often still were). Components could now be assembled into the boards by machine and soldered all at once in a flow solder bath, in a continuous process. This led to more reliable circuits as solder joints became more reproducible and consistent.

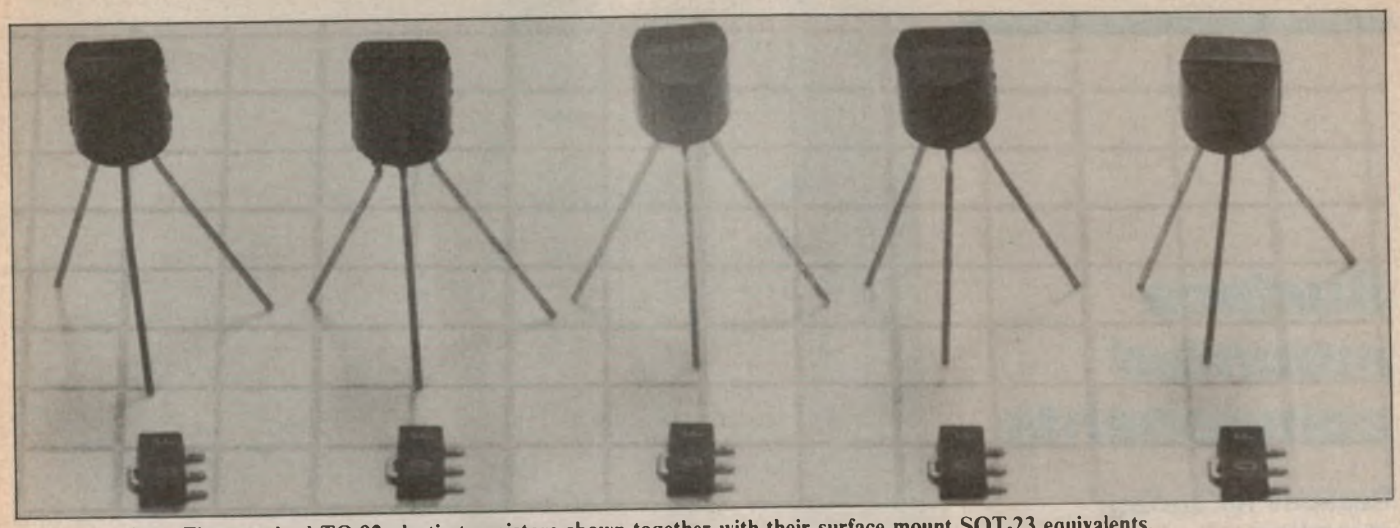
With the wider use of transistors, circuit voltages were lower and components could become much smaller, as they were anyway, as component dielectrics improved. As the components became smaller they also evolved into essentially single-ended components (ie, with the pitgails at one end, as for PC mount electros).

Finally, as semiconductor miniaturisation and integration progressed, housings such as the dual in-line IC package were developed.

Today, between 80 and 90% of all electronic components produced are intended for assembly into printed boards.

Below is part of the range of Siemens surface mounted components, depicted several times actual size.



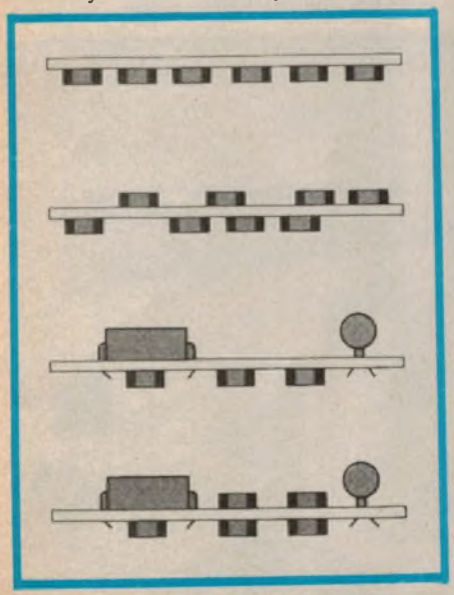


Size comparison: Five standard TO-92 plastic transistors shown together with their surface mount SOT-23 equivalents.

Surface mount components

Thin film and thick film hybrid circuits were a special development aimed at achieving further miniaturisation and higher reliability, plus greater control over circuit parameters. Since it is very difficult to provide holes for PC mounting components in ceramic or glass substrates used for these thick and thin film circuits, the natural result was that the components (usually passives such as resistors, inductors and capacitors) were simply soldered to the surface metallisation of the substrate. They were said to be "surface-mounted".

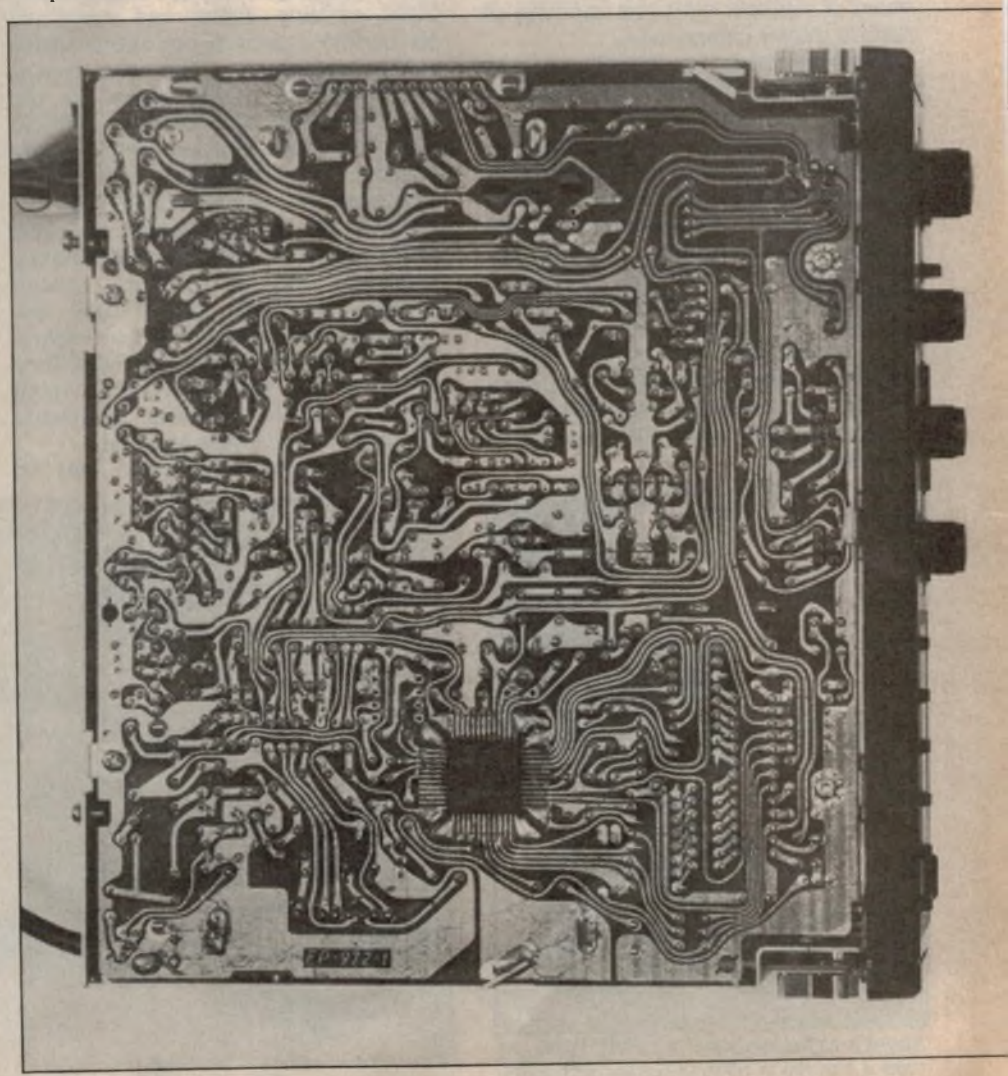
Inevitably, there were pressures to further reduce the size of these components and this was achieved by keeping the encapsulation of the component body to the minimum size possible and using only those component technologies which automatically ensured small size. For capacitors, this meant an emphasis on tantalum electrolytics and multi-layer ceramics.



SMCs can be mounted on or below PC boards.

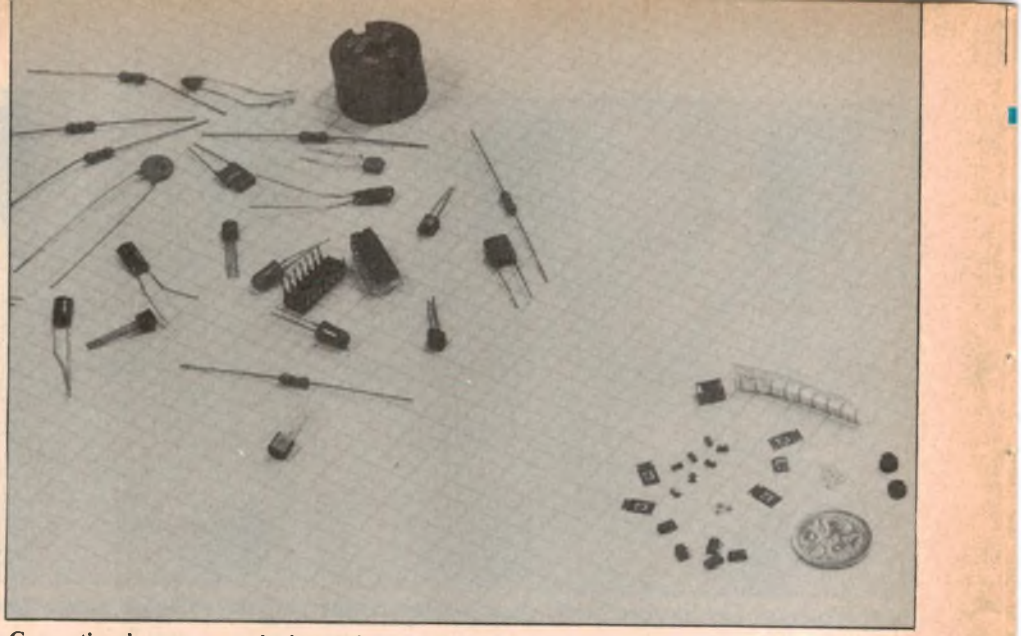
Because of the generally higher costs involved, the use of surface mount components on printed boards has been adopted only recently. Two of the obstacles which have had to be overcome before this could occur were their ability to be flow-soldered and differences in temperature coefficients of expansion which can lead to fractured components and solder connections.

Now, with these problems effectively solved, by careful choice of component materials, surface mount components are rapidly spreading to all branches of electronics and, particularly in Japan, to consumer electronics.



This is a surface mounted microprocessor in a car radio chassis.

Surface mounted components



Conventional components look very large compared with surface mount types.

Reasons for surface mounting

One significant reason for adopting surface-mounting components has already been mentioned: miniaturisation. To put it another way, surface mount components allow a much higher packing density on printed circuit boards. Typically, it is possible to obtain a 50% reduction in size when a circuit board is replaced with one carrying all surface mount components.

Another reason for changing over to surface mount components is reduction in cost. This may not be self-evident especially as surface mount components are presently a little dearer than ordinary components. However, when the total cost of a circuit is considered, the cost savings become apparent. For example, the drilling of printed boards to take each component is a significant cost, especially for dual in-line IC packages. Mass production of circuit boards requires a major investment in precision drilling machines and maintenance of tungsten carbide tipped drills is difficult and expensive.

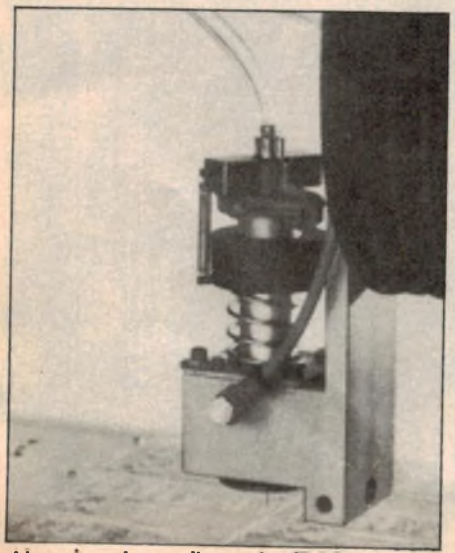
Component types

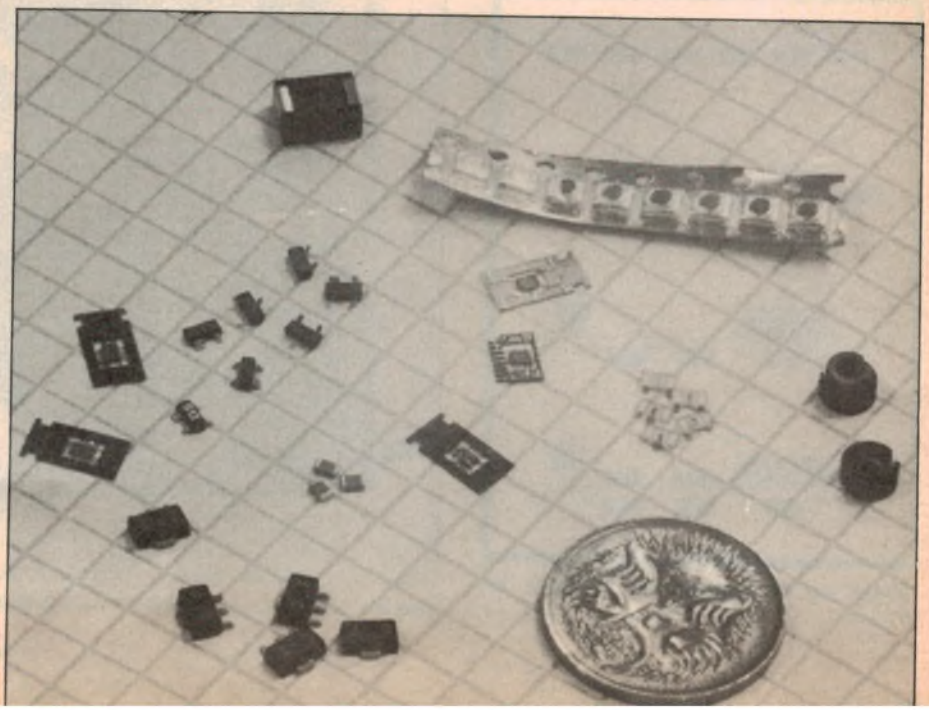
There are two major types of surface mounting component (SMC). The first type is the rectangular or chip component, which includes transistors and IC packages having vestigial leads. Light emitting diodes and metallised plastic film capacitors are also available as chip components. The other type is cylindrical and is also known as the metal electrode face bonding (MELF) type. The latter type comprises mainly resistors and capacitors and is not as widespread as the rectangular types.

SMCs also do not require any lead preparation such as cutting and bending, although they do require special handling measures, as we shall see. Offsetting this, SMCs are particularly suited to automation and indeed, if they are to be used successfully in anything but very small quantities, automatic placement on boards is essential.

Surface mount components may be used in conjunction with conventional components and the soldering process in production needs practically no modification. This can lead to an easy transition to a wider use of surface mounting. What tends to happen is that surface mounting technology can be introduced with just a few components on a board to provide initial experience without incurring substantial risks.

As the trend to SMCs accelerates, they are rapidly becoming cheaper. They are presently about 15% dearer than equivalent conventional components and should shortly be lower in price. Indications are that SMCs of all kinds will have at least 50% and possibly as high as 70% share of the total component market by 1990. This forecast is substantiated by Japanese production figures which were approximately one billion in 1980 and 15 billion in 1983. These figures are for chip resistors and capacitors alone.





Above is a glue applicator for SMC fixing. At right is a group of SMCs together with a five-cent coin to set the scale.

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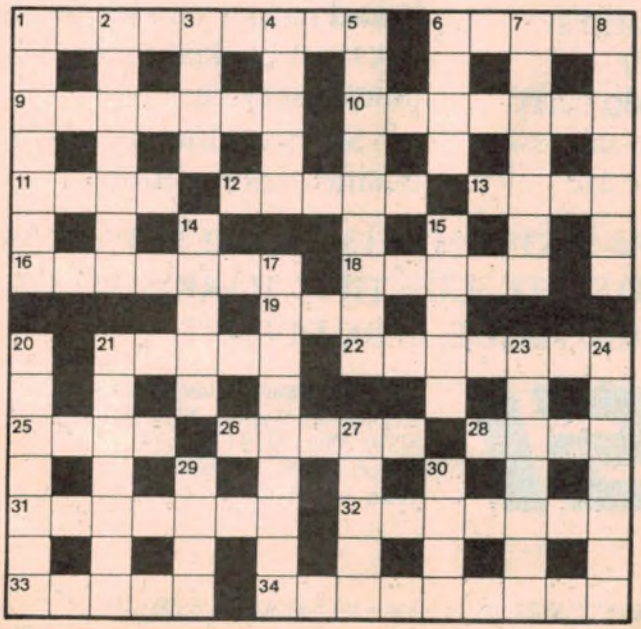
JULY CROSSWORD

ACROSS

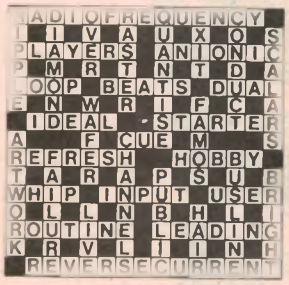
1. Short-lived electronic phenomenon. (9)
6. Memory system. (5)
9. Record handling system. (7)
10. Element used with indium in magnetic bubble technology. (7)
11. Possible cause of mistracking. (4)
12. An EA project, the Railmaster . . . controller. (5)
13. Collection of records. (4)
16. Type of loop on certain cassettes. (7)
18. Station broadcasting on 846kHz. (3,1,1)
19. Acronym for an electronic instrument. (3)
21. Erase digital data. (5)
22. Type of cable. (7)
25. Shade of black and white. (4)
26. Description of an electronically guided weapon. (5)
28. Type of transistor. (4)
31. Adjusting component. (7)
32. Base SI unit. (7)
33. Line-addressable memory. (5)
34. Oscillatory effect. (9)



DOWN

1. Specialised conductor. (1,1,5)
2. Set for detection. (7)
3. This can be positive or negative. (4)
4. Deviation. (5)
5. Switching device. (9)
6. Data units. (4)
7. This is determined by a pH meter. (7)
8. Notation expressing digital data. (7)
14. Communication system. (5)
15. Concerned with certain charged particles. (5)
17. Security device in telecommunications. (9)
20. Said of elements used in computer design. (7)
21. Tape-recording accessory. (7)
23. Said of the mathematical system used in computer logic. (7)
24. Power. (7)
27. What one does to a particular kind of switch. (5)
29. A memory. (4)
30. Basic structure of 5 down. (1,1,1,1)

SOLUTION FOR JUNE



Surface mounted components

In the case of these passive components, substitution for conventional leaded components is already quite advanced for Japanese mass-produced electronic equipment. By 1983 it was already between 20 and 30%. The declared target figure for Japan is 50% by 1987. By comparison, Europe is moving more slowly and it is expected that 30 to 40% of conventional components will be replaced by SMCs by 1990.

In the USA, the trend is probably somewhere between Japan and Europe. Note that the Data General One computer, previewed in this issue on page 88, uses a very high proportion of surface mounting ICs, particularly for memory devices.

In the light of this trend, the forecast of at least 50% of all components to be SMCs by 1990 looks entirely realistic.

RF advantages

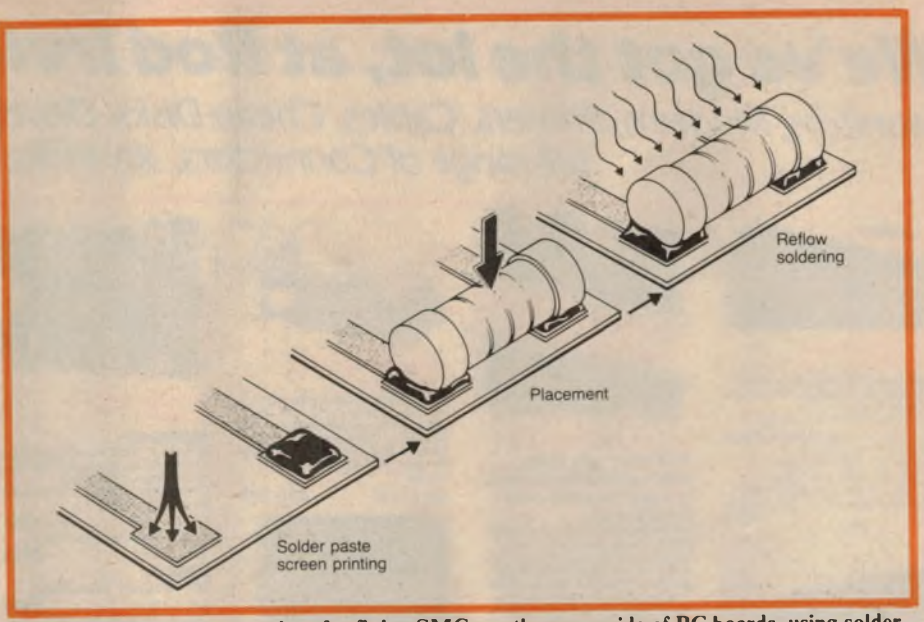
The small size and lack of any leads automatically gives improved RF characteristics to SMCs, because inherent lead inductances and stray capacitances are reduced. In addition, the solid connection between the component body and the circuit board provides the shortest possible path and improves the consistency of the circuits in mass production. The solid connection path also leads to greater RF stability.

These improved RF characteristics are also beneficial to digital circuitry in providing improved switching and transit times. This becomes more important with the general trend towards higher frequencies in analog circuits and higher data rates in digital circuits.

Consequences

As the photos within this article show, SMCs are very small. So small in fact, that they are difficult to handle manually. Assembling them onto a printed circuit board and soldering is not really a practical proposition for anything but the smallest of production runs. It is clearly a job for machines.

As already noted, SMCs can be used in conjunction with conventional leaded components and may be soldered by the flow method in a solder bath. But how are these miniscule components held precisely in position while they are soldered? Two methods of placement and soldering have been developed and both involve the use of placement machines.



This diagram shows a procedure for fixing SMCs on the upper side of PC boards, using solder paste screen printing.

Method 1: solder paste

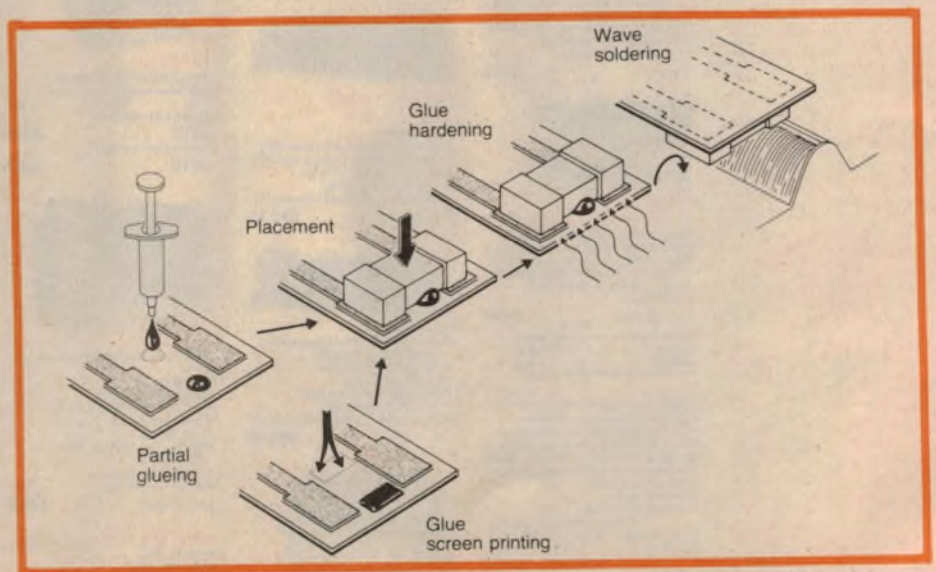
This involves the screen-printing of solder paste onto the copper pattern of the printed circuit boards before any components are assembled into or onto it. Each copper land intended for a surface mount component connection must be covered with just the right amount of solder paste. The screen printed boards are then loaded into automatic component insertion machines and are fully populated, which is a fancy way of saying that all the components are assembled onto them.

This method is frequently used in thin film circuit technology and is also suited for populated printed boards which only have components on the upper side.

The SMCs are precisely located and pressed on the boards so that they are temporarily held in place by the solder paste. This done, the boards are reflow soldered. This is achieved by heating the boards under radiant elements or by using a gas flame directly onto the components. This cures the solder paste so that it forms viable solder connections.

Method 2: Glue and solder

In this method, adhesive is applied on the copper pattern of the printed circuit board by screen-printing or stamp



This is the alternative mounting procedure whereby glue is used to hold the component to the board during flow soldering.

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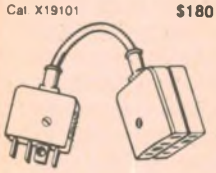

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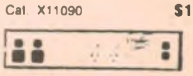

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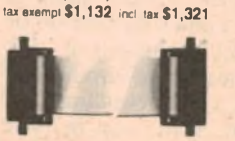

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If not, then very nearly!

Errors and ommisions excepted

Surface mounted components

printing using a needle matrix. The minute dots of glue must be matched to each SMC to be assembled. The glue is hardened after the components are placed by heat or ultraviolet light, or by a combination of both, depending on its composition.

Components placed in this way can then be safely soldered in a solder bath without any danger of them dropping off into the solder.

Note that during soldering the components are completely submerged in the hot solder. They must be able to withstand this process without heat shock or other damage. The adhesive used in this process must not only hold the components during soldering but it must also have no further reaction with the SMCs or board after soldering. Nor must it be so effective that the components cannot ever be removed from the board, if repair becomes necessary.

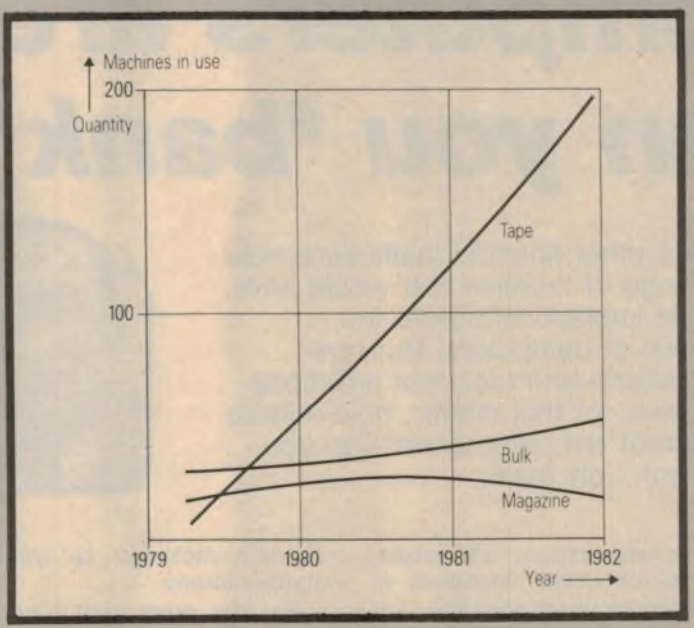
Such repairs are made by first melting and sucking off the solder, and then by heating the component body to soften the glue. This allows the component to be removed without damaging the board or any conductors which may be below the component.

The external design of SMCs for transistors and ICs, which have vestigial leads, must allow clearance for a precisely determined amount of glue, while still allowing the component to be pressed firmly onto the board.

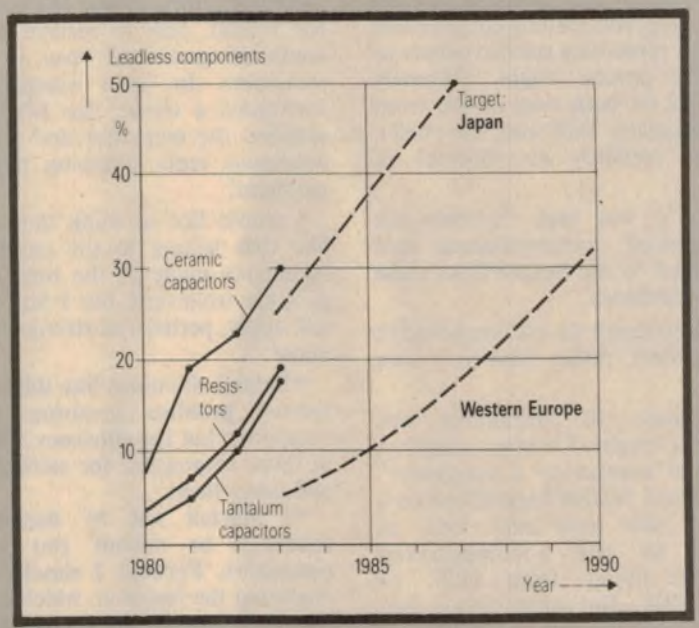
A range of automated machines has been developed for the assembly of SMCs into printed boards. One of these is shown in the photos accompanying this article.

What about the hobbyist?

All the foregoing seems to indicate that electronics is progressing to the point where hobbyists will no longer be able to be involved because the components are just too small to handle. This is not necessarily the case. While chip capacitors and resistors are exceedingly small and difficult to handle, the larger packages are quite practical for use by hobbyists. Indeed, *Electronics Australia* has a circuit design using a surface mounting microprocessor presently under development.



Numbers of automatic placement machines in Japan



Substitution of components with leads by leadless types (quantities)

Component feed	Machines in use	Component processing capability*) Quantities in billions	%
Tape	200	3,9	36
Bulk	50	4,8	44
Magazine	15	2,1	20
Totals	265	10,8	100

*) Two-shift operation, efficiency 70%

Table 1 Automatic component placing machines in Japan (figures for 1982)

Acknowledgement:

This article has been adapted from material published by Siemens and chiefly from an article in *Siemens Components*, Volume XIX, October 1984, by Hans Hein. All diagrams and most photos also came from Siemens publications. We thank Siemens Ltd for their assistance in providing this material.

Computers are great but can you 'bank' on them?

Banks and other financial institutions now offer a range of facilities that would have been quite impractical before the introduction of computers. But how secure, reliable and foolproof are those facilities and, for that matter, how reliable and foolproof are computers? Can you really "bank" on them.

FORUM

Conducted by Neville Williams

To a certain extent, the above questions mirror doubts expressed in these columns exactly six years ago — in July of '79. At that time, the "computerisation" of business houses, large and small, was gaining considerable momentum, prompting spirited debate as to how the process might ultimately affect people on both sides of the front counter: company staff and the public. There was certainly no shortage of critics.

Already, it was said, "citizens are being affronted, inconvenienced and disadvantaged by the output from these 'inhuman' machines.

"All to frequently we are compelled to fit in with them, rather than they with us!"

Appropriately, the instalment was headed: "The height of human indignity: being bossed around by a computer!" That sentiment, further highlighted by a cartoon, is still alive and well, as evidenced by the accompanying apprehensive letter from H.N. of Gulgong, NSW. But more about that later.

In July, '79, by way of example, we detailed a frustrating car insurance problem that staff writer (now Assistant Editor) Greg Swain had encountered in respect to his 1974 model 3300cc six-cylinder automatic Holden Torana.

The problem was eventually solved — four years later!

Toy/Ford Ghiolla!

Later we'd heard from a former staff member (Nov '79, p32) who had been prompted to examine the details on his renewal notice. He was startled to discover that, according to the insurance company's computer, the Toyota Corolla that he thought he was driving (and insuring) was really a Ford Cortina Ghia with air-conditioning! After a similar abortive exchange, he transferred to another insurer.

But the prize story (Oct, '79, p24) concerned a customer who ignored an "account" from a large Melbourne store for $00.00, only to receive a series of computer generated "pay up or else" reminders. In sheer exasperation, he forwarded a cheque for $00.00, which satisfied the computer and prompted a courteous reply thanking him for his payment!

I would like to think that situations like that belong to the past and that comments made at the time (July '79, p25) are irrelevant; but I fear that they still apply, perhaps as strongly as ever. I quote:

"Behind situations like this is a multi-faceted problem involving, not just computers but the efficiency and attitude of those responsible for setting them up and using them.

"I started out by deploring our tendency to submit too easily to computers. Perhaps I should really be deploring the isolation, which computers foster, between people requiring service and those in the business of providing it.

"Computers have become, at the one time, a symbol of progress and an excuse for just the reverse."

A recent example

As you've possibly guessed, these observations were prompted by another, more recent, close-to-home example of computer related ineptitude — this time involving a relative, a building society and an associated bank.

The person concerned took out a home purchase loan some years ago and arranged that payments be made automatically, each month, from her cheque account at the bank.

The arrangement worked smoothly until November last, when she received a computer printout from the building society indicating that "interest" of just over $200 was outstanding, which should be paid as soon as possible.

This was followed, some days later, by a further computer printout, in letter format but lacking a signature or any sign of human involvement. It requested "prompt" payment of over $500, including the regular, instalment due at the end of the month.

Unfortunately, nobody at the building society or the bank could offer a ready explanation for the special "interest" charge. As far as they could ascertain, all transfers had occurred on time and there had been no short payment due to lack of funds.

Ultimately, it transpired that the society's accounts had been transferred to a new computer system and that certain discrepancies had been picked up in the process. The trouble was that it had been left to the new computer to implement the adjustments, with no provision for a "human" explanatory note to the customers affected.

Since it was now December, with the holiday season approaching, the lady concerned decided to pay the required $500-odd over the counter, arranging with the bank to stop the automatic transfer for that month. That should have been the end of it.

But no: in mid-March she received yet another $500 arrears notice from the building society, and her exasperation knew no bounds. This time, it turned out to be the fault of the bank: instead of stopping just one month's automatic transfer, they'd stopped them altogether!

The last word is that everything now appears to be back on the rails — after a dozen or more interviews and phone calls over a period of five months!

Bank staff (and others) are quick to point out that such aberrations are rare, when considered against the total number of transactions. Perhaps so, but they are none the less disconcerting and

Computers: Are we paying a hidden price?

Mr Williams,

Much has been written in "Forum" and elsewhere on the technology of computers but very little on the sociological impact of these machines upon our lives.

You may have seen a report on the "National" (ABC-TV April 18) of an apparent wave of computer "vandalism" in Australia. If nothing else, the report highlighted what most of us have probably suspected anyway, namely the vulnerability of computer systems to outside interference.

You may also have seen the TV program "Whiz Kids" which, aside from any entertainment value seems, to me at least, to be a potential source of encouragement, particularly for youngsters, to experiment in computer activities somewhat less harmless than computer games and educational programs.

Whether this series is a good or bad influence on children, I cannot tell but, either way, it dramatises the ever-expanding involvement of computers in the intricate workings of a computer orientated society.

We are all aware, for example, that our bank statements are handled by computer, as also are our tax records, telephone accounts and so on. Businesses depend on computers and even the fate of our national security, I presume, is in the hands of that electronic beast — the computer.

Whether we like it or not, and whether or not we have ever been near a keyboard, our lives are in some way affected by computers.

You might argue that the same could be said about electricity and the internal combustion engine but no technology, I believe, has the capacity to revolutionise the working and social structure of a society as much as has computer technology.

Consider just one aspect that may touch a few sore spots for some of us: that of personal privacy. Just how easy (or difficult) would it be for someone with the knowhow to access personal information on you or me (tax records, credit rating, medical history, etc) that is stored on computer? I have in mind someone with no legal or moral right to such information.

Again, how easily could computer-stored information be tampered with to the detriment of the person(s) concerned. Come to think of it: how safe are my life savings? How secure is national security?

As technology progresses, the potential usefulness of computers grows at a remarkable, even explosive rate. The more useful that computers become, the more they are being used, and the more we become dependent on them.

The price of computers has fallen dramatically over the last decade or so, but is there a hidden price that we haven't reckoned on? That we can't even conceive yet, until it is maybe too late? Is it already too late?

When we've finished playing with our shiny new computer toys, maybe we should pause and consider whether computers, even science and technology, as a whole, has really made the world a happier, safer, better place to live in. You think it has? Well, tune in to the news any day of the week.

H.N. (Gulgong, NSW)

time wasting when they occur — and I could readily quote other examples, involving government and local government authorities.

Now "TV" banking

Such observations give me cause to wonder how things will work out when, in response to a flood of publicity for the Commonwealth Bank Telebank, people begin to manipulate funds and pay accounts from home by way of a Telebank (or other) keyboard or a suitably extended personal computer.

For some, it will come almost as "second nature" to do so but for others, I fear, "TV" banking could turn out to be yet another source of mutual confusion, adding to that already created by a multiplicity of accounts, books, forms, access cards, credit cards, etc.

It's easy to imagine a cynical scenario for TV banking: Oops . . . I've misspelt the password! What's the next transaction number? Hold on: did I transfer the money from here to there or from there to here? Curses! I should have paid this account first, not that one. Can I cancel that last entry? I could have sworn that I paid that bill last week. What do you mean you want to watch "Country Practice" . . . And so on.

When I tried to explore the subject with local bank managers and accountants, I didn't get very far. They're suitably familiar with banking

and accounting but, for the most part, they have problems enough coping with existing electronic gadgetry, without standing out front looking for more! Several times, I was told:

"You probably know more about computers than I do. You should really be talking to someone at our electronic systems centre. They're the experts at this sort of thing and I'm sure that every aspect of TV banking would have been looked at before the system was (or is) made available to the public."

Said one manager: "Our bank hasn't announced TV access yet. We're looking at it of course, but I'm not too worried about it. If our customers can learn to cope with computer printout statements and card systems, I guess that they'll be able to handle the same sort of information from a TV screen."

But an accountant at another bank was less comfortable about the impending introduction of "TV" banking:

"For sure, the terminals are linked to electronic data centres and that's where it all happens. But they're our customers too and, if something goes wrong, they'll front up at this very counter!

"We'll have to talk to them and then try to sort things out as best we can by back-tracking through our own electronic data, or getting somebody else to go back through theirs."

When I did talk to people in the EDP (electronic data processing) centres, they were as keen as one might expect about their latest technical "toy" which, incidentally, can offer a whole range of information and services in addition to actual banking functions.

They showed unbounding confidence in the reliability of modern "hardware", as such, to provide the new "TV" services reliably and efficiently. To invoke the play upon words in the heading, there was no doubt in their minds that they could "bank" on their computers. (Whether the distribution networks will prove to be as reliable is another matter.)

$25 million debit

Bank charges may have gone up, but ... Margaret Renshaw of St Ives ordered a new cheque book from Westpac recently. Instead of the usual $2.50 charge, her account was debited $25 million. A hasty check of the computer the next day resulted in the bank crediting her with $25 million.

"Occasionally", according to one EDP manager, "we find an error or omission in a program, as indicated by some recurrent problem, but programs can usually be fixed without much bother.

"Most of the problems we expect to encounter are of the 'people' variety, in the way of wrong data input and wrong instructions."

That checks. Among the silly situations mentioned earlier, the Melbourne computer could hardly be blamed for "processing" an account for $00.00 if, as seems likely, the programmer had failed to specify a minimum amount.

The insurance, building society and bank problems would have arisen, in turn, from entry errors ("Garbage in garbage out"), a failure to communicate adequately, and wrong instructions from branch personnel.

(A cynic might well be tempted to speculate whether the kind of people likely to be using a domestic terminal could get into worse trouble!)

Privacy, security?

But, with thousands of customers' bank accounts becoming accessable via the normal telephone network, what problems could follow with privacy and security? Might not unauthorised people be able to pry into the financial affairs of others and, worse still, divert money for their own use?

Given the reports about computer "hackers" overseas, who have allegedly penetrated computer traffic involving organisations such as US Telemail, NASA and the Pentagon, banking systems might seem to offer easy pickings. Bank executives, however, are confident that they won't, for two main reasons:

(1) Even if a private line is tapped, bank account facilities cannot be accessed or resolved without the appropriate decoding equipment and a knowledge of the customer's confidential passwords and randomly generated code numbers, which provide "multi-level" security.

(2) In the unfortunate event of someone (eg, in a home or company) acquiring the password and transaction code numbers for an account, Telebank — and presumably other such systems — does not provide means to access cash or divert funds to an unauthorised account. In this respect, it is probably more secure than existing access cards.

Money can only be transferred between "linked" accounts, as agreed to by customer and bank. Similarly, accounts can only be paid to authorities or creditors, as mutually agreed, and on behalf of the customer and (possibly) relatives as named.

So, are modern electronic banking methods reliable and secure?

On present indications, they are.

Are they foolproof?

That's a very personal question!

What of H.N.'s letter?

H.N. of Gulgong complains that very little has been written in "Forum" about the sociological impact of computers ("these machines") on our lives.

That's probably true, mainly because Forum — and EA as a whole — is written for readers who expect to find technically orientated articles. We try to take an objective view of technology but undue space devoted to the political and/or socio-economic aspect is likely to signal howls of protest.

H.N. is clearly very nervous about computers and in this he is not alone. Unfortunately, there is no simple answer to his questions about data security. Australia has a good record in this respect, thanks to the widespread use of encryption systems, but security is an on-going tussle between those who want to safeguard it, and others who want to crack it!

On a broader basis, apprehension about new technology is neither unusual nor unique to computers. Indeed, it would be a most interesting exercise to assess the socio-economic impact of a whole range of technological developments through the years, to see how they compare.

In the process, one might even become convinced that technology is essentially neutral; able either to be used or abused for social good or ill. If certain technology appears to offer particular promise, or a special threat, it will normally do so because it is exceptionally powerful or pervasive.

Undoubtedly, unthinking, unwise or unworthy people do abuse computers in various ways but, equally, computers are being directed to all kinds of worthwhile — even enthralling — objectives, such as exploration of the universe.

The real problem posed by new technology is not so much what it makes possible, but the ability of homo sapiens to turn it to constructive rather than destructive ends.

Historically, that seems always to have been the problem, with each new development contributing its quota of contentment and misery, probably without changing the balance all that much. And that, I believe, is a reflection, not on H.N.'s "computers or science and technology as a whole," but on the human race itself.

That sounds rather like a sociological comment!

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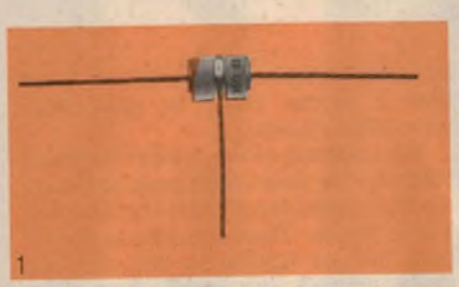
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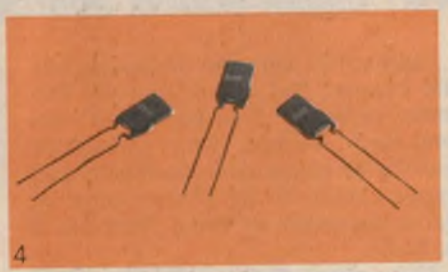
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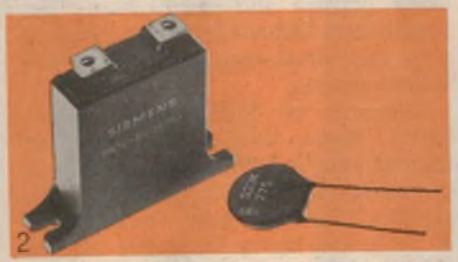
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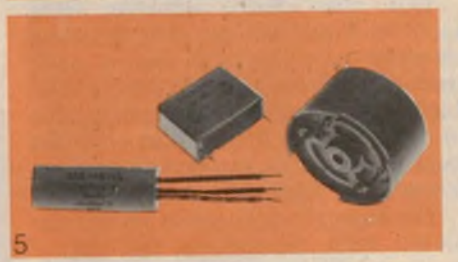
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INGENIOUS ELECTRONIC ENGINEERING

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Luxman L-215 stereo amplifier

Amongst hifi enthusiasts, the name Luxman has always been held in high regard so it was with interest that we approached this review of the new Luxman L-215 stereo amplifier. It is a medium powered unit which is fully compatible with digital sound sources.

Quite some years ago the names Lux and Luxman had a reputation for fine audio products. The equipment was beautifully finished, with expensively tooled front panels, deluxe cabinetry and rugged chassis. In fact, Lux equipment had a reputation for being "built like a battleship".

This new stereo amplifier from Luxman is not built to quite the same standards of ruggedness and is quite modest in size compared to much earlier Lux amplifiers which were comparable in power output. Still, it does have the same flavour as the earlier gear, as it has a beautifully finished front panel.

The highlight of Luxman styling has always been the look of the control knobs and this amplifier is no different in this respect. It has a very large volume control knob inset into the panel and lit in a subtle way. Surprisingly perhaps, the volume control is not detented although this is no longer the sign of an expensively matched dual ganged potentiometer. Nowadays, even the cheapest volume controls can be fitted with a detent plate, to give easily repeatable settings.

The large size of the volume control is offset by the three other main knobs on the front panel, for the Selector, Bass and Treble knobs. These are also relatively large but are tapered so that they are easily grasped and manipulated. The seldom used Balance control is relegated as a very small knob, adjacent to the volume control.

Selection of loudspeakers, filters, signal source, tape deck and mode (stereo/mono) is accomplished by a bank of pushbutton switches along the lower portion of the front panel. The net result of the control line-up is a simple and tidy layout which any user can quickly get used to.

The overall champagne gold finish of the panel is a refreshing change from the all-black styling adopted for the majority of hifi equipment. The steel top cover of the amplifier is finished in black crinkle enamel and perforated with fine slots over the internal heatsink, to give ventilation.

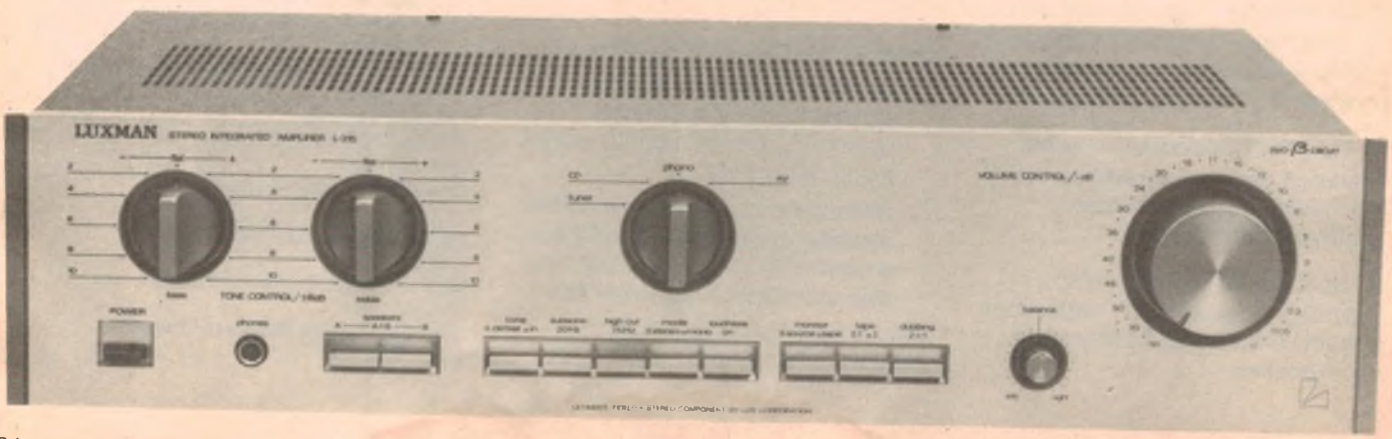
Dimensions of the L-215 are 453mm wide, 111mm high and 317mm deep, including knobs and rear projections. Mass is 7.5kg.

On the rear panel is the usual array of RCA sockets although the pair of sockets for the AV (audio-visual) source appeared to have been included as an afterthought. The L-215 has inputs for moving magnet cartridge (no moving coil input), AV, CD player and tuner. Two tape decks are provided for and dubbing can be performed in one direction (ie, from tape deck two to tape deck one).

Two pairs of loudspeakers terminals are provided and they are of the twist-lock variety which takes bared wires.

A recessed 2-pin socket is provided for mains power connection and the unit is supplied with a two core power flex with moulded 2-pin Australian mains plug. We were not too happy with this aspect of the Luxman as the unit is certainly not double-insulated, as it should be if it is used with a two core flex.

Inside, the L-215 appears to be well-designed and well-made. An interesting feature is the use of a light-emitting diode in the power amplifier of each channel. These red LEDs are visible through the ventilation slots of the top cover and doubtless are intriguing to the casual observer. Their purpose is merely to provide a bias source in the cascode driver stage of the amplifiers. The fact



that they glow is irrelevant.

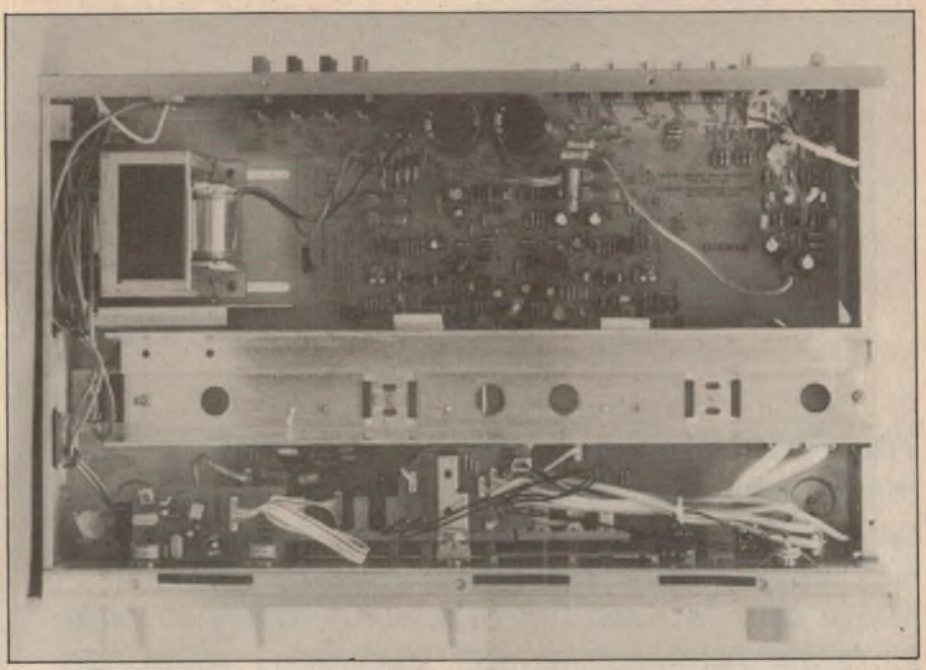
The cascode driver stage is not the only unconventional aspect of the L-215. Examination of the circuit reveals that it does not have the usual tone control section employing separate stages. Instead, the Bass and Treble controls are part of the feedback circuitry of the power amplifiers. This is most unusual. The L-215 is the first amplifier that we have come across which uses this technique.

It could be said that this approach minimises the number of stages that the signal must pass through and certainly the overall component count is much lower than equivalent amplifiers. In fact, the L-215 really only has two major portions in its circuitry. They are the phono preamplifier/equaliser, which uses an 8-pin integrated circuit, and the power amplifiers, which employ a total of 15 transistors each. Both the subsonic and high-cut filters are passive (ie, they use no transistors or op amps) which has the advantage of simplicity but it does result in a modest slope of only 6dB/octave.

The output stages are quite conventional, being fully complementary and incorporating simple over-current protection.

All of the circuitry is accommodated on one large printed circuit board which occupies most of the chassis area. A large aluminium extrusion runs across the width of the chassis and the four plastic output transistors are bolted to its underside.

No relays are used in the circuit although it does incorporate a power-on mute feature.



Above is the inside view of the Luxman L-215 stereo amplifier.

Performance

Rated power output of the Luxman L-215 is 45 watts continuous per channel into 8-ohm loads at less than .02% harmonic distortion, at 1kHz. Measured when powered from a regulated 240VAC source, the Luxman proved to be right on the button for power output at the onset of clipping although the distortion was lower at .01% or less. This applied for the whole audio bandwidth, from 20Hz to 20kHz, which is a creditable performance.

Luxman have not rated the aplifier for performance into 4-ohm loads but we tested this condition as a matter of course, as it is likely to occur in practice when two pairs of speakers are in use at the same time.

Under the 4-ohm load condition the power output proved to be exactly the same as for the 8-ohm condition. This is a surprising result since most amplifiers can be expected to deliver substantially more power output into a lower impedance load. In fact, this normal characteristic is desirable since all loudspeakers can be expected to be a substantially lower than nominal impedance at some point in the audio range. For example, it is usual for a nominal 8-ohm loudspeaker system to dip to around five or six ohms at between 200Hz and 500Hz, or thereabouts.

Evidently, the current limit circuitry of the Luxman is set to limit at around 4.7 amps peak which results in 45 watts continuous into 4-ohm loads. As such, while it may represent a safe and conservative limit as far as the output transistors are concerned, it means that the amplifier may have problems driving "difficult" speakers which have pronounced dips in their impedance characteristic.

We were not surprised to find that the Bass and Treble controls had strictly limited boost and cut of ±8dB at 100Hz and 10kHz. This is a necessary consequence of having the tone controls in the feedback loop of the power amplifiers. Having more boost and cut would be an invitation to instability. Even so, we think the maximum boost and cut is a little on the light side, especially so since the boost and cut characteristic "shelves" (ie, limits) beyond the two above-mentioned frequencies.

The usefulness of the subsonic and high cut filters is also circumscribed by their modest 6dB/octave slopes. To be really useful, they should have a slope of 18dB/octave.

We found the RIAA equalisation to be within ±0.3dB of the curve and the frequency response for high level inputs to be 0.5dB down at 11Hz and 35kHz, which is good.

Signal to noise ratios were good: 79dB with respect to 10mV at 1kHz for the phono inputs and 95dB for the CD and other high level inputs. These figures are unweighted and refer to full power.

Phono sensitivity was 1.8mV RMS at 1kHz and high level input sensitivity was 160mV. Both figures were right on spec, as was the phono input overload capacity of 120mV at 1kHz.

Separation between channels was −82dB at 100Hz, −68dB at 1kHz and −50dB at 10kHz. These are very good results.

Conclusion

Overall, the L-215 can be said to conform very closely with its specifications and with most loudspeakers it can be expected to perform well. However, we do think there are a number of drawbacks to the clever though unconventional design. It cannot be regarded as an amplifier with "plenty in reserve" and therefore it should be used with fairly efficient loudspeakers.

Recommended retail price of the Luxman L-215 stereo amplifier is $445. For further information, contact your hifi dealer. (L.D.S.)

Dolby* NR works well — if it's correctly adjusted!

*Dolby is a registered trademark.

The Dolby-B noise reduction system is one of the factors responsible for the compact audio cassette winning acceptance as a hifi medium. But, says a correspondent, he often finds it necessary to switch it off during replay in order to retain reasonable high frequency response.

by NEVILLE WILLIAMS

If the above observation sounds familiar, it's possibly because you saw a letter in the March '85 issue from a New Zealand reader suggesting that "Dolbyised" cassettes could often be played back to advantage with the Dolby compensation switched off.

Referring particularly to an in-car sound system he said: "There is no doubt in my mind that the treble has more 'presence' than with the Dolby on, especially with poorer quality tapes."

Prompted by that remark, another correspondent has taken the matter a step further:

Dear Sir,

I believe that the design of many cassette recorders actually hinders the correct operation of Dolby noise reduction.

In my own cassette deck (and, I think, many others) signals from the L&R tape heads pass through preamplifiers, thence through the Dolby processor to level meters, and on to a volume control which governs the signal to a power amplifier and headphones.

I make all recordings with the VU meters peaking at 0dB. However, depending on the kind and brand of tape, the indicated level on playback (which does not depend on the setting of the playback volume control) can peak anywhere between +3dB and −7dB. With the tapes giving lower output levels, the Dolby has to be turned off to obtain acceptable treble.

Given the known fact that different tapes have different input/output characteristics, it seems to me that it would be sensible to design cassette decks so that, in playback, the volume control would operate before the Dolby circuit. The level could then be adjusted to peak at 0dB, so that the replay Dolby could track properly.

Agreed, additional level controls (perhaps presets) would be needed to set output levels to the amplifier or headphones but this arrangement would at least ensure that the Dolby circuitry worked as intended.

