AUG. 1980
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eti
ELECTRONICS TODAY INTERNATIONAL

TURNTABLE TECHNOLOGY
Inside the modern turntable

LED Tacho
Super car project

DIGITAL CLOCK PROJECT
Has 60mm high display

Digital Frequency Meters
How to choose, how to use

Hi-Fi: FM's booming - new Rotel receiver reviewed

plus - Dick Smith mini speakers, how good?

A new dynamic generation of Maxell tapes.

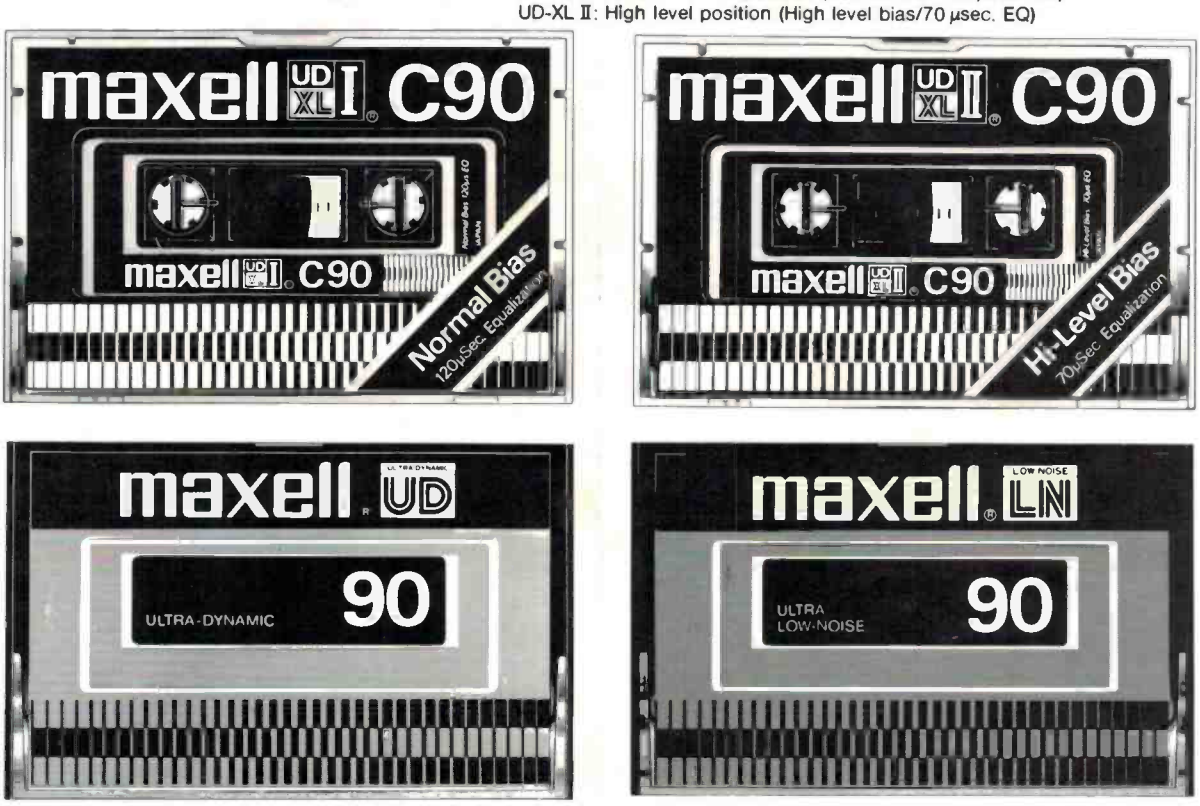
When Maxell announces an improvement in the quality of its tape, you can bet the improvement has to be pretty dynamic. In fact, we think our new generation has even gone beyond our own standards of superior sound reproduction.

Take our high level (CrO_2) position tape — the UD-XL II. Maxell engineers have succeeded in expanding its dynamic range in the middle-low frequency range by 1 dB, while also pushing its sensitivity by 1 dB in the high frequency range. Then look at our normal position UD-XL I, UD and LN tapes — our engineers expanded the dynamic range at all frequency points, while also boosting output in the high frequency range. The new dynamic range, of course, allows for better music reproduction even for LN-type tapes.

On the UD-XL I and II, we also added an exclusive shell stabilizer for significantly improved tape running and track positioning.

One thing hasn't changed on all Maxell tapes — our functional features like 4-function leader tape, replaceable index labels for UD-XL series tapes and Maxell's through-production system — your guarantee of quality and superior sound reproduction.

Tape selector position UD-XL I, UD, LN: Normal position (Normal bias/120 μsec. EQ)
UD-XL II: High level position (High level bias/70 μsec. EQ)



For details on all Maxell Recording Tape write to
Maxell Advisory Service, P.O. Box 307, North Ryde, N.S.W. 2113

Available time length UD-XL I: 60, 90 min./UD-XL II: 60, 90 min.
UD: 60, 90, 120 min./LN: 60, 90, 120 min.

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simply excellent

WT126/79

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eti ELECTRONICS TODAY INTERNATIONAL

QUICK INDEX

THE CHICAGO Consumer Electronics Show, held each year in June, is the biggest of its kind in the world, attracting 50 000 people from all over the world. Every year a more fantastic array of products is presented — want a pair of $20 000 loudspeakers, a $10 000 satellite TV receiver system, a voice controlled TV, a solar powered radio? It's all there. Dennis Lingane, who reports in this issue on the 1980 show, has a few caustic observations to make on the crazier aspects of the industry. Some products — like power saving devices — obviously do play a useful role, but others seem to be produced solely to extract money from " . . . bored people who want new toys, and want to keep ahead of the Joneses." Is the demand for high-priced, high technology toys a real or created one? I fear it's the latter.

The craziness of this phenomenon was thrown into sharp relief for me by a local news story about a University of NSW research team whose research into breast cancer detection has come to a standstill for lack of funds. They don't need huge sums of money — just $15 000 or so to buy an essential X-ray camera. Meanwhile, $300 000 worth of other equipment lies idle as Dr Veronica James, of the University's School of Physics, struggles to build the camera herself (acting as her own mechanic and electronics technician!). It seems that grants for this sort of research tend to be the absolute minimum — any less and the research can't go ahead at all.

So there's lot of money for 'toys' but none for health research. Where are our priorities?

Roger Harrison
Editor

advertisers

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COVER

Cutaway view inside a modern direct drive turntable. Picture courtesy of Pioneer. Cover design by Ivy Hansen.

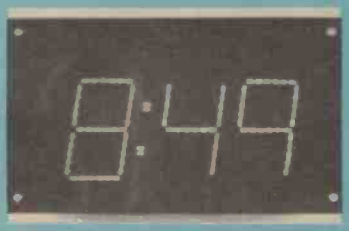
features

news

★ DON'T MISS SEPTEMBER'S ★
GREAT COMPUTER CONTEST

You could win a Dick Smith System 80 for yourself — or one for your school !

projects



sound

general

next month

THE COMET CHASERS

This fascinating story tells how the power of the sun may be used with ion drive motors to take our spacecraft to much greater velocities than has yet been possible. Plans have been made for such spacecraft to chase comets.

QUALITY AM TUNER

The AM band stations have been broadcasting 15 kHz bandwidth audio for some time now, and remarkably good quality can be obtained — if you have an appropriate tuner! Our feature project is a relatively simple design, yet delivers top performance. There's life in the old AM yet !

TAPE TEACH-IN

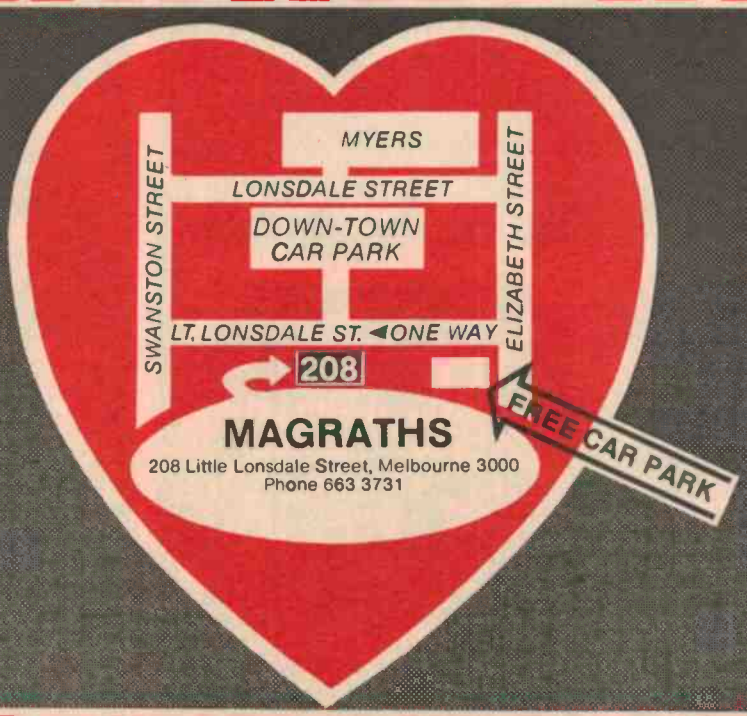
The popular magnetic medium — reel-to-reel and cassette tape — is often misunderstood, along with the basic techniques of recording. This article clears up the confusion, plus provides a guide to tape and recorder care products.

CELEF SM LOUDSPEAKERS

Mini loudspeakers are popular with people who have a premium on space. These Celef 'mini professionals' are an interesting product and the review springs a few surprises.

Although these articles are in an advanced state of preparation, circumstances may affect the final content. However, we will make every attempt to include all features mentioned here.

MAGRATHS



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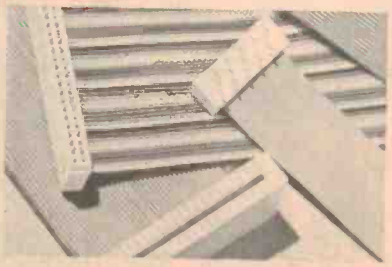


FOR ALL YOUR ELECTRONIC COMPONENTS

NEWS digest

Typewriter talks back !

Two researchers at Macquarie University in Sydney have developed a typewriter which 'reads back' the letters typed into it.

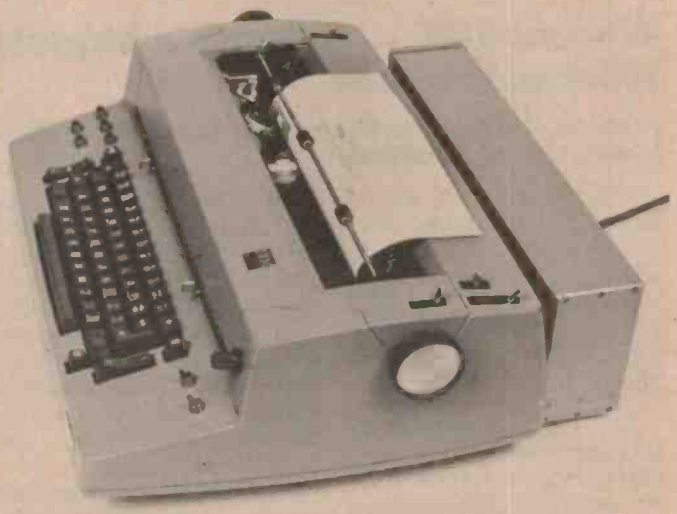
Developed by Ron Aitchison, Professor of Electronics at Macquarie, and Terry Brown, a systems analyst, the typewriter enables a blind person to communicate in writing with sighted people.

Although blind people can be taught to type just as easily as the sighted, they have hitherto been handicapped by having to rely on sighted people to point out errors. The talking typewriter, which took about 18 months to develop, solves this problem.

It is based on an IBM Selectric correcting typewriter with a standard keyboard, which the typist uses in the normal way. Whenever a key is pressed, the machine speaks the name of the character which has just been typed, indicating whether it is a capital letter or not.

Keyboard functions like 'space', 'backspace', 'margin release' and so on are also called out as the appropriate key is pressed. To give the typist a second chance to correct errors, the machine is also capable of reading back, character by character, an entire line of text.

A Selectric typewriter has mechanical linkage between the keys and the 'golfball' typing element. To make it talk, Aitchison and Brown have attached small magnets to each key lever and used reed relays to sense their motion. The pulses passed by the reed relays are stored in a CMOS memory for line playback as well as being used for the real time speech synthesis.



The typewriter that talks. Two researchers at Macquarie University have modified this IBM Selectric to provide a speech output corresponding to each key depressed. The box houses the electronics. All mechanical work, including modifications to the typewriter, was carried out by Ingram Paterson of the School's mechanical workshop.

The prototype uses a Telecentury speech synthesis board, but it is expected that later models will make use of the new single chip from Texas Instruments and thereby cut the cost by as much as $170.

Professor Aitchison is confident that the talking typewriter can be sold commercially in its present form for about $1500 and hopes that it will lead to more jobs for blind people. The next stage of the project is to adapt the system to computer and word processor terminals and open up even more employment opportunities.

Tape coating breakthrough

A new cassette tape coating process makes it possible to get better sensitivity and recording density from a magnetic layer only one-tenth as thick as normal.

Instead of coating the tape in the normal way with a mixture of 70% resin and 30% magnetic particles, the new method developed in Japan by the Matsushita company uses a vacuum evaporation process to apply a very thin film of 100% metal.

This means that for the same thickness of polyester film substrate, cassette tape can now be made one-third thinner than was previously possible, without any diminution of its mechanical strength. In fact the makers claim that their new product is actually a little stronger than conventional tape.

Thinner tape of course allows a greater length to be wound on a given spool. Matsushita are exploiting this feature in a microcassette which will be test marketed in Japan this month under the brand name of Angrom. At a recording speed of 1.2 cm per second (which is adequate for recording speech intelligibly), the new microcassette will run for 90 minutes in each direction, giving businessmen and other users three hours of recording time on a pocket machine.

The cobalt based metal tape coating is claimed to have a better coercivity than resin and particle mixtures, allowing a ten times higher recording density.

Matsushita's accumulated experience in the development of metallised capacitors has enabled them to overcome the problems involved in getting the evaporated metal to adhere to the substrate and produce this novel kind of recording tape about five years earlier than the industry in general had thought would be possible.

So far the company doesn't seem to be rushing to exploit the many commercial possibilities of their new tape. Although they have taken out patents on twelve applications in half a dozen countries in Europe and America, they have not yet decided to release even the microcassettes outside their own country.

ERRATA JULY ISSUE

The Four-Input Preamp, ETI-467, on page 47 of the July issue had a number of errors which no doubt set a few readers scratching their heads.

Firstly, on the circuit (page 49) exchange R34 and R35. The 1k resistor, R34 should now be connected from pin 9 of IC2b to the common rail (earth, or 0 V). The capacitor across the presence control, a 4n7 marked 'C20', is actually C24. These three components are correctly marked on the overlay.

Next, on the overlay photo (page 50) IC1 and IC2 have been shown with the incorrect orientation. Pin 1 of IC1 is located diagonally opposite to where it is shown on the overlay. It should be adjacent to R1. Similarly with IC2, pin 1 should be located adjacent to R23.

On the Parts List, R35 and C24 do not appear. Add a 270R resistor and a 4n7 greencap, respectively. Finally, in the second paragraph on page 50, the maximum output is quoted as " . . . 200 volts peak to peak . . . ". In reality, it is a more modest 20 volts peak to peak. Kit and component suppliers have already been notified.

NEWS digest

Wescom/80 — America's biggest electronics show

Anaheim, California will be host city this year to the USA's leading electronics exhibition.

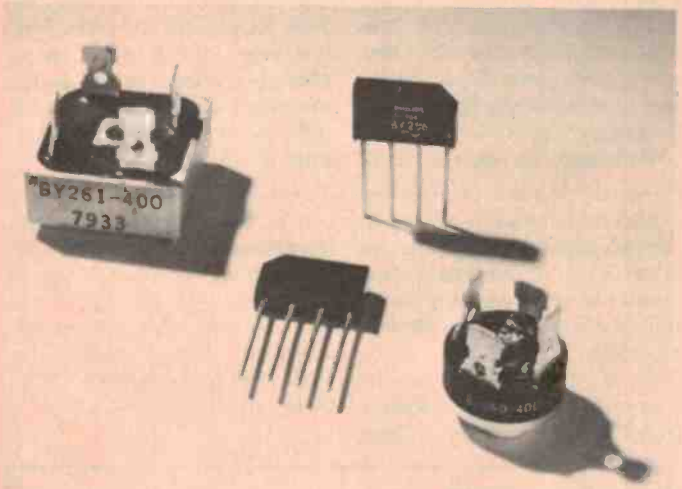
Wescom/80, which will run from September 16th to 18th, is conceived on a grand scale with over 1000 exhibitors' booths, more than 120 'Professional Program Sessions' and a film theatre showing the latest scientific movies.

Four product categories will be especially emphasised — micro-electronics and fibre optics; production, packaging and test equipment; instrumentation and control systems; and mini/micro computers and EDP peripherals.

Among the many topics covered by the Professional Program Sessions, special attention will be given to the microprocessor. Other topics include satellite systems, bipolar LSI, bubble memories, semiconductor and non-volatile memories, EMI radiation, picosecond electronics, biomedical engineering . . . the list is almost endless.

Anyone wishing to attend can count on assistance from the US Consulate in the form of information and contacts. Enquiries to Deborah Corrigal, Commercial Section, US Consulate General, Sydney.

Philips widen rectifier range



The introduction of four new types of full wave bridge rectifiers by Philips means that their range now extends from 1 A to 25 S.

The BY256 is a 1.5 A device with a maximum input voltage of 80 Vrms, suitable for equipment such as hi-fi amplifiers which use an input mains transformer. The BY257 is also rated at 1.5 A average output, but it can handle inputs up to 280 Vrms. It is recommended for colour television receivers and switched-mode power supplies up to 200 W.

The BY260 and BY261 series are both general purpose types for industrial applications. Both series have three versions with maximum rms input ratings of 140 V, 280 V and 420 V. BY260s can handle a maximum of 12 A and BY261s are rated at 25 A.

Further information from: Philips Electronic Components and Materials, 67 Mars Road, Lane Cove 2066. (02) 427-0888.

Ion out your problem?

If you don't like jogging and you can't afford acupuncture, don't give up all hope of ever becoming a healthy and happy individual.

Negative ions could just turn the trick for you! As with all 'fringe' ideas, some of the claims made for negative ions are far fetched and others more credible.

People **do** tend to get ratty before thunderstorms when the air is full of positive ions and they **are** invigorated at mountain resorts where negative ions abound.

On the other hand, the lady whose rash disappeared when she switched from nylon to cotton underwear had probably been suffering from an allergy rather than from inadequate penetration of negative ions to the flesh beneath her flimsies.

Creative Electronics are now distributing an inexpensive portable 'negion' generator for anyone who wants to settle the issue by personal experience. Their Bionaire 300 uses a cold corona discharge to create nearly 10 billion ions per second (according to their brochure). It's designed to work off a 12 Vdc supply for use inside cars.

Some drivers report striking reductions in stress and fatigue after installing the device, but since we haven't tried one out ourselves we're keeping an open mind. More info from Bionaire International, 24 Perry St, Matraville 2036. (02) 666 4000.

World's largest earth station

Raisting in West Germany will become the biggest satellite earth station in the world when two new antenna systems come on-line in 1981.

The new antennas will be 32 metres in diameter and weigh 300 tonnes each. Both will operate at 4 GHz on the receive side and 6 GHz on transmit.

A new feed system, equipped for different transmit and receive polarisations, will be fitted to the existing three antennas as well as the two new ones to make the whole station compatible with the new generation of Intelsat V communications satellites which will go into service early in 1981.

Siemens, who built the existing equipment at Raisting, are once again the main contractor and the steel structure will be made by MAN, the German heavy engineering firm.

Mitsubishi enters VCR market

A new video cassette recorder from Mitsubishi has all its functions remotely controllable by infrared transmitter.

Facilities available on the HS 300 include fast picture search at seven times normal speed, slow motion search at half speed, freeze-frame, single frame advance and automatic rewind. In the freeze-frame and single frame advance modes the machine automatically searches for the most stable adjacent frame so as to avoid the picture deterioration often found in other VCRs operating in these modes.

A flip-down front panel reveals the comprehensive timer controls, which allow the user to record unattended up to six programmes of varying length on any station over a period of a week. Or the same programme (perhaps the news) can be recorded every night until the tape comes to an end. Special circuitry is included to guard against accidental alteration of the instructions.

Although it has been available in some countries since May of this year, it is still not known when the HS 300 will be on sale in Australia.

Home safety system

A new home emergency warning system can bring the right kind of qualified help quickly and almost immediately.

Run by Monitor Protection Services of Melbourne, the service is so far only available in Victoria, but the company hopes to provide national coverage within six months.

The key to the system is a wall mounted transmitter in the home, which is connected directly to Monitor's headquarters through normal telephone lines. A distress signal from the wall unit activates a central computer to print out relevant medical information and emergency instructions to the service's paramedical staff.

All relevant data is provided by the subscriber when he or she joins the service, which is claimed to be cheap enough for the average Australian family.

At the push of a 'crisis button', the wall unit will automatically dial the computer. If all the lines are engaged it will wait 32 seconds and try again, and if that fails it will dial a different number which is connected to the computer through a different Telecom exchange.

In case the crisis button can't be reached, the subscriber wears a small transmitter which can activate the wall unit at a distance of 45 metres. The wall unit optionally also includes automatic smoke and gas detectors and microwave equipment to sense intruders.

Briefs

Philips are going all out for domination of the video disc market. They have just signed a licensing agreement with Sanyo which allows the latter to make and sell the laser pickup system developed by Philips and MCA Inc of the USA. Similar agreements have already been made with Pioneer, Sony, Sharp and Trio-Kenwood.

Amplified cordless headphones for the hard of hearing were recently released by Sennheiser Electronic. A small infrared transmitter plugs into the headphone socket of a TV, radio or other audio source. Its output is modulated by the audio signal and detected by a compact receiver amplifier unit connected to the earpiece. The system is also now available to patrons of the hit musical 'Evita'.

Uni-board is a re-usable 'protoboard' designed to accommodate both discrete and integrated components. Power transistors can be mounted complete with heatsink on the same board as 40 pin ICs. An introductory kit, including an illustrated applications manual, is available for $9.95 from the makers, Advanced Electronic Systems Pty Ltd, of Elsternwick, Vic.

Krohn-Hite tell us their 4400 oscillator, designed specifically for analysing audio equipment, generates a 7 Vrms sine wave at any frequency from 1 Hz to 110 Hz with distortion of less than 0.001 percent. Simultaneous inverted and quadrature outputs are available at the same output level and quadrature outputs are available at the same output level and source impedance of 600 ohms. Output voltage varies less than 0.05 dB over the frequency range and can be precisely attenuated up to 90 dB by vernier control.

A series of power FETs designated TIPF 101, 102 & 103 are the first in a family of such devices planned by Texas Instruments Drain-source voltage ratings are 40 V, 60 V and 80 V, with continuous drain current outputs of 3 A, 2.4 A and 2A respectively. Suggested applications are driving bipolar switch devices, switching power supplies and as CMOS interface to power, voltage and current levels.

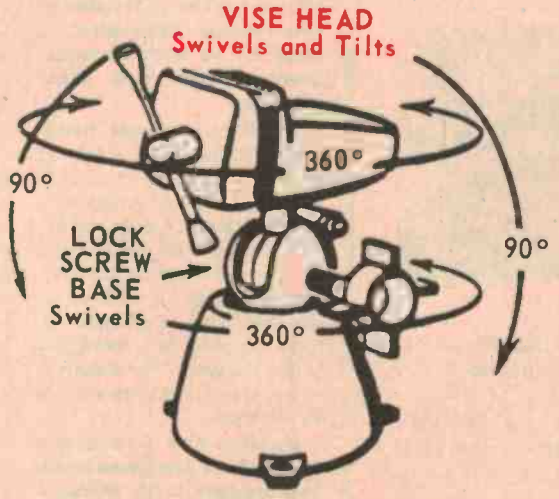
The Standards Association has published a new general standard, AS 1541.1, on 'fixed capacitors for electronic applications.' It establishes test methods and terminology and is to be the basis for future standards on particular types. Copies are obtainable from offices of the Association in state capitals and Newcastle. The Association is also making comment on a draft test method for fixed capacitors used to suppress radio interference. The new draft, DR 80110, aims to bring us in line with the International Standard this special area. Free copies from the Association's offices.

The Allsop 3 is a new video cassette recorder cleaner which slots into the machine like any other cassette and cleans the capstan, pinch roller, audio and video heads with a soft chamois and solvent. Available from most local video dealers.

Built-in calibrators are the leading feature of two new DMMs in the Kentron 31/2-4 1/2 digit range from Applied Measurement Australia Pty Ltd. A complete recalibration involves three adjustments and takes minutes. A 'hold probe' option is available which freezes the reading when the probe is removed from the measurement point — useful for readings in hard-to-get-at places. Phone (02) 816-2651 or (03) 25-4435 for details.

A $25000 grant will be awarded to the winner of the 1980 Marconi International Fellowship. To qualify, candidates must have contributed to the science or technology of comunications for the betterment of children. Winners in previous years have mostly been professors at prestige institutes like M.I.T. or Caltech, but hopefuls can address applications to the Marconi International Fellowship, Aspen Institute of Humanistic Studies, 1229 University Avenue, Boulder. Colorado 8-303, USA.

Hold it! Anywhere you want it. Scope Panavise tilts, turns and rotates to any position. (better than a third hand)

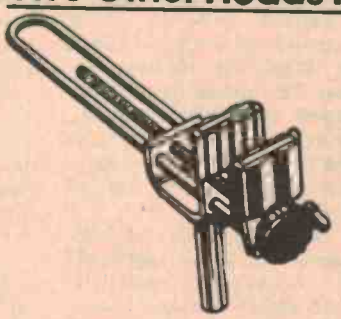


WITH THE EXCLUSIVE STAR KNOB☆

There is a PanaVise that fits your exact needs. Select the most suitable combination from the five interchangeable heads and four bases. You have the flexibility of more than one head for your base, greatly increasing your Panavise's range of usage at a modest additional cost.

Illustrated is the ORIGINAL PANAVISE MODEL 301 showing the tilts, turns, and rotations of this fine tool, all controlled by the patented single variable load control knob and split ball feature. There is nothing else like it! Electronic assemblers and camera repairmen, jewelry designers and instrument makers, gun smiths, and engravers are finding this robust little vise to be one of the most important and useful tools on their bench.

✻Two Other Heads To Suit Your Scope Panavise ....

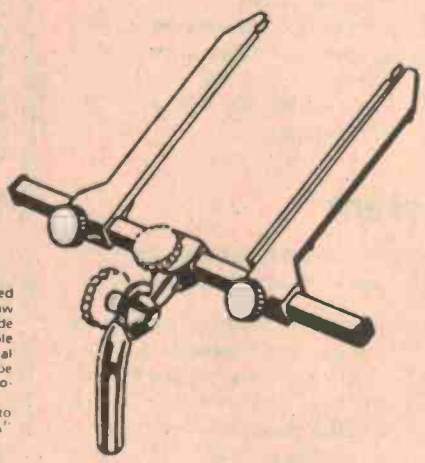


MODEL 366 WIDE OPENING HEAD

Opens to a full 6 inches (152 mm). The contoured neoprene jaws provide a cushion over the steel jaw plates. These jaw pads are deeply ribbed on one side to firmly grip odd-shaped items. They are reversible to the wide 'V' configuration for holding cylindrical objects. When working with heat, the pads may be removed. The fine thread screw permits micro-pressure adjustment.

This multi-purpose vise has a black oxide finish to reduce glare and eye fatigue. Jaw width is 1¾" (44.5 mm) and throat depth is 2" (50.2 mm).

✻



MODEL 315 CIRCUIT BOARD HOLDER

This versatile head holds p.c. boards of any size and shape, and it holds them exactly where you want them—flat or vertically, or any angle in between when used with one of the PanaVise bases. It may also be moved laterally in either direction without re-positioning the arms.

Both arms extend 6" (152 mm) from the cross bar. The 'V' grip grooves hold any board to 5/32" (4 mm) thick. Found only on the PanaVise Circuit Board Holder is a second set of 'V' grooves positioned laterally near the tip end of the arms. These facilitate holding exceptionally small p.c. boards and small electronics parts.

The exclusive PanaVise fingertip spring tension adjustable arm firmly holds boards yet permits the board to be inserted and removed repeatedly without further adjustment.

Please send me an illustrated pamphlet showing the complete Range of Heads, Bases and Accessories.

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OPAL 1000

The OPAL 1000 can be used as a basis for expansion.

The OPAL 1000 is an 8 slot S-100 system conforming to the new IEEE standards. A Delta Products Z80a 4MHz CPU card with 2 RS232c serial and 3x8 bit parallel ports is used in conjunction with the Delta Products Disk Controller. Memory is provided by a 4 Mhz 64k dynamic RAM Board by Measurement Systems and Control. The memory board is fully bank selectable and is designed for upgrading to a multi-user system. Disk drives are 2x8" Shugart SA801R running at double density (480k/drive) and fitted with our exclusive Disk Saver which prolongs the life of the drives and floppy disks by turning off the AC power to the drives 14 seconds after the last drive select and thus reduces routine maintenance. The Disk Saver also reduces the risk of data loss due to power failures. The software is CP/M version 2.2 with Delta Product's utilities which include DTEST (for testing drives and floppy disks) and M2 (a comphrensive memory test program). The Delta PROM monitor enables fault finding to be carried out independently of the Disk Drives. The system is mounted in an attractive pressed Aluminium housing with a cast front panel fitted with reset button and key operated on/off switch. **PRICE $4,174.00 plus sales tax.**

MPI 88T

SERIAL/PARALLEL PRINTER

The MPI model 88T is supplied with a dual tractor/pressure-roll paper feed system and a serial (RS232c) or parallel (Centronics) interface. (The printer is tested and supplied setup for a serial interface as detailed on the connection sheet). The tractor paper feed provides the precision required to handle multi-copy fanfold forms, ranging in width from 1" to 9.5". For those applications where paper costs are important, the pressure-roll feed can be used with 8.5" roll paper. A long-life ribbon cartridge gives crisp, clean print without messy ribbon changing. The microprocessor controlled interface has 40, 80, 96 or 132 column formatting capability while printing the 96 ASCII upper and lower case character bi-directionally at 100 characters per second.

- Full 96 ASCII character code set.
- Automatic line feed and print functions.
- Built in self-test facility.
- Any one of 5 baud rates (110, 150, 300, 600, 1200) for the RS232 serial interface. The printer is also equipped with a switch selectable parallel interface (TTL level).
- Price includes RS232c Serial cable and Parallel cable for TRS-80 with Expansion interface or standard Centronics fitting.
- The printer can print single or double wide characters.
- Any one of 8 standard forms lengths can be switch selected (default) or programmed on-line.
- Printing 6 or 8 lines per inch.
- Select any one of four character densities (number of characters per line)
- Warranty: 30 days. **Printer $935.00 plus sales tax**

SPECIALS

CROMEMCO SYSTEM Z2H
with 1- megabyte IMI hard disk drive, CDOS, Basic and other utilities. $8,970.00 plus sales tax. Ex stock.

VECTOR GRAPHICS MZ
with televideo 920c serial terminal and CP/M. $5,000.00 plus sales tax.

NORTHSTAR
48K, 2 serial ports with CP/M and a televideo terminal. $4,700.00 plus sales tax.

NDK S-4000

PRINTING

MATHEMATICS

$F(w) = aT\frac{\text{Sin } wT/2}{wT/2} e^{-jwT/2}$

$e_{rms}^2 = 4KTR(f_2 - f_1)$

$L_1 = 10\log\frac{1}{80} \times S_n \text{ (dB)}$

$A^2+B^2=C^2$

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$A^2+B^2=C^2$

$A^{\wedge}+B^2=C^2$

PRICE $3,105.00
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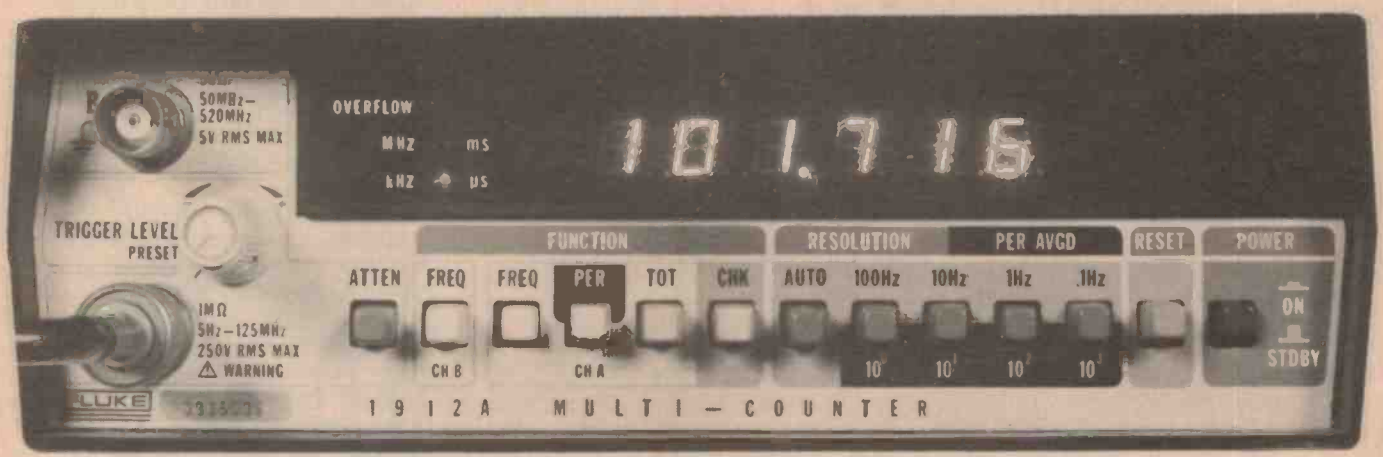
Digital counter/timers

These instruments are very handy in many branches of electronics. Here is a basic rundown on how they work, how to choose them and how to use them.



The Fluke model 1912A is a very versatile instrument. They are distributed here by Elmeasco.

MEASURING frequency and time intervals to a known accuracy is often important in many areas of electronics: in communications, broadcasting and audio applications, in digital work and particularly in computer applications — from micros to mainframes. Digital frequency meters (DFMs), or counter/timers as they are also called, have become such an essential item of test equipment that many manufacturers are offering a diverse range of instruments ranging in price from a $150 instrument covering the range 20 Hz to 200 MHz to many thousands of dollars for a microprocessor-controlled instrument capable of measuring frequencies well into the gigahertz region and time intervals in the picosecond range.

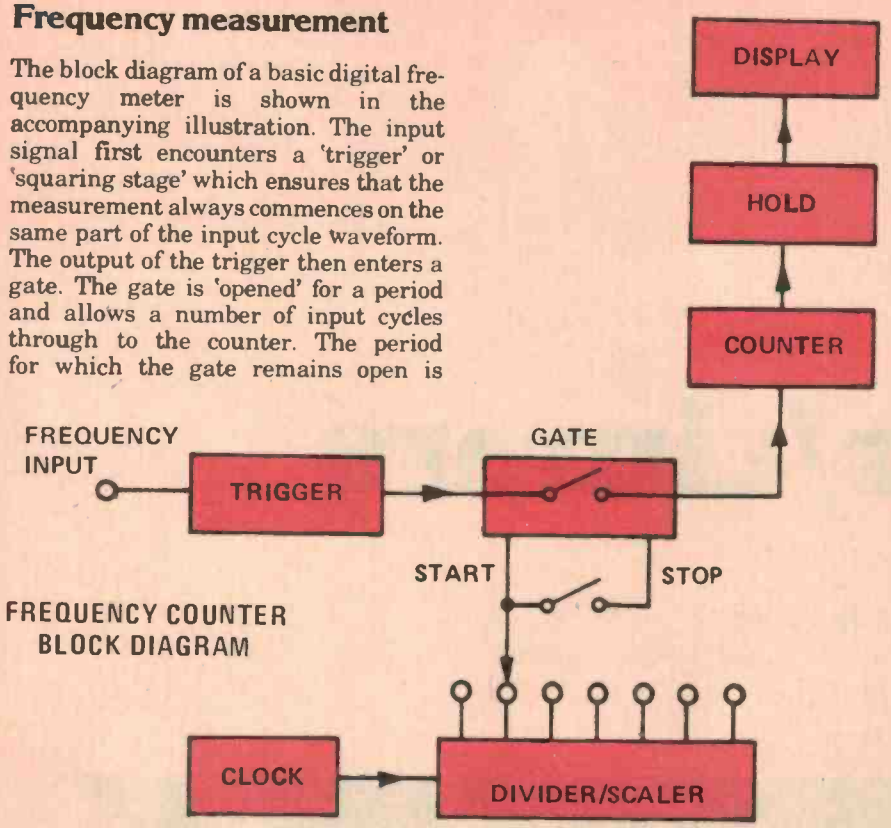
Frequency and time interval measurement is an area where digital techniques come into their own. The object is to accurately quantify a measurement. Prior to the development of digital instrumentation to do this job, analogue techniques were used — often ingenious and highly refined, but laborious. Heterodyne frequency meters were used widely. These consisted of a stable, accurately calibrated, variable oscillator (VFO) driving one input of a wideband mixer, the unknown frequency being applied to the other input. The output of the mixer was monitored on headphones or an audio amplifier while tuning the VFO. As the unknown frequency was approached an audible 'beat note' would be heard, decreasing in pitch as the VFO was tuned closer to the frequency being measured. At 'zero beat' you could then read off the unknown frequency from the instrument's calibrated dial. The old BC221 will no doubt be familiar to many of our older readers. The method was laborious, especially when you didn't even know the 'ballpark' of the unknown frequency, and to get a measurement accuracy better than several hundred Hertz (. . . maybe that's cycles/second!) was tantamount to magic: Top frequency was about 20 MHz.

These days *pocket* DFMs can measure frequency to within +/– 50 Hz or better, up to 200 MHz ! That's at least a factor of ten better all round than the old BC221. And readout is obtained in a few seconds or less.

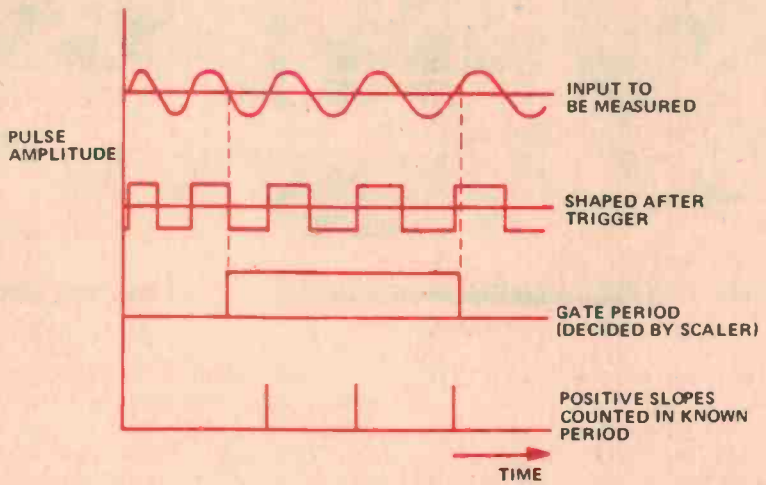
Time interval measurement was, and still is, very much left to that old workhorse — the CRO. But, a CRO has its limitations and quantifying a time measurement to the accuracies required these days is best done with a digital counter. ▶

Frequency measurement

The block diagram of a basic digital frequency meter is shown in the accompanying illustration. The input signal first encounters a 'trigger' or 'squaring stage' which ensures that the measurement always commences on the same part of the input cycle waveform. The output of the trigger then enters a gate. The gate is 'opened' for a period and allows a number of input cycles through to the counter. The period for which the gate remains open is determined by the output from a divider/scaler driven by a very stable, accurate clock oscillator. A number of outputs from the divider/scaler may be selected to vary the period the gate is open. Usually, a number of decade steps are provided.



FREQUENCY COUNTER BLOCK DIAGRAM



The output of the gate drives a counter which provides a binary coded decimal (BCD) output for the display. A 'hold' or 'latch' stage is generally added so that a steady group of numerals is displayed. (For a description of the various ways of making a digital display, see "Electronics Its Easy" — an ETI publication — Volume 3, Chapter 26).

The timing diagram below the block diagram illustrates the sequence of events. The input signal, often sinusoidal, is shaped by the trigger stage into a train of rectangular pulses. The gate allows a number of pulses through to the counter, in this case three, during the period it is 'open'. The circuit selects only the positive-going pulses in this example, though negative-going pulses from the trigger stage could equally well be used.

If, say, a gate period of one millisecond (1 ms) were selected the counter would display '3000'. In other words, the input frequency would be 3 kHz.

Practical instruments will have selectable gate periods ranging from one microsecond (1 us) to as much as 10 seconds. The display may have five digits, though eight digit displays are more common.

Many modern digital frequency meters incorporate a high speed divider immediately following the gate, the output of this divider being used to derive the first and seond digits of the display. To extend the range of the instrument, a 'prescaler' may be included. This is a high speed divider providing a fixed division ratio of ten. Its output may drive either the trigger stage or the gate directly.

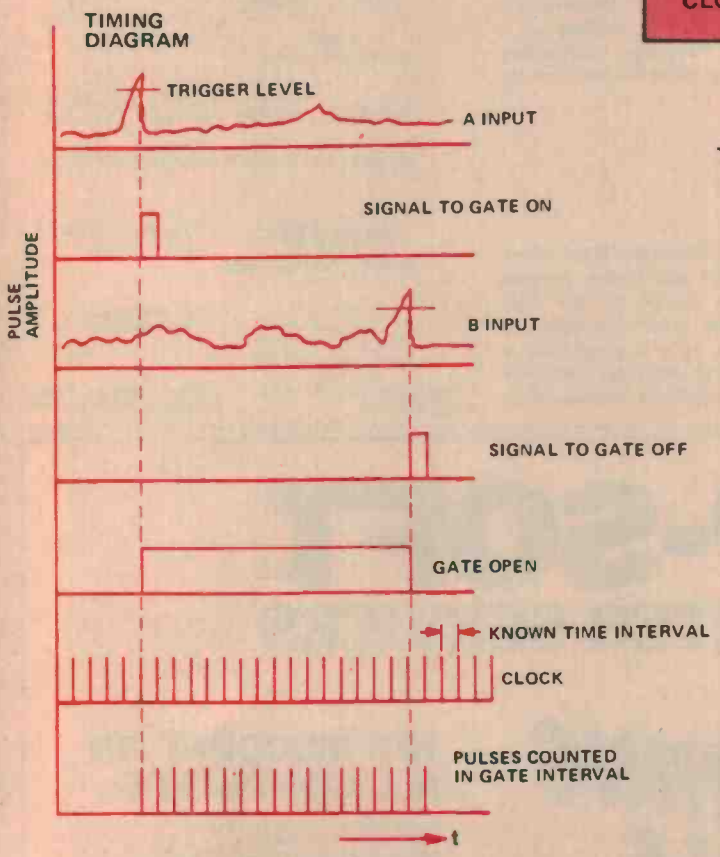
Period measurement

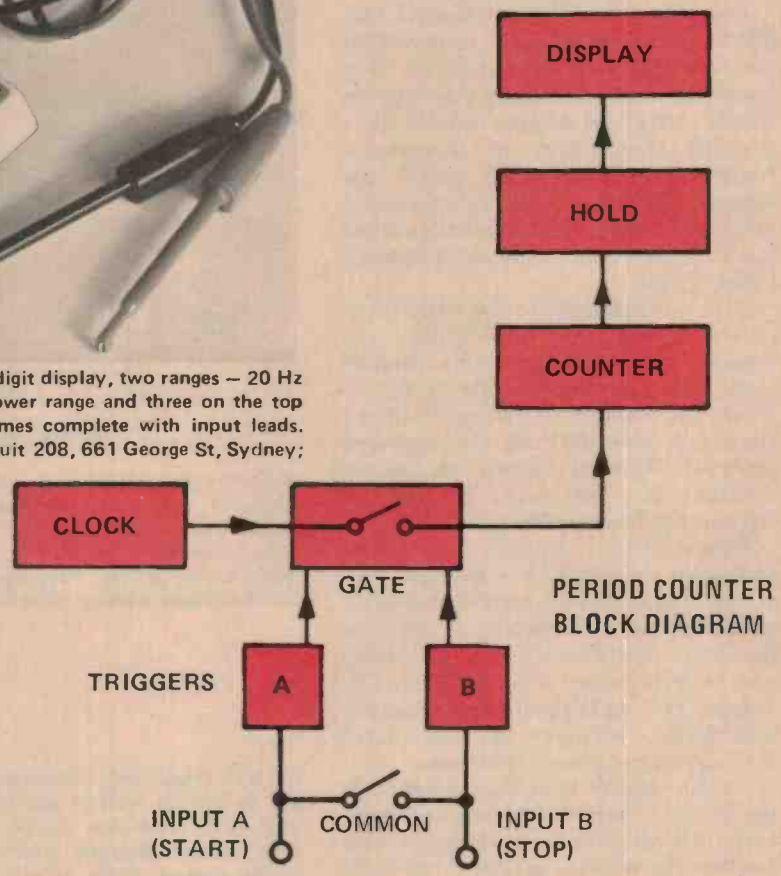
Measuring the period between 'events' is done by re-arranging things a little. The gate, counter and display are used as before but the gate is turned 'on' and 'off' by the input events and the clock signal is passed through to the counter. As the clock is a highly stable, accurate oscillator, the period between input events can be measured with great precision. The accompanying block diagram shows the general arrangement of the instrument for period measurement.

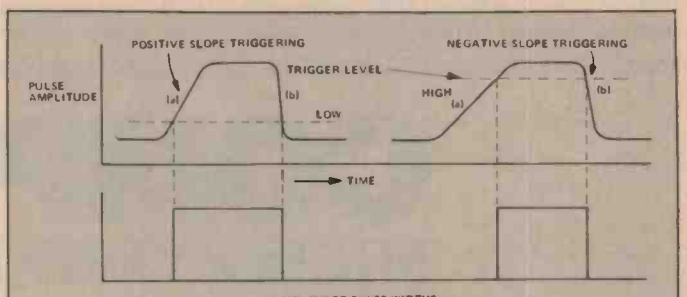
Separate input signals in the arrangement shown are used to trigger the gate on and off. However, a single repetitive input signal may be used to trigger the gate with a slightly different circuit arrangement. The timing diagram with the period counter block diagram shows the sequence of events. If the clock was running at 1 kHz, for example, the time interval between pulses would be one millisecond. As 17 pulses passed through the gate in the example, the period between the A input event and the B input event was 17 ms and the display would read, say, 17 000 (resolution of one microsecond).

Pulse widths can be measured with a period counter, too. In this instance, the gate is triggered on the positive-going and negative-going edges of the input pulse. However, some difficulties arise. If the input pulse had a perfectly 'square' shape, the on and off gating points would always give an accurate result because the triggering transitions would occur precisely on the rise and fall of the pulse. Trigger level would not affect the interval measured. Real-life pulses however, are seldom perfect, the edges having definite rise and fall times. In this case, the trigger level becomes critical in determining the width of a pulse. The diagram here shows why and how it is overcome. Counters are

This handheld DFM from Sinclair Electronics features an eight digit display, two ranges – 20 Hz to 10 MHz and 5 MHz to 200 MHz, four gate times on the lower range and three on the top range. It is powered by a single No. 216 9 V battery and comes complete with input leads. Sinclair Instruments are available through Emona Enterprises, Suit 208, 661 George St, Sydney; Phone (02)212-4815.







When measuring pulse widths with a counter/timer a number of difficulties arise. The result will depend on whether you select positive or negative slope triggering and where you set the trigger level. It is a good idea to examine the waveform with a CRO prior to making a pulse width measurement.

usually provided with a 'slope selection' control which determines whether the trigger operates on the positive or negative slope — (a), or (b) respectively in the diagram.

Noise error reduction

The above descriptions give the basic operating modes of the various counter/timer/frequency-meter combinations. In practice, a number of refinements may be incorporated to obtain better practical performance.

Noise can be reduced by incorporating a fixed amount of backlash in the trigger circuit; this produces what is called the 'trigger window'. On the way▶

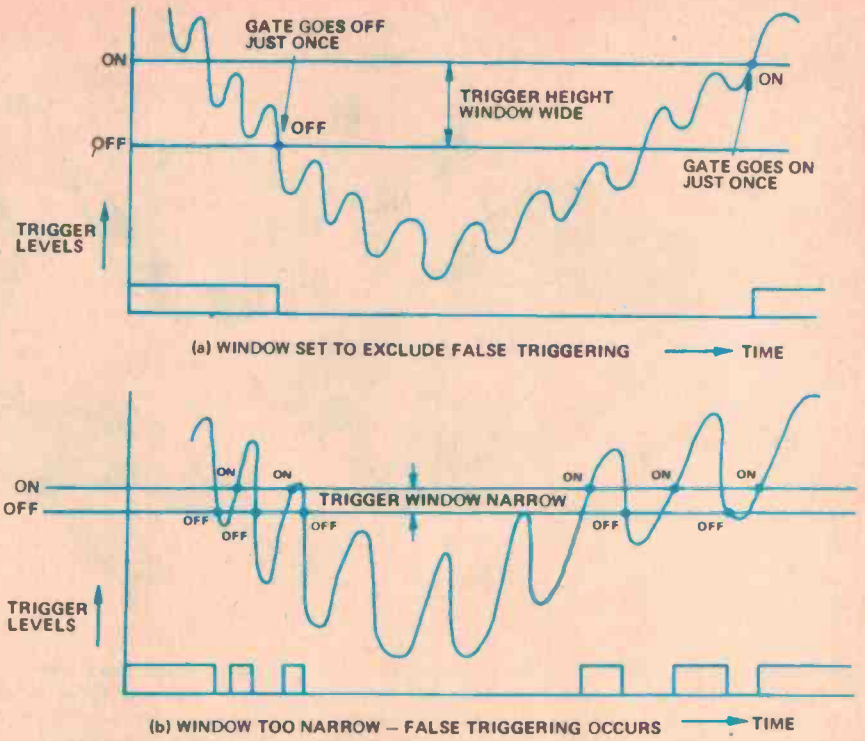
up the trigger level is at a higher level than on the way down, as shown in the Trigger Window Diagram here. Provided the noise added to the signal has an amplitude smaller than the window width, the counter will only trigger once on the way up and once on the way down. This method works well for high-frequency measurements where the noise is usually a small percent of the signal-plus-noise signal amplitude.

Low frequency measurements can often involve interference sources that produce rapid spike transients. One simple method of reducing this is to use filters. Advanced designs contain filter systems that reject all frequencies higher than that being tested, the appropriate filter being automatically selected by the counter itself after it has made a determination of the frequency of the signal.

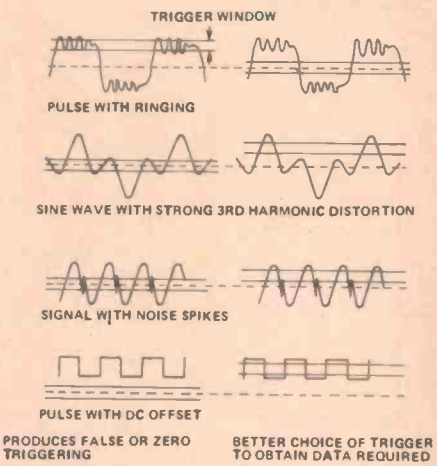
A recent approach to the noise problem is to set up a time-window (as opposed to the trigger height window) that, once the counter gate is on, inhibits the off-state chance until after a time just shorter than the expected interval. This is known as trigger masking. It is very useful in eliminating contact-bounce retriggers.

Before using a counter/timer on an unknown waveform, it is good practice where ever feasible to kook at the waveshape on an oscilloscope in order to decide the best strategy for trigger-level and height-window width settings. The Trigger Setting Diagram illustrates the differences between window level settings on various waveshapes.

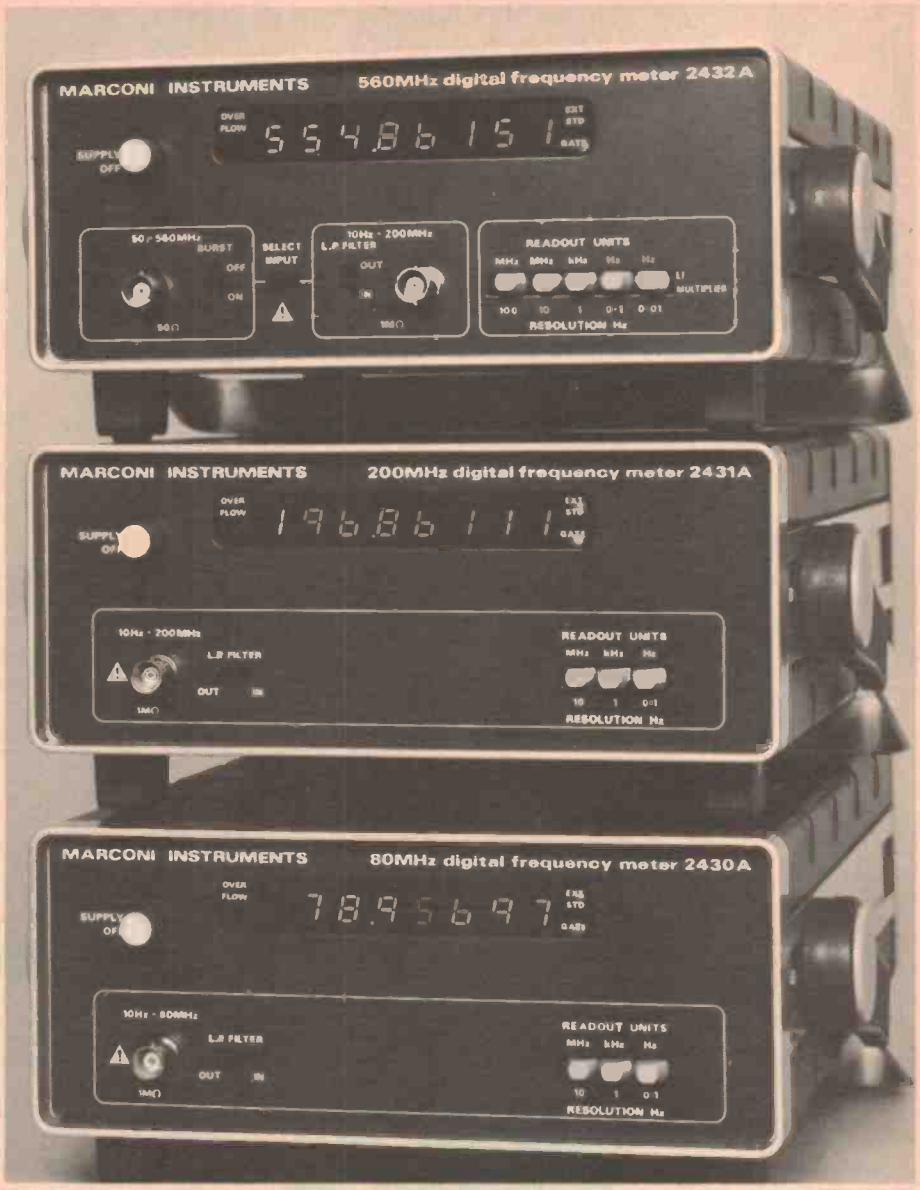
As the readout is in digital form it is necessary to hold the display at the determined value for a period long enough to allow the value to be read. Some units incorporate a control that gives the operator a choice of hold time. ▶



ABOVE: Trigger Window Diagram. The width of the trigger window will greatly affect the accuracy of measurement when attempting to take a reading on a signal having a high frequency component. Set the trigger window wide for best results.



RIGHT: Trigger Setting Diagram. It is important to set the level of the trigger window such that extraneous signals on the main signal do not adversely affect the accuracy of the reading. Again, it is a good idea in many circumstances to examine the waveform with a CRO prior to making a measurement.



These three counters were recently added to the range of instruments offered by AWA. Made by Marconi Instruments, each features an eight digit display and a switchable low-pass filter. First in the range is the low cost model 2430A. It covers 10 Hz to 80 MHz and has three selectable gate times. The model 2431A (middle) covers 10 Hz to 200 MHz while the top-line 2432A includes a prescaler that permits measurements to 560 MHz, plus five selectable gate times.

In use

The input impedance of most counters that operate up to 50 MHz or so is generally 1 M with a few pF of stray capacitance in parallel, hence the actual impedance decreases at the higher frequencies. An input impedance around 1 M is generally high enough for most applications such that connecting the counter does not load the circuit to which it is connected. However, it is always wise to remember that the input impedance falls at the higher frequencies, as does the sensitivity. An input cable will significantly increase the input capacitance but a x 10 CRO probe will improve matters considerably without unduly affecting sensitivity.

Prescalers for the VHF/UHF range will have an input impedance of 50 ohms across the range and this may severely load a circuit having an impedance significantly higher. Fortunately, most instruments have a sensitivity in the tens of millivolts region and the counter can usually be coupled to a higher impedance by means of a small value series capacitor. Cable capacitance is generally not significant enough to be considered in 50 ohm systems.

The last digit in a readout will generally be 'uncertain' as a single digit is usually the limit of an instrument's resolution and the accuracy of the clock oscillator is generally of the same order, except in the high-priced highly accurate models.

When making period measurements it is best to select a gate time as long as practicable as greater precision results. Extend the gate open time to 100, 1000 or even 10 000 periods if convenient. With relatively slow events, this could be tedious — you may have to wait tens of seconds to several minutes!

This low cost B & K Precision counter has a six digit display and a switch to select either a one second gate time or auto-ranging. B & K instruments are distributed by Parameters Pty Ltd; phone (02)439-3288 in Sydney, or (03)90-7444 in Melbourne.

Philips Test and Measuring Instruments recently added these two DFMs to their range. The upper one, model PM6667, covers 10 Hz to 120 MHz. The lower one , model PM6668, covers 10 Hz to 100 MHz and has a prescaler covering to 1 GHz. Both feature seven digit LCD displays.

Always take care not to exceed the maximum dc or ac input levels specified for your counter — such carelessness can be disastrous.

How to choose

First, look in your piggybank! Prices for a straight digital frequency meter start at around $150. Next step in the price/features bracket for a DFM is around $230 - $250. Instruments range right up to several thousand dollars, which is generally beyond most hobbyists!

Next step is to look at your applications. But, keep in mind future applications and get something a little better — if your budget will stretch that far. The number of digits in the display will certainly be a deciding factor, depending on your applications. The majority of instruments available have either six- or eight-digit displays. Next consideration is the number of ranges offered (gate time selection). Resolution is important and is related to the display, an eight-digit instrument has a better resolution than a six-digit instrument, naturally enough.

The clock oscillator stability determines the inherent accuracy of the instrument and it is instructive to compare the specifications of different makes and models when considering this parameter. Generally, a temperature range over which the accuracy is maintained will be quoted along with this specification. Accuracy will be quoted in parts-per-million (ppm) or parts in 10^n. A reasonable figure for accuracy, for most hobbyist applications, would be one ppm (one in 10^6) over a temperature range of 15°C to 50°C.

Whether you get a battery operated or a mains/battery operated instrument will depend largely on your applications.

Refinements like filters, trigger window control, gate time delay, frequency ratio, totalizing etc depend entirely on your application — and your budget! ●

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Toys for a bored consumer society

Dennis Lingane

"They need all kinds of s . . . these days. We never needed any of it in our time." This comment by a bemused old lady sums up Lingane's feelings about the 10th Summer Consumer Electronics Show in Chicago last June.

THE GREAT electronic circus has left town. The streets of the windy city are strangely quiet and the hotel bars and foyers very, very empty.

For four days this northern metropolis has been bedlam. Over 60 000 delegates from 58 countries filled the official 35 hotels and a fleet of buses carried hung-over executives back and forth between McCormick Place, McCormick Inn, and the Pick Hotel where 600 exhibitors showed their new products for 1980/81.

Now the video companies with their attendant porn queens, the bevy of Playboy and Penthouse girls, the army of long legged models that handed out magazines, daily newspapers (four every day), brochures, and drinks in the hospitality suites that operated round the clock — all of them have gone. Seven hundred and fifteen dazed and disoriented journalists from all over the world are left to analyse what it was all about.

Jack Wayman, who organised the show says it's a "sexy industry" and so the show should be a "sexy show". Certainly the number of leggy ladies with slits up the sides of their skirts, down the back, and up the front gave it that kind of feeling.

But underneath all the hype and hysteria this is an annual opportunity for the industry to take a good look at itself and assess the past year and the potential of the future.

The economy is bad and the atmosphere during the show is one of desperate optimism. Everyone says that things will get better. Meanwhile they are all talking themselves into an economic recession.

Video boom

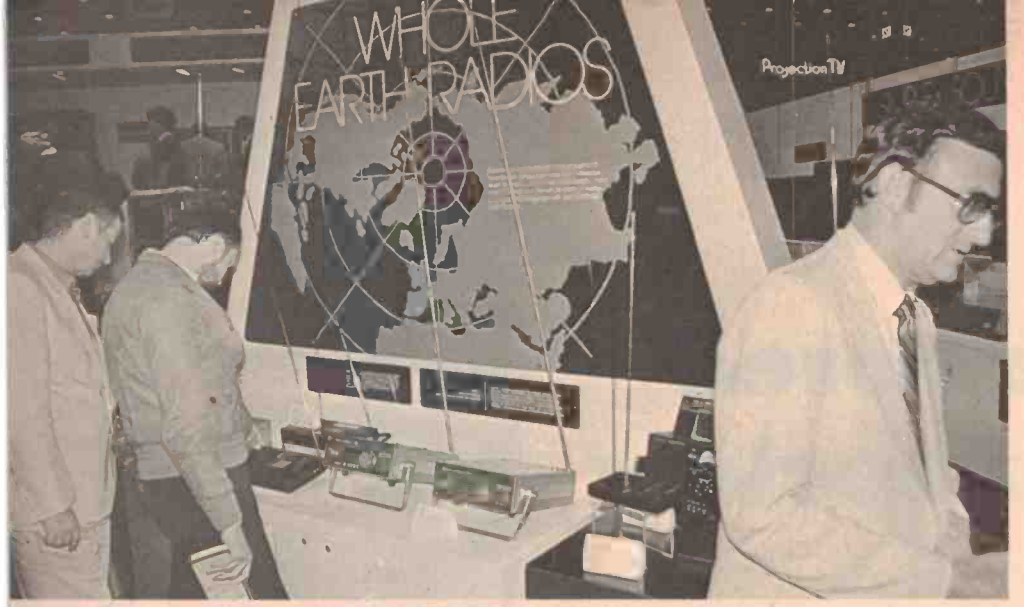
The big bright star on an otherwise gloomy horizon is video. All the major film companies are now in the market place trying to jump on the band wagon.

