Australia's Top Selling Electronics Magazine

Electronics Australia

Registered by Australia Post publication No. NBP 0240

February 1985
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NZ $3.30

Busker's Amplifier to build

Philips stereo TV sets: new technology

Review: the Marantz CD-84 CD player

Turntable strobe light

Review: BL-41 turntable by Micro-Seiki

BONUS! 60-page Altronics catalog

Simple, low-cost door minder

Win a PCB kit!

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Cat K-6315

And it's complete to the last nut and bolt — including the deluxe two-tone brown case shown here PLUS our exclusive step-by-step construction manual!

STOP PRESS! Stations transmitting Teletext include ATN7 Sydney, BTQ7 Brisbane, CTC7 Canberra and all NSW Regionals except NRN11 Coffs Harbour. Many commercial stations, and the ABC, transmit Teletext subtitles for deaf people. Teletext services are expanding all the time, so check your local station for details.

A 823 M

Electronics Australia

Volume 47, No. 2
February 1985

On the cover

Our new portable amplifier is just the thing for busking or guitar practice at home. It is capable of mains or battery operation and features 17W RMS output, bass and treble controls and an in-built loudspeaker. Details page 36.

Philips Stereo TV Receiver

TV receiver design has come a long way in the last few years. This month, we take a look at the main features of the new Philips stereo TV receiver chassis. Turn to page 14.

Stereo amplifier

Presentation of the second article on the Playmaster Series 200 Stereo Amplifier has been delayed by our recent office move and the Christmas holiday period. The next article will appear in the March issue.

Low-cost Door Minder

Just starting out in electronics? Here's a project designed especially for beginners. When someone interrupts a light beam, it sounds a warning buzzer. See page 66.

Features

Hifi, Video and Reviews

Projects and Circuits

Personal Computers

Columns

Departments

Marantz CD-84 CD Player

The Marantz CD-84 is an upmarket CD player with full programming facilities and infrared remote control. Find out how it performs by turning to our review beginning page 30.

What's coming

Next month we intend to publish a stereo TV tuner which can be teamed with your existing set (see also page 124).

at the leading edge

WANGTEK TAPE DRIVE'S GOT IBM'S BACK-UP

Designed as an add-on for **IBM PC,® XT®** and **AT®** the **Wangtek PC-36** board and **5000E** Series half-height 5.25" **cartridge tape drive** provide **20, 45** or **60 MByte** of **hard disk back-up** in minutes. Mirror image or selective file backup/restore require minimal operator intervention. Software utilities supplied with the controller allow for easy integration and operation.

PTD PUTS MEGAVAULT 212 MBYTE HARD DISK IN FAST LANE

The super fast **MVP212 PTD** (Parallel Transfer Disk) offers 212 MBytes of storage in a compact **8" format.** A modified **SMD** interface yields a per channel transfer rate of **9.67 MHz.** When used in its **4 channel** concurrent mode the rate increases to **38.6 MHz.** or **4.8 MBytes** per second. Units may be daisychained for up to **1.696 Gigabytes** of storage. CAD/CAM, satellite data collection, high resolution animated graphics and digital video data dumps will find ready application for the MVP212 PTD.

AUSSIE INTERFACE FOR JUMBO LCD GRAPHICS DISPLAYS

Originally targetted at the **Sharp** range of large scale dot matrix graphics displays the **LCD-01** will also find application with other brands using similar driving techniques. ASCII data is entered via a **Centronics** port or, equally, graphics information may be directly loaded into an on-board memory via an 8 bit bidirectional bus. The interface effectively allows an **LCD** to be used as an **alternative** to the **VDU** especially where its **5V** operation would make it a **safer** choice.

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*Recommended and maximum price only.

Editorial Viewpoint

Engineers have strong opinions

The editorial on the subject of engineers in the August 1984 issue generated strong feelings in many engineers. Entitled "So you think you're an engineer, mate!" it was intended to make engineers sit up and think about their vocation. We had become very concerned about the attitude of many engineers and the way in which many graduate engineers seemed to be very complacent.

The result was a torrent of abuse from engineers who were incensed that anyone should venture an opinion on what they should know. Some also seemed proud to proclaim that they knew nothing about the subjects listed in the editorial and could not see any reason why they should know.

This is a sad outcome for Australia. Do the majority of engineers have this "head in the sand" attitude? We hope not. We know that many engineers agree with the sentiments expressed in the editorial. Some academics even indicated to us that "engineers who have not published a paper in the last two years" are out of touch. We would not go that far. But it does seem as though many engineers become complacent once they have obtained their degree. This attitude may be acceptable for those who intend to move straight into administration but those who work as engineers should be far more curious about the technical world around them.

On a personal note, it would be nice if more readers who agreed with the tone of an editorial would write and say so. It would make for a more balanced line-up of letters. We publish many letters which strongly disagree with our opinions in the hope that they will stimulate debate. So far the debate on engineers has been pretty one-sided.

There were also a few instances where letters took us to task for opinions which were not expressed in the editorial. Some seemed to think that we are against academic qualifications per se. A look at our staff qualifications shows that to be untrue. We also have two engineering students on our staff.

The reason why we are concerned about the complacent attitude of many engineers to technology outside their chosen field is that, if they are so hidebound, their ability to innovate will be seriously prejudiced. As an example, how can an engineer who designs computer systems seriously hope to meet EMI standards if he does not understand the ways in which computers can interfere with communications (eg, he must understand how superhets work). That computers do cause serious interference is an indication that many engineers do not have this knowledge.

There must be this cross-fertilisation and engineers who imagine that they can solve all problems by reverting to first principles are kidding themselves. There is no substitute for a wide background knowledge and the engineer who keeps up to date in as many related fields as possible has done himself and his employer a favour.

Finally, those engineers who are so keen to draw distinctions between themselves and technicians can only be pitied. Sure, there are practical distinctions in terms of salary and working skills. But if an engineer is worthy of the title, he will not regard any knowledge as being solely the preserve of technicians. That is intellectual snobbery of the worst kind.

Leo Simpson

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- Facilities for transistor and diode testing
- Clearly laid out front panel
- 10A DC, AC range
- Priced to undersell the others!

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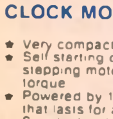

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With pins for easy board insertion.

1+	10+	100+
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Cat. A12030 $19.95

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Economy knobs with elevated white pointer

Cat. H10001	RED
Cat. H10002	BLUE
Cat. H10003	GREEN
Cat. H10004	YELLOW

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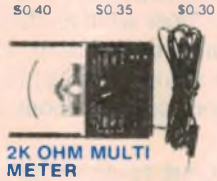

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11 Ranges, pocket size.
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Cat. H19125
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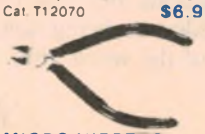
Cat. T12070 $6.95



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- Large 3½ digit display (½ inch high)
- Autopolarity, "-" display for Negative input
- High over-load protection for all ranges
- Over load display, highest figure "1" or "-1" alone glows
- Power consumption 20mW approx

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All $2.50 each!
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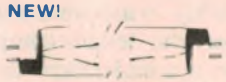
Not noisy pullouts! Stacks of uses in power amps, computers hotspot cooling etc. Anywhere you need plenty of air.

Cat. T12461	240V	4½"	$16.95
Cat. T12463	115V	4½"	$16.95
Cat. T12465	240V	3½"	$16.95
Cat. T12467	115V	3½"	$16.95

10 Fans (mixed) less 10%

NEW!



U.V. TUBES
Fits into standard 20W fluoro holder. Suitable for Scotchcal, Eprom erasing etc. As used in ETI Eprom Erasing Kit.
WARNING: Do not look directly into UV Tubes!!
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MICRON SOLDERING IRON
240V, 30 W general purpose for electrical and electronic soldering

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$5.95 slashed to $3.95

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Our RF modulators are channel selectable either Channel 0 or Channel 1.

1-9	10+
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Cat. S16040

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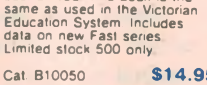
Cat. S12500

TAPERED REAMER
Great for enlarging holes that are a bit too small. Enlarges from 5mm to 20mm.

Cat. T12370 $6.95

FAIRCHILD TTL DATA BOOKS
Just arrived! This book is the same as used in the Victorian Education System. Includes data on new Fast series. Limited stock 500 only.

Cat. B10050 $14.95



POWERFUL MINI DRILL
Featuring a powerful 6000 r.p.m. motor, this lightweight (113gm) drill is ideal for many jobs. Perfect for PCB work! Has a 0.8 to 1.2mm chuck and 1mm drill bit.
Requires 12V 1 AMP fuse with M19010.

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250 ua Sen[illegible] Panel cut out 36 x 16mm, mounting hole centres at 49mm

Cat. Q10400 normally $4.50 this month $2.95

250 ua Sensitivity centre 0 very useful for balanced circuit and applications needing a centre 0 or null indication

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TELECOMMUNICATION PLUG TO 2 SOCKETS.
Ideal for modem connections.

Cat. Y16014 $12.95

TELECOMMUNICATION PLUG/SOCKET

Plug	Cat. Y1601	$3.95
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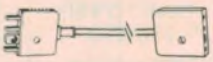

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Cat. Y16010	5m	$12.50
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BREADBOARD SPECIALS
Why pay more??

Competitors Price	Our Price
Cat. P11000 100 holes $2.95	$1.50
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P11012 1680 holes $27.95	$19.95
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TO3 HEATSINK

1-9	10+	100+
$1.00	$0.90	$0.75

NEGATIVE & POSITIVE CIRCUIT RESIST
Make your own presensitized PC Boards. POSITIVE PHOTO RESIST for using 1:1 tapes and pads on clear film for one off or prototypes. Resist 50ml bottle for approx 1500 sq cm of pcb.

Cat. P85500 $6.95

DEVELOPER: 70 gms of crystals to mix with 2 lt of water, enough to complement 50ml of resist.

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NEGATIVE PHOTO RESIST for using normal negative PCB images. Resist 50ml bottle for approx 1500 sq cm of pcb.

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DEVELOPER: 500ml bottle enough to complement 50ml of resist. No dilution reuqired.

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3 ½" MAGNIFYING GLASS
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It's infuriating when all you need to do is drill one hole a little bigger and haven't got a drill that fits in your tool box. Buy one of these for drilling circuit boards. Will hold drill bits, taps, files, etc up to 3mm.

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BULK CABLE 100M ROLLS

Cat W11222 3C2V75 OHM **$22.00**

Cat W11224 5C2V75 OHM **$35.00**

Cat W11219 4 Core Shielded **$49.00**

MINI MODEM

300 baud full duplex
Answer originate
Plugs straight in (hardwired phone)
Superior VLSI chip performance (identical to Multi Modem)
Telecom Approval (C84/37/1173.)

Incl. phone only **$199**

ALUMINIUM SHEETS .8mm

CAT.	SIZE	PRICE
H10770	150x150mm	$1.75
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19 Keys, Unencoded, 76 x 95mm
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Leakproof and in 3 convenient sizes, these long service life batteries are ideal for burgular systems, emergency lighting or as a computer backup power supply. Ideal for many power needs.

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BLANK DATA CASSETTES

Brings out the best in any micro!

1-9	10-99	100
$1.10	$1.00	$0.90

Cat D11141

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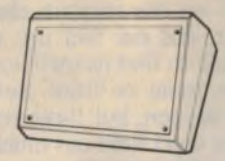
PRIME SPEC RED LEDS

We bought 100,000 so you can reap the benefits!

1-9	10+	100+	1,000+
10¢	9¢	8¢	7¢

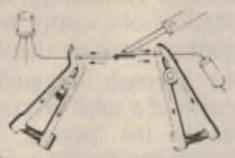
Cat Z10150



NEW SLOPING CASES

Plastic with metal front panel, available in two sizes:

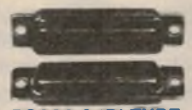
Cat H10450
190x120mm **$9.95**
Cat H10455
265x185mm **$17.95**
(measurements are approx. only)



HEAT STOPPERS

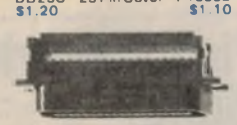
For protecting parts which have little resistance against heat when soldering. Normally $3.50

Cat T12440 **$2.50**



RS232 & 'D' TYPE CONNECTORS

PART	DESCRIP.	CAT.NO. 1-9	10-25
DE 9P	9 Pin Female	P10880 $1.75	$1.60
DE 9S	9 Pin Male	P10881 $2.25	$2.10
DE 9C	9 Pin Cover	P10882 $2.55	$2.45
DA 15P	15 Pin Male	P10894 $2.10	$1.95
DA 15S	15 Pin Female	P10895 $2.25	$2.10
DA 15C	15 Pin Cover	P10892 $1.15	$1.05
DB 25P	25 Pin Male	P10900 $2.95	$2.80
DB 25S	25 Pin Female	P10901 $3.45	$3.30
DB 25C	25 Pin Cover	P10902 $1.20	$1.10



36 WAY CENTRONICS CRIMP PLUG

Cat P12200

1-9	10-99	100+
$6.50	$5.95	$5.50

SOLDER CENTRONICS PLUGS

Unreal price for absolute top quality. Normally $14.95 (Our opposition charge up to $19.95)

1-9	10+	100+
$6.95	$5.95	$4.95

CENTRE RETURN JOYSTICK

Features 2 x 150K pots, long shaft 40mm with 25mm control ball. Bonus adjustable offset feature on pots.

Cat X15637 1-9 **$9.95** 10+ **$8.95**

PIPER MOUSE ROBOT

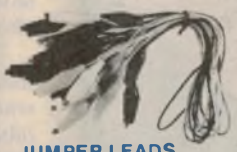
This is a Super-Sonic robot, controlled by a super-sonic sound sensor and an electronic circuit (1 channel). By using the whistle included with this Kit, Piper Mouse will obey your commands immediately turning to the left, stop, turning to the right, stop, advance and stop

Cat K96680 **$34.95**

SWITCH MODE POWER SUPPLY

DC +5V @ .5A, +12V @ .4A
DC −5V @ .5A, −12V @ .4A

Cat M16680 **$89**



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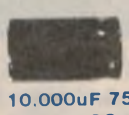

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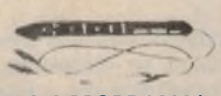

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Size: 96mm diameter

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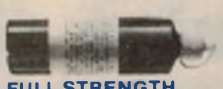

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News Highlights

National rear view TV device

National Rear View Television, a new device for improving safety, economy and convenience of heavy vehicle operation, is now being marketed in Australia by GEC Australia Ltd.

When mounted on trucks, buses and commercial vehicles, Rear View Television eliminates blind spots and provides a field of vision unequalled by mirrors.

The new system switches on automatically when the vehicle transmission is shifted to reverse. It provides a bright, clear picture and unobstructed driver view under all weather conditions. By using floodlights, the system can even be operated at night.

Both camera and monitor are shock and vibration resistant and are protected from rain, moisture, dust and direct sunlight. The monitor, which can be mounted anywhere in the cabin, can be tilted after installation to suit each driver.

Machines unlikely to take this job

Will the time come when we can switch on the vacuum cleaner or lawn mower, put our feet up, and leave the machine to find its own way around the lounge room or front garden? Well, it could happen, but those researching the subject don't hold out much hope for an early breakthrough.

But at least they are trying. The appliance manufacturers are keen to develop such machines and the Cranfield Institute of Technology, near Bedford in England, is one centre which has been retained to work on the idea.

One approach is to guide the machine by means of a cable laid under carpets or buried in the ground. This is being seriously considered for relatively simple situations, such as guiding a vacuum cleaner along a public building corridor.

The other approach is to let the machine roam free, but to equip it with enough sensors to enable it to avoid tables, chairs, and other objects and, presumably, to kick Pongo up off his favourite spot in front of the fire. As one expert put it, "We need software that can recognise a cat and take appropriate action." He didn't say what "appropriate action" meant.

Another problem is power for such an applicance. Power flex is hardly practical, and the amount of power is beyond current battery technology. So, for the moment, there appears to be no substitute for a human being or a trained monkey.

Piezoelectric flight sensor

Collins Avionics have recently begun production of a radical new gyroscope. Unlike normal gyroscopes which are gymballed and move independently of the aircraft, the new device is fixed rigidly to the aircraft structure.

Error signals are produced in the gyro by the flexing of piezo-electric elements on the rotor. When the aircraft is not subject to any

New standards from SAA

The Standards Association of Australia has released several new or updated standards sheets. Some of those related to electronics include "Power Transformers, Loading Guide", "Dimensions of Racks and Panels of the International 19 inch Series", "Computer Installations" and "Performance of Frequency Modulated Radio Receivers".

The sheet relating to FM receivers recommends the adoption, without change, of the IEC publications for measurement of radio receivers.

Five TV transmissions in one fibre

An optical fibre transmission system that can handle up to five television transmissions simultaneously has been released by the Video Systems Division of GEC Australia.

The system uses a single optical fibre for analog transmissions, making it more economical than digital systems for short distance transmissions normally associated with security applications. This makes it possible to transmit a television signal without processing it.

GEC's Video Systems Division says the transmission system is ideal for trunk lines requiring high security as there is no leakage from the fibre optic cable. The system can transmit up to four kilometres without relay amplifiers.

New TV sets using thin-film transistor arrays

Joining Casio's LCD television in the Japanese marketplace are two new models — one from Seiko and one from Citizen.

The Seiko t-101 measures only 160 x 80 x 31mm. Its 50mm diagonal screen has 52,800 thin film transistor elements. The display was developed jointly with Epson and incorporates a backlight for night viewing.

The TV has a power consumption of 1.1W (in bright light). The alkaline battery should have a life of about five hours. Power consumption rises to 1.9W when the backlight is used.

The Citizen LCD TV measures 135 x 75 x 24mm, but it includes an AM radio. At 69mm diagonal, its screen is larger than the Seiko's but it has fewer elements — only 18,056. It has a reflective back panel, similar to conventional liquid crystal displays. This improves the contrast in bright light but prevents backlighting. Power consumption is only 0.4W, giving a 10 hour life for its four AA size batteries.

acceleration, the piezo elements give out a constant DC voltage. As soon as the aircraft begins a manoeuvre, the piezo elements are subjected to additional stress which superimposes an AC voltage on the normal DC.

There are four piezo elements on the rotor — two aligned along the axis and two across it. This permits the computer detection system to distinguish movement in two axes. Two such rotors will provide full three axis monitoring.

The main advantage of the new system, claim Collins, is a big improvement in reliability. The gyro rotor is operating at only 3200 RPM compared to around 24,000 RPM for conventional gyroscopes. This leads to greatly extended bearing life, one of the major causes of failure in previous systems. Presumably, the new system is free from gyroscopic precession which normally requires a complex correction system.

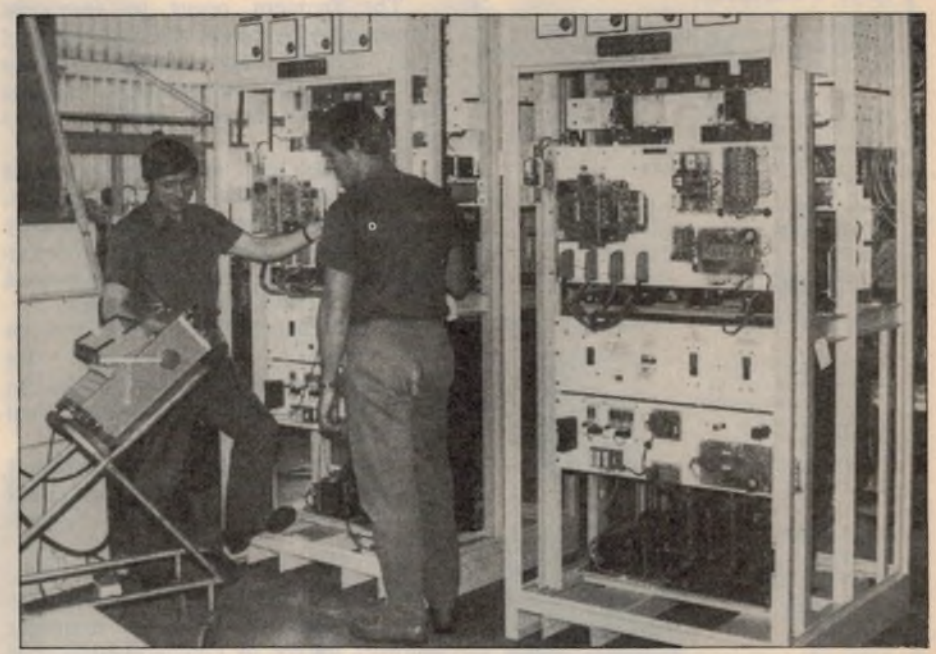
Say goodbye to QWERTY

Complaints by telex operators at the Australian Post Office have led to the development in Britain of an entirely new keyboard design.

Operators claimed that using keyboards all day resulted in neck, shoulder and wrist pain. The resulting investigation determined that holding the hands close together with wrists turned outwards leads to tension and, eventually, to pain.

The Qwerty arrangement of the keys, inherited from the typewriter, has also been changed. This layout was originally adopted to prevent the most used letters from jamming together. Obviously, this can not happen with computers. The new layout groups all of the most used letters close together. For example, the left "home row" now reads ANISF and the right DTHOR. The most used letter — E — is pressed by the left thumb.

Ninety percent of the 100 most used words in English are on the home rows (including the E). Operating speed can apparently be improved by 20% to 40%.



$1.7M export contract to STC

Standard Telephones and Cables has achieved overseas sales of $1.7 million for telephone exchange power supplies. These are the first overseas sales for the supplies, although Telecom has been using them for six years.

The Hong Kong Telephone Company chose the STC rectifiers in an update of its four busy exchanges. Two more have also been supplied to China.

The patented "buck-boost" system is designed to economically supply a smooth source of power to an exchange and thus protect sensitive electronic equipment. During periods of normal AC supply, the system charges the back-up batteries at about 56V and simultaneously provides a regulated output of 48V. If the AC supply fails or is interrupted, the system is still able to supply a regulated 48V output.

The new equipment is more efficient, both in terms of the power consumed and the amount of heat generated. It also permits the use of batteries which are only 60% to 70% as large as those previously required, thus giving significant space savings.

News Highlights

Don't talk dirty to me

Computer buffs call it "flaming", and now scientists are documenting and trying to explain the surprising prevalence of rudeness, profanity, exultation and other emotional outbursts by people when they carry on discussions via microeclectronics.

As small computers proliferate in offices and homes, more business discussions, once pursued face-to-face, by telephone, or on paper, are now taking place by way of keyboards and video display terminals.

With electronic mail, messages are left in a central computer for reading by correspondents on their own computers at their own convenience. In some offices, observers say, the traditional typed memorandum is all but extinct, and computer mail is replacing even telephone calls.

The frequent resort to emotional language is just one of the several special traits of computer commmunications discovered by behavioural scientists studying how this new medium affects the message.

Observing both experimental groups and actual working environments, scientists at Carnegie-Mellon University in the USA are comparing decision-making through face-to-face discussions with that conducted electronically.

A sociologist at Carnegie-Mellon, Dr Lee Sproull, said whatever the company's pre-existing standards for the expression of opinion, "electronic mail seems to loosen them".

The frequent presence of exuberant and offensive terms has long been noted by observers of computer bulletin boards.

In 1982 the US Defence Communications Agency, which manages the world's oldest and largest computer network for use by Pentagon employees and contractors, issued the following message to potential bulletin-board contributors: "Due to past problems with messages deemed in bad taste by 'the authorities', messages sent to this address are manually screened (generally, every couple of days) before being remailed to the boards."

Struggling to explain the free-wheeling language which people use on computers, the Carnegie-Mellon scientists noted that electronic communications convey none of the non-verbal cues of personal conversation — the eye contact, facial expressions and voice inflections that provide social feedback and may inhibit extreme behaviour.

New display for UTA Buses

Sydney's Urban Transit Authority (UTA) is currently evaluating a new electro-mechanical destination display for its buses. One Mercedes bus equipped with prototype display is to be used for the six month trial. It is expected that a further 20 buses will be ordered if the trial is a success.

The displays, which cost around $11,000 each, are manufactured by STC-Cannon. They use rotating yellow and black "eyes" for each display element. A microprocessor selects the appropriate elements once the driver has entered the route number.

The electro-mechanical display is far more flexible than the traditional scroll types. It is capable of "memorising" all of the UTA's present destinations, whereas three different rolls, each with a capacity of 100 destinations, are needed.

New study confirms nuclear winter

A new study by the US National Academy of Sciences has confirmed that a nuclear winter — ie, the onset of winter-like conditions after a nuclear war — is a "clear possibility".

The concept of nuclear winter first gained prominence in December 1983, following the publication of a paper by five US scientists: Turco, Toon, Ackerman, Pollock and Sagan. The paper shocked the world with its predictions and seriously upset the plans of nuclear strategists who had failed to consider the long-term weather implications of nuclear conflict.

According to a recent report in *New Scientist*, the Academy study confirmed the mathematical models used by Turco and his colleagues. These predict that temperatures in the northern hemisphere will drop by up to 25°C following a nuclear war in which about half the world's nuclear arsenal (about 6500 megatons) is detonated.

The Academy study added a new twist of its own, however. The "freeze" would occur within a few days after a war, not after a week or two as the original paper predicted.

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Letters to the editor

Helpful advice

We wish to express our appreciation of the service you provide to the industry by such articles as *A story with a kick in it* in your October, 1984 issue.

We would, however, offer a modified explanation for the start-up mechanism which provides a more enduring start-up supply to IC401.

Whilst the charge current flowing into C14 through T1 primary would certainly contribute to the output of T1, the application of 340 volts from the bridge rectifier turns on TR2, providing supply to IC1 which breaks into self oscillation, producing the 115V and 8.8V outputs from T1.

The 115V is supplied to C530 via the 8.2kΩ resistor (R510) as you describe, starting IC401 and providing drive to the horizontal output stage. The horizontal pulses are then fed back to IC1, pin 4, locking it to line frequency. The output to TR3 is pulse-width controlled to regulate the T1 output voltages.

The 340V applied via TR2, thus causing IC1 to oscillate, is also applied to the time constant consisting of R3, R35 and C1. When the charge on C1 is sufficient to result in a voltage greater than the 6.8V rated zener D2, TR4 turns on and TR2 turns off, thus disabling the start-up circuit.

The current through TR4 flows through the two resistors R2 and R34. Your comment that these resistors were over-run caused us some concern, but a check first of dissipation, then voltage compared to rating, and finally service records, all suggested no cause for action at this time.

Considering these factors we believe that the problem encountered was either the normal statistical possibility of a resistor becoming faulty, or was caused by some extra-terrestrial encounter (lightning).

Once again, whilst querying the validity of a couple of points in your article, we very much appreciate the logical approach to problem solving.

M. C. Plumley,
NEC Home Electronics,
Penrith, NSW.

Errors in 'Printers'

I refer to your article "Printers — New Technology, Lower Prices" in EA, December, 1984.

In the discussion of dot matrix print mechanisms the writer has got his description of the printhead rather incorrect. A dot matrix impact printer has only one vertical row of pins. The character is made up by moving the printhead across the width of the character and firing selected pins in the single vertical row until the shape of the character is complete. Thus, a 7x7 character would be formed from seven separate firings of the pins, not from "49 little metal pins enclosed in the printhead in seven horizontal rows and seven vertical rows."

Even those matrix printers that print a row at a time still have only one pin per vertical position for any one character. The only exception to this is some printers designed for high quality work that have two slightly offset vertical rows of pins in order to produce overlapping dots, and therefore a higher print quality, in a single pass. Even dot matrix inkjet and thermal printers, where the cost of each pin is perhaps less, do not have multiple vertical rows of elements.

I appreciate that the article was a reprint, but I believe EA has a responsibility to vet the articles more thoroughly than this one was.

On a slightly different point, I have not noticed a single printer article, whether a survey or review, that has commented on the tendency of newer, cheaper printers to do non-overlapping input. That is, these printers are not capable of receiving data at the same time as they are printing out the contents of the buffer.

While manufacturers talk about "bidirectional, logic-seeking" capability they are strangling the throughput of the printer by making it wait until the print is finished before receiving more characters. Each discussion of printers should contain a warning to prospective purchasers to insist on a demonstration of the printer printing text received from the computer. The impressive speed and intelligence of the printhead in self-test mode is less than half of the story.

J. Richards,
Jamboree Heights, Qld.

Further comment: the engineers strike back

You further display your lack of understanding of the role of an engineer in your reply to J. P. Murphy (EA, December 1984).

You state ". . . an electronics engineer who does not understand the details of a superhet is like a mechanical engineer who does not understand how a two stroke petrol motor works".

As a mechanical engineer with 12 years experience in a diverse range of manufacturing industries I have never needed to know the internal details of a two stroke motor, nor do I envisage I ever will. Few professional mechanical engineers would need to know, unless they were involved in the design, testing or servicing of petrol motors, and these are fairly specialised fields. When it is realised that most engineers move into managerial positions by mid career, the requirement becomes even more remote.

Mechanical engineers do not learn about petrol motors during their study course. What they do study in considerable depth is thermodynamics, which covers the theory of all gas power cycles. Hence, if it were necessary, most engineers could refresh their memory after a few hours study and could then deduce and explain the working principle

More on 'Printers' article

I refer to the article in the December 1984 edition of your magazine entitled "Printers — new technology, lower prices", reprinted from an American magazine.

This article contains glaring technical errors which imply that the writer possesses only a superficial knowledge of the technology he has written about. For example, in the discussion of dot-matrix printers, it is apparent that the writer believes that a dot matrix print head consists of a matrix of print wires, rather than just a vertical column. Such statements as "if the density of a printhead is 7x7, it would have 49 little metal pins enclosed in the print head in seven horizontal rows and seven vertical rows" attest to this. Because of this misconception, he also seems to think that dot-matrix printers cannot print overlapping dots unless they have "overlapping vertical rows of pins".

Other technically inaccurate

of any IC engine. However this would be a rare case.

This is precisely the point your correspondent J. P Murphy is making. All engineers are trained and used by industry to solve problems, not for their knowledge of how things work.

The questions you should have asked your electronic engineer applicants are those designed to test their ability to think through a problem. During job interviews I have never been asked to explain how something works, but I have been asked how I would solve a particular problem. I have also used the latter question myself when recruiting staff.

Frankly, I don't think you need electronic engineers at EA. Your own lack of an engineering degree does not hinder your ability to design innovative and reliable state of the art circuits. What you need is an innovative, inquisitive technician with a flair for circuit design and journalism, possibly with a hobbyist background. An engineering degree and industrial experience guarantee none of these attributes, simply because a professional engineer's work does not require them.

Finally, I would like to assure you that I do understand how a two stroke petrol motor works. I read about it during my school days in one of those boys' books on how things work.

P. Stuart, B.E.,
Carlingford, NSW.

statements are made, such as "That ROM contains the ASCII code for the characters and the pins corresponding to that code are all fired at the same time to produce the required letter". The ROM, of course, primarily contains the *pattern* of the character. It may also contain the ASCII code as part of a lookup table. Again we have the mistaken belief that the character is printed at one impact, rather than a vertical column at a time.

In the discussion of low-cost ink-jet printers, only the older piezoelectric system is described. No mention is made of the newer cartridge type systems, where the ink is ejected by steam pressure generated by the heating of a small resistive element. This system is used in the Hewlett-Packard printer pictured on page 88.

Please, if you must present articles which are reprints from other publications (and I appreciate that staff shortages may make this necessary from time to time), at least have one of your technical staff read over the article first.

C. Mitchell,
Wavell Heights, Qld.

CSIRO paper on data storage available

Recently there was a need in our division for a device which would allow an Apple type computer to store large quantities of data at high speed on a main-frame compatible magnetic tape unit.

An interface was designed and built which enabled a standard 1600 bpi 9-track magnetic tape unit to receive data from the computer at 60K 8-bit words per second.

The system, comprising a Basis MedFly computer and a Digi-Data magnetic tape unit, has now been used successfully as the data logger for a laser radar system and an airborne (CSIRO Fokker F27) spectrally scanning radiometer.

Technical details have now been published as a CSIRO technical paper and I am enclosing a copy of this document for your perusal. In publishing the paper, the CSIRO hopes to inform professional engineers of the relative simplicity of such a system and to attract enquiries from companies that may be interested in commercial manufacture.

Dr J. C. Scott, CSIRO,
Private Bag No. 1,
Mordialloc, Vic.

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Over the years we have seen numbers of small electronics retailers try to turn their hand to mail orders: and after just a few orders they're suddenly justified in claiming they're 'number one'.

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In the interests of fair competition, we'd like to pass on a few tips from our sixteen years of experience:

- Stop using hand written invoices covered with illegible scrawls. Instead, invest half a million dollars in an IBM System 38 Computer with a team of programmers, 12 months planning and finally an 'on-line' mail order department. Clear, concise and detailed information – what the customer wants. Just like we do!
- When customers send in too much money don't return a scrap of paper in their order with the amount on it. They could lose it! Instead, use your on-line system to itemise any credit on the invoice and then **automatically** deduct it from the next order.
- If you run out of stock don't just scrawl 'out of stock' on the order. Put it on back-order, inform the customer of the delay and check all back-orders daily until the stock arrives. When it does, post it out at no extra charge. It's expensive, but it's the type of service you should offer. Just like we do.
- Support your mail order department with at least $5 million worth of stock and surround with 150 skilled people all geared to provide the customer with the best possible service. Just like we do.
- Ensure that you despatch all orders within 24 hours of receipt: no-one wants to sit around waiting weeks for the goods to arrive. If there **must** be a delay, tell the customer why. Just like we do.
- And occasionally when you make a mistake – and you will (you're only human) be strong enough to admit it. Just like we do.

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Philips stereo TV receivers

. . . a look at the technology

Since the advent of stereo TV broadcasting in Australia in December 1983, quite a few brands and models of stereo TV receivers have come on to the market. But Philips is the only brand which is wholly designed and manufactured in this country. Editor Leo Simpson has taken a close look at the Philips chassis and here is his report.

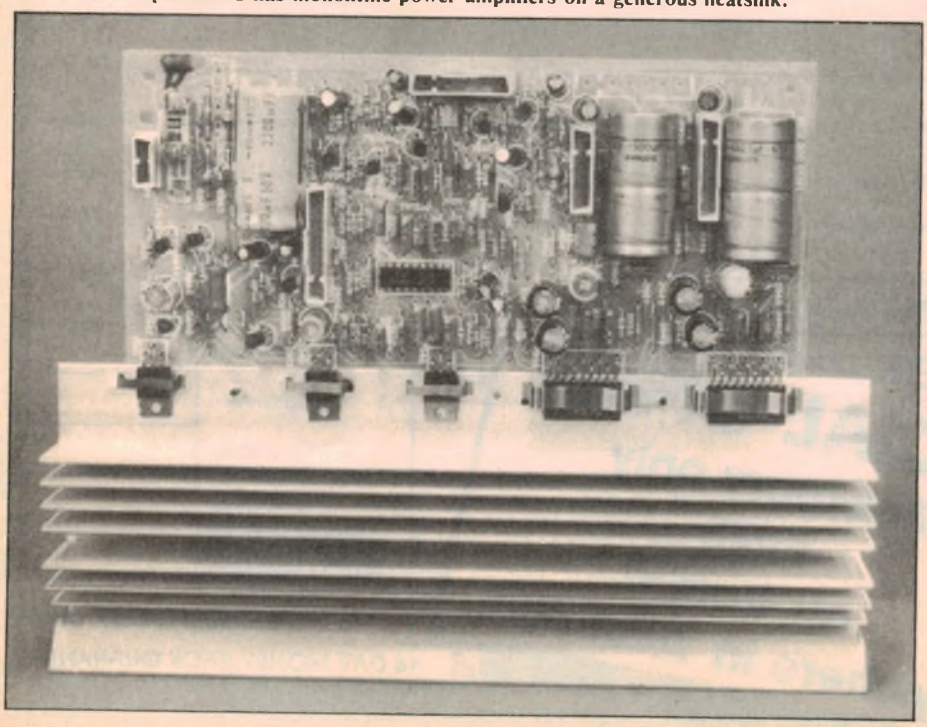
by LEO SIMPSON

Philips make and market a range of 63cm and 54cm stereo and mono colour TV receivers but they are all based on the one chassis design, the KL9A-3, which is really a large printed circuit board assembly as the photos show. The receiver we had for evaluation was a 63cm model, the KR683, which does not have the Teletext facility, although it is identical in all other respects to the KS683 which does have Teletext. The equivalent models now in the marketplace are the KS684 and KR684 and it is these models to which we shall refer for the rest of this article.

Physically, the KR684 is large, with overall cabinet dimensions of 793mm wide, 505mm high and approximately 480mm deep. It is supplied with a timber stand to raise it some 270mm above floor level. The set has clean and simple styling which avoids making it look too bulky and imposing. Weight of the set is 52kg.

Since it is a stereo set, it is fitted with two loudspeakers on either side of the screen, one an oval type, nominally 190 x 70mm and the other a cone tweeter about 50mm in diameter. The front grilles may suggest that the tweeters are horn types or that the grille itself functions as a horn type diffuser but it is merely a styling exercise.

The audio output board has monolithic power amplifiers on a generous heatsink.



Control functions

One reason why the styling of the Philips KR684 is so clean and uncluttered is that there are no control knobs at all. The set is intended to be adjusted and used with the infrared control. This takes in virtually all user-adjustable functions of the set, apart from those needed to initially tune the wanted stations. For the latter function there are a number of controls concealed behind a panel just above the righthand speakers.

At the top righthand corner of the set is a dark translucent panel which is a red filter for the two-digit channel LED display. Below this are five LED indicators marked Standby, Stereo, Bilingual, Spatial and Balance. The red standby indicator is on whenever power is present but the set not actually in use. Power consumption in this mode is only a few watts. The standby indicator also flashes rapidly whenever one of the remote control buttons is being pressed, to indicate reception of the command via the infrared sensor. This is also behind the top righthand translucent panel.

When the set is turned on, by pushing the green button on the remote control, the set will tune itself to the station received during the last watching session and will have all the user's preferred settings for contrast, brightness, colour saturation, volume and the last-used settings for bass, treble, and balance (more on this most useful function later). If the station received is transmitting in stereo the green stereo indicator will light.

Again, if the sound is a bilingual transmission (not being used at present in

The Philips KS684 is one of a series of stereo sets using the KL9A-3 chassis.

Australia), the yellow indicator will light instead.

Two other indicators remain. The spatial indicator is lit to indicate whether the "spatial" function is selected or not. When a stereo transmission is being received, the Philips receiver gives an enhanced stereo reproduction which simulates a much wider speaker separation than is actually the case. Similarly, when a mono transmission is received, the Philips set feeds the signal through a stereo simulator to enhance the sound quality.

The balance indicator is lit when the balance is adjusted via the remote control. At the same time, a narrow vertical blue bar appears on the screen to indicate the balance setting. It moves across the screen depending on whether the volume of the right or left speaker is increased.

Stereo headphones

A standard 6.5mm jack socket is hidden behind a small flipdown panel adjacent to the Philips logo at the lower lefthand corner of the set. Associated with the socket is a three-position slide switch which gives either standard stereo sound reproduction (without spatial enhancement) or one of the bilingual sound channels in the case of a bilingual transmission. When listening via the headphones, the speakers can be muted with the remote control but the headphone sound level is set via a small knob in the main control compartment referred to earlier.

As we shall see, the provision of the stereo headphone facility means that the Philips KL9A-3 chassis has a completely separate stereo amplifier for this function.

Remote control functions

As can be seen from the accompanying photos, the remote control handset has no less than 30 pushbuttons although it does not need a licence to drive it as may be first thought. Eight of the buttons pertain to Teletext functions and a numeric keyboard is for channel selection (up to 16). Volume, bass, treble, brightness, colour and stereo balance are all variable continuously via the handset but the loudspeaker may also be muted completely in one step via the muting button. Pushing the red button turns the set off.

The cabinet is strongly built of 18mm particle board and covered with a simulated woodgrain material which looks to be between walnut and teak in colouring.

The rear of the cabinet is largely featureless except for a number of sockets which are as follows: a 75-ohm coax socket (Belling Lee type) for the antenna connection, two two-pin DIN sockets for connection of external loudspeakers (which mutes the internal loudspeakers), and a SCART socket. This last socket is a multipurpose socket which is becoming standard on European TV sets and is also known as a Euroconnector.

SCART socket

SCART stands for Syndicat des Constructeurs d'appareils Radio Recepteur et Televiseurs — a committee of French radio and TV manufacturers which devised the standard connector for domestic video appliances. The socket accepts a shielded 21-pin connector which carries video input and output signals, red, green and blue inputs (RGB) for the picture tube, a blanking signal and stereo line inputs and outputs. Associated with the socket is a switch to select the external video input or the internal video signal from the set itself.

The reason for having the SCART socket is firstly to bring all the inputs and outputs together and secondly to give a superior picture from sources such as VCR or laserdisc player or from computers which may have direct video output or RGB outputs.

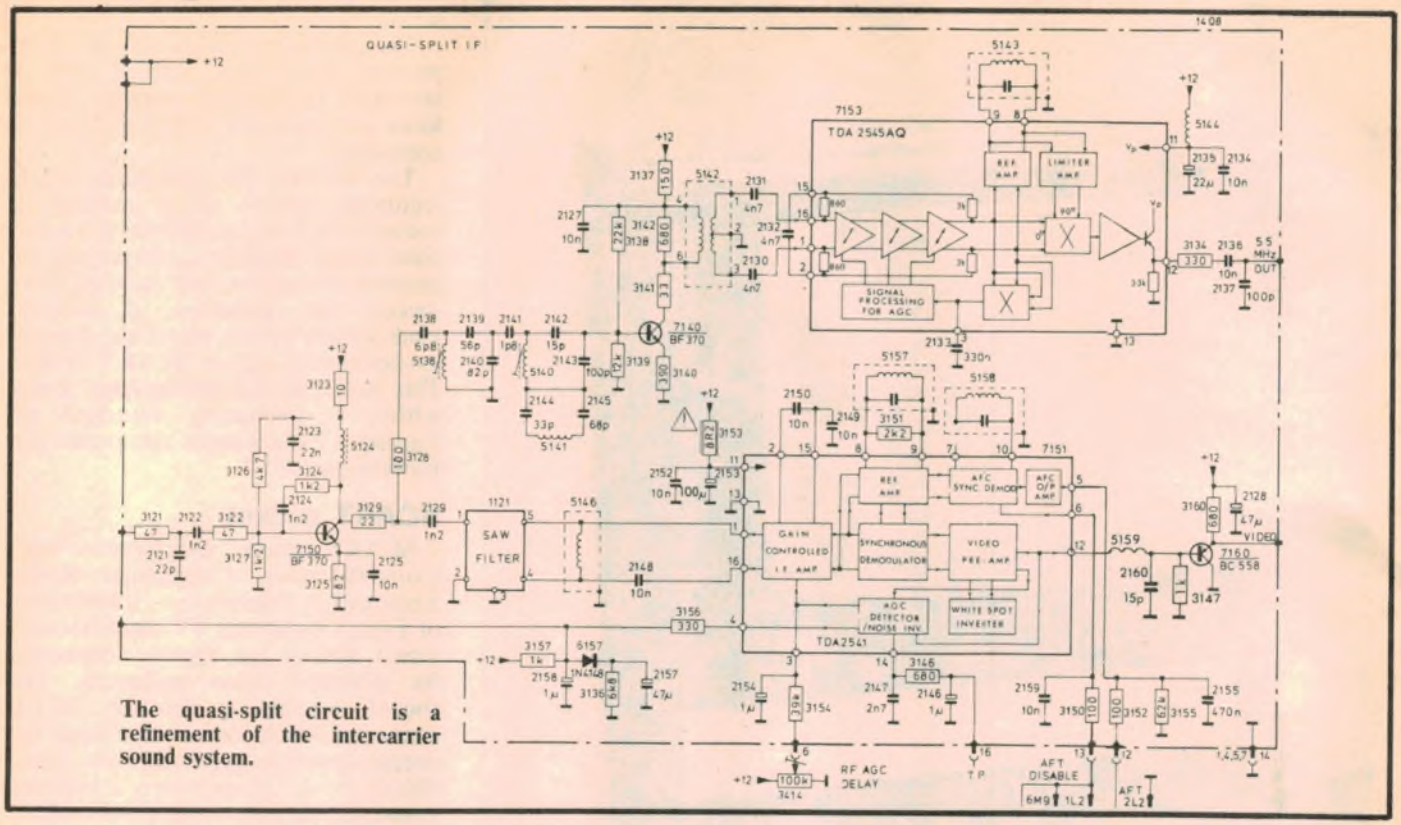
Inside the cabinet

Removing the back of the cabinet is quick and easy and is a revelation compared to sets of many years ago which had countless nutdriver screws retaining the Masonite back. The Philips set has a moulded plastic back which is retained by four plastic lugs. These are released by inserting a screwdriver and levering it slightly. Nice and easy.

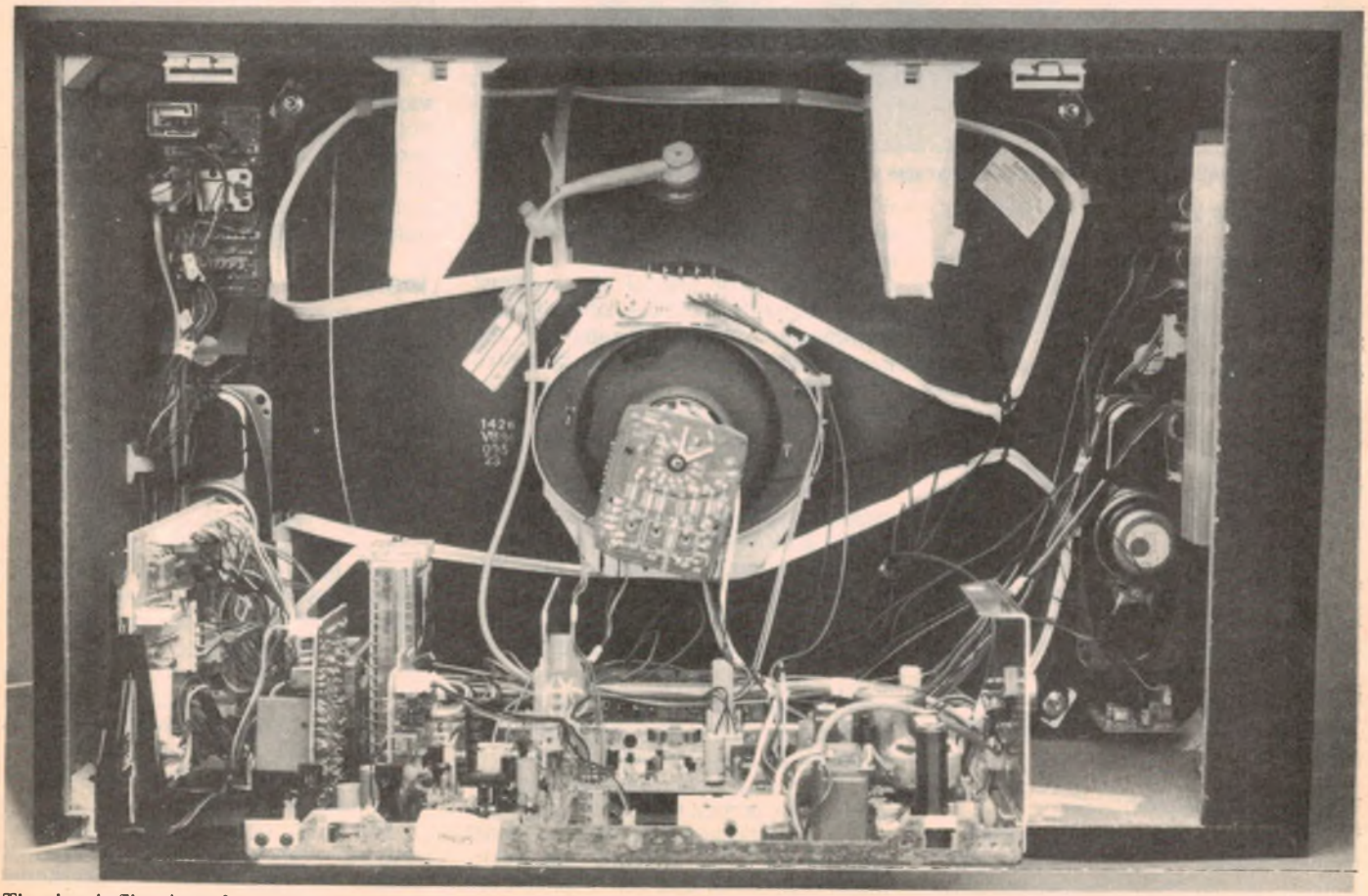
As noted at the start, the chassis is really a large printed circuit board but it has a galvanised steel frame to give strength and rigidity. The chassis is held vertically by two plastic clips at the top. These are easily released by hand to allow it to flip down to an angle of about 45 degrees. Lifting the chassis slightly in its hinges will then allow it drop into a horizontal position without the need to disconnect any cables.

The layout of the chassis-cum-PCB is relatively standard with the switchmode supply and yoke driver (vertical output and horizontal output) stages on the

Philips stereo TV receiver



The quasi-split circuit is a refinement of the intercarrier sound system.



The chassis flips down for easy access while still operational.

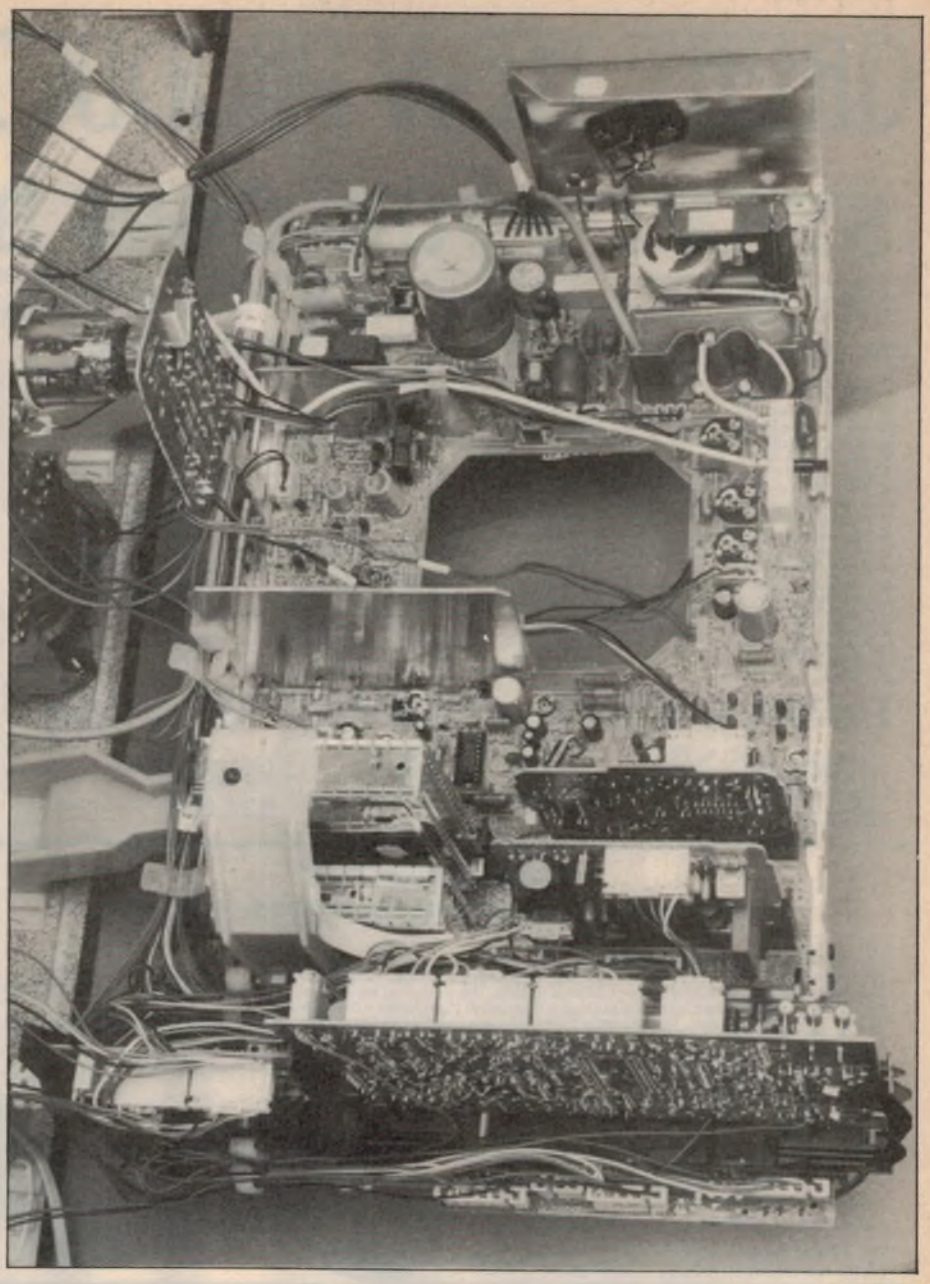
righthand side. On the lefthand side are UHF and VHF tuner modules plus four vertical boards. The largest of these is the microprocessor board which provides most of the user control functions. In line with this is a smaller board which provides the vertical blue line display on the picture for the stereo balance control adjustment.

To the right of the microprocessor board is the chrominance and luminance processor using the TDA3560. To the right of this again is the dual sound IF board using TBA120U ICs working at 5.5 MHz and 5.72 MHz.

Within the cabinet itself are another five printed circuit boards. On the lefthand side is the audio power board which has a large extruded aluminium heatsink. Below it is a small board associated with the stereo headphone jack.

On the lefthand side of the cabinet are three boards. One is immediately behind the user control panel and is merely a connector interface for the pushbuttons there. Below that is the audio processing board which provides the stereo/bilingual, spatial and mono enhancement functions before the audio signals are fed to the stereo power board. And finally, there is the buffer board for the RGB signals.

Mounted on the base panel of the cabinet is the large C-core mains power transformer. This is necessary because so many of the set inputs and outputs are accessible to the user and so need to be tied to earth potential, which requires the use of an isolating transformer.



The KL9A-3 chassis is a large PC board with plug-in modules. The microprocessor board is at the bottom of the picture. Note the C-core transformer at the left, just below the neck of the picture tube.

Circuit details

In an article of this length it is not possible to fully describe all the interesting circuit functions of this new Philips set. Instead, we will attempt to highlight the more innovative aspects, starting with the microprocessor control system. This uses a dedicated 40-pin microprocessor which controls all the functions provided by the infrared remote control handset.

Serial data (ie, a pulse train) from the infrared receiver is fed directly into the microprocessor for decoding. In response to a user command to, say, change a channel, the processor generates switching voltages to select high band or low band VHF or UHF operation. Then it generates an analog voltage via two digital-to-analog converters, to tune the varicap diodes in the appropriate tuner module.

Two D-A converters are required because each converter is only capable of 64 discrete output voltages. This is insufficient for fine-tuning so two converters are cascaded, via resistor weighting networks, to improve the tuning resolution to 64 x 64 or 4096 increments.

The processor also monitors the AFC voltage from the appropriate tuner module (via and LM339 comparator) and adjusts the tuning voltage up or down accordingly. As well, the processor generates DC control voltages for volume, treble, bass, balance, brightness and colour saturation.

Other functions of the microprocessor are scanning the keyboard (in the hidden compartment on the front of the set), providing the channel number indication for the digital readout, muting the sound during channel change, generating the data words to control the (optional) Teletext decoder and generating the switching voltages for the stereo/dual language functions.

Memory retention is assured for all settings even when the set is disconnected from the mains by means of a nickel-cadmium cell. This is sufficient to ensure memory retention for three to four months.

Intermediate frequency stages

Included with this article is the circuit of the "quasi-split IF stages". The quasi-split IF system is a variation of the standard 5.5MHz intercarrier system. As with any Australian set, the intermediate frequency for the video carrier is 36.875 MHz and this is fed from the tuner output to an amplifier stage based

continued on page 21

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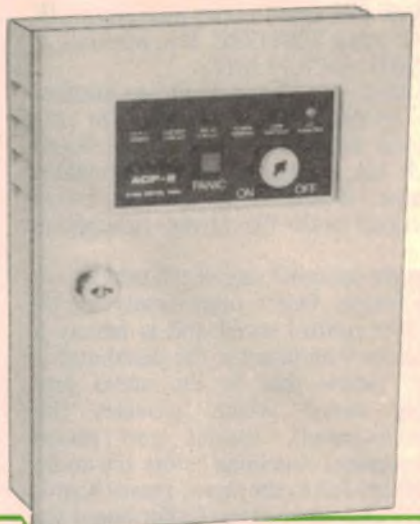

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- **Dual cassettes. Once only outgoing recorded announcement. You can play back the messages on any cassette player including your car.**
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- **Precision & Quality. Japanese made. Need we say more?**
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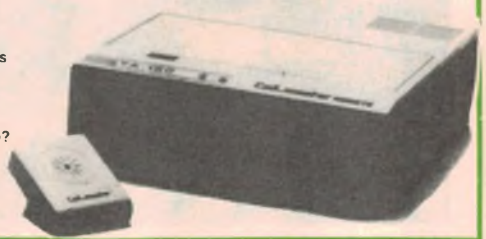

Cat. YT7010 Standard TA100 Callmaster $225

Cat. YT7020 Remote control version (all the features of TA-100 plus remote option) $299

VCR STEREO ADAPTOR NEW

- ★ Converts mono sound of standard VCR's or TV's, AM radio etc to pseudo-stereo signal
- ★ 1 x RCA'S socket input, 2 x RCA socket output
- ★ NOT A KIT, built, tested and guaranteed
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Cat. AV-6506

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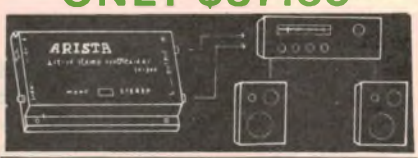

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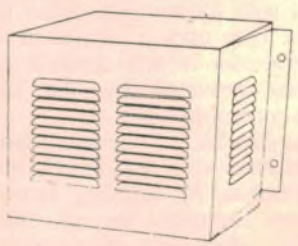
$23.50



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ALARM STICKER - A durable self adhesive sticker that clearly tells a would be thief that an alarm is fitted. Does not refer to a particular type of alarm - creats more doubt in the thieves mind.
Cat. LA-5100
95¢ each or 85¢ for 10 or more

UNIDEN 27MHz/156 MHz Marine Two-way

"Sea Wasp"
This great new marine two-way radio is fitted with all current 27MHz marine channels (**inc.** both distress), **plus** 2 vacant 27MHz channels for your own use. But the big news is that this radio will **receive** 2 of the OTC "Seaphone" VHF FM channels. That's right, it will receive channel 16 (Distress) & Channel 67 (weather). What a great idea! Apart from this it is a fully approved 5 watt 27MHz transceiver with many features.

ONLY $199

Cat. No DT5410

Jaycar ELECTRONICS

"You ain't seen nuthin' yet!!!"

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NEW

ONLY $69

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 above.

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 I 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, 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 severe pest problems!
Your pest problem may not be as bad but it may still be a nuisance, which is why the domestic Verminex unit 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 clean original condition & 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 its a great solution. It is supplied with a 240V plug pack but can be battery powered.