I don't believe that this aspect of noise reduction has been discussed before, and I would welcome your comments.

N.B. (Glebe, NSW).

Off hand, I can't recall any recent article dealing specifically with the question raised by N.B. and, having given it closer thought, I do wonder whether it may, perhaps, have been dismissed too lightly by the domestic hifi industry; a case of "She'll be right, mate!"

N.B. is certainly not alone in his complaint, because many others have expressed the same opinion over the years. There has been a tendency to brush it aside, however, on the grounds that their ears are being tickled by the touch of treble boost which non-Dolby playback provides.

Undoubtedly, Dolby tracking has been

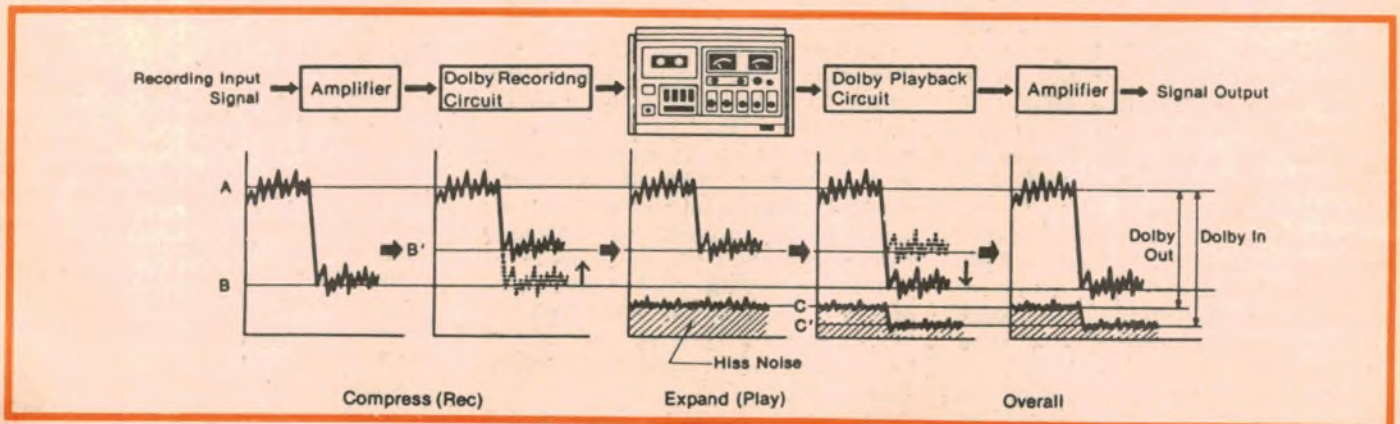


Fig. 1: Reproduced by courtesy of National Panasonic Australia, this diagram illustrates the operation of the Dolby-B noise reduction system in a typical domestic cassette recorder.

examined and reported upon many times in engineering circles, as evidenced by the following passage from John Earl's book on "Cassette Tape Recorders" (Fountain Press, 1977):

"It will be appreciated that when a tape of different sensitivity from that on which the Dolby circuits were initially adjusted is used, it may be necessary to readjust the circuits for optimum signal integrity. Failure to do this could result in an overall frequency response which deteriorates from the ideal with reducing signal level."

That quote contains at least one vital clue to the mystery but let's talk about it, anyway.

Fig.1, reproduced from a Technics booklet, illustrates the basic principle of the Dolby NR (noise reduction) system, as incorporated in most good quality compact cassette decks. Its function is to raise the wanted signals — particularly low level signals — above the so-called "noise floor" of the tape system, thereby improving the overall signal/noise ratio.

Referring to the diagram, a typical audio signal, as fed to the in-built microphone preamplifier, contains high level segments or passages (A) which pose no real problem, because they are loud enough to override (or "mask") the tape noise, anyway. It is the low-level segments or passages (B) which are at risk.

From the preamplifier, the audio signal passes to a Dolby NR processing stage which, without modifying the higher level segments, senses and progressively boosts the level of weaker segments by as much as 10dB — from (say) B to B'. In so doing, it effectively compresses the dynamic range by that amount.

The processed (or "Dolbyised") signal is then passed to the cassette record/replay section, which characteristically introduces a noise component (or tape hiss) typically about 45 to 50dB unweighted below the nominal maximum recording level. Hopefully, the noise will also be below the level of the weaker but now artificially boosted segments of the signal.

During playback, signal from the head circuitry again passes to a Dolby NR stage, often the same one as used for recording, but now switched into playback mode.

As before, it senses the weaker segments but, this time, automatically drops them back to their original level (from B' to B) effectively restoring the dynamic range to what it was originally.

In so "de-emphasising" the lower level segments, the system also attenuates the tape noise so that, as implied by the diagram, the audio signal ultimately fed to the power amplifier has a considerably reduced noise content and hence an improved signal/noise ratio.

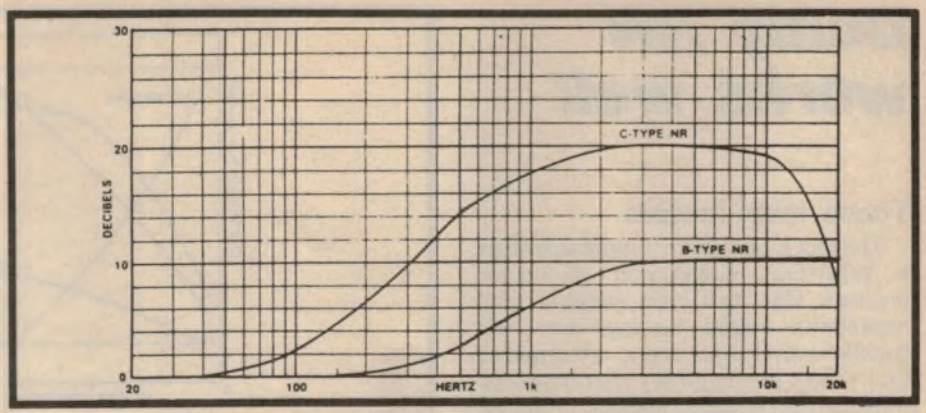


Fig. 2: Dolby-B NR (lower curve) operates mainly over the frequency range above 1kHz. Dolby-C is not discussed in this article but much the same considerations would apply in respect to tracking.

An advantage claimed for the Dolby system is that it does not attempt to process high level signals and therefore minimises potentially audible "pumping" or other undesirable processing effects. Whatever happens does so at lower and less obvious levels.

Dolby NR systems in professional equipment normally process signals over the entire audio spectrum but, while very effective, are also relatively complex and expensive.

The Dolby-B system

The system most commonly used in domestic cassette recorders processes signals — and noise — mainly in the region above 1kHz, as illustrated in Fig. 2 (lower curve). Referred to as Dolby-B, it is now a relatively inexpensive inclusion, thanks to modern IC technology. It offers a potential improvement in signal/noise ratio of about 10dB above 5kHz — a figure that, historically, has proved commercially acceptable.

For the Dolby-B system to operate as intended, each and every Dolby-equipped deck should "track" and play back accurately all Dolby recorded cassettes, the accentuated low amplitude, higher frequency components being suitably restored to their original level.

To this end, an official Dolby reference level was nominated (200nWb/m, 333Hz = 0VU) and calibration tapes produced so that, in the factory, or on the service bench, replay head/preamplifier sensitivity could be preset accurately.

As well, Dolby-equipped cassette decks are normally provided with manual recording level controls and calibrated level meters so that, hopefully, even unskilled home recordists can, with practice, get the signal level on their Dolbyised cassettes at least "in the ball park".

To judge by his letter and his concern about recording and playback levels, correspondent N.B. could scarcely be grouped with the "unskilled".

When he makes a recording, he says, he adjusts things so that the peaks just hit 0dB on the level meter. Not unreasonably, he expects it to read the same on playback but, depending on the tape in use, the peak level can finish up anywhere between +3dB and −7dB!

Tracking problem?

That's hardly reassuring. With the whole dynamic window displaced downwards by 7dB, the treble playback de-emphasis would be affecting a larger slice of the lower level high frequencies than it should, possibly resulting in a loss of treble and an urge to switch out the Dolby playback compensation to restore it.

My initial reaction was to question N.B's figures and to suppose that he may be overstating the problem. But I had to admit that, although I have cassette equipment set up, I do not have reason to use it as frequently or as critically as N.B. apparently does.

So, as a quick check, and using a 1kHz L+R track on a CD test recording as a signal source, I fed it through to a relatively late model stereo cassette deck. This done, I picked out seven different cassettes, ranging from an ancient bargain store ferric tape through chrome and ferrichrome to pure metal, and proceeded to record a test segment on each one, at exactly 0dB level.

On playback, two of the cassettes returned 0dB, two more −1.0dB, the other three reading −4.0 to −4.5dB. On repeating the exercise on an ageing Sony deck, the same pattern was evident except that the readings ranged from −1.0dB to −6.5dB. The latter readings were repeated when the Sony recordings were played back on the late model deck.

While the spread was smaller than indicated in N.B's letter, the figures left open the likelihood that, given a wider selection of cassettes, and input signals less predictable than a 1kHz sine wave, more serious tracking discrepancies would have become evident.

Dolby NR works well

Those level meters

The fact is that there is more to it than a superficial comparison of meter readings. One may even question how meaningful output readings are with complex waveforms, and to what extent they reflect the frequency distribution of the meter drive signal and the influence of supersonic bias level.

A mid-frequency sine wave test is singularly unrevealing in that it involves only one frequency, with no conflict between RMS, average and peak values and only moderate sensitivity to bias level.

When attempting to measure the amplitude of an audio program signal, things are quite different, as illustrated in Fig.3, reproduced from a TEAC White Paper (1975).

A program signal may contain very high amplitude peaks (or transients) without sounding subjectively louder than another program without such peaks. Moreover, a conventional VU meter may give little hint of the peaks which, in extreme cases, could extend into the tape overload region, resulting in signal crushing and distortion.

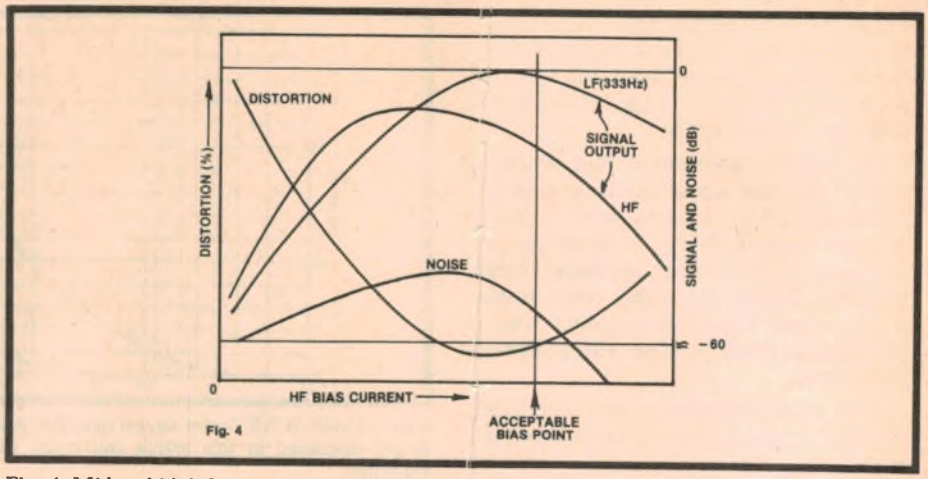


Fig. 4: Mid and high frequency signal level, noise and distortion plotted against bias current. An acceptable or "optimum" bias level is indicated.

On the other hand, a predominantly peak-reading meter may induce the operator to raise the level of non-peaky signals, causing them to sound subjectively much louder than other material.

While it is possible, particularly with LEDs and bargraph indicators, to convey information about both average and peak amplitude, cassette deck manufacturers have to consider cost and the need to present non-technical users with a non-confusing (even if compromise) readout.

They may also need to decide, rather arbitrarily, how best to compensate the frequency response of the metering circuit to take account of the anticipated frequency law of the signal being monitored.

In my own case, the analog meters on the ageing Sony deck would appear to be reading about 1.5dB higher in record mode with a 1kHz sine wave than the bargraphs in the late model deck; in consequence, the flux level on an ex-Sony tape is down by that amount. But how the respective meters would react or be interpreted with program input would be anybody's guess.

On playback, to the extent that high frequency energy contributes to the meter reading, it must be influenced by the high frequency response of the tape, head and preamplifier.

But high frequency response, in turn, is linked intimately with bias level, probably to a greater degree than is commonly allowed for.

Fig.4 shows mid and high frequency response, noise and distortion plotted against the level of supersonic bias. The coordinates will vary from tape to tape but the shape of the curves remains substantially the same.

Optimum bias for a tape is normally considered to be slightly above the level which produces maximum sensitivity and minimum distortion at 333Hz. This same level offers an acceptable compromise between falling noise and rising distortion, without excessive loss of high frequency response.

Fairly obviously, bias in excess of the optimum will reduce the effective sensitivity and output of the tape — to the detriment of Dolby tracking — while at the same time causing a disproportionate loss of treble response.

Who knows? Over and above metering problems and differences in the sensitivity of cassette tapes, non-optimum bias may have to take a significant share of the blame for imperfect Dolby tracking and poor treble response.

And how do you end up with non-

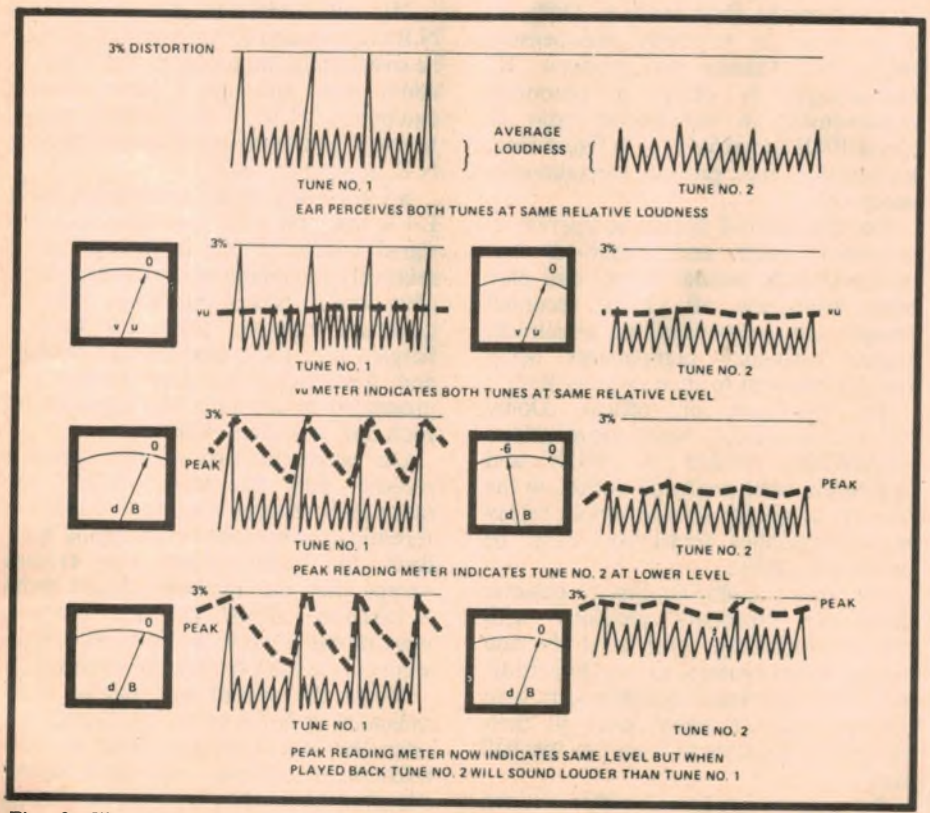


Fig. 3: Illustrating the connection between program waveform, level meter readings and subjective loudness, as discussed in the text. (From a White Paper by TEAC).

optimum (particularly too-high) bias? Easily and without knowing it: by using types or brands of cassette requiring less bias than what your deck has been set up to provide in the respective categories (Fe, Cr, Metal, etc).

Much the same remark applies to Dolby mistracking: you can run into that problem, as per the quote from John Earl, by using cassettes having a different sensitivity from that for which the Dolby circuits were adjusted.

Unfortunately, it is easier to spell out the warning than to heed it. Deck manufacturers may recommend certain cassettes but that doesn't necessarily help with other brands or new releases which the user may find attractive.

Again, some decks have in-built facilities for optimising the bias level and even aligning the Dolby system on test tone — which is fine for those who can afford them. Most can't!

For the rest of us, the most obvious recourse is to recognise the fact that the tape in audio cassettes does vary considerably in technical specifications, despite the continuing efforts of tape manufacturers to achieve greater uniformity in the various categories.

From a recent cassette deck user manual:

"The FL (Fluorescent Level) meter lighting position may differ during recording and playback. This is caused by a difference in the tape's sensitivity and a slight deviation will have no adverse effects."

QUESTION: How large is a "slight" deviation?

They all "work", in the sense that they will all record and play back but their ultimate performance in any given deck will depend on how compatible they happen to be.

If the aim is to produce consistent, top quality recordings, it seems to me that it is going about it the hard way to attempt to do so using a variety of cassettes, even if good, reliable brands. The chances are that some of those cassettes will not be wholly compatible with any one deck. N.B's experience and my own hurried check would seem to confirm that.

N.B's idea of having an extra control (or using the preset that may be there already) is OK as it goes but it wouldn't solve the problem of non-optimum bias.

Surely the logical recourse is to try a few likely cassettes in the deck, as is, in an effort to locate one that does appear to track, in Dolby terms, does retain normal high frequency response and does perform satisfactorily in other respects. Then use that brand and type until further notice!

Or am I just lazy?

Check appliances & electrical wiring

Build this 1000V Megohm Meter

Featuring an in-built transistor inverter power supply, this Megohm Meter tests at 1000V and covers the range from 2MΩ to 2000MΩ. It is particularly handy for checking appliances and electrical wiring.

by ANDREW LEVIDO

There are many situations where a stringent test of insulation resistance is required. For example, whenever mains operated equipment is repaired or built, an insulation test between the active and neutral conductors and the case should be carried out. Similarly, it is a good idea to check for insulation breakdown whenever electrical wiring is installed.

The hobbyist will usually make these tests using a multimeter switched to a high ohms range. While this method is better than nothing, it leaves a lot to be desired. Firstly, the test is made at a very low voltage. Many types of insulation breakdown only occur at high voltages — what appears to be an open circuit at 1.5V can very easily be a virtual short circuit at a few hundred volts. For this reason, it is preferable to make the insulation test at an elevated voltage.

Secondly, most multimeters are incapable of resolving the very high resistances involved. Most simply show an infinite reading when the resistance being measured is above a few megohms. In the case of insulation measurements, we are interested in resolving resistances as high as a few thousand megohms.

The time honoured method of checking insulation is to use a "Megger" tester incorporating a hand cranked generator. These rely on the user to crank the generator to produce the test voltage (nominally 500V) which is applied to the circuit under test. These meters are still used by many electricians today.

Before going further, we should point out that the word "Megger" is a trade name. For this reason, it is more correct to use the term "megohm meter" to describe instruments of this general type.

Naturally, the hand cranked megohm meter is rapidly being replaced by battery operated solid state models featuring transistor inverters. Many of these use a test voltage of 1000V rather than the 500V commonly used in the past. 1000V megohm meters offer better resolution of high resistances and an extra margin of safety since they apply a more stringent test to the insulation.

The megohm meter described here is of this type. It uses a transistor inverter to produce a regulated 1000V DC supply which is applied to the insulation under test. Insulation resistances between 2MΩ and more than 2000MΩ can be measured. These specifications should more than satisfy the needs of hobbyists and professionals as well.

In addition, the instrument is compact, easy to build and inexpensive.

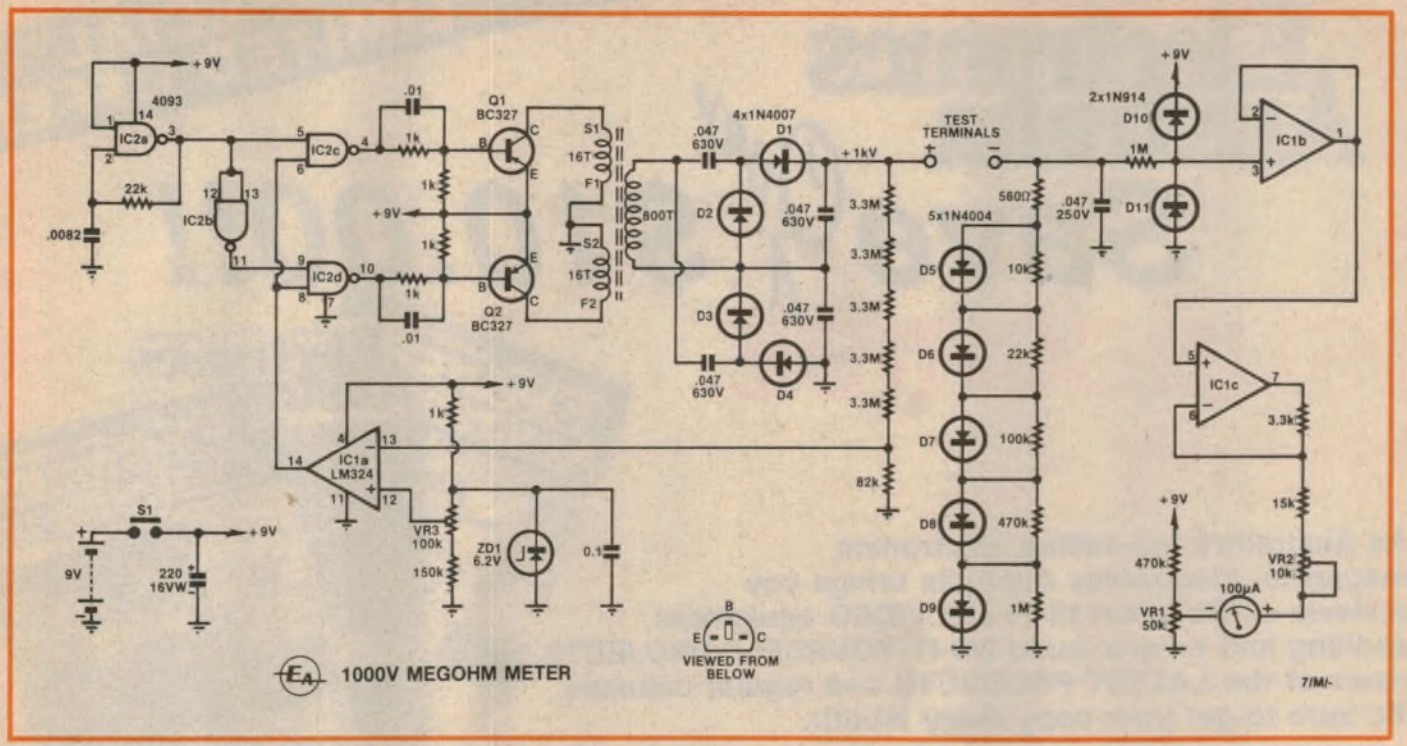
There are many circumstances in which a tester of this type can be used. Apart from the applications mentioned above, a megohm meter can be used to check the insulation between transformer windings and the frame. Insulation breakdowns in automotive alternators and generators can also be diagnosed. As well, rough checks of the leakage of high voltage capacitors can be made.

Below: the prototype was housed in a low-cost plastic zippy case.

How it works

There are two main sections to this circuit: the transistor inverter and the measuring circuit. Each of these sections will be examined separately.

The inverter is a driven type and is



The circuit features a 1000V inverter power supply and covers the range from 2MΩ to 2000MΩ.

based on IC2, a quad Schmitt NAND gate. IC2a is configured as a squarewave oscillator with a nominal frequency of 5kHz. The output of this gate is inverted by IC2b to produce a complementary drive signal. The two drive signals are then each applied to one input of another pair of NAND gates, IC2c and IC2d. These are used to switch the drive to transistors Q1 and Q2 on or off, according to the state of the gating signal applied to the other inputs of IC2c and IC2d.

Thus, if the gating signal is high, the transistors will be driven by out of phase squarewave signals at 5kHz. If the gating signal is low, both transistors will be turned off.

Q1 and Q2 drive the primary of the inverter transformer. Because the windings are driven out of phase, the supply voltage (9V) will be applied alternately to each half of the primary. By virtue of transformer action, the same voltage will appear across the other half of the transformer primary. This means that, during each half cycle, twice the supply voltage will be impressed across the primary windings. The polarity of this voltage alternates from one half cycle to the next.

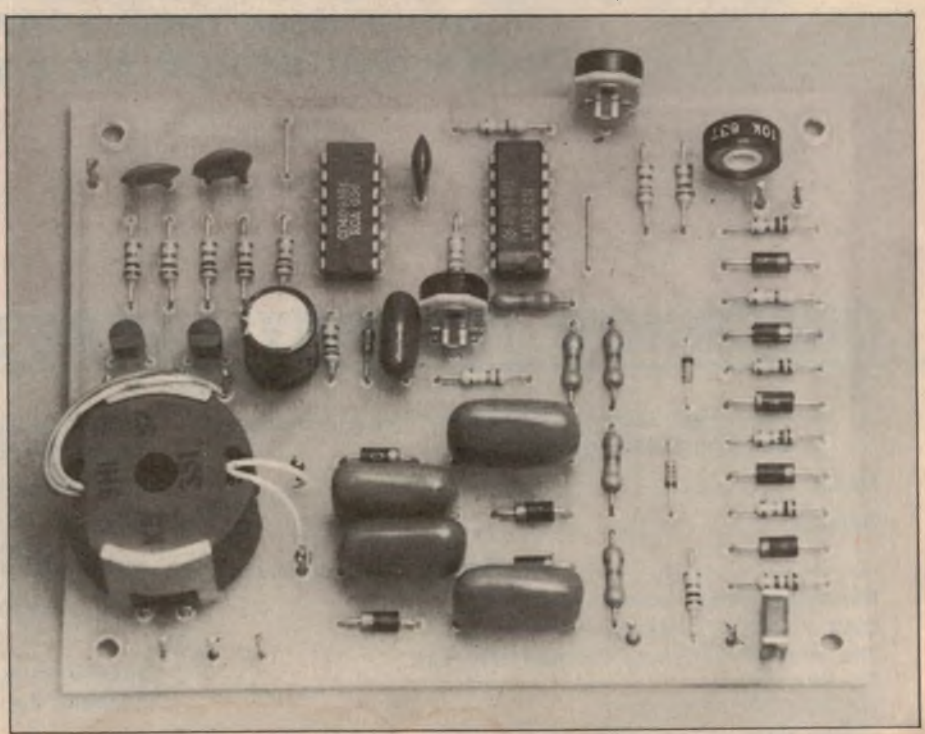
So each half-primary winding sees a waveform of 18V peak-to-peak and the total primary winding sees a voltage of 18V RMS. This is stepped up by the transformer turns ratio (800:32) which, after allowing for losses, produces a peak-to-peak voltage of around 400V across the transformer secondary winding. This is applied to a voltage quadrupler formed by diodes D1 to D4 and the associated .047μF capacitors.

Diodes D1 and D2 and two of the capacitors form a simple voltage doubler producing approximately 800V between the cathode of D1 and the lower end of the transformer secondary. The second doubler, formed by D3, D4 and the remaining two capacitors, produces 800V between the anode of D4 and the lower end of the secondary winding.

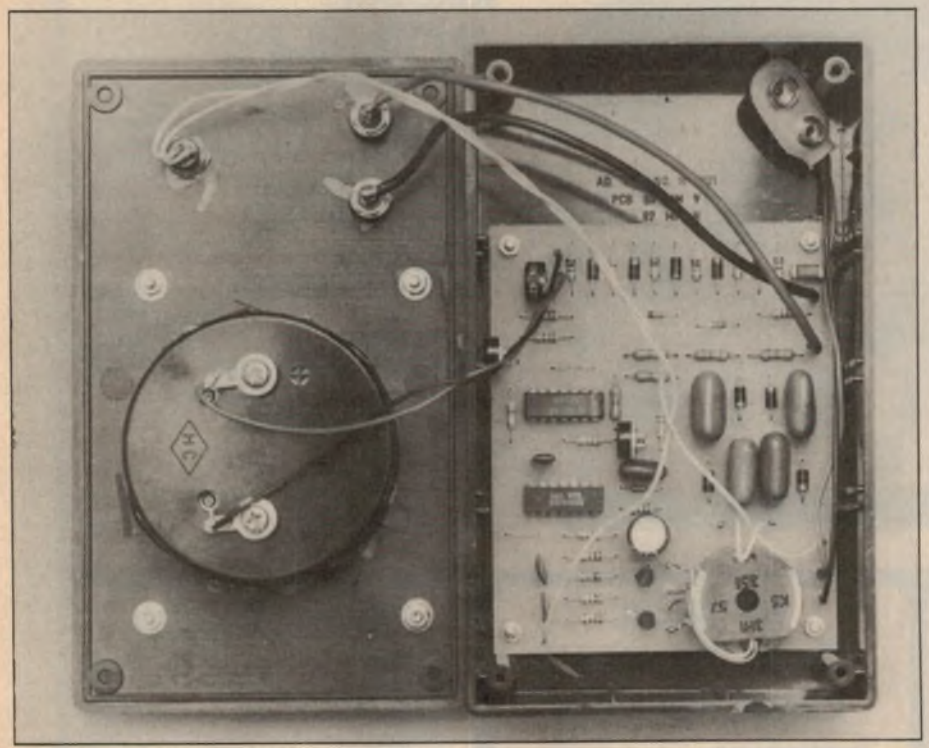
As can be seen from the circuit diagram, D3 and D4 form a negative doubler. Thus, the lower end of the secondary winding will be 800V above ground and D1's cathode will be at 1600V with respect to ground. All this supposes that the inverter runs continuously but, as we shall see, it does not.

A voltage divider formed by a string of five 3.3MΩ resistors and an 82kΩ resistor

Below is a view of the assembled PC board. Note the four .047μF 630V capacitors.



1000V Megohm Meter



View inside the prototype. Use 240V AC cable for the test leads.

samples this output voltage. This sample is compared to a reference voltage derived from a 6.2V zener diode and applied, via trimpot VR3, to pin 12 of comparator IC1a.

Whenever the sample voltage at pin 13 rises above the sample voltage at pin 12, IC1a switches its output (pin 14) low. This turns gates IC2c and IC2d off and removes the drive from both transistors. The output voltage now drops until the sample voltage at pin 13 allows the comparator to switch high again to enable the gates.

The voltage divider ratio and the reference voltage have been chosen such that the feedback action of this set-up maintains the output voltage at 1000V. VR3 provides a small amount of adjustment so that the inverter output voltage can be set to exactly 1000V.

Resistance measurement

The principle used to measure the resistance between the test terminals involves inserting a known resistance in series with the resistance to be measured. The voltage across the known resistance is proportional to the current flowing through it and this current is, in turn, inversely proportional to the resistance under test.

This system is simple but it has a major drawback in that its response is nearly linear. Since we want to measure resistances over a three-decade range, a logarithmic response would be more suitable. If a linear responding circuit were used, the scale would be unreasonably crowded at the low resistance end.

What we really need is a resistance which decreases as the current through it increases. This has been approximated with the network of resistors and diodes (D5-D9) shown on the circuit diagram.

Consider the situation where the resistance between the test terminals is very high. In this case, the current through the network is very low so the voltage across each of the resistors in the network is less than that required to forward bias the diodes. Thus the equivalent resistance of the network is the sum of all the resistances that make it up.

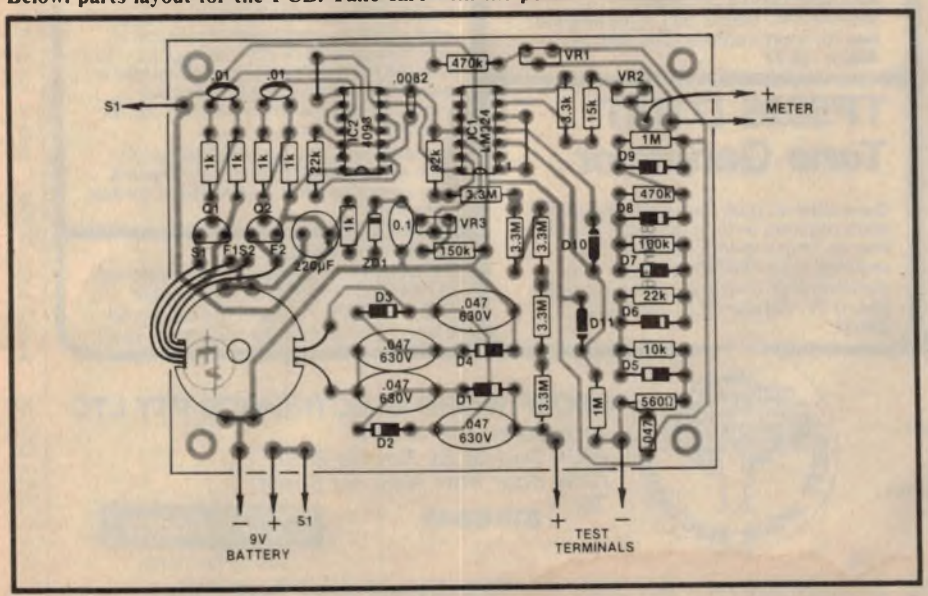
As the resistance between the test terminals decreases, the current through the network increases and the voltage across each resistor in the network increases accordingly. When the voltage across the 1MΩ resistor is sufficient to forward bias D9, the voltage will effectively cease to rise. The equivalent resistance of the network will now be that of the rest of the resistor chain (ie 470kΩ + 100kΩ + . . . + 560Ω).

This process continues, with the equivalent resistance of the network dropping as the current through the network increases. The result is a stepwise approximation of the smooth characteristic that we require. Fortunately, the effect of each step is made less noticeable by the non-ideal nature of the diodes. In fact, they do not snap into conduction at a certain forward voltage; the transition is smooth.

The voltage developed across the resistance network is buffered by voltage follower IC1b. The 1MΩ resistor and diodes D10 and D11 protect this op amp against damage should the test probes be shorted together. In this situation, the voltage applied to the input of the buffer cannot exceed the supply voltage by more than 0.6V.

IC1c is used to convert the measured voltage into a suitably scaled current to drive the 100μA meter movement. VR2 is used to calibrate the meter scale with some known resistance across the test terminals. VR1 and its associated 470kΩ resistor form a voltage divider with output adjustable between 0V and 0.9V. This voltage is used as an offset for the

Below: parts layout for the PCB. Take care with the potcore connections.



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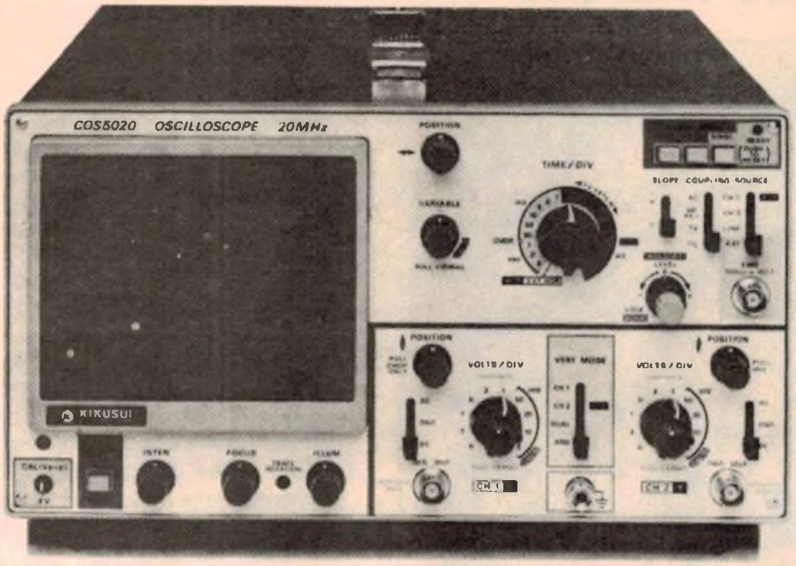

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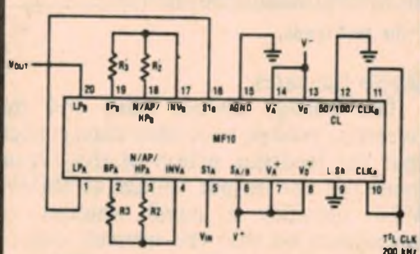

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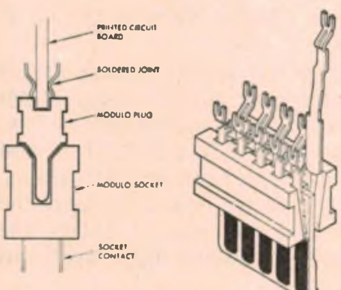

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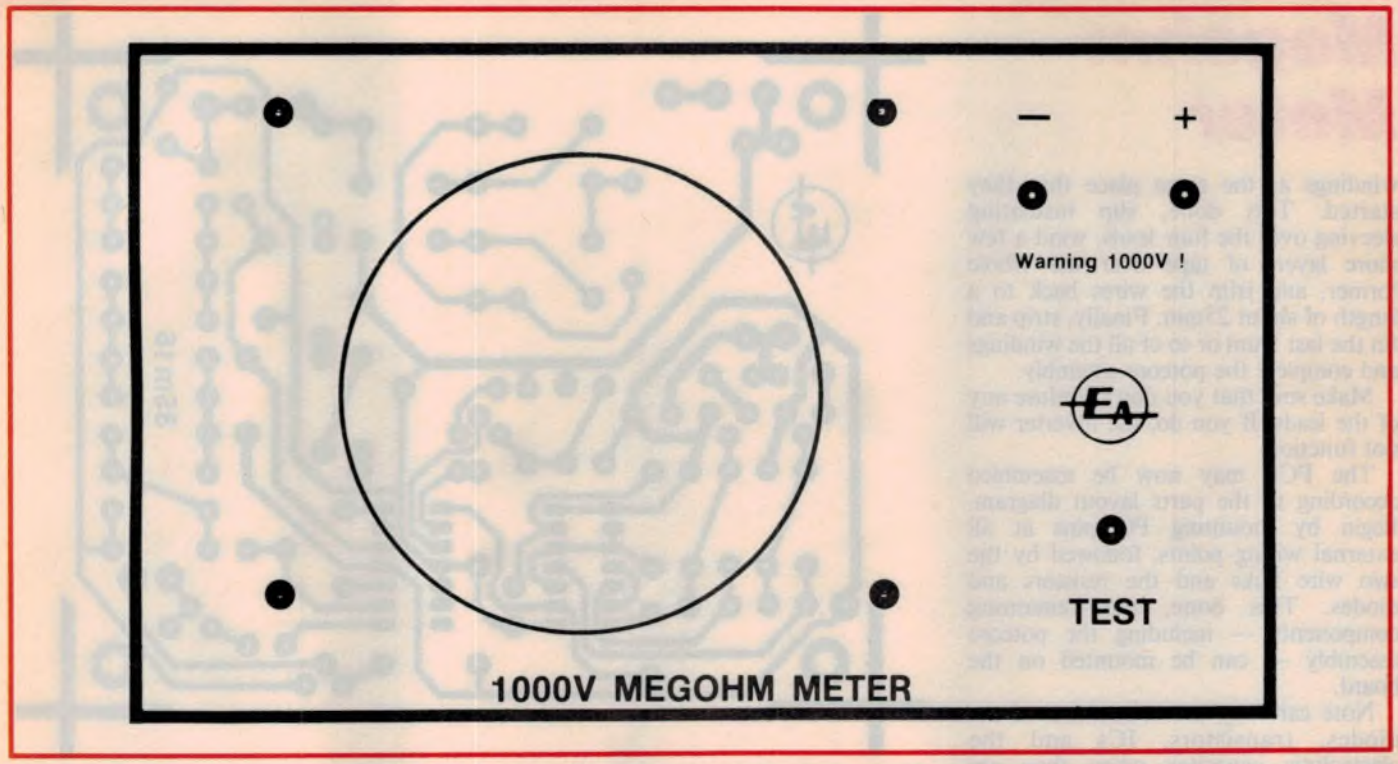


Above: here is an actual size artwork for the front panel.

1000V Megohm Meter

meter to compensate for any offset introduced by the op amps and the resistance between the test leads.

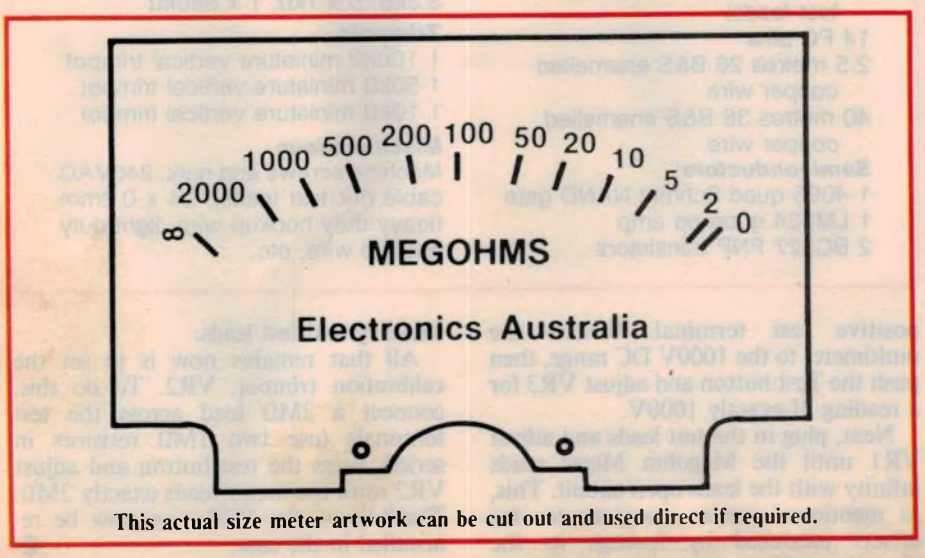
Power for the circuit is derived from six 1.5V AA batteries connected in series to give 9V. Momentary contact switch S1 (Test) switches the supply rail while the 220μF capacitor provides supply line decoupling. Note that the current drain is too heavy for a single 216-type 9V battery.

Construction

Most of the parts are mounted on a small printed circuit board (PCB) coded 85mt6 and measuring 105 x 84mm. This board is mounted inside a plastic utility case fitted with a Scotchcal front panel.

Begin construction by winding the potcore transformer. Apart from the core assembly itself and the wire, you will need some ordinary sticky tape, some 50mm pieces of insulating sleeving (we used insulation which we stripped off some scraps of telephone wire) and a certain amount of patience.

The 800 turn secondary is wound first. This can be done by hand if necessary, although we used a hand drill to make the job a little easier. If you are doing it this way, the first thing to do is to determine the gear ratio of the hand drill to ascertain the number of turns of the handle necessary to give 800 turns of the chuck. This done, the former can be mounted in the hand drill using a suitable bolt through the centre hole of the former. It is best to mount the drill in a bench vise to prevent it moving around too much.



This actual size meter artwork can be cut out and used direct if required.

Begin by slipping a piece of the insulating sleeving over one end of the 36 B&S wire. Lay this end in one of the slots in the former and secure it with a small piece of the tape. We suggest that you also tape the end of the wire to the chuck to prevent it getting in the way.

Now carefully wind 800 turns onto the former. Try to wind the layers as evenly as possible, although it is not necessary to lay each turn next to the previous one. The wire is very thin and breaking it means that you will have to start again, so be careful.

When the 800 turns have been wound on the former, slip another piece of sleeving over the end of the wire and secure the winding with a few layers of tape. This completes the secondary.

The primary is wound bifilar; that is, two wires are wound together simultaneously. Divide the 26 B&S wire into two equal lengths, sleeve both ends of both wires, and label the two starts S1 and S2. Similarly, label the finish ends of the respective wires F1 and F2. Lay the two starts in the slot opposite the leads for the secondary windings and secure them with tape.

Wind on 16 turns, finishing off the

Megohm Meter

windings at the same place that they started. This done, slip insulating sleeving over the four leads, wind a few more layers of tape over the whole former, and trim the wires back to a length of about 25mm. Finally, strip and tin the last 5mm or so of all the windings and complete the potcore assembly.

Make sure that you don't confuse any of the leads. If you do, the inverter will not function.

The PCB may now be assembled according to the parts layout diagram. Begin by mounting PC pins at all external wiring points, followed by the two wire links and the resistors and diodes. This done, the remaining components — including the potcore assembly — can be mounted on the board.

Note carefully the orientation of the diodes, transistors, ICs and the electrolytic capacitor when they are being installed. Note also that the .047μF capacitors must be 630V types.

Attention can now be turned to the plastic case. Attach the Scotchcal label to the front panel and use this as a drilling template for the test switch and input jack terminal holes. The meter cutout can be made by drilling a series of holes inside the perimeter of the large circle and then carefully filing to shape.

Before mounting the meter, it is necessary to re-calibrate the scale using the artwork supplied. To do this, unclip the clear plastic front cover and carefully remove the meter scale by undoing the two small retaining screws. The new scale is then affixed to the old scale and the meter re-assembled.

Additional holes will have to be drilled in the bottom of the case for mounting the PCB. The board can then be mounted in position using machine screws and nuts and the wiring completed. Use heavy-duty (24 x 0.2mm) hookup wire for the connections to the input terminals and light-duty hookup wire for the remaining connections.

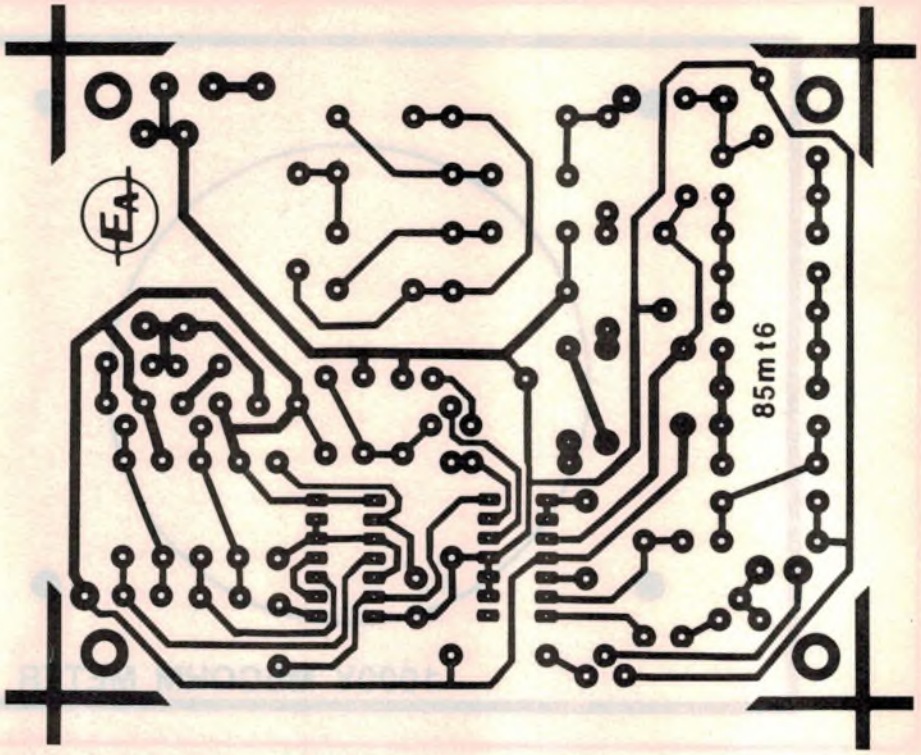
Good quality 240VAC-rated twin lead is recommended for the test leads. This is to ensure that insulation leakage is kept to a minimum. We soldered insulated alligator clips to the ends of the leads to facilitate connections to the device under test.

Adjustments

A few simple adjustments are necessary before the Megohm Meter can be used. Remove the PCB from the case, clip on the 9V battery pack, and connect a multimeter between ground and the positive test terminal. Switch the multimeter to the 1000V DC range, then push the Test button and adjust VR3 for a reading of exactly 1000V.

Next, plug in the test leads and adjust VR1 until the Megohm Meter reads infinity with the leads open circuit. This, as mentioned earlier, compensates for offsets produced by leakage in the circuitry and test leads.

All that remains now is to set the calibration trimpot, VR2. To do this, connect a 2MΩ load across the test terminals (use two 1MΩ resistors in series), press the test button and adjust VR2 until the meter reads exactly 2MΩ. That's it — the PCB may now be re-installed in the case.



Here is an actual size artwork for the printed circuit board.

PARTS LIST

1 printed circuit board, code 85mt6, 105 x 84mm
1 plastic case, 150 x 90 x 50mm
1 Scotchcal front panel label, 152 x 90mm
1 SPST momentary contact pushbutton switch
1 FX2240 potcore with former and mounting clip
1 100μA moving coil meter, 100 x 82mm
1 meter scale
1 9V battery clip
1 6-cell battery holder (AA size)
2 banana plugs and sockets
2 insulated alligator clips (to suit test leads)
14 PC pins
2.5 metres 26 B&S enamelled copper wire
40 metres 36 B&S enamelled copper wire

Semiconductors

1 4093 quad Schmitt NAND gate
1 LM324 quad op amp
2 BC327 PNP transistors
1 6.2V, 400mW zener diode
5 1N4004 diodes
4 1N4007 diodes
2 1N914 diodes

Capacitors

1 220μF 16VW electrolytic
1 0.1μF polyester
4 .047μF 630V polyester
1 .047μF 250V polyester
2 .01μF ceramic
1 .0082μF polyester

Resistors (0.25 W, 5%)

5 x 3.3MΩ, 2 x 1MΩ, 2 x 470kΩ, 1 x 150kΩ, 1 x 100kΩ, 1 x 82kΩ, 2 x 22kΩ, 1 x 15kΩ, 1 x 10kΩ, 1 x 3.3kΩ, 5 x 1kΩ, 1 x 560kΩ

Trimpots

1 100kΩ miniature vertical trimpot
1 50kΩ miniature vertical trimpot
1 10kΩ miniature vertical trimpot

Miscellaneous

Machine screws and nuts, 240VAC cable (for test leads), 24 x 0.2mm heavy duty hookup wire, light duty hookup wire, etc.

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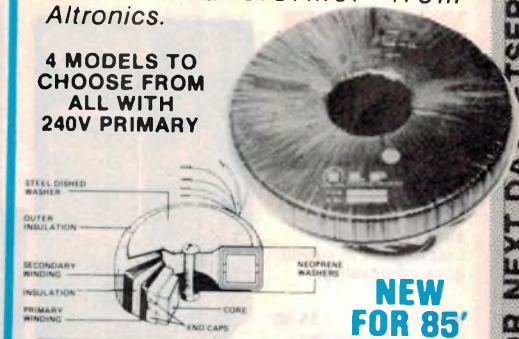

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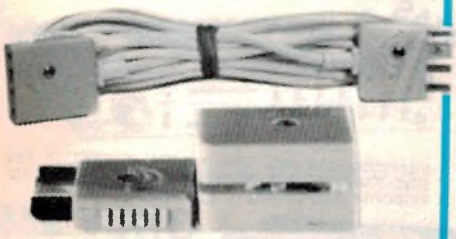

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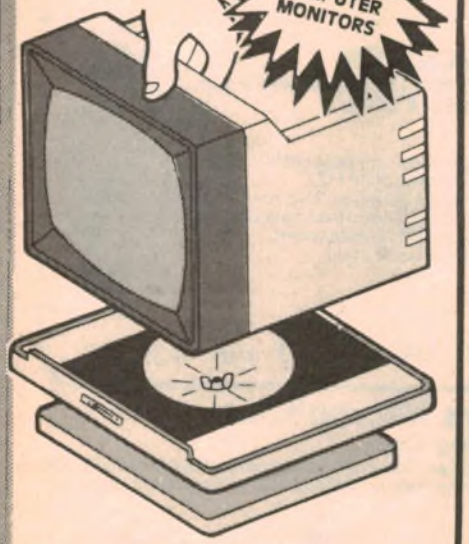

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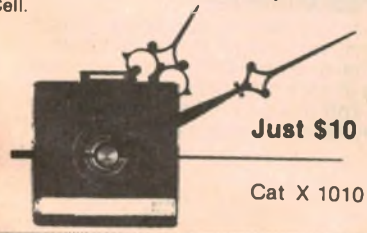

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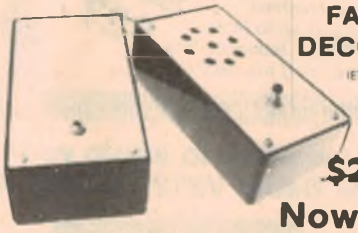

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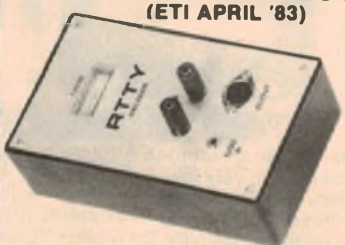

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D 1420

Simple receiver tunes airport NDBs

Weather radio for pilots

With small radios now virtually throwaway items, there is usually not much advantage in building your own. But there are still a few radio projects worth the effort. This little tuner covers the range from 190kHz to 500kHz which is the band used for airport weather beacons.

by COLIN DAWSON

This project was inspired by a friend of a colleague (well, actually, a friend of the boss) who wanted such a device for use in his Tiger Moth. Having satisfied the edict, we decided that the circuit would make an interesting project!

After all, up-to-date weather reports would also be of use to people outside the flying fraternity. Boating enthusiasts, for example, could tune to the nearest airport weather beacon (within reason) to monitor weather changes. Weather beacon reports include any significant changes within a large radius of the airport so any information broadcast will be of relevance to small boats in the vicinity.

Airport weather beacons operate in the region below the broadcast band and are generally known as non-directional beacons, or NDBs for short. A recorded message is broadcast continually, advising of the latest weather conditions and other pertinent information. The message usually includes airfield barometric pressure (QNH), visibility, wind direction and speed, rain (if any) and advice regarding initial contact with the control tower.

The said Tiger Moth pilot needed to tune alternately to two NDBs in his flying area — one at Bankstown and the other at Sydney. As the need to monitor two airfields is a common one, the circuit has provision for two tuning capacitors. A switch is used to select between the two, so that each can be used as a preset. The radio will work quite happily with only one of the tuning capacitors if the preset option is not needed.

Circuit description

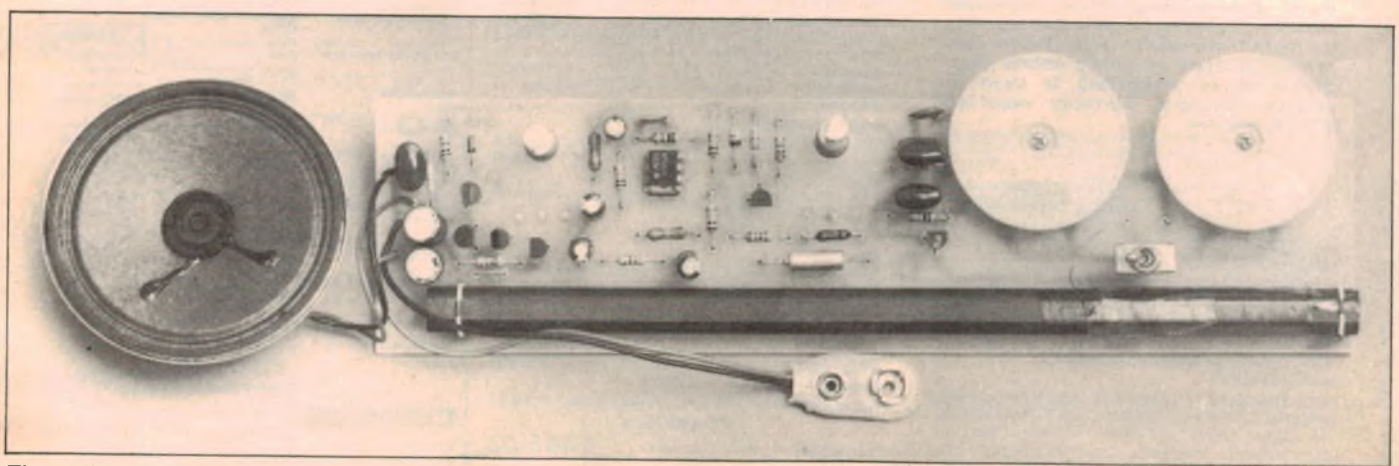
The circuit is quite simple, due mainly to the inclusion of a Ferranti ZN414 IC. Although packaged in a TO92 transistor case, it actually contains 10 transistors and is actually a complete tuned radio frequency (TRF) receiver. It includes an RF amplifier, a detector and an AGC circuit.