Over 10% of the massive McCormick Pavilion convention centre was taken up by video software manufacturers. At the packed video seminar Bob Reed from the National Video Clearing House said that there are now over 30 000 titles available on video. Only 21% of that is feature films, but that share is growing almost daily.

VHS manufacturers are now offering feature laden machines with six hours play and record time. Toshiba was showing yet another format which will record two channels at once — and you can play them together or one at a time.

RCA showed its video disc player and announced that it would launch America wide in January 1981 with a massive software back up. Matsushita exhibited their JVC VHD video disc ▶

Show organiser Jack Wayman says it's a "sexy industry" and the show should be a "sexy show" — how that relates to electronics is left to our imaginations. All pictures in this article courtesy of Geoff Matthews from Convoy International.



Technology for the energy conscious — solar powered receivers

system but said that launch would not be until the end of 1981. It has signed G.E. and Thorn to back the system.

One very interesting extra displayed by Matsushita is a digital to analogue converter, which makes their video disc into an audio system as well. This seems to be the first time that PCM techniques have broken into the consumer domain.

Al Bergano from MGM (which joined the video software market only four weeks before the show) says that his company will be putting film out on cassette within 90 days of it being released in the movie theatres. He's not alone — Columbia, Disney, United Artists, Paramount and 20th Century Fox have all joined in the video hysteria sweeping America.

The ultimate in loudspeakers ? — the $20 000 Infinity monitors. It'd be cheaper to book a lifetime subscription to the five best concert and opera venues in the world.

Audio fade-out

This year's poor relation is definitely audio. Star of the show for so many years it's now a very sorry sight. But there is the occasional show of defiance. Thorens were showing a hand built turntable for $15 000 and Infinity had speakers at $20 000 a pair, just stealing a march on Sony, whose best effort cost a mere $16 000 per pair.

But by and large the mood is one of defeatism. Few dealers bothered to turn up at the Audio Seminar and Technics Vice-President Jeff Berkowitz (who chaired the meeting) was unable to resist commenting.

In an emotional attack on hi-fi retailers he warned that they could no longer expect to "hang on for the ride". He said that retailers are going broke and more would go broke this year.

"Audio is going through a rough time. The glamour is gone out of audio and so has the profit. Yesterday 700 people attended the video conference. Look around you today. Anyone walking into this meeting would agree that audio is dead".

"We must get pride back into our industry. This used to be an audio show, now all everyone talks about is video, video, video."

TV comeback

While audio sinks to the low profile held by television for the last few years the colour TV industry looks set for a renaissance.

One star exhibit which is due for release in Australia later this year is the new slimline National Panasonic rear projection TV, whose 45 inch (1143 mm) screen is concealed behind the doors of an antique style cupboard when the set is not in use. This giant TV has 105 channels, 23 of them for cable TV, and won't be as expensive as you might imagine. Predicted price in Australia is $3000.

Sanyo exhibited a 26 inch (660 mm) TV on which you could draw coloured pictures with a special electronic pen, and Toshiba showed a voice controlled set.

You tell it to turn on and off, and to change channels and what volume level you want. It replies "right" after every command if it understood, and "repeat" if it doesn't understand.

The set is programmed to a selection of voices and will not work for any other voice. It's a good way to restrict viewing in a house where children put TV ahead of homework!

Computer standstill

Calculators are a stable market, but the computer industry still doesn't quite know where it is headed.

Atari chief Ray Kassar says that instead of getting to the consumer the industry is frightening him off. "Instead of simplifying things we are making them more complicated", he told an industry seminar.

"We must put our energy and talents into simplifying things so that we can reach and communicate with the general public. They are afraid of us".

Kassar says the industry is still relying on hobbyists and small businessmen for its growth.

Saving energy

Power factor controllers are devices that can reduce the power drawn by a fridge or other appliance using an electric motor by anything up to 60%.

They measure the amount of power the electric motor needs and when it is not under full load feed only sufficient power to do the job.

They save electricity and increase the life of the electrical motor as well. The concept was developed by NASA for the space project and the patents as a consequence belong to the American people.

So companies are free to use the technology and are doing so in increasing numbers. In fact the government has made the item tax deductible to encourage people to fit them to appliances in their houses.

One manufacturer says that if 25% of the fridges in the USA were fitted with these devices it would save the US 11 000 barrels of crude oil a day.

The units cost about $60 and are selling like hot cakes.

Novelty audio items abound — the Bone Fone (you wear it around your neck like a scarf) being a good example.

Entrance to the vast main show venue in McCormick Place.

Carry-around sound

Hip stereo is the big thing with the young generation. Sony recently launched a play only cassette player that hangs on the hip, and comes with a set of lightweight headphones.

They sold astonishingly well and several companies are now trying to cash in on the boom. Aiwa released a similar unit that also records, and a new company, Technadyne have a unit similar to Sony's but $50 cheaper. Roller skating enthusiasts, cyclists, and pedestrians are hungry for these mobile lightweight stereo systems which have a very high quality sound.

AM/FM head phones are also popular and a new radio concept called the Bone Fone, which is an audio scarf that hangs around your shoulders, is selling strongly.

Stealing scenes?

Three companies were selling satellite receivers that can pinch up to 50 TV stations off the six satellites sitting out in space.

The receiver consists of a 12 ft (3.7 m) dish which is mounted on a concrete block in your garden, and a black box that plugs into your TV. You aim the dish at whichever satellite you want to take programmes off. Units are priced under $10 000 each.

Remote control

The list of gadgets at the show is endless. For example I was intrigued by a remote control system for starting your car from 500 ft away. The idea is to allow the car to either heat up or cool down — depending on the weather — before you get in.

But the FBI are interested in it, and several have been sold to Europe — especially Italy where people have a nasty habit of wiring cars for bombs.

Ladies like the remote start because you can turn the car lights on as well as start the engine. So when they are approaching their car in a dark car park they can start the car and switch on the headlights to frighten off marauders.

Remote control systems for switching domestic appliances are also gaining popularity. BSR has a unit for controlling 16 lights and appliances, which comes with an ultrasonic remote control and a timer. The light modules have automatic dimmers built in.

What's it all about?

It was when I was trying to sort out my jumbled thoughts after four days of this sort of razzamatazz ready to do a radio report live from Chicago that these words cut through my thoughts.

"They need all kinds of s . . . these days. We never needed any of it in our time."

I looked round and there just a few steps behind me was a wrinkled old lady in a large green floppy hat, and a green suit. She was one of those people who wander around the streets talking aloud to themselves.

No doubt most people just dismissed her as a 'nutter', but her comment crystallised my own thoughts. She was right. A lot of what I had seen and would be reporting about in the next few weeks was electronic s . . . Toys for a bored consumer society.

Who needs a $10 000 satellite receiver system to receive 50 channels? One TV station is bad enough. And who needs a bedside clock that tells you the time at the touch of a button when you can just look at it. Or a microwave oven that tells you everything it does?

Once it's been refined, voice synthesizer technology will be excellent, for blind people, but who really needs a humidity sensor that sounds a siren when the plant needs watering, or a TV that will plug into the telephone socket so that you can take calls through your TV without moving from your armchair?

But that is the industry we are part of. There are those massive Japanese production lines to keep rolling, and all those bored people who want new toys, and want to keep ahead of the Joneses.

For some of us the excitement of bending the rules of physics, and making technological breakthroughs makes it all worth while but for better or worse, win or lose, the show is over for another year. Exhibitors are on the way home and their order books will tell if the show has been a success or not.

PRO Ralph Jones, who kept us in coffee and danish pastries for four days as we dashed back and forth attending almost 200 press conferences, is now getting organised for Las Vegas, the winter show.

Organiser Jack Wayman is already back in his office processing the complaints from exhibitors and he too is drawing up plans for Vegas.

For them it is a year-round job. At least journalists escape for a few months between shows and come back to the Australian sun and sanity. ●

ABOUT THE AUTHOR

DENNIS LINGANE is a freelance journalist who specialises in writing about the electronics and audio industries. When asked to be rational he claims to be Irish, the rest of the time says he's English.

We do know he lives in Western Australia where for seven years he was a full time journalist with a Sunday paper. He also wrote a hi-fi column that became so successful that two years ago he retired to freelance. That column now runs to five pages regularly in the mass circulation Sunday Times.

He travels extensively and writes for such national circulation publications as Playboy, The Bulletin and ETI (when we can afford him). He has admitted to having a wife and son who, it is rumoured, he does see occasionally. Dennis has been asked often during the last two years to write similar columns for Sydney newspapers but has consistently refused because of what he describes as the "buy an ad. and we'll give you a nice write up" syndrome. When newspapers take the industry seriously he says he will write for Sydney papers. Meanwhile, he refuses to give up his W.A. sunshine and sailing.

It has been said that Dennis is one of the most informed journalists writing on the industry. This article would tend to support that . . . Ed.

PARTS FOR NEW KITS

If a kit you want to build is not listed, the parts may be available anyway. Check the Dick Smith Catalogue, or call in to your nearest Dick Smith store.

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NASA POWER CHOPPER (See EA August)
Short form kit (All components & PCB) ..... Cat K-3325 $16.50
PCB only ..... Cat H-8378 $3.00

LEDS AND LADDERS GAME (See EA August)
Complete kit inc. printed panel ..... Cat K-3390 $15.75
PCB only ..... Cat H-8378 $3.00

LED TACHO (see ETI August)
Short Form Kit (includes PCB components etc, but no case – build it into your dash board). ..... Cat. K-3240 $27.50

(Above kits are from magazines' forecasts. We will endeavour to have these kits on sale when the magazines are released; however, delays can occur! Please enquire at your nearest Dick Smith Store).

FAST NICAD CHARGER (See ETI August)
PCB only ..... Cat H-8627 $3.00
(All other components in this kit are normal stock lines)

GUITAR/PA PREAMP (See ETI August)
Short form kit PCB & components, no transformer or case). ..... Cat K-3035 $29.50

300 WATT AMPLIFIER (See EA June)
Printed Circuit Board only ..... Cat H-8376 $9.95
(Most other components are normal stock lines).

TV CRO ADAPTOR (See EA May)
Complete Kit ..... Cat K-3060 $29.95
Printed Circuit board ..... Cat H-8375 $3.75

AT LAST! A CHASER!

In response to huge numbers of requests, Electronics Australia have produced a light chaser kit (see article this month). It features variable flash rate, auto reverse, auto invert, etc etc. It is a great companion to our popular 'Musicolor'. Cat K-3145

$69.50

TV CRO ADAPTOR

If you're like many people, the old B&W TV is sitting around doing nothing. And you've probably always wanted a CRO. Why not use the old TV? This simple kit from Electronics Australia turns your TV into an audio oscilloscope which you'll find very useful. The kit is complete with instructions. Compare our price with others!

PUT YOUR OLD B&W TV TO WORK!

$29.95

Cat K-3060
SEE EA MAY ISSUE

AMATEURS: Don't miss our exciting new Yaesu contest! Full details on page 96 . . .

SEEN IT YET?

OVER 600 SOLD IN 6 WEEKS!

Cat. X-4005

AUSTRALIA'S FASTEST SELLING COMPUTER

$695.00

Everyone's talking about the System 80. Australia's best value in a computer! Compatible with all Tandy level II software, but much, much cheaper! But it's much, much more: see our advert on pages 82 & 83 for more details of this incredible technological breakthrough.

NOW: TWO BASIC BOOKS

BY POPULAR DEMAND

$9.95 ea.

Cat. B-6103 Cat. B-6200

Yes — you asked for them, so here they are. Written in language anyone can understand, and they start at the basics (like how to turn it on!). Now there are two books, similar in content, but each written specifically for its own computer system. The first is for the superb Exidy Sorcerer, the second is for the incredibly popular Dick Smith system 80 (but it also applies to the TRS-80). If you don't know what a computer is all about, then these books will help you understand!

16K UPGRADE KIT: SAVE $30!

SUITABLE FOR ALL COMPUTERS!

Incredible bargain from Dick: Save a massive $30.60 on this pack of 8 4116 RAMs for upgrading your computer memory. YES! These are top quality 250nS types which are suitable for ALL microcomputers. We're buying so many of these that we get huge bulk buy discounts: & our savings are passed on to you. You reap the benefit. X-1186

~~$109.50~~

$79.00

INCLUDES INSTRUCTIONS

ALSO AVAILABLE: Individual 250nS 4116 RAMs, also at a huge saving. Buy at Dick's low bulk prices and save! Cat Z-9310 Were $14.40 $9.90

WORD PROCESSOR KEYS FOR SORCERER

11 special red keytops with word processor legends embossed on them, to replace the numeric keypad keys when using the Sorcerer as a word processor. Makes remembering the word processor functions so much easier!

$14.95 SET OF 11 Cat X-3036

COMPUTER MAINS FILTER

Don't lose that important program through mains spikes! This filter removes the gremlins that come down the power cord which cause programs to crash! A necessity for serious computer users! Cat M-9850

$75

THE DICK SMITH SOLDERER'S SPECIAL!

SAVE OVER $4!

STOP PRESS! Current stock sold out Next shipment due soon!

ALL ITEMS AVAILABLE SEPARATELY

1: 30W, 240 VOLT IRON
A budget iron for the hobbyist beginner or expert. Ideal for all electronic assembly work. Cat T-1300. Normally $9.75

2: 250g ROLL SOLDER
Economy pack of popular 1.25mm solder, enough to last you for many, many projects. Cat N-1019. Normally $4.95 roll

3: SOLDERING STATION
Our incredibly popular 3-in-1 stand which holds PCB at any angle, iron and solder. Incredibly versatile: you'll wonder how you got along without it! Cat T-5700. Normally $19.50

ALL THREE FOR ONLY $29.90

NOW! Professional Quality ¼W Metal Film Resistors

- 1% Tolerance!
- Competitively priced
- 10 OHM - 1M range
- T.C. 100 ppm/°C
- Excellent construction & solderability characteristics
- Available EX STOCK

FROM ONLY 5c ea.

PER 100 OF SAME VALUE

INFRA-RED BEAM

Great for hallways, doorways, (shop doors especially!) Easy installation, just connects to master alarm system. Complete with infra-red reflector.

$89

Cat L-5050

Dear Customers . . .

Quite often, products we advertise are completely sold out within a few days. Or problems may hold up delivery of promised goods so they are not in the stores when the advert appears.

Please don't blame the store manager or staff: they are powerless to solve this type of problem!

What we are trying to say is that, if you are about to drive across town to pick up a particular product, why not give the store a ring first: just in case!

Dick Smith and Staff

YOU'VE SEEN IT ON TV?

The incredible Time Machine from Kambrook. Turn on and off any domestic appliances when you want. Completely settable. Heaters, electric blankets, security lighting, pool filters, etc etc. A real bargain! Cat. X-1120

$24.50

NEW BOOKS

'TOP PROJECTS' Vol. 6 (from ETI). A huge selection of the best of ETI projects. 162 pages Cat B-3649

$3.95

WEEKEND PROJECTS For the radio amateur. A collection of quick and easy projects for amateurs from the pages of QST. (ARRL) Cat B-2213

$4.50

COMPUTERS AND COMPUTING Another handbook from ETI. 154 pages of articles, projects, equipment reviews etc. Good value!

$4.95 Cat B-5095

PROTECT YOUR VALUABLE COMPUTER.

Just released: Dust covers to suit the Sorcerer and System 80. Great protection for your valuable investment.

SORCERER: Cat. X-3005
SYSTEM 80: Cat. X-4008

$3.95 ea.

ONE-OFF BARGAINS!

We often buy samples from overseas: most are tested to destruction; some we keep in as-new condition. Here we have three samples which we no longer need, at savings of over 50% off normal retail prices! These samples are sold strictly 'as is', with any faults and no warranties. They are available only from our Mail Order Centre at North Ryde on a first come, first served basis. (Personal callers welcome)

Thinker Toys 'Wunderbus' 20 No documentation; list price $226.00 One only for $99.00!!!!

Thinker Toys 'Keyed-Up 8080' Again, no documentation. List price $310.00: one only for $149.00!!

ESCON Universal Interface for connecting IBM Selectric to a computer via Centronics or RS-232C port. Not working, sample is minus solenoids. (Easily obtainable). Current retail $729; one only $290.00!!!

25-IN-1 KIT

$15.25

Cat K-2032

Here's one for the kids (and maybe the not-so-young!) An experimenter's kit featuring the latest field of electronics, solar power. Learn more about this fascinating subject with these 25 projects: all in one handy package. Cat K-2032

SPEAK'N'SPELL IS BACK!

A lot of customers have missed out on the Speak & Spell talking game. A lot of people have been disappointed! Now they're back: but hurry, stocks are still not as good as we would like them to be! The Speak & Spell is a great aid to teaching your children letter construction and spelling. It uses a special microprocessor IC to synthesise speech electronically: no tape recordings!

NOW THE SPEAK & SPELL IS EVEN BETTER!

Three new plug-in modules to extend the Speak & Spell's vocabulary and give it more interesting variations:

Vowell Power (X-1305)
Super Stumper 1 (X-1301) $17.95 each
Super Stumper 2 (X-1302)

$79.50 Cat X-1300

PLAYMASTER GRAPHIC EQUALIZER

YES! Build your own graphic equalizer and save $70.00! Easy to build with comprehensive step-by-step instruction manual (not just a reprint of the magazine article). With full connection details to suit your amplifier. It's easy to build: why not give it a go?

$99.50 Cat K-3500

ANOTHER TWO NEW STORES SOON!

Yes! We're still growing and serving you better. In the next two months we plan to open a store on Sydney's northern beaches, and then one in Melbourne's north eastern suburbs.

Watch your local papers for opening dates:

BROOKVALE, NSW: 531 Pittwater Rd. (Near Brookvale Oval)

SPRINGVALE, VIC: Cnr Dandenong Rd and Springvale Road

MAJOR DICK SMITH RESELLERS

Listed below are re-sellers who stock a large range of our products. However, we cannot guarantee that they will have all items in stock or at the prices we advertise.

ADVANCED ELECTRONICS 5a The Quadrant, Launceston, Tas. (317 075)
AERO ELECTRONICS 123a Bathurst Street, Hobart, Tas. (348 232)
AMATEUR'S PARADISE 121 Nerang Street, Southport, Qld. (322 644)
A & M ELECTRONICS 78a High Street, Wodonga, Vic. (244 588)
COASTAL ELECTRONICS 43 Vulcen Street, Moruya, NSW. (742 545)
COFFS HARBOUR ELECTRONICS Shop 3, C/H Plaza, Park Ave, Coffs Harbour, (525 684)
CRYSTAL TV RENTALS PTY LTD 66 Crystal Street, Broken Hill, NSW (6897)
DECRO ELECTRIC Cnr Magellan St & Brunner Hwy, Lismore, NSW. (214 137)
ELEKTRON 2000 181 Wharf Road, Newcastle, NSW. (262 644)
ELECTROFIX 133 Malop Street, Geelong, Vic. (97 827)
GOODWIN ELECTRONICS 123 Station Street, Blackheath, NSW. (878 379)
HAWKESBURY ELECTRONIC CENTRE 111 George Street, Windsor, NSW. (773 411)
HUNTS ELECTRONICS 18 Neil Street, Toowoomba, Qld. (326 944)
HUTCHESSONS COMMUNICATIONS CENTRE 5 Elizabeth Street, Mt Gambier, SA. (256 404)
KELLER ELECTRONICS 218 Adelaide Street, Maryborough, Qld. (214 559)
KINGSTON ELECTRONICS & RECORDS Channel Court, Kingston, Tas. (296 802)
KB ELECTRONICS & MARINE 361 Main Terrace, Geraldton, WA. (212 176)
KENT ELECTRONICS 42 Stuart Highway, Darwin, NT. (814 749)
LYREBIRD ELECTRONICS 50 Berry Street, Nowra, NSW. (25 525)
MELLOR ENTERPRISES Shop 2, Forsytha St, Whyalla Norrie, SA (454 764)
M&W ELECTRONICS 48 McNamara Street, Orange, NSW. (626 491)
NAMBOUR ELECTRONIC SHOP Shop 4, Lowan House, Ann St, Nambour, Qld. (411 604)
OOYSSEY ELECTRONICS 101 Main Street Bairnsdale, Vic. (525 262)
POWER'N'SOUND 15 Franklin Street, Traralagon, Vic. (743 638)
P.J. O'BRIEN ELECTRONICS 62 Wee Waa Street, Walgett, NSW. (243)
PURELY ELECTRONICS 15 East St, Rockhampton, Qld. (21 058)
SOUND COMPONENTS 78 Brisbane Street, Tamworth, NSW. (661 363)
SUMNER ELECTRONICS 95 Mitchell Street, Bendigo, Vic. (431 977)
STEVENS ELECTRONICS 42 Victoria Street, Mackay, Qld. (511 723)
SILICON CHIP ELECTRONICS Suite 3, 98 Bridge Street, Muswellbrook, NSW.
TABLELAND RADIO SERVICE 2 Jack Street, Atherton, Qld. (912 017)
TOMORROWS ELECTRONICS & HI FI 68 William Street, Gosford, NSW. (247 246)
TRILOGY WHOLESALE ELECTRONICS 40 Princes Hwy, Fairy Meadow, NSW. (831 219)
TROPICAL TV 249 Fulham Road, Vincant, Qld (791 421)
WAGGA WHOLESALE ELECTRONICS 82 Forsyth Street, Wagga, NSW 2650
VIKING ELECTRONICS PTY LTD 3108 Gold Coast Hwy, Surfers Paradise, Qld. (388 280)

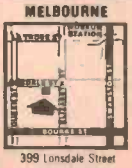
BUYING BY MAIL?

ORDER VALUE:	P&P
$5 (min) to $9.99	$1.00
$10.00 to $24.99	$2.00
$25.00 to $49.99	$3.00
$50.00 to $99.99	$4.00
$100 or more	$5.50

NOTE: These charges apply to goods sent by post in Australia only. Large and bulky items cannot be sent by post.

If you prefer, we will despatch your order by Comet Road Freight to anywhere in Australia for only $6.00 — that's below what it costs us! Large and bulky items are normally sent by Comet unless you specify differently (eg by rail or air — you pay freight on delivery.)

DICKSMITH ELECTRONICS

MELBOURNE

399 Lonsdale Street
Ph (03) 67 9834

RICHMOND

656 Bridge Road
Ph (03) 428 1614

BURANDA

166 Logan Road
Ph (07) 391 6233

CHERMSIDE

842 Gympie Road
Ph (07) 59 6255

CANBERRA

96 Gladstone Street
Ph (062) 80 4944

ADELAIDE

60 Wright Street
Ph (08) 212 1962

PERTH

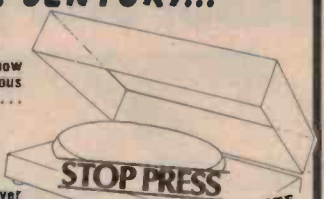
414 William Street
Ph (09) 328 6944

THE BARGAIN OF THE CENTURY!!!

A DIRECT DRIVE TURNTABLE, INC. CARTRIDGE, UNDER $200!!

Impossible? No! Dick's incredible bulk-buying power now brings you this superb direct-drive turntable at a ridiculous price! It's so new, we haven't even taken a photo yet . . . stocks are due in by the time you read this.
Check out the features: and the value!

- Heavy duty diecast platter with strobe
- Brushless DC servo motor with pitch control
- Semi-automatic operation
- Housed in magnificent wooden plinth with clear cover
- Complete with Shure magnetic cartridge.



AND THE PRICE: $199.00 Cat. A-3078

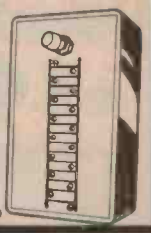
LEDS AND LADDERS GAME

NEW, UPGRADED CIRCUIT AS IN EA THIS MONTH: AND IT'S $1.00 CHEAPER THAN IT WAS IN 1976!!!!

One of our most popular kits of the past was the intriguing 'LEDS AND LADDERS' game described by Electronics Australia back in 1976. Now EA have come up with a new version of this game which is easier to build, and just as much fun. Can you climb out of the well without being plummeted down again?
And the best news of all: this kit is actually CHEAPER than it was in 1976. Yes, $1.00 cheaper, despite 4 years of inflation!

WAS $16.75 IN 1976

NOW ONLY $15.75 Cat K-3390



EFFEMARISE YOUR CAR

FM has arrived: Can your car radio pick it up? Come up to the clean signals of FM with this superb Dick Smith car cassette radio featuring FM (as well as AM). Easy, do-it-yourself installation (instructions included). Recommended.

Cat. A-6480 $149.00

- FM STEREO
- AM
- STEREO CASSETTE

WHAT ABOUT THE OTHER CAR?

The second car hasn't got a radio? Here's a beauty: a powerful push button model at a low price — but not usual supermarket rubbish. Easy do-it-yourself installation.

Cat. A-5980 $45.00

QUALITY CO-AX SPEAKERS

While you're improving your car sound, why not install a set of co-axial speakers. They make a world of difference! A-7000 $39.50

HANDS OFF!

SPEAKER PHONE FOR HANDS-FREE TALKING

What a beauty! You've seen them on overseas TV shows: here they are in Australia. Push-button dialling with last-number memory, loud or soft volume control. Incredible value, use in place of conventional phone.

Cat. X-1177 $99.00

PLEASE NOTE: Although these three devices work perfectly with the Australian Telephone System, current regulations do not permit them to be used for this purpose.

BUILD A KIT!

UNIVERSAL AUDIO MIXER

$49.50

Here's a great kit for the audio buff: a 'universal' mixer designed to do those jobs the others can't — for example, sound on home movies! Professional quality with autotrak, tone controls & VU meter.

Cat K-3492

MORSE KEYER

For all hams or would-be-hams! This kit includes paddle & all components, inc. case (panel is not marked). Variable speed in correct proportion, inbuilt oscillator. Suits most transceivers.

Cat K-3470 $39.50

ULTRA MINI ULTRA HIFI

- 30 WATT RATING!
- 90x90x100 mm!

They might be tiny, but they pack a real hi fidelity punch. Great for cars, vans, units, etc — anywhere that space is at a premium. And look at our low, low price.

$35.00 pair! Cat. A-2380

CLEAN, CLEAR, COMMUNICATION!

That's what you get with the Philips FM320 UHF Cb radio. Use it for business or pleasure, with 40 channels to choose from there's plenty of clear channel space available. Digital read-out with push-button scanning. A beauty!

Cat. D-1800 $330

UHF CB ANTENNA

Here's a roof-mounting antenna to suit the FM320. Quality low-loss construction, easy to fit.

Cat. D-4023 $9.50

IC SOCKETS LEAP DOWN IN PRICE!

Why take chances with expensive IC's? Use sockets for best protection: now there's no excuse as our IC socket prices have taken a huge leap in price:

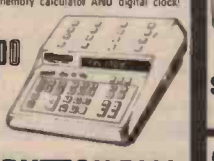
DOWNWARDS!

(All sockets are DIL type)

Pins	Cat No	Was:	NOW:
8	P-4080	30¢	20¢
14	P-4140	35¢	25¢
16	P-4160	35¢	28¢
18	P-4180	85¢	29¢
24	P-4240	90¢	35¢
40	P-4250	$1.10	50¢

CALCUDIALLER

Great for busy executives, secretaries, — or even the home. Remembers 32 numbers, dials them for you at the push of a button. But it's more than that: it's also a comprehensive memory calculator AND digital clock! All this for only



$179.00 Cat. X-1176

DIGITAL FREQ. METER

$99.50

A 7 digit frequency meter you can build for under $100!! 40MHz bandwidth (you can change to 200MHz by adding one 95H90 IC. Z-5360 @ $15.00)

Cat K-3437

SCREWDRIVER BARGAINS!

What a bargain! 10 pieces for less than $4!! Flat blade, Phillips, range of lengths: all for only

$3.90 Cat T-4000

NIBBLE, NIBBLE

Another bargain for the hobbyist. Don't struggle: nibble out holes, corners, etc. For thin aluminium, PCB material, even thin steel. No hobbyist should be without one:

$12.50 Cat. T-4940

WHAT DO YOU BUILD PROJECTS INTO?

You've just built a superb project. Goes perfectly, too. But what do you build it into? It's been a problem up till now! SOLVED! We've just released stocks of two of our most useful project cases: the Playmaster Amplifier and the Musicolor (see sizes below). Rugged construction, but look really great. Add your own front panel and you've got a professional looking project!

'PLAYMASTER' CASE:
(370 x250 x80mm) Passivated steel, with holes in front and rear for pots, switches, terminals, etc. Black vinyl finish top. Cat H-3110. Was $12.50, now only $9.95

'MUSICOLOR' CASE:
(250 x 200 x 80mm). Similar to above, suit a great range of smaller projects.

Cat H-3160 Was $10.90 $7.95

115V PROBLEMS?

A very common request is for a transformer to operate 115V equipment from 240 volts. Here it is: rated up to 60VA (suits most audio & entertainment appliances). Fully approved, ready to plug in.

$42.50 Cat. M-1156

PUSH BUTTON DIAL

Replace your rotary dial with this 20th century push-button type. Ideal for private and experimenter's systems. Simple 4 colour-coded wire installation, no soldering required. Great value! Cat X-1175

$49.95

YOU WON'T BELIEVE THE DIFFERENCE!

You won't believe the difference a Graphic Equalizer can make to your hi fi system without trying it for yourself!

They can make a set of $50 speakers sound like $150 . . . or $150 sound like $450!!! The difference is staggering: and the best part of all is you choose the type of sound you like the best. Imagine: tailor-made sound!

Just hook the graphic equalizer up to your amplifier, and adjust the slider controls. If you don't like the way a particular piece of music sounds, change it! This superb unit also features the latest LED level display: looks really impressive as it shows the level of your music.

Cat. A-1650 $169.00

WANT TO BUILD YOUR OWN? SEE THE PLAYMASTER GRAPHIC EQUALISER ON OPPOSITE PAGE!

A CCTV SYSTEM FOR UNDER $400!

- SECURITY
- SURVEILLANCE
- MONITORING
- HOME, OFFICE
- INDUSTRY

Think of the applications! Extremely simple to set up, light weight and portable (240V operated). Compare the price of this system with others: and you can still watch TV when it's not being used as a monitor!

TV Camera: Cat X-1195
12" TV Monitor: Cat X-1198

BOTH FOR $398

(Items available separately: Camera $299; TV $99)

COMING VERY SOON!

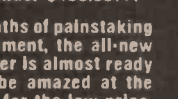
Would you believe a fully operational kit computer for under $400.00???

YES! After many months of painstaking design and development, the all-new NOVA 80 kit computer is almost ready for release. You'll be amazed at the incredible features for the low price. Like:

- Powerful BASIC interpreter included in cost!
- Z-80 based microprocessor
- On-board RAM of up to 48K!!!
- S-100 compatibility
- Full 53 key keyboard 'on board'!
- Modulator for TV output 'on board'! (Video output too)
- Quality cassette interface 'on board' (extremely reliable!) with cassette motor control
- Double sided professional quality fibreglass PCB with plated-through holes
- All components (except transformer) 'on board' virtually eliminates wiring!

YES, all this – and much, much more. See our ads next month for more exciting details!

9kHz WHISTLE FILTER



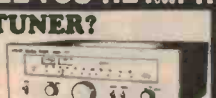
Enjoy your AM listening without those annoying inter-station whistles. Easy to build kit adds on to almost any tuner, a must for the serious music lover.

Cat K-3496 $19.75

AND WHILE YOU'RE IMPROVING YOUR HI FI SYSTEM:

A NEW TUNER?

Now that FM has really started, you deserve a good tuner! This one is ideal for any hi fi system, great on AM too!



Cat. A-1350 $229.00

A NEW DOLBY™ DECK?

For really spanking sound you need the advantages of Dolby™ noise reduction system. You also need to be able to use 'chrome' tapes. You can with this superb Dick Smith Dolby Deck. Front loading, easy to use and superb in quality.

Cat. A-3500 $149.00

DON'T THROW AWAY GOOD BATTERIES!!

Why waste money? Check out your batteries before throwing them out. They may still have plenty of life left in them. Check all standard sizes, plus fuses, globes too. Ingenious!

$9.95 Cat. Q-1525

DICKSMITH ELECTRONICS

SYDNEY

125 York Street
Ph (02) 290 3377

GORE HILL

162 Pacific Hwy
Ph (02) 439 5311

CHULLORA

147 Hume Hwy
Ph (02) 642 8922

PARRAMATTA

30 Grose Street
Ph (02) 683 1133

BLAKEHURST

613 Princes Hwy
Ph (02) 546 7744

WOLLONGONG

263 Keira Street
Ph (042) 28 3800

MAIL ORDER AND SERVICE CENTRES:

Cnr Lane Cove & Waterloo Rds, North Ryde NSW 2113
Ph (02) 888 3200

(Monday to Friday, 9AM to 5PM only)

SHOPS OPEN:
9AM TO 5.30PM MON. TO FRI.;
12 NOON SATURDAY.
(Brisbane ½ hour earlier)

bankcard
master charge
VISA

A 6.5MHz Bandwidth Laboratory Oscilloscope for just $199!

($183.26 Excluding Tax)

★ALL NEW SOLID STATE
★HIGH SENSITIVITY
★COMPACT AND RELIABLE

Designed for Australia to outperform oscilloscopes costing much more! Solid state electronics throughout ensures extremely low drift and almost instant operation.

SPECIFICATIONS:
VERTICAL DEFLECTION
Sensitivity: 10mV/DIV
HORIZONTAL DEFLECTION
Sensitivity: 500mV/DIV
TIME BASE
Sweep frequency: 10Hz-100kHz in 4 ranges. Synchronising: Internal & external
POWER REQUIREMENTS
100/234V 50/60Hz APPROX. 10W.

DIMENSIONS
202Wx160Hx305D (mm)
WEIGHT
APPROX. 3.8kg
COMPREHENSIVE USER'S MANUAL supplied with each unit.

★★★★★★★★★★★★★★

FREIGHT ANYWHERE IN AUSTRALIA $6.00!

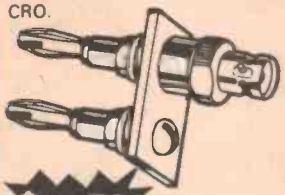
BELOW COST!

Cat. Q-1280

Here's what Electronics Australia magazine had to say: (June 1980)
'Our overall impression of the Q-1280 oscilloscope is that it represents good value for money'.
Ideal for the hobbyist who cannot afford an expensive CRO & yet get the performance he requires.
'The best part of all is the price - just $199, including sales tax!'

Adaptor Plug

Converts the banana socket of the Q-1280 CRO to popular 'BNC' socket. Use a huge range of BNC accessories with your CRO.



$9.50

Cat. Q-1281
P&P $1.00

100MHz Universal Probe

Make your job easier with this versatile high spec probe. Has 3 position slide switch in the lead & 1.5 metres of cable. Complete with all accessories & comes in a deluxe plastic wallet. Use with the above adaptor (or with any CRO).

$34.50

Cat. Q-1245 P&P $3.00

DON'T BE FOOLED!

Cat D-2892

A precision, 500MHz 6 digit DFM for less than $500???
Sounds impossible – but this counter can out-perform many units costing hundreds of dollars more!

Who makes it?
The Yaesu Musen company of Japan – one of the world's largest manufacturers of top quality commercial and amateur receiving and transmitting equipment.

If you need a quality counter at the right price, you need the Yaesu YC-500S. Ruggedly designed for years of trouble-free operation.

High accuracy: one part per million!

* Frequency range 10Hz to 500MHz
* Choice of high or low impedance
* 6 digit LED display
* Temperature range 0° to 40° C
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DSE786

Digital clock features huge display

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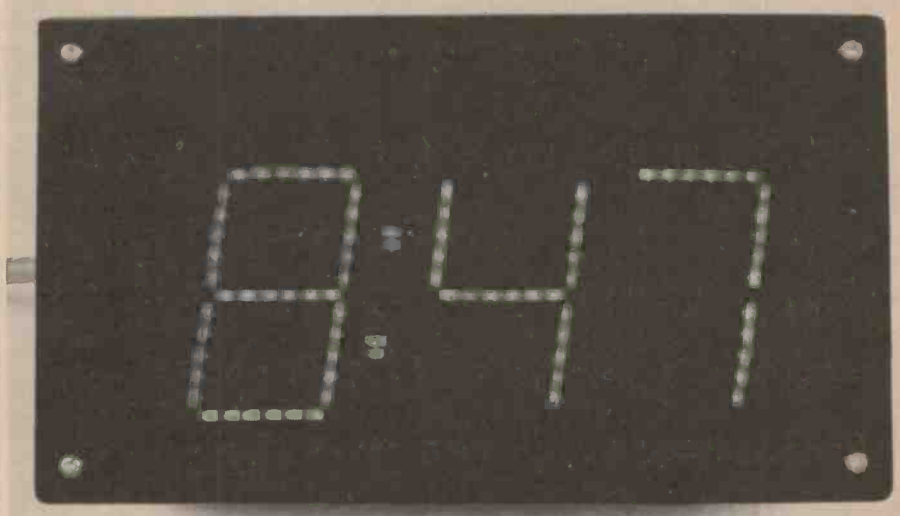
Barry Wilkinson

ISN'T IT just what you've always wanted — a digital clock with a decent sized display? Seeing the time at a glance is convenient in many situations and that's just what this clock has been designed for. The display features three seven-segment digits for the 'minutes units', 'minutes tens' and 'hours units' plus a single column '1' for the 'hours tens' displays. Each segment in the individual displays is made up of a string of LEDs connected in series. Each vertical segment contains five individual LEDs, while each horizontal segment contains six. Overall height of the display is around 60 mm.

We used rectangular LEDs as they provided by far the best looking display compared to the more familiar round LEDs. Suitable rectangular LEDs are made by a number of manufacturers and are readily available through a variety of suppliers. A 'flashing colon' between the hours and minutes digits is provided to reassure you that the clock is going ! However, as a binary divider clocking from the mains is used to drive the clock, a one-second output is unfortunately not available and so the next best output was chosen. This proved to be a division of 32 and thus, from 50 Hz, a pulse every 1.56 seconds is obtained and this is used to flash the colon.

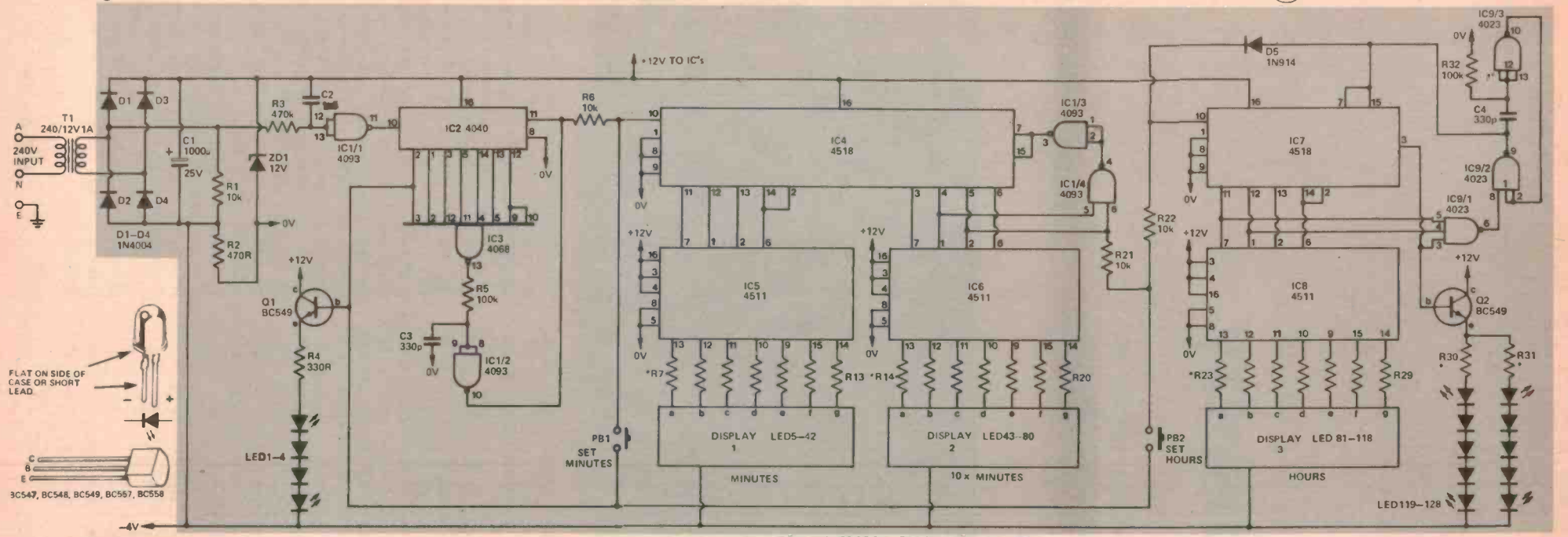


Design

There are a number of interesting aspects to the design of this digital clock. For a start, conventional CMOS binary dividers have been used in preference to one of the special clock divider chips. The latter are very handy, no doubt about that, but they are incapable of driving a large sized display like the one used here. Firstly, the voltage drop across each segment of the multi-LED display varies depending on the type and colour of LED used. Whilst we have used red LEDs, which have a voltage drop of around 1.6 V each, red or yellow LEDs may be used and these have around a 2.1 V drop each. The Philips rectangular LEDs type CQX10-2 are red but have a voltage drop of 2.1 V too while some of the new 'high efficiency' LEDs also exhibit a 2.1 V drop. This means that, for a horizontal segment in our display the maximum voltage drop may be as high as 12.6 V (six LEDs times 2.1 V). The clock chips available cannot readily cope with this but CMOS decoders can be arranged to do what we want.

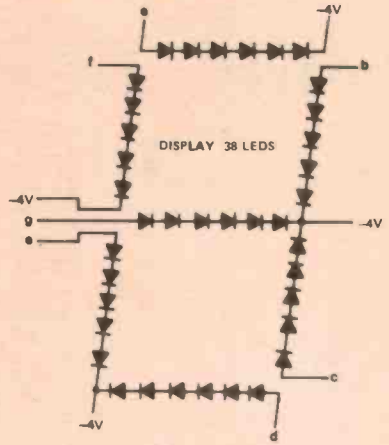
You will notice from the circuit that the LED segments are driven by 4511 CMOS decoders which provide up to 25 mA per segment, with the actual current being determined by current limiting resistors. The current per segment in our circuit is limited to around 20 mA. However, the maximum voltage across CMOS is limited to 15 volts and a supply of around 18 volts was necessary to allow for the drop across the display segment plus the drop across the limiting resistor and the 1.5 V lost in the 4511 output circuit. To overcome this difficulty, we stabilised the negative supply rail for the CMOS to 12 volts and the negative side of all the display segments is taken to the *unregulated* negative supply. The zener action of the LEDs (i.e: there is no current flow below about 1.4 volts per LED) the outputs of the 4511s are never 'pulled' below their negative supply rail.

To obtain a 'clean' 50 Hz square wave for accurate clocking, the ac input (taken from the power transformer) is 'squared-up' by a 4093 two-input NAND gate. This device is similar to the 4011 except that it has Schmitt trigger inputs and this helps to prevent false triggering. ▶



*FOR VALUES OF R7 – R20, R23 – R31, SEE TABLE.

NOTE: rectangular LEDs have one lead longer than the other. The longest lead is the anode.



A total of 38 LEDs are used in each seven-segment display. Each of the vertical segments uses five LEDs, while the horizontal segments use six.

HOW IT WORKS ETI-564

The power supply is simply a 12 V output transformer, full-wave rectified and filtered by C1. The IC supply is stabilised by ZD1 to 12 volts. For timing, the ac voltage is coupled to the input of IC1/1 via R3, with C2 providing some filtering to prevent false counting. The value of R3 protects IC1/1 against input damage as the ac voltage exceeds the supply rails of the ICs. IC1 is a 4093, which is a two-input NAND gate, similar to the 4011, except that it has Schmitt trigger inputs, and this helps to prevent false triggering with the output of IC1/1 being a clean 50 Hz square wave.

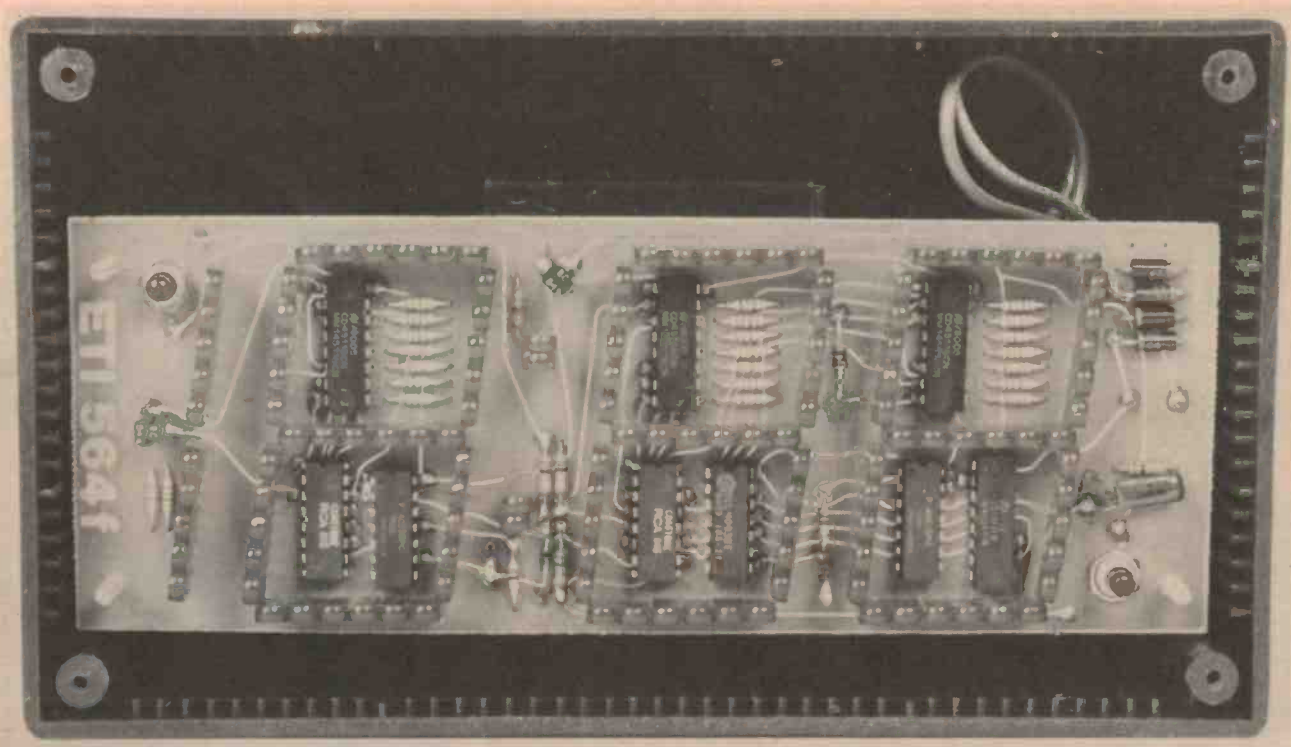
As the first digit is the minutes display, a division of 3000 is needed. For this IC2, 3 and IC1/2 are used. IC2 is a 4040 which is a 12-stage binary divider. The outputs of the 4th, 5th, 6th, 8th, 9th, 10th and 12th stages are decoded (when all are high) and the counter reset at that time to provide a division ratio of 3000 (binary 101110111000). This is detected by IC3 whose output gos low on that number. After a short delay (about 30 us) due to R5/C3 the output of IC1/2 will go high, resetting IC2. This immediately causes the output of IC3 to go low but, again due to R5/C3, the output of IC1/2 will remain high for about 20 us, ensuring correct resetting and the clocking of the minutes counter.

An output of IC2 (pin 2) is used to drive the colon and to provide the clock for the fast set modes. Unfortunately, exactly one second is not available using a binary divider so we chose the 1.56 second (50/32) output.

The output of IC1/2 (a 20 us pulse once per minute) clocks IC4 which is a dual decade (10) counter. The first half is used as a ÷10 and its output is decoded by IC5 to give the minutes display. The second half is clocked by the output of the first (10 minutes) and is decoded by IC6 to display the tens of minutes. As time has yet to be decimalised (!), we have to reduce the second half from ÷10 to ÷6. This is done by IC1/4 which detects when the 2nd and 3rd outputs are high (binary 0110) and resets it to zero.

The third output is used to clock the hours counter, IC7. This, like IC4, is a dual decade counter with the first half being decoded by IC8 and the second being clocked by the output of the first. As only a simple "1" is needed for the tens of hours (12 hour clock) no decoder is necessary, only a buffering transistor. IC9 is used to decode when IC7 reaches decimal 13 (0001 0011 binary) and this triggers a monostable formed by IC8/2,3. This is used to reset IC7 to zero hours, but, as there is no zero hour in the 12 hour system we need a reset to "1". This is done by the diode D5, which pulls pin 10 high for the duration of the reset pulse and allows it to fall back again — a few microseconds (delayed by stray capacitance) after the reset pulse, clocking it on to 1.

Fast setting is done simply by injecting, by the use of push buttons, the 1.5 second pulse directly into the minutes or hours counters.



The pc board patterns are on page 137

PARTS LIST — ETI-564

Resistors all ¼W, 5%

R1,R6,R21,R22	10k
R2	470R
R3	470k
R4	330R
R5, R32	100k
R7 - R20	see Table 1
R23 - R31	see Table 1

Capacitors

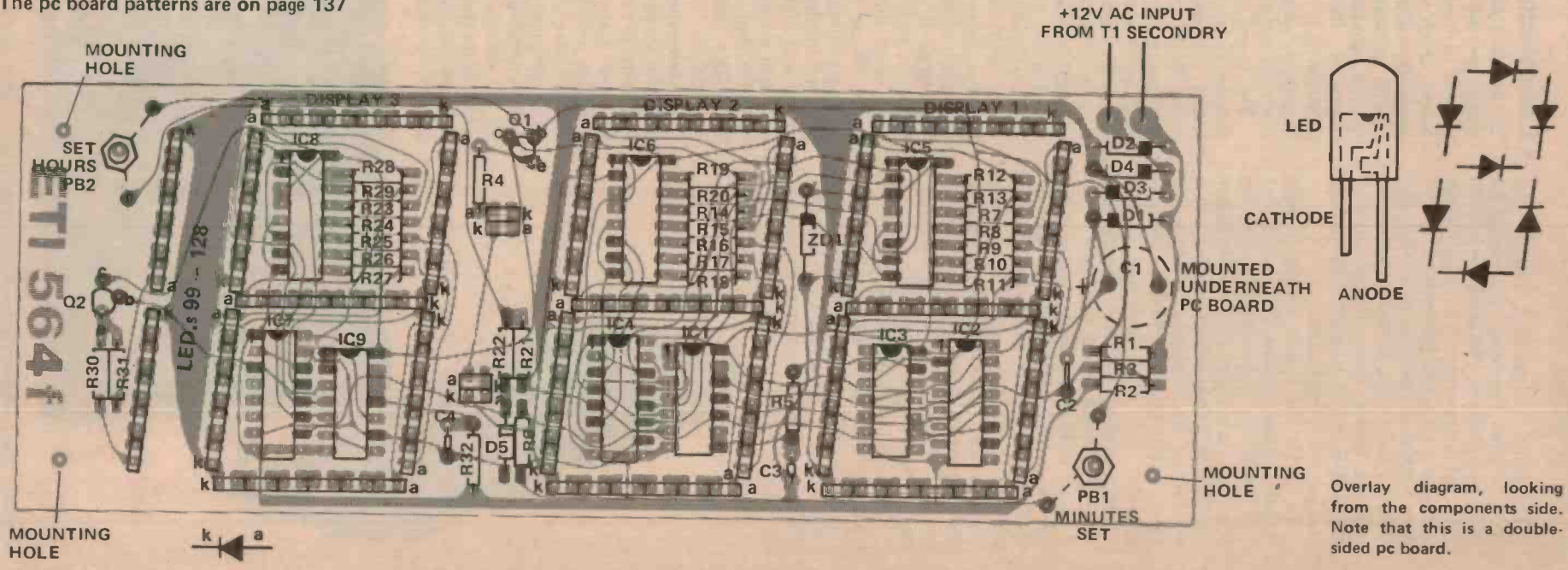
C1	1000u, 25 V pc electro
C2	4n7 polyester
C3 C4	330p ceramic

Semiconductors

IC1	4093
IC2	4040
IC3	4068
IC5, 6, 8	4511
IC9	4023
Q1, Q2	BC549
D1-D4	1N4004
D5	1N914
ZD1	12 V, 400 mW zener
LED1-128	LEDs (see text)

Miscellaneous

Two push-button switches; transformer 240 V to 12 V at 1 A; sheet of polarised plastic; pc board ETI-564, case to suit; nuts, bolts etc.



Overlay diagram, looking from the components side. Note that this is a double-sided pc board. ▶

To derive a 'minutes' output, the 50 Hz mains frequency is divided by 3000. To perform this division a 4040 12-stage binary counter is used. As this provides a total division ratio of 1:4096 ($2^{12} = 4096$) the counter has to be reset once it reaches the 3000th count. To do this we detect when the outputs of stages 4, 5, 6, 8, 9, 10 and 12 are all high and provide a reset pulse.

To derive the 'hours' output, a dual decade counter is used. This is IC4. One half is used just to divide by 10 while the other half is arranged to be reset before completing its count to provide a further division of six, resulting in a total division of 60. A decoder on the ÷10 stage provides the 'minutes units' display while a decoder on the ÷6 stage provides the 'minutes tens' display.

The output from the tens-of-minutes divider (second half of IC4) is divided by six in the same way as just described to provide the 'hours units' output and this is followed by decade counter to provide the 'hours tens' output. These divisions are provided by IC7 which is reset to '1' when it reaches a count of '13'.

The hours units display is derived by a decoder from the first half of IC7 as for the other digits, but the 'hours tens' is only ever a '1', provided by a row of 12 LEDs. A buffer transistor drives this display.

Construction

We found it necessary to use a double-sided printed circuit board for this project to avoid a large, cumbersome board which we feel sure you'd agree would be rather unattractive. To avoid ulcers, premature greying of the hair, muscle tremors and other assorted maladies that may develop from attempting to completely handwire this project, we suggest you obtain a printed circuit board as specified.

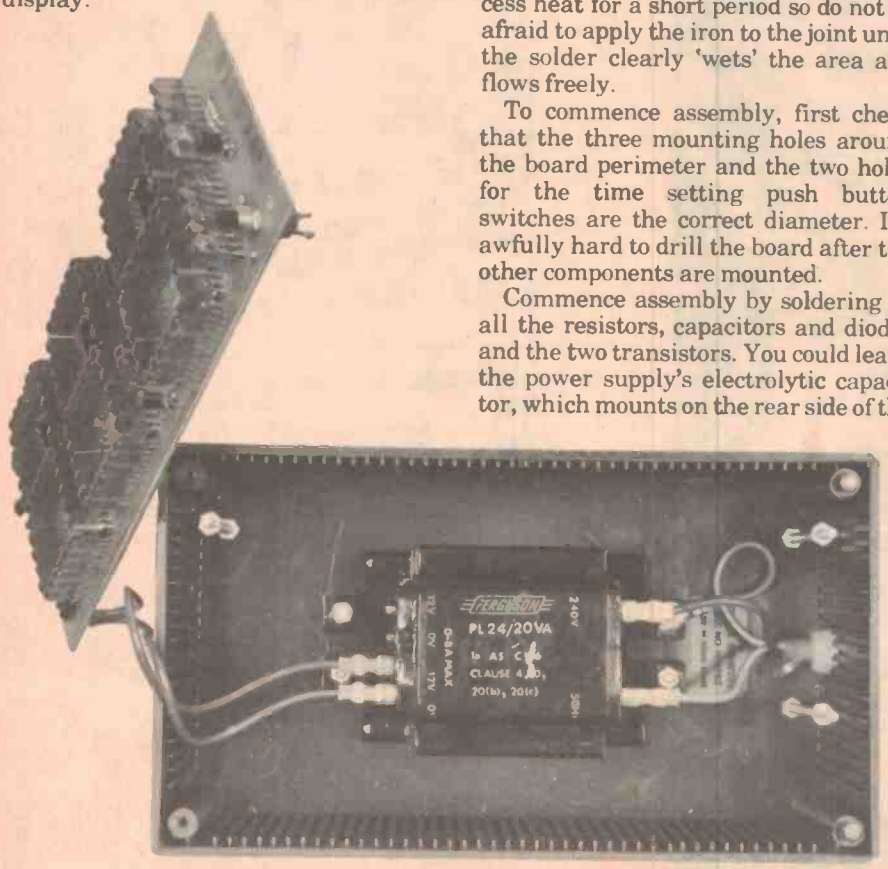
The board used in our prototype did not use plated-through holes as it is not really necessary. However, there are many fine tracks on the board and we recommend you use a soldering iron with quite a small tip. When soldering tracks on the top side of the board where a component lead connects to a corresponding track on the underside of the board, always ensure that you heat the joint sufficiently to get a good flow of solder and avoid a dry joint. From previous experience we find that many constructors tend to be afraid of overheating an IC or other components and do not provide enough heat for a good joint with the result that dry joints occur. These may work initially but often give problems some time after the project is completed and in use. Modern components will readily withstand excess heat for a short period so do not be afraid to apply the iron to the joint until the solder clearly 'wets' the area and flows freely.

To commence assembly, first check that the three mounting holes around the board perimeter and the two holes for the time setting push button switches are the correct diameter. It's awfully hard to drill the board after the other components are mounted.

Commence assembly by soldering in all the resistors, capacitors and diodes and the two transistors. You could leave the power supply's electrolytic capacitor, which mounts on the rear side of the board, until all the other components are assembled if you wish. Take care with the orientation of the diodes, paying particular attention to the component overlay. Note that different value ballast resistors are required, according to the type (and thus the voltage drop) of LEDs chosen. Refer to Table 1 for the appropriate values.

As CMOS ICs are used, take care when inserting them that you handle the devices with due care. Carefully remove them from their packaging, taking care not to handle the pins — pick them up with your thumb and forefinger grasping the ends of the package, not the pins. Make sure you have them correctly oriented before inserting them in the board. Also ensure that you put each IC in its correct place and on the correct side of the board too! Sockets cannot be used for the ICs as many of the pins are soldered on both sides of the board.

With the LEDs used in our prototype (Siemens LD80-2 and Philips CQX10-2) we first taped the groups for each segment together. To do this, lay a group of five or six LEDs down, anodes or cathodes all facing the same way, butt their heads against a straight edge and run a strip of tape first over one side, then the other. This makes assembly much easier. Having done this, insert the LEDs into the board. The LEDs we used have a shoulder or 'step' in their leads a few millimetres from the base. We pushed the LEDs down onto the pc board until this shoulder stopped them going any further. The outside lead of each segment array was soldered and then each group checked for align-



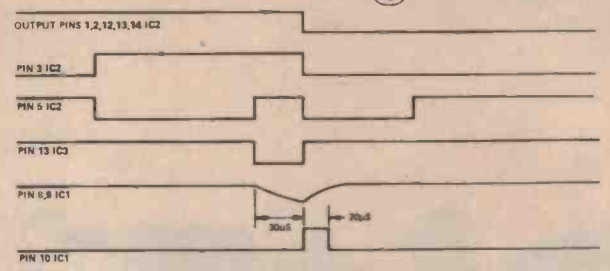
Inside the clock, showing how we mounted the transformer. Take care with the mains wiring.

Setting the time

1. Switch on.
2. Press the minute button (the right hand one) until the minutes display is correct. To prevent multiple pulsing due to contact bounce, the button should be pressed and released when the colon is **OFF**.
3. Set the hours in a similar manner to the minutes (left hand button). If the minutes display is less than 40, again operate the button when the colon is **OFF**. If the minutes display is 40 or more, operate the button when the colon is **ON**.
4. An easy way to set the clock to the *exact* time is to first set it some 20 - 30 seconds fast by the push buttons, then compare it to a known time standard (you might use Telecom or a radio time signal for this). Turn off the power for the exact time *difference* and the clock will cease counting. The large filter capacitor will hold its charge long enough to store the last time, for up to a few minutes, until the power is turned back on. When the time signal equals the clock display, turn the clock on.

TABLE 1: Value of ballast resistor for the LEDs

RESISTOR	1.6V LEDs	2.1V LEDs
R7, 10, 13, 14, 17	180R	150R
R20, 23, 26, 29	180R	150R
R8, 9, 11, 12, 15, 16	270R	180R
R18, 19, 24, 25, 27, 28	270R	180R
R30, 31	270R	180R



Waveforms around IC2 and IC3.

ment before soldering the other leads.

The rectangular LEDs specified measure 2.5 mm wide by 5 mm long. If you elect to use conventional round LEDs, the miniature 3 - 4 mm diameter types should be used. Many of the larger sized round LEDs will not fit this pc board as they have a shoulder around the base of the unit that measures 6 mm diameter, preventing the close packing possible with the other types.

Once you have the LEDs mounted and soldered in place, the two push button switches may be mounted. Short lengths of tinned copper wire are run from the switch lugs to the adjacent pads on the pc board.

At this stage, if you are satisfied everything has been mounted correctly, the board may be tested — *but give it another thorough check first!* In particular, look for solder 'bridges' between IC pins or across closely-spaced tracks as well as possible dry joints.

Simply apply 12 Vac to the two pins marked on the board overlay and see that the clock operates as it should. Try the 'hours set' and 'minutes set' buttons to see that they have the required effect. If all is not well, switch off and re-check the component placement and orientation, check for dry joints, etc.

We mounted our clock in a convenient plastic 'jiffy' box measuring 196 x 113 x 60 mm. The PL12/20VA 'low height' transformer is screwed to the rear of the box. The mains lead enters one side through a cable clamp. The pc board is mounted on three 58 mm long bolts with nuts positioned at a distance from the rear of the case determined by the height of the transformer.