What have you got to lose except the bugs? Cat. No YS5500

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Once again we were not happy with the cheaper units on the market. Several low-cost models were evaluated which we found to be unreliable in service (e.g. many would not penetrate from the front of a brick house to the back of the backyard. Some had very short NiCad battery life. Many were not approved).
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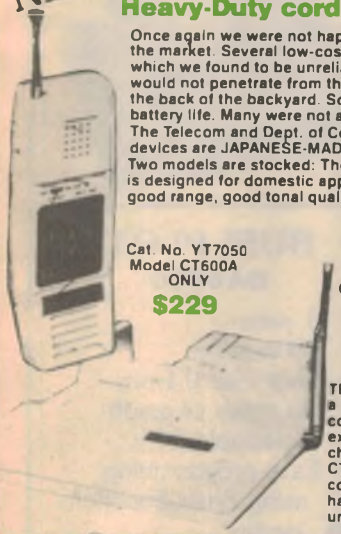
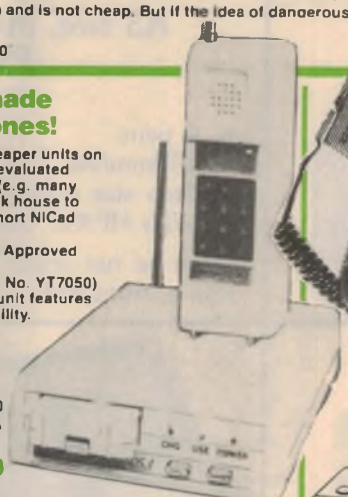


Cat. No. YT7050
Model CT600A
ONLY
$229



Cat. No. YT7060
Model CT505A
ONLY
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The CT-505A is a deluxe heavy duty unit which features a twin battery pack system. This enables you to continue operation in high-usage circumstances. Simply exchange the discharged battery pack with a freshly charged unit which comes from the base unit. The CT-505A provides the maximum range available in compliance with Australia's legal requirements. It also has unique security coding which prevents unauthorised use of your telephone.

Kids Bike "Emergency" Siren – Great New Toy –

CB-type microphone with siren/speaker/horn 4-way switch on mic. gives you: Police, Fire & Ambulance Sirens (all distinctive) PLUS Public Address! (It doesn't make enough noise to be a nuisance but is great fun!)

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(Please note that the illustration is indicative of PIR. We reserve the right to ship units of similar performance but possibly different physical appearance)
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At long last a good quality, stable video/audio-to-RF modulator. It even will enable you to connect a Commodore VIC-20 to a VHF T.V.! Note that this module is specially tuned for Australian T.V. (VHF CHAN 0 & 1 5.5MHz Sound Subcarrier). A full data sheet & connection diagram is included!

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Intelligent PLOTTERS

A1 size, PINCH ROLLER TYPE
GP9101

★ 4 pens
★ 250mm/sec
★ Step size 0.05mm
★ With HP/GL option

It can be run under lotus 123 + Auto cad

A3 size, HIGH SPEED MULTIPEN
FP5301

★ 10 pens
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It can be run under lotus 123 + Auto cad

A3 size, PLOTWRITER
WX4731

★ 4 pens
★ 200mm/sec
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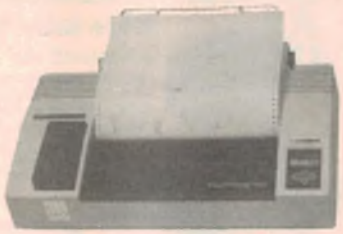
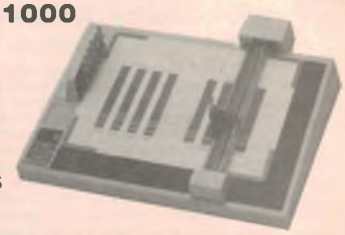
★ Up to 1m plot



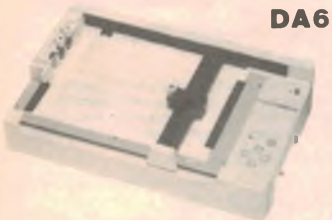
A3 size, MULTI FUNCTION, PORTABLE
MP1000

★ 6 pens
★ 150mm/sec
★ Step size 0.1mm
★ With HP/GL option

It can be run under lotus 123 + Auto cad



A4, COMPACT
DA6100



★ 3 pens
★ 200mm/sec
★ Step size 0.1mm
★ With HP/GL option

DA6100 with RS232 **$768** inc tax

8 Bit parallel **$732** inc tax

BUSI-PLOT
DA6500

★ 3 pens
★ 200mm/sec
★ Step size 0.1mm
★ Six types of graphs selectable
★ Storage of graph data auto cassette type
★ Easy programming using Basic Functions

DA6500 **$2136** inc tax

A4 SERVOPLOT
DA8400

★ 6 pens
★ 410mm/sec
★ Step size 0.1mm

A3 DIGITIZER
KD4030

★ Electro magnetic method
★ Resolution 0.1mm
★ Accuracy ± 0.5mm
★ 3 types of reading mode

Interfaces available for the above plotters are RS232, 8 Bit parallel and in most cases GPIB

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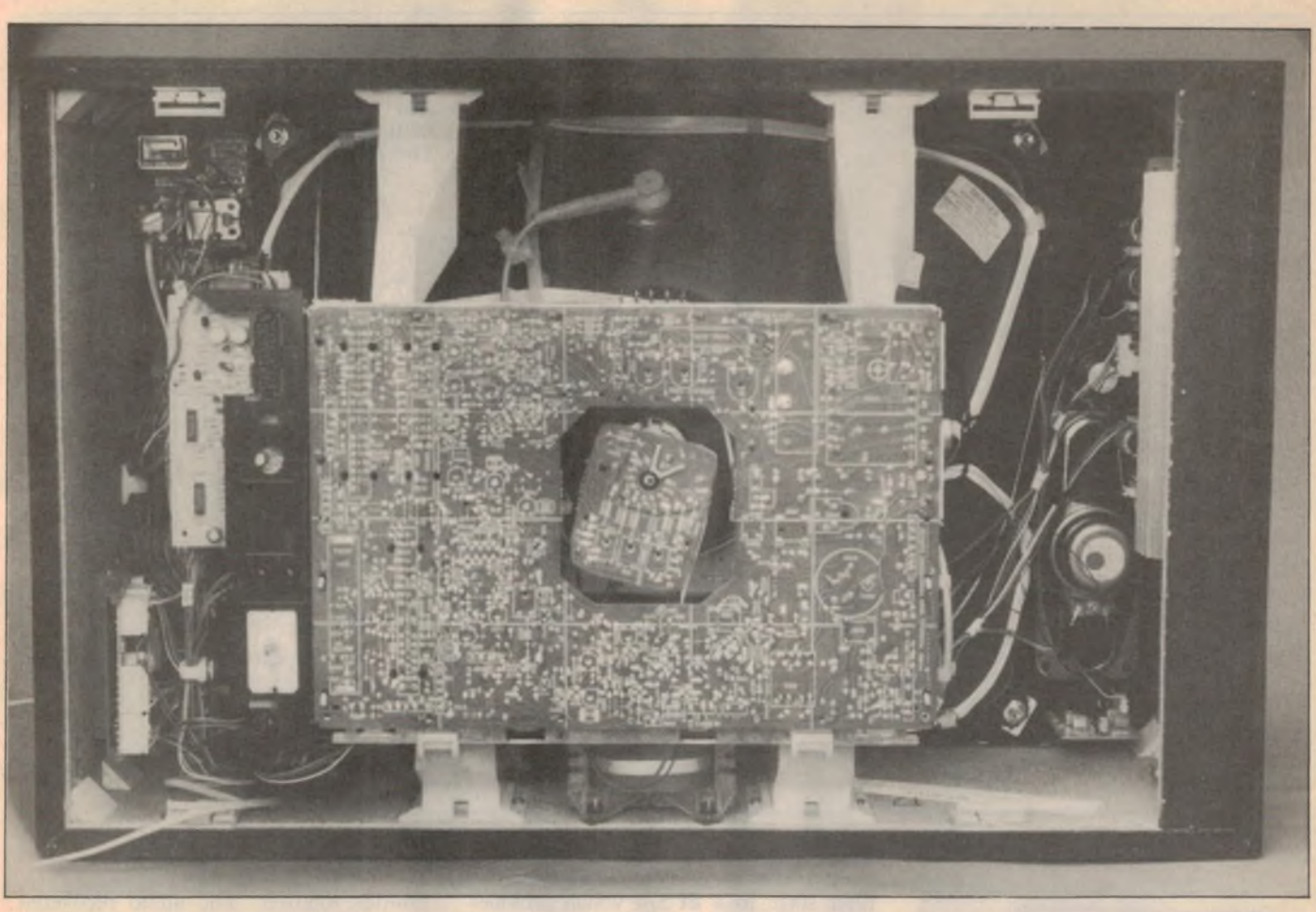
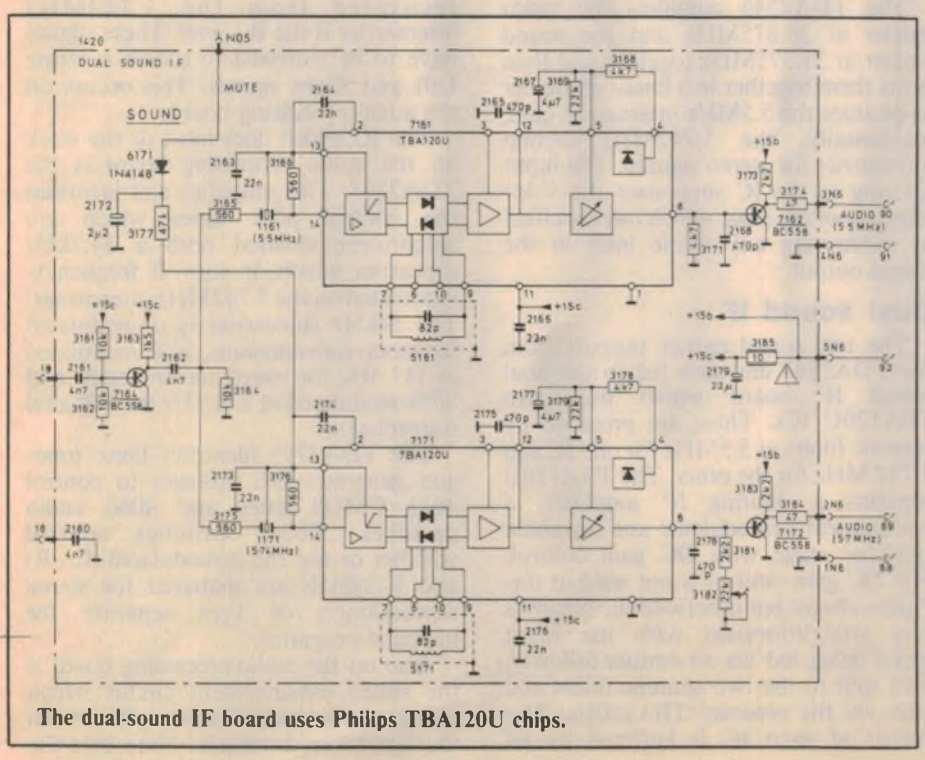
Philips stereo TV receiver



This view shows the rear of the KS683 receiver with the back removed. The chassis flips down for easy access.



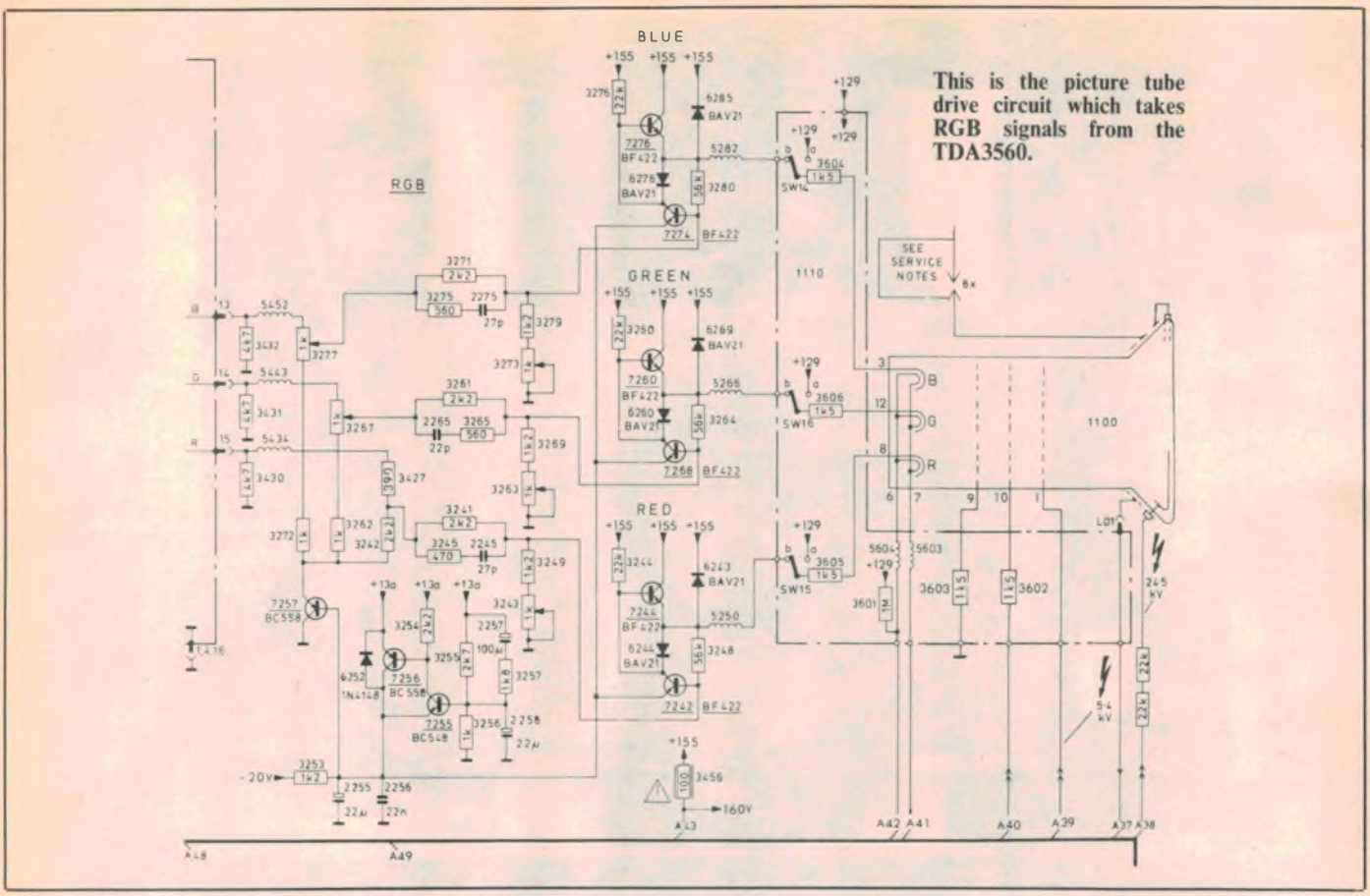
The dual-sound IF board uses Philips TBA120U chips.

on a BF370 transistor. From there the signal is fed to a SAW (surface acoustic wave) filter and thence to a TDA2541 IF amplifier and synchronous demodulator. The demodulated video output appears at pin 12.

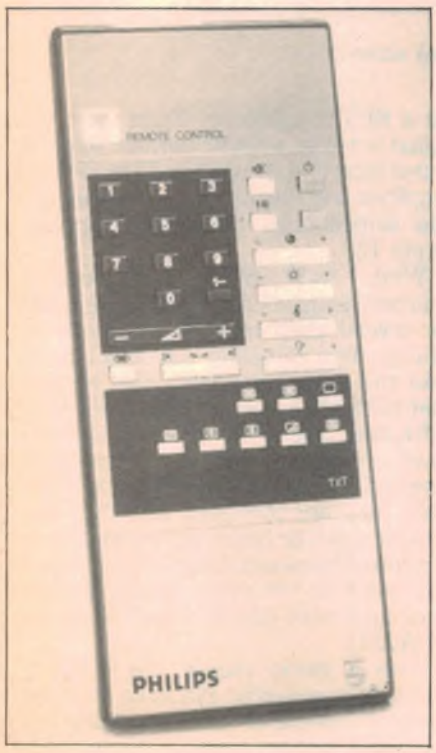
While SAW filters have been a standard feature of many Japanese sets for several years now, they are new to Philips. This company was reluctant to take this path until they could be sure that the SAW filters could be made with sufficient precision (in the relatively small numbers) for the Australian standard. Now that they have the SAW filter they are confident that they can provide equal or better picture quality to previous Philips sets. Only two coils need alignment for the video signal: they are associated with pins 8, 9 and 10 of the TDA2541.

With a mono chassis, the 5.5MHz intercarrier would be extracted after the video demodulator but not with the quasi-split system. Instead, the sound is processed by a parallel path via the TDA2545. This takes the IF signal from before the SAW filter and feeds it via a

Philips stereo TV receiver



This is the picture tube drive circuit which takes RGB signals from the TDA3560.



The infrared remote control handset eliminates the need for most of the controls on the set itself. It is easy to use.

filter stage to a BF370 which provides gain and balanced outputs via an IF transformer to the TDA2545.

The TDA2545 amplifies the video carrier at 36.875MHz and the sound carrier at 31.375MHz together and then beats them together in a linear multiplier to produce the 5.5MHz intercarrier (and, incidentally, the 5.742MHz second intercarrier for stereo signals). The input filtering to the IC suppresses the video response of the stage which has the effect of minimising any frame buzz in the sound output.

Dual sound IF

The two sound carrier outputs from the TDA2545 are then fed to the dual sound IF board which uses two TBA120U ICs. These are preceded by ceramic filters at 5.5MHz for one IC and 5.742 MHz for the other. The TBA120U contains a limiting IF amplifier, a symmetrical demodulator and an audio amplifier stage with DC gain control. The DC gain control is not used in this Philips circuit but otherwise the circuit is very straightforward with the input signal being fed via an emitter-follower, then split to the two ceramic filters and then via the separate TBA120Us. The output of each IC is buffered by an emitter follower. The audio recovered from the 5.5MHz intercarrier is the compatible L+R signal while the audio recovered from the 5.742MHz intercarrier is the R signal. These signals have to be matrixed to obtain separate Left and Right signals. This occurs on the audio processing board.

The IC which does most of the work on the audio processing board is the TDA2795. This amplifies and identifies the control pilot tones which are amplitude-modulated onto a 54.7kHz subcarrier which, in turn, is frequency-modulated on the 5.742MHz intercarrier. The 54kHz sub-carrier is unmodulated for mono transmissions, 50% modulated at 117.5Hz for stereo transmissions and 50% modulated at 274.1Hz for bilingual transmissions.

The TDA2795 identifies these tones and generates DC voltages to control 4011 CMOS gates and 4066 audio switches. These switches control whether or not the demodulated (L+R) and R signals are matrixed for stereo reproduction or kept separate for bilingual programs.

Also on the audio-processing board is the stereo enhancement circuit which produces the "spatial" stereo effect from the KS684 loudspeakers. Note that the

audio output signals from the SCART socket are not subject to any enhancement and thus give the full stereo separation (around 40dB) which can be expected from the twin-carrier system.

Audio signals from the audio processing board are then fed to the audio output board. The circuit of this is reproduced with this article.

Audio output board

This uses one 18-pin integrated circuit, the TDA1524, two TDA1520 monolithic power amplifiers, a three-terminal regulator and two BD202 power transistors which provide regulated 33V rails for the two power amplifiers. The whole board is separately powered from the mains transformer.

The TDA1524 is an active stereo tone/volume/balance control system operated by voltages from the microprocessor which are fed to pins 1, 9, 10 and 16.

The monolithic power amplifiers require little comment apart from noting that they incorporate short circuit protection which is essential since the TV receiver has sockets for external loudspeakers.

The headphone socket driver board also uses a TDA1524 which drives three-transistor complementary symmetry output stages of low power. However, in this case the treble, bass, volume and balance control pins are run from a single potentiometer (in the hidden compartment above the righthand loudspeaker).

Chrominance and luminance

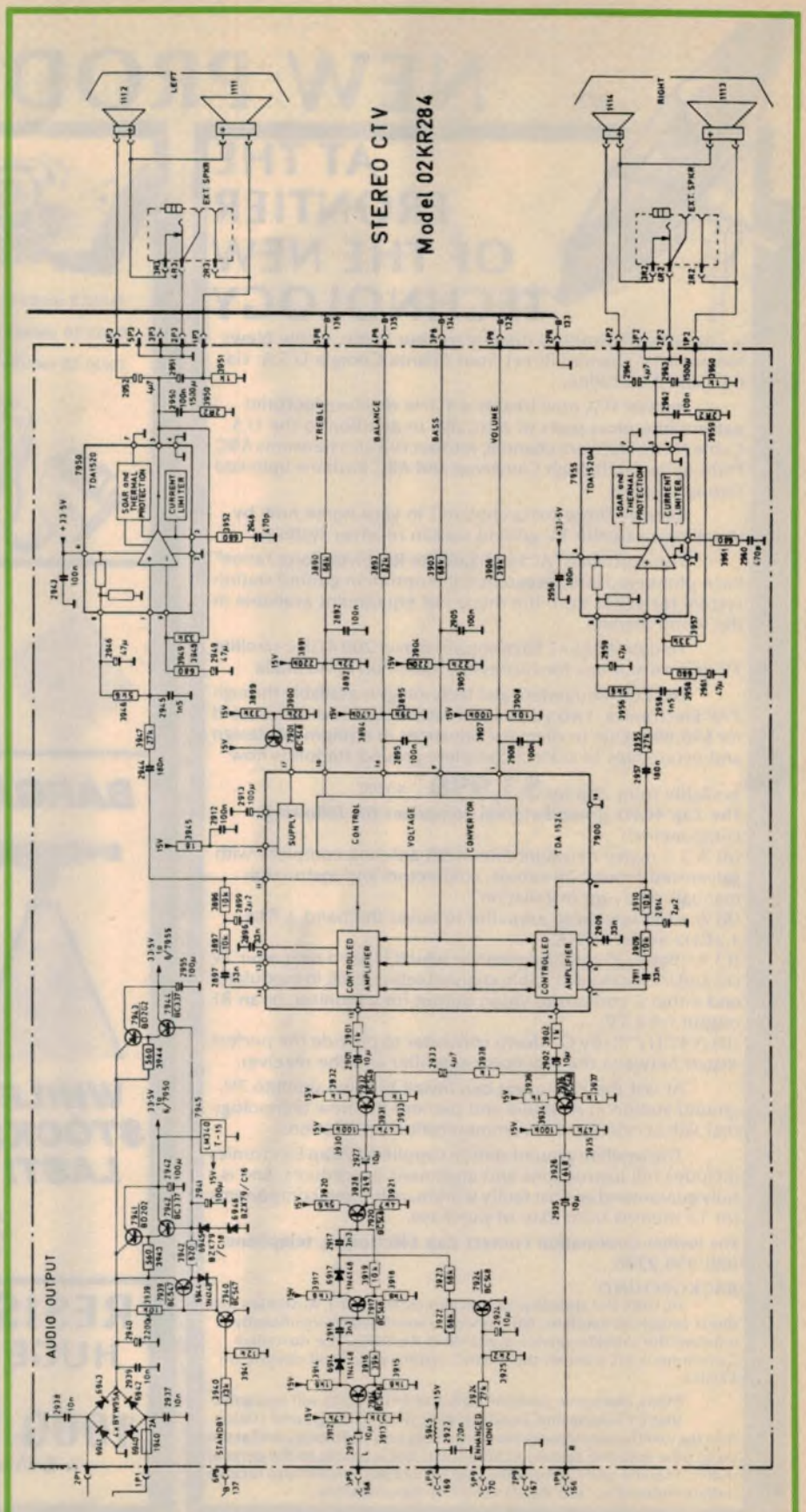
Compared with all the machinations for the audio, the video process is simple. The video output from the TDA2541 is fed via a transistor buffer to the SCART socket and thence into the luminance and chrominance inputs of the TDA3560 PAL decoder.

The particular attraction of this device is that it incorporates video switching which makes it ideal for integrating the program video signals with RGB signals from external sources such as computers or from the optional Teletext decoder.

To ensure an excellent picture, both for ordinary programs and for Teletext presentation, the Philips circuit achieves a video bandwidth via TDA3560 to the picture tube of around 6MHz.

Complicated but good

Summing up, the Philips chassis is pretty easy. It certainly is a complicated circuit overall although the heavy reliance on ICs should ensure good reliability over time. This writer would be happy to have the set in his home. The picture quality is excellent and the sound quality is a big step ahead of what we have become used to.



Acknowledgement: All circuit diagrams in this article are reproduced by arrangement with Philips Industries Ltd, Clayton, Victoria.

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For further information contact Zap Electronics, telephone (02) 858 2288.

BACKGROUND

In 1985 the shuttle is due to launch AUSSAT I, Australia's first direct broadcast satellite. This service is expected to significantly improve the satellite service available in Australia. The Australian Government will pioneer the B-MAC system which will operate on 12GHz.

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The end of the Carbon Microphone

The year 1984 marked the end of an era in Australian telephone engineering; the phasing out of the ubiquitous carbon microphone or "transmitter" in telephone engineering parlance. The result should be better speech transmission and greater reliability with less maintenance.

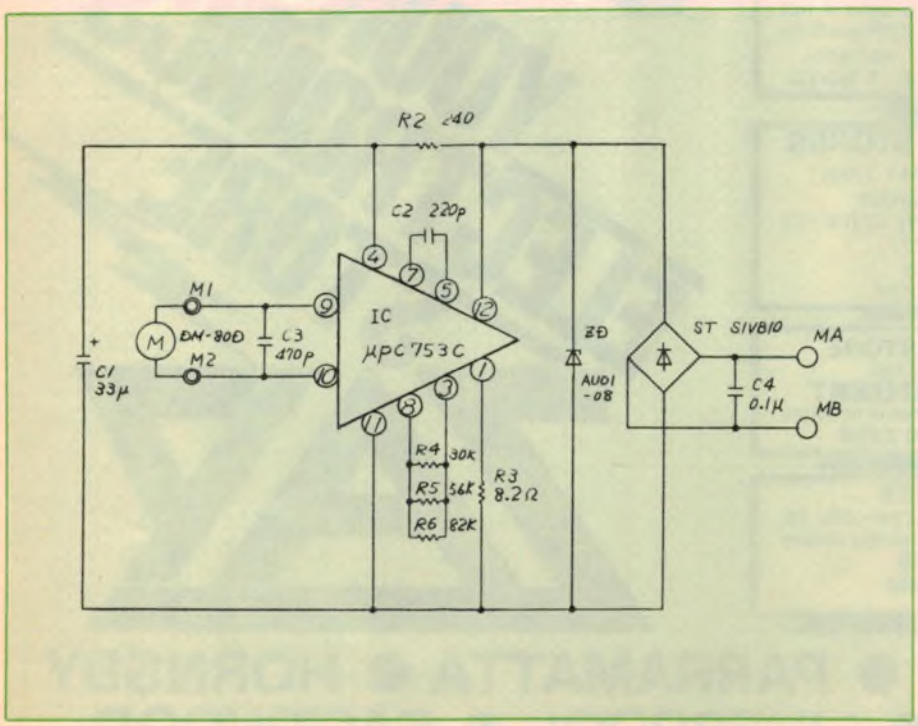
The passing of the carbon microphone is a sad event in some ways because it is virtually a symbol of the telephone system and the technological development which made it possible. In fact, it was the development of the carbon microphone which transformed the telephone from little more than a scientific novelty into a practical commercial instrument.

It wasn't the first microphone used for telephone experiments. Bell's original patent of 14 February 1876, plus a number of earlier sketches, all show what are essentially magnetic microphones; typically an electromagnet in close proximity to a diaphragm either of soft iron or containing a soft iron slug. In simple terms the "transmitter" and "receiver" (earphone) were virtually indentical.

Such a system will work, as has been demonstrated many times by enthusiasts connecting a pair of earphones to each end of a short line. But, as Bell was forced to realise, such a simple arrangement has limitations.

The most serious was lack of sensitivity. This was not so important over short lines, or if the users had strong voices, but was quite inadequate to cope with longer lines, soft voices, or careless usage.

Just who invented the carbon microphone — if, in fact, any one man can claim the credit — is in some doubt. A man named Hughes appears to have been the first to exploit the characteristic of carbon that varying pressure between two pieces will result in varying resistance. Hughes used a pointed rod suspended between two notched supports, all mounted on a sounding board — the "pencil" microphone.



The 20E transmitter contains an IC amplifier, a bridge rectifier and a zener diode.

This was in 1878, only two years after Bell's first patent. The device worked, in a fashion, and was extremely sensitive, but also extremely critical in adjustment and suffered from poor speech quality.

In the same year Thomas Edison came into the act. His design was much closer to the modern concept, except that he used powdered carbon — lamp black — rather than granules. An English clergyman named Hunnings is one of those credited with the granule concept, but there may have been others. In any event, the carbon granule microphone was an accomplished fact by the end of 1878.

And so, for over 100 years the carbon microphone, with numerous improvements and modifications, has been the virtual heart of our telephone system. But not without problems. The carbon microphone is a troublesome beast. It can be attitude sensitive (though less so today than with early models), it always generates some background (frying) noise and, worst of all, the granules can pack together either temporarily or permanently, producing weak distorted signals.

The temporary condition can be cured by "giving the transmitter a bash" to shake up the granules. But when this brute force approach eventually fails the microphone insert has to be discarded and a new one fitted. Despite these limitations, it has reigned supreme for all these years, simply because of its extremely high output; it was, in fact, the only microphone which would work in the telephone system.

At the same time, the advent of radio broadcasting and allied applications produced a whole range of new microphones, the carbon version having been tried and found wanting in this sphere. These include moving coil, ribbon, piezo, capacitance types etc, in a wide variety of styles. They all out-perform the carbon types in almost every respect; fidelity, reliability, lack of background noise, etc. But they all need amplification — a lot in some cases — to bring their output up to that of the telephone transmitter.

The idea of using an alternative microphone, plus an amplifier in the telephone to lift the level, had been considered over the years, but it is only recently that solid state technology has progressed to the point where components were cheap and reliable enough to make the idea practical.

According to Telecom engineers, the

by PHILIP WATSON

Group General Manager of AWA, Mr R. D. Stewart, makes the official handover of the new AWA-manufactured Touchfone to Mr K. Douglas, Assistant General Manager, Telecom Australia, and Miss M. Bourke, Manager-Supply.

limitations of the carbon transmitter already mentioned — the "frying", the "packing" and eventual failure — were particularly apparent in the No. 13 transmitter inserts as used in the 300, 400, and 800 series telephones. In the 800 series they have the highest replacement rate of any component, approximately 3% failure rate a year.

Another problem, and a major one as far as Australia was concerned, was the fact that the 800 series telephones had a marginally lower "send performance" than the previous models. This was aggravated, in some situations, by the fact that the carbon unit's performance falls off as increasing distance from the exchange reduces the excitation current due to line resistance.

After a study of available transducers (ceramic, electret, moving coil) and integrated circuit amplifiers available overseas, the Telecom Research Laboratories produced a specification for an electronic transmitter which would be a direct replacement for the No. 13 carbon transmitter.

This specification required that the new transmitter:

- Fit into the 800 series handset and anchor the handset cord.
- Operate correctly in a telephone in parallel with a second telephone fitted with a No. 13 transmitter.
- Improve the 800 series telephone transmission performance.
- Be as robust as the No. 13 by withstanding adverse electrical conditions occurring on telephone lines, such as sustained ring current and voltages from back EMFs or lightning surges.
- Be independent of the effect of feed current on transmit performance.

Following this tenders were called in 1977 for the design and development of an electronic transmitter. NEC was the successful tenderer and their contract required them to provide Telecom with developed samples and full design details, so that Telecom would "own" the design.

Telecom Research Laboratories provided all the testing and consultancy during each phase of the development. The transmitter designed by NEC is known as the 20E electronic transmitter.

The microphone itself is a moving coil unit manufactured by the Japanese firm Primo Ltd. It has a flat frequency response from 400Hz to 5kHz. The microphone is held in a printed circuit board assembly (PBA) by a rubber grommet which also provides a seal between the microphone diaphragm and the aluminium front cover.

The PBA contains an integrated circuit (amplifier), rectifier bridge (polarity independence), resistors and capacitors (trimming gain and frequency response), zener diodes (protection), and quick connect terminals. The assembled PBA and microphone are contained in a plastic housing and are held in position by the front cover.

To shield the circuit from radio frequency interference, the plastic housing is coated with a nickel filled resin which is electrically connected to the aluminium front cover and to one of the transmitter wires.

The circuit will function from a supply as low as 2 volts, which allows a telephone fitted with the 20E to work in parallel with a second telephone fitted with a No. 13 transmitter.

Following design completion, a field trial of 10,000 production transmitters, supplied by NEC, was organised from March to October last year.

During the trial the following problems emerged:

- High frequency feedback or howling when the handset was placed on a hard surface.
- Short circuiting on PBA tracks.
- Open circuit microphone wires.
- Turning of cord anchor screw insert.

All these problems have been subsequently overcome by small changes to the design.

During the field trial tenders were called for the manufacture of the 20E transmitter. NEC and AWA were successful tenderers for units to be used in new telephones made by STC and AWA and, later, as replacements in the field.

The transmitters will be manufactured entirely in Australia but some electrical components will be imported, such as the moving coil microphone, resistors, capacitors and some diodes.

Although the integrated circuit amplifier was developed and supplied by NEC Japan, arrangements were made with Philips Industries (Aust) to develop an equivalent amplifier and become a second source of this vital component.

Although the 20E will be three times the cost of No. 13 transmitter, its long term advantage to Telecom will be the savings brought about by the significant reduction in the number of maintenance visits.

A bonus to customers will be the improved transmission performance which will not deteriorate as the transmitter ages.

(Technical details of the 20E transmitter were taken from the Telecom journal "Telegen" by kind permission of Telecom.)

Micro Seiki BL-41 Turntable

This latest BL-41 belt drive turntable from Micro Seiki is fully automatic. It features pushbutton controls with LED indicators and a microprocessor-controlled lightweight carbon fibre tonearm which is suitable for high compliance cartridges.

The Micro Seiki BL-41 turntable is attractively presented with a walnut wood grain vinyl finish on a timber base and a clear perspex dustcover. A black anodised aluminium angle strip is located along the front edge of the turntable base to house the control switches and indicating LEDs. Gold coloured lettering further enhances the quality look of the unit.

Overall dimensions of the BL-41 are 440 x 145 x 380mm (WxHxD), with the lid closed. A fully open lid requires 420mm of free height. Total mass is 6.8kg.

The Micro turntable uses a straight lightweight tone arm with an angled headshell. The arm is made from pure carbon fibre, while the detachable headshell is made from H-2, a carbon fibre and plastic mixture.

The arm is supported on gimbal bearings and is balanced by a counterweight. A simple antiskating mechanism is included in the arm base, while a hydraulic arm lifter provides smooth control of the arm.

The speed of the turntable is controlled by a servo-controlled DC motor. It is not crystal locked but referenced to the mains frequency which is a reasonably accurate source of 50Hz. In principle the feedback signal from the motor is compared to the mains reference to provide an error voltage. If the motor speed drifts, the error voltage changes and the motor is given a different driving voltage so that the error voltage and consequently the motor speed remains a constant.

The DC servo motor is used to drive the turntable platter via a belt which prevents vibrations from the motor being transferred to the platter. The motor itself is also isolated from the turntable base with rubber bushings. Effective spring-loaded mounting feet are provided on the turntable base to isolate the entire turntable unit from external vibrations.

Before use, the BL-41 requires a small amount of assembly. This includes installing the turntable platter and connecting the drive belt to the spindle. The platter is a heavy unit weighing 1.6kg. This mass helps reduce wow and flutter or speed variation of the turntable by virtue of its flywheel effect.

The tone arm comprises a detachable headshell to facilitate the installation of a cartridge, which is not included with the turntable. However, mounting screws and nuts for a cartridge are included.

A circular template is supplied to allow adjustment of the stylus overhang for correct tracking of the cartridge. This involves placing the template on the platter and adjusting the stylus so that it overhangs the centre spindle by 15mm. It is an easy adjustment and is clearly illustrated in the owner's operating manual.

The arm is balanced by adjusting the counterweight at the rear of the tone arm and then setting the adjusting ring to indicate zero. Correct tracking weight for the cartridge is then set by rotating the counterweight inward toward the cartridge.

Antiskating adjustment is available over the tracking force range of zero to three grams.

Operation

Operation of the BL-41 is easy. Once power is switched on, the controls of the turntable always return to 33.3rpm speed and 30cm record size regardless of the previous settings before power was switched off.

If you require automatic play of a 17cm sized record, press the "size" switch and the LED will indicate 17. If the switch is pressed again, the 30cm size will again be selected. Similarly, with the "speed" switch. Press it once for 45rpm and again for the 33.3rpm speed.

To start record play, use the "start/reject" switch. This will set the turntable in motion and the arm will automatically move across and begin play.

Once the record has been played the tone arm will return to rest unless the "repeat" switch was pressed, in which case the record will be replayed.

To stop the record in mid play, just

press "reject". The arm will return to its resting position.

For manual operation, a "cueing" switch gives control over the hydraulically damped arm lifter. One press will lower the arm gently onto the record while repressing the switch will gently lift the arm from the record surface.

All these controls are accessible while the perspex dustcover is down. Of course, for manual use, the lid will need to be open in order to manually move the arm to the required position.

One criticism of the cueing control is its hesitancy to indicate the lifting of the tone arm. While ever a record is being played, the "cueing down" LED is lit. However, when the cueing button is pressed the "cueing up" LED does not immediately light in response to the pressed button.

Instead, the "cueing up" LED lights up only after the stylus has left the record surface. This keeps the user in suspense for some seconds wondering whether the turntable has responded to the cueing command.

The BL-41 has a speed control knob which gives a range of plus and minus 3% (equivalent to half a semitone). The template mentioned above also has a strobe pattern on it to enable the speed to be set precisely. (To be set really precisely, the user needs the EA Turntable Strobe light described elsewhere in this issue. Ed.)

Performance

We measured wow and flutter of the turntable at .02% (weighted RMS). This is slightly better than the .025% specified and is a very good result.

Rumble is specified at better than 50dB (DIN A) or 72dB (DIN B). We measured the rumble and noise at −58dB with respect to 5cm/sec and the rumble was actually a long way below the surface noise — a good result.

As a test of the speed range we found it possible to adjust a 1kHz recorded tone from 1050Hz to 970Hz. This means the range of adjustment was actually +5% and −3%. When the speed of the turntable was adjusted to exactly 33.3rpm, however, the equivalent 45rpm setting was found to have a very slight error. This means it is necessary to trim the speed control for each speed if an exact setting is required. In normal circumstances though, this small variation is unimportant.

We found the turntable very resistant to vibration and external bumps and thumps. Our test cartridge tracked even when the test bench was thumped in very close proximity to the turntable base. This resistance is mainly due to the well damped spring-loaded mounting feet on the turntable base.

Overall then, we found the Micro Seiki BL-41 turntable to perform very well and combined with a quality cartridge it should provide a very good performance indeed.

The Micro Seiki BL-41 is distributed by Audax Loudspeakers, PO Box 100 Huntingdale, Vic 3166. It is available from retailers throughout Australia (see advertisement below). Recommended retail price is $499. (J.C.)

Marantz CD-84 compact disc player

The new Marantz CD-84 compact disc player has all the features that most users could possibly want combined with an infrared remote control for truly relaxed listening.

In common with other Marantz products, the CD-84 compact disc player is finished in "champagne gold" aluminium with a matt black plastic escutcheon. Its dimensions of 416 × 90 × 300mm put it well out of the compact component class, while at 9.2kg it is hardly a lightweight.

At the left of the front panel is a large, square power switch, and immediately below this is a headphone socket. Next to these is the motorised disc drawer which, in common with current practice, merely requires the disc to be dropped in. The open/close switch is set into the front of this drawer.

Directly below the drawer are 10 pushbuttons, numbered 0 to 9 which are used to enter track numbers when programming the player. To the right of these, still under the disc drawer, are six buttons labelled MEMO, CANCEL, INDEX, TIME, LAP/REMAIN and MIN. The job of the MEMO button is fairly obvious; it is used after the digit buttons to store that track or selection number. The CANCEL button is also self explanatory.

If the disc being played has an index, then the INDEX button allows playing to commence from any desired section. The LAP/REMAIN button toggles the display between the length of time that a selection has been playing, and the time remaining on that section. The TIME button, in conjunction with the MIN button, is used to enter the time after the start of the track at which playing is to commence. This would be used if, say, you wished to hear a passage beginning three minutes into a particular track.

Further to the right is a vacuum fluorescent display which indicates the track number, the index number is applicable, the time display and the tracks to be played. A number of annunciators are included to indicate the mode in which the player is currently operating.

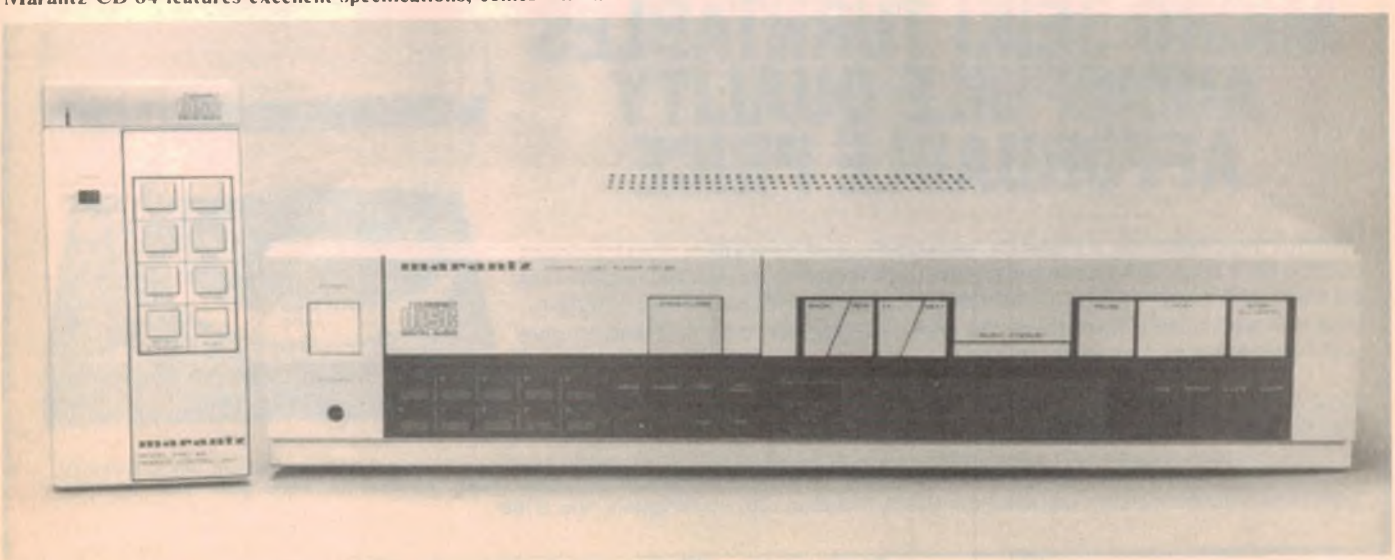
Above this are the FAST FORWARD, REWIND, NEXT and BACK buttons. FAST FORWARD and REWIND operate in the normal way while the NEXT and BACK buttons cause the player to begin playing the next or the previous track respectively. Continuing to the right across the panel are the PAUSE, PLAY and STOP buttons, none of which require any explanation.

The last four buttons, below the PLAY and STOP buttons are the AMS (auto music search), REPEAT, A<>B, and CLEAR buttons. The auto music search facility automatically steps through each track on the disc, playing the first 10 seconds of each. The repeat button causes the programmed selections to be repeated. The A<>B and CLEAR buttons can be used to repeat a particular passage.

The rear panel sports a large finned heatsink for the internal voltage regulators, a fuse holder, and a mains input socket. An unusual feature of the back panel in a large black plastic box which was found to contain a mains filter.

As well as the usual right and left channel output sockets there are two

Marantz CD-84 features excellent specifications, comes with an infrared remote control.



RCA sockets for connecting the machine to either of Marantz's two control bus systems. There is also a socket to support "synchro" recording on a cassette deck but what this term means is not explained in the user manual. The other socket on the back panel is not connected.

Another unusual feature is the inclusion of separate left and right output level controls on the back panel. These allow the output level to be set anywhere between 0V and 2V RMS.

Test results

Objective testing was carried out in the usual way. We used the Technics SH-CD001 test disc in conjunction with our Sound Technology distortion bridge, and a dual channel oscilloscope.

The first test we carried out was a linearity check which involves a 1kHz tone stepped down in level from 0dB to −90dB in 10dB steps. This player proved to be on a par with most others that we have reviewed, remaining perfectly linear to about −70dB. At the −90dB level we measured the output to be −87dB.

The signal to noise ratio proved to be a respectable 95dB, both with and without emphasis. Stereo separation was very good; better than −90dB up to 10kHz, reducing to −86dB at 20kHz.

Frequency response was flat from 20Hz to 15 kHz, and only 0.5dB down at 20kHz which is a good result. The manufacturer's specifications quote a frequency response from 4 - 20,000Hz but with no tolerance limits.

In trying to make distortion measurements we ran into the same trouble that we have met in some other machines. That is, there is a residual signal at 88.2kHz, resulting in high distortion readings which do not indicate the true calibre of the machine. We built up a notch filter which attenuated this signal by 40dB to allow realistic measurements to be made.

With the filter in circuit we found the distortion of 1kHz to be .055%. Without the filter, the reading was 0.3%. Marantz quote the distortion to be less than .003%, and we have no reason to assume that this would not be so, if we had been able to effectively eliminate the remaining extraneous signals at 88.2kHz and 44.1kHz.

Intermodulation distortion proved easier to measure using a 4:1 mixture of 400mHz and 7kHz signals. We came up with the creditable figure of .008%.

We then used the Philips test disc NR 4A which has a selection of artificial scratches, dirt spots and a simulated

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- 12 sheets of autopositive film.
- 6 double-sided fibreglass blank boards, all measuring 160 x 100mm (Eurocard size).
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- developers • fixer • film clearing solution • photoresist • copper etchant • and a combined soldering flux/protective lacquer
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- A liquid measure.
- A retouching pen.
- A liquid-crystal thermometer.
- A couple of 1.1mm PCB drills.

And all extras like:

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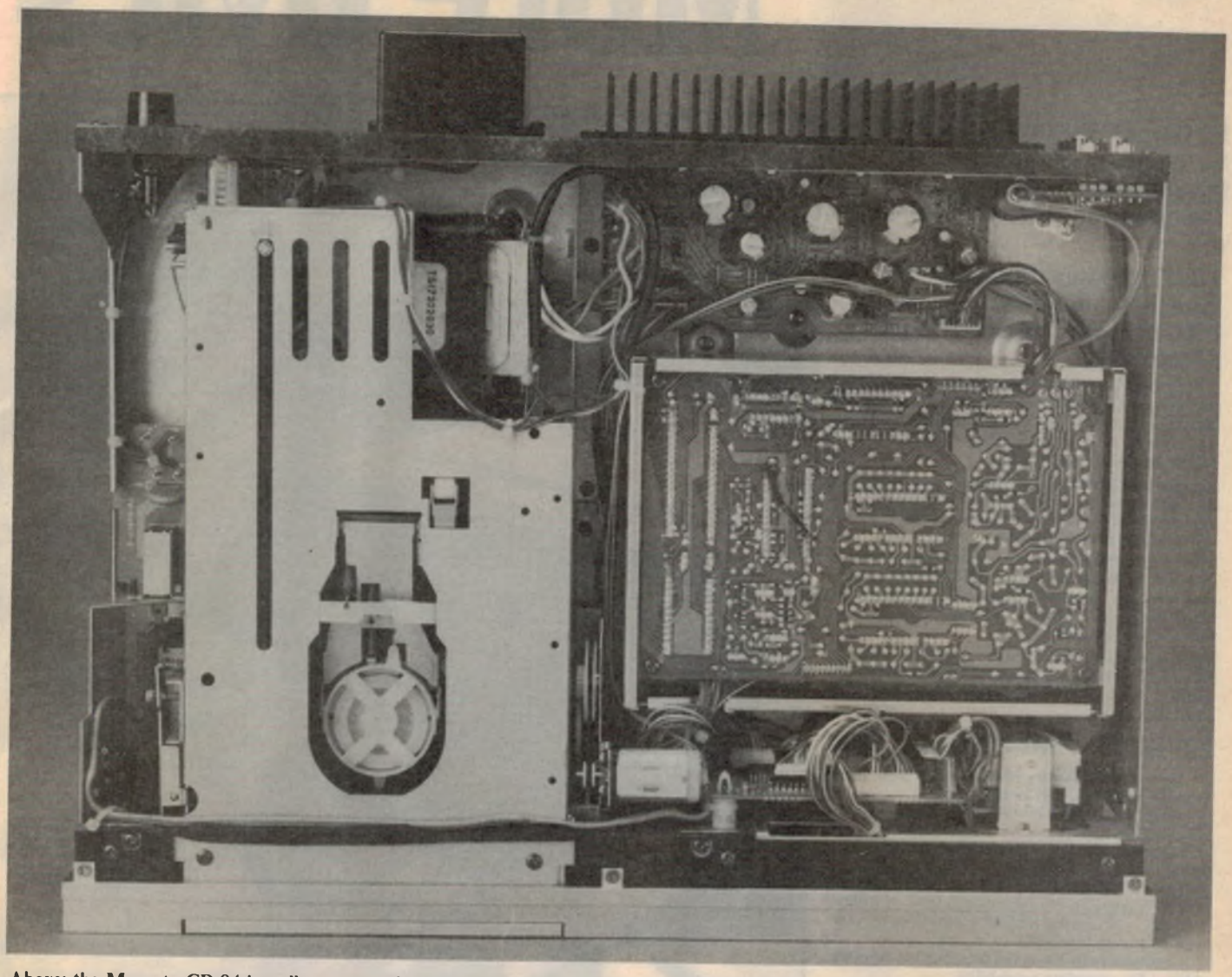
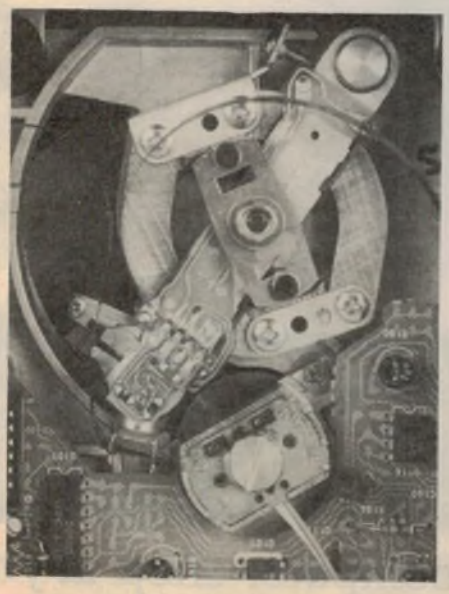


Above: the Marantz CD-84 is well constructed as this internal shot shows. Below is a close-up view of the swing-balance laser pickup.



fingerprint. As we have found with most of the players tested recently, the CD-84 was able to track all these imperfections without the slightest audible trace of distress.

Vibration resistance, tested by the good old "thump and bump" technique, was also good. The player required a considerable jolt before the laser could be made to mistrack.

The infrared remote control appeared to work well over a reasonable range. Only eight of the most frequently used functions are available on the remote handset.

Physical construction

Internally, the player appeared to be of a very high standard. The entire left hand half of the case is taken up by the disc transport and a large mains transformer. The right hand side is devoted to the circuitry which is accommodated on a number of printed circuit boards.

Connection between these boards is by means of cables terminated with plugs or sockets, a feature which should simplify servicing should it ever become necessary. We were also interested to note the extensive use of chip resistors on some of the printed circuit boards.

In summary, with a price tag of $899 this player represents good value for the buyer who is looking for a compact disc player with all the wanted control features as well as a very respectable performance.

For further information contact your nearest hifi dealer or Marantz Australia Pty Ltd, 19 Chard Road, Brookvale, NSW, 2100. Phone (02) 939 1900. (A.L.)

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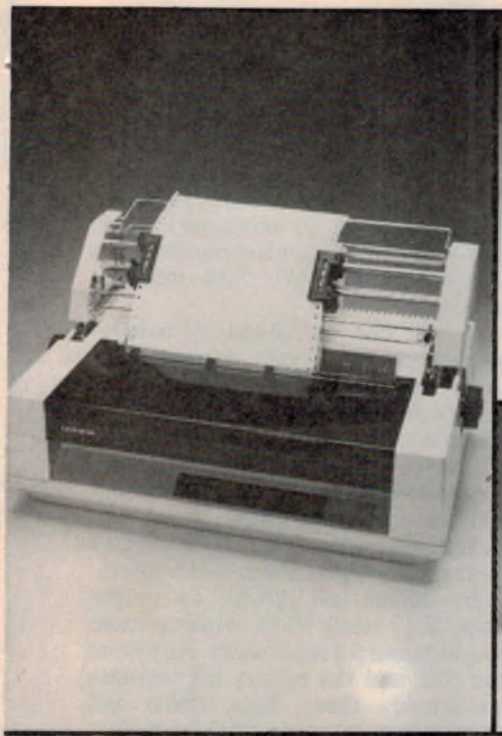

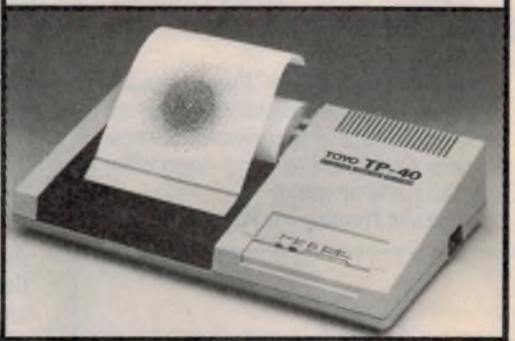

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A882

The Busker

Portable Amplifier

This handy amplifier is completely portable and is capable of operating from either the mains or a 12V battery. Main features include guitar and high-level inputs, an inbuilt loudspeaker, and bass and treble controls. It's just the thing for busking or for guitar practice at home.

We named this amplifier after the street musicians who are a common sight in our cities these days. Most seem to play an acoustic guitar or a wind instrument, but occasionally you see one playing an electric guitar or an electronic keyboard instrument. These musicians must use a battery-powered amplifier of some kind, and a few enquiries showed us that these can be very expensive, at around $300 or more.

Since the humble busker is not reputed to be one of the more wealthy members of our community, we wondered if it was possible to design a similar amplifier for a much lower price. We think we have succeeded.

We set out to design a battery-powered amplifier with a reasonable power output. This was to be incorporated in a small cabinet which would be rugged enough to stand up to outdoor use yet be easily portable. Mains operation was desired so that the battery could be conserved when power was available. The battery was to be charged automatically when power was applied.

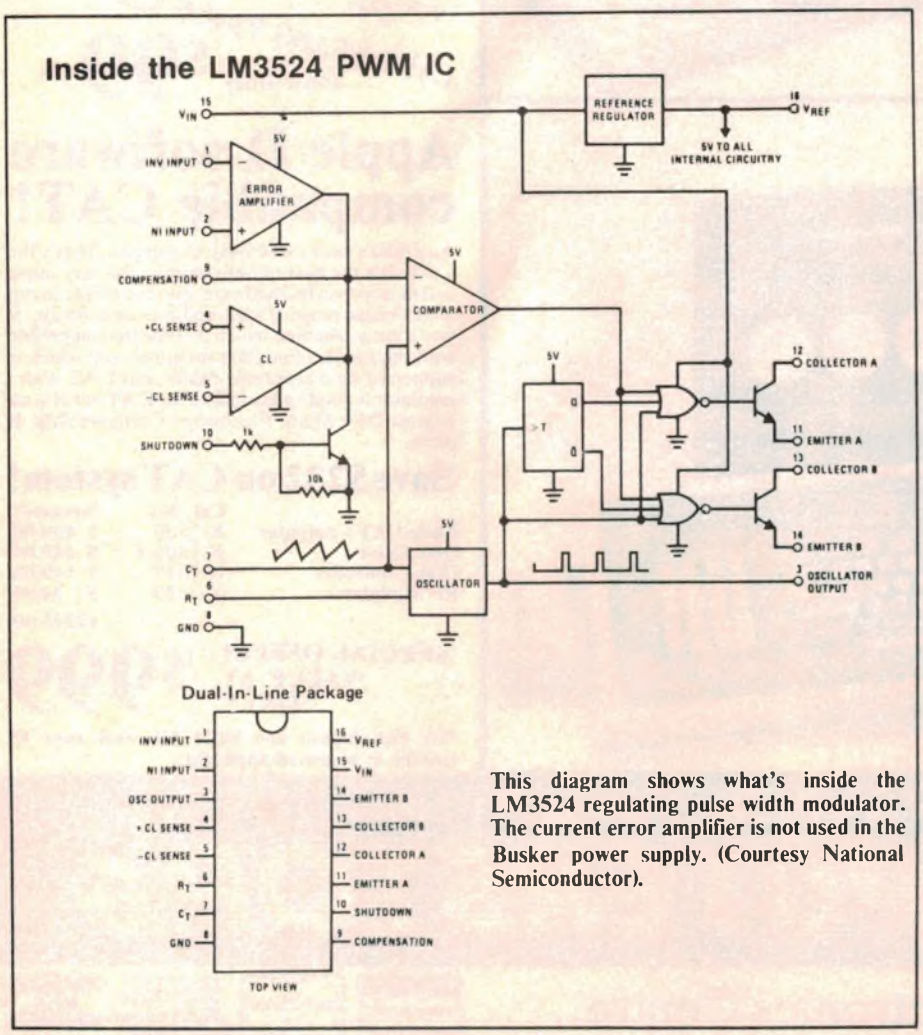
The Busker will provide an output power of 17 watts RMS, which is more than adequate for most needs. Any more than this, and the battery life becomes unacceptably short. Bass, treble and volume controls are included, as well as inputs for both high and low level signals. This allows the Busker to be used either with a guitar or with a keyboard instrument.

A 2.6Ah, 12V battery is used, which should provide adequate hours of use at typical output levels. Obviously, playing at very high levels will reduce this somewhat, and vice versa. One thing to bear in mind is that while ever the amp is switched on there will be some current drain, so to maximise battery life the amp should be switched off when not in use.

The amplifier is housed in a chipboard cabinet measuring 370 x 260 x 200mm (HxWxD). We covered the prototype in black vinyl and added a piece of expanded aluminium mesh over the speaker cutout. This is necessary to prevent damage to the speaker cone.

How it works

The circuit of the Busker guitar amplifier can be conveniently broken down into three sections to simplify explanation. These sections are: the preamplifier, the power amplifier, and the power supply circuit. The power supply in this amplifier includes an inverter to produce a 40V supply rail from the 12V provided by the battery. It is this relatively high supply voltage which allows us to obtain the necessary output power.



This diagram shows what's inside the LM3524 regulating pulse width modulator. The current error amplifier is not used in the Busker power supply. (Courtesy National Semiconductor).

By ANDREW LEVIDO

The circuit must operate either from the mains or the battery, so a mains transformer and a bridge rectifier are also included to produce a DC supply of about 20V. When the mains is connected, this 20V will be present so D5 will be reverse biased, and the inverter will be run from the mains-derived supply. At the same time the battery is charged via the 47Ω resistor. The 15V zener diode, ZD1, is included to prevent the battery from being overcharged.

If the mains is disconnected, D5 will become forward biased, and the battery will supply current to the rest of the circuit.

The inverter itself is based on an LM3524 regulating pulse width modulator chip. This is a general purpose chip suitable for use with switching regulators of all types. It is considerably cheaper than the uA494 switchmode regulator which was used in the 50V, 5A power supply described in the May and June 1983 issues of this magazine. Our chip came from Geoff Wood Electronics in Sydney, and cost $4.35.

The internal works of this chip are shown in Fig. 1. The current limit amplifier and shutdown facility are not used in our circuit.

The LM3524 has an internal oscillator which provides a sawtooth waveform to one input of a comparator. The other input of this comparator is connected to the output of an error voltage amplifier and a current limit amplifier. We need only consider the error voltage amplifier.

In our circuit, the inverting input of this amplifier is fed with a proportion of the output voltage, from the voltage divider formed by the 10kΩ and 1kΩ resistors across the inverter output. The non-inverting input is fed with a reference voltage of 3.65V and this is derived from an internal 5V reference via a divider consisting of 10kΩ and 27kΩ resistors. A 0.1μF capacitor decouples this reference voltage.