Only six external components must be added to the ZN414 to provide a low-power AM tuner. We have also added an audio amplifier so that the circuit can drive an 8Ω speaker.

The main components which must be added to the ZN414 are an antenna and a tuning capacitor. The antenna consists of 205 turns of enamelled copper wire on a 9 × 200mm ferrite rod. On the prototype, this provided tuning over the range 190kHz to 500kHz. Component tolerances may affect this range slightly.

In order to tune the medium-wave (broadcast) band, the number of turns would have to be reduced to around 120. Actually, the ZN414 will operate over the range from 150kHz to 3MHz. Most of this range should be achievable by "fiddling" the number of turns on the antenna.

The ferrite rod used is fairly long, so the receiver is quite directional.



The receiver has sufficient output to drive a loudspeaker or can be fitted with a pair of 8Ω headphones.

Tiger Moth pilot David Voight tunes into Sydney NDB (317kHz) prior to a recent flight.

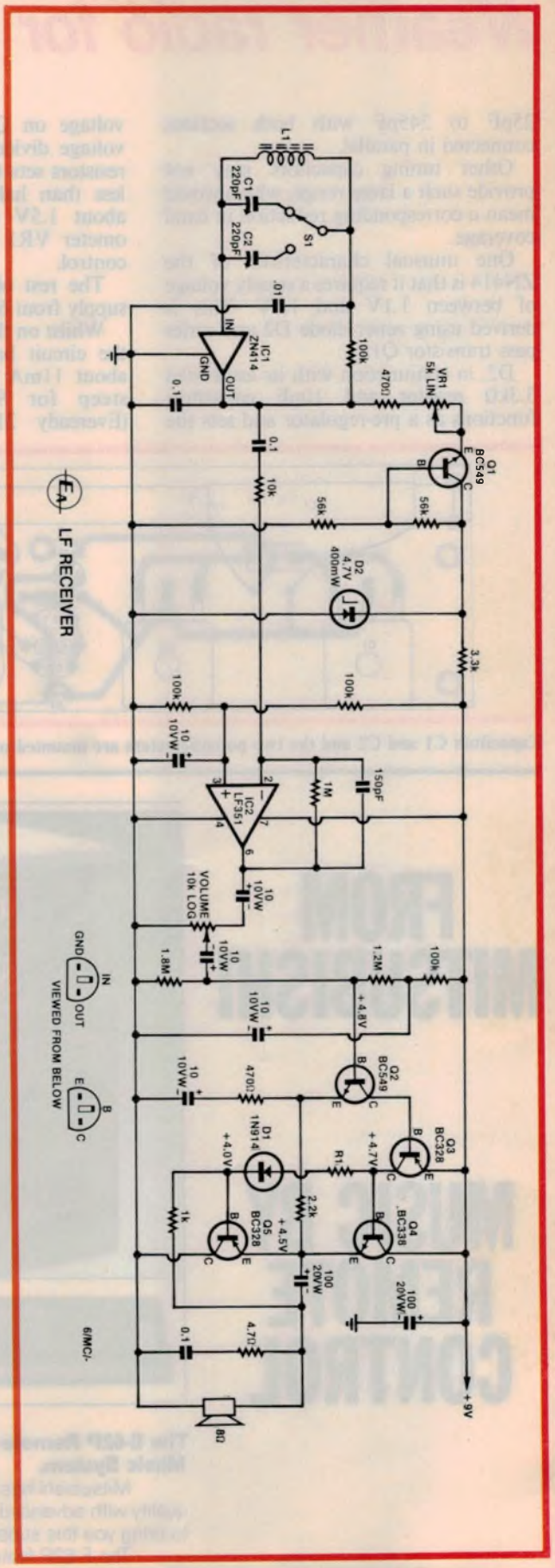
Changing the orientation of the rod will thus have a considerable effect on the signal quality. This is advantageous as it allows noise (of which there is plenty at this frequency) to be selectively reduced.

A miniature solid dielectric tuning capacitor is used to tune the receiver. This is the same as the types used in most small commercial radios and is specified as having a range of 60-160pF. In fact, the two units we used had a range of

Continued on page 44

NDB (VOICE)	FREQUENCY (kHz)	NDB	FREQUENCY
ADELAIDE	362	LAUNCESTON	242
ALICE SPRINGS	224	MACKAY	308
AMBERLEY (RAAF)	359	MILDURA	272
ARCHERFIELD	206	MOUNT ISA	338
BANKSTOWN	212	MOORABBIN	398
BRISBANE	302	NOWRA*	401
BROKEN HILL	332	OAKEY (ARMY)	254
BUNDABERG	266	PARAFIELD	206
CAIRNS	364	PERTH*	400
CANBERRA	263	PORT HEDLAND	260
CARNARVON	323	PEARCE (RAAF)*	340
CHARLEVILLE	269	RICHMOND (RAAF)*	347
COOLANGATTA	278	ROCKHAMPTON*	257
DARWIN	344	WILLIAMTOWN (RAAF)	364
EAST SALE	350	SYDNEY	317
EDINBURGH (RAAF)*	311	TAMWORTH	341
ESSENDON	356	TOWNSVILLE	376
GERALDTON	359	WYNYARD	302
GINGIN (RAAF)*	372	AUCKLAND	347
KARRATHA	404	CHRISTCHURCH	274
		WELLINGTON	298

*Intermittent or emergency operation.



The circuit consists of a TRF receiver (ZN414) followed by an op amp and a power amplifier (Q2-Q5).

Weather radio for pilots

25pF to 245pF with both sections connected in parallel.

Other tuning capacitors may not provide such a large range, which would mean a corresponding reduction in band coverage.

One unusual characteristic of the ZN414 is that it requires a supply voltage of between 1.1V and 1.6V. This is derived using zener diode D2 and series pass transistor Q1.

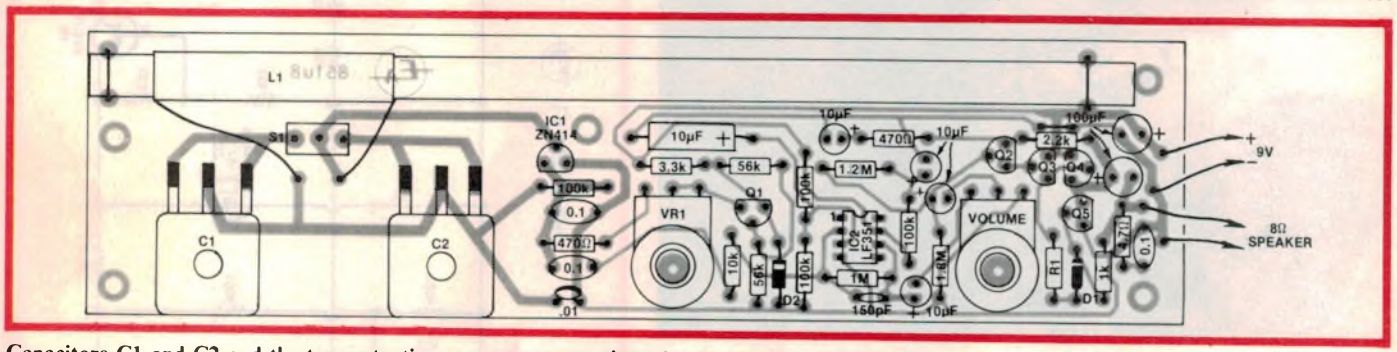
D2, in conjunction with its associated 3.3kΩ resistor and 10μF capacitor; functions as a pre-regulator and sets the voltage on Q1's collector to 4.7V. A voltage divider consisting of two 56kΩ resistors sets the base voltage to slightly less than half this figure which gives about 1.5V at Q1's emitter. Potentiometer VR1 functions as a sensitivity control.

The rest of the circuit can use any supply from 6V to 12V.

Whilst on the subject of power supply, the circuit has a quiescent current of about 11mA which would prove a bit steep for 9V transistor batteries (Eveready 216, etc). In fact, these batteries are not at all suitable for powering a 1W amplifier, as is the case here. A better alternative would be a six-pack of AA cells or larger.

The audio section of the circuit is quite similar to several previous EA circuits. Op amp IC2 (TL071 or LF351) applies a nominal gain of −100 to the signal on its pin 2 input, the output appearing at pin 6. This figure is somewhat reduced for higher frequencies (to improve speech intelligibility) by means of the 150pF capacitor included in the feedback circuit of the op amp.

Four transistors are used in the power amplifier which is a direct-coupled complementary symmetry configuration. Q2 sets the DC bias conditions for the amplifier circuit while the 2.2kΩ resistor



Capacitors C1 and C2 and the two potentiometers are mounted on the copper side of the board.

provides both AC and DC negative feedback.

Base bias for Q2 is set by the 1.2MΩ and 1.8MΩ voltage divider network with decoupling provided by a 100kΩ resistor and 10μF capacitor. This biases Q2's base to about 4.8V and sets the emitters of Q4 and Q5 to mid-supply to ensure maximum power output before signal clipping occurs.

The collector of Q2 is direct coupled to the base of Q3 which is the driver transistor for the output stage, Q4 and Q5. Crossover distortion in the output stage is minimised by the small amount of forward bias applied by D1 and R1.

Actually, R1 can be regarded as optional. If R1 is simply a wire link, then the output stage quiescent current is set to the lowest practical value. This means that there is a degree of crossover distortion but this is of no real importance for this receiver. As broadcast, the NDB signal is by no means hifi and the same might fairly be said of the tuner. Hence, there is no particular advantage in optimizing the circuit for distortion.

However, if the tuning range is changed to cover the medium-wave band, then there may be a case for improving the circuit performance. This can be achieved quite simply by making

David Voight with his Tiger Moth aircraft. David runs Red Baron Scenic Flights Pty Ltd out of Bankstown aerodrome and has put our receiver to good use.

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R1 a 180Ω resistor. The reduction in crossover distortion will be at the expense of about 5mA extra quiescent current.

The AC voltage gain of the amplifier is set to around four by the ratio of the 2.2kΩ and 470Ω resistors in the feedback network, while the 10μF capacitor in series with the 470Ω resistor curtails the frequency response below 30Hz. Bootstrapping of the output stage drive is provided by connecting a 1kΩ bias resistor from the base of Q5 to the load side of the 100μF output capacitor.

Finally, the 4.7Ω resistor and series 0.1μF capacitor across the output form a Zobel network to ensure that the amplifier remains stable into all types of loads.

Construction

Construction to the stage we have developed the project simply amounts to winding the antenna and mounting the parts on a single printed circuit board (PCB). The antenna coil is wound using 205 turns of 0.2mm enamelled copper wire over a single layer of adhesive tape (either electrician's tape or sticky tape will do). This prevents the enamel on the wire from being damaged by the ferrite and also makes the wire less inclined to unravel.

Begin by winding on 70mm of adhesive tape at one end of the ferrite rod, then tape one end of the winding wire in position about 10mm from the end. The 205 turns can now be carefully wound over the adhesive tape and secured at the other end. Trim and tin the ends of the leads so that they are ready for soldering to the PCB.

The PCB measures 205 × 54mm and carries the code number 85tu8. Once the antenna coil has been wound, it can be carefully assembled according to the parts layout diagram. Note that the tuning capacitors and potentiometers are mounted on the copper side of the PCB. The potentiometer terminals are then connected to the PCB using short wire links.

Short loops of hook-up wire soldered to the PCB are used to hold the ferrite rod in place. Pull the loops tight before soldering them in place.

R1 can either be a 180Ω resistor or a wire link, as discussed above during the circuit description. Note that R1 must be a wire link for supply voltages greater than 12V otherwise you will get excessive power dissipation in the output stages.

If you want to house the project in a box, be sure to use a plastic one — metal is definitely out. With the tuning capacitors mounted directly on the PCB, slots will have to be cut in the side of the box for the tuning "dials". The volume and sensitivity controls would require holes in the front panel.

For most constructors, there is no specific test procedure — just turn the thing on and see if it works. For those with access to an audio signal generator, the amplifier section can be tested separately. Disconnect the 0.1μF capacitor connecting the op amp to the ZN414 (on the ZN414 side). A signal of no more than 10mV (peak to peak) fed into the free end of the capacitor should allow the volume control of the amplifier to be adjusted for quite high volume.

If an RF signal generator is available, the tuning range of the circuit can also be checked and adjusted. In the absence of such equipment, the range will have to be determined on a trial and error basis. The most obvious error is tuning into the medium-wave band. If this occurs, increase the number of turns on the ferrite rod.

PARTS LIST

1 small 8Ω loudspeaker
1 PCB, code 85tu8, 214 × 55mm
1 ferrite rod, 9 × 200mm (or similar)
1 battery clip
1 6 × AA-size battery holder
12 metres of 0.2mm enamelled copper wire

Semiconductors

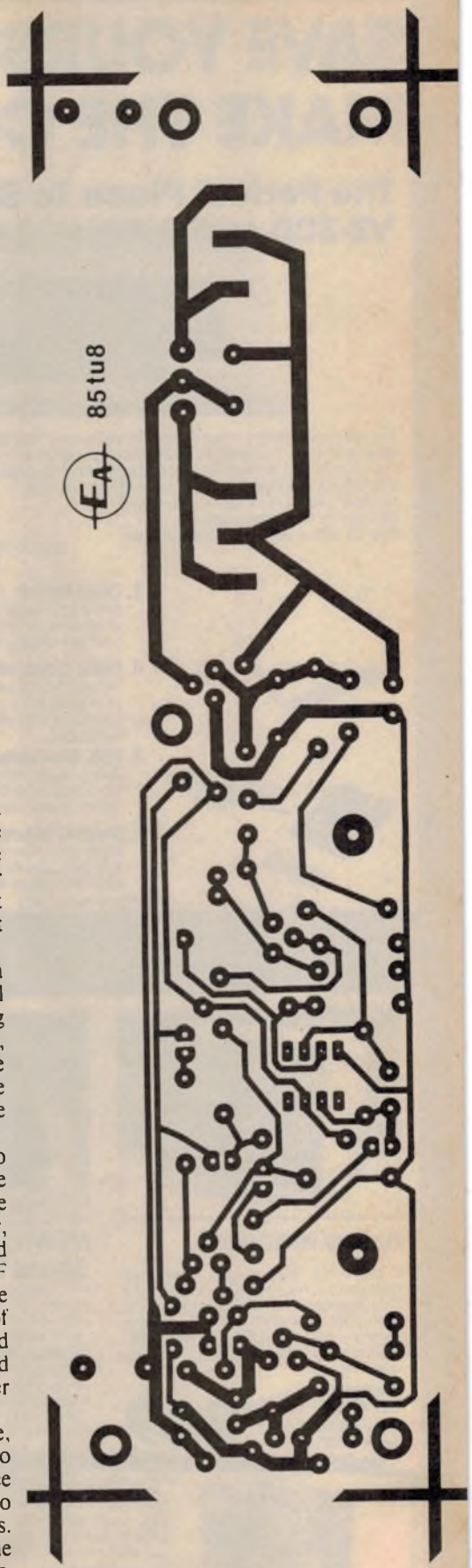
1 ZN414 AM tuner IC
1 TL071 or LF351 FET-input op amp
2 BC549 NPN transistors
1 BC338 NPN transistor
2 BC328 PNP transistors
1 4.7V, 400mW zener diode
1 1N914 diode

Capacitors

2 100μF 25V electrolytics
5 10μF 10V electrolytics
3 0.1μF metallised polyester (greencap)
1 .01μF greencap
1 150pF greencap
2 60-60pF miniature tuning capacitors (see text)

Resistors

1 × 1.8MΩ, 1 × 1.2MΩ, 1 × 1MΩ, 4 × 100kΩ, 2 × 56kΩ, 1 × 10kΩ, 1 × 3.3kΩ, 1 × 2.2kΩ, 1 × 1kΩ, 2 × 470Ω, 1 × 180Ω (see text), 1 × 10kΩ logarithmic potentiometer, 1 × 5kΩ linear potentiometer



Above is an actual size artwork for the printed circuit board.

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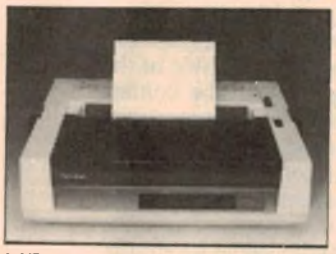

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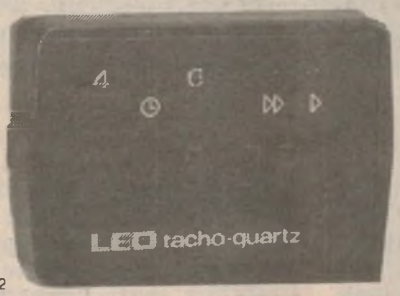

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The Serviceman

First aid for a motel TV system: Pt.2.

Last month I set out to present a story from my colleague on the NSW south coast, involving a moderately large TV distribution system for a motel, the problems he encountered, and how he overcame them. Unfortunately, we had to leave our hero, if not hanging over a cliff, then at least in mid-stream. So here's the rest of the story.

When we left the story last month the job had been half completed, but work was suspended for approximately six months while the central block was refurbished. My friend takes up the story from there.

Time went by and, quite frankly, I lost track of it. Uppermost in my mind was the fact that the ball was in the manager's court; he had promised to contact me. I also realised that building projects like this often run over schedule.

Thus it was that the six months came and went without my realising it, or hearing from the manager. In fact, several more months went by until about a week before the Christmas break. Then the manager was on the phone with a real tale of woe. He opened the conversation by asking whether I was ". . . the guy who does the TV service for this motel?"

I replied that I was, but it was obvious that this manager was not the one I had dealt with previously. And so it proved; he was new to this motel and had been in charge for only a couple of months.

My first reaction (privately) was that, if they wanted the job finished before Christmas, at such short notice, there was no way I could do it. But that was not the story; his complaint was simply that virtually the whole of the central block was without any TV. And, with every unit booked for the holidays, he was naturally very concerned. So I agreed to make a quick dash to the site — it is in the next town — and see what could be done.

The truth is I was puzzled. I had left the central block working on the old system which, with some patching and not having to serve the southern unit, was giving reasonable service. I was trying to guess what had gone wrong.

I loaded as much equipment and as many devices as I could think of into the truck, including, for some instinctive reason, several small masthead amplifiers I had in stock. I didn't want to be like the plumber and have to come back for something I had forgotten; I wanted to be like the boy scout, and be prepared.

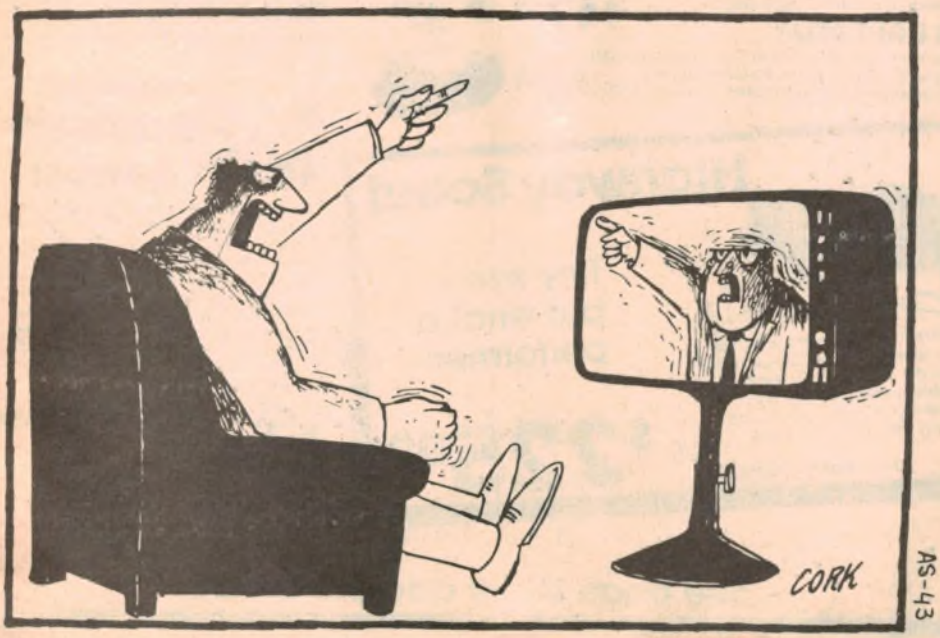
But I wasn't prepared for what I did find. It turned out to be an administrative and technical shambles. It appeared that the new manager had been told nothing about the arrangement between myself and the previous manager and had authorised an electrician to go ahead and finish off the work I had started. This was a bit of a shaker in itself.

But, putting aside any argument about contractual arrangements, the immediate problem was that the system wasn't working. Only the first few units on each line were receiving a worthwhile signal. This was rather puzzling because, at first glance, the electrician appeared to have done all the right things. He had fitted "T"s behind the facia at each of the loops I had left, run a cable neatly into each unit, fitted a wall outlet, and even provided new fly leads from the outlets to the sets.

So why wouldn't the system work? Closer examination soon revealed the reason. The electrician hadn't used "T"s at all; he had used splitters which, in the make concerned, are physically identical with the "T"s. But, of course, the difference in performance was quite dramatic.

We now had a through loss of at least 3.5dB (plus cable losses) for each unit, plus a side loss of 3.5dB to each unit. Even on the short run serving seven units on the western side, the signal to the last set would be down by around 25dB at least; probably over 30dB in practice.

On the longer run, covering the southern, eastern, and northern sides, there were 15 units plus the games room, dining room, and manager's residence; 18 sets in all. On this basis the signal to the last set would be down by at least 63dB, not counting cable and other losses.



What to do?

So what could be done about it? The

long term solution was simply to replace each splitter with a "T" and, by using the same make, replacement would be relatively simple. At the same time, the cost of the replacement units would be a substantial figure, since the electrician had chosen one of the most expensive brands available.

To this would have to be added labour costs and the whole exercise looked like making a mess of $1000. So the first thing I had to do was clarify this situation with management; did they want me to go ahead? The manager phoned head office, explained the problem, and asked for a ruling. The answer was immediate and to the point: "Get it fixed." So that point was settled.

The more immediate problem wasn't so easily solved. Within a few days of Christmas there was no way that I could get a delivery of "T"s and replace them in time. On the other hand the manager was desperate; he would have to face a barrage from irate customers unless I could do something.

And this was where the masthead amplifiers came to the rescue. By running some temporary power leads and cutting several of these amplifiers into the line at various intervals at a convenient splitter I was able to get a usable signal into all the units. The less important outlets, like the dining room, manager's residence etc, were chopped off in the interest of simplicity.

It was very makeshift and not all the signals were crash hot, but they were watchable. In fact, the manager was delighted and the goodwill I generated was certainly worthwhile. More to the point it gave me some breathing space to organise a supply of "T"s and do the job properly.

I was particularly anxious to get the "T"s in the same brand, to minimise labour costs, and was afraid I might encounter a shortage, as happens from time to time. So, immediately after Christmas, in the few active days before New Year, I started searching. The exercise was somewhat abortive, but the comments I encountered from various people are worth recording.

First I rang my regular supplier, but they were out of stock and would have to wait until the makers opened their factory early in the new year. I rang another wholesaler and, at first, the assistant said he was sure they had stocks. But when I told him how many I wanted he decided to check the stock.

When he came back it was a different story. They didn't have any "T" units, only splitters. When I insisted that I wanted "T"s he was equally insistant that splitters would do just as well. And when, rather foolishly perhaps, I tried to explain the difference all he could say was, "Aw, they'll both split up the signal."

At that point I indicated that I was not interested, and that splitters were of no use in a master distribution system. To which his parting remark was, "Well, that's all our customers use." I didn't trust myself to reply.

I rang a second warehouse and, would you believe, the conversation was almost identical. Everyone seemed to use splitters, and there were plenty on hand. But there were no "T"s because no one seemed to want them.

Finally, in desperation, I rang the makers, hoping that there might just be someone in the stock room who could help me. There wasn't, as it turned out, but I found myself talking to someone in the engineering and design department, the only section that was functioning. When I explained what I wanted he was most apologetic, explaining that he had no access to the stock and that I would have to wait for the factory to re-open.

But he was most sympathetic when I explained the problem.

"You sound like a cracked record, mate."

"What do you mean?" I asked.

"Listen, every day of the week I get blokes ringing up here wanting to know why their systems won't work. And when I ask a few questions I find that they are using splitters instead of "T"s. There seems to be no way we can get the message across that these are two different devices, for quite different jobs."

Putting all these conversations together made it obvious that my problem was not an isolated case, nor is it necessarily only electricians who are confused. On the contrary, there appears to be confusion and ignorance right throughout the industry.

Which isn't a very happy thought.

As far as my problem was concerned I simply had to be patient and wait for the factory to open. When it did I phoned through an order and the "T"s were duly delivered. Then it was back to the motel, confident that all would be plain sailing from here on.

And so it was at first. My temporary system of masthead amplifiers was pulled out, along with the splitters, and the "T" units fitted instead. Then we were ready to switch on and try again. I would like to say that everything went perfectly and that that was the end of the story.

But it wasn't. To be sure, the system was working a good deal better than it had originally, but I wasn't convinced that it was right. The problem was that the performance varied between units, without any logical pattern. One unit would be weak, the next one strong, the next one weak again, perhaps on one channel, and so on.

The Serviceman

I brought in the field strength meter and began checking levels at the outputs of the fly leads. This confirmed my suspicions; signal levels were all over the place, with no logical reason behind the quite drastic variations.

Back tracking, I moved down to the wall outlets and took readings there. Now it was a different story. The levels were very much as I had expected them to be, and were consistent from unit to unit. I pulled one of the fly leads apart, which apparently had been made up by the electrician, and found that he had carefully trimmed back the braid at both ends so that it was not connected to anything. All that was connected was the centre conductor.

So I had to re-make every fly lead, then check the whole system out again. And this time it really worked, with a first class signal in every unit. What's more, it has been working like that for nearly two years now, with almost no maintenance. The most serious fault was caused by a cleaner who smashed the outlet plate in the first unit of the western block, breaking the leads and putting all 10 units out of action. That was quickly rectified.

A happy ending

And so the story had an — eventual — happy ending. But the number of things that went wrong must surely constitute some kind of a record. First there was the technician who installed the 10dB amplifier to serve the western block and who, apparently, didn't know the difference between a high power amplifier and a high gain one.

Then there was the miswired power plug on this amplifier which could easily have killed someone. The fact that it didn't was pure good luck.

Next there was the administrative bungle whereby the electrician was given the job of finishing off the main block because no one had told the new manager about my contract with the company. As it turned out, the company was the only loser because I finished up doing the job anyway.

Fourth, there was the classic technical boo-boo involving splitters instead of "T"s and, to cap it all, the incorrectly constructed fly leads — five major goofs in all. Can anyone beat that?

But the most disconcerting aspect of the whole story must be the evidence that a large percentage of technicians — along with accessories salesmen, etc. — don't even know the difference between a splitter and a "T". These technicians are charging their customers substantial sums for systems that are obviously inferior — and getting away with it. If this story does anything to clarify the situation, then it will have been worth the effort.

Well, that's my friend's story and I can only heartily agree with his sentiments. Let's hope the story does help.

And from my own bench here is a short story showing how familiarity, if not actually breeding contempt, can at least breed over-confidence. Or, putting it another way, the very experience on which we base our work can sometimes turn against us.

The story concerns an HMV model C221 colour set; a successor to the model C211 and, in many ways, very similar to it. In fact, several of the boards are directly interchangable. Both sets, and particularly the 221, have proved to be very reliable and are generally highly regarded by their owners.

The set in question was owned by a long-time customer who had recently moved some little distance out of my normal district, involving a length of journey I try to avoid. However, due to our long association, I do try to help him out when necessary, at least by combining the call with other business which might take me in that general direction.

The symptoms, as described by the owner on the phone, were not unfamiliar. He complained that the picture would intermittently go very dark and stay that way for quite long periods; a fault I had already encountered at least twice in the same model set and, as I recalled, always in the same section.

More specifically it had been on the luminance board and involved intermittent faults in the luminance gain transistors TR612 and TR613. On this basis I made sure I had replacements for these and three other associated transistors, TR614, 615 and 616; blanking, line clamp, and emitter follower repectively.

Not surprisingly, when I arrived at the customer's home and he turned the set on, there was no sign of the fault. Considering the travelling involved, and the previous experience already mentioned, I decided to adopt a somewhat brute force approach and replace all five transistors on the luminance board. I was encouraged by the fact that all the transistors were common low cost types and also readily accessible. And, by doing the job on the spot, I would save time and another trip.

So the job was duly done and the customer advised that all should now be well; but if it wasn't he was to call me. Well, he took me at my word and was on the phone a couple of days later complaining that the fault was still as much in evidence as before. But this time he volunteered some more information; it appeared that the fault usually showed up when the set was switched on from cold and lasted anything up to an hour before coming good.

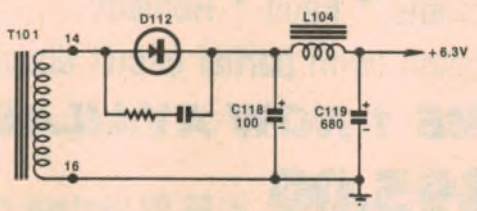
So I promised to call the following day and asked him not to switch the set on before I arrived. And this time I was lucky, the fault showing up immediately the set was switched on. But it wasn't as I had envisaged it from the owner's description. To be sure there was a marginal drop in brightness, but the real symptom was a gross loss of contrast; it was just as if the contrast control had been turned way down.

I realised then that I should really have quizzed the owner for a more accurate description. On the other hand, have you ever tried to explain the difference between brightness and contrast to the average viewer? If you have, you'll know how futile it is.

Anyway, this put a completely different complexion on the case. It appeared that there was a gross loss of gain somewhere in the system, and which could be anywhere from the tuner onwards. It was no longer an in-house job, it would have to come back to the shop.

So this was done and, at first switch-on, the fault appeared. I let it run to confirm the owner's story and, sure enough, after about half an hour, I suddenly realised that the picture was back to normal. I switched it off, left it to cool down, then tried again. And again it came up with the fault condition.

This time I was ready with a spare tuner, which took only a few moments to



Above: the picture tube heater circuit in the HMV C221. The arrangement used in the actual set differed slightly from that shown.

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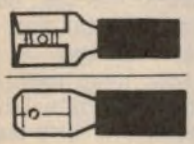

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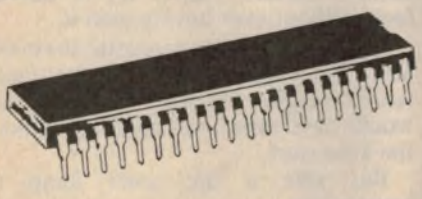

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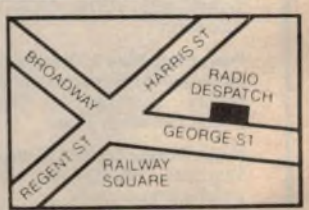

wire in. Result, fault still in evidence. Next I substituted a spare IF board. Same result. Then I changed the luminance board and, finally, the chrominance board. Again, there was no change.

But that only deepened the mystery, because I was rapidly running out of things to try. More or less in desperation I decided to make a detailed voltage check, with and without the fault, in the hope that some change would be found which would provide a clue. And I decided that the best bet was the luminance board, carrying the video chain already described and the five replaced transistors, plus the R,G,B, output stages.

To this end I measured and recorded a whole swag of voltages on this board while the set was in fault condition. Then I waited for the set to come good and measured them all again. Result, virtually no change. I did the same for the G2 voltage on the picture tube, and even the EHT. No joy.

I put the set to one side and busied myself with more routine jobs while I concentrated on the problem. This produced the next line of attack. Assuming that there was no lack of gain in the system, could the low contrast picture be due to a faulty tube? Certainly the image had all the appearance of a sick tube but if this was the fault, by what mechanism was the tube coming good?

On this basis I had to discard the faulty tube theory, but I didn't completely discard the tube circuitry. Directly or indirectly I had checked all the voltages being applied to the tube, without result. Or had I? What about the heater volts? I almost discarded the idea immediately on the basis that, visually at least, the heaters were operating normally. But I had to be sure.

Expecting to find some 20kHz of AC on the heaters from the switch mode power supply, as in the model C211, I reached for a suitable meter to measure it; a Fluke 8060A. Finding a suitable spot on the CRT board I applied the prods and glanced at the meter. It showed a string of zeros. I double checked the measuring points, which seemed to be correct, then moved back to the output of the switch mode board. The meter still showed a string of zeros.

In desperation I fished out the circuit and took a closer look at it. Then all became clear. This model used a DC heater supply, output from the heater winding being rectified by diode D112, smoothed by a 100μF electro, C118, further filtered by a choke, L104, then by-passed by a 680pF capacitor, C119. And I need hardly add that this meter would not accept DC in its AC mode.

Switching to DC produced a different story, although an equally puzzling one. The meter now read 3.6V. On the one hand, this suggested that I was on the track of the fault. On the other hand, I found it hard to accept this reading on the basis of the visual brightness of the heaters. Heaters which operate on about 4V in "instant-on" circuits don't run at anything like this brillance.

But this anomaly aside, it was obvious that all was not well in the heater circuit. Close examination of the circuit suggested a possible cause: the 100μF electro. If this was faulty it would have a significant effect on the heater voltage, and also on the waveform, which might account for the funny meter reading.

I fished out a spare 100μF unit and found a spot on the board where I could connect it in parallel with the existing one. Result, an instant cure. So that was it, a faulty 100μF electro. Or was it? Regular readers will know that I have little regard for Japanese electros, their reliability, in my opinion, being extremely poor.

But these sets didn't use Japanese electros; they used an Austrian brand and, in all the years that I have been servicing these sets, I have never yet had a need to replace one. And there was one other factor. Not shown in the circuit, but present on the board, was a low value resistor of about 1Ω in series between the negative end of the electro and deck. This had presumably been added to limit the peak current through the electro.

The electro was a double ended pigtail type with its positive end conected directly to the board and its negative pigtail making a mid-air connection to the resistor, the other end of which was soldered to the PCB earth pattern.

So was the resistor faulty? No, it wasn't. The fault was a classic fractured joint where the resistor was supposedly soldered to the board. A few seconds work with a hot iron was all that was needed to fix it.

So the Austrian electro was OK, but my own performance was not above criticism, at least in hindsight. One mistake was not to seek more specific details of the symptoms from the customer. Another, because of time and distance factors, was to try to fix the fault without ever having seen it.

Still, it's easy to be wise after the event and I did eventually find the real fault. And I imagine this part of the exercise would have taken just as long, without the false start.

But take a tip; don't jump to conclusions.

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This information is supplied by courtesy of the Tasmanian branch of The Electronic Technicians' Institute of Australia. Contributions should be sent to J. Lawler, 16 Adina St, Geilston Bay, 7015.

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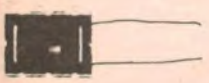

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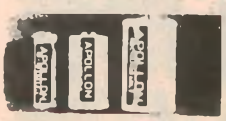

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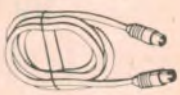

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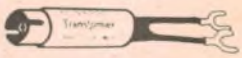

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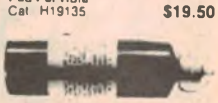

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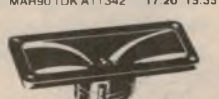

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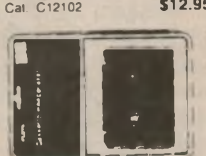

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Errors and ommisions excepted

Remote control for the Teletext Decoder

Here is an infrared remote control for the Dick Smith Teletext Decoder. Designed by staff at Dick Smith Electronics, it requires only a handful of parts, is easy to build, and duplicates all the control keys of the original wired unit.

by ANDREW LEVIDO

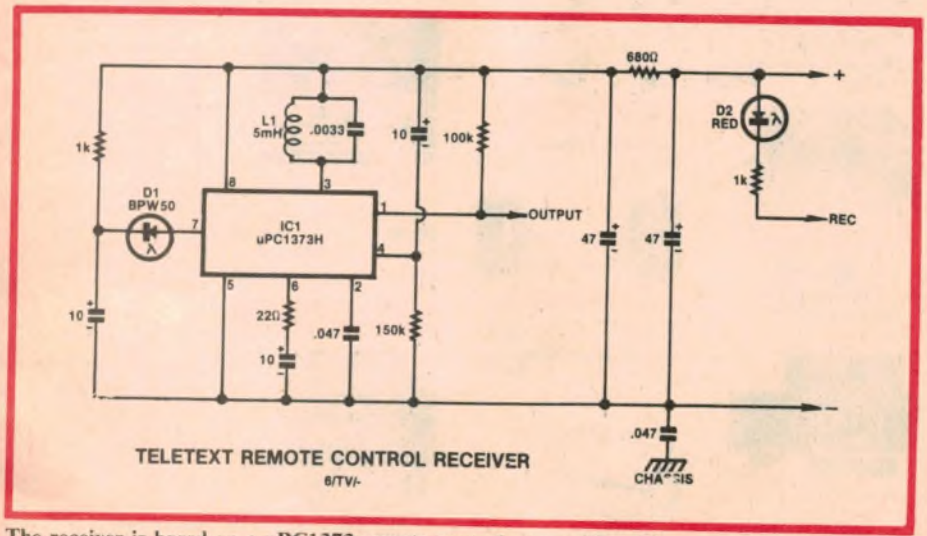
Described in the August and September 1984 issues of *Electronics Australia*, the Teletext Decoder has proven to be a very popular project. It offers all the standard Teletext functions and sells for a very attractive price — just $199. Of course, it does need to be teamed with a VCR or with the Stereo TV Decoder (EA, March and April 1985).

A drawback of the original design is the wired remote control which can often be inconvenient. Having the cord draped across the lounge room is not only a nuisance but can be dangerous as well. Apart from this, anything but an infrared remote control is now regarded as being "old fashioned".

This infrared remote control overcomes these problems. It replaces the old wired remote control unit and consists of two parts: a hand-held remote control unit and an add-on infrared receiver which is mounted inside the Teletext Decoder.

The handset has the same control keys as the existing wired controller, but uses modulated infrared light with a wavelength of about 940nm as the transmitting medium. The chip included inside the original controller, the SAA5000, is specifically designed for use in infrared and ultrasonic remote control applications so the extra circuitry required is minimal.

A little more work is required for the receiver. This requires an infrared detector and a preamplifier circuit, the output signal of which is fed into the existing SAA5010 decoder chip included on the original decoder PC board.



The receiver is based on a uPC1373 remote control preamplifier IC.

How it works

We will look first at the transmitter circuit which is shown in the accompanying diagram.

As mentioned above, the transmitter is based around the SAA5000 transmitter encoder IC from the Teletext chipset. This IC performs two functions. It decodes the keyboard to determine which key has been pressed, and it modulates the transmitted signal. Modulation suitable for either ultrasonic or infrared transmission can be selected.

Very few external components are required by the SAA5000 for correct operation. Six 33kΩ resistors are used as pulldown resistors for the keyboard inputs. The 22kΩ resistor and the 270pF capacitor are the timing components for the internal oscillator which determines the output bit rate. Pin 17 is the output select and is tied high to select infrared modulation.

The output of the SAA5000 IC appears at pin 16 and consists of a 24-bit code. This code is specifically designed for protection against errors caused by adverse transmission conditions.

When a key is pressed, the pulse train from pin 16 is differentiated by a .001μF capacitor and the 560Ω and 10kΩ resistors. Diode D3 clips the positive going spikes of the resulting signal, while the negative going spikes are inverted by Q1 and applied to the base of output

Shown here with the Teletext Decoder, the new infrared remote control duplicates the functions of the original wired unit. Note cutout in the front panel of the main unit, below the mains switch.

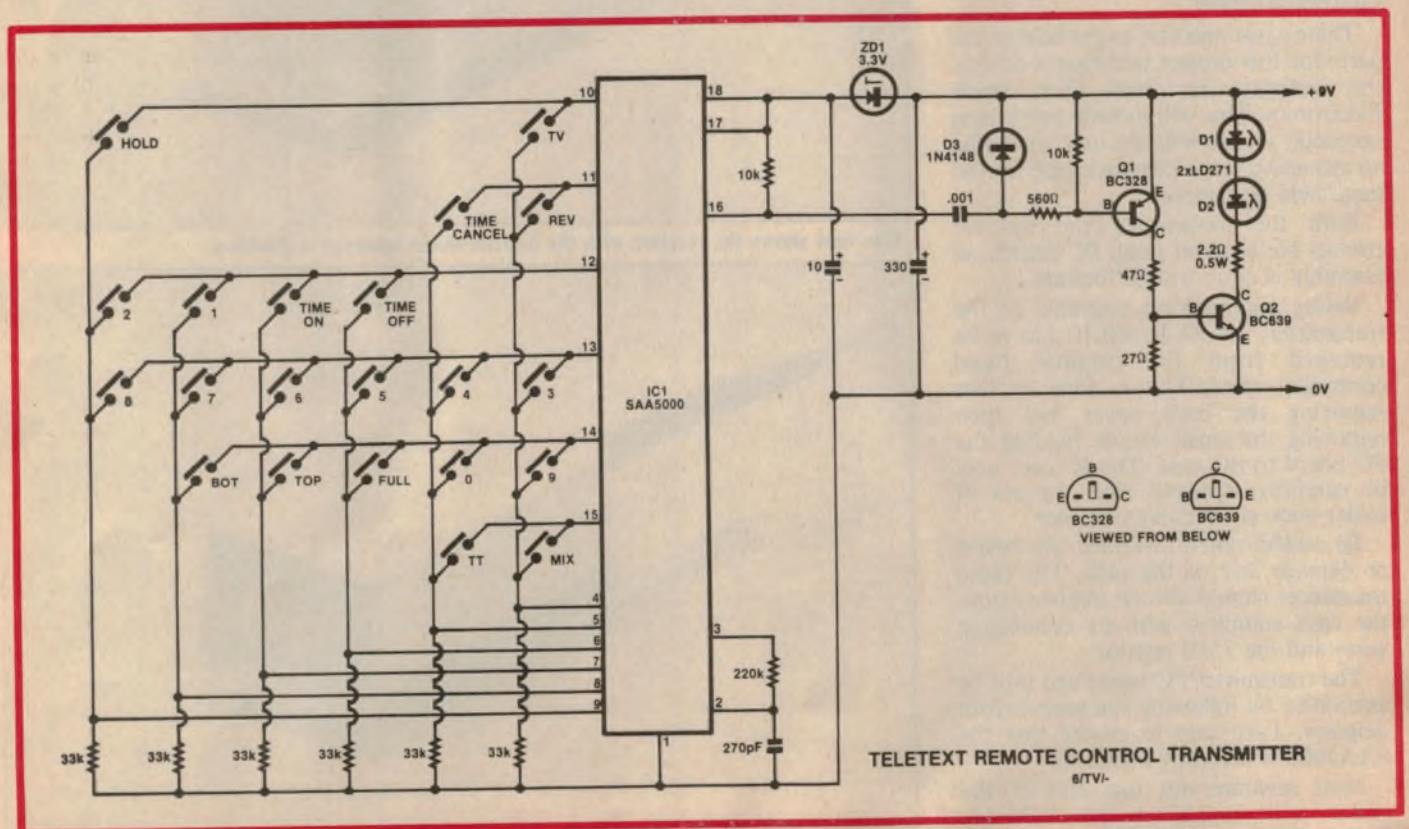
stage Q2 via a 47Ω resistor.

Q2, in turn, drives the two infrared LEDs while the 2.2Ω resistor limits the current pulses to about 1.5A.

The entire transmitter circuit is powered by a 9V battery. A 330μF capacitor is included to store the energy required for the high current pulses. The 3.3V zener diode is necessary to reduce the battery voltage to approximately 6V, as required by the SAA5000 IC.

The receiver is also based around a single integrated circuit, in this case the μPC1373 remote control preamplifier. This IC contains all the necessary functional blocks to correctly bias the photodiode and to amplify and process the signals received by it. Again, only a few external components are required.

The photodiode is connected to pin 7 of IC2. An internal circuit maintains the bias on this diode at the optimum level,



An SAA5000 encoder IC forms the heart of the infrared transmitter circuit.

Remote control for Teletext Decoder

thus providing a degree of immunity against ambient light variations. A 1kΩ resistor and 10μF capacitor decouple the supply to the photodiode.

The first stage in IC2 is an amplifier, the gain of which is determined by the ratio of the impedance connected to pin 3 to that connected to pin 6. A tuned circuit is connected to pin 3 which means that the amplifier response has a pronounced peak at the resonant frequency of this circuit. This frequency corresponds to the transmitting frequency of the hand held control.

The amplifier stage is followed by a limiter and level shifter which serves to reduce the effects of noise and poor transmission conditions. Following this is a peak detector which extracts the data from the bit stream.

The final stage provides pulse shaping and filters out the carrier frequency from the data. Note that the output circuit consists of an open collector transistor, hence the 100kΩ pullup resistor between pin 1 and the positive supply rail.

Finally, the circuit includes a LED to provide "message received" indication. The signal to control this is produced by the SAA5010 IC in the Teletext Decoder.

Construction

There's just one way to get hold of the parts for this project and that is to buy the complete kit from Dick Smith Electronics. This will include everything necessary to assemble the unit, including an attractive moulded plastic case for the hand held transmitter.

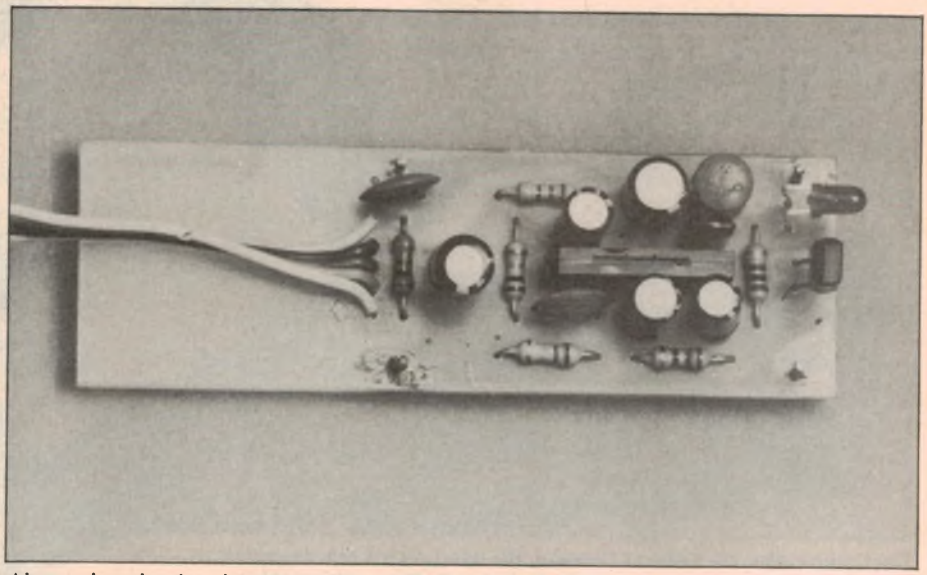
Both the transmitter and receiver circuits are built on small PC boards, so assembly is quite straightforward.

Before commencing assembly of the transmitter, the SAA5000 IC has to be removed from the original hand controller board. This is done by first removing the back cover and then removing the small screws holding the PC board to the case. The IC may now be carefully removed with the aid of solder wick or a desoldering tool.

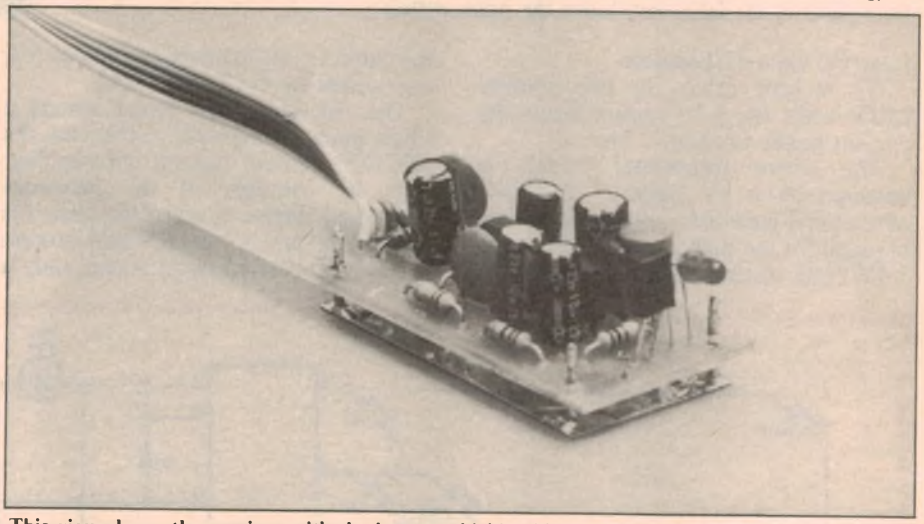
Be careful not to overheat the device or damage any of the pins. The piezo transducer should also be removed from the case complete with its connecting wires and the 22kΩ resistor.

The transmitter PC board can now be assembled by following the parts layout diagram. Take care to ensure that the SAA5000 is correctly installed.

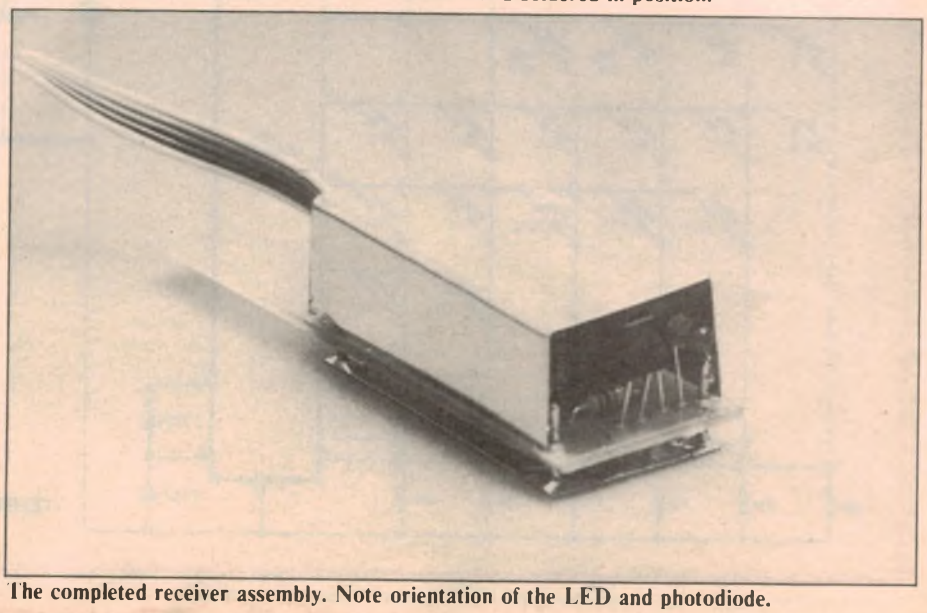
Next separate out one end of the ribbon cable supplied to about 25mm. Strip each wire back for about 3mm, tin



Above: view showing the assembled receiver board. Note PC stakes for shield connections.



This view shows the receiver with the bottom shield soldered in position.



The completed receiver assembly. Note orientation of the LED and photodiode.

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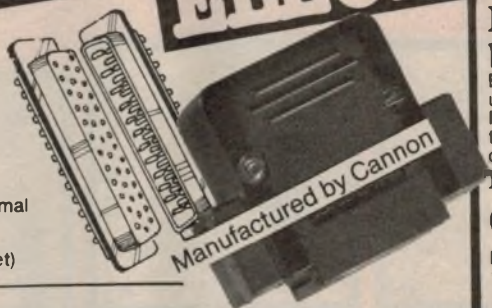

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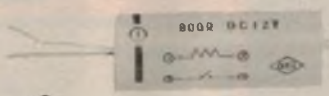

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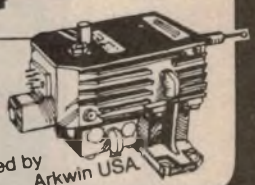

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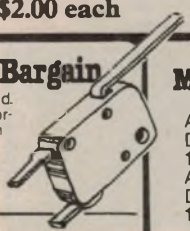

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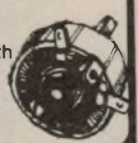

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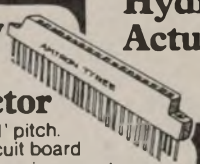

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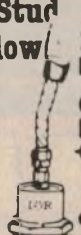

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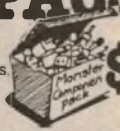

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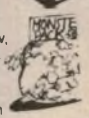

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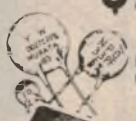

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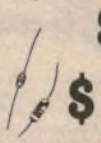
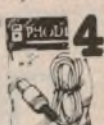


8 Connector Lead Pac. Look what you get here. Talk about value.....
1 x 5 pin DIN plug to 4 x 6.5mm Mono Plugs.
1 ditto to 1 x 3.5mm plug
2 x 6.5mm line socket to 1 x 6.5mm stereo plug
1 x 3.5mm plug to 1 x RCA Line Socket **4 for $5**



9 Monolithic Cap Pac. Now here's value. Mini Bypass caps manufactured by Emcon USA. 50 assorted from 12pf to 270 pf 100V. In radial and axial. Worth at least $15. Our special price. **$7**

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Remote control for Teletext Decoder

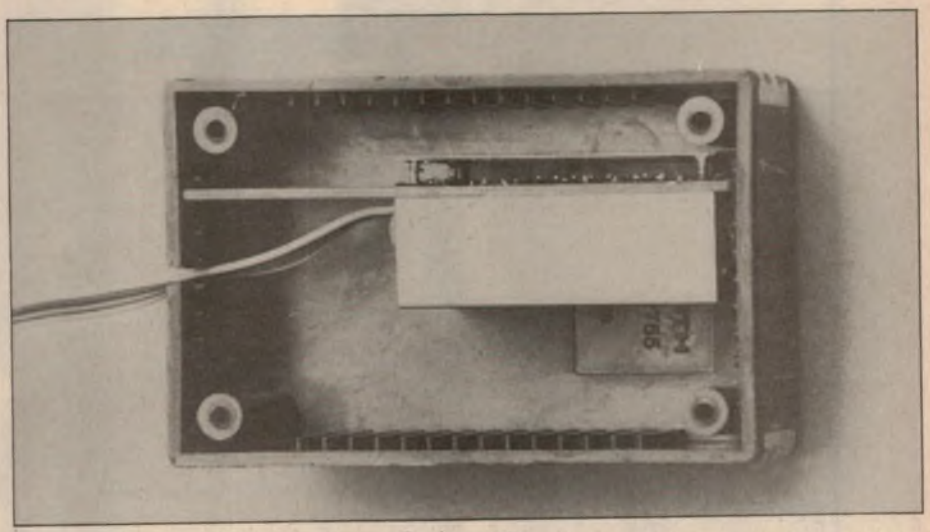
the conductors, then solder the wires to the PC board. The PC board can now be positioned in the lower half of the case and the infrared LEDs installed so that they rest on the two plastic supports.

Mark the LED positions, then remove the board and solder the LEDs in position.

A separate PC board accommodates the control keys. This carries a number of insulated links and these should be soldered into place using the minimum possible amount of solder (to prevent them from interfering with the keyboard operation). Once the links have been mounted, the ribbon cable from the transmitter board can be connected.

This done, insert the 21 keys into the slots in the front of the case and locate the rubber keyboard membrane, with the black conductive pads towards you, over the studs on the rear of the keyboard area. Now fit the keyboard over the same studs and secure it with the screws provided.

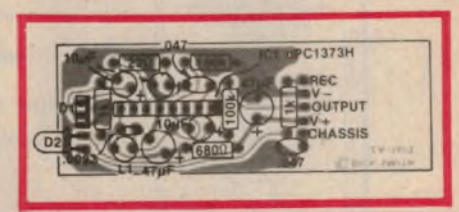
Finally, feed the battery clip through into the battery compartment, assemble the two halves of the case and fit the aluminium front panel. The latter can be held in place using a few drops of contact adhesive.