To drill the case, first mark the position of the holes for the pc board mounting bolts. Use the pc board as a template, laying it face down on the outside rear of the case. It's probably best to do this before loading the board. Failing that, measure the position of the holes and accurately mark them on the case. Use the photographs here as a general guide.

The board is not located centrally between the two long sides of the case. The upper edge of the board is located about 30 mm from the top side of the box. Ensure that the board does not foul the inside mounting flutes or pillars. If all is well, drill the holes and check that the board mounts properly.

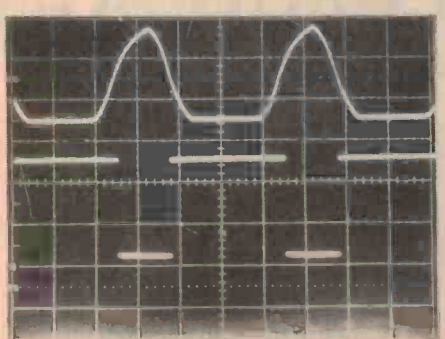
Next, mark the position of the mounting bolts for the transformer, which is located under the board. Drill these and check that the transformer will mount without fouling anything. It should, there's plenty of space. The hole for the mains cable clamp should be located and drilled next.

The front panel may now be tackled. A large rectangular cutout is made in the front panel, just larger than the display. A piece of circularly polarized plastic is cut to the *outer dimensions* of the case, using the case as a template. As we chose red LEDs, we bought a piece of red plastic. For other colour LEDs, use grey. This plastic is available through Polaroid Australia. Lay the case face down on the piece of plastic and scribe around the edge. Remove the case and carefully cut around the scribe mark. Next, place the panel over the piece of plastic and mark where the four panel mounting holes are located, then drill them. Two further holes have to be drilled in the plastic panel to permit access to the time setting push buttons. You're going to have to use a little judgement in locating these, but they don't have to be located all that accurately, just such that a match can be inserted to depress the buttons.

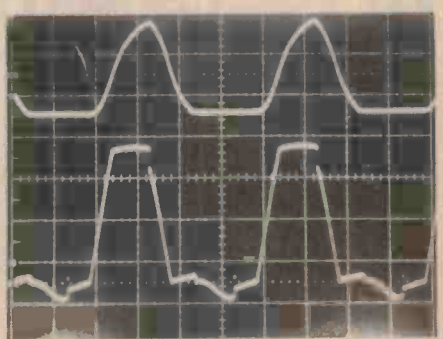
The plastic may now be glued carefully to the panel, or stuck on with double-sided sticky tape. As the clock dissipates some ten watts, ventilation is necessary. The easiest way to provide this is to stack some washers behind the front panel, on the mounting screws, such that the panel stands out from the case about 2 mm.

Now the clock may be finally assembled. Mount the mains transformer and secure the three pc board mounting bolts. Attach the mains cable and clamp then wire up the transformer primary and secondary. An earth lug should be mounted under one of the transformer mounting bolts and the mains cable earth soldered to it. A piece of cardboard, about 80 mm by 50 mm, should be stuck to the top of the transformer with a piece of double-sided tape. This is to insulate the rear of the pc board from the transformer case.

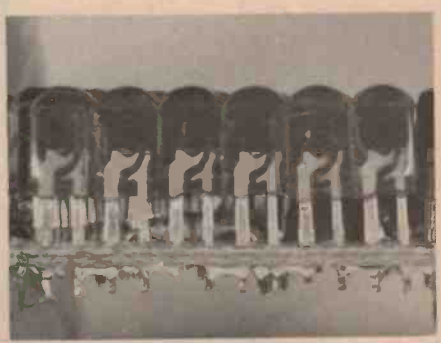
The nuts to locate the rear of the pc board should now be put on the mounting bolts and the pc board carefully secured in position. Make sure the board is held securely without it bending. Mount the front panel, plug in and you're ready to set the time! ●



Waveforms around IC1. At top is the waveform on the input, bottom shows the output.



Top waveform shows the input to IC1/1, lower trace shows the ac input to R3.



How the LEDs were mounted. The 'shoulders' on the leads are butted against the pc board.

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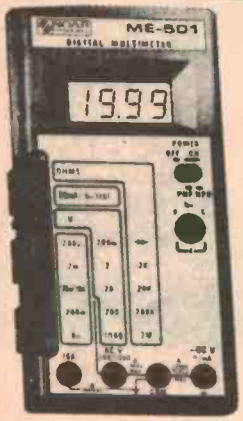

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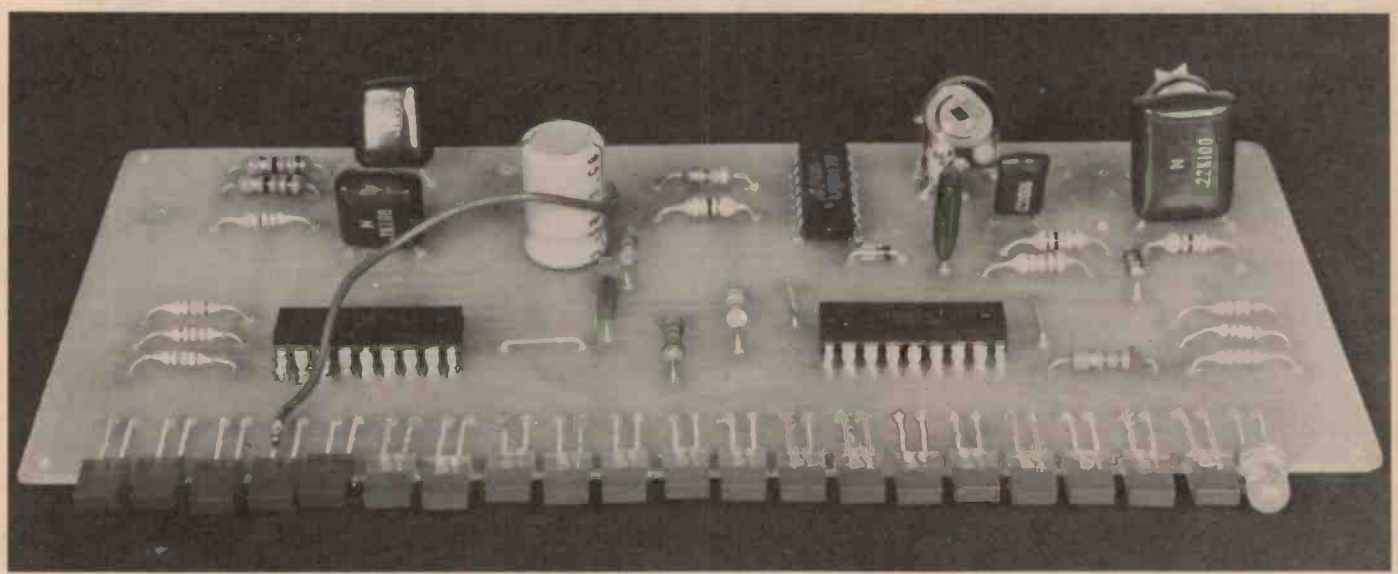
Project 324

Twin range tacho features LED bargraph display

Staff

Another in our series of projects to "update your car electronically", this tacho has many advantages over conventional types.



FEATURING a bargraph display of 20 rectangular LEDs arranged in a single line, plus one 'zero' LED, this tachometer incorporates an over-rev alarm feature and a high/low range switch. It displays engine speed in an analogue form (as with a conventional tacho) as an illuminated section of the row of LEDs, the length of the 'bar' being proportional to engine speed. This form of display indicates at a glance what your engine is doing, without the necessity of having to mentally interpret a numerical display as you would with a digital tacho — you don't have to take your eyes off the road, nor try to interpret rolling numerals during acceleration or deceleration.

This unit may be used with virtually any type of multi-cylinder petrol engine. The two speed ranges are calibrated by means of preset trimpots to give any full-scale speed range required. The lower range is of great value when setting or checking an engine's ignition and carburation for recommended tick-over speeds. The unit has been designed for use on 12 volt, positive or negative earthed electrical systems. It can be used with conventional (Kettering), capacitor-discharge (CDI) or transistor-assisted ignition systems — where a contact breaker system is used. Only three connections are required to install the unit — one to the positive supply, one to the negative supply and one to the contact breaker points. Protection circuitry has been included to prevent noise on the supply from causing problems and high voltage spikes from the points and coil circuit damaging the electronics.

Design

The tacho has been designed around a frequency-to-voltage converter IC, the LM2917, driving two LM3914 LED bargraph driver chips. We covered various applications of the LM3914 in 'Lab Notes' in our March issue (page 61).

The LM3914s have an alarm facility which we have incorporated as a feature of the circuit. The triggering point for the alarm is arranged by taking a connection to an appropriate LED in the display. When the engine revs reach the point where this LED is turned on, the alarm will be triggered and the display will flash. An optional audible alarm can also be attached, the better to attract the driver's attention.

We chose a conventional (round) orange LED for the (zero) indicator in ▶

HOW IT WORKS ETI-324

The circuit consists of a pulse conditioning circuit, R4 - R6, C5 and ZD1, a frequency-to-voltage converter, IC1, and two LED bar display drivers, IC2 and IC3. Each display driver is capable of driving 10 LEDs, giving a total of 20, plus one 'zero' LED. The number of LEDs illuminated is proportional to the output voltage from the frequency-to-voltage converter.

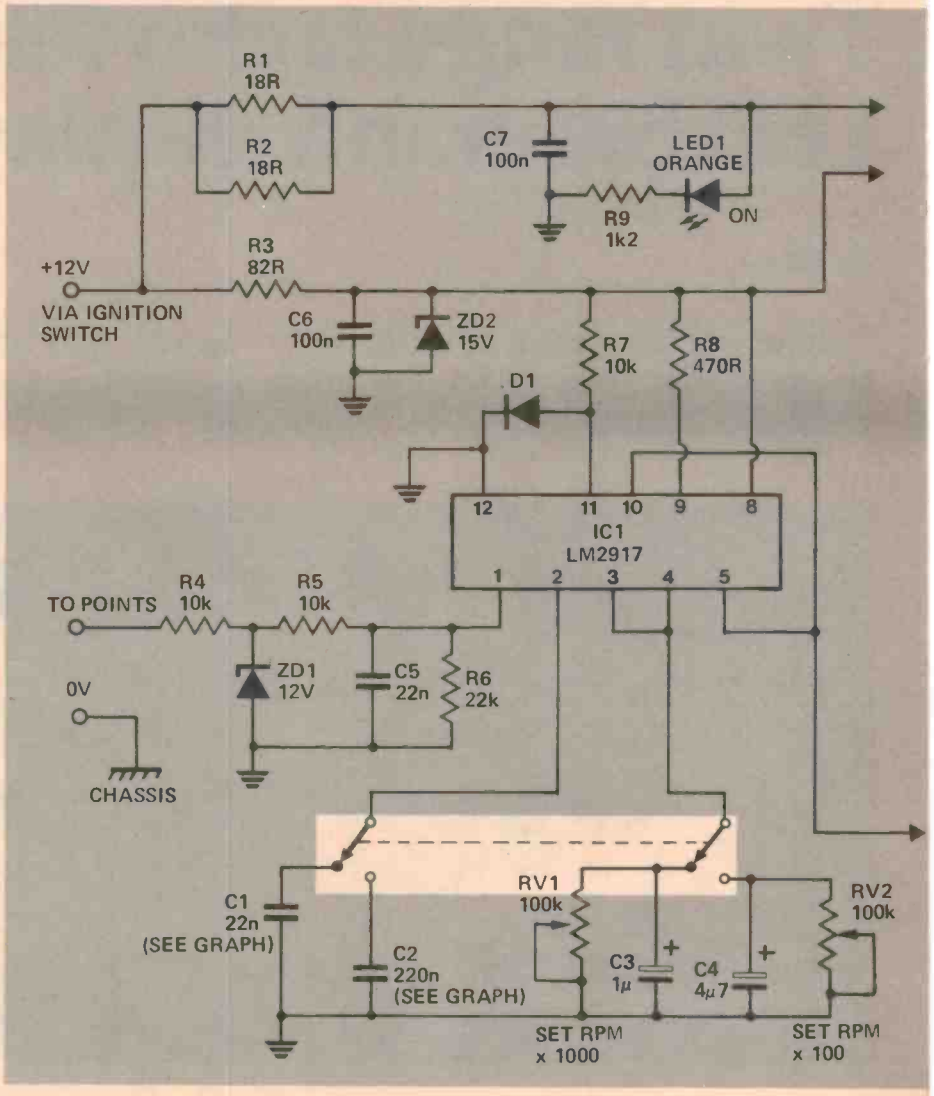
The ignition pulses from the contact breaker points in the vehicle have a repetition rate proportional to the RPM of the engine. The pulses from the points contain high voltage ringing components on the rising and falling edges of the waveform. These can be as high as 250 V at frequencies up to 10 kHz. These pulses would almost certainly damage the electronics so the input to IC1 is preceded by a pulse conditioning circuit. The 12 V zener diode, ZD1, shorts out any voltage spikes above 12 V while any remaining high frequency component is removed by R5 and C5.

The 'cleaned-up' rectangular waveform is fed to pin 1 of IC1. This is a voltage-to-frequency converter, providing an output voltage directly proportional to the frequency of the input waveform. The operating range of the IC is determined by the value of a capacitor connected to pin 2, either C1 or C2, and by a timing resistor and smoothing capacitor connected to pins 3 and 4. (RV1, C3 or RV2, C4). In our application, two preset ranges are provided by the range switch, SW1. The IC contains a constant current charging circuit for the timing capacitors (to ensure an output that is linear with frequency) and an internal voltage regulator. The network of R7 and D1 provides an input threshold level to guard against false triggering from noise.

The dc output of IC1 is fed to the inputs of the display drivers IC2 and IC3. These are LED 'bar' or 'dot' display drivers. Each IC can drive a chain of 10 LEDs and the number of LEDs illuminated is proportional to the output voltage from IC1. Put simply, the ICs act as LED voltmeters. The two ICs are 'cascaded' such that they perform as a single 20-LED voltmeter with a full-scale range of 2.4 volts. The resistors R13 to R18 are wired in series with the display LEDs to reduce the power dissipation in the two ICs. LED1 is permanently illuminated, providing a 'power on' indication and a 'zero' point for the display.

The LM3914 ICs incorporate an alarm facility. The triggering point for the alarm can be connected via a flying lead to any of the LEDs, selecting the trigger point. When the selected LED is turned on, the voltage on its cathode goes low, triggering the alarm. Capacitor C8 discharges, blanking the display. The LED is then turned off and the alarm resets. The capacitor is then re-charged, the display lights, and the alarm is triggered once again. The audible alarm will sound and display flash a few times a second. As soon as the RPM drops so the selected LED does not light, the function of the tacho returns to normal.

Supply line filtering of noise pulses is achieved by R1 - R3, C6 and C7. Reverse polarity and overvoltage protection is provided by ZD2.



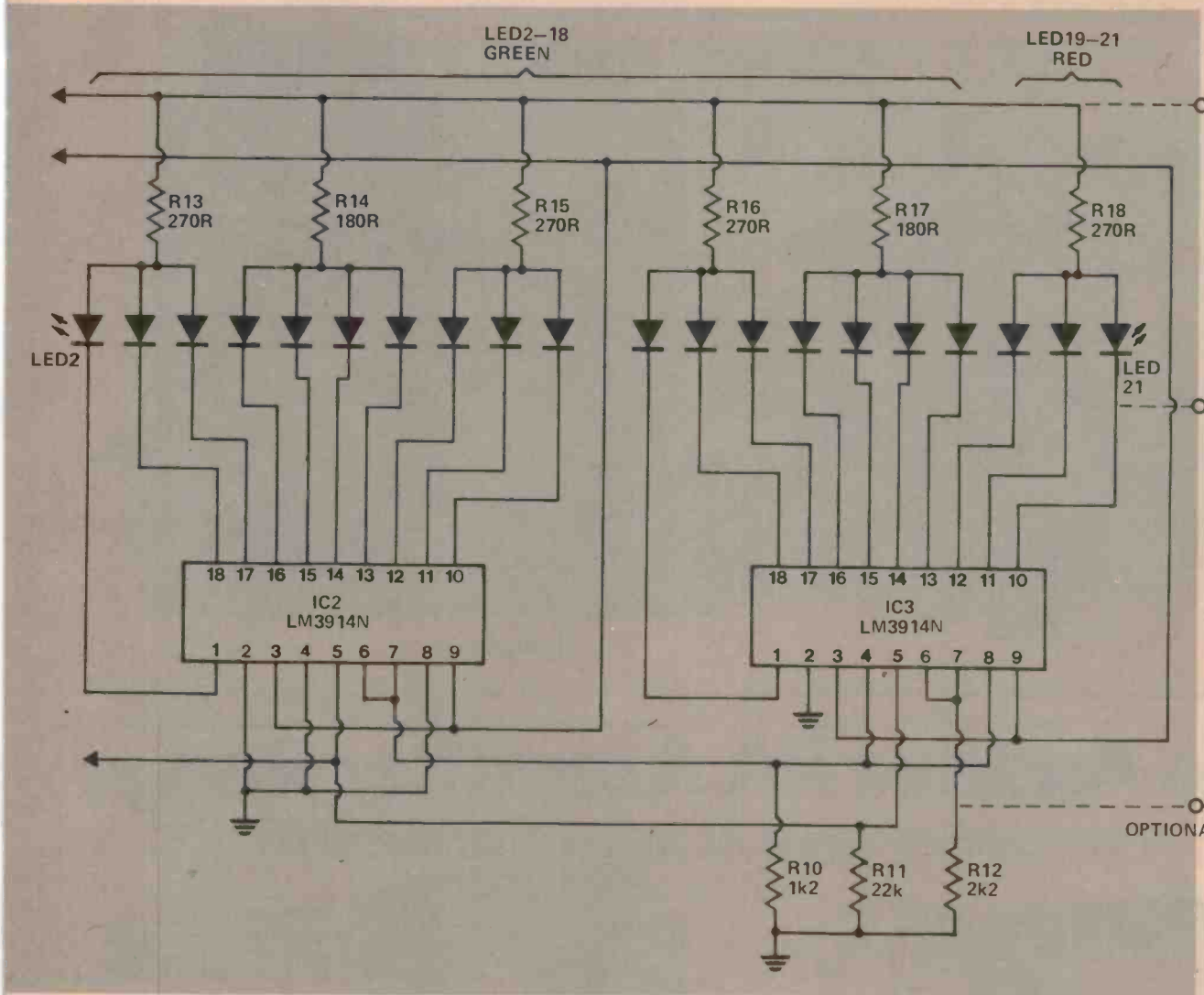
position one (it also indicates power on), rectangular green LEDs in positions 2 - 18 for the normal driving range, and rectangular red LEDs for the positions 19 - 21 giving a 'red line' area of 25% of full display. We thought this was the most convenient arrangement but you may vary it to suit your particular situation. All round LEDs may be used if you wish, but we found the rectangular LEDs provide a better looking display.

Construction

Our printed circuit board is pretty well essential for constructing this project. The LEDs for the bargraph display are all mounted in a row down the front of the board. As you can see from the accompanying photographs, all the components with the exception of the range switch and audible alarm are mounted on the pc board.

You will find construction easiest if you mount all the ICs, resistors and capacitors first, leaving the LEDs till last. Make sure you have the ICs correctly oriented, as well as the diodes and tantalum and electrolytic capacitors. Refer to the component diagrams and pc board overlay.

When mounting the LEDs it is *most important* that they be placed in the board the right way around. One of the best ways of ensuring this is to first place them on the table or workbench in a row in front of you, with their leads all correctly oriented, just as they would be when mounted on the board. To ensure the leads are the right way around, refer to the overlay and the accompanying



The pc board patterns are on page 137

drawing showing LED orientation. Now comes the hard part — mounting the LEDs so that they're all level! Insert LED2 first and bend it such that it lies flat on the board with the base of the LED flush with the edge of the board — as shown in the pictures. Solder its leads. Bend it back upright and then insert LED3, carefully positioning it such that it is flush with LED2. Solder it in position. Proceed like this until all the LEDs are in place and then bend the whole row over, parallel to the board.

A flying lead is used to connect the alarm circuit to one of the LEDs. This determines when the display will flash and the audible alarm (if used) will sound. This lead should be left floating until the two speed ranges are set up. Attach flying leads for the switch connections, supply and points connection.

Mounting

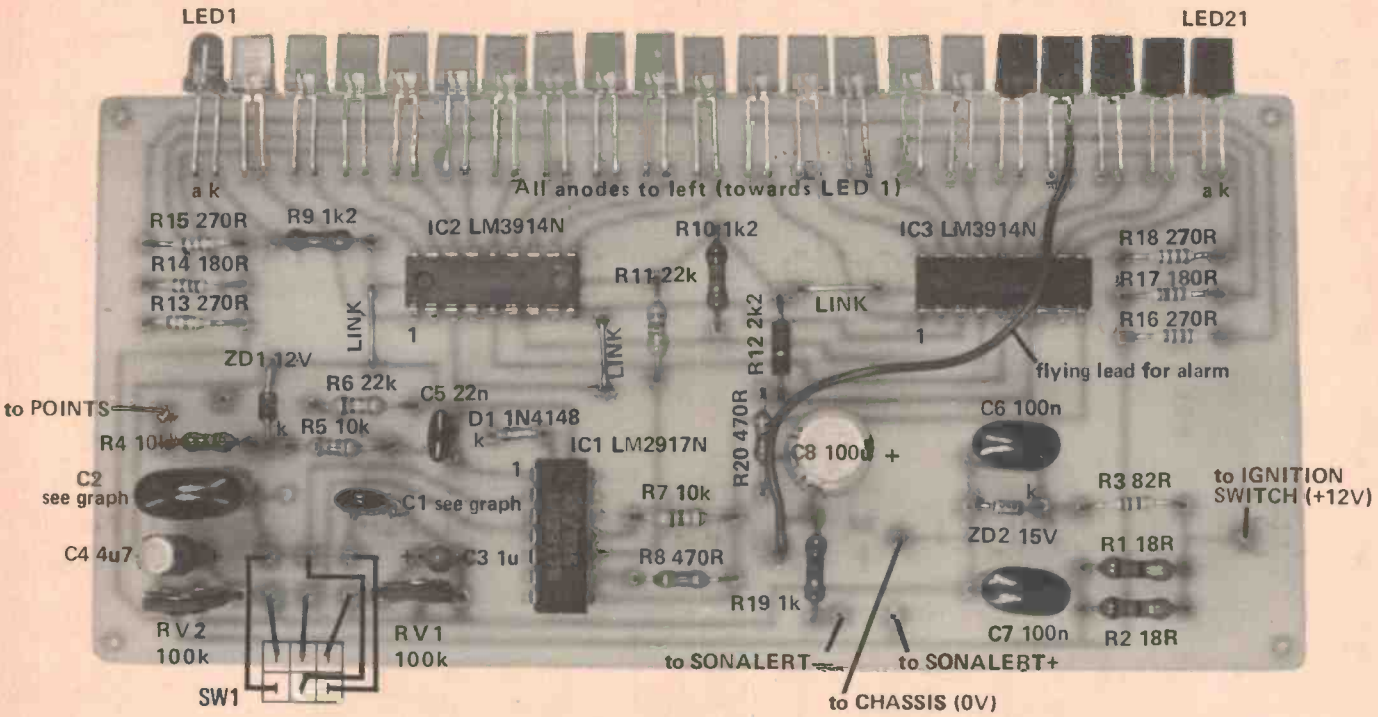
Having built the unit, you'll have to consider where it is to be mounted. In fact, it may be prudent to think about this as your very first step! The tacho can be mounted such that the display is either horizontal or vertical, depending on your preference and available space in the dashboard. It is best mounted not too far from the driver's line of view so that it can be seen without his eyes leaving the road for too long, and to the side of his normal vision.

If you are brave enough, the unit can be mounted behind a slot cut in the vehicle's dash, as near to the speedometer as you can manage. Watch out that there's enough space to accommodate the unit behind the panel before you cut, though!

If that doesn't appeal to you, the unit may be housed in a slim plastic case which is then mounted in a convenient position on the dashboard.

The range switch and audible alarm may be mounted in any convenient position, no matter where or how you mount the tacho itself, as lead length to these components is not at all critical.

Only three connections are made to the vehicle's electrical system: battery +12 V, contact breaker points and chassis (0 V). The battery connection should be taken after the ignition switch so the unit is only on when the ignition is on. The wire to the points will have to be taken through the fire wall to ▶



PARTS LIST — ETI-324

Resistors all ¼W, 5%
- R1, R2 ..... 18R
- R3 ..... 82R
- R4, R5, R7 ..... 10k
- R6, R11 ..... 22k
- R8, R20 ..... 470R
- R9, R10 ..... 1k2
- R12 ..... 2k2
- R13,15,16,18 ..... 270R
- R14, R17 ..... 180R
- R19 ..... 1k

Potentiometers
- RV1, RV2 ..... 100k, minlature vert, mounting trimpots

Capacitors
- C1 ..... 22n greencap (see text)
- C2 ..... 220n greencap (see text)
- C3 ..... 1u, 16V electro. or tant.
- C4 ..... 4u7, 16V electro
- C5 ..... 22n greencap
- C6, C7 ..... 100n greencap
- C8 ..... 100u, 16V electro.

Semiconductors
- IC1 ..... LM2917N
- IC2, IC3 ..... LM3914N
- D1 ..... 1N914, 1N4148 or similar
- ZD1 ..... 12 V, 400 mW zener
- ZD2 ..... 15 V, 400 mW zener
- LED1 ..... Orange LED, round or rectangular
- LEDs 2 - 18 ..... Green LEDs, round or rectangular
- LEDs 19 - 21 ..... Red LEDs, round or rectangular

Miscellaneous
SW1 — DPDT minlature toggle switch, ETI-324 pc board, case (if required), Sonalert (if required).

the points terminal on the outside of the distributor. The easiest way, rather than drilling a hole in the firewall, is to run the wire next to a wiring loom or the speedo cable, through an existing hole. Make sure the wire is well insulated and there is no possibility of the insulation being rubbed off, causing the points to be shorted to the chassis. The chassis connection can be made to any convenient point on the car body under the dash.

Setting up

All that's left is to set the two RPM ranges by adjusting the two trimpots and to set the point when the alarm triggers.

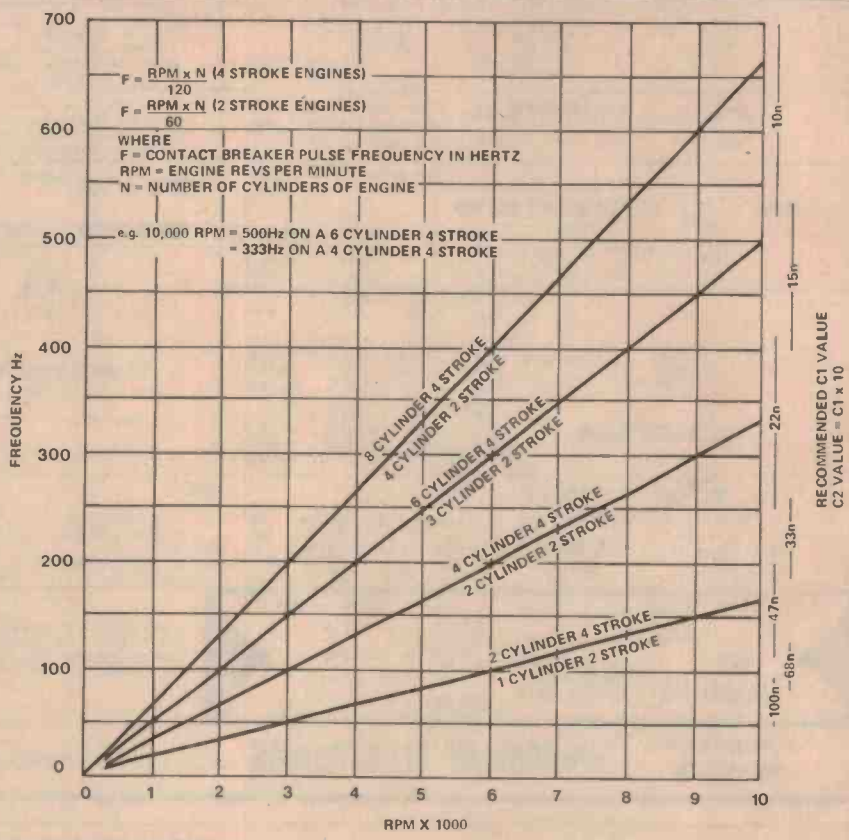
The easiest way to set the RPM ranges is to borrow a friend's tacho. All good dwell angle test meters have an RPM range so it shouldn't be too hard to find a suitable unit.

Run the engine at half the required maximum RPM range and set RV1 so that the *eleventh* LED just lights. Full scale will then be *twice* the engine speed. This technique avoids having to run the engine at full RPM with no load which can be very damaging to your engine as well as you ears!

The low speed range can be set by adjusting RV2 until the *21st* LED just lights at the desired engine RPM. As this is a low speed range there is no danger to the engine.

The alarm triggering point is set by soldering the flying lead directly onto a LED cathode lead. We set ours on the lead of the second red LED. This can be made to trigger at say 6000 RPM by adjusting RV1 for a full range of 7000 RPM. If you don't need the alarm, the flying lead can be left off or the optional components left off the board completely.

That's it — project completed, calibrated and ready to roll! ●



Setting C1 and C2

The values of the two timing capacitors, C1 and C2 are selected to give the desired full-scale RPM ranges.

The graph gives the value of C1 (right hand scale), for various RPM ranges (bottom scale). As the number of breaker point openings per revolution depends on the number of cylinders and whether it is a two-stroke or four-stroke engine, four lines are drawn on the graph for the eight common engine types.

Select the RPM range over which you want your tacho to operate (i.e: 10 000 RPM full scale) and draw a line upwards from the bottom scale until it intersects the line for your particular engine type. Then, draw a horizontal line across to the capacitor scale and read off the value of C1.

Since the low speed range is one-tenth the scale of the high range the value of C2 will be 10 times C1. i.e: if C1 is found to be 22n, C2 will be 220n.

If your engine is something out of the ordinary, like a five cylinder two stroke diesel (!! . . . Ed), you will have to draw your own line on the graph! This is what the left hand frequency scale and the formulae are for. The formulae give the frequency of the points openings for all engines. Work them out for two RPM values, at say 2000 and 8000 RPM, plot the points on the graph, and draw a straight line between them. You can now work out the values of C1 and C2 as before.

If you have some entirely different use for the tacho, for example: on a piece of rotating machinery, if you know the maximum frequency, or speed, in revolutions per second draw a straight line across the graph from the frequency scale to the capacitor scale and read off the value of C1.

Facts from Fluke on low-cost DMM's

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House alarm is simple to construct, features high reliability

Collyn Rivers

This project is adequate for the average household or small business and will provide years of reliable operation.

WHEN YOU HEAR a burglar alarm the chances are less than three in a hundred that the alarm has been set off by an intruder. The other 97 times it's been falsely triggered. And if it's raining at the time — especially if there's a thunderstorm — the chances of the alarm being genuine are very much smaller still.

This is a thoroughly unsatisfactory situation and one that has caused police and security organisations many headaches over the years.

False alarms are generally caused by poor installation techniques and/or the wrong choice of alarm control unit for the specific application. In the case of non-professional designs and installations the cause is usually lack of appreciation of the problems inherent in what at first seems to be a simple problem in electronic circuit design.

The alarm unit and installation techniques described in this article have been devised to combine total reliability with immunity to false triggering. Both were progressively developed over a number of years and the unit itself was produced commercially (by the author) in large quantities for the security industry some years ago. It is still one of the simplest and most reliable units around.

The system is adequate for the average household or small business. If built and installed as described it will provide years of reliable operation.

Defining the risk

Really determined and skilled burglars will find ways to break into almost anywhere — no matter how well it is protected. But experts like these will be far too occupied sizing up the local bank to bother about most houses or small businesses. Who you're mainly up against are 15-25 year olds with generally limited intelligence.

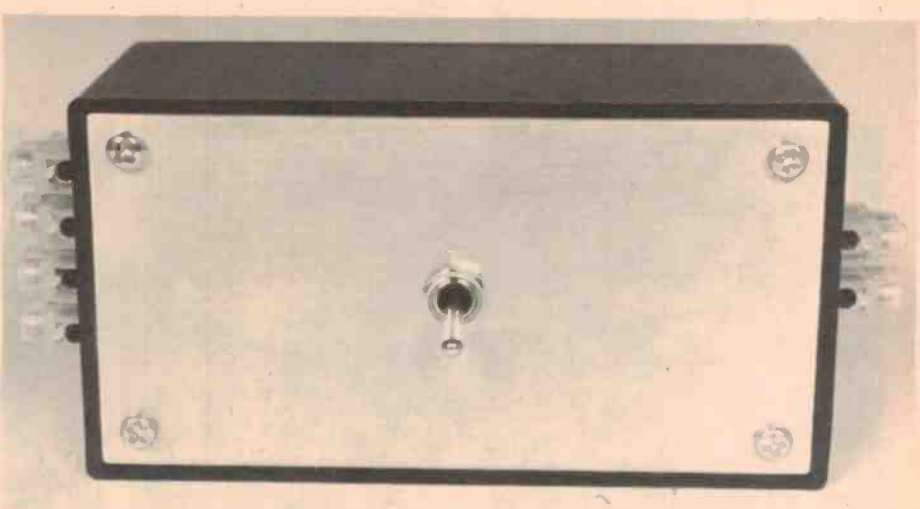


Figure 1 shows how and where most forced entries will be attempted. A surprising 29.2% of illegal entries are made through unlocked doors or windows. Most other entries are made by forcing with a jemmy. Only rarely is entry made by breaking glass.

So your first step should be to 'harden up' the house. Fit really strong concealed catches, especially to those windows which are not overlooked from the street or by neighbours' houses. You'll have to search around for decent fittings — the sliding bolt catches sold by most hardware stores are jokes. One good kick will tear them in half — if the toy screws supplied don't pull out first! So consider carefully how the various devices will withstand a jemmy used in earnest — and whether the woodwork to which they are attached will need strengthening.

Once this is done it's time to think about alarm protection.

The basic system

The simplest adequate alarm system detects the opening of doors or windows and when an 'opening' signal is received causes the alarm to sound continuously even after the door is subsequently closed.

The alarm should also sound and continue to sound if any associated wiring is detected and cut. The alarm should be battery operated so that it will continue to operate if mains power fails or is disconnected.

This all seems simple enough to do but there are a number of unsuspected traps along the way.

Detecting entry

Doors and windows may be protected by switches which are closed when the openings to be protected are closed. All such switches are connected in a series loop so that if one or more are opened, or interconnecting wiring is cut, the alarm is actuated.

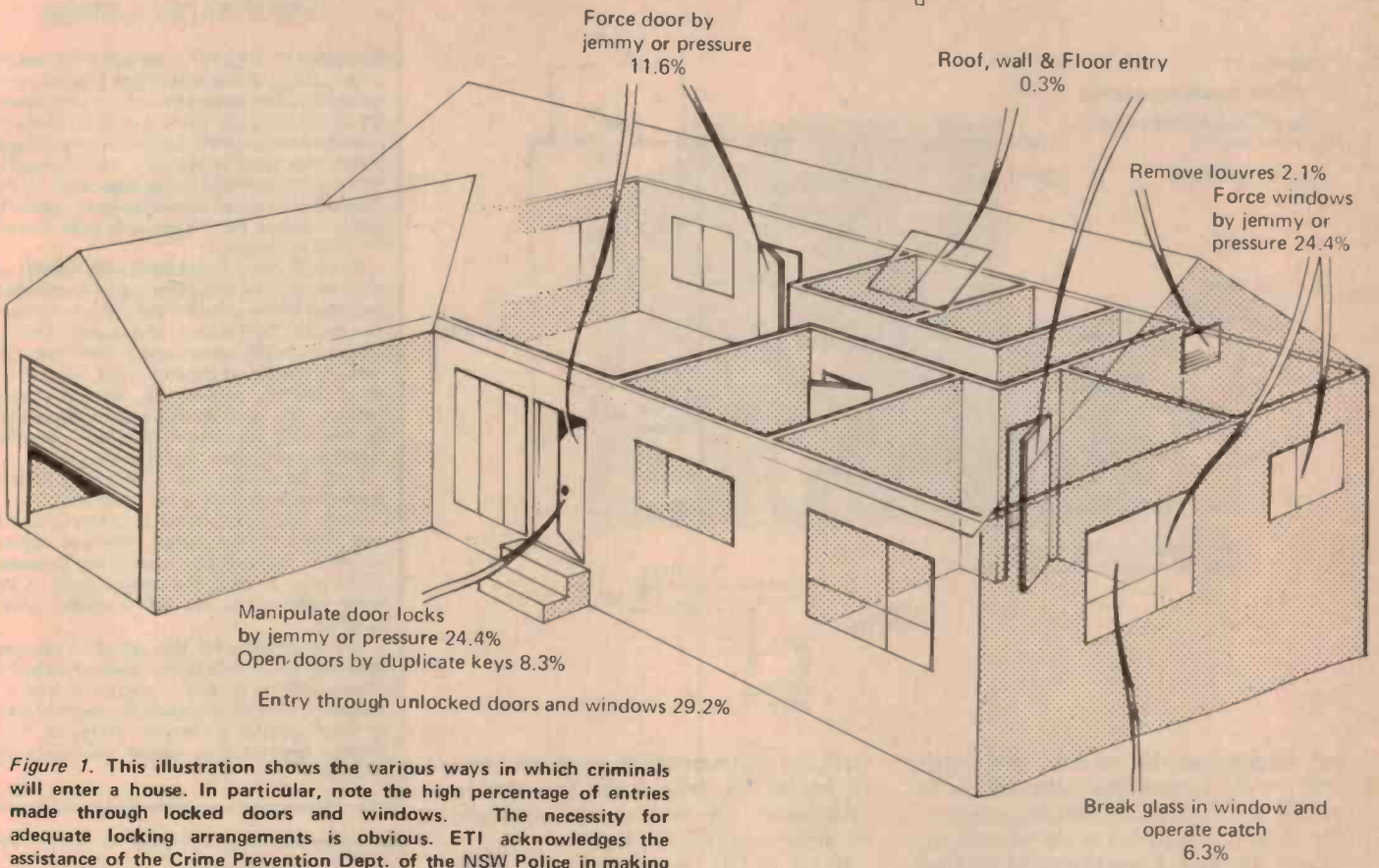


Figure 1. **This illustration shows the various ways in which criminals will enter a house. In particular, note the high percentage of entries made through locked doors and windows. The necessity for adequate locking arrangements is obvious. ETI acknowledges the assistance of the Crime Prevention Dept. of the NSW Police in making these statistics available.**

Many of the windows to be protected may remain closed for months — sometimes years — so the switches chosen must be absolutely reliable and resistant to corrosion. Most switches are designed so that the contacts are automatically cleaned every time the switch is operated — but this doesn't help much if the switch is actuated only once in ten years!

Another essential requirement is that the door or window must be able to open at least 20 mm before the switch is actuated. This will allow for movement caused by swelling in wet weather and rattling during storms.

The ideal device for this purpose is the magnetic reed switch. This consists of a pair of ferro-magnetic reeds and contacts, hermetically sealed in a small glass tube, and held closed by a magnet a few millimetres away. The contacts open when the magnet is moved away from them.

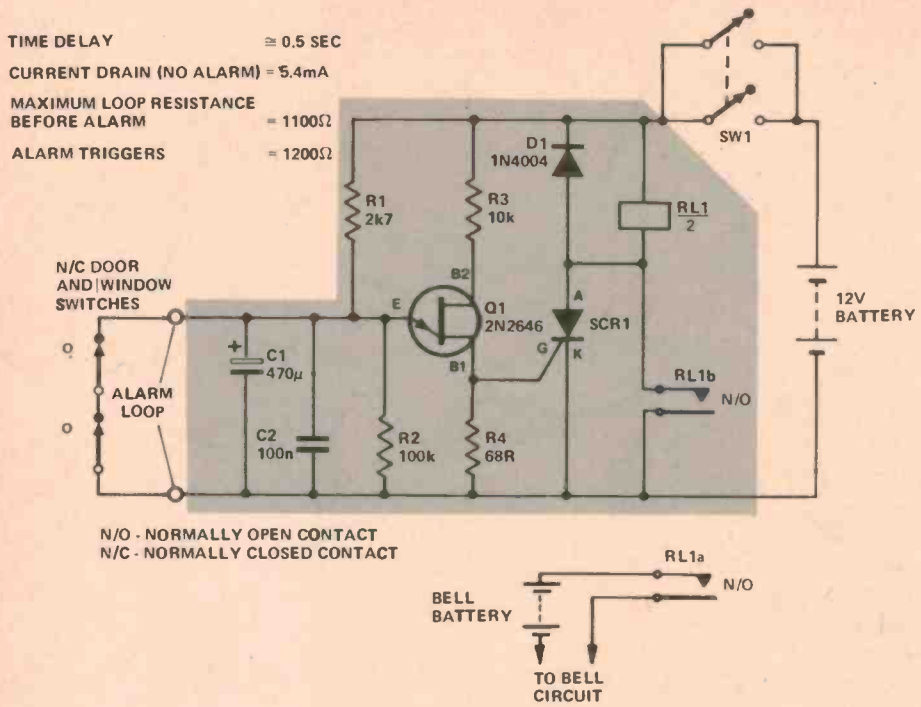
Commercial installers use these switches extensively but they generally keep them packaged in rectangular plastic mouldings. A neater, but more time-consuming method, is to recess them into the architrave surrounding the opening. Whichever type is used the magnet should always be attached to the moving part of the door or window.

The reed switches *must* be designed specifically for security and similar applications — standard reed switches may not necessarily be suitable as some tend to remain closed when the magnet is removed if they've been held closed for any length of time. To be on the safe side, buy your switches from a security equipment supplier — you'll find addresses in the Yellow Pages.

The best magnets are ferritic-ceramic bar types — they're made by many companies and should not be hard to locate. They're usually round or square and sections 25 mm or so long will be fine. These will pull in the switch at a distance of 10-12 mm and will hold it closed at 15-20 mm.

Choose suitable locations and install switches and magnets as shown in the accompanying picture. Before making the final choice of position make sure that the door can open 20-30 mm with- ▶

External connections to the unit are made via the two plastic screw-terminal blocks.



out triggering the switch. One trick that's not immediately obvious is to mount the switch and magnet closer to the hinged side rather than the moving side of the door. Keep the wires leading to and from the switches as far apart as possible. Leave a small amount of slack in the wiring so that building movements will not stress the wiring or connections.

It is worthwhile protecting one or two internal doors — particularly if you have one leading from a garage or carport into the house — but don't overdo the number of protected entry points. Every additional switch increases the probability of false alarms.

The switches should be connected in series using multi-strand wire (14/0076 is about right). Don't use single strand wire — it's more prone to failure if moved. Solder the wires to the switches using *non-corrosive* solder and clean off any residual flux with detergent and clean water. When all switches are installed and connected, check the overall resistance around the loop with a multimeter. The total should not exceed 20 ohms — preferably less.

If all is OK, paint over the solder points and any bare wire with bituminous paint — or smear well with Vaseline. This may seem technical overkill but it's surprising what pollution can do to wire left bare for several years.

The unit itself

The alarm unit should ideally be battery powered and draw little current. It should be capable of accommodating *some* resistance in the external signal loop but must *not* accept more than two hundred ohms before triggering. And that's where so many amateur and magazine-designed alarms go wrong, for in the quest for low current consumption designers plump for a high impedance input. Figure 2 shows what can happen if the woodwork around the

HOW IT WORKS — ETI 262

Resistors R1, R2 and R3, capacitor C1 and the unijunction transistor Q1 form a basic pulse generator. With the external alarm loop 'open', C1 charges via R1 until the voltage across it reaches about half the applied battery voltage. When this level is reached the unijunction 'fires' — C1's charge being dissipated via R2. This action causes a positive-going pulse to appear across R2, the pulse in turn causing the SCR to conduct.

An SCR once conducting will remain so even though the triggering signal is removed, provided the anode-cathode voltage remains steady. The SCR is thus 'latched on' and energises the double-pole relay RL. The instant the relay is energised contacts RLb connect the relay directly across the battery supply, 'latching' the relay on. The relay will now stay latched even if the entire circuitry — both internal and external — subsequently fails.

Diode D1 protects the SCR against voltage transients generated by the relay coil.

In use, the external alarm loop shorts out C1, and whilst voltage spikes may well appear across C1, they will not charge the capacitor sufficiently to raise the voltage level to the firing potential of the UJT's emitter — B1 junction.

The time taken for the circuit to respond following an alarm signal is determined by the combination of R1 and C1. Do not *reduce* the value of C1 nor substantially *increase* the value of R1. Capacitor C1 may be increased by a desired amount if a longer time delay is required.

PARTS LIST — ETI-262

Resistors all ¼W, 5%
- R1 ..... 2k7
- R2 ..... 100k
- R3 ..... 10k
- R4 ..... 68R

Capacitors
- C1 ..... 470u16 V electro
- C2 ..... 100n greencap

Semiconductors
- Q1 ..... 2N2646 UJT
- SCR1 ..... C106D SCR
- D1 ..... 1N4004 or similar

Miscellaneous
RL1 — cradle relay, 12 V coil with two changeover contacts (Pye, type 265/12/G2V); SW1 — DPST toggle switch; 12 V battery; pc board ETI-262; small box to suit; barrier strip terminals (six-way), plated type; suitable reed switches; magnets etc as per the article.

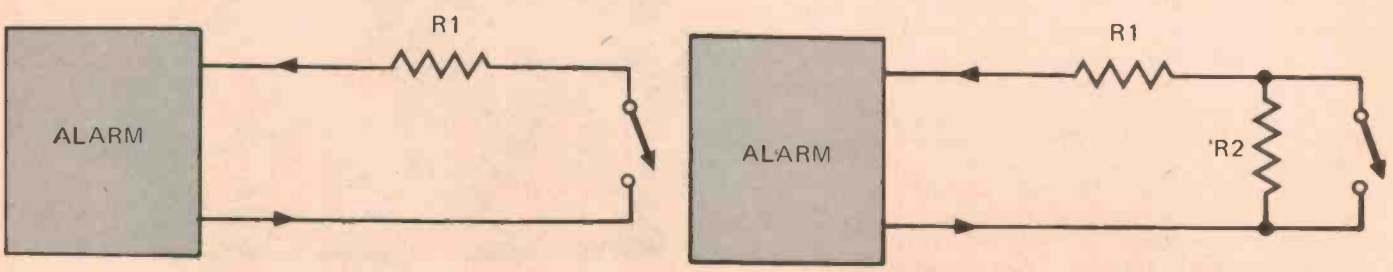
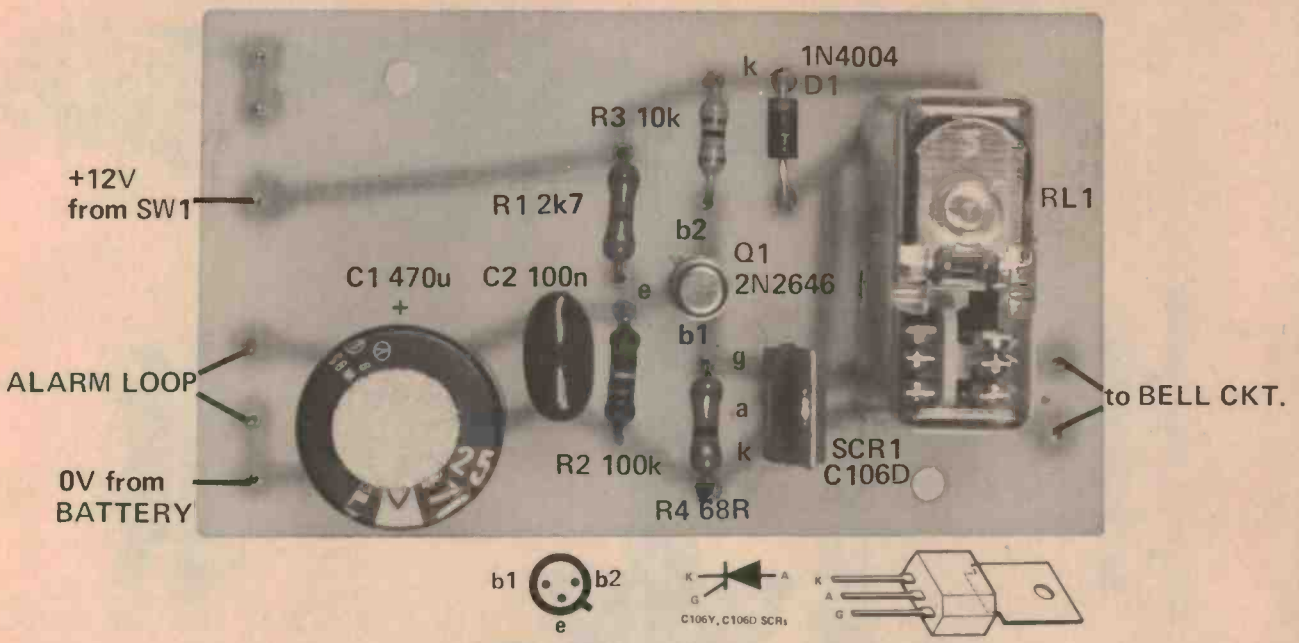


Figure 2. Resistance R1 represents series resistance of the loop (see text). Resistance R2 represents leakage paths across alarm contacts.



switches gets moist — a leakage path may develop in parallel with the switch (that's why you keep those leads apart) and if this happens when the control unit can tolerate more than a few hundred ohms, that switch can be opened *without triggering the alarm* !

The alarm unit must be insensitive to voltage spikes picked up by the external loop — remember that's quite an antenna you'll have there. Such voltages can be surprisingly high and are caused by lightning strikes, arc welders, faulty fluorescent lighting starters, capacitor start motors (often found in 'fridges and freezers), contactors, etc. Existing alarms can be protected to some extent by connecting two capacitors (in parallel) across the input terminals. One should be about 10 uF, the other about 10n. Figure 3 shows how — and why you need the two.

A good test for voltage spike immunity is to wind fifty to a hundred metres of wire around a power drill. Connect the two ends to the input of the alarm unit and switch the drill on and off about fifty times. If the alarm isn't triggered by this it's a fair bet it will be satisfactory when installed. Very few alarm control units will withstand this test and those that don't will sooner or later cause problems.

Don't for a moment consider any alarm unit in which the external loop is connected directly to the gate of an SCR. It is *impossible* to protect such a circuit if the external loop is more than a few centimetres long. Yet, incredibly, such circuits are shown time and again in electronics magazines — presumably because at first sight an SCR is (almost) a single component control unit.

Likewise, don't connect a bell or siren directly to the anode of an SCR. Voltage spikes induced in the wiring to and from the bell can and will trigger the SCR into conduction. If you have such a device at present, modify it by interposing a relay between the SCR and the bell circuit — and connect a diode across the relay coil to protect the SCR against the relay's collapsing magnetic field.

The circuit of the ETI-262 alarm con-▶

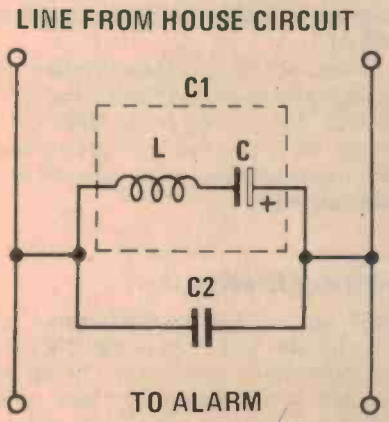
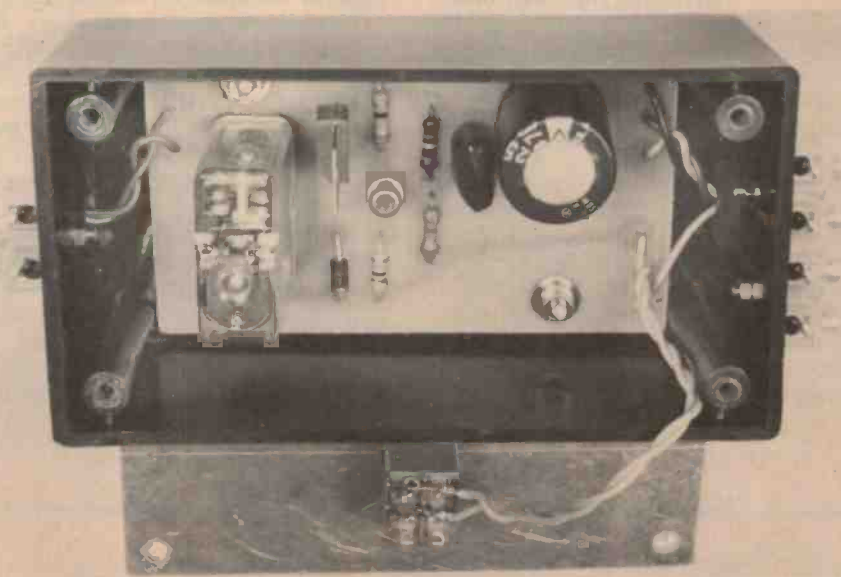
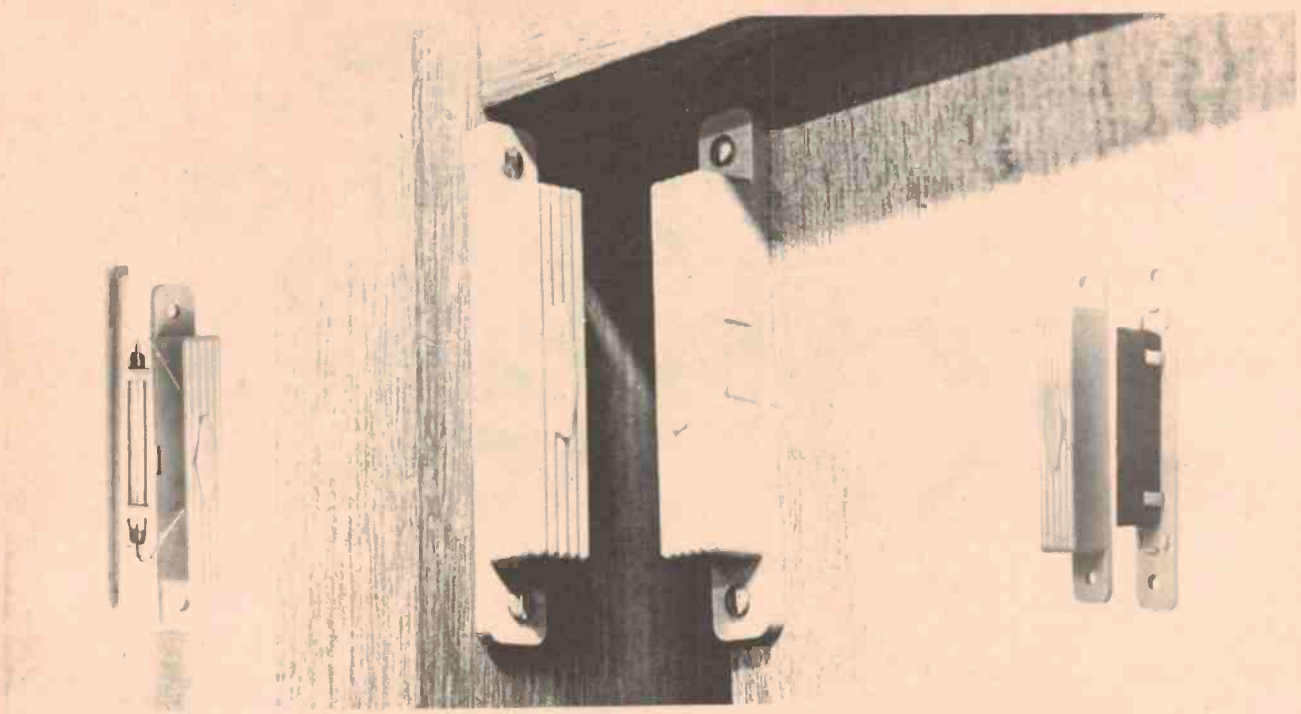


Figure 3. The large value capacitor, C1, will effectively bypass low frequency interference but its high series inductance, L, will prevent the bypassing of high frequency interference. A smaller value capacitor, C2, usually a ceramic type with a low series inductance, will bypass the high frequencies effectively.





Reed switches and magnets for burglar alarm systems are designed for easy installation.

trol unit is shown in the accompanying diagram. It's essentially a simple circuit but one in which several components perform more than one function. The basic idea is that a unijunction pulse generator is normally prevented from operating by the closed external alarm loop. When the loop opens, the unijunction 'fires', causing an SCR to conduct and latch on, which in turn actuates the alarm relay.

The best way to construct the control unit is to use the printed circuit board shown (full size) on page 47. Make sure that C1 is inserted the right way round and that all joints are very carefully soldered. Clean off any residual flux after soldering.

Resistor R1 controls the length of time between a switch being opened and the alarm being triggered. The value shown will trigger the circuit after approximately ¾ sec. Altering values to reduce the triggering delay will increase battery drain. The delay enables doors to rattle in a gale without triggering the alarm accidentally (it is impossible to open a door, pass through and close it again in less than one second).

Don't be tempted into replacing R1 by a potentiometer — it will rarely be moved once the alarm is installed, so that corrosion will eventually build up between the wiper and the track.

Keep the leads from the alarm unit to the battery as short as possible — 300 mm at most. Preferably build the battery in with the unit as we've shown. Use a *second* battery to power the alarm bell.

Do not delete the relay and run the bell straight off the SCR. *It will work*, but with reduced reliability and increased susceptibility to false alarms.

The alarm unit draws very little current, so batteries will normally last for nine to twelve months. It is advisable however to replace them routinely every six months. It's not worth building a mains power supply. You'll need an automatic mains/battery changeover unit to cater for mains failures — so you'll have to have a battery anyway. The best power sources for this application are six volt 'lantern' batteries. Use proper soldered terminal lugs on the ends of the battery leads.

It is worth considering powering the *bell* from a small Nicad battery with an automatic charger. This is also an elegant way of ensuring that the bell cuts out after an hour or two when the Nicad has exhausted itself.

Arrange for a key operated switch to short out the alarm switch on a chosen 'silent entry' door. Suitable switches may be obtained from security equipment companies. The associated wiring should be concealed.

The main on/off switch on the unit itself should be double-pole single-throw with the contacts wired in parallel (to enhance reliability). Do not attempt to economise by fitting a cheap switch.

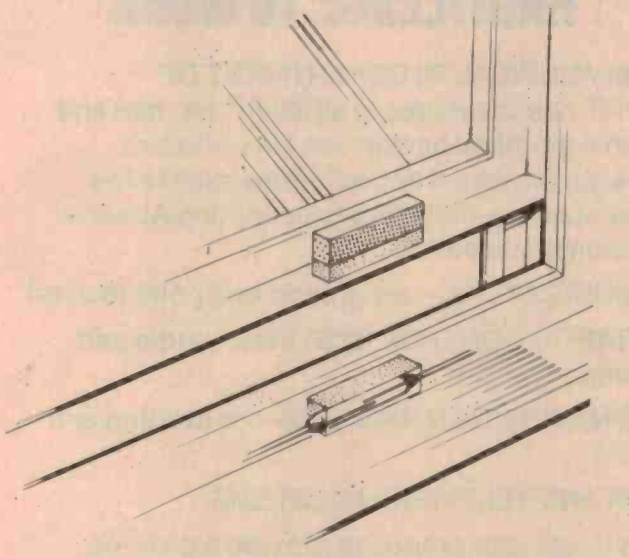
If you wish to further increase reliability you could duplicate the entire system, but as long as the unit and external wiring is put together carefully the chance of failure is almost negligible anyway.

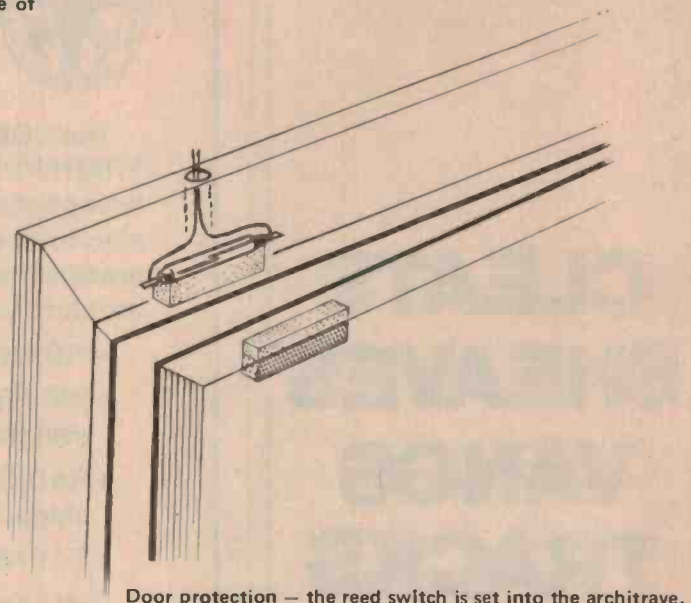
Scaring them off

Good quality electro-mechanical bells are still the best form of audible alarm for household protection. Being mechanically resonant they make a very large amount of noise and consume little power whilst doing so. The average 12 inch bell (it's an old-fashioned industry and they still think in inches) draws less than half an amp and can be heard at least a hundred metres away.

A magnetic reed switch.

For window protection, the reed switch is recessed into the frame of the casement window. The magnet is set into the moving part.





Door protection — the reed switch is set into the architrave.

A siren has a potentially larger range but is more directional. Good ones draw a lot of power — five to ten amps or more. Small cheap sirens should not be considered. The alarm bell should be mounted unobtrusively, and high up in an inaccessible position. Leads to the bell should be totally concealed. Use 40/0076 wire to reduce voltage drop.

It is worth locating one or two spotlights in strategic positions and arranging for these to be switched on as the alarm is actuated.

Finally, don't be put off by stories about people ignoring alarm bells — burglars don't!