The comparator in the LM3524 produces a train of rectangular pulses which have a width proportional to the error voltage. A logic circuit ensures that these pulses are applied to the two on-chip transistors alternately. These transistors cannot be used to switch the full transformer current since they are only rated at 100mA. Instead, this job is performed by Darlington transistors Q11 and Q12.

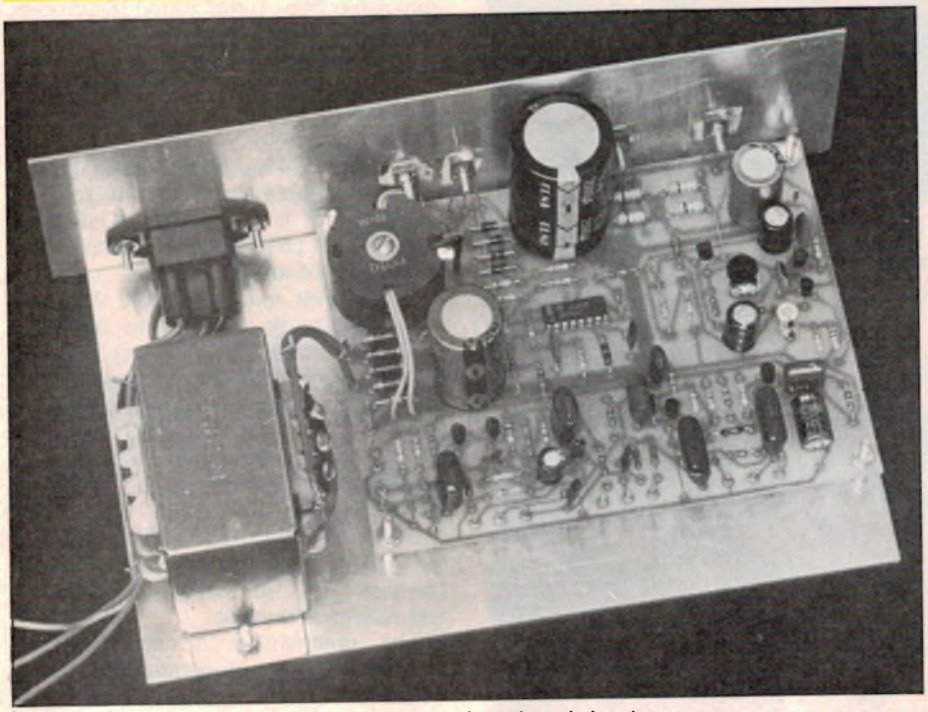
When one of these transistors turns on, current flows from the collector of that transistor to ground through one half of the primary winding. Almost the full supply voltage will appear across this half of the primary winding and, by transformer action, a similar voltage will be induced across the other half. Thus, during each half cycle, there will be 24V across the transformer primary.

This voltage will be stepped up by the transformer and rectified by diodes D6 to D9, a 2500μF capacitor being used to store the energy thus produced.

The actual output voltage of the inverter is dependent not on the turns-ratio of the transformer, but on the amount of energy being supplied to the 2500μF capacitor and the amount of energy being removed from it. If these two factors are balanced the voltage on the capacitor will remain constant.

The amount of energy being removed from the capacitor depends on the power amplifier, and varies with the amplitude of the signal passing through it. The amount of energy delivered to the capacitor is dependent on the width of the pulses applied to the transformer (the pulse amplitude being virtually constant).

The Busker



This photograph shows the electronics mounted on the subchassis.

Regulation is achieved in the following way: If the output voltage falls below 40V, the error amplifier will produce an error voltage proportional to the difference between the output voltage and 40V. The width of the pulses produced by the comparator will increase accordingly, so the amount of energy supplied to the reservoir capacitor will increase, and the voltage will rise. As this voltage rises, the pulse width will narrow, becoming zero as the capacitor voltage reaches 40V.

Rear view of the Busker. The battery holder is made from scrap aluminium.

In practise this will never happen because there will always be some current drain from the capacitor.

The inverter operates at a frequency of 22.2kHz, as set by the 2.2kΩ resistor and the .01μF capacitor on pin 6 and 7 respectively. This frequency was chosen because it renders the inverter and any switching hash on the output inaudible.

The preamp circuit used here may be familiar to some readers; it is, in fact, the same as was used in the Guitar Practice Amplifier described in March 1981. This preamp has been quite successful and so has been adapted to this application.

Transistors Q1 and Q2 form a direct-coupled amplifier circuit which has a gain of about 45. This gain is set by the ratio of the 68kΩ and the 1.5kΩ resistors. Bias for the input stage is derived from the junction of the 330Ω and 270Ω resistors. DC feedback is provided by the bias network and by the 68kΩ resistor. The response of this amplifier is rolled off above the audio range to prevent RF interference and to minimise pickup of noise from the inverter.

Following this stage is an active tone control stage based around transistor Q3. This stage has unity gain with the controls set to their mid positions.

From the tone control stage the signal passes through the volume control pot to an amplifier stage formed by Q4. This stage acts as a buffer between the volume control and the input to the following power amplifier.

The power amplifier is almost identical to the 20W power amplifier described in the November 1984 issue of this magazine. That amplifier, you may recall, had a maximum supply voltage limit of 35V, so some modifications have been made in order to run the amplifier from the higher supply voltage.

The operation of this amplifier was described in some detail in the original article, so a brief explanation will suffice here.

Bias for the whole amplifier is provided by the voltage divider consisting of the 180kΩ and 220kΩ resistors. Transistor Q5 provides some of the voltage gain of the amplifier, and sets the DC conditions at the output via DC feedback through the 5.6kΩ resistor.

This resistor and the 150Ω resistor in the emitter circuit of Q5 provide AC feedback, and the ratio of the resistances sets the gain of the amplifier. With the values shown, the gain of the amplifier is approximately 37.

Q7 and associated components form a Vbe multiplier circuit which keeps the output transistors operating in class AB to minimise crossover distortion.

Construction

Commence construction with the electronics. A printed circuit board coded 85ba2 (153 x 115mm) holds all the components except for the mains transformer, battery and front panel hardware. Mount the components on the board according to the overlay diagram, leaving the larger components till last.

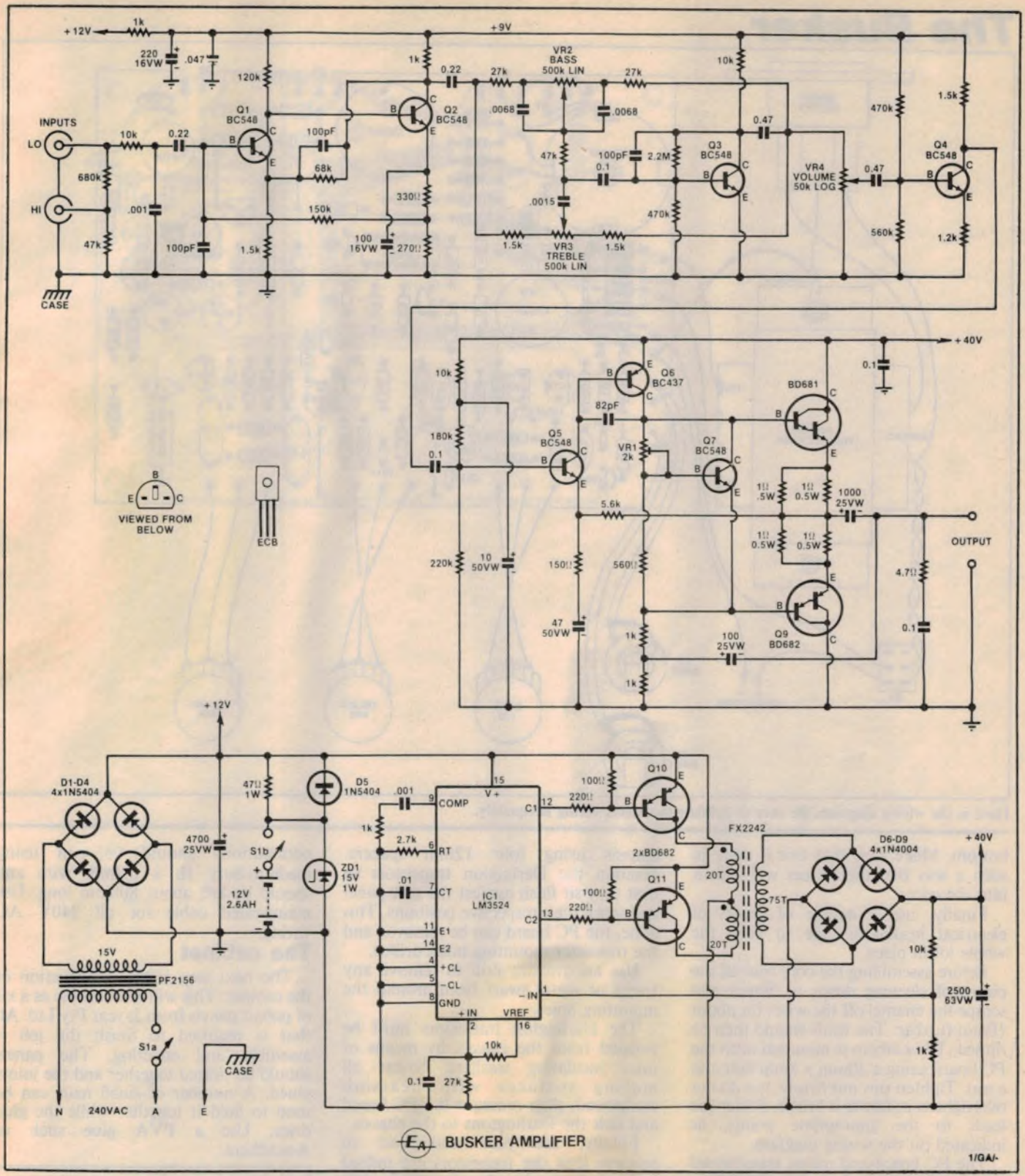
The use of PC stakes is recommended to make the job of connecting leads to the board easy. You will require 19 stakes in all.

Note carefully the orientation of diodes, transistors, electrolytic capacitors and the IC when they are being installed. The Darlington transistors should be mounted using their full lead lengths.

The next thing to do is to wind the potcore. You will need some short (70mm) lengths of plastic sleeving, 5m of 0.5mm (25 SWG) enamelled copper wire, 3m of 0.63mm (23 SWG) enamelled copper wire, and some ordinary adhesive tape.

Begin by winding the secondary. Slip a piece of sleeving over one end of the 25 SWG enamelled copper wire and anchor it to the top of the former with a piece of tape. You can start at any one of the V-shaped slots in the former.

Wind 75 turns of wire onto the former, laying each turn neatly against the next. Use a single layer of tape between each layer of wire. Finish off at the same place that you started. Fit another piece of sleeving, and wind a couple of layers of tape around the whole thing. This completes the secondary winding.



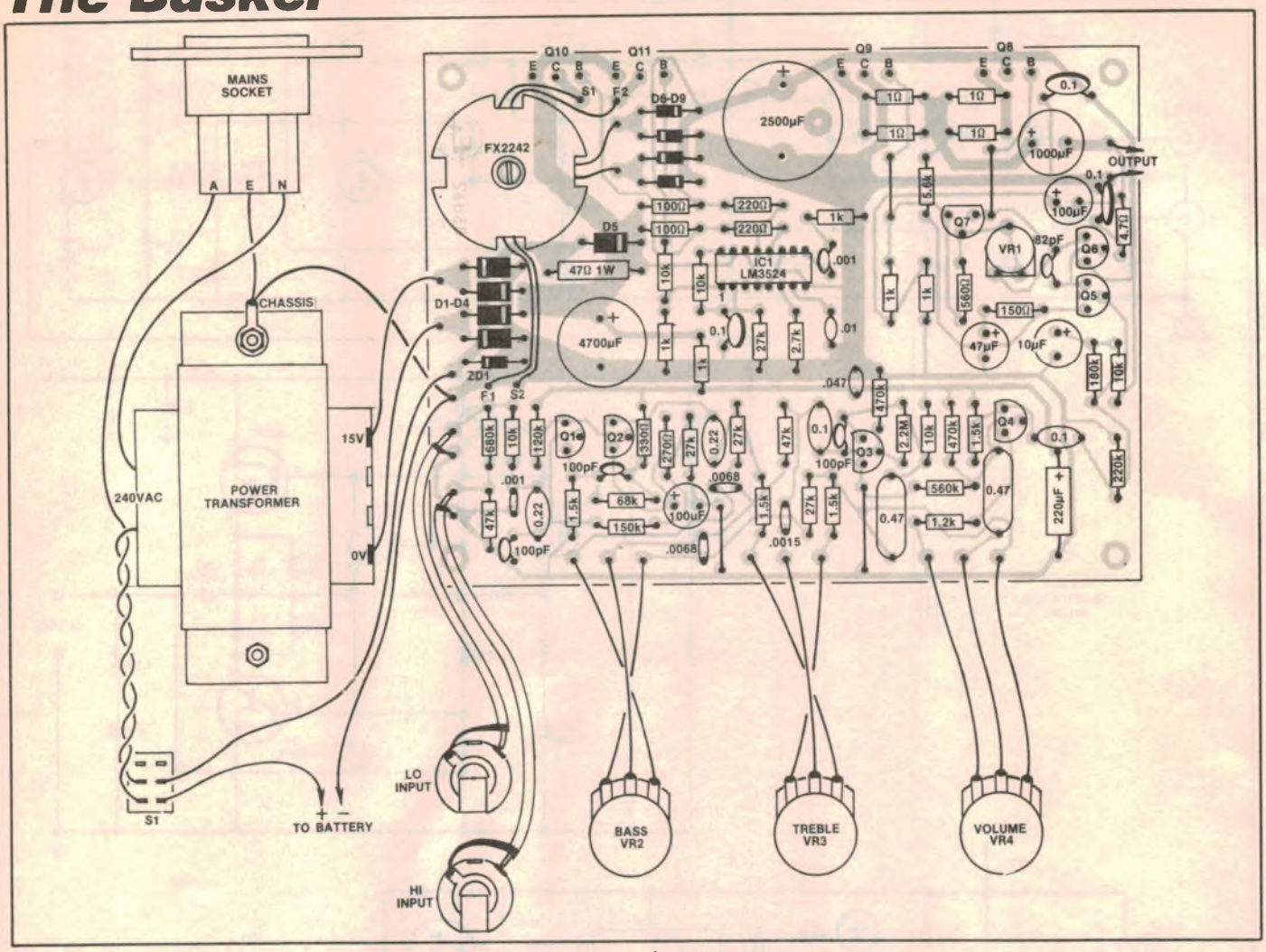
The circuit diagram. VRI sets the bias current in the output stage. Adjustment is not critical.

The primary is bifilar wound, using the 23 SWG wire. Double the wire over, and slip two pieces of sleeving over the ends. Mark these two Start 1 and Start 2. Secure them to the top of the former on the opposite side to the primary, and wind on 20 turns. Secure the winding with a small piece of tape.

Trim the end of the winding, leaving 100mm for the connections. Now, using a multimeter set to the Ohms range, identify which wire is the end of winding 1 and which is the end of winding 2. Label these accordingly. Slip another two pieces of sleeving over these wires.

Note that all the winding leads should emerge from the top of the former.

Hold the former so that the top faces towards you, and the secondary wires emerge from the right. Bend the primary wires so that the start of the first winding and the finish of the second emerge from the top slot, and the start of the second and finish of the first emerge from the



Here is the wiring diagram. Be sure to insulate the mains wiring adequately.

bottom. Make sure that this is done in such a way that the former will still fit into the core.

Finally, use a couple of layers of electrical insulating tape to keep the whole lot in place.

Before assembling the core trim all the pieces of sleeving down to 50mm and scrape the enamel off the wires for about 10mm further. The leads should then be tinned. The potcore is mounted onto the PC board using a 30mm x 3mm bolt and a nut. Tighten this nut firmly, but do not overtighten it; ferrite is brittle. Solder the leads to the appropriate points, as indicated on the wiring diagram.

The PC board and mains transformer are mounted on an L-shaped aluminium sub-chassis which doubles as a heatsink for the Darlington transistors. The PC board can be used as the template for its mounting holes, as can the transformer. The IEC mains panel socket is also mounted on the back panel (see wiring diagram).

Drill all the necessary holes, then temporarily mount the PC board on the chassis using four 12mm spacers. Position the Darlington transistors so that they sit flush against the rear panel and mark their respective positions. This done, the PC board can be removed and the transistor mounting holes drilled.

Use an oversize drill to remove any traces of metal swarf from around the mounting holes.

The Darlington transistors must be isolated from the chassis by means of mica insulating washers. Smear all mating surfaces with heatsink compound, then remount the PC board and bolt the Darlingtons to the chassis.

Finally, use your multimeter to confirm that the transistors are indeed isolated from the chassis (check that there is no continuity between chassis and the middle lead of each transistor).

The transformer and mains input socket can now be installed and the external wiring leads connected. Leave about 250mm of lead length for the front panel connections and note the use of shielded cable for the input connections.

The leads for the battery and speaker connections should be run using medium-duty 10 x 0.2mm wire and should be left about 800mm long. Use mains-rated cable for all 240V AC wiring.

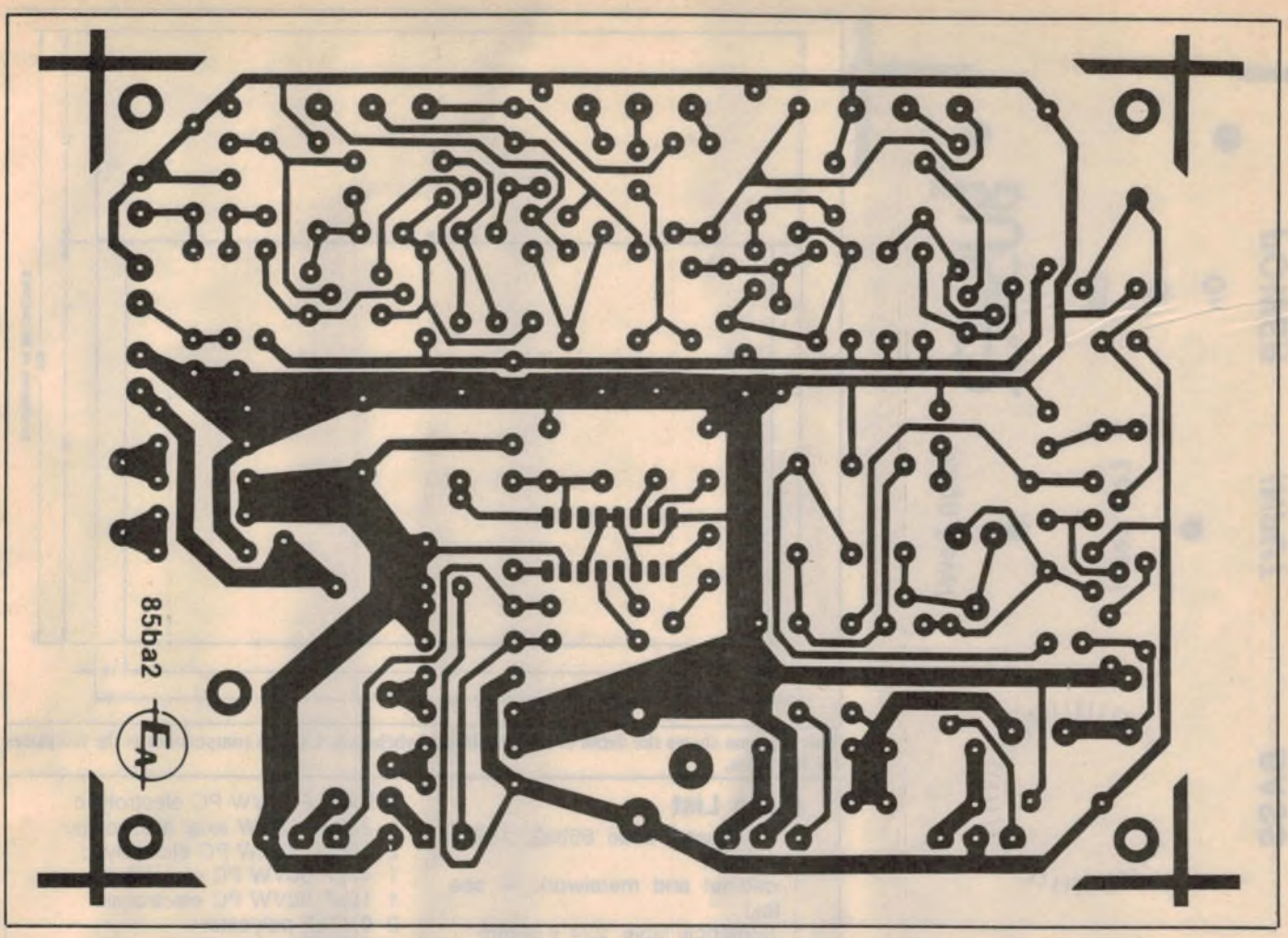
The cabinet

The next step is the construction of the cabinet. This will be available as a kit of precut panels from Jaycar Pty Ltd. All that is required to finish the job is assembly and covering. The panels should be slotted together and the joints glued. A number of small nails can be used to hold it together while the glue dries. Use a PVA glue such as Aquadhere.

We estimate that the current cost of parts for this project is approximately

$149

This includes the cost of the cabinet, metalwork and the battery.



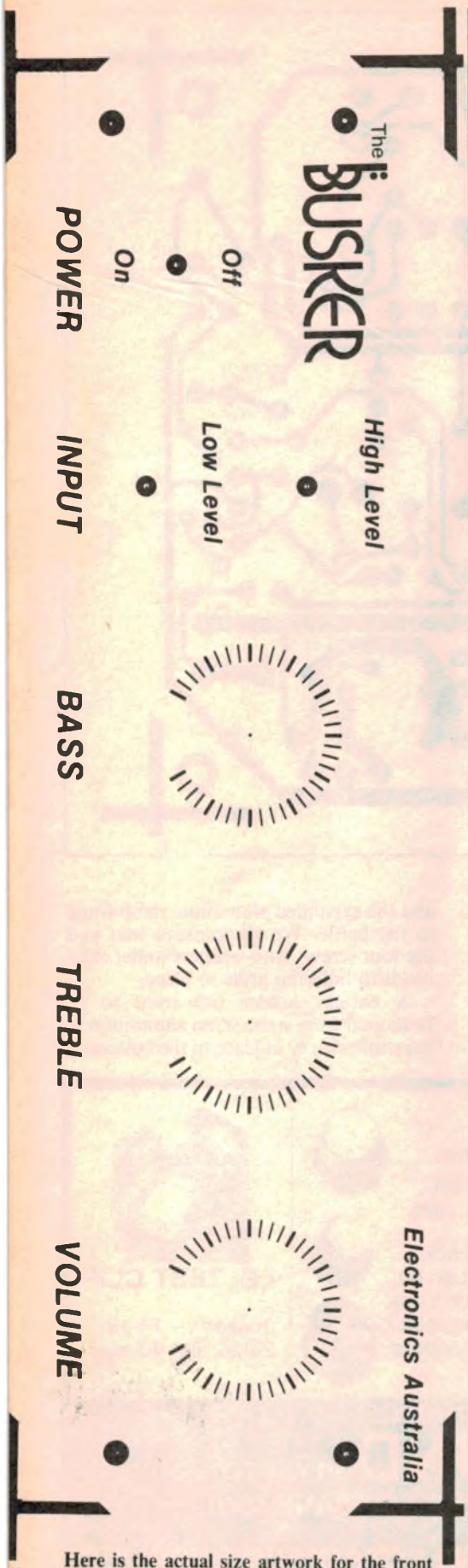
Actual size artwork for the printed circuit board.

We covered our prototype with vinyl, but if you wish you could paint the cabinet. This is easier, but will not give as serviceable a finish. If you do elect to cover the box with vinyl, don't forget to paint the speaker baffle black before the vinyl is applied.

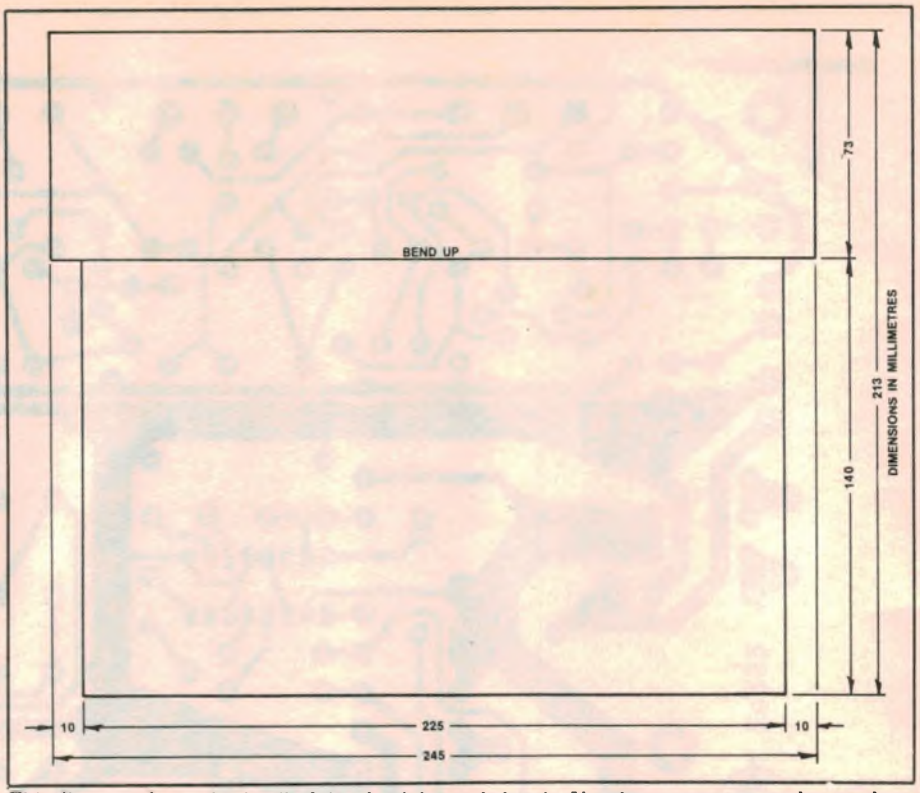
Be careful when cutting the vinyl to fit around the edges of the wooden panels, since it is easy to miscalculate and spoil the appearance of the box. If you do make a mistake you might have to glue in a small piece of vinyl as a patch.

This done, the speaker can be fitted and the expanded aluminium mesh fitted to the baffle. We recommend that you use four screws with washers under their heads to hold the grille in place.

A battery holder will need to be fashioned from some scrap aluminium to keep the battery in place in the bottom of



Here is the actual size artwork for the front panel of the Busker.



This diagram shows the detail of the aluminium subchassis. Use the components as the templates for the holes.

Parts List

1 PC board, code 85ba2, 153 x 115mm
1 cabinet and metalwork — see text
1 Scotchcal label, 224 x 66mm
1 8Ω 200m loudspeaker, Jaycar type CE-2325 or equivalent
1 12V 2.6Ah sealed gel battery
1 mains transformer, 15VAC at, type 2156 or equivalent
1 IEC-320 mains cable and line socket
1 IEC-320 chassis mains plug
1 DPDT toggle switch (240V rated)
1 FX2242 potcore with former
2 6.5mm phone jack sockets
4 mica washers to suit TO-126 transistors
19 PC stakes
4 12mm metal spacers

Semiconductors

3 BD682 PNP Darlington transistors
1 BD681 NPN Darlington transistor
6 BC548 NPN transistors
1 BC327 PNP transistor
5 1N5404 diodes
4 1N4004 diodes
1 LM3524 regulating pulse width modulator
1 15V, 1W zener diode

Capacitors

1 4700μF 25VW PC electrolytic
1 2500μF 63VW PC electrolytic
1 1000μF 25VW PC electrolytic
1 220μF 16VW axial electrolytic
2 100μF 25VW PC electrolytic
1 47μF 50VW PC electrolytic
1 10μF 50VW PC electrolytic
2 0.47μF polyester
2 0.22μF polyester
2 0.1μF polyester
3 0.1μF ceramic
1 .047μF polyester
1 .015μF polyester
1 .01μF polyester
2 .0068μF polyester
1 .0015 polyester
2 .001μF polyester
3 100pF ceramic
1 82pf ceramic

Resistors (¼W, 5% unless stated)

1 x 2.2MΩ, 1 x 680kΩ, 1 x 560kΩ, 2 x 470kΩ, 1 x 220kΩ, 1 x 180kΩ, 1 x 150kΩ, 1 x 120kΩ, 1 x 68kΩ, 2 x 47kΩ, 3 x 27kΩ, 5 x 10kΩ, 1 x 5.6kΩ, 1 x 2.7kΩ, 4 x 1.5kΩ, 1 x 1.2kΩ, 6 x 1kΩ, 1 x 560Ω, 1 x 330Ω, 1 x 270Ω, 2 x 220Ω, 1 x 150Ω, 2 x 100Ω, 1 x 47Ω 1W, 1 x 4.7Ω, 4 x 1Ω ½W

Potentiometers

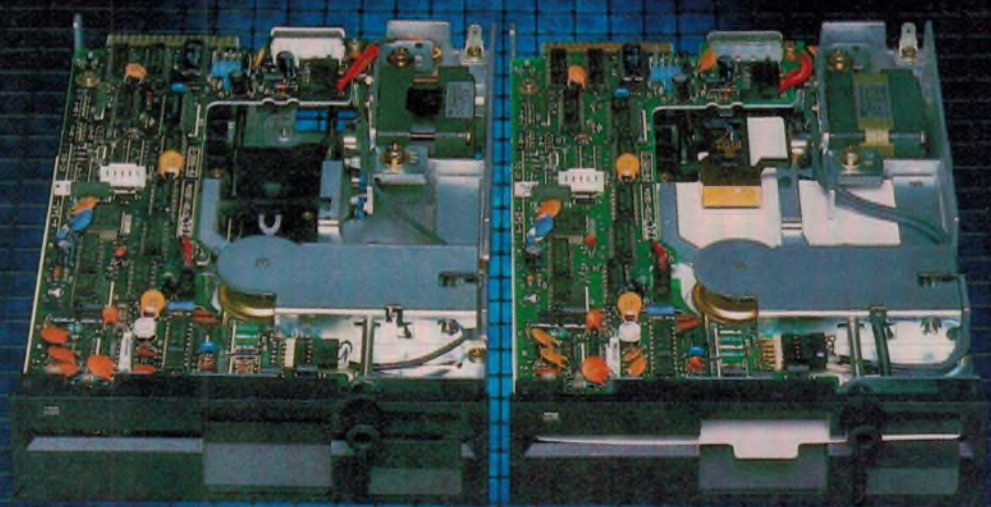
2 500kΩ linear potentiometers
1 50kΩlog potentiometer
1 2kΩ miniature horizontal trimpot

Miscellaneous

Mains-rated cable, hookup wire, shielded cable (500mm), machine screws and nuts, wood screws, heat shrinkable tubing, plastic sleeving, etc.

SIEMENS

The better the drive, the smaller the disc



True half height 5¼" floppy disc drives competitively priced from Siemens.

Designed for office electronics, business computers and OEM applications, this slim-line FB500 series has four versions with unformatted storage capacities from 250K to 1M bytes. Apart from compactness, these drives offer fast access time by an advanced stepping motor and steel belt mechanism. The brushless direct drive DC motor is highly reliable and very quiet. The full range is now in stock together with Siemens relentless determination to provide complete service and technical assistance throughout Australia.

Siemens Ltd.
544 Church Street, Richmond, Vic.
Melbourne: 420 7318. Sydney: 436 8730.
Brisbane: 369 9666. Perth: 362 0123.

Distributors:
Auckland: Delphi Industries Limited. 567 258
Adelaide: R.G. Pank Pty. Ltd. 51 2411
Adelaide: Protronics Pty. Ltd. 212 3111
Brisbane: ECQ Electronics. 376 5677
Melbourne: Promark Electronics Pty. Ltd. 878 1255
Perth: Reserve Electronics. 328 9755
Sydney: Promark Electronics Pty. Ltd. 439 6477

Siemens. The discs may be flexible, but never our standards.

646/1189A

The Busker

the cabinet. This has to be reasonably substantial because the battery is fairly heavy and the amplifier will probably be moved around a lot.

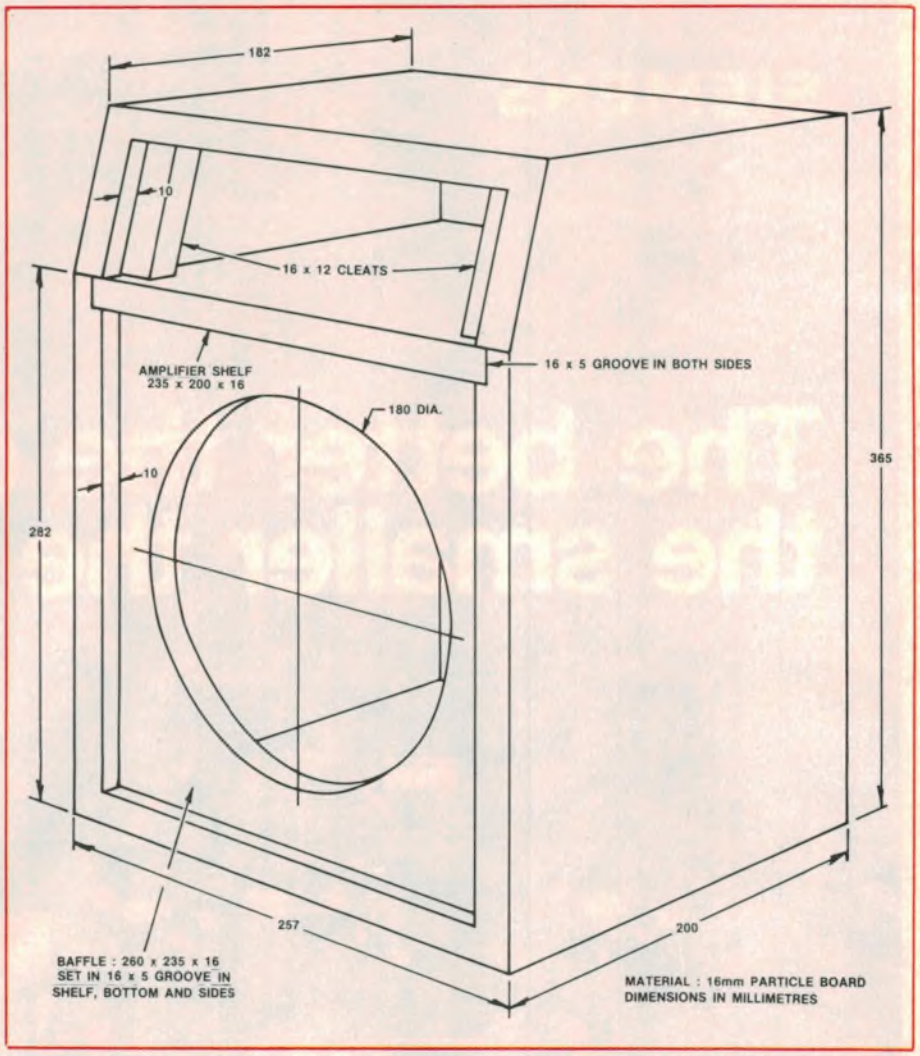
The Scotchcal label can now be affixed to the front panel and the necessary holes drilled. Mount the front panel hardware, then offer the panel up to the front of the cabinet and mark the positions for the four mounting holes. These holes should be drilled to accept small woodscrews.

Now slide the aluminium chassis into the cabinet from the rear, making sure that the wires to the battery and speaker are fed through the hole into the lower section of the cabinet. Use a few woodscrews to hold the chassis in position, then wire the leads to the front panel controls.

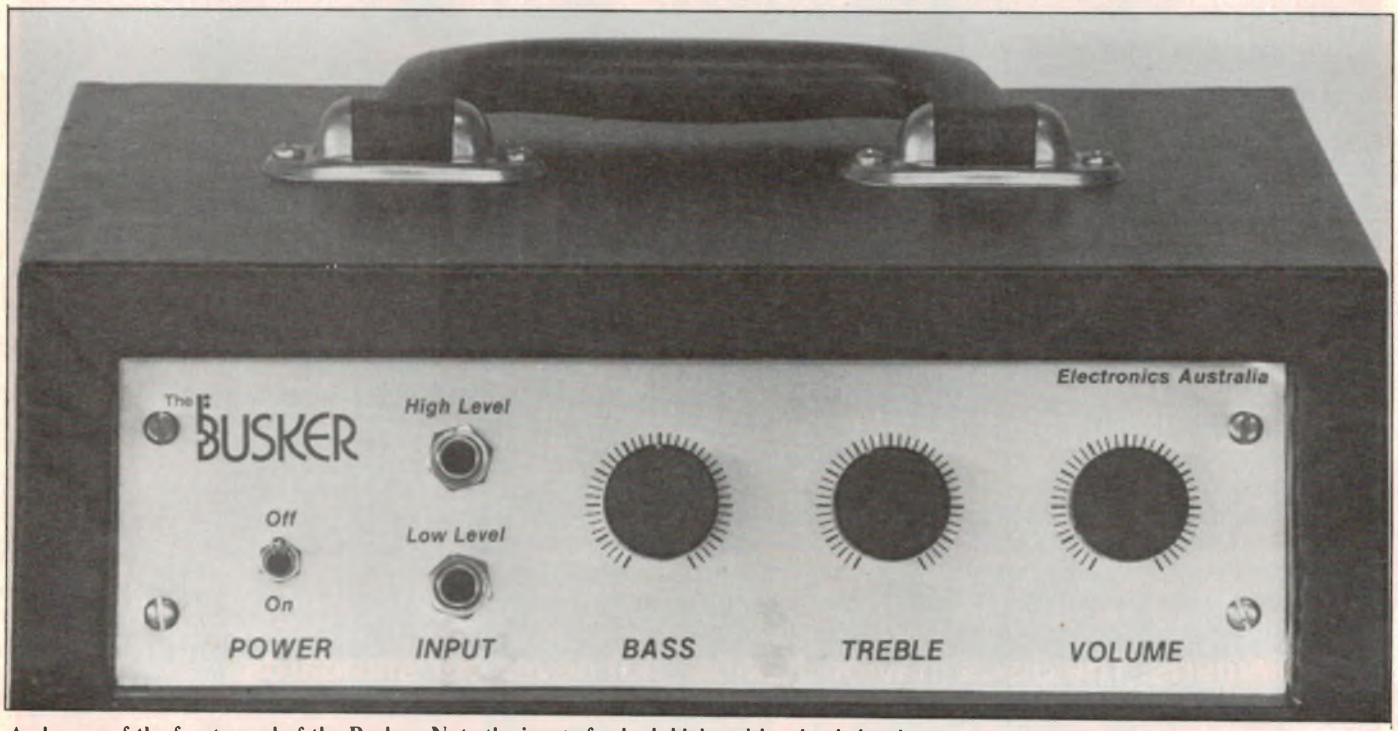
Pay careful attention to the mains wiring and keep it well separated from the low voltage leads. The mains on/off switch should be shrouded in heat shrinkable tubing to prevent accidental contact with the mains while the unit is being worked on.

Finally, mount the front panel in position and complete the wiring to the speaker and to the battery. The Busker is now complete and ready for the smoke test.

Provided that you've carried out the job of assembly carefully, the Busker should work first time. All you have to do now is to find yourself a suitable location and a receptive audience. Happy busking!



This diagram gives the details of the cabinet for those who want to build their own.



A closeup of the front panel of the Busker. Note the inputs for both high and low level signals.

It's more than an editor. More than an image enhancer. More than a duplicator. More than a mixer and more than a special effects generator.

VERTICAL WIPE

CORNER WIPE

3 SIDED WIPE

HORIZONTAL WIPE

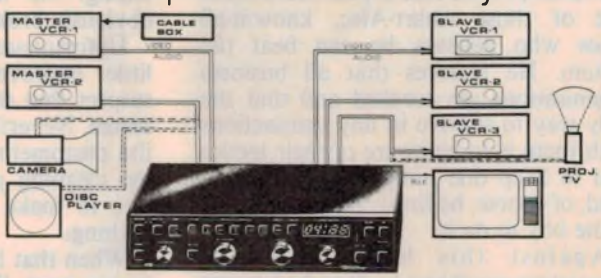
CONVERGING FROM 4 SIDES

CONVERGING FROM 2 SIDES

CORNER WIPE FROM TOP

FADE TO BLACK

Before the Hybrid 8 was created you needed several separate components strung together with a lot of connector cables to do just some of what this remarkable multi processor can do. The Hybrid 8 is a complete video editing, viewing and duplicating system that gives home video the quality than normally comes from expensive studio equipment. Here are just a few of the system's capabilities.



Add fades, wipes, credits, special effects to home movies. Eliminate snow and static. Make dubs as good as (and sometimes better than) the original.

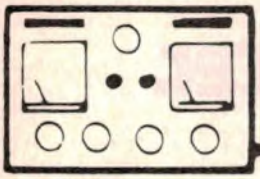
Make up to 3 stereo dubs at one time. Works with both VHS and Beta. 12 months warranty. Edit from 2 video sources. Add music to your movies. Fade in pictures and sound with total control. A fraction of the cost of a system built up of separate components. **$998**

Leads not included.

The Hybrid 8 home video master control.

Victoria Templestowe: Odyl Communications Pty. Ltd. Phone: (03) 846 3022. Albert Park: VMS Phone: (03) 690 5677. **New South Wales** Sydney: Kent Hi Fi. Phone: (02) 267 2400 Sans Souci: VMS Phone: (02) 529 5700 **South Australia** Adelaide: Ford Electrical. Phone: (08) 223 5944 Prospect: VMS Phone: (08) 344 9688 **Western Australia** Perth: VMS Phone: (09) 275 6358. If your local video specialist doesn't have supplies of the Hybrid 8, phone Odyl Communications Pty. Ltd., Melbourne, on (03) 846 3022. **Trade enquiries welcome.**

Concord 0483R



The Serviceman

The weirdos a serviceman meets

More than one serviceman has commented, from time to time, that servicing would be a beaut occupation if it wasn't for the customers! That's a contradiction in terms, of course, but is prompted by the totally irrational behaviour of some customer types. A story from my own bench, plus some contributions, should provide a few laughs this month.

As far as your Serviceman is concerned this story started in the middle; a number of things had happened before I became involved and several things happened after I had, at least in theory, ceased to have any interest in the case. In fact, due to factors which the customer did not appreciate, I was able to piece together a fairly continuous sequence of events, even if some finer technical points may be missing.

The customer involved might be best described as one of my "casuals"; he seeks my advice and assistance when it suits him but is not above playing the field, or one serviceman against another, in the hope of shaving a few dollars off the price of a job.

Not to put too fine a point on it he is one of those smart-Alec, know-it-all types who believes he can beat the system. He believes that all business organisations are crooked and that the only way to survive in any transactions with them is to be aware of their tactics and to keep one jump ahead of them. And, of course, he firmly believes that he is the boy to do it.

Against this background our association could best be described as one of mutual distrust, masked by a thin veneer of politeness. I know he doesn't trust me and I certainly don't trust him.

My introduction to the case occurred when he arrived at the shop carrying a Toshiba, Beta format, video recorder. (And, before I go any further, I should make it clear that this story is not a criticism of either the make or format. If anything, the reverse would be true.)

His complaint was that the video performance of the machine had virtually failed, in the sense that the picture was of such poor quality as to be virtually unwatchable. A quick check confirmed this. In greater detail the picture quality varied; at best it was extremely noisy and at worst would become even more noisy, lose colour, and then lose sync.

According to the owner the set was only about 14 months old and this fact, together with the symptoms, suggested nothing worse than dirty heads; something which I felt quite competent to tackle, even though I was not familiar with this particular machine. So it was agreed that I should clean the heads and that we would take it from there.

So I duly went through a routine head cleaning procedure, using appropriate alcohol based cleaning solutions, and exercising appropriate care. In fact, there was some evidence of foreign matter build-up but this came away readily enough. And to the exent that I could examine the heads I could find nothing wrong. At least there was nothing obviously broken.

Unfortunately, this produced very little improvement and I began to suspect that the trouble was more deep seated. Nevertheless, and being aware of the customer's nature, I went through the cleaning procedure a second time, just to make sure that I had missed nothing.

When that failed I felt convinced that it was most likely due to worn heads, even though I would not have expected that degree of wear in a machine as new as this one was, even allowing that, by the customer's own admission, he used it "a fair bit".

At that point I elected to bow out. Head replacement is a job for the factory, the more so in this case because I was not familiar with the machine, nor particularly keen to become any more deeply involved with a potentially difficult customer. So I simply advised him that I thought the heads needed replacing and that he should send the machine back to the local agents. I would have done this for him had he asked, but he didn't, and I didn't feel inclined to press the point.

And that, in theory, was the beginning and the end of the story as far as I was concerned. But, as I intimated earlier, it was only the middle of a much longer story. I was able to piece it together because I am on very friendly terms with two other people: a local appliance retailer who sells video recorders, and another serviceman in the area.

The opposition

Superficially this latter party is my opposition, and I suspect the customer banked on this. In fact, we are on very friendly terms, something which is not unusual in the electronics field generally, where a mutual interest in the technology is much stronger than business opposition. We frequently seek each other's advice on tricky problems, exchange service manuals, and even "borrow" components when one or the other is temporarily out of stock.

In fact, I received a phone call from him later the same day and pricked up my ears when he asked me if I knew anything about Beta recorders. I held back initially, simply asking him what the problem was, but it quickly became evident that the customer had taken the machine to him, apparently not being prepared to take my advice.

Once the cat was out of the bag we both had a good laugh and I filled him in on my side of the story. On this basis, and convinced that it was not a dirty head problem, my colleague ventured a little further than I had and dismantled the drum assembly for a closer look. And, at his suggestion, I called into his shop later in the day to see what progress he had made.

As far as the heads were concerned my colleague had come to much the same conclusion as I had; that while there was no visible damage to them, there had to be a wear problem in order to produce the dreadful results we had observed. And, as if to support this, my colleague pointed out the condition of the drum, something that was much easier to observe now that he had dismantled it.

It is not easy to describe the drum's condition, except to say that the tape path was clearly worn, exhibiting a different kind of "polish" to that of the remainder. Even to my relatively inex-

perienced eye the wear was obvious, while my colleague, who is rather more experienced, reckoned that it looked as though it had had about 10 times the amount of tape over it that one would expect for a machine of that age.

All of which simply confirmed my original suspicions, but put it on a more factual basis. And with honour thus satisfied I left my colleague to break the bad news to the customer. I rang him a couple of days later to find out what had happened and he told me that the customer had authorised him to send the machine to the Toshiba service department, having been warned that repairs were likely to be quite expensive.

A few days later my colleague rang me to bring me up to date. It transpired that Toshiba had rung him back with the advice that the wear on the heads and drum was quite excessive for a machine of that age and after quoting for a new head and drum assembly — which was going to make a mess of several hundred dollars — wanted to know how this amount of wear could possibly have occurred.

My colleague could only answer that he had no idea; that the customer had simply presented him with the machine and a complaint about its poor performance. But, since he had to ring the customer anyway, to quote for the repairs and get his OK, he decided to tackle him on the subject.

Head cleaning tape

It was only then, when he was able to quote Toshiba's comments about the excessive wear, that the customer finally confessed as to the likely cause. On his own admission he had been running an abrasive head cleaning tape through the machine at least once a month. As my colleague put it, the "at least" was probably more than a little significant, plus the fact that the customer mumbled something about "a couple of times" in relation to each occasion.

In one sense that could be regarded as the end of the story, at least as far as the basic head and drum wear problem, and its cause, was concerned. But, as I mentioned earlier, I am on friendly terms with a nearby retailer for whom I sometimes do service work, and happened to mention the saga of the video recorder, more or less as I have related it so far. And that brought forth his side of the story.

It transpired that the customer had first approached him some 15 or 16 months earlier, with the idea that he was interested in a video recorder. So he looked over the available models, declared that they were far too expensive, and announced his intention of looking elsewhere.

This he apparently did, and eventually settled for some cash-and-carry deal which he regarded as better value. Which is all fair enough, of course, and the retailer's attitude was to simply shrug his shoulders and say "Good luck to him". It's all part of the game.

But now comes the raw prawn bit. The customer, having brought his new toy home, discovered that he couldn't cope with the instructions, or the necessary interconnections between the recorder and his TV set. So what does he do but approach the retailer on a "give us a hand, mate" basis and suggest that he come down to his house and set everything up for him.

The only aspect of this that is more surprising than the hide of the customer is the goodwill of the retailer who, believe it or not, agreed. As my colleague put it, he would have advised him as to the best way to enter a large expanse of water in a nearby park!

So the system was duly set up, the recorder worked fine, and everyone was happy — well, more or less. As far as the retailer was concerned, he reckoned that would be the end of it. But quite recently, just before I came into the picture, and during a very hot spell, the customer was on the phone to the retailer.

"Listen mate, I'm in real trouble with this recorder. Would you drop in and have a look at it for me?" In greater detail he explained that the machine would run for only about 20 minutes and then the picture would deteriorate until it was unwatchable.

So once again the retailer, without any prospect of remuneration for his time, was conned into visiting the customer's home. (It so happened it was a stinking hot day, a matter of some importance as it turned out.) The first thing he noticed when he arrived was that the recorder had been built into a totally enclosed cabinet with no ventilation whatsoever.

"I'd do something about that cabinet if I were you," he told the customer. "Provide some ventilation, give the thing a chance to breathe. They don't like being overheated." But the customer wouldn't listen, dismissing the advice with a "she'll be right mate" attitude. So the retailer let him go ahead and demonstrate the problem.

Sure enough, a tape played satisfactorily for about 20 minutes, then suddenly began to break up and quickly became unwatchable. "See what I mean," said the customer, "that's all I can get out of it. The only way I can continue to play it is to cool the tape and run it for another 20 minutes or so."

"Cool the tape?" queried the retailer.

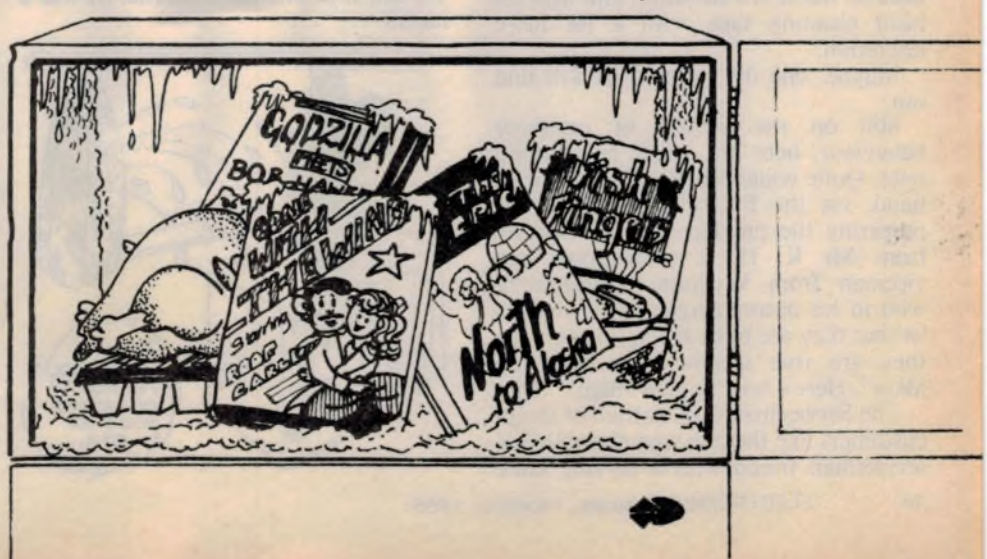
"Yes, like this," said the customer, whereupon he withdrew the cassette from the machine and — wait for it — popped it in the freezer compartment of his refrigerator. He left it there for about five minutes, put it back in the machine and off it went for another 20 minutes or so.

The retailer watched all this with mounting incredulity and horror, not trusting himself to speak for some time. He was well aware of how touchy VCR manufacturers are about the effect of natural humidity on the complex transport mechanisms, to the point where most have a "dew" indicator, carry a warning not to use the machine after moving from a cold location to a warm one, and may provide a cutout mechanism to operate under extreme conditions.

When he finally found his voice he didn't mince words. "You must be crazy to treat the machine like that. No VCR can stand that kind of abuse. You'll ruin the thing in no time."

But the advice seemed to fall on deaf ears. Once again the customer poohpoohed the idea; as far as he was concerned the machine should be able to take it.

And on that note the retailer took his leave, convinced that he was butting his head against a brick wall. Needless to say, he was very interested to hear what was, to him, the sequel to the story. And just as interested was my colleague, to whom I subsequently related the story.



The Serviceman

Unfortunately, neither of us can be quite sure what was happening when the machine and the tape overheated. As far as the retailer could determine the tape continued to run, at least nominally, but apparently was no longer able to sync or track correctly. We are also not sure how much effect the freezer ritual had on the recovery. Was it solely responsible, or was the mere shutting down of the machine during this period all that was needed?

We'll never know — and I doubt whether anybody will try to find out!

The final chapter

The final chapter was played out when the machine was returned from Toshiba with an account for about $250; a figure which had already been quoted and which the customer had approved. But it seemed that seeing it in print touched a sensitive nerve and he blew his top, claiming that he had been given a raw deal by Toshiba (though not by my colleague), and that he intended to take the matter to the Consumer Affairs Bureau.

"Well", said my colleague, "you can take it to Consumer Affairs if you like, but I reckon they'll give you very short shrift if they find out about how you've abused the machine. Not only did you grossly overdo the head cleaning tape, you ran the thing without any ventilation and fed it with frozen cassettes."

And that, apparently, was the last straw as far as the customer was concerned. His jaw dropped and he gazed at my colleague in wonderment, because he wasn't supposed to know anything about the ventilation or the freezer. He made some attempt to find out where the information had come from, but my colleague wasn't telling.

What has happened since we don't know. Hopefully he will have learned his lesson, mounted the VCR in a more reasonable manner, done away with the need to freeze his cassettes, and uses his head cleaning tape with a lot more discretion.

Maybe, one day, one of us will find out.

Still on the subject of customer behaviour, here are a few more weird ones. Quite coincidentally these came to hand, via the EA office, while I was preparing the previous story. They are from Mr K. H., a professional serviceman from Wynnum, Queensland, who in his accompanying letter assures us that they are to be taken seriously; ie, they are true stories, "not made up jokes". Here's how he tells them.

The Serviceman does not tell of tough customers like the one who chased a TV serviceman friend with a carving knife after being shown the repair bill. He is probably laughing down at the pub telling the boys how he frightened the TV man and got a free repair.

Five weirdos

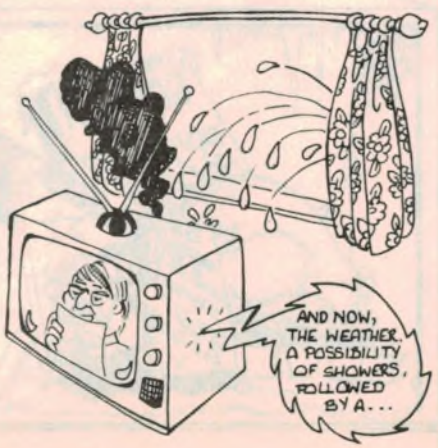
Case 1: Customer (teenager) bought a handheld electronic game which required the user to "beat the computer". The machine kept beating him every time, so he lost his temper and threw it against a brick wall. The pieces were brought in, but it was beyond repair.

Case 2: A man wandered up and down outside the shop seemingly looking at the window display. It soon became apparent that he was waiting until the shop was empty of customers. When the last one walked out, he entered with a small plastic bag. The contents were deposited on the counter and proved to be a transistor radio with a large hole through the speaker grille.

He explained that on the previous Saturday he had placed a goodly amount on a "certainty" in race so and so. The horse lost, so he stabbed the radio with a screwdriver he was using. The speaker was replaced and the copper tracks bridged with wire over the breaks. To date it is still working.

Case 3: Radio-cassette brought in with complaint that new cells had just been fitted but nothing worked. Open battery compartment, all batteries around right way. Check with multimeter, voltage OK. Switch on radio, no sound, meter still hooked up to terminals shows zero volts. Story — three fresh "D" cells on top, three old ones below. Replace old cells. Bingo. Everything works. (He did it to save money.)

Case 4: Rank Arena TV sitting under window in lounge. Father decides to water front lawn with garden sprinkler. Turns sprinkler on full blast near house with window wide open. Water showers through flyscreen and over back of hot TV set. Exit one Rank Arena. (It was a mess.)



Case 5: Service call re one channel not working on amplifier. Enter room to repair same. See amplifier with no cover, just the chassis with figure eight mains cable twisted around connections inside. Other end pushed into wall outlet without benefit of three pin plug. Turn off power and withdraw cable from socket, burn fingers on output transistors.

Note assortment of speakers around room, some on floor, others on wardrobe, one in old wooden trunk with holes bored in the front. All sorts of speakers, 4Ω from car radios, old oval TV types, all joined up with odd bits of cable. What sort of load this presented is anyones guess.

Take unit away, repair same, fit three core cable and plug, make plywood cover for top. Test amplifier works like new. Return same and suggest disconnecting odd speaker assortment. Pick out two 8Ω units, check with meter, and hook up to the amplifier. Sounds good. Collect fee.Warn that damage will occur if setup altered. Leave for next job.

Get phone call next day. Customer wants fee refunded, "Only worked for a few minutes". Call back to calm down customer and see what went wrong. Enter room, see all previous wiring reinstated to original setup. Feel heatsink running hot as before. Pack up tools, leave.

Case 6: Saturday 6.30pm, phone call from "difficult" customer. TV set with no picture, sound only. Recall set is Pye Pedigree monochrome. Hunt about for suitable valves, pack gear into car. Arrive at flat to see wife with black eye and drunken husband in bad mood. Look at TV set sitting on table with hole right through the centre of picture tube. Shine torch inside hole, find yoke and part of tube neck fallen down on chassis. Answer incredulous "you can't fix it?" with one word — "No!" Pack all gear back in car, head home for aspirins.

Thank you, K. H., for what must be about the weirdest collection of customer types that I have heard about for a long time. I was also intrigued by your opening remark: "The serviceman does not tell of tough customers like the one who chased a . . . friend with a carving knife."

From this I get the impression that K. H. believes (1) that all servicemen get chased by someone with a carving knife at some time during their career, and that (2) because of (1) I must be withholding the story of my own personal experience in this regard!

I can assure you I'm not K. H. Fortunately for my peace of mind, if not for the amusement of my readers, I have managed to avoid this experience so far. With a little luck I might just get through my career without it. On the other hand, I get the impression that K. H. is inclined

The Serviceman

to look down on anyone who hasn't been chased with a carving knife, as if they don't really qualify as one of the mob.

So where does that leave me?

(I'm only joking K. H., thanks again for the stories.)

Ghost suppresion

To change the subject rather abruptly, here is the latest on TV ghost suppression. Regular readers may recall that I discussed this subject several years back, in January 1977 and again in December of that year.

The December article described a system developed in basic form by the Japan Broadcasting Corporation (NHK) and being developed by Toshiba. The basic idea was to look for spurious signals, ie, ghosts, during that part of the vertical blanking period where there should, ideally, be no video content. This information was then used to program a Charge Coupled Device (CCD) type video delay line so as to produce a ghost cancelling signal.

At that time Toshiba had produced a short version of the delay line, enough to prove the concept, but they expected to take up to two years to develop a full-size version. Well, that was seven years ago and it is only recently that I have heard anything more about it.

The latest report was in the Japanese publication "JEI" (Journal of the Electronics Industry) for July 1984, which came to hand rather belatedly. As far as I can determine from the very brief details given it is either the same as, or very similar to, the Toshiba system previously described but, strangely enough, is being produced by Hitachi.

More to the point, it is now in commercial form, Hitachi announcing that a 48cm set, model C19-DIG, was to be released in August 1984, with a price tag of around $US730. The makers claim that the system suppresses ghosts by between 14 and 20dB — which is quite substantial — and a pair of "before and after" photographs (somewhat degraded by reproduction) would seem to support the claim.