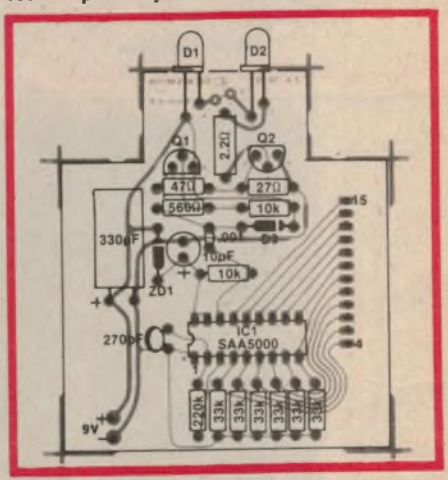
The receiver board is slotted into a plastic zippy case.

The receiver

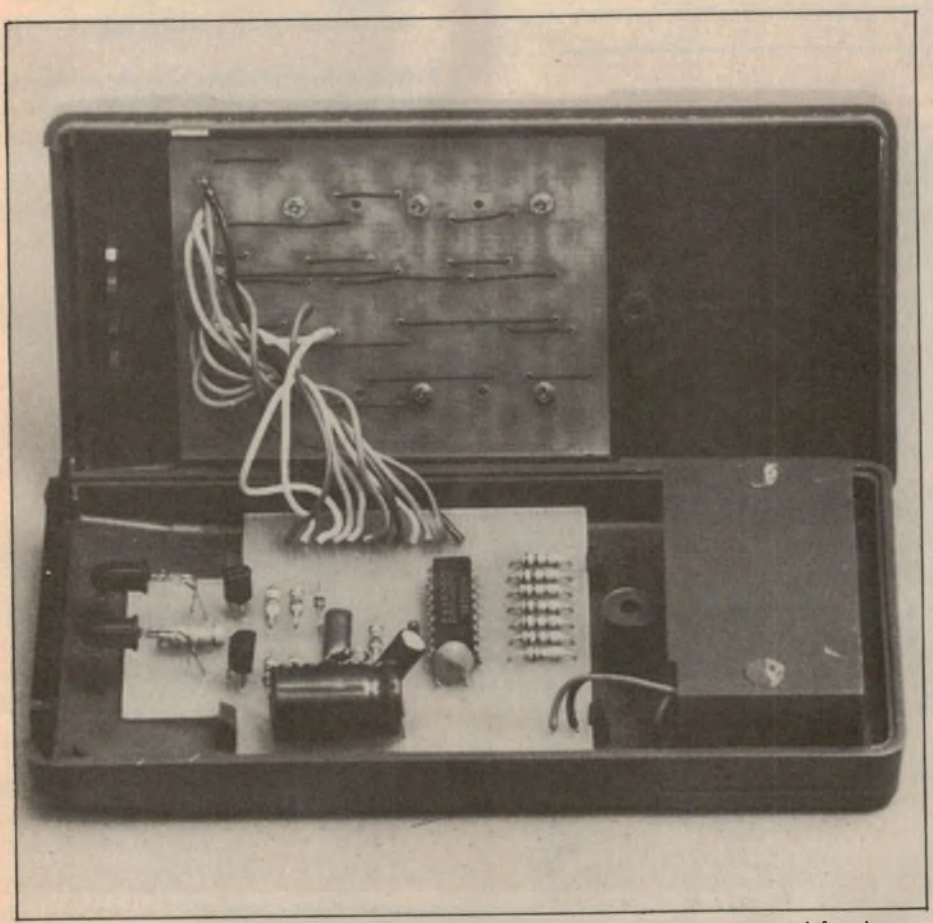
Now for the receiver board assembly. The first thing to do is to fit the four PC



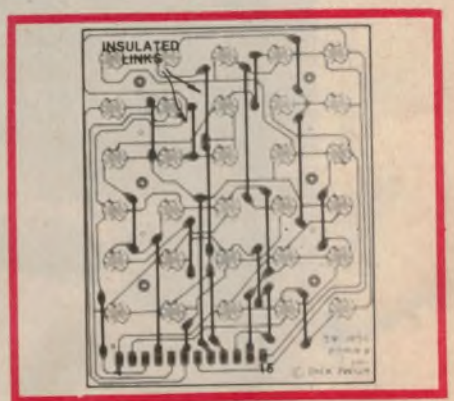
Above: parts layout for the receiver board.



Above: parts layout for the transmitter board.

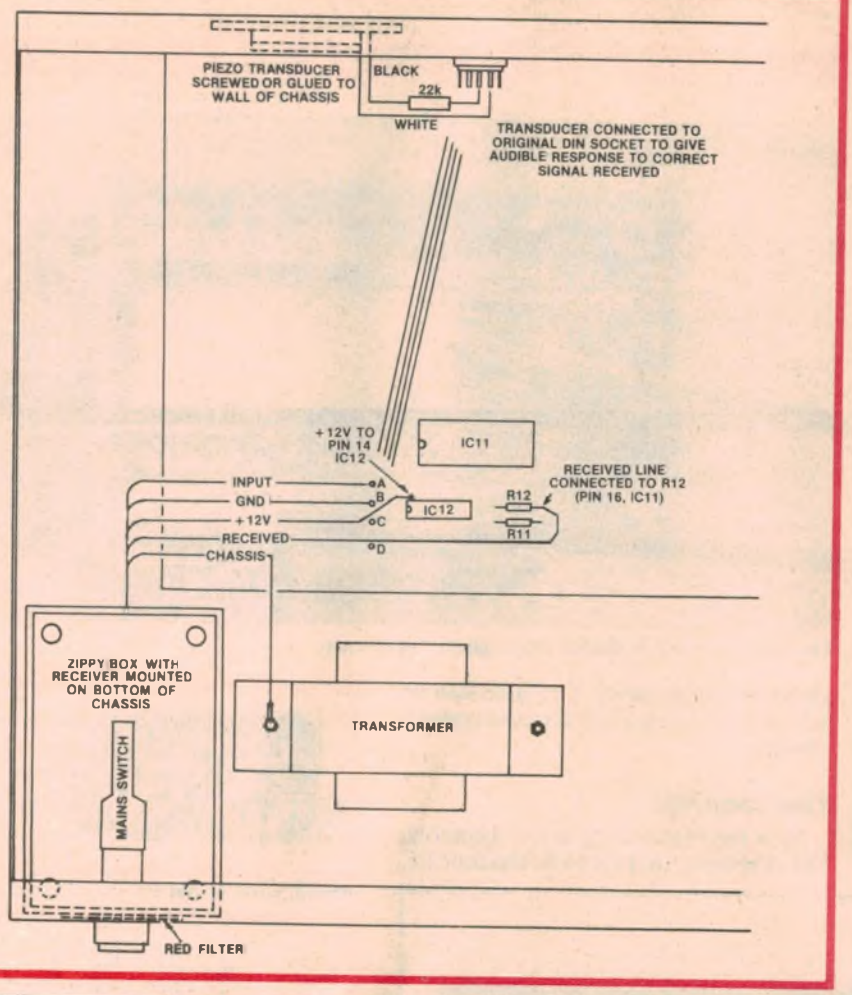


View inside the hand-held transmitter unit. Note the mounting arrangement used for the two infrared LEDs.



This diagram shows the keyboard assembly.

Remote control for the Teletext Decoder



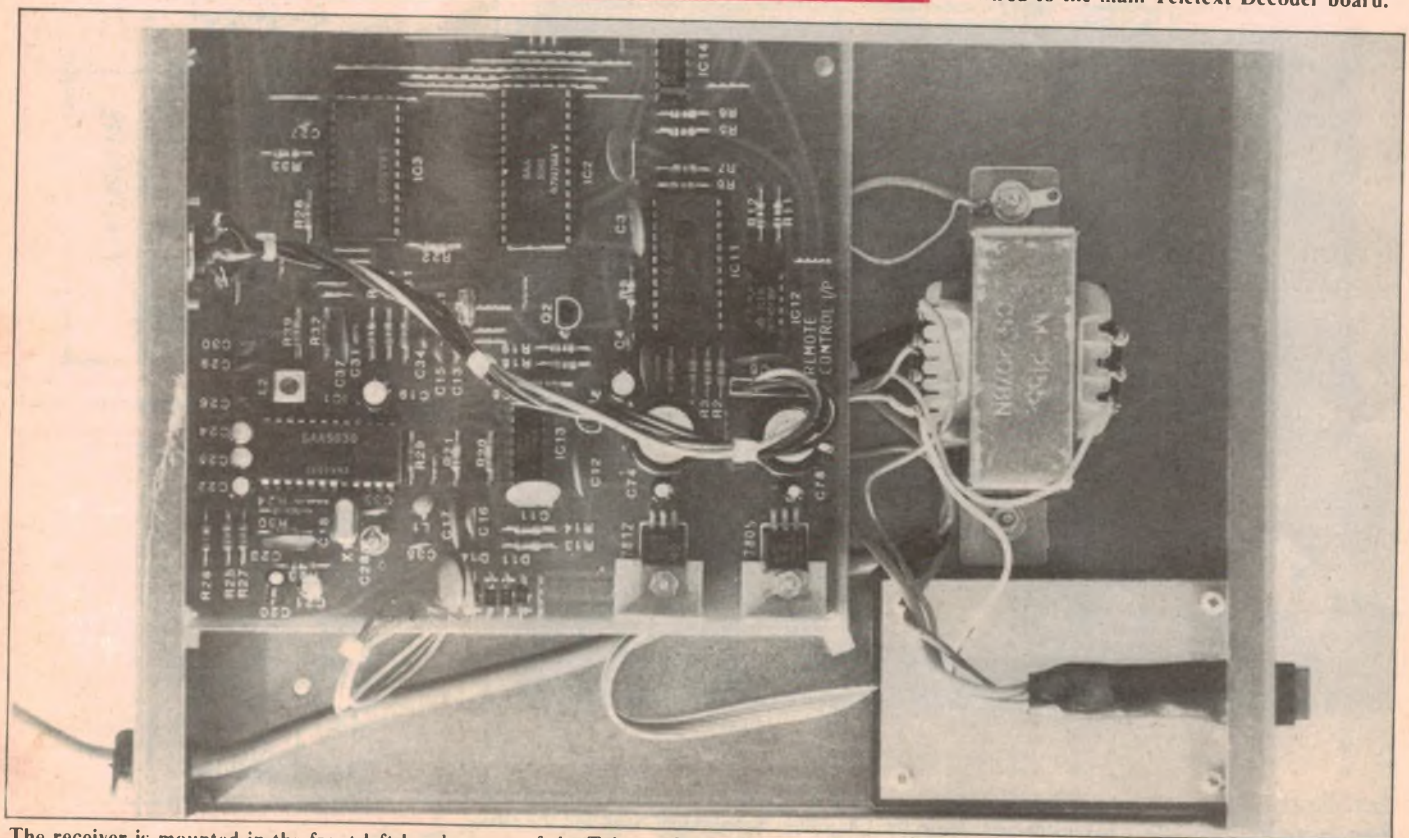
pins to the board. These pins are used to mount the tinplate shields and should be inserted into the board from the copper side. Push the longer end of the pins through the board and solder them in place.

The remainder of the parts can now be installed but don't mount the LED or photodiode at this stage. Note that the bevelled edge of the IC faces towards the rear of the board; ie, away from the LED and photodiode. You should also take care to ensure that the LED and photodiode are correctly oriented.

When all the parts have been mounted, connect a length of ribbon cable to the board as described previously.

As shown in the photographs, the

Left: this diagram shows how the receiver is wired to the main Teletext Decoder board.



The receiver is mounted in the front left hand corner of the Teletext Decoder chassis, immediately below the on/off switch.

transmitter board is mounted in a small plastic zippy case. This, in turn, is secured to the front lefthand corner of the Teletext Decoder chassis.

Two holes must be drilled in the plastic box in the positions shown in the accompanying diagram. A slot is also required in the rear of the box to accommodate the ribbon cable.

Once the box has been prepared, slide the PC board into the last slot and align the photodiode and the LED so that they are opposite their respective holes. The PC board can now be removed and the LED and photodiode soldered permanently into position. Note that the leads of the LED are bent at right angles.

Next, the two tinplate shields must be soldered into position. The larger piece of tinplate must be bent into a "U" shape so that it will fit over the component side of the board, while the smaller piece is mounted on the underside of the board. The shields are soldered to the PC pins as shown in the photographs.

Finally, a piece of red filter material is supplied with the kit and this should be affixed to the front of the box.

Installation

The diagrams and photographs show the location of the receiver inside the Teletext Decoder case. There is already a hole in the front panel of the chassis for the LED and photodiode, so all that is necessary is to carefully cut a matching hole in the front panel label. This can be done by running a sharp blade around the perimeter of the hole.

The receiver can be secured in position using machine screws and nuts or, if you prefer, some contact adhesive. Make sure that the LED and photodiode are correctly aligned with the hole in the front panel otherwise the unit will not work.

All that remains now is to wire the receiver to the Teletext Decoder board. The accompanying wiring diagram shows the necessary details. We recommend that all connections be made to the underside of the PC board.

Finally, if you require an audible response to a received command from the remote control, it is possible to include the piezo transducer salvaged from the original handset. The transducer is wired to the socket on the rear panel via the 22kΩ resistor (see wiring diagram), and can be glued or screwed to the rear panel.

That's it. You can now sit back in your armchair and operate your Teletext Decoder by infrared remote control.

We've got kits galore at

LATEST KITS!

MICROBEE ENHANCER 1

This brand new, totally amazing kit for the Microbee is a must for all Microbee owners/users!

Most expansion units up to this time offered at best only one or other features; and this made it impossible to run, say, complex sound effects mingled with speech. The Enhancer 1 will do all this and much more as well. It is quite amazing how much has been shoe-horned into this compact unit. The Enhancer 1s many powerful features inlcude:

- Two ATARI/COMMODORE/ COLECO/SEARS type joystick inputs.
- Two TRS COLOR COMPUTER type joystick inputs.
- Allows the connection of Touch Pads, Paddles, Proportional Joysticks, Trakballs, Mice, temperature senors, lights level sensors, transducers, etc, etc!!
- A 4 voice music/sound effects sythesizer.
- A real time clock.
- Unlimited vocabulary speech synthesizer (option).
- Parallel printer interface (option)
- A built-in speaker with volume control.
- Listings of all necesary routines for use.
- An impressive demonstration program package.
- Compatible to all Microbees.
- All units carry a 90 day warranty and servicing is also available.
- Digital recording and playback of speech and sound.
- An 8 channel analog to digital converter with variable voltage or variable resistance type analog inputs and also user selectable resolution from 1 to 9 bits.
- A digital to analog converter with selctable resolution from 1-8 bits.
- Allows automatic data acquisition and logging.
- 5 digital input lines, 4 digital ouput lines.
- A voice input channel.
- A 40 pin experimenter socket with all 8 analog inputs, 5 digital inputs, 4 digital ouputs, 3.58 MHz buffered clock, sound output (so that you can play the sound effects through your HI FI), 3 high resolution voltage comparators, DAC output etc.

The amazing Microbee Enhancer is available exclusively from Rod Irving Electronics.

Cat. **$149**

300 BAUD DIRECT CONNECT MODEM

Modem? What do I want with a modem? Think of these advantages:

- Can't afford a floppy disc? Use your telephone to access one for the cost of a call.
- Bored with your old programs? Download hundreds of free programs.
- Want to get in touch with fellow computer enthusiasts? Use electronic mail.
- Ever used a CP/M system? CP/DOS? UNIX? Well a modem will make a your computer a remote terminal on some of the most exciting systems around.

Save on ready built modems.

Cat. **$99**

MULTI SECTOR ALARM STATION

Protect your home from intruders with this up-to-the-minute burgular alarm system. Its easy to build, costs less than equivalent commercial units, and features eight seperate inputs, individual sector control, battery back up and self-test facility.

Specifications:

- Eight sectors with LED status indication.
- Two delayed entry sectors.
- Variable exit, entry and alarm time settings: entry delay variable between 10 and 75 seconds; exit delay variable between 5 and 45 seconds; alarm time variable between 1 and 15 minutes.
- Resistive loop sensing: suits both normally open and normally closed alarm sensors.
- Battery back-up with in-built charger circuit.
- Built-in siren driver.

Complete kit including deluxe prepunched metal work and electronics for only...

Cat. K85900 **$119**

LOW BATTERY VOLTAGE INDICATOR

Knowing your batteries are about to give up on you could save many an embarrassing situation. This simple low cost project will give your early warning of power failure, and makes a handy beginner s project. (ETI 280, March '85)

Cat. K42800 **$7.95**

PARALLEL PRINTER SWITCH

Tired of plug swapping when ever you want to change from one printer to another? This low-cost project should suit you down to the ground. It lets you have two Centronics-type printers connected up permanently, so that you can select one or the other at the flick of a switch. (ETI 666, Feb. '85)

Cat. 46660 **$69.95**

STEREO ENHANCER

The best thing about stereo is that it sounds good! The greatest stereo hi-fi system loses its magnificence if the effect is so narrow you can't hear it. This project lets you cheat on being cheated and creates an "enhanced stereo effect" with a small unit which attaches to your amp. (ETI 1405, ETI MAR '85)

Cat. K54050 **$79.50**

50 W AMPLIFIER MODULE

Cat. K44880 **$27.50**
(Heatsink optional extra)

100 W AMPLIFIER MODULE

Cat. K44801 **$29.95**
(Heatsink optional extra)

CUDLIPP CRICKET

A fascinating Electronic Cricket with just two ICs. The Cudlipp can be used to bug your home, office etc! Great fun! (EA Feb. 82) 82EG2

Cat. K82022 **$12.00**

BIPOLAR PROM PROGRAMMER

Every digital workshop should have one! Can be used to program the popular fusible-link PROMS like the 74S188/288, 82S23 & 82S123 etc. (ETI June '83) ETI 688

Cat. K46880 **$49.50**

EPROM PROGRAMMER

If you have ever wanted to rewrite or extend the operating system of your microcomputer or if your re interested in dedicated microprocessor applications then this EPROM Programmer is just the thing. It is an inexpensive unit that uses readily available IC's, interfaces directly to the expansion bus on the back of all the popular 8080/Z80 microcopmputers and programs 2708's, 2716's, 2758's and 2732's. (EA July '80) 80PP71

Cat. **$79.50**

1W AUDIO AMPLIFIER

A low-cost general-purpose 1 watt audio amplifier, suitable for increasing your computers audio level, etc. (EA Nov. '84)

Cat. K84111 **$9.95**

ELECTRONIC WATT METER

This unit will measure the power consumption of any mains appliance with a rating up to 3 kilowatts. It makes use of a special op amp called an "output transconductance amp" or OTA, for short. (EA Sept. '83) 83WM8

Cat. K83082 **$89.95**

SERIES 5000

PRICES SLASHED!

By directly importing and a more technically orientated organisation, ROD IRVING ELECTRONICS can bring you these products at lower prices than their competitors. Enjoy the many other advantages of RIE Series 5000 kits such as "Super Finish" front panels at no extra cost, top quality components supplied throughout. Over 1,000 Sold.

For those who haven't that time and want a quality hi-fi, we also sell the Series 5000 kits Assembled and Tested.

POWER AMPLIFIER

OUR PRICE **$289!**

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

- ★ 1% Metal Film resistors are used where possible.
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- ★ Super Finish front panel supplied at no extra cost.

Please note that the "Superb Quality" Heatsink for the Power Amplifier was designed and developed by ROD IRVING ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms

POWER OUTPUT: 100 W RMS into 8 ohms (±55 V SUPPLY)
FREQUENCY RESPONSE: 8 Hz to 20 Hz +0 -0.4 dB, 2.8 Hz to 65 KHz +0 -3 dB. NOTE: These figures are determined solely by passive filters.
INPUT SENSITIVITY: 1 V RMS for 100 W output
HUM: 100 dB below full output (flat)
NOISE: 116 dB below full output (flat, 20 KHz bandwidth)
2nd HARMONIC DISTORTION: <0.001% at 1 KHz (0.0007% on Prototypes) at 100 W output using a ±56 V SUPPLY rated at 4A continues. <0.003% at 10 KHz and 100 W.
3rd HARMONIC DISTORTION: <0.0003% for all frequencies less than 10 KHz and all powers below clipping.
TOTAL HARMONIC DISTORTION: Determined by 2nd Harmonic Distortion (see above)
INTERMODULATION DISTORTION: 0.003% at 100 W (50 Hz and 7 KHz mixed 4:1)
STABILITY: Unconditional

Cat. K44771. **Assembled and Tested $499**

PREAMPLIFIER

OUR PRICE **$249!**

THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES 5000 PREAMPLIFIER KIT ARE:

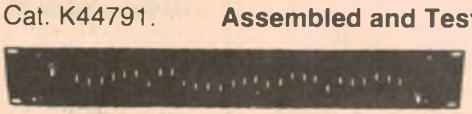
- ★ 1% Metal Film Resistors are supplied.
- ★ 14 Metres of Low Capacitance Shielded Cable are supplied (a bit extra in case of mistakes).
- ★ English "Lorlin" switches are supplied (no substitutes here).
- ★ Specially imported black anodised aluminium knobs.

Available Assembled and Tested. (We believe that dollar for dollar there is not a commercial unit available that sounds as good.)

SPECIFICATIONS:

FREQUENCY RESPONSE: High level input: 15 Hz-130 KHz, +0 -1 dB. Low Level input - conforms to RIAA equalisation, ±0.2 dB.
DISTORTION: 1 KHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N NOISE: High-Level input, master full, with respect to 300 mV input signal at full output (1.2V) >92 dB flat, >100 dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input 50 ohms source resistance connected: >86 dB flat, >92 dB a-weighted. MC input, master full, with respect to full output (1.2V) and 200 uV input signal: >71 dB flat, >75 dB A-weighted.

Cat. K44791. **Assembled and Tested $599**



THIRD OCTAVE GRAPHIC EQUALIZER

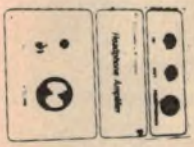
SPECIFICATIONS:

BANDS: 28 Bands from 31.5 Hz to 16 KHz.
NOISE: <0.008 mV, sliders at 0, gain at 0 (-102 dB0).
20 KHz BANDWIDTH DISTORTION: 0.007% at 300 mV signal, sliders at 0, gain at 0; maximum 0.01%, sliders at minimum.
FREQUENCY RESPONSE: 12 Hz-105 KHz, +0, −1 dB, all controls flat.
BOOST AND CUT: 14 dB.

Cat. K44590 1 Unit...**$199**
2 Units...**$379**

POST & PACKING: $10 per SERIES 5000 KIT.

Rod Irving Electronics!



HEADPHONE AMPLIFIER

PRACTICE WITHOUT ANNOYING THE FAMILY!

If you play any type of electronic instrument this headphone amplifier will surely interest you. It will let you practice for hours without upsetting the household,or you can use it to monitor your own instrument in the midst of a rowdy jam session. (EA Feb.'84) 83MA11

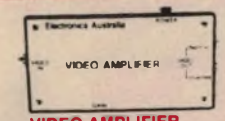
Cat. K83011 **$28.00**

LAB SUPPLY

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

(ETI May 83) ETI 163

Cat. K41630 **$175.00**



VIDEO AMPLIFIER

Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead, it's much better! The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugpack supply.

(EA Aug. 83) 83VA8

Cat. K83081 **$15.00**

COMPUTER DRIVEN RADIO-TELETYPE TRANSCEIVER

Here's what you've been asking for, a full trasmit-receive system for computer driven radio teletype station. The software provides all the latest "whizz-bangs" like split-screen operation automatically repeating test message, printer output and more. The hardware uses tried and proven techniques. While designed to team with the popular Microbee, tips are available on interfacing the unit to other computers.

(ETI Nov. 84) ETI 755

Cat. K47550 **$139.00**

ELECTRONIC MOUSETRAP

This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again!

(ETI Aug. 84) ETI 1524

Cat. K55240 **$29.95**

HUMIDITY METER

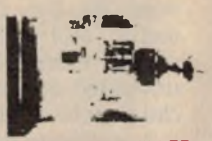
This project can be built to give a readout of relative humidity either on a LED dot-mode display or a conventional meter. In addition it can be used with another project as a controller to turn on and off a water mist spray in a hothouse, for example. (ETI May 81) ETI-256 (Includes humidity sensor $19.50)

Cat. K52460 **$29.50**

MICROBEE SERIAL-TO-PARALLEL INTERFACE

Most microcomputers worth owning have an "RS232" connector or port, through which serial communications (input/output) is conducted. It is a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel Centronics interface printers. Save money by building this interface. (ETI Jan. 84) ETI 675

Cat. K46750 **$59.00**



CAR IGNITION KILLER

Most car burgular alarms are easily circumvented, but not this cunning "Ignition Killer". This sneaky antitheft device uses a 555 timer to place an intermittent short circuit across the points. Until disabled by its hidden switch the circuit effectively makes the car undriveable — a sure deterent to thieves! (EA Feb.'84) 84AU1

Cat. K84010 **$16.95**

(Our kit includes the box!)

TRANSISTOR TESTER

1000's SOLD

Have you ever desoldered a suspect transistor, only to find that it checks OK? Trouble-shooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester, such as the EA Handy Tester. (EA Sept.'83) 83TT8

Cat. K83080 **$15.00**

MOTORCYLCE INTERCOM

OVER 300 SOLD!

Motorcycling is fun but the conversation between rider and passenger is usually just not possible. But build this intercom and you can converse with your passenger at any time while you are on the move. There are no "push-to-talk" buttons, adjustable volume and it's easy to build!

(EA Feb. 84) 84MC2

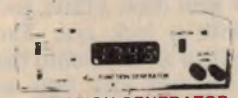
Cat. K804020 **$45.00**

DUAL TRACKING POWER SUPPLY

Built around positive and negative 3-Terminal Regulators, this versatile dual tracking Power Supply can provide voltages up to 2A. In addition the Supply features a fixed +5V 0.9A output and is completely protected against short circuits, overloads and thermal runaway.

(EA March 82) 82PS2

Cat. K82030 **$87.50**



FUNCTION GENERATOR

This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 160Hz with low distortion and good envelope stability. It has an inbuilt four-digit frequency counter for ease and accuracy of frequency setting.

(EA April 82 82AO3A/B)

Cat. K82040

Cat. K82041 **$87.50**

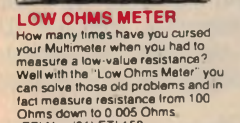
EPROM PROGRAMMER EP1

No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms.

(EA Jan. 82) 82EP1

Cat. K82013 **$47.50**

With Textool Sockets **$59.95**



LOW OHMS METER

How many times have you cursed your Multimeter when you had to measure a low-value resistance? Well with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms.

(ETI Nov. 81) ETI 158

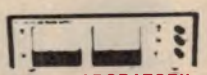
Cat. K41580 **$34.50**

TEMP PROBE

Can measure temperature from -50 to 150 c. It simply plugs into your multimeter - great for digital multimeters. Accuracy of 0.1 c resolution of 0.1 c.

(ETI June 83) ETI 153

Cat. K41530 **$24.50**



50V 5A LABORATORY POWER SUPPLY

New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design.

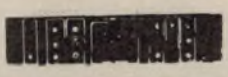
(Ea May,June 83) 83PS5

Cat. K83050 **$149**

PHONE MINDER

Dubbed the Phone Minder, this handy gadget functions as both a bell extender and paging unit, or it can perform either function separately. (EA Feb. 84) 84TP2

Cat. K84021 **$24.00**



150W BASS AMP

This guitar amp for impeccable bass players features many facilities found on expensive commercial ones. It delivers 150 watts into 4 ohms, has a t-band graphic limiter, line out and bi-amp facilities.

(ETI Aug. 84) ETI 1410

Cat. K54100 **$299**

RADIOTELETYPE CONVERTER FOR THE MICROBEE

Have your computer print the latest news from the international shortwave news service. Just hook up this project between your short wave receivers audio output and the MicroBee parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too. (ETI Apr.'83)

Cat. **$20.00**

SOUND SIMULATOR FOR MODEL TRAINS

Fancy a diesel sound simulator for your model train layout? This circuit mounts inside the train for added realism and even vanes its 'speed' according to the throttle setting.

(EA Nov. 84)

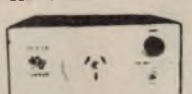
Cat. K84110 **$18.00**

EA AM STEREO DECODER

AM stereo is now broadcast in Australia on an experimental basis. This add-on decoder works with the Motorola C-QUAM system.

(EA Oct. 84) 84MS10

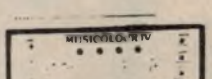
Cat. K84101 **$24.95**



40 W INVERTER

This 12 240 V inverter can be used to power up mains appliances rated up to 40 W or to vary the speed of a turntable. As a bonus, it will also work backwards as a trickle charger to top up the battery when the power is on. (EA May 82) 82IV5

Cat. K82050 **$49.50**



MUSICOLOR IV

Add excitement to parties, card nights and discos with EAs Musicolor IV light show. This is the latest in the famous line of musicolors and it offers features such as four channel "color organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety.

(EA Aug. 81) 81MC8

Cat. K81080 **$89.00**

MOSFET POWER AMPLIFIER

Employing Hitachi Mosfets, this power amplifier features a "no compromise" design, and is rated to deliver 150 W RMS maximum and features extremely low harmonic, transient and intermodulation distortion.

(ETI Jan. 81) ETI 477

Cat. K44770 **$69.50**

ELECTRIC DUMMY LOAD

With this unit you can test power supplies at currents up to 15 Amps and voltage up to 60 Volts. It can "sink" up to 200 Watts on a static test and you can modulate the load to perform dynamic tests.

(ETI Oct.'80) ETI 147

Cat. K41470 **$109**

DIRECTIONAL DOOR MINDER

Most electronic door minders function by having a beam of light shinning across doorway interrupted, but are incapable of detecting whether the light beam is broken by a person entering or leaving the room. this project overcomes that problem with the aid of digital logic.

(ETI Nov. 84) ETI 278

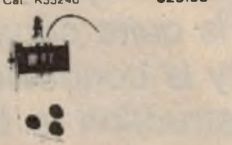
Cat. K42780 **$29.95**

ZENER TESTER

A simple low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes.

(ETI May 83) ETI 164

Cat. K41640 **$9.50**



PH METER KIT

Build this pH meter for the swimming pool season is here again! From swimming pools to fish tanks to gardening, this pH meter has many applications around the home. This unit features a large 3 1/2 digit liquid crystal display and resolution to .01 pH units, making it suitable for use in the laboratory as well.

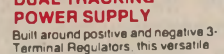
(EA Dec. 82) 82PH12

Cat. K82123 **$139**

PARABOLIC MICROPHONE

Build a low cost parabola, along with a high gain headphone amplifier to help when listening to those natural activities such as babbling brooks, singing birds or perhaps even more sinister noises. The current cost of componenets for this project is around $15 including sales tax, but not the cost of batteries or headphones. (EA Nov. 83) 83MA11

Cat. K83110 **$15.00**

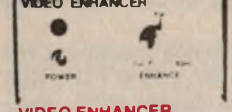


EFFECTS UNIT

An "effects unit" that can create phasing, flanging, echo, reverb and vibrato effects.

(EA June '83) 83GA6

Cat. K83060 **$75.00**



VIDEO ENHANCER

100's SOLD

Like tone controls in a hi-fi amplifier, touch up the signal with this Video Enhancer. (EA Oct '83) 83VE10

Cat. K83100 **$35.00**

30 V/1 A FULLY PROTECTED POWER SUPPLY

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

Cat. K41620 **$52.50**

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Second article has the construction details

Rally computer for cars Pt. 2

Although the way in which the Rally Computer operates is quite complex, most of this complexity is concealed within the three major ICs. Construction is therefore relatively simple.

by JOHN CLARKE and GREG SWAIN

All of the circuitry for the Rally Computer is accommodated on two double sided PCBs. These are coded 85rc4a and 85rc4b and measure 164 x 87mm and 154 x 82mm respectively.

The first board (85rc4a) contains the CPU, PIA, EPROM and associated components, while the second board (85rc4b) accommodates the LED displays, switches and display driver components. The two PCBs are connected together via a 26-way cable terminated with double-sided insulation displacement edge connectors. These plug onto the bus at the edge of each PCB.

A plastic console box measuring 161 x 96 x 39 x 57mm (W x H x TD x BD) is used to house the display PCB, while a standard plastic utility box measuring 195 x 113 x 60mm houses the main CPU PCB. A Scotchcal label is fitted to the console box to provide a professional appearance.

In order to accommodate the edge connectors, it is necessary to file slots adjacent to each side of the copper bus on each PCB. These need to be positioned so that the slider pins on the edge connector sockets line up with their respective tracks on the bus. As a guide, the slots are 4mm wide x 7mm deep and begin 2mm away from the edge of each end track.

The display PCB (85rc4b) also requires filing at the top left and top right hand corners near the FND508 display and the ENTER LED (see parts layout diagram). File the corners down at 45 degrees until the top edge of the PCB can be butted hard against the inside top of the console box without fouling the corner mounting posts.

The display PCB is secured within the box using the integral tapped pillars provided on the base. The 15mm-long tapped rods screw into these pillars and are each fitted with a lock nut. The tapped spacers are then screwed onto the rods and locked with the lock nuts so that the top of each spacer is 17mm from the front of the box.

Note that the 25mm spacers are mounted at the deep end of the box while the 12mm spacers are mounted at the shallow end. Adjust the assembly as necessary so that the PCB sits evenly on the spacers. If tapped rods are unavailable, then long screws can be used by cutting off the heads with a hacksaw.

The Scotchcal label can now be affixed to the front panel of the console box and the holes drilled. Drill 9mm holes at the switch positions and 3mm holes for the LEDs. For the display cutout, drill a series of holes along the inside perimeter and remove the unwanted material. The display cutout can then be carefully filed to shape until it is possible to neatly insert the six LED displays.

A word of advice here. Always file inwards, using single strokes, away from the Scotchcal material. If you file the other way, the Scotchcal material will lift at the edges and possibly tear.

PCB assembly

Before actually beginning assembly, we suggest that you inspect the two PCBs for possible shorts between tracks or breaks in the copper pattern. A few minutes of careful checking here can save a lot of frustration later on. In particular, check that the two outside tracks on each board are not shorted together.

Satisfied that all is well, the CPU board (85rc4a) can be assembled according to the parts layout diagram.

This photograph shows the completed display unit. The socket for the remote pushbutton is on the right-hand side of the case.

Start by inserting all the pin-throughs. These consist of short lengths of tinned copper wire which, when soldered in, form links between tracks on each side of the PCB. These pin-throughs must be inserted first since some are actually located beneath ICs.

Note that some of the pin-through links are actually formed by using the component leads and pins of the ICs. The rule when assembling double-sided PCBs without plated-through holes is to solder on both sides of the board everywhere copper pads are provided.

Note carefully the orientation of the diodes, transistors, ICs and electrolytic capacitors. IC5 (74C14) is a CMOS device and should have its supply pins (pins 7 and 14) soldered first.

IC sockets are used for IC1, IC2 and IC3. These must be mounted proud of the PCB surface so that the pins can be soldered to the copper tracks on both sides. Note that a number of pins on the other ICs must also be soldered to both sides of the PCB. The same comment applies to some of the electrolytic capacitors.

Do not install the ICs in their sockets at this stage. This step will be described later on, during the testing procedure.

A mini U heatsink is provided for the 7805 3-terminal regulator. Apply a smear of heatsink compound to the mating surfaces, then bolt the regulator and heatsink to the PCB using a machine screw and nut. Note that the leads of the regulator must be bent at right angles so that it will mate with the PCB.

Display Board

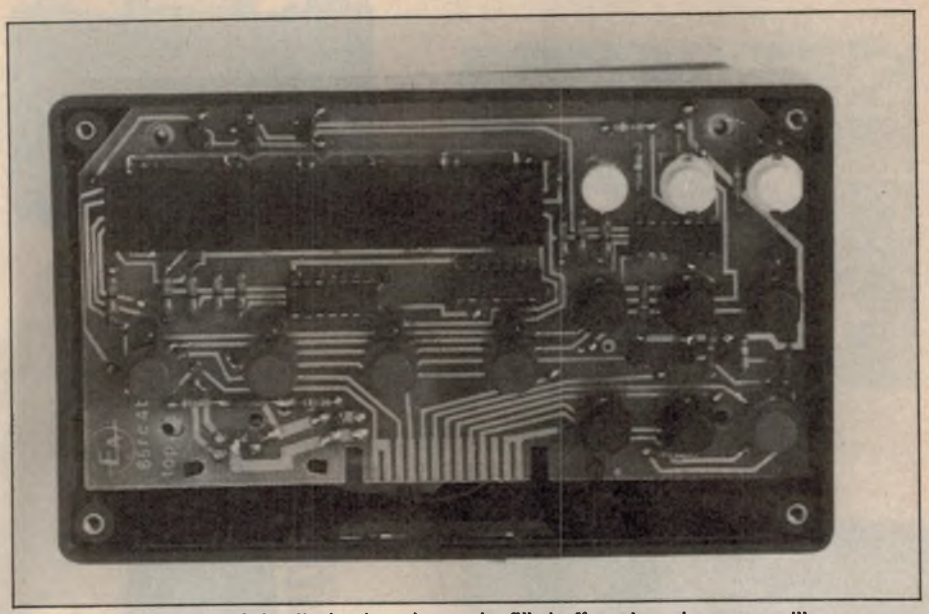
The display PCB differs from the CPU PCB by having components mounted on both sides. For this reason, two separate parts overlay diagrams are provided for this board, one for the top and one for the bottom.

Once again, you must solder the component leads to both sides of the PCB where appropriate. This comment applies to the switches, transistors, ICs, LEDs and displays, as well as to the resistors.

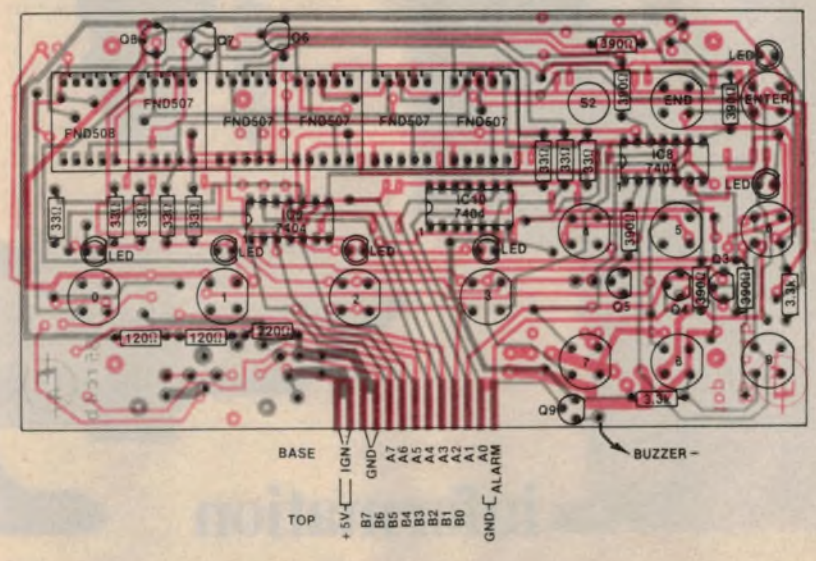
First, install the pin-throughs, followed by the resistors and ICs. Check that the 7404 ICs are correctly oriented before soldering. The transistors should be pushed down close to the PCB so that they will not foul the front panel.

The tops of the switches should be removed before the switches are installed on the PCB. This is to avoid damage to the switch tops during soldering. They are easily removed by carefully prising out one of the side catches with a small screwdriver. If this is done with the switch upside down, the internal spring, circular contact and clicker spring will remain intact within the switch top.

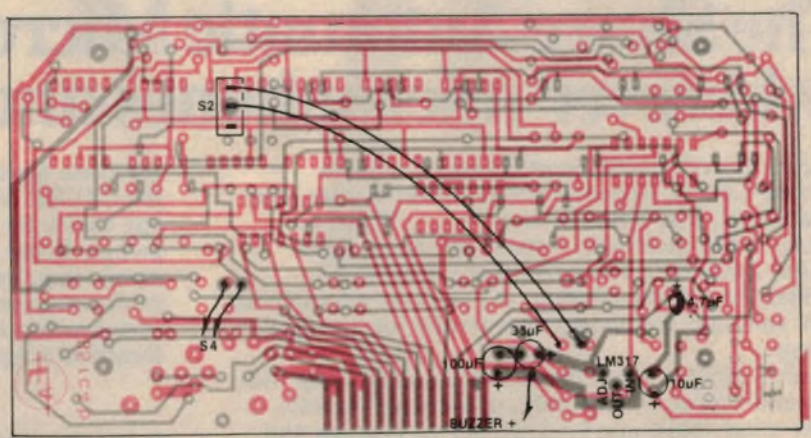
The switch bases can now be installed,



Note that the corners of the display board must be filled off to clear the corner pillars.



This is the component overlay for the top side of the display printed circuit board. Some of the pin-throughs are under the seven segment display.

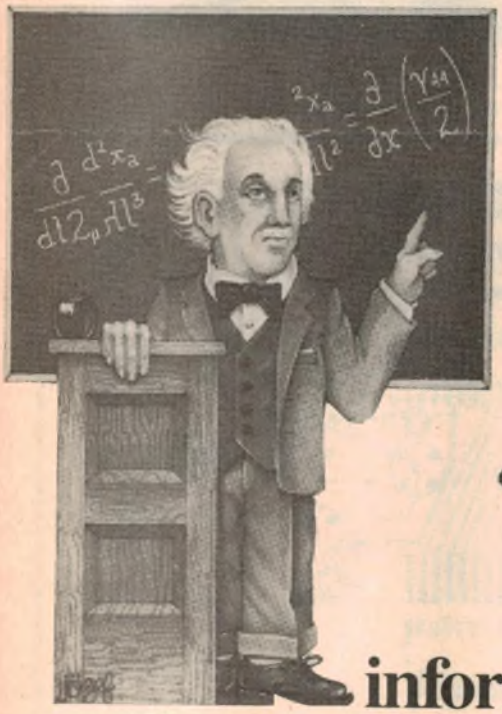


This is the overlay for the bottom of the display board. The LM317 is mounted on a small finned heatsink.

legislation

deliberation

observation



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Rally computer for cars

noting that the flat edge of each switch faces towards the right hand side of the board. Push them down hard onto the PCB and before soldering.

Now for the LED displays. The ribbed edge of each display goes towards the top of the board while the +/−1 display is mounted at the extreme left.

The displays must be mounted proud of the PCB to permit soldering to either side. Perhaps the simplest method of locating the displays off the PCB is to use a strip of cardboard 1.5mm thick, 10mm wide and at least 90mm long. Temporarily insert this beneath the displays, then push the displays in as far as they can go and solder the pins.

The tops of the switches can now be clipped onto the switch bodies. We used red for the Time, Road and Cal switches; black for Set, Hold, Clr/1, — and +; and white for End and Enter. As each cap is replaced, check for correct operation of the switch. If they stick, the problem is probably that the plastic of the switch base has been melted during soldering. A sharp knife will clean up any melted protrusions on the switch body.

The Dim switch (S2) is installed with a nut screwed right down onto the switch spindle to act as a spacer. If this is done, the top of the switch cap should be at the same height as the remainder of the switches. A second nut then secures the switch to the board.

The LM317 regulator and the capacitors are mounted on the underside of the PCB as shown in the wiring diagram. Make sure that the capacitors are correctly oriented and again mount them proud of the board so that the leads can be soldered on both sides. The regulator is bolted to a Thermalloy 6038 heatsink which is secured to the PCB via three mounting lugs.

Don't forget to install the leads to the Dim switch.

Cable termination

The edge connectors can now be fitted to the 26-way cable. First, neatly trim each end of the cable with a sharp knife or side cutters, then insert one end into the insulation displacement section of one of the sockets so that the end of the cable is flush with the edge of the socket. Now, using a vice and two pieces of wood, clamp the two halves of the socket together so that the side clips are latched on their locking tabs.

The second socket is terminated in like fashion but with the pin side facing the opposite way to the other socket when the cable is lying flat. In other words, one socket faces up and the other faces downwards. In this way, the cable will exit from the rear of the display PCB and from the top of the CPU PCB.

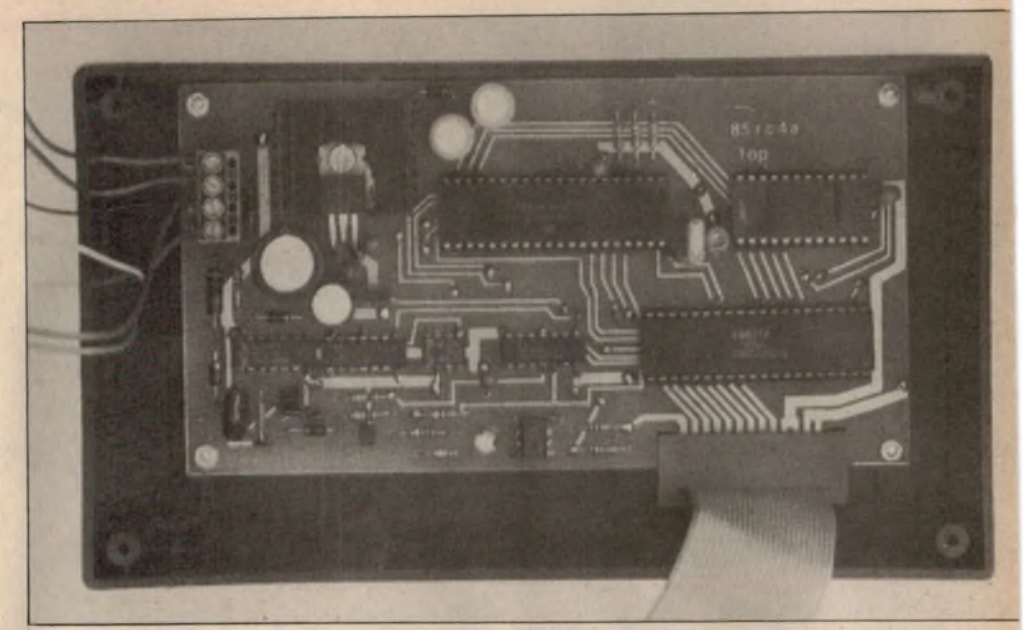
Final assembly

A cutout is required in the base of the console box to allow the socket connector to be plugged into the display PCB. Temporarily locate the display PCB on the spacers, then position and mark the cutout area by tracing around the socket and the cable. This done, drill and file the cutout to size.

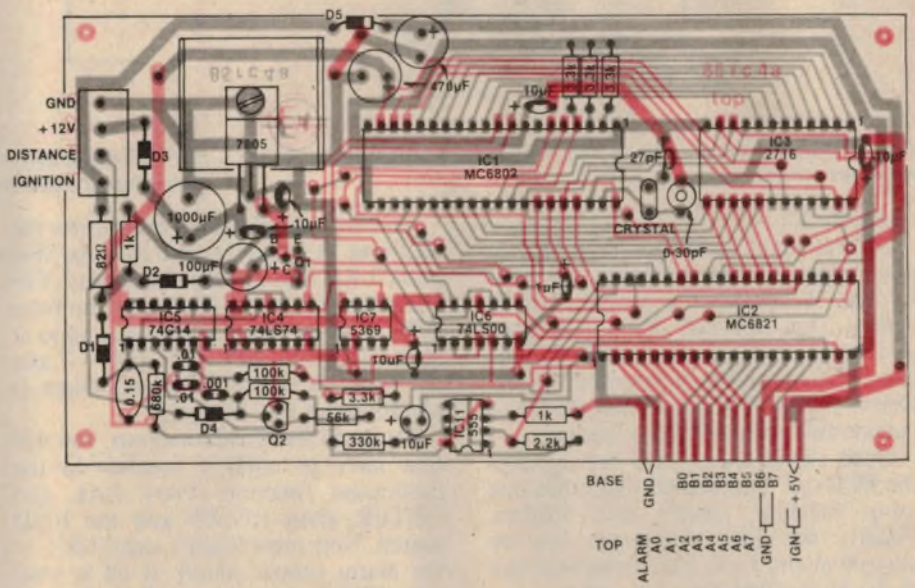
Holes for the optional socket and for the buzzer can also be drilled at this stage and the wiring completed. The remote CLR/1 switch can be any momentary contact pushbutton type. We housed the switch in a small plastic film container.

Once all the wiring has been completed, the display PCB can be screwed to the spacers and the front panel fitted. The latter simply clips over the six LEDs (using the mounting bezels supplied) and is screwed to the four mounting pillars inside the case.

Attention can now be turned to housing the CPU PCB. Begin by marking out the mounting holes for the PCB on the bottom of the box such that the top edge of the PCB touches the side of the box. This provides maximum

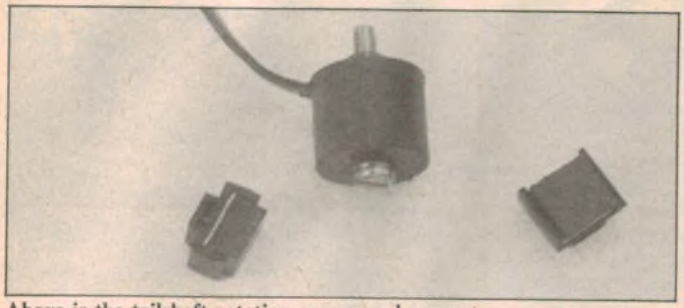


This photograph shows the CPU board in its case. The ribbon cable on the lower right connects to the display board.

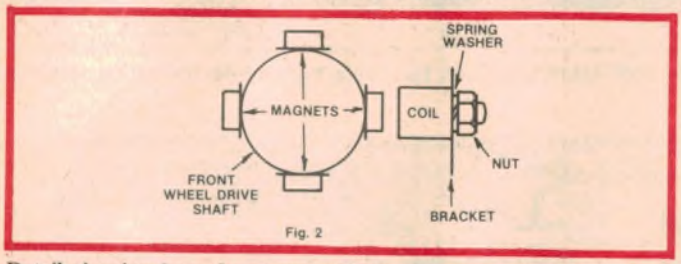


Here is the component overlay for the CPU board. Do not forget to solder the components to the top of the board where pads are provided.

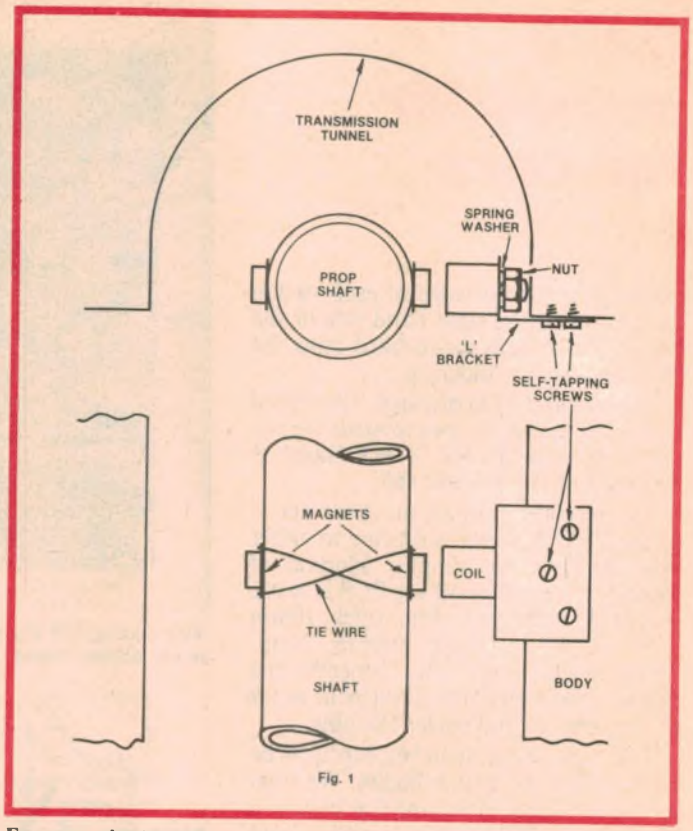
Rally computer for cars



Above is the tailshaft rotation sensor and magnets.



Detail showing how the sensor and magnets are arranged for front wheel drive cars.



For rear wheel drive cars only two magnets are required. A suggested mounting arrangement is shown above.

clearance for the edge connector socket.

Several holes must also be drilled at one end of the case to accept the leads for the PCB-mounting screw terminal block. The optional ignition bypass switch can be mounted on the lid of the case, directly above the terminal block. Delete the switch if you don't wish to include the ignition bypass feature.

Once all the holes have been drilled, the PCB can be mounted inside the box using machine screws and spacers. Finally, the edge connector can be plugged in and a slot filed along one edge of the lid to allow for cable entry.

Testing

The Rally Computer is now ready for the smoke test. This requires a power supply capable of delivering between 12 and 14V DC at 500mA. Either a mains supply or a car battery will do.

Connect the power supply between the +12V and GND terminals on the CPU PCB and switch the supply rail to the ignition input. Now, using your multimeter, check that there is +5V on the supply pins of IC1, IC2 and IC3. Assuming this checks out, disconnect the power supply and install the ICs in their sockets. Double check that they are correctly oriented, then re-apply power.

The display should now show +/− 0.00 when the Time function is selected. Now press SET and "—". The display should begin counting down at one second intervals.

To check the alarm function, press the SET and "+" switches and then the SET and CLR/1 keys to clear the display. The Time display should now count up from 0.00. Wait for the time to count up to at least 0.01, then press SET and "—" and wait for the alarm to sound when it counts down to 0.00 again.

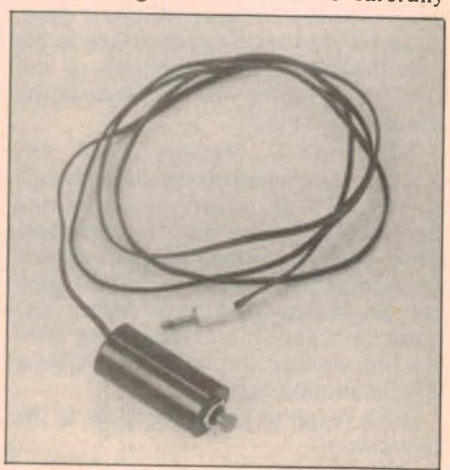
To check the Road functions, you will first have to enter a number in the calibration function. Press CAL and ENTER, then 199,999 and the END switch. Now press Road 1 and CLR/1 — the alarm should sound. If all is well, press SET and "—" or "+" so that the Road 1 counter is ready to count down or up.

Finally, temporarily connect a wire from the distance sensor input of the CPU board to pin 1 of IC7. This will provide a 15Hz input to the distance input and the Road 1 counter should now begin to count. The same applies to the other Road counters. Set them to count either up (+) or down (-) by using the SET switch and check that they also count.

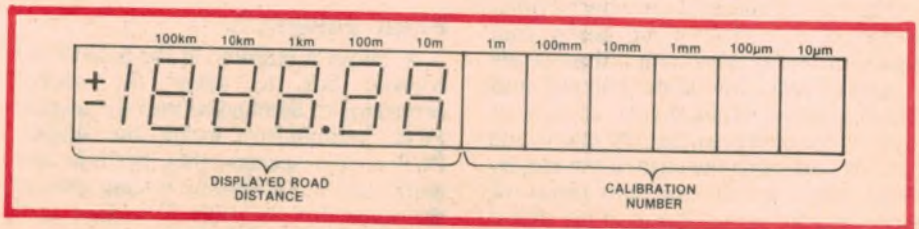
Troubleshooting

If the Rally Computer fails to operate, do not replace the ICs. Provided that they have been correctly installed and the power supply is correct, the ICs are not likely to be at fault.

Instead, go over the PCBs carefully



We mounted the remote CLR/1 switch in a discarded plastic film container.



This diagram shows how the calibration number is represented in relation to the display.

and check that all the pin-throughs have been inserted and soldered correctly. Check also that the components have been soldered on both sides where necessary and that they are correctly oriented. Sometimes a very fine solder bridge between two adjacent tracks can be the cause of the problem. This can be cleared by running a sharp knife or a razor blade between adjacent tracks.