Should you tell

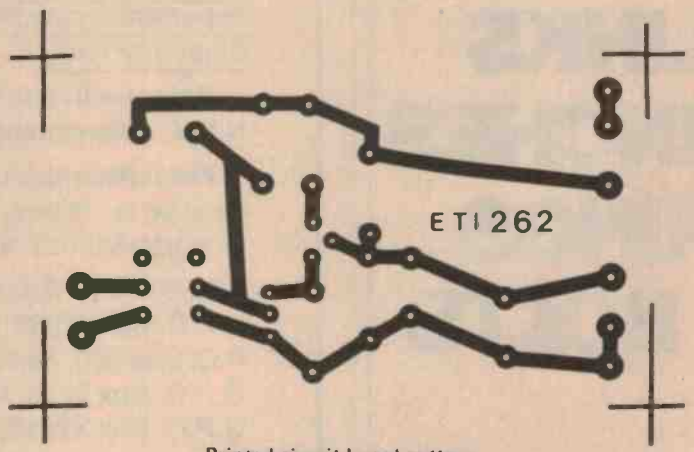
Providing you have a good installation and a concealed bell there's a lot to be said for making it clear to intending intruders that the premises *are* protected.

One way of doing so is simply to place warning notices in strategically chosen windows. This is done by most professional security companies — to such effect that there's quite a strong argument for using just notices alone!

We've included a suitable warning notice in this issue — (extra copies printed on heavier paper may be obtained directly form the magazine for 50 cents each plus a large, stamped addressed envelope).

A further very worthwhile tactic is to install a circuit which flashes red LEDs set into the frames of all visible windows and doors. The old 555 will do nicely, or those new-fangled self-flashing LEDs. Combine these with the printed notices plus the alarm circuit, just in case anyone thinks you're bluffing, and your chances of being robbed are negligible.

One final note: no matter how good the installation, it's *useless* unless you switch it on. ●



Printed circuit board pattern.

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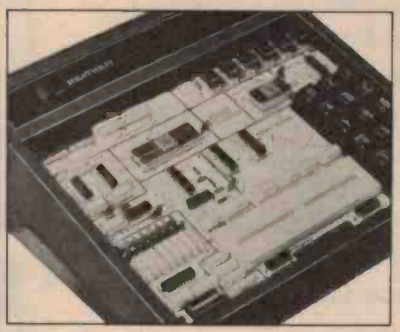

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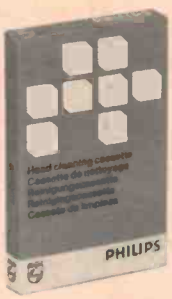

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Lab Notes

Designing with diodes

— tricks of the trade

The humble diode can extricate you from some difficult circuit problems, be it in logic or linear applications.

Ray Marston

THERE ARE numerous occasions when one needs a basic gate circuit or two and is faced with the possibility of having to wastefully commit an entire IC to this simple function. Alternatively, it may be the case that the inputs to a gate come from such widely separated points of a circuit that the use of an IC in a particular application will result in an excessively complicated pc board layout. In both of these instances, a simple diode gate may offer an ideal solution to the problem.

Figure 1 shows the practical circuit of a three input diode OR gate. The circuit is simple, reasonably fast, very cost-effective and can readily be expanded to accept any number of inputs by merely adding one more diode to the circuit for each new input.

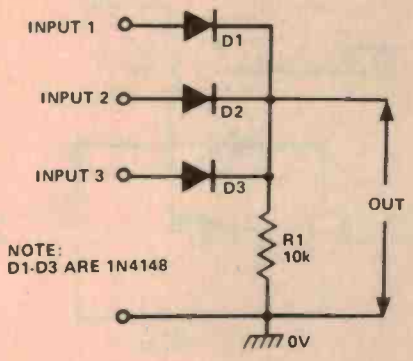


Figure 1. The diode OR gate is simple, but efficient. It can be expanded to accept any number of inputs by adding extra diodes.

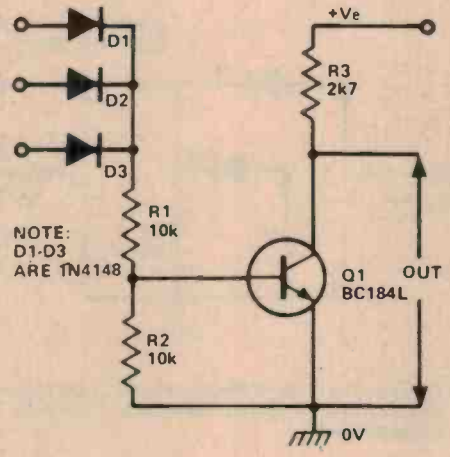
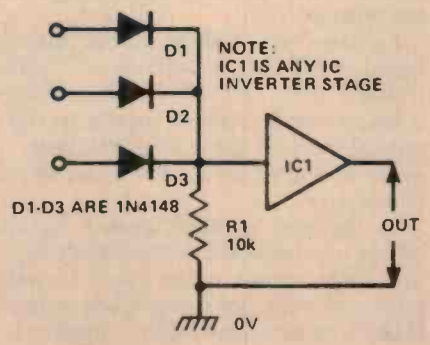


Figure 2. The diode OR gate can be converted to a NOR type by feeding its output through a transistor, as in (a) above, or through an IC inverting stage, as in (b) below.



The diode OR gate can be converted to a NOR type by either feeding its output through an NPN transistor inverting stage, as shown in Figure 2a, or by feeding its output through any type of IC inverting stage that happens to be 'spare' in the circuit you are playing with, as shown in Figure 2b.

Figure 3 shows the connections for making a three input diode AND gate. The circuit can again be expanded to accept virtually any number of inputs by simply adding an appropriate number of diodes.

The AND gate can be converted to a NAND type by feeding its output through a pnp transistor or an IC inverting stage, as shown in Figures 4a and 4b respectively. ▶

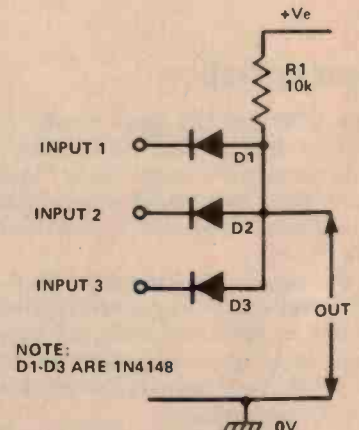


Figure 3. The circuit of a three-input AND gate. The number of inputs can be increased by adding extra diodes.

Lab Notes

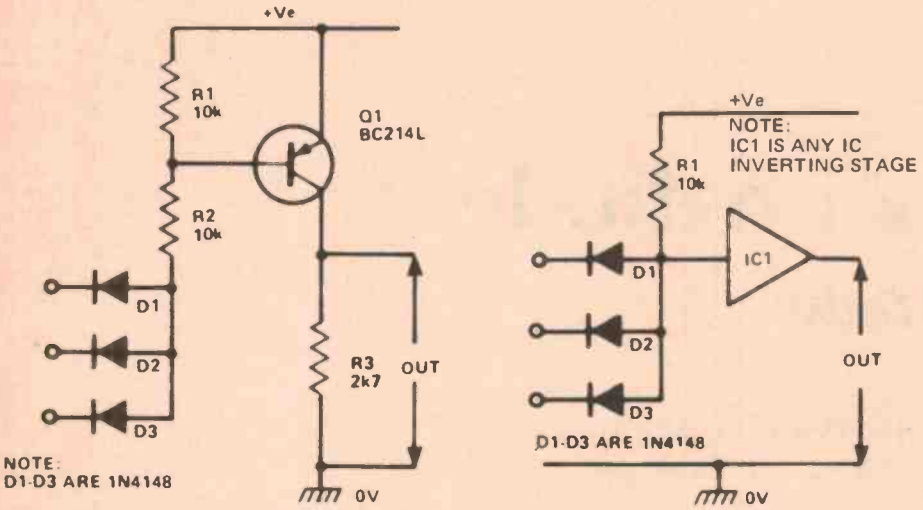


Figure 4. The diode OR gate can be converted to a NAND type by feeding its output through an inverting stage using either a transistor, as in (a) at left, or an IC as in (b) at right.

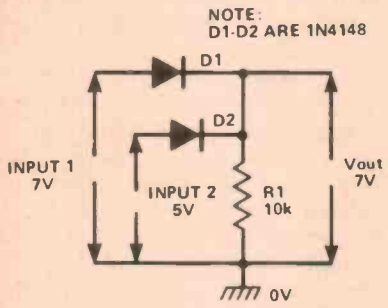


Figure 5. When a diode OR gate is used in the linear mode, Vout equals the greater of the two inputs.

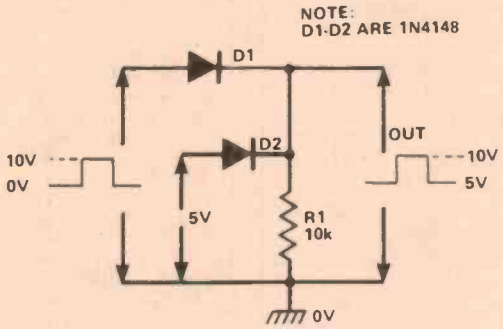


Figure 6. The effect of feeding a pulse to one input and a dc voltage to the other input of a two-input diode OR gate.

Diode volt drops

We've mentioned above that the output of the 'analogue' diode gate may be 'within a diode volt drop' of the input signal. The magnitude of this 'volt drop' depends on the type of diode that is in use, on the magnitude of the diode forward current and on the temperature of the diode junction. All silicon diodes have a negative temperature coefficient of about −2 mV/°C.

Figures 9 and 10 show typical volt-drop curves for the popular 1N4148 and 1N4001 silicon diodes at 25°C. The graph of Figure 9 spans the current range 100 uA to 1 mA and the graph of Figure 10 spans the range 1 mA to 50 mA.

Note that the 1N4148 volt drop typically ranges from 519 mV at 100 uA to 874 mV at 50 mA, compared to the 1N4001's range of 441 mV at 100 uA to 744 mV at 50 mA.

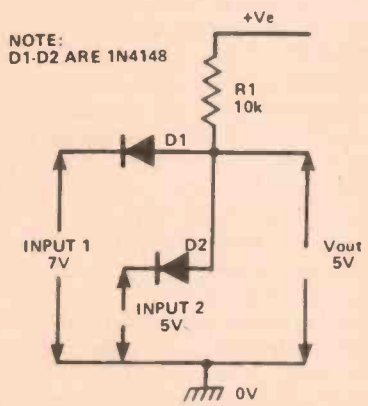


Figure 7. When a diode AND gate is used in the linear mode, Vout equals the less of the two inputs.

Linear operation

Diode AND and OR gates can be very useful when one or more of their inputs are operated in the linear mode. Figures 5 and 6 show two useful ways of using the two-input diode OR gate in linear applications

In the case of the Figure 5 circuit, in which analogue voltages are applied to both of the input terminals, the output of the circuit (ignoring a diode volt drop of about 600 mV) equals the greater of the two input voltages.

Figure 6 shows what happens when a pulse signal is fed to one input of the OR gate and an analogue voltage is fed to the other. The output signal comprises a pulse with a peak amplitude equal to that of the input pulse and with a 'zero' value equal to the analogue input voltage.

Figures 7 and 8 show similar circuits based on the two-input diode AND gate. In the Figure 7 circuit, where analogue voltages are fed to both inputs, the output (ignoring a diode volt drop 'gain' of about 600 mV) equals the lesser of the two inputs.

In the case of the Figure 8 circuit, where a pulse is fed to one input and an analogue voltage to the other, the output pulse has a peak amplitude equal to that of the analogue input voltage.

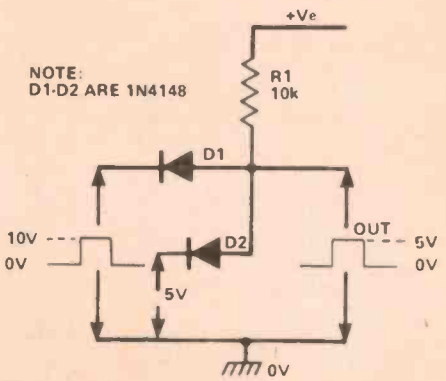


Figure 8. The effect of feeding a pulse to one input and a dc voltage to the other input of a two-input diode AND gate.

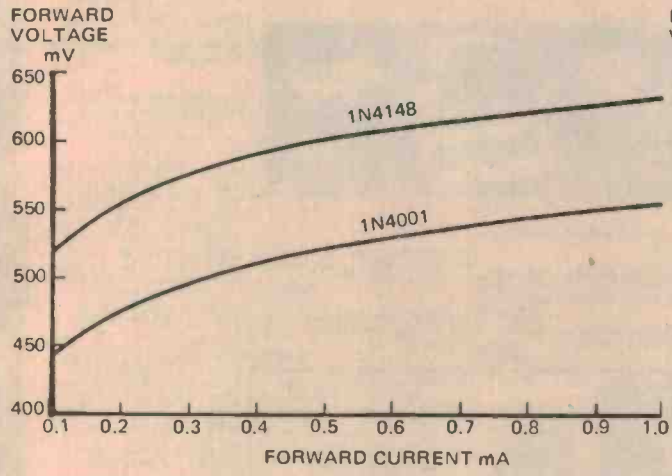


Figure 9. Diode volt-drop curves for the 1N4001 and 1N4148 diodes over the 100 uA to 1 mA current range.

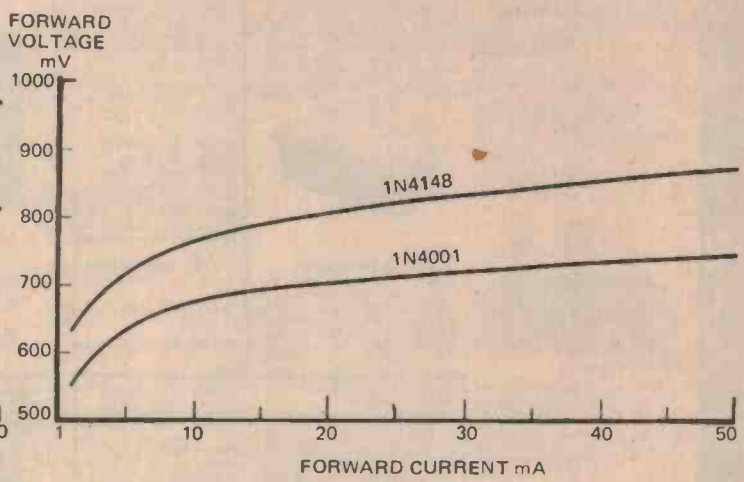


Figure 10. Diode volt-drop curves for the 1N4001 and 1N4148 diodes over the 1 mA to 50 mA current range. Note that these two diode types are the most commonly used (highest volume sales of any single component).

A point of particular note about the 1N4001 curve is that its volt drop of 714 mV at 25 mA increases by only a fraction over 4% (to 744 mV) when the forward current is doubled, to 50 mA. In other words, the diode has a voltage-to-current coefficient of about 0.04%/% in this current range. The diode can thus be used as a reasonably stable voltage reference at these current levels but has a negative temperature coefficient of about −0.3%/°C.

Constant current generator

Figure 11 shows how the 'voltage reference' characteristics of the 1N4001 can be put to good use in a simple constant-current generator circuit that can be used for re-charging Ni-Cad cells or for linearly charging large capacitors, etc. Here, two 1N4001s are wired in series and operated at a current level of roughly 50 mA. Consequently, the voltage across Rx is equal to the volt drop of the two diodes minus the base-emitter volt of Q1 (about 700 mV), which gives an Rx voltage of about 700 mV. The emitter (and hence collector) current of Q1 is thus approximately 700/Rx in (mA).

To give an idea of the magnitude of things, an Rx value of 1R2 (1.2 ohms) gives an output current of about 600 mA, 3R9 (3.9 ohms) gives about 200 mA, and 6R8 (6.8 ohms) gives about 100 mA. All in all, a simple but very useful circuit.

Diode protection circuits

To wrap up these Lab. Notes, let's take a quick look at some diode protection circuits. By 'protection' we mean circuits that are designed to insure devices against irreversible damage and also circuits that are designed to prevent simple malfunctioning. Figures 12 to 15 show four circuits in this latter category.

In the case of Figure 12, we have a basic time constant circuit in which a rising voltage, with a time constant of about 100 seconds, is developed across C1 each time SW1 is closed. This voltage may be used to activate some additional circuitry. The problem is that, once C1 has charged up it has no means of rapidly discharging again (resetting) once SW1 is opened. If there is a load in parallel with the C-R network, as shown dotted in the diagram, C1 will of course discharge via R1 and the load but then has a very long time constant (greater than 100 seconds).

An easy way round this problem is to connect a discharge diode in parallel with R1 as shown in Figures 12 and 13.▶

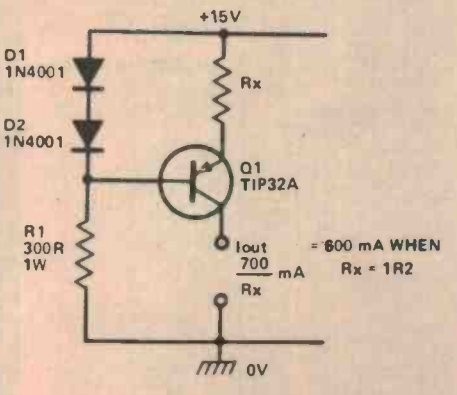


Figure 11. A simple and very useful current generator.

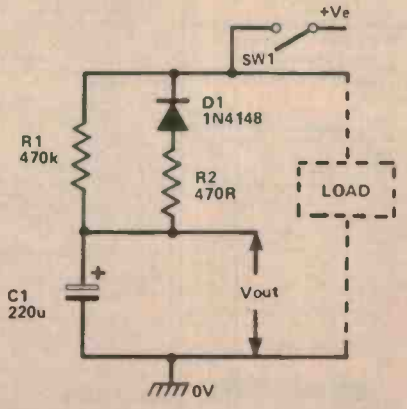


Figure 12. An example of the use of a diode to rapidly discharge a timing capacitor when the power supply connection is broken.

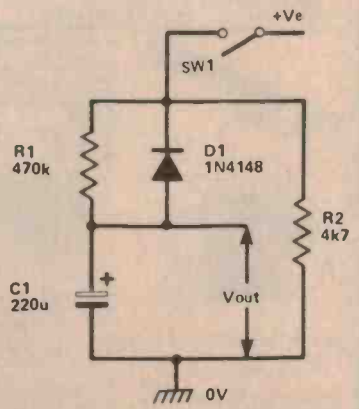


Figure 13. A modification to the Figure 12 circuit.

Bill Edge's ELECTRONIC AGENCIES

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FEATURES:

- One control operation.
- Quality PC fibreglass board.
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- Assembled in ½ hour with simple tools.
- Very simple to follow instructions.
- Doesn't take up much space.
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SPECIFICATIONS: Input sensitivity 500mV. Lamp load up to 1800 watts. Preset frequency division. Bass 15 to 250Hz, middle 250 to 1200Hz, treble 1200 to 5000Hz.

It will suit almost any audio amplifier ... you don't have to be technically inclined to get the machine working, as all the hard part has been done for you, and unlike some kits this kit is guaranteed to work.

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Standard base for lamps ..... $1.10 ea.
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(Kit is complete right down to last nut and bolt!.

TV CRO ADAPTOR KIT

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(without power adaptor)

Two power adaptors available:
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See details in August '80 ETI. A fantastic little device that will suit all cars with 2 to 8 cylinders; and will inform driver if he is revving too high ... hence a good check on petrol consumption. Complete kit available from us .. including zippy box and all hardware ..... only $29.95

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Uses Intersil 7106 A/D converter, PCB, all caps, resistors and instructions. Has many uses and features a guaranteed zero reading for 0 volts input on all scales, direct display drive, low noise, on-chip clock and reference. $42.50

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An array of software programmes is available for business and other applications including General Ledger, Creditors, Debtors, Word Processing, Stock Control, etc.

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WITH EVERY SYSTEM PURCHASED WE'LL THROW IN, ABSOLUTELY FREE 1 ONLY STOCK CONTROL PROGRAM (disc) valued at $400.

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(Cassette) $12.95

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SHAPEMAKER In studying this program you will be on your way to making effective use of the Sorcerer's graphics capability in your Basic programme.
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APPLE SOFTWARE

FASTGAMMON(TM) Similar to Fastgammon on TRS80, but on diskette (24K)
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Diskette (32K) $26.95

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Cassette (32K) $15.95
Diskette (32K) $21.95

TRS80 and SYSTEM 80 SOFTWARE

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MATCH CARDS & BANKSHOT – Two programmes on one cassette.

MATCH CARDS is a concentration type game where you match numbers, letters or graphic shapes. For one or two players. Automatic scoring rates your recall ability.

BANKSHOT is a billiard-like game for those who think they know all angles. Hit the ball into the pocket, but you must hit a wall first.
(Cassette) $11.95

FASTGAMMON(TM) As described in Sorcerer Software, but made for TRS80 or System 80
Cassette $21.95
Diskette $26.95

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..... $15.95

LOWBALL POKER – How low can you go. It's you against Micro Molly and the lowest hand wins. Don't take her for granted – Molly plays an excellent game.
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PHILIPS/ETI 4-WAY SPEAKER SYSTEM (ETI4000/1)

100 watts RMS, 8 ohms impedance) (See ETI Feb '80).

A really superb system for the 1980's. Using the latest Philips speakers and a marvellous design by David Tilbrook, this speaker system has outstripped all projected sales figures. They sound so good, they are rivalling commercial units in the $1,500 price bracket.

PHILIPS/ETI 3-WAY SPEAKER SYSTEM (ETI4000/2)

(100 Watts RMS, 8 ohms impedance). (See ETI June '80). Another completely new system. Designed for those with a space problem but still require good sound.

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200mm(8")
(AD8066/W8 or AD8065Z/W8)
woofer, 40W,RMS., 8ohm, freq. response 35Hz to 7kHz $29.50

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40W,RMS., 8ohm, freq. response 40Hz to 5kHz $57.80

300mm(12") (AD12100/W8) Woofer
40W,RMS., 8ohm, freq. response 30Hz to 1.2 kHz $57.50

300mm(12")(AD12250/W8) Woofer
100W,RMS., 8ohm, frequency response 40Hz to 2kHz $86.95

ETI4000/1 SPEAKER KIT:

Includes 2 only AD12250/W8 300mm(12") woofers 2 only AD70601/W8 178mm(7") lower midrange, 2 only AD02160/SQ8 50mm (2") midrange, 2 only AD01610T8 25mm(1") dome tweeters, 2 only 4-way crossover networks (designed by ETI and in kit form) plus full instructions on assembly, (box kit separate).
Mail Order: $1.00 packing,
"freight on" carrier ..... $459 pair

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Includes all speakers as used in ETI4000/1 system with the exception of the 178mm(7") lower midrange speakers. The crossover network is also different as it is a three way system (in kit form).
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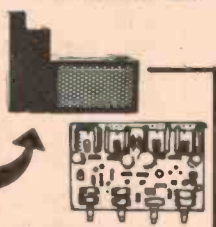
157mm(7")
(AD70601/W8) Low Midrange or Woofer
30W,RMS., 8ohm, frequency response 40Hz to 3kHz $22.95

125mm(5") (AD0060/SQ8) Midrange
40W,RMS with recommended crossover, 8ohm, frequency response 180Hz to 10kHz $23.50



50mm(2") (A00210/SQ8) Midrange
50W,RMS with recommended crossover, 8ohm, frequency response 500Hz to 5kHz $34.75

50mm(2") (A002160/SQ8) Midrange
80W RMS., with recommended crossover, 8ohm, frequency response 500Hz to 10kHz $35.50

TWEETERS

25mm(1")
(A00152/T8) Tweeter
40W,RMS with correct crossover, 8ohm, frequency response 1600Hz to 20kHz. $13.95

25mm(1")
(A001610/T8) Tweeter
100W,RMS with correct crossover, 8ohm, frequency response 2kHz to 22kHz. $16.95

ETI4000/2 SPEAKER BOXES (ONLY)

Includes two professionally *assembled* boxes exactly as described by ETI. All you do is screw speakers and crossovers in and mount innerbond. Walnut finish. Dimensions: 80cms(h) x 39.5cm(w) x 35.5cms(d).
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"freight on" carrier ..... $200 pair

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Includes two professionally *assembled* speaker boxes exactly as described by ETI for this project ... all that is required for you to do is screw speakers and crossovers (in kit form) in and mount innerbond inside. Walnut finish. Dimensions: 100cm(h) x 39cm(w) x 35cm(d).
Mail Order: $1.00 packing,
"freight on" carrier ..... $300 pair

Complete 4000/1 Speaker System
(including speakers, crossovers and boxes – everything you need to complete this fantastic pair of speakers).
Mail Order: $1.00 packing,
"freight on" carrier ... ONLY $759 pair

Complete 4000/2 Speaker System
(including speakers, crossovers and boxes – everything you need to complete this fantastic pair of speakers)
..... ONLY $560 pair

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ETI4000/1 4 WAY CROSSOVER NETWORK (Kit Form)
Crossover points: 150Hz, 750Hz, 3kHz 100W, RMS, (designed by ETI) 8ohm. Size: 330mm x 246mm ..... $170 pair

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Crossover points: 500Hz and 4500Hz, 40W, RMS (Philips design), 8ohm Size: 105mm x 100mm ..... $41 pair

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Complete 60 watt amplifier module kit (as used in ETI4000 amplifier). Absolutely everything including heat sinks and all hardware. Features very low distortion and very simple mechanical construction. Can be used to replace existing amplifier modules and bring your present system up to scratch.
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Designed to complement 60 watt ETI470 modules, but is such an exceptional design it can be used to update existing systems or incorporate in new designs, as it has features unheard of in other pre-amp designs, eg., all connections through RCA sockets and controls going direct to PCB. Everything designed for high performance. Power requirements: +15, –15 Volts DC at less 5 Amp.
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As used in 4000 Amplifier. From 240 V A.C. input gives out + and – 40 volt rails to supply power to amplifier modules. Also gives out + and – 15 volt rails for pre-amp supply. Kit comes complete with transformer.

- with Standard Transformer .. $47.90
- with "C" Core Transformer .. $57.90
- with Toroidal Transformer .. $79.00

All components are available separately for the ETI4000 Amplifier.

- ETI470 PCB $3.50
- ETI471 PCB $9.50
- ETI472 PCB $4.50
- BDV648 ..... $3.56
- BDV658 ..... $3.56
- Washers and bushes for BDV648/658 (Set of 4) $1.45
- Front Panel (drilled) $15.00

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10 WATTS RMS PER CHANNEL AMPLIFIER FOR ONLY $24.50

(less metalwork, knobs, power transformer) ... A FANTASTIC BUY ... Limited stocks.

(See EA August '79 for review). This amp is suitable for crystal ceramic cartridge input. Can be driven from magnetic cartridge with simple addition of special preamp kit ... $8.50 ... preamp can be powered direct from rail voltage of amp (diagram provided).

Transformer (specially wound for this amp) ... only $9.50

THE FANTASTIC ETI "SERIES 4000" AMPLIFIER KIT

Comes complete with instructions plus our own specially prepared 5-page hints & advice.

This amplifier kit was originally marketed by us around August '79 and so far has surpassed all projected sales figures – over 500 have been sold in all, and it still has not lost any of its popularity. The reason for this enormous interest is because the amplifier looks and performs like commercial units around the $600 mark, and yet it sells from $199 (with wooden sided case).

Picture shows amplifier with rack mounting case. Also available in wooden sided, with teak woodgrained 13mm pieces of wood instead of metal for sides – exactly the same otherwise.

When you buy this magnificent kit from us you are assured in writing that the kit is complete to the most minute detail ... we also offer a 7 day money back guarantee if you think this kit may be a little too advanced for you, and you'd rather not attempt it.

- Series 4000 Amplifier (with wooden sides $199.00
- Series 4000 Amplifier (with rack mounting sides) $209.00

For the real audiophile we have also made available two transformers with extremely low hum characteristics.

A "C" Core Transformer for $10.00 extra, or a specially imported toroidal transformer for $32.00 extra. No change is needed to amplifier circuitry to add these transformers. They are both rated at 28 – 0 – 28 volts/2 Amps on secondary and could be used in many applications where A.C. hum or in the case of the toroidal, where size is also a problem. (Save up to $70 on locally produced toroidal transformers)

TOROIDAL TRANSFORMER .. $59.90
(size: 40(h) x 100(diam)mm approx.)
"C" TRANSFORMER $26.50

300 WATTS!

300 WATT AMPLIFIER KIT

"The BRUTE" – develops 300 watts into 4 ohms. 200 watts into 8 ohms.

COMPLETE KIT FOR ETI466 300 Watt AMPLIFIER MODULE (less heatsink and power transformer), exactly as described in ETI Feb '80, including predrilled heatsink bracket, all nuts, bolts, silicon grease etc.

ONLY $63.50 per module.

All parts for ETI466 are available separately: ETI466 printed board $7.00; MJ15003 and MJ15004 transistors $5.00 ea; 2500 uf/80V Caps $3.90 ea; .1 ohm 5W Resistors 65c ea; 62 volt zener $1.00

HEATSINK FOR "THE BRUTE"

This can be done in two ways as mentioned by ETI, i.e., you can make your own out of aluminium (which is not as easy as it looks and is very critical), or you can buy the **Philips 6SD6C Heatsink for $29.50**
(N.B. This is the only commercial heatsink available in Australia that is recommended).

HEATSINK BRACKETS FOR POWER TRANSISTORS FOR 300 WATT AMP (Pre-drilled)

Could be used wherever four T03 case power transistors have to be clamped to a heatsink (also takes 4 x TO220 case transistor) ..... $5.00 pr.

PLAYMASTER 300 WATT AMPLIFIER KIT (See EA June '80).

The full technical know-how of the "Electronics Australia" staff has been put into designing this superb 300 watt amplifier.

The 300 watt amplifier module kit includes heatsink, thermal cut out, nuts, bolts, etc.

ONLY $75.00

POWER SUPPLY TO SUIT: Includes transformer and all necessary components $52.95

POWER TRANSFORMER to suit "Brute"

Specially designed high power transformer ... 240V a.c. primary; Secondary: 2 x 47V @ 3A, 2 x 15V @ ¾A (96 x 114 x 110mm) $32.50

..... $32.50

FAN is also available (which runs directly off 94V a.c. secondary of power transformer $29.90

CASES suitable for 300 watt Amp or wherever a large case is required:–

RACK MOUNTING ETI4000 CASE

Beautifully designed (supplied in flat pack), satin anodised 1.6mm aluminium front and back panels, with surfaces suitable for screen printing etc. Top and bottom panels of hard wearing black "marvinplate" with 1.0mm steel base. Side panels 3.0mm satin anodised aluminium with chrome handles.

Four aluminium extrusions are used to hold the top, bottom, front and back panels in position.
Size: 134mm(h) x 419mm(w) x 280mm (d) $55.00

WOODEN SIDED ETI4000 CASE

Exactly the same size and same materials as used in ETI4000 rack mounting case, except side panels are made of teak wood (13mm) for a really superb looking case.

ONLY $45.00

Lab Notes

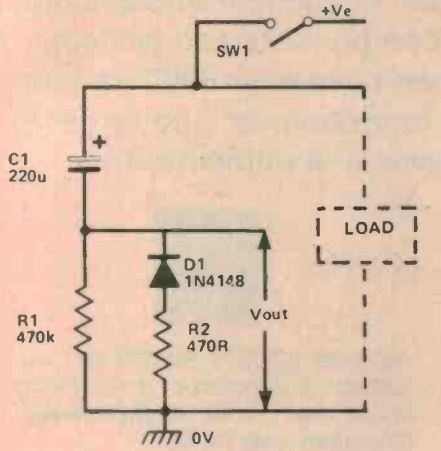

Figure 14. A basic variant of the Figure 12 circuit.

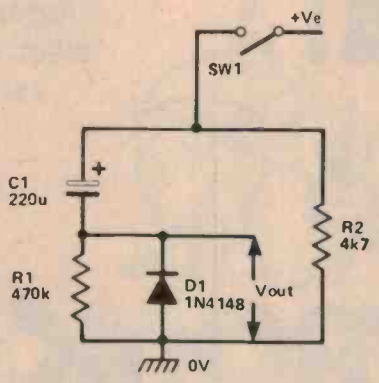

Figure 15. A basic variant of the Figure 13 circuit.

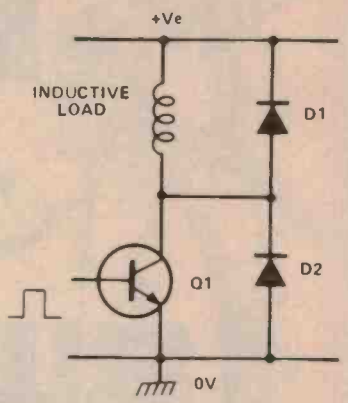

Figure 16. An example of the use of diodes to protect a pulse-driven common emitter amplifier with an inductive collector load.

If there is a low-impedance load in parallel with the C-R network a current-limiting resistor must be wired in series with the discharge diode, as shown in Figure 12. If there is no load in parallel with the C-R network then an artificial load must be provided to complete the discharge path, as shown in Figure 13.

Figures 14 and 15 show two basic variations of the above circuits in which the C and R networks are configured to give a falling output voltage across R1.

Finally, Figures 16 and 17 show ways of using diodes to protect two types of transistor circuit from destructive damage. Figure 16 shows how to protect a pulse-driven common-emitter amplifier that has a highly inductive collector load, such as a transformer or a relay coil. Very high back EMFs can be generated by inductive loads and can easily destroy transistor junctions. In the diagram D1 prevents the collector of Q1 from being driven above the positive supply rail value by these back EMFs and D2 prevents it from being driven negative.

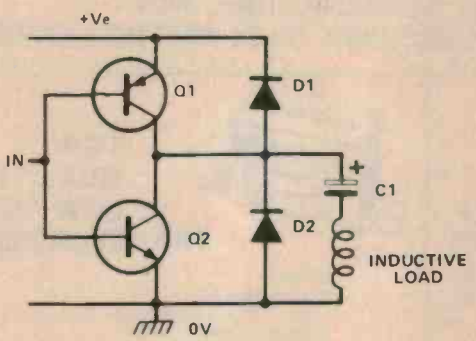

Figure 17. An example of the use of diodes to protect the complementary emitter follower output stage of a power amplifier that is used to drive an inductive load.

Figure 17 shows how a similar type of protection can be given to the complementary emitter follower output stages of a power amplifier used to drive highly inductive loads. This circuit can give good protection to hi-fi amplifiers in which the speakers may be inadvertently plugged in at a moment when the amplifier is being hard driven. The protection diodes must have a current rating that is compatible with the inductive (speaker) load. ●

ETI S100/Z80 MICRO COMPUTER SYSTEM

★ LEARN AS YOU BUILD

★ START SMALL E·X·P·A·N·D LATER

★ AFFORDABLE - FLEXIBLE

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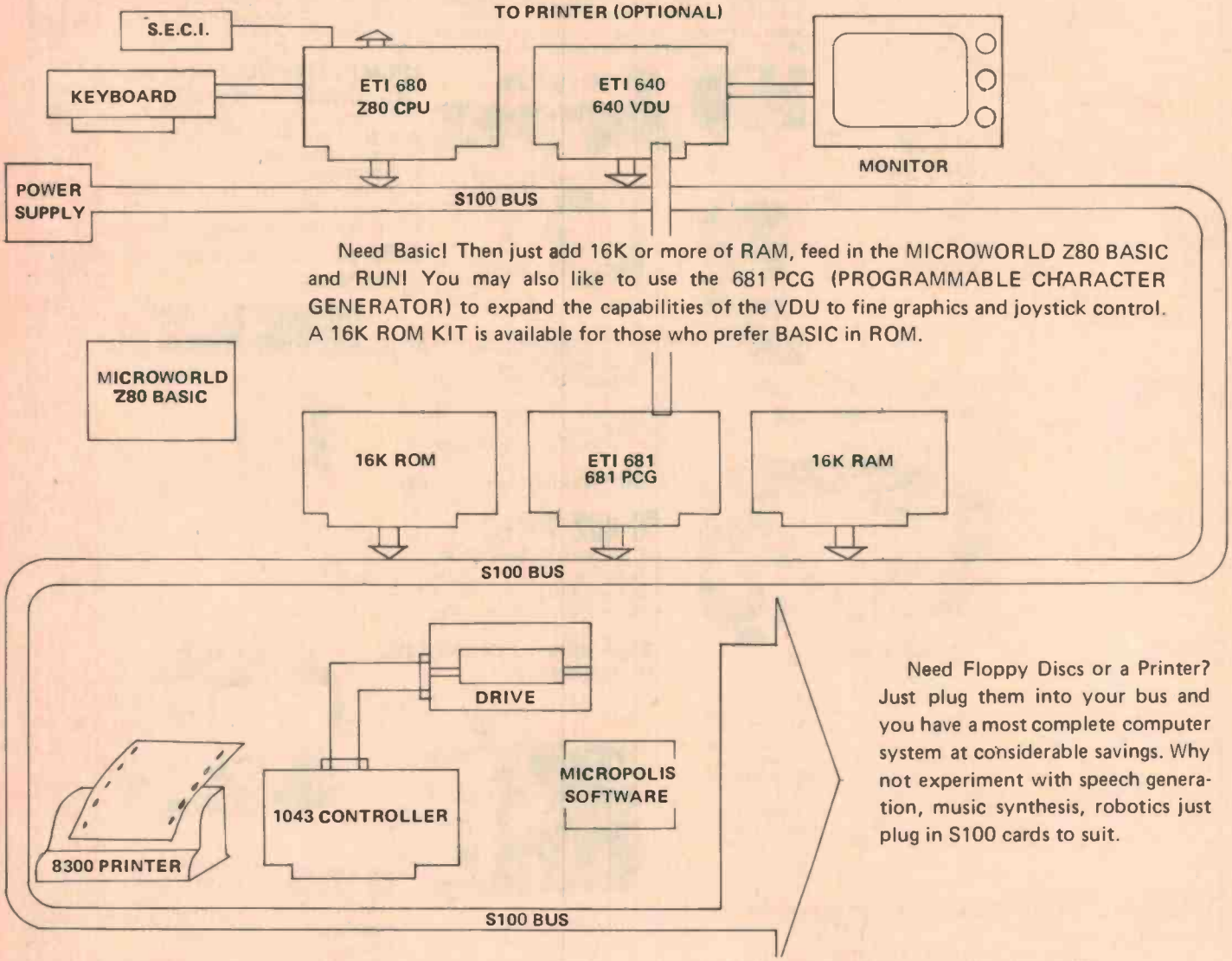

Need Basic! Then just add 16K or more of RAM, feed in the MICROWORLD Z80 BASIC and RUN! You may also like to use the 681 PCG (PROGRAMMABLE CHARACTER GENERATOR) to expand the capabilities of the VDU to fine graphics and joystick control. A 16K ROM KIT is available for those who prefer BASIC in ROM.

Need Floppy Discs or a Printer? Just plug them into your bus and you have a most complete computer system at considerable savings. Why not experiment with speech generation, music synthesis, robotics just plug in S100 cards to suit.

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CLARE. C70/MGP microprocessor controlled keyboard	$165.00	Z80 BASIC – 11K Microworld basic on tape if purchased with DGZ80 (kit or assembled & tested)	$10.00
DGZ80 S100 computer board complete kit (fully socketed)	$199.25	If purchased separately	$32.00
Assembled and Tested	$240.00	8300 printer with RS232 connects direct to DGZ80	$915.00
DGOS ROM – operating system, single 5v EPROM	$40.00	MICROPOLIS 1043 QUAD DENSITY DISC CONTROLLER with drive, power supply and software package	$1350.00
DG640 VDU Kit	$139.50	SECI. Kansas City Cassette Interface Kit	$24.50
Assembled and Tested	$149.50	S100 Mother Board plated through with active termination	$49.50
MONITOR – Converted TV for direct video	$149.50	Card Frame with professional finish	$49.50
TCT 16k RAM (2114 RAM) Complete kit	$285.00		
Kit less RAMS/SOCKETS	$100.00		
ETI 681 PCG as described in ETI June 1980 – kit	$140.00		

NOTE – Prices include Sales Tax. Contact office for availability of Tax Exempt pricing.

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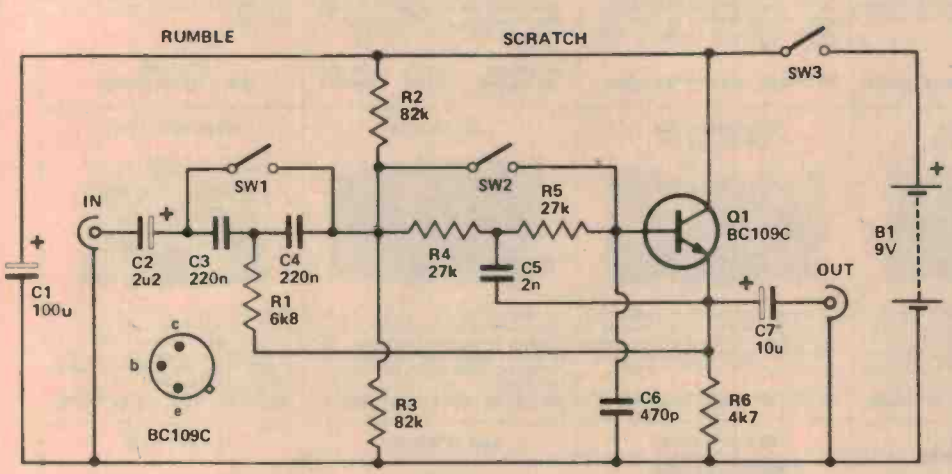
Telephone: 487-2711.

Scratch and rumble filter



Circuit of the Scratch and Rumble filter. This unit may be mounted on matrix board and mounted inside your amplifier — don't forget two will be needed for stereo. If you construct it as an out-board unit it should be mounted in a metal box and connected into your amplifier system with short lengths of shielded cable. It may be connected between the "preamp out" and "main in" sockets.

SCRATCH AND RUMBLE filtering is a valuable feature in a hi-fi amplifier but is one which is absent from many designs, or if this filtering is present it may well be in the form of a relatively ineffective 6 dB per octave type filter. This circuit is a 12 dB per octave add-on scratch and rumble filter which can be connected into the 'tape monitor' circuit or some similar facility of the amplifier.

This is a conventional second order filter circuit having passive high pass filter formed by the series capacitance C3 and C4, plus the parallel resistance of R2 and R3 (the latter also being used to bias emitter follower transistor Q1). A passive filter of this type gives only a very slow initial roll off and an ultimate attenuation rate of only 6 dB per octave. A bootstrapping resistor is therefore used to improve performance.

Above the cutoff frequency, where the gain of the circuit would otherwise fall off somewhat, R1 has the effect of reinforcing the input signal from the output of the buffer amplifier based on Q1. Well below the cutoff frequency, losses through C4 result in the signal level at Q1 emitter being well below that at the junction of C3 and C4. This results in some of the signal at the junction of C3 and C4 being tapped off through R1, with C3 and R1 effectively forming a second high pass filter network. This eliminates the slow initial roll off rate (in fact there is a small and insignificant peak of about 0.5 dB above the cutoff frequency) and speeds up the attenuation rate to a nominal 12 dB per octave.

The low pass filter works in much the same way as the high pass one, except of course the R and C filter elements have been transposed so as to give the correct filter action.

If only low pass filtering is required, SW1 can be used effectively to bypass the high pass filter components. C2 then maintains dc blocking at the input. SW2 can be used to bypass the low pass filter components when only high pass filtering is required.

With the specified component values the rumble filter response falls below unity at approximately 45 Hz, reaches the −6 dB point just above 30 Hz and then falls away at a nominal 12 db per octave. The scratch filter response crosses the unity gain point at about 6.5 kHz, reaches the −6 dB point at approximately 10 kHz, and then falls away at a nominal 12 dB per octave. The worst-case input impedance is around 30 k to 40 k with SW1 and SW2 closed.

A BC549 or similar transistor may also be used for Q1. The circuit should be housed in a shielded enclosure to avoid hum pickup. Use shielded input and output leads. A dual circuit, with two-pole switches for SW1 and SW2, is necessary for stereo operation. ●

'THE S100 BUS STOP'™

SBC200

Z80 single board computer, 4MHz, 16K EPROM, 1K RAM, 16K EPROM, 1 serial port, 1 input & 1 output parallel port, power on jump, 2K monitor-2716 4 channel counter/timer, software controlled baud rate generator, modem look alike, vectored interrupt

KIT $360.00 ASS & TESTED $440.00

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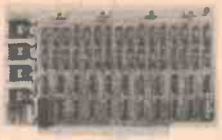
Z80 CPU board, switchable 2 or 4 MHz operation, power on jump to any 4K boundary, on board 2716 PROM socket, optional front panel provision, wait state generator, 2K monitor available, will suit dynamic rams.

Kit $260.00 ASS & TESTED $310.00

16K STATIC RAM



2114 low power RAM chips, 4K address boundary, standard bank select (40H) 4 MHz operation with no wait state required when using our chips, wait state generator for above 4MHz plated thru holes, solder resist, optional 300nS RAMS available.

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KIT 32K-$525 48K-$670 64K-$815
A&T 32K-$605 48K-$750 64K-$895

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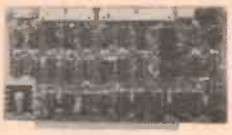

Operates with single & double den. single & double sided drives & 8" or 5" drives in any combination of 4 drives simultaneously, phase lock loop data recovery, with SDOS operating system you can run all CP/M and CDOS programmes.

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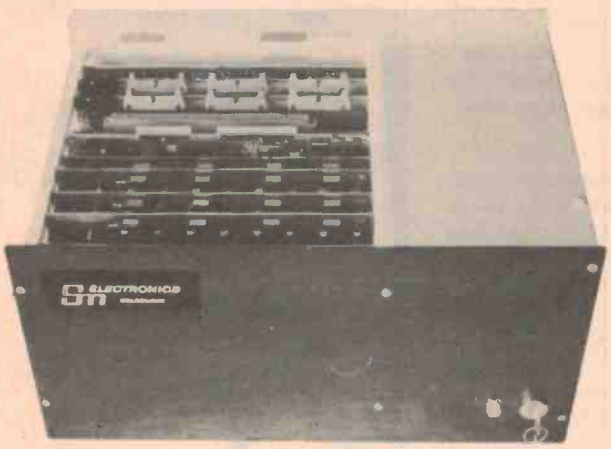
S-100 & 6800 CHASSIS



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AC range booster for your multimeter

MEASURING small audio frequency signals is often impossible using an ordinary multimeter because most of these have a lowest ac range of about 1 V to 5 V full-scale deflection (fsd). A simple and inexpensive solution to the problem is to add an amplifier, such as the one shown here, ahead of the multimeter.

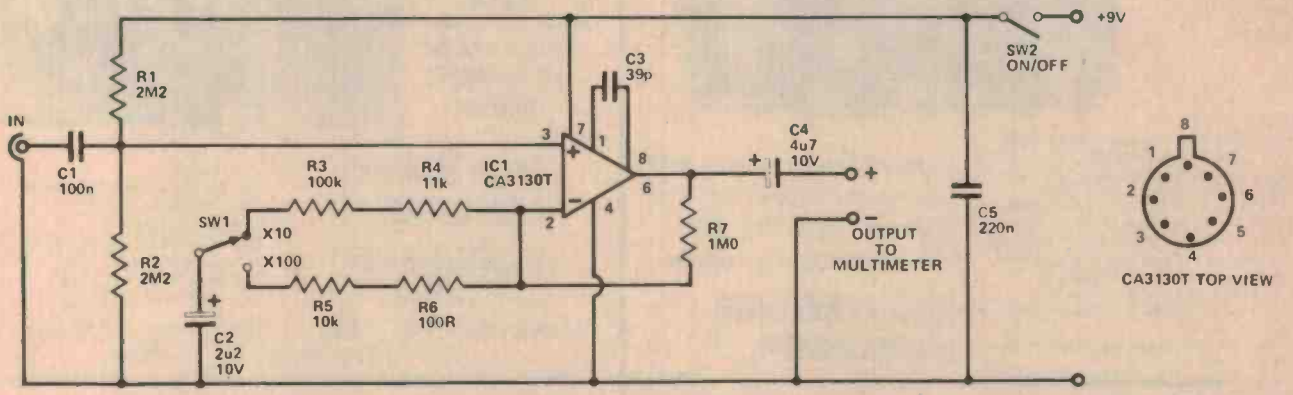
The amplifier has a switched voltage gain of 10 or 100 and would therefore boost the sensitivity of (say) a multimeter switched to the 2.5 Vac range to 250 mV and 25 mV fsd respectively. Measurements down to just a few millivolts rms can then be made with reasonable accuracy.

The circuit uses a CA3130T operational amplifier in the non-inverting mode. The non-inverting input is biased to about half the supply voltage by R1 and R2 and the input signal is coupled to this point by C1. The input impedance of the circuit is set at over 1 M by R1 and R2 so that the unit places little loading on the circuit under test. R7 biases the inverting input and gives a quiescent output voltage of about half the supply potential.

Although IC1 has an extremely high (open loop) voltage gain, the voltage gain of the amplifier as a whole (closed loop) is much lower, and is set by the ratio of two resistances. With SW1 in the x10 position the two resistances are R7, and R3 plus R4. The voltage gain is equal to the sum of the two resistances divided by the shunt resistance (R3 + R4) in this negative feedback network. This gives almost exactly the required figure of 10 with the specified values. With SW1 in the x100 position the lesser shunt resistance of R5 and R6 is switched into circuit, boosting the voltage gain to almost exactly 100.

Capacitor C4 provides dc blocking at the output. C5 is a supply decoupling capacitor and should be mounted physically close to IC1, C3 is the compensation capacitor for IC1 and prevents the device from becoming unstable. Note that a carefully designed layout having the input and output well isolated from one another is required or the circuit as a whole may become unstable.

Screened input and output cables should be used to prevent stray signal pickup affecting the signals. The unit has a maximum output of about 3 V rms. It should therefore be used with the multimeter set to a range of 3 V or less, or if a higher range must be used, the part of the scale above 3 V is ignored. The amplifier has a flat response up to about 30 kHz in the x100 mode, and up to about 300 kHz in the x10 mode. ●



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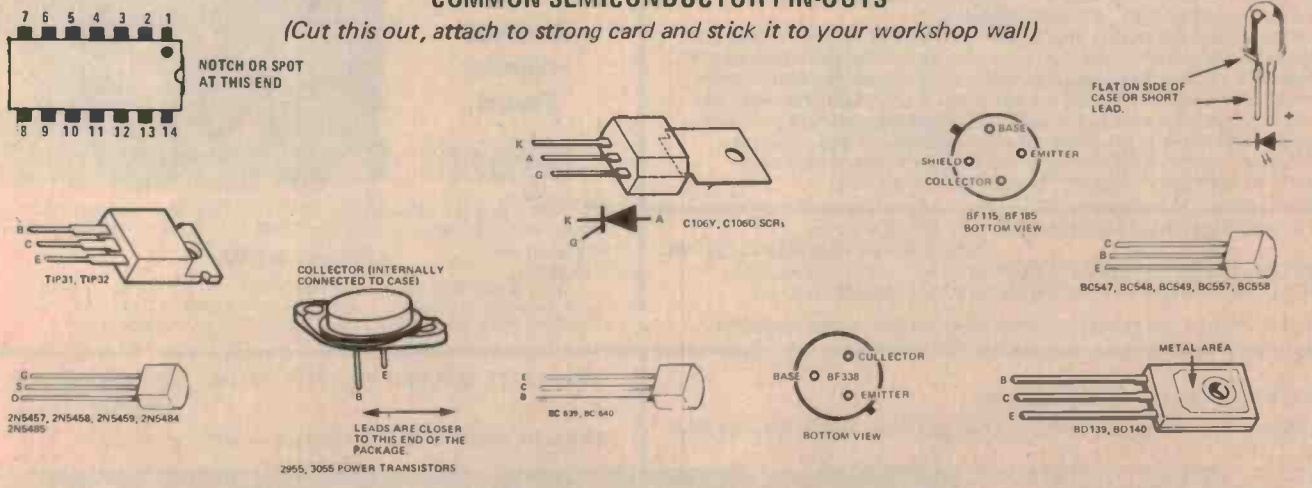

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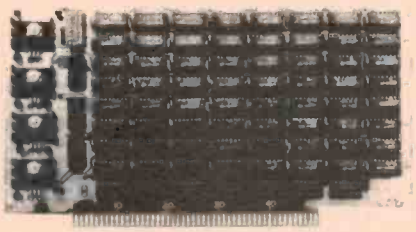

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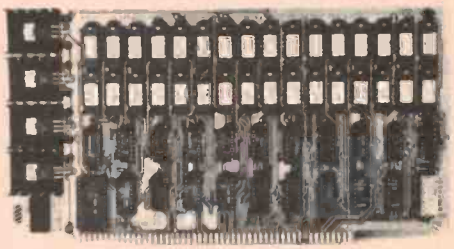

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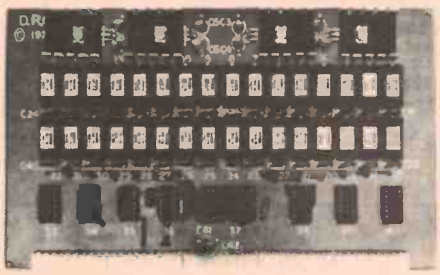

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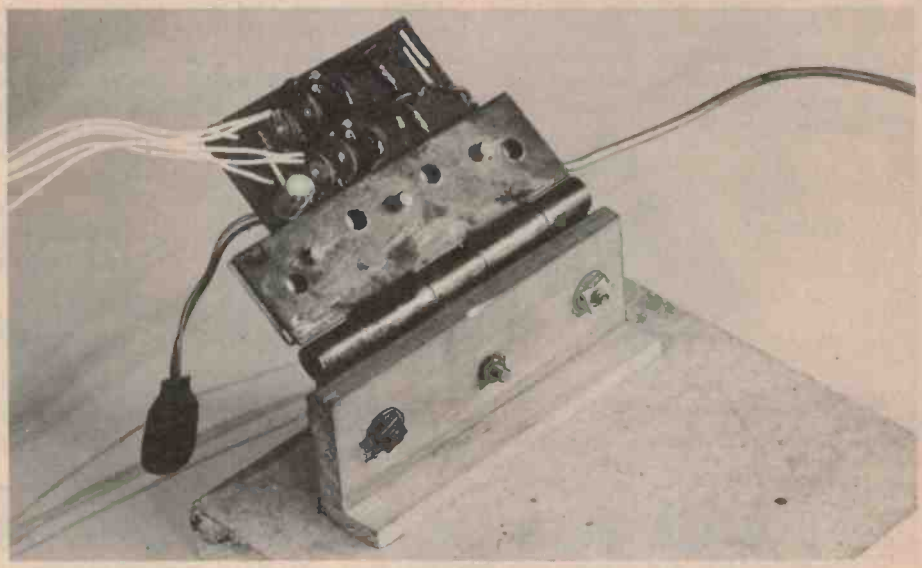
The spare hand

A.J. Lowe

THIS IS one of those gadgets that, once you've made it, you'll wonder how you did without it! It is a simple, very cheap circuit board manipulator, used while fitting and soldering components into a pc board or while testing or fault-finding a board.



The completed Spare Hand with a project securely held and tilted into the 'up' position.

General view of the unit in the 'up' position.

The accompanying photos show the "spare hand" in the up i.e: 'load components' position, and — minus the circuit board, in the down, or 'solder' position.

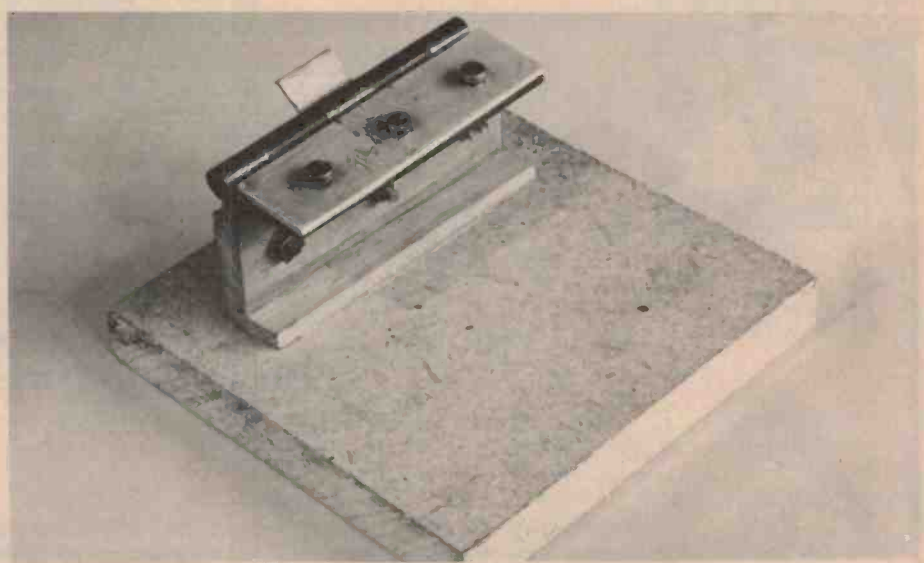
The base is a 150 x 150 mm block of 20 mm particle board. The support is a strip of 12 mm timber about 45 mm high and 110 mm long. This was glued in the position shown and reinforced a little with a small strip glued alongside.

The top rear edge of the support is chamfered (see the drawing) to accommodate the hinge barrel.

The 'works' is simply a 100 mm butt hinge — the heavier the better, with wings about 35 mm wide (to the centre line of the hinge pin) and a 'gripper' attached to the moving wing of the hinge by three clamping screws tapped into the wing.

The hinge is affixed to the support by two bolts so that the moving wing can sit firmly on the top of the support in the down position.

The gripper may be a strip of aluminium (that's what I used in the prototype), brass or steel, the same length as the hinge and 28 mm wide — nearly the width of the moving wing. The strip is actually a shallow angle — see the drawing, so that when the three screws are tightened, the gripper pivots on the short arm of the angle and grips along the front edge. The gripper can be cut from angle stock or fabricated from ▶



General view of the unit in the 'down' position with the 'stop' clearly shown.

two strips as in the prototype. The depth of the inside of the angle must be slightly more than the thickness of the circuit board — about 2.5 mm is deep enough.

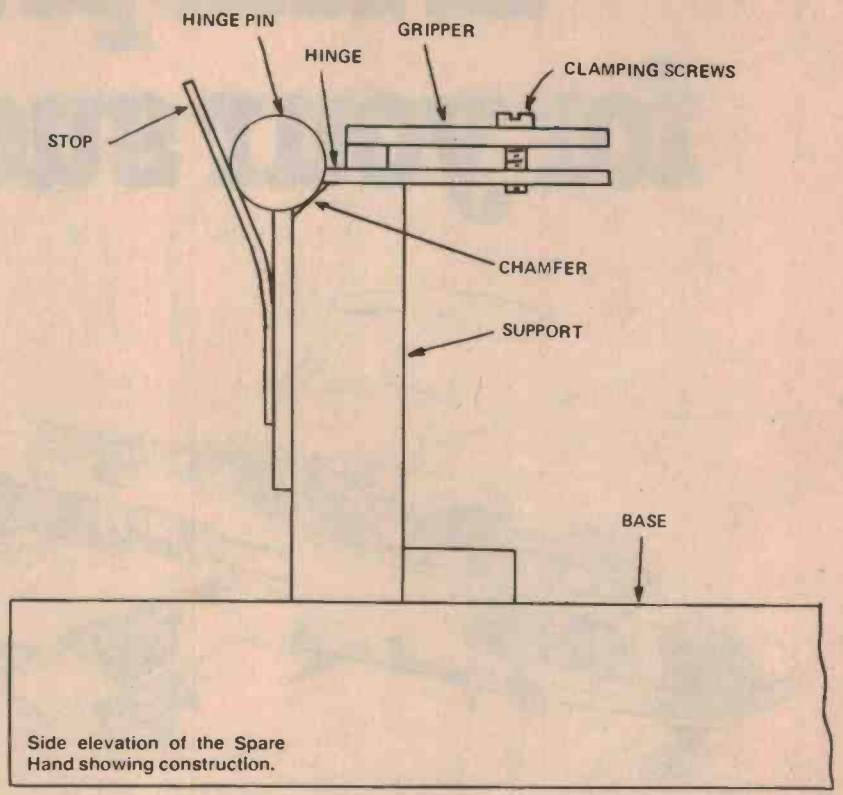
The screws were tapped into the wing of the hinge in positions to avoid the existing holes in the hinge, and to give a good grip on the circuit board. In the prototype the centre line of the screws is 10 mm back from the front edge of the hinge. The outer edge of the gripper is made to align exactly with the outer edge of the hinge.

The stop which limits the backward movement of the hinge is simply a strip of aluminium about 12 mm wide cut and bent to a suitable shape and bolted through the hinge and support.

If you have a hinge handy — make one of these right away, it'll take only an hour, and you'll be glad you did.