Hitachi also advised that this was the first of a full product line, including large screen sets, which would incorporate the new technology. At the time of writing there is nothing to indicate that any other manufacturers are using the system (Hitachi has filed 56 patent applications for it) but I imagine it will only be a matter of time before the rest of the industry adopts it — assuming it really works, that is.

And if it does work it probably won't be long before such sets appear on the Australian market. If so, we had better be prepared, if not from a servicing point of view, then at least to the point where we can advise customers as to whether their particular ghost problem is likely to benefit and whether the price of a new set would be justified.

Video faults of the month

This feature is compiled by The Electronic Technicians' Institute of Australia (TETIA).

HMV C211, C212 etc

Symptom: No sound or picture but with a loud warbling noise coming from the power supply; sounds somewhat like the chirping of a cricket.

Cause: R101 (2.2kΩ, half-watt) is open circuit. This prevents the chopper transistor from reaching its correct operating frequency.

RANK C2203 (PWC315)

Symptom: Top of picture folded over slightly, just enough to show the teletext lines. No combination of vertical, height or linearity controls will give an even scan.

Cause: C458 (10μF/160VW electrolytic) in the emitter circuit of TR412 is open circuit.

BLAUPUNKT "CARDONA"

Symptom: at switch-on, channel selector jumps about over all eight programs. It may settle on program 5 and display a picture with bad horizontal timing and with the accompaniment of a loud screech.

Cause: C1153 (0.18μF/1200VW) is leaky. This fault is the first stage of a breakdown which will ultimately stop the set. The offending capacitor will have a pronounced bulge in its waistline.

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Buy the 5000 Black Monolith Power Amp and 5000 Blueprint Preamp TOGETHER for only $498!

That's right, save over $120 on normal prices or over $60 if bought separately from this months SPECIAL prices!

PACKAGE DEAL No.2

Buy the following:

	NORMALLY
Power Amp 5000 "Black Monolith"	$319.00
Preamp 5000 "Blueprint"	$299.00
Graphic 5000 Equalisers (2 off)	$398.00
	NORMALLY $1016.00

THIS MONTH YOU GET THE LOT FOR ONLY $699!!!

THAT'S A MASSIVE SAVING OF $317 (i.e. YOU VIRTUALLY GET THE "BLACK MONOLITH FREE) EVEN AT THE SPECIAL INDIVIDUAL PRICES IN THIS AD IT IS STILL A MASSIVE SAVING! - Special freight deal: anywhere in Australia $12!!

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TRANSISTOR-ASSISTED IGNITION. "Electronics Aust." All parts inc. die cast box included!!! Hall-Effect type cat. KA1505. Normally $36.95 **FEB $29.50**

Breaker points type cat. KA1506 Normally $35.00 **FEB $28.50**

Hall-Effect points installation kit. Fits most cars (except Aust. 6's or V-8's). 90% of European, 60% of Japanese. Send for a list or return unit for full refund if it does not convert your distributor into a breakless unit! cat. KJ6655 – Normally $29.95 – **NOW $19.95**

IGNITION KILLER Ref: E.A. Feb '84 This nifty little project could prevent a thief from getting away with your car! Kills the ignition automatically cat. KA1535 **$14.95**

BONUS!! 2 x Car alarm window stickers supplied for FREE (Feb only).

MOTORCYCLE INTERCOM Ref: EA Feb '84 Talk to your friend while riding with your helmets on with this handy gadget. Why didn't someone think of it before (kit contains all specified components). Cat. KA1533 Normally $39.95 **FEB ONLY $35.**

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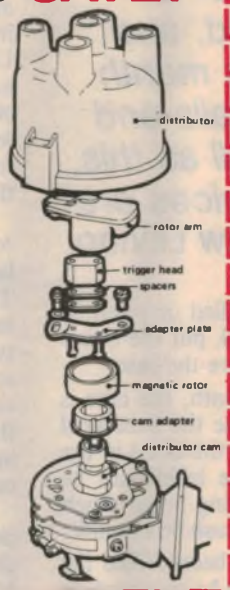

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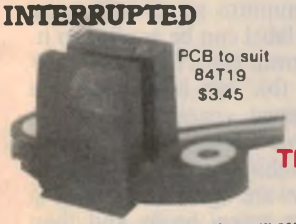

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Multi Sector Burglar Alarm

PART 2

In last month's article the main features of our new Home Burglar Alarm were described, and the circuit operation was explained. This month we follow on with the constructional details and present a few tips on installation. As well as this, some of the sensors and accessory devices are described.

by ANDREW LEVIDO

Construction

Begin construction by assembling the printed circuit board. This board is coded 85hal and measures 150 × 190mm. Install the wire links first, followed by the rest of the components, leaving the relay and the buzzer till last. Ideally, PC pins should be used for all external connections to the board.

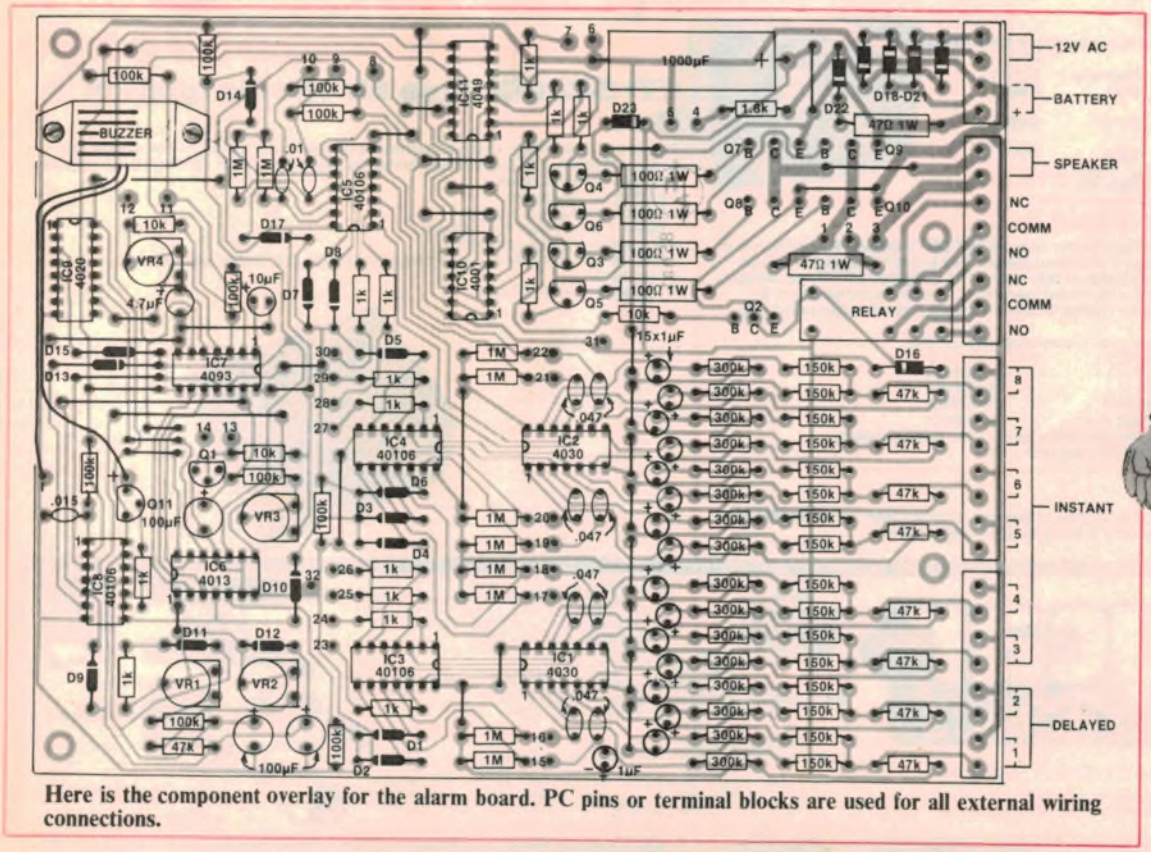
Once all the components are installed, check the board over carefully, watching out for incorrectly installed or oriented components. If all is well, put the board aside and begin to prepare the case.

As mentioned last month, the case is an adapted cash box. Use the Scotchcal label as the template for the holes in the front of this box. These labels can be positioned over the existing holes which are meant to accept the cash box handle.

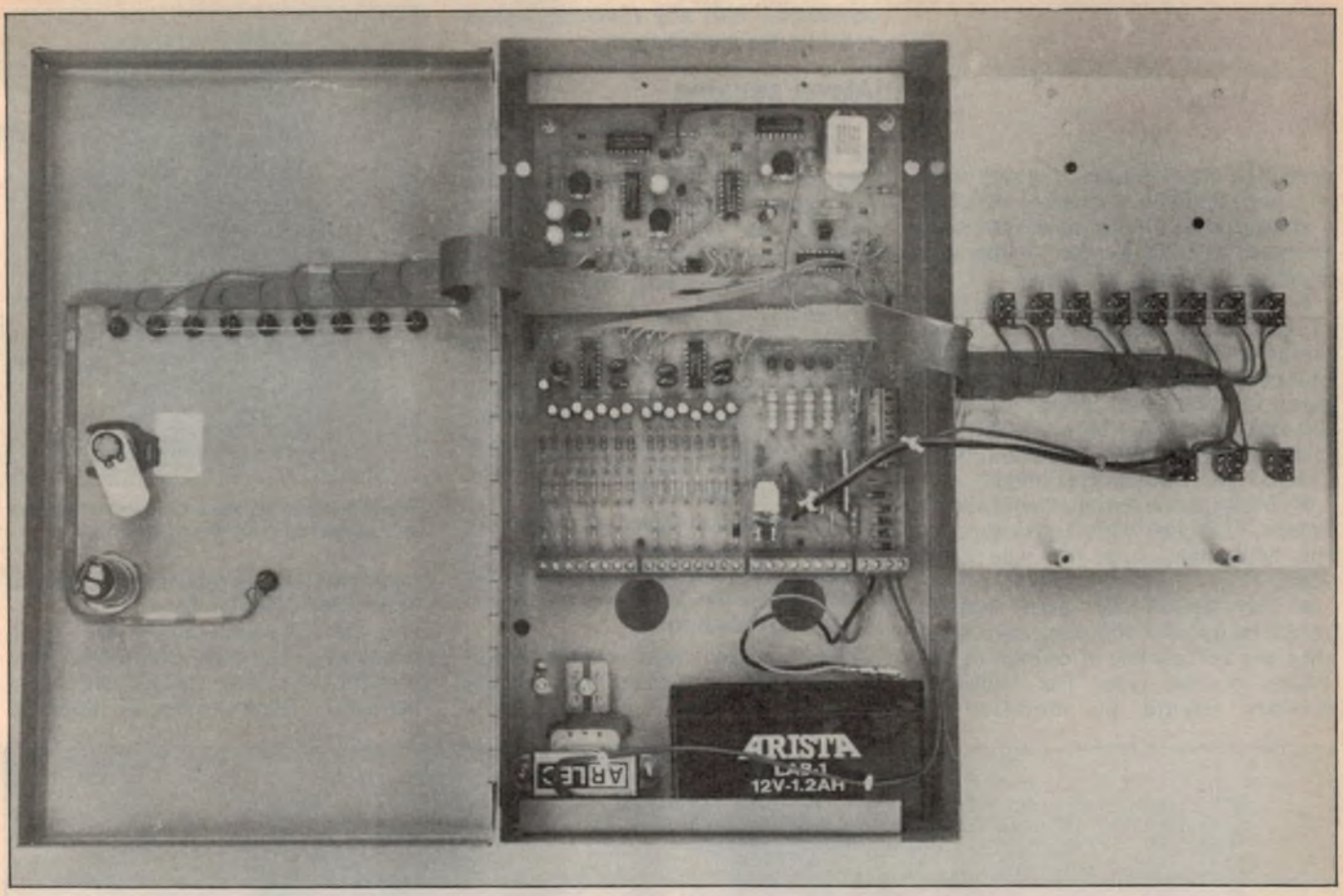
When the holes have been drilled the LEDs and keyswitch can be mounted on the front of the box. The transformer and mains terminal strip can be mounted in the base of the box at this time also. Use the photographs and diagrams to establish the positions of these parts. The circuit board should be used as a template for its mounting holes. Don't forget to drill suitable mounting holes in the base of the box.

Two holes have to be drilled in the 150 × 190mm aluminium panel before the large Scotchcal label can be applied to it. The wiring diagram gives details of their location. Once this has been done the two 25mm tapped spacers should be screwed to this panel using short, countersunk machine screws. Make sure that these screws are tight, as the label is applied over the screw heads and they cannot be tightened later.

This done, stick down the label in the normal way and use it as a template for drilling the rest of the holes in this panel. Mount the switches on this panel as



Here is the component overlay for the alarm board. PC pins or terminal blocks are used for all external wiring connections.



This photograph shows how the alarm is assembled. The large holes below the circuit board are for the wiring to the sensors and the output devices.

shown in the diagrams.

Wire up the alarm using the wiring diagram as a guide. Use rainbow or ribbon cable for a neat job. You will need to use some adhesive tape to keep the wiring inside the front panel in place. Use slightly heavier wire to switch S11b, since this takes the full speaker current.

The whole thing can be assembled once the wiring is complete. The diagram included in this article gives details of the way the alarm goes together. Follow this diagram closely as the assembly can be a little tricky.

Having completed the wiring the alarm should be thoroughly tested. You will need to make sure that the battery is well charged before testing the siren. Alternatively, a bench power supply (capable of providing a couple of amps) can be used when you test this function.

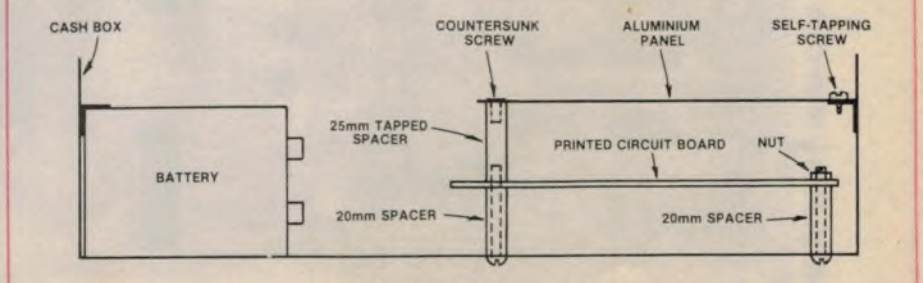
The battery charging circuit can be tested without having to wait for the battery charge up. Simply remove the battery and measure the voltage across the 1000μF capacitor. This voltage will be the same as the maximum battery voltage, and should not go significantly higher than 14V. If it is it will be necessary to change the 15V zener. Ideally, a 14V zener should be used in this position but such a device is not readily available. We found no problems using a 15V zener, but difficulties may be experienced if the mains voltage in your area is particularly high.

If you find that the voltage is too high and you can locate a 14V zener, use it, but otherwise you will have to select a 15V zener on the lower extreme of its tolerance range, or a 13V one on the high side. Alternatively, you may be able to use a 13V zener with a diode to "pad" the voltage up a bit.

Installation

As in the case with any alarm system, no matter how sophisticated the electronics is, the protection afforded is only as good as the job done installing the sensors and other equipment. There is not enough space to cover the details of alarm installation in an article such as this, but some pointers which may be helpful are set out below:

- The alarm box itself should be installed in an inconspicuous location near to the front door, or other major entry point. Inside a cupboard is an ideal location. It should be securely attached to the wall using heavy gauge screws.
- All wiring into the case should be run through the wall, into the cavity. The mains cable should be fairly long, so that the alarm can be plugged in at some remote point. It should not be too easy to identify which power point the alarm is plugged into.
- Connections to the horn speaker



This cross sectional view shows how the alarm is assembled. Note that the Scotchcal label is applied over the countersunk screws.

Burglar Alarm

should be run with heavy gauge wire. The horn should be located outdoors, in a conspicuous but inacessible location, protected from the weather. Wiring to it should not be easily accessable.

- We recommend that a second siren or bell be used. This can be mains powered, and controlled by one of the sets of relay contacts provided on the alarm. It could be located at some distance from the horn speaker, to minimise the chance of them both being disabled by an enterprising burglar.
- Wiring to the sensors should also be hidden. Only fine wire is necessary for this application, twin bell wire being ideal.
- The sensors for each location should be installed with some care, since they are the first line of defence in any system of this type. The individual sensors should be mounted in accordance with any recommendations made by the manufacturer.

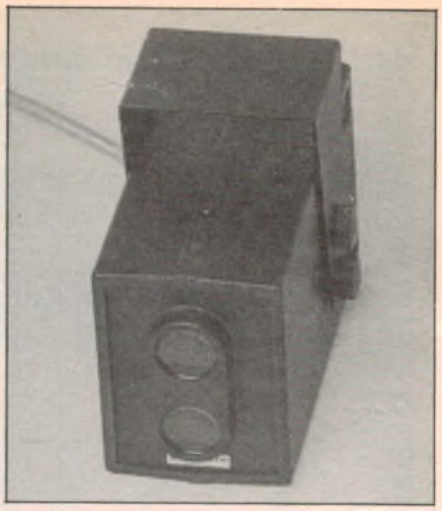
Alarm sensors

The variety of alarm sensors available on the market today is truly staggering. Because of space limitations only some of the sensors which are suitable for domestic use will be covered in this article. Even so the range is very broad, covering all areas of the home.

Probably the most familiar type of sensor is the reed switch. These have been around for a long time now and have proven reliability and usefulness. They are relatively cheap, but each one can only protect one door or window, so a large number are required to fully cover the average house.

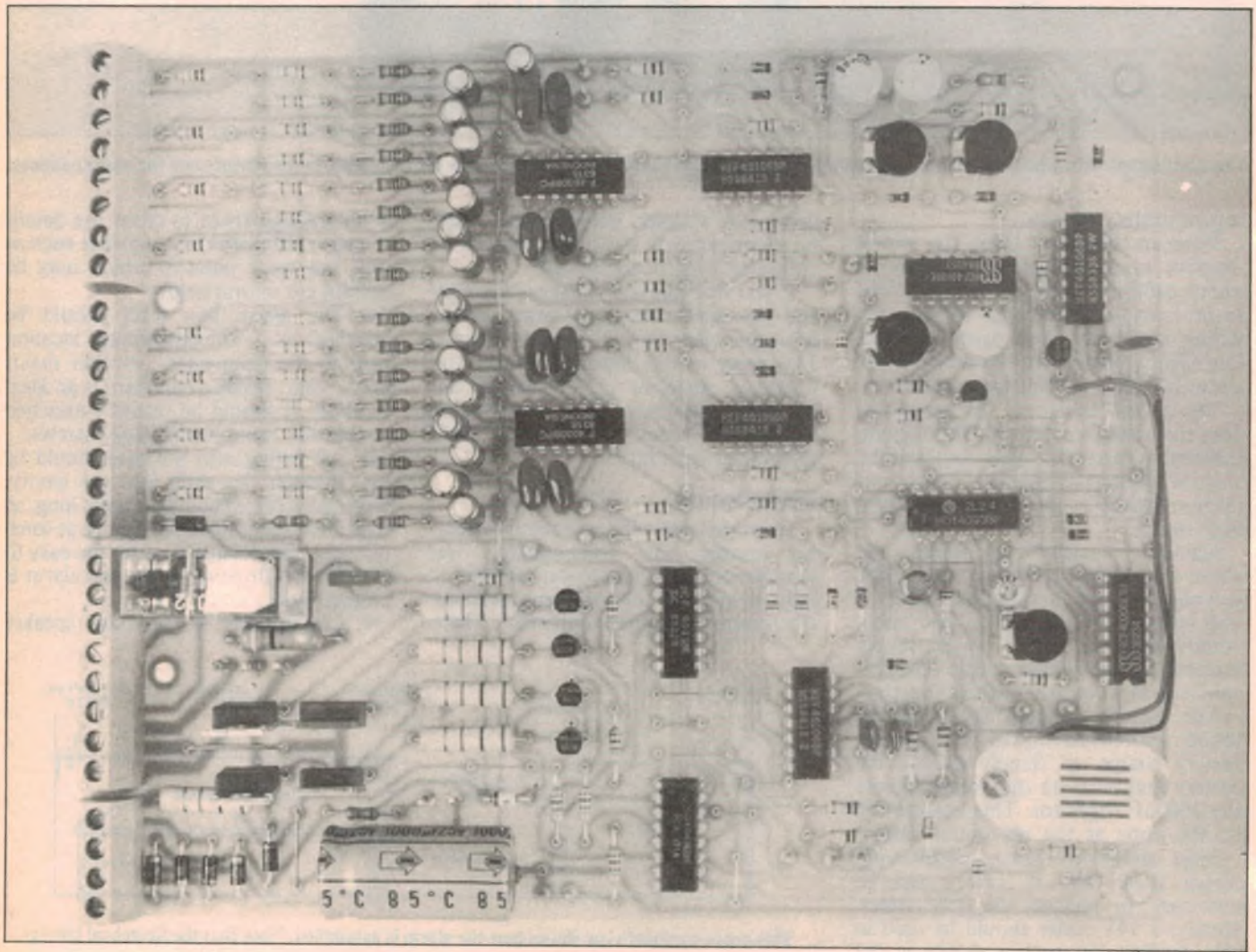
Other common types of sensors for protecting windows include glass breakage detectors and window foils. Examples of the latter can be seen in many shop windows.

Some of the more exotic sensors available include pressure mats, passive infrared detectors, ultrasonic and microwave movement detectors, infrared beam relays and the like.



This is an infrared beam type sensor suitable for monitoring doorways or hallways.

A few of these sensors are worth mentioning in a little more detail. This goes for the passive infrared detector in particular. These devices are relatively



The assembled circuit board. The buzzer is attached to the board using machine screws and nuts.

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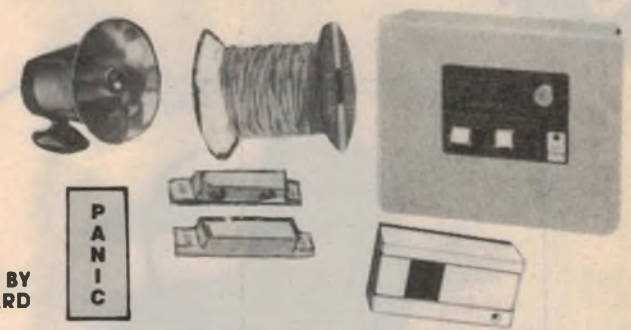

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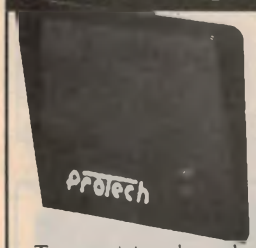

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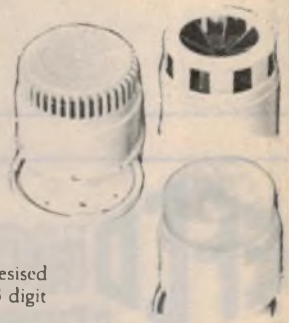

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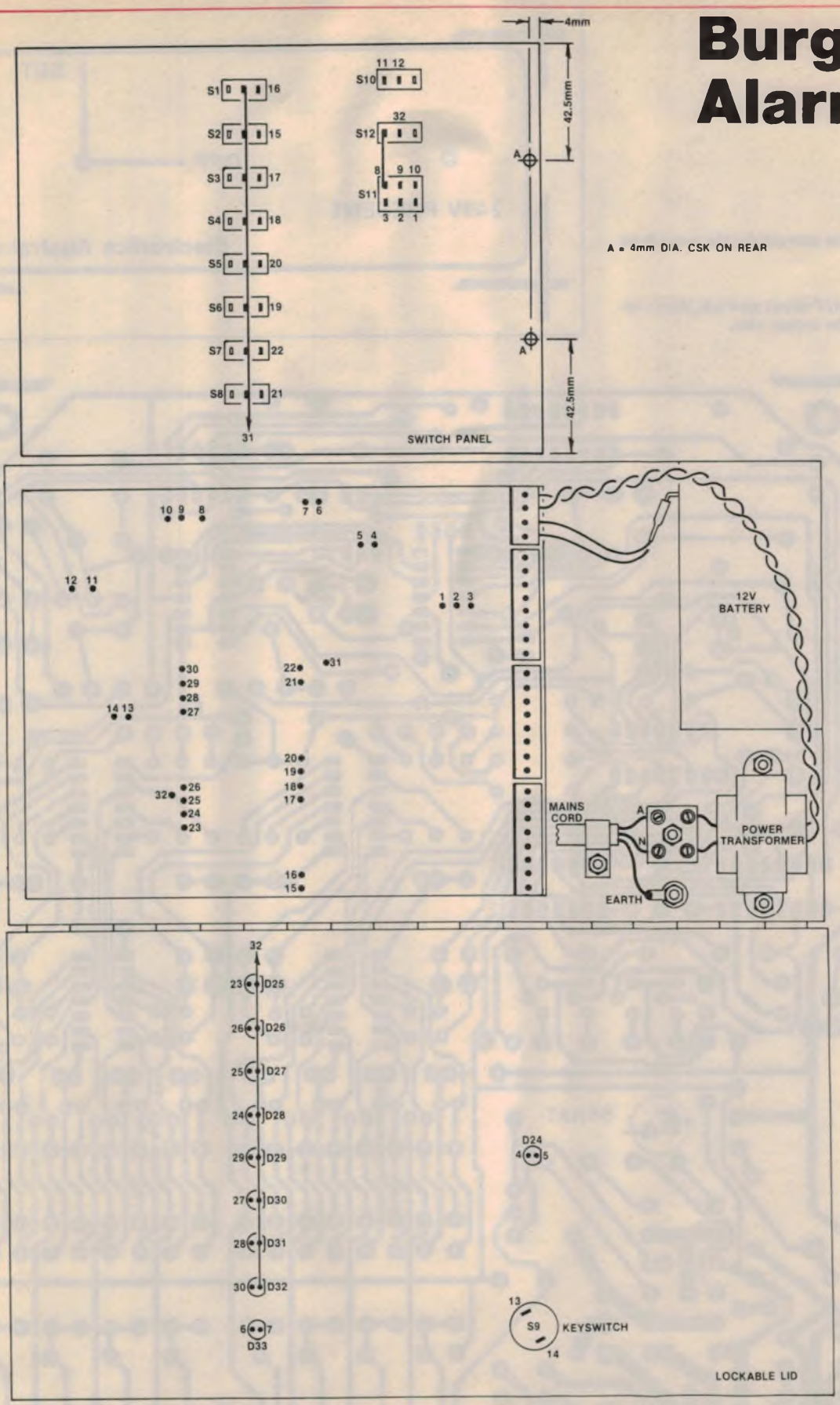
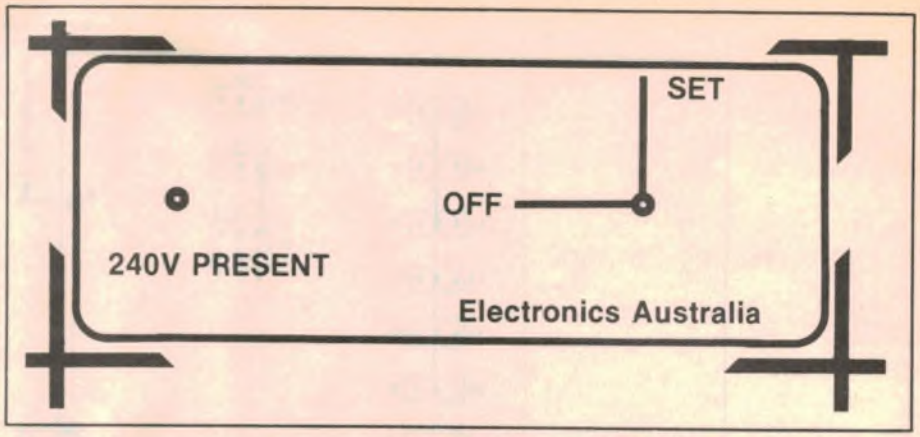
Burglar Alarm



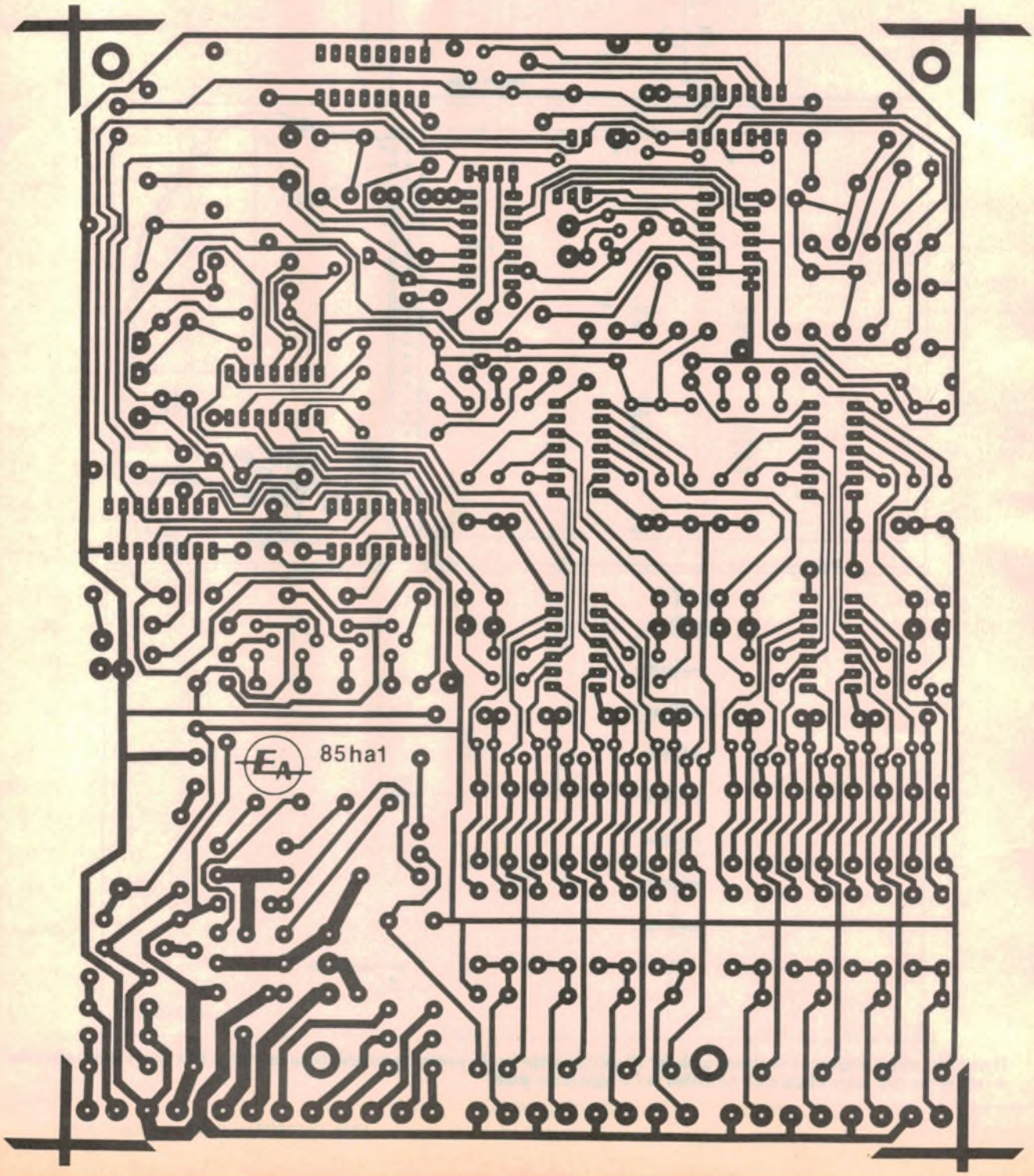
Here is the wiring diagram. Use ribbon cable for all wiring except for the power supply and the siren wiring. This diagram also gives the details of the two holes which must be drilled in the aluminium panel.

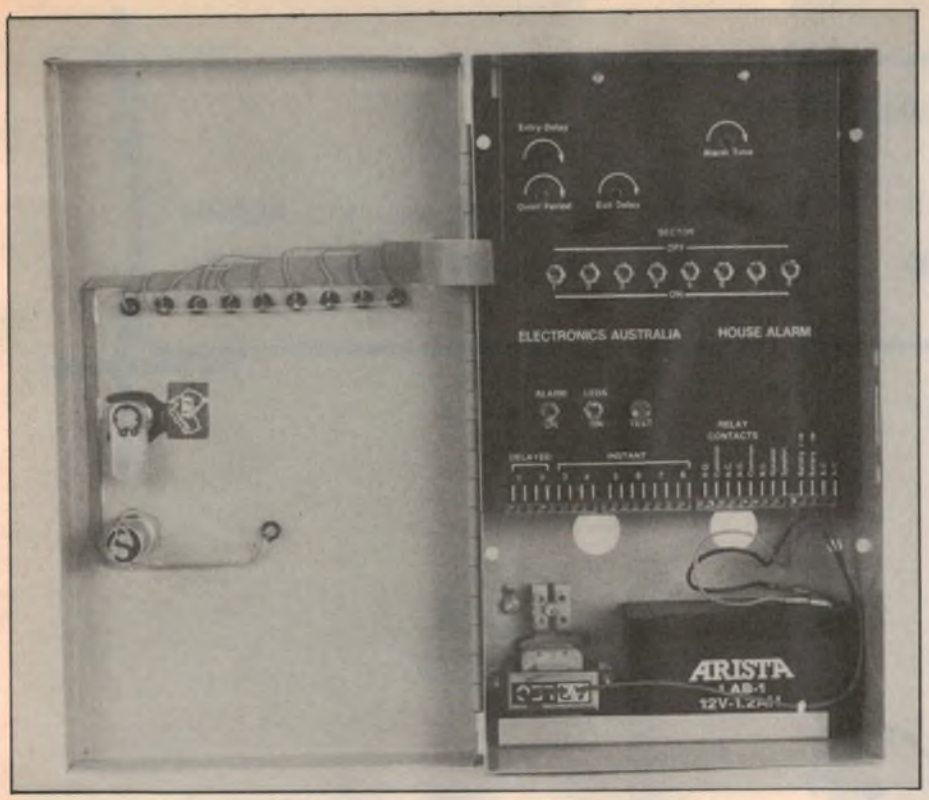
Burglar Alarm



Right: Actual size artwork for the lower front panel label.

Below: The printed circuit artwork, shown actual size from the copper side.





View inside the assembled unit with the main control panel in position.

new on the consumer market. but are making quite an impact. This is not surprising since the detector is less prone to false triggering than are the movement detection type sensors.

Passive infrared detectors work on the principle of sensing the infrared radiation given off by humans (and other living things). For this reason these detectors are less prone to false triggering by moving objects such as curtains or fans.

This type of detector is not totally free from problems however, since the sun is a good source of infrared radiation (!) While the design of the sensors is such that they are not affected by an overall variation in sunlight level, they can be triggered by a sudden localised intensity change. For this reason it is not recommended that this type of sensor be installed too close to windows which receive direct sunlight.

Infrared beam relays differ from the above detectors in that they include both an infrared transmitter and a receiver, and rely on the intruder breaking the beam. These are most useful in doorways, hallways and other areas likely to be crossed by a burglar. An infrared light beam relay was described in *Electronics Australia* in April 1981.

Pressure mats are most usefully located under the carpet in areas which would be crossed by an intruder.

Movement detectors, usually operating on the Doppler principle, are also a very common method of protecting large areas such as lounge rooms or hallways.

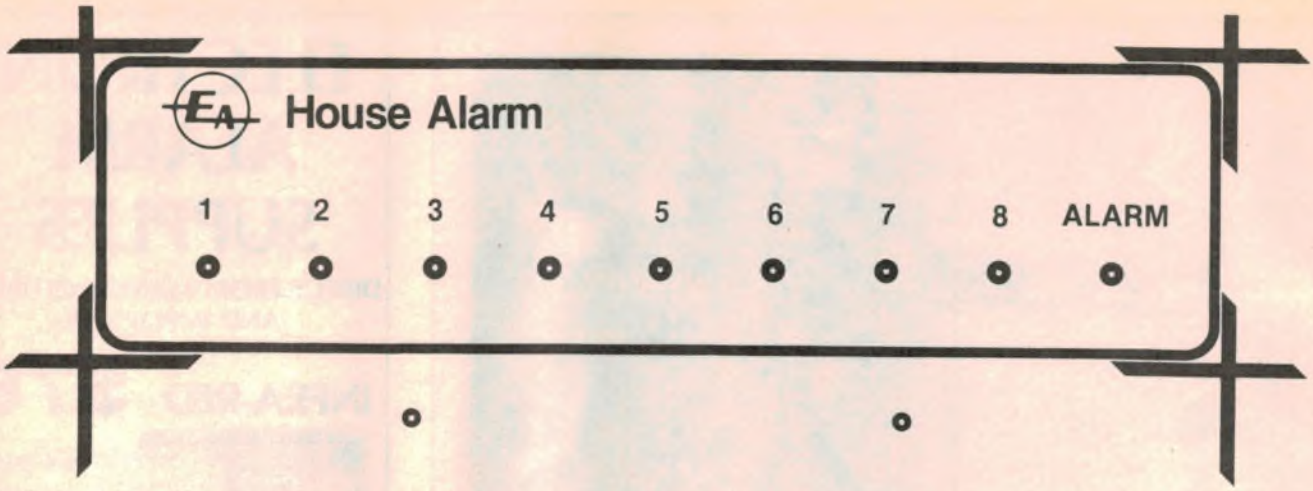
Make sure that all sensors are installed as shown in Fig. 3 on page 39 of the January issue. Do not leave out the 47kΩ resistor, otherwise the input detection circuitry will not function correctly.

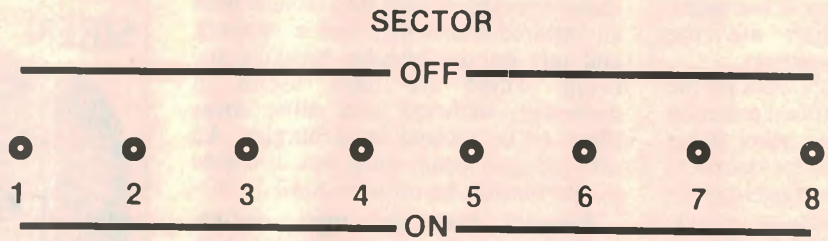
The choice of the appropriate sensors to protect your home may seem like a complicated business, but the benefits of choosing the most appropriate alarm sensor are high. The best way to select the most suitable sensor for your needs is to get in contact with a few alarm equipment suppliers, state you needs and budget, and listen to their advice.

Below: Three types of output device. A siren speaker, an electromechanical bell, and a weatherproof strobe light.

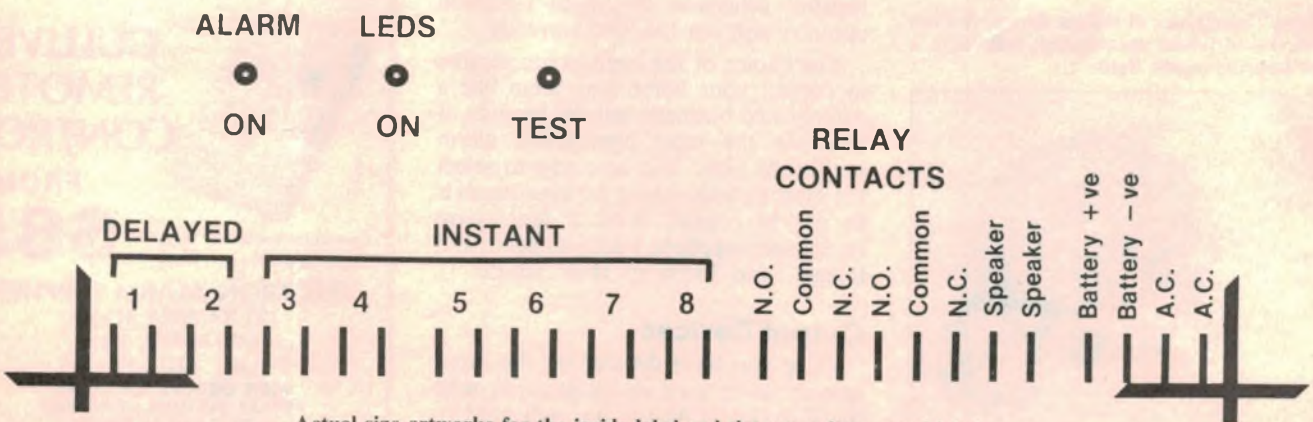
Output Devices

Once you have decided on the input sensors to be used in conjunction with the EA House Alarm you will need to consider output devices. The alarm has a

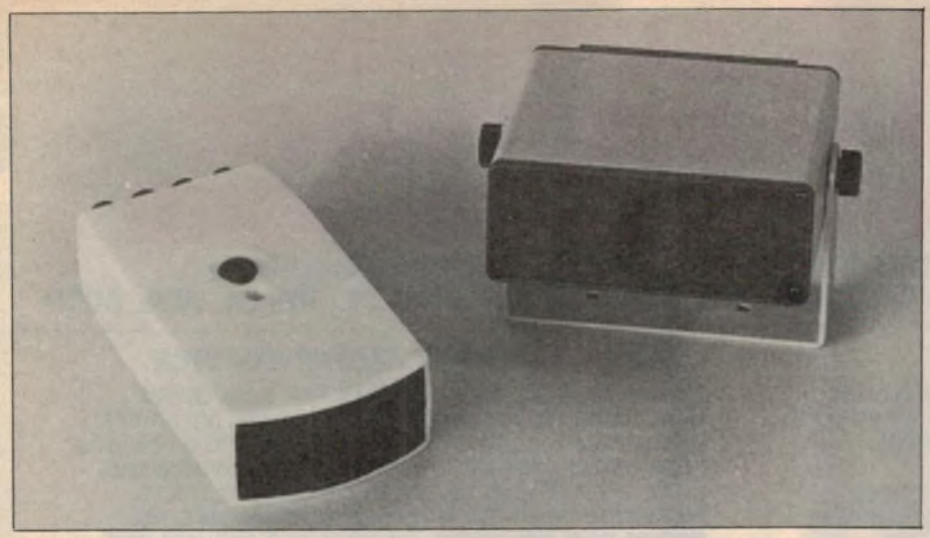




ELECTRONICS AUSTRALIA HOUSE ALARM



Actual size artworks for the inside label and the upper front panel label.



Ultrasonic (left) and microwave movement detectors from Dick Smith Electronics. Both devices operate on the Doppler principle.

built in siren driver so some type of weatherproof horn speaker will be required.

We also recommend that some other form of audible alarm be used in addition to the siren. This could take the form of an electromechanical bell or a second siren. A large range of electronic and electromechanical sirens is available from various suppliers.

It is possible to use the House Alarm described here as a silent alarm. In this mode of operation the audible alarms are disabled, and some form of remote signalling is used. This would normally take the form of an autodialler which would automatically telephone a security firm, and inform them that there is an intruder on your premises.

Finally, remember the advice given in the first of these articles; any alarm system, no matter how sophisticated, is a waste of money unless it is used. Get into the habit of setting the alarm each time you leave the house, even if you will only be away for a few minutes.

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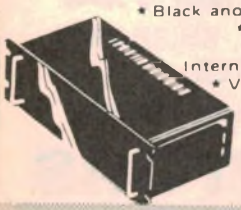

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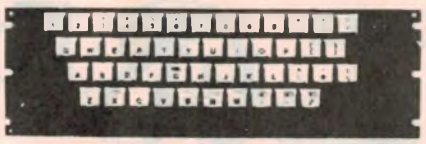

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PROJECT 1

Elementary Electronics

Keep an ear on the door, with this

Doorway Minder

If you've always been meaning to have a go at building an electronic project but never quite got around to it, why not start now? This shop doorway minder is an ideal project for beginners.

by COLIN DAWSON

You don't need any previous experience or any knowledge of electronics to build this simple project. All you need is a soldering iron and a couple of spare hours.

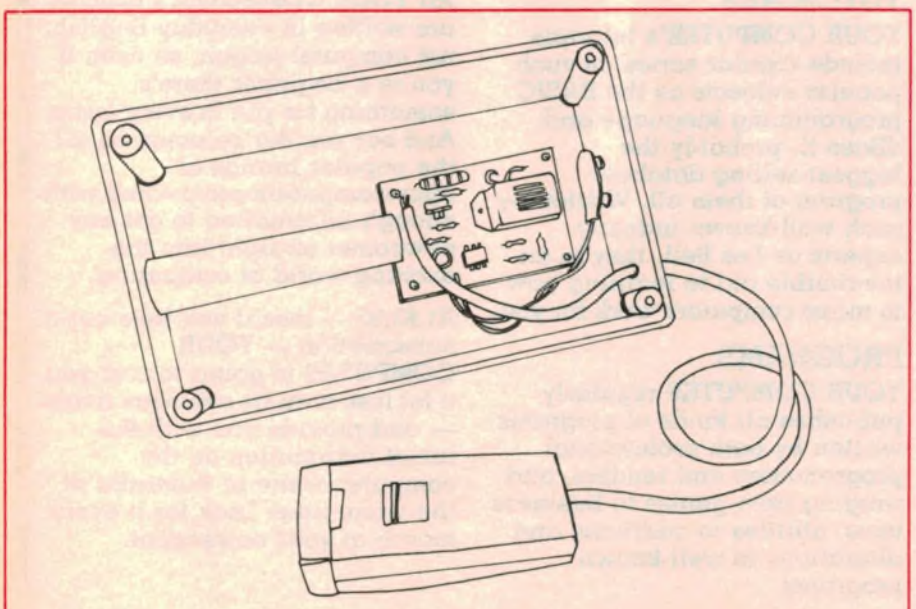
Once finished, you can put the Shop Minder to good use — not necessarily in a shop, either. It could also be used for a number of domestic applications.

Just about all shop minders detect a light beam which "shines" across the doorway. In most modern systems, the beam is actually invisible infrared (IR) light. Because this leads to a rather more complicated and expensive system, we've decided to stick with a visible beam. Actually, it's just a torch! This system works quite well and it makes construction really simple.

So that the circuit won't cost you a fortune in batteries, it is powered from a plugpack transformer. Many people will already have one, but even if you have to buy the plugpack, it will come in handy for future projects.

Any door minder which is based on a light beam consists of two main parts — a transmitter and a receiver. We've seen that the transmitter simply consists of a torch, but what about the receiver? Although this is rather more complicated, it is still quite easy to understand. Let's see how it works.

The receiver is based on a light dependent resistor (LDR). Whenever this device is in bright light, its resistance is quite low — around 100Ω to 200Ω. This increases to about 1MΩ when the LDR is in total darkness. Taking advantage of this characteristic enables us to come up with a circuit that can detect the presence, or otherwise, of the light beam.



Suggested method for fitting the project into a case. Note light tube for LDR.

The only catch is that the light beam has to be brighter than the normal, or ambient, light level. To make the circuit less sensitive to ambient light, the LDR can be placed at the end of a tube. When this tube is aligned with the torch beam, the door minder will have a much greater range than if the LDR had simply been left exposed.

To detect when the beam has been broken and the LDR resistance has increased above a certain critical value, an operational amplifier (op amp) IC is used. An op amp can be used in many ways but in this circuit it is set up as a comparator. This means that it compares two voltages and gives an indication of which is higher.

Op amps have two inputs — an inverting input and a non-inverting input. For the LF351 op amp used in this circuit, the non-inverting input is pin 3 and the inverting input is pin 2. Whenever the inverting input is higher than the non-inverting input, the output (pin 6) goes low. The output goes high when the non-inverting input is higher. In this way, the op amp compares the two input voltages and its output indicates which is higher.

One of the comparator input voltages is set by the LDR, but the other must be a "reference" voltage. For this reason, we have three resistors connected in series across the supply as a voltage divider. Notice that one of these resistors is actually a 10kΩ potentiometer (VR1). The reference voltage is actually taken from the wiper of this potentiometer and is fed into the non-inverting input (pin 3) of the op amp.

Because the door minder must be able to handle widely differing ambient light levels, the reference voltage needs to be adjustable. This is the reason for including the potentiometer in the reference circuit. When the project is set up at a door that is exposed to bright light, the reference voltage is adjusted to its highest level to prevent the bright light from swamping the light beam.

The type of potentiometer used here is a miniature type that mounts on the PC

board and is called a trimpot. Because it is mounted on the board, adjustment must be made with a screwdriver through a hole in the side of the box.

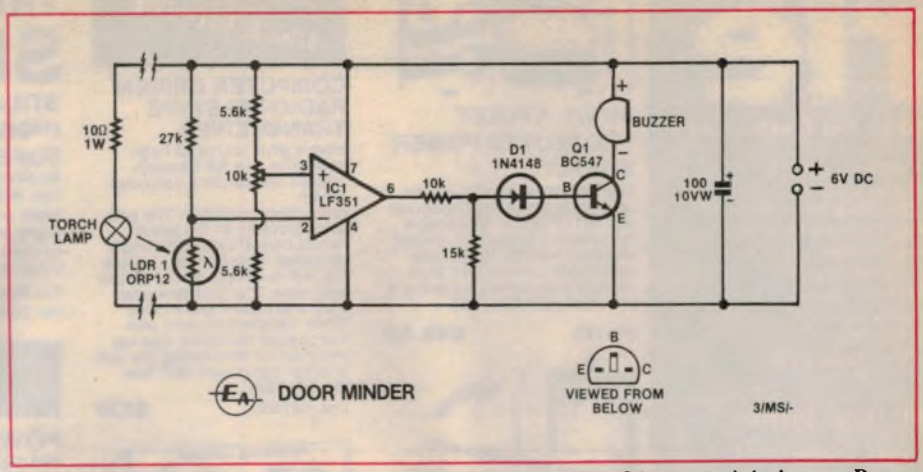
The output of the op amp will be high whenever the light beam is broken and the LDR has high resistance. When this happens, transistor Q1 will be on. This means that it will present a low resistance path between its collector and emitter.

Note that only NPN transistors, such as this BC547, are switched on by a positive voltage at their base. PNP transistors need a negative voltage to turn them on.

Whenever Q1 is on, it effectively connects the buzzer to the negative supply. Since the buzzer's positive lead is already connected to the positive rail, this completes the circuit and causes the buzzer to operate.

Diode D1 is included to ensure that Q1 is completely turned off when the output of the op amp goes low. This is necessary since pin 6 does not go all the way down to the negative rail. The 100μF capacitor is included to provide supply line decoupling.

With a relatively simple circuit such as this, there are bound to be a few disadvantages. One notable example is the duration of the warning sound. This lasts only for as long as the beam is interrupted. If someone decides to rush through the door, the buzzer will sound only briefly. Conversely, if some miscreant is determined to linger in the doorway, the buzzer will sound continuously.



The op amp (IC1) acts as a comparator and drives the transistor (Q1) to sound the buzzer. Power is suppled from a 6V DC plugpack transformer.

Construction

Since the transmitter simply consists of a torch, construction for this part of the project is rather simple. Just dash off to Woolworths and buy the cheapest torch you can find! Make sure that it is a two cell torch though, otherwise the globe will not have the correct voltage rating of 2.5V.

Construction for the receiver will take a little longer — you will have to solder the printed circuit board components in place and then fit the circuit board into a box.

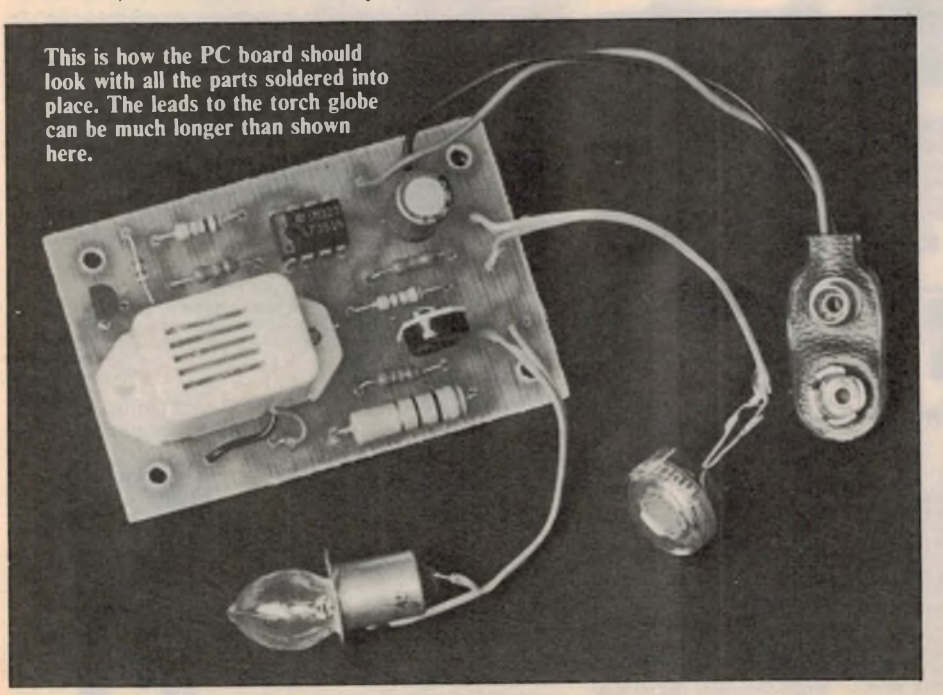
Actually, the box should be prepared first. Position the PC board inside the case and use it as a template to drill the mounting holes. Additional holes are required for the power socket, torch leads, and for screwdriver access to the trimpot. A large hole is also required at one end of the box to match the LDR tube (see diagram).

The PC board for this project is coded 85lr2 and measures 64 x 42mm. It should be spotlessly clean before you begin soldering. Give it a rub over with methylated spirits and a clean cloth to make sure. If the board is not clean, your best attempts at soldering will inevitably be frustrated.

Don't be afraid to apply plenty of heat to each joint when soldering — components such as these are not very sensitive to heat and are difficult to damage. The correct procedure is to use the soldering iron to heat the joint and to then apply the solder (ie, the joint itself must be hot enough to melt the solder, otherwise you will not get a good electrical connection).

Note that the LDR must be mounted proud of the PC board so that it can be fitted into the end of the tube.

Once the PC board has been assembled, it can be fitted into the case and the leads soldered to the power socket. Take care with these connections — if the power supply is connected with reverse polarity, the LF351 will almost certainly be damaged.



This is how the PC board should look with all the parts soldered into place. The leads to the torch globe can be much longer than shown here.

PARTS LIST

1 PC board, code 85lr2, 64 × 42mm,
1 LF351 or TL071 op amp
1 BC547 NPN transistor
1 1N4148 diode
1 6V DC 300mA plugpack transformer
1 electronic buzzer
1 plastic utility box, 41 × 68 × 130mm
1 torch (see text)
1 5cm (approx) length of conduit
1 socket to suit plugpack

Resistors

1 × 27kΩ, 1 × 15kΩ, 1 × 10kΩ, 2 × 5.6kΩ, 1 × 220Ω/1W, 1 × 10kΩ trimpot

Miscellaneous

Insulated hookup wire, solder, machine screws and nuts.

rie

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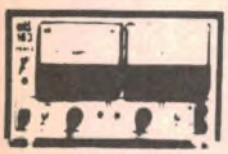


LAB SUPPLY

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 a unique relay switching system switching between taps on the transformer secondary. (ETI May '83).

ETI-163 **$175.00**

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 voltage and current metering is provided. (ETI Dec. '83).

ETI-162 **$49.50**

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 **$15.00**

EPROM PROGRAMMER EP1

No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms. (EA Jan. '82).

82EP1 **$47.50**
With Textool Sockets **$59.95**

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 **$24.00**

MICROBEE SERIAL-TO-PARALLEL INTERFACE

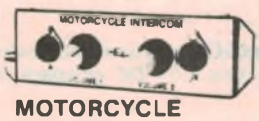
Most Microcomputers worth owning have an 'RS232' connector, or port, through which serial communications (input/output) is conducted. It is a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers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

ETI-675 **$55.00**

COMPUTER DRIVEN RADIO-TELETYPE TRANSCEIVER

Here's what you've all been asking for — a full transmit-receive system for a 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 inter-facing the unit to other computers. (ETI Nov. '84, ETI-755)

Cat. K47550 **$139**



MOTORCYCLE INTERCOM

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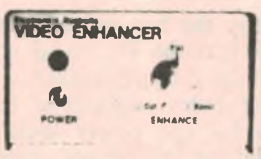
Motorcycling is fun, but the conversation between rider and passenger is usually just not possible. But build this intercom and you can converse with your passenger at any time while you are on the move. There are no "push-to-talk" buttons, adjustable volume and it's easy to build! (EA Feb. '84).

84MC2 **$45.00**



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 **$35.00**

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 plugback supply. (EA Aug. '83).

83VA8 **$15.00**

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 **$84.00**

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POWER AMPLIFIER

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

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- ★ Aluminium case as per the original article.
- ★ All components are top quality.
- ★ Over 1000 of these kits now sold.
- ★ 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 continuous. <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. K4471 Normally $339, **Special Price $309**
Packing and Post $10 **Assembled & Tested $499**

PREAMPLIFIER

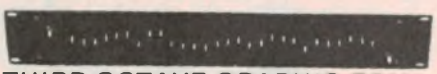
THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES 5000 PREAMPLIFIER KIT ARE:

- ★ 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 Normally $299, **Special Price $269**
Packing and Post $10 **Assembled & Tested $499**



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**
PACKING AND POSTAGE $10

SERIES 4000 SPEAKERS

8 Speakers On	$295
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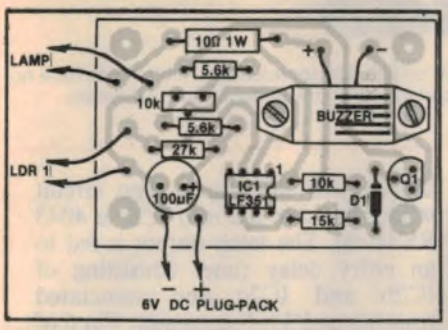
Assembled, tested and ready to hook up to your system	$899

Errors and Ommissions Excepted

Doorminder



This wiring diagram shows the PC board from the component side.

The connections to the torch are not polarity sensitive, but you should clamp the wires inside the case so that they won't be pulled out if somebody trips over them. The light tube can be held in place with epoxy adhesive applied to both ends. A 5cm length of plastic conduit would be quite suitable for the tube.

Testing

Before connecting the power, it's always worthwhile making a final check to ensure that everything is correct. Better still, get someone else to check your work for you.

Now that you are ready to take the plunge, position the torch close to the case so that the light shines directly into the tube. The buzzer may sound as soon as power is applied, but adjustment of the threshold control trimpot should silence it. Don't overdo this adjustment — you should advance the trimpot just enough to stop the buzzer.

Moving the torch away from the tube should make the buzzer sound again.

If all is well so far, try moving the torch some distance away from the box. The range over which the Door Minder will work reliably depends on the ambient light level. At night, it will probably be about five metres.

This range could be reduced to less than 1m if you attempt to operate the project out-of-doors during daylight hours. Note that the project will not work at all if sunlight is allowed to shine directly down the light tube and onto the LDR.

Troubleshooting

Don't despair if the project fails to work first time. This simple troubleshooting procedure should get you out of trouble. All you need is a multimeter.

Measure the voltage at pin 2 of the op amp and then at pin 3. In both cases, the voltage should be between 1V and 5V. Anything outside this range points to a solder bridge between tracks. The voltage at pin 2 should change in response to shining the torch down the tube or even covering the tube with your hand.