Installation

Figs. 1 and 2 show how the magnetic distance sensor is installed in rear-wheel drive and front-wheel drive vehicles respectively. In the case of rear-wheel drive cars, the sensor should be mounted as close to the gearbox as possible, where vertical suspension movements of the tailshaft are minimal. The magnets are secured to the tailshaft using tie wire and epoxy resin adhesive.

The coil was mounted on an L-shaped bracket made from aluminium and secured to the underside of the car using self-tapping screws. This bracket should be positioned so that there is a 10mm gap between the end of the coil and the magnet when they are directly opposite each other. Be careful not to damage any wiring cables running along the floor when drilling the mounting holes for the bracket.

It is a good idea to try to position the coil above a crossmember to protect it from flying debris. The Rally Computer will be quite useless if the pickup coil is damaged at the first creek crossing!

Wiring to the coil can be run along the underside of the car, with the leads secured at various points. Do not connect the earth lead to chassis at the coil mounting position. Instead we suggest that both the earth and signal leads be run as a twisted pair all the way back to the computer via a hole in the firewall. Plastic tubing can be used to protect the leads from damage.

Front-wheel drive vehicles are a different proposition. In some cars, it may be possible to mount the magnets on a drive-shaft coupling flange where it bolts onto the transaxle (provided it is not covered by a rubber boot). The coil could then be mounted on a suitable bracket secured to the nearest convenient mounting point.

Note that, for front wheel drive cars, four magnets are required. These must be mounted 90 degrees apart as shown in Fig. 2. The reason for this is that, for a given speed, the driveshafts on a front-wheel drive car rotate three to four times slower than the tailshaft of rear wheel drive vehicles. By using the two extra magnets, we can derive a similar number of pulses from the pickup coil for a given distance.

Once the sensor has been installed, wiring for the Rally Computer can be

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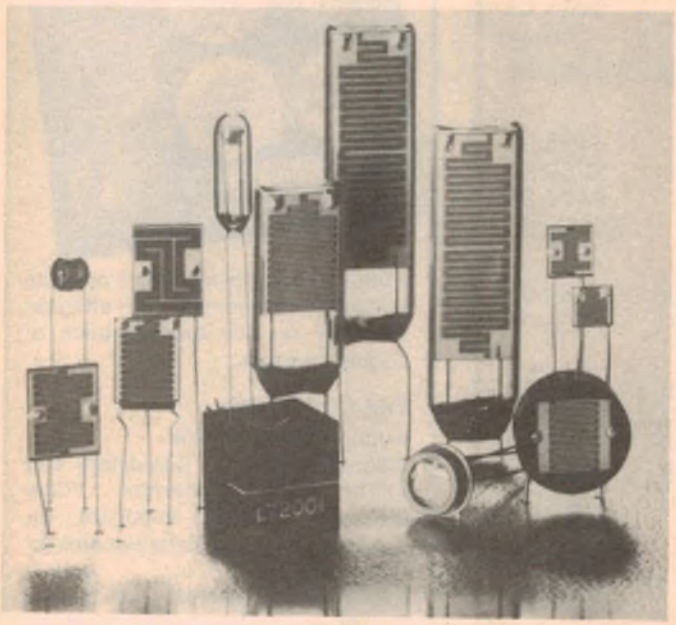

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Rally computer for cars

completed. The +12V from the ignition switch and the permanent +12V can be obtained from the fusebox. Check the voltages with a multimeter before actually connecting the leads and make connections to the fused side. The ground connection can be made at any suitable chassis point.

The main CPU box can be mounted at any convenient location (eg, under the dashboard) and secured using a suitable bracket. Depending on its location, some readers may prefer to mount the ignition bypass switch (S1) on the dashboard. Another option is to wire the switch so that the ignition switch input is deleted. In this way, the computer can be switched on and off by S1 rather than by the ignition switch.

The display box can be mounted on the dashboard using either a solid L-bracket or a swivel mounting (eg, a gooseneck or ball and socket). Some microphone accessories may be suitable.

Calibration

Fig. 3 shows how the calibration number is represented in the Rally Computer. The calibration number is the distance travelled between each pulse from the distance sensor. Each distance counter (Road 1, 2 and 3) is actually 12 digits long, extending from 1000km readings on the most significant digit to 10μm at the least significant digit.

Only the first six most significant digits are displayed on each distance counter, however. The remainder are hidden within the "workings" of the Rally Computer memory.

As each distance pulse is received, the calibration number is added to the least significant digits of the distance counter. When the one-metre digit overflows from nine to 10, the 10-metre display digit alters by one. Note that this digit increases by one when the counter is set to count up and decreases by one when the counter is set to count down. The undisplayed least significant six digits always count up.

When the CALibration switch on the Rally Computer is pressed, the 6-digit calibration number is displayed. Any number can be entered by use of the Enter switch, from zero to 199,999. Note that the most significant digit can only be either one or zero.

The calibration number for your particular vehicle can be roughly calculated by using some simple mathematics. Measure the wheel diameter in metres (measure horizontally) and multiply by pi (3.14). Divide this by the number of magnets on the driveshaft and, in the case of a rear-wheel drive car, also by the differential ratio. The result will be some fraction of a metre.

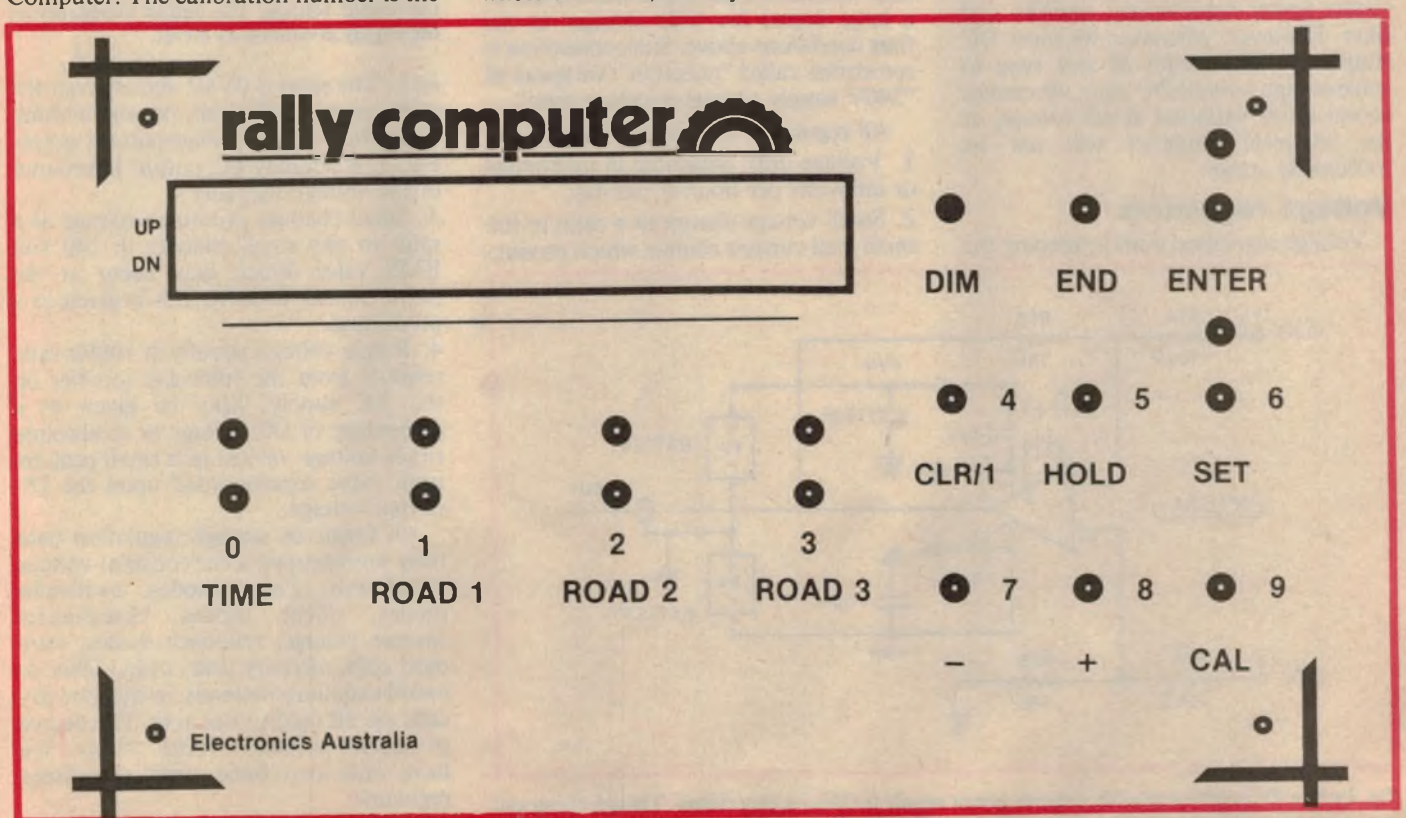
In the case of our test vehicle, which used a tailshaft mounted sensor, a figure of 22700 was used for the calibration number.

The exact calibration number can be calculated by using the kilometre marking posts alongside major roadways. Enter the calculated calibration number and select Road 1. Press SET and HOLD to stop counting and press CLR/1 to clear Road 1. Now press SET again and be ready to press "+" as you pass the first marker post.

Road 1 will now begin to count up the distance. Press SET again and be ready to press HOLD as you pass the last marker post. To correct the calibration number, divide the actual distance by the computer reading on Road 1 and multiply this by the calibration number — re-enter this new calibration number.

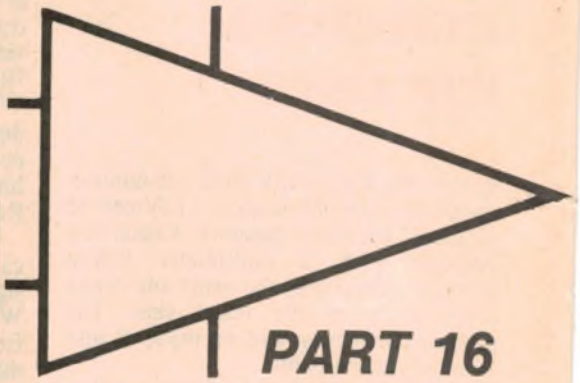
Finally, if the ventilation fan (or radiator cooling fan) is switched off via the ignition switch, the Rally Computer may not go through its correct power-down sequence and the data in standby memory may be corrupted. This is due to the voltage generated by the fan motor during the time it takes to slow to a stop.

If this presents a problem, a simple cure is to add a series diode in the supply line to the fan motor. This will allow the battery voltage to drive the motor when the ignition is on but will isolate the motor when the ignition is off. Any 10A 400VW diode should do the job.



Here is the full sized front panel artwork for the display unit.

OP AMPS Explained



PART 16

Zener diodes provide a simple, inexpensive method for regulation of the rail voltages for operational amplifiers. If necessary, they can be augmented with an emitter follower transistor, to increase the current rating.

Single stage amplifiers or combinations of low gain capacitance-coupled stages may work well without any rail voltage regulation at all, especially if we use integrated circuits having high rejection of rail voltage disturbances. The LM308A type IC with its 100dB rail rejection ratio operates quite happily in single stages from a simple power transformer, rectifier and filter. However, whenever we must DC couple multiple stages of any type to achieve high overall DC gain, we cannot accept much variation in rail voltage, or the complete amplifier will not be sufficiently stable.

Voltage regulators

Voltage regulation aims at keeping the supply rail voltage at some constant value regardless of:

(a) Temperature variations,
(b) Current load changes,
(c) Variations in the 240 VAC supply,
(d) The AC nature of the 240 VAC supply.

Though a perfect voltage regulator does not exist, a good one will correct to a large degree for wide changes in the four conditions above. Such correction is sometimes called "rejection"; we speak of "240V supply change rejection ratio".

All regulators have some value of:

1. Voltage drift, measured in microvolts or millivolts per hour or per day.
2. Small voltage change as a ratio to the small load current change which produced it. The ratio is dV/dI and is given the units ohms, milliohms or micro-ohms. This *slope* of the voltage-current graph, Fig. 1, is actually the output impedance of the voltage regulator.
3. Small changes in output voltage as a ratio to any small changes in 240 volt RMS value which may occur at the power mains. Usually, this is given as a percentage.
4. Ripple voltage, usually at 100Hz rate, residual from the full-wave rectifier on the AC supply. May be given as a percentage of DC voltage or as absolute ripple voltage, or just as a small peak-to-peak value superimposed upon the DC output voltage.

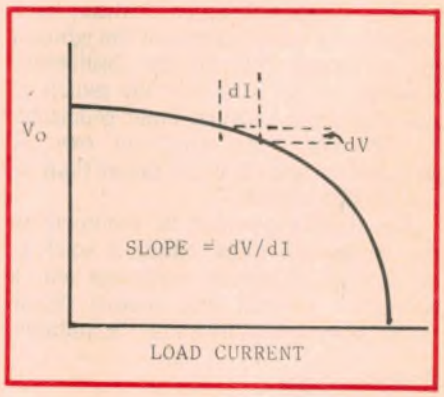


Fig. 1: DC output voltage Vo from a zener regulated power supply. A small change dI in load current produces a small change dV in the output voltage. The output impedance of the supply is defined as dV/dI.

All forms of voltage regulation base their success upon some constant-voltage component. Zener diodes, avalanche diodes, silicon diodes, base-emitter reverse voltage, reference diodes, standard cells, mercury cells, nickel-silver or nickel-cadmium batteries, or alkaline dry cells are all used in this role. The degree of success achieved varies widely. We have only two basic types of voltage regulator:

(a) Simple regulators without any feedback.

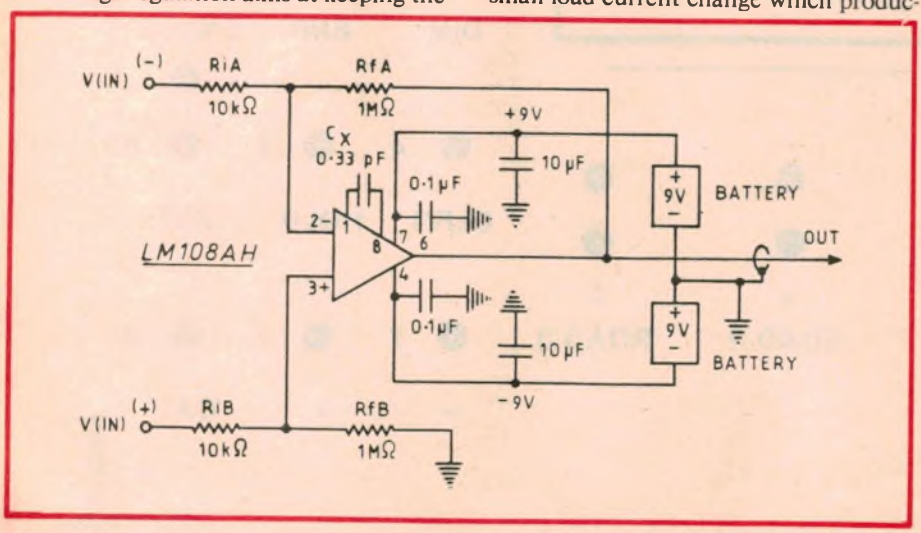


Fig. 2a: two 9V batteries provide a simple power supply for this op amp circuit. Though cheap and not regulated (in the usual sense), it is ripple free. The circuit works because of the LM108's very small supply current and large rail rejection ratio.

(b) Negative feedback voltage regulators but within each type there are many variations.

Simple voltage regulators

In Fig. 2(a), a very simple arrangement, one-stage amplifier uses an LM308AH integrated circuit operated directly from two 9 volt dry batteries. Success comes from the 308A's very small rail current (about 480 microamps) and the 308A's high rail rejection ratio (100dB). But don't push your luck, as the DC stability of the output is not good enough to be DC-coupled to later stages. Fig. 2(b) shows an improvement. Q1 and Q2 together form a little power amplifier with output at D constant. This voltage value is determined by the battery B2 and R2/(R1+R2). Q3 is your signal amplifier.

Fig. 3 shows the circuit commonly known as a zener voltage regulator, depending for success upon the "constant" voltage characteristics of diode D, operated in "reverse current mode". Such action is illustrated in Fig. 4, a voltage-current curve applicable to *every* silicon diode, with V_Z occurring anywhere within a great range of voltages, depending on the type of formation and degree of doping used in the manufacture of the diode. To a lesser degree, the voltage V_Z is also a function of the current flowing through it and the diode junction temperature.

Using the Alloy Junction manufacture method a diode can be made such that V_Z occurs at a point in the range -2.4 volts to -12 volts, with heavier doping producing the lower values. The Diffused Junction method can be used to produce a diode having V_Z somewhere in the range -6 volts to -1000 volts or more. At voltages substantially less than V_Z, diodes are used as ordinary rectifiers. Manufacturers market a complete range of diodes for voltage regulator applications, the V_Z range covering from -2.4 volts to -200 volts.

All diodes intended for voltage regulation use are found in the market place under the name "Zener Diodes", although this name is strictly incorrect, as two different mechanisms of diode breakdown are known to occur.

Zener breakdown

Firstly, in heavily doped diodes where the depletion layer is thin enough that the electric field intensity across it exceeds 100 millivolts per nanometer (10^8V/m), an effect first described in 1934 by Zener (Ref. 1) in terms of quantum mechanics theory occurs. In this description, the intensity of the electric field literally pulls electrons from valency

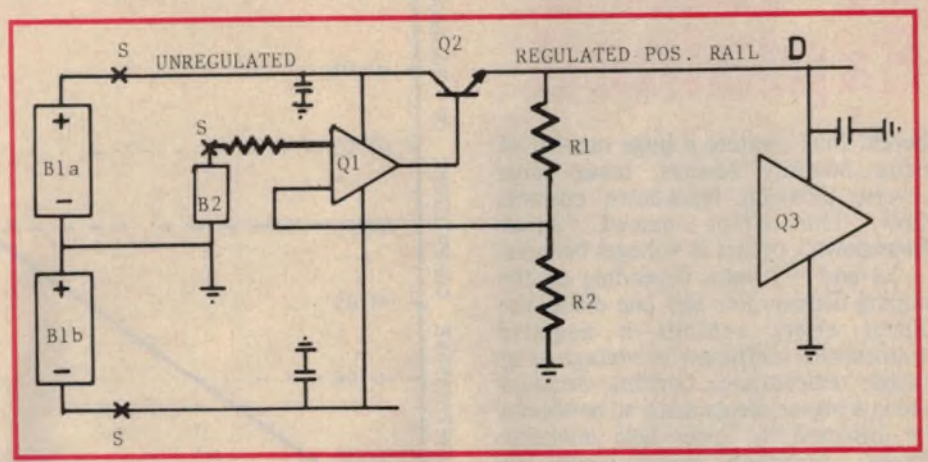


Fig. 2b: an improved battery power supply. Batteries B1a and B1b provide power to the voltage regulator (Q1, Q2), while resistors R1 and R2 set the value of the regulated positive rail voltage. Q3 is an amplifier requiring only a small supply current. Battery B2, a single mercury cell, holds the regulated positive rail at a constant voltage, even if VB1 decreases somewhat.

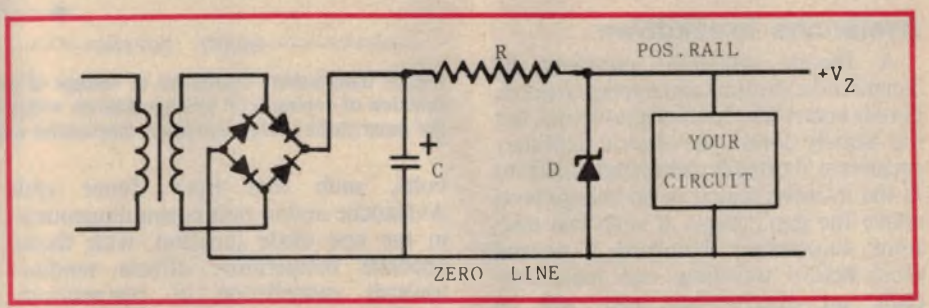


Fig. 3: this simple voltage regulator depends on the constant voltage characteristic of diode D operating in the reverse breakdown mode at voltage V_z.

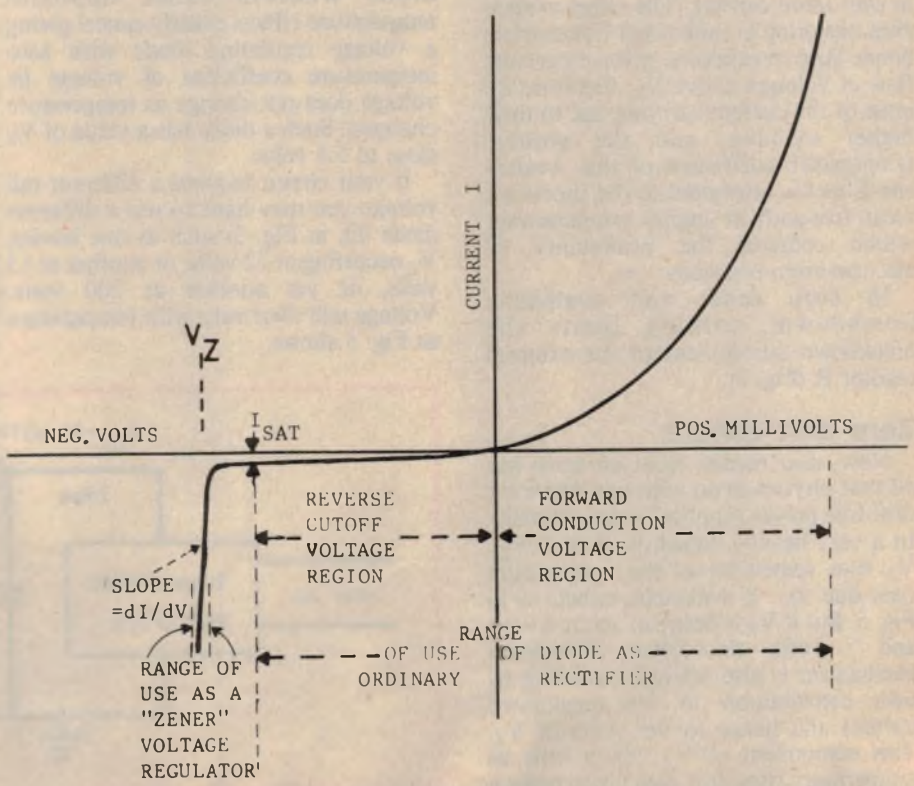


Fig. 4: voltage-current characteristic for any silicon diode. Note different voltage scales positive and negative.

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bonds, thus creating a huge number of extra minority carriers, hence large reverse direction breakdown currents flow. This effect, named "Zener Breakdown", occurs at voltages between −2.4 and −7 volts, depending on the doping density. For any one diode, the Zener effect exhibits a negative temperature coefficient of voltage as at higher temperatures bonding electrons are in a higher energy state, so bonds can be disrupted by lower field intensity. (Note: Although minus signs on breakdown voltages are strictly correct, many texts don't write the minus sign, readers understanding the negative direction. Henceforth we shall too).

Avalanche breakdown

A theory originally proposed by Townsend a century ago applies to gases, liquids and solids. In semiconductors, not too heavily doped, the electric field may accelerate thermally generated electrons in the intrinsic region to an energy level above the gap energy. If such fast electrons successfully bombard a neutral atom before travelling one mean-free-path, an electron-hole pair will be created. These new carriers may also be accelerated and further collisions result in ever more carriers. The effect avalanches, resulting in millions of free carriers hence large breakdown reverse currents flow at voltages above V_Z. Electrons do most of the current carrying due to their higher mobility, and the positive temperature coefficient of this Avalanche Effect is attributed to the shortened mean-free-path at higher temperatures, which reduces the probability of electron-atom collisions.

In both zener and avalanche breakdown, nothing limits the breakdown current except the external resistor R (Fig. 3).

Zero drift zeners

Now, dear reader, what on earth has all that physics to do with our desire for drift-free power supplies? A lot, actually. In a very heavily doped diode (low V_Z), V_Z rises somewhat as the temperature rises due to the avalanche effect, as in Fig. 5. But if V_Z is between about 4 volts and 7 volts, the Zener breakdown mechanism is also acting, producing its own contribution to the breakdown current and hence to the value of V_Z. This component of V_Z falls a little as temperature rises. It is possible to make a diode, with doping level and hence value of V_Z somewhere in between 4 and 7 volts, such that both Zener and Avalanche action occurs simultaneously in the one diode junction, with those opposite temperature effects tending towards cancellation of temperature coefficient.

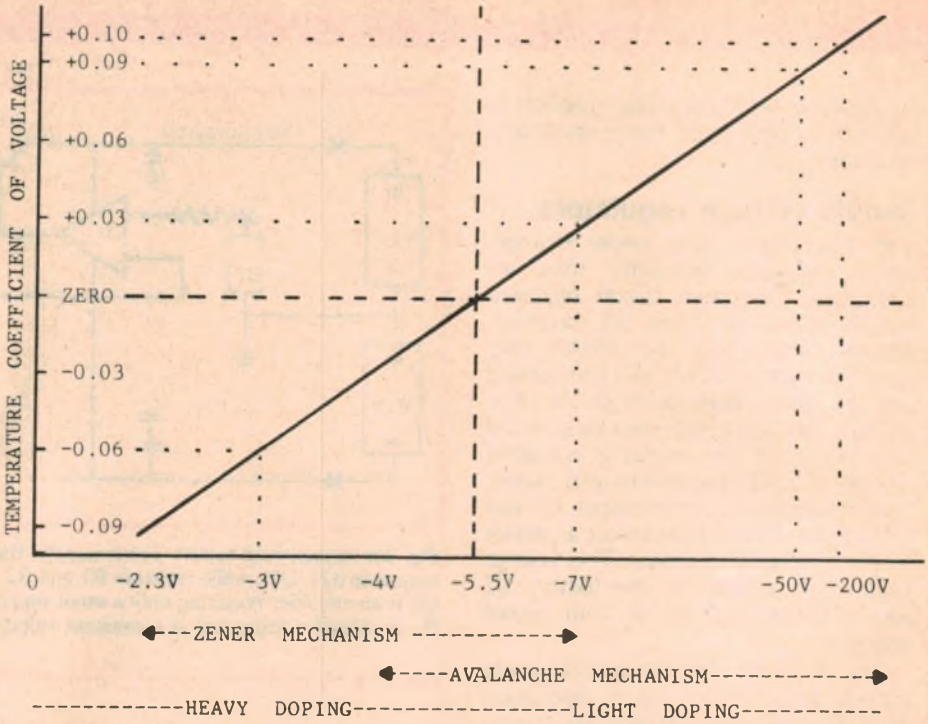

Fig. 5: temperature coefficient of voltage of zener and avalanche voltage regulating diodes as a function of doping level and breakdown voltage V_z. Diodes doped so that V_z occurs at 5.5V are the most stable. Note non-linear horizontal axis.

Optimum choice of doping results in a diode wherein those opposite temperature effects exactly cancel giving a voltage regulating diode with zero temperature coefficient of voltage (ie voltage does not change as temperature changes). Such a diode has a value of V_Z close to 5.5 volts.

If your circuit requires a different rail voltage you may have to use a different diode (D, in Fig. 3) such as one having V_Z occurring at 12 volts, or another at 15 volts, or yet another at 200 volts. Voltage will then vary with temperature as Fig. 5 shows.

If you desire the most stable voltage in any zener regulated system, you could arrange your circuit such that the voltage to be held constant is either 5.5 volts, 11 volts, 16.5 volts or some other multiple of 5.5. Then you will purchase several 5.5 volt diodes and put the required number in series as in Fig. 6.

Zener impedance

Notice in Fig. 6 that the circuit current i_L plus the current i_Z flowing down through the diodes together make up the total current i_T. The resistor R should be as large in value as possible. This tends to make i_T almost a constant current.

Constant $i_T = (i_Z + i_L)$ (approx)

However, if your circuit takes a varying current i_L from the rail (as many do) then as $(i_Z + i_L)$ add up to approximately a constant, if the current i_L rises it

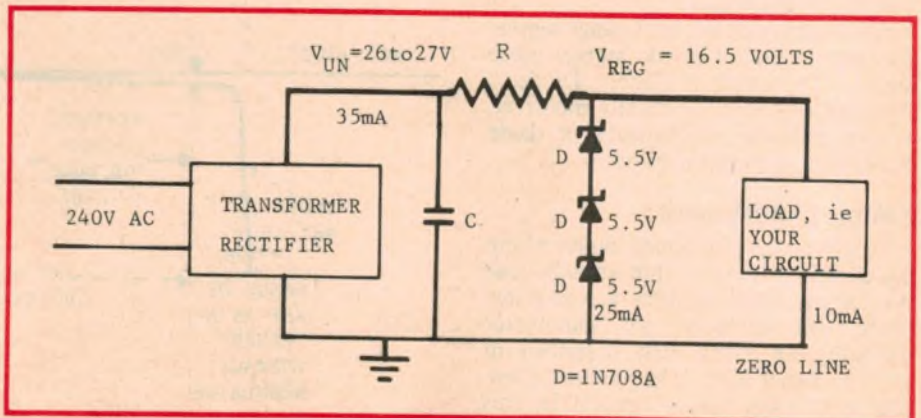

Fig. 6: using a series string of 5.5V zener diodes rather than one 16.5V diode gives a more stable regulated voltage.

ICL7106 19.50
ICL7116 19.50
ICL7117 21.50
ICL7611 6.95
ICL7612 6.95
ICL7660 5.90
ICL7663 4.90
ICL7664 4.90
ICM7211 12.50
ICM7216A 48.50
ICM7216B 44.50
ICM7217A 18.50
ICM7218A 18.50
ICM7224A 21.50
ICM7226A 48.50
ICM7227A 19.95
ICM7213A 15.50
ICM7240 7.50
ICM7242 3.90
ICM7250 7.90
ICM7260 7.90
ICM7555 2.75
ICM7556 2.95

74S

74S00 .60
74S02 1.00
74S03 1.00
74S04 1.00
74S05 1.50
74S08 1.00
74S09 1.50
74S10 1.00
74S11 1.00
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74S38 1.70
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74S65 1.20
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74S160 5.90
74S161 5.90
74S162 7.90
74S163 7.90
74S168 11.50
74S169 11.50
74S174 4.50
74S175 4.50
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74S182 3.40
74S199AN 4.10
74S189 8.50
74S194 3.30
74S195 2.90
74S196/82590 4.90
74S197/82591 4.90
74S201 9.90
74S214AN P.O.A.
74S225 10.90
74S226 7.90
74S240 6.90
74S241 6.90
74S244 9.90
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74S301 13.90
74S314 POA
74S330 POA
74S331 POA
74S373 9.90
74S374 9.90
7[illegible] .30
[illegible]8212 5.90
74S428 8212 7.90
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74S473 9.90
74S474 9.90
74S475 9.90
74S482 11.90
74S489 7.90

74H

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74H87 7.90
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74H102 1.80
74H103 2.50

Errors and Omissions Excepted

74H106 2.50
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74H114 1.10
74H183 7.90

74C

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74C989 8.90

74LS

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74LS669 1.75
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74LS674 12.55
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74LS692 3.95
74LS693 3.95
74LS696 3.85
74LS699 3.95

CDP

CDP1802 10.50
CDP1864 17.50

CPU

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6502A 14.00
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6520 5.50
6507 13.00
6520 5.50
6521 5.90
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2650 21.00
2651 23.00
6800 6.00
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6860 19.50
6875 15.00
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Z80ACTC 6.50
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Z80ADMA 19.00
Z80AS10 15.00
Z80S10 13.00
AD570 88.50
AD590 9.50
AD7524 17.50
AY-3-8910 14.50
AY-3-2513 14.50
MSM5832 16.50

MM58174 19.50
MM5303 7.50
MM5309 14.50
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LH0042CH 9.50
LH0070 9.50
LH0071 9.50
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TL064 4.90
TL071 1.20
TL072 2.90
TL073 3.20
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TL084 3.45
TL494 4.90
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TCA280 4.50
TDA1024 2.80
TA7205P 3.90
TEA1002 17.50
UAA170 5.95
UAA180 3.75
LM10CH 7.50
LM301 .50
LM301H 1.50
LM302H 6.50
LM305H 1.50
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LM311 1.00
LM311H 1.80
LM317T 2.50
LM317K 4.50
LM318 4.90
LM324 1.00
LM325 4.50
LM326 4.50
LM329DZ .90
LM344Z 1.90
LM335Z 2.20
LM336 2.5V 2.95
LM338K 12.50
LM339 1.20
LM348 1.80
LM349 1.60
LM350K 10.50
LM351N 1.00
LM353 2.50
LM356N 2.40
LM357 2.40
LM358 1.40
LM381 3.50
LM377 4.90
LM378 3.95
LM380 8 PIN 1.80
LM380 14 PIN 1.90
LM381 3.50
LM382 3.50
LM383 3.90
LM384 3.50
LM386 1.95
LM387A 3.95
LM387 2.00
LM390 2.95
LM391 2.90
LM393 1.00
LM395T 9.85
LM396K 22.50
LF398 5.90
NE544 6.50
NE555 .40
NE556 1.20
NE558 5.00
NE560 4.60
NE567 2.00
NE570 5.90
NE571 5.90
NE592 6.90
NE594 9.50
LM709-14 1.50
UA710CN 1.00
LM711 1.20
LM723 .75
LM723CH 1.50
LM725 4.75
LM733 1.50
LM739 2.75
741 .40
UA747 1.30
UA748 1.00
MC1310 9.50
MC1312 7.95
MC1314 7.95
MC1315 6.95
MC1327 7.95
MC1350 1.95
MC1408L8 7.50
MC1437 4.95
MC1445 5.95
MC1456 1.95
MC1458 1.20
MC1466L 14.50
MC1469R 6.90
MC1488 1.20
MC1489 1.20
MC1494 8.40
MC1495 8.90
MC1496 2.50
LM1596 3.00
MC1648 8.90
LM1812 10.50
LM1830 3.90
LM2907 3.90
LM2917 8 PIN 4.90
LM2917 14 PIN 4.90
MN3001 17.50
CA3028 2.00
CA3046 1.90
CA3056 6.50
CA3059 5.95
CA3080 1.90
CA3086 1.90
CA3100E 7.95
CA3130E 2.20
CA3130T 2.95
CA3140E 2.20
CA3140T 2.95
CA3240E 11.95
CA3401 1.00
CA3900 1.20
CA3905 1.75
CA3909 2.95
LM3911 2.95
LM3914 5.90
LM3915 5.90
LM3916 5.90
LM3999Z 2.60
RL4136 1.95
RC4145 20.90
RC4194 3.90
MM5369 1.95

SCR & TRIACS

SC141D 1.90
SC141E 1.95
SC142E 2.95
SC146D 2.85
SC150D 4.95
SC151D 2.95

SC152D 6.90
C103YY .90
C103B .90
C106B .90
C122D 2.50
C122E 2.95
C260D 8.50
C260E 9.90
2N2646 1.20
2N2647 2.50
2N6027 .90

TRANS.

AC125 1.20
AC126 1.20
AC127 1.20
AC128 1.20
AC187 1.50
AC188 1.50
AC149 3.40
AD161 2.90
AD162 2.90
AF118 2.90
AF126 2.90
AF127 1.50
BC107 .50
BC108 .50
BC159 .50
BC177 .60
BC178 .60
BC179 .60
BC182L .40
BC212 .30
BC318 .30
BC320 .40
BC327 .30
BC328 .30
BC337 .40
BC338 .40
BC546 .40
BC547 .20
BC548 .20
BC549 .20
BC550 .40
BC556 .40
BC557 .20
BC558 .20
BC559 .20
BC639 .50
BC640 .50
BCY70 1.90
BCY71 1.90
BD135 1.00
BD136 .90
BD137 .90
BD138 .90
BD139 .60
BD140 .60
BD201 .90
BD232 .90
BD233 .90
BD235 .90
BD236 .90
BD237 .90
BD238 .90
BD262 1.20
BD263 1.20
BD437 1.50
BD488 1.50
BD647 1.80
BD648 1.80
BD677 1.80
BD681 2.00
BD682 2.00
BDV64B 3.90
BDV65B 3.90
BDX63 6.50
Y96 (BUX 80) 4.90
BDY97 (BUX 80) 4.90
BF115 1.50
BF167 1.20
BF173 1.20
BF177 1.20
BF180 1.20
BF182 .90
BF183 .60
BF184 .60
BF198 .60
BF199 .60
BF200 1.20
BF245 1.50
BF337 1.50
BF338 1.90
BF458 1.00
BF459 1.00
BF469 1.20
BF470 1.20
BF494 .90
BF495 .80
BFW10 1.50
BFW11 1.50
BFW16 1.50
BFY50 1.20
BFY90 1.90
BFX90 1.50
BU126 2.50
BU208 1.90
BU326 3.90
BUX80 4.90
MFE131 2.90
MFE3001 9.90
MFE3003 6.95
MJ413 5.90
MJ802 7.50
MJ901 4.50
MJ1001 3.90
MJ11011 9.90
MJ11015 14.50
MJ11016 14.50
MJ15003 6.50
MJ15004 6.50
MJ15024 10.00
MJ2501 8.90
MJ2955 1.50
MJ3001 8.00
MJ4032 12.50
MJ4502 6.90
MJE340 1.70
MJE350 1.90
MJE371 2.90
MJE521 2.50
MJE700 3.50
MJE800 2.90
MJE2801 3.95
MJE2955 4.90
MJE3055 3.90
MJE13005 5.90
MJE13007 7.90
MJE13009 12.50
MPF121 2.50
MPF131 2.50
MPSA05 1.00
MPSA06 1.00
MPSA10 1.00
MPSA12 1.00
MPSA13 1.00
MPSA14 1.00
MPSA20 1.00
MPSA42 1.00
MPSA43 1.20
MPSA55 1.00
MPSA56 1.00
MPSA63 1.00
MPSA65 1.00
MPSA92 1.00
MPSA93 1.20
MPF102 .90
MPF103 .90
MPF105 .90
MPF106 .90
MPF109 .90
MPSL01 1.50
MPSL51 1.50
MPSU02 1.75
MPSU52 1.90
MPSU56 1.75
MP131 1.75
MRF221 19.50
MRF237 5.90
MRF238 29.50
MRF245 53.50
MRF421 53.50
MRF454 52.50

MRF456 37.00
MRF475 7.70
MRF603 19.50
MRF641 49.00
MRF646 53.00
MRF901 3.75
MPF131 1.90
TIP31A .70
TIP31B .70
TIP31C .75
TIP32A .70
TIP32B .70
TIP32C .75
TIP41C 1.50
TIP42A 1.40
TIP42C 1.50
TIP49 1.90
TIP50 2.20
TIP53 2.50
TIP111 1.50
TIP112 1.50
TIP116 1.50
TIP117 1.50
TIP120 1.50
TIP122 1.50
TIP125 1.50
TIP127 1.50
TIP145 3.40
TIP2955 1.50
TIP3055 1.50
2N301 4.00
2N697 1.00
2N918 1.00
2N1304 1.00
2N1613 1.20
2N2102 1.90
2N2219 .90
2N2222A 1.00
2N2369 1.00
2N2484 1.00
2N2646 1.20
2N2647 2.50
2N2894 1.00
2N2904 1.10
2N2905 1.10
2N2906 1.10
2N2907 1.10
2N3019 1.90
2N3053 .90
2N3054 1.90
2N3055 1.00
2N3096 1.20
2N3109 1.90
2N3251 1.90
2N3302 1.90
2N3440 1.80
2N3441 2.90
2N3442 3.50
2N3563 .30
2N3564 .30
2N3565 .30
2N3566 .30
2N3567 .30
2N3568 .30
2N3569 .30
2N3638 .30
2N3640 .30
2N3641 .30
2N3642 .30
2N3643 .30
2N3644 .30
2N3645 .30
2N3646 .30
2N3702 1.20
2N3704 1.40
2N3739 4.50
2N3771 5.50
2N3772 5.70
2N3773 5.90
2N3792 6.00
2N3819 1.20
2N3866 2.95
2N3904 1.00
2N3906 1.00
2N4030 1.50
2N4032 2.20
2N4033 2.20
2N4036 2.50
2N4121 1.50
2N4123 1.50
2N4236 1.90
2N4237 1.90
2N4248 .40
2N4249 .40
2N4250 .40
2N4258 .50
2N4355 .50
2N4356 .50
2N4360 1.00
2N4401 .30
2N4402 .30
2N4403 .30
2N4416 1.90
2N4427 2.90
2N4919 2.90
2N5088 1.00
2N5089 1.00
2N5139 1.20
2N5179 1.20
2N5190 2.50
2N5191 3.30
2N5192 3.10
2N5193 2.50
2N5194 2.85
2N5195 3.30
2N5210 1.50
2N5245 1.50
2N5303 8.50
2N5401 1.50
2N5457 1.00
2N5458 .90
2N5459 .90
2N5461 .90
2N5462 .90
2N5485 .90
2N5486 .90
2N5489 14.50
2N5590 16.50
2N5591 18.50
2N5641 19.50
2N5656 2.50
2N5770 .30
2N5777 1.50
2N5830 .30
2N5831 .30
2N5873 1.40
2N5874 1.70
2N5944 15.50
2N5945 18.50
2N5946 19.50
2N5961 1.90
2N6027 1.00
2N6049 1.90
2N6080 18.50
2N6083 21.90
2N6084 32.50
2N6124 1.90
2N6125 1.90
2N6130 1.90
2N6133 1.90
2N6256 14.50
2N6259 13.50
2N6274 29.50
2N6378 4.90
2N6425 4.50
2N6578 4.90
3N201 1.50
2SA683 1.50
2SC2028 3.95
2SC2029 3.95
2SC2166 4.95
2SC1730 1.95
2SC1969 6.30
2SC1973 3.95

VN88AF 3.95
2SC372 1.95
2SC495 2.95
2SC710D 1.95
2SC73 1.95
2SC900F 1.95
2SC945A 1.95
2SC1014 2.50
2SC1017 4.95
2SC1018 4.95
2SC1061 2.95
2SC1096 2.95
2SC1173 2.95
2SC1226 2.96
2SC1306 6.30
2SC1419 2.95
2SC1449 1.95
2SC1674 1.95
2SC1307 6.90
2SD288 3.95
2SD325 2.95
2SD525 3.95
2SK45 3.95
2SJ49 6.00
2SJ56 12.50
2SK134 6.00
2SK176 12.50
1N4001 .10
1N4002 .15
1N4007 .20
1N5400 .40
1N5404 .30
1N5408 .40
0A47 .80
0A90 .50
0A95 .50
5082-2800 2.95
5082-2811 4.95
HLMP6620 5.95

BRIDGES

1.5 AMP
W005 .50
W02 .40
W04 .50
6AMP
BPC602 2.90
KBPC604 3.50
KBPC608 4.50
10AMP
KBPC10005 3.90
KBPC1002 4.20
KBPC1004 4.90
35AMP
KBPC3502 5.90
KBPC35014
MD A3504 6.90
KBPC3510
MDA 3510 9.90

74

7400 .35
7401 .45
7402 .45
7403 .45
7404 .60
7405 .80
7406 .80
7407 .80
7408 .60
7409 .60
7410 .60
7411 .70
7412 .70
7413 .70
7414 .80
7415 .70
7416 .80
7417 .80
7420 .60
7421 .80
7422 .80
7423 .90
7425 .90
7426 .70
7427 .80
7428 .80
7430 .70
7432 .70
7433 .70
7437 .80
7438 .90
7439 .90
7440 .90
7442 .90
7443 1.60
7444 1.50
7445 1.00
7446 1.20
7447 1.50
7449 1.20
7450 .90
7451 .90
7452 .80
7453 .70
7454 .80
7455 .90
7460 .70
7461 .90
7462 1.00
7463 1.20
7470 .80
7472 .90
7473 .90
7474 .70
7475 .70
7476 .80
7477 1.20
7478 1.20
7480 1.20
7482 1.80
7483 1.10
7485 1.20
7486 1.20
7489 3.90
7490 1.00
7491 1.00
7492 1.00
7493 1.00
7494 1.50
7495 1.00
7496 1.50
7497 2.30
74100 1.65
74107 1.20
74109 .90
74110 1.50
74111 1.50
74112 1.50
74113 1.50
74114 1.50
74120 1.95
74121 .90
74122 .90
74123 1.50
74125 1.00
74126 1.00
74128 1.80
74132 1.00
74136 1.00
74138 1.80
74139 1.50
74141 1.10
74142 1.45
74143 1.45
74144 3.90
74145 1.45
74147 1.95

74148 2.00
74150 1.50
74151 1.20
74154 1.75
74155 1.20
74156 1.70
74157 1.00
74158 1.00
74160 1.00
74161 1.20
74162 1.20
74163 1.40
74164 1.20
74165 1.20
74166 1.70
74167 2.20
74174 1.45
74175 1.20
74176 1.40
74177 1.40
74178 2.15
74179 2.15
74180 1.20
74182 1.20
74184 1.20
74190 1.00
74191 1.45
74192 1.65
74193 .80
74194 1.10
74195 1.00
74196 1.20
74197 1.10
74198 1.10
74199 2.90
74221 1.90
74367 1.50
74368 1.50
74373 2.25
74374 2.25
74375 1.75
74377 2.45
74390 1.95
75107 2.50
75110 2.50
75150 2.50
75154 2.50
75450 1.50
75451 .90
75452 .90
75453 .90
75461 1.50
75462 1.50
75471 3.00
75472 3.00
75491 2.00
75492 2.00
75493 3.00
8121 5.00
8123 4.00
8130 6.95
8131 5.95
8136 6.95
8303 5.50
8304 6.95
82S23 5.95
82S123 6.95
8311 5.95
8641 5.95
8820 6.95
8830 6.95
8832 6.95
8833 6.95
8834 6.95
8835 5.95
1488 1.00
1489 1.00
81LS95 3.75
81LS96 3.75
81LS97 3.75
81LS98 3.75
8T26 3.00
8T28 3.00
8T30 3.00
8T96 1.80
8T97 1.80
8T13 2.95
8T14 2.95
8080 8.00
8085 9.50
8086 59.00
8088 29.00
8155 6.50
8156 11.50
8185 37.50
8202 52.50
8203 69.50
8212 2.90
8214 4.90
8224 3.50
8226 4.90
8228 5.50
8231 199.00
8232 199.00
8237 39.00
8238 9.50
8243 8.50
8251 6.90
8253 7.50
8255 5.50
8257 16.50
8259 6.50
8271 89.00
8272 33.00
8273 65.00
8274 42.50
8275 38.50
8276 28.50
8279 8.50
8282 6.90
8283 6.50
8284 8.50
8286 6.50
8287 6.50
8289 73.00
8291 43.00
8292 34.50
8293 10 26.50
8741 57.50
8748 65.00
8749 58.50
8755 33.50
8035 6.90
8039 7.90

74HC

74HC00 .60
74HC02 .60
74HC04 .60
74HC08 .60
74HC11 .60
74HC14 1.40
74HC27 .60
74HC30 .60
74HC32 .60
74HC74 1.10
74HC76 1.10
74HC85 1.40
74HC86 1.10
74HC123 1.40
74HC138 1.40
74HC139 1.40
74HC157 1.40
74HC165 2.50
74HC174 1.40
74HC221 3.60
74HC240 2.50
74HC244 2.50
74HC245 3.90
74HC367 1.40
74HC373 2.90

FD1771 19.00
FD1791 (8876) 39.00
FD1793 (8877) 39.00
FD1795 39.00
FD1797 39.00
WD1691 29.50
WD2143 14.50
WD1931 22.50
WD1933 34.00
WD1983 14.75
WD1993 59.00
WD2123 26.50
WD8250 16.50
TR1602 (S1883) 8.50
TR1863 8.90
COM8116 24.00
BR1941 23.00
CRT8002A 59.90

74F SERIES

74F00 .79
74F02 .79
74F04 .92
74F08 .79
74F10 .79
74F11 .79
74F20 .79
74F32 .79
74F64 .79
74F74 .89
74F86 1.19
74F109 .99
74F138 1.79
74F139 1.79
74F151 1.79
74F153 1.79
74F157 1.79
74F158 1.79
74F175 2.78
74F181 5.98
74F182 2.73
74F189 7.44
74F190 4.86
74F191 4.86
74F194 2.41
74F241 3.72
74F243 4.34
74F244 3.72
74F251 1.93
74F253 1.93
74F257 1.93
74F258 1.93
74F350 4.34
74F352 1.93
74F353 1.93
74F373 4.84
74F374 4.84
74F399 2.78
74F521 4.22
74F533 4.84
74F534 4.84

MEMORY

2101 6.90
2102 2.50
2112 7.90
2114 2.95
2708 8.90
2716 6.90
2732 7.00
2764 12.00
27128 29.00
4116 3.95
4164 8.00
6116 8.00
6264 59.00
58725 (6116) 7.00
2101 (5101)
(8101) 7.90
5101 7.90
8101 7.90
2532 12.50

OPTO

4N25 1.20
4N26 1.20
4N27 1.20
4N28 1.20
4N29 1.50
4N30 1.60
4N32 1.50
4N33 1.50
4N35 1.50
4N37 1.50
MCT6 2.50
MCT66 6.90
MCT2 1.50
1LD74 5.90
1LQ74 6.50
FND500 2.00
FND507 2.00
TIL31A 2.95
TIL81A 2.95
TIL306 14.50
MAN72
(DL702) 3.50
(DL704) 3.50
BPW50 2.25
HP5082-2811 4.95
HLMP 6620
3 95 LEDS
3mm RED .25
2mm YELL .30
3mm GRN .30
5mm RED .15
5mm YELL .30
5mm GRN .30
5mm ONG .30
RED RECT .30
GRN RECT .30
YEL RECT .30
RED CHROME BEZEL 1.20
YELLOW CHME BEZEL 1.20
GRN CHRME BEZEL 1.20

VOLTAGE REGS

7805C .80
7805KC 2.50
7812UC 1.20
7812KC 2.50
7815UC 1.20
7815KC 2.50
7818UC 1.20
7818KC 2.50
7824UC 1.20
7824KC 2.50
7905UC 1.90
7905KC 3.00
7912UC 1.90
7912KC 2.50
7915UC 1.90
7915KC 2.50
7918UC 1.90
7924UC 1.90
78L05 .50
78L12 .50
78L15 .75
78L18 .75
78L24 .75

79L05 1.20
79L12 1.20
79L18 1.20
79L24 1.20
LM309K (7805KC) 1.90
LM317T 2.50
LM317K 1.50
LM317HV 9.50
LM323K 7.50
LM337T 2.90
LM338K 10.50
LM350T 6.50
LM350K 8.50
LM395K 22.50
LM396K 19.50
78H05KC 9.00
78H12KC 9.00
78HGKC 9.50
78P05KC 16.50
79HGKC 16.50
78S40 3.50
MC1496L 14.50

SPECIAL FUNCTION

LM4250 2.45
NE5534N 2.50
NE5534AN 2.95
MC3340 1.90
MC3341 2.90
76477 8.95
76488 8.95
76489 9.95
8038 6.50
OM335 22.50
OM350 10.50
XR2206 7.95
XR2207 7.95
XR2208 6.90
XR2209 6.90
XR2211 7.45
XR2216 5.90
XR2240 6.95
XR2243 7.95
XR8038 7.50
ICC7660 12.50
95H90 8.50
11C90 16.50
LM7555 1.90
LM7556 3.50
MC10116L 1.50
LM13600 3.95
LF13741 .80
LF13741H 1.50
DS75451 .60
DS75452 .60
DS7591 2.00
DS7592 2.00
DM2502 22.50
ADC080 16.00
DAC0800 4.50
DAC0808 4.50
SAK140 9.50
ZN414 1.95
UA170 5.95

4000 .50
4001 .50
4002 .50
4006 1.90
4007 .40
4008 1.20
4010 .90
4011 .40
4012 .40
4013 .60
4014 1.90
4015 1.90
4016 .75
4017 1.50
4018 1.90
4019 .90
4020 1.50
4021 1.50
4022 1.50
4023 .75
4024 1.20
4025 .80
4026 2.40
4027 1.20
4028 1.20
4029 1.50
4030 1.50
4031 2.95
4032 2.75
4033 2.75
4034 3.50
4035 1.95
4038 3.25
4040 1.20
4041 1.50
4042 1.00
4043 1.60
4044 1.20
4045 4.90
4046 2.50
4047 1.20
4048 1.20
4049 1.00
4050 1.00
4051 1.50
4052 1.50
4053 1.50
4054 3.90
4055 3.90
4056 4.20
4060 2.50
4063 2.00
4066 2.50
4067 9.90
4068 1.00
4069 1.00
4070 .90
4071 .40
4072 .90
4073 .90
4075 .90
4076 1.50
4077 .80
4078 .80
4081 .40
4082 .80
4085 2.20
4086 2.30
4089 3.50
4093 .75
4094 3.35
4095 2.40
4096 2.40
4097 6.50
4098 2.90
4099 3.90
4104 6.90
4160 1.25
4161 1.25
4163 1.25
4174 1.25
4175 1.60
4194 1.85
4402 1.00
4404 1.15
4408 6.90
4409 13.50
4410 11.50
4411 12.60
4412 5.45
4415 10.15
4416 5.60
4419 3.45
4422 9.50

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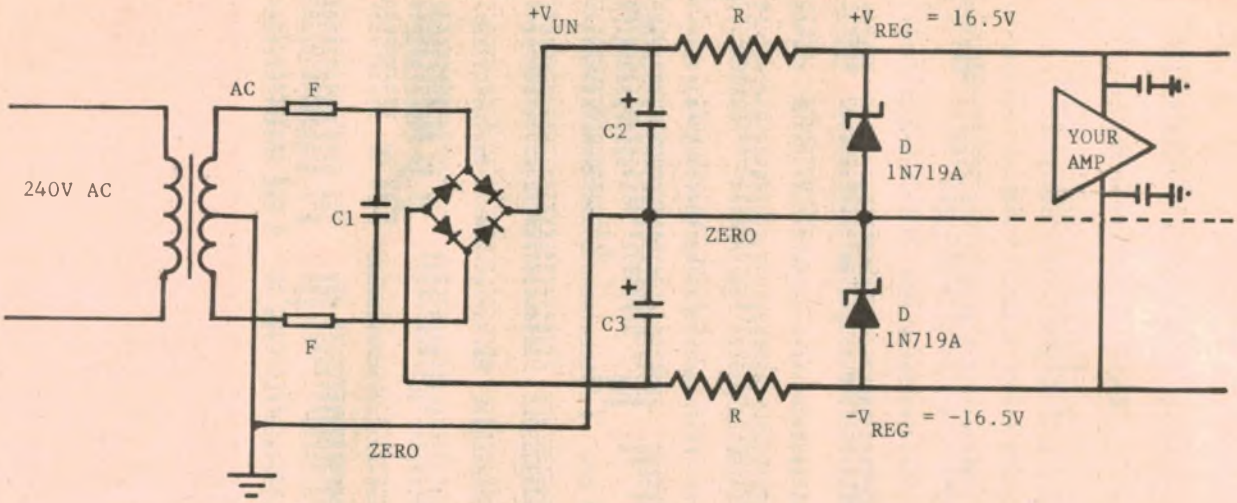

Fig. 7a: the essential components of a simple shunt zener dual voltage regulator. Blocks "F" are protection fuses and limiting resistors, C1 is a small high-voltage ceramic capacitor for lightning and interference suppression. The diode bridge provides full-wave rectification, while C2, C3 may be 1000μF. The circuit may take 20mA and each zener diode may pass 12mA. V_{REG} will be stabilised close to 16V and, as well, much of the ripple at V_{UN} will be removed.

OP AMPS Explained

follows that i_Z must fall. And vice versa. Unfortunately, the diode breakdown voltage V_Z is also a function of the current i_Z. So V_Z will change a little, as in Fig. 1. The slope of this curve is called the zener impedance Z_Z, thus:

$$Z_Z = (d\ V_Z/d\ i_Z) \text{ ohms.}$$

Different diodes with different values of V_Z have different values of slope Z_Z; the smallest slope belonging to those with V_Z close to 5.5 volts. We emphasise that Z_Z is a ratio of voltage *change* to current *change*, so is called ohms, but this is NOT any physical resistance. Some examples are given in Table 1; also observe that Z_Z is lower in high current diodes (at a given voltage).