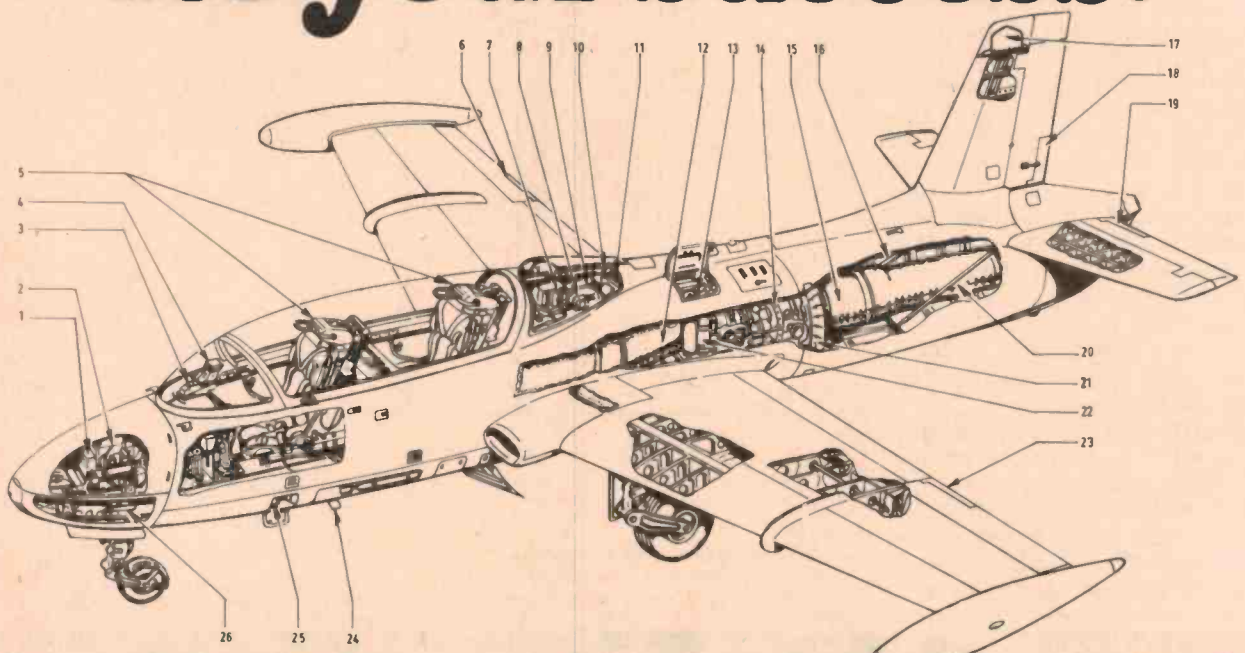
If you use the spare hand for testing a circuit, a strip of plastic under the gripper will prevent short circuits.

For those who make large boards, the spare hand could be increased in size with two hinges attached to the support, but make sure their axes are in line.●



Side elevation of the Spare Hand showing construction.

A blueprint for your success.



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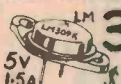

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4	100 TAGSTRIPS asst.	$2.50
5	100 asst. KNOBS Radio, TV Amplifier	$5.50
6	100 asst. POTS Trimpots, std. slider, gang	$9.95
7	100 asst. GREENCAPS ceramic 15pF to .1	$5.95
8	100 HOBBYISTS SPECIAL PARTS Containing plugs, jacks sockets, fuses, tubes switches, and many more items, 100 pcs in all	$9.95

DECADE PAKS!

1	10 TRIMPOTS asst. values horiz+vert	$3.65
2	10 CERMET TRIMPOTS	$1.00
3	10 std. POTS LOG & LINEAR single Gang	$1.90
4	10 switch POTS LOG & LINEAR asst. types	$2.70
5	10 dual gang POTS asst.	$3.90
6	10 PVC mains cable CLAMPS	75¢
7	10 ⅜" diam FERRITE RODS	$3
8	10 asst. TRANSISTOR H'SINKS	$1
9	10 asst. FUSEHOLDERS 3AG	$2
10	10 3AG FUSES to 3Amps, asst.	$1
11	10 asst SWITCHES Slide, roh toggle etc	$2.50
12	10 14 pin DIL SOCKETS	$2.00
13	10 14 pin DIP PLUGS	$1.50
14	10 16 pin DIL SOCKETS	$2.30
15	10 PL-259 co-ax PLUGS	$3.30
16	10 600 PIV 25A RECT.	$3.50

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Stainless Steel or Gold finish! Please advise.

CRAZY LOW PRICE!

6 Months Guarantee With Instructions and display case!

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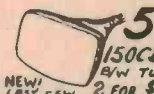

NEW! LAST FEW. 5" TV TUBE 150CB4 B/W TUBE 2 FOR $11 or $5.95 ea

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- ALL TEST GEAR
- Elect. Parts BUY & SELL ONLY!
- Elect. MAGAZINES BACK ISSUES 1970 ON

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12v CAR CASSETTE TAPE HEAD DEMAC. PROBE

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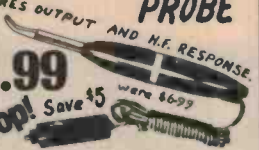


$1.99

Scoop! Save $5 were $6.99

NEW DOLBY DECK

EXPO front loading model WITH DOLBY

- TWIN VU'S
- BIAS SWITCH
- EQUAL. SWITCH
- TAPE COUNTER
- GUARANTEED
- LOOKS GOOD
- SOUNDS GOOD

CASSETTE DECK $139 (Sent 'Freight On')

BSR Belt-Drive TURNTABLE

NEW MODEL

- FEW ONLY!
- FULLY AUTOMATIC OPERATION

$105 Sent 'Freight On'

With base, cover and ADC mag. cart!

ECONOMY TURNTABLE $79 'Freight On' BSR Semi-Auto pin drive with base, cover and cartridge

PRICES CRASH!

1KW TVI FILTERS	JD-150 for Ham or CB	$15
250 mixed RESISTORS	¼w up	were $3 $2
Lock-down CAR AERIAL	by Clarion 3metre	were $6 $3
INTERCOMS, 2 Way	100ft	were $15 $10
5m SPEAKER CABLE	Colour-coded usually 15pm	50¢
AY3-8500 TV Games IC Chip		$3
Marine CB AERIALS	Fiberglass, were $39, below cost!	$18
Tranimate RF BOOSTER	AM signal pre-amp	$2
5pin DIN→5pin DIN LEADS	1.2M long	$3
Telescopic AERIALS for TVs	1.6m to 4m, 4 sizes	$1
Stereo CERAMIC CARTRIDGE	4pin	$2
6x4 or 5x4 15Ω SPEAKERS	were $3	$2
De-Soldering WICK	1M long, best quality, were $3	$1.25
Sharp TV TUNER	12 Channels, all trans. were $5-$15	$3.50
5" Hi-Fi Mid-range SPEAKER	2 for $7	
50 Plastic POT WASHERS	⅜" diam	$1
	(Ideal for spacing and protecting front panels)	
SWR METERS	FOR CB were $19.50	$9.50
FM WIRELESS MIKE	with $16	$10

88-108 MHz, up to 300ft, only 103x25x34mm

'THEFT-ALERT' POCKET PAGER ALARM SYSTEM

THEFT ALERT

$125

UP TO ½ MILE RANGE! Designed specifically as a car, truck, boat or caravan burglar alarm system, the 'THEFT-ALERT' personal pager has 100's of uses eg. on farms for security protection of outbuildings or equipment etc, for "fail-safe" indication of critical remote machinery or for paging in offices or factories of key personnel or vehicles and many more!

LOW COST PERSONAL PAGER.... The tone-selective transmitter permits many systems to be used independently on the 27m Hz band without interaction or without interference to or from other transmitters.

THE BEST BURGLAR ALARM..... When burglars strike, you usually don't know until after words.....too late to prevent the crime. But now THEFT-ALERT will do just that! Two PIEZO SENSORS (supplied) attached to each side of a vehicle or to doors, windows etc. will trigger the transmitter to alert you. You can add more PIEZO SENSORS to the bonnet and boot or to wheels etc and to other doors, windows or.... anywhere. With "Trigger Input" and "Trigger Output" the transmit may operate an additional siren alarm system or may be operated by an existing alarm, it's so versatile and yet so compact.

EASILY INSTALED..... 300mA operation (quiescent current) No special antenna needed - uses your car radio aerial or simple 6ft long wire aerial. Takes less than 1Hr to instal on a car - full instructions supplied.

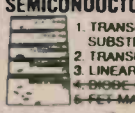
PRICES - Complete 'THEFT-ALERT' with pager, transmitter and 2 PIEZO SENSORS $155. Extra PIEZO SENSORS $15 ea. Extra pager $90 ea. Electronic alarm siren $19 ea. Car entry/exit delay alarm module $45 and 479. Power supply for 240v use $12.50

Introductory Offer - POST FREE this month only. Large stocks avail. now!

WERE $12 ea EA **$10** 100,000uF 16vW COMPUTER QUALITY ELECTROS 10+ New Siemens $9 ea

LATEST JAPANESE SEMICONDUCTOR MANUALS

NOW ONLY $8 LIMITED QUANTITIES



1. TRANSISTOR SUBSTITUTION MANUAL
2. TRANSISTOR MANUAL
3. LINEAR IC MANUAL
4. ~~DIODE MANUAL~~ SOLD OUT!
5. ~~FET MANUAL~~ SOLD OUT!

240v LIGHT FLASHERS

SALE

Complete, wired with lamp holder (no globe) HANDLES 60W GLOBE, UP TO 300W WITH H'SINK

Ideal for blinking Advertising signs, Discos etc

SAVE $3 $2.95 ea was $5.95

MINI H.D. RELAY

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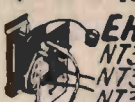
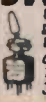


NT3100 NT3101 NT3122 All New ONLY $4.50 EA

LOWEST PRICED SWITCHES SALE



B. ON-(ON)
D. ON-OFF-(ON)
E. (ON)-OFF-(ON)
SPDT (3P) 80¢ 10 FOR $7

G. ON-(ON)
I. ON-OFF-(ON)
J. (ON)-OFF-(ON)
DPDT (6P) $1 EA or 10 FOR $9

DPDT De-Lux TOGGLE 10+ $1.35 $11.50

Mini SPST ON-OFF ROCKER 10 for $1.59 20¢

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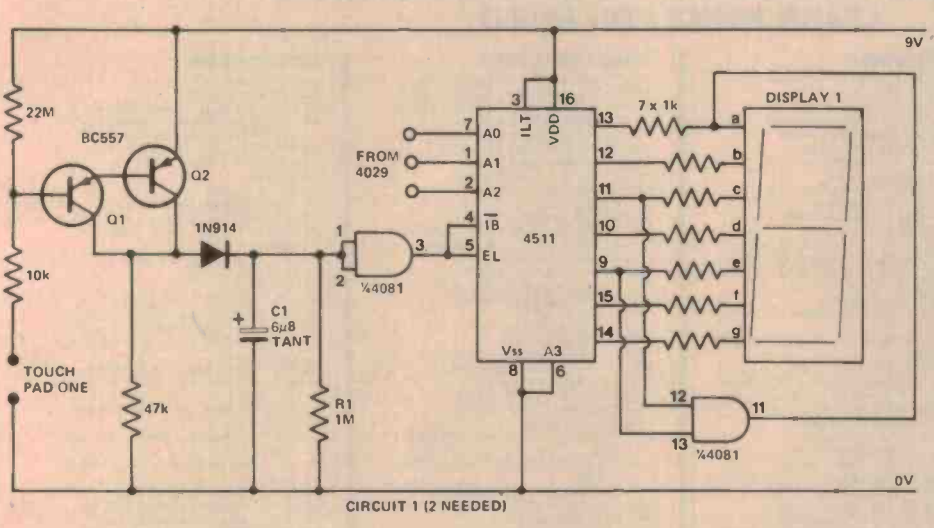
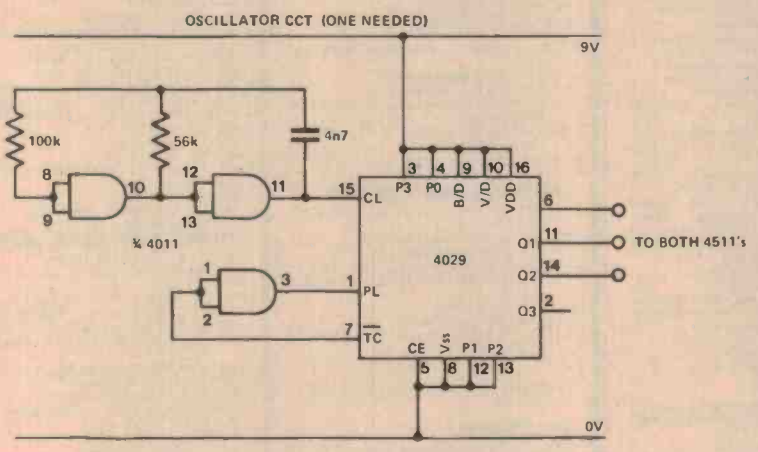
Ideas for Experimenters

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.

Dual digital dice





Two identical seven-segment display driver circuits, driven from a common counter circuit, provide the numerals for this dice devised by **Russell Sharp of Belmont, Victoria.**

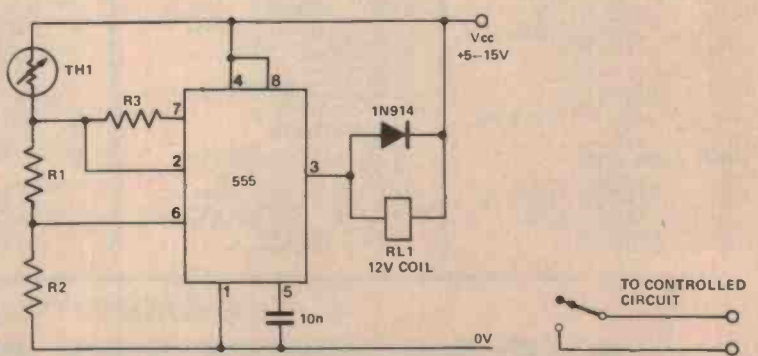
The counter is driven from a 2 kHz oscillator, the 4011, and generates a count sequence from 1001 to 1110. The terminal count (low on output 1111) is inverted to load 1001 into the parallel input of the 4029. When your finger is pressed on the touch pad the collectors of Q1 and Q2 go high and pins 4 and 5 on the 4511 are held high for about three seconds after your finger is removed from the touch pad. The delay is provided by C1 and R1, together with the 4081 gate. The high on pin 5 of the 4511 loads the last data present on the address inputs (A0 to A2) into the latch of the 4511, whilst a high on pin 4 releases the display from the 'blank' mode to display the contents of the latch. The number is then displayed. When pin 4 goes low again after three seconds, the display is blanked to conserve battery power.

The high clock frequency ensures that the dice has a random result. Even if you attempt to touch both pads simultaneously, each die shows a different throw.

Electronic thermostat

Yet another idea for a 555. This circuit, **from Benjamin Simons of Beecroft, NSW,** uses a 555 timer IC to switch a relay when the temperature on a thermistor reaches a preset upper level and turn it off when the temperature reaches a preset lower level. The on and off states are determined by the values of R1, R2 and R3 and on the resistance of the thermistor. You'll have to experiment to find them.

Mr Simons suggests the circuit may be used to control a ventilator, fan or chemical bath.



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STEREO UNITS

S1 ETI 484 Compressor Expander
S2 ETI 482 50 watt per channel Amplifier
S3 ETI 482A Preamp Board
S4 ETI 482B Tone Control Board
S5 ETI 485 Graphic Equalizer
S6 ETI 480 50 watt Amplifier less H/S
S7 ETI 480 100 watt Amplifier less H/S
S8 ETI 480 Power Supply for above
S9 ETI 443 Expander Compressor
S10 ETI 444 Five Watt Stereo
S11 ETI 422B Booster Amplifier including metalwork
S12 ETI 438 Audio Level Meter
S13 ETI 440 25 watt Stereo Amplifier including metalwork
S17 ETI 422 50 watt per channel Amplifier *
S18 ETI 426 Rumble Filter
S19 ETI 429 Simple Stereo Amplifier
S21 ETI 417 Over led Distortion Monitor
S22 ETI 410 Super Stereo Sound Source Width Control
S24 ETI 427 Graphic Equalizer *
S25 E.A. Playmaster 10 + 10
S26 E.A. Playmaster 128 40 watt
S27 E.A. Playmaster 132 40 watt
S28 E.A. Playmaster 136 13 watt
S29 E.A. Playmaster 137 3 watt
S30 E.A. Playmaster 143 12.5 watt
S32 E.A. Musicolour 11 1000 w/ch
S33 E.A. Musicolour 111 1000 w/ch
S34 E.A. Stereo Dynamic Noise Filter
S35 ETI 470 60 watt audio amplifier module
S36 ETI 4000 Series 60 watt stereo amplifier
S37 ETI 451 Hum Filter for Hi-Fi systems
S38 E.A. Stereo Infrared Remote Switch
S39 ETI 455 Stereo Loudspeaker Protector
S40 E.A. Super-Bass Filter Less Power Pack

PRE-AMPLIFIERS AND MIXERS

P1 ETI 445 Stereo Pre-amplifier
P2 ETI 449 Balance Mic Pre-amplifier
P5 ETI 414 Master Mixer 8 channel
P6 ETI 419 Mixer Pre-amplifier - 4 ch. Mixer Pre-amplifier - 2 ch.
P7 ETI 401 F.E.T. 4 Input Mixer
P9 E.A. Simple Mixer for Pick up and Microphone
P10 E.A. Playmaster 145 Mixer
P11 ETI 446 Audio Limiter
P12 ETI 471 High Performance Stereo Pre-Amplifier
P13 ETI 477 Moving Coil Cartridge Pre-amp
P14 ETI 474 High to Low Impedence Interface

RECEIVERS/TRANSMITTERS

R1 ETI 711 Remote Control Transmitter Switch
R2 ETI 711R Remote Control Receiver
R3 ETI 711D Remote Control Decoder
R4 ETI 711B SIngle Control
R5 ETI 711C Double Control
R6 ETI 711P Power Supply
R7 ETI 707A 144 MhZ Converter
R8 ETI 707B 52 MhZ Converter
R9 ETI 708 Active Antenna
R10 ETI 710 R.F. Power Amplifier
R11 ETI 780 Novice Transmitter
R12 ETI 703 Antenna Matching Unit
R14 E.A. 240 Communications Receiver
R15 E.A. 110 Communications Receiver
R16 E.A. 160 Communications Receiver
R17 E.A. 130 Communications Receiver
R18 E.A. All Wave 1/C2
R20 E.A. Fremodyne 4 Complete Kit
R21 E.A. Fremodyne 4 RF Section
R23 E.A. Mos Fet 52 MhZ Converter
R29 E.A. Short Wave Converter for 27 Mhz
R30 E.A. Simple S.W.R Meter
R31 E.A. 27 MhZ Pre-Amp
R32 E.A. 10-30 MhZ Pre-Amp
R33 ETI 718 Shortwave Radio
R34 ETI 490 Audio Compressor
R35 ETI 721 Aircraft Band Converter (less XTALS)
R36 ETI 726 6 or 10 meter Power Amp

MODEL TRAIN UNITS

MT1 ETI 541 Model Train Control
MT2 E.A. 1974 Model Train Control
MT3 E.A. 1971 S.C.R. P.U.T. Control Unit
MT4 E.A. Electronic Steam Whistle
MT5 E.A. Electronic Chuffer
MT6 E.A. 1978 Train Control

TEST EQUIPMENT

TE1 ETI 134 True RMS Voltmeter
TE2 ETI 133 Phase Meter
TE3 ETI 533C Digital Display
TE4 ETI 129 R.F. Signal Generator
TE5 ETI 130 Temperature Meter
TE6 ETI 706 Marker Generator
TE7 ETI 709 R.R. Alternator
TE8 ETI 122 Logic Tester
TE9 ETI 124 Tone Burst Generator
TE10 ETI 123 C Mos Tester
TE11 ETI 116 Impedence Meter
TE12 ETI 533 Digital Display
TE13 ETI 117 Digital Voltmeter 1975 Display
TE14 ETI 117 Digital Voltmeter 1976 Display
TE15 ETI 704 Cross Hatch Dot Generator
TE16 ETI 120 Logic Probe
TE17 ETI 121 Logic Pulser
TE18 ETI 118 Digital Frequency Meter 1975 Display
TE19 ETI 118 Digital Frequency Meter 1976 Display
TE20 ETI 222 Transistor Tester
TE21 ETI 1137 Input Thermocouple Meter
TE22 ETI 107 Wide Range Voltmeter
TE23 ETI 108 Decade Resistance Box
TE25 E.A. SWR Reflectometer
TE26 E.A. R.F. Impedence Meter
TE27 E.A. Antenna Noise Bridge
TE28 E.A. 1968 Transistor Test Set
TE29 E.A. 1971 Transistor (F.E.T.) Tester
TE30 E.A. 1977 Digital Logic Trainer
TE31 E.A. 2½ Digit Volt Ohm Meter
TE32 E.A. Simple Function Generator
TE33 E.A. Direct Reading Capacitance Meter
TE34 ETI 487 Real Time Audio Analyser
TE35 ETI 483 Sound Level Meter
TE36 ETI 489 Real Time Audio Analyser
TE37 ETI 717 Cross Hatch Generator
TE38 E.A. 3 MhZ Frequency Counter
TE40 E.A. Direct Reading Ohm Meter
TE41 E.A. Function Generator
TE42 E.A. Transistor Tester Incl. Bipolar & F.E.T.S.
TE43 ETI 591 Up Down Pre-setable Counter
TE44 ETI 550 Digital Dial (less case) includes ETI 591
TE45 ETI 144 Expanded Scale R.M.S. Voltmeter
TE46 ETI 148 Versatile Logic Probe
TE47 ETI 724 Microwave Oven Leak Detector
TE48 ETI 150 Simple Analog Frequency Meter
TE49 ETI 151 Linear Scale Ohm Meter
TE50 ETI 152 Linear Scale Capacitance Meter
TE51 E.A. Digital Capacitance
TE52 ETI 589 Digital Temp. Meter
TE53 E.A. TV C.R.O. Adapter
TE54 E.A. Zero Voltage sx. Heat Controller
TE55 E.A. XTAL Locked TV Pattern Generator
TE56 E.A. Decade Resistance Box
TE57 E.A. Decade Capacitance Box
TE58 E.A. Capacitor Substitution Box
TE59 E.A. Tantalum Cap Sub Box

POWER SUPPLIES

PS1 ETI 132 Experimenters Power Supply
PS2 ETI 581 Dual Power Supply (High Powered Version)
PS3 ETI 712 CB Power Supply
PS4 ETI 131 Power Supply
PS5 ETI 119 5 volt switching regulator supply
PS6 ETI 105 Laboratory Power Supply *
PS7 ETI 111 I/C Power Supply
PS8 E.A. D.C. Voltage Reference
PS9 E.A. 1976 Regulated Power Supply
PS10 E.A. Dual 30-2 0-30V • 2A or 0-60V • 2A or Dual Pos and Neg 30V • 2A
PS11 E.A. C.B. Power Supply
PS12 ETI 142 Power Supply 0-30 V 0-15 A (fully protected)
PS13 ETI 472 Power Supply
PS14 E.A. Power Supply for Dream 6800
PS15 ETI 577 Dual 12V supply

AUDIO TEST UNITS

AT1 ETI 441 Audio Noise Generator
AT2 ETI 128 Audio Millivolt Meter
AT3 ETI 112 Audio Attenuator
AT4 ETI 102 Audio Signal Generator
AT5 E.A. A.F. Tone Burst Generator
AT6 E.A. Laboratory Solid State A.F. Generator
AT7 ETI 137 Audio Oscillator
AT8 ETI 138 Audio Power Meter

MISCELLANEOUS KITS

M1 ETI 604 Accentuated Beat Metronome
M2 ETI 546 G.S.R. Monitor (less probes)
M3 ETI 549 Induction Balance Metal Detector includes wire for search Head
M4 ETI 547 Telephone Bell Extender
M5 ETI 602 Mini Organ (less case)
M6 ETI 544 Heart Rate Monitor
M7 ETI 044 Two Tone Doorbell
M8 ETI 043 Heads and Tails
M9 ETI 068 L.E.D. Dice Circuit
M10 ETI 539 Touch Switch
M11 ETI 529 Electronic Poker Machine
M12 ETI 236 Code Practice Oscillator
M13 ETI 218 Monophonic Organ
M14 ETI 701 Masthead Amplifier
M15 E.A. I/C Volume Compressor
M18 E.A. 240 volt Lamp Flasher
M19 E.A. A/C Line Filter
M20 E.A. Bongo Drums
M21 E.A. Keyless Organ
M22 E.A. Auto Drums
M23 E.A. Electronic Roulette Wheel
M25 E.A. Digital Metronome
M26 E.A. Voice Operator Relay
M27 E.A. Gas Detector Car Boat
M28 E.A. Led Chaser
M29 E.A. Sound Effects Generator * see below
M30 ETI 551 Light Chaser 3 channel 1000 watt/ch.
M31 E.A. Electronic Poker Machine
M32 E.A. Remote TV Headphone
M34 ETI 650 STAC Timer
M35 ETI Wheel of Fortune
M36 ETI 557 Reaction Timer
M37 ETI 249 Combination Lock (less lock)
M38 ETI 814 Dinky Die
M39 E.A. Electronic Combination lock (including lock)
M40 E.A. Mast Head Amplifier
M41 ETI 576 Electromogram
M42 E.A. Prospector Metal Locator Including Headphone
M43 ETI 561 Metal Locator Less dowel & tubing potplant stand
*set as for Steam Train and Prop Plane noise

VOLTAGE/CURRENT CONTROLS

V1 ETI 481 12 volt to ± 40V D.C. 100 watt Inverter
V2 ETI 525 Drill Speed Controller
V3 E.A. S.C.R. Speed Controller
V4 E.A. Stage (etc.) Auto Dimmer 2 K.W.
V5 E.A. Stage (etc.) Auto Dimmer 4 K.W. & 6 K.W. add on for above
V6 E.A. 1976 Speed Control
V7 ETI 592 Light Show Controller (3 ch.) (1000 w/ch)
V8 E.A. Inverter 12V D/C Input 230V 50hz 300VA output
V9 ETI 593 Colour Sequencer (for use with ETI 592)

PHOTOGRAPHIC

PH1 ETI 586 Shutter Speed Timer
PH2 ETI 548 Photographic Strobe (less reflector)
PH3 ETI 514B Sound Light Flash Trigger
PH4 ETI 532 Photo Timer
PH6 ETI 505 High Powered Strobe (less reflector)
PH7 ETI 513 Tape Slide Synchronizer
PH8 ETI 512 Photographic Process Timer
PH9 ETI 515 Slave Flash
PH10 ETI 540 Universal Timer
PH11 E.A. 1970 Stroboscope Unit (less reflector)
PH12 E.A. Sync-a-Slide
PH13 E.A. Auto Trigger for Time Lapse Movies
PH14 ETI 558 Mast Head Strobe
PH15 ETI 553 Tape Slide Synchronizer
PH16 E.A. Digital Photo Timer
PH17 ETI 594 Development Timer

TUNERS

T1 ETI 062 A.M. Tuner
T2 ETI 740 F.M. Tuner *
T4 E.A. Playmaster 146 AM-FM Tuner *
* Wooden Cabinet not included

AUTOMOTIVE UNITS

A1 ETI 317 Rev. Monitor
A2 ETI 081 Tachometer
A3 ETI 316 Transistor Assisted Ignition
A4 ETI 240 High Power Emergency Flasher
A5 ETI 239 Break Down Beacon
A6 ETI 312 Electronic Ignition System
A7 ETI 301 Vari-Wiper
A8 ETI 502 Emergency Flasher
A10 ETI 303 Brake Light Indicator
A11 ETI 309 Battery Charger
A12 E.A. 1970 C.D.I. Capacitor Discharge Ignition
A13 E.A. High Efficiency Flasher
A14 E.A. Dwell Meter
A15 E.A. Variwiper
A16 E.A. Tacho for Tune-ups
A17 E.A. Ignition Analyser and Tachometer
A18 E.A. Strobe Adaptor for Ignition Analyser
A19 E.A. 1975 C.D.I. Capacitor Discharge Ignition
A20 E.A. Mains Supply for Car Cassettes
A21 E.A. Automatic Heavy Duty Battery Charger
A22 ETI 318 Digital Car Tachometer (less Metalwork)
A23 ETI 319A Variwiper Mk. 2 (no dynamic braking)
A24 ETI 319B Variwiper Mk. 2 (for dynamic braking)
A25 ETI 555 Light Activated Tacho
A26 ETI 320 Battery Condition Indicator
A27 E.A. Transistor Assisted Ignition

GUITAR UNITS

G1 ETI 447 Audio Phaser
G2 ETI 413 2 x 100 watt Bridge Amplifier
G4 ETI 408 Reverberation Unit
G5 ETI 413 100 watt Guitar Amplifier
G6 ETI 410 A.D.U. for your Guitar
G7 E.A. PM 125 50 watt Guitar Amplifier
G8 E.A. PM 134 21 watt Guitar Amplifier
G9 E.A. PM 138 20 watt Guitar Amplifier
G10 E.A. Waa Waa Unit
G11 E.A. Fuzz Box
G12 E.A. Sustain Unit
G13 E.A. PM 135 12 watt Guitar Amplifier
G14 ETI 452 Guitar Practice Amplifier
G15 ETI 466 300 watt Amp module - less H/S & Transformer

COMPUTER AND DIGITAL UNITS

C1 ETI 633 Video Synch Board *
C2 ETI 632M Part 1 Memory Board V.D.U. *
C3 ETI 632P Part 1 Power Supply V.D.U. *
C4 ETI 632A Part 2 Control Logic V.D.U. *
C5 ETI 632B Part 2 Control Logic V.D.U. *
C6 ETI 632C Part 2 Character Generator V.D.U. *
C7 ETI 632 Mother Board Including P/S *
C8 ETI 632 U.A.R.T. Board *
C9 ETI 631-2 Keyboard Encoder *
C10 ETI 631 A/Sch. Keyboard Encoder (less keyboard) *
C11 ETI 630 Hex Display
C12 E.A. Educ-8 Computer
C13 E.A. Cassette Tape Interface
C14 ETI 638 Eprom Programmer
C15 ETI 637 Cuts Cassette Interface
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C17 ETI 730 Getting Going On Radio Tele Type
C18 E.A. Dream 6800 Computer for Beginners less keyboard and cover

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WS2 ETI 066 Temperature Alarm
WS3 ETI 528 Home Burglar Alarm
WS4 ETI 702 Radar Intruder Alarm
WS5 ETI 220 Wailing Siren
WS6 ETI 219 Hee Haw Siren
WS7 ETI 313 Car Alarm
WS9 ETI 503 Electronic Thief Trap
WS10 ETI 506 Infre Red Intruder Alarm
WS11 ETI 305 Automatic Car Alarm System
WS12 ETI 582 House Alarm
WS13 E.A. Electric Siren
WS14 E.A. 1976 Car Alarm
WS15 E.A. 10 Ghz Radar Alarm

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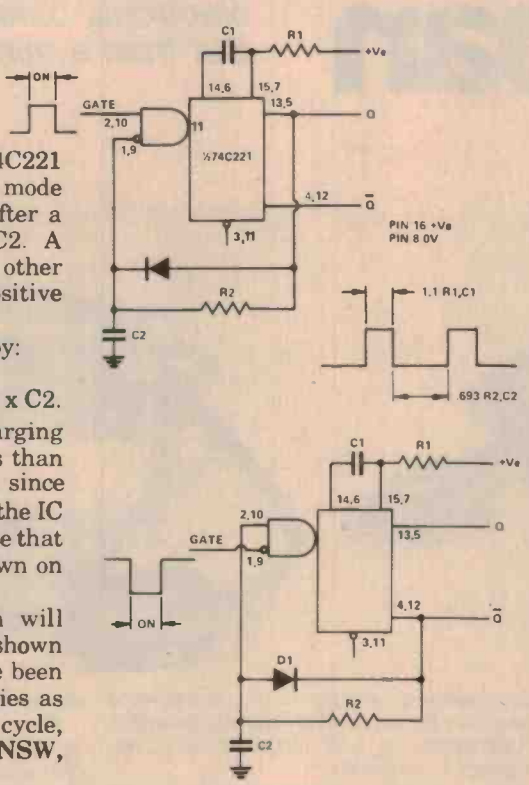
Ideas for Experimenters

Astable mono



This circuit idea uses half a 74C221 operating in a normal monostable mode except that it retriggers itself after a delay determined by R2 and C2. A gating facility is provided by the other input, and should be tied to the positive rail for a free running mode.

The 'on' time is determined by:

1.1 x R1 x C1

and the 'off' time by 0.693 x /r2 x C2.

The diode D1 ensures rapid charging of C2 when the duty cycle is less than 50%. This is not necessary for C1 since it is automatically discharged by the IC at the start of its timing cycle. Note that alternative pin numbers are shown on the circuit.

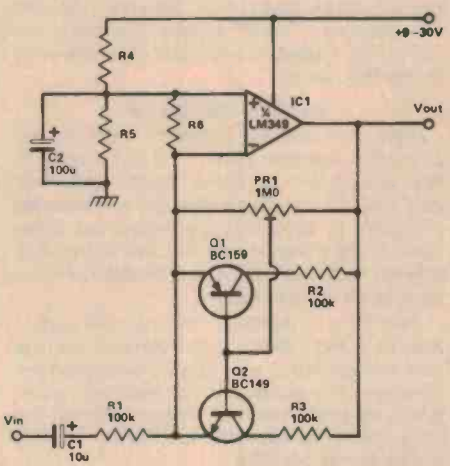
An alternative circuit, which will operate from a negative gate, is shown below the first. The circuits have been used to drive a LED at frequencies as low as two Hertz at a 30% duty cycle, says **Phillip Dennis of Berala NSW,** who sent them in.

'Soft' limiter

One of the fundamental differences between valve and transistor amplifiers is their behaviour when driven into clipping. The valve amps go into so--called 'soft' clipping whilst their transistorised counterparts generate large quantities of harmonic distortion. The circuit shown simulates the soft clipping of valve amplifiers and is intended to be used between the power amplifier's input and the preamplifier's output.

Resistors R4 and R5, decoupled by C2, set a half supply reference for the non-inverting input of the op amp. Input signals are fed into the inverting input via the dc blocking capacitor and R1, the latter defining small signal gain and input impedance.

For small signals, the amplifier's output is an exact unity gain copy of the input. As the signal level increases however, the time will come when the voltage across the output and slider of PR1 will be sufficient to bias Q1 or Q2 on. When this occurs the feedback increases due to the shunting effect of R2 and R3.



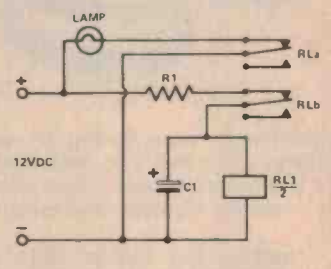
R4, R5 = 4k7 R6 = 22k

The net effect is that musical peaks above a certain threshold are reduced in amplitude to prevent the power amplifier going into hard clipping. As a result, distortion is noticably decreased whilst the subjective loudness appears unaffected.

The circuit is adjustable in operation between 130 mV and 10 V rms input sensitivity by means of PR1. To set the circuit up, simply set the slider so that it is shorted to the output of the amp. Play some music at high volume through the system and adjust until the harshness just disappears. It's easier to do than describe, says **J.P. Macaulay of Crawley, UK.**

Simple flasher

M. Sully of Niddrie, Vic must have devised just about the simplest circuit possible for a light flasher. A relay is wired as a pulser with a set of relay contacts breaking the power to the coil as soon as the relay operates. Normally with this connection, the relay would buzz, operating many times a second. By adding a resistor in series with the coil and a capacitor across the coil the buzzing can be slowed down to a slow pulsation. The lamp is wired across the supply, in series with a second set of relay contacts so it flashes on and off with the relay.



When the power is first applied, the capacitor charges through R1. When the voltage across the capacitor has risen sufficiently, the relay operates. Power is then disconnected from the relay coil, and C1, by the relay contacts in series with the supply and the capacitor starts to discharge through the relay coil. When the voltage across the coil falls below the 'hold in' voltage, the relay drops out. This is one flash cycle.

The capacitor is again charged through R1 for the next cycle.

Try values for C1 from 470 uf to 10 000 uf and values for R1 from 10R to 470R.

Extended Lifespan

JS&A was destined for failure when we introduced our first electronic blood pressure unit. But then a miracle happened.

Model 310

Model 410

Advertisements were starting to appear everywhere. JS&A had just introduced the world's first home electronic blood pressure unit in a massive national advertising campaign.

But something was strange. JS&A often tests its products in its catalog first before they are nationally advertised. If they sell well, we then start a national magazine advertising campaign. The blood pressure unit sold well in our catalog, but for some strange reason, it wasn't selling well in magazines.

SHOCKING DISCOVERY

And then we found the answer. A few months earlier after our blood pressure unit appeared in our catalog, our computer manager (let us call him Ralph to protect his identity) handed us a computer printout of the catalog sales results.

Scanning the results, we discovered that the blood pressure unit was the best-selling product in our catalog—far exceeding every other product by five times.

The results were so positive that we immediately placed hundreds of thousands of dollars in an advertising campaign launched in early 1978.

Just as the advertisements were starting to appear, Ralph walked into our president's office with some startling news. "There's been a mistake," Ralph said. "The computer printout was wrong. The blood pressure unit is actually our worst selling product but a computer error gave us the wrong information."

And so our president sat back and watched JS&A advertisements appearing everywhere, knowing full well that the campaign would cost his company almost the price of a new computer.

Then came the miracle. As if by plan, the American Medical Association came out with an advertising campaign urging consumers to take their blood pressure regularly to combat hypertension or high blood pressure. Ads appeared everywhere.

The campaign revealed that there may be as many as 25 million Americans who have high blood pressure and don't know it. Simply by taking their own blood pressure and discovering hypertension early enough, Americans could be saving their lives and reducing the chances of heart attacks. Suddenly our campaign started to sell blood pressure units by the thousands.

AWARD RECEIVED

This year JS&A's president received the Extended Lifespan award for "pioneering in the distribution of home health electronic devices" by the Committee for an Extended Lifespan. In accepting the award, our president made it very clear that the award was earned as a result of a computer error and not as a result of his brilliance.

This story is painfully true. And although it may be a slight embarrassment to us, there is one aspect that is not. JS&A was indeed the company that pioneered the electronic blood pressure units and has always selected the very best units available to offer at the very lowest prices possible.

NEWEST UNIT

Our newest unit shown above is another example. The model 310 sells for only **$79.95** plus $2.50 for post and handling. You simply wrap the velcro cuff around your arm (you can even keep your shirt on) and inflate the cuff. Both an audible tone and a visible red light will indicate your systolic and diastolic readings. The system is extremely accurate, comes with a self-bleeding air valve and can be stored in a convenient carrying case that comes with each unit.

The deluxe model 410 functions similar to the first system except that the readings are displayed in digits, and the unit also displays your pulse reading. It sells for **$149.95** plus $2.50 per unit for postage, insurance and handling. If for any reason you are not completely satisfied with either unit, you may return it within 14 days for a prompt and courteous refund including your $2.50 postage and handling. To order either unit, credit card buyers may call our phone number, or you may send your check or money order to the address below.

Both units use solid-state components, come complete with instructions and a one-year limited warranty, and should give you years of trouble-free service. If service should be required, we maintain a service-by-mail center as close as your mailbox. JS&A is America's largest single source of space-age products—further assurance that your modest investment is well protected.

If you are concerned about your blood pressure or know somebody who is concerned about monitoring his or hers, we recommend JS&A's latest units.

Incidentally, Ralph left JS&A on his own accord and bought a farm in another state. There were no hard feelings when he left. How could there be? Order your blood pressure unit at no obligation, today.

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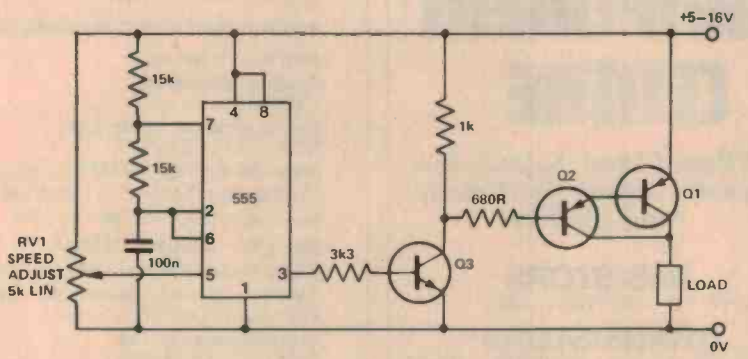
Ideas for Experimenters

Pulse width modulation controller

This novel idea, **from Donald Wallace of Bundaberg,** uses a 555 IC to generate a variable width pulse to run slot cars, model trains etc or the unit may be used as a light dimmer.

The pulse width is controlled by the voltage on pin 5, set by the potentiometer. The output transistor is switched on and off at several hundred hertz, the on to off ratio determining the speed of the motor, or brightness of the lamp.

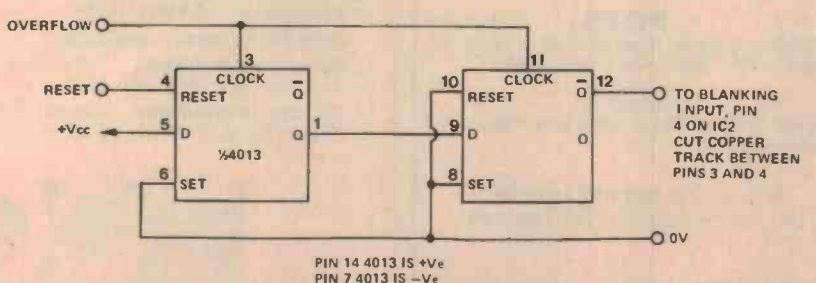
The supply voltage may be 16 V maximum and the circuit can switch up to 10 A with an appropriate heatsink on the output transistor.

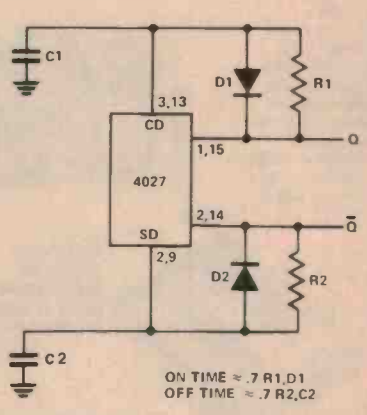


Overrange for ETI 117 digital voltmeter

After building our ETI 117 digital voltmeter, **S. Springett of Scarborough, WA,** decided to add an overrange facility. It is an inexpensive addition which does not interfere with the normal operation of the instrument. The display will flash when overrange occurs and reset to normal when the voltage is within range.

In normal operation there is an overflow pulse between the reset pulses. The first flip flop will be continuously clocked and reset. When overrange occurs there will be multiple pulses on the overflow line between the reset pulses, causing the second flip flop to change state, blanking the display. The display will re-appear after a reset pulse and the first overflow pulse. This produces a flashing display which can still be read.





4027 Oscillator

Taking Barry Wilkinson's idea one step further (see ETI Nov '79 p. 61) an oscillator can be made using half a 4027. The 'on' time is set by R1, C1 while the off time is set by D2 and R2. Another idea from **Phillip Denniss of Berala, NSW.**

Any ideas?

Have you had a bright idea lately, or discovered an interesting circuit modification? We are always looking for items for these pages so naturally, we'd like to hear from you.

We pay between $5 and $10 per item – depending on how much work we have to do on it before we publish it.

The sort of items we are seeking, and the ones which other readers would like to see, are novel applications of existing devices, new ways of tackling old problems, hints and tips.

The Challenger 4

Whichever way you look at it, no other computer offers so much for so little, and in colour!

Minifloppy – two can be added.

Full 53 key, keyboard which in polled mode can recognise up to 8 simultaneously depressed keys.

RF shielded aluminium case with 2 step baked on enamel finish.

Inside: real time clock and countdown timer 24K memory 6502A processor

Solid oiled walnut sides.

Control line interfaces, parallel lines for home security, accessory BUS, parallel I/O lines or other TTL signals.

Joystick sockets – add realism to games.

Colour adjustment.

Video Display 64 × 32

Sound outputs, programmable tone generators – 8 bit companding digital to analog convertors.

RF output for control of AC appliances.

Printer RS232 interface

Numeric key pad slots.

Cassette sockets.

You'd have to go a long way to get better value in a computer. It has execution speed that really separates the computers from the toys. We think the Challenger 4 is way ahead of anything you've seen so far, for a wide variety of uses including business, personal, educational and games, as well as a real-time operating system, word processor and a data base management system.

The Challenger 4 has a 2MHz 6502 processor, and if that's not fast enough we can supply the GT option with the 6502C processor, and 120 nanosecond memory which averages over one million instructions per second.

A real time clock and count down timer, a 64 x 32 display in 16 colours, including 8K memory in the cassette version, 24K for the minifloppy. A BUS structure allows easy plug in of extra memory or many more OHIO boards. The BUS means modularity. If you bought your vintage C2-4 in 1977 we can change the boards at a much lower cost than a new computer.

For the best surprise of all ask our opposition if they can provide all these facilities. When they can't, ask us!

For the complete list of dealers, please refer to listing on opposite page.

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Shoparound

THIS PAGE is to assist readers in the continual search for components, kits and printed circuit boards for ETI projects. If you are looking for a particular component or project — check with our advertisers if it is not mentioned here. Also, for a list of suppliers who stock the ETI projects published over the last few years, our "Kits for Projects" page may generally be found on the page immediately before the DREGS page (inside the back cover).

We can't deny that the **ETI-564 Digital Clock** is a *brilliant* project, a *shining* example of what can be done with solid state devices, a *dazzling* display of expertise — so on and so forth! It uses a total of 128 LEDs for the four seven-segment displays and the two flashing points.

The rectangular LEDs are relatively new on the market but all suppliers have indicated that they will have stocks of them for project constructors. Several companies manufacture them, notably Philips, Siemens and Hewlett Packard. Be careful when you buy your LEDs to make sure that they are all of the same type from the same manufacturer because the angle and intensity of the light they emit varies from type to type.

Polarised plastic for the face of the clock is available over the counter from Polaroid Australia at Unit 3, Eden Park Estate, 31 Waterloo Rd, North Ryde, Sydney or you can write to them at P.O. Box 163, North Ryde, NSW 2113. For 12 cents per square inch, Polaroid will cut the sheet to the exact size of the box you are using for your clock or you can buy a full sheet measuring 19" x 50" (48cm x 127cm) for $66. In either case you will have to pay sales tax of 15%. For red displays use red circular polarised display plastic; for green or yellow displays you need grey circular polarised plastic.

The LED tacho, ETI-324, uses either round or rectangular LEDs. Both types are easily available from all major suppliers. It's up to you how you install the tacho in your vehicle, but if you want to house it in a slim box it's worth while checking out the range of Pactec plastic boxes from Associated Controls, 55 Fairford Rd, Padstow, NSW 2211. These come in a variety of colours which could no doubt be matched to most modern vehicle dashboards.

Do you experience vanishing video, trouble with Teletext in the TV sets in your block of units? Getting enough signal to each of the TV receivers in a distribution system can present problems, particularly in low signal areas. The Ecraft range of distribution amplifiers, made locally by Electrocraft, have been designed to suit the wide range of conditions experienced with TV reception in Australia. Low noise figure, adequate gain, high output and good crossmodulation performance are necessary requirements in achieving good performance. The Model 27-500 for example, shown in the picture, claims a gain of 27 dB (+/− 2 dB), maximum output of 500 mV at −60 dB crossmod and a noise figure of 9.8 dB. Input and output impedance is 75 ohms to suit coaxial systems. For a brochure on Electrocraft's complete range of distribution amplifiers for TV and FM reception, write to them at 68 Whiting St, Artarmon, NSW 2064. Phone (02) 439-3266.

Announcements

Eagle-eyed and nimble-footed Melbourne readers would have by now checked out **Rod Irving Electronics'** new store at 425 High St, Northcote 3070, just down the street from his old shop front.

The Series 4000/1 Four-Way and 4000/2 Three-Way Loudspeakers have both been popular beyond our wildest expectations. We published a note on suppliers of kits for this project in the April issue Shoparound (page 71). A new addition to the list is **Pre-Pak Electronics of 1A West St, Lewisham NSW.**

Project price estimates

This information is published as a guide and a variety of factors may affect the actual price of projects, whether bought separately or as kits.

ETI-564 Digital Clock	$70 - $80
ETI-324LED Tacho	$30 - $40 (depending on case)
ETI-262 Simple House Alarm	$13 - $16 (electronics only)

ALL TOGETHER !

— the top projects from the past few years' issues of ETI !

Assembled in one great volume, here are more than 25 projects including: the Series 4000 stereo hi-fi amplifier system; the superb Series 4000 four-way speaker system; the monstrous 300 W amplifier module; Guitar Practice Amp; Fuzz/Sustain Unit; Electronic Tuning Fork; Aircraft Band Converter; Analogue Frequency Meter; Linear Scale Capacitance Meter; Electronic Ohmmeter; Ultrasonic Switch; Radio Remote Control Unit; Transistor Assisted Ignition; Theatrical Lighting Controller; Electromyogram; Disco Strobe . . . and many more.

On sale now at newsagents and selected specialist suppliers. If sold out (highly likely), you can obtain a copy from **Electronics Today International, Subscription Department, 3rd Floor, 15 Boundary St, Rushcutters Bay NSW 2011.** *Send $3.95 plus 65 cents post and handling.*

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PF 3577 4 Amp
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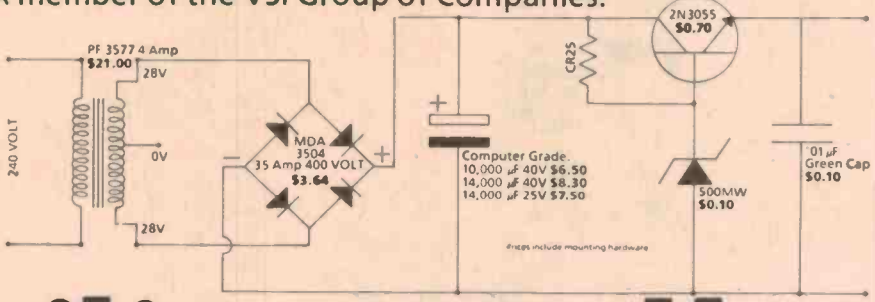
MDA 3504
35 Amp 400 VOLT.
$3.64

2N3055 **$0.70**

Computer Grade.
10,000 μF 40V **$6.50**
14,000 μF 40V **$8.30**
14,000 μF 25V **$7.50**

Note:–
All prices shown include tax.
Trade quantities available through CEMA Electronics Pty Ltd.
A member of the VSI Group of Companies.



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LETTERS

NEW APPROACH TO ELECTRONICS EDUCATION.

Dear Sir,

I would like to comment on the content of the above article. These comments are based on experience with the Victorian scene, but I do not believe that NSW is very different.

Firstly, the impression is given of private firms battling with bureaucracy in a vain attempt to lift electronics courses out of the dark ages. As a private company representative on a TAFE course committee, I can assure you that industry has plenty of opportunity to put its point of view.

It is a sad fact that many firms are reluctant to formulate their requirements in terms specific enough to base a training course thereon. If the companies who co-operated so enthusiastically with Mr. Burnett had taken the trouble to accept some of the invitations to attend, which are extended from time to time by TAFE committees, they might find that technical college courses more nearly fit their requirements.

In one area of electronic employment (Instrument Making) the NSW Education Department has conducted an industry survey in recent years, and no doubt has done so in allied areas.

Secondly, the article is written on the supposition that there is such a thing as "the electronics industry". If by that term is meant consumer electronics (and the content of the article suggests that this is so) then this should be clearly indicated. In the wide sense there is no electronics industry, any more than there is a mechanics industry.

A general electronics course will no more fit a trainee to enter many of the diversified fields in which electronic devices are now used, than a general mechanical course would enable a trainee to become, say, a car mechanic, an airframe fitter, or a toolmaker. Furthermore, there are many areas of electronic employment to which entry can only be gained via the apprenticeship system. You may think this is old-fashioned and slow, but the plain blunt fact is that this is the present legal position, and to indicate otherwise to an eager young student would be quite misleading.

Next, Mr. Burnett intends to "update his course every year". This is no doubt a laudable objective, but if carried out conscientiously will soon result in courses bursting at the seams as Mr. Burnett struggles to include the new material, while retaining as much of the old as possible. If the old is retained at the expense of the new, the course will be open to the criticism of being out of date. If the old is dropped, the course may turn out graduates who are either deficient in basic theoretical concepts, or who will be lost if they encounter, say, a piece of valve equipment (or even something using those old-fashioned discrete components!).

Faced with this constant dilemma, technical college courses tend to concentrate on first teaching the basic concepts which govern the operation of all electronic devices, then follow this with as wide a choice of specialist subjects as it is practical to offer. Some of these are so up-to-the-minute that frequent review and re-writing is required.

A further point is that Mr. Burnett uses the "practice reinforced by theory" approach. Some people do learn most effectively this way; it is particularly useful for students whose formal academic record may not be as good as hoped. But it is by no means true for all. And in a sphere which is becoming increasingly complex, a solid theoretical grounding is very important, if not essential. As a prospective employer, I would tend, everything else being equal, to prefer a trainee well versed in theory, because they are much more capable of dealing with unfamiliar equipment or systems, by the application of basic principles combined with logical thought processes. Of the five apprentices I currently supervise, two had Leaving Certificates, one had HSC, and two had completed the first year of a Certificate of Technology (Technical Officers) course, at the beginning of their employment. Not really a "theory via practice" group.

Finally, you say that the new course had been "welcomed enthusiastically" by employers. I'm not surprised. A company employing one of Mr. Burnett's graduates will be getting a person who has completed his training (even though short of experience) at someone else's expense. And what are their future prospects ? You mention positions all the way up to management. People with management potential will rise through the system, and there is no reason to believe that these trainees are at any disadvantage in this regard. But I sincerely hope that, at the start of their careers, these young people are not used as electronic cannon fodder, occupying relatively low-paid positions while technical-college trained tradesmen move up the ladder.

On the other hand, if this course helps even a few trainees to hold down jobs when they would otherwise be unemployed, the exercise will have been well worthwhile, and it may be that, from this point of view, Mr. Burnett has filled a gap in the system.

To sum up, I have a few reservations about this approach. For a young person who is keen on electronics, but who is either not able to get an apprenticeship or traineeship, or whose academic record is not quite up to scratch, it could be just the thing. But for those with the ability and stamina to follow the more formal route, I would still recommend that way.

Ronald F. Salter, M.I.I.C.A.
MacLeod, Vic.

Dear Sir,

I would like to thank ETI for Mini-Mart. It provides an essential forum for 'electrophiles' to pursue their interests with as little impact on financial resources as possible.

My own area of interest is audio and I was wondering when an article concerning noise reduction/expansion devices would appear. I have acquired a fairly extensive record music library and these devices offer the real saving of extending the life of the collection, thus reducing or delaying the cost of replacement.

Do you have an index of product reviews, and back copies available so that gaps in information could be eliminated?

Once again, thanks for an excellent 'umbrella' magazine that succeeds in expanding one's horizons of interest.

Mr R. White
Adamstown, NSW

Thank you for your kind remarks about Mini-Mart and the magazine in general.

We publish a yearly index each April. On page 95 of the April 1980 issue, you'll find all the product tests listed back to April 1979. We plan to include a ten-year index in our April 1981 issue. That should keep you busy for a little while! A cumulative index of reviews that appeared in the demised 'Hi-Fi Review' appeared in their October 1978 issue. If you turn to page 169 in this issue of ETI you'll see a coupon which you can use to order back copies of issues or photostats of articles.

An article on the 'ADRES' noise reduction system appeared in the July 1979 issue, page 23 and we plan to examine other noise reduction/expansion systems in forthcoming issues.

Roger Harrison, Editor

WHY IS THIS AUSTRALIA'S FASTEST SELLING COMPUTER?*

*OVER 600 SOLD IN 6 WEEKS!!!

SIMPLE:
IT IS FAR AND AWAY THE BEST VALUE COMPUTER IN AUSTRALIA

It has everything the TRS-80 has, and then some . . .

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  (Tandy charge extra for level II)
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  (They use their own non-standard system)
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  (You have to buy a true video monitor)
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  (Theirs only has one)
- **Inbuilt cassette deck (no inter-connections)**
  (Their cassette is completely separate)
- **Inbuilt power supply (no inter-connections)**
  (Tandy power supply has to be connected up).
- **AND THE BEST PART OF ALL: IT IS MUCH CHEAPER THAN THE TANDY EQUIVALENT**

DICK SMITH

SYSTEM 80

Not only the best value, but the lowest price!!!

ONLY $615

4k RAM MODEL, CAT X-4003

WITH LEVEL II BASIC

Compare the System 80 with the TRS-80. Notice the additional features. Then notice the lower price. Which would you choose?

	PARAMETER	SYSTEM-80	TRS-80 (level I)	TRS-80 (level II)
1	CPU type	Z-80	Z-80	Z-80
2	Speed	1.7MHz	1.7MHz	1.7MHz
3	Amount of RAM	16K	16K	16K
4	Built-in cassette recorder	Yes	No	No
5	Built-in video modulator	Yes	No	No
6	Capacity of BASIC ROM	12K	4K	12K
7	Type of BASIC supplied	Microsoft 12K Floating point	Floating point	Microsoft 12K Floating point
8	RAM expansion on-board to:	16K	16K	16K
9	Machine language programs accessible from executing BASIC programs	Yes	No	Yes
10	Full ASCII characters	Upper case only	Upper case only	Upper case only
11	Programmable graphics characters	No	No	No
12	Graphics resolution (dots)	8192	8192	8192
13	Mixed graphics/text – any format	Yes	Yes	Yes
14	Text format	16 lines x 64 or 32	16 lines x 64	16 lines x 64 or 32
15	Number of cassette interfaces	2	1	1
16	Baud rate	500	250	500
17	Time to load 8k program	2 min 30 sec	4 min 50 sec	2 min 30 sec
18	Cassette file names	Yes	No	Yes
19	Number of cassette recorders	2	1	1
20	Motor control for cassette recorders	Yes (2)	Yes (1)	Yes (1)
21	Number of string variables	930	2	930
22	Maximum length of string variables	255	16	255
23	S-100 compatible (with expansion unit)	Yes	No	No
24	Supports disc drive system	Yes	Yes	Yes
25	**Cost of basic unit with 16K RAM including monitor and cassette recorder.**	**$844.50***	**$989.00**	**$1169.00**

* This price includes the monitor shown above. However, as the System 80 does not need a video monitor, if you have a surplus B&W TV set you can save another $149.50 – making the savings over the Tandy system even more dramatic!

AND REMEMBER: All of the thousands of programs written for the TRS-80 are compatible with the SYSTEM 80 . . . you cannot lose!!!

BELOW COST Freight anywhere in Australia JUST $6.00!

SEE US AT 'DATA 80'
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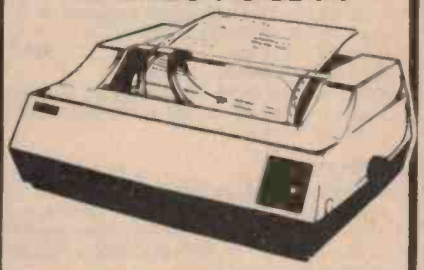

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NOTE: This printer does NOT need an expansion interface; however you will need an X-4012 printer cable (@$89.50) to connect to the computer.

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*TRS-80 is a registered Trademark of Tandy Radio-Shack

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Trade enquiries welcome.

Printout

Flabbergasting flexibility

— that's the EXORset 30!

The latest addition to Motorola's family of EXORciser microcomputer equipment is a software development system called EXORset 30, which is designed to fill the gap that previously existed between limited low-cost systems and expensive EXORciser-based machines.

The EXORset 30 can communicate with EXORciser systems via a serial port, or it can be used as an EXORciser terminal, and is compatible with the whole range of Motorola Micromodules.

A standard parallel printer interface allows connection to a printer of any selected performance and external storage of programs on microcassettes is also provided for.

A single console incorporates a full size ASCII keyboard with 16 user-assigned function keys, a dual mini-floppy disk drive and a 230 mm CRT which is capable of displaying 22 lines of 80 characters each or a combination of a 320 x 256 dot graphic image and 16 lines of 40 characters each.

The standard RAM provision is 48K bytes, but this can be extended to 56K using extra memory modules. Twelve EPROM/ROM sockets will accept up to 24K bytes of user firmware. The two disks give 160K of mass storage.

The memory map is defined by a PROM, which allows users to reconfigure the system quite easily.

The heart of EXORset 30 is an MC6809, Motorola's latest 8-bit microprocessor. Standard disk-resident software enables this chip to perform the functions of an editor/assembler and a compiler/interpreter.

The Compiler

An improvement in speed of one or two orders of magnitude over standard BASIC interpreters is claimed by the manufacturers. The compiler generates executable codes, which can be used independently of the compiler itself, at a rate of 100 lines per second.

Programming possibilities are extended by the use of BASIC-M, a compatible extension of BASIC which is said to have several advantages over its parent.

Individual bits of a specified byte can be accessed in BASIC-M; 'byte declaration' allows a specified byte location in memory to be assigned a variable name; 'integer declaration' names a 16-bit integer starting at a specified location.

REAL variables have an allowable range from 10^{-38} to 10^{+38} with nine significant digits and CHAR or STRING variables may run up to 31 ASCII characters.

ARRAYS of the same type of data may be as large as 255 x 255 (or 65535 elements) and there is a set of twelve instructions for inputting, outputting and performing operations on MATRIX elements.

For disk input and output with sequential organisation, BASIC-M allows random access to fixed length records or sequential access to records of variable length. Indexed files may have their record lengths defined by the user and can be accessed by means of keys.

There are several new control statements. WHEN . . . THEN instructs the machine to test the WHEN condition on each subsequent line of the program and execute the THEN clause if the condition is met.

A family of instructions with the basic form ON . . . THEN executes the THEN clause in case of a specified external event, which may be a keyboard entry, NMI, IRQ, FIRQ or a runtime error, as specified.

PRINT USING is a statement which allows the output to be formatted in one of seven different ways. New system commands available include automatic line numbering, renaming of variables, patch, and list erroneous statement.

Disk Control

The disk operating system, known as XDOS, permits random file organisation and has system call routines that are compatible with MDOS, the standard Motorola disk operating system.

A wide repertoire of commands includes backup duplication of disks, copying from disk to disk, disk to device or device to disk, and copying from memory to disk.

XDOS can search the directory for prescribed file names and display them, or delete a file name from the directory and free the corresponding disk space. It can display the total content of any physical sector or display the number of available directory entries and disk sectors.