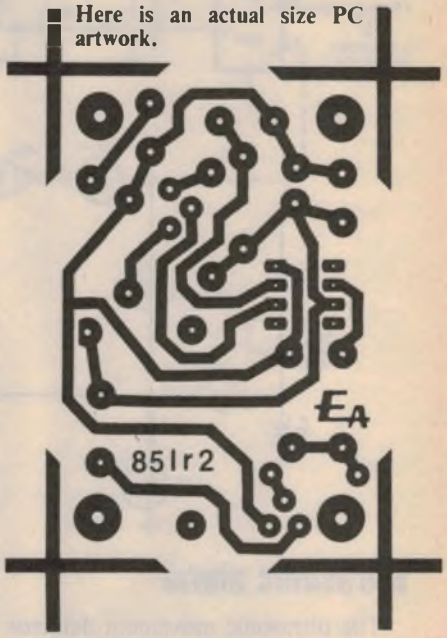
Similarly, the voltage at pin 3 should change in response to adjustments to the threshold trimpot. Remember, whenever the voltage on pin 3 is higher than the voltage on pin 2, the output (pin 6) should be high. If not, there is either a solder bridge between the tracks on the board or the IC is suspect.

We estimate that parts for this project will cost

$10-12

This includes sales tax but not torch or plugpack transformer.

Here is an actual size PC artwork.



Elementary Electronics Explained

Resistor colour code

The coloured bands on a resistor indicate its value in ohms and its tolerance in percent. On most of the resistors you are likely to encounter, three bands are used to indicate the value while a fourth band indicates the tolerance. The tolerance band will be slightly separated from the value bands so it's easy to tell them apart. Some other types of low tolerance resistors have four value bands as well as the tolerance band — they can be quite confusing to read because there is no space between the two groups.

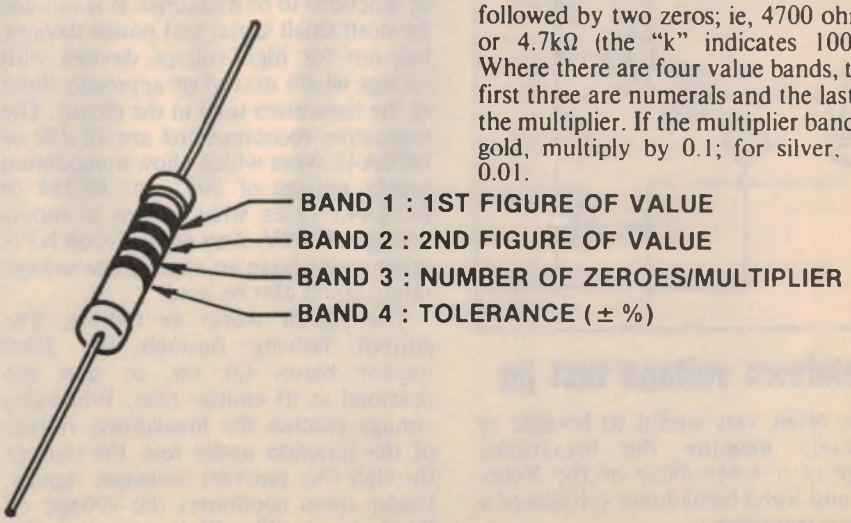
Here's what the colours mean for the value bands:

BLACK	0	GREEN	5
BROWN	1	BLUE	6
RED	2	VIOLET	7
ORANGE	3	GREY	8
YELLOW	4	WHITE	9

For the tolerance band, the colours are:

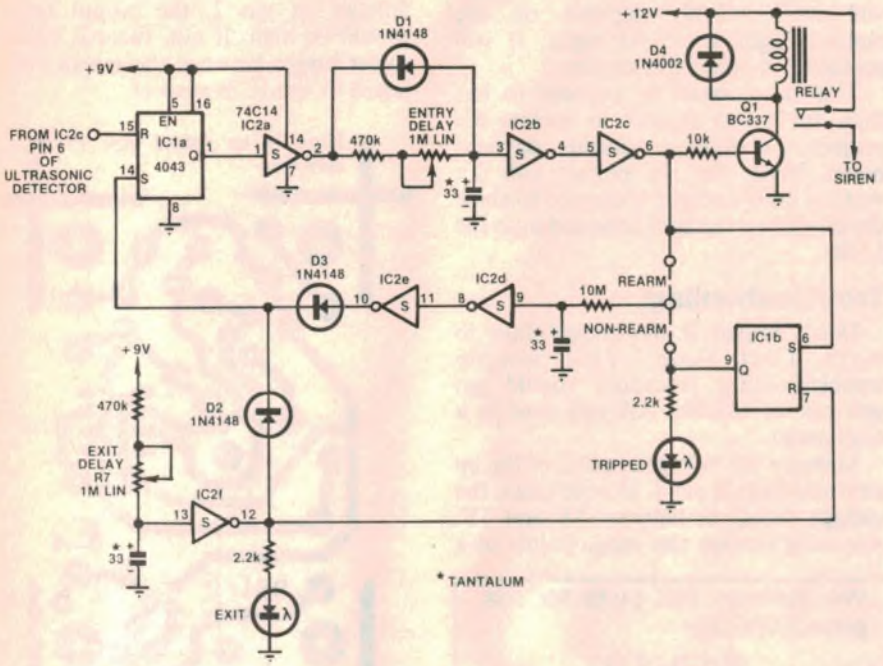
BROWN 1% RED 2% GOLD 5% SILVER 10%

When reading the value of a resistor, start with the band furthest away from the tolerance band. The first two bands indicate the first two digits of the value while the third band is the multiplier (ie, it indicates the number of zeros). For example, the bands might be yellow, violet and red. This means the value is 47 followed by two zeros; ie, 4700 ohms or 4.7kΩ (the "k" indicates 1000). Where there are four value bands, the first three are numerals and the last is the multiplier. If the multiplier band is gold, multiply by 0.1; for silver, by 0.01.



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.



Ultrasonic alarm

The ultrasonic movement detector described in the August '84 issue of EA must be used in conjunction with an alarm control unit. With this add-on circuit, the movement detector can be converted to a stand-alone alarm.

The completed unit features adjustable exit and entry delays, five minute alarm period and selectable automatic or manual re-arming. It also has a 'Tripped' LED which indicates that an intruder has been detected in the owner's absence.

A moving object in the field of the movement detector causes pulses to appear at pin 6 of IC2c. These pulses are coupled into the add-on circuit where they are fed into IC1a (a 4043 RS latch). The latch output is fed to an entry delay timer consisting of IC2b and IC2c and associated resistors and 33μF capacitor. Pin 6 of IC2c will go high about 30 seconds after an input pulse is latched into IC1a. Q1 is then turned on and the relay is energised. At the same time, latch IC1b is tripped and turns on LED D5.

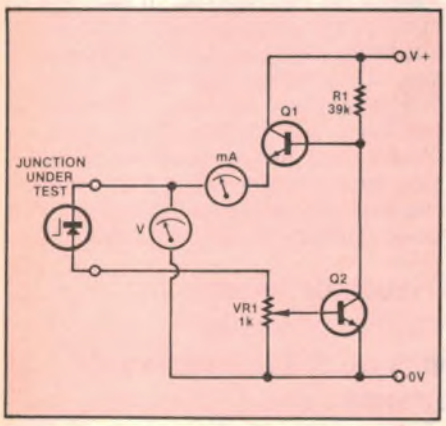
For automatic rearming, a link must be made from the output of IC2c (pin 6) to the input of the alarm period timer. The output of IC2c will go low for a detect and after about 5 minutes, the input of IC2d (pin 9) will also be taken low. Through IC2e and D3, this causes the Set input of IC1a to be taken high which leaves the circuit rearmed.

When automatic rearming is not required, the link connection is made between the alarm timer and the output (pin 9) of IC1b. As this IC latches after the detection, no resetting occurs until the circuit is switched off.

During the exit delay period, LED D4 will be illuminated. The exit delay can be set for periods of up to 30s.

A. Hardy
Richmond, NSW

$20



Breakdown voltage test jig

It is often very useful to be able to accurately measure the breakdown voltage of a zener diode or the Vcbo, Vceo and Vebo breakdown voltages of a junction transistor.

This simple circuit allows the reverse bias breakdown voltage of various types of junctions to be measured. It is suitable for both small signal and power devices, but not for high voltage devices with ratings which exceed or approach those of the transistors used in the circuit. The transistors recommended are BF259 or MPSA42 types which allow a maximum supply voltage of 300V, or BF258 or MPSA43 types which allow a supply voltage of 250V. Any other silicon NPN types which have an appropriate voltage rating could also be used.

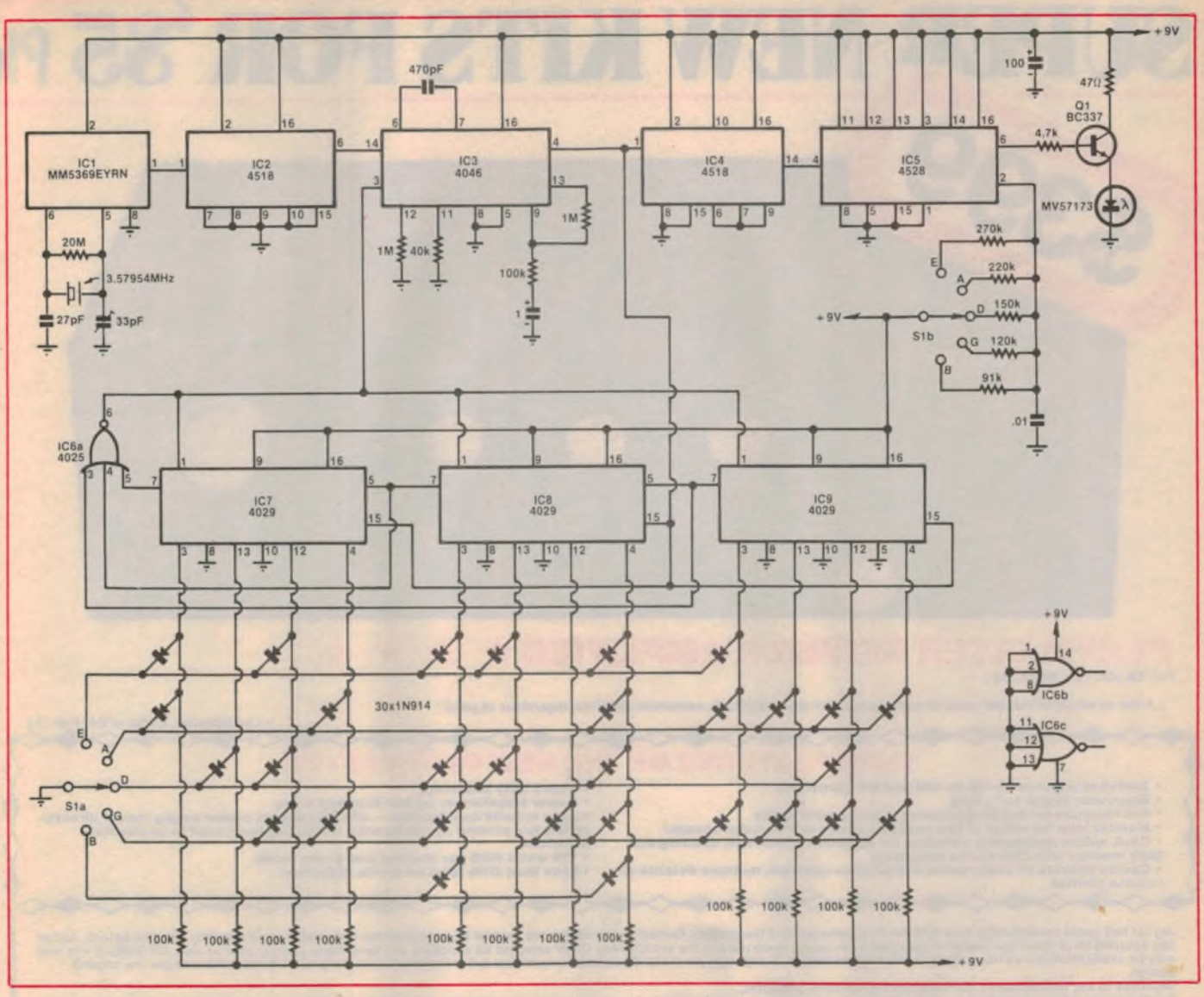
The circuit works as follows. The current flowing through the 39kΩ resistor biases Q1 on, so that the potential at its emitter rises. When this voltage reaches the breakdown voltage of the junction under test, the current through this junction increases rapidly. Under these conditions the voltage on the base of Q2 will increase, so this transistor will begin to conduct, robbing Q1 of base current. Thus the current through the junction under test will be limited to a value dependent on the setting of the 1kΩ pot.

The voltmeter is used to measure the breakdown voltage, and the optional milliameter will measure the current flowing through the junction. This circuit allows the breakdown voltage to be measured over a wide range of current values. This feature is especially useful in the selection of zener diodes for particular applications.

(Editor's note: The BF469 would be suitable for this application as it has a Vceo rating of 250V. If high voltages are used, care should be taken not to exceed the rated transistor junction temperatures.)

B. Dance,
Alcester UK.

$15



Guitar tuner

This guitar tuner relies on a LED operating as a stroboscope. If the LED flashes at the same rate as the string oscillations, the string will appear stationary. If the frequencies differ slightly, the string will appear to be moving slowly, and a badly detuned string will appear to be vibrating quickly.

The frequency of oscillation can be set to five different values, corresponding to the lower five open string notes of the guitar. The top E must be tuned using the lower E setting.

The circuit consists basically of a frequency multiplier. IC1 generates a 50Hz reference frequency, adjustable over a small range by the 33pF trimmer capacitor. The reference frequency is divided down to 5Hz by IC2 and fed into a phase locked loop (IC3). The multiplication factor of IC3 is set by ICs 6 to 9 which form a 12 bit presettable binary counter.

The multiplication rate is set by Sla and yields output frequencies of 1319, 1760, 2349, 3136 and 3951Hz. After division by IC4 these signals become 82.4, 110, 146.8, 196 and 246.9Hz. Accuracy of the tuner is 1/16 Hz.

To maintain the LED at constant brightness when switching between notes, Slb is used to alter the duty cycle of the pulses. This is achieved in conjunction with IC5, a monostable pulse generator.

A large rectangular LED was used with the original circuit. This was mounted on a bracket so that it could be held in position underneath each of the strings.

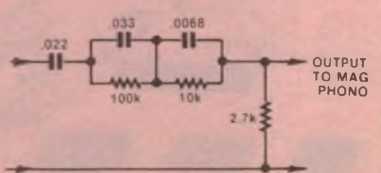
S. Rae,
Mt Waverly, Qld. **$25**

Inverse RIAA Attenuator

This circuit arose from a need to mix two microphones, two cassette decks and a reel to reel tape recorder using a mixer with inputs for two microphones, a stereo magnetic cartridge but not enough tape inputs. This circuit was used to allow a tape recorder to be used with the phono inputs.

The circuit not only provides inverse RIAA equalisation but also attenuates the signal from the tape deck to a suitable level for the phono input. The degree of attenuation can be adjusted by varying the value of the 2.7kΩ resistor.

H. Swan,
Bulimba, Qld. **$10**



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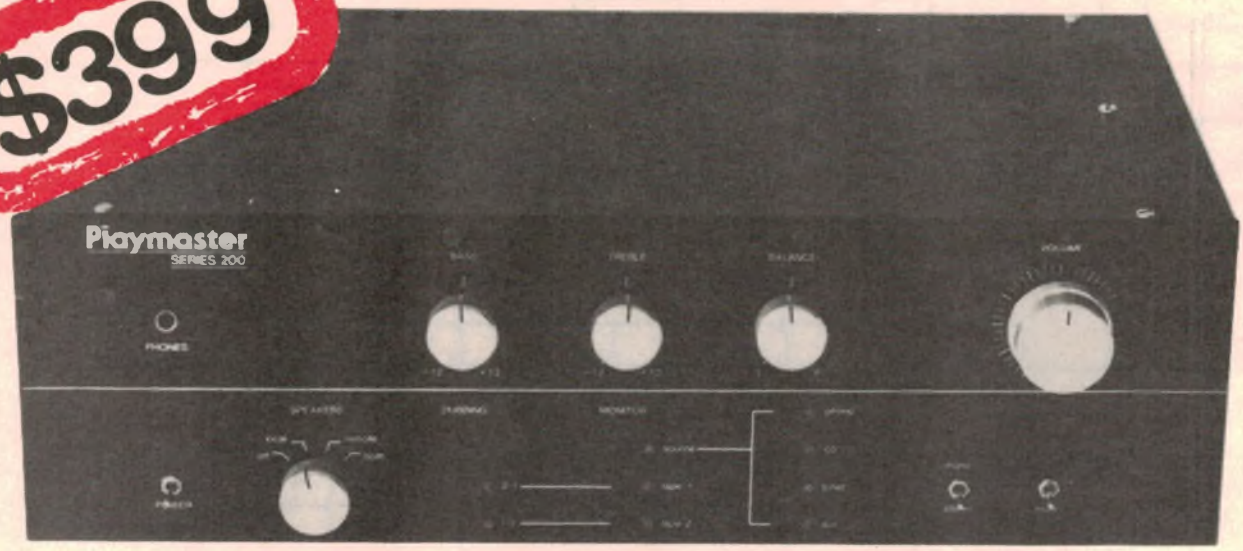

PLAYMASTER SERIES II AMPLIFIER ★ ★ ★ ★

Ref: EA Jan, Feb, March '85.,

"...A stereo amplifier that will equal or better just about any integrated commercial amplifier, regardless of price."

– Leo Simpson, Editor of EA, Feb. '85.

MAIN FEATURES OF THE NEW PLAYMASTER

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- **Electronic signal switching**
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- **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 construction – 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 loads**
- **Less than .01% total harmonic distortion.**

Jaycar has spent considerable time with EA in development of the project. Central to the design are several key components not used in local amplifier designs before. Jaycar has sourced all of these components (samples from Jaycar were used in the prototypes). Other selected kit suppliers will have these components as well. BEWARE of kits that may be available that may not comply to the original design. Some aspects of the design are very critical & it is important that the project is assembled as per the original design.
Needless to say the Jaycar kit for the project is 100.00% ORIGINAL.
Finally, we are now in a position to advise that the cost of this kit amplifier down to the last nut & bolt is $399. Thats right! A pittance compared to the performance & facilities that you get.

EXCLUSIVE! JAYCAR AMP REPAIR GUARANTEE

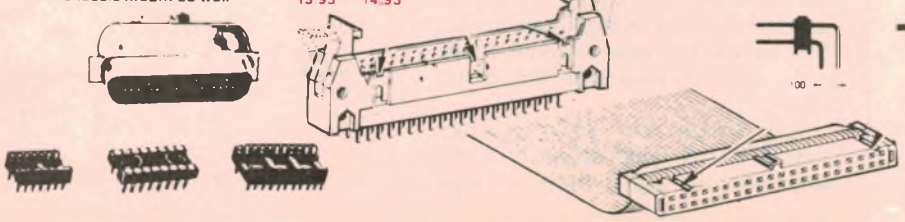
We cannot imagine an amplifier of this magnitude being easier to make. Provided you can insert components into the PCB the right way around & not solder dry joints you should have no problems!
If however, you do have hassles getting the amp going, no problems!
Jaycar will provide a fixed price repair facility for this amp. This means, no matter what happens, you will get a great working amp. at a great price!
The price? $39.95 which includes service, all main board parts (up to $30 value). (Transformer & filter caps extra). It is highly unlikely that any damage over $50 would ever occur.
See the kit instructions with the amp. for further details.

New range of IDC (Insulation Displacement) Connectors.

We have vastly expanded our range of PCB launchers, PIN headers & IDC Header plugs, Centronics connectors etc.

"CENTRONICS" (Similar Amphenol 57-Series Ribbon)

Cat. No.	DESCRIPTION	PRICE	10 UP
PP0890	36 way Standard solderable plug inc. Backshell "Centronics plug"	12.50	11.50
PP0892	36 way plug. IDC ribbon connect	12.50	11.50
PS0895	36 way socket. Solderable inc. Backshell but will chassis mount as well	15.95	14.95



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PP0945	16 WAY STRAIGHT ENTRY	3.50	3.25
PP0947	26 WAY STRAIGHT ENTRY	3.95	3.60
PP0948	34 WAY STRAIGHT ENTRY	4.95	4.50
PP0950	50 WAY STRAIGHT ENTRY	6.50	6.00
PP0965	16 WAY RIGHT ANGLE ENTRY	3.50	3.25
PP0967	26 WAY RIGHT ANGLE ENTRY	3.95	3.60
PP0968	34 WAY RIGHT ANGLE ENTRY	4.95	4.50
PP0970	50 WAY RIGHT ANGLE ENTRY	6.50	6.00

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PP0993	26 WAY (ECON) RIGHT ANGLE	2.95	2.70
PP0994	34 WAY (ECON) RIGHT ANGLE	2.95	2.80
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PS0990	IDC LINE SOCKET 50 WAY	6.50	6.00

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PI6503	18 PIN SOCKET	0.32	0.16
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PI6506	24 PIN SOCKET	0.50	0.35
PI6507	28 PIN SOCKET	0.50	0.25
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8 SECTOR BURGLAR ALARM KIT... NEW KIT

REF: EA Jan 1985
★ 2 delay sectors ★ 6 instant sectors ★ Steel box ★ Price includes battery ★ Siren driver ★ Variable exit/entry delay ★ Can use N.C. & N.O. on the one circuit!!
Cat. KA-1580

ONLY $129

DRILL SPEED CONTROLLER NEW

This brand-new design gives you better speed regulation over previous drill controller designs. It's also easier to make as all parts are mounted on the PCB. All parts supplied including special high voltage MR754 diode.
Cat. KA-1555 **ONLY $24.95**
Ref: EA Dec 1984

12/230V - 300W 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 is voltage regulated, gives a precise 50Hz and 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
$195

50/500MHz DIGITAL FREQUENCY COUNTER

Ref: EA Dec 1981/Feb 1982
High performance kit that uses just 5 IC's to measure periods and frequencies up to 500MHz. Everything about the Jaycar kit is special from its gold plated BNC input connectors thru to the special pre-punched heavy plastic front panel that is silk screened in epoxy ink. The standard kit works to 50MHz
Cat. KA-1390

ONLY $119

A 500MHz prescaler kit fits directly onto main circuit board in above unit
Cat. KA-1392 **$29.50**

NEW STEAM SOUND SIMULATOR

Ref: EA December 1984
Features infra-red optical switch to synchronise "chuffs" with wheel rotation.
Cat. KA-1562 **$15.95**

NOW OPEN BURANDA QUEENSLAND

ELECTRIC FENCE

Ref: EA September 1982

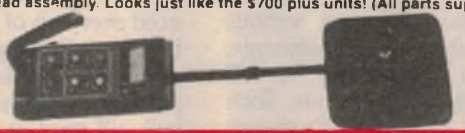
$15.00

Mains or battery powered, this electric fence controller is both inexpensive and versatile. It should prove an adequate deterrent to all manner of livestock. Additionally, its operation conforms to the relevant clauses of Australian standard 3129. (Kit does not include automotive ignition coil which is required).
Cat. KA-1109

DELUXE METAL DETECTOR

REF: EA December 1984

This very sensitive unit works as well as units costing hundreds more! Features special English-made quality case and pre-wound and sealed head assembly. Looks just like the $700 plus units! (All parts supplied).
Cat. KA-1554
$199



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NEW!!

Busker Amp. Ref: EA Feb. '85

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CQAM STEREO DECODER KIT - Ref: EA October 1984

Set of parts for this project including PCB, 10uH choke, MOC13020 IC (Whistle filter coil extra - Cat. EE-3814 ONLY $19.95)
Cat. KA-1555 **ONLY $19.95**

RAILMASTER KIT

REF: EA SEPTEMBER 1984

The most up to date train controller kit we've seen in a long time. It offers all those wanted features including inertia, full overload protection. Kit includes front panel, correct console box and all parts.
Cat. KA-1560 **$79.95**

★ DIESEL SOUND ★ SIMULATOR WITH LIGHTING CIRCUIT FOR RAILMASTER

REF: EA NOVEMBER 1984

You will be amazed how authentic this kit sounds. Kit includes PCB and all parts for sound effects as well as all the components for the lighting circuit.
Cat. KA-1561
$19.95

240-9V Plug adaptors Slashed!

Genuine 'ARLEC' 9V 200mA plug packs at unbelievable prices! Our 9V 100 MA unit usually sells for $8.95. For this month you can grab them for
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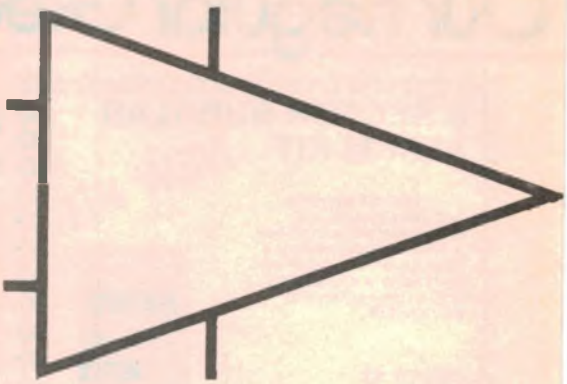

The subject of power amplifiers was introduced last month and is continued in this article with discussion of efficiency, non-linearity, load lines and transient intermodulation distortion.

PART II

Last month we considered various basic power output stage arrangements, their three classes of operation, A, AB and B and defined a lot of terms. Such aspects of power stages as Crossover Distortion and Total Harmonic Distortion were discussed and we also referred to Efficiency, the ratio of power output divided by power input.

The overall picture

In beginning the design of any power amplifier, first we must stand back and look at the overall picture before getting down to details. Probably your thinking will start with:

(a) What power output do we want? (watts, hundreds of watts or kilowatts?)

(b) Type of load (speakers, motors, other devices?)

(c) Acceptable distortion quantity? (super hifi, ordinary hifi for music, or rough for motors).

While "type of load" is decided for us by the job-in-hand, the questions "power output?" and "acceptable distortion?" don't always have definite answers.

Loudspeaker load

The modern domestic trend is towards loudspeaker systems of low efficiency so that our homes are graced by small, neat, but inefficient speaker boxes.

Little wonder that the owners of small hifi speakers use amplifiers rated at 30 or 60 watts, or even more! A quick look through a domestic hifi buyer's guide shows amplifiers rated at anything from 22 to 400 watts per channel. And for your car, models up to 100 watts. In contrast, if the provision of sound for a rock concert is your requirement you will need every bit of acoustic power you can muster, forcing you to use high efficiency speaker systems and high power amplifiers as well. Even so you will still need an amplifier in the region of a kilowatt capability. The two examples given appear extreme, but it is true that whatever our application, it will fall somewhere in that range.

Efficiency vs power

Efficiency considerations enter our discussion forcefully at the mere mention of high power. After all, low efficiency simply means that we have wasted a large fraction of the input DC power supplied by the supply rails. We define amplifier efficiency as:

$$\text{Efficiency} = \frac{\text{Elec Power out}}{\text{Elec Power in}}$$

For a one watt amplifier, who cares if the efficiency is only 50%? That would simply mean that for one watt output the power supply rails must provide two watts, of which half is converted to useful output and the other half is wasted, converted to heat mainly in the output transistors. We note that low efficiency means two things:

(a) The transistors are heated.

(b) We need more powerful power supplies.

But that's all it means, apart from the increased cost. But if you want a two kilowatt output, 50% efficiency means that you will have two kilowatts useful output plus two kilowatts heating of your expensive output transistors. And four kilowatts of DC power supplies to boot! (That's equivalent to building a two-bar electric radiator inside your amplifier!)

Even for a 100 watt output amplifier, 50% efficiency means 100 watts of heat!! Too much!!! The secret of high efficiency is to minimise the losses which basically arise from:

(a) The voltage drop between collector and emitter (or drain and source in FET).

(b) Transistor conduction which does not produce output current.

(c) Resistances placed in the current path.

Fig. 1 shows an output signal swinging between $+Vo$ and $-Vo$ at full output, about plus and minus 25 volts in this case, with the amplifier working on plus and minus 40 volts supply.

Why not drive this output stage harder, until full output means an output signal of nearly plus and minus 40 volts?

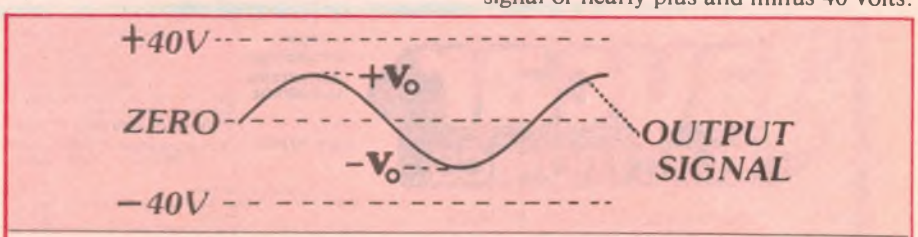

Fig. 1: If $+V_0$ and $-V_0$ are the positive and negative limits of the output signal of an amplifier operating on ± 40 volt rails, then the nearer these limits are to ± 40 volts, the more efficient the amplifier at full output.

Why not indeed! If we could do that, the losses at, say, 39 volts peak output would amount to only (40-39) volts, ie, one volt, multiplied by the current at the moment. Full output losses would then be very small, but of course at half voltage output (quarter power) the losses would be much higher: (40-20) volts x current.

If output swings almost to the supply rail voltage, transistor power loss is:
(a) low at no signal (small current)
(b) low at full signal (small voltage drop)
(c) greatest at some point in between where the product (voltage drop and current at the moment) is a maximum.

The $64 question is can we successfully drive the output stage all the way up to nearly the rail voltage? Meaning — can we push the transistors hard enough until at full current they are conducting so well that there is only about one volt between collector and emitter? Fig. 2 shows that we can push transistors into that much conduction but at a price! Distortion! This time it has nothing to do with crossover and is much the same no matter in what class our amplifier is working. Furthermore (contrary to crossover) this kind of distortion increases as we turn up the volume.

Non linearity

In short:

(a) At low drive, low transistor current, an increase in drive of, say, 1% may produce an increase in output of perhaps 0.99%.

(b) When transistors are driven hard, ie at high current and thus have a small collector-emitter voltage, a further increase in drive of 1% may only produce an output increase of 0.9% or even less. And this situation rapidly gets worse as the emitter voltage approaches closer to the collector voltage.

Fairly obviously we should call this effect "non linearity distortion". Every type of electronic amplifier device shows the same defect, to greater or lesser degree; junction transistors, FET's, valves, you name it; all have non linearity.

Each stage of the amplifier introduces some non linearity distortion. We hear the sum total over all stages. You may be surprised to learn that the large transistors in an emitter follower output stage often produce the least share, because it has a natural local negative feedback action and unity gain. This makes an obvious good point in favour of choosing an emitter follower output. Worse distortion is caused by stages giving high voltage gain and high voltage swing. Thus in the case of emitter follower output, Fig. 3, the most distortion is generated by the voltage amplifier driving the final stage. But the villain is the output stage itself when collector output, Fig. 4, is used as this configuration has everything going against it in this regard; large voltage swing, large voltage gain, high current and the fact that typical output transistors have their lesser current gain h(FE) at high currents.

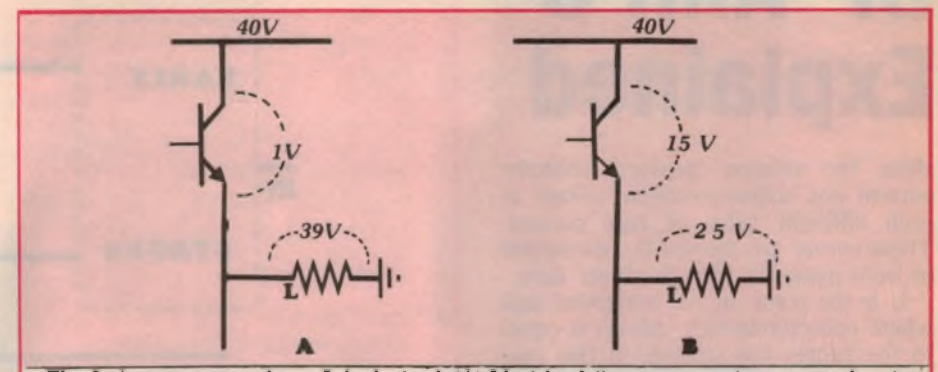

Fig. 2: An output transistor; L is the load. (A) Ideal for full output; transistor power loss is small as 1V × load current is small; (B) If you cannot push transistor into heavy conduction, large voltage loss across transistor occurs. This causes less power output because 15V × load current is a large quantity of power lost in heating the transistor. Thus (A) is much more efficient and has cooler transistors than (B).

Graphical representation

The basics of a junction transistor class AB power output gain stage, as in Fig. 4, are shown by Fig. 5. First, Fig. 5(a) shows the relation known as the "diode equation":

$$i_B = i_{SAT}\left(i - e^{\left(\frac{qV}{KT}\right)}\right)$$

where:
i(B) = base current
i(SAT) = a negative constant current known as the "saturation current"
e = 2.71828 · · ·
q = charge on one electron
V = base-emitter voltage = (drive + bias)
K = Boltzmann's constant
T = absolute temperature

Fig. 5(a) is literally a graph of this equation showing how base current varies non linearly as drive voltage changes. Q is the quiescent point, the point on the graph where the system rests at no signal, and as drive signal increases, the base current increases through points M,N,S up this approximately exponential curve.

Fig. 5(b) shows how non-linearity distortion comes about. The vertical axis is collector current, which in this case is almost the same as load current. The horizontal axis is collector — emitter voltage, which if subtracted from the rail voltage (40V in this case) gives output voltage V(out). The four curved lines shown are some of an infinite number which could be drawn on the picture to

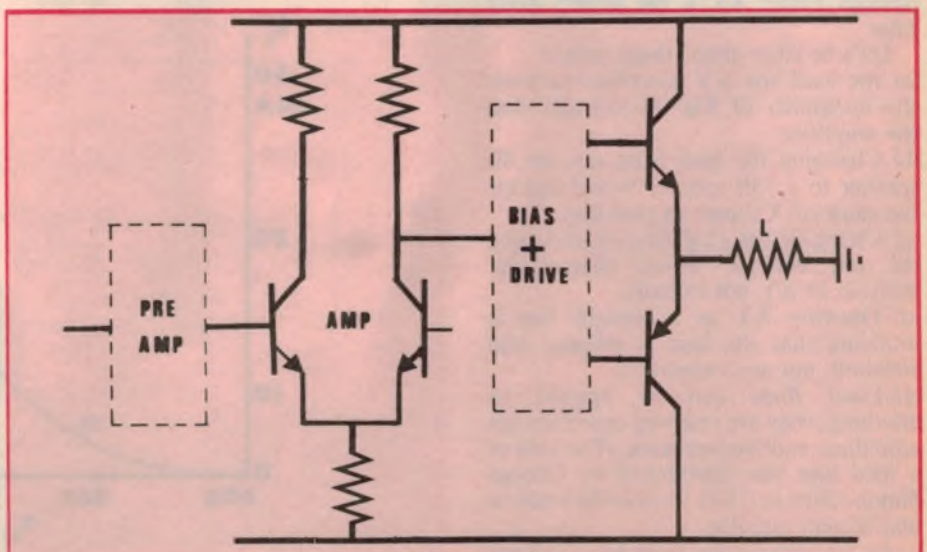

Fig. 3: Load L is driven by the unity gain emitter follower output stage. If 'bias + drive' section is also unity gain, the stage with all the gain and large voltage swing is the amplifier 'AMP'. Hence 'AMP' is the source of most of the non-linearity distortion.

OP AMPS Explained

show the relation between collector current and collector-emitter voltage at each different value of base current. These curves are derived by calculation or from transistor manufacturers' data.

U is the point on the horizontal axis where collector-emitter voltage is equal to the supply rail voltage, in this case 40V, so obviously is also the point of zero output voltage, zero output current and zero base current.

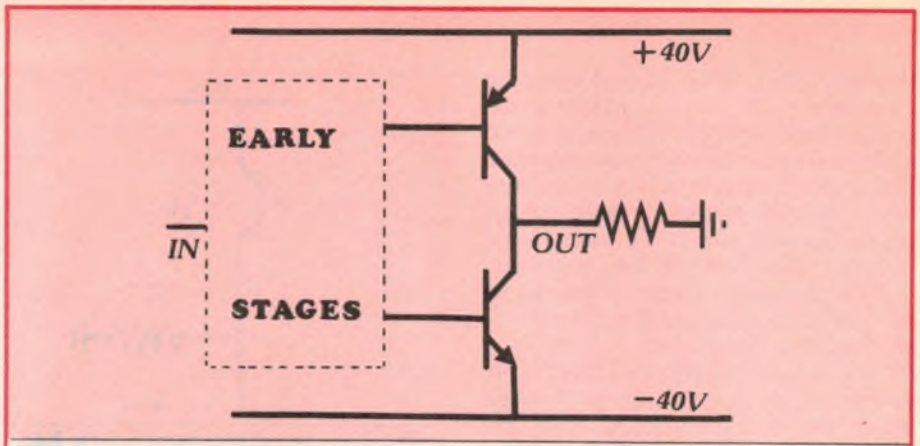

Fig. 4: Collector output (common emitter) stage has high gain and large voltage swing, so generates most of the non-linearity distortion in this power amplifier.

Load line

Through U we draw a line XY to describe the admittance of the load L. (Admittance is the inverse of impedance). Because we *assume* that the load is constant and resistive (a shaky assumption, that's true, but it makes calculations easier) instead of admittance we write its real part, conductance, measured in Siemens thus:

Conductance (in Siemens) = 1/Resistance (in ohms). And just how should that line XY represent the load conductance? Observe, if you will, that the line is a plot of a current as a function of a voltage or

Admittance Y, or Conductance

$$G = \frac{\text{current}}{\text{voltage}} = \frac{di}{dv}$$

Therefore it is the **slope** of line XY, not its position, that represents load conductance. Assuming load L to be constant, we use a straight line. Because it fully describes the load, we give it the obvious name; XY is the system *Load Line.*

Let's be clear about these points:

(a) the load line XY describes the load; the remainder of Fig. 11-5(b) describes the amplifier.

(b) Changing the load from say, an 8Ω speaker to a 15Ω speaker would change the slope of XY (not its position).

(c) Changing the amplifier, eg, changing the rail voltage, would change the position of XY not its slope.

(d) Drawing XY as a straight line is implying that the load is resistive and constant, (an approximation).

(e) Load lines can be applied to anything; they are reserved especially for amplifiers and loudspeakers. (The idea of a load line was introduced by George Simon Ohm in 1826 to describe resistor and battery circuits).

As we change the base drive voltage from 0.640 volts to 0.667 volts, we shift up the curve of Fig. 5(a) from Q to M or a base current increase from 5mA to 17mA. That change means we move our operating point on Fig. 5(b) from Q (intersection of i(B) = 5mA and load line) to M (intersection of i(B) = 17mA and load line). The idea is that changes in base drive voltage make the operating point slide up and down that load line.

Further increases in drive voltage, push the operating point up to N then to S. At each point on the load line we can read off the transistor and load current (on vertical axis, Fig. 5(b)) and also the voltage across the transistor Vce and voltage across the load (horizontal axis).

The "Q point" denotes the operating condition at no signal input, Q standing for "Quiescent Operating Point". We can see from Fig. 5(b) that the amplifier is working in class AB, because the Q point is on low, but non-zero, base current. Negative drive input quickly slides us down the load line extended to U, on the zero base current curve, with zero collector current, but obviously can go no further. By that time, as explained last month, the complementary output transistor would have taken over.

Fig. 5(a) and (b) are for the NPN member of a complementary pair; the corresponding graphs for its PNP mate are (or should be) mirror images about the baselines. If we had decided in the first place to design our amplifier for class B, then we would have placed Q at U by so adjusting the standing, or no signal, bias.

The highest increment of drive voltage V(B) from 694mV to 720mV results in a change of load current from 3.2 amps to only 4.0 amps, instead of the 5.0 amps expected. This is because the drop in transistor collector-emitter voltage causes a reduction in transistor current gain, h(FE). Furthermore, in some cheap power transistors at 3 or 4 amps collector current the h(FE) would have reached a peak, and drops off in value at higher currents. The result is that the output

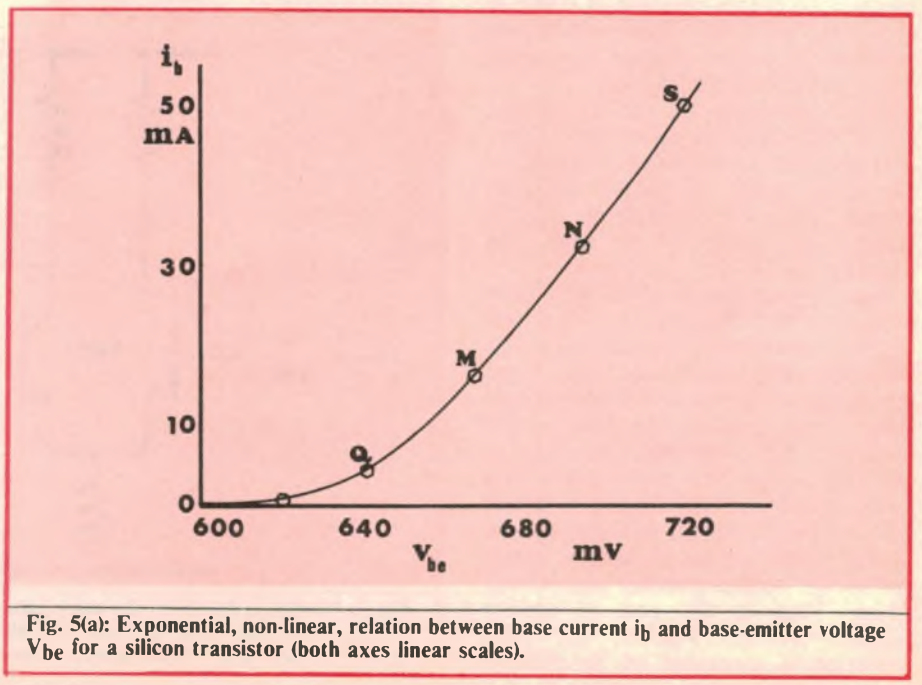

Fig. 5(a): Exponential, non-linear, relation between base current i_b and base-emitter voltage V_{be} for a silicon transistor (both axes linear scales).

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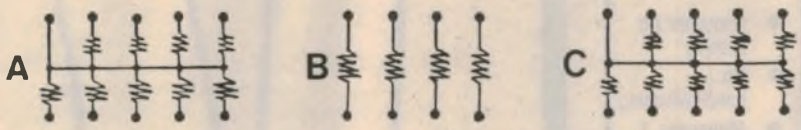
C—AHR-XXXJ-C2	15 RES. PIN 16 COMMON	1K. 1.5K.3.9K.10K	88c



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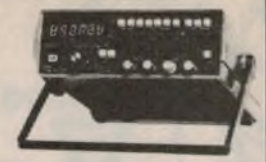

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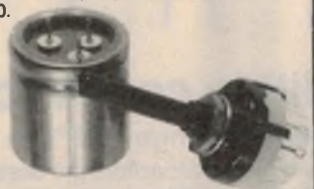

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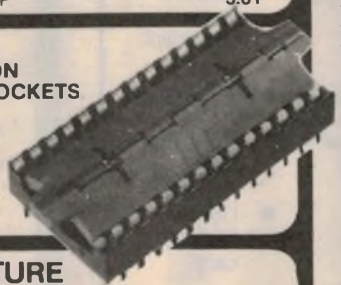

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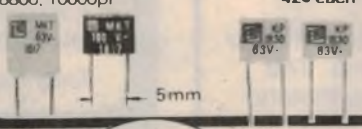

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OP AMPS Explained

voltage waveform is quite a faithful reproduction of the input waveform (but of course larger) for values of input voltage from 640mV up to 694mV, but has a "softly squashed down" look about the highest increment. Fig. 6 shows the example of sine waveform input but the output is not a sine wave as it ought to be. The amplifier may be said to have a "soft overload characteristic".

So far we have not applied any feedback. Now, most valued reader, let us argue in favour of making power amplifiers into power operational amplifiers.

Reiterating negative feedback theory from earlier parts of this series, Fig. 7 shows the general idea where G represents all the forward gain of the amplifier. H represents any method whereby some fraction of the output may be fed back to the differencing stage to be subtracted from the input. The difference (IN — FB) is called Error, E, which is the actual signal amplified by G, the overall closed loop gain T being:

$$T = \frac{G}{1 + GH}$$

In our previous discussions we just called this scheme a negative feedback amplifier if the forward gain G is a low to medium number, but if the gain G is a very large number, say 30,000 to 3,000,000, we defined Fig. 7 to be an operational amplifier. As long as H is a reasonable fraction, not too small, then for very large G, in that equation for T, the one becomes insignificant, G cancels out, and the equation condenses to:

$$T \text{ approx} = 1/H$$

As long as G is large, because it cancelled out, its characteristics do not affect the output, meaning that cross-over and non linearity distortion caused by transistors within G does not appear in the output. We could say that just the right amount of distortion is fed back to appear in negative polarity within the error signal E, amplified by G up to a distortion signal equal and opposite to the distortion generated in the high level stages of G, neatly cancelling all those nasties and leaving in the output only the pure sweet larger version of the input. Is this a real story of just a pious hope? — an unattainable ideal?

The answer is that it is always an approximation and a simplification of the full picture; but provided that the gain G is quite large, and a few other conditions are fulfilled, the above is approximately true. Thus large forward gain and a large feedback factor make it possible to use classes A, AB or B freely as we choose. And even make a class B amplifier into a system with distortion performance about as good as class A. The attendant high efficiency, low power loss and low heating of the class B design are reward enough for the painstaking care needed to approach the ideal.

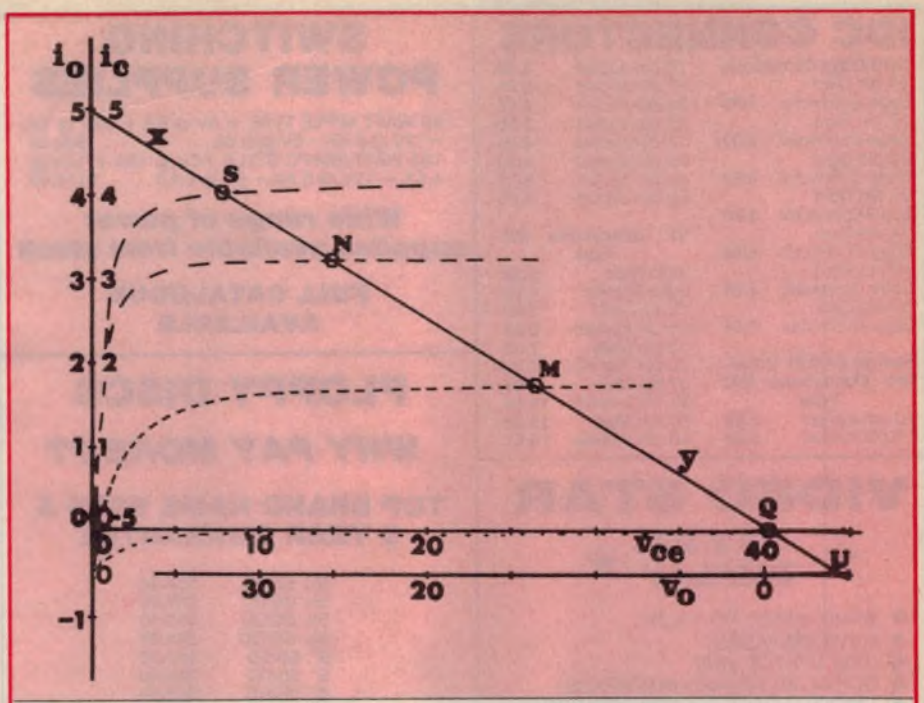

Fig. 5(b): xy is the DC load line describing an 8Ω resistive load. Remainder of figure describes one transistor of a class AB complementary output stage. Vertical axes in amps are operating current i_o and collector current i_c. Horizontal axes linear in volts are transistor V_{ce} and operating voltage V_o. Each dotted line represents constant base current; from top to bottom 50, 32, 17, and 5mA. Points S, N, M, Q correspond to those on Fig. 5 (a). Q is quiescent or no-signal point.

Now what about that point of the story, the question of reducing losses, increasing efficiency by driving the output transistors so hard that the output voltage peak is almost as high as the rail voltage? ... Is the process incurring loads of non linearity distortion? The answer is yes, decidedly yes; but we can use negative feedback to remove such distortion. Or at least reduce it to a low value.

The crux

The crux of the matter is that the further up towards rail voltage we want to drive the output, and use class B too, the more distortion to be cancelled by feedback, so the more need for lots and lots of feedback. But that implies very high forward gain G, approaching such large value that, by our own definition, we should be calling the whole system an operational amplifier.

We have at last reached the point of our story! And, too, we now know why a discussion on power amplifiers was included at all in this series titled "Op Amps Explained"! (Author exonerated).

Could we emphasise one important point: the *whole system* is one big operational amplifier. Often no integrated circuits are in sight (because of the high voltages), just big power transistors and high voltage driving transistors. So what's new? We have met such schemes before, everything inside one big feedback loop! We could be poetic:

"An IC doth not an Op Amp make
Nor high gain without feedback," etc.

T.I.M.D.

A few readers are concerned because we glossed over a sentence "provided a few other conditions are met". Don't worry — you have good reason! The main other "condition" which is so difficult to meet is that we have assumed that an input signal applied causes output and feedback instantaneously. So we think that any input to the differencing stage has the accompanying appropriate feedback signal. Super optimists that we are! No way could such an ideal ever be achieved! Yes it could for the case of DC only; but any change at all implies some rate-of-change, some equivalent frequency. Recalling that *every* circuit contains one or more time constants resulting in time lag, feedback is *always* late arriving at the differencing stage. Just how late depends on the time lag and the loop bandwidth of our whole circuit. And, for any one circuit, just how serious a certain time lag appears

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OP AMPS Explained

depends on how far the input has changed during that time lag. (Today we omit our earlier discussions on such time lags being bad enough to cause outright unstable oscillations). A possible chain of events could be:

1. Slow changing music input signal, low frequency content, applied to differencing stage.
2. Appropriate feedback FB appears at differencing stage.
3. (IN − FB) is the effective, quite small, signal to be handled by differencing stage amplifier.
4. So far everybody happy, nice music from system.
5. Then fast transient occurs in music, input contains high dv/dt or rate of change, high frequencies, at fairly high level.
6. FB cannot change that fast.
7. For a very short time, at the onset of that fast input change, signal to be handled by the differencing amplifier is the whole input, undiminished by non-existent feedback!
8. During such a short period, the differencing stage is hopelessly overdriven, well into non linear amplification region.
9. Temporarily non linear differencing stage causes intermodulation between the low frequency content and that fast high frequency component.
10. Intermodulation produces sum and difference frequency signals, as well as passing on the original components.
11. This sequence of events occurs only transiently; very soon FB arrives, input to differencing stage becomes small as FB subtracts, life returns to normal.
12. We heard those sum and difference frequencies for a short time and we are left wondering where on earth those extraneous sounds came from.
13. We sadly label the effect "Transient Inter-Modulation Distortion" or TIMD

So — what to do? We could:

1. Bandwidth limit all input signals, using a low pass amplifier ahead of the feedback amplifier. No over-kill please — we don't want to lose all beautiful transients.
2. Design forward gain sections G and also feedback sections H to be as fast as we can. Especially spend some dollars on fast output power transistors, ie let's have high open loop frequency bandwidth. Perhaps use speed-up capacitors around part of FB path.
3. Design the differencing stage amplifier to be low gain, operating from high voltage rails, consuming higher than usual current, and not too high value load resistors. These steps allow differencing stage to cope with larger input before entering overload region.
4. Expend our skill in high gain design in stages after the differencing stage.

That will go a long way towards curing this elusive TIMD. Elusive, because tests and demo's using sinewave input, oscilloscopes, speakers and even wave analysers or THD meters will never find any TIMD. Yet it annoys customers on music and speech input and loses sales. A CRO on output with such real live inputs is too hard to interpret. Furthermore square-wave input is too far removed from real life. What's needed is a specially generated and shaped signal with just the critical risetime for input; and a CRO and Harmonic Wave Analyser on output. Onset of TIMD will show as extra frequencies in the output.

Next month we will illustrate some of this month's (and last month's) theory in practical designs of class A, AB and B bias circuits and complete power amplifiers for speaker and other loads.

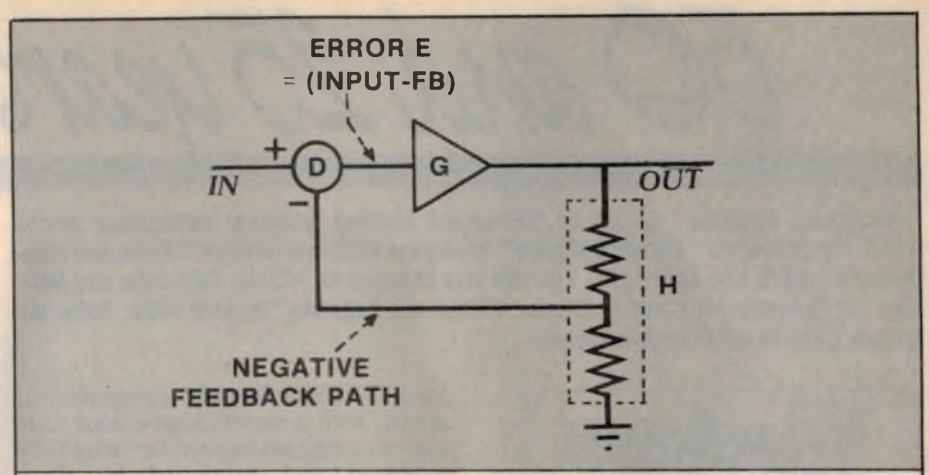

Fig. 7: Fundamental negative feedback amplifier. The differencing stage D normally works upon a small signal E = (IN-FB) where FB is the negative feedback derived from the output by voltage sampling circuit H. If it is a power operational amplifier, G is a very large number, E is normally very small voltage. TIMD occurs when FB is late, leaving D to cope briefly with full undiminshed input, resulting in overdriving and hence non-linearity for a short time. Normally distortion in G is cancelled by a suitable inverted sample of distortion fed back via H, FB and D, to G.

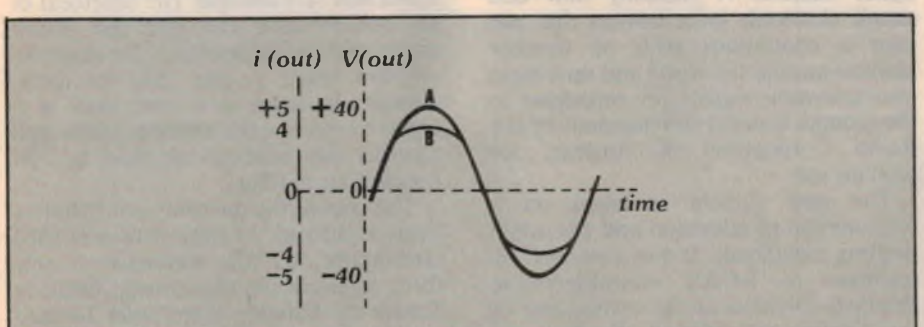

Fig. 6: Non-linearity distortion of large signals. For sinewave input, waveform A is the ideal output we hope for, but B is the real output actually achieved when we try to force the transistor into heavier conduction. Scales are amps and volts for an 8Ω load for some small TO3 transistor. Larger transistors will eventually give this effect, but at some larger current value.

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.

February 1935

Set designers' competition: "Wireless Weekly" is pleased to announce the greatest radio competition yet held in Australia.

It is a competition in which £100 in cash prizes is offered to unearth twelve circuits — six AC circuits one of which will be declared champion, and six battery circuits, one of which will be battery champion. The intention is to describe these designs fully in "Wireless Weekly" for the benefit of home set builders.

Women's Lib, 1935: The Norwegian radio announcers are known as "Hallowmen"; and Iceland Radio, at Reykjavik, has gone one better for its lady announcer; she is the "Hallodame." France calls its announcers "Speaker" and "Speakerine," and once tried to cope with lady announcers by calling them "Annoncatrices."

Education or propaganda? Mussolini wants every Italian village to have its own wireless set and has appointed the Secretary of the Fascist Party, Signor Starace, to be President of Radio Rurale, or The Rural Radio Corporation. There are 50,000 rural schools, and the Government has decided that Radio Rurale must force the radio manufacturers to sell a five-valve set, the "Radiorurale," to schools at 600 lire; the cost must be borne by the schools themselves, or by private persons. The scheme has run eight months, but so far only about 300 schools have sets.

Industry standardisation: On Monday, February 4, an impromptu meeting of prominent Sydney coil manufacturers was held and it was decided that in future they would work together more closely in the interests of business and service to the public and the trade.

One of the first co-operative efforts will be the production of a special coil kit for a "Wireless Weekly" constructional article, with a standardised colour code and mounting arrangements. Being fully approved and supported by these prominent firms, it is expected that it will have a greater attraction for the public than is the case with special circuits designed for only one brand of kit.

More television rumours: The television world is seething with activity at the present time. Behind the seeming quiet are the comings and going of people who have millions of pounds at stake.

Television sets are now down to about £12 and just as soon as the Postmaster-General gives his verdict as to the control of this new miracle so soon will hundreds of thousands of sets be launched on the market.

In London one company has been demonstrating their product on a full size screen. The picture is said to have been almost as clear as that seen in an ordinary film theatre.

A great difficulty at the moment is that it is not possible to televise in any place but a specially prepared room.

February 1960

Space camera: A radically new and simple electronic space camera that can take a continuous strip of weather pictures around the world and turn them into television signals for broadcast to the ground, is under development by the Radio Corporation of America for satellite use.

The new camera is based on a combination of television and electronic printing techniques. It was described by scientists of RCA's Astro-Electronic Products Division at the convention of the Society of Motion Picture and Television Engineers, held at the Hotel Statler in New York.

According to the RCA scientists, the new camera has several potential advantages for remote viewing of terrestrial clouds or the moon's surface from space. Among them, they mentioned these characteristics that have either been achieved or can be expected with further development:

1. Extreme simplicity and durability, in contrast to systems combining television cameras and magnetic tape storage.
2. Very large picture capacity, based on the ability to erase and re-use the tape after each passage, in contrast to photographic film.
3. Reduced sensitivity to radiation effects in space.
4. Widely variable speed of operation, ranging potentially from a few pictures per orbit up to picture-taking speed comparable to the 16-per-second rate of 8-millimetre motion picture film.

Computer to analyse heartbeat: The US Bureau of Standards has developed a method for using computers to compare and analyse heartbeat information, in work sponsored by the Veterans Administration. It represents an important advance over present methods which rely a great deal on memory and observation.

Making use of magnetic tape to record heatbeat data and a high-speed digital computer to compare these records, the method can help a physician in making an objective diagnosis of a patient, and it represents an important step toward using a computer to study heart disease.

The method was developed by L. Taback, Ethel Marden, and Dr H. L. Mason of the Bureau's data processing systems laboratory with the co-operation of Dr H. V. Pipberger of Veterans' Administration Hospital, Washington DC

Electronic stethoscope: The heartbeat of an unborn child can give the doctor much valuable information; for example, whether there is one child or more, whether its heart is normal, how it is likely to react to the shock of birth, and whether complications are likely to arise for child or mother.

The beat of the unborn — or foetal — heart is difficult to hear with a normal stethoscope, but the soniscope, a new form of electronic stethoscope made in Britain by Faraday Electronics Limited and mentioned recently in a BBC broadcast, will make it possible to obtain a clinical picture of the sound of the foetal heart at great volume without interference from other noises outside or inside the body.