Ripple reduction

If the unregulated voltage V_{UN}, Fig. 6, is from a rectified AC supply (as it usually is), then V_{UN} contains lots of 100Hz ripple. Say V_{UN} is nominally 26.5 volts; in truth it may be a DC voltage varying from 27 volts to 26 volts at 100Hz rate as the 240VAC sinewave Fig. 7(b) rises and falls:

V_{UN} = (26.5V DC + 1V_{pp} ripple)

where V_{pp} means a peak-to-peak voltage measurement. Question: how much ripple voltage will appear in the regulated output in Figs. 6, 7(a)? The answer involves the value of R and the value of Z_Z.

If in Fig. 6 each diode D is a 1N708A,, with V_Z = 5.6 volts and Z_Z = 3.6 ohms, the total Z_Z = 3(3.6 ohms) = 10.8 ohms. The total regulated voltage is decided by the voltage of the diodes so in this case is 3 × 5.5V = 16.5V, but the ripple content of that voltage is decided by the pseudo "ripple voltage divider" effect formed by R and Z_Z, thus:

Ripple on V_{REG} = (Ripple on V_{UN})(Z_Z/(R + Z_Z))

In this case:

Ripple on V_{REG} = (1V_{pp})(10.8/310.8)
= 35 millivolts

Alternatively you could simply use one 15V zener diode 1N3794 (a more expensive 1.5 watt type), giving the same ripple as its Z_Z = 11 ohms.

Design example

Fig. 7(a) is an example of a simple zener regulated dual power supply. The idea is that the transformer, rectifier and capacitors C2, C3 together provide ±V_{UN} unregulated DC with some ripple superimposed. The amplitude of ripple, in Fig. 7(b), depends on the load current and the size of capacitor and is approximately 10 millivolts per milliamp load current if C = 1000 microfarads. Smaller values of C give increased ripple in inverse proportion.

Zener diode D may be used to remove much of this unwanted ripple. Say the load is a few integrated circuits taking a total current varying between 15 and 20 milliamps and the desired regulated voltage V_{REG} = 16.5 volts. You could choose zener diode type 1N719A for each D in Fig. 7(a) which would give you 16 volts within ±5% at 12mA zener diode current. This current is well below the 25mA maximum for this unit, dictated by its 400 millivolt power rating.

The desired current through resistor R will therefore be the sum of zener and load currents ie, between (12 + 15) = 27 and (12 + 20) = 32mA. Designing for the largest current, if V_{UN} is arbitrarily chosen as 26 volts DC (measured from zero to *bottom* of ripple), then:

Required R = (26V − 16V)/(32mA)
R = 313 ohms.

So we choose resistors R as near to this as available. Power dissipated by R will be approximately the product:

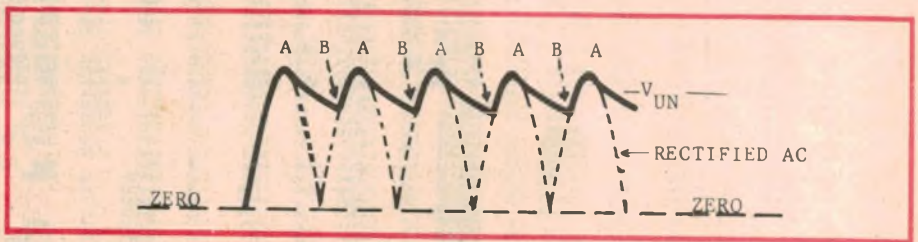

Fig. 7b: production of the unregulated voltage V_{UN} in Fig. 7a starts with the diode bridge which gives the full-wave rectified AC voltage shown dotted. This is sorted in capacitor C2 (or C3) to give DC with ripple as represented by the heavy line. The horizontal axis is time (10ms from A to A), while the vertical axis is volts. From B to A the rectifier is charging the capacitor and supplying the load. From A to B the capacitor is discharging into the load while the rectifier is in the cutoff mode. The slope from A to B is approximately 1V/ms if C = 1000μF for every ampere or load current. The average voltage from A to B is approximately V_{UN} while the difference of the voltages at A and B is the ripple.

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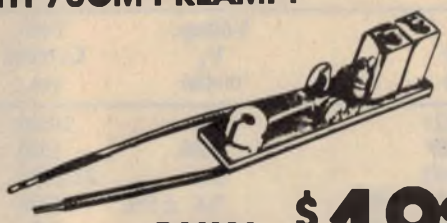

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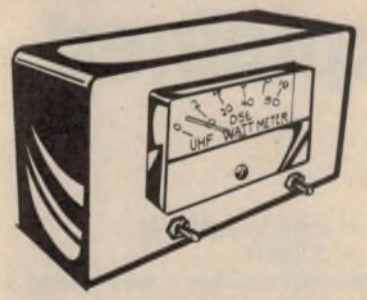

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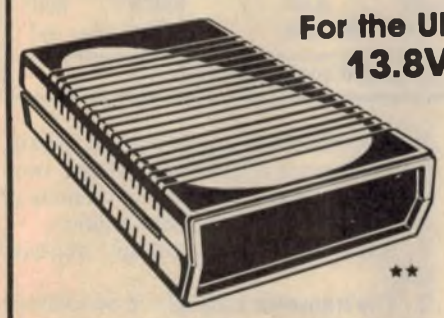

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OP AMPS Explained

Pwr = (10Vdrop)(32mA)
= 320mW

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The action of the circuit is that when the load current swings down from 20mA to 15mA, an extra 5mA is taken up by the zener. Then if the 240V supply should fall a little the zener will take less current, all the time maintaining V_{REG} close to 16 volts by automatically regulating that voltage drop across R. Everything is repeated for the negative supply.

We call the resistor R a "pass element" and as the zener shunts the output voltage, we call the whole system a "simple shunt zener voltage regulator".

Clearly the system will not work if you try to take 32mA or more from it. Also the zener will be in serious trouble (very hot) if the load current drops below 7mA, as at that point the zener must be passing 25mA, its maximum safe rating. If that might occur, buy a higher power zener diode. Observe that R automatically provides inherent short-circuit or current overload protection.

For bigger load currents or higher voltages you can buy larger zener diodes, up to 50 watt size such as the 1N3317, or use a supplementary pass transistor.

Supplementary transistors

In Fig. 8 we use a simple emitter follower as a series pass transistor, the output from the emitter simply "following" the base voltage. The base voltage should be smooth, well regulated, ripple-free and stable; any source fitting that glowing description will do. About the simplest source is as shown, a zener and a resistor from V_{UN}, with the stabilised voltage V_Z supplying only the transistor base current. A constant current source instead of R would be an improvement, if you wish.

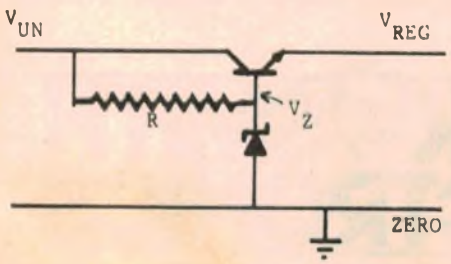

Fig. 8: basic scheme for combining a series pass transistor with a shunt zener to provide a regulated voltage (V_{REG}) with greater current capability. V_{REG} is about 0.65V less than V_Z.

TABLE 1
Selected Zener Diodes

Zener Diode	Voltage V_Z (volts)	Test Current mA	Zener Impedance Z_Z ohms	Temperature Coefficient % V per deg	Max Pwr W
1N5221	2.4	20.00	30.00	−0.085	0.5
652CO	5.55	5.00	2.00	Low	0.4
1N4553	5.6	2250.00	0.12	+0.03	50.0
1N708A ±5%	5.6 ±5%	25.00	3.6		0.4
1N829A ±5%	6.2	7.5	10.00	0.0005	
1N37948±5%	16.00±5%	23.00	11.00	+0.07	1.5
1N2816	180.0	700.00	2.00	0.075	50.0
1N5281	200.00	0.65	2500.00	0.11	0.5

Note: 1N829A is actually a temperature compensated compound diode.

It is not just for convenience that R is connected to V_{UN}. Some other dangerous designs would supply R from a separate source as in Fig. 9(a) and/or place a capacitor C in parallel with the zener diode as Fig. 9(b). Either approach puts the passing transistor at grave risk, in a slightly subtle possible chain of events, as follows in Fig. 9(a):

1. If load L has some fault, current is limited to twice full current by base current limiting effect of R.
2. Eventually fuse F blows.
3. R continues to supply current to base. In the absence of collector voltage, transistor goes into saturation, ie millions of charges accumulate in base region.
4. Some unthinking person replaces fuse.
5. The transistor is caught in an extreme situation:
(a) base saturated with charges
(b) full collector voltage applied.
6. In a matter of microseconds, the transistor goes into full saturation, emitter voltage rises to within 0.5 volts of collector voltage, fully charged C1 supplies many hundreds (maybe thousands) of amps from C1 to the load fault and also to try to bring C2 up to collector voltage.

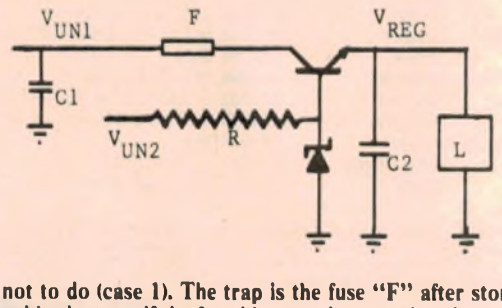

Fig. 9a: what not to do (case 1). The trap is the fuse "F" after storage capacitor C1. As explained in the text, if the fuse blows and you replace it, you can burn out the transistor.

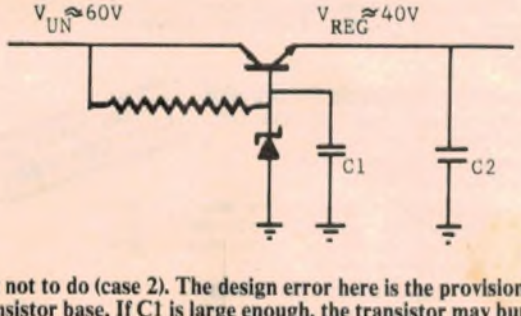

Fig. 9b: what not to do (case 2). The design error here is the provision of capacitor C1 at the transistor base. If C1 is large enough, the transistor may burn out during a brief power interruption (see text).

7. Transistor internal emitter connection burns off in a surprisingly short time.
8. You go and buy some more transistors and consider it an expensive lesson.

Fig. 9(b) can produce the same results, more easily, thus:
1. Circuit working nicely, C1 does in fact smooth ripple at base successfully, everyone with smiling faces.
2. Fault occurs on some power line maybe 100km away, but your home lights dip down for perhaps 200 milliseconds, then back to normal (a common occurrence).
3. During that 200 milliseconds, large C1 remained almost fully charged, keeping base voltage higher than temporarily lowered collector voltage, ie, transistor quickly goes into saturation.
4. When power returns to normal at end of 200 milliseconds, transistor is caught in full saturation and 60 volt V_{UN} tries to instantly charge C2 from 40V to 60V. This results in momentary current of hundreds or even thousands of amps, destroying the transistor.

Having now learned that circuits like Fig. 9(a) and (b) must be avoided like the plague, we may use Fig. 8 with some confidence, provided we recognise that it is not ideal. Its over-current protection, afforded by R limiting the base current, is somewhat uncertain as it depends entirely on the value of transistor h_{FE}. This in turn varies so much from one transistor to another, and even for a single transistor the value of h_{FE} changes with emitter current and also rises with temperature.

Summing up

Zener shunt regulators, with or without supplementary pass transistors, have advantages in their simplicity and low cost, but have disadvantages because:
1. Output voltage can only be chosen in discrete steps; precise setting to a desired voltage or variable voltage is not possible.
2. Output impedance of a few ohms is too high for some applications.
3. Change in output current causes change in zener current and hence change in zener voltage.
4. Adding supplementary pass transistors leads to over-current protection difficulties.

Curing all three shortcomings requires a move into the world of active voltage regulators. That fascinating topic we must leave till next month. Bye!

Reference

Ref. 1: On Zener Breakdown Mechanism. C. Zener, in Proceedings Royal Society, London, No. 145, 523 (1934).

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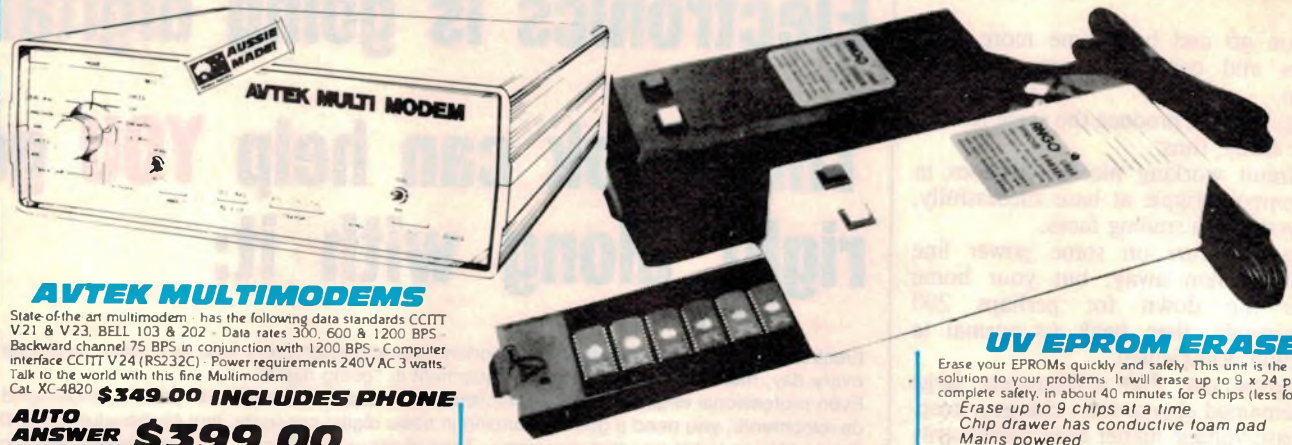

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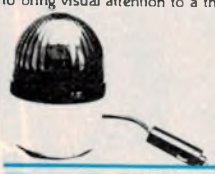

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ONLY $32.50

Electricity Authority Approved Fuseholder!

At Last! A 3AG 240V 10A fuseholder that is approved but at a reasonable price! (Approval No. CS2929). Ideal for manufacturers.

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GENUINE SIEMENS

Universal voltage tester with LED indicator

The Siemens "UNISPANN" voltage probe has been around for some time now. You can determine the presence of AC or DC voltages safely anywhere with this quality probe. It will even tell you which AC mains conductor is active and works from 6-500V AC or DC. It also shows DC polarity.

Normally these units are very expensive but a Jaycar SCOOP PURCHASE brings them to you at a great price!

WHILE STOCKS LAST AN INCREDIBLE BARGAIN

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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 for 9 chips (less for less chips).

- *Erase up to 9 chips at a time*
- *Chip drawer has conductive foam pad*
- *Mains powered*
- *High UV intensity at chip surface ensures thorough erase*
- *Engineered to prevent UV exposure*
- *Long life UV tube*
- *Dimensions 217 x 80 x 68mm*
- *Weight 670 grams*

Cat. XE-4950

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At Last! A car 12V cigarette lighter SOCKET!

A panel mount source of 12V for cars, boats, planes. You even can plug a cigarette lighter into it!

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Specifically for charging Gel-cells with ¼" quick connect tabs on them. 240V AC to 12V DC @ 300mA ensures fast charge!

Cat. MB-3506 **ONLY $10.95**

MICRON PROFESSIONAL 20W IRON

240V AC SOLDERING IRON

This great iron has all the features of those costing a lot more ● 370°C fixed temperature ● High efficiency patented heating element ● Iron clad, chrome plated, long life interchangeable tips

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IRON CLAD TIPS

This soldering iron uses high grade iron clad, chrome plated and pre-tinned tips. Tip life expectancy is many times that of conventional plated tips.

Cat. TS-1552 ..... MICRO CHISEL - 1mm
Cat. TS-1553 ..... MINI CHISEL - 1.5mm
Cat. TS-1554 ..... STANDARD CHISEL - 3mm

ALL TIPS $3.50 EACH

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Ideal for the hobbyist and handyman. 240V operated with spare tips available. Lightweight. Tip temperature variation is well within limits suitable for electronic work. Comes complete with tip.

Cat. TS-1440

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SPARE TIPS TO SUIT

Cat. TS-1441 ..... MICRO CHISEL
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Cat. TS-1443 ..... STANDARD CHISEL

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Soldering Iron Stand

Holds virtually any iron for convenient use. Includes tip wiping sponge.

Cat. TS-1500

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ONLY $1.50 ea

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AT LAST! An Economical RACK CABINET MOUNTING SYSTEM!!

This fully Australian-made product we believe will become one of our hottest selling items!

It has taken an Aussie manufacturer to come up with the *world's first* low cost rack mounting system especially for the budget-conscious home constructor!

The rack mounting system basically consists of specially designed aluminium extruded frames. Moulded plastic corner and feet pieces connect the extrusions together to form a rigid frame. No spanners, screwdrivers are needed but the use of a rubber or wooden mallet is advised to securely fit together the self-aligning pieces. When assembled the frame can be further strengthened with pop rivets. The system is supplied in knocked-down (kit) form to keep costs and freight down. Assembly takes around 20 minutes and instructions are supplied. In keeping with the low cost philosophy, side and top panels are not included. Any reasonably competent reader should be able to fashion wooden or metal panels to suit. (Edge finish is not necessary as the panels recess into the frame). Jaycar will have special side panel sets available shortly however. Please watch our ads for further details.

THE RACK IS AVAILABLE IN 3 SIZES

6, 12 and 18 rack unit

(One rack unit is 44.5mm or 1¾").

Each kit comprises: ★ 12 frame pieces, including 2 pieces with pre-punched holes for front panel mounting. Natural anodised finish. (You can use the rack back-to-front to mount non-standard racks). ★ 4 top corners (black) ★ 4 bottom corners (black) ★ 4 x clip-in M-6 nuts (for mounting your equipment) ★ 4 x M-6 Phillips head mounting screws ★ easy to follow instructions.

But the best part about this exciting concept is ***THE PRICE!***

ONLY

Cat. HR-5310 **6 RACK FRAME $ 99**
Cat. HR-5320 **12 RACK FRAME $119**
Cat. HR-5330 **18 RACK FRAME $139**

Extra M-6 captive nuts (Pack of 12)
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Extra M-6 x 16mm plated Phillips head mounting screws (pack of 12)
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AT LOW, LOW PRICES FOR YOU

ULTRASONIC PEST REPELLER

Which of these do you need to get rid of? Mice, blowflies, birds, spiders, bats, rats, cockroaches, flies, moths or fleas? The Verminex ultrasonic insect/pest repeller creates a sonic environment which is totally hostile to the creatures mentioned.

HOW DOES IT WORK? The environment is relatively devoid of ultrasonic sounds. Evolution has not had a compelling reason to protect non-acoustic sensory mechanisms from ultrasonic stimulation. By subjecting an insect or rodent to a high level ultrasonic soundwave of a particular pattern the creature begins to behave in a typical fashion. The pest becomes disoriented, lethargic and bewildered. The natural reaction is to escape from the sound affected area. The sonic pattern is the secret and this pattern is a combination of scores of frequencies mixed together. The pattern was developed by Professor J.L. Stewart – the man who invented the Bionic ear. It works!

Like us, you would be skeptical at first that this would work. Our first reaction was, "If they are so good why haven't we heard about them before?" or "Surely a product like this – if it was any good – would have been around years ago". There have been ultrasonic repellers around but none of them have the patented soundwave pattern of the Verminex. We have on our file, many letters of testimony to the fact that the Verminex is effective. The letters are from Australian Universities, Animal Husbandry research institutions, commercial Piggeries, restaurants etc. Many of them had several pest problems!

Your pest problems may not be as bad but it may still be a nuisance, which is why the domestic Verminex was developed. We are so confident of the Verminex units effectiveness, we make the following offer.

Buy the Verminex from us and use it for up to 14 days (21 days for mail order customers). If you are not happy with the product after using it as directed, return it to us in a clean, original condition and we will refund your money in full!! (Less post/packing). What have you got to lose?

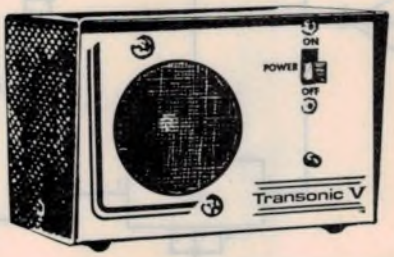
The Verminex covers an area of 2000 sq ft (uninterrupted) and is not cheap. But if the idea of dangerous chemicals, sprays, baits etc worries you it's a great solution. It is supplied with a 240V plug pack but can be battery powered.

Cat. YS-5500

WHAT HAVE YOU GOT TO LOSE EXCEPT THE BUGS! **$79.00**

NEW! BY POPULAR DEMAND!

Verminex Transonic V Commercial Ultrasonic Pest Repeller



Everything that we have said about the Verminex domestic unit except that it is for commercial applications!

- ★ Sturdy metal cabinet
- ★ 3 selectable pitch and loudness settings to optimise for particular problems
- ★ Low power consumption
- ★ 14 day satisfaction guarantee
- ★ Includes AC mains adaptor

Cat. YS-5510

ONLY $159.00

FERGUSON TRANSFORMERS

PC MOUNT 3VA

Cat. MF-1000	PL9/5VA 2 x 4½V @ 1.11A
Cat. MF-1002	PL12/5VA 2 x 6V @ 830mA
Cat. MF-1004	PL15/5VA 2 x 7.5V @ 670mA
Cat. MF-1006	PL18/5VA 2 x 9V @ 560mA
Cat. MF-1009	PL24/5VA 2 x 12V @ 420mA
Cat. MF-1012	PL30/5VA 2 x 15V @ 330mA
Cat. MF-1015	PL40/5VA 2 x 20V @ 250mA

ALL AT $10.95 each

2.5VA PC MOUNT

Cat. MF-0950	PL18/2.5VA 2 x 9V @ 280mA
Cat. MF-0952	PL24/2.5VA 2 x 12V @ 210mA
Cat. MF-0954	PL30/2.5V 2 x 15V @ 170mA

PRICED AT $9.95 each

PL20VA FLAT PACK

Cat. MF-1030	PL12/20VA 2 x 6V @ 1.67A
Cat. MF-1033	PL15/20VA 2 x 7.5V @ 1.33A
Cat. MF-1036	PL18/20VA 2 x 9V @ 1.11A
Cat. MF-1039	PL24/20VA 2 x 12V @ 830mA
Cat. MF-1042	PL30/20VA 2 x 15V @ 670mA
Cat. MF-1045	PL40/20VA 2 x 20V @ 500mA

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PL40VA FLAT PACK

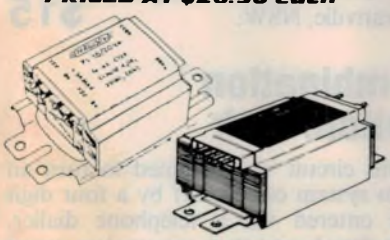
Cat. MF-1051	PL15/40VA 2 x 7.5V @ 2.67A
Cat. MF-1054	PL18/40VA 2 x 9V @ 2.22A
Cat. MF-1057	PL24/40VA 2 x 12V @ 1.67A
Cat. MF-1060	PL30/40VA 2 x 15V @ 1.33A

PRICED AT $20.95 each

PL60VA

Cat. MF-1072	PL15/60VA 15V @ 4A one winding only
Cat. MF-1075	PL18/60VA 2 x 9V @ 3.33A
Cat. MF-1078	PL24/60VA 2 x 12V @ 2.5A
Cat. MF-1081	PL30/60VA 2 x 15V @ 2A
Cat. MF-1082	PL40/60VA 2 x 20V @ 1.5A

PRICED AT $26.50 each



REGENCY BRAND RF-ONE X & K BAND RADAR DETECTOR

Quality Regency (U.S.)/Japanese made radar detector at an unbelievable price!

- ★ **Receives both X & K band radar.**
- ★ **Adjustable sensitivity for city/country driving**
- ★ **Loud buzzer for radar alert**
- ★ **LED pilot lamp**
- ★ **3 mounting positions**
- ★ **Installs in seconds with 12V lighter plug**

NEW

Cat. XR-0500

ONLY $129.00

ONLY $169

SQUEAKY CLEAN MAINS FILTERS

Two fantastic low cost models. MS-4010 will supply up to 4 appliances. Each 240V socket is isolated from the other, i.e. interference from disc drives is de-coupled from the CPU power supply etc. It will supply up to 4 outlets with a total load of 6 amps (unswitched).

Cat. MS-4010 **ONLY $125.00**

Single 10 amp line socket type filter (unswitched).

Cat. MS-4012 **ONLY $34.95**

2¼" DIAMETER SPEAKER 32 OHM VOICE COIL

We have a small quantity of these handy little speakers. The high voice coil impedance enables you to drive them directly with, say, a BC 548 (without an output transformer).

Cat. AF-3002

NEW

ONLY $3.00 each

DESK MOUNTED LAMP MAGNIFIER

This unit magnifies any object under a clear cool fluoresecent light. The magnification is the maximum obtainable (lens 127mm diameter bi-convex 4 Dioptres, focal length 254mm) consistent with minimum distortion and eyestrain and good off angle viewing.

It is NOT cheap, but then again it will definitely last a lifetime. It is built like a Rolls Royce. (We doubt whether 20 years continuous use would wear out the German made flexible arms for example). Spare fluoro tubes are available either from us or electrical outlets.

If you have trouble with fine PCB work or component identification but still want both hands free, this is for you. We thoroughly recommend this quality Australian made product.

Technical Information

Illumination: **22W Fluoroscent**
Weight: **8.16kg**
Lateral Extension: **254mm**
Vertical Extension: **254mm**
Fixing: **Heavy table base (grey) with two chrome plated flexible arms.**
Lens: **(see text)**

Cat. SL-2700

Jaycar ELECTRONICS

Incorporating ELECTRONIC AGENCIES

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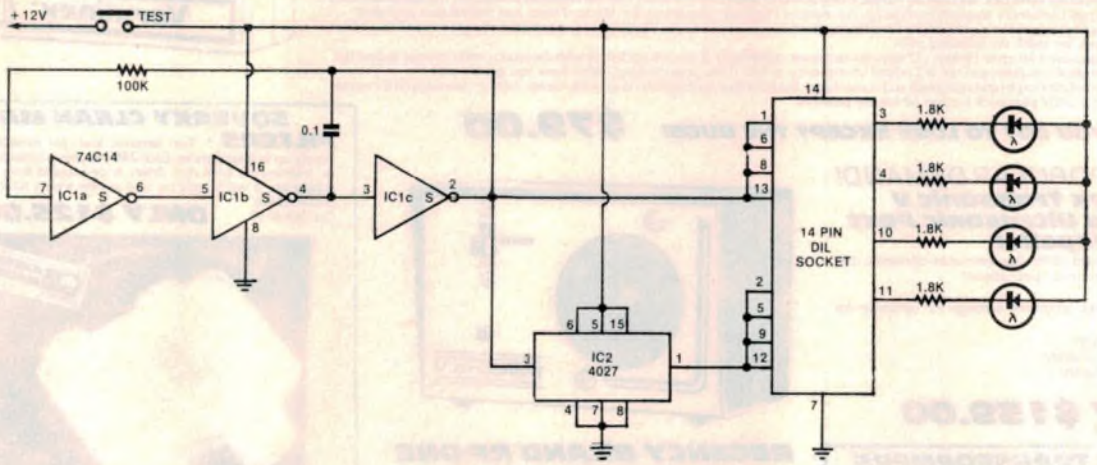
COMET ROAD FREIGHT ANYWHERE IN AUSTRALIA ONLY $12

MAIL ORDER VIA YOUR PHONE

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.



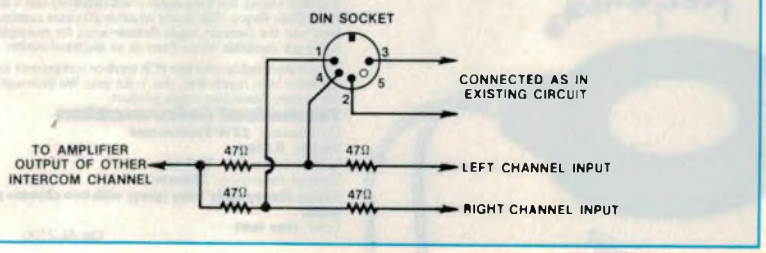
4000 series CMOS gate tester

This circuit was designed to test some of the more commonly used buffered CMOS ICs (ie, those 4000-series devices with a B suffix). It tests the quad two input logic gates such as 4001, 4011, 4071, 4081, 4030, 4070, and 4093. The IC under test is simply plugged into the test socket, and the test button is pressed. If all four gates are working correctly, the four LEDs will flash. If any of the LEDs remain permanently on or off, that gate is defective.

The circuit is based around an oscillator formed by three gates from a 4049 hex inverter. The squarewave output is divided by two in the 4027 flipflop. The output of this is applied to one input of each of the gates under test, while the signal from the oscillator is applied to the other input of each gate.

Thus all four possible logic states are applied in turn to each gate. The outputs of the gates drive the LEDs directly, via 1.8kΩ current limiting resistors. OR and NAND gates will flash the LEDs with a 25% duty cycle, NOR and AND gates will produce a 75% duty cycle and XOR (exclusive OR) gates will produce a 50% duty cycle.

P. Stoddard,
Tamworth, NSW. **$15**



Radio/cassette addition to motorcycle intercom

This circuit enables the connection of a stereo radio or cassette player to the motorcycle intercom system published in the February '84 issue of *Electronics Australia*. The circuit incorporates the radio by mixing the output of the radio with the intercom output.

To obtain the full impact of stereo, two earpieces are required in each helmet, and an extra audio line must be run between each helmet and the intercom. The 3-pin DIN sockets on the intercom are replaced with 5-pin DIN sockets to accommodate the extra audio line.

The leads connecting the helmets to the intercom are replaced with three core shielded cable (or a piece of two core and a piece of single core cable taped together). These cables should have 5-pin DIN plugs on one end and a 3.5mm stereo jack for the audio and a 2.5mm mono jack for the microphone on the other end.

At the helmet, a 2.5mm line socket is connected to the microphone insert, and a 3.5mm line socket is connected to the two earpieces.

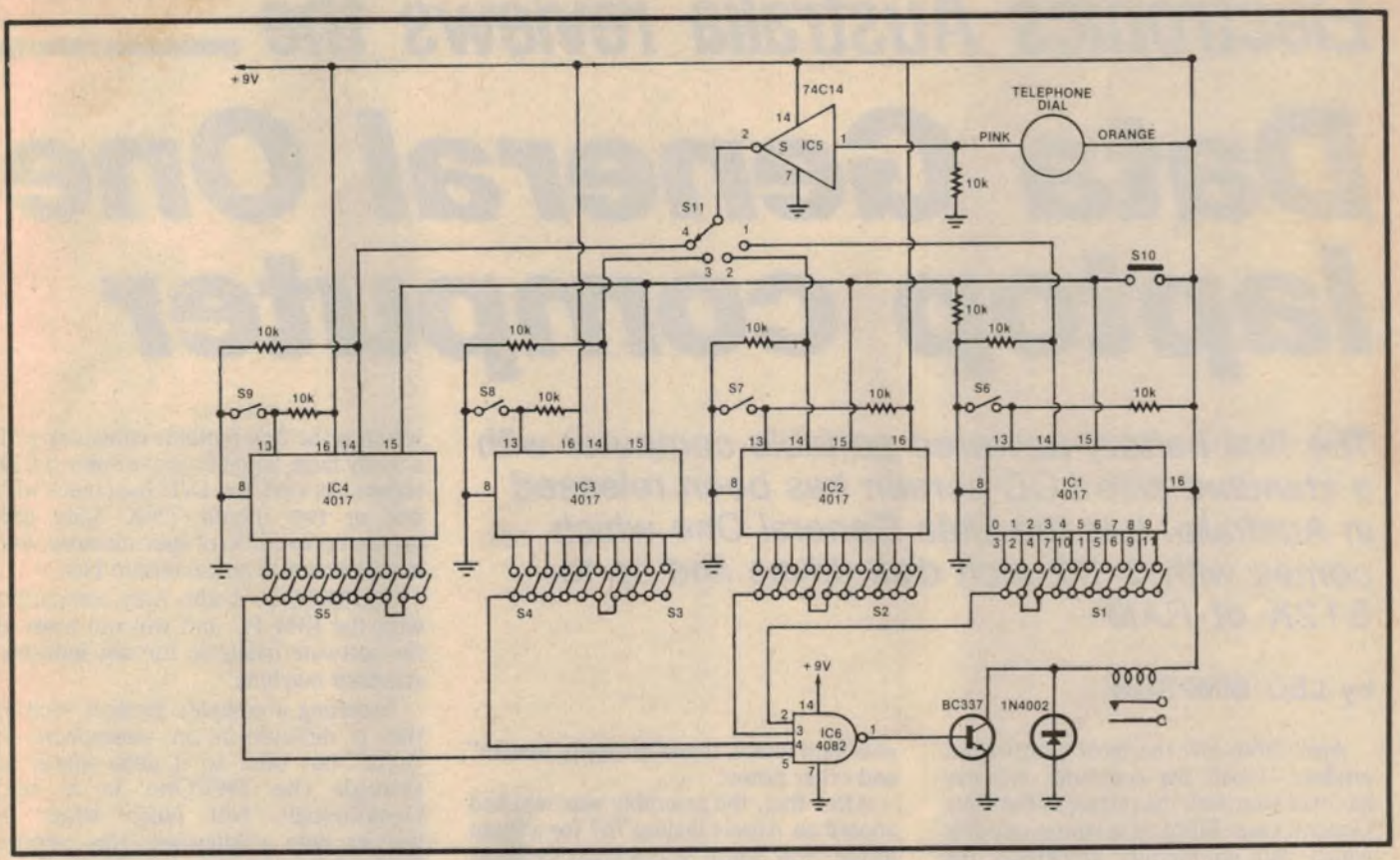
The mixing resistors were connected inside the case of the intercom. An important point to note is that if the intercom is to be used without the radio connected, these two inputs should be grounded to prevent excessive crosstalk between the two intercom channels.

D. Dawes,
Granville, NSW. **$15**

Combination switch/lock

This circuit was designed to turn an alarm system on and off by a four digit code entered via a telephone dialler. Four decade counters are used to count the pulses from the dialler and the outputs from these counters are compared with a code preset by switches. When the combination is correct, a relay is switched on.

IC1 to IC4 are the decade counters which provide 10 outputs labelled from "0" to "9". Each of these outputs go high in sequence as each clock pulse is counted at the pin 14 clock input. For example, when the counter is reset, the "0" output is high and after the first



clock pulse is counted, the "1" output goes high.

Telephone dial, TD1, sends clock pulses to the counters via Schmitt trigger inverter IC5 and switch, S11. Dialling a "1" on TD1 sends a single clock pulse to S11. Similarly, a "2" dialled sends out two clock pulses. If S11 is set to position 1, then IC1 will count the clock pulses from IC5.

If the dialled digit is the first number of the combination, the high output at IC1 is connected to a closed switch contact on S1. This high is applied to the pin 2 input of AND gate IC6.

With switch S11 set to position 2, the code dialled for the second digit is counted by IC2. If the high output of IC2 matches the closed switch contact then the pin 3 input of AND gate IC6 also goes high.

Entering the combination code for digits three and four is made in a similar fashion to digits one and two.

If the entered code is correct, all the inputs to IC6 will be high to give a high IC6 output. This turns on the transistor which in turn energises the relay.

By pressing the Reset switch the outputs of the counters are all reset to "0". This will switch off the relay provided of course that the combination has not also been set to 0000 by the switches.

A count disable feature has also been provided on the circuit. If switch S6 is open, then the clock input of IC1 is disabled to prevent counting of the clock pulses from the dialler. Similarly for switches S7, S8 and S9 which prevent counting for IC2, IC3 and IC4 respectively.

Note that switches S1, S2, S3, S4 and S5 are eight-way DIL (Dual In Line) switches. Each switch can be independently opened or closed but note that, for the circuit to work, only one output from IC1 can be selected by S2. A similar condition applies for ICs 2, 3 and 4. In other words, the output lines from the 4017s cannot be connected in parallel.

Five 8-way switches are used for the 10 outputs from IC1, IC2, IC3 and IC4.

As an extra feature, LEDs can be added to each 4017 output to indicate the dialled sequence.

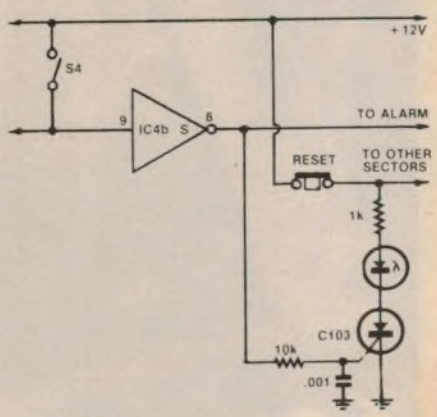
A. Fong,
Carlingford, NSW. **$25**

Latched indicators for multi-sector alarm

This is a useful addition to the home burglar alarm described in the January and February 1985 issues of EA. As it stands, the alarm has no facility to inform the user if any of the sectors have been tripped while he has been absent. An additional LED and a latching circuit for each of the eight sectors provides this feature.

The extra circuitry is minimal, consisting of an extra LED and an SCR for each sector, plus a couple of resistors and a capacitor.

If the sector is tripped a narrow positive-going pulse appears at the output of the Schmitt input inverter. This pulse turns the SCR on, lighting the LED. The 1kΩ resistor limits the current through the LED and the SCR, while the 10kΩ resistor limits the gate current of the SCR.



Thus the LED will remain alight, even after the gate pulse has disappeared, until the reset button is pressed. Note that the normally closed reset switch is common to all the sectors.

A. Levido, Electronics Australia.

Electronics Australia reviews the

Data General One laptop computer

The first battery-powered portable computer with a standard size LCD screen has been released in Australia. It is the Data General One which comes with 3-1/2 inch disk drives and up to 512K of RAM.

by LEO SIMPSON

April 1985 saw the most extravagant product launch the computer industry has ever seen with the release of the Data General One. Billed as a laptop portable which can go literally anywhere, the Data General One was launched first at Sydney's Kingsford Smith Airport, where the assembled crowd from the industry and press saw a narrated tableau complete with actress miming the part of a jetsetting business person plus loud music, liquid nitrogen "smoke" and other pizazz.

After that, the assembly was whisked aboard an Ansett Boeing 767 for a flight to the New South Wales coast as far as Port Macquarie, ostensibly to demonstrate the inflight behaviour of the new computer.

The extravagant nature of the marketing effort tended to overshadow the significance of the product itself which is the first portable computer with a really large liquid crystal display (LCD) screen. As well, the DG/One comes with one or two inbuilt 720K 3.5in disk drives, up to 512K of user memory, two serial ports and an expansion bus.

The DG/One is also fully compatible with the IBM PC and will run most of the software available for this industry-standard machine.

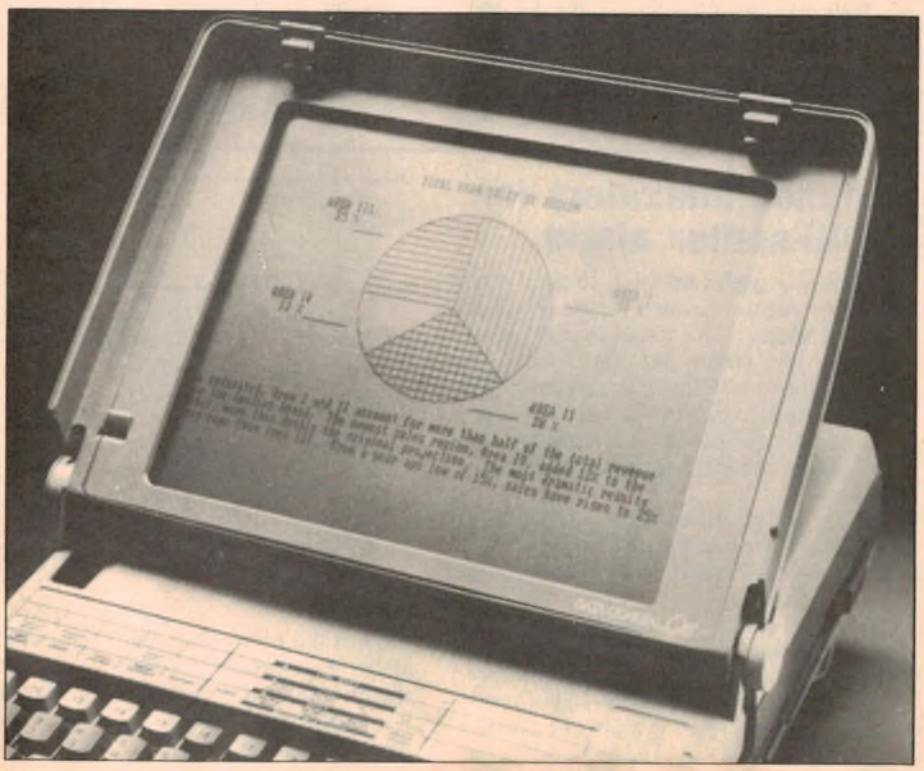
Assessing a complex product such as this is difficult in an atmosphere of "hype" but even so it does appear as though the DG/One is a real breakthrough. Not much larger or heavier than a Microbee, this battery-powered machine has just about all the capabilities of the IBM PC and it has its own inbuilt screen.

When closed up, the Data General One is the size and form of a very compact portable typewriter. Undoing a clip on each side of the case lets the lid tilt up to reveal a large LCD screen with an area roughly equal to that of a typical 30cm video monitor and capable of displaying 25 lines of 80 characters each, or 256 × 640 pixels, for software that uses bit-mapped graphics. Weight of the unit, including the internal batteries, is just 4.5kg.

The standard QWERTY keyboard has a total of 79 keys: 47 alphanumeric, 10 function and four cursor position plus the usual special keys associated with the IBM PC such as PrtSc (print screen), Ctrl (control), Alt, Num Lock, Scroll Lock and Esc (escape).

Unlike the IBM PC, the DG/One has large Shift and Return keys where a typist would normally expect to find them. A numeric keyboard is superimposed over a group of keys on the righthand side of the keyboard and is brought into play by pressing the aforementioned Num Lock key.

Disks are loaded into the side of the unit and the rear of the unit slides down to double as a keyboard tilt and reveal the serial and expansion ports. An external 5-1/4 inch disk drive may be attached to the unit, allowing it to run most of the software available for the



Above: The LCD screen and tilt control of the Data General One.

IBM PC and transfer non-copy-protected software to the 3-1/2 inch format.

Innovative circuit

Three aspects of the DG/One represent breakthroughs in computer design. The first is the large LCD screen. The size of this is stretching the present technology to the limit both in manufacturing the display itself and in the circuitry required to drive it.

Such a large screen, with 163,840 individual picture elements (pixels) cannot be refreshed often enough to produce a dark enough image. The solution was to break the display into five sections which are effectively driven in parallel, using multiplex circuitry. This solution presents a problem in itself as it makes it difficult to obtain smooth scrolling down the five "screens". Complicated video driver circuitry is needed.

To solve this, the DG/One uses two CMOS 4000-gate arrays. One array controls the LCD screen's contents and contrast while the other controls the microprocessor as it accesses the video memory. The latter array effectively provides the key functions of the Motorola 6845 video controller chip (as used in the IBM PC).

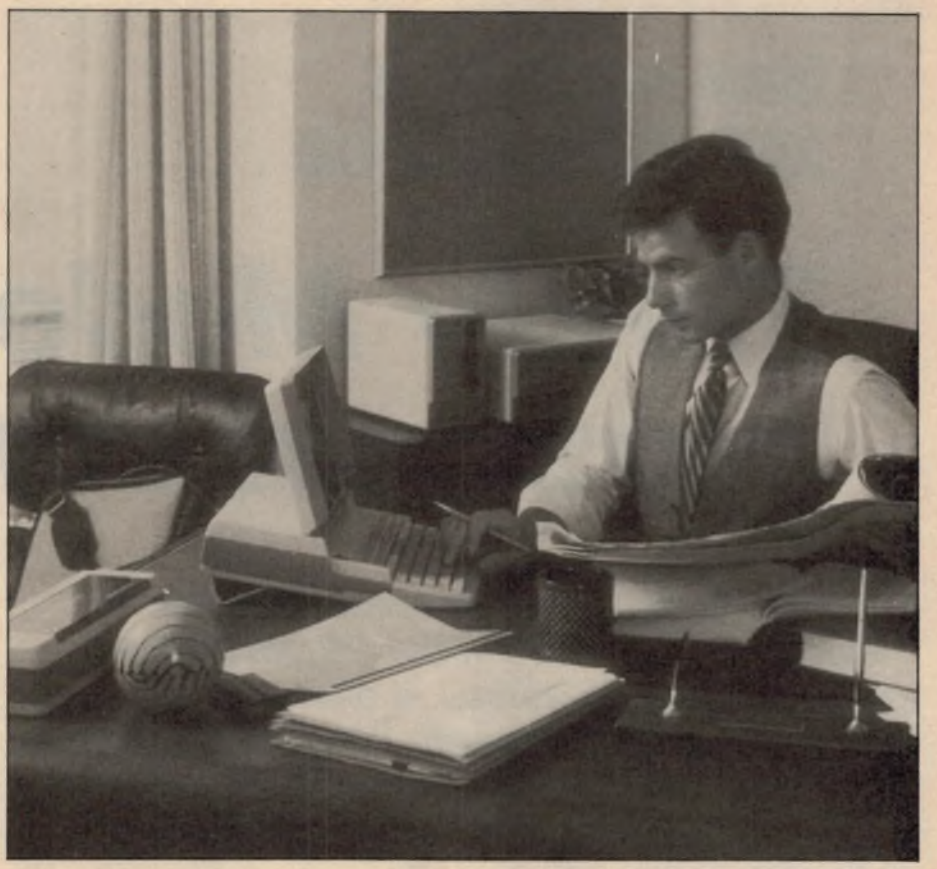
All the other key circuit elements are also CMOS devices, to minimise internal heat and current drain. The processor is an 80C88, a CMOS version of the 8088 used in the IBM PC. It runs at 4MHz, versus 4.77MHz in the IBM.

The circuit boards were also kept as small as possible by using a large proportion of surface-mount components. For example, the 128K memory board is about the size of a playing card and has 18 chips on it; nine per side.

What's it like to use?

Within the constraints of a restricted operating session during an airline flight, the DG/One appears to perform very well. During the flight a large batch of machines were available to try for all and sundry and they were running a large variety of software. The programs included Wordstar Professional, Lotus 123, dBase III, Open Access, Multiplan, Supercalc 3, Crosstalk and Flight Simulator. All appeared to run identically to the IBM, and at much the same speed. But your intrepid editor found that there are difficulties.

The first is the LCD screen. It is difficult to get the screen at an optimum angle which gives good display visibility without reflecting the ambient lighting unduly. Clearly, such screens have a long way to go before they match the convenience and legibility of a conventional CRT display or the much more expensive electroluminescent display.



The Data General One gives you at-the-office features in the go-anywhere size of 348 × 297 × 71mm.

The character set of the display is good and has a 2:1 aspect which matches that on a typical 25-line by 80-column CRT display. Characters M and N are hard to distinguish though and if the cursor is buried within a paragraph of text it is impossible to find. In this circumstance, the only way to locate the cursor is to move it to the end of a particular block of text.

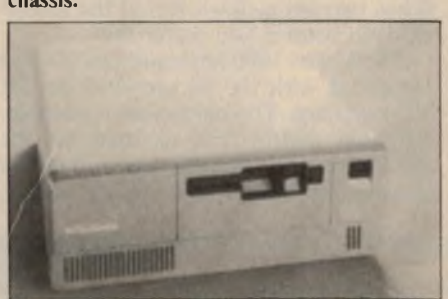
On the other hand, scrolling the display did not present any problems. In fact there was less "after-image" than with typical high resolution monochrome CRT displays using long persistence phosphors.

There is one particular problem entailed with operating the DG/One within the confines of a standard airline seat. Even when the seat in front of you is fully upright, there is not enough room to position the DG/One comfortably far enough away on your lap; the result is that your elbows are jammed into your seat's back as you use the keyboard. Just whether the airlines will allow use of computers like the DG/One has yet to be determined too. On the same flight were two technicians who were measuring the incidence of any radiated signals from the machines. At the time of writing, the results of these tests were not known.

Clearly though, the Data General One is a significant development which will become the benchmark by which all future laptop portable computers are likely to be judged. Price of the machine with one disk drive and 128K of RAM is just over $4000.

For further information, contact Data General Australia Pty Ltd, 30 Ellingworth Parade, Box Hill, 3128 or interstate branches.

Below: Data General One's expansion chassis.



New machine is IBM PC-compatible . . .

Tandy Model 1000 personal computer

The new Model 1000 personal computer is Tandy's first real entry in the PC-compatible stakes. Attractively priced, it offers a high degree of compatibility with PC software. At the same time it comes complete with its own suite of easy-to-use integrated office applications software.

by JIM ROWE

As someone who has been using an IBM PC fairly constantly for the last year or so, I was very interested to check out the new Tandy Model 1000. During my recent sojourn in retailing I also spent some time working on the development of another PC compatible, which can remain nameless here. This gave me quite a reasonable insight into the various aspects of software compatibility. In case this sounds as if I'm likely to be too critical of the Model 1000, I should perhaps add that I was the first person to review the original Tandy TRS-80 in Australia — and it was a very favourable one.

To proceed, then. The new Model 1000 is the latest addition to the Tandy stable of computers. It uses a 16-bit 8088 processor, like that used in the IBM PC, and is advertised as being software compatible with that machine.

It even looks a little like the PC, although it's actually more compact — about 65mm less wide, and about 75mm less from front to back. Overall size of the main case is 418 × 335 × 145mm (L × D × H). The keyboard is separate, like the IBM, and is also more compact — about 45mm less wide, with overall dimensions of 416 × 196 × 34mm (L × D × H).

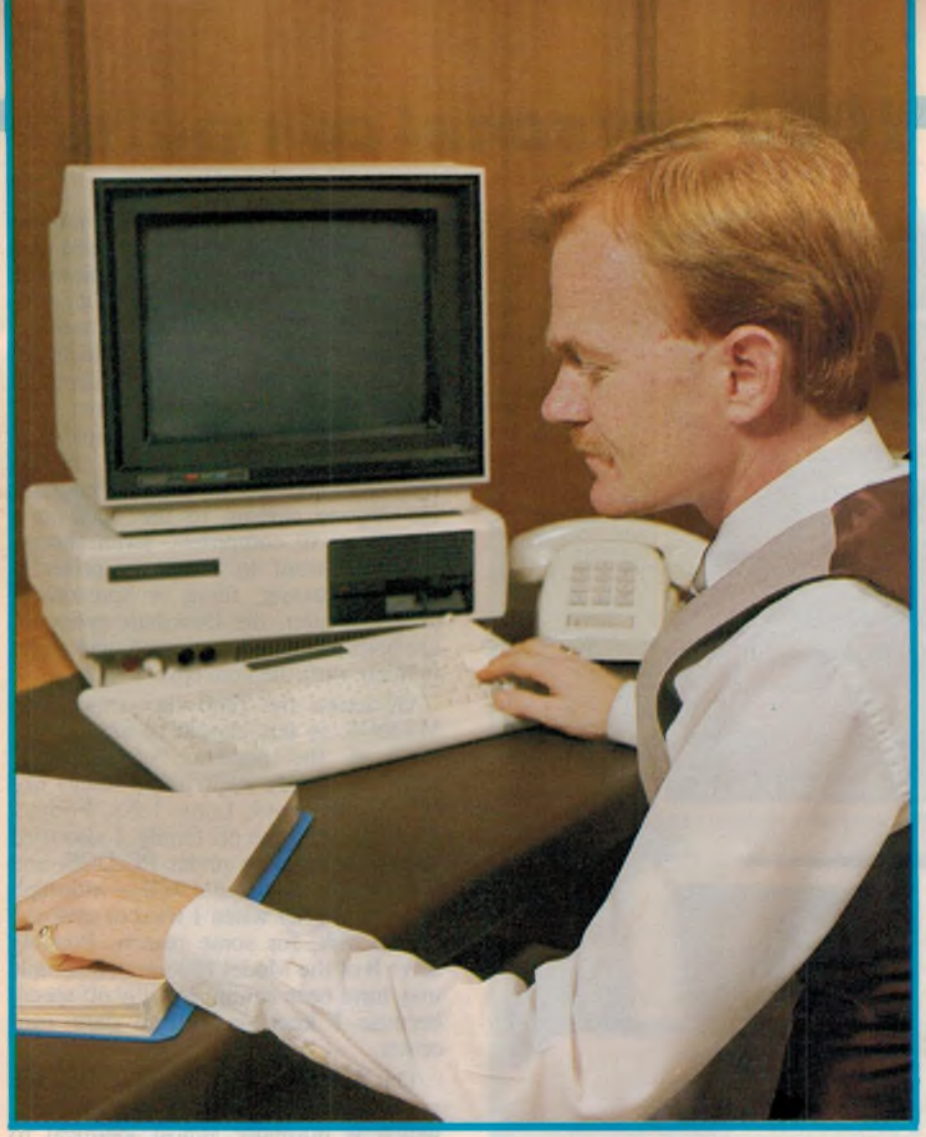
Both the main case and the keyboard are moulded in an attractive buff-coloured plastic, ABS by the look of it. They are particularly high quality mouldings, finished in a very nice "wrinkle" texture. Being moulded in plastic the keyboard is very much lighter than that of the IBM, but despite this it is quite stable on the desktop and feels surprisingly solid. Like the PC keyboard it has two swing-down feet at the rear to tilt it forward if you prefer this.

The Model 1000 keyboard has 90 keys compared with the 83 provided on the PC keyboard. The key action is positive, although slightly less so than on the IBM. There are quite a few differences between the two in terms of key layout, however. Perhaps the most obvious of these is that the programmable function keys on the Model 1000 are in a horizontal row along the top, above the normal number keys, instead of in two vertical columns at the left end. There are also 12 of these keys, instead of only 10.

Another noticeable difference, at least for someone used to the IBM keyboard, is that cursor movement is not controlled by second functions of the numeric keypad's 7, 8, 4, 6 and 2 keys, but by five dedicated keys positioned just below and to the right of the ENTER (return) key. And the main four keys are not in the familiar (and handy) "diamond" configuration, but in an "inverted-T" with the left, down and right movement keys all in a row, and the up and HOME keys above them. The HOME key is to the right of the up key, as well. Not much difference, perhaps, but just enough to throw you for a while!

On the really positive side, the CAPS LOCK key is in a much better position than on the IBM. The PC keyboard has this key immediately to the right of the shift bar and immediately below the right-hand SHIFT key, where I for one tend to hit it accidentally quite often. Instead, the Model 1000 keyboard puts the key right out of harm's way, at the lower left-hand corner.

Another really good thing about the Model 1000 keyboard is the place its cable plugs into the computer: not right around at the rear, but on the front. This not only makes it very much easier to connect it up, but also allows you to have the keyboard on your lap or knees if you



like to relax a little while "slaving over a hot keyboard". In theory you might be able to do this with an IBM, but it's almost impossible to do so because most of the cord is used up in going around the computer to plug in at the rear.

Incidentally, just alongside the keyboard socket on the lower left front of the Model 1000, there is a red RESET button. It's easy to find when you want it, but not in a position where you could press it accidentally and come to grief. It's a handy feature, even though you can still boot using the same three-key combination of CTRL.ALT.DEL as used on the IBM.

The Model 1000 itself normally comes with 128K of RAM and one half-height 5¼ inch double sided, double density 360K floppy disk drive. The RAM can be expanded up to 640K with the usual plug-in boards, which are pin compatible with the IBM 62-way bus connectors. Similarly a second half-height floppy disk drive can be fitted inside the case, above the first. The machine reviewed had been fitted with the second drive, and also had an extra 128K of RAM.