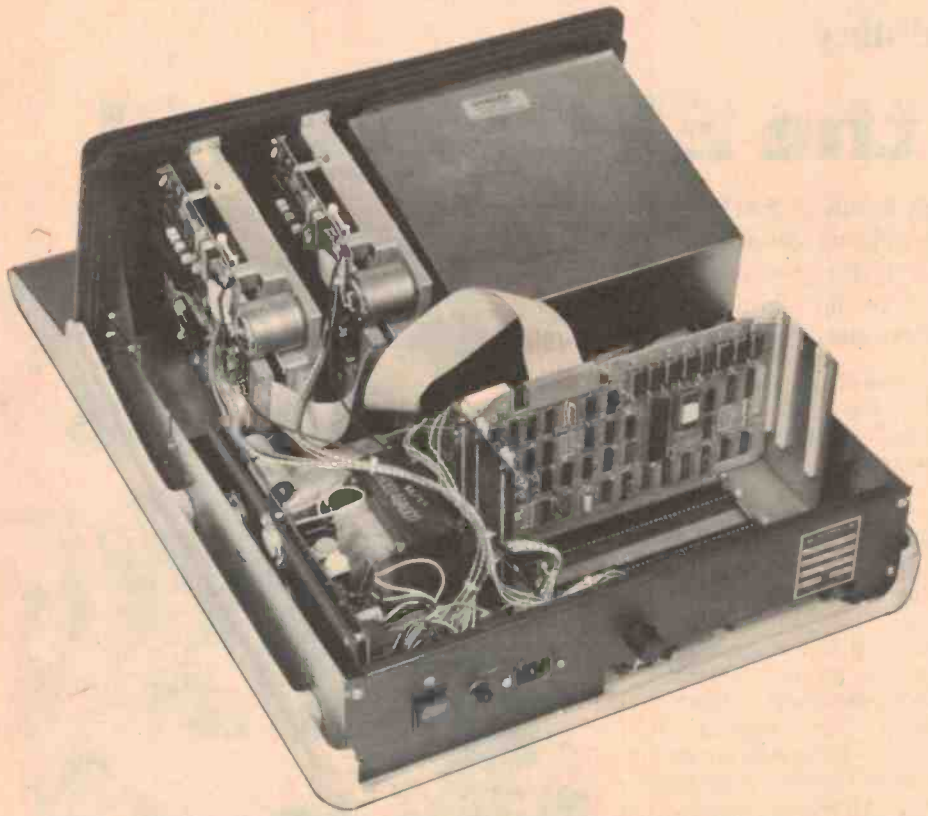
File names and suffixes in the directory can be altered and soft sector addressing information can be rewritten. Two or more files can be chained together to make a single new file.

Debugging

Extensive debugging facilities are provided by the EXORbug monitoring system, which is on-board in ROM.

Sixteen separate debugging functions are listed in the manual, including memory read and change, memory initialise and block move of ▶

Printout



Inside the EXORset 30. Note the expansion card cage behind the enclosed VDU. Interface buss at lower right.

memory. Users can search for a specified 8-bit pattern, read and change the MPU register, trace with printout of a selected memory location or trace to ending address.

Up to 4096 hardware breakpoints are available within a 4K address range, in RAM, ROM, and in any selected cycle of instruction, with real time execution at full speed between breakpoints.

In addition, the EXORbug operating system controls the screen and printer functions, transfers and verifies between audio cassettes and memory, and controls the operation of EXORset 30 as an EXORciser terminal.

We were fortunate enough to have one of these machines to play with for a short while recently, along with some software on disk and a set of manuals. Pity that the period we had the machine was so short, really, else we'd have a great deal more to say about it . . . no one on staff is all that familiar with 6800 machines and Motorola software so we couldn't rip straight into.

However, the graphics capability of the machine, from what we saw from the demonstration disk, is extraordinarily powerful. The on-board mass memory capability, quite apart from the available user RAM and ROM, makes the machine very versatile — more so when you consider the expansion capabilities. Just from our short first look — " . . . we think it 'mazing". And for something over $6000, it's got to be a steal in its price/performance class. Maybe we can have one back to play with later . . . hmm ?

More information from Rank Electronics, Sydney — 12 Barcoo St, East Roseville NSW 2069, (02)406-5666; Melbourne — 60 Rosebank Ave, Clayton South Vic 3169, (03)541-8444.

Specifications

Microprocessor:	MC6809
Clock Cycle Time:	1 MHz.
Keyboard:	Full ASCII 16 function keys
Display Type:	9" CRT monitor
Display Format:	
Alphanumeric	22 x 80 characters
or	16 x 40 characters
Graphic	320 x 256 dots
Mass storage:	Dual mini-floppy disk drives
Disk capacity:	2 x 80K bytes
RAM capacity:	48K expandable up to 2-56K bytes (Additional 2K reserved for alphanumeric display)
Connectors:	2 Micromodule-compatible board connectors
Printer Interface:	Parallel Centronics-type
Serial I/O:	RS-232C (or current loop with use of MM11)
Programmable timer module:	Yes
Software:	EXORbug monitor XDOS operating system* ASM09 assembler* Text editor* BASIC-M compiler/interpreter* BASIC-M runtime package* *disk resident
Power Supply:	100 –130/200 – 250 V
(jumper-selectable)	45 –100Hz 100W
Overall dimensions:	
length	640 mm (25.2")
height	280 mm (11.0")
width	465 mm (18.3")
Weight	22.2 kg (49 lb)

Hewlett Packard donation

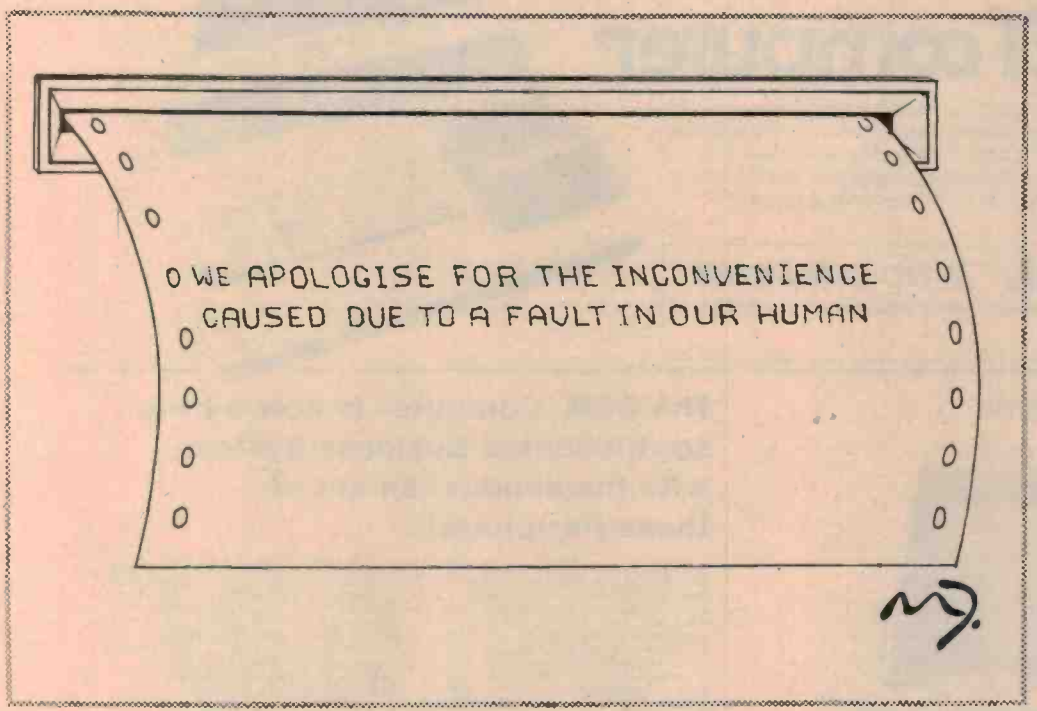
Hewlett Packard Australia has donated $35 000 to the Royal Melbourne Institute of Technology towards a computer upgrade of the administration of the college.

The HP 3000 Series 2 is being upgraded to the Series 3 to provide one Megabyte of memory.

RMIT has developed three data base systems for use in Colleges of Advanced Education and Technical Colleges.

These include a Staff/Establishment system to provide management information on staff salaries, classification and personal information, a Finance System, and a Student/Academic Administration system which is used to assist student enrolments.

◁▶■◀▷



TAFE courses

The IREE Microcomputer Interest Group are organising ten week computing courses which will begin in Brisbane the first week of September.

Three of the courses are hardware oriented and are entitled Digital Electronics and Logic Circuits, Introduction to Microcomputers, and Microcomputer Systems. A fourth course, called Micromputer Software, deals with programming concepts in machine code and the use of assemblers. Last in the series is Introduction to Computer Programming, which will use the computer facilities at the various Brisbane colleges of Advanced Education.

Enrolments will be taken from August 11th and further details can be obtained from the QLD TAFE on (07) 224-7847 or 224-7839.

Philips to push minis/micros

Philips Data Systems France are using the new 16-bit NMOS based P800 microprocessor at the heart of four new minicomputers and one microcomputer in an effort to expand their business machine market.

The computers have a cycle time of 650 ns and the cheapest machine, the P853 with 32K of memory will sell for around $5000. The top of the line P859 has 16 registers and 1M of memory.

New generation Z80

Zilog announce that refinements in process technology enable the latest version of their Z80 microprocessor to run at a clock rate of 6 MHz.

This is 50% faster than the Z80A and more than twice as fast as the original Z80 which runs at 2.5 MHz.

The Z80B is completely pin and software compatible with its predecessors and is said to be ideal for users who are currently in Z80/Z80A design activities but need additional speed for specific applications.

The new microprocessor is priced at $20 in plastic and $31.85 in a ceramic package, for quantities between 10 and 100.

Apple 2 enhancement

Apple computers with at least 48K of memory and a disc drive can now handle programs written for Z80 and 8080 based computers with a new card which fits in one of the buss slots.

The card is made by Microsoft Consumer Products of Bellevue, Washington. It is used with two diskettes — one for the CP/M operating ystem from Digital Research and the other for Microsoft's Disk Basic.

Cobol for the TRS80

Tandy has announced the introduction of a Cobol interpreter suitable for the TRS80 Model 2.

The Vice President of Radio Shack, the US parent company, says that the Cobol language offered is an enhanced Level 2 ANSI '74 which has been adapted for the TRS80 and is similar to a minicomputer language rather than a more limited microcomputer version.

He states that although it is not suitable for use on the TRS80 Model 1, because of its limited memory, a condensed package will be introduced for this machine sometime in the future.

We have no information as to when it will be available here.

Computerised newspapers

On the heels of the journalists' strike comes the announcement of Australia's first computerised metropolitan daily newspaper — the Advertiser of Adelaide.

The paper uses eight minicomputers and 30 microcomputers together with 138 video display terminals (VDT's) to automate the preparation of features, news and classified advertising.

Journalists type their copy on the VDT, storing the complete article on magnetic disks.

The editing stage is conducted by calling the file name on the editor's terminal and altering the article on the screen.

A similar procedure is used for classified advertising.

Layout is performed easily on an enlarged screen called a 'page view terminal' (PVT) where the articles are called from the computer memory and moved around to achieve maximum visual effect on the page. When the editor is satisfied, the whole page is typeset photographically.

commodore

the PET computer

The Pet has a television screen, a keyboard as simple to use as a typewriter and a self-contained cassette recorder which is the source for programmes and for storing data in connection with these programmes. And it has, in its standard configuration, an 8K user memory. (This is in addition to the 14K operating system resident in the computer).

SPECIAL AT NO EXTRA COST

$200 value of programmes will be provided with each PET purchased

2001-16/32

The CBM Computer is now a truly sophisticated Business System with the announcement of these Peripherals.

The CBM incorporated with the Floppy Disk and Printer makes an ideal business system for most professional and specialized fields, medicine, law, dental, research, engineering, toolmaking, printing, education, energy conseration etc . . . The CBM Business System as a management tool, delivers information to all levels of Business previously attainable only with equipment many times more expensive, the CBM Business system is one of the most cost efficient business tools today. It offers a wide range of applications from logging management strategy in major corporations to organizing accounts and inventory control of small businesses. Here are just a few of the cost saving uses in the corporation, professional office or small business stock control, purchasing, forecasting, manufacturing costing, customer records, mailing list, etc. The CBM Floopy Disk and Printer, a compatible business system at a reasonable price — Take a closer look at these Peripherals.

2040

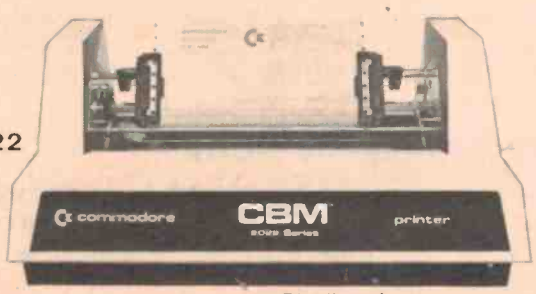
Dual Drive Floppy Disk

The Dual Drive Floppy is the latest in Disk technology with extremely large storage capability and excellent file management. As the Commodore disk is an "intelligent" peripheral, it uses none of the RAM (user) memory of the CBM The Floppy Disk operating system used with the CBM computer enables a programme to read or write data in the background while simultaneously transferring data over the IEEE to the CBM The Floppy Disk is a reliable low cost unit, and is convenient for high speed data transfer. Due to the latest technological advances incorporated in this disk, a total of 340K bytes are available in the two standard 5¼" disks, without the problems of double tracking or double density. This is achieved by the use of two microprocessors and memory I.C.s built into the disk unit. Only two connections are necessary — an A/C cord and CBM interface cord.

Tractor Feed Printer

2022

The Tractor Feed Printer is a high specification printer that can print onto paper (multiple copies) all the CBM characters — letters (upper and lower case), numbers and graphics available in the CBM The tractor feed capability has the advantage of accepting mailing labels, using standard preprinted forms (customized), cheque printing for salaries, payables, etc. Again, the only connections required are an A/C cord and CBM connecting cord. The CBM is programmable, allowing the printer to format print for: width, decimal position, leading and trailing zero's, left margin justified, lines per page, etc. It accepts 8½" paper giving up to four copies. Bidirectional printing enables increased speed of printing.



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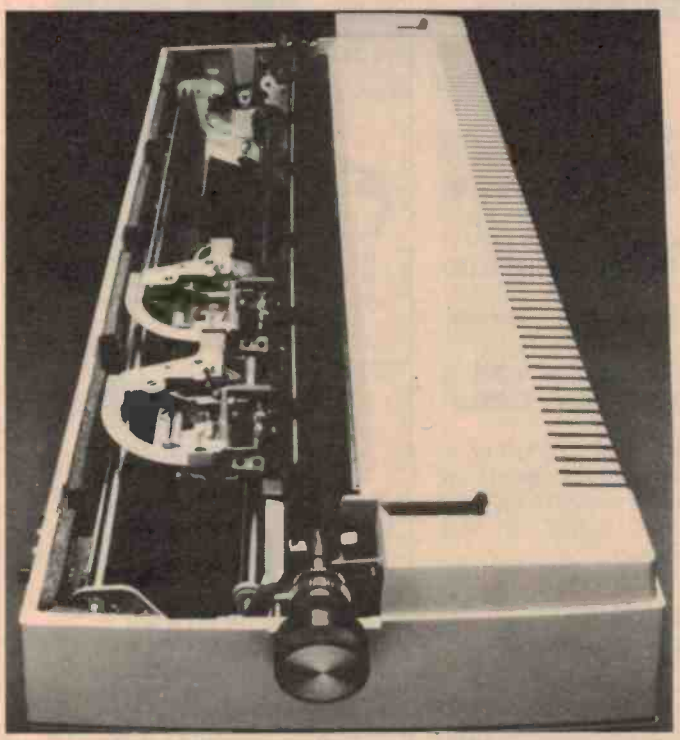

Two heads are better than one

A new twin-head character printer, the Qume Twin Track, has been introduced into Australia by ADE.

This printer enables printing in two independent columns simultaneously.

Both heads use daisy wheels whose founts may be independent. This means that it is possible to include Greek or mathematical characters in text printed in normal typeface, as is required for instance in scientific documents.

It is also possible to print text in, say, English and Japanese side by side. The Twin Track can be used to print at twice the normal speed of a single print head. Printing is also bi-directional to provide fast throughput.

The print area is 388 mm wide and printing speed is 45 characters per second. Further information can be obtained from Anderson Digital Equipment, P.O. Box 294, Ryde. NSW. (02) 808-1444.

ERRATA ETI-681 PCG PROJECT (June issue)

There were a number of minor errors in the Programmable Character Generator, ETI-681, published in the June Issue. Firstly, in Table 1 on page 69, the heading at the top of the left hand column should read "Value of Rp" as the values of RV1 and RV2 are fixed at 5k. On page 70, IC27 has a pin at the bottom marked "18" when it should be 15 — it's only a 16-pin chip, anyway! On page 73, in the parts list, R3 is listed as 1k9, 2%. A 1k8, 5% resistor is OK here. On page 74, under "Dip switch No.2:", second paragraph, the lines "We recommend that you put the joystick port at hex "FF . . ." should say ". . . *put the joystick port at hex 'EF' . . .*". The joystick setup procedure is correct as it places the joysticks at EF.

In addition, a number of typographical errors appeared on the circuit diagram on page 70. Address lines A11, A13 and A14 were shown as going to pins 27, 35 and 36 respectively. This is incorrect. A11 goes to pin 87, A13 to pin 85 and A14 to pin 86.

Eyes and ears for your PET

Edible Electronics are importing a new analogue to digital input conversion system for the popular PET microcomputer.

Known as PETSET, the system will give PET users an interface between their computer and the real world, allowing them to monitor up to sixteen physical variables at a time. One of the inputs may be used for a joystick control which is provided as part of the package.

Two input modes are possible — ratiometric and absolute. In the ratiometric mode the PETSET gives a digital output which corresponds to the ratio of the actual input to its maximum value; in the absolute mode, raw voltages in the range −0.3 V to +5.4 V produce a digital output of one pulse per 20 mV input.

The number of potential applications is enormous, since the ratiometric mode allows almost any kind of transducer to be used. One good suggestion by the manufacturers is to use the PETSET for monitoring temperature, humidity, light intensity, soil moisture and pH in greenhouses.

Edible Electronics (03)41-5708.

Siemens ink jet

Siemens has introduced an ink jet version of their impact printer, the PT80I.

It uses an 8085 microprocessor to control the bi-directional printing mechanism and ensures that the print head covers as few empty spaces as possible to triple the speed to 270 characters/second.

The 12 vertically arranged ink jets can produce up to 125 different characters in a 12 x 9 point matrix. The machine uses normal paper and can be switched for normal, cursive, or wide character printing.

With appropriate character generators, the PT80i can produce national alphabets as well as ASCII standard characters.

Recycling by computer

The computer owned by the Southwestern Bell Telephone Company of Abilene, Texas made rather a blunder when it was listing the Yellow Pages of this year's telephone directory.

More than 70 000 phone books were distributed with a tasteless error in the entries in the category of "Frozen Foods-Wholesale": a local funeral parlour was featured! Yuk.

The same computer sought to compensate the same company by including its subsidiary which sold life insurance in the category "Funeral Homes"!

Note that this was not the same computer which almost recycled us all when it scrambled the US airforce in a false missile alert in June.

PET gets new handler

MicroPro Design has become an authorised dealer of Commodore products such as the PET microcomputer and the CBM business system.

The engineers and programmers at MicroPro Design will offer maintenance, custom interfacing and applications software. They have already developed a number of interfaces for the Commodore IEEE 488 buss which are manufactured locally.

For further information contact MicroPro Design, P.O. Box 153, North Sydney NSW. (02)438-1220.

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- 96 Character ASCII Set
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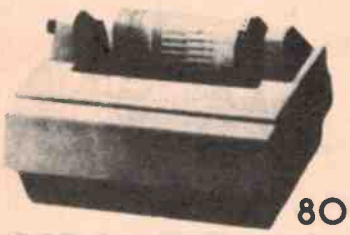
- 7 x 7 Matrix
- Bi-directional
- 100 Characters/second
- Parallel and Serial Interfac



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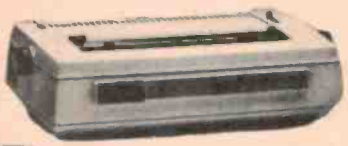
- Impact Matrix Printer
- 132 C.P.S.
- High Quality
- Heavy Duty
- 7 x 7 Dot Matrix
- Use with Apple, TRS-80, PET, Ohio Scientific
- Available ex-stock

$899 inc Tax



Qume

Daisywheel Terminal

- Typewriter quality print
- 96 Printable Characters and Symbols
- Six to Ten Copies

TI 810

$2495 inc. Tax

- Bidirectional
- 256 Ch. Buffer
- 9 x 7 Dot Matrix
- Up to Five Copies
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- Full ASCII Character Set
- 150 C.P.S.

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NEW	CIP II (MF)	@ $1649.00
	C4P	@ $ 865.00
	C4P (MF) Mini-Floppy	@ $2095.00
NEW	C4P (DF) Dual 8" Floppy	@ $3099.00
	C8P	@ $1075.00
	C8P (DF) Dual 8" Floppy	@ $3269.00
	C2 – OEM	@ $3559.00
NEW	C2–D with 8" Hard Disk (10MB)	@ $8295.00
NEW	C3–D with 8" Hard Disk (10MB)	@ $8999.00

NEW SOFTWARE AVAILABLE in addition to Business Packages (Australian Written) are SARGON (CHESS), USCD PASCALL and FORTRAN and Universal Calculator. e.g. (VISI-Calc. but more powerful);
Prices available on request.

IMS Business Systems

IMS 8000

This attractive business Computer is an S - 100 based system incorporating a Z - 80A 4MHz C.P.U. card with 2 RS232C Serial Ports. Disk Storage is via 2 Shugart SA800/801 disk drives providing up to 960 K bytes/drive. Comes complete with 32K static RAM (expandable to in excess of 500 k bytes).
Operating System is either CP/M™ or UCSD PASCAL Software System.

IMS 5000

Features 5¼" disk drives and can expand to three disk drives in same cabinet.

Software

These transportable software packages run on any machine using the standard CP/M™ operating system and CBASIC 2™. Designed in Australia using standard Australian Accounting practices and Australian Date Formats.

Systems Available:–

- General Ledger
- Accounts Receivable
- Accounts Payable
- Inventory
- Payroll
- Direct Mail
- Word Processing

~~$1466~~

$1395 inc Tax while stocks last

SOROC IQ 120

Remote Video Display Terminal

- Upper and Lower Case
- 24 Line Screen, 80 characters per line
- Numeric Keypad
- 1920 Character Screen Memory

~~$1788~~

VISUAL 200 $1688 inc. Tax

- Self contained Micro-processor based terminal
- Numeric Keypad
- Full ASCII Keyboard
- Standard features include Line drawing, Switchable Emulations Background/Foreground Modes
- Programmable Function Keys

SUPERBRAIN™ $3995 inc. Tax

- Two 5¼" Double Density Mini Floppies
- 64K RAM
- 12 Inch CRT
- CP/M Disk Operating System
- Full ASCII Keyboard with numeric Pad and user-programmable function keys.

TI 825

$1995 inc. Tax

- 132 Columns
- Upper and Lower Case
- Bidirectional
- 9 x 7 Dot Matrix
- 75 C.P.S.

KSR Versions of TI810/825

THE ELECTRONIC CIRCUIT

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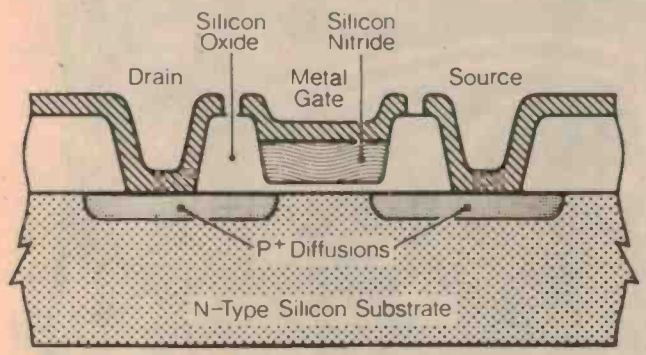
BRISBANE'S CALCULATOR/MICRO-MINI COMPUTER CENTRE

*Prices Subject to Change without notice and while Stocks last.

Printout

Logic with memory



A range of non-volatile logic products using MNOS FETs has been introduced to Australia by Plessey.

The MNOS FET construction prevents stored charge under the gate of a FET from leaking away through surface effects, which is the problem with conventional chip construction.

Charge may be stored for up to one year at the interface between the silicon oxide/silicon nitride interface under the gate (see diagram).

The range of devices using this technique include a 4-bit data latch with output enable, (MN9102) a four decade BCD counter with 16-bit memory and a 4-bit latch (MN9105), the MN9106 6-bit counter with 24-bit memory and multiplexed output, and the MN9107/8 which are adaptations of the MN9106 for use in timer applications. Further details can be obtained from Plessey, P.O. Box 2, Villawood, NSW 2163. (02) 72-0133

New disk will store 6.3M

Shugart Technology of California has developed a new 133 mm (5") Winchester disk drive which will store 30 times more data and transfer it 20 times faster than a standard mini floppy.

The Shugart ST506 uses standard Winchester head technology to store 6.3M of data in unformated form. The disks have 153 tracks and access time is 170 ms on average.

The US price is $1500 /drive.

Shugart have also introduced two new 203 mm (8") fixed disk drives into Australia. These are designed for use in microcomputer systems and provide the user with 5M or 10M of storage. Data transfer rates of 4.34 Mbits/sec for the SA1002 and SA1004 fixed disks are specified, using double density recording.

These "low cost" disk drives and further details can be obtained from Warburton Franki.

New Apple

Apple Computer of the US have released details of their new Apple 3 micro which is aimed at the serious hobbyist and small business user.

The computer has two versions: the 'Information Analyst' and the 'Word Processor'.

The Information Analyst is designed to be used as a tool for business planning, modelling, forecasting, scheduling, budgeting and costing. It has 96K of RAM, a 133 mm (5") minifloppy disk drive and a keyboard with two extra keys with program-defined functions to enable commands to be executed with a single key stroke.

The peripheral options include a thermal printer or letter-quality printer, and 305 mm CRT monitor or colour monitor for colour graphics.

Software includes a Mail List Manager, Business Basic, Visicalc 3 and the company's Sophisticated Operating System.

The Word Processor differs from the business version in the provision of a second disk drive and alternative software.

The Apple 3 can be expanded up to four disk drives and up to 128K of random access memory. The prices for the Australian market have yet to be announced but will be around $4000 for the Information Analyst and $5400 for the Word Processor.

Budget micro for novices

At $550 the Series 2 C1P is designed specifically to appeal to people buying a computer for the first time.

The makers expect its low price and versatility will make it attractive to schools and other educational institutions, who will be able to purchase two or three C1Ps for the price of one of their more expensive competitors.

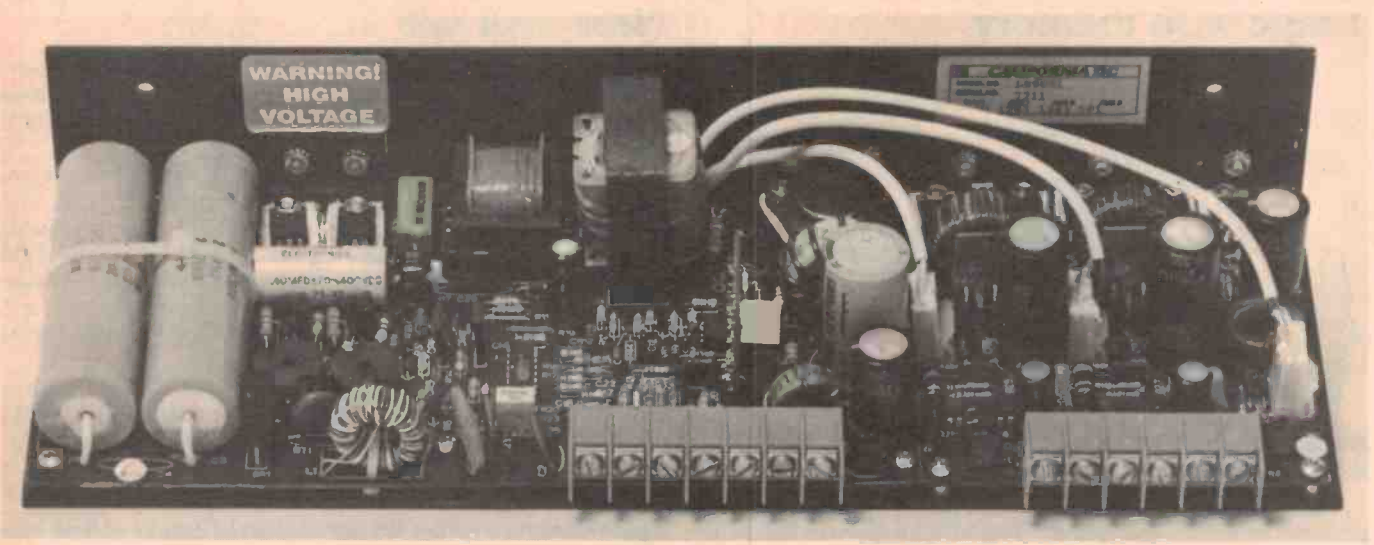
The standard system has 8K of memory and a cassette input, but plug-in boards are available which can expand the memory to 32K, allow the computer to accept inputs from two floppy disks, and drive a printer. In addition there is a minifloppy version of the C1P, the MF Series 2, which offers a dual floppy disk facility.

Both the standard and the minifloppy versions can be used with an I/O Expander to give colour displays, remote keypad operation, dual joystick control and programmable sound and musical effects.

A wide range of support material is offered, in the form of educational, entertainment and small business programs, and a data base management system option allows users with no knowledge of programming to store information on diskette for instant recall.

Enquiries to Systems Automation Pty Ltd, 31 Hume St, Crows Nest NSW 2065.

Printout



The California DC range of switching power supplies available from MicroPro Design range in price from around $170 to $330.

New power supply

A new range of switching regulated power supplies, designed for use in microcomputers, disk drives and industrial controls, was recently introduced by MicroPro Design.

The supplies are smaller and lighter than linear, series-regulated supplies. The MicroPro LR range includes versions with up to four independent output voltages.

Standard features include 20 percent line tolerance, thermal protection, 50 mV peak-to-peak ripple and noise and 70 percent minimum efficiency at full load.

Further enquiries to MicroPro Design, P.O. Box 153, North Sydney 2060 NSW. (02) 438-1220.

Renaissance software

The Logic Shop are now selling the following software packages for the Compucolor 2: (the "Renaissance Machine") a Word Processor ($75), Basic Tutorial Lessons ($36), Fortran Compiler ($92), and Inventory ($100).

The Word Processor includes the usual edit functions, right margin adjust, automatic paragraph indent and spelling corrections. The tutorial lessons in Basic are aimed at the beginner and it is claimed that even school children should be able to program after the series of ten lessons.

The inventory package allows the storage of up to 900 goods classifications on a minifloppy disk. It should therefore be suitable for many small businesses including the corner store, maybe! Further details can be obtained from The Logic Shop in Melbourne (03) 51-1950, or Sydney (02) 699-4919.

Computers out to stud

Computerland of Melbourne have released a set of programs written in Basic which may be of interest to the farming community who have access to an Apple microcomputer.

The 'stud book' programs enable the listing, for up to 100 animals, of information such as family trees, offspring of any animal, all information for any animal, animals born or sold within a period of time, select animals with a combination of characteristics and find animals with a certain characteristic.

The programs require an Apple II micro with 48K of memory and a disk drive. The programs have been developed in Australia to suit the requirements of breeders here and it is hoped to develop further programs for rural applications over the next 12 months.

TRS-80 and SYSTEM 80 OWNERS

NOW YOU HAVE BOUGHT YOUR SYSTEM, YOU NEED

MICRO 80

MICRO-80 offers the most comprehensive support in Australia for TRS-80's and SYSTEM 80's. The support starts with our monthly magazine. At least 44 pages of editorial matter and program listings each month, dedicated entirely to the TRS-80 and SYSTEM 80. Every issue has a minimum of 6 new programs catering for Level I, Levell II, machine language and Disk BASIC, plus problem solving columns, hardware articles (both add-on and modifications), reader's letters, hints, etc. etc. Each edition will keep you entertained at your 80's keyboard until the next arrives. For those with less time, we also offer a monthly cassette containing all that month's software.

Support continues with our allied business **MICRO-80 PRODUCTS** which publishes software by Australian authors on cassette and disk, manufactures and sells hardware peripherals, publishes books, imports the best U.S. software, books and supplies at sensible prices.

MICRO-80 PRODUCTS is rapidly becoming the largest independent source of software, hardware and supplies for TRS-80 and SYSTEM 80 owners because we really understand the systems we support (we couldn't produce the magazine if we didn't), we sell products at sensible prices (we don't need to make an overnight killing, we are in business to stay) and we guarantee all we sell. Read about just a part of our range of products, below. Send a stamped, SAE (40c) for our free catalogue to discover our full range.

FREE

$40 WORTH OF SOFTWARE FOR TRS-80 AND SYSTEM 80 WITH EVERY NEW SUBSCRIPTION TO MICRO 80

EVERY NEW SUBSCRIBER WILL RECEIVE ON CASSETTE, READY TO LOAD, 3 x LEVEL I AND 3 x LEVEL II PROGRAMS (INCLUDES OUR FABULOUS HOUSEHOLD BUDGET PROGRAM), WITH A REGULAR RETAIL VALUE OF AT LEAST $40.

MICRO-80 PRODUCTS

284 GOODWOOD ROAD, CLARENCE PARK, ADELAIDE.

BOOKS

LEVEL II ROM REFERENCE MANUAL $24.95 plus $1.20 p&p
Produced in Australia by MICRO-80, this book is a must for the machine language programmer or for the BASIC programmer who wants to understand how the BASIC interpreter works. Over 70 pages packed full of useful information and sample programs. Applies to both TRS-80 and SYSTEM 80.

TRS-80 DISK AND OTHER MYSTERIES $24.95 plus $1.20 p&p
The hottest selling TRS-80 book in the USA. Disk file structures revealed, DOS's compared and explained, how to recover lost files, how to rebuild crashed directories — this is a MUST for the serious Disk user.

LEARNING LEVEL II $16.95 plus $1.20 p&p
The next hottest selling book in the USA. TEACHES you how to get the most out of your Level II machine in BASIC. A must for both TRS-80 and SYSTEM 80 users.

HARDWARE

16K MEMORY EXPANSION KIT FOR TRS-80 $97 inc. p&p
These are prime, branded, 200 ns. (yes 200 ns!) chips. You will pay much more elsewhere for slow, 350 ns. chips. Ours are guaranteed for 12 months. A pair of DIP shunts is also required to upgrade the CPU memory — these cost an additional $4.00. All kits come complete with full, step-by-step instructions, no soldering is required. You don't have to be an electronic type to instal them.

DISKS FOR THE TRS-80 $45.00 per pack of 10 inc. p&p
High quality disks at a sensible price. You will pay over $7.00 each for the same disks elsewhere.

SCOTCH BRAND PERSONAL COMPUTING CASSETTES
C-10 pack of 10 $26.00 incl. p&p
C-30 pack of 10 $28.00 incl. p&p
These are digital cassettes of the very highest quality from one of the world's leading manufacturers.

AUSTRALIAN SOFTWARE

(Suitable for TRS-80 & SYSTEM 80)

BMON (L2/16K) $19.95 plus 50c p&p
The ultimate program to assist BASIC programmers

TOUCHTYPE (L2/4K) $19.95 plus 50c p&p
22 lessons to teach you to type on your own keyboard and screen!

RPN CALCULATOR (L2/16K & 32K) $14.95 plus 50c p&p
Turns your computer into a $600 calculator. Ideal for Architects, Surveyors, Engineers, Teachers, Scientists etc.

U-BOAT (L2/16K) $7.50 plus 50c p&p
You're the Commander, read all the guages, fire the torpedoes, crash dive, get the enemy before his depth charges get you!!

MMM-1 GAMES PACK (L2/4K) $7.50 plus 50c p&p
3 fast moving games — INDY 500, SUBHUNT, KNIEVEL

MMM-2 GAMES PACK (L2/4K) $7.50 plus 50c p&p
3 more games with fast moving graphics — TANK, THIEF, SHOOTOUT.

To: MICRO-80,
P.O. Box 213, Goodwood, S.A. 5034.

Please rush me the items checked below.

..... 12 month subscription to MICRO-80 and my free software cassette $24.00

..... 12 month subscription to MICRO-80 and the cassette edition, plus my free software cassette $60.00

..... The latest issue of MICRO-80 $2.50

PLUS THE ITEMS LISTED BELOW:

DESCRIPTION	PRICE
TOTAL ENCLOSED	

NAME .....

ADDRESS .....

..... Post Code.....

bankcard welcome here No ..... Expiry Date .....

Please debit my Bankcard $.....

Signature .....

ETI

THE INCREDIBLE A.E.D. S100 Terminal

THE UN-SERIAL

MORE FEATURES! MORE SPEED! MORE SALUBRIOUS THAN ANY SERIAL TERMINAL WE KNOW.

CAN OUTPERFORM SERIAL TERMINALS PRICED ABOVE $2300.

YET ONLY $1350 + SALES TAX FULLY INCLUSIVE.

'CP/M' PATCH SOFTWARE AVAILABLE FROM A.E.D.

THE TERMINAL YOU DESERVE!

This memory mapped terminal can be configured to have the intelligence of top serial terminals such as Hazeltine, Lear Siegler, Soroc 'etc' without the eye strain and sludgy slow speed.

STANDARD ARE ALL THE FEATURES YOU WOULD LIKE BUT WERE AFRAID TO ASK THE PRICE OF.

- WIDE, 16 MHz BANDWIDTH.
- 160 x 96 GRAPHICS FOR BUSINESS AND TREND ANALYSIS, CURVED BAR CHARTS ETC.
- HALF TONE, UNDERLINE, BLINKING, STRIKE THRU, REVERSED VIDEO, BLANK OUT, OR ANY COMBINATION OF THE SCREEN AT ONCE.
- SHARP, GREEN PHOSPHOR SCREEN.
- CONTRAST ENHANCING FILTER.
- SUPERB, SCULPTURED WORD PROCESSING KEYBOARD.
- STRONG WELL ENGINEERED HOUSING SCULPTURED FROM SOLID TIMBER AND METAL.

ALSO WE CAN PROVIDE 256 x 256 OR 512 x 256 HIGH RESOLUTION GRAPHICS AS AN OPTION.

WE ARE NOW GAINING A NAME FOR OUR 8" DISK SYSTEM FOR

SORCERER

- 8" IBM SINGLE AND DOUBLE DENSITY.
- 600K BYTES PER DISK — ALMOST TWICE AS MUCH AS QUAD DENSITY 5" SYSTEMS.
- MORE SPEED AND DATA RELIABILITY THAN 5".
- CP/M PROVIDED FULLY INTEGRATED WITH THE SYSTEM.
- CAN READ AND WRITE SINGLE DENSITY AS WELL AS 256, 512 OR 1,024 BYTE DOUBLE DENSITY FULLY TRANSPARENT TO THE USER.
- PRICED GENERALLY LESS THAN MICROPOLIS 5".
- INCLUDES SHUGART DRIVE(S), CABINETS, CABLE AND CONTROLLER + CP/M DISK OPERATING SYSTEM.

PRICED FROM $1285.20+ SALES TAX

DESIGNED BY GEORGE MORROW, THE GUY MOST INSTRUMENTAL IN WRITING THE IEEE SPEC FOR S100

SEE US ALSO FOR:

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- VIDEO CARDS, I/O CARDS ETC.
- PROTOTYPING BOARDS, SOCKETS WIRE WRAP "SLIT AND WRAP".
- DRIVE CABINETS FOR YOUR RENEX, OR SHUGART OR SEIMENS DRIVES.
- KEYBOARDS AND ENCLOSURES.
- S100 CABINETS.
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- VIDEO MONITORS "WIDE BAND WITH GREEN PHOSPHOR".

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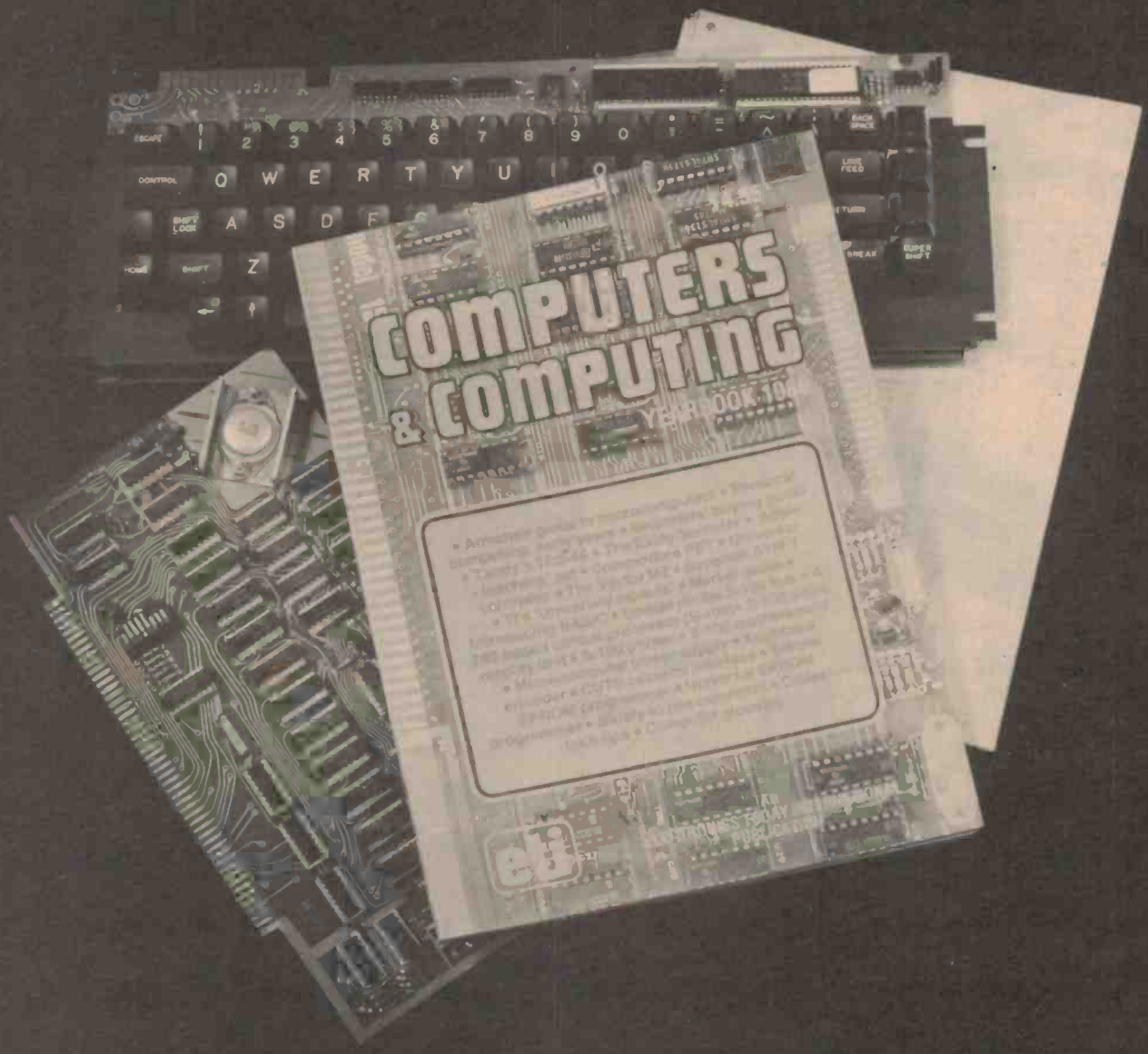
Here at last !



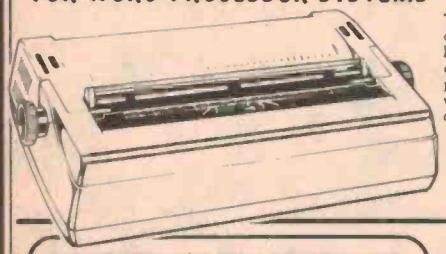
A book on computing that takes you from *what-is-all-this-fuss-about-computers* through a thorough *beginners'-buying-guide* to *building-your-own-computer*.

When faced with the awesome task of choosing or assembling a computer system — whether you want a "learning aid" or a "working tool", a "ready rolled machine" or "project kit", you'll find very few places to go. This book rolls it all into one. Assembled from articles published in Electronics Today International over the past few years, *with additional material to aid the newcomer*, it's an invaluable reference work. Running to 156 pages, this book contains 16 articles on various aspects of computing and 10 construction projects.

On sale now at newsagents and selected specialist suppliers, or direct from **ETI Subscription Department, 3rd Floor, 15 Boundary St, Rushcutters Bay NSW 2011.** Price: $4.95, plus 65 cents post and handling.

HARDWARE

PROFESSIONAL DAISY WHEEL PRINTER
FOR WORD PROCESSOR SYSTEMS



This superb unit is a self-contained printer with in-built asynchronous serial interface conforming to the established RS-232C standard. It prints on business stationery up to 380mm wide at the rate of 45-65 characters per second – three times faster than golf-ball typewriters. Top quality office systems printer that is below competition prices. . .

$3,390.00

Cat. X-3260

THE SORCERER

Cat. X-3001 **SORCERER**

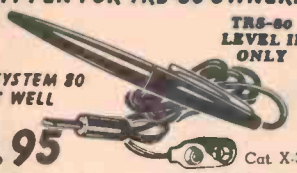
Cat. X-1196 **MONITOR**

The Sorcerer is the expandable Z-80 based microcomputer that allows you to add peripherals to take it from basic computing through to advanced office business systems.
● 16K RAM expandable to 48K (on board) ● Serial I/O and Parallel I/O ● S-100 BUS compatible ● Cassette I/O for two recorders at speeds of 300 or 1200 baud ● Video I/O – 1920 characters full screen ● Full ASCII 128 characters (64 defined characters and 64 undefined characters) ● Graphic resolution 122,880 pixels ● Includes 8K BASIC plug-in ROM PAC™ in MICROSOFT™ ● Dimensions 490 x 330 x 100mm ● Weight 6 kilograms.
(Ask for our FREE comparison chart between the Sorcerer and other well known computer brands).

Dust cover to suit
Cat. X-3005 *$3.95*

$1,395.00

LIGHT PEN FOR TRS-80 OWNERS



TRS-80 LEVEL II ONLY

FOR SYSTEM 80 AS WELL

$9.95 Cat. X-3645

Use this light pen with the TIC-TAC-TOE cassette shown below or with the SKETCH 80 (see opposite page). Comes complete with plug for insertion into your cassette and battery snap for 9V transistor type battery (not supplied).

TIC-TAC-TOE

Cat. X-3647

Just insert this program cassette into your computer cassette player and enjoy playing the game with your light pen **$11.95**

MICROPOLIS™ QUAD DENSITY DISC DRIVE

The Micropolis mod 2 drive with controller enables you to store 315,000 bytes on just 1 disc. By adding the mod 2 add-on drive (up to 3) you can obtain up to a maximum of 1.26 Megabytes! Complete with all software to enable you to be up and running in a very short time.

Model 1043/mod 2 with controller.
Cat. X-3205 **$1,350**
Model 1023/mod 2 add-on
Cat. X-3208 **$750**

VIDEO MONITOR

This is a superb 30cm black and white video monitor that can be used on AC and DC. Simple connection to your computer. Features jitter free and distortion free characters. Can be used with most computers on the market.

Cat. X-1196 **$149.50**

WORD PROCESSOR PAC™

Remove the plug-in BASIC PAC™ and replace it with the powerful WORD PROCESSOR PAC™ and you will have the basis of an office computer system.
Features: ● Automatic text wrap ● Automatic checking of drastic commands ● Powerful search function ● Auto commands ● Macro programming – all this plus extensive user instructions.

Cat. X-3085 **$275.00**

SPECIAL WORD PROCESSOR KEYS

To enable you to use the Sorcerer's Word Processing function more readily we can supply specially embossed keys (11 units) to replace the normal beige keys. The colour allows you to identify the special keys immediately. Just another touch of professionalism for the Sorcerer owner. . .

Cat. X-3086 **$14.95**

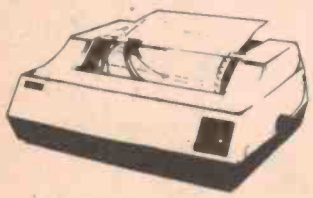
EXIDY S-100 BUS EXPANSION

By using plug-in cards with the S-100 BUS and your Sorcerer you can use many other manufacturers peripherals (see our special 'Blue Board' cards on this page). The world of computing has been made even more exciting through the S-100 BUS. Comes complete with in-built powre supply, ribbon cable and connector.

Cat. X-3010 **$575**

● Allows up to 6 plug-in cards ● Connects directly to Sorcerer's 50-way expansion socket via supplied cable ● All S-100 lines fully buffered ● Separate 2.000MHz crystal clock provided for S-100 cards which cannot use the Ø1 and Ø2 clock signals derived from the Sorcerer's 2.106MHz clock ● Provision for mounting up to six 25 pin "D" connectors for additional I/O ports, etc.

C.ITOH BRAND DOT MATRIX PRINTER



The model 8300P dot matrix printer is a no-nonsense unit that can churn out the full 96 character ASCII at a brisk 125 characters per second on standard fan-fold paper. Character spacing of 80, 40 or 132 columns which are software selectable. A quality unit that costs less than $1,000!!

Cat. X-3255 **$970.00**

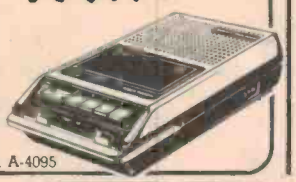
DYNAMIC EXPANSION KITS

These are top quality ICs that can expand your basic 16K Sorcerer to 32K or even 48K (expands the 8K to 16K etc). They can also be used with the TRS-80 level I and II and the Apple II computers to expand their on-board RAM. Superb value and complete with installation instructions.

SAVE $30.50 **NOW $79**

CASSETTE RECORDER

$79.95



For cassette storage of data, or for loading programs into your Sorcerer you need a quality cassette recorder that has been tested and found to be reliable. The National Panasonic was tested by us along with other units and came out as the best unit available in its price range. Works on AC or DC and can be controlled from your Sorcerer.

Cat. A-4095

JABEL COMPUTER MAINS FILTER

Having trouble with memory crashes? Then the answer is the Jabel Mains Filter – it will remove those annoying spikes from the 240V mains and thereby protect your memory!

Cat. M-9850 ..... **$75.00**

SERIAL DATA CABLE

Connect 2 cassette recorders to your Sorcerer and be able to control them both from your computer keyboard.

Cat. X-3110 ..... **$34.50**

PRINTER INTERFACE CABLE

Connect your Sorcerer to the C.ITOH printer or any Centronics compatible printer.

Cat. X-3112 ..... **$49.50**

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DUE IN SHORTLY

COGNIVOX™
VOICE INPUT & OUTPUT FOR THE SORCERER

★ Recognizes up to 16 words.
★ 16 word voice response vocabulary
★ Easy two pass training
★ Up to 98% recognition accuracy
★ Generates music & sound effects
★ Excellent software support
★ Connects directly to Sorcerer

Cat. X-3150 ..... **$199**

2 PARALLEL & 2 SERIAL I/O BOARDS

2 serial I/O ports (2 in and 2 out) with full handshaking status from UART's and 2 latched I/O ports (2 in and 2 out) using 8212 latch buffers. Independent DIP switches for setting address of serial and parallel port blocks. Ideal for the person who wishes to control a number of appliances in the home, office and factory.

Built unit Cat. X-3300 **$250.00**
Kit form Cat. X-3301 **$190.00**

MUSIC SYNTHESISER BOARD

A fantastic synthesiser with a frequency range of 15Hz to 25KHz with a nine octave frequency change via software. Attack and sustain can be defined by user. Includes "MUS-X1" a high music interpreter which can drive up to 8 boards at once – even includes a music program to get you up and going fast!

Built unit Cat. X-3305 **$310.00**
Kit form Cat. X-3306 **$250.00**

8K & 16K PROGRAMMER & 4K/8K EPROM BOARD

Now you can program your EPROM's (2708 or 2716) and also have the facility for on-board 4K of 2708 or 8K of 2716 EPROMs. This extends the capabilities of your computer system and provides a powerful unit for those who wish to do their own programming on EPROMs.

Built unit Cat. X-3310 **$250.00**
Kit form Cat. X-3311 **$190.00**

FAMOUS 'BLUE BOARD' PLUG-IN CARD MODULES FOR THE S-100 BUS. . .

And now for the famous 'Blue Boards' from SSM in the US of A. Three boards available for your S-100 unit in ready built form or as kits with comprehensive instructions.

SOFTWARE

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	162 Pacific Highway,	GORE HILL	Ph 439 5311	QLD	166 Logan Road,	BURANDA.	Ph 391 6233
	30 Grose Street.	PARRAMATTA	Ph 683 1133		842 Gympie Road,	CHERMSIDE.	Ph 59 6970
	396 Lane Cove Rd,	NORTH RYDE	Ph 888 3200	ACT	96 Gladstone Street,	FYSHWICK	Ph 80 4944
	263 Keira Street,	WOLLONGONG.	Ph 28 3800	SA	60 Wright Street,	ADELAIDE	Ph 212 1962
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MAIL ORDER CENTRE: PO Box 321, NORTH RYDE NSW 2113. Ph 888 3200. PACK & POST EXTRA.

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RE-SELLERS OF DICK SMITH PRODUCTS IN MOST AREAS

FOR YOUR SORCERER

MAGIC MAZE
A challenging game with 10 levels of play – wander through the maze and meet many obstacles. Automatic scoring on screen.
Cat. X-3620 ..... **$14.95**

PLOT
Get superb graphics in both super high resolution mode and quick low resolution mode.
Cat. X-3621 ..... **$17.95**

Z-80 DISASSEMBLER
Decode machine language programs, including Sorcerer's monitor and ROM PACs. Written in BASIC the instruction mode prints out machine code and Zilog mnemonics in standard format. Or use the ASCII mode which converts machine code to ASCII.
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DSE784

Licence fees changed

There will be a large drop in many radiocommunication licence fees as the result of changes announced in June by the Minister for Post and Telecommunications, Mr Tony Staley.

"In many cases radio equipment is essential for safety and in the case of private, or non-commercial harbour and land mobile stations and private ship stations, the Government has agreed to cut licence fees by more than half", the Minister said.

"Taxi owners and most small businesses which use radios will also benefit by lower licence fees."

For the first time the new scale of fees differentiates between private or non-commercial use, and non-private use. The Minister said that this corrected an anomaly in the old system where there had been no distinction between different uses. The new fees will operate from July 1 and there will be a discount of 10% where the fees are collected by clubs and submitted for renewal in a group.

"This should provide an incentive for people to work through clubs", the Minister said.

The Minister said that harbour mobile station fees would drop from $37 a year to $15 a year for private radios and $37 to $32 for non-private. Radio licence fees for ships would drop from $50 a year to $20 a year for the private (non-commercial) category and from $50 a year to $32 for the non-private category.

A new category "Marine Rescue Station" has been created at a minimal $2 fee, for radios provided by clubs and organisations mainly for safety of life.

Fees paid by private users of the Citizens Band Radio Service will reduce to $20, but will increase to $40 for non-private use.

Although radios used solely for life-saving, rural fire fighting and ambulance services must be licensed, there will be no fee for these licences in future.

The Minister said that although fees for both private and business users of radio facilities had dropped in many cases some fees had risen.

Those which have risen are: Novice amateurs, up from $6 to $10; Limited and Full amateurs, up from $12 to $15 and Radiodetermination stations, up from $25 to $60. As the Department is likely to make stuff all out of an increase in amateur licence fees, why increase them at all? It smacks of pettifogging pedantry (or is that pederasty?) from the beastly bureaucracy.

CB review bait attracts many bites !

The P & T Department's call for submissions on the CB radio service with a view to reviewing the allocations and regulations has attracted quite a response.

Australia's two largest CB user organisations, the National Citizens Radio Asssociation (NCRA) and the Citizens Radio Emergency Service Teams (CREST), have submitted lengthy documents along with a host of submissions from CB clubs and a number of private individuals.

A number of clubs and associations are still preparing submissions, but it seems the response shows that there's plenty of life left in the CB movements.

From what we have seen to date, most submissions argue for: retention of the 27 MHz band beyond 1982 (the originally proposed cutoff looms up in June, 1982), more channels on both HF and UHF, provision for phone patching, the permission to work both local and overseas DX (with other countries having similar CB regulations on 27 MHz), permission to use beam antennas, point-of-sale licensing, continued licensing for older 23 channel equipment and the removal of business activities from the CB bands.

There is strong support for the retention of a dual (HF and UHF) CB service for Australia, citing the usefulness of HF for country and remote areas and the convenience of UHF for local and urban working.

More details when the fight hots up !

Common channel VHF repeater

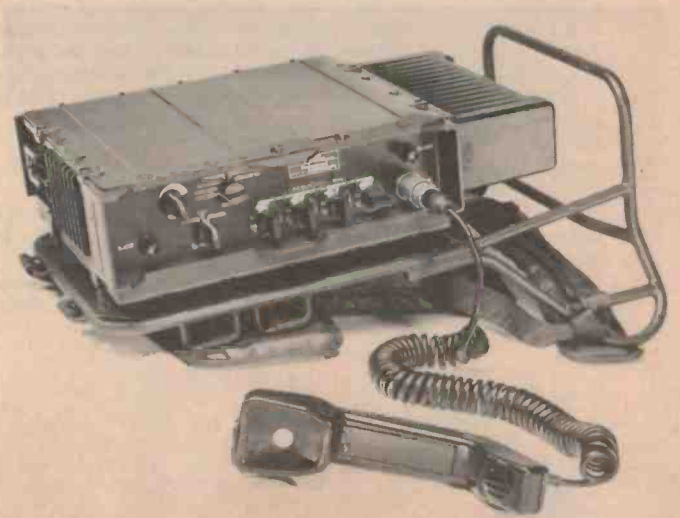
Plessey has designed a portable automatic VHF repeater which can receive and transmit simultaneously on the same frequency.

This was hitherto been considered impossible because of interference between transmitter and receiver.

The Groundsat PTR 3411 has already won a British Design Council award and the 1980 Duke of Edinburgh's Designer's prize for its unique design.

Designed primarily for military applications, it can be carried easily, concealed and left unattended, remaining on standby until required. By contrast, two-frequency repeaters are bulky and need to be continuously manned, which makes them prime targets in battle.

As well as its military uses, a common channel repeater clearly has great potential for civil applications, where the available frequency bands are already overcrowded.



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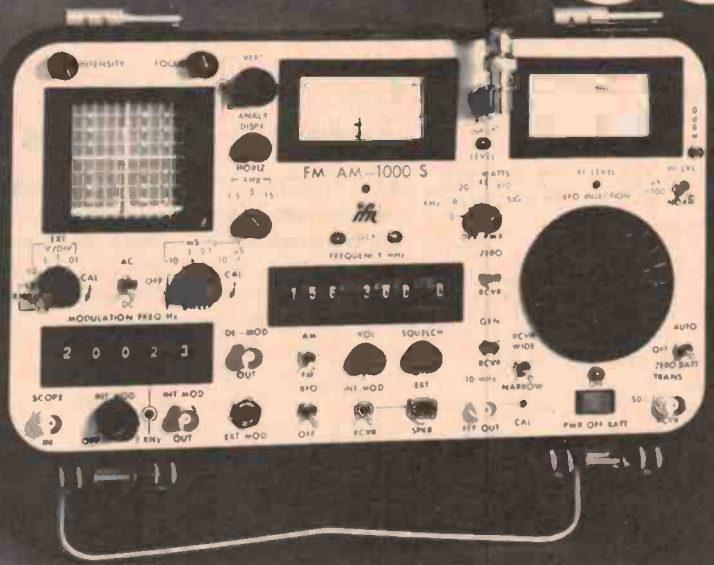
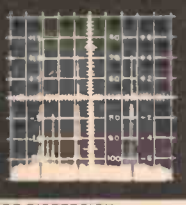
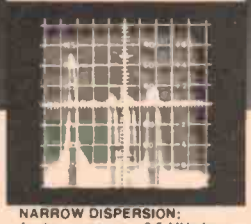
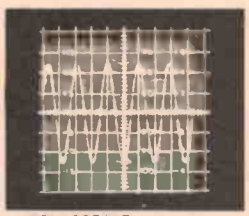




WIDE DISPERSION:
Analyzer sweeps ±5 MHz from selected frequency (10 MHz span)



NARROW DISPERSION:
Analyzer sweeps ±0.5 MHz from selected frequency (1 MHz span)



OSCILLOSCOPE:
Oscilloscope features DC to 1 MHz frequency response

We gave you the features you needed and the performance you expected to get the job done... on the bench and on the go!

The FM/AM-1000S is a compact, light weight, completely portable test set which is easily and efficiently used with no sacrifice in versatility. Its ruggedly constructed circuits are housed in a deep-drawn, heavy gauge metal case, allowing it to withstand the rigors of portable operation as well as being a highly functional bench instrument.

As a generator, the FM/AM-1000S features continuous frequency coverage from 100 Hz to 1 GHz, AM or FM modulation, internal variable audio tone generator, 1000 Hz fixed tone generator, and 0 dBm RF output level into 50 ohms.

Automatic switching to monitor mode occurs at 100 MW, allowing measurement of transmitter frequency, FM deviation or % AM modulation, and RF power throughout the operating range of the test set.

A sensitive receiver allows measuring the characteristics of radiated signals, including SSB and DSB. The Beat Frequency Oscillator features variable injection level and is phase-locked to the master oscillator for precise suppressed carrier frequency measurement. The 15 kHz Narrow IF selectivity allows monitoring a desired signal within 25 kHz of adjacent channel interference without difficulty.

The Oscilloscope/Spectrum Analyzer operates simultaneously with all other indicators to provide detailed analysis of monitored signals. The 70 dB dynamic range of the analyzer is equal to that of many individual analyzers.

Features... Performance... Portability. The FM/AM-1000S Communications Service Monitor has them all — plus it's priced below comparable, competitive test equipment.

the best is cost effective

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shortwave loggings

New transmitter for Nigeria

Test transmissions have been noted in Melbourne from a powerful new shortwave transmitter located at Kaduna in northern Nigeria.

The broadcasts are in English and a local language, presumably Hausa, and are currently heard in our early mornings up to sign-off at 2315.

The frequency being used is 4770, in the 60 metre tropical band. These broadcasts identify as being from the Federal Radio Corporation of Nigeria, Kaduna.

Kaduna is the capital city of Kaduna State, and the Federal Radio Corporation has for some years operated a powerful shortwave transmitter from that city on the 49 metre outlet of 6090.