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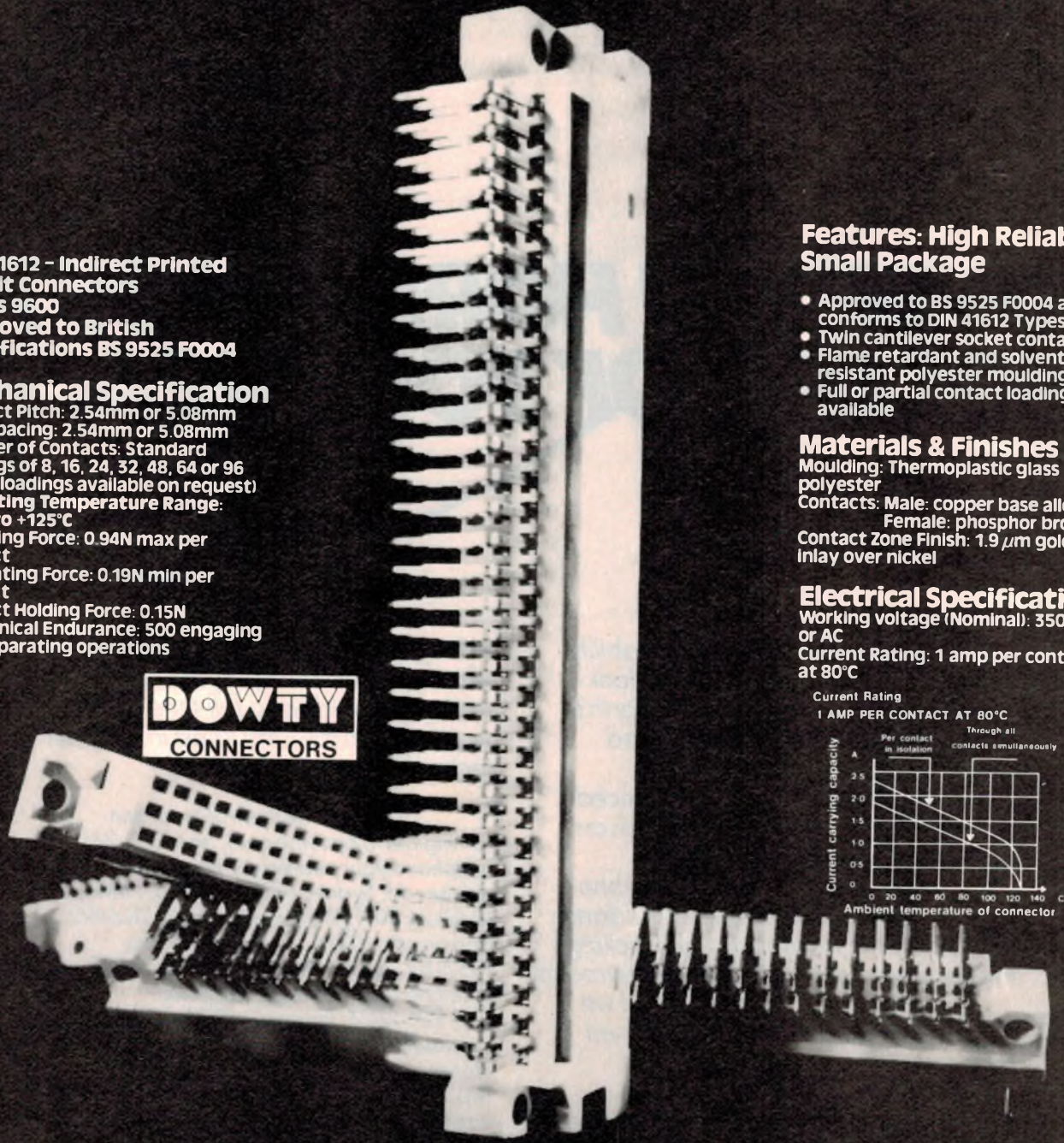
Separating Force: 0.19N min per contact
Contact Holding Force: 0.15N
Mechanical Endurance: 500 engaging and separating operations



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Books & Literature

Power capacitors

POWER CAPACITOR HANDBOOK by T. Longland, T. W. Hunt & A. Brecknell. Published 1984 by Butterworths & Co. (Publishers) Ltd, London. Hard covers, 160 x 240mm, 308 pages. Fully illustrated with photos, circuits, diagrams and tables. ISBN 0 408 00292 1. Recommended Australian price $60.00.

Textbooks on capacitors of any sort are few and far between so this text on power capacitors is especially welcome. This is particularly so since it was written after the embargo on polychlorinated biphenyl (PCB) impregnants was established. As such, it deals with the modern practice of using unimpregnated metallised film capacitors for low voltage applications and, for high voltage applications, capacitors with non-chlorinated impregnants.

In practice then, this text will mainly be of interest to electrical engineers practising in the power field and to electronic engineers involved in high voltage AC applications.

The first chapter has a brief revision of the fundamental principles of capacitors and is followed in the second chapter by a history of the development of power capacitors and the various types being manufactured today.

Chapter three is a general discussion of power factor correction while chapter four is more specific in dealing with power factor correction of induction motors and transformers. Chapter five continues with capacitors for marine, mining and welding plant applications where special environmental conditions such as a corrosive atmosphere exist. Chapter six deals with electric arc and induction furnace applications.

Chapters seven, eight and nine deal with capacitor location and installation, control gear and protection and applications involving high voltage transmission circuits.

Chapter ten deals with the problem of harmonic generation by thyristor circuits and the application of harmonic filters. Chapter eleven is on special applications of high voltage capacitors such as surge protection and energy storage.

Chapter twelve deals with capacitors for fluorescent and discharge lighting, motor starting and commutation of thyristors.

There are also four appendices: on power capacitor standards, a glossary, formulas and a bibliography.

Overall, this is a very useful book which we can thoroughly recommend even though it is a little on the pricey side. (L.D.S.)

Computer Controllers

THE COMPUTER CONTROLLER COOKBOOK by Tom and Kelda Riley. Published by Creative Computer Press, USA. Soft covers, 208 x 277mm, 197 pages. Illustrated with circuits and diagrams. ISBN 0 916688 45 3. Price $19.95.

This book describes the construction of a number of accessories for use with home computers. The majority are aimed at computer games players — paddles and joysticks, steering wheels, foot pedals and the like. In addition, there are chapters describing the construction of converters between Apple and Atari machines and a mains controller, plus tutorials on electronics and construction techniques.

The book is aimed primarily at owners of Apple computers, and the few pieces of software which are included are for this machine although the controllers described in the book can be adapted to run on other machines. Specific instructions are given for Atari, Commodore VIC-20, IBM PC and Radio Shack systems.

The chapter on construction and materials contains very little useful information, and could probably have been dispensed with. The electronics chapter is a lot more useful. Starting from Ohm's Law and resistor colour codes, the reader is introduced to most of the electronics necessary to construct the projects described. This chapter makes no attempt at a comprehensive coverage of electronic theory, but rather, concentrates on the relevant background to the projects presented.

As the book is intended for the American market, all the suppliers listed are in the USA. All dimensions are in Imperial units and, inevitably, the projects are designed for use with a 115VAC mains supply. This could be a problem if the reader is not sure how to upgrade them for 240VAC operation. Unfortunately too, the presentation of the diagrams is not up to the standards we have seen in other publications.

In conclusion, this book is probably not suitable for the raw beginner with no knowledge of electronics or computer programming. But if you do have a little expertise in these areas, this book may provide you with some good ideas for simple computer accessories.

Our copy came from Jaycar Electronics and carries the catalog number BM-0800. (A.L.)

120VA switchmode power supply

Manufactured by Boschert Incorporated of the USA, this 120VA switchmode power supply module will supply up to 10A at 12V. Designated the SL120-4612 it has voltage adjustment from 11.5 up to 18V and a one-year warranty.

by JOHN CLARKE

The Boschert SL120-4612 switchmode power supply module is distributed by Amtex Electronics and is available at the special price of $150 plus 20% tax to EA readers. This price is due to an order cancellation. However the offer is strictly limited as there are only 150 units available. (See the Amtex advertisement on page 49 of this issue for further ordering details.)

When we saw this switchmode power supply we thought it a most useful unit that would interest many of our readers. In fact we decided on the spot to build one into a case for use in our own lab. The result is shown in the photos accompanying this article.

As such, the supply is suitable as a general purpose high current power supply. It could be used as a base power supply for an amateur transmitter or CB transceiver or even as a heavy duty battery charger. That is not to say that it might not be purchased by some manufacturer wanting the unit as a component to be built into a product. So individual readers who are interested in buying the unit should not dilly dally.

Specification, performance, mechanical and electrical connection details are supplied with each unit.

The module comprises a single printed circuit board measuring 118 × 292mm and weighing in at 1.2kg. Minimum clearance height is 54mm. Screw terminals at each end of the PCB are for connection to the mains supply to the load.

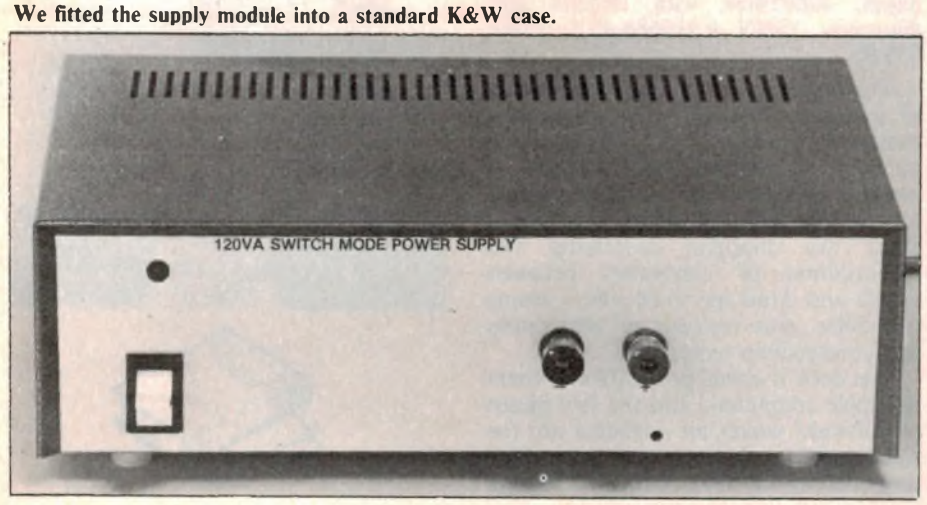
Considering that the power supply has a rating of 120 watts, it really is a light and compact unit with quite small heatsinks. There is a small flag heatsink for the switching transistor and a large aluminium sink extending right across the back of the PCB for the power diode.

A 5A 250V rated 3AG fuse is mounted on the PCB and provides protection directly at the mains supply input.

Eight 1000μF capacitors are connected in parallel to filter the load output voltage. A further 1000μF in conjunction with an inductor provides additional filtering at the output. The use of multiple capacitors rather than a single 8000μF capacitor is necessary to ensure sufficiently low series impedance.

Overall, the quality of construction is excellent. The PCB is made from high quality glass fibre reinforced plastic and quality components are used throughout.

We fitted the supply module into a standard K&W case.



Specifications

The module includes some very versatile features including voltage adjustment from 11.5V up to 18V. It is also fully short circuit proof and brown-out rated. Remote sense terminals are provided so that good regulation can be maintained when long supply leads are used. The output terminals are fully floating to allow earthing of either the negative or positive terminals.

Output specifications for the power supply are very good. The typical hold-up time of the output voltage when supplying 120W from the time that mains power drops out is 20ms. Ripple and noise is quoted as 1% while line regulation is ±0.1% for a mains input range of 180 to 265VAC. The unit is rated, by the way, for mains power frequencies from 47Hz to 440Hz.

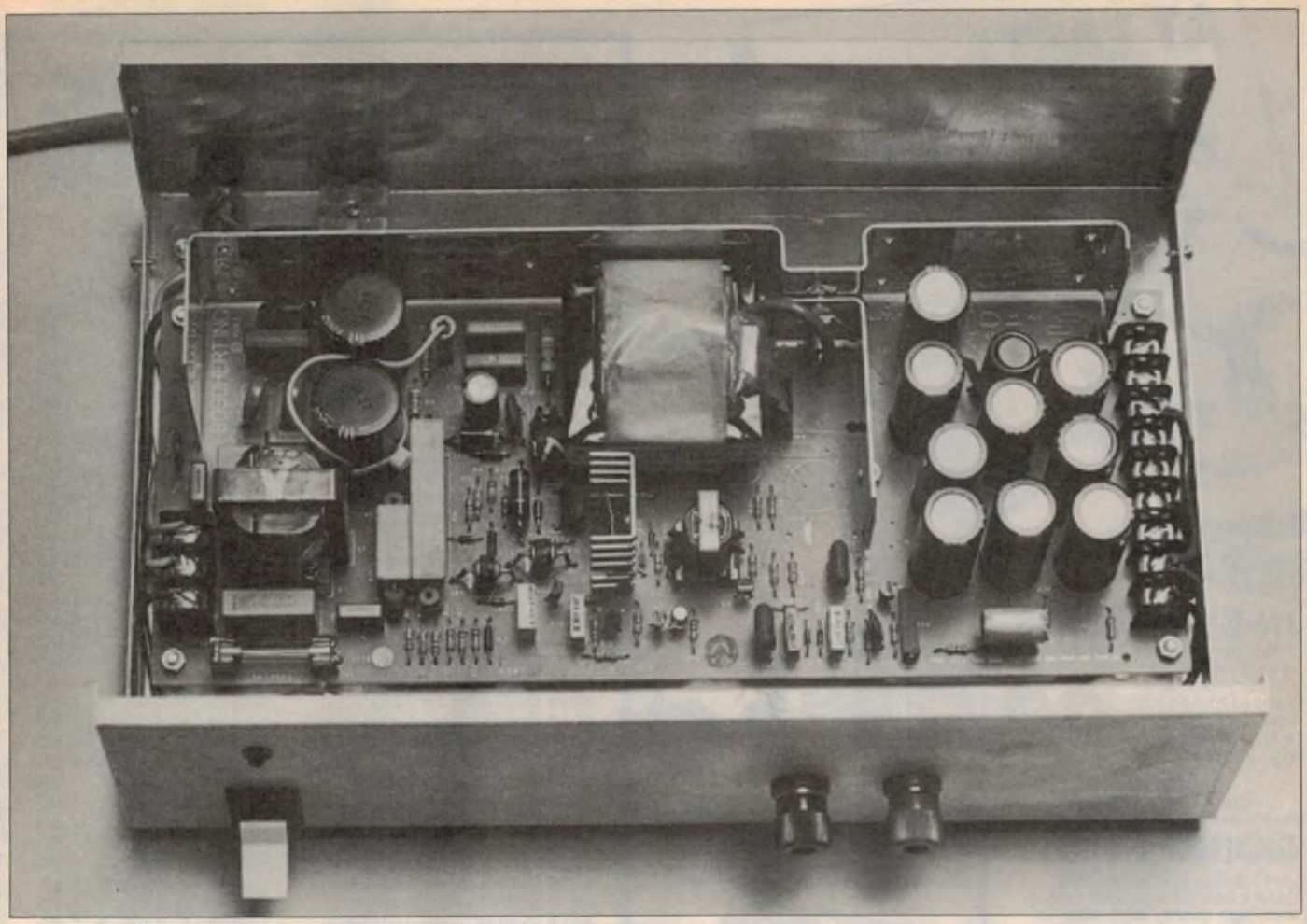
Load regulation, for a load change from 20W to 120W, is quoted as ± 1%. Temperature coefficient of output voltage is .02%/degree Celsius.

Switching mode

The SL120-4612 switchmode power supply module operates as a discontinuous-mode flyback converter. Basically, the circuit rectifies and capacitively filters the mains waveform to obtain unregulated DC at about 300VDC. A high speed switching transistor is used to chop this DC to provide a lower output voltage and this is smoothed with an output filter consisting of an LC network.

The resulting output voltage is monitored and compared with a voltage reference to provide an error signal which is then fed back to the transistor switching circuit. This circuit consists of a comparator which compares the error voltage with a ramp voltage and results in a variable duty cycle waveform which is adjusted so that a constant voltage results at the output.

Note that the Boschert circuit uses current mode regulation rather than voltage mode regulation. The main difference is that while the voltage mode generates the ramp with a fixed RC oscillator, the current mode (in the Boschert circuit) generates the ramp from the transformer winding connected in series with the output.



View inside the completed supply. Use heavy-duty cable between the PCB and the output terminals.

The major advantage of current mode regulation is that the phase shift caused by the output inductor is removed from the feedback circuit. In voltage mode regulation, however, there can be a 180 degree phase shift between the ramp and switching waveforms which can lead to instability in the feedback network. Consequently, for the current mode, less compensation is required, resulting in a faster transient response and freedom from instability due to component ageing.

Another advantage is that a very simple form of overcurrent protection is available. Just limit the error voltage level to correspond to the safe output current. Still another advantage is that the power supplies can be paralleled together for greater load current capability.

Isolation from the mains is provided by a transformer which doubles as the output inductor. When the switching transistor, which incidently is a Philips BUW12 8A 400V NPN type, turns off, the collapsing field in the transformer develops a voltage across the output capacitors and charges them to the required output voltage. A second LC filter following this is designed to reduce the resulting spikes impressed on the DC waveform at each switching point of the transistor.

Reduction of radiated electromagnetic fields is reduced with a line filter at the mains input. This consists of an inductor in both the active and neutral lines with shunting capacitors to ground and across the active/neutral lines. The resulting levels of radiation comply with several international standards.

Construction

We fitted our power supply module into a K&W case measuring 305 × 90 × 200mm (W × H × D). Five 6mm high spacers are used to mount the PCB onto the base of the case. The front panel simply consists of a power switch and indicator LED, and two output terminals.

The mains cable is brought through the rear panel via a cord clamp grommet and is terminated in a terminal block. Mains rated cable runs to the power switch and terminals on the power supply module. The mains earth is first taken to an earth lug screwed securely to the chassis and then taken to the earth terminal on the power supply module.

Rather than bringing the voltage sense terminals out to the front panel, we opted to connect the + remote sense to the +DC output voltage and the − remote sense to the output common terminal directly at the screw terminals on the PCB. The common terminal is connected to earth at the chassis. Use heavy duty cable for the leads between the output terminals on the chassis and the output screw terminals on the power supply module.

We used a 560Ω resistor in series with a LED connected to the output terminals to provide a power-on indicator.

Performance

Noise and ripple on the supply was measured at 12V. At 8A there was 30mV RMS of ripple and noise with 80mV peak spikes at the switching frequency. At 0.5A the ripple and noise was lower at 20mV RMS with 60mV peak spikes. While this is not extremely low compared to a good linear power supply, it is suitable for most applications requiring this level of power.

We were also able to confirm the regulation performance figures quoted.

For further information on the SL120-4621 module contact Amtex Electronics, 36 Lisbon Street, Fairfield, NSW 2165. Ph (02) 728 2121. Telex AA27922 Attn Amtex. More details are on page 49.

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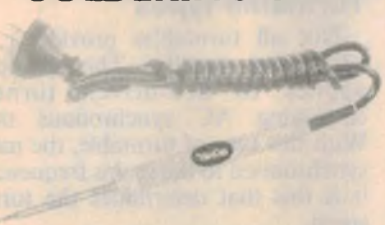

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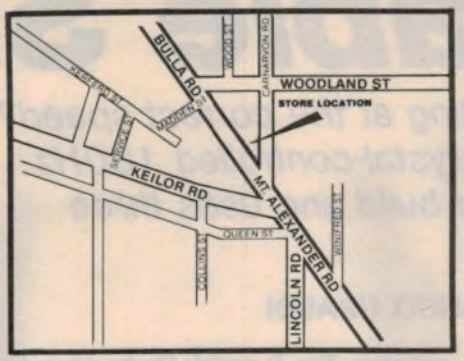

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Turntable Strobe

Is your turntable operating at the correct speed? Check it out with this crystal-controlled 100Hz strobe light. It's easy to build and uses three low-cost ICs.

by FRANCO UBAUDI

Many turntables feature some form of speed adjustment together with an in-built neon strobe light for checking platter speed. The strobe is invariably referenced to the mains and that's where the problem comes in: the mains are not really all that accurate as a frequency source.

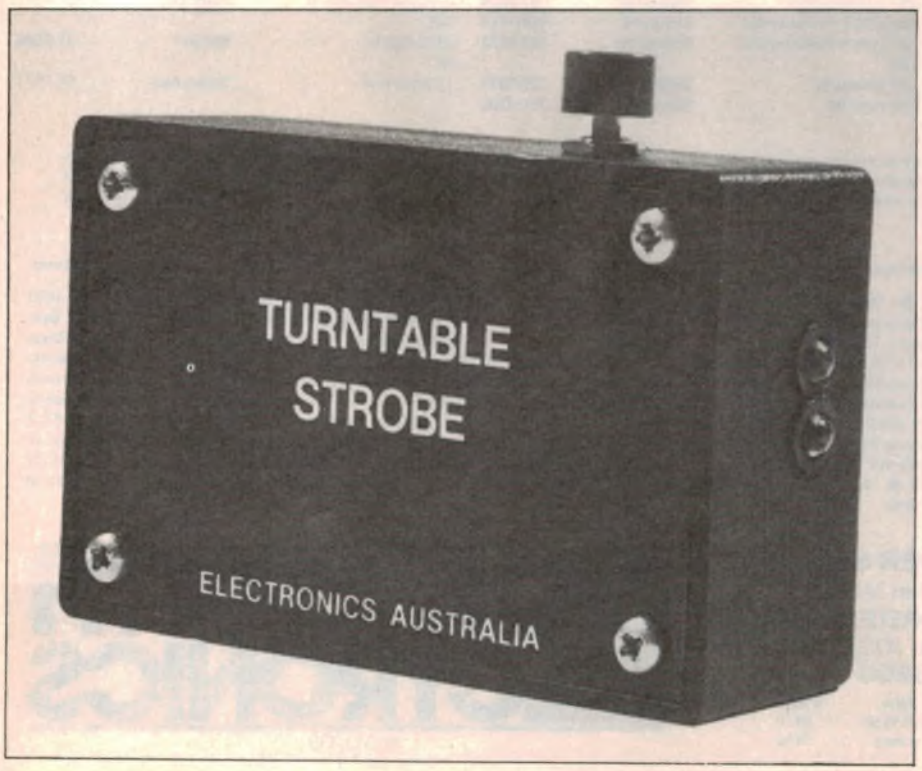
Using an internal (or even external) mains-referenced strobe to check platter speed doesn't make a lot of sense. The frequency reference for the turntable motor is usually highly stable and yet provision is made to check it using a less accurate source.

Our new Turntable Strobe overcomes this problem. It uses an in-built crystal oscillator as the frequency reference and so is completely independent of the mains. And, unlike the mains, the Turntable Strobe frequency is highly accurate.

The basic concept is really quite simple. The Turntable Strobe drives two high brightness LEDs at a 100Hz rate and these illuminate a strobe disc on the turntable platter. When the lines on the strobe disc appear stationary, the turntable is operating at the correct speed.

But why does the strobe pattern appear to be stationary? That's easy to answer. Because of the strobing (or pulsing) effect of the light source, our eyes see the lines on the strobe disc only when the light is on. In between flashes, each radial line moves to the position occupied by its predecessor. So, each time the strobe light comes on, the disc appears to be identical.

If, however, the platter is revolving faster than it should, the lines on the strobe will appear to move in a forwards direction. Similarly, if the speed is slower than normal, the lines will appear to move backwards.



The Turntable Strobe uses a crystal-controlled 100Hz oscillator to drive two high-brightness LEDs. Prototype was housed in a plastic zippy case.

Turntable types

Not all turntables provide a speed adjustment facility. This particularly applies to belt-driven turntables employing AC synchronous motors. With this type of turntable, the motor is synchronised to the mains frequency and it is this that determines the turntable speed.

So if the mains frequency varies, the platter speed also varies. There's absolutely nothing you can do about it.

As an interesting aside, let's consider what happens when the mains frequency varies from its nominal 50Hz frequency by just 1%, or 0.5Hz. At 10kHz, for example, this would result in a change of pitch of 100Hz, while at 1kHz the change would be 10Hz. These changes are comparatively small but, nevertheless, quite noticeable to the ear.

The above example is also quite realistic. According to the Sydney County Council, the mains frequency for the Sydney region is generally within the range 49.3 to 50.5Hz and usually is close to 50.15Hz. So a 1% variation in frequency is quite possible at any given time.

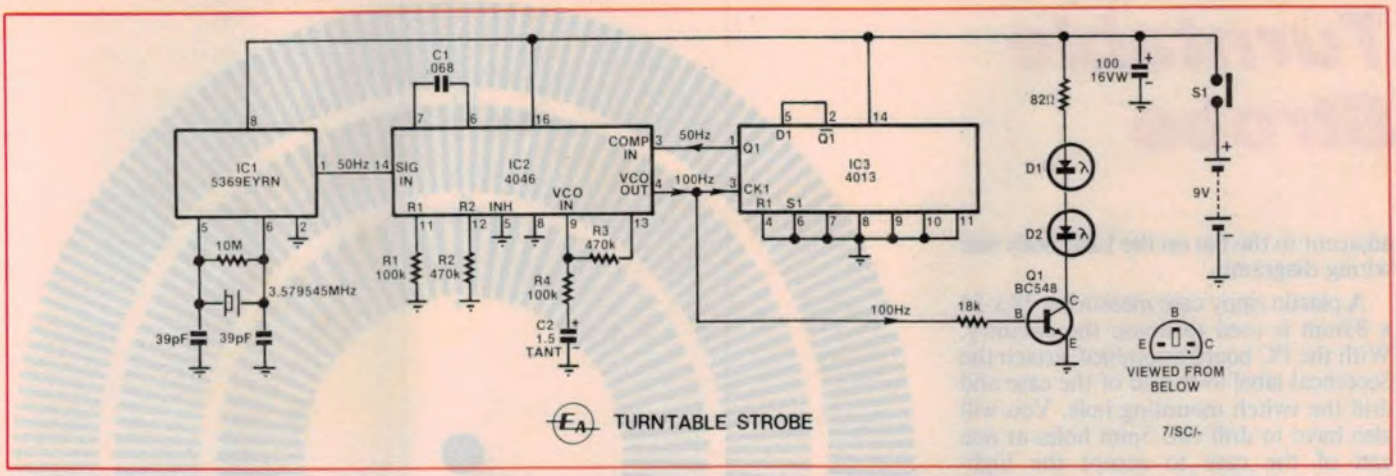
As an aside, it is interesting to note that the loss of a 1MW generator by the NSW State Electricity Commission results in a reduction in the mains frequency of about 0.1Hz. Also frequency stability tends to be better during daytime due to the fast response time of the hydro-electric generators in the Snowy Mountains Scheme. (This is generally not used at night while reservoirs are being replenished.)

Turntables with a speed adjustment facility generally employ either brushless DC motors, often in direct-drive configuration. The speed of the motor is controlled by means of a feedback circuit with the appropriate reference derived either from the mains or, more often, from a crystal-controlled oscillator.

These turntables are the types that will benefit the most from our new Turntable Strobe. Because it is independent of the mains, it can be used to set the speed of the turntable with much more precision than before.

How it works

Three CMOS ICs form the basis of the circuit: a 5369EYRN 50Hz timebase; a 4046 phase lock loop; and a 4013 dual D-type flipflop. Briefly, IC1 delivers a precise 50Hz signal to the PLL which functions as a frequency doubler. The 100Hz strobe frequency appears at pin 4 of the PLL and drives transistor Q1



IC1 delivers a 50Hz signal to IC2 which, in conjunction with IC3, functions as a frequency doubler.

which, in turn, drives the high-brightness LEDs.

In greater detail, IC1 works in conjunction with an American standard colour TV subcarrier crystal operating at 3.5795MHz, and divides this frequency down to give a precise 50Hz output at pin 1. This is a very economical method of obtaining a 50Hz timebase since both the 5369 and the 3.5795MHz crystal are quite cheap.

The 50Hz output from IC1 is coupled to the signal input (pin 14) of the PLL (IC2). Inside the PLL is a voltage-controlled oscillator, a phase comparator and a filter. Pin 14 actually forms one input to the phase comparator; the other input (pin 3) is coupled to the Q1 output of divide-by-2 stage IC3.

The output of the comparator (pin 13) drives the filter network and is fed back to the input of the VCO (pin 9) via a 470kΩ resistor. Resistors R1 and R2, together with capacitor C1, set the free-running frequency of the VCO and the VCO range.

What happens is that the phase comparator compares the signal frequency with the divided output frequency and produces a control voltage to bring the VCO into lock. In other words, the VCO output frequency at pin 4 is equal to the input frequency multiplied by the external division factor.

Since the input signal frequency is 50Hz and the external division factor is two, the VCO output (pin 4) is locked precisely to 100Hz. So the PLL functions as a frequency doubler.

D-type flipflop IC3 performs the external frequency division. Note that although this is a dual device, only one section of the IC is used in this application. The inputs to the other section have all been tied low.

Notice also that the D1 input is tied directly to the Q1 output. By this means, the Q1 output (pin 1) only changes state on the rising edge of each positive clock pulse. Thus, the input signal frequency is halved.

The 100Hz VCO output drives transistor Q1 into saturation via an 18kΩ base current-limiting resistor. The 82Ω resistor in series with the LEDs limits the average current through them to about 25mA.

Power for the circuit is derived from a 9V transistor battery with decoupling provided by a 100μF electrolytic capacitor.

Alternative circuit

Readers may be interested in the alternative circuit idea shown in Fig. 1 which is included mainly for academic interest. This circuit replaces IC2, IC3 and transistor Q1 with IC4, a quad exclusive OR (XOR) gate.

IC4a accepts the 50Hz output from IC1 and performs the frequency doubling function. Note that one input (pin 2) is connected directly to the 50Hz source while the other input (pin 1) is connected via an RC delay network consisting of a 100kΩ resistor and a .068μF capacitor.

Thus, when the input signal changes state, one input of IC4a changes state immediately while the other is delayed from making this change until the .068μF capacitor charges or discharges. As a result, pin 3 of IC4a switches high on each positive or negative-going transition of the 50Hz input and is low in between times.

The resultant 100Hz output from IC4a drives parallel inverter stages IC4b, 4c and 4d. These provide the necessary current drive to the LEDs. The 10Ω resistor limits the current through the LEDs to a safe value.

So why didn't we use this circuit in the prototype? The answer is that it suffers from a certain amount of jitter due to the uneven duty cycle of the 50Hz signal from IC1. As a consequence, the lines on the stobe disc appear "fuzzy" when using this circuit.

This problem does not arise in the final version however, since IC1 simply provides the input signal to the phase comparator in the PLL (IC2) and the PLL output does have a 50% duty cycle.

Interestingly, there is another way in which the 100Hz output could have been produced with just one IC. Using the EST/N version of the 5369 timebase chip, a 100Hz output is available directly from pin 1 and this can be used to drive Q1 via the 18kΩ resistor. Unfortunately, this version is not readily available in Australia.

Construction

All the parts, with the exception of the pushbutton switch, are mounted on a PC board coded 85ss2 and measuring 62 × 46mm.

No special procedure need be followed when assembling the board, although we suggest that the three CMOS ICs be left till last. Note carefully the orientation of the ICs, LEDs, transistor and the tantalum capacitor.

The two LEDs should be mounted using the full lead length. The cathode lead is the shorter of the two and is

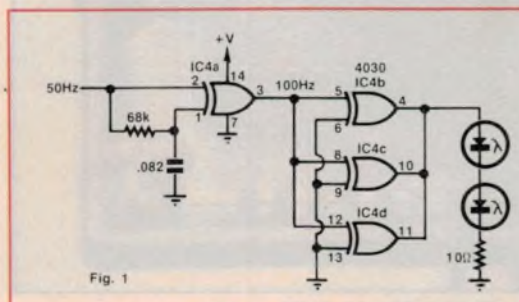
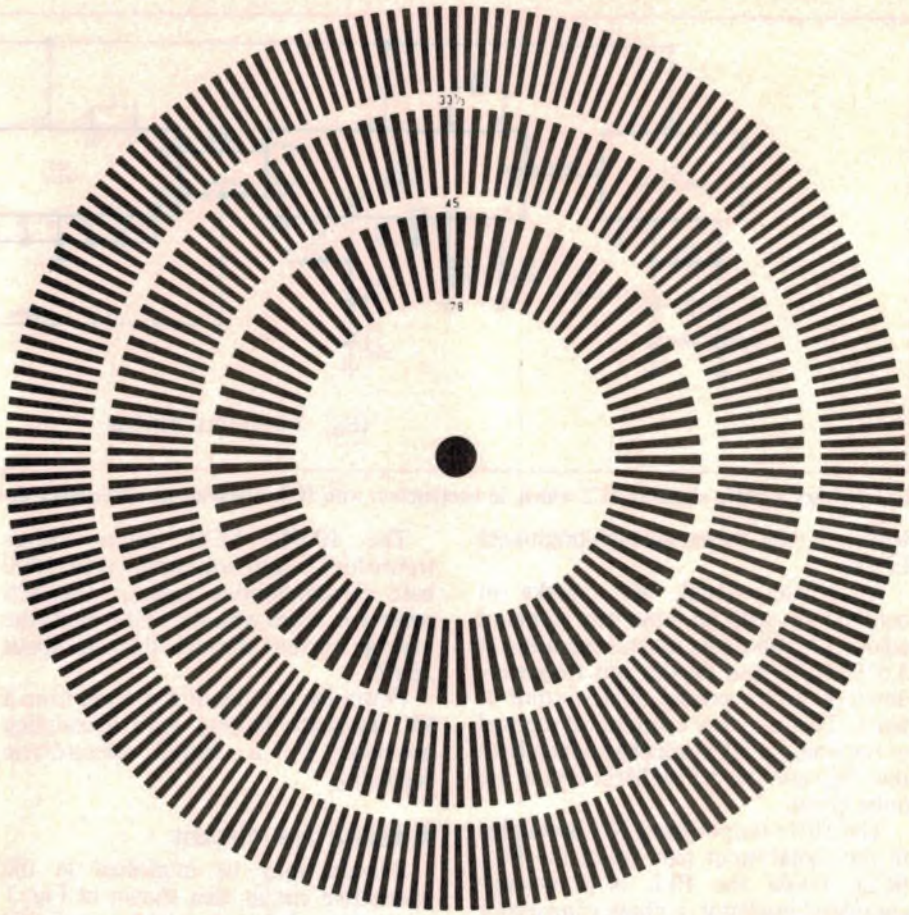


Fig. 1

This alternative circuit may be used to replace IC2 and IC3, but with some compromise in performance.

Turntable Strobe



adjacent to the flat on the LED body (see wiring diagram).

A plastic zippy case measuring 28 x 54 x 83mm is used to house the circuitry. With the PC board assembled, attach the Scotchcal label to the lid of the case and drill the switch mounting hole. You will also have to drill two 5mm holes at one end of the case to accept the high-brightness LEDs. These holes should be positioned so that the PC board will sit comfortably on the bottom of the case.

The wiring to the switch and to the battery clip can now be completed according to the wiring diagram. We used foam insulation to isolate the battery from the PC board and to hold these items in place when the lid is screwed down. The LEDs were secured using bezels.

Once construction has been completed, the unit can be tested using a strobe disc. You can either use a photostat copy of the strobe disc published with this article, or you can buy a commercial disc from your nearest hifi retailer.

Note that most strobe discs feature several bands. These are included to cater for different turntable speeds and different mains frequencies (50 or 60Hz). The strobe pattern published with this article is intended only for 50Hz operation and has bands for 78rpm, 45rpm and 33.3rpm.

We estimate that the parts for this project will cost

$24-28

This includes sales tax.

PARTS LIST

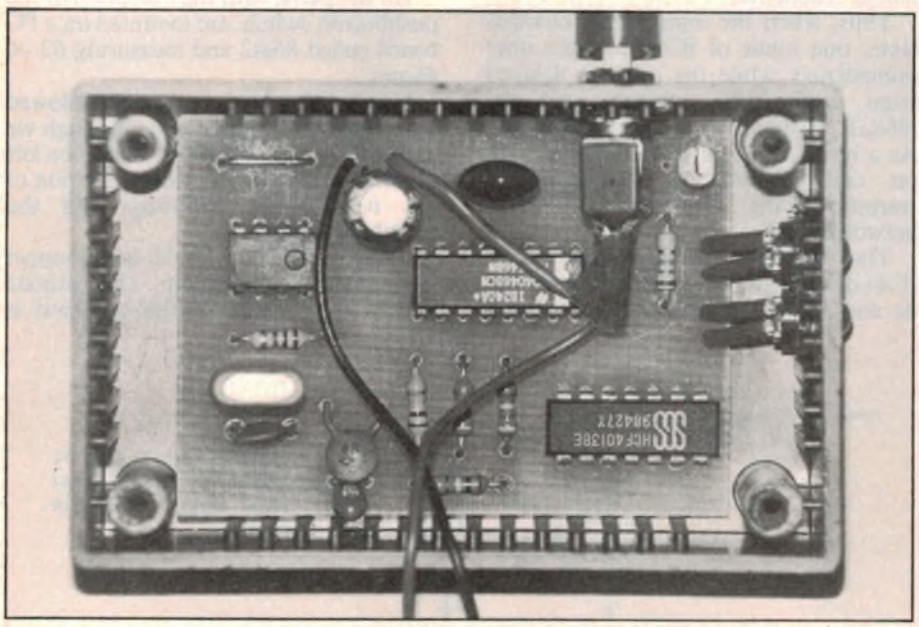
1 PC board, code 85ss2, 62 × 46mm
1 plastic zippy case, 28 × 54 × 83mm
1 Scotchcal front panel, 79 × 51mm
1 SPST momentary contact pushbutton switch
1 battery clip
1 9V battery, Eveready 216
1 3.579545MHz crystal

Semiconductors
1 MM5369EYRN 50Hz oscillator/divider IC
1 4046 phase lock loop
1 4013 dual D flipflop
1 BC548 NPN transistor
2 high-brightness LEDs

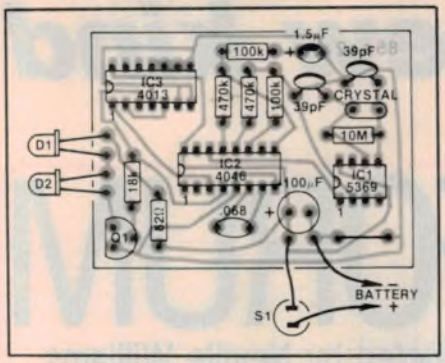
Capacitors
1 100μF 16V PC electrolytic
1 1.5μF tantalum
1 .068μF metallised polyester
2 39pF ceramic

Resistors (0.25W, 5%)
1 × 10MΩ, 2 × 470kΩ, 2 × 100kΩ, 1 × 18kΩ, 1 × 82Ω

Miscellaneous
Hook-up wire, spaghetti sleeving, solder etc.

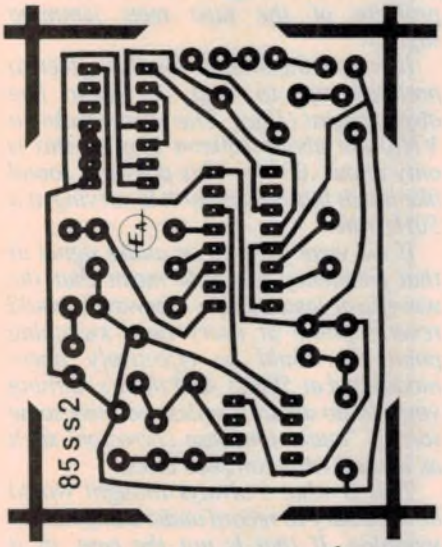


View inside the prototype. Note mounting of high-brightness LEDs at right.



Above: Parts layout diagram. Take care when installing the two LEDs (see text).

◀ Left: This strobe disc has bands for operation at 78, 45 and 33.3rpm. It can be cut out or photostated, as desired.



Above is an actual size reproduction of the PC artwork.

Actual-size reproduction of the front panel artwork. Finished boards and panels will be available from parts retailers.

Hifi VCRs and a new kind

In an uncharacteristic display of commercial consensus, distributors of the latest hifi VCRs are extolling the revolutionary sound quality which they make possible — this, without rubbishing other brands and formats. But what's this? From far-off New Zealand comes a lone, discordant voice, asking embarrassing questions about so-called "skew-effect" distortion. How very inopportune!

FORUM

Conducted by Neville Williams

As I turned from the glowing advertisements and rave reviews to this sobering letter from the shaky isles, I was reminded of an occasion, some years ago, when absorbed in photographing a breathtaking alpine landscape.

"Don't be taken in" came a quiet voice at my elbow. "The scenery in Switzerland isn't as good as it looks!"

What a let-down it would be, if something of the kind proved to be the case with video hifi sound. If, for theoretical reasons, we had to stop enjoying what we had thought was so good!

What's it all about? I'll let our correspondent put his own case and you can judge for yourself. So read on:

Dear sir,

The recent introduction of the hifi domestic VCRs such as the National NV850 has generated a lot of interest. I do a lot of technical training on the subject of VCRs generally and was thus very keen to get hold of a service manual to see just how this miracle was achieved. I'd heard all about the system of "depth multiplexing" and different azimuth heads and so on; what I wanted to see was how they deal with the problem of skew error. "With what?" the man in the service department asked.

I looked in the book. I read the description. Basically they convert the audio to an FM signal, which is recorded much the same way as the video signals are.

I have been teaching people about VCRs for years now. The explanation I always gave for the poor audio quality was that it was impossible to record the sound with helical scanning because of the violent disturbance which can occur when switching from one video head to the other.

Fig. 1 shows a typical recording pattern. The control track serves as a reference to keep the linear tape speed constant. The vertical sync pulses are recorded just after the start of each video track. The next vertical sync pulse is also recorded at the end of each track but is not used as the drum flipflop pulse switches in the other head just before it is reached.

In Fig. 2 we see the ideal situation at the switching point. The phase of the horizontal sync at the end of track A is the same as at the start of track B. The horizontal oscillator in the TV set thus carries on as if nothing unusual was happening. However this situation rarely occurs.

Consider what happens if the tape is stretched slightly after being recorded. Longitudinally, there is no problem. Because the control track pulses will be further apart, the capstan servo will compensate by increasing the linear tape speed slightly. The problem is with the video tracks; because they are recorded diagonally, their increase in length will not be directly proportional to the increase in the length of the tape.

The control track will ensure that the heads are still switched at the appropriate place: just before the vertical sync at the start of each video track. The trouble is that, because the effective increase in the video track length is proportionally less than the increase in linear tape speed, the video head doesn't travel quite as far along the track before head switching occurs.

The result is as shown in Fig. 3. The horizontal sync pulses suddenly appear in a different place. This is what produces the familiar "flag waving" at the top of the picture on an unmodified TV set when using a VCR. The modification usually carried out is to shorten the time constant of the horizontal AFC so that it can sort itself out during the vertical blanking period. This is also why the VCR manufacturers specify that the head switching be carried out so many lines before the vertical blanking period. (four in VHS) as this gives the set the maximum chance to recover. The phenomenon is called "skew error".

Now VCRs have a fairly elaborate braking system to keep the supply reel tension (back tension) fairly constant. Variations in this will, of course, affect the tape length slightly and produce the effect described. This is why you can get away with an unmodified TV if you only play tapes on the same machine as they were recorded on. Tapes recorded on a different machine will inevitably have different back tension settings. Rental tapes will stretch as they age and produce the same affect. There is also the problem of the tape reels jamming slightly.

It is not uncommon for this effect to produce up to half a video line displacement (32μs). The video tracks (in VHS) are about 100mm long so this is only about .003%. This does not sound like much but remember it is varying at a 50Hz rate.

If we were playing an audio signal at that frequency it would mean that the waveform (assuming a sinewave) would reverse phase at every head switching point. It would be effectively phase modulated at 50Hz! And there's nothing you can do about it unless you use some sort of "audio timebase corrector" such as is used with compact discs.

This is what I always thought would be necessary to record audio using helical scanning. If that is not the case, as it appears to be, then you'd think they would have done it that way from the outset. One can only assume that, by being very careful with back tension stability, they have managed to reduce this effect to the point where no one has noticed it yet!

After all, it's not really wow or flutter as we know it. Measured that way it would appear to be very small. But wow and flutter are relatively smooth in their effects. This is a very sharp dislocation of the signal. Has anyone checked the interchangeability of tapes with different machines? I wonder what they will sound like after a year or two? The "golden ear" boys will have a field day!

K.W. (Auckland, New Zealand).

A new thought

I must confess, right at the outset, to not having a ready-made answer for K.W., mainly because, until now, I hadn't stopped to consider the matter to anything like the extent that he has.

For sure, I was aware that the FM sound carriers in a VHS or Beta hifi VCR could not be continuous; that they would be made up of 1/50th second segments recovered from the tape by the

# of distortion?

twin audio heads on the rotating drum. I had taken it for granted, however, that momentary discontinuities in the 1-2MHz carriers would be effectively taken care of by the limiting and demodulation circuitry.

Indeed, I made a similar assumption when preparing the recent article on Sony's Space Diversity FM receiver (November '84). In that instance, alternative 10.7MHz IF inputs are available from entirely separate antennas and front-end tuners, the limiter/demodulator system switching from one to the other according to the instantaneous strength of the respective signals. Occurring within a time interval equivalent to 4kHz or 0.25ms, the signal switching was said by Sony to be subjectively inaudible; I simply took their word for it.

But K.W. is not so trusting, at least in the context of hifi VCRs. If discontinuity in the flow of line information can upset the picture, it seems reasonable to assume that it could also compromise the sound, even if in subtle ways. Such is his theme.

In reading his letter, however, there were a few points that caused me to hesitate on the way through.

K.W.'s Fig. 1, for example, shows two complete frame sync blocks in each recorded field, only the first being actually used. This is at variance with similar diagrams in manufacturers' literature which indicate that, after providing the full complement of active (ie image) lines, the remainder of each helical scan is virtually obliterated by the guardband and the adjacent analog audio track. No second frame sync block is shown.

There seems to be some confusion, too, in respect to the relative positions of tracks A and B. K.W.'s diagram shows the heads scanning from right to left, as they would appear to do when viewed from within the drum; ie looking at the magnetic coating. Since the tape travels in the same direction as the head, it must also be moving from right to left in Fig. 1. Therefore tracks A, B, C . . . (or 1, 2, 3 . . .) would occur in order from left to right.

Further down, K.W. suggests that, because the effective increase in helical track length must be proportionately less than any tape stretch present, "the video head doesn't travel quite as far along the track before head switching occurs". It seems to me that, if the video track is proportionately too short, it would tend to be overscanned rather than underscanned.

Elsewhere he states that it is not uncommon for this so-called "skew effect" to result in a displacement of "up to a half-line (32μs)" at the end of each field. I do not have any figures to hand, for purposes of comparison, but I do wonder whether K.W.'s half-line represents the largest likely time discrepancy (up to 32μs maximum) or the most awkward possible displacement for the sync circuits: ie any number plus half a line.

However, while I had to raise these points — if only to indicate that I was awake — they do not materially affect the basic thrust of the letter. What most concerns me is K.W.'s unqualified statement that sync pulse displacement, as per his Fig. 3, "is what produces the familiar flag waving at the top of the picture" . . . etc.

The statement is valid enough, provided one is careful to distinguish exactly what is meant by the term. To many people, flag waving, picture bend, picture pulling, etc, are all variations of the one basic theme. In fact they are not; nor are they attributable to a single cause, or responsive to a single cure.

In my experience, disruption of the TV image often results from overload of the TV receiver by the RF signal from the VCR. Set up a CRO and you can watch the line sync pulses disappear with certain kinds of video information, and especially during the frame sync block. When this happens, the line oscillator slows towards its natural frequency and lags behind the incoming video information, resulting in the top of the picture being displaced to the right. During the next few (or more) lines, as the oscillator catches up again, power poles in the picture revert gracefully to vertical!

In such cases, readjustment of the TV receiver AGC will often correct the condition.

Video peaking in the VCR, either preset or adjustable, can also lead to problems with some program material. When the video level changes abruptly from white to black, and especially to full blanking level at the end of each line, excessive peaking can cause overshoot and the production of spikes, which can be misinterpreted by the receiver as line sync pulses, again disturbing the image. This effect, too, can be readily seen on a CRO.

I make these points in case we should unwittingly blame skew effect for a whole range of picture problems and, by inference, exaggerate its possible threat to the hifi FM sound track.

If we accept K.W.'s figure of 32μs as a potential skew effect error, this would be equivalent to 3200 cycles at 100MHz and a proportionately greater number at higher sound carrier frequencies.

It is important to realise, however, that tape stretch would probably affect adjacent tracks in a fairly uniform manner. Rather than cause a difference between adjacent tracks of, say, 3200 cycles — therefore inter-field phase modulation — it would more likely produce an overall shift of that order in the number of cycles per track; in other words, in the apparent carrier frequency.

That would respresent a discrepancy at 100MHz of .0032%, equivalent to K.W.'s original figure of "about 0.003%" for skew effect effor. As such, I doubt that it would be any more significant than routine tolerance affecting the original carrier source and the

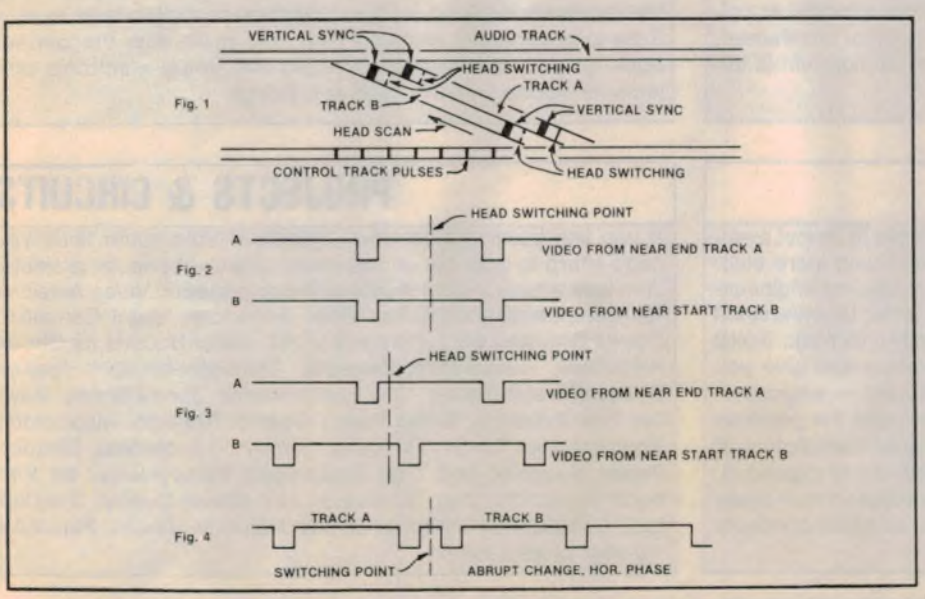


Fig. 1: Typical video tape tracks, as depicted by K.W. In an ideal situation (Fig. 2) the line sync pulses from adjacent tracks coincide. When they do not (Fig. 3) there is a discontinuity in the sequence of sync pulses to the line oscillator system.

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record/replay speed control systems.

For sure, if a residual frequency differential did occur between successive fields, it would result in some modulation of the carrier at a 25Hz rate but the modulation depth for that much carrier shift would be so low that we would probably run out of fingers trying to count the noughts!

I am not entirely clear as to the point K.W. is trying to make when referring to "that frequency" in his third last paragraph. Whichever way you take it, however, the modulation percentage would still be minute, and any resultant buried way down in the noise.

Well then, putting aside the carrier(s) what about possible discontinuities in the moduation itself? What about the surplus or missing bits, if the recorded tracks are either over or under-scanned?

If we're talking about bits up to 32μs long, again, I think we can forget them. The fact is that our FM-multiplex broadcasting and even our much esteemed digitally sourced recordings and compact discs are composed of bits, present or absent, of about that same order. If they don't bother us in those areas, I doubt that they will do so in hifi VCRs either.

At the end of his letter, K.W. wonders whether anyone has checked a range of hifi VCRs for mutual compatibility in respect to tapes. The answer happens to be "yes". In the November issue of "Audio" magazine, Len Feldman reports in detail on five hifi VCRs of different brands from three different OEM suppliers. In the case of four out of the five, tapes appeared to be completely interchangeable; the fifth VCR exhibited difficulties with some tapes, which Len Feldman attributed to "alignment problems" — presumably much more basic than mere skew effect.

The last word?

Well then, is that the last word on the subject, with hifi VCRs completely exonerated and K.W. battered and bleeding by the wayside?

The appropriate answer, I suspect, is "no", for reasons that aren't too far removed from K.W.'s proposition.

While it may be possible to ignore skew effect, as such, the same may not be true of the noise pulse produced by the actual head switching. It is said not to be noticeable, being either masked by the audio signal or else dropped below audibility by the noise reduction circuitry, in the absence of signal. But it is there and can be isolated by a special measurement technique, according to Ontje Arpe, Chief Video Engineer for BASF, and guest speaker at a recent seminar in Hobart.

I gather that Leo Simpson, or one of his staff, will be following up his suggestion for a forthcoming issue.

That aside, the practical reality is that VCR hifi sound is, after all, an FM system and, as such, can be expected to fall somewhat short of the best digital technology. But it's still way ahead of that dawdling analog track along the edge of the tape, and that's what really matters.

Best you enjoy it while you can, before K.W. or Leo Simpson or the "Golden ear boys" (mentioned tongue in cheek, I believe) convince you that it's really not as good as it sounds!

Beware of copiers

To change the subject, we reproduce in the accompanying panel a news item clipped by a reader from the "Sydney Morning Herald". The reference to ozone reminded me of past discussion in these columns, involving that particular gas in connection with negative ion generators.

As you may recall, these are electronic gadgets which are designed to release a steady stream of negatively charged air molecules — negative ions or "negions" — into homes, offices or public buildings, supposedly making life more pleasant for the occupants.

We were frankly dubious about the claims being made for ion generators but our efforts to debate them yielded very little of a definitive nature. There was spirited support and equally spirited condemnation but nothing much in the way of scientific proof, either way. We summed up the situation, as we saw it, in the May '81 issue.

One point that did emerge from the discussion was the possibility that high voltage circuitry, intended to ionise air particles, might also change a significant number of normal oxygen molecules into the tri-atom form: ozone. Once thought to be a healthful, invigorating gas, ozone is now known to have definite toxic qualities. At low concentrations, it has been used to "purify" polluted air in underground workings and to kill bacteria in public buildings. In higher concentrations, it can affect people as well!

In the May '81 article, we quoted a figure for the natural concentration of ozone in surface air as up to 50 parts per hundred million, or 0.5ppm. The then recommendation from the Australian Commonwealth Department of Health was that no device add to this by more than 0.1ppm per eight-hour working day. Some early models of negative ion generators appeared to meet this criterion, others did not.

Since then, debate about negative ion generators appears to have lapsed, mainly, I suspect, because both sides have tired of the subject. But now comes the warning about a tendency for office

Continued on page 124

Are photocopiers a health hazard?

Photocopiers can be a health hazard, causing dermatitis and bronchial and sinus complaints, a new report says.

Results of a study by the Workers' Health Centre in Sydney were published in last month's edition of the *Victorian Public Service News*.

The study outlined various health risks from photocopiers, saying they were greatest when working in a poorly ventilated area, with several photocopiers running simultaneously.

The report said the most serious health risk resulted from ozone, a gas produced by high-voltage machines.

It said ozone, which had a pungent smell like bleach, irritated the mucous membranes and could be a lethal gas at relatively low concentrations.

The report quoted a German study which noted that people exposed to quantities of ozone suffered chest cramps, headaches, dizziness and severe fatigue.

This could be accompanied by a slowing of the heart and respiration rate.

The study said a layer of ozone was found on the plates used in photocopiers and could be released in the air when the machine was charged with high voltages.

The study showed that ozone emission levels were highest in poorly maintained photocopying machines operating in badly ventilated conditions.

It advised that machines should be reguarly checked so that ozone emission levels did not exceed 0.05 parts per million.

The report also said the chemical carbon black, found in the toners used in photocopiers, was a cause of skin cancer.

Sydney Morning Herald, November, 1984

Why the distortion on orchestral strings?

by NEVILLE WILLIAMS

Engineers at an audio convention may, at times, debate specialised, even esoteric subjects; at other times, the discussion is very much at a hifi enthusiast level. In this final report on the AES Convention in Melbourne, we refer to discussion and lectures which fall into this second category, beginning with some open-ended speculation about orchestral string tone.

When commenting on newly issued orchestral records, reviewers frequently find reason to complain that the strings have a "zizzy" or "papery" or "wiry" quality, an unpleasant "edge" or a rough, "congested" sound.

Only rarely do they offer any suggestion as to why it might be so but, when they do, speculation can range all the way from musicians, acoustics and microphone arrangements, through the recording procedures or process to a suspect pressing or tape cassette.

All of these things, and more, may conceivably qualify as contributing factors to whatever is meant by "zizzy", "papery", "wiry", "edgy" or "congested" string tone, but I doubt that any one of them would be consistently or totally responsible for the complaints. I'm far from certain that we understand the effect well enough to be all that specific about the cause.

Having just completed a batch of record reviews, the subject was fresh in my mind when I turned up for the initial function of the AES (Audio Engineering Society) Convention in the Melbourne Arts Centre. What better place could there be to find a kindred spirit with whom to exchange ideas on such a topic?

In preparing the reviews, I had criticised the string tone in a particular orchestral recording — a devotional album where one would reasonably expect that the arranger's intention had been to produce a "lush" sound. Instead, the string chorus had a rough, congested "edge", as if suffering from some kind of intermodulation. Not that the album was a rarity in this respect; I've heard the effect often enough to be apprehensive about any popular orchestral recording that relies on "singing strings". Sometimes they sing sweetly, but often they don't — not to my ears, anyway!

As it happened, I struck up a conversation with another convention guest, Mr Denis Vaughan, an acoustics consultant, conductor and organist, involved with the Melbourne Arts Centre. I quote him only in a general way, because I have to rely on memory to summarise what was said in a fairly mobile group situation, with distractions common to such a gathering.

However, in the course of conversation, I shared with him my puzzlement about the often congested sound of massed strings playing in unison: a certain roughness not unlike that due to a partially worn stylus or the onset of amplifier overload. It was easy to blame the record/replay system but I was convinced, I said, that I had heard the same "distortion" effect, when I had consciously listened for it in a live music situation. Was it an acoustic effect, an aural problem, or an over-active imagination? Had he ever been aware of it himself?

His reply was at least reassuring, even if it confirmed the need for a lot more answers.

No, I was not imagining things and, yes, he had been aware of congested string sound, at times, from the podium. He went on to suggest that it was probably an acoustic and/or aural effect, occasioned by a substantial and compact group of similar instruments, all playing identical or harmonically related notes.

In fact, the notes are never identical and the multiple instruments (eg orchestral strings) produce a most complex interplay of effectively random overtones which may be interpreted by the ear, at best as music, at worst as noise — hence distortion.

You can hear a hint of the problem, he suggested, when playing some pipe organs. Certain pipes, not well positioned, may interact with each other, when played simultaneously, to produce a non-musical resultant. It seemed logical to suggest that the instruments in a large string section could interact to a proportionately greater degree in certain circumstances.

I was particularly interested, however, in his further observation:

"I've been aware of much the same effect, when conducting a large choir. In that case, the 'instruments' are multiple human voices arranged in compact groups."

To that point in the conversation I had not mentioned choirs, although it had been my intention to do so. Time and again, when reviewing choral albums, I have noticed the same kind of "intermodulation" sound riding the massed voices. Here was someone volunteering the information that the effect could, on occasions, be heard at

the conductor's podium.

The implication is obvious: if the same effect is picked up by the microphones and ultimately reproduced in the home, the listener would be likely to blame the equipment for it: a poor recording, a suspect cartridge, a tizzy tweeter, etc. But, for the moment, I was more anxious to follow up the statement that had just been made:

"Tell me," I said, "is there anything a conductor can do to reduce the sort of congestion you've described?"

"Yes," he replied, "he can reduce the number of string players, on the basis that a smaller, more dispersed orchestra is likely to sound more 'transparent' than a large orchestra. But, of course, it may not be an option to use a smaller orchestra."

"In the case of a choir, I've tried breaking up the sections so that sopranas, altos, etc, are interspersed rather than concentrated in individual groups. It certainly opens up the sound but it is not necessarily an acceptable way to organise a choir!"