Inside the 1000, there is the usual U-shaped metal chassis with a large mother PCB mounted horizontally on the bottom. A compact switch-mode power supply is above the main PCB at the rear on the right-hand side, with the floppy disk drives also above the main PCB but at the front right. The expansion card slots are on the left-hand side, in virtually the same place as they are in the IBM.

There are only three expansion slots, which superficially seems to give less expansion potential than the five provided on the IBM. However, the Model 1000 has the video graphics display controller and all of its associated housekeeping on the main PCB; this is also the case with the Centronics printer interface and the floppy disk controller. With the IBM these are all "options" on plug-in cards, which take up at least two of the five slots before you start.

So in reality, the Model 1000 has exactly the same expansion potential. Or more accurately, it's slightly ahead — because joystick and light pen interfaces are also built in already.

By the way, the Tandy literature implies that the Model 1000 video graphics circuitry is virtually equivalent to both the monochrome and colour graphics adaptors on the IBM. Unfortunately, I wasn't able to check this out in detail, but it certainly seems to be compatible with "cranky" software.

Before going any further, a general comment. I think there is still quite a deal of confusion around regarding the real meaning of "IBM-PC software compatibility". So it seems a good idea to clarify at least what I understand that term to mean.

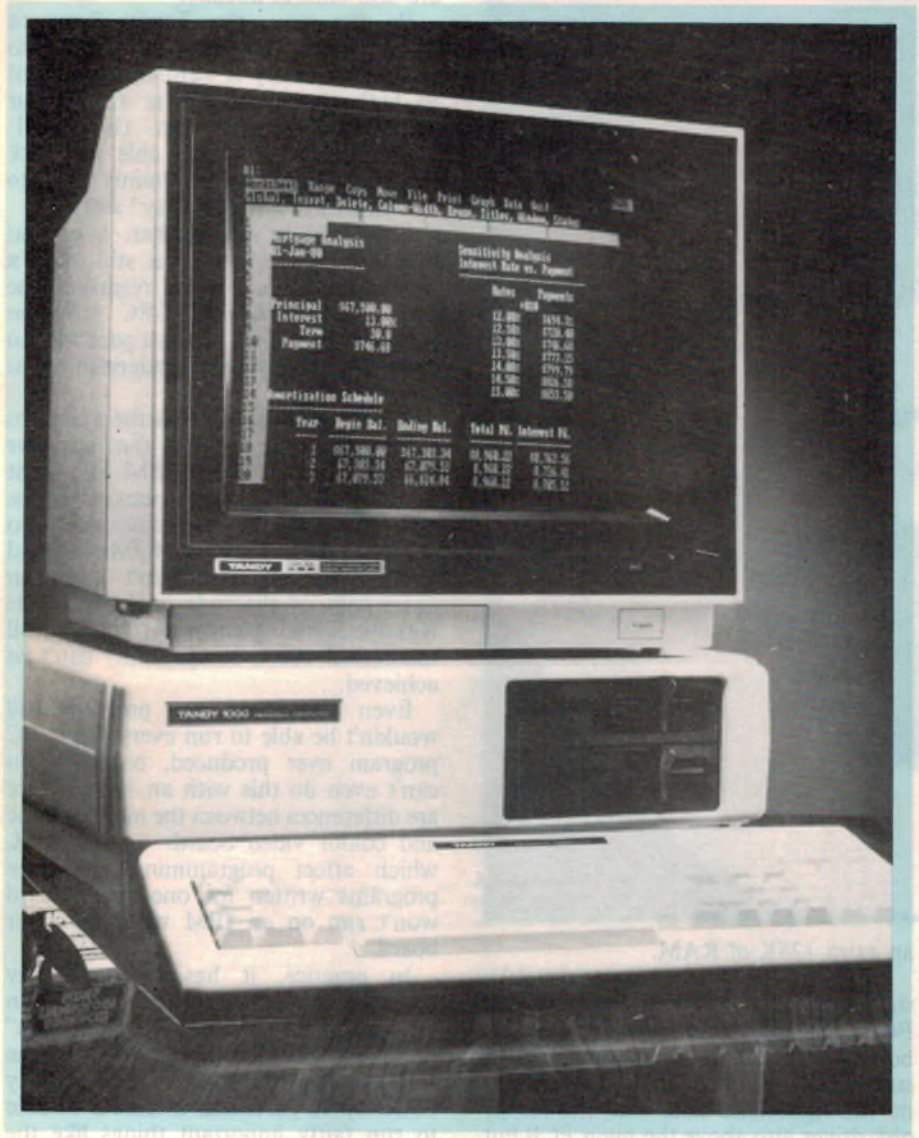
What it *doesn't* mean is the ability to run every single program that has ever been produced for the IBM PC. That isn't legally possible, because some programs make use of routines built into the IBM PCs internal ROMs — and another manufacturer can't make an exact copy of the code in these ROMs without breaking copyright law. So full theoretical 100% compatibility can't be achieved.

Even if it could, you probably still wouldn't be able to run every single PC program ever produced, because you can't even do this with an IBM. There are differences between the monochrome and colour video boards on the IBM, which affect programming. So some programs written for one video board won't run on an IBM with the other board.

In practice, it has become fairly accepted that a personal computer can be described as "PC compatible" providing that it will run most of the software written for the PC (say 85-90%). In particular it should be able to run fairly important things like the PC-DOS and MS-DOS disk operating systems, and at least PC BASIC's half-twin GW BASIC. To get the full "maximum legal compatibility" rating, it should also be able to cope with some of the trickier applications programs like Microsoft's "Flight Simulator", which makes naughty calls directly to the IBM's video graphics hardware circuitry rather than use the machine's own BIOS routines as an intermediary.

Well then, how does the new Tandy 1000 stack up when judged on these criteria? From the tests I have been able to perform, it comes out very well. PC-DOS ran quite normally, while Flight Simulator also ran without a hitch. And it actually comes complete with its own versions of both MS-DOS and GW

Tandy Model 1000 personal computer



BASIC, so these obviously run also — although more about the GW BASIC later.

Needless to say, it won't run BASIC or BASICA, the two IBM disk BASICs. And it shouldn't be able to, either, as these both call routines from the PC's ROM BASIC. If you call them from a PC-DOS disk, they won't even load. But this is what you'd expect. In short, the Model 1000 certainly seems to get its "wings" as a fully PC software compatible machine.

It's interesting, though, that Tandy has been shrewd enough to limit compatibility the other way. The Model 1000's own version of MS-DOS won't boot up on a PC — when you try it, all you get is a prim little message advising you that it will only work on a Tandy 1000. Similarly, although the Model 1000's suite of office applications software seems to run on the PC under PC-DOS, most of the crucial functions like saving files to disk and returning to the main function menu screen are controlled by the Model 1000's two extra function keys, not present on the IBM keyboard!

The suite of office software that comes with the Model 1000 is called "Deskmate". It consists of six basic applications programs, integrated within a "shell" which provides a friendly display of date, time and diary notes plus cursor-controlled selection of both the applications program you want to use, and the data file it is to use.

The six applications programs are TEXT, a modest but quite practical word processor; WORKSHEET, an easy to use spreadsheet; FILER, a basic data filing system; TELECOM, a communications terminal program; CALENDAR, which is like a monthly planning diary; and MAIL, which lets you exchange electronic mail with other Model 1000 users over the phone.

All of the Deskmate programs seem very friendly and easy to use. In fact they seem an excellent suite of programs for anyone coming to the 1000 as a newcomer to computers. Even though you may want to use more powerful word processing, filing or spreadsheet programs later, the Deskmate programs are both practical and a good way to get familiar with the concepts.

Of course the 1000 also comes with MS-DOS, so you should be able to run most of the popular "sophisticated" software. Tandy itself offers things like Microsoft's Word, Lotus 1-2-3, Friday!, Multiplan and the pfs family. I also tried Wordstar, running under PC-DOS, and it seemed to work quite well — although it came to grief when I tried to save the file to disk, for some reason. Possibly drive B of the Model 1000 review sample may have been running a trifle off speed, because I kept on getting data read errors.

On the Model 1000's MS-DOS disk you also get Microsoft's GW BASIC, which is normally almost identical to IBM's BASICA in terms of functions. However, in trying some of the colour graphics functions I could not get some of the high-res plotting commands to work. Then I found a little note with the manuals, saying that the version of GW BASIC currently supplied does not have all of the features implemented as yet. Apparently Tandy is working on these, and registered owners will be advised when the enhanced version is available. Things not implemented at present include some high-res graphics modes, OPEN COM and some of the other communications features, and BEEP ON/OFF.

This is a little disappointing but at least Tandy does give you the DOS and BASIC along with the computer itself. With the IBM, the DOS and Disk BASIC are "options" for which you have to pay extra — although you do get rather better manuals.

There are four manuals supplied with the Model 1000. One is an introduction to the computer itself and a tutorial for the Deskmate suite of programs; another is a more complete reference manual for

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*User installable. **Note: only 3 slots available on PC for expansion. †TM IBM Corp.

Compare Tandy 1000 with the IBM PC†

Feature Description	Tandy 1000	IBM PC
Monochrome Graphics	Yes	Option
Color Graphics	Yes	Option
Printer Interface	Yes	Option
Joystick Interface	Yes	Option
Keyboard	90 Key	83 Keys
Light Pen Interface	Yes	No
Hard Disk	Option	Option
Secondary Floppy	Option*	Option
DOS/BASIC Included?	Yes	No
Bundled Applications	Yes	No
PC Expansion Slots	3	5**

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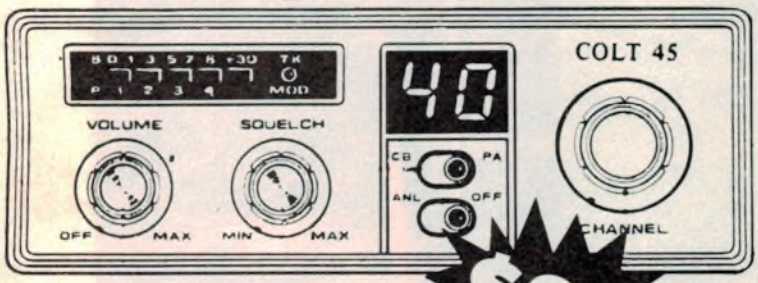

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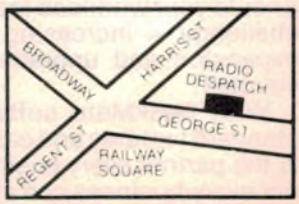

MSX computers in the US: not yet, maybe never!

The Japanese have long sought a share of the international home computer market, especially in the US. Fifteen manufacturers (12 Japanese), have home computers ready to go, but are hesitant to release them.

by LOUISE UPTON

The Japanese face several problems in entering the very competitive US market. The first is the slump in the total computer market which is affecting the demand for all the cheaper home computers. Consumers are moving towards the more expensive IBM and Apple models. Although these are pricey, their capabilities are more suited to the buyer who now wants a more practical machine.

In the light of this trend, some hesitation on the part of the Japanese is understandable but this lucrative American market, predicted to reach $3.7 billion this year, is not about to collapse completely. The bubble may be bursting but the Japanese have always been noted for their tenacity. The question being asked by some US analysts is, "Why not strike while the iron is still warm?"

The Japanese were supposed to have entered the US market with MSX computers by Christmas 1984 but their hesitation means they may not be seen in large quantities until the end of 1985, and this could be too late.

The second problem confronting the Japanese is the newness of the MSX system. It is not well-known in the American marketplace. And unless Matsushita can be persuaded to spend $30 million for a concentrated advertising campaign, MSX computers will face a further lack of support on the part of both the consumer and retailer.

A consequence of, and contributing factor to, the relative obscurity of the MSX system is the lack of adequate software support. The small amount of software that has been converted to run on MSX machines is mainly game packages. It seems that the software houses are just not bothering to convert and produce packages until MSX computers begin to arrive in large numbers.

The main sales feature for MSX home computers is the standardisation of products amongst suppliers. Any software cartridge can be plugged into any computer, and any MSX computer can be plugged into any printer. This standardisation may help to stop it becoming just another home computer product failure.

MSX machines have been introduced onto the Japanese and British markets, with a certain amount of success. Since the arrival of MSX machines in Britain, over 150 software packages have become available. Most have been games, although programs for business applications are growing in number and variety.

In Britain however, MSX machines have been more expensive than most competing models and the consumer has tended to purchase the cheaper machines instead. At the same time, the "shakeout" occurring in the US has hit Britain. In the light of this trend, the Japanese may have the ideal home computer but it could be two years too late.

As a footnote, Sony and Toshiba have recently launched their MSX machines on to the Australian market. It remains to be seen whether they forge ahead or sink into obscurity.

Tandy Model 1000 computer—ctd from p92

Deskmate; the third is a Quick Reference Guide for Deskmate; and the fourth is a BASIC Reference Guide. Other relevant books are available from Tandy separately, including a full BASIC Reference Manual and "Learning BASIC for the Tandy 2000/1000", by that excellent writer David Lien.

To return briefly to the Model 1000's hardware, it provides both composite colour video output via an RCA-type socket and discrete RGB video, via the same kind of DB-9 connector used on the IBM. In addition to the inbuilt speaker there is also an audio output, via a second RCA socket at the rear. But there is no provision for turning the video monitor on and off using the Model 1000's power switch.

The Model 1000 reviewed came with a sample of Tandy's new CM-2 33cm high resolution RGB colour video monitor, as shown in the photographs. This gave very good results indeed. It seems to have plenty of brightness, high bandwidth and resolution, clean colours and freedom from convergence errors. The EHT and focus supplies seem to be well regulated also, as there is very little picture "blooming" or defocusing when you increase brightness. In short, it seems an excellent colour monitor, not only for the Model 1000 but also for a PC. The pin connections seem to be identical, and it works perfectly.

All in all, I'm very impressed with the Tandy Model 1000 package. At $1,999 for the basic 128K/single floppy machine, complete with DOS, BASIC and Deskmate software, it seems excellent value for money. It is certainly a very welcome entry into the PC compatible arena, and seems likely to give many of the other contenders a tough time.

The quoted cost for a second 360K floppy drive is $399, not including installation if required. The 256K memory expansion board fitted with 128K of RAM costs $599, while a further 128K of memory costs $499. The optional board to provide an RS-232C serial port for data communications is $199.95. The CM-2 RGB colour monitor costs $899, but there is a VM-2 monochrome monitor available for $349.95. There is also a hard disk controller board priced at $549.95. Tandy can provide a matching hard disk drive, other memory expansion cards and of course a variety of suitable printers. It can also supply the Australian-designed "Attache" range of business software, in addition to the software mentioned earlier.

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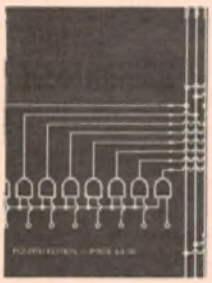

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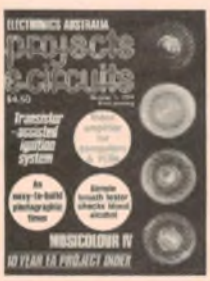

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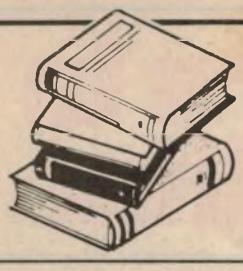


VLSI design principles

BASIC VLSI DESIGN principles and applications: by D. A. Pucknell and K. Eshraghian. Published by Prentice-Hall of Australia Pty Ltd, 1985. Hard covers, 282mm × 218mm, 301 pages. Illustrated with line drawings, tables and circuits. ISBN 0-13-067851-1. Recommended price in Australia, $35.95.

Since the early 1960s there have already been four distinguishable generations of integrated circuits; from Small Scale Integration through to Medium Scale Integration in the 1960s followed by, in the 1970s, Large Scale Integration. Now for the 1980s, we have Very Large Scale Integration (VLSI).

VLSI circuits are available as stock items from the various IC manufacturers or they can be custom designed for specific applications. The ability to design VLSI circuits will become more and more important, particularly for the design engineer and indeed for other disciplines. This book is to educate those requiring the skills to design VLSI circuits and is the result of three years teaching experience at the University of Adelaide.

Many of the design examples provided in the book have been tested as projects for Australian Multi-Project Chips (AUSMPC) fabrication. This facility was created by the Australian CSIRO VLSI research group led by Dr Craig Mudge.

The book concentrates mainly on nMOS technology since nMOS design methodology is easily learned. Further, nMOS fabrication is such a stable process that manufacturing facilities are widely available. As a consequence, the nMOS design process is an excellent background for other technologies such as CMOS. It has the added advantage of being fast and the possible integration density is high.

Chapter one reviews microelectronics and introduces nMOS technology. It investigates enhancement and depletion mode transistors and then their fabrication. All text descriptions are fully complemented with many line drawings which enables a full understanding of the discussion.

The second chapter moves on to the basic electrical properties of nMOS circuits. It explains that the concept of the nMOS transistor is to provide a voltage on the gate to induce a charge in the drain-source channel. This charge can then be moved from source to drain by the influence of a voltage between drain and source. Equations are then given to describe the transistor as a physical device.

All aspects of the transistor are covered and these include the saturated and unsaturated regions, the threshold voltage, transconductance and the figure of merit (indicates frequency response). Arrangements such as series pass transistors, inverters and the effect of coupling these together completes the chapter.

The next few chapters cover circuit concepts. These include design that shows both layer information and topology, components such as sheet resistors, layer capacitors and delays. Once these are understood, the subsystem design can be implemented. This includes switch logic, gates and combinational logic.

Chapter six is titled Scaling of nMOS Circuits. This is an interesting chapter which details how designs are formulated so that they can be directly scaled from the dimensions of the circuits. This means that a design is not automatically outdated when line widths in the IC manufacture are reduced.

There are 12 chapters overall. They include design examples and tutorial exercises. Computer Aided Design tools are needed for laboratory work, however and exceptional amount of design knowledge can be obtained simply by reading this book. It is both practical and informative.

Several appendices are included mainly on CAD programs and languages such as BELLE and ABCD.

The book is recommended without reservation to anyone interested in serious study on VLSI design. (ACL)

Practical circuit analysis

ELECTRIC CIRCUITS, THEORY AND ENGINEERING APPLICATIONS: by Carl H. Durney, L. Dale Harris and Charles L. Alley. Published 1982 by College Publishing, New York. Hard or soft covers, 242mm × 185mm, 481 pages, illustrated with diagrams. ISBN 0-03-057951-1. Recommended retail price $24.95 (soft covers), $64.95 (hard covers).

This book was written by three academics from the University of Utah specifically as a text book for an early circuit theory subject for electrical engineering students. The content of the book is fairly traditional in that it covers the various methods of circuit analysis familiar to anyone who has studied electrical engineering or electronics. The book differs from the usual texts in that it attempts to present this work in as practical way as possible.

This approach is based on the philosophy that students will be motivated to learn only if they perceive the material as being useful or relevant. Unfortunately it is not possible to escape from the mathematical basis of circuit analysis, and the authors have wisely chosen not to attempt to do this. The result is a very useful and instructive book which thoroughly covers the appropriate material while remaining in contact with the type of engineering problems encountered in the real world.

Emphasis is placed on the problem solving approach right from the start, with the student being encouraged to look for the simple answers before launching into an unnecessarily detailed analysis. Importantly, the student is encouraged to examine the consistency of the solution that he has obtained with the problem he is attempting to solve.

Being written as a text book for first or second year engineer students the book does assume that the reader has a certain amount of background knowledge. This includes the fundamentals of calculus, complex number theory, matrix algebra and basic physics. As well, the reader ought to be fairly adept at algebra, most of the book being devoted to examples.

The first part of the book covers a wide range of DC circuit analysis techniques including Kirchhoff's laws, voltage and current division, circuit reduction, Thevenin's and Norton's theorems, superposition, as well as branch, loop and nodal analysis.

The book then moves on to cover AC circuit analysis using sinusoidal steady state analysis, Fourier series and the Laplace transform. Further topics covered include resonance, magnetically coupled circuits (transformers) and polyphase systems. Appendices cover complex number theory and techniques for more complex networks.

Continued on page 124

Letters to the editor

Time delay in CD players

The reaction of people to the 11.34μs time delay between channels during compact disc reproduction never ceases to amaze me. I had hoped that with the realisation that an 11.34μs delay is inaudible all reference and complaint about it would cease.

Not so, however. A. L. Jones in your May magazine has found a new "problem" caused by this time delay. Apparently, noticeable high frequency attenuation occurs when stereo recordings are reproduced in mono.

In order to put the time delay question to death once and for all, I will briefly cover a few of the processes involved in generating the audio signal you listen to in your own home (record and CD).

(1) First the recording studio. As any one familiar with the characteristics of sound waves in air is aware, sound travels less than 4mm in 11.34μs. A movement of less than 4mm by the microphone, instrument or recording artist would have the same effect as the CD channel delay

(2) The studio mixer. More than two microphones are in use in most studios with their outputs mixed to produce the left and right stereo channels. The mixers are good but the possible phase relationships caused by this process defy description.

(3) Digital mastering. If the studio recording was direct digital mastered there may already be a phase delay (perhaps the CD phase delay cancels this delay) due to the analog to digital conversion process on the original signal.

If the master recording was analog, then it must eventually be digitised for the CD.

(4) Playback. Since you eventually hear the CD in air, the same point I made in (1) above applies. Any movement of the head or speaker by 4mm will have the same effect as the 11.34μs channel delay.

The point I am making? The effect of the speed of sound on the original and reproduced signal will swamp any channel delays. More importantly, this effect is common to both CD and the original vinyl record.

Why were these "problems" never noticed until CD? Because CD is better quality and has so little wow and flutter that these effects can now be observed without expensive equipment.

One final point to A. L. Jones. The "notch" caused by turning a stereo signal into mono would occur at 44.1kHz not 22.05kHz. The effect of the CD phase delay at 20kHz (the limit of most ears) is negligible. The noticeable high frequency fall off of a mono version of a stereo signal is not due to the CD phase delay. Signal interaction between the left and right channels of a stereo recording has and always will occur.

The same phenomenon is detectable on vinyl records and is one of the reasons stereo sounds better than mono. If you know of anybody who has bought a CD phase compensation device to remove the channel delay on a compact disc, I would like to talk to them. I know of some beach front property in Alice Springs they may like to buy.

A. Burton,
Pascoe Vale, Vic.

Mosfets: the myths dispelled

I am writing to dispel, somewhat, the myths that have been floating around about the marvellous bias stability of power Mosfets.

Sometime ago I was developing an amplifier in the course of my job. Basically the amp was required to deliver 100V peak at up to 1A peak, with a frequency response from about 5kHz to over 100kHz. I decided to opt for a transformer coupled output (for isolation and voltage step up) driven by two N-channel FETs (IRF250s) in a common source configuration, the nett effect not much unlike old push-pull valve output stages.

I cannot recall what prompted me to check the bias behaviour of the FETs, but it is a good thing that I did. Mosfets are not really that stable. They can and do display thermal runaway behaviour, possibly greater than that displayed by bipolar transistors.

The problem is that the threshold voltage drops approximately 0.5V if the junction temperature rises from 25°C to 125°C. This is an average of 5mV/°C, so that if a cold FET is biased for a particular quiescent current with a fixed gate-source voltage (no source resistors, or small source resistors) the quiescent current will in fact rise (quite dramatically sometimes) as the device heats up.

With the FETs I used the increase in current was 60mA/°C! This makes it virtually impossible to set a quiescent current at (say) 50mA or 100mA and expect it to stay there without some sort of stability feedback (source resistors or thermal feedback source resistors are not always an option).

I found that it was possible for the FETs to reach a quiescent current of 1A after being set (and sometimes reset) at 100mA, even at fairly moderate voltages (24V).

Mission DAD 7000 CD player review

I am writing in reference to your review on the Mission DAD 7000 compact disc player in the March issue. While I found the review to be technically exacting I noticed with some interest that at no stage did you speak of the audible performance of the unit, other than to say in conclusion that "it sounds beyond reproach".

While I am aware that technical measurements are essential in such a review, it is also obvious that they only tell half of the story. The industry has known for many years that good specifications do not ensure good sonic performance and vice versa.

The compact disc player market is, like all other areas of the market, becoming fragmented. Already some companies are producing units with price becoming the major criterion, while others are producing more expensive units with quality being the major goal. In fact, I feel that the time is close when some compact disc players will not be found in hifi specialty shops as their performance will not measure up (we do not carry $99 turntables for this reason).

So surely when reviewing compact disc players you should treat them the same way as any other category of product that you review, and comment on their audible performance. How else can brands such as Mission, Meridian or Nakamichi justify their higher prices? After all, they do not offer any extra facilities.

L. Wallis,
Len Wallis Audio Pty Ltd,
Lane Cove, NSW.

I checked as best I could (power Mosfet data is not all that common) and found, for example, that quite a lot of Hexfets (International Rectifier) had virtually the same average −5mV/°C temperature dependence of the threshold voltage. The variation in drain current is dependent upon the device's gain (Gfs).

According to Horowitz & Hill ("The Art of Electronics", p66), the temperature coefficient of a bipolar transistor Vbe is −2.1mV/°C. Whether this applies equally to power transistors as it does to small signal jobs is unclear — data is pretty scarce here too. This is less than half the analogous parameter for a Hexfet.

The actual roll off in transconductance of the FET with increasing temperature does not really start to happen except at fairly high temperatures, ie Mosfets display reasonably good bias stability if you want to fry eggs on them.

I realise that Mosfets are less likely to self destruct from thermal runaway but I would not say it was impossible. I realise also that it depends on the power dissipated, the heatsinking used and the ambient temperature, but it does not alter the fact that these devices are not as stable as the popular electronic press might have us believe. I am not the only person to have come across this phenomena.

What happens for example in a hifi amp that delivers 100W for a while. It might dissipate 50W in the output stage, 25W in each half (top and bottom, for complementary symmetry). If the total thermal resistance from junctions to ambient is 2°C/W (a bit generous), then the junction temperatures may rise 50°C, so the threshold voltage drops by 250mV while the gate-source voltage is held essentially constant (at least in all the designs I have seen).

Supposing the transconductance of the devices is about 1S (conservative for medium to big devices), then the quiescent current rises by a quarter of an amp. For the Playmaster 200 amplifier (EA Jan, March, May 1985) with 65V supplies, this amounts to another 16W to be dissipated by the output transistors. No wonder Mosfet power amps tend to drop in output capability as they warm up — a lot of the warm up is probably due to unstable quiescent current.

This is a fairly arbitrary example but not unrealistic. I believe the problem could be worse than I have described. Whether it will ever lead to the death of a device is debatable, but at least the performance (at high temperatures) and the bias and thermal stabilities can be improved simply by using the humble Vbe multipier seen so often in amplifiers using bipolar output transistors. The idea works well with some consideration given to the different situation that exists with power Mosfets (higher threshold voltage and higher temperature coefficient).

I have presented all this to clarify things and perhaps save a few burnt fingers.

P. Denniss,
Department of Plasma Physics
University of Sydney.

● *We agree that Mosfet power transistors are temperature dependent but above a certain level of bias they do have a temperature co-efficient. You are right in asserting that this level of bias generally means a fairly high level dissipation.*

Amateur radio cook book

The Wagga Wagga District Amateur Radio Club is compiling an Australia-wide "VK Cook Book".

Letters were sent to over 100 radio clubs throughout Australia inviting amateurs and families (eg, XYLs, YLs and OMs) for their favourite recipes.

The book will be printed and for sale at our convention which will be held in Wagga on the 26th and 27th of October '85. So send your entries to this address: PO Box 126-s, South Wagga, 2650.

D. Longmore, VK2ZYE,
Wagga Wagga, NSW.

JAYCAR - KIT SUPPORT FOR ALL

'ELECTRONICS AUSTRALIA'

BUSKER AMPLIFIER

Ref: EA February 1985

Fantastic portable amplifier kit for low-level P.A., Buskers or for practice.

☆ **Battery or mains operation** ☆ **Full control - bass, treble and volume** ☆ **2 inputs (low and high)** ☆ **17 WATTS RMS output** ☆ **Gel battery automatically recharged when mains used.**

☆ **INTRODUCTORY PRICE** ☆

All electronics including GEL battery, 8" speaker, metal chassis etc
Cat KA-1592

ONLY $125

PRE-CUT WOODEN CABINET to suite Cat KA-1593

ONLY $30.00

BUY BOTH AND PAY ONLY

$149.00

A FURTHER SAVING

BRAND NEW KIT FROM JAYCAR

8 SECTOR BURGLAR ALARM

Ref: EA Jan/Feb 1985

Why buy a commercially made up unit for more when you can buy this kit and SAVE money! A unique feature of this kit is the fact that you can wire N/O and N/C alarm sensors ON THE SAME LINE.

☆ **8 sectors** ☆ **2 delayed entry sectors** ☆ **Steel box** ☆ **Includes battery and siren driver in the price** ☆ **Variable exit and entry delays.**

Cat KA 1580 **$149.00**

MOTORCYCLE INTERCOM

Ref: EA February 1984

What a great kit! This full duplex unit enables you to talk to your pinion passenger whilst driving with your helmets on! Powered by the bikes battery - you can both talk at the same time if you wish as there are no switches to activate. The Jaycar kit includes the special headphone inserts and all parts.
Cat KA-1533

ONLY $39.95

MUSICOLOR IV

Ref: EA August 1981

The ultimate lighting controller. Combines a four channel sound-to-light effect with a four channel chaser

- Front panel LED display
- 4 different chaser patterns
- Auto and manual reverse chase
- Sound triggered chase
- Inbuilt electret microphone
- Safe, opto-isolated circuitry

Cat KA-1010

ONLY $99.90

12/230V - 300 WATT INVERTER -

This unit provides up to 300VA of power at 235V from an ordinary car battery. It is ideal as a standby AC power supply. The output voltage is regulated and gives a precise 50Hz. The kit also has current limiting with ultimate thermal shutdown.

The Jaycar kit features quality conservatively rated components and is complete down to the case and front panel.

Ref: EA June 1982

Cat KA-1574

$220.00

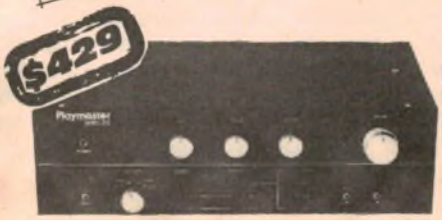
PLAYMASTER SERIES II MOSFET AMP KIT

Ref: EA Jan/Feb/March 1985

"... a stereo amplifier that will equal or better just about any integrated commercial amplifier, regardless of price". - Leo Simpson, Editor of EA, February 1985.

AUSSIE MADE

NOW IN STOCK



MAIN FEATURES OF THE NEW PLAYMASTER

- ★ Switchable phono input for MM and MC cartridges
- ★ Electronic signal switching
- ★ Full facilities for dubbing between two cassette decks
- ★ Monitor loop for either of two cassette decks or a signal processor
- ★ Click action pushbutton switches for selection of sources, dubbing and tape monitor with LED status indicators
- ★ Centre detents on bass, treble and balance controls, multiple detents on volume control
- ★ Heavy duty heatsinks
- ★ Power transformer for low hum and noise
- ★ Easy to build - all parts except power supply mount directly on the two printed circuit boards; wiring has been kept to an absolute minimum
- ★ 100 watts RMS per channel into 8 ohm load
- ★ Less than 0.01% total harmonic distortion

MAIL ORDER HOTLINE

To save you time (and therefore money) we have installed a special HOTLINE direct to the inner workings of our Mail Order dept. This saves you from going through our Head Office switchboard! If you wish to place an order, enquire about an order or simply check for more information, call:

(02) 646 1300

AUSTRALIAN ELECTRONICS WELCOME!

We would like to say "Welcome!" to the brand-new electronics hobby magazine "**Australian Electronics Monthly**". The editor Roger Harrison is known to us all and David Tillbrook chief project engineer, is very highly regarded. David, you may recall designed the incredibly successful ETI 5000 series amplifiers.

Jaycar is very excited about the new magazine, the planned projects and what **AEM** has planned for the electronic enthusiast. Shown below are the Jaycar kits for the **JULY '85 ISSUE** of **AEM**. Don't forget to buy a copy!

AEM 3500 'The Listening Post'

Ref: July 1985 AEM. This device attaches between the audio output of a short wave receiver and the input port of a computer. It allows decoding and printing of Morse Code, Radioteletype (RTTY), AND radio facsimile (FAX) pictures! You can, for example watch weather maps from the Met and dump them on to your printer!

Specific software for the Microbee is in the first article. Programs for other popular computers will be printed in later issues of Australian Electronics Monthly.

Complete set of specified components (inc. IDC plug).
Cat KM-3015

ONLY $29.50 NEW!

8 CHANNEL MIXER Model 8002

Jaycar engineers have produced a real winner with the 8002 stereo mixer. The front panel measures 19" wide x 14" high (8 rack units). This enables the 8002 to be mounted into PA racks if necessary. It has many features including: ● Balanced (600 ohm) mic. inputs/line inputs ● Input attenuators ● Bass, mid and treble qualisation on each input ● "Effects" capability ● Foldback on all 8 inputs ● Stereo pan on all 8 inputs ● 5534A OP amps for low noise and very low distortion PLUS many other features and specs to be found in our 1985 catalogue on page 4/5.

Ref: EA April/May 1983 Cat KJ-6504

ONLY $535.00

★ ★ ★

Meet Roger Harrison & Dave Tillbrook!

Come and have a talk to Roger and Dave at our GORE HILL Store on SATURDAY JULY 13th and 20th from 10.30 a.m. NOON.

Now you can ask them all those questions that you have always wanted, or suggest to them what you think would make a good project. You never know, maybe you will see YOUR idea in print!

5 (6.5)MHz OSCILLOSCOPE KIT

Ref: EA October 1984

Over the years many people have asked, "Do you have a CRO kit?" Our answer - up until now - has been that built and tested units were no dearer than kits, if you get a kit at all.

The Jaycar KJ-7050 Cathode Ray Oscilloscope kit has a guaranteed 5MHz bandwidth but should go to around 6.5MHz. It also features 75mm (3") CRT Blue Phosphor with accurate graticule, separate vertical and horizontal BNC type input sockets etc. Remember, a 5MHz 'scope is usually adequate to troubleshoot most microprocessor and other digital circuitry as well!

This is a wonderful opportunity to learn electronics AND end up with a valuable piece of test equipment as well.

The Jaycar KJ-7050 kit is absolutely complete. The chassis is pre-punched and every component including nuts and bolts are provided, along with instructions.

Cat KJ-7050

ONLY $269

AUSSIE MADE

DELUXE CAR BURGLAR ALARM

Ref: EA May 1984

This unit provides a very comprehensive array of facilities viz:

- ★ Two delayed inputs, six instant
- ★ 10 second delay exit, 10 second delay entry
- ★ Provision for auxiliary battery
- ★ Alarm trips for 2 minutes with automatic rearming
- ★ No separate siren driver required
- ★ 13mA current consumption; 500mA when alarm is triggered
- ★ Flashing dash panel lamp, key operated on/off, provision for 2 way protection

The Jaycar kit includes all PCB components, specified case and Scotchcal front panel.

Cat KA-1550

ONLY $69.50

AUSSIE MADE

THREE PROJECT MAGAZINES

MONTHLY

AEM 6500 - 60/120 Watt Utility Mosfet Amp Modules
Ref. July 1985 AEM

This is a low cost high performance design using proven MOSFET technology. A single pair of (2SJ49/2SK134) Mosfets will deliver up to 60 watts output. Another pair may be added for 120 watt performance. The module has been designed to fit into a large variety of commonly stocked instrument cases and rack boxes. It features VERY LOW distortion and impeccable transient performance. It is unconditionally stable and virtually blow-up proof. It can be powered from common transformer/rectifier/capacitor combinations. A Winner!
As usual, the Jaycar kit reflects a quality approach. All specified components for each version are included.

60 WATT MODULE Cat. KM-3010 **$49.50**
120 WATT MODULE Cat. KM-3012 **$65.00**

AEM 9500 Beat Triggered Strobe - Ref. AEM July 1985
This project provides a very bright stroboscopic effect for parties, discos, etc., but with an ADDITIONAL FEATURE! This strobe will actually flash in synchronisation with the music!
The Jaycar kit includes case, photographic reflector, flash tube etc.
Cat. KM-3018

ONLY $59.00

VIDEO AMP/BUFFER
Ref. EA August 1983

The answer to a maidens prayer? This device can be made to fit inside a TV set (or in a separate box if necessary). It basically enables you to connect straight into the video drive of your TV turning it into a colour monitor. This means that the video signal from your computer, VCR, TV game etc., does not need to be converted to RF and go through the TV IF strip. You will be amazed by the clearer, sharper signal that has less interference! Notes on how to fit to various TV sets included.
Cat. KA-1527

ONLY $14.95

ELECTRONICS TODAY INTERNATIONAL

NEW 4 Input Mixer ETI 1404
Ref. ETI June 1985. This unit enables you to mix 4 separate signal sources. The mixer can be configured to take line, phono, or microphone level inputs. In other words, you can tailor the mixer to your individual requirements! The Jaycar kit includes all parts EXCEPT the front panel & the case, which comes from TANDY!
Cat. KE-4700

ONLY $99.00

NEW OP-Amp Tester
Ref. ETI April 1985. Test OP Amps with 741-type pinouts (e.g. TL071, TL074, 5534 etc), with this nifty tester. Checks single, dual and quad packages!
Cat. KE-4693

ONLY $29.95

NEW Microbee Dialler ETI 698 - Ref. ETI July 1985. Complete set of parts.
Cat. KE-4696

ONLY $19.95

GREAT NEW KITS FROM ETI

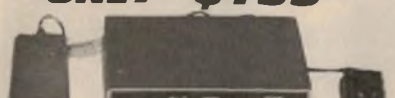
Modem Kit - Ref. ETI May 1985
This brilliant new design is a price breakthrough. Never has a modem with such SOPHISTICATED FEATURES been offered at such an incredibly low price. Now you can have no excuse to gain the tremendous benefits that a modem will offer viz:

- Access to huge data banks
- Networking
- Telecommunications
- Electronic shopping
- Software exchange
- And much more

Cat. KE-4695 **ETI 699**

This ETI kit is a full modem with facilities similar to units costing hundreds of dollars more. It even includes a Telecom approved push button telephone! Now is your chance to use your electronic skills in your new hobby and save a fortune over ready builts.
You can obtain this modem kit (which includes a telephone for us humans) for the incredibly low introductory price of only $149. That's right! $149, inc case, down to the last nut and bolt. But hurry! Stocks of the critical modem chip are very low and will severely limit kit supply.

ONLY $139



ETI ECONOMY HOUSE/CAR ALARM MODULE - Ref. ETI May 1985
This low cost full feature module can form the basis of a sophisticated anti theft system!

ETI 1527 Cat. KE-4698 **$24.95**

ETI 675 Centronics to RS-232 Adaptor
Ref. ETI January 1984

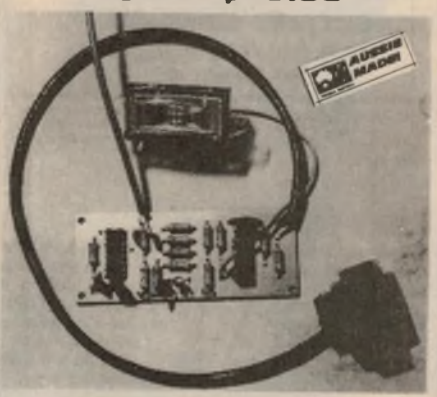
This small project enables you to interface a printer to the RS-232 serial port of your computer. The kit consists of PCB and parts (including a special right angle Cannon DB25 plug) but not the Centronics plug or DIP switches, which are optional anyway.
Cat. KE-4666

ONLY $34.00

ETI 733 RTTY Decoder
Ref. ETI April 1983

This simple project allows you to hook up your Microbee to a communications receiver (or a similar good quality receiver) and print radio teletype messages on your VDU screen. A simple bit of software does the decoding. The kit can be adapted for use on other Z80 based systems. The Jaycar kit includes box, centre-zero meter, DB15 plug and software listing as well as other kit instructions.
Cat. KE-4654

ONLY $19.95

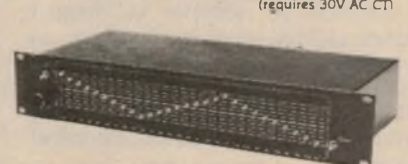


1/3 OCTAVE (28 BAND) GRAPHIC EQUALISER
This kit enables you to control 28 narrow bands of frequencies between 31.5Hz and 16kHz. By being able to do this you will be able to very effectively compensate for acoustic deficiencies in any indoor environment.
The 1/3 (i.e. 3 controls per octave) equaliser has been chosen for the 5000 system as most professional equalisation is done by 1/3 octave units. It gives total control over listening environment.
The Jaycar kit includes fully prepunched and plated chassis, prepunched heavy gauge front panel, anodised and silkscreened to match the other 5000 components. It is original to the ETI design (Jaycar supplied the prototypes) but includes refinements such as quality IC sockets. UNBRAKO front panel fixing screws and matching brushed finish black anodised level control.
Each unit is mono, two will be required for stereo operation.
Cat. KE-4204

1 of $199
stereo pair $389 (SAVE $10)

SPECIFICATIONS

Signal to Noise	−102dB with respect to 1V
Frequency Response	12Hz - 105kHz to −1dB
Boost/Cut	14dB (28dB total)
Distortion	100Hz (0.007%)
	kHz (0.007%)
	10kHz (0.008%)
	(essentially irrespective of cut or boost)
Current Consumption (DC)	Approx. 100mA @ ±15V (requires 30V AC CT)



New Products...

Product reviews, releases & services

New Fluke Multimeters

John Fluke Mfg now offers two new editions to the 20 series of high performance, industrial grade hand-held multimeters. They are the Fluke 21 and 23.

The meters are high-energy protected and designed to survive in rugged environments for such applications as plant facilities and production equipment maintenance, motor and electrical controls, petrochemical and mining operations, automechanics and electrical contracting.

Extensive overload protection and high-energy fusing have been built-in to exceed the most rigorous safety standards. The 21, for example, uses a 1200V MOV (metal oxide varistor) while the 23 features a 430V MOV in series with a spark gap.

The high-visibility (industrial) yellow case is constructed entirely from non-metallic materials with specially recessed input jacks to accommodate safety designed test leads. Both meters come with insulated alligator clips.

The Fluke 21 and 23 include such features as liquid crystal display with digital readout and analog bar graph, fast autoranging, auto-zero, auto-polarity, continuity beeper and diode test and an easy to use rotary dial.

Their accuracy and resolution exceed other 3½ digit meters. The 3200 count digital display updates 2.5 times per second and provides up to 10 times the resolution of conventional 2000 count 3½ digit multimeters.

The Fluke 21 provides 0.5% basic DC accuracy, and the 23 0.3% basic DC accuracy.

Elmeasco Instruments, PO Box 30, Concord, 2137. Phone: (02) 736 2888.

New desoldering station

A portable temperature controlled desoldering station has been released by Weller. The DS600 is self-contained, requiring only a 240V power source for operation.

Its features include a built-in air supply, a push button vacuum control built into the desoldering tool handle, and a temperature controlled head which can operate at up to 370°C. It has a lightweight metal case, is fitted with a carry handle and has room for power cord storage.

For further information, contact the George Brown Electronics Group, 174 Parramatta Rd, Camperdown, 2050. Phone (02) 519 5855.

Fast settling monolithic op amp

The LF400C from National Semiconductor is a monolithic op amp with the performance of a hybrid amplifier. It has a 400ns settling time to .01% of final value when responding to a full 10V step on the input.

The LF400C is stable across 0-16MHz bandwidth (unity gain stable) and the slew rate is 30V/μs. An adjustable short circuit current limit allows the op amp to drive loads of up to 600Ω.

Prime applications for the LF400C include data acquisition converters, instrumentation, DAC output amplifiers, and other high performance applications.

National Semiconductor (Aust) Pty Ltd, 23 Cleg St, Artarmon, NSW 2064. Phone (02) 439 6455.

Hand-held digital tachometers

Digital tachometers and in-contact adaptor kits from the Veeder-Root series 6611 provide a safe, portable and economical means of measuring rotational and surface speeds using only a single instrument.

For non-contact measurement, the tachometer's photoprobe detects a reflective tape target on a rotating object. For in-contact measurement applications, an adaptor is fitted over the photoprobe. These fittings are supplied.

The meter measures from 60 to 19,999rpm in increments of 1rpm and has a high contrast LCD that shows readings instantaneously and also indicates overrange, low battery input and reflective light input.

Elmeasco Instruments, PO Box 30, Concord, 2137. Phone: (02) 736 2888.

New range of PA amplifiers

Audio Telex Communications has announced the release of a new public address amplifier, the model TX100. This unit features four microphone channels, two auxiliary channels, bass and treble controls and a power output of 100W.

An unusual feature is the provision of a voice operated switching system (VOX) on mic channel four. The VOX input enables any type of microphone to be used for paging and provides muting of both auxiliary inputs.

Other features include 240V AC or 24V DC operation, an inbuilt battery charger, a VU meter and tape recorder input/output connections. A 100W booster (model TX100B) is also available, making it possible to slave a number of boosters to one TX100.

For further information contact Audio Telex Communications Pty Ltd, PO Box 421, 1 Little St, Parramatta 2150. Phone (02) 633 4344.

200°C silicon rectifier diodes

Electronic Devices Inc. have produced a high temperature, 3000PRV silicon rectifier diode that provides an exceptionally fast recovery time of 300ns at 200°C.

The recovery/temperature characteristics of this Series HTDR3 diode make it particularly suitable for equipment used in oil exploration, miniaturised equipment and other high ambient temperature applications.

For further information contact Bryan Catt Industries, 10/59-61 Gymea Bay Rd, Gymea, 2227. Phone: (02) 526 2222.

VCR fault data manual

Ophir TV Services have compiled a fault manual covering most brands of video recorders. The manual consists of over 100 separate faults and is fully documented with symptoms, faults and remedies, together with partial circuits diagrams and faulty parts locations.

This data manual is claimed to be the first of its type and buyers of Fault Manual Vol. 1 will be included on the proposed bi-monthly update service mailing list. Available at a cost of $97. Contact Ophir TV Services at PO Box 531, Orange, 2800. Phone (063) 62 6055.

New premises for VSI Electronics

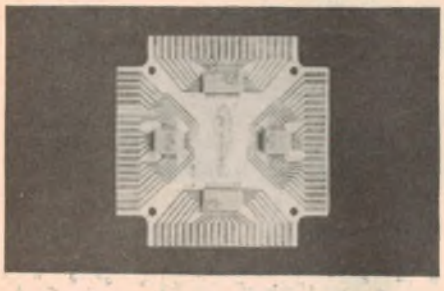
VSI Electronics (Australia) Pty Ltd advises that their Melbourne branch office moved to larger premises on June 17. Their new address and telephone number is 6/417 Ferntree Gully Rd, Mount Wavereley, Vic 3149. Tel: (03) 543 6445.

Baud rate converter for Avtek modem

Avtek Electronics has released a split baud rate option for their MultiModem. The converter allows computers to communicate at the new higher baud rates of 600 and 1200 baud.

The converter is claimed to be essential with the introduction of Videotex, which is going to use a 1200/75 baud split rate. For further information contact Avtek Electronics. Phone: (02) 42 7668.

New Products...



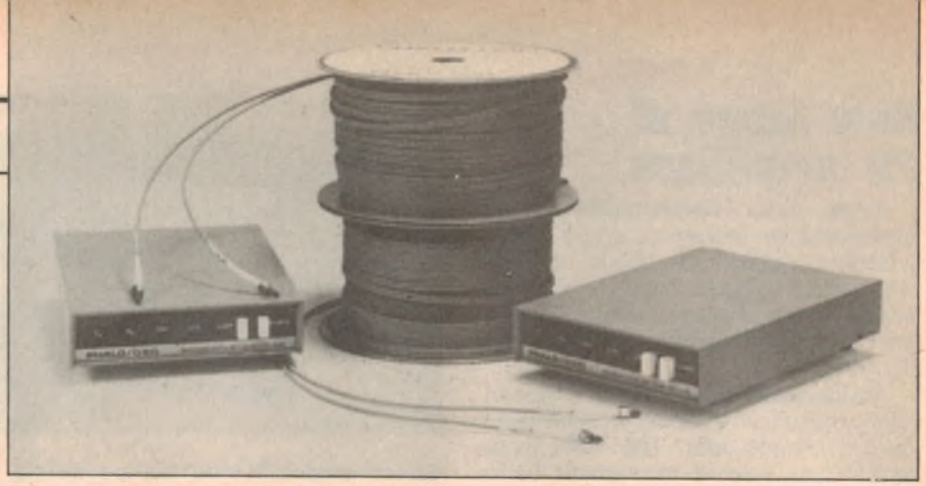
Moulded plastic chip carrier

The Bourns moulded plastic chip carrier packages released by RIFA enable PCB designers to allow for higher board densities.

This new 4200P series can be mounted on the track side of the board. Both 10 and 20 pin models are available.

The Bourns resistor surface mounted networks allow the PCB designer to reduce the number of through board holes which increases track layout flexibility and allows more dense packing of board components.

For further information, contact RIFA, Cross House, 2 Cross St, Hurstville, 2220. Phone: (02) 570 8122.



Full duplex communication set

Computer Cables and Components of Australia announce the release of the Model ODS-306E fibre optic wideband data set which provides full duplex, serial binary synchronous data transmission at speeds up to 2M bits per second. It also has asynchronous transmission capability of up to 300K bps and will operate over a distance of 5km without repeaters.

The ODS-306E comes as either a desk top or rack mounted version and is plug-compatible with V.35 or RS-422 interface standards.

For further information contact Computer Cables & Components Australia, 5 Gibbons St., Telopea, 2117. Phone: (02) 683 4200.

DMM temperature adaptor from Fluke

The 80TK thermocouple convertor is a high performance accessory which plugs into any bench or hand-held DMM (standard banana plug input) to allow instant temperature measurement capability.

Powered by a standard 9V battery the device converts the microvolt output from a "K" type thermocouple into a 1 millivolt per degree signal. The compact package contains both cold junction reference and scaling and works with any 3½ digit multimeter having a 10 megohm or greater input impedance.

The 80TK comes with a general purpose bead thermocouple probe with a measurement range of −40°C to 260°C. There is an optional immersion probe for liquids or gels and a surface probe. The

80TK also accepts a wide variety of specialised probes from other manufacturers who use similar mini-connectors.

For further information contact Elmeasco Instruments, 15 McDonald St, Mortlake; or PO Box 30, Concord, 2137. Phone: (02) 736 2888.

PKW-1000 intelligent EPROM

Alfatron have released intelligent EPROM programmers. The system firmware PROM is mounted in a ZIF socket under the programming module, allowing it to be updated without opening the case when new releases are issued.

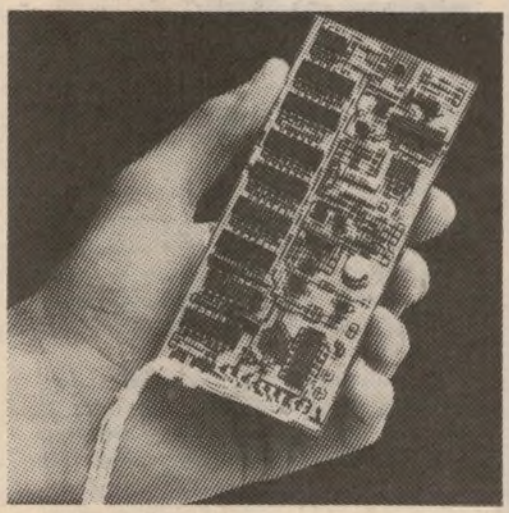
The standard FX-1 module that comes included with the main frame of the programmer supports all devices from 2716 up to 27256 and also covers the CMOS and "A" versions.

The PKW-1000 can operate in fully

stand-alone mode or under the control of a host computer and weighs only 3kg.

Alfatron, 1761 Ferntree Gully Rd, Ferntree Gully, Vic., 3156. Phone: (03) 758 9000.

Learn to fix this and you could have a job for life.



There are now thousands of computers in use right around Australia.

And whilst they are usually reasonably reliable, none are failproof.

Which is precisely why there is a screaming need for well trained technicians capable of servicing almost any brand of computer currently on the market.

Because computers are no different to televisions, stereos or typewriters. They all need skilled technicians to ensure that they stay operating at maximum efficiency.

Now Control Data Australia is offering a course for people who'd like to train as computer maintenance technicians.

The Computer Technician Course

Control Data is recognised as a world leader in computer education and overseas our Computer Technicians Course is now our most popular.

In Australia we already train hundreds of Computer Programmers and Operators every year.

But just as importantly, we also help more than 90 per cent of our graduates get their first job in this rapidly expanding industry.

So if you want to get an exciting career in computers call Control Data now and come along to a free seminar.

Telephone:
(03) 2689666 or (02) 4381300

CONTROL DATA INSTITUTE

YOUR CAREER BEGINS HERE

An education service of Control Data Australia Pty. Limited.

Burrows Doble Lawrence CDA/1299

New Products...

18GHz millivolt-power meter

Rohde & Schwarz has introduced a new millivolt/power meter, the model URV5. A special feature is a patented circuit technique that stores the complete characteristics of a diode rectifier on a semiconductor memory integrated into the measuring head. This dispenses with the need for non-linear amplifiers, control circuits and conventional choppers, allowing both measurement speed and accuracy to be increased.

Measurements may be taken at the rate of 30 per second with a basic error of 1%. For frequency response correction, it is necessary only to enter the test frequency via the keypad or IEEE-488 bus. The calibration factor is then taken into account in the measured result.

Six different measuring heads make the URV5 ideally suited for all voltage and power measurements at DC and within the frequency range 9kHz to 18GHz. A low-capacitance DC probe permits DC voltage measurements in RF circuits.

Insertion units are mainly used for loss-free voltage measurements in coaxial-line systems. 100V insertion units are claimed to exhibit approximately the same sensitivity as conventional power meters but with a 30dB better dynamic range.

Rohde & Schwarz Ltd, 13-15 Wentworth Ave, Darlinghurst 2010. Phone (02) 267 2622.

Ultrasonic burglar alarm

Recently introduced by Arlec, the AM828 home burglar alarm uses ultrasonic waves for detecting movement within a six metre range. The unit is designed for easy installation and the range can be adjusted to suit the application. Once triggered, the alarm sounds an internal siren.

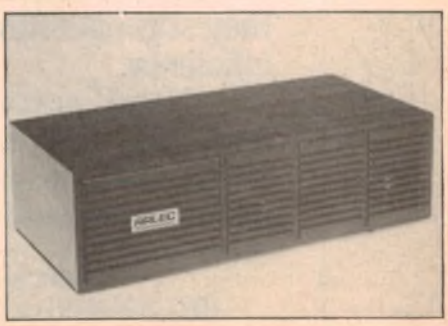
The alarm is battery operated (9V) or it can be used from the mains via an Arlec PS9200 low voltage AC adaptor.

In normal use, the AM828 provides automatic delay periods to allow the householder time to leave the premises and return without triggering the alarm. The controls consist of unmarked switches concealed behind a panel on the front of the unit. These are pressed in a particular sequence, according to the type of protection required.

An optional extra for the AM828 is the LS690 high power siren loudspeaker. This speaker is suitable for both internal and external use and is supplied complete with a mounting bracket and 15 metres of connecting wire.

Also available are Arlec's MS8M magnetic switches which can be fitted to windows and doors. Any number of switches may be wired in series with the terminals on the back of the unit. The alarm will trigger immediately if a protected window or door is opened.

Arlec Pty Ltd, 47 Drummond Street, Belmore, NSW 2192. Phone (02) 789 6733.



Surface mounting tantalum capacitors

Recently released by Siemens is a new range of tantalum capacitors in chip format (B 45 193) for automated PCB assembly. They come in five different case sizes and have a range of values from 0.1μF to 100μF.

The new capacitors do away with conventional leads. Instead, the small plastic bodies (only a few millimetres long) are provided with contact areas which permit them to be soldered directly to the board. Their operating temperature range is from −55 to +125°C.

Siemens Ltd, 544 Church St, Richmond, Victoria 3121. Telephone (03) 429 7111.

Cellular radio from Motorola

For two-way radio users, congestion, lack of privacy and the unreliability of shared systems can cause major problems.