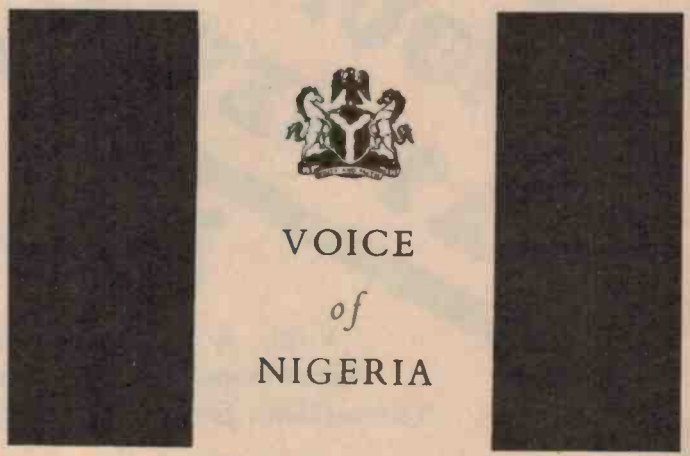
Unfortunately for Australian listeners, 6090 is also used by the ABC shortwave domestic service from Sydney. During our winter months, the best we can hope for is to hear a weak signal from Kaduna underneath our strong ABC station.

With the current broadcasts on 4770, this has changed dramatically, and good reception is noted up to 2315 of the Kaduna station. A relay of the English news from Lagos, Nigeria's federal capital, is taken at 2300, when 4770 may be heard in parallel with Lagos station on 4990.

The Kaduna 4770 transmitter gives much stronger signals than Lagos on 4990, and as the Lagos transmitter is rated at 50 kilowatts, it is thought that the new Kaduna outlet may be using a transmitter of at least 100 kilowatts, if not 250 kilowatts. Kaduna's transmitter on 6090 is rated at 250 kilowatts.

Current test broadcasts on 4770 are part of Nigeria's extensive plans to upgrade the country's communications network, using funds available thanks to major oil finds along the Nigerian coast in recent years.

DXers will recall the test transmissions on 4755 by the Federal Radio Corporation during 1979, made on behalf of the Imo State Broadcasting Service in Owerri, which were well heard throughout Australia in the 2100 to 2305 time period.



Each Nigerian state (there are 19 states) is now responsible for broadcasting and communications within their boundaries. The Federal authorities, following test transmissions, have handed over the 4755 transmitter to the Imo State radio, and no doubt the transmitter on 4770 will also eventually be handed over to the Kaduna state broadcasting authorities following the current test transmissions.

Reception reports of the current test broadcasts could be sent to the Federal Radio Corporation of Nigeria, Kaduna, Kaduna State, Nigeria.

Guatemala all night

La Voz de Guatemala at Guatemala City has recently been broadcasting 24 hours on 6180 in the 49 metre band.

For many years, La Voz de Guatemala broadcast from their morning sign on at 1100 through until sign-off at 0500.

Australian DXers, especially on the east coast, had the best opportunity to hear Guatemala at their sign on at 1100, which is during our evening, when a darkness path meant signals reached us across the Pacific Ocean.

In recent weeks however, La Voz de Guatemala has been broadcasting on 6180 right throughout their former 0500-1100 silent period.

Signals have been strong on 6180, with Spanish announcements and distinctive marimba music of Guatemala.

Station identification is often given, sometimes for La Voz de Guatemala, and sometimes as Radio Nacional de Guatemala. Reception is best between about 0800 and 1200, as noted from Melbourne.

Portugal move

Radio Portugal in Lisbon is currently well heard in east Australia uring the North American service between 0500 and 0530 daily, on both 9575 and on 11 925.

Another Radio Portugal English service well heard here, although not directed to Australia, is that beamed to Europe daily from 2030 to 2100 on both 6025 and 9740.

Meanwhile, Portugal's broadcast in Portuguese, directed to Macau and Australia, is heard daily on 21 735 plus the new outlet of 21 645 (replacing 21 700) between 0925 and 1055.

Last chance for 90 metre Latins!

August should prove the last chance for east coast DXers to log Latin American signals on the 90 metre band.

These signals are an exciting feature of mid-winter DXing along the east coast.

All stations on the 90 metre band in Latin America are fairly low powered Home Service and commercial stations, usually broadcasting to their small local region or even their local town.

Here is a list of some of the stronger Latins on 90 metres you might hear, but make sure you get the household to turn off that colour TV befor you tune down to 90 metres as this sort of low frequency DXing and colour TV interference just don't mix!

ECUADOR: Strongest of the 1980 crop of Latins on 90 metres is Radio Iris at Esmeraldas on 3380. Reception is sometimes very strong between 1100 and 1140, with popular Ecuadorean music and Spanish announcements. The station identification is usually given as "Esta es Radio Iris" (This is Radio Iris).

HCJB the Voice of the Andes in Quito, transmits their Home Service programmes in Quechua (the language descended from the Incas) on 3220, and is audible from 0930 to about 1130. There is interference from Radio Morobe in Papua New Guinea, which also uses 3220, but HCJB's signal often dominates on the channel.

GUATEMALA: The religious broadcaster TGNA Radio Cultural, is often heard with strong signals on 3300, from 1100 to past 1130, with Spanish religious talks and prayers. Interference from a utility station is sometimes present.

NOTE! All times are given in Greenwich Mean Time (GMT). To convert to Australian Eastern Standard Time, add 10 hours (11 hours for Daylight Saving Time). To convert to Central Time, add 9.5 hours and for Western Time add 8 hours. All frequencies are in kHz.

Shortwave Loggings is compiled by Peter Bunn on behalf of the Australian Radio DX Club (ARDXC). Further information on DXing or the activities of ARDXC may be obtained from — PO Box 79, Narrabeen NSW 2101, for a 30c stamp.

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We at Dick Smith Electronics want to know what you, the amateurs of Australia want from your hobby: the amateur radio service. And we want to know how we, as a company, can serve you and Australia best for the benefit of Australia. So we're asking you to tell us, in fifty words or less, 'The best way that Dick Smith Electronics can promote the fantastic hobby of Amateur Radio to the benefit of Australia'

Entry to this competition is only open to purchasers of any Yaesu equipment from Dick Smith stores or authorised Dick Smith Yaesu re-sellers, between August 1, 1980, and November 1, 1980.

If you think about it, your chances of winning this trip are very, very good: the number of entries cannot be all that high – all it takes is a little originality and constructiveness of comment from you, and you could be going to Hong Kong: free!

Entries will be judged initially by a panel from Dick Smith Electronics to produce five finalists: these will be judged by Neville Williams, MIREE, Editor-in-chief of Electronics Australia magazine.

The winner will be notified by Dick Smith, and will be announced in Electronics Australia and Electronics Today International.

So if you're thinking about buying Yaesu, why not buy it in the next three months: of course, only from Dick Smith Electronics or authorised Dick Smith Yaesu re-seller!

Remember: we're the number one supplier of Yaesu amateur gear in the Southern Hemisphere!

HERE'S HOW TO ENTER: RULES AND CONDITIONS

Entries will only be accepted on the official entry form, which is available only with the purchase of any item from the Yaesu range from a Dick Smith store or a Dick Smith authorised re-seller.

All entries must show the model number and serial number of the item purchased, (if applicable), and be signed by the store manager or authorised person.

In the space provided on the entry form, write in one paragraph of not more than 50 words,

'The best way that Dick Smith Electronics can promote the fantastic hobby of Amateur Radio to the benefit of Australia'

Post your entry to:

Amateur Radio Contest,
Dick Smith Electronics
PO Box 321,
North Ryde, NSW, 2113.

Entries close at 5PM on Monday, 3rd November, 1980. Entries received after this date will not be considered.

Final judging will take place on 10th November, 1980. The judge's decision will be final and no correspondence will be entered into.

As this flight departs from, and returns to Sydney, the winner must travel to Sydney at his/her own expense.

All entries become the absolute property of Dick Smith Electronics Pty Ltd, who may use such entries as they see fit.

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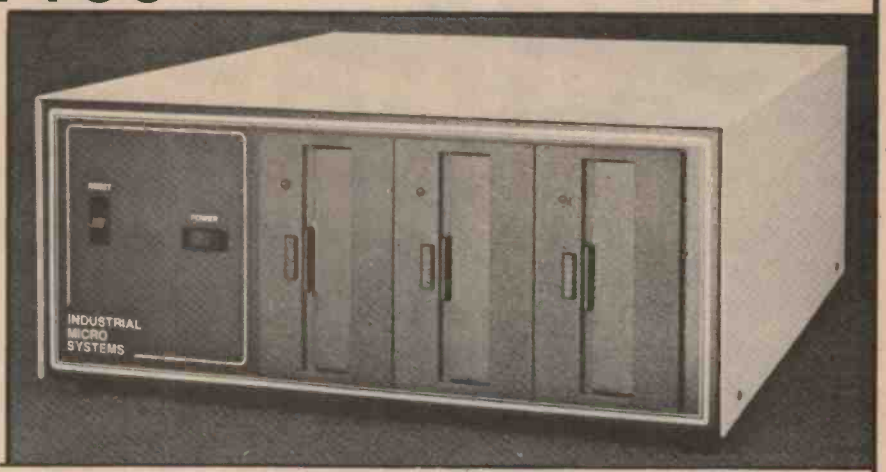

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Complete information on using these predictions can be obtained by sending a stamped, self-addressed envelope to:-

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These GRAFEX style computer generated predictions are provided courtesy of the Australian Ionospheric Prediction Service.

KEY TO SYMBOLS

A blank area means no normal propagation is possible.

% . . . . . path open 50 - 90% of days in month.

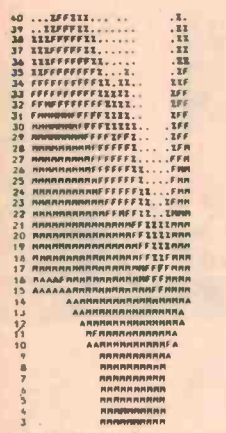
F . . . . . path open at least 90% of days in month.

B . . . . . propagation possible via E and F layers over 90% of days. Overrides 'F'.

M . . . . . propagation possible by both 1st and 2nd F-layer modes. Expect strong fading.

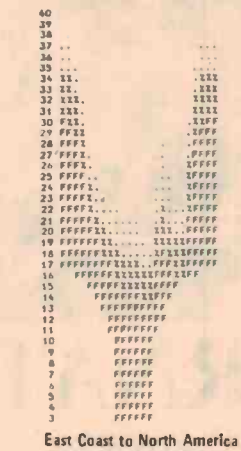
S . . propagation possible by 2nd mode (also 3rd and mixed E and F modes). Expect strong fading, weak signals.

A . . . . . High absorption indicated. Expect weak signals.

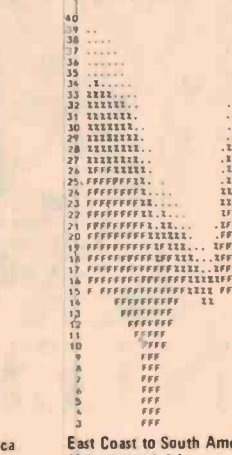


East Coast to Japan (Also serves N.E. and S.C.)

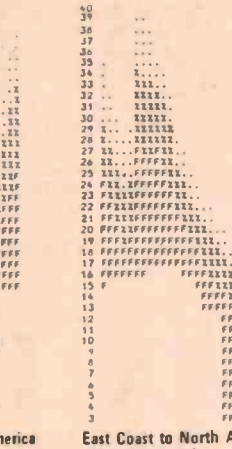
East Coast to South Pacific



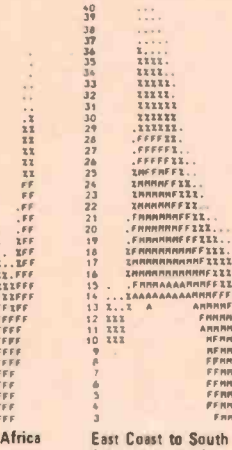
East Coast to North America (Also serves N.E. and S.C.)



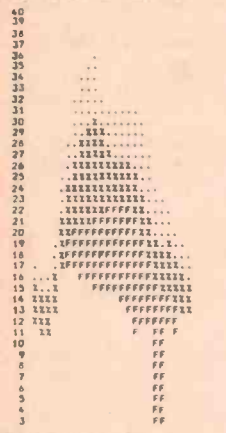
East Coast to South America (Also serves S.C.)



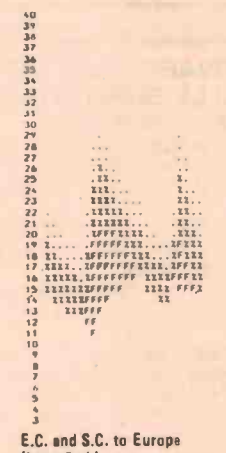
East Coast to North Africa (Also serves S.C.)



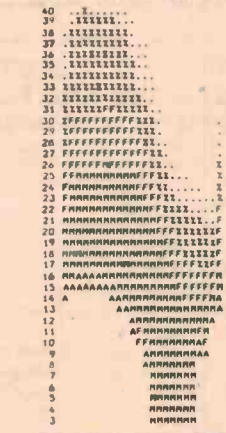
East Coast to South Africa (Also serves S.C.)



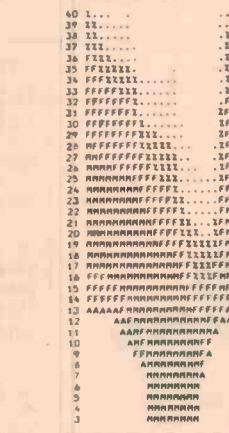
East Coast to Europe (Short Path)



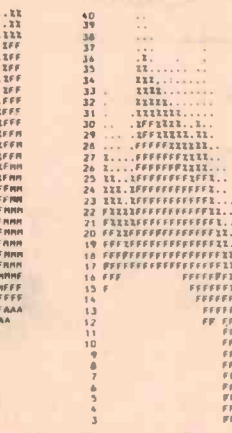
E.C. and S.C. to Europe (Long Path)



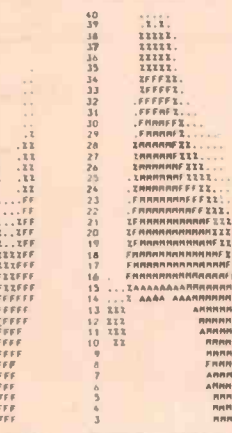
East Coast and S.C. to Persia



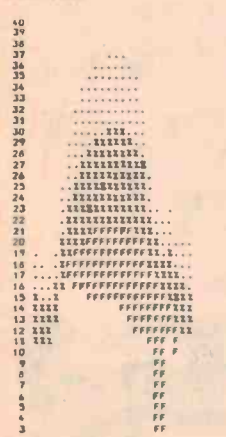
North East to South Pacific (Also serves S.E.)



North East to North Africa

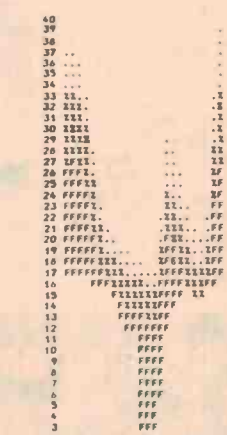


North East to South Africa

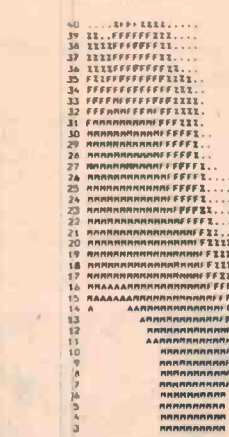


North East to Europe (Short Path)

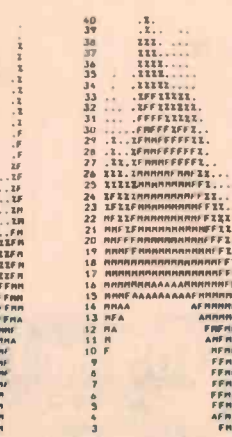
S. Central & W.C. to Europe (Short Path)



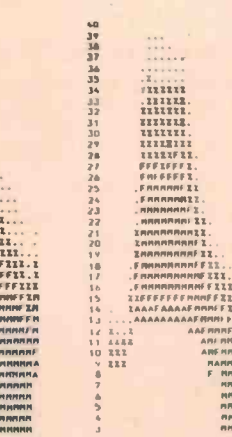
West Coast to North America



West Coast to Japan



West Coast to North Africa



West Coast to South Africa

"I have always wanted a really good loudspeaker system."

Today the cost of excellent turntables, cartridges, tape decks and amplifiers has fallen to the point where the average family man can afford equipment of a quality and performance-level that was impossible ten years ago.

But good loudspeakers have remained extremely expensive and, in most domestic hi-fi systems, the rest of the equipment can dramatically outperform the speaker.

Philips have set out to correct this imbalance.

In co-operation with Philips Elcoma Division, a leading Electronics magazine has developed the ETI 4000/1 speaker system.

The ETI 4000/1 is available in kit form which means you save money by assembling it yourself.

A total kit, including:

- 8 loudspeaker drivers (4 per box)
- 22 element crossover networks
- pre-assembled boxes.

For around $798.00 per pair. ($300.00 less, if you build your own boxes)!

The ETI 4000/1 is comparable to systems selling for twice the price.

See your Philips dealer today or send for complete details including a free reprint of the original construction article. Further information on Philips loudspeakers; a list of Philips dealers and a free 4-speed stroboscope card for checking the speed accuracy of your turntable.

Philips Electronic Components and Materials
P.O. Box 50
LANE COVE, N.S.W. 2066
Please send me complete information on the ETI 4000/1 loudspeaker system plus my free 4-speed stroboscope card and further information on loudspeakers.

NAME _____
Please Print

ADDRESS _____

_____ STATE _____ P'CODE _____

ETI

PHILIPS
Electronic Components and Materials

PHILIPS

AHEARN EL 30

sound

A dream come true
demands music
as true as the dream
– Nakamichi

For further information contact Convoy International Pty Ltd 4 Dowling Street Woolloomooloo NSW 2011
Telephone (02) 3582088

The dawn of a new recording era

Auto Azimuth Alignment

Undoubtedly the most advanced and sophisticated cassette recorders in the world today, the ZX Series launches a new era in high-fidelity cassette recording. These revolutionary transports feature exclusive Nakamichi Discrete-Head technology, 4-Motor, Dual-Capstan, Asymmetrical, Diffused-Resonance Transport, Random Access Music Memory, and Auto Azimuth Alignment. For the first time, you can be assured of perfect azimuth alignment – on any cassette – at the touch of a button. Unprecedented frequency response – to 22kHz at standard speed, to 15kHz at half speed! The culmination of Nakamichi's commitment to excellence in the fine art of recorded sound.

Nakamichi

680ZX

The premier Model 680ZX – half-speed response that rivals that of other decks at full speed! And, at standard speed, a full 22kHz! High-resolution wide-range FL level indicators and 18 program RAMM. Choose your speed, choose your program. The 680ZX does it all!

670ZX

Full off-tape monitoring facilities with Double Dolby and two complete sets of electronics. Single-speed operation to an astounding 22kHz! Nine program RAMM and wide-range peak-responding meters. Outstanding performance.

For further information contact Convoy International Pty Ltd 4 Dowling Street Woolloomooloo NSW 2011 Telephone (02) 3582088

What is hi-fi ?

The Australian Hi-Fi Industries Association is on the point of completing a $20 000 research programme to define hi-fi, according to the chairman of the Association, Mr Les Black.

Addressing a meeting of Pioneer dealers in Perth recently (he is also managing director of Pioneer Electronics), Mr Black said the words "high fidelity" were "meaningless".

He says there are still a good many electronic systems, and trillions of three-in-ones, that do not meet what is generally accepted as hi-fi standards.

But as there is no definition of hi-fi, these items can be advertised as hi-fi without any recriminations.

A definition of hi-fi is long overdue and many industry people wanted the matter looked into several years ago when England and America set down a legal definition.

But, although our Australian standards are late in being drawn up, Mr Black says that they are far more comprehensive than overseas efforts to define hi-fi.

He says that in America, the hi-fi definitions were limited to specifications relating only to amplifiers and receivers.

The Australian standards will cover all components sold and related to hi-fi equipment, including cassette decks and turntables.

The research programme, to cost $20 000, started 18 months ago and is within three months of being completed. A rough draft is already finished and it is now only a matter of formalising the definitions.

What will the definitions mean to the public, and how will they be used?

A special sub-committee headed by Philips executive Arno Rieuwers is looking at ways to use the $20 000 standards.

One obvious way to give the standards some real meaning is to get the Federal Government to accept them as a standard and pass legislation accordingly.

Then anyone advertising sound equipment that doesn't meet the specifications as hi-fi could be prosecuted under the Trade Descriptions Act.

This would make life much easier for the consumer.

However, the Federal Government may be reluctant to accept the fact that there are two standards of sound equipment. If they do then the industry would be able to push for abolition of tariffs on a wide range of products.

The government currently doesn't differentiate between public address quality sound equipment and hi-fi quality sound equipment. So while there are companies in Australia making P.A. equipment we have to pay heavy protective tariffs on hi-fi equipment.

It's going to be a hot potato and will keep Arno Rieuwers quiet for a while because if the industry association pulls it off it will mean the loss of millions of dollars to the Federal Government funds.

Tariffs currently stand at around 37% and the hi-fi industry is worth around $100 million a year. The only exception to the tariff protection system is the cassette deck. This was cleared on its by-law 18 months ago and prices fell dramatically overnight. Because of it, sales have boomed since.

Audax Kit 51 speaker prices

Our review of these speakers in the July issue missed out on a price breakdown and we feel readers may be interested to know the details.

The recommended retail price of the completely assembled speakers is now slightly lower than quoted in the review and is now $719.

As a kit, complete with all components, cabinets and drivers, the price is $459. The cabinet kit alone costs only $169. Enquiries to Audax Loudspeakers, 32 Wilson St, Oakleigh Vic 3166. (03) 579-5196.

Pointing in the right direction

A new design of rear shelf speaker from Pioneer cuts down the high frequency losses which are common in car interiors.

The trouble with normal car speaker designs is that high frequency sound is very directional. For the driver of a car to hear good treble the axis of the speaker should be pointing more or less towards him.

Ideally this means mounting the speakers on the windows or the roof, both of which are ruled out by considerations of visibility and headroom. So car speakers are usually fitted in the rear shelf or the front doors, with the result that most of the high frequencies are sent in the wrong direction.

Pioneer have got round this problem in the design of their TS-1600 unit. This has a cross-axial arrangement with the tweeter axis inclined at 60° to that of the woofer. When the unit is mounted on the rear shelf with the woofer pointing upwards, the tweeter directs most of its output at the heads of the front seat occupants.

The TS-1600, nicknamed the Music Director for obvious reasons, also incorporates a diffuser in front of its 57 mm tweeter cone to give a wider horizontal spread of sound.

Computing Cassette Deck

Nakamichi has just released an extraordinarily sophisticated cassette deck.

The 1000ZXL has a microprocessor which independently controls tape head azimuth, bias, recording level and equalisation to optimise these parameters for the particular tape actually running in the machine.

By compensating for the small differences that can exist even between different tapes of the same type and brand, this system is claimed to give an astonishingly flat frequency response of +/– 0.5 dB from 20 Hz to 20 kHz.

Fine setting of all the variables is a multistage process. First of all the processor sets the azimuth, then it fixes a rough level and determines the peak bias. After testing the frequency response, it trims the bias and sets up a first approximation to a proper equalisation. Then the processor rechecks the frequency response, trims the equalisation, checks again and finally sets the level.

The whole process takes about 20 seconds, including the time taken to rewind the tape. Adjustment data can be stored in one of four memories in case the same tape is used again.

Another interesting feature is the improvement in erasing ability which has been achieved by abandoning the standard practice of using the same oscillator frequency for biasing and erasing. Although low frequencies are best for erasing and high ones for biassing, a single compromise frequency of about 80 kHz is generally used to avoid beats.

Nakamichi have improved on this practice by using a quartz-locked master oscillator to generate the bias frequency of 105 kHz. A frequency halving circuit, which is phase locked to the master oscillator, is used to drive the erase head at 52.5 kHz.

The 1000ZXL is promoted as a long term investment that should not become obsolescent with future developments in tape technology. To this end the machine is provided with a bias set switch that can shift the entire range of settings inherent in the microprocessor adjustment system up or down by 12.5% in case tapes of the future require bias settings outside the range of today's.

Nakamichi expect this machine to supercede their older Model 1000 and once more place the compay 'head and shoulders' above the rest of the market. Enquiries to Convoy International, 4 Dowling St, Woolloomooloo NSW 2011. (02)358-2088.

TDK cassettes

The TDK advertisement on page 91 of the July issue suffered om a slight problem of missing copy.

The column on the right hand side of the advertisement referring to the OD, AD and D tapes had the column heading missing — it said "Normal Position Tapes". We thought it prudent to explain the problem in case some readers though the Optimum Dynamic (OD), Acoustic Dynamic (AD) and Dynamic (D) tapes appeared to be included in TDK's list of High Position tapes. — *to page 115.* ▶

MARANTZ ROLLING THUNDER CAR STEREO

ALFASUD: Car of the Decade, 'Car' Magazine, Jan '80

Marantz, makers of the world's most uncompromising hi-performance, hi-fi components, hits the highways with the new Rolling Thunder Car Stereo range.

Tailored sound, precision engineered, with a performance equal to the high fidelity you expect from quality home audio equipment: dynamic, clear, soft and sweet. Or bold and gutsy. Take your choice.

Rolling Thunder Radio Cassette-players' features include auto reverse, AM/FM pushbutton selection, powerful 12 watts total power output, locking fast-forward and rewind controls. And you get it all through Rolling Thunder speaker systems — an extensive range of round and oval types from a space-saving 4" to the sophisticated 5-way SS 569 shown, with all but a few having 20 oz. magnets. And every one designed for maximum performance.

Pack the powerpunch with the sensational SA 230 Integrated Amplifier. Individual bass and treble controls and 40 watts total power give you the liveliest rock venue on wheels. It's also compact and easy to instal.

Or, if at 80 k's you can still hear the siren behind you, turn on to the SA 247 7-band super powerful Equalizer-Amplifier. You get 60 watts of clear highs and punchy bass, you colour it to car or concert effect.

And you can connect it to almost any car stereo receiver.

Rolling Thunder is different. You'll hear that difference. Even feel it.

marantz.
Now you're listening.

MARANTZ ROLLING THUNDER CAR STEREO

MARANTZ (AUST.) PTY. LTD.
32 Cross Street, Brookvale, N.S.W. 2100

Please send me more information on Marantz Rolling Thunder range of car stereo.

NAME .....

ADDRESS .....

.....

Distributed by: MARANTZ (AUST.) PTY. LTD., 32 Cross St., Brookvale, NSW 2100, Phone (02) 939 1900 Telex AA24121, Melbourne (03) 329 7655, Brisbane (07) 48 8266, Adelaide (08) 223 2699, Perth (09) 328 3874.

The Sony Casseiver.

A name like no other for a system like no other.

Never before has such a high quality system been so reasonably priced. The Casseiver by Sony.
The Casseiver combines a front-loading Dolby* cassette deck, with twin LED displays and soft-eject mechanism; a built-in amplifier delivering 15 watts/channel RMS; a sensitive 4-band AM/FM/SW1/SW2 stereo tuner and a full-range speaker system with passive cone radiators. And with provision to add on other components, such as a turntable, the Sony Casseiver is truly a system like no other.
Recommended retail price $499.

*Dolby is a registered trademark of Dolby Laboratories.

The PS-212A turntable (pictured) is an optional extra.
Recommended retail price $210.00.

SONY AUDIO

AP3412

Hi-fi consoles from Hitachi

Hitachi have recently introduced a range of consoles which will accommodate most of their hi-fi units.

Model VC 1 is a 'vertical' design which will hold any of their four turntables, a cassette deck and a stereo receiver. The taller VC 2 will take a record deck, cassette deck, AM/FM tuner and a separate stereo amplifier.

Two 'horizontal' styles of console are also available. The HC 1 has space for three units and the HC 2 will house similar units to the VC 2.

All the new consoles have generous storage space for records and cassettes, are attractively styled and reasonably priced. The VC 2 for example retails for a little less than $50.

High speed Technics tape deck

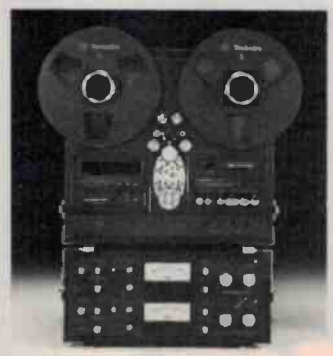
The latest open reel tape recorder from Technics is designed for professional recordists and features a tape speed of 76 cm/sec.

The RS 1800 has a three motor direct drive tape transport system which will also run at speeds of 38 or 19 cm/sec. A quartz synthesizer pitch control system allows speed variations of up to 9.9% in increments or decrements of 0.1%. Nominal speed and variation are displayed digitally.

Rather surprisingly for a studio quality deck, the RS 1800 uses quarter inch tape. The standard model is two-track two-channel record and reproduce but Technics can supply four-track head assemblies as well.

The heads themselves are made from an improved version of the Sendust alloy called SX, which is claimed to have improved wear and resistance as well as better magnetic characteristics.

The amplifier is completely separate from the tape transport unit and has its own power supply. Both the playback and



the recording amplifiers are designed to preserve every aspect of a waveform by accurately reproducing the relative phases as well as amplitudes of the various frequency components.

An integral oscillator provides automatic equalisation at set frequencies of 100 Hz, 1 kHz, 10 kHz and 20 kHz and an automatic bias adjustment system allows virtually any tape formulation to be used. For total control, manual bias and equalisation adjustment is also provided.

Improving speakers is easy as ABC !

A new range of speakers from KLH are equipped with sophisticated equalisation and overload control.

The control circuitry is contained in a separate module which the makers call an Analog Bass Computer, or ABC for short. Each of three sizes of speaker in this range has its own version of the ABC, which is specifically matched to the characteristics of that speaker's enclosure and drivers.

Equalisation to improve linearity of the perceived sound output at low frequencies has long been employed in professional monitor speakers, but it's rare to find it on systems intended primarily for domestic use.

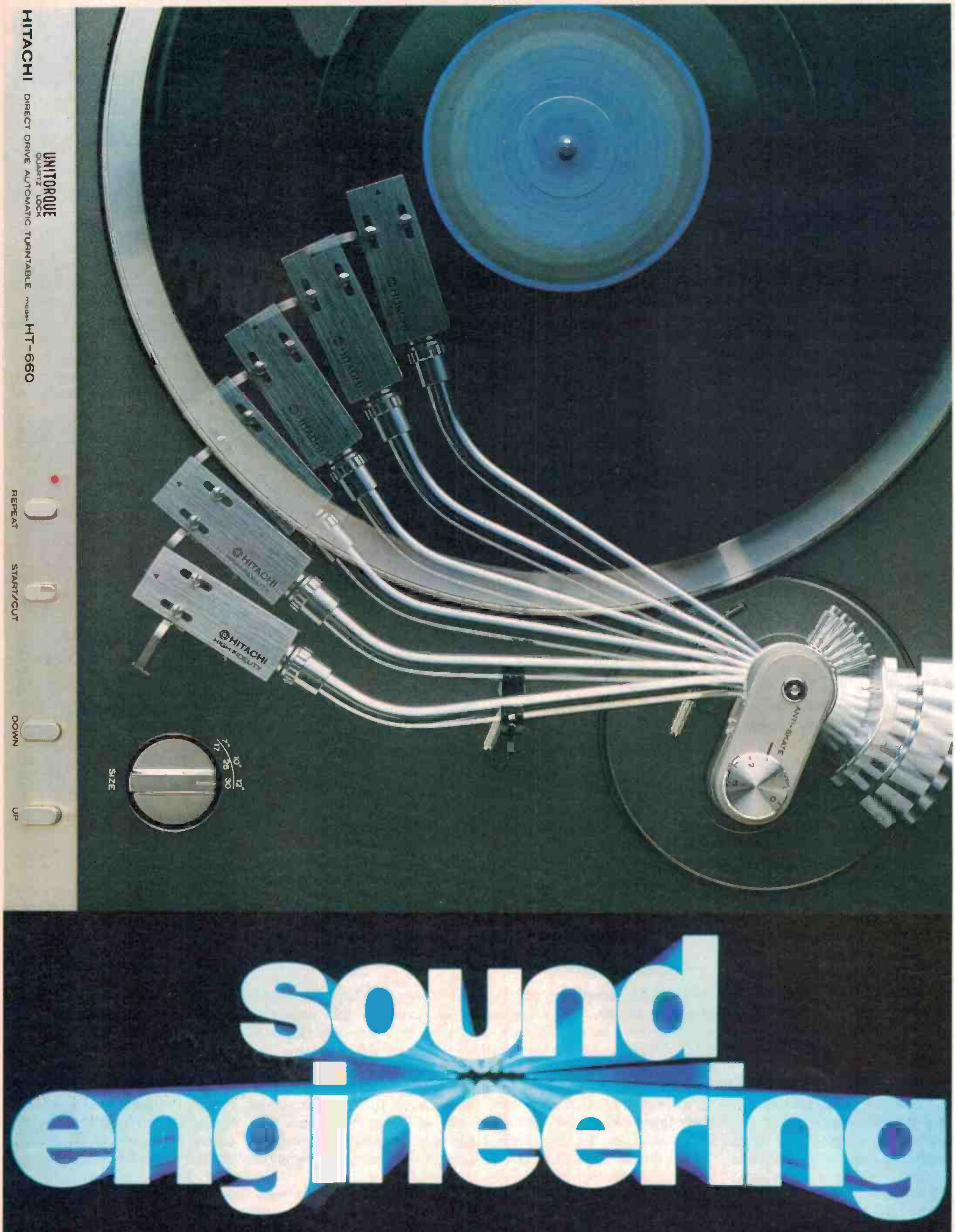
The Analog Bass Computer which provides this equalisation on the KLH-1, KLH-2 and KLH-3 speaker systems is basically an extra amplifier whose gain varies with frequency. Above 70 Hz the gain is unity; at frequencies below this the gain increases to compensate for the reduced efficiency of the speakers.

This method of compensation, which is also known as bass pre-emphasis, carries with it a considerable risk of distortion or damage from overloading the drivers. Two methods are used to prevent this.

Very low frequency (bordering on subsonic) transients caused by surface irregularities or turntable rumble are eliminated by a steep cut high pass filter. Musical bass transients cannot of course be dealt with so simply, and this is where the description 'Computer' begins to be justified.

To prevent the woofers from exceeding their maximum safe displacement on very loud bass passages of a piece of music, the Analog Bass Computer incorporates a special signal processor network. This processor detects the voltage present at the speaker terminals and modifies the input voltage to the equalising circuits as a function of this voltage and the electro-mechanical characteristics of the driver. KLH claim the processor responds so quickly when it senses a potential overload that distortion is very unlikely.

More details can be obtained from the distributors, Concept Audio, P.O. Box 422, Dee Why NSW 2099.


HITACHI
UNITORQUE
QUARTZ LOCK
DIRECT DRIVE AUTOMATIC TURNTABLE model HT-660
REPEAT
START/CUT
DOWN
UP
SIZE
ANTI-SKATE
HITACHI
HIGH FIDELITY
sound
engineering

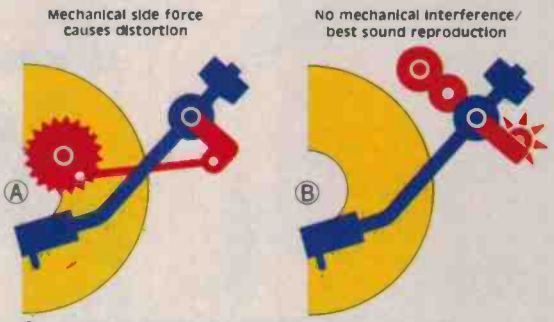
HITACHI

Hitachi's Photo Sensing Tone Arm

Optically-activated return eliminates side force to make the HT-660 Turntable the accurate choice.

The photo sensing tone arm is sound engineering. Precision engineering. It's a remarkable design concept that achieves unsurpassed turntable accuracy. Because with photo sensing return, the side force of conventional systems doesn't exist. And in the HT-660 Turntable, it's joined by Quartz-locked Unitorque that makes every revolution of the platter perfectly smooth.

The benefits of non-contact switching are readily apparent — every time you play a record. Distortion-producing mechanical parts have been eliminated. Instead switching is activated by a light beam. And because unnecessary side force doesn't exist, the arm requires far less tracking pressure.



Ⓐ Conventional mechanical sensor tone arm return system
Ⓑ Hitachi photo sensor tone arm return system with LED
Graphic illustrations are reconstructed from Hitachi Toyokawa audio laboratory data.

Unitorque direct-drive with Quartz further contributes to the unit's fine sound reproduction. Wow and flutter is a low, low 0.025% WRMS.

Of course the system is fully automatic, but all auto functions are independently powered so there's no drain on the main drive motor. And the controls for those functions are right up front. You never have to lift the dust cover to get to them.

Hitachi technology is at work to bring you greater turntable accuracy through advanced electronics. The HT-660 Turntable with the photo sensing tone arm system and Unitorque with Quartz is the result of those efforts. Listen to the soundness of Hitachi engineering today.

Professional sound through sound engineering

HT-660

Hitachi Sales Australia Pty. Ltd., 153 Keys Road, Moorabbin, Victoria 3189 Tel: 95 8722

If he were around today we know he would use it.

Throughout his career as a composer and performer, there is no doubt that Franz Liszt went first class all the way. So it's logical to suppose, if he was around today, he would choose a chromium dioxide tape for recording and playback.
If you want to go first class too, choose Agfa Stereochrom and get unsurpassed recording characteristics, high frequency replay response, outstanding H.F. output and dynamic range, clearer tone with enhanced presence. Even the cassette features a special mechanism for better tape transport.
Agfa Stereochrom C60+6 and C90+6 cassettes are available at hi-fi specialists, music stores and photo dealers.

Agfa*

*Registered trademark of AGFA-GEVAERT Antwerp/Leverkusen.

AGFA-GEVAERT FOR STILL CAMERAS, FLASHGUNS, COLOUR FILM FOR SLIDES, PRINTS AND MOVIES, MAGNETIC TAPES.

E 310

Modern turntable technology

Here we look at the requirements of the modern record player and discuss how advanced electronics can provide 'the ultimate' in this branch of hi-fi. We also consider the products of the major manufacturers and some of the special facilities offered in high quality decks.

Brian Dance

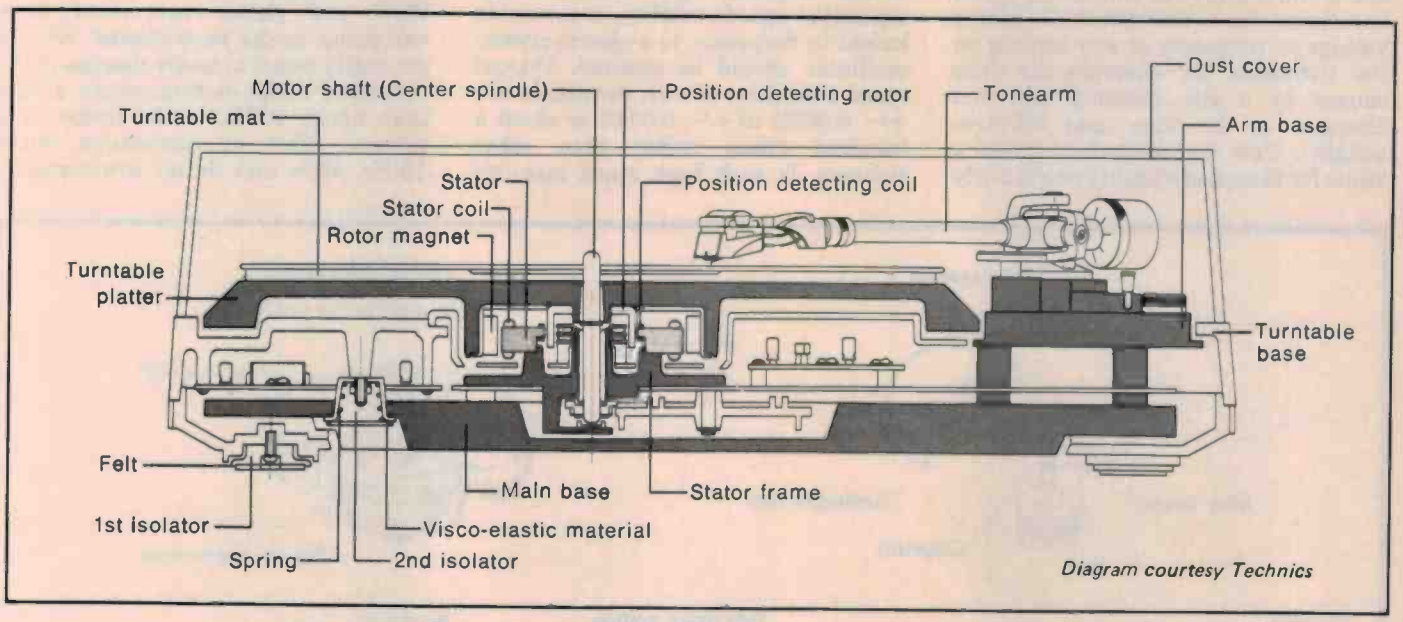


Diagram courtesy Technics

THE BASIC REQUIREMENT of any record player assembly is that the turntable shall rotate noiselessly, at the required speed without any short-term or long-term variations in this speed. This sounds a simple enough requirement, yet sophisticated, modern players contain quite complex circuitry with large numbers of integrated circuits and discrete components; indeed, the circuitry is too complex for us to reproduce in full for any of the latest players mentioned in this article!

Turntable mechanisms have evolved a very long way from the purely mechanical gramophones of about fifty years ago where one had to wind up a spring motor with a handle. All of the audio power came from the mechanical interaction of a large steel needle with the surface of the revolving record; the steel needle moved a mica diaphragm at the narrow end of a flexible horn which provided suitable acoustic coupling to the air. The weight of the moving arm part of the horn seemed almost enough to push the needle through the record! However, it is this old type of gramophone which has set the pattern for the modern record player of today.

Turntable speed

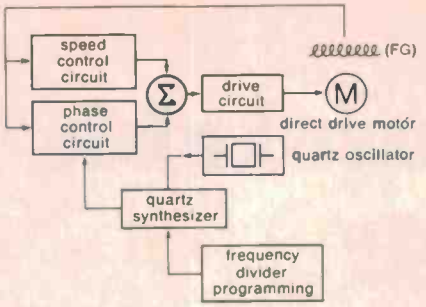
The rate of rotation of the turntable directly controls the frequency of the audio signal reproduced from the record track. Any slight increase or decrease in the rate of rotation will produce a proportionate increase or decrease in the pitch of the recovered audio signal. Most modern recordings are made for use at either 33⅓ or 45 revolutions per minute. How accurately must the player match these speeds of rotation in order to be acceptable? This is not a question to which one can give a definite answer, since so much depends on one's hearing, on the listening experience one has had previously and on the amount of hard cash one is willing to spend in order to obtain a constant rate of revolution. (See April 1980 ETI, p.108.) (One might even add that it could even depend on how much one is willing to spend to be able to praise one's equipment to one's friends and neighbours!)

Most of the fairly economical turntables employ a strobing system which enables the rate of rotation of the turntable to be set quite accurately to the required speed. The cheapest strobing system employs a lamp (normally a light emitting diode) which flashes at the mains frequency of 50 Hz. However, if one uses the mains frequency as one's standard, any ▶

changes in the mains frequency will produce errors. This problem can be avoided by driving the lamp from an astable multivibrator circuit which is operated from a stabilised supply voltage.

In the simplest systems the lamp may be placed under the edge of the turntable so that light passes through a pattern of bars on the edge; the speed is correct when the bar pattern for that speed remains stationary as the turntable rotates.

To stabilise rotation speed a tachometer and an F/V converter can be used to give a voltage proportional to rotation rate. The difference between this and a reference voltage is used to adjust the speed of rotation so that the error voltage is reduced almost to zero. The use of such a system minimises speed variations due to changes in the mains voltage or frequency or any loading on the turntable (for example the drag caused by a disc cleaning arm and changes in the tone arm effective weight). Few manufacturers quote a value for the speed stability over a fairly long period for such equipment, but generally a few tenths per cent speed variation is reasonable.



Block diagram of a quartz stabilised turntable drive circuit, as devised by Technics.

Quartz stabilised

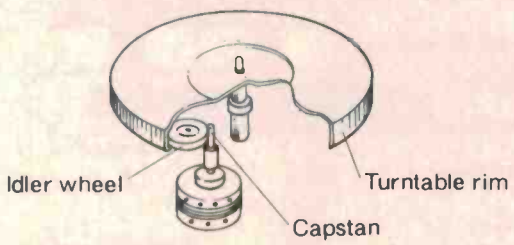
If one requires much more closely controlled speed stability, a turntable locked in frequency to a quartz crystal oscillator should be selected. Typical speed stabilities of such turntables are +/− 0.002% to +/− 0.004% or about a hundred times better than other systems. Is such high speed stability necessary? Only you, the user, can answer this question after prolonged listening to both quartz stabilised and other equipment.

In some quartz stabilised equipment one cannot vary the turntable speed at all without switching the quartz control out of use. In others the crystal reference frequency is divided by different factors to enable the speed of rotation of the turntable to be varied without losing the advantages of quartz control. Some manufacturers of top quality decks offer quartz control systems with a digital display of the platter speed. Changes in speed of a quartz controlled system with temperature can be as low as 0.2 parts per million per centigrade degree.

Wow and Flutter

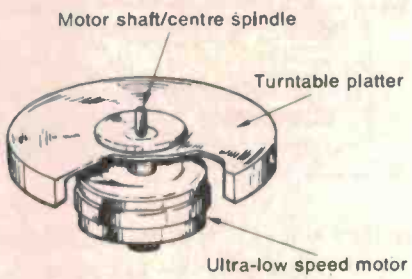
Wow and flutter are short term variations in the record speed. Wow is generally taken to mean changes of the recovered audio at frequencies of less than about 10 Hz, whilst flutter is a similar effect at frequencies above 10 Hz. Wow and flutter are normally

Rim drive system



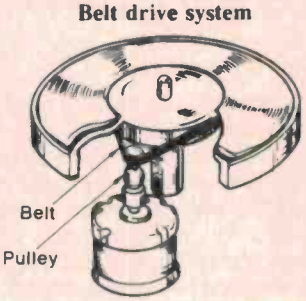
Rim Drive
In this system the motive power provided by the drive motor is applied to the inner or outer edge (rim) of the turntable by means of a capstan on the shaft of the motor. Since a high speed motor is used, one or more idler wheels are inserted between the capstan and the rim to reduce the speed and achieve the desired ratio to obtain the correct platter speed. (This system is also known as 'idler drive'). The rim drive system is relatively low in cost, permits the use of a low torque motor and allows mechanically simple speed changing. Its main disadvantage is rotational instability due to slippage occurring between the capstan, idler and rim.

Direct drive system



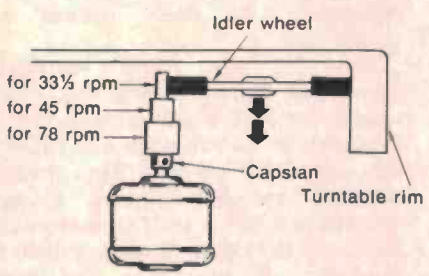
Direct Drive
As the name implies, this system uses no speed reduction devices to transfer the motive power from the motor to the turntable platter. Rather, the shaft of the platter is set in the centre of the motor itself and is driven directly. The motor rotates at exactly the required speeds (33 1/3 or 45 rpm) and its rotational accuracy is maintained by any one of a variety of electronic servo mechanisms. The slower rotational speeds and very high rotational accuracy of this system have brought both rumble and wow and flutter specs to levels seldom if ever before achieved. Since the introduction of the first direct drive turntable by Technics in 1970, this system has rapidly become very popular and many manufacturers have entered the market with their own models.

Belt drive system

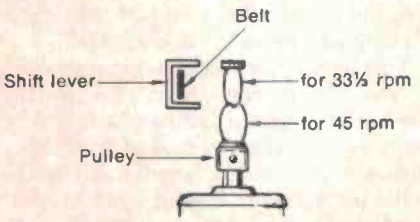


Belt Drive
This is a very common drive system like the rim drive. A relatively high speed motor is used and coupled to the turntable platter by a compliant belt. By moving the belt up or down over different diameter sections of the motor shaft pulley, speed changes may be effected. One of the big advantages of this system is that the belt serves to dampen motor vibrations, thereby reducing noise and rumble. Polyurethane is the preferred belt material because of its resistance to heat, humidity and oil and its low elasticity. The problems encountered with belt drive are instability due to belt slippage and a relatively large amount of vibration due to the high rotational speed of the motor.

Speed change of rim drive



Speed change of belt drive



measured together as a total percentage, but a form of weighting network is often used which attempts to take account of the degree of annoyance to the listener so that wow and flutter of particularly annoying types produces a larger contribution to the percentage figure than a similar amount of other types.

Wow and flutter can be measured in various ways. If one uses a test record, replay cartridge and tone arm, one will usually obtain a higher percentage figure than if one measures the fluctuations of speed in the turntable more directly with a tachogenerator. Many of the Japanese manufacturers employ the tachogenerator technique to obtain a percentage figure for wow and flutter expressed as a WRMS figure (weighted root mean square). The German standard DIN (Deutsche Industrie Normal) is a peak weighted figure expressed as a percentage which is a *third* figure to catch the unwary.

It has been agreed that DIN peak weighted wow and flutter percentages of less than about 0.1% are probably undetectable in normal listening. However it has recently been shown that intermodulation products which can be generated by pitch fluctuations can impair the recovered audio signals, so it is wise to select a system with the minimum wow and flutter percentage figures you can afford. The percentage figures quoted are normally in the range 0.01% to 0.1%. (See also, April 1978 ET, p.108).

Table 1 shows wow and flutter percentage figures for the Philips AF877/AF977 and AF677/AF777 turntables measured in various ways for comparative purposes. The lower values obtained for the AF877 and AF977 are due to improved control circuitry and differences in the mass of the turntable.

Cogging

Most turntable motors are dc electric motors which employ Hall Effect cells for commutation instead of the conventional brushes and copper commutator ring. Brush sparking can generate much noise; the use of Hall Effect cells for detecting the changes of magnetic field and for generating the switching pulses eliminates brush noise.

However, the problem remains that the energy is given to the motor in small discrete pulses as each coil passes through one of the magnetic fields. The uneven running due to this effect is known as 'cogging'; it can result in appreciable rumble combined with wow and flutter. Technics have developed a 20-pole, 30-slot brushless dc motor to minimise the effects of cogging. Hitachi employ their 'Unitorque' motor which incorporates a 200-pole rotary magnet. The coils are arranged 22.5° physically or 90° electrically out of phase with each other. The torque produced by a single coil fluctuates in a linear mode between a maximum value and zero. When the coils are out of phase at a given rotor angle, the sum of the torque produced is equal to the maximum torque of a single coil. This results in a motor action which has a uniform torque which is completely free from cogging.

Other effects

Various other effects can cause minor variations in turntable rotation. One of these is 'platter wobble' in which the turntable wobbles on its axis. It may be reduced by the use of a large diameter centre shaft, but Pioneer employ a hanging rotor system in which the main bearing is placed at the centre of gravity of the rotating system at the top of a *fixed* motorshaft. This provides a kind of gyrostatic action, increasing the stability and allowing the platter and the attached 'hanging cup rotor' to glide without any wobbling.

The actual recorded groove can cause small fluctuations in the speed of rotation of the platter. Figure 1 shows a stylus tip following a heavily modulated signal. It can be seen that the pressure of the stylus on the one wall of the groove acts as a variable braking effect on the rotation of the turntable. This problem can be reduced by using a turntable of high moment of inertia, but in turn this involves the use of a high torque motor which can bring the turntable up to its correct speed reasonably quickly.

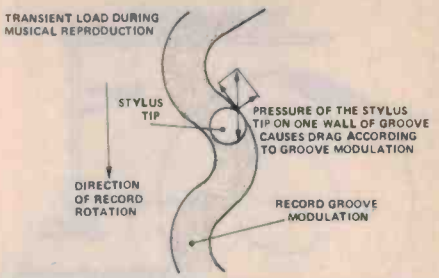


Figure 1. **The groove modulation can apply a variable braking effect on turntable rotation.**

Vibrations from the motor, transformer and acoustic waves from the speakers can also affect the rotational stability of the platter.

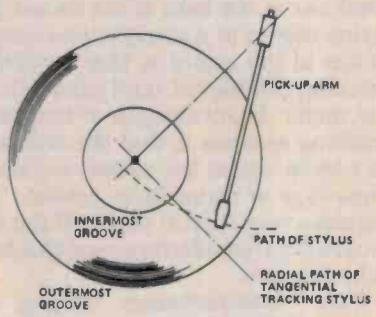


Figure 2. **The path a conventional tone arm traces across the record is different to the path taken by the cutting arm of the original disc cutter. Thus, the stylus is not always tangent to the groove. Tangential tracking arms were devised to overcome this.**

Tangential tracking

The conventional tone-arm moves across the record in an arc of a circle so that the path of the stylus is as shown in Figure 2. When a record is being cut, however, the cutting arm moves inwards along a radius towards the centre of the record. Thus the cutting path is a straight line unlike the arc of the replaying stylus. This leads to the important point that the direction of the motion of the recording head relative to the record surface is a tangent to the recording groove at all times. A conventional stylus cannot move at a tangent to the record groove at more than two places. At all other points there will be a small angle between the direction of relative movement and a tangent to the groove.

Many people feel that a stylus which follows the path of the cutting head across the disc as accurately as possible is likely to achieve a more faithful reproduction of exactly what is on the disc than a stylus which moves at an angle to the direction of movement of the cutting head. A few record decks are now coming onto the market in which 'tangential' or 'parallel' tracking is achieved. ▶

AF877-AF977	AF677-AF777	Measurement technique
0.05	0.08	% DIN using test record, cartridge and tone arm.
0.03	0.05	% WRMS using test record, cartridge and tone arm.
0.02	0.04	% WRMS measured directly at output of tachogenerator (thus eliminating effects due to the test record, cartridge and tone arm).

Table 1. Wow and flutter figures for Philips turntables measured in three ways.

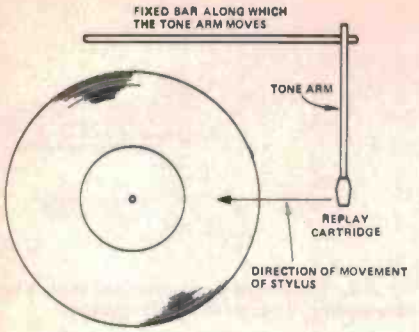


Figure 3. **The basic arrangement of a tangential tracking turntable system.**

The basic idea of the tangential tracking system is shown in Figure 3. The tone arm does not swing in an arc, but moves from right to left along a fixed bar at the back of the record. The stylus moves in a straight line along a radius of the record so that tangential tracking is achieved at all points. One of the major disadvantages of tangential tracking systems is that the arm must be moved across the record surface by some type of motor drive system. This requires very careful design of the tone arm motor if satisfactory performance is to be obtained.

Most manufacturers employ an optical feedback system to control the tone arm motor. In the normal or equilibrium position a beam of light from a lamp is blocked off by a shutter on the tone arm so that it cannot reach a photo-resistive cell. If the record now rotates so that the stylus is closer to the centre of the record, the position of the tone arm will be changed by a small amount so that the shutter no longer prevents the beam of light from reaching the photoconductive cell. The current through this cell activates the tone arm motor which moves the arm inwards towards the centre of the record until the shutter again blocks the beam of light.

A successful optical system of this type must be very accurate, since the record grooves are very small and close together. The tone arm motor system must also be carefully designed to prevent 'hunting' in which excessive or inadequate movement of the tone arm takes place and the system hunts for the correct position.

Tangential tracking systems generally provide tracking angles to within a few tenths of a degree of the desired angle, whereas conventional systems may have angles of up to a few degrees at some point on the record. But what is the practical effect ? Tracking error angles tend to introduce second harmonic distortion which, whilst obviously undesirable, is not nearly so objectionable as third harmonic distortion. There seems to be some controversy as to exactly how much distortion is introduced by such tracking angle errors. Pioneer state that reduction of crosstalk between channels can be achieved by the use of tangential tracking.

In a tangential tracking system the effective arm length can be relatively short and the equivalent mass low even if strong materials are used to obtain a highly rigid arm. This can bring the advantages of minimum vibrational levels and small resonance patterns and hence of cleaner reproduction.

In spite of their important advantages, tangential tracking decks must be very carefully designed if they are to be better than conventional systems. Designers have not yet had extensive experience with linear tracking, so the intending purchaser would be well advised to try any linear tracking equipment very thoroughly before committing himself to purchase. However, it may well be the system of the future for top-of-the-market systems.

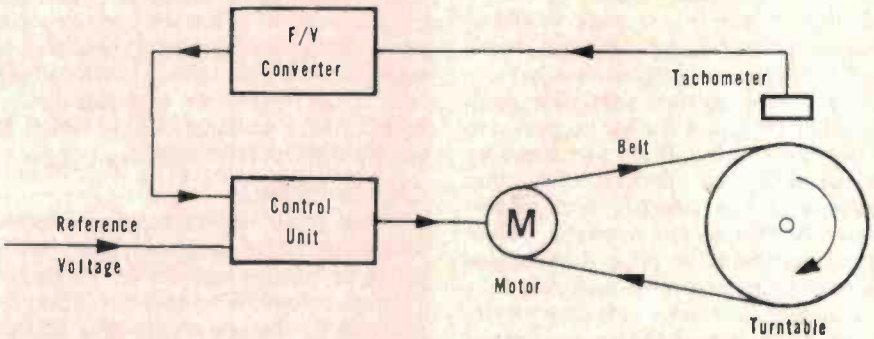


Figure 4. **The Philips 'direct control' system employs belt drive for the platter and servo feedback to the motor control circuitry via a tachometer sensing the platter speed.**

The pickup arm of a conventional system will tend to 'skate' towards the centre of a record unless the correct amount of bias compensation is applied. If no bias or an incorrect bias is applied, the inner groove is likely to receive more force from the stylus which will result in signals of an unequal amplitude in the two channels and which is likely to cause the inner groove to wear at an increased rate. These problems are said not to arise in tangential tracking systems, whereas in conventional systems the application of bias is only a compromise, since the required bias varies with the position of the tone arm on the record and with the modulation levels.

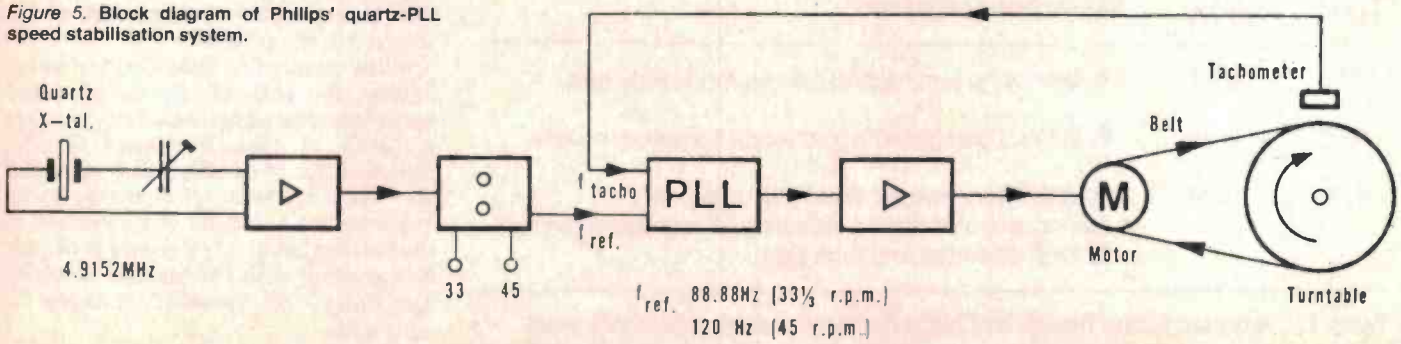
TURNTABLE SURVEY

We will now review various turntables and will stop to examine any unusual features offered in specific types. As the Japanese seem well ahead in this market, most of the models considered are Japanese.

Philips turntables

The Philips AF685 turntable is at the low-price end of the market and has electronic speed control with belt drive. The AF677 features 'direct control' and has about half the wow and flutter level of the AF685. The AF777 is rather similar to the AF677, but has automatic record diameter selection and arm

Figure 5. **Block diagram of Philips' quartz-PLL speed stabilisation system.**



positioning, variable pitch controls with a LED speed display, etc. The AF877 offers lower wow and flutter (see Table 1) and completely silent operation is achieved by the use of touch control switches; at the end of each disc, a photo-electronic sensor detects the acceleration of the arm as it follows the run-out groove and the arm is automatically returned to its rest. The AF977 employs a quartz stabilised speed system.

Let us look at the Philips 'direct control' belt drive system which is said to provide similar specifications to direct drive systems without the expensive constructional techniques required in direct drive systems to avoid rumble, etc. The direct control system is shown in Figure 4. Unlike servo control systems, in direct control the feedback signal is obtained from the turntable itself and not from the motor. Thus, stabilisation is related to the speed of the turntable itself — which is what matters most of all. Any slackness in the belt will have a much smaller effect than if the tachometer were connected to the motor. Fine control of the turntable speed is effected by varying the reference voltage with which the feedback voltage is compared.

The AF977 deck employs a quartz stabilised circuit of the type shown in Figure 5. The 4.9152 MHz signal from the crystal controlled oscillator is divided by a suitable factor, the value of which depends on whether one requires the 33⅓ or 45 rpm speed. The resulting reference frequency is fed to a phase-locked loop (PLL) circuit together with the speed frequency fed back from the tachometer. The output from the loop is used to control the motor speed. Thus, the phase of the tachometer generated signal is continually compared with that of the reference frequency and very high stability is obtained.

Philips' AF977 turntable features 'state of the art' specifications, digital speed indication, automatic operation and direct readout of the adjustable stylus force.