Unfortunately, the discussion was interrupted at about this point and I did not get the opportunity to take it up again. But it provided an interesting starting point for further questions and speculation, which I leave you to think about:

Why is the focus of attention on orchestral strings and choirs?

Because they provide the most common examples of a large number of similar sound sources heard in unison.

Are audiences at orchestral and choral performances aware of "congested" sound from massed strings or massed voices?

Not directly, because their attention is divided between visual stimulation and the more obvious aspects of the performance.

Might it be more noticeable when listening to a recording of the same presentation?

Yes, because attention is then focused on the sound only and, in the case of a hifi buff, on subtle details of the sound. If, in those circumstances, the sound from a section of the orchestra or choir is perceptibly "edgy" or "congested", it will be noted and may well be put down to limitations in the recording and reproducing system.

Does this mean that some of the "distortion" we complain about in recordings is attributable to the program source?

That inference can be drawn but with an important qualification: its subjective impact may be aggravated by unsuitable acoustics, the over-use of microphones, signal processing, etc, such that the surfeit of random phase overtones is further increased.

Surely, this last qualification amounts to re-inventing the wheel? All would agree on the desirability of good acoustics, and "purist" engineers commonly support the principle of using a minimum number of microphones and minimum signal processing. That plus a good recording and a good amplifier system . . .

Agreed . . . but the whole thrust of the earlier remarks was to suggest that massed strings and massed voices pose a special problem, which may not have been appreciated as widely as it should. How else can we account for any number of recordings which sound clean and unstressed with woodwinds, brass, percussion, even organ, going full bore — only to "distort" with the entry of massed fiddles or massed voices?

I guess that it all gets down to the broad question: Do they present a special problem? If so why, and how best can it be dealt with?

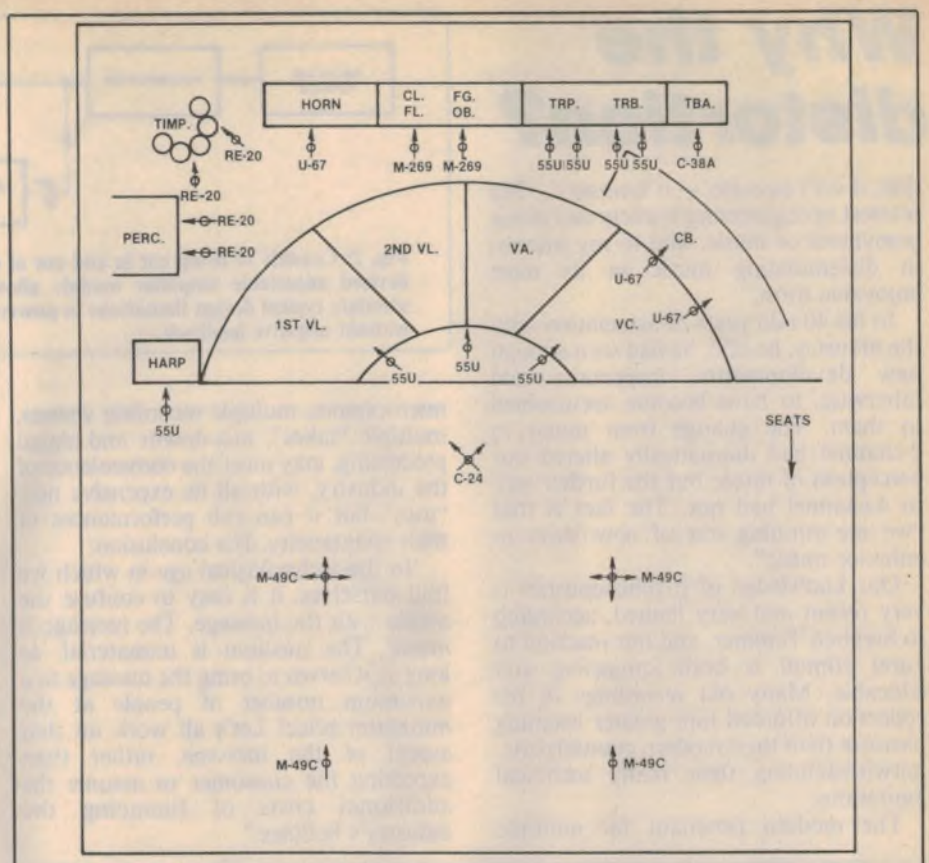


Fig. 1: The converse of "purist" microphone techniques, as used for the Japanese Victor direct-cut recording of "Orchestrations Astromantic" by the Tokyo Philharmonic Orchestra. A conventional crossed pair of microphones is out front but there are 22 others distributed within the orchestra and auditorium!

Voice of caution

Notwithstanding the foregoing, it would be wrong to assume that all audio engineers are preoccupied with technology and obscure effects. Guest lecturer, Stephen F. Temmer, President of the Gotham Organisation, New York, made this very clear in his subsequent presentation:

"The actual name of our field of endeavour is *music*. It isn't tape, it isn't

LET'S TALK ABOUT HEARING

"I believe we will never get as good a grasp of our hearing as we have of our sight. The ears appear to be much more educable, much more adaptable than the eyes. Or is it perhaps our brain which, stimulated by our aural organs, responds in very subjective ways — ways which, like all subjective responses, change with time, experience and environment.

"All our psychoacoustic testing is based on 'response' — on the interconnection within our brain between the sensation of hearing (input) and the verbalising of our reaction to that input (output). I am unwilling to admit that there is a perfect communications channel between that input and that output. I rather suspect that there are many blockages in the way, which have to do with prejudice, conditioning, wishful thinking, social amenities, etc."

Stephen F. Temmer

Why the distortion?

disc, it isn't cassette — it's *music* . . . My interest in engineering is solely tied to my enjoyment of music, and to my interest in disseminating music in its most enjoyable form."

In his 40-odd years of association with the industry, he said, he had seen enough new developments, important and otherwise, to have become accustomed to them. The change from mono to 2-channel had dramatically altered our perception of music but the further step to 4-channel had not. The fact is that "we are running out of new ways to enhance music".

Our knowledge of psychoacoustics is very recent and very limited, according to Stephen Temmer, and our reaction to aural stimuli is both subjective and educable. Many old recordings in his collection afforded him greater listening pleasure than their modern counterparts, notwithstanding their many technical limitations.

The modern penchant for multiple microphones, multiple recording venues, multiple "takes", mix-downs and signal processing, may meet the convenience of the industry, with all its expensive new "toys" but it can rob performances of their spontaneity. His conclusion:

"In the technological age in which we find ourselves, it is easy to confuse the media with the message. The message is *music*. The medium is immaterial, as long as it serves to bring the message to a maximum number of people at the minimum price! Let's all work on that aspect of the message, rather than expecting the consumer to assume the additional costs of financing the industry's hobbies."

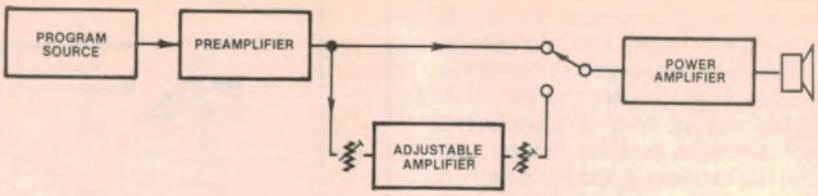


Fig. 2: Capable of being cut in and out of circuit by special logic switching, a specially devised adjustable amplifier module allowed Lecturer Professor E. M. Cherry to simulate typical design limitations in power amplifiers; eg crossover distortion with and without negative feedback.

Voice of restraint

Moderation of another kind came from a quite different and unexpected quarter: from Professor E. M. Cherry of Monash University, Victoria. Professor Cherry is an accepted authority on high quality amplifier design and has been active in researching TIM (transient intermodulation) and other subtle forms of distortion.

For the purpose of his lecture, he set up an amplifier, which he credited to Dr Richard Small, as comparing more than favourably with any other that he had come across. This was coupled to a high quality signal source, high quality loudspeakers, and a special switching system which allowed the signal to be routed directly from the pre- to main amplifier, or via a specially designed supplementary unit.

Although shown in the basic block diagram as a simple two-way switch (Fig. 2) it was, in fact, a four-way push-button logic control selector, so arranged that it would minimise the likelihood of the user making consistent choices by chance. Precautions were taken also against the influence of different earth currents, etc, while a 500ms delay served to disguise genuine from simulated changeovers.

The supplementary unit contained a sequence of stages, with provision to modify their operating conditions so that, as far as the signal was concerned, they would duplicate the effect of typical failings in the main amplifier. By simply setting switches, the lecturer could demonstrate the following:

1. Minimum distortion for reference purposes.
2. Hard clipping in a moderately good amplifier.
3. Crossover distortion without negative feedback.
4. Crossover distortion with negative feedback.
5. Slewing distortion (transient intermodulation distortion).
6. An "awful amplifier". Everything has been cut to the bone to save cost!

Surprisingly (for Professor Cherry) the purpose of the demonstration was not to show how very tiny percentages of distortion might be apparent to a

Sealed Loudspeaker Enclosures

QUESTION: You decide to construct a sealed loudspeaker system which has reputedly been designed to strike an optimum balance between low frequency response and enclosure volume for the particular bass driver. But you discover that you have timber and space to spare, allowing the enclosure to be made considerably larger. Would this result, as a matter of course, in better bass response?

ANSWER: A paper presented to the AES Convention by H. J. Wiebell and A. R. Bywater of Cepstrum Research, Victoria, says: "No, it wouldn't".

Basically, the paper examines the effect of dissipative losses in typical sealed enclosures, with or without filling. It is well beyond the scope of this article but, for purposes of the question, the answer can be resolved in terms of the accompanying diagram (Fig. 3).

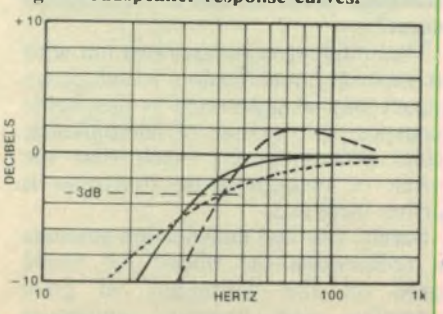
An optimally designed sealed enclosure may give a response as per the solid curve, offering a nominal "cut-off" (—3dB) at, say, 35Hz — low enough to cope with all normal bass response requirements.

If the enclosure volume was significantly reduced, there would be a rise in both the "Q" and the resonance of the system, typified by the dashed curve. A peak has become evident around 70Hz, with the response falling fairly steeply through —3dB at around 43Hz.

Significantly increasing the enclosure volume would have the reverse effect of lowering both the resonance and the "Q" of the system. As a result, the response curve (dotted) would tend to broaden and sag, such that the system bandwidth, in terms of the —3dB point, would actually be reduced.

While there may not be any great difference, subjectively, between the solid and the dotted curves, the fact remains that a consciously oversize sealed enclosure is a dubious investment — the more so because it also offers less protection for the driver in the event of spurious sub-sonic excitation.

Fig. 3: loudspeaker response curves.



discerning audience, but rather the reverse: "A prime conclusion from the demonstration is that many types of nonlinear distortion are remarkably inaudible".

Under lecture room conditions, and in the time available, it was not possible to reach firm conclusions about the validity of the statement, except to say that, with most of the excerpts, whole number distortion was certainly not obvious. One inference is that, with amplifiers of reasonable design merit, perceived quality is mainly dependent on the signal source, the loudspeakers, the listening environment — and the listener.

However, the thrust of Prof. Cherry's preprint paper was no less surprising — and thought provoking — than what he set out to demonstrate:

"Although it must be admitted that the manufacturers of compact discs and associated equipment have had little apparent difficulty in meeting the basic 16-bit 44kHz sampling format, it appears that this format could have been relaxed considerably with little loss of audible quality. This should be borne in mind if some simpler digital audio system is proposed for the future. Such a system might stand in the same relation to the CD system as the tape cassette stands to the reel to reel system."

After repeated complaints from purists that system standards for compact disc are too low, it is quite a change to hear someone suggesting that there might be scope for something less pretentious!

He's puzzled, too!

The sound of the violins in orchestral pieces . . . Are they strident, steely, hard or unmusical? Could the high-order harmonics, many decibels softer than the fundamental, be over-emphasised or distorted to cause an edgy, unpleasant sound? Or do violins picked up by closely placed, non-flat mikes really sound like that?

William Burton,
Associate Editor,
"Stereo Review" (May '84, p.60)

Office furniture from Rank Industries

Rank Furniture Marketing has recently launched a new concept in the marketing of domestic furniture. Rank will begin with a promotion of their range of desks, tables and cabinets. These have been specifically designed to solve special furniture needs around the home, office and other commercial areas.

All units are supplied securely boxed with full instructions. They can be assembled quickly by any unskilled person with nothing more than a screwdriver. The products have an all synthetic surface.

The current range of furniture is centred around two main products: a utility desk and table that can be used for computers, word processors or video games; and a video cabinet, featuring a TV set table surface plus an additional shelf for cassette recorder or disc drive.

Rank Furniture Marketing Pty Ltd, 99 Carnarvon St, Auburn 2144. Phone (02) 648 3773.

12-bit D/A from National Semiconductor

Two fast 12-bit digital-to-analog (D/A) converters, the DAC1265A and DAC1265, are now available from National Semiconductor. These D/A converters are superior replacements for any 12-bit converter of this type.

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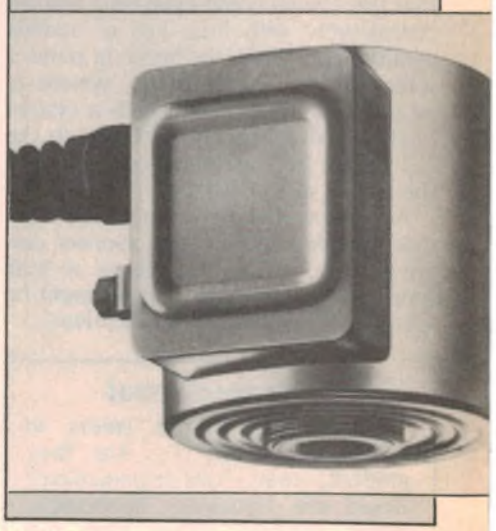
Philips Scientific & Industrial, 25-27 Paul Street North, North Ryde. Phone (02) 888 8222.



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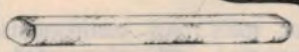

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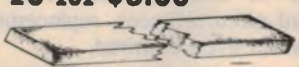

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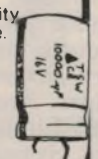

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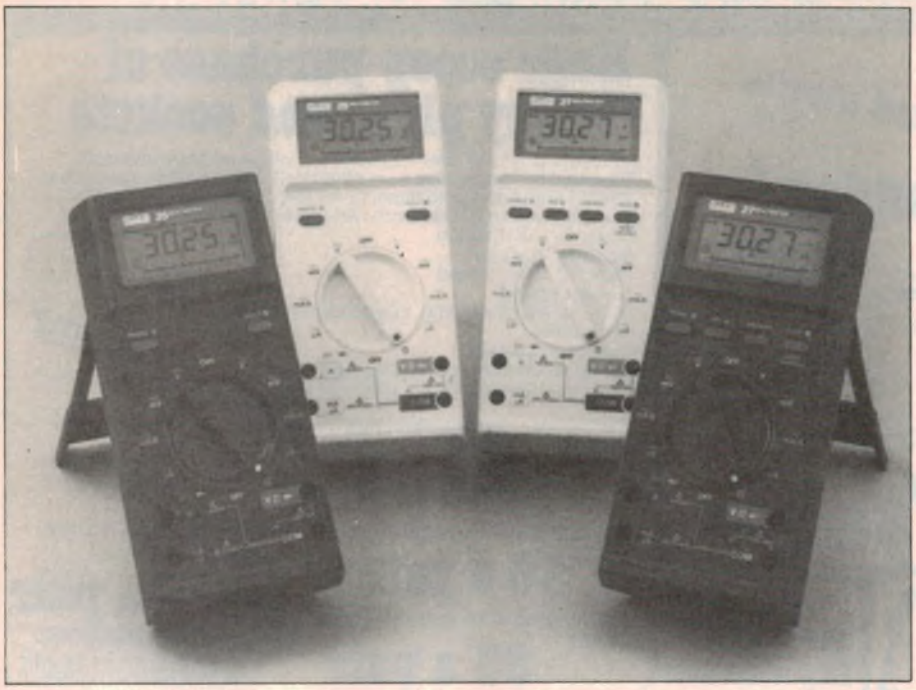


Heavy duty meters from Fluke

The Fluke range of multimeters has been expanded with the addition of a new family of instruments intended specifically to cope with the rigours of industrial use. The Fluke 20 Series, like the recently introduced 70 Series, combines the superior accuracy of a digital meter with the dynamic measurement capabilities of an analog meter. The 31-segment bar graph makes measurements such as peaking and nulling much simpler.

The new meters have been built to withstand the environmental and electrical abuses common to construction, maintenance, petrochemical and other heavy industries. They are guaranteed to stay in calibration for one year despite drops, shock, vibration or chemical spills. All components are shock-mounted and safeguarded with high energy fuses and extensive overload protection to prevent mechanical damage or electrical shock. In most overload circumstances, replacement of fuses is not even required.

A new liquid crystal display works at extreme temperatures. Operation is guaranteed from -15°C to +55°C, with typical operation being specified from -20°C to +60°C.

The Fluke 25 has all of the features of the 75, including "touch hold" sample and hold. The Fluke 27 has the additional facility to record the maximum and minimum values occurring during the sample.

For further information, contact: Fluke Instruments Pty Ltd, PO Box 30, Concord, NSW 2137. Phone (02) 736 2888.

New Zealand's electronics industry

New Zealand's National Electronics Development Association (NEDA) has produced a 1984 "Electronics Review", described as "an annual overview of the (NZ) electronics industry". It is a 72-page soft cover booklet, measuring 210 x 295mm, illustrated with photographs of personalities, factories, manufacturing processes etc, from New Zealand's electronics industry.

According to the promoters, electronics is now playing a major role in helping manufactured goods displace this country's traditional products, such as wool, meat, and dairy products as the major export earners. And, apparently, the firms profiled in the review are those that have met the challenge of high technology in today's electronics market.

Further information and copies of the publication are available from National Electronics Development Association (NZ) Incorporated, PO Box 9092, Wellington, New Zealand.

Cermet pots from Philips

With the addition of a range of cermet potentiometers, Philips PP17 family of modular potentiometers is now complete. Like the earlier carbon versions, the cermet types can be customized to suit a wide range of applications. Both cermet and carbon types use a basic high-quality module; the cermet types are intended for high-end industrial equipment.

All the potentiometers have a compact, modern design which allows for high packing densities. The rigid terminals are accurately positioned and have small spacings; different spacing and terminal styles are possible, depending on customer requirements.

Available options are: with or without spindle; single or tandem drive; vertical or horizontal design. Accessories include heatsinks, reduction drives and single pole single throw switches.

Pulse width modulator IC

Motorola has introduced the second source of an industry standard pulse width modulator (PWM) control circuit family. Known as the SG3526 series, these ICs provide improved performance and reduce external parts count by including all of the functional elements necessary for control switching regulator power supply systems.

The new PWM series includes a 5V ±2.0% reference capable of sourcing up to 20mA of current. A sawtooth oscillator operates up to 400kHz with the capability of being externally synchronized. An error amplifier and current limit comparator are provided for voltage regulation and cycle-by-cycle (digital) current limiting.

The internal logic circuitry safeguards against double pulsing of the outputs and includes under-voltage lockout with hysteresis. A reset pin indicates the under-voltage lockout state during power supply cycling or interruptions. Other control features include a shutdown pin, and programmable soft start and dead time pins.

Dual totem-pole outputs permit push-pull or single-ended operation, and provide sink and source output drive current up to ±200mA. This feature permits direct drive of TMOS power FETs and transformers without additional circuitry in many applications.

Motorola Semi Conductor Products, 250 Pacific Hwy, Crows Nest 2065. Phone (02) 438 1955.

Electrical characteristics for the new cermet potentiometers are: maximum power dissipation (at T_{amb} = 40°C) 1.25W to 2W (3W with heatsink); resistance range 220Ω to 4.7MΩ linear. The standard tolerance is ±10%.

Philips Electronic Components and Materials, PO Box 50, Lane Cove, 2066. Phone (02) 427 0888.

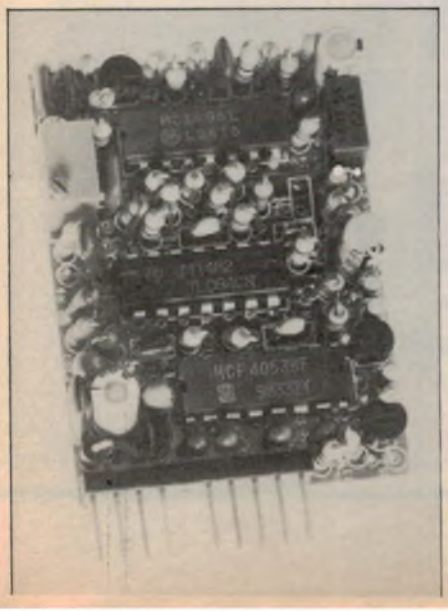
Scrambler for two-way radios

Privacy on shared radio channels and security from eavesdropping scanners is now practical for most two-way radio users with the release of a voice scrambler by Sepac Industries.

The S900 encode/decode scrambler module has been miniaturized in order to allow internal fitting to most radios. Selection of normal or coded speech is made by a single switch operation.

No Department of Communication type approval is required for this where it is fitted to an already approved radio.

Sepac Indusrtries (Australia) Pty Ltd, 134 Beach St, Frankston, Vic 3199. Phone (03) 781 3144.



Versatile antenna tuner

Manufactured by MFJ Enterprises this versatile Antenna Tuning Unit, the Model MFJ-949B, has been designed to incorporate many useful features. It is available in Australia through their Australian distributors, GFS Electronic Imports.

Built in to a neat, compact and fully shielded enclosure the MFJ-949B features a 200 watt dummy load and switching for two coax fed antennas, a balanced line and a single wire-fed antenna.

The MFJ-949B is capable of matching continuously from 1.8 to 30MHz over a very wide impedence range. It's built in power/SWR meter covers two power ranges, 0-300 and 0-30 watts.

Price of the MFJ-949B is $284 plus $12 P&P. For further information, contact GFS Electronic Imports, PO Box 97 Mitcham, Vic 3132. Phone (03) 873 3777).

Westinghouse line filter

The power line filter, type FN660, has been designed not only to protect equipment and systems from line-borne interference, but to also prevent interference generated within equipment from reaching the supply lines.

With total leakage currents of less that 0.4mA, at currents up to 20A and frequency range from 1MHz to 300MHz, the FN660 is suitable for computers, office machines and measuring instruments.

The FN660 is available in ratings of 1A, 3A, 6A, 10A and 20A at +40°C, with an operating temperature range of −25°C to +85°C.

Westinghouse Rectifier Division: PO Box 131, North Altona, Vic 3025. Phone (03) 391 9111.

Electronic speedo from VDO

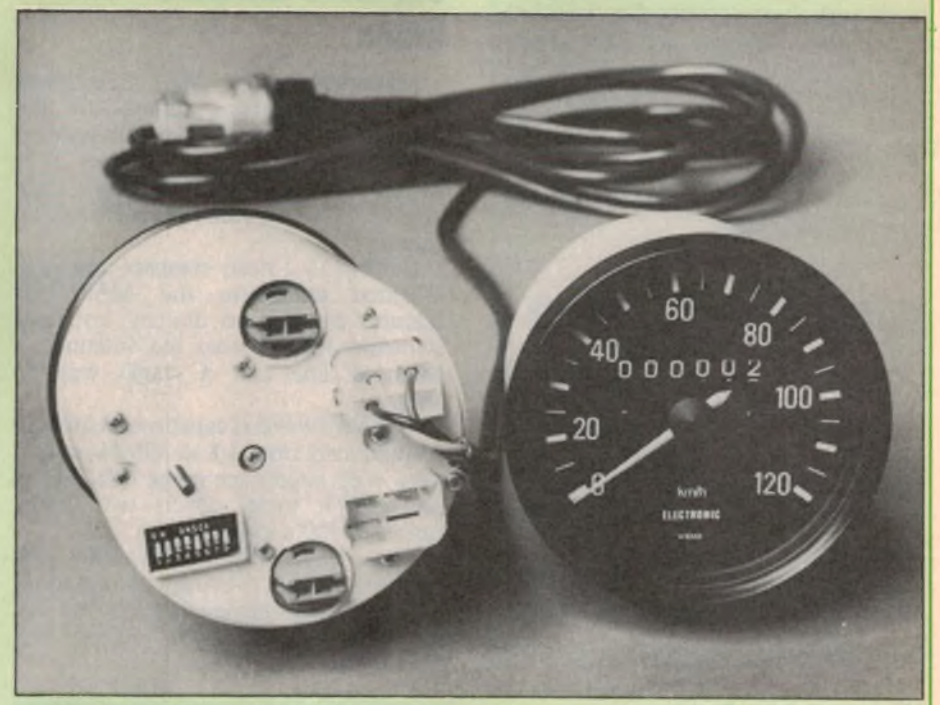
VDO Instruments Australia has introduced an electronic speedometer for commercial vehicles with a universal signal generator to cater for all final drive ratios.

Previous electronic speedos required a wide range of electronic signal generators when coupled to different final drive ratio transmissions.

Electronic speedos eliminate the need for drive cables which are sometimes unavailable as spare parts and are frequently difficult to route through the vehicle.

VDO claims the Hall Effect speedo is far superior in accuracy to mechanical types, with less than 1% error throughout the speed range.

Details can be obtained from VDO Australia, 115 Northern Rd, Heidelberg West, Vic 3081.



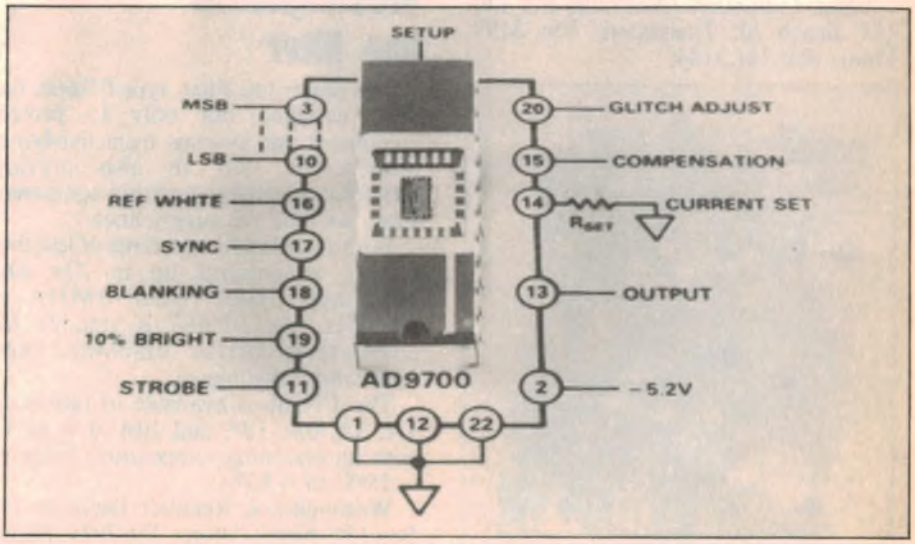
Fast DAC from Analog Devices

A new monolithic 8-bit digital-to-analog converter (DAC) is the first to combine an on-chip reference with composite controls for raster scan graphics rates to 125MHz. Introduced by Analog Devices, Inc, the AD9700 settles to ±0.4% of grey scale in 10ns and offers a complete range of functions that were previously available only in hybrid and modular DACs.

The features and performance of the AD9700 make it well-suited for many high-speed display applications including colour graphics, automatic test equipment, and TV video reconstruction.

The AD9700 interfaces directly with ECL logic and operates with a single −5.2V power supply; typical power dissipation is specified at 625mW. For applications not requiring the full 125MHz update capability of the DAC, it can be configured for interfacing with TTL logic. The AD9700 can also be operated in a low power dissipation mode in applications where slower update rates are utilised.

For further information, contact: Parameters: 41 Herbert St, Artarmon, NSW 2064. Phone (02) 439 3288.



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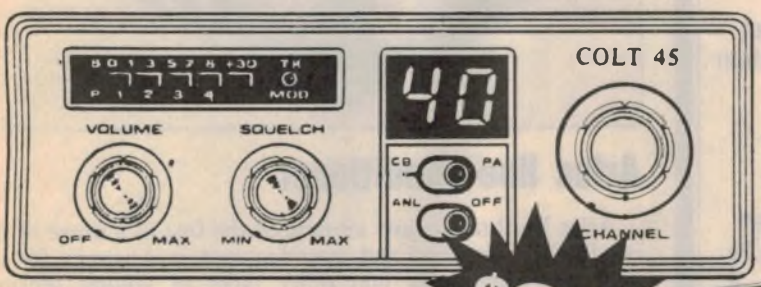

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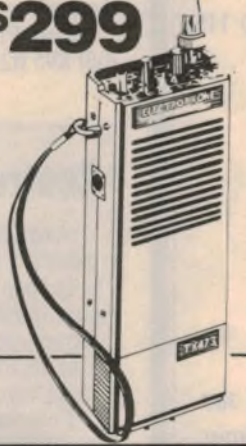

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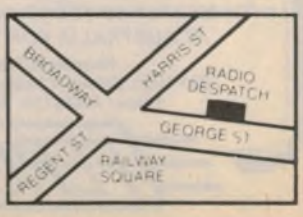
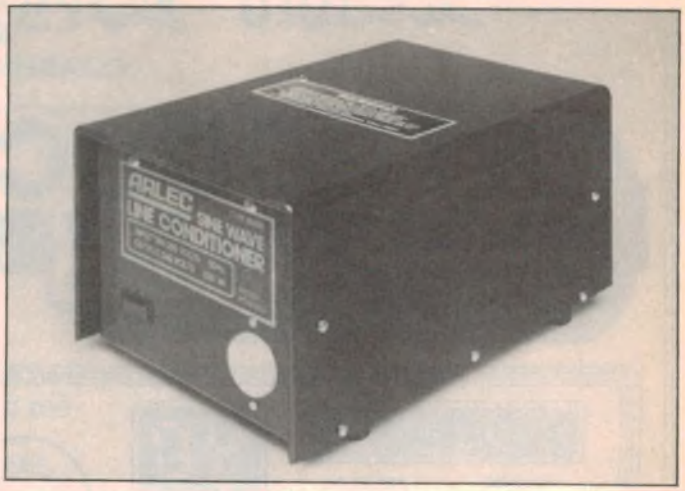


NEW PRODUCTS



Arlec line conditioner

Arlec Pty Ltd has just introduced the first of a range of line conditioners designed and manufactured in Australia for use with microcomputers and other types of voltage sensitive electronic equipment.

Rated at 250VA, the 80250 is designed for operation on 50Hz only. Input voltage fluctuations of up to 15% are regulated to within 3% at the output, ensuring a constant supply with less than 5% harmonic distortion.

The device eliminates interference carried in the power line including voltage spikes caused by electrical equipment and lightning. Output voltage can never exceed 250V RMS.

The 80250 is inherently short circuit protected and does not need any protective devices. It will operate continuously at 275V input and take transients up to 1kV peak without damage.

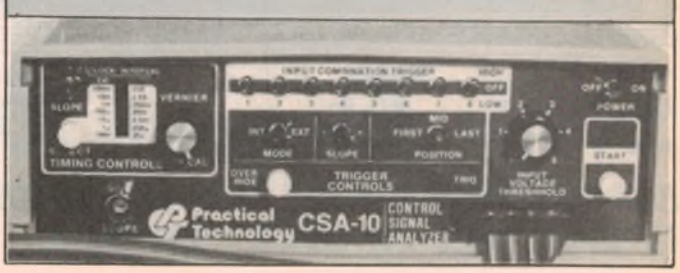
Arlec Pty Ltd: 30 Lexton Rd, Box Hill, Vic 3128. Phone (03) 895 0222.

Control sequence analyser

Available through Neotronics, Practical Technology's model CSA 1 and CSA 10 are general purpose control sequence analysers. The instruments are ideal for simultaneous recording of up to eight logic signals or timing sequences. This information is stored in a 256 bit memory and repetitively fed to an oscilloscope producing an eight trace waveform complete with time interval markers.

Features such as external clocking, external start, external qualifier, clock out, trigger out etc are also incorporated and are available on the rear of the instrument.

For further information, Neotronics, PO Box 289, Newport, NSW 2106. Phone (02) 918 8220.



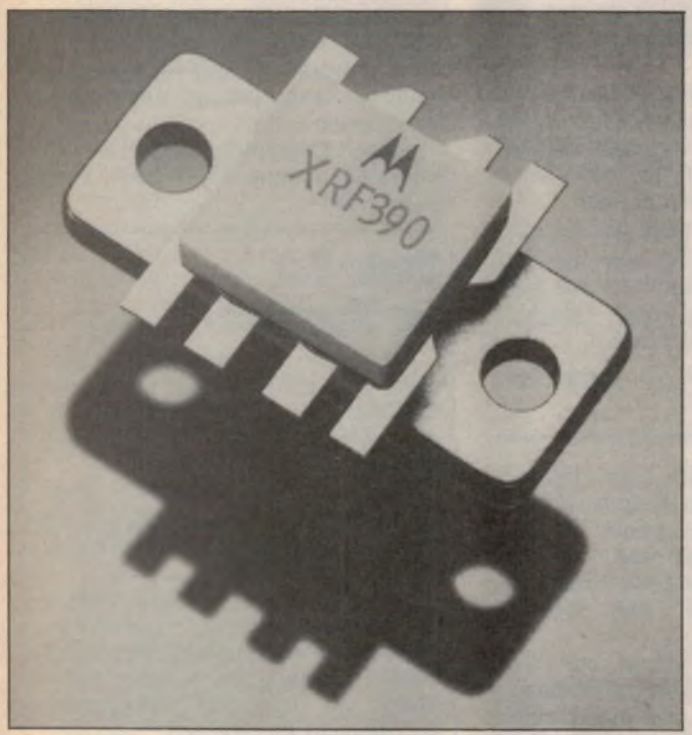
Shared radio channel: selective calling

New measures, known as quiet base (QB) operations, are to be introduced by the Department of Communications. They will make it mandatory for all new mobile stations, personal mobile stations, and radio frequency control stations using the VHF and UHF land mobile service, to be fitted with selective calling devices from 1 July 1984. The measures also provide for all new station equipment to be fitted with decoding facilities.

Owners of equipment now in use, however, will have until 1995 to incorporate the new devices. This is to ensure that owners can obtain the full operational life from their present equipment before upgrading their facilities to QB status.

The system works by an encoding/decoding process. Manufacturers arrange for each operator to be assigned a specific calling tone or digital signal which activates the receiver's loudspeaker system when a message is to be transmitted. This means that operators do not have to put with noisy radio traffic.

Another measure, the use of time out timers (TOTs), will prevent congestion or unnecessary disruption of the system. TOTs automatically shut down a transmitter after a continuous operation in the network, or the inadvertent jamming of a channel by a transmitter being accidentally left activated.



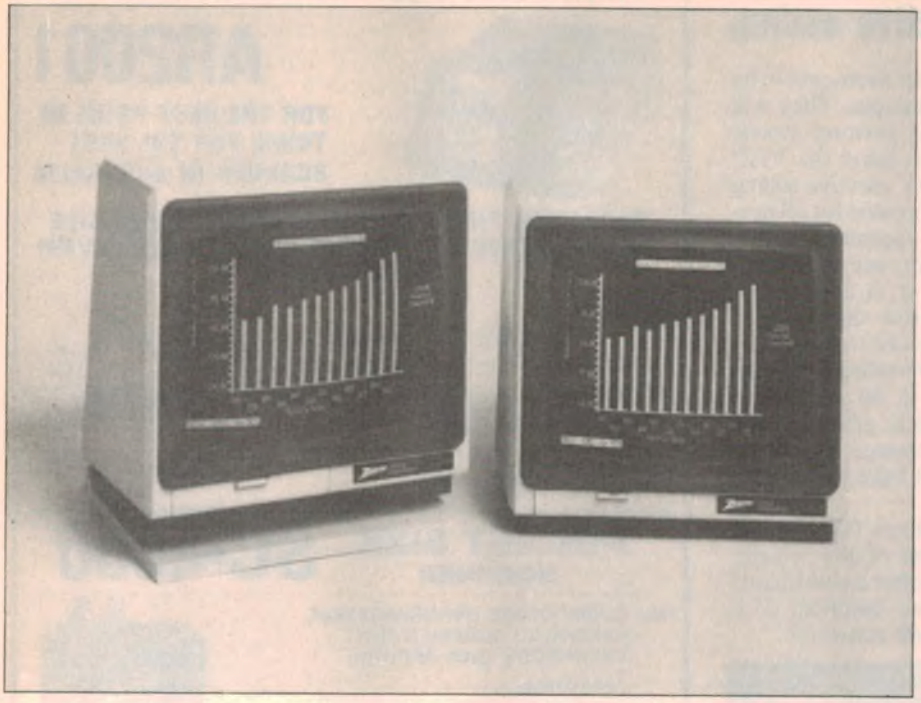
Motorola UHF transistor

Motorola has introduced its first UHF push-pull transistor: the 28V MRF390.

Device characteristics include a POUT of 60 watts; typical gain of 9.5dB; and typical efficiency of 55%. Input matching networks give the device a broadband operation of 30 to 500MHz while gold metalization ensures long-term reliability.

Consisting of two transistor dies in one package with independent base and collector leads but common emitters, the MRF390 is designed for use in commercial and military avionics radios.

Motorola: Suite 204 Regent House, 37-43 Alexander St, Crows Nest, NSW 2065. Phone (02) 43 4299.



Zenith monitor — another IBM compatible

Warburton Franki are distributing a new compact monochrome video monitor, the ZVM-124. Intended for use with IBM or compatible machines, the monitor has a 30cm amber screen and is housed in a cabinet less than 33cm wide.

The new monitor utilizes the IBM TTL input giving it increased resolution over composite video units designed for use with the IBM Graphics Colour Card. It is capable of displaying 25 lines of 80 characters and has a video bandwidth of 25HMz. This gives it the potential to display over 900 horizontal lines.

In addition to the IBM PC, XT and 3270 PC and compatible machines, the Zenith monitor is suitable for use with the Hercules Monochrome Graphics Card or the USI Graphics Card.

Warburton Franki, 7 Birnie Av, Lidcombe, NSW 2141.

Microsoft flight simulator

Flight simulator is a real-time simulator program which puts the user in the pilot's seat of a Cessna 182. The lower part of the PC screen displays the craft's true-to-life instrument panel, complete with such devices as altimeter, tachometer, artificial horizon, and turn coordinator. Fully functioning magnetic compass, navigation and communication radios, fuel and oil gauges and indicators are also included on the instrument panel. The "pilot" can handle all the controls from the keyboard.

Flight simulator includes improved 3-D and out-the-window views of scenery. Complete highway systems and notable landmarks are viewed from the cockpit. For instance, pilots flying in or out of New York City will see such landmarks as the Empire State Building, the Statue of Liberty, the Brooklyn Bridge, and Central Park. Lights flash on top of buildings and on wingtips. Shaded mountains stand out against the sky. Flight simulator flies into over 80 airports, giving users an endless source of challenging take-off and landing opportunities.

Sound and crash effects are very realistic, as are the plane performance features such as dives, rolls and climbs. The "World War I Ace" war game offers improved scenery and a new "war report" feature.

The comprehensive manual contains over 20 detailed airport charts, four regional maps, an index, and separate sections describing controls for the PC.

Flight simulator supports one or two joysticks and the Microsoft Mouse. If two joysticks are connected, one is used for the control yoke, the other for the throttle.

Microsoft Pty Ltd: PO Box 95, Forestville, NSW 2087. Phone (02) 452 5088.

Emona's EPROM programmer

An easy to operate and economically priced EPROM programmer is now available from Emona Computers. The EPROM programmer package is a complete system consisting of both hardware and software that is designed for use with the IBM PC, EMTEK-PC and other IBM compatible computers.

The hardware consists of an interface card which is inserted into one of the expanion slots of the PC and the supporting software is provided on a single floppy diskette. The system is very versatile and will program all of the common EPROMs currently in use.

The programmer can perform the following functions: verify that the EPROM is blank; read EPROMs; fully of partially copy EPROMs — the EPROMs need not to be the same type; load and retrieve EPROM data to and from the disk; fully or partially program EPROMs; verify that programming is correct; program directly from computer memory and many other data manipulation tasks.

Emona Computers Pty Ltd: 661 George St, Sydney, NSW 2000. Phone (02) 212 3463.

Basic 2.0 for Macintosh

Microsoft has announced that Basic 2.0, the enhanced version of the Microsoft BASIC interpreter for the Apple Macintosh, is now available.

Microsoft BASIC is the most widely used software package in the world and is the only BASIC available for the Macintosh.

Designed to take full advantage of the Macintosh's unique capabilities, Version 2.0 offers enhancements that benefit programmers in three major areas: an improved applications development environment, improved interface capabilities, and special features that enable users to write Macintosh-style applicable.

Basic 2.0 has a 50% larger default program data area than the previous version and provides two interpreters, one very accurate (BCD format) with 14-digit precision and the other very fast (binary IEEE format) with 7-digit precision.

For further information contact Microsoft Pty Ltd, PO Box 95, Forestville, NSW 2087. Telephone (02) 452 5088.

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FX550 — 48 Func, 10 Digit LCD, Lithium	29.40	35.28	42.50
FX370 — 70 Func, 10 Digit LCD, Lithium	31.80	38.16	47.00
FX570 — 79 Func, 12 Digit LCD, Lithium	35.30	42.36	49.90
FX85 — 45 Func, 10 Digit LCD, Solar	26.60	31.92	40.00
FX115 — 67 Func, 12 Digit LCD, Solar	31.70	38.04	47.50
FX911 — 51 Func, 10 Digit LCD, Solar	31.70	38.04	47.50
FX991 — 76 Func, 12 Digit LCD, Solar	39.90	47.88	59.00
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EPROM programmer for Commodore 64

Downs Electronic Services announce the availability of a low cost versatile EPROM programmer/copier for the Commodore 64 and Commodore SX-64 personal computers. This new EPROM programmer simply plugs into the user port of the Commodore 64 and SX-64, and using the supplied software allows easy programming of 2716, 2532, 2732, 2732a and 2764 EPROMs. Personality modules are being developed for other EPROMs.

Cost of the programmer is $110.00 including sales tax and a listing of the software required. Software on cassette is available for $10.00 and on disc for $20.00. An upgraded version of the disk-based software, which allows storing of EPROM data onto disk and dumping from disk to EPROM, is also available on disc for $35.00. Three months parts and labour warranty are given on the programmer.

Further information from Downs Electronic Services, 28 Victoria St, Toowoomba, Qld, 4350. Phone (076) 38 5299.

High performance Macintosh

Apple Computer has introduced its high-performance Macintosh personal computer with 512 kilobytes of internal memory. The powerful, innovative business computer enables users to take advantage of larger memory, faster response time, and increased document size and gives users another option in choosing the Macintosh system that best fits their needs.

For example, it increases the capacity of MacProject, Apple's project managment tool to be released next month, enabling users to work on 2000 tasks. Alternatively, should a user need to develop a project with only 200 tasks, the Macintosh 128K system would be the right choice.

With MacWrite, users can now store up to 80 pages of text. In addition, users can now work with 15 times the number of objects in MacDraw, a structured graphics program scheduled for release at the end of September.

For users that want to run the Lotus Macintosh product, to be available from Lotus Development Corporation in the future, a 512K system is necessary. But with the availability of a 512K memory expansion kit, 128K users can expand their systems at any time.

Adam bites the dust

Coleco Industries has abandoned its beleaguered Adam home computer and says that it will concentrate on what it seems to do best: selling low-tech Cabbage Patch dolls!

The toy manufacturer, based in Hartford, Connecticut, said it was selling off its inventory of Adam systems, only 18 months ago hailed as one of the most promising entries in the chaotic home computer industry, and would report a "substantial loss" for the fourth quarter of the year.

US analysts speculated that Coleco could take write-off of as much as $US110 million, before taxes, reporting a loss of about $US75 million for the quarter, and perhaps $US55 million for the year.

— Australian Financial Review

Flight planning with Sharp portable PC

A computer program which saves time, and dollars, in calculating charter costs for general aviation plans is just one in a series of aviation programs developed by Bruce Whalen, a Pan American pilot.

Now heading Aviation Computers, appropriately headquartered at Moorabin Airport, Mr Whalen is responsible for the development of many programs intended for use with Sharp hand held computers. All are directly related to the aviation industry and designed to increase the accuracy and speed of complex route and flight planning calculations.

Aircraft charter costs are determined after evaluation of a number of factors — winds speeds, fuel density (which alters with temperature), the type of aeroplane and the price the operator thinks his competitors will charge for the same trip.

As Mr Whalen says: "The slightest slip up in calculation could cost an operator dearly — maybe even his business, particularly when he's working in the big league."

The user is prompted by the computer for each required input factor enabling any staff member to make accurate quotes without forgetting any points. A printout option provides hard copy for the files. The Flight Planning component is of major appeal to pilots, allowing them to complete the plan in a few minutes. Frequently flown routes may be stored in the computer so the pilot needs only to select the number corresponding to his route and the flight plan will be immediately computed.

Further information can be obtained from Sharp Corporation, phone (02) 728 9111.

Computer aided design kits

Technical Imports Australia, the supplier of the general purpose computer aided design package CADEC and the Design Kit Series, announces the forthcoming Microwave design kit.

This kit is a microwave circuit synthesis program. It allows the design of microwave amplifiers with the following options: narrowband design, (10-15% bandwidth); wideband design, (1 or 2 octave bandwidth).

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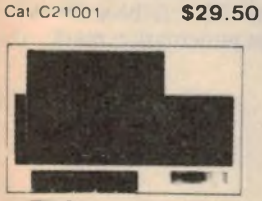

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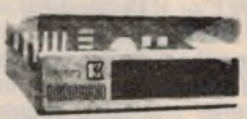

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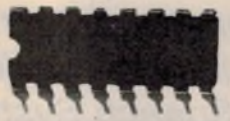

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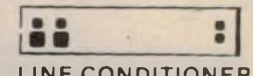

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Errors and Ommissions Excepted

The Votrax Personal Speech System

by PETER VERNON

Several years ago computer enthusiasts were introduced to the first speech synthesisers. Now the second generation has arrived and we asked Peter Vernon to take a look (listen) to the new Votrax Personal Speech System.

The Votrax Personal Speech System (PSS) may well be the last word in "phoneme-based" speech synthesis. The PSS uses the popular Votrax SC-01 chip, but with its own on-board Z80 microprocessor, "text-to-speech" translation software in 32K of ROM and both parallel and RS-232C serial interfaces, the PSS offers flexibility and versatility unmatched by previous equipment.

In additon to speech direct from ASCII text with a wide range of pitch and intonation controls, the PSS provides music and sound effects and a "talking clock" mode. User-accessible RAM and provision for down-loading other programs to the controller also mean that the PSS can be used as a printer buffer, communications converter or dedicated microprocessor-based controller.

Physically the Votrax Personal Speech System is an attractive unit. Measuring 312×116×65mm (W×D×H) in a grey metal cabinet, the PSS comes ready to use, with a Ferguson plugpack providing operating power of 18VAC and 12V-DC. The power pack has a 1.5m cable terminated with a two pin mains plug and a 40cm cable to the Votrax unit, connected by a 5-pin DIN plug.

The front panel is bare except for a small volume control knob and a red "Power On" indicator. At the rear is the connection for the power supply, a pushbutton on/off switch, parallel and RS-232C serial interface connectors, a cut-out to provide access to the 8-way DIP configuration switch and a socket for an external speaker.

The DIP switches are used to specify whether the parallel or serial interface will be the primary input port, set parameters for the serial port, activate a self-test mode and select whether the unit will produce a "ready" message when first switched on. For serial communications, the switches can select baud rates from 110 to 9600 bps, with XON/XOFF or RTS handshaking and a 7 or 8 bit word length. No parity is used.

Installing the Personal Speech System is easy if you have or can make the proper cables and have details of the configuration of the parallel or serial port of your computer. The slim but comprehensive manual supplied with the speech unit contains full details of the connections which are required and connecting cables for particular computers are available as an optional extra.

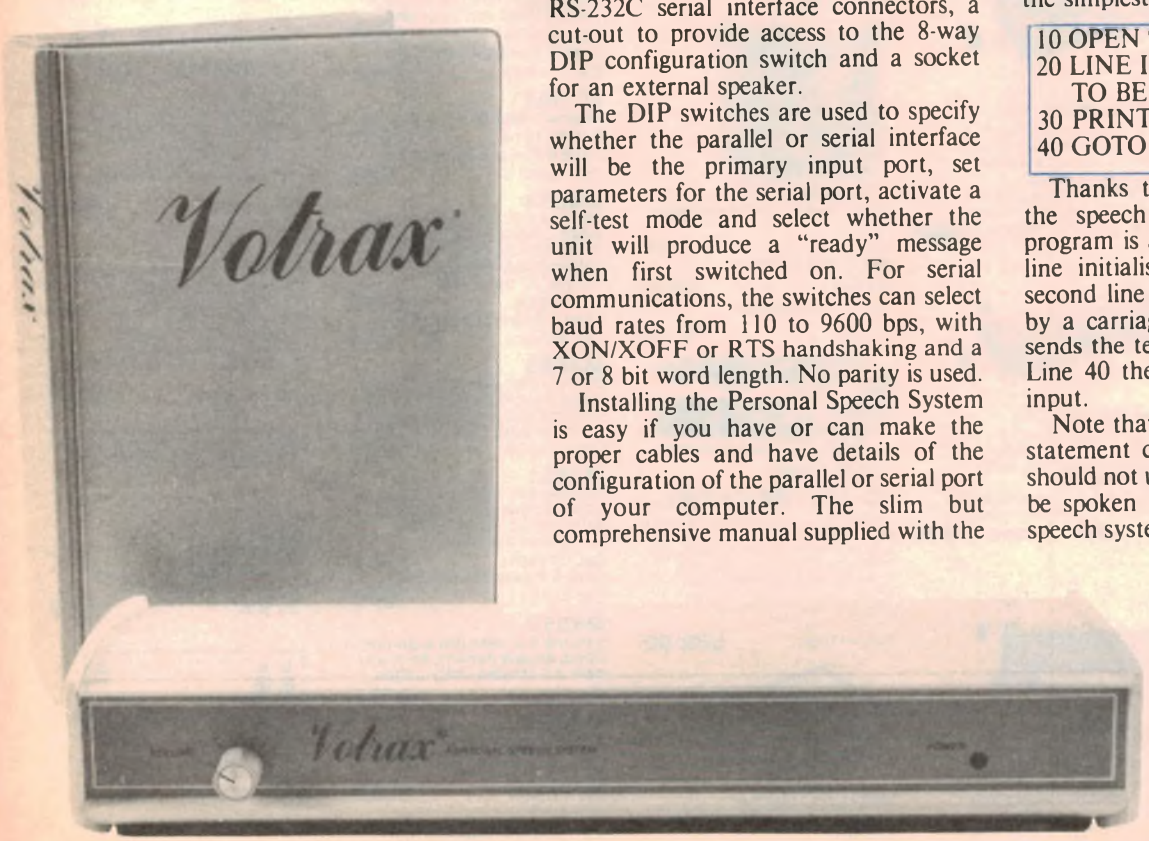
For this review we used the serial port, setting the DIP switches for communication at 9600 baud with RTS (Ready To Send) hand-shaking. The Personal Speech System has its own command buffer, but at high transmission rates some form of hand-shaking is necessary so that the speech system can indicate to the host computer that the buffer is full. The host should then stop sending instructions or speech codes until there is again space in the buffer.

The manual also includes examples of software for driving the Personal Speech system. Once communication is established the procedure is simple thanks to the translation routine built into the PSS. This routine, the text-to-speech translator, takes text in standard ASCII code and produces speech output. For the IBM PC and compatible computers using serial communications the simplest demonstration program is:

```
10 OPEN "COM1:9600,N,8,1" AS #1
20 LINE INPUT "ENTER PHRASE
   TO BE SPOKEN";A$
30 PRINT #1,A$
40 GOTO 20
```

Thanks to the on-board software of the speech system, the simple Basic program is all that is required. The first line initialises the PC serial port, the second line accepts a phrase terminated by a carriage return and the third line sends the text to the speech synthesiser. Line 40 then loops to wait for another input.

Note that although the LINE INPUT statement can accept punctuation, you should not use punctuation in any text to be spoken directly. This is because the speech system uses punctuation marks to



The last word in phoneme-based speech synthesis? Votrax PSS uses the SC-01 chip and an on-board Z-80 microprocessor for a wide variety of programmable effects.

activate special functions of the synthesiser. An exclamation mark for example, is used to begin a special command string, and a full stop terminates a command string, although the control characters can be re-defined if required.

A wide variety of programmable effects can be applied to the speech produced by the Votrax chip. Amplitude, rate of speech and inflection can be controlled by sending a control character (the ASCII @ symbol) followed by a hexadecimal number. In the case of amplitude, the rate at which the sound fades can also be controlled.

Two additional conversion modes are also available to override the standard text to speech translation mode. Conversion mode 1 allows the use of an "exception table", a user-defined table of words and their phonetic equivalents which can be accessed in place of the standard ASCII translation. Conversion mode 2 corrects the pronunciation of strings of numbers. In the standard mode, a number such as 12,345 is pronounced correctly as twelve thousand . . . etc, but the numbers 12345 will be spoken as separate digits. Conversion mode 2 corrects the translation of unpunctuated numbers.

One of the most interesting abilities of the PSS is the "vochord mode", which feeds the output of the internal musical tone generator to the clock input of the SC-01 chip. This procedure allows the production of special effects such as musical voices.

Music and Sound Effects too

As well as the SC-01 speech synthesiser chip the Personal Speech System includes a General Instruments AY-3-8910 musical tone generator chip which provides music and sound effects on three independently programmable channels. Music is programmed by sending a "non-speech control character", which is normally defined as an exclamation mark. To play a phrase of music for example, the Basic code would be:

LPRINT"!T10:E1040:1363100."

The exclamation mark indicates that the following characters are to be interpreted as control codes rather than speech. T10 sets the tempo in "clock ticks" of 8.19ms each and E sets the envelope shape of the sound produced. Notes are specified as numbers between 0 and 96, and duration, amplitude and "glide" can also be set. "Glide" allows notes to glide from one pitch to another without a definite break between them.

Extensive envelope controls are available, with attack, decay, sustain and release times separately programmable for each of the three sound channels. Using this feature it is possible to make music produced by the PSS resemble a flute, trombone or harpsicord, for example.

Any of the three channels of the musical tone generator can also be used to produce noise by specifying note number 97 while an envelope setting is in effect. Twenty-six "noise values" are available, ranging from hisses to gunshots, all of which can be tailored with appropriate envelope settings.

Even more special effects are possible by controlling the setting of the system's on-board filter. In normal (mode 0) speech the filter setting will change both the pitch and resonance of the sound produced by the system. In the Vochord mode the sound spectrum of the speech will be derived from a specified music channel, opening the way to all sorts of programmed effects and even singing.

A talking clock?

A programmable clock on board the PSS will maintain the correct time for as long as the system is on. The time can be set in either 12 or 24 hour format and spoken on command. Up to eight alarm calls are also available, combining a clock reading with programmed speech, and the system can also be set to announce the time or sound a chime at regular intervals.

Speech Quality

For all its capabilities, however, the worth of a voice synthesiser system must still be judged by the intelligibility of the speech it produces. Intelligibility is a subjective matter, and a person who is familiar with the speech system is not necessarily the best judge. Almost unconsciously the ear becomes accustomed to the mechanical inflection of standard Votrax speech so that after a very short time it becomes perfectly clear and understandable. A person coming fresh to the system however, may only hear gibberish unless they know what the system is supposed to be saying.

This problem in common to all methods of speech synthesis. Recently, a Texas Instruments engineer was quoted as saying "Three or four engineers may all agree that pronunciation is perfect, that speech is understandable, while another person cannot make out what is being said".

Be assured however that if you use the speech system regularly you will quickly come to understand it completely, even when the text being spoken is unfamiliar. You may even find it hard to believe that someone else has difficulty in making out what the system is saying. A number of visually handicapped people are already using the system and have found it an invaluable aid, as it allows them to work with computers in ways that would otherwise be impossible.

(These comments on intelligibility apply only to the standard speech mode, with flat inflection and no special pitch and amplitude controls. Programming which takes account of these features can greatly improve the "first-time" recognition rate of the Votrax speech system.)

While considering intelligibility, note that there are some words that the Votrax system just *cannot* say. Incredibly, the standard text-to-speech translation algorithm has a censor built-in! One popular expletive, for example, is pronounced "Sugar", regardless of what is sent to the unit — the Votrax speech system is something of a wowser.

Price and Conclusion

This minor shortcoming(?) aside, the Votrax Personal Speech System is one of the most versatile and powerful sound systems we have seen. The text-to-speech translation software is accurate in around 90% of cases, and difficult words can be programmed phonetically or added to the on-board exception table to further increase the range of the system. The music and sound effects capabilities are on a par with the best dedicated music generators available for microcomputers, and the addition of a clock mode is a further bonus. Many other features of the system have only been touched on here, including the user-programmable mode, which would keep an enthusiastic programmer occupied for months. No doubt at the end of that time there would still be many avenues to explore. Overall, in spite of the retail price of $699, the Votrax Personal Speech System offers good value for money.

The Votrax PSS is available from Mike Boorne Electronics, 61A Hill St, Roseville, NSW, 2069. Phone (02) 46 3014.

SPECIFICATIONS

Microprocessor	Z80
Memory	32K ROM (translation software)
Interface	Parallel and RS-232C serial
Features	Speech synthesis, music and sound effects, talking clock
Dimensions	312mm x 116mm x 65mm (W x D x H)
Price	$699

REVIEWS OF RECENT RECORDS AND CLASSICAL • POPULAR • SPECIAL

MAHLER

Symphony No. 1 in D Major. Chicago Symphony Orchestra conducted by Sir Georg Solti. Decca Digital Disc 411 731-1.

In a recent issue I wrote that I found it impossible to respond favourably to the ardour with which Solti embraced the simple structure of Mahler's Fourth Symphony. Such pressures tend to push it out of shape. Solti uses much the same treatment in the composer's First Symphony but here the chassis is made of much tougher material of a stronger shape which can tolerate such pressures without notable injury.

For instance in the funeral march of the third movement, the one based on the French nursery tune (Frere Jacques) the second theme, usually treated as a slow dance, emerges here as a sort of lullaby, and very effective it is. There are many examples of the same treatment elsewhere in the performance and I must admit that they all add up to a very exciting performance indeed.

The very wide digital dynamic range is exploited by Solti to his very great benefit — and I guess satisfaction. The trumpets in the introduction to the symphony are very distant indeed and despite the too long drawn out material in this segment Solti introduces nuances that securely bind the attention. And when material begins to lose interest Solti refocuses the attention on the wonderfully subtle changes in harmonies and scoring.

The summit of the movement in the middle, the one with "three cheers" on the brass, shoots up in an abrupt climax like a gigantic belch. It is electrically effective in a recording of such wide separation. Then the ironic funeral march steals in from silence and fades away again with graveyard robbers' stealth.

The coloration is minute. I couldn't help thinking that the conductor had pondered every bar; the way he turns the landler in the second movement into a waltz is something every student should study. The whole performance is alternately fiercely expressive and delicately shaded. Some segments are often volcanic in their eruptions.

Self indulgent? Undoubtedly. But the work is big enough to stand it. So much so that you can even forget the longueurs of so many of the slow parts.

Despite minor blemishes it is a very exciting performance and the orchestra playing is peerless.

RICHARD STRAUSS

Sinfonia Domestica. Vienna Philharmonic Orchestra conducted by Lorin Maazel. DGG Digital Disc 413 460-1.