According to Motorola Australia, these problems have been all but solved with the development of computer-based cellular radio systems. With Motorola's new Mostar cellular radio, the user gains fast access to the communications network, the messages are private, and it is inherently reliable. In addition, the computer-based system allocates access time equally and fairly.

Motorola Electronics Australia, 666 Wellington Rd, Mulgrave, Vic 3170. Phone (03) 561 3555.

Low-cost EPROM programmer

Data I/O's new 21A EPROM and EEPROM programmer is a versatile new unit that offers a range of features. It programs over 120 EPROMs and EEPROMs up to 256K; it uses intelligent algorithms and electronic device identification, it incorporates a powerful data editor, it comes standard with remote control software and it offers front panel entry of data transfer functions such as baud rate and parity.

Other features of the 21A include comprehensive self-testing and device testing which, it is claimed, guarantee reliable programming. At switch-on, a self-diagnostic routine checks internal RAM and ROM, front panel display, microprocessor and serial I/O port.

Before programming, the 21A monitors devices for programmed bits and protects them from overvoltage, overcurrent and incorrect insertion. After programming, the 21A checks devices for Vcc margin and correct output polarity, as well as calculating a sum-check of the programmed data.

Warburton Franki, 7 Birnie Avenue, Lidcombe, NSW 2141.

Versatile DC/DC converter IC

Analog Devices has released a monolithic DC/DC converter which accepts a single +5V input and generates −5V, −10V, −15V, +10V and +15V output voltages. With this capability, the AD7560 can power

Only IRH can meet your

1985 PIEZO BUZZER
SELECTION GUIDE

KPE1100
(Style 1)
NEW

KPE1000
(Style 2)
NEW

KPE960
(Style 3)
NEW

KPE920
(Style 4)

KPE657
(Style 5)

KPE757B
(Style 6)

PKM44EW-1001
(Style 7)
NEW

PKB5-3AO
(Style 8)

PKB6-5AO
(Style 9)

KPE26
(Style 10)

PKB24SP-3301
(Style 11)

PKB9-3AO1
(Style 12)

PKB8-4AO
(Style 13)

PKB7-3AO
(Style 14)

PKM11-6AO
(Style 15)

PKM11-4AO
(Style 16)

Pictures not to scale

PKM24-4AO
(Style 17)

PKM25-6AO
(Style 18)

PKM35-4AO
(Style 19)

muRata

1985 PIEZO BUZZER
SELECTION GUIDE

KINGSTATE

New Products

components such as op amps, analog-to-digital converters and digital-to-analog converters which require plus and minus power supplies.

The AD7560 contains two cascaded DC/DC voltage converters, a zener reference diode, an operational amplifier and an oscillator. The first converter changes the +5V input to a −5V output; the second converter takes the +10V (+5V to −5V), commutates it and then adds it to the −5V supply, resulting in −15V output. This voltage is applied to the 5V zener diode and buffered by the op amp for the −10V output. Users have the option of using either the on-chip oscillator to drive the converters or using an external clock.

To obtain a −5V supply, the only external components required are two capacitors for the voltage converter and one capacitor for the clock. To obtain the −15V supply and −10V reference, two additional capacitors are needed. Nominal voltages of +10V and +15V are available using another capacitor and diode.

Over the specified operating temperature range of −25°C to +70°C, the −5V output has a maximum source resistance of 200Ω and a minimum conversion factor of 0.85. The −15V output specifies source resistance of 1200Ω over temperature and a minimum conversion factor of 2.75. All outputs are short-circuit protected and latch-up free.

Parameters Pty Ltd, 41 Herbert St, Artarmon, NSW 2064. Telephone (02) 439 3288.

New Teac disk drives

Two new models have recently been added to the Teac FD-55 series half height 5¼-inch floppy disks drives. Both use Teac LSIs to control the read and write functions, reducing the power consumption of the drive to 4.9W.

The FD-55F, with its dual density capacity, is actually two disk drives in one. It can read standard 5¼-inch normal density single and double-sided disks, as well as read and write high density single and double-sided disks. The FD-55GF additionally offers 1.6MB in high density mode and the ability to read and write in a variety of formats.

Electrical Equipment Ltd, Unit C, 8 Lyon Park Road, North Ryde, NSW 2113.

Electroluminescent portable display

Vicom, the Australian distributors for GRID, recently announced new, larger models of the Compass II electro-luminescent (EL) screens. In addition, Vicom has introduced three new software packages to take advantage of the larger screen.

The EL displays used on all GRID computers are said to be easier to read than the liquid crystal displays commonly found on other portable computers.

Measuring 20.3cm diagonally, the new

New Products

light emitting EL display can hold up to 128 characters on a single line. As a result, it accommodates larger spreadsheets and databases and reduces the amount of scrolling needed.

Vicom Pty Ltd, PO Box 366, South Melbourne, Vic 3205. Phone (03) 63 6931.

New optocouplers from Siemens

To lengthen the voltage breakdown paths between the pads on PC boards, Siemens is now supplying its SFH 601 optocoupler with a greater pin centre-to-centre distance. On the new SFH 601G, the pins are 0.4-inch apart.

Also recently introduced by Siemens are optocouplers with the ends of the pins bent out at right angles. This design permits surface mounting and automated assembly. The 6-pin SFH 601 is offered in this design as the SFH 6016 while the 4-pin SFH 610 is offered as the SFH 6106.

Siemens Ltd, 544 Church St, Richmond, Victoria 3121. Phone (03) 429 7111.

Tape backup for the IBM PC

Cipher Products Inc has packaged its ¼-inch tape backup technology into an easy to use system that will interface with the IBM PC-XT.

Cipher Data's Model 5210 Floppy Tape Backup System is the company's first product for users in the IBM PC market and is the first in a series of products designed to support IBM PC compatible machines.

The 25MB system is based on Cipher's Floppy Tape ¼-inch cartridge tape drive. It uses the industry standard floppy disk interface and responds to floppy disk type commands. This scheme enables users to plug 5210 systems directly into the computer's external floppy disk interface connector.

The 5210 system can back up two entire IBM 10MB hard disks or one 20MB hard disk at approximately one minute per MB on a single standard 3M DC600A ¼-inch tape cartridge. Larger disks can be backed up on multiple cartridges.

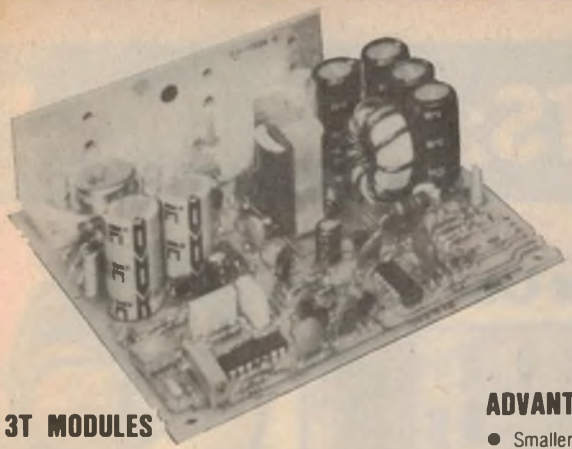
Elmeasco Instruments Pty Ltd, PO Box 30, Concord, NSW 2137. Phone (02) 736 2888.

New generation CD players

Two new compact disc players are available from Teac. The PD500 is designed to fit in with most standard sized hifi systems. Its width is somewhat larger than most CD players at 440mm, making it the same size as a typical hifi "component" such as an amplifier or tape deck.

The PD11 is a more conventionally styled compact disc player offering a frequency range of 5 to 20,000Hz (+/− 0.5dB), harmonic distortion of .0015% and dynamic range of 95dB. Recommended retail price for the PD11 is $731.

For further information contact Teac Australia Pty Ltd, 115 Whiteman St, South Melbourne, Vic 3205. Phone (03) 699 6000.



DC-DC SWITCHING REGULATORS

Boschert

3T MODULES

The wide-range input three-terminal 25kHz switching regulators are flexible, inexpensive, efficient design modules providing a single adjustable output from a raw positive DC source.

The 3T modules are complete, functional blocks whose input and output flexibility easily and quickly solve unique power system requirements. Seventy-five percent typical efficiency is an added advantage of the switcher which helps reduce transformer and heatsink requirements over an equivalent linear regulator. Also, efficiency is essentially independent of input voltage; hence output current need not be derated with increasing input voltage.

ADVANTAGES OF DC/DC CONVERTERS

- Smaller 60Hz transformer needed.
- No need for customary multiple transformer taps for multiple outputs.
- No extra components such as inductors or pass transistors needed.
- Lighter weight.
- Less heat.
- Smaller heat sinks.
- Higher input bus voltage means smaller rectifier diodes and input caps.
- Wider practical input voltage range.
- Lower design risk.
- Lower stock inventory.
- UL recognized.
- Shorter design cycle.

STANDARD FEATURES

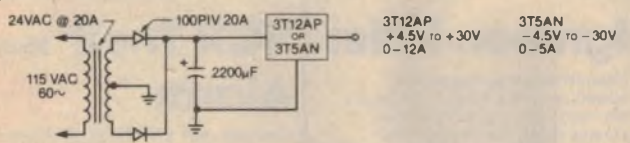
- + DC Input (3T12AP, 3T20AP, and 3T5AN).
- + DC Output (3T12AP, 3T20AP).
- − DC Output (3T5AN).
- 25kHz Switching Frequency.
- 75% Typical Efficiency.
- Overload Protection.
- Short Circuit Protection.
- Low Power Dissipation.
- Adjustable Output Voltage.
- No External Components Needed.
- Remote Sense.
- Inter-Module Sync.
- Parallelability.
- Remote On/Off.
- Application Note #4 Describing system construction and use of the 3T.
- Soft Start.

SELECTION GUIDE

Model	Input Voltage Range	Output Voltage Adjustment Range	Output Current
3T12AP-6130	+10V to +60V	+4.5V to +30V	0-12A
3T20AP-6115	+10V to +60V	+4.5V to +15V	0-20A
3T5AN-6030	+20V to +60V	−4.5V to −30V	0-5A
3T5AN-4030	+10V to +40V	−4.5V to −30V	0-5A

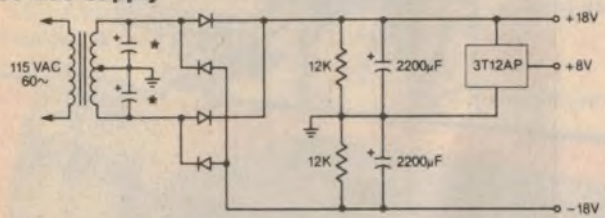
TYPICAL APPLICATIONS

Typical Connection



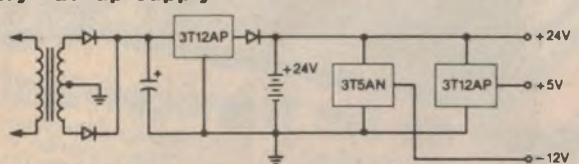
Higher input voltages to the 3T module will reduce stress on the rectifier diodes, input capacitor and 3T module.

S100 Bus Supply

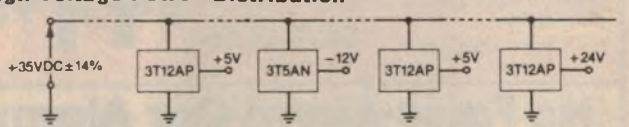


*1μF 100V Mylar capacitors improve RFI attenuation

Battery Backup Supply

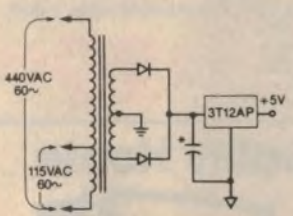


High Voltage Power Distribution

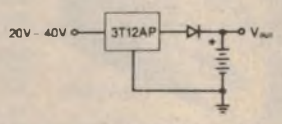


Minimizes IR drops, provides excellent local regulation, accepts wide input voltage range, including brownout.

Supply with High Isolation

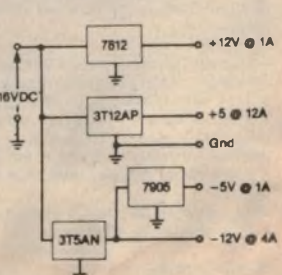


60Hz transformer provides low ground leakage current, high isolation — can conform to UL544 leakage spec.



Set V_{OUT}-no load to 13.8V for float charging a 12V lead acid battery, or to 14.4V for a fast charge. 1_{lim} sets max charge current.

Single Input Voltage — Multiple Outputs



7812 and 7905 are commercially available three terminal I.C. regulator circuits.

AMTEX ELECTRONICS

A DIVISION OF TLE ELECTRICAL PTY. LTD.

(Incorporated in New South Wales)

36 LISBON STREET, FAIRFIELD, NSW 2165 AUSTRALIA

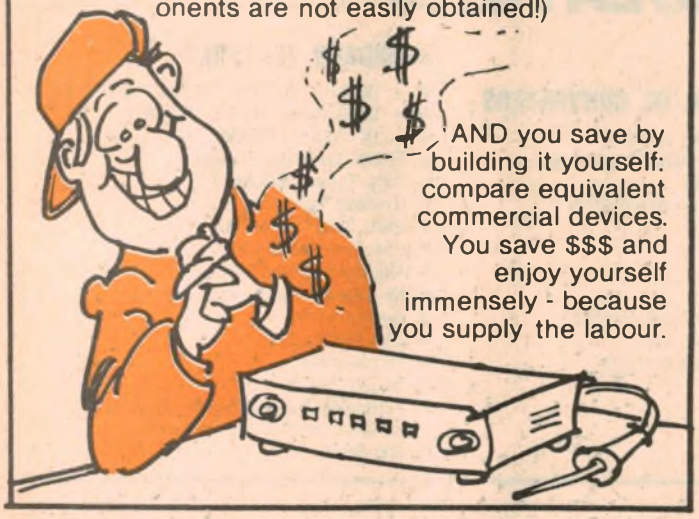
TELEPHONE (02) 728 2121, 727 5444

TELEX AA27922 ATTN AMTEX

KITS: THE DO-IT-

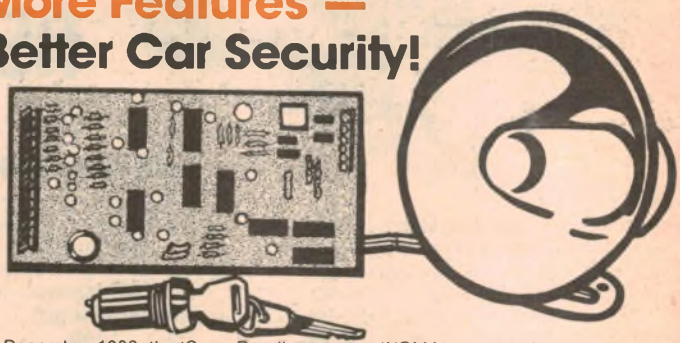
THINK OF ALL THE MONEY I'VE SAVED!

Actually you make a double saving: You save because our kits represent a saving over the individual component price (many kit components are not easily obtained!)



AND you save by building it yourself: compare equivalent commercial devices. You save $$$ and enjoy yourself immensely - because you supply the labour.

More Features — Better Car Security!



In December 1983, the 'Open Road' magazine (NRMA) gave ten features a car alarm should have. The best commercial system available had only eight. This alarm system from Electronics Australia, has nine (and if used in conjuction with the ignition killer below, has ten!)
Your car needs protection. Good door locks and an ignition lock aren't enough. Build this incredibly effective alarm system and your car has the best chance it will ever have of being where you left it when you return.
Cat K-3252
As described in EA
SAVE $2.55
$64.95

Bargain Car Protection

This alarm senses the voltage drop in your car's electrical system when a thief breaks into it. There's a visual warning for thieves so that chances are they will not even attempt a break-in. Easy to install — save a lot of trouble.
Cat K-3250
As described in ETI
SAVE $1.55
$11.95

Supa-Ultrasonic Movement Detector!

Cat K-3251
As described in EA

The perfect add-on kit for the Deluxe Car Alarm!
The problem with 99% of car alarms is that they cannot prevent the thief who breaks a window and reaches in for the goodies. While this kit won't prevent the window being broken, it will protect your property inside the car. Silent ultrasonic rays detect any movement and trigger the main alarm system.
$23.95

No False-Alarm Car Alarm!

Cat K-3253

One of the most sophisticated, yet simple alarms around. It uses a triggering technique which makes it less prone to false alarms — a common problem with many car alarms, yet it will sense a voltage drop anywhere in the electrical system. For example, when a door is opened, or a jumper lead is applied to the starter, etc.
As described in ETI
$29.95

Ignition Killer

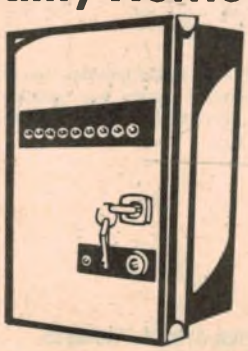
Ingenious but simple circuit based on a 555 timer that literally kills your car ignition and then re-sets itself, making the thief think something is wrong with the engine. The theory is he'll then go and pinch someone else's car instead.
Cat K-3255
$16.95
As described in EA

VCR Theft Alarm ~~$54.95~~ $29.95

Don't let your VCR become the most talked about item behind the pub! Build this neat little kit and it will scream its head off with your pride and joy!
Cat K-3423
As described in EA

Professional Quality Home Security

What a superb kit! EA have thought of just about everything in the development of this design. It offers features which you'd normally find on $200 and more commercial units (even ours!)
It offers:
• Security key operation • 2 instant and six delay sectors • Inbuilt mains power supply with battery backup* • Siren (up to two speakers) PLUS bell (relay) output and also capable of driving telephone diallers, strobes, etc etc.
• Inbuilt local test facilities, including buzzer.
And we've made the EA design even better: a heavier steel case, for example. And our kit includes our specially prepared instructions - so you won't have any problems!
*BATTERIES NOT INCLUDED



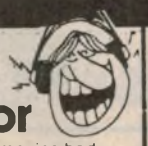
$120
Cat K-3424
As described in EA

Save on 2m Transceivers!

The perfect mate for the UHF kit. The DSE Commander VHF transceiver has been developed in response to the huge number of requests from our customers; those who had the 'Explorer' under their belts and had been bitten by the old 'home brew' bug! (In fact, a number of customers said they didn't really need another 2m transceiver: they'd built it for the sheer fun of making something again!)
Cat K-6308
SAVE $10
$189

YOURSELF SAVINGS ACCOUNT!

Stereo Simulator



Wish those old video movies had modern stereo sound? This low-cost gadget turns almost any mono signal into amazingly good synthetic stereo!
Cat K-3421

$23.95

Turns TV To Stereo!

Build this stereo TV decoder and get full hi-hi quality stereo television sound for just a fraction of the cost of replacing the telly!
You have a choice of building the decoder with its own power amplifiers — or you can simply feed the output into your hi fi stereo system to cut costs even further.
The result: stereo TV sound you'll be proud of! And even more: included is a TV tuner which picks up UHF — so if your telly can't quite manage UHF you're even further in front!
Cat K-6325

~~$249~~ **$199**

Stereo Enhancer

Here's a great kit for those on a space budget! If your listening area is not exactly stereo quality, the stereo enhancer will 'widen' the sound to make it sound like it's almost designed that way!
Cat K-3419
As described in EA

$79.95

Servicemans Dream — TV Pattern Generator

With just seven IC's you get three patterns: dot, crosshatch and blank raster. Not bad value, huh? An indispensable aid for the serviceman or hobbyist — and this one's small enough to carry around anywhere. Includes deluxe front panel and VHF modulator.
Operates from plug-pack adaptor (9V DC).
Cat K-3472

$33.95

4 Sector Protector

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Here it is: designed by Dick Smith Electronics Research and Development division to suit the requirements of the majority of users.
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Easy to build - and could save your property!
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Now almost 1000 DSE UHF Explorer transceivers have been built and, from the reports we've received, very few problems have been found: most constructors are delighted with the ease of assembly and the performance.
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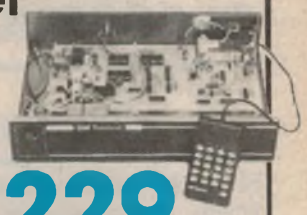
Cat K-6315



Teletext — that mine of information given out free by a lot of TV stations - hasn't really taken off in Oz: mainly because of the cost of Teletext Televisions (most are around or over the big $1000 mark!)
We've kept the price way, way down by designing this Teletext converter to be used in conjunction with a VCR. Check with your local TV station(s) to ensure Teletext or captions are being transmitted before commencing construction!

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Unless you're lucky enough to have one of the new hi fi videos, the sound from your VCR is probably pretty pedestrian! Now you can give it a lift with this VCR Sound Processor!
Cat K-3422

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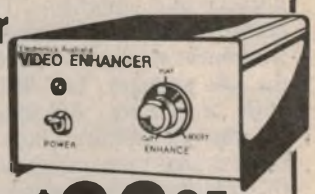

If the sound on your VCR is crook, what about the video! Especially when you're making copies of tapes (yes, the ones you shot yourself of course). Make sure you don't lose detail when dubbing: use the EA video enhancer.
Very simple to use: all control is via one knob. And unlike most enhancers, you can cut as well as boost (ideal for softening harsh pictures).
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REVIEWS OF RECENT
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GRANADOS

Six piano pieces based on Spanish popular songs. Allegro de Concierto. Romantic Scenes. Alicia de Larrocha (piano). Decca Digital Disc 410 288/1.

Alicia de Larrocha plays this recital delightfully and the sound is admirably recorded. But throughout its length the composer spreads such a plenitude of rising arpeggios that they impart an air of amateurishness to the whole.

The main work consists of a suite of six piano transcriptions of popular Spanish songs. There is a short prelude, an improvisation-like piece in which the arpeggios mentioned above abound. There are far too many of them.

The second is scherzo-like with the usual slow middle section. There is a hint of the composer's Goyescas in the slow section, but again the arpeggios give it an amateurish effect.

The fourth piece is brisk with a nursery-like quality. There is an occasional fleeting likeness to Falla and the pianist shows much deft fingering in the fast passages. The fifth too is brisk with a strong folksong influence. Number six rambles a little and makes it obvious that these pieces will never rival the composer's Goyescas in popularity.

The next has sultry rhythms and harmonies, again a hint of the Goyescas, with every phrase strongly Spanish. In playing this it began to dawn on me that the arpeggios were the result of a guitar technique transferred to the piano. Somehow the practice sounds much more natural on the guitar. Ms de Larrocha makes it all a splendid example of pianism.

The last is a breathless piece of writing with complicated fast changing rhythms. It must be very difficult to play it with the energetic accuracy used by Ms de Larrocha and this adds a touch of excitement to a not very exciting suite.

Then comes Allegro de Concierto, a virtuoso piece showing great homage to the memory of Chopin. The slow middle section might well have been composed by Chopin himself in an off moment and doesn't command much attention. If you can imagine it, here is Chopin with a lot of extra notes.

The recital ends with a Schumannesque group of short pieces though harmonically they are far removed from the German composer. They are also a little longer than Schumann's examples in Papillons and Carnival. There are very few surprises and one is the close resemblances to the "nightingale" Goyescas, melodically and harmonically. The amateurish style persists through the whole recital which I can only tepidly recommend. (J.R.)

BACH

The French Suites. Glenn Gould (piano) and Overture in the French style BWV831. Two Boxed Discs. CBS Masterworks M2 39099.

The composition dates of these suites is uncertain. The later additions and alterations made by the composer likewise. Nor is it even known why they were called French. The items they contain are in the form of dances.

Those accustomed to what has been described as a "Bach style" will alternately praise and deride some of Gould's extravagancies of interpretation and will be exasperated by his singing during the slow numbers. He is less audible in the fast ones.

Gould himself was a strange figure. Starting out as a virtuoso pianist for a while he gave successful recitals in the U.S., Europe and the Soviet. But he became increasingly interested in recording. So much so that while still young he forsook public recitals and concentrated solely on recording. He reasoned that he could not achieve the same perfection in a fleeting public performance as he could in a recording where a single bar could be repeated endlessly until it satisfied the performer.

He retired from the concert platform in 1964 and spent the next 20 years broadcasting and recording until his untimely death last year. But his interests were not confined to these activities. He was also active in music criticism, articles and essays some of which showed a pleasing sense of humor, writing his record sleeve notes and providing plays and scripts for broadcasting.

Gould plays them on a modern piano and not the harpsichord for which they were originally written. I admit without awe of the baroqueniks that I prefer them this way and record my total agreement with the late Beecham's description of the harpsichord's tone — as sounding like a "bird cage played with a toasting fork."

The two discs are a little short on playing time but the piano tone is lifelike. Gould has a wonderfully clean technique and while some of his tempos astonish his purity of line is never in doubt. Items sometimes go so slowly or fast that they make nonsense of the music. But his admirers — and there are many — will readily forgive such quirks.

His technique is curiously harpsichord-like in its crispness on a modern piano, more expressive, however than its forerunner. The records are digitally remastered from analog tapes. (J.R.)

BARBER

Violin Concerto, Op.14. Isaac Stern (violin) and the New York Philharmonic conducted by Leonard Bernstein. Piano Concerto Op.38. John Browning (piano) with the Cleveland Orchestra conducted by George Szell. CBS Stereo MP39070.

This performance was recorded in 1962, reissued in 1975 and its sound betrays its age. Its origin is strange enough to earn mention. The violin concerto was commissioned by a rich businessman for a protégé. The recipient who had expected a virtuoso work refused it on the grounds that it was too easy. The businessman refused to pay for it and demanded his money back.

The composer replied that the money had been spent and rewrote the Finale in a virtuoso manner which the recipient found too difficult. The businessman settled for a return of half his money but agreed to sacrifice his protege's right to its first public performance. How American!

The Violin Concerto is an early work, neo-romantic in form and content and strongly reminiscent of Walton before his inspiration started to fail. These traces are at their strongest in the finale though the general lyricism of the two earlier movements also contribute a likeness.

The concerto opens with a quiet reverie sweetly intoned by Isaac Stern's violin. The romantic overtones of the music of the early part of this century are immediately evident. Not immediately arresting, the better you get to know it the better you like it despite its surface simplicity. The sound is not all that untidy and the violin continues to muse contentedly.

The second movement shows little difference in mood though the dreamer seems a little more moved than in the first. Stern makes it all sound very easy. It probably is.

The disputed Finale is a perpetuo moto, all very sprightly. The balance between orchestra and soloist is fine and the orchestral playing is all one used to expect from the martinet Szell back in those great days. After a while the Finale seems to start to rev like a two-stroke motor.

The Piano Concerto is less acceptable and echoes still more memories of Walton. It is dazzlingly played by John Browning with the same Cleveland Orchestra under Szell. It wholly lacks the freshness of the violin work and hints strongly of midnight oil. Its mood is post-romantic virtuosity. The best movement is the slow one and even that is less than impressive. I gave it generous time to make its acquaintance.

The sound, despite its age, is satisfactory and for those interested in American music of the more serious kind this will interest, as it is the only available example of Barber's early work.

(J.R.)

TCHAIKOVSKY

Francesca Da Rimini. Romeo and Juliet. The Cleveland Orchestra conducted by Riccardo Chailly. Digital Recording. The Decca Record Company.

Andrew Clements' sleeve notes make a fair assessment of the merits and demerits of this work. The tone poem is based on a short interlude in Dante's Inferno which describes the torments of a pair of adulterous lovers in hell.

The air is full of moaning and a furious storm continuously rages. Tchaikovsky's piece is illustrative of the story — the wind rages and the lovers embrace despite their pain. In fact the wind rages so much that one begins to tire of it before the end is reached.

But much compensation is to be found in the very beautiful love music, some of the loveliest that this master melodist ever wrote. As Clements writes, it all ventures close to self-indulgence and is far less sophisticated than its partner on the disc, Romeo and Juliet.

Francesca opens with a series of chords full of foreboding in handsome contrast to the gusty gales that follow — and continue throughout a bit too much of the work. Although it is a tone poem it is in more or less sonata form yet it would be difficult to imagine a symphony with so continuous a swirl.

Despite speed and noise the rushing passages have little urgency. But all is atoned for when the love theme is reached, a haunting clarinet solo followed by a melting melody on the strings. It stretches through many bars, but despite its beauty isn't four repetitions just a little too much? Or has familiarity worn out my response?

Romeo and Juliet which will probably be more familiar to readers is in much the same mood as Francesca but here, instead of hell's tempests, you have flashing swords and other violent action, with in between one of the most beautiful themes in all music.

The digital recording suffers from the now only too familiar too-wide dynamic range with almost inaudible pianissimos and ear-bashing 'ffs'. And the performance of both tone poems though well played lack true Tchaikovskian panache — the composer's best friend.

(J.R.)

Records & Tapes

BIBLE MUSICAL

It's Cool in the Furnace II. The Adventure Continues. By Larry Mayfield and Grace Hawthorne. Stereo LP, Word SPCN7-01-892410-3. (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135. Phone [03] 729 3777.)

Some years ago, as I recall, I reviewed what now becomes "It's Cool in the Furnace-I", a musical based on the Bible story of three young Israelites delivered miraculously from Nebuchadnezzar's fiery furnace.

As a production, it was popular with church youth groups and it is therefore not surprising that a sequel should now have appeared, based on the story of the prophet Daniel in the lions' den. This, of course, is the album but a note on the jacket indicates that, as well as the cassette version, a choral book is available from the Word organisation, along with musical accompaniment only, on reel or cassette tape.

In the manner of stage musicals, this one adheres to the original story only to the extent that it can be fitted into or between the songs — 10 of them on this recording:

We're Having Party — Mene, Mene, Tekel, Parsin — Yes Indeed — God All the Way — That's Never Gonna Work — Sing A Prayer — A Very Bad Mistake — Shut My Mouth — The Lord's Day.

While the story line is old, the wry humour is contemporary, as also is the musical format — cleverly written, melodic, but heavily dependent on a

modern up-beat accompaniment. Local production would demand accomplished "mod" musicians of which, fortunately, quite a few seem now to be available in churches.

But, whether or not you have local production in mind, the old story with a modern twist would make diverting family listening, with special appeal to the young. It's fun, it's tongue-in-cheek but its never irreverent. Technically, the quality is excellent. (W.N.W.)

MORE AMOUR

Tom Jones: Love is on the radio. Stereo LP. Starcall SFL-10120. Distributed by RCA.

Born in a Welsh mining town, working as a teenager by day and singing in local pubs by night, Tom Jones now lives with his wife Melinda in Bel Air, California, a permanent resident of the United States of America.

Along the way is a string of gold records and other awards, the fattest TV contract ever signed in Britain, a series of international tours, packed concerts, and the world's largest private collection of orang-outangs — an expression of Tom Jones' personal concern for endangered species.

This album is devoted to what has helped to make him so popular world-wide: love songs ranging from romantic to rock:

My Kind of Girl — All the Love is on the Radio — That Runaway Woman of Mine — Give Her All the Roses — Bad Love — A Picture of You — The Moonlight Hours — Still a Friend of Mine — Only My Heart Knows — I'm an Old Rock and Roller.

The sound quality is well up to normal LP standards and, if you're a Tom Jones' fan, you'll enjoy it for sure. (W.N.W.)

VOCAL EVERGREENS

Roger Whittaker: All Time Favourites. Stereo LP, Starcall SFL-10108. Distributed by RCA.

Buy this record and you'll get 50 minutes or more of what must surely qualify, these days, as vocal evergreens. The tracks on side one, for example are: Lara's Theme — Unchained Melody — Making Believe — Scarlet ribbons — Red Sails in the Sunset — Red Roses for a Blue Lady — Red River Valley — Vaya Con Dios.

Side two carries on with a further 11 tracks in a similar vein, some, I would assume, re-mastered from earlier recordings.

Roger W. makes no attempt here to vary his style and the backing, arranged by Chet Atkins, is similarly pleasant but with no great variation from track to track. Some will see the album as dull; others will thoroughly enjoy it as a generous collection of songs written "as they used to write them!" I guess it's a matter of what you like.

The sound quality, by the way, is well up to standard. (W.N.W.)

NEW "HIT" MUSICAL

"Chess" by Benny Andersson, Tim Rice and Bjorn Ulvaeus. Featuring the London Symphony Orchestra and the Ambrosian Singers, with additional instrumentalists. Conducted by Anders Eljas. RCA two-record LP album SFL20118.

I may be going out on a limb to label as a "Hit" a musical that, as I write, has yet to make its debut in London and New York. But, having listened to this superbly produced album and followed the lyrics supplied with it, I can't see it being anything but a brilliant success on stage and probably on screen, as well.

As the title suggests, it centres on chess, once just a game but, over the past 100 years, the focus for incredible international rivalry. And that is certainly the case here, with the fictional contenders for the world title being the respective champions of America and Russia.

To the administrators of such championships, chess is an ancient and honourable tradition; almost a religion.The orchestra and chorus accordingly set the tone with suitably dignified music — tongues firmly in cheek!

But, unfortunately, the American contender is a typical decadent "western" male, who appears able to express himself only in terms of rock'n'roll.

By contrast, his Russian rival takes himself very seriously — even when he falls for the American's girl friend and decides to defect on her account. But, to the local Tyrolean consul, defection is a tedious business and the negotiations which follow are pure Gilbert and Sullivan.

Add to all that the emotions of the would-be girlfriend and the spurned Russian wife, plus vividly descriptive music to suit the venues — The Tyrolean Alps and Bangkok — and it starts to sound like a recipe for musical mish-mash.

But that overlooks the talents of lyricist Tim Rice ("Jesus Christ, Superstar", etc) and the musical resources of Benny Andersson and Bjorn Ulvaeus from the Swedish "Abba" group. What they come up with is both

clever (there's no other word for it) and entertaining.

As for the performance, I gained the firm impression that the London Symphony Orchestra and the Ambrosian Singers thoroughly enjoyed making the recording, along with the supporting musicians and soloists of the calibre of Elaine Paige (the original "Evita") and Murray Head (the original "Judas"). Digitally mastered, the recording itself is excellent.

If you enjoy musicals or operattas, or a long giggle, or are a chess fan, you owe it to yourself to have a listen. Recommended (W.N.W.)

INTERESTING SOUND

Jolley & Swain: Backtrackin'. Stereo LP, Powderworks POW-6094. Distributed by RCA.

Tony Swain and Steve Jolley are reputed to be the most successful team currently writing and producing records in the UK. They discovered their common interest in songwriting when Tony (cameraman) and Steve (soundman) were working at ATV on the "Muppet Show".

Subsequently, they joined Red Bus Records as in-house writer/producers, and later helped launch "Imagination", with one success following another.

"Backtrackin" is their latest project, in which they feature as musicians in their own right, playing their own material, except for the opening track. Nothing is said about their individual instrumental skills but, to judge by the sound, electronic keyboards are well to the fore.

The track titles: Autumn Leaves — Walk On — The Amazon (Follow Me) — Backtrackin' — The Journey — Patterns — Soul Street — Lost in the Night.

The sound is rhythm-based, very open, very distinctive and potentially descriptive. Perhaps it's the ATV background showing through but, to me, they were ear-catching (award winning ?) themes just waiting for matching visuals! And this is not meant as a put-down: a further reaction was to check for the existence of a cassette version (POWC 6094) for potentially pleasant, but different, in-car listening.

The technicalities of the recording itself are not mentioned but the sound quality is first rate. In short, well worth a hearing. (W.N.W.)

TOP QUALITY CD

Vivaldi: The Four Seasons. Joseph Silverstein, violin, and the Boston Symphony Orchestra conducted by Seiji Ozawa. Compact disc, Telarc CD-80070. (From PC Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4122. Phone [07] 343 1612.)

Recorded in October '81, this particular performance has been awaiting review for some time — mainly because there's been something of a "Four Seasons" queue.

In passing the disc over, however, I may have done it a disservice, because it takes a few seconds only to sense that it could be an outstanding recording — a promise that is duly fulfilled. The sound of the supporting strings is superb, as also is that of Joseph Silverstein's 1742 Guarnerius del Jesu violin.

In so saying, I probably invite comparison with the Delos version, reviewed in August '84, featuring Elmar Oliveira and the Los Angeles Chamber Orchestra conducted by Gerard Schwarz. Without in any way diminishing my enthusiastic remarks about the "transparency" and "intimacy" of the Delos version, I fancy that most would prefer the Telarc sound, which combines similar qualities with rather more weight in the bass end.

The "Four Seasons" were originally published in 1725 as part of Vivaldi's Opus 8, a set of 12 violin concertos, but the foursome has since emerged as the composer's most popular work(s).

They are programmic in character, depicting spring, summer, autumn and winter in that order. Lest there be any doubt as to what he had in mind, Vivaldi provided marginal notes and four sonnets for the guidance of soloists. The sonnets are reproduced in the accompanying booklet, along with further explanatory notes by Steven Ledbetter — although less detailed than those offered by Amelia Haygood for Delos.

The soloist, Joseph Silverstein, joined the Boston Symphony Orchestra in 1955, later becoming concert master, featured soloist and assistant conductor, as well as first violinist and music director of the widely travelled Boston Symphony Chamber Players — presumably as featured on this recording. The performance combines precision with a sense of spontaneity.

Technically, as I've said, the sound is superb, with not the slightest suggestion of "edginess" or distortion to mar the strings. A recording I can certainly recommend. (W.N.W.)

Next month in Electronics Australia

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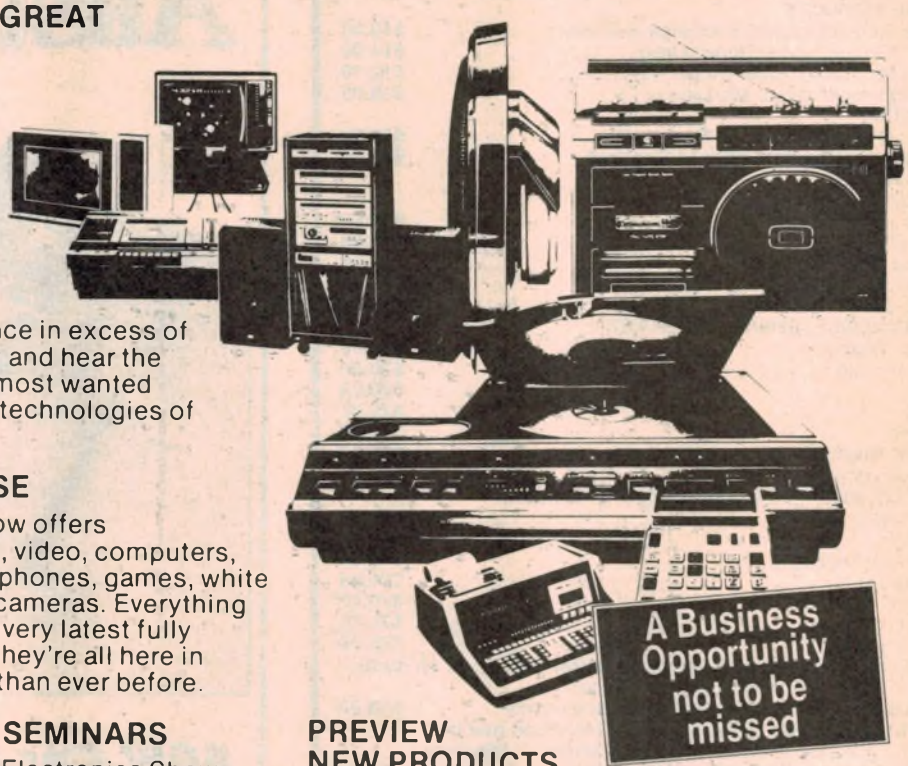

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August is an ideal time for buyers and retailers to plan orders with manufacturers for the Christmas period. The Perth Electronics Show has also proven popular with the publishers of our industry journals featuring many new releases, direct from Chicago. The Perth show gives ample time to make the important deadlines for the October/November issues.

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Hobart	792	918	795	927	738	813	747	813
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50 and 25 years ago...

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

July 1935

Hear no evil: If you want to be a listener in Romania, you have to obtain certificates, including one from a priest saying that the applicant is a person "of high moral integrity," although we should have thought that it was the purpose of broadcasting to bring, not the just, but the sinners, to repentance.

Frequency modulation: A new system of radio communication on ultrahigh frequencies which overcomes to a great extent the bug-a-boos of static and fading was announced recently by Major Edwin H. Armstrong, veteran radio expert and inventor of regenerative, superheterodyne and super-regenerative circuits.

Television in England: The British Broadcasting Corporation is planning to inaugurate a service of high-definition television in London in the latter half of this year. The service area will have a 25-mile radius. Two television systems will be employed and are to give alternate programs. These two systems are: the Baird television system, which is controlled by Gaumont-British; and the Marconi-EMI Company. The receivers are estimated to cost from £50 to £80.

Shortwave cure for angina: Irradiation of parts of the body by shortwaves has been found effective in the treatment of angina, it is reported by German doctors Schliephake and Stiebboeck. They report that in nearly all cases the fever dropped the first day, the pains and swellings reduced. The angina did not last longer than three days after this treatment and dangerous complications were avoided.

Facsimile messages: The ultimate possibility of flashing entire pages of handwritten or typewritten letters by radio facsimile, instead of by the Morse code, is discussed in the 1935 report of the Radio Corporation of America.

The report reveals that substantial progress has been made in the last year in the high-speed radio facsimile. It is expected that a high-speed ultra-short wave facsimile circuit between New York and Philadelphia will be placed in service in the present year.

Midget valves for ultra-shorts: We have received from AWA a sample of the new 954 Acorn screen-grid type valve, developed by the RCA factory for use on ultra-short waves. These valves are produced especially for experimental use, and have already proved themselves as invaluable for receivers operating on wavelengths as low as ¾ metres. At a wavelength of one metre, a gain of three is obtained with conventional circuits.

New Zealand keeps the pace: Radio continues to make rapid strides in popularity in New Zealand. Nearly 15,000 licences were taken out in May, increasing the total to nearly 160,000, which means there is now a radio set in practically every second house in the Dominion.

July 1960

Aircraft static: When ice crystals in snow and clouds rebound from an aircraft, electrons are removed from them and remain in the fuselage. The cumulative effect of millions of such impacts cause the aircraft to become quickly charged to a high voltage. Corona discharges occur at sharp extremities, seriously impairing the function of radio equipment.

To eliminate the radio interference special discharge devices have been designed. They have a sharp tungsten pin supported by a resistively coated plastic element for attachment at points where discharges occur. With several of these devices attached to the aircraft, discharge noise becomes undetectable.

Heat shrink: A new type of polyethylene film can be stretched by more than 200% in two directions. It automatically starts to shrink equally in all directions back to its original size when heated to 180°F.

The film is expected to find a number of novel uses in industry such as form fitting wrapping for foods and mechanical parts.

100 watt amp: Here is the most powerful public address amplifier ever to be described in these columns, capable of delivering 100 audio watts. It is ideal for handling the really big jobs in large halls, fair grounds and such like. Its general design is right up to the minute.

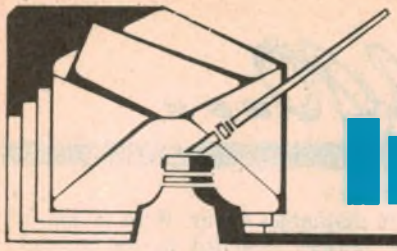
Wide band antenna: An aerial currently in the news overseas is the logarithmic periodic. It is intended for amateur, combined UHF-VHF TV, and similar applications.

This antenna may be the answer to the antenna man's dream because it is broadband, omni directional and exhibits high gain. The log periodic is so named because its electrical characteristics are repeated periodically as the logarithm of the frequency.

Opto valve: An extremely interesting electron tube has just been released by Philips. It is the Z510M, a decade numeral indicator tube of all-glass construction and miniature 13-pin base.

Essentially a cold cathode glow tube with 10 figure-shaped cathodes, the tube is an ideal read out device for the many types of counters used in modern electronics. Typical uses include computers, lifts, digital voltmeters and cash registers.

Miniature tape cassettes: Despite the enormous popularity of LP records, the proposition of using tape as a home entertainment medium is not by any means dead. Various manufacturers are currently working on an idea and the latest to make a public announcement about their efforts is the CBS organisation in the United States. The pre-recorded tape comes in a small cassette, measuring 3 ½in square and about 5/16in thick. Each contains one complete hour of music.



Information centre

No colour from IBM colour display board

I have an IBM personal computer with a colour graphics display board but I only have a monochrome monitor which is driven from the composite video output of the said colour board. Now this has worked well to date but recently I acquired a copy of Microsoft's "Flight Simulator" which looks a lot better in colour than all in green. What to do?

I cannot afford a colour monitor presently but I had a brainwave. I connected the composite video from the computer to the video input of my video cassette recorder and then connected the RF modulator output from the VCR to my colour TV set. Voila! It worked but sad to say, it was now in black and white instead of black and green. What did I do wrong and what do I have to do to get colour? (K.A., Hornsby, NSW).

● We admire the ingenuity of your method but it was doomed to failure from the start. The problem is that the composite video output from the IBM colour graphics board (or any other computer for that matter) is not PAL encoded. It is not even NSTC coded. Instead, it is a black and white signal only which has been provided as a stopgap feature so that the cheaper monitors with 1V video input can be used.

The colour graphics board is only suitable for colour monitors with RGB inputs which are mandatory if the required video bandwidth of 14MHz or more is to be obtained. So even if you went to the trouble of extracting the RGB signals and fed them to a PAL encoder and RF modulator, the results would be disappointing because the video bandwidth would be restricted to 4MHz or so.

The solution: (1) modify your present colour TV set to accept direct RGB inputs; (2) purchase a new colour set with a SCART socket with direct RGB inputs; (3) buy a new colour monitor; (4) stop playing Flight Simulator.

Incubator for chook eggs

I am considering making an incubator to hatch fowl eggs. As the temperature control is seasonally critical I would be grateful if you could let me know:

(a) If your magazine has published an incubator as a project.

(b) If your magazine has done any articles on temperature control — perhaps using the LM3911 (the data book for the LM3911 chip gives a few examples of temperature control circuitry which I could use).

In addition to the above matter, I would be grateful if you could refer me to any publications dealing with circuits for 1.5V model aero glow plug engines. Basically I would like a circuit which allows the 12V DC from a car battery to be used to produce the 1.5V DC (and necessary current) for the Cox glow plug engine. (L.T., Shelley, WA).

● We have published two articles which are relevant. They are the Triac-controlled soil heating unit described in September 1983 and the heat controllers described in July 1984. The latter article featured the LM3911. We can supply photostat copies of both articles for $3 each, including postage.

A glow plug driver circuit was published in Circuit and Design Ideas, October 1983.

Multi-sector Burglar Alarm

While building the Home Burglar Alarm (EA, January 1985), I have encountered a number of wiring and functional difficulties. I will describe the wiring errors first.

(1) The wires to the green LED, D33, are shown incorrectly on the wiring diagram. I had to swap the wires numbered 6 and 7 to obtain correct operation.

(2) The PC pin marked 32 on the printed circuit board is connected to the 0V rail, shorting out the LEDs switch. This means that the LEDs are always on. The solution is to bypass this pin altogether, or to cut the track on the PC board, isolating this pin.

(3) The wires to switches S3 and S4 are shown swapped over. I corrected this by swapping wires 17 and 18 at the switches, although this could also be done at the PC board.

(4) Switches S11 and S12 are incorrectly numbered for the switches supplied. To correct this, the terminals marked 1, 2 and 3 should be renumbered 2, 3 and 1. Similarly, the terminals marked 8, 9 and 10 should be renumbered 9, 8 and 10. On S12, the wire link and the wire marked 32 should be transposed.

As well as these wiring anomalies I have encountered a functional problem with my alarm. The alarm timer seems to

Ultrasonic movement detector

Recently, a friend brought his ultrasonic car alarm to me for repair, saying he couldn't get it to work in his Tarago minibus.

I replaced the two transistors in the receiver amplifier and obtained the specified voltages. To give the unit a quick test I placed the transducers face to face about 25cm apart on the bench and got a healthy signal on my CRO at the test point — about 5V p-p. Waving a hand around in the beam caused a LED to flicker.

Upon installation in the van, the alarm showed a distinct lack of sensitivity and I couldn't get more than 100mV on the meter during the setting up procedure. The alarm also showed a tendency to false trigger, even though the transducers were spaced apart by the full width of the vehicle which was closed and unoccupied. However, while sitting in the middle seat, full body movement was required to set the unit off.

The behaviour of the device has puzzled me considerably and I would be grateful for any advice that you could give me to improve its performance. (D.M., Tamworth, NSW).

● The ultrasonic detector was not envisaged for such a big vehicle as the Tarago. We suggest that you try mounting the transducers at either end of the cabin (ie, one at the front and one at the back). This may give a worthwhile increase in sensitivity.

The false triggering may be cured by increasing the 0.1μF capacitor on pin 3 of IC2b. We suggest that you try a 1μF electrolytic.

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be giving an extremely long alarm time. The minimum is about six minutes and I gave up trying to work out the maximum period after one hour. Please help. (M.M., Canterbury, Vic).

● There are, as you have pointed out, a number of minor errors on the wiring diagram. You are correct in noting that the wires to the LED D33 must be transposed for correct operation. Similarly, the wiring to switches S3 and S4 should be transposed. As things stand, the switches are reversed.

As you have noted, there are three PC pins marked 32. The pin on the printed circuit board should be ignored.

The switches that we used in our prototype had their common poles at one end, rather than in the centre as with another popular make. The wiring diagram is quite correct for the type of switch that we used, however rewiring is necessary if centre-common switches are used.

The problem with the extra long time delay in the alarm timer is due to the very wide spread of Schmitt trigger threshold voltages in various brands of ICs. The solution is to reduce the value of the capacitor associated with IC7c. Try a 1μF capacitor instead of the 4.7μF.

No exit delay on burglar alarm

I have just completed a Dick Smith kit of the eight-sector home alarm control box and I have encountered the following problem.

Sectors one and two will only operate the entry delay and not the exit delay as well. Exit delay can only be obtained on sectors three to eight. This is very inconvenient as this means that you cannot exit and enter by the same path.

I have checked and re-checked my work and can find nothing wrong. Is this a problem with the circuit and have other readers also had this experience?

Dick Smith's catalog says this kit has "two instant and six delayed sectors." Maybe he's right! (M.T., Highton, Vic).

● Dick Smith's catalog is wrong! The exit delay must be made longer than the entry delay, otherwise the alarm will trip whenever you leave the house. The cure is to adjust VR1 for a shorter entry delay and VR3 for a longer exit delay.

Designing inverter transformers

I am in the process of designing a switch mode power supply for use with my computer and am having a little difficulty with the main switching transformer.

In the Busker's Amplifier (EA, February 1985) you used such a transformer which, I assume, you designed yourself. I was hoping that you could pass on some information on how you did it. The main things I am finding difficulties with are choosing the correct core material, determining the size of former that I need and determining the thickness of wire for each winding.

I also need to wind some inductors for filtering and am having the same difficulties. As yet, I have been unable to find any good books that provide a general method for designing this type of inductor. The fact that the coil must carry a large DC current seems to have been neglected by most books. (J.K., East Doncaster, Victoria).

● A full explanation of the design process would take far more space than we are able to devote to these replies.

However, a general guide is set out as follows:
(1) The ferrite material that you choose is dependant on the switching frequency of the power supply. The core manufacturer's data will help in selecting the type to use.
(2) The core size is a function of the power rating of the power supply and the type of operation. Push-pull type converters usually require a smaller core than do forward or flyback converters. If your power supply is rated at more than 50W or so it might be better to consider other types of cores other than potcores. There are many other types of cores designed for switchmode power supplies.
(3) A common rule of thumb used in determining the wire size necessary to carry a given current is to use the figure of 300A per square centimetre as the maximum current density. This figure can be stretched quite considerably if the windings are only a few turns as is often the case in switchmode power supplies. This can be done because the heat build up is not as great as in conventional 50Hz transformers since these usually have many more turns.
(4) As for the design of the inductors, the inductance value itself can be calculated from the number of turns and the core data. But there is, as you have suggested, more to it than this. You will have to calculate the maximum flux density in the core and compare this with the maximum allowable flux density given by the core manufacturer. If the flux density rises above this figure the core will saturate.

We have not seen any really good books on the subject but recommend wide reading to try to glean as much information as you can from the sources available. Especially useful in selecting the type of core to use are the manufacturers' data sheets.

Loudness control for Playmaster 40/40

I am building the Playmaster 40/40 Stereo Amplifier. Upon reading the January 1981 edition of EA, I found the preamplifier of the 40/40 to be the same as the 50/50 Mosfet stereo amplifier, except for the inclusion of loudness control and muting switch.

I am contemplating putting a loudness control into my 40/40 but I cannot seem to find a 50kΩ potentiometer with 40% loudness tap. In my search, I found a 100kΩ potentiometer with 40% tap. Could you please tell me where I could get the 50kΩ version or how to adopt the 100kΩ version? (C.C., Peppermint Grove, WA).

● You should be able to purchase the 50kΩ version of the pot from Dick Smith Electronics as a spare part for the Playmaster 50/50. It is not normally in stock but any Dick Smith store can order it for you from their kit department.

Alternatively, you could adapt the 100kΩ pot by increasing the associated 4.7kΩ resistor in the loudness circuit to 10kΩ and reducing the .068μF capacitor to .033μF.

Stereo decoder for AM radio

I have built up your add-on AM stereo decoder (EA, October 1984) but, on setting the voltage on pin 19 of the MC1302P to 4.1V, am unable to get the 4.3V on pin 10 as specified. In fact, the reading does not go below 8.3V.

Could you please tell me why this is so as I am in a quandary over this. The unit does produce stereo but it is hard to get it into lock. (E.L., Forest Hill, Victoria).

● We're happy to inform you that your AM stereo decoder is working correctly. The text on page 43 of the October 1984 issue is in error. It should have read: "check that the voltage on pin 10 is at approximately 4.3V or above".

As stated in the article, accurate tuning is necessary for stereo reception. Not only that, but the tuner must also be very stable. Any drift in the local oscillator or in the bandpass characteristics of the front end will result in audible distortion and eventual dropout from the stereo mode.

For these reasons, fully synthesised tuners are the best candidates for conversion to AM stereo.

Help wanted with Eprom programmer

Recently, I constructed the Eprom Programmer described in the July 1980 issue of *Electronics Australia*. Unfortunately, the software presented with the article is written for the 2708 and I wish to program 2732 Eproms. Can you supply me with a modified program listing? (A. Pozniak, 188 Denison St, Newtown 2042).

● We are unable to help you directly but perhaps one of our readers has successfully modified the program.

Books & Literature . . . ctd from page 97

The authors have gone to great pains to emphasise that circuit analysis is just a tool in the engineer's range of problem solving aids. Unlike other texts, the examples in this book do not begin with a circuit to be analysed, but rather with a real life problem. This gives the student valuable experience in the important step of developing a circuit model from a stated problem.

This book does not teach the reader to be a circuit designer. This is not the purpose of circuit analysis. Rather a circuit analysis text ought to equip the reader with a number of useful techniques which can be applied to any branch of electrical engineering. Some of the techniques have far wider application than electrical engineering. Fourier analysis, for instance, is used in many areas outside the electrical field.

In conclusion, this book would be ideally suited to the student, either as a primary text, or as a secondary text or reference book. The serious hobbyist could use this book providing that he had the appropriate mathematical background and the motivation to work through it. Our copy came from Holt-Saunders Pty Ltd. (ACL).

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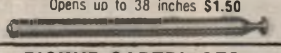

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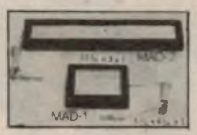

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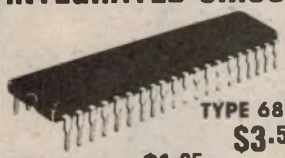

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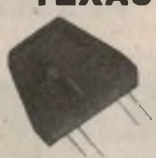

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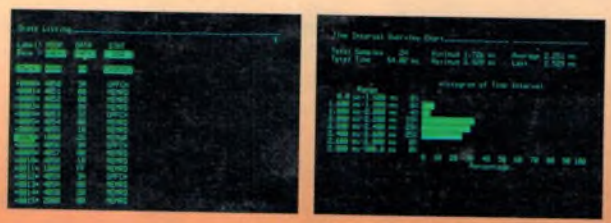

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