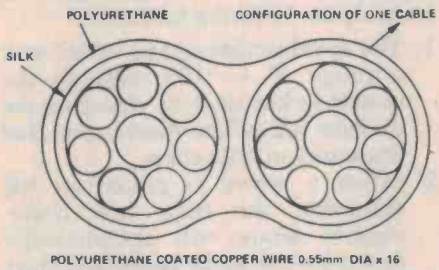


Figure 6. The Trio-Kenwood low capacitance tone arm wire.

Trio-Kenwood Turntables

Japanese manufacturer Trio-Kenwood produces the KD-600/650/750/850 range of quartz/phase-locked loop stabilised turntables and the electronically speed controlled types KD-3100 and KD-4100. This manufacturer emphasises the importance of using a turntable of a high moment of intertia to prevent transient changes of speed due to load variations. The turntable bases have been developed from a limestone-resin-concrete mixture to reduce low frequency resonance problems to a minimum. Brushless 20-pole, 30-slot dc motors are employed to minimise cogging and to provide DIN weighted rumble levels of −75 dB. Electronic braking is employed to minimise resonance effects. The tone arm wiring in these models consists of 'Penta-Litze' wire of the cross section shown in Figure 6; this has a very low capacitance and therefore signal losses and cross talk are minimised.

The model KD-850 has a fully automatic tone arm controlled by a digital-optical electronic system; it is both completely silent and error proof even if the arm is operated manually whilst set for automatic operation. ▶

The Trio-Kenwood KD-850 fully automatic direct drive turntable.

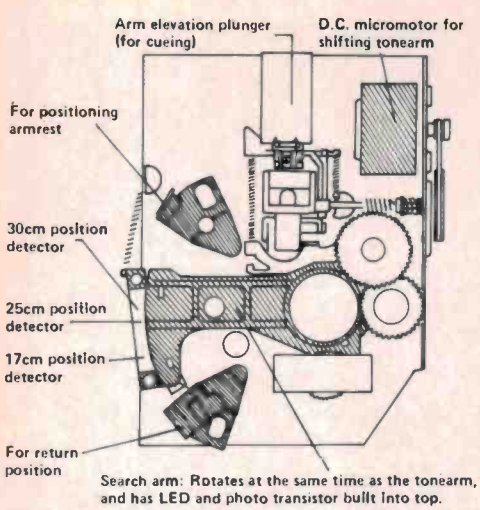


Figure 7 (a). **The automatic mechanism of Trio-Kenwood's model KD-850 turntable.**

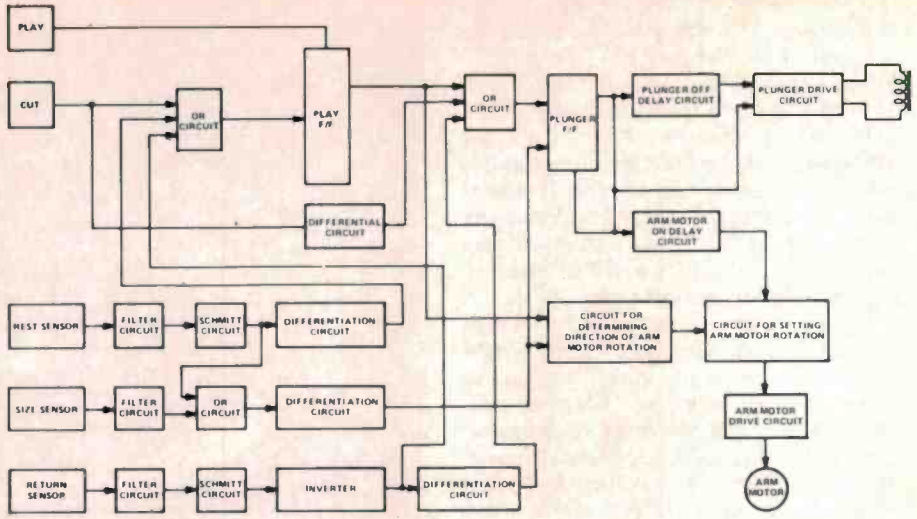


Figure 7 (b). **Block diagram of the logic system employed for automatic operation in the Trio-Kenwood KD-850.**

The automatic mechanism is shown in Figure 7. A photo-sensing system automatically selects the record size for the tone arm by sending a light beam to any of the prism slots in the platter not covered by records so that the information is signalled back to the disc size selector. The KD-4100 also employs an electronic system for automatic tone arm control, but the turntable is not locked in frequency to a quartz oscillator circuit.

Hitachi Turntables

Hitachi manufacture a range of turntables, including the HT324 and HT354, with electronic speed control, the HT356, HT353, HT550Q (semi-automatic) and the HT463 and HT660 (fully automatic) quartz crystal stabilised types. Perhaps the most interesting model, however, is the new HT-860 microcomputer controlled, quartz stabilised, fully automatic turntable.

The microcomputer control system (shown in block form in Figure 8) controls the following functions:

1. The speed control can be varied over a range of +/−9.9% even in the quartz locked state by changing the division ratio of the quartz generated frequency in 0.1% steps.
2. When a record is placed on the turntable, the lamp and photo-electric sensor will automatically detect the size of the record and move the tone arm into the correct position.
3. The speed is automatically set on detection of the record size, except in the case of 300 mm, 45 rpm and 170 mm, 33⅓ rpm records.
4. Optical sensors are used for moving the tone-arm in this fully automatic deck.
5. A repeat function allows the automatic replaying of any record up to nine times.
6. The tone-arm can be swung to any position by front panel button operation.
7. A safety mechanism prevents damage to the stylus under error conditions (such as operating the start button with no record on the turntable).
8. A fluorescent tube display indicates the turntable speed, any pitch variation, the record size and the number of repeat cycles.

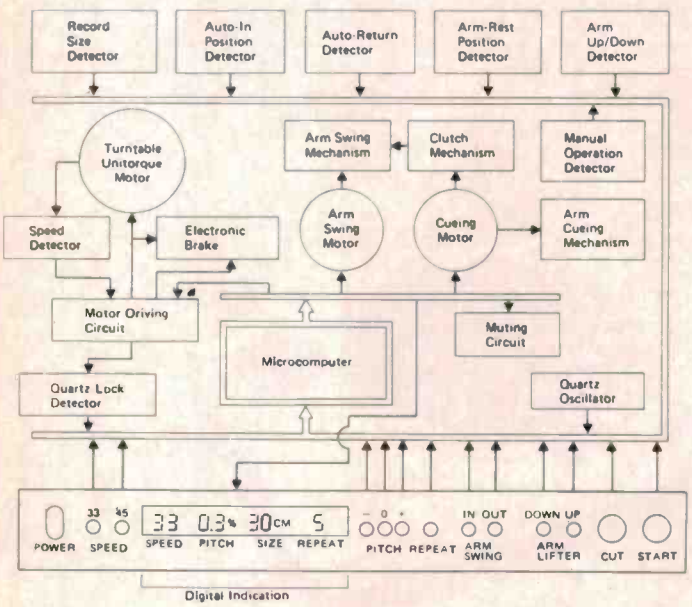


Figure 8. **Block diagram of Hitachi's HT-860 microcomputer controlled deck.**

The Hitachi HT660 quartz locked, fully automatic deck features optical sensing for the tone arm return and electronic platter braking.

Sharp Optonica Turntables

Sharp Optonica produce three types of turntable. The RP-5100 is a fully automatic, direct-drive type with stroboscopic indication, the RP-7100 is a quartz locked unit with an Auto Programme Locate Device (APLD) and the RP-9100 has all of these features plus remote control, digital speed display, etc. One may note that the RP-9100 employs some 40 integrated circuits, 40 transistors, 22 diodes, two Hall cells and two quartz crystals, so it is quite complex! The integrated circuits include a Z-80 microprocessor, an EPROM, 256 x 4-bit random access memories and a host of other logic devices.

The quartz locked motor systems of the models RP-7100 and RP-9100 are similar. A frequency generator comprising a 160-pole magnet and a multigap head having 80 pairs of pole teeth and coils is connected to the motor and generates a 44.44 Hz sine wave signal, when the motor is rotating at 33⅓ rpm and a 60 Hz sine wave signal when the motor is rotating at 45 rpm.

The signal from the generator is fed to an operational amplifier and then to an astable circuit which produces a rectangular waveform of 50% duty cycle. This frequency is compared with a reference frequency generated from a crystal oscillator in the following way.

The crystal oscillator frequency of 9.3312 MHz is divided first by four and then by 972. The resulting frequency is then divided by either 27 (for 33⅓ rpm) or by 20 (for 45 rpm) and finally by a factor of two to produce the reference frequency of either 44.44 Hz or 60 Hz.

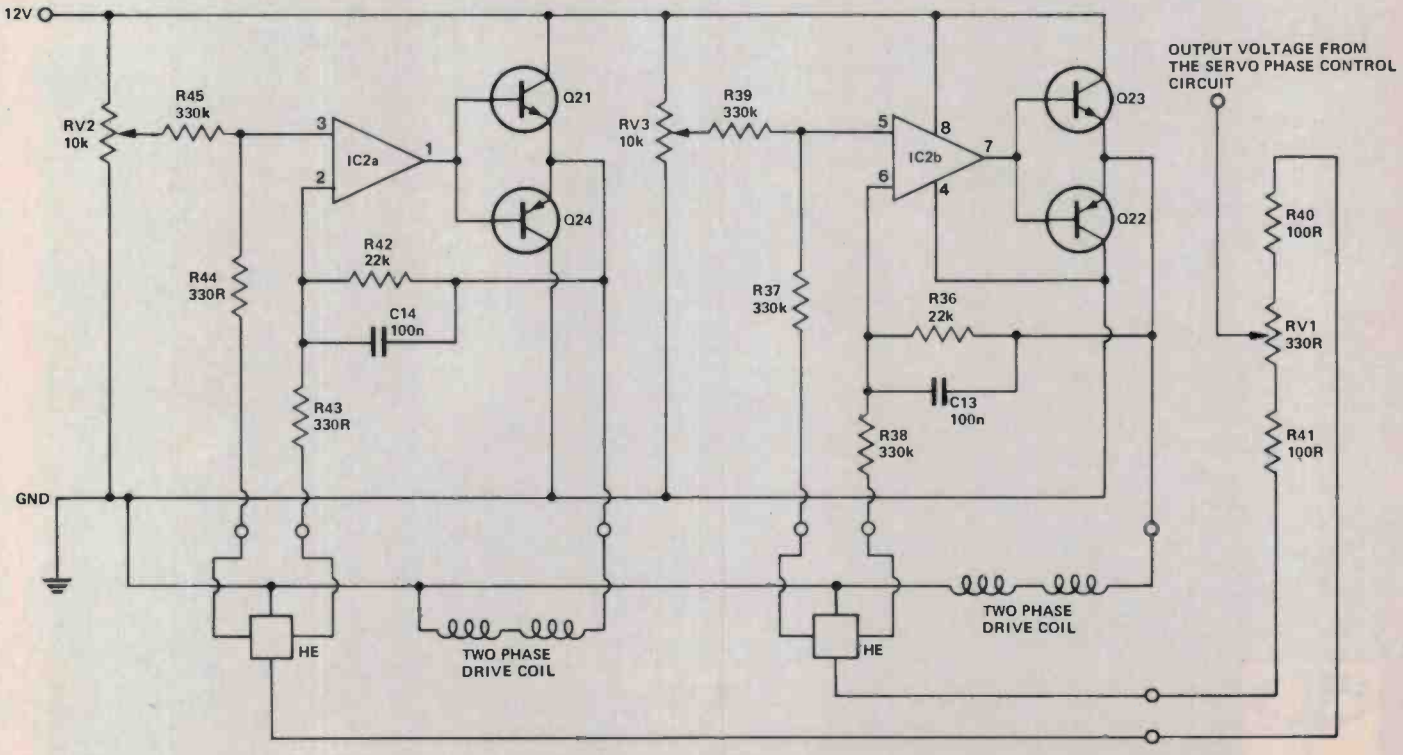
The Optonica RP-7100 turntable features a special 'Auto Programme Locating Device' (APLD).

The operation of the direct drive motor circuit with its Hall effect commutating devices is well illustrated in Figure 9. The outputs of each of the two Hall Effect cells (marked HE) are fed to the inputs of operational amplifiers. The output of each operational amplifier drives a pair of complementary transistors which in turn control the current in the motor drive coils. The Hall cells detect the position of the rotor magnets and cause the currents in the motor drive coils to be phased accordingly. In addition, the voltage applied across the Hall cells is controlled by the servo phase control circuits and alters the switching times of the motor drive coil current so that the motor rotates at the desired speed.

The automatic programme locate

— to page 128. ▶

Figure 9. Basic circuit diagram of the Sharp Optonica motor drive system.



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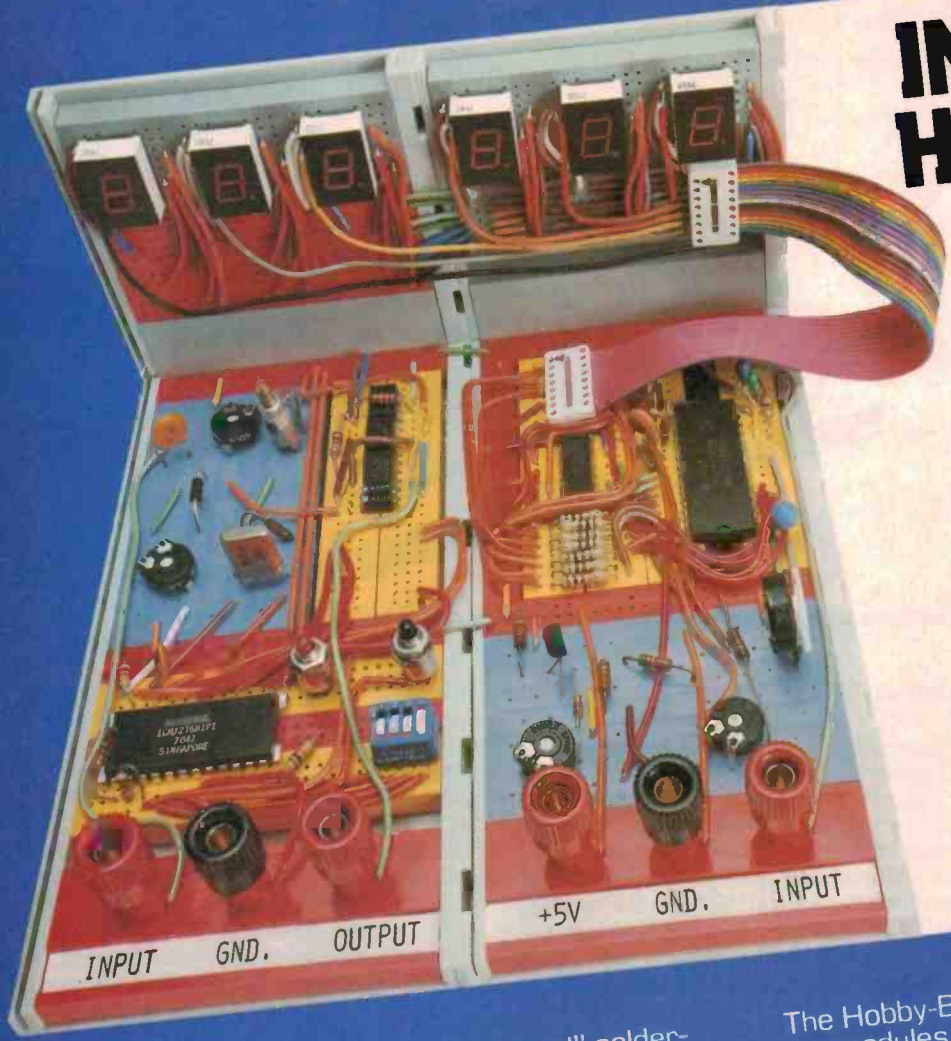

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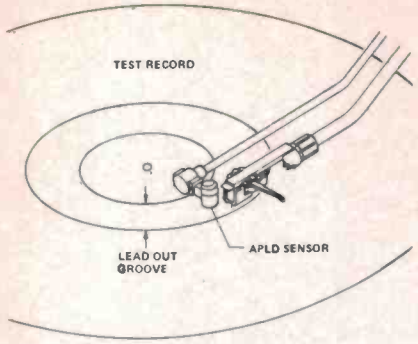
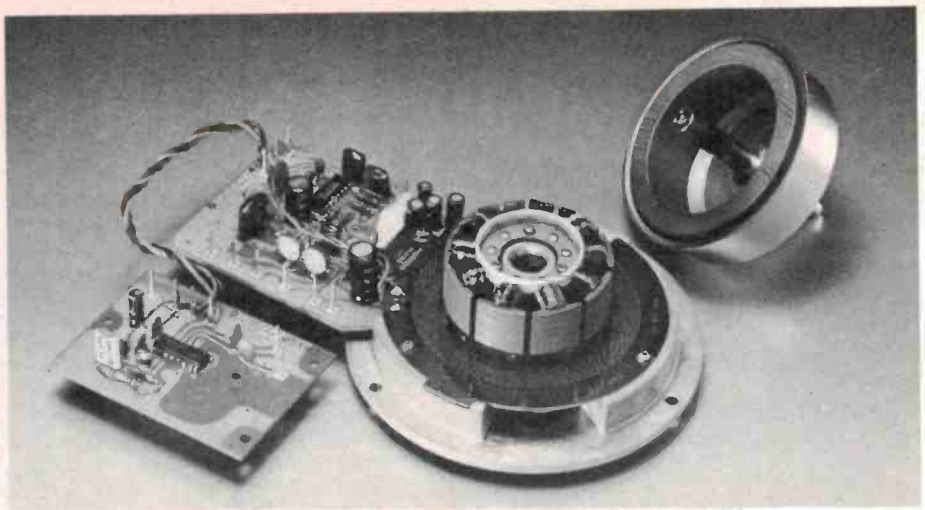
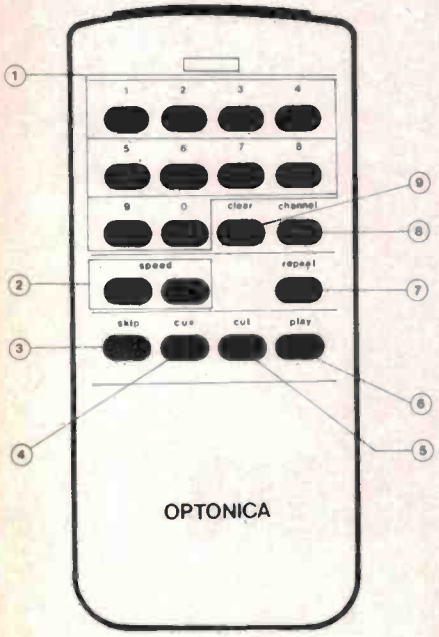


Figure 10. The Sharp Optonica 'APLD' sensor system is mounted on a separate arm adjacent to the tone arm.



The Hall Effect dc drive motor and control electronics from Pioneer's model PL-560 turntable.



1 APMS NUMBERED INPUT BUTTONS
2 TURNTABLE SPEED SELECTOR BUTTONS
3 SKIP BUTTON
4 CUEING BUTTON
5 CUT/CLEAR MEMORY BUTTON
6 PLAY START BUTTON
7 REPEAT PLAY BUTTON
8 CHANNEL BUTTON
9 CLEAR BUTTON

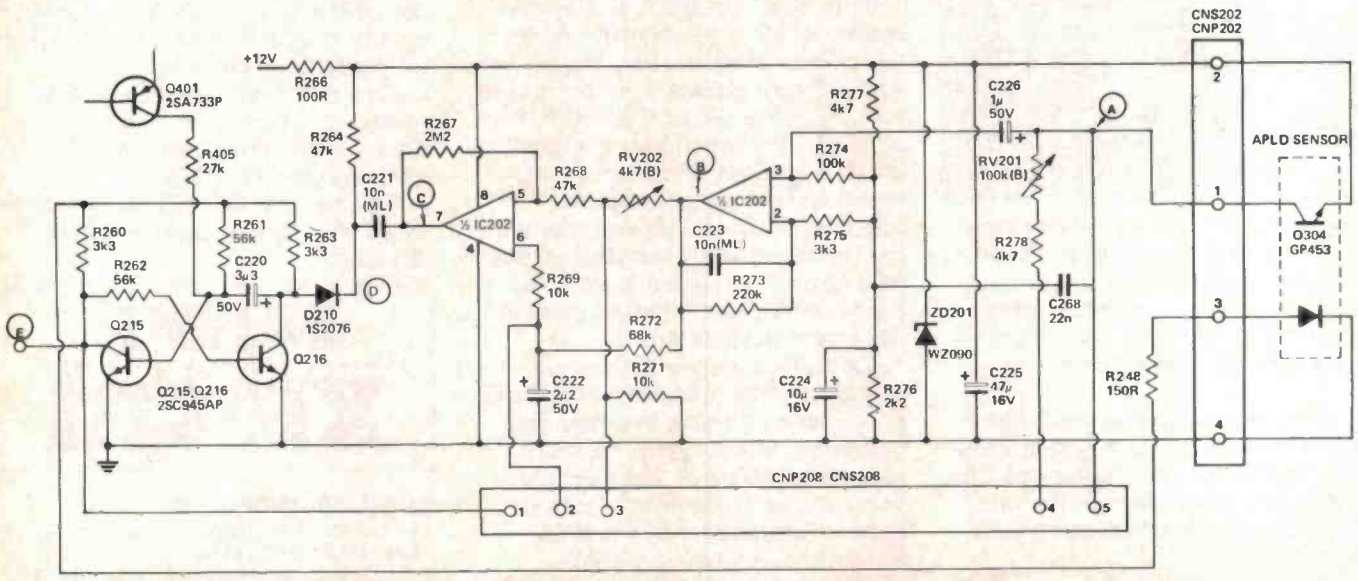
Figure 12. Configuration and functions of the remote control unit for the Sharp Optonica RP-9100 turntable.

device (APLD) is carried on an arm separate from the tone arm, as shown in Figure 10, so that it does not alter the stylus force. This device utilises the difference in the reflection factor for infra-red radiation of sound modulated grooves and unmodulated grooves to detect the spaces between parts of the recorded material. When using the RP-7100, the user can push any APLD button, from one to seven, to select, for example, any song on a record. In the case of the RP-9100, the unit can be programmed to play up to 10 songs (with any specific songs repeated, if desired) in any order and to repeat the entire programme up to four times or indefinitely. A digital indicator displays the number of songs remaining.

The circuitry of the APLD sensor is shown in Figure 11. When the sensor reaches an unmodulated groove, positive-going pulses of some 20 to 40 mV in amplitude appear at the collector of the sensor device. This is amplified to a level of 1 V to 3 V by the operational amplifier whose output is at B. The second amplifier shapes the pulses into square waves of 7 V amplitude at point C, after which they are differentiated by C221 and R264 to form sharp pulses which are used to trigger the monostable circuit of Q215 and Q216. The output pulses from this circuit are of constant amplitude and duration and are fed to the complex logic circuitry of this record player.

The remote control unit of the RP-9100 turntable is shown in Figure 12. The keys provide for the 10 song locations of the microprocessor controlled automatic programmable music selector to be entered into the turntable memory by means of infra-red radiation carrying the data from the remote control unit to the turntable itself. Speed selector buttons and other controls are also provided. – *to page 130.* ▶

Figure 11. Basic circuitry of the Sharp Optonica APLD sensor system discussed here.



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– from p. 128.

Technics turntables

Technics is an associate of the well-known Matsushita Electric Company of Japan. They produce a wide range of turntables from the SL-200 and SL-B2 semi-automatic servo types to the SL-Q2 fixed speed, quartz locked, the SL-5200 fixed speed with quartz lock or manually variable speed without quartz locking and the SL-150Mk2, the SL-1300Mk2, the SL-1400Mk2 and the SL-1500Mk2 which all offer +/−9.9% variation of speed with quartz locking and digital display of speed. Perhaps most remarkable is the SL10 which has tangential tracking and is extremely compact.

The SL10 has a record clamp built-in and the tracking force is applied by means of a fine spring, so this remarkable turntable can be used in any position, including on its side or even inverted! The arm runs along a pair of guide bars and is driven by a coreless electric motor. The motor is controlled by an optical system mounted in the shorter of the two arms near the tip of the stylus.

The SL10 will accept only the special moving coil cartridge with which it is supplied. The low output cartridge can be used with a step-up head amplifier which may be switched in and out of the circuit. However, this turntable is most remarkable for its portability.

Revox turntables

The Revox Company (based in Switzerland) offer two turntables which both have the same type of tangential tracking system. The B790 has been available for over a year and incorporates a quartz controlled direct-drive system with a manual speed variation facility of +/−7% and digital indication of the speed to two decimal places by a four digit display. The B795 is a more economical turntable which has the same general performance, but without the speed variation facility and without the digital display. The stopping time of the platter is longer with the B795 than with the B790.

A servo-controlled motor is employed to achieve tracking together with a cord and pulley system which move a headset along horizontal parallel bars. The whole of the tracking system assembly is mounted in a rectangular shaped housing of substantial size on the right hand side of the turntable. This housing gives these turntables an unusual appearance and it can be swung forwards through 90° (or even through 180° to the right) when changing records. The shuttle carrying the cartridge moves in a straight line from the right hand edge of the record towards the centre during the playing time. The shuttle is driven by two horizontal pulleys, one at each end of the parallel bars, and a nylon cord.

Technics' SL-1500Mk2 turntable features direct drive, which the company pioneered, digital speed display and quartz-locked speed variation of nearly +/− 10%.

An infra-red sensor containing a diode emitter and a pair of photodiodes in a symmetrical circuit is used to detect any tracking error. Any displacement of the head from the tangential position causes a movement of the slot through which the infra-red beam passes and the photodiodes become unequally energised. This operates the control circuit and a small motor operates one of the pulleys so that the nylon cord moves the shuttle just far enough to restore the symmetry of the circuit. The sensing circuit has an accuracy such that the lateral tracking error cannot exceed half a degree.

The shuttle has some free vertical movement to enable the cartridge to be raised and lowered. A solenoid-controlled lifting arm can hold the cartridge clear of the record or allow it to descend. The damping mechanism ensures that the stylus descends onto the record slowly and a muting circuit ensures that there is no audio output until the cartridge has been completely

– to page 132.▶

The Revox B790 turntable is another tangential tracking unit, shown here with the tangential tracking assembly in the playing position.

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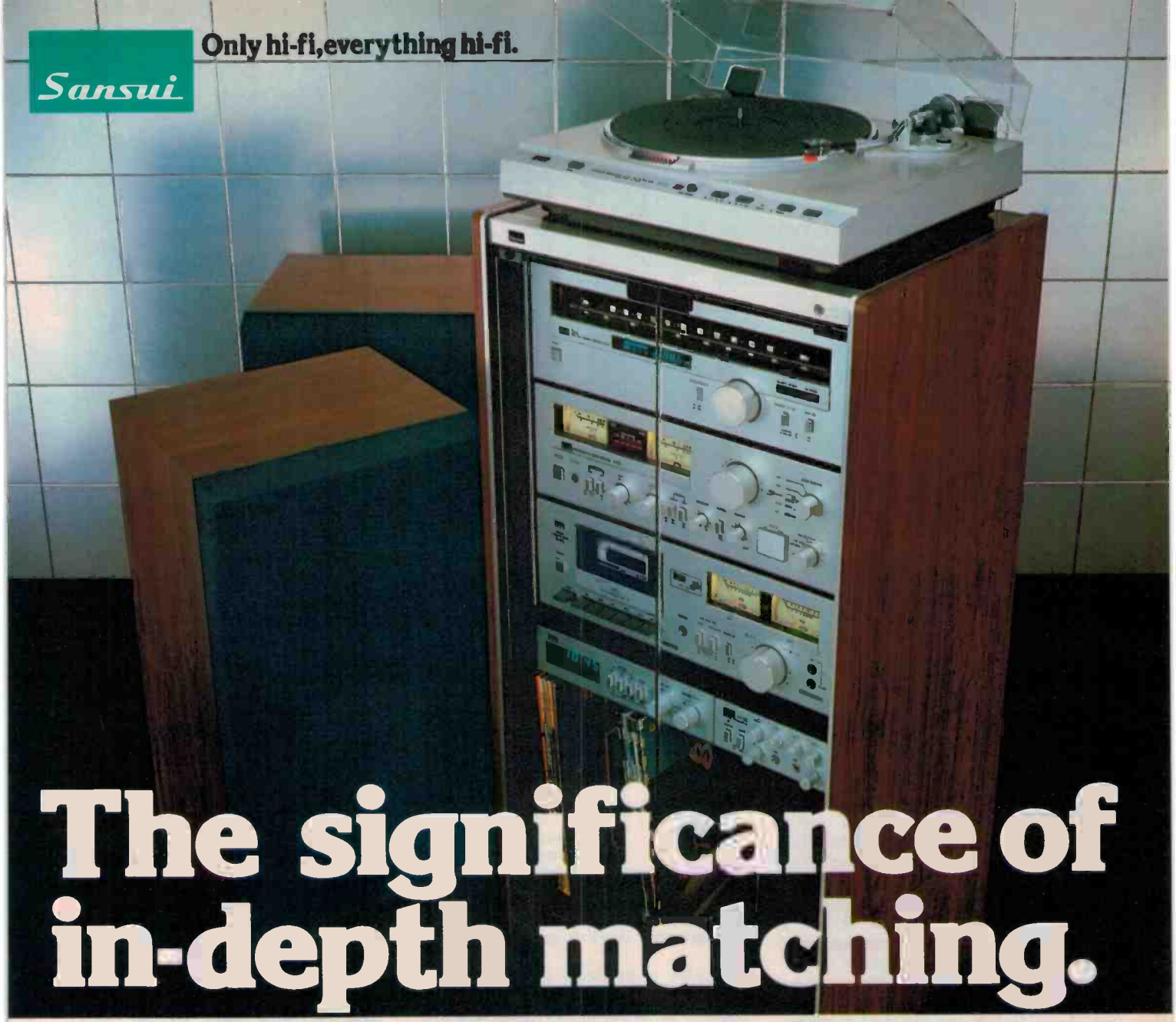

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– from p.130.

lowered onto the record. The amount of movement is limited so that it is impossible for the stylus to touch the rubber mat on the platter if there is no record on the turntable.

Three touch switches on the left hand side of the B790 set the speed to 33⅓ or 45 rpm or to the variable speed which is controlled by a small thumbwheel. Two of the buttons on the right hand side control the rapid movement of the shuttle inwards or outwards whilst the pick up is raised. When the third button on the right hand side is touched the cartridge will descend, whilst pressing this button again will raise the cartridge.

When a 300 mm diameter record is to be played, the cartridge will automatically position itself at the start of the record, but the position of the cartridge must be adjusted manually for playing records of a smaller diameter. The shuttle control buttons will move the stylus by about one groove when touched momentarily, but when a button is held down, the stylus takes some seconds to move from one end of the track to the other. At the end of a record, the widely spaced groove near the centre moves the stylus so that the optical system produces a signal which causes the stylus to be lifted off the record and the shuttle is returned to its rest position.

A particular advantage of these turntables is that it is almost impossible to damage the stylus, even if over-enthusiastic children operate the equipment. Any slight movement of the carriage immediately causes the stylus to be lifted off the record; for example, if the carriage is swung out whilst a record is playing, the mechanism will lift the stylus extremely rapidly.

Wow and flutter of both Revox decks are quoted as being better than 0.05% weighted. Speed accuracy is +/−0.01% — more than adequate, although lower than that quoted for many quartz controlled decks. The length of the tone arm is only 15 mm and this minimises any problems with resonances.

Pioneer

The Pioneer Company of Japan's PL-L1000 turntable (reviewed Feb. '80 ETI) features tangential tracking using an ingenious linear motor to drive the arm. Two speeds are provided by a dc motor stabilised with a quartz oscillator, but no fine speed adjustment is possible. A small red lamp glows when the speed has become locked to the quartz frequency standard.

Perhaps the most unusual feature of the PL-L1000 is the use of a linear motor to drive the tone-arm. Although the principle of the linear motor is not

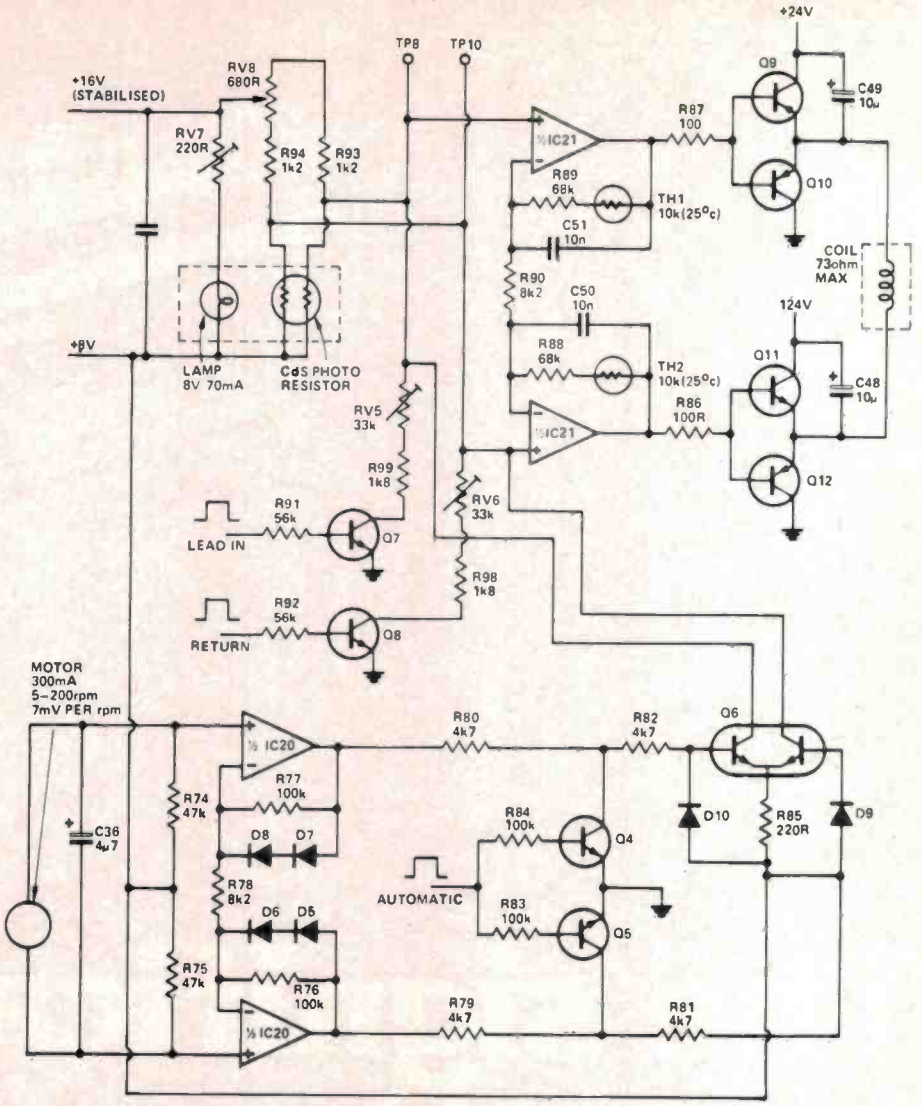


Figure 13. The Pioneer PL-L1000 turntable has a tangential tracking tone arm employing an optical tracking system. This is the optical sensor circuitry.

new, this is probably the first time a linear motor has been used in the hi-fi field. The uses of linear motors are few, although there is interest in their possible use for high speed rail transport; in the Pioneer deck the stylus must be transported along a rail. The coil of the motor is linear and magnets placed on either side of this coil move in a straight line under the influence of the magnetic fields.

The PL-L1000 employs an optical tracking sensor for its tangential tracking system which is sensitive to 0.2 degrees of deflection. See Figure 13. When the stylus is positioned exactly at right angles to the carrier, the beam from a miniature lamp illuminates both sections of a twin photoresistor which, together with R93, R94 and RV8, forms a Wheatstone bridge, RV8 being adjusted so that there is no potential difference between TP8 and TP10 when the stylus is accurately located at right angles to the stylus carrier.

If the stylus happens to move either to the right or to the left, the amount of light striking each section of the photoresistive cell will change so that the bridge becomes unbalanced and a potential difference appears between TP8 and TP10. This potential is amplified by the differential amplifier stage comprising the two parts of IC21 which drive the twin complementary output stages Q9 to Q12 inclusive. These output stages form a push-pull bridge circuit which can drive a current of up to 300 mA in either direction through the 73 ohm motor coil. The tracking motor moves to return the bridge back to the balanced state, whereupon the potential at TP8 becomes equal to that at TP10.

When a record is about to be played, a current is fed to the base of Q7; the collector of this transistor therefore takes a current through R99, RV5 and R93 and the potential drop across R93 causes the stylus carrier to move to the

left so that the stylus is above the record. The speed of movement is controlled by the setting of RV5. Similarly, after a record has been played, Q8 is made to conduct so that the potential difference between TP8 and TP10 causes the stylus carrier to return to its rest position on the right hand side at a rate determined by the setting of RV6.

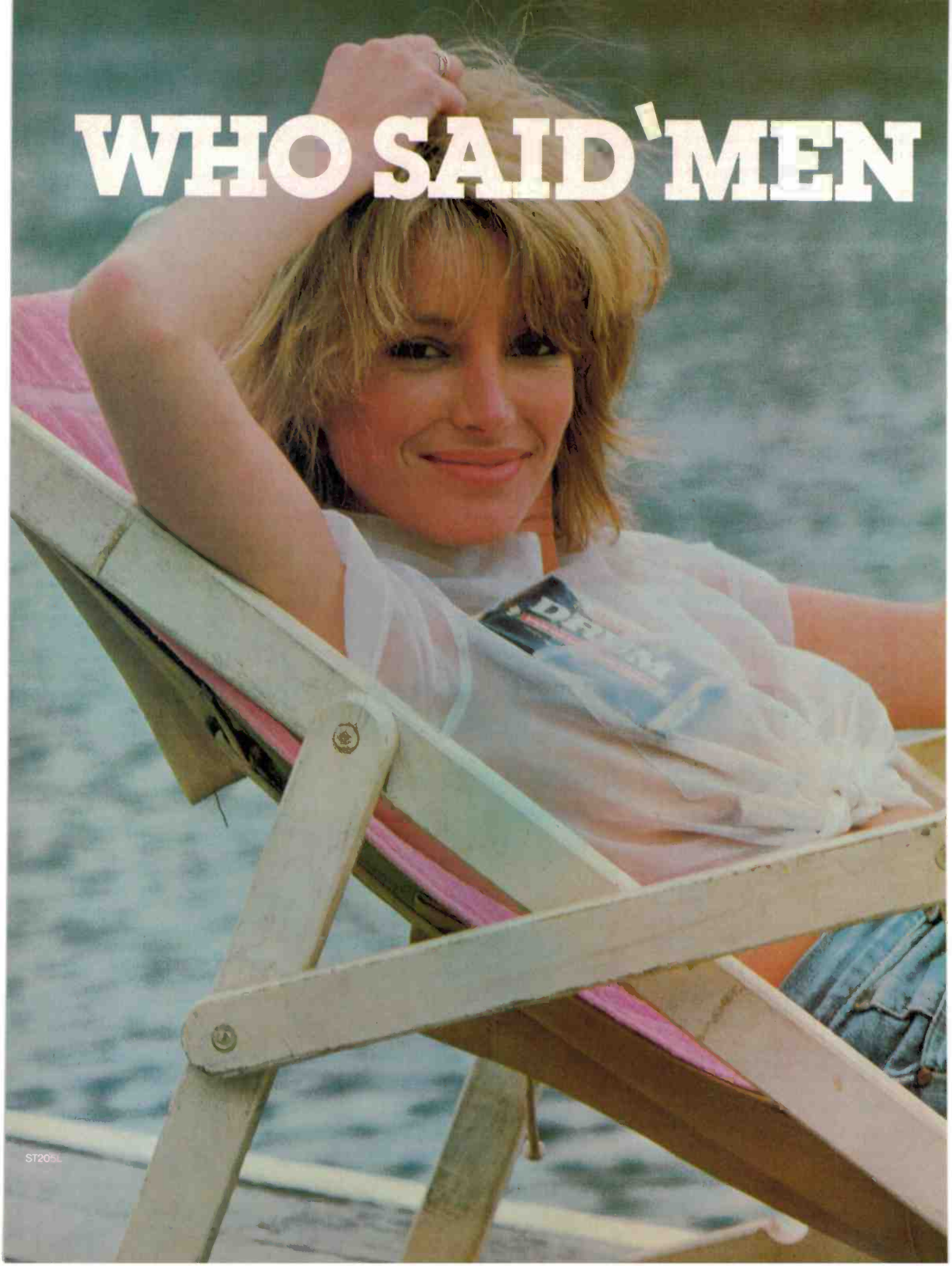
During the automatic modes (lead-in, return or repeat), Q4 and Q5 are turned on and the resulting currents flowing through D9 and D10 turn Q6 off so that the groove locating function is inhibited. During manual operation, the differential amplifier IC20 is activated and this causes one side of Q6 to be turned on, the side being determined by the rotation direction of the dial. A voltage drop therefore occurs across R93 or R94 which, after amplification, causes a current to be passed through the coil to move the stylus carrier. This linear motor system has the advantages of being gearless and without mechanical linkages, the tone arm running on rails along the rear of the deck. The equipment will operate only if the turntable is accurately levelled and a spirit level is provided for this purpose; any tilting will probably result in the stylus carrier moving along its rails. The tone arm is 190 mm long and (unlike most conventional decks) the equipment can accurately track records which are off-centred.

The Pioneer PL-L1000 features a tangential tracking tone arm driven by a unique linear motor system. It employs an optical tracking sensor to maintain the arm position to within 0.2° of deflection.

Pioneer's hanging rotor system (already mentioned) is employed. Wow and flutter figures of 0.025% and 0.013% WRMS (depending on the measurement technique) are quoted. Speed drift is less than 0.8 parts per million per hour and less than 0.3 parts per million per centigrade degree at 33⅓ rpm.

Conclusion

Modern electronic circuitry has enabled record decks to be made which offer a standard of performance and a level of automation which would have been out of the question just a few short years ago. ●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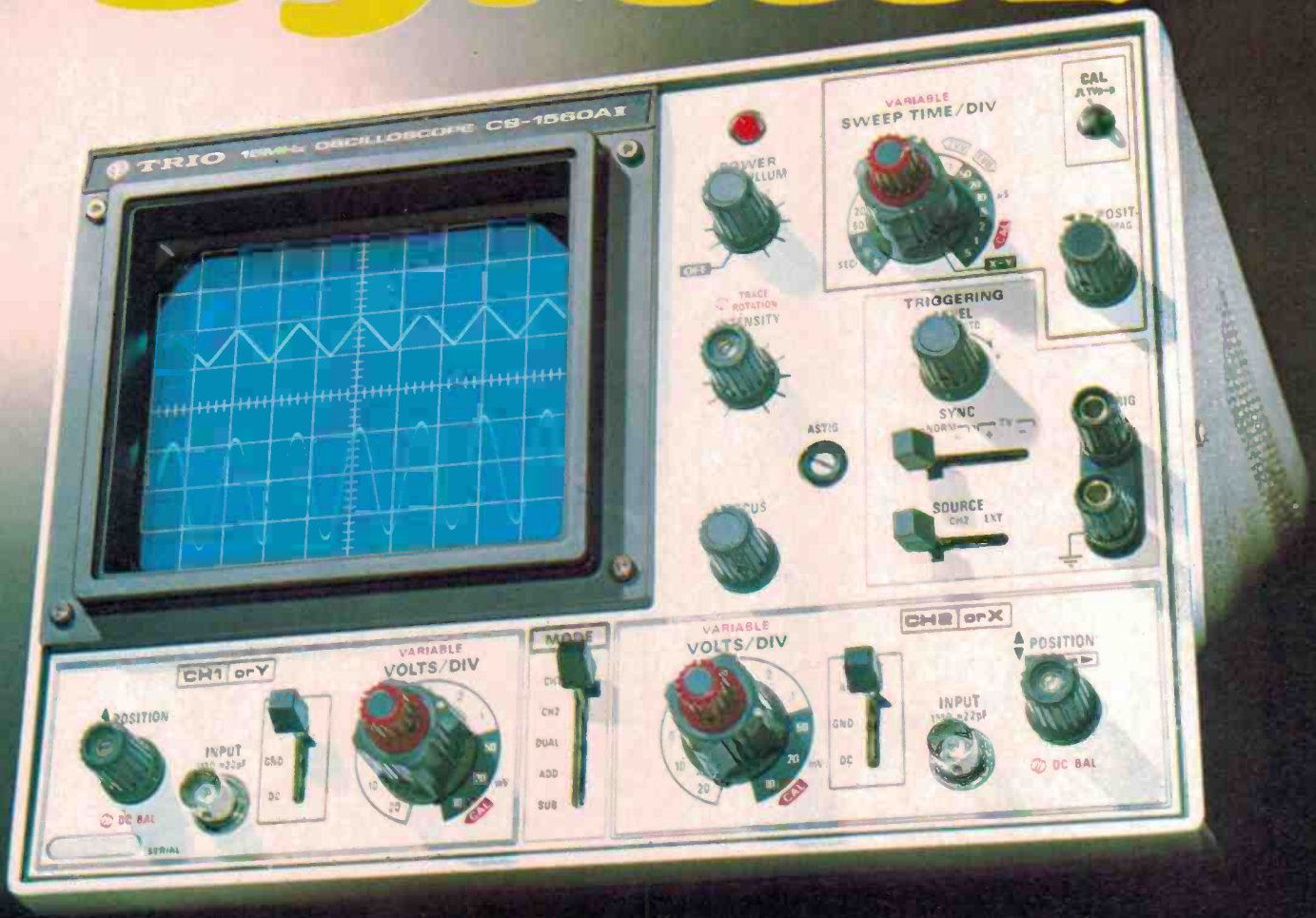

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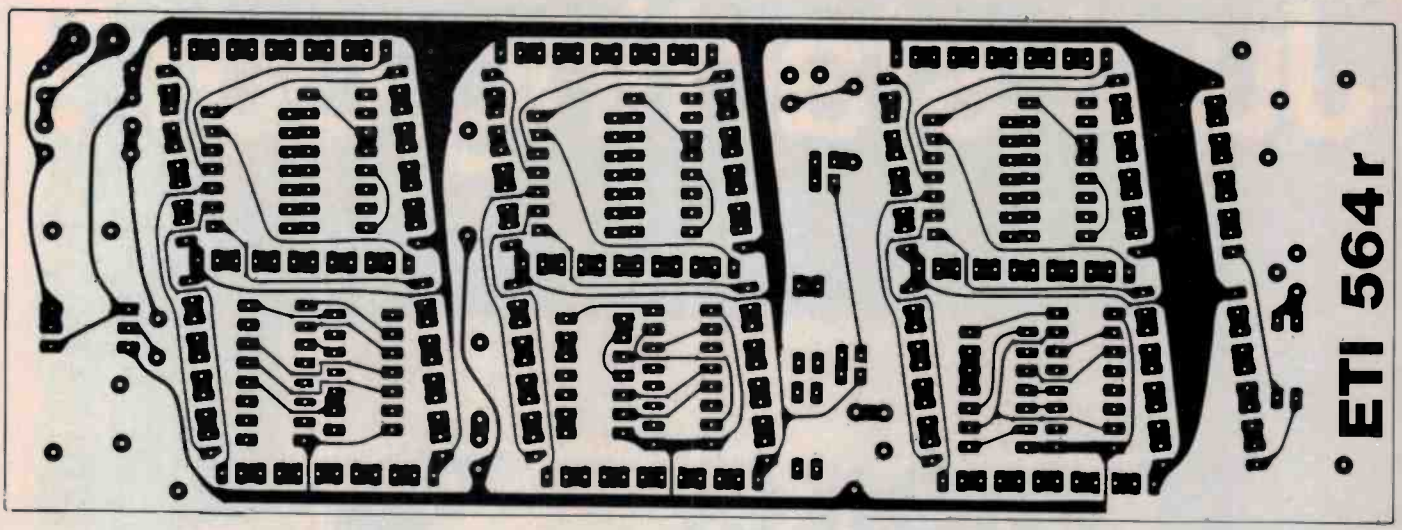

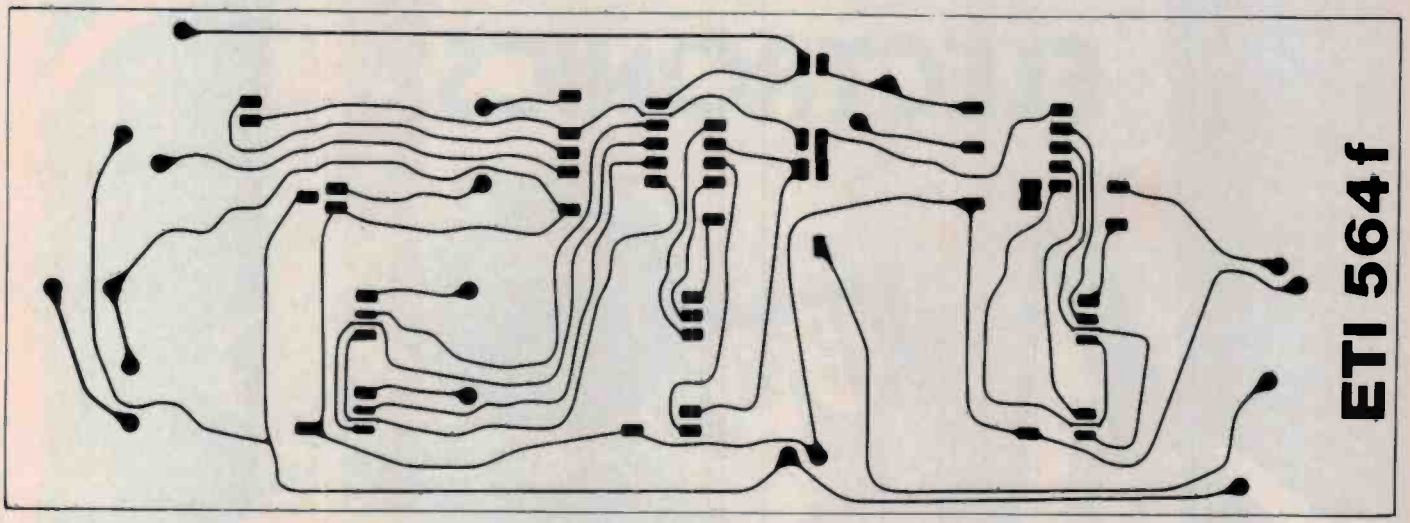

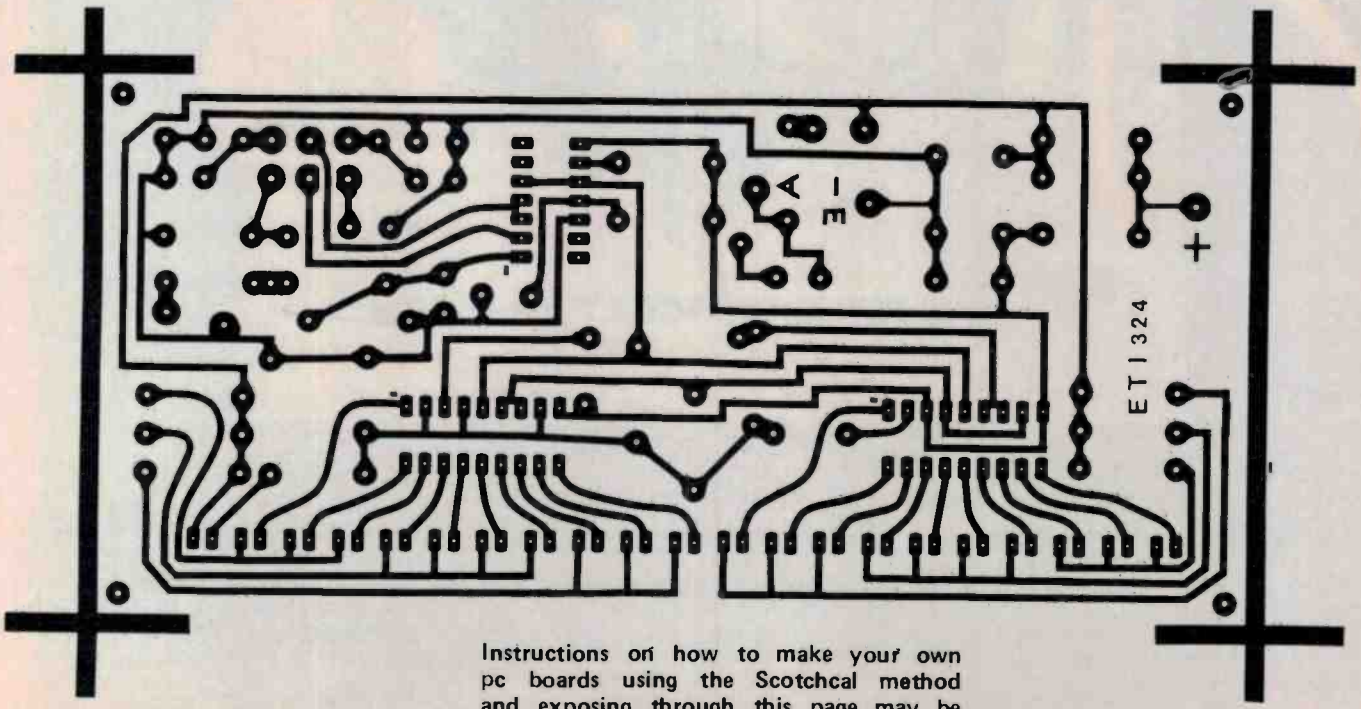

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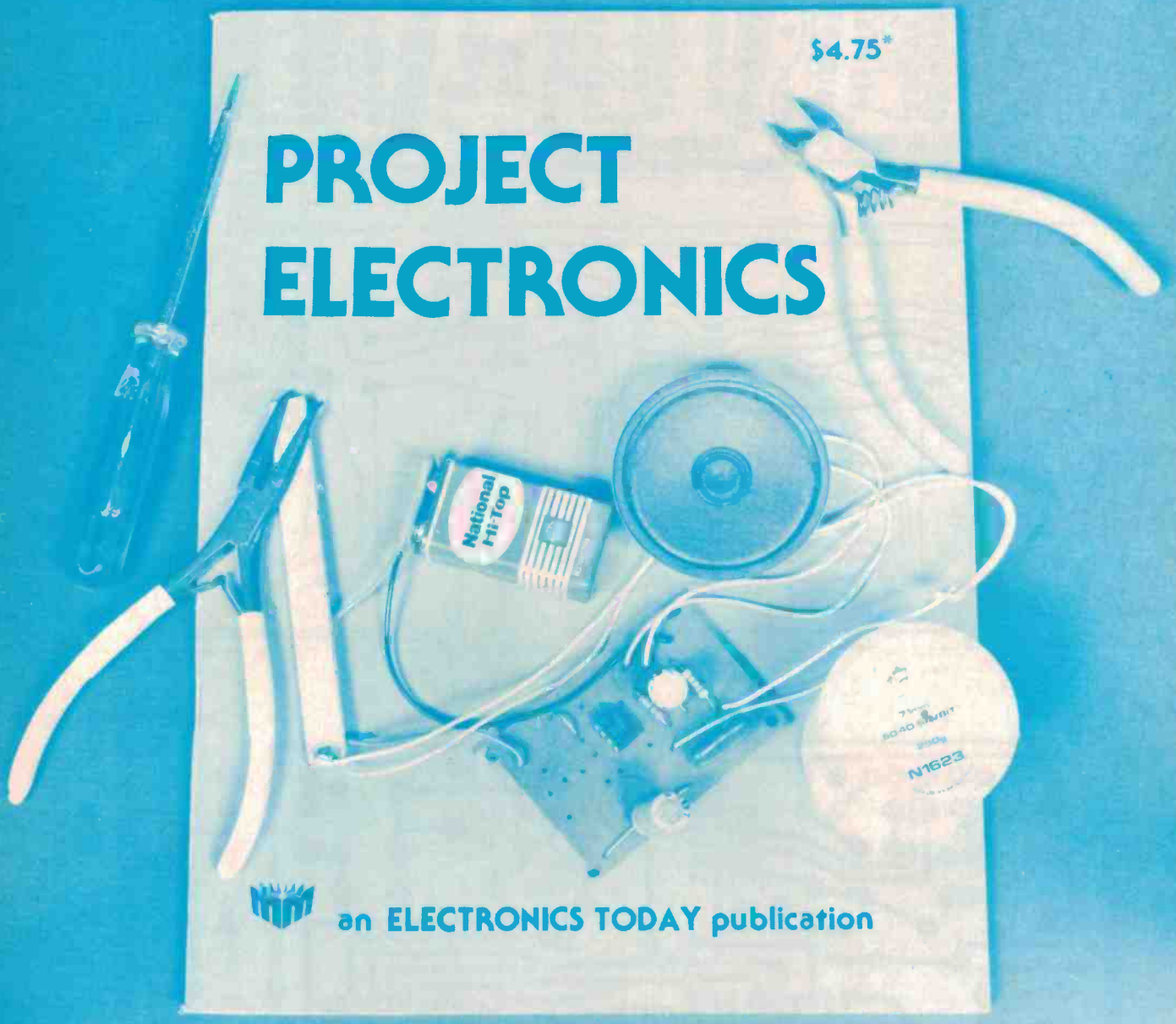

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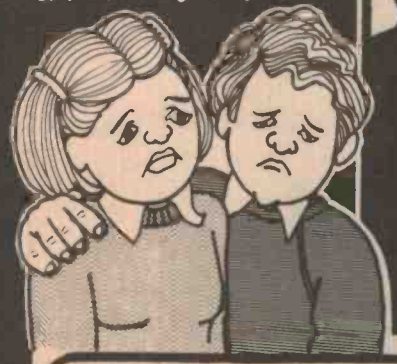

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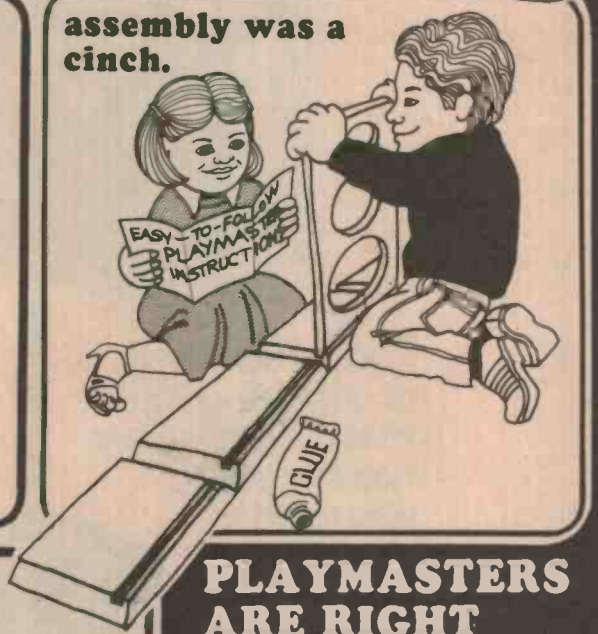

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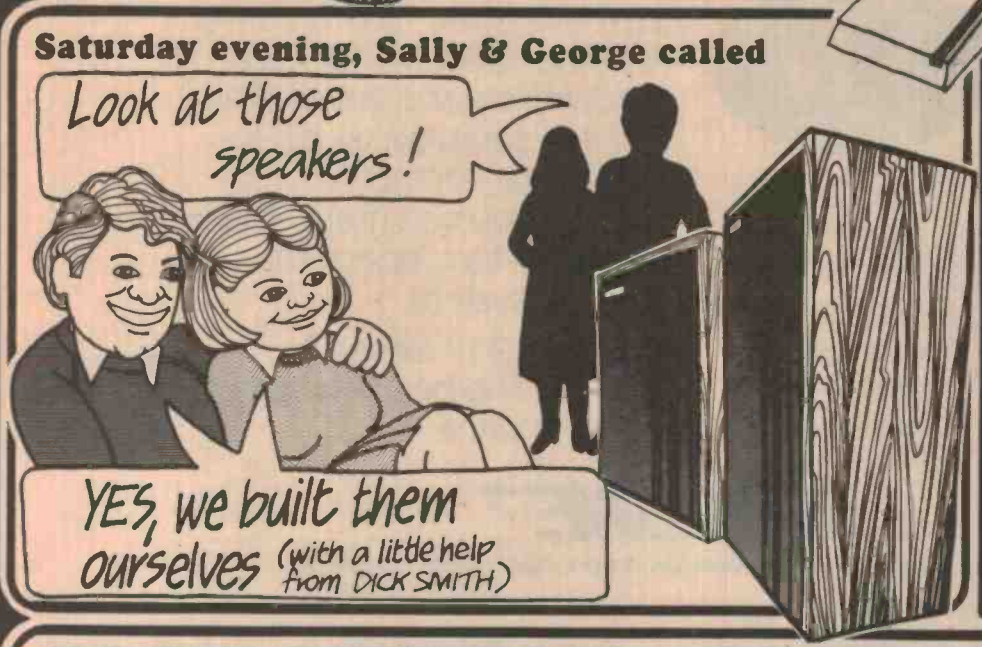

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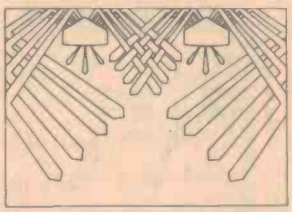

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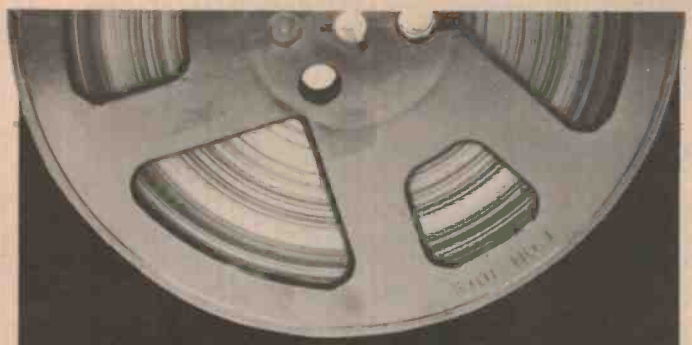

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* Adjustable tonearm height
* Cueing and Stand-