Richard Strauss claimed that he could describe a glass of beer in a musical phrase. He was boasting of his talent for musical realism. Now this might sound a bit extravagant if you use, as he does in Don Quixote, the 100-odd musicians in a symphony orchestra to describe the braying of a few sheep. But in the work it is an astonishing achievement and never fails to impress any newcomer.

The Domestic Symphony is a work that demands and receives much of the same kind of ingenuity even to the extent of realising that a baby is being bathed under your very ears, so to speak. Unlike Bottom in a Midsummer Night's Dream, "you go to hear a sound that you have seen." And when you hear it there's no mistaking it.

Diverting a moment it may be of interest to Britons that this echt-German composer wrote the Domestic Symphony while on a holiday on the Isle of Wight. And more expectedly, his self-portrait in the symphony is very flattering indeed.

His own thematic material consists of five phrases, in turn easy going (cellos), dreamy (oboe), moody (clarinets), fiery (violins), and high spirited (trumpet). His wife is one of his tunes turned upside down. This, he claimed, showed how well they got on but has perhaps other implications for Freudians. Other phrases, according to William Mann's excellent sleeve notes, describe her as "rough tempered, but full of feeling," and other disclosures of character.

Read these notes attentively and Strauss' complete picture of domesticity will emerge after a few hearings. It is a virtuoso exercise in musical realism. That it hasn't stood up to time as other of Strauss' tone poems is perhaps because of lack of time for an average audience to accustom themselves to the description of the various interludes set out in their programs. Moreover, there are overlong slow interludes which leave an intelligent listener in no doubt as what the couple are up to.

All this domestic felicity ends with papa's shout of happiness after a day of work and love. Not great music, perhaps, but always attractive, sometimes marvellously evocative. It is splendidly played by the Vienna Philharmonic Orchestra conducted with brilliant understanding by Lorin Maazel. (J.R.)

CANTELOUBE

Songs of the Auvergne Vol 2. Kiri de Kanawa with the English Chamber Orchestra conducted by Jeffrey Tate.

This is a most attractive record, the luscious voice of Kiri te Kanawa sensitively accompanied by Canteloube's arrangements played by the English Chamber Orchestra under Jeffery Tate. It features Volume 2 (series 4 and 5) of the Auvergne songs, and contains many different moods — wistful, cheeky, gay, sad, beast and birds, even a lullaby.

Most are taken slower that you might expect folk songs to go but such is Kanawa's delightful style that they serve to emphasise her glorious voice. There is one small fault which in no way impaired my enjoyment. Kanawa's diction makes it impossible to follow a single word in the text supplied. But since the words are in the Auvergnat dialect and the Bachianas in Portuguese it suffices to get a general meaning of a particular song before playing it.

The Auvergne songs in Volume 2 have a strong family likeness to the previous ones in Volume 1. You have the same deliciously hazy orchestrations, sometimes bright but often distant sounding with the harp and flute distributing prisms of light through the mist. The result is a curious sense of infinity, nothing like you'd expect from honest folk material. A bit rich for such stuff? Perhaps. But enchantingly effective.

Despite all these delights I recommend a rest after playing the first side and another before the Bachiana recorded on the second.

VILLA — LOBOS

Bachianas Brasileiras No. 5. Similar Cast.

These suites were intended by the composer to show the effect of J.S Bach's music on that of Brazil. I see little resemblance except for an occasional long rhapsodic melodic line and some very forward-moving horizontal writing. The first, called Cantilena, starts with a beautiful volcalise (a wordless melody), and speaks of a passionate love of nature.

(continued on page 118)

Sampler, Demonstration CDs from Telarc

Sampler Volume 1. Telarc compact disc CD-80101. From PC Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612.

While their prime role is normally to promote the albums from which the tracks are drawn, "sampler" recordings are of potential interest to hifi buffs for an entirely different reason.

Since the excerpts are commonly taken from a dozen or so different sources, they frequently offer, on the one handy disc, a variety of program material — potentially useful for evaluating or demonstrating equipment. In most cases, the excerpts will also have been chosen with due regard to their technical quality.

This is certainly true of the Volume 1 compact disc sampler from Telarc. It contains 18 tracks in all, each one qualifying as an excellent example of modern digital recording.

Consistent with Telarc's catalog, most of the excerpts are of classical origin although, at only three to four minutes apiece, they are too brief for serious listening. But they're fine for sampling and for demonstrating system performance to friends or customers. The tracks are listed in the booklet (really a mini catalog) and encoded for ease of access or programming.

They certainly provide some interesting options. Track (2), for example, from Bach's Toccata and Fugue in D, offers spine tingling organ sound, which might be compared with the orchestral texture in (14): Shostakovich Symphony No 5. Track (5) offers the massively complex structure of Mahler's symphony No. 2 (concl), followed by the spirited Rienzi Overture of Wagner (6). Either one could be contrasted with the gentle sound of silence of (12): Debussy's Dance Profane.

But then, (12) contrasts naturally with (13). Gliere's Russian Sailors' Dance. Beethoven's No. 8 (15) provides outstanding string tone, while Liszt's Battle of the Huns (16) and Tchaikovsky's Waltz of the Flowers (17) say all that needs to be said about dynamic range and signal to noise ratio.

A touch of more popular fare? Well, track (1) offers John Williams' "Superman" Theme, while (18) provides some rhythm, bass and dynamics from a yet to be issued Wilson-Lowe album, "Good Vibrations". In short, a most useful recording for evaluating and showing off your system. (W.N.W.).

Sampler Volume II. Telarc compact disc CD-80102.

Whereas Volume I has 18 tracks and about 65 minutes of playing time, Volume II is even longer, at 20 tracks and 67 minutes — good value for money in both cases. Not all CD players can be pre-programmed to handle as many items as this, but they should still be able to play them in normal sequence, without bother.

Volume II gives greater prominence to piano, with excerpts from Beethoven's Piano Concerto No. 5, and Gershwin's Rhapsody in Blue, plus six minutes of the Chopin Polonaise in A-flat, played by Malcolm Frager on his magnificent Bosendorfer Imperial Grand.

In fact, the "Polonaise" is preceded by Stravinsky's colourful Rite of Spring, and followed by six minutes of Moussorgsky's "Pictures" (Hut of Baba Yaga, Great Gate of Kiev), marked by more brilliant orchestral colour and thunderous bass — 16 minutes of program that few would want to interrupt. For more of the same, Stravinsky's Firebird Suite is featured in track (18).

Incidentally, Tchaikovsky's 1812 Overture on track (19) is the much discussed Kunzel/Cincinnati version but minus the more ponderous of the cannon. Presumably, in this context, Telarc considered it prudent to omit them from the mix.

Vocal sound is represented modestly in Orff's Carmina Burana, and on a grand scale in Beethoven's Choral Fantasy. Other notable excerpts include Holst's Song of the Blacksmith, Beethoven's No. 5 "Victory" (Mvt 1), and the sonically sensational entry of the great organ in Saint Saens' Organ Symphony.

Which of the two did I prefer? I'd almost be prepared to assert that Telarc have arranged the selections to make that decision as difficult as possible. If you can't afford both immediately, follow the numbers: buy Volume I now and Volume II later! (W.N.W.)

It ends with the same, but while the first is sung mezzoforte and forte the repetition is magically pianissimo.

The nature loving part is sandwiched between the two.

The accompaniment is on cellos only and the wonder is that they never grow to sound monotonous. One group has the melody, the other provides a running plucked bass. The playing is remarkably assured. The second item is a Dance (Martelo). It goes with infectious briskness and though most of it sounds more Brazilian than Bachian the rest is more Brazilian than Portuguese. (J.R.)

ELVIS

Elvis. The First Live Recordings. 12-inch EP. RCA Victor DXL1-3264.

Looking for old Elvis recordings must be like fossicking around a worked-out goldfield. Look hard enough and long enough and you might just come across something that everybody else has missed.

Well, on this disc endorsed "Never before realeased" is a little something that somebody taped in 1955 and 1956 at the Louisiana Hayride, Shreevport, probably without realising that they were taping history.

At the time, Elvis was still driving a truck for the Crown Electric Company but he was rapidly climbing the radio and TV appearance ladder to national recognition. The style of the emerging superstar is clearly recognisable in the first four numbers on the disc: "I Wanna Play House With You", "Maybelline", "Tweedle Dee" and "That's All Right".

But the final track might well have marked the beginning of his career proper: his final contract appearance at the Hayride and a performance of "Hound Dog" that can barely be heard over the screams of ten thousand teenagers. He'd made it!

In program terms, the recording adds up to ten minutes or so of rough-round-the-edges Elvis, plus a couple of minutes of spruiking to match. But I guess that, to his fans, it will be another piece of highly collectable memorabilia. (W.N.W.)

POPULAR VOCAL

Night Games. Charley Pride. Stereo LP, RCA Victor APL1-4822.

If you're tempted to reach for this album on the assumption that it's traditional country music, be warned by the pattern of city lights behind the pictures of Charley and his languorous, dusky companion.

In only one track, "Down in Louisiana", is there any thought of the cotton pickin' countryside; in the other 11, Charley's mind is firmly on love, requited or otherwise:

Draw the Line — Love on a Blue Rainy Day — The Late Show — Night Games — Ev'ry Heart Should Have One — Thanks for Wakin' Me Up This Mornin' — Livin' It Up — Just Can't Leave That Woman — I Could Let Her Get Close To Me.

The backing is still pure Nashville, and the sound quality's fine, but Charley's changed since he took up with them city girls. Of course, some reckon they've given him a new interest in life. (W.N.W.)

PATHETIQUE SYMPHONY

Tchaikovsky: Symphony No.6, "Pathetique". Eugene Ormandy conducting the Philadelphia Orchestra. Compact disc, Delos D/CD 3016. [From P.C. Stereo Pty Ltd, PO Box 272, Mt. Gravatt, Qld 4122. Phone (07) 343 1612]

In one important respect, this could be considered a companion disc to the Ormandy/Philadelphia Tchaikovsky No.5, reviewed in the January '84 issue. Both were recorded during 1981 by "Conductor Laureate" Ormandy, a title that he had assumed on stepping down after 45 years as Musical Director of the famous Philadelphia Orchestra — and successor to Leopold Stokowski.

But, whereas the 5th was recorded in the historic "Old Met", once favoured by Stokowski and the Orchestra as a recording venue, this present 6th was recorded in the Orchestra's official home, the Philadelphia Academy of Music.

I note that a 1968 CBS recording of the same work by the same conductor and orchestra is still on sale in the USA, which would seem to auger well for this more recent performance. Recorded in September '81, it has the advantage of modern technology, with twin Schoeps microphones and a Soundstream digital mastering system.

As such, it offers very low noise level and an ability to handle with ease the dynamic range which this particular work demands. Be careful to set the opening stanza to a suitably low level, or you'll be forced to reduce the volume later on.

Even though still in his early fifties, Tchaikovsky seems to have had a premonition of approaching death as he worked on this 6th symphony. As it transpired, the work was premiered at St. Petersburg on October 28, 1893 and, a mere ten days later, Tchaikovsky was dead, reportedly after drinking unboiled water during a cholera epidemic.

The first movement begins in sombre mood, brightens briefly with a typical Tchaikovskian melody, but recalls an orthodox liturgy for the dead and sinks back into melancholy.

The second movement is a waltz but in 5/4 time, as if for the heavy of heart. This is followed by a brilliantly orchestrated march, but grief and despair again take over in the fourth and final movement. It was after listening to the first performance that the composer's brother, Modya, suggested the title which Peter Tchaikovsky himself added to the score: "Pathetique".

Given Ormandy's mature understanding of the work, the quality of the Philadelphia Orchestra, and of the Delos recording, this performance should find ready acceptance. (W.N.W.)

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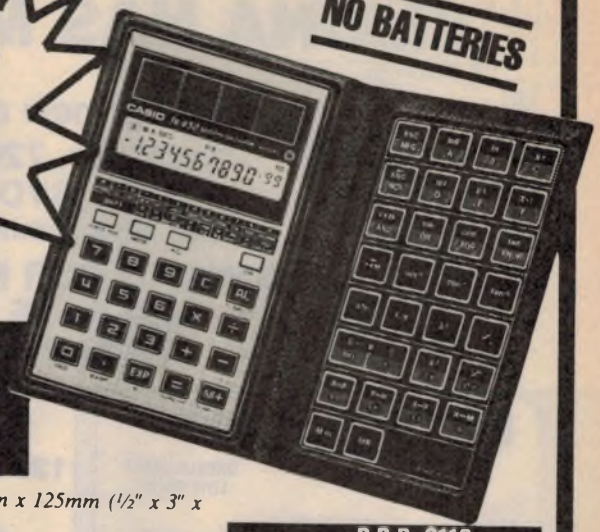

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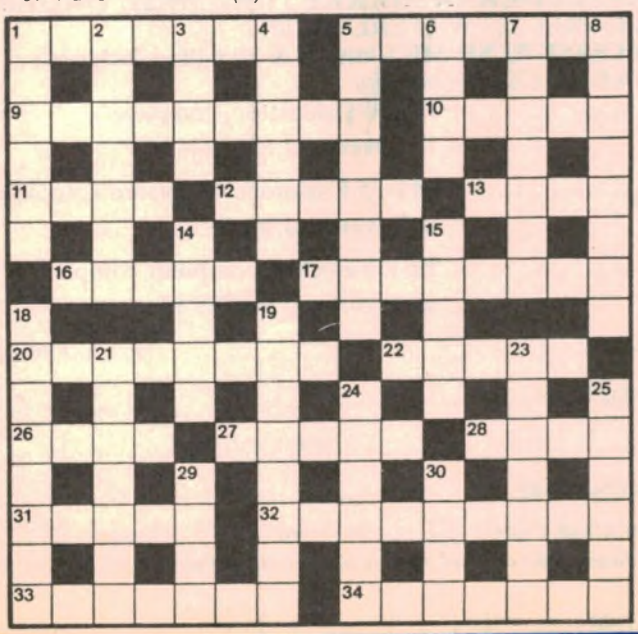
FEBRUARY CROSSWORD

ACROSS

1. *Visual data. (7)*
5. *Electronic component with reduction capability. (7)*
9. *Runs of records. (9)*
10. *Conductors. (5)*
11. *Name assigned to a magnetically significant temperature. (4)*
12. *Light fitting. (5)*
13. *Graphical position. (4)*
16. *Tend to move stylus laterally. (5)*
17. *A very small unit of mass. (8)*
20. *Connecting components. (8)*
22. *Pulse generator. (5)*
26. *Position on a grid. (4)*
27. *A suitable complement to make. (5)*
28. *A bit. (4)*
31. *Said of an inactive metal. (5)*
32. *Unidirectional signal. (5,4)*
33. *Fused solder. (7)*
34. *Magnetic alloy. (2-5)*



DOWN

1. *Additive to a semiconductor. (6)*
2. *Name of a thermoelectric effect. (7)*
3. *Dissipation of energy. (4)*
4. *Word of the phonetic alphabet. (6)*
5. *Computer accessory. (8)*
6. *Electrical unit. (4)*
7. *Device used in a communication system. (7)*
8. *Specification of a pulse. (4,4)*
14. *Sensational skin effect. (5)*
15. *Non-metallic element. (5)*
18. *These are subjected to computational processes. (8)*
19. *Rays discovered by Herschel in 1800. (5-3)*
20. *A radio is normally such. (7)*
23. *Part of an antenna. (7)*
24. *Method of connecting certain networks. (6)*
25. *Tape type. (6)*
29. *Supporters of the Imperial system? (4)*
30. *Wiring harness. (4)*

SOLUTION FOR JANUARY

	A	M	P	L	I	F	I	C	A	T	I	O	N	
C	A	E	U		A		I		V		E			
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Devotional songs

Tom Netherton: Scrap Book. Stereo LP, Word SPCN7-10-891510-4. From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135. Phone (03) 729 3777.

Tom Netherton, billed on the jacket as "one of Gospel music's favourite recording artists", has a pleasant baritone voice with excellent diction, and is capably backed here by a rhythm style instrumental group and chorus.

While the album itself is dated 1984, the tracks are re-issues from earlier recordings, one or more of which you may happen to have on hand.

"What a Friend We Have in Jesus" comes from a 1975 album by that name, along with "Shadow of the Cross". "Just as I Am" is the title track of a 1976 album, from which comes also "Amazing Grace". "Hem of His Garment", 1976, contributes the title track — a recent composition, by the way — and "The Cornerstone".

The remaining three tracks come from a 1981 album "Reflection": "The Same Spirit", "The Kingdom of the Lord" and "Depend on Me". Total playing time adds up to about 29 minutes.

As will be apparent, the tracks are a mix of old and new, although the arrangements are basically contemporary. In summary: pleasant family listening. (W.N.W.)

String Serenades

Tchaikovsky — Dvorak: String Serenades. Berlin Philharmonic Orchestra conducted by Herbert von Karajan. Compact disc DG 400-038-2.

Both Tchaikovsky and Dvorak were in relaxed mood when they composed the respective works on this disc — doing what they wanted to do and, in the case of Tchaikovsky, relaxing after an unrelished assignment: the noisy, nationalistic "1812 Overture".

The two serenades were composed in the reverse order to their presentation on this disc. Dvorak's Serenade for String Orchestra in E major, op 22, was produced in just 11 days in May of 1875 and premiered in Prague during the following year. It has five movements and a playing time of about 31 minutes.

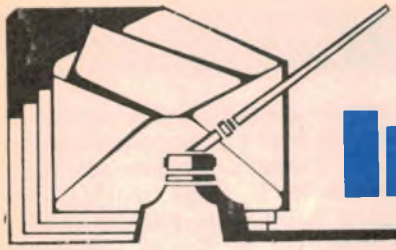
Its mood belongs essentially to the 18th century, in the style of a divertimento: intended mainly to please. Movement (1) Moderato, contains suggestions of folk music; movement (2) Minuet is waltz like, followed by a canon structured Scherzo (3), Larghetto (4) and Finale, Allegro vivace (5).

But, while these terms define the work, they are not essential to its enjoyment.

Tchaikovsky's Serenade for String Orchestra in C major, op 48 came five years after the Dvorak Serenade: composed in 1880 and performed, with ready public acceptance, in 1881.

It has four movements, adding up to 30 minutes in all. Movement (1) Pezzo in forma di Sonatino, is simple and tuneful and is followed by a waltz, which most will recognise immediately and enjoy. Then comes an elegy (3) and a finale (4) built around two Russian themes. Again, you need only to relax and enjoy the music for its own sake.

The sound from the strings of the Berlin Philharmonic is very smooth, very clean and stereo definition is first rate. But a word of warning: the dynamic range is surprisingly wide, so don't expect to enjoy the record in a noisy environment or in the company of a talkative friend. You simply won't be able to hear the pianissimo passages! (W.N.W.)



Information centre

Problems with 40W inverter

Recently I bought a 12/240V 40W inverter (EA, May 1982) kit and find some problems which I hope you may help overcome. Firstly, I was supplied with a PL18/40VA transformer which had two 9V windings. I wired the transformer in and, on turn-on, had severe voltage drop problems.

With an 11W 240V fan the voltage was 190V and with a 30W TV 185V. With the frequency switch set to variable the voltage increased by 20V. In the fixed mode one 2N3055 runs warmer than the other. After checking the circuit I changed the transformer to a PL12/40VA and noticed, with the 11W fan, that the voltage rose to around 230V. With the TV, the voltage was the same.

In the fixed mode the voltages drop to 220V and 210V respectively. I used a Tandy colour burst crystal and changed both ICs, as well as checking all the other components. I would like some advice on the problem of voltage drop, and would welcome suggestions. (D.F., Marsden, Qld).

● First of all, we recommend that you return to using the original transformer for this project. If the rest of the circuit is working properly, and the input voltage is correct, this transformer will provide the correct output voltage.

Make sure that the battery or power supply that you are using is capable of providing 12V at 3 or 4 amps. If this is OK, run the inverter in the fixed mode and measure the voltage across the transformer primary. This should be about 24V AC. Under these conditions the unloaded transformer secondary voltage should be about 275V AC.

Similar results should be obtained using the variable frequency oscillator. If there is still a significant difference, it is most likely due to a fault in this oscillator, since there is nothing to go wrong in the fixed one — either it will work properly or it will not work at all.

It is normal for one transistor to run warmer than the other in the fixed mode due to the slightly uneven duty cycle at the output of IC2 (5369).

Infrared TV remote control

I recently completed construction of your Infrared TV Sound Control but have encountered difficulties. After a number of tests on the transmitter board, I have come to the conclusion that all three oscillators are running at several times the quoted frequencies. Using the specified 10kΩ resistor and .0082μF capacitor, the 10kHz oscillator (IC1d) has a frequency of 50kHz.

Changing the timing capacitor to .047μF or the resistor to 56kΩ gives the required 10kHz frequency.

Similarly, the 5ms and 1ms oscillators give negative-going pulses of about 1ms and 0.1ms respectively every 42ms. I have not experimented with changing component values here as I would like to ask if you can shed any light on these results and confirm that 10kHz is the correct transmitter frequency.

I also note that the signal pulse on the base of the Darlington transistor is about twice what it is on the collector, which again appears to be incorrect unless the current drawn by the infrared LEDs causes this low reading. (K.F., Albion Park, NSW).

● Your problem lies with the 4093 NAND Schmitt trigger IC. It seems that the hysteresis of a 4093 varies according to the manufacturer, something that we were unaware of at the time of

Teletext decoder has the jitters

Recently, I constructed the teletext decoder (August, Sept, '84) and wish to compliment all concerned on its design and, in particular, the printed board layout and quality of manufacture.

There is one problem: when the unit is connected from a National 777 to a Sony Profeel (audio direct from VCR to monitor), a considerable amount of vertical "jitter" is evident when using tape playback.

There is no "jitter" with the teletext unit by-passed or using TV as a source through the teletext unit. Can your technical department assist me in correcting this instability?

I do note a great deal of IC switching is carried out in the video circuits and wonder if this could cause sync pulse distortion and or clipping. A quick check with a Trio CS 1560 scope indicates slight alterations but nothing too serious to complain about. Other than this, the unit works fine and is most useful as an in-home information source. Oh! — one last question.

I have read and used your publication for education and entertainment since 1948. I find at the end of this kit construction how little I know about modern electronics. One constructs something knowing so little as to how it functions. Terminations listed as AHS, HIE, DLIM ring no "bells". For this reason I enjoy reading your projects on valve type radios. The time your technical staff spend on these is very much appreciated. (I.T., Bellevue Park, Qld).

● We are not sure from your letter exactly what you are trying to do, but we assume that you want to play a videotape back through the teletext decoder in the TV mode. That is, merely routing the signal from the VCR through the teletext decoder, into the TV.

Since the system works well with the TV providing the video signal it would seem that there is no major problem with the circuit. It is most likely that the problem lies with the level of video signal which is being used.

We suggest that you use your oscilloscope to compare the video signals obtained from the TV and the VCR. If the signal from the VCR is appreciably different in magnitude compared to that from the TV, this is probably where the problem lies.

If there is no significant difference, then check the components around Q6, Q7 and Q8, as well as the transistors themselves.

publication of this project.

If you were supplied with either the Philips HEF4093B, SSS SCL4093B or Motorola MC1409ZB device, then the following circuit changes should be made: (1) increase the 2.2kΩ resistor on pin 2 of IC1a to 6.8kΩ; (2) increase the 18kΩ resistor on pin 12 of IC1b to 47kΩ; and (3) increase the 10kΩ resistor on pin 6 of IC1d to 33kΩ.

The circuit is correct for the National CD4093BC, RCA 4093B and SGS HCC/HCF4093B types.

The voltage reading recorded at the collector of the BD681 is correct and is simply the saturation voltage of the transistor.

EA Car Burglar Alarm

In the May 1984 edition of *Electronics Australia* you published a Deluxe Car Burglar Alarm project, which I have built and find excellent. This alarm is set to sound for two minutes and then reset. Could you please tell me if there is any way to modify the circuit or change component values so that the alarm would sound for more than two minutes and then reset.

The two minute alarm may be adequate for some but for someone like myself, who is a fair distance from his car most of the day, a longer alarm period gives the owner more chance to hear it. Keep up the good work as we do appreciate it. (J.G., Thornbury, Vic).

● It is quite easy to increase the alarm time for the Car Burglar Alarm. All you have to do is increase the value of either R3 or C2 on the Q output of IC3a. For example, increasing R3 to 1.5MΩ should increase the alarm time by 50%.

There is a limit to how far you can go though. If the capacitor leakage current is greater than the charging current, the alarm will never shut off

Autodim affected by control tones

I have been reading over the last few issues of people having problems with the Autodim project (Jan, 1981). I have built 14 of these dimmers and not had any problems yet, but one!

All 14 of these dimmers have worked successfully first time, though when dimming from full brightness to "off" at some stages the light would fluctuate, not flicker. This occurred at different times during the dimming cycle. This light fluctuation lasted approximately 5-10 seconds: "not much to worry about" you say, but I am using the dimmers to create a false sunrise and sunset in bird avaries and need a stable effect.

I borrowed an oscilloscope from work and checked all waveforms listed in the article; they were found to be correct. Next step was to watch the mains waveform for any deviation: shock horror. At precisely the time when the lights acted up, the mains waveform took on a ripple effect, though still maintaining a 50Hz sine wave.

Since the sync signal is taken directly from the mains could this be upsetting the circuit? I noted that the output of IC1a changed its high & low periods during this time. Is this the carrier signal used by the council to switch hot water services? Would the problem be within the dimmer or could it be the mains? Is there anything else I could check for? (E.B., Busby, NSW).

● The effect that you describe is indeed due to the control tones used by the supply authorities to switch off-peak hot water systems. The control tones have a frequency of about 1kHz and an amplitude of around 20 volts peak-to-peak.

While we have not had any complaints about tones affecting this circuit before, it should be reasonably easy to de-sensitise the circuit. Our suggestion (which we have not tried) is to connect a 10kΩ resistor in series with the signal line from D3 and a shunt .033μF capacitor from pin 9 of IC1a to the neutral line.

Flickering digits on capacitance meter

Some time ago I built your Digital Capacitance Meter (EA March 1980) and have found it to be a very useful piece of equipment indeed. However there is one annoying little problem. The right hand digit flickers rapidly between zero and one. When a capacitor is attached the flickering ceases and all is well, but remove the capacitor and away she goes. This fault only shows up on the Microfarad range; on the other two ranges she is rock steady.

I have noted the errata and made the changes you recommend. I see that I am not the only one who has this problem and I refer to a letter from RRE of Panawonica, WA in the Information Centre page 141 of November 1981 EA. I followed your suggestions to that writer and would swear that everything relating to switch S1b is OK. Can you help me with this please. (W.Y., Belmont, NZ)

● The flickering of the least significant digit which you describe is quite normal for this project. This only happens when there is no capacitor connected to the Cx terminals, and only when in the μF range. This occurs because the auto nulling circuit is switched out when this range is selected.

While we agree that this may be

mildly annoying, be assured that it is not due to a fault of any kind. We feel that the minor nature of the problem does not warrant any modifications being made.

VHF-UHF conversion for B&W TV set

I have a Princess colour TV set which I was told will not work in conjunction with a computer as it does not have UHF channel selection. I would like to modify the antenna board and/or the VHF tuner to accommodate a computer input without the expense of removing the existing VHF tuner and substituting a UHF tuner. Could you advise me if this is possible and provide me with a schematic diagram for this alteration. (H.P., North Ryde, NSW).

● It is not practical to convert your VHF only television into a combined VHF/UHF receiver. By far the simplest solution is to purchase a ready made UHF-VHF down converter.

A more satisfactory result could be obtained by feeding composite video directly into the TV. This was explained in some detail in the article on the video amplifier which appeared in the August 1983 issue of this magazine. It would seem from the portion of the circuit diagram that you sent that your set is an ideal candidate for this conversion.

Forum . . . continued from page 97

copiers to produce ozone in harmful quantities.

My first reaction was to dismiss the warning as alarmist. But then copiers do involve high voltage circuitry and it would not be unreasonable to expect some ozone to be generated as a result. For sure, I had not noticed it but then the copiers that I had been involved with have always been in an open-office situation.

However, the very first person that I questioned had a quite different view. Two copiers at her place of employment were in a small room and the "fumes" had proved so distressing to those needing to use the copiers that an exhaust system had had to be installed!

Would the "fumes" have been ozone?

How could she know? But they would certainly have answered the description in the panel: pungent like bleach, etc.

Faced with two extremes of opinion, I called up a friend who spends most of his time servicing copiers of all shapes and sizes. His observations were most enlightening.

There were some copiers, he said, that gave no evidence of ozone. Others produced only a faint hint of the gas, noticeable mainly in a confined space. But a few were really bad and these were the ones that some unionists had taken a stand against.

"Were they old models or odd brands?"

"Not necessarily either."

"Can you do anything to reduce the ozone emission when you service them?"

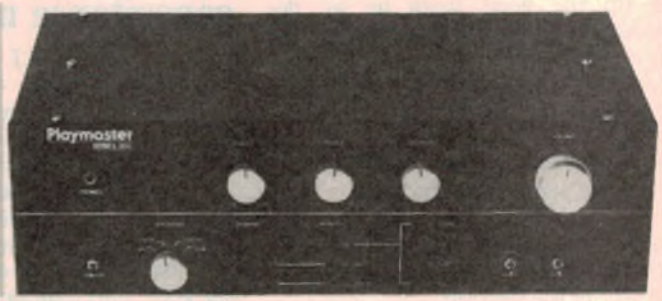
"I clean them and I do whatever has to be done but I wouldn't know where to start to reduce the ozone emission. My impression is that it is a function of the original design, the level of high voltage, and so on. Some designers have been concerned about ozone emission; others seem to have ignored it."

A few more minutes of this and I had a distinct feeling of deja vu. That's when I took another look at the 1981 article.

But whereas, in the '70s, a small-time manufacturer of ion generators might understandably be caught out by ozone emission, it seems strange that, in the '80s, similar complaints, on a much larger scale, should have to be directed at the designers of some office copiers.

As for the complaint about carbon black, I wouldn't know. These days, one encounters so many warnings about the things one drinks, eats, uses or wears: they're either illegal, immoral or carcinogenic!

Next month in Electronics Australia*



PLAYMASTER SERIES 200 STEREO AMPLIFIER

The second article on this amplifier was delayed due to our recent office reorganisation. Next month, we will present the full circuit details and give the specifications.

AM STEREO FEATURE ARTICLE

Now that AM stereo is a reality in Australia, you will want to know how it works, which stations are broadcasting stereo and what tuners are available. March EA supplies you with all the details.

MISSION DAD-7000 CD PLAYER REVIEWED

Widely acclaimed in Europe, this CD player is now available in Australia. EA takes a close look.

AUSTRALIAN HIFI INDUSTRY AWARDS

Next month we will announce the winners of the inaugural hifi awards

STEREO TV TUNER

Here's what you've been waiting for: a complete stand-alone stereo TV sound receiver with inbuilt VHF and UHF tuners and featuring loudspeaker outputs, audio line level outputs, composite video output and a modulated RF output. Other features include a stereo indicator LED, mode selector and preset tuning.

**Although these articles have been prepared for publication, circumstances may change the final content.*

L. E. CHAPMAN

122 PITT ROAD, NTH CURL CURL.
MAIL ORDERS: BOX 156, DEE WHY, NSW. 2099.
TELEPHONE 93-1848.

SUPER SPECIAL
BSR GRAMO MOTOR AND PICKUP 240V

3 speed 33-45-78 includes cartridge and stylus turnover

$12

P&P NSW $2.75
INTERSTATE $4.20
WA, NT $5.20

SUPER SPECIAL
FM STEREO KITS

Sets of 3 modules includes FM tuner decoder and if detector. Circuit diagram supplied

ONLY $22 PP $1.40

Send stamped envelope for copy of Electronics Australia magazine review of the units.

SPECIAL
BALANCE METERS
CENTRE ZERO

$2 PP $1

6P VALVE SOCKETS
9 pin 25c — 7 pin 25c — octal 25c.

SPECIAL
DUAL VU METERS

$3 PP $1

VALVES

EF86	$4.00	VT128-955	$5	7V4	$4
12AX7	$4.00	CV423	$4	6CM5	$6
12AU6	$4.00	B79	$4	6CU5	$5
12AX7	$4.00	EM84	$5	IL4	$4
6BM8	$3.00	VR101-102/280	$4	6BW7	$4
6BL8	$3.00	IC4	$5	6AT6	$4
6BQ5	$4.00	EL37	$12	6BA8	$4
6K8	$10.00	ID8	$4	6GW8	$5
6K7	$7.00	41	$6	6BD6	$4
5AS4	$4.00	42	$6	6AM6	$4
6V6	$10.00	6B7	$6	6BF5	$4
6AL3	$4.00	80	$6	00V03	$6
6GV8	$4.00	6F6	$10	12AV6	$4
6SA7	$5.00	6BX6	$4	12AN7	$5
6Y9	$4.00	6BD7	$5	12AQ5	$6
6BE6	$5.00	6HG8	$5	IA3	$4
6BH5	$5.00	6AX4	$5	6AD8	$5
IT4	$2.00	6QD6	$6	6CW5	$5
6AV6	$3.00	6CW7	$3	2E26	$7
1D8	$4.00	IC7	$5	5Y4	$6
VT121-955	$5.00	IK6	$5	5V4	$6
ECH33	$7.00	IM5	$5	2525	$4
6CBVT163G	3.00	6EH7	$4	6BK7	$5
VT66	$5.00	6DX8	$4	30AE3	$4
6H6	$4.00	6AW8	$5	6BV7	$5
6V4	$5.00	6W6	$5	3O4	$4
6U7	$7.00	6V9	$5	6C8	$4
IS2	$3	6EJ7	$4	VT66	$4
6V4	$3	6ES8	$4	6BD6	$4
6AQ5	$6	6BH8	$5	12BY7	$5
6BU8	$4	6CQ8	$5	6BZ6	$4
6N3	$3	IX2	$4	57	$5
6X9	$5	6S2	$3	58	$5

SPECIAL

12 mixed switches $4 PP $1.40 not a lucky dip, c wot u get!

POTS ROTARY

½ Meg	50c	10K Switch	50c
1 Meg	50c	250K	30c
100K	30c	50K	30c
100K Switch	50c	20K	30c
50K Double Pole Switch	50c	10K Min Pots	25c
7.500	30c	50/ohm	50c
Extra Pots ¼mg LIN	50c		
½ or 1 Meg Switch	50c		

½ 1 meg dual Concentric tapped at 100K $1
2 meg ganged double pole switch $1
1.5 meg dual ganged 50c 2 meg ganged log $1
1 meg dual ganged $1 ½ meg dual ganged LIN 75c
25K 50K dual ganged Concentric double switch $1
100K dual ganged linear pots 75c
200K single line 30c 10K sub min log pots 50c
20K wire wound 75c 250K ganged pots 75c
dual log 10K 75c 25K in ganged pots 75c

PYE TV TUNERS
FOR B/W TV SETS **$7**

PP NSW $1.80; VIC $3.60; QLD $3.60; TAS $4; WA $5.

MICRO SWITCHES
5A 250V 50 cents

SLIDE POTS

½ meg dual	$1	1K dual	$1
1 meg dual	$1	50K single	50c
2 meg dual	$1	250K single	50c
25K dual	$1	10K single	50c
250K dual	$1	2 meg single	50c

TOUCH MICRO SWITCHES
As used in front control panels in colour TV sets.

4 FOR $1

SPEAKER
2-way crossover networks
30 WATTS RMS **$2**

CRYSTALS for colour TV $1 each

SPARK GAPS
10 for $1

THERMISTERS
4 for $1

DIODES BY 406
10 for $1

455KC IF Trans for valve radios
$1 each
OS coils 75c each

CAR RADIO Suppressors
5 for $1

SPECIAL
Chrome ¼ shaft push-on knobs. 10 for $1. Usual price 60c to 80c each

IC SOCKETS

24 pin	35c
28 pin	40c
18 pin	25c

Slide pot knobs
10 for $1

TRANSISTORS AD161-162 $1 pair
100 mixed Capacitors, fresh stock, all handy values $2 AD149 $2 pair
100 mixed resistors, handy values $2

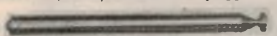
STICK RECTIFIERS
TV 20-SC $1 each

AM FM TUNING CAPACITORS
$7

4 PIN SPEAKER SOCKETS
4 for $1

FERRITE RODS
8in x ¼in with coils $1.50

TELESCOPIC AERIALS
Opens up to 38 inches $1.50



PICKUP CARTRIDGES
Ceramic BSR Turnover Stylus universal type $5

TOGGLE SWITCHES
4 FOR $1

CELLULAR HORN TWEETER HT.3

Mounting Specification p.p. $1.40
12.5cm x 7.1cm
Frequency Range:
2000 — 20,000Hz
Impedance: 8 Ohms
Sensitivity: 105 dB
Maximum Power:
30 Watts

Capacitors ELECTROS

2500 16V	4 for $1
220 16V	4 for $1
1000 UF 50V	each $1
1000 UF 63V	each $1
22 UF 160V	3 for $1
1000 UF 16V	each 50c
63 UF 25V	5 for $1
470 UF 63V	each 50c
47 UF 160V	3 for $1
470 UF 25V	4 for $1
40 UF 25V	5 for $1
470 UF 40V	3 for $1
47 UF 10V	10 for $1
100 UF 25V	5 for $1
25 UF 25V	10 for $1
470 UF 16V	5 for $1
220 UF 50V	each 50c
47 UF 200V	each 50c
1000 UF 10V	4 for $1
2.2 UF 200V	4 for $1
22 UF 16V	10 for $1
330 UF 63V	each 50c
1MFD 50V	10 for $1
33 UF 10V	10 for $1
33 UF 10V	10 for $1
1MFD 50V	10 for $1
33 UF 10V	10 for $1
0.0039 1500V	each 50c
6N8 1500V	each 50c
220 UF 35V	4 for $1
1000 UF 25V	each 50c
680 UF 50V	each 50c
22 UF	10 for $1
100 UF 6.3V	10 for $1
330 UF 25V	3 for $1

2000mfd 25V chassis mount $1
50mfd 400V chassis mount $1
Dual 75mfd 65V 20mfd 450V chassis mount $1

Transistor TV Tuner
MSP 46300-5
11 volt

$10 p.p. $1.40

4 POSITION PUSHBUTTON SWITCH
$1.00

MAGNETIC PICKUP CARTRIDGE
Diamond Stylus ES70SH Goldring $15

DIODES

AN752	4 for $1	OP478	10 for $1	OA662	4 for $1
DS150A	75c	IN5059	10 for $1	BY188A	3 for $1
BY223	4 for $1	IN4001	10 for $1	AT324	4 for $1
BA244	4 for $1	OA645	50c	AT347	4 for $1
DS230	$1	BAX18	10 for $1	AT322	4 for $1
BA219	6 for $1	BA217	4 for $1	C1051H	each $2
DS130	4 for $1	AN755	10 for $1	2SB405	50c
0404	4 for $1	B279	10 for $1	2SB303	50c
BAV18	10 for $1	OP478	10 for $1	IN4001	10 for $1
DS130Yb	30c	546	50c	OA626	4 for $1

JACK PLUG SOCKETS

2.5mm	5 for $1
3.5mm	4 for $1
6.5mm	3 for $1

TOGGLE SWITCHES 4 FOR $1

HOR OS COILS
for B & W TV sets $1

TRANSISTORS

OC9554	75c	B234C	50c	BY84	4 for $1
OC987	50c	BS140	50c	DS113AC	$1
OC988	50c	BS14E	50c	BD202	50c
OC968	50c	D330D	50c	BD139	50c
OC967	50c	D33E	50c	2SB186	50c
OC9304	4 for $1	B514D	50c	25C154B	$1
AC128	50c	BD202	50c	AS128	50c
608DK	4 for $1	BC548	50c	BF494	50c
BF469	50c	OA626	4 for $1	A437	50c
AC187	50 cents	OA662	4 for $1	2SB77	50c
Sanyo DS18	$1	BY188	3 for $1	2SB75	50c
C1048C	$1	AT324	4 for $1	BP559	50c
BC559	50c	AT347	4 for $1	BE549	50c
2SB274V	$2	AT322	4 for $1	A2090	50c
D400	75c	C1051H	each $2	106F1	50c
RD516	$2	2SB405	50c	2SA15	50c
C875F	$1	2SB303	50c	2350	50c
OC9524	$1	OC955	75c	2SA351	50c
OC9524	$1	OP57	50c	B544	50c
C106F1	50c	2N1111	50c	C1048P	$1
OC957	75c	BP139	50c	2N2175	50c
BA2622	50c	2SB407	$2	B1135	50c
				BF245A	50c

POWER TRANSFORMERS
240V pair 25V taps
260V
117V **$10**

MUTING SWITCHES
EBM209 4 for $1

CONTACT SWITCHES
EBM3320 4 for $1

SPEAKER SPECIALS
PP: NSW $2.80; INTERSTATE $4.20; WA/TAS/NT $7

MSP	8 inch dual cone 8 Ohm 12 Watt	$8.00
MSP	9 x 7	$6.00
	5 x 7in 8/or 15 ohm	$4.50
	8 x 4 8/or 15 ohm	$4.50
	6 x 4 8/or 15 ohm	$4.50
	6 x 4 8/or 15 ohm	$3.50
	6 inch dual cone	$6.00

	5 inch dual cone 27/ohm	$5.00
	4 inch 27/ohm	$4.00
	4 inch 4/ohm	$4.00
	5 inch 4/ohm	$4.00
	5 x 4/ohm	$4.00
	Tesla Mini woofer 4 or 8ohm 4 inch	$5.00 each
	10 watts	
Mini woofer mid range	4 inch 10 watts RMS 4/or 8/ohms	$10 pair.

Colour convergence coils
Delta 11270 ..... $5

Hor Drive Transformer for Colour TV — 3021, 39/6 ..... $3

240V 285 ASIDE 6.3 60ml $10
pp: NSW $3; Qld, Vic. $4.80; Other States $7.

240V 150v 6.3/30mil $6
pp: NSW $2; Qld $4; Vic $4; Other States $6.

Power Transformers
240V 2 amp 30V 12V $10
Prim 240V sec-240V 60MA $5
pp: NSW $2; Qld, Vic. $4.80; Other States $6.

Minituning capacitors 50c
Sub mini **75c**

Infra Red Audio Transmitter
for colour TV
3102-108-50301

$7

$6

Video Det & AFT
3102-108-58741

SPECIAL! TRANSISTOR EAR PIECES
with plugs & leads — top quality in sealed plastic packets

4 for $1

SHIELDED LEADS
3.5 to 3.5MM 7ft $1
6.5 to 3.5MM 7ft $1
6.5 Single ended 50c

EA marketplace EA marketplace

FOR SALE

AMIDON FERROMAGNETIC CORES: Large range for all receiver and transmitter applications. For data and price list send 105×220 SASE to: R.J. & U.S. Imports, PO Box 157, Mortdale, NSW 2223.

EX-ABC AUDIO TAPES: ¼" wide on 10½" metal spool, $6.85; plastic spool, $5.85; 7" spool, $2.25; 5" spool, $1.25. Post extra. Also in stock: ½", 1" and 2" tapes. Waltham Dan, 96 Oxford St, Darlinghurst, Sydney. Phone (02) 331 3360.

8 INCH DISKETTES: SSSD, IBM Part No. 2305830C. Have had very little use. 108 for sale, $3 ea. (02) 799 1926 after 6 pm.

TRANSISTORS: BC546, 547, 548, 549, 556 & 557 all 15¢ each. Special, below cost, SGS 2N3055 65¢ each. Limit 5 per order. BD139 30¢ ea. PUT 2N6027 60¢ ea. Post and pack $1.00 to LMF Products, PO Box 384, Cootamundra, 2590.

CHEAP ELECTRONIC COMPONENTS: Low as 4¢ each polycaps, electros, diodes, 2¢; resistors — 70¢ per 100 same. Croc clip jump leads $1.90 per 10. 500 mix resistors $2.95. Postage 50¢. Send for free list. Diggerman Electronics Box 33, Coramba 2450.

MAGAZINES: EA/RTVH Jan 59-Dec 79 (2 missing) ETI April 71-Dec 79 (3 missing) High Fidelity Aug 79-June 83 (3 missing) Sold as 3 lots. Phone Rick (03) 606 7637

DISPLAY ADVERTS IN MARKETPLACE are available in sizes from a minimum of 2cm × 1 col rated at $15 for a col cm. Ad sizes may be increased up to a maximum of 10 col cms.

CLASSIFIED RATES $3.60 for 40 letters or part therof per insertion payable in advance. Minimum 80 letters.

CLOSING DATE is six weeks prior to the on-sale date. Issues are on sale the first Monday of each month.

NEW RADIO VALVES: For entertainment or industrial use. Waltham Dan, 96 Oxford St, Darlinghurst, Sydney. Phone (02) 331 3360.

DIGITAL THERMOMETERS
FULL KIT – $49.95 INC. ASSM PROBE, 'PAC TEC' CASE & FRONT PANEL ASSEMBLED & GUARANTEED – $74.50
MINIATURE 3½ DIGIT D.V.M. MODULE (10mm HIGH DISPLAY)
FULL KIT – $27.95 ASSM & TESTED – $35.95
P.C.B & DATA – $7.95 TCS 7106 D.V.M. CHIP – $11.95
LARGE 3½ DIGIT L.C.D. DISP – $8.95
ALL PRICES INCLUDE S/TAX POST & PACK ADD $2.75 PER ORDER BANKCARD ACCPETED.
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SUITE 10, 4TH FL. 422 COLLINS ST MELBOURNE 3000 PH: 67 9619
TELEX: AA30625 (ME 1830)
LIC Instruments

R.C.S. RADIO PTY. LTD.
Established 1933
IS THE ONLY COMPANY WHICH MANUFACTURES AND SELLS EVERY PCB & FRONT PANEL published in EA and ETI
651 Forest Road Bexley 2207 AUSTRALIA
RING (02) 587 3491 FOR INSTANT PRICES
24-HOUR TURNAROUND SERVICE

48 HOUR PCB SERVICE
Single Sided . . . . . 5c per cm²
Double Sided . . . . . 9c per cm²
(Minimum 100cm²)
DRILLING (0.8mm) . . . . . 2c per hole
Send artworks on film or transparency P&P $2.00
J.W.D. ELECTRONICS
PO Box 341
Riverstone, NSW 2765
Phone (045) 73 6097

A basic text for the electronics enthusiast . . .
BASIC ELECTRONICS
Available from "Electronics Australia", 140 Joynton Avenue, Waterloo, Sydney, 2017. **PRICE $4.50** OR by mail order: Send cheque to "Electronics Australia", PO Box 227, Waterloo, 2017. **PRICE $5.40.**

An offer you can refuse . . . . . ?
- FREE POSTAGE
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- FREE CATALOGUE WITH EVERY PURCHASE.
- ALL E.A. AND E.T.I. P.C. BOARDS (All Boards tined)

ACETRONICS P.C.Bs.
112 Robertson Road,
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Electronic Components
PC Boards, Computer Repairs
OPEN 7 DAYS
(02) 621 5809
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CQ ELECTRONICS

DO YOU WANT TO BE A RADIO AMATEUR?
The Wireless Institute of Australia, established in 1910 to further the interests of Amateur Radio, conducts a Correspondence Course for the A.O.C.P. and L.A.O.C.P. Examinations conducted by the Department of Communications. Throughout the Course, your papers are checked and commented upon to lead you to a successful conclusion.
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THE COURSE SUPERVISOR
W.I.A. (N.S.W. DIVISION)
P.O. Box 1066
PARRAMATTA, N.S.W. 2150.

projects
e-circuits

Number 3

THE CONTENTS:

Audio, Video Projects
Video Amplifier for Computers and VCRs; Video Enhancer; Vocal Canceller; Stereo Simulator for Tuners and VCRs; Guitar Booster for Stereo Amplifiers.

Automotive Projects
Transistor-Assisted Ignition System; Breath Tester Checks Blood Alcohol Level; Low Fuel Warning Indicator; Speed Sentry for Cars; Audible Turn Signal Indicator.

Mains Power Control Projects
Musicolour; Photographic Timer; Driveway Sentry; Touch-Lamp Dimmer.

Power Supplies & Test Equipment
Battery Saver for Personal Portables; Dual Tracking ±22V Power Supply; 3½-Digit LCD Capacitance Meter; In-Circuit Transistor Tester.

Miscellaneous
Nail Finder; Portable 3½-Digit Heart Rate Monitor. 10 Year EA Project Index.

Available from "Electronics Australia", 140 Joynton Avenue, Waterloo, Sydney, 2017, **PRICE $4.50** OR by mail order: Send cheque to "Electronics Australia", PO Box 227, Waterloo, 2017, **PRICE $5.40.**

A.C.E. RADIO ELECTRONICS CENTRE

136 VICTORIA RD, MARRICKVILLE, NSW 2204.
PHONE 51 3845.

PROUD TO BE AUSTRALIAN

* SUPA-DUPA SCOOP *

EX-REUTERS

PROFESSIONAL COMPUTER VIDEO DISPLAY UNIT

THE MONITOR IS NOT TESTED ● BUT IS IN GOOD CLEAN CONDITION ● AND WE DO GUARANTEE THE DISPLAY HAS A GOOD PICTURE TUBE AS WITH ALL OUR SUPA-DUPA SPECIALS THIS IS A **REAL BARGAIN**

32cm B/W (sorry it isn't colour) ● Video in/video out ● 75 Ohm switchable ● Solid state circuitry ● Controls — Push on/off ● Contrast ● Brill ● Vert hold ● Hor hold ● Height ● Vert lin ● Inbuilt circuit breaker ● 220VAC 50Hz

$35 P-P NSW $7.50 Q, SA, V, T $10.50 NT, WA $13.50

TEXAS TIL 139

Source and Sensor Assembly ● Gallium arsenide LED and PNP silicone photo transistor ● Can be PCB mounted

P-P $2

75c EACH **10** FOR **$6.00**

CRYSTAL

3.579545 MHz. Mini Solder in.

95c P-P 75c

JUMBO SIZE FIBREGLASS

PRINTED CIRCUIT BOARD
A1 QUALITY 365 x 330mm

$5.35 NSW $2 P-P INTERSTATE $3.50

34 WAY SHIELDED CABLE

High Quality ● PVC Covered ● Very Flexible ● Diameter 10mm ● 8 Colours ● Multi Strand

$2.50 PER METRE P-P 80c

A AND R POWER TRANSFORMER

Primary. Tapped from 200v to 250v 50Hz.

Secondary. 0—20, 30,48v 2 Amps.

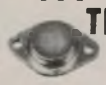
Size 95 x 80 x 85mm

$9.95 P-P NSW $3.50 INTERSTATE $5.50

TIMER 555

10 FOR **$2.95** P-P $1.50

A1 QUALITY TRANSISTORS 2N3055



10 FOR **$6.** P-P $1.50

GEARED MOTOR

240VAC 50Hz 3W

$3.50 PP 75c

5 RPM Plenty of torque With Cam and N/O N/C microswitch 15 switch contacts per min OA size 65 x 60 x 35mm

●HOLE PUNCHES●

TOP QUALITY IN METAL CASE

OK for steel up to 22 gauge, aluminium 16 gauge ● 5 sizes 12, 16, 19, 22, 25mm includes 3-14mm tapered reamer.

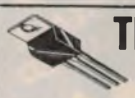
$15.95 NSW $3 P-P INTERSTATE $4.50

REGULATORS

7812. + 12V 1A
7805 + 5V. 7905 – 5V 1A

10 MIXED **$6.** P.P. $1.50

TRANSISTORS TIP 31-32C

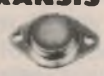


100V 1A 40W

10 FOR **$9.50** P-P $1.50

2SD200 = BU205 TRANSISTOR

NPN VCBO 1500V ● VCEO 700V ● 2.5 AMPS

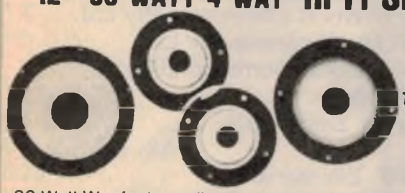


4 FOR **$3.75** P-P 75c

MAGNAVOX ... MAGNAVOX ... MAGNAVOX ...

LOOK ... ONLY $19.50 FOR THIS TOP QUALITY 8 OHM

12" 30 WATT 4 WAY Hi Fi SPEAKER SYSTEM



OR **$35** PAIR

That's 8 Speakers ... 2 Woofers ● 2 Midrange ● 4 Tweeters.

P-P. NSW. 1 Set $3. 2 Sets $4.
INTERSTATE 1 Set $5.50. 2 Sets $7.

30 Watt Woofer has rolled foam surround and big Ferrite Magnet — extra good bass and nice clean highs. 3 way crossover network to suit. $14.95 ea. Heavyweight innerbond acoustic packing $4.95 sq m.

BD 139-140 TRANSISTORS

10 FOR **$3.35** P-P $1.

MJE 3055 TRANSISTORS

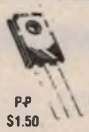
10 for **$9.** P-P $1.50

INTEGRATED CIRCUITS

P-P 75c

TYPE 6802P	$3.50
TYPE 6821	$1.95
TYPE 2708	$3.95

MJE 2955 TRANSISTORS



P-P $1.50 **10** FOR **$12**

BSR STEREOPHONIC RECORD CHANGER

(BE QUICK — THEY ARE ALMOST EXTINCT)

Latest Model ● 240VAC 50HZ ● Auto/Manual Operation ● 3-Speeds ● Big Platter ● Cue Lever ● Magnetic Cartridge ● 2 Spindles ● Instructions ● 4 Pole Motor ●

$79.95 P-P NSW $3.50. Q. V. SA. T. $5.50, WA, NT, $8.50

POWER TRANSISTORS

140V 20AMP
MJ15003 NPN
MJ15004 PNP

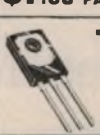
$7.90 PAIR P-P $1

HI-POWER BRIDGE RECTIFIER

400 PIV 25 AMP **$3.75** P-P 75c

400 PIV 35 AMP **$4.75**

TRANSISTORS



BD135 NPN. 45V, 1A, 8W
10 FOR **$1.95** P-P $1

50 WATT RMS SPEAKERS

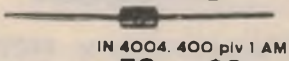
FOR **$39.95** PAIR OR $22.50 EA.

ETONE FACTORY SCOOP.

30cm 8 Ohm Hi-Fi Woofer. Rugged Top Quality with Warranty. Foam Surround. 3.5cm V.C. Hefty Ferrite Magnet. Freq. Response. 35–4500 Hz.

P-P NSW for one, $3.50. Interstate. $5.00. P-P NSW for two, $5.00. Interstate, $7.00

DIODES



IN 4004. 400 piv 1 AMP.
50 FOR **$2.50**

IN 5404. 400 PIV 3 AMP
50 FOR **$7.50** P-P NSW 80c INTERSTATE $1.20

5mm LEDS 20 FOR ...

GREEN **$3.50** RED **$2** P-P 80c

ADVERTISING INDEX

FROM HOBBYIST TO PROFESSIONAL – FLUKE MUST BE YOUR FIRST MULTIMETER CHOICE FOR FEATURES, QUALITY AND VALUE

FLUKE MULTIMETERS CARRY A ONE YEAR MINIMUM WARRANTY AND ARE BACKED BY COMPREHENSIVE SPARE PARTS, CALIBRATION AND SERVICE

1 8050A
• 4½ digit bench portable • 0.03% basic accuracy • 10uV, 10nA, 10mohm sensitivity • True RMS to 50kHz • dB with 16 reference impedances • Relative reference for comparing values • Mains/Battery option

8010A 8012A (similar to 8050A)
• 8010A has 10A range and true RMS • 8012A has low ohms (0.001ohm resolution) • Both have conductance • Mains/Battery option

2 8020B
• 3½ digit • 0.1% basic accuracy • Eight functions including conductance • Continuity beeper

3 8021B 8022B
• 3½ digit • 0.25% basic accuracy • Diode test • Continuity beeper (8021B only)

4 8024B
• 3½ digit • 0.1% basic accuracy • 11 functions including temperature with K type thermocouples • Peak hold on voltage and current • Logic detection and continuity testing • Audible and visible indicators

5 8026B
• 3½ digit • 0.1% basic accuracy • True RMS to 10kHz • Conductance to 10,000Mohm • Diode test and continuity beeper

6 8062A
• 4½ digit • 0.05% basic accuracy • Similar to 8060A without counter and dB • Relative reference • True RMS to 30kHz

7 8060A
• 4½ digit • 0.05% basic accuracy • True RMS to 100kHz • Frequency counter to 200kHz • dB and relative dB • Microprocessor self diagnostics • Relative reference for comparing values • Direct resistance to 300Mohm

LOW COST 70 SERIES WITH ANALOG & DIGITAL DISPLAY

3 YEAR WARRANTY

8 73
• 3200 count display • 32 segment bar graph • 18 ranges • Automatic power down • 10A current range • Autorange • 0.7% basic accuracy • 2000 hour battery life

75
All the features of the 73 plus:
• Audible continuity tester • Autorange/ Range hold • 0.5% basic accuracy • Low mA range

77
All the features of the 75 plus:
• Touch Hold function • 0.3% basic accuracy • Multipurpose protective holster

ACCESSORIES INCREASE THE VERSATILITY OF YOUR FLUKE MULTIMETER

An extremely wide range of accessories is available for your Fluke multimeter

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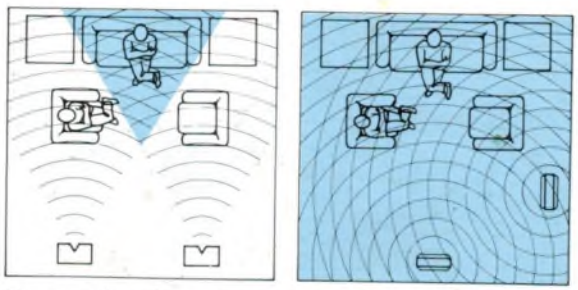
Until Grumpy bought BES speakers, only Snow White enjoyed the stereo.

No matter how good conventional loudspeakers are, they all suffer from a huge disability: there's only one spot in the room where the full stereo effect can be heard.



Conventional speakers **BES speakers**

BES electro-acoustic speakers overcome the problem. Instead of producing two "cones" of sound, BES speakers radiate sound in every direction. This means that no matter where you are in the room, you still hear the music in stereo with perfect clarity.

BES speakers start at $990 a pair.

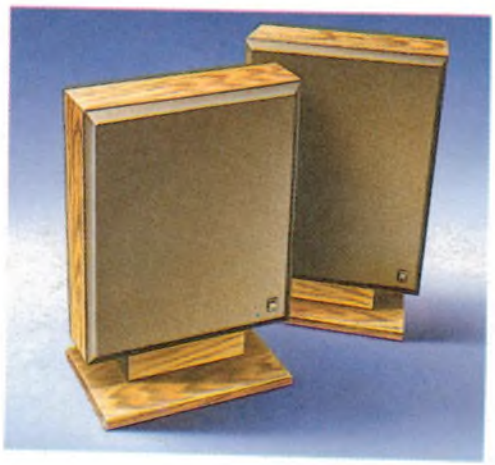
You can connect them to almost any make of amplifier with a rated output of up to 250 watts RMS. They will faithfully reproduce your music with solid bass response, smooth mid-range and crisp high frequencies. All this from a slim, graceful enclosure that complements your furniture and decor rather than overwhelming it.

No more do you have to put up with those big, ugly boxes.

The remarkable performance and slim lines of BES speakers are the result of years of dedicated research by acoustic designer Professor Jose Bertagni.

Abandoning clumsy, old-fashioned cone speakers, Bertagni developed a specially moulded Soniflex™ diaphragm, energized by acoustic "hammers", to give exceptional clarity, expanded dynamic range, lower distortion and greater power-handling capacity.

And the full performance is heard in stereo wherever you sit, stand or lie. No matter what furniture is in the way.



Do yourself a favour. Listen to a demonstration of BES loudspeakers soon.

After all, why should Snow White have all the fun?

BES speakers

Give everyone the best seat in the house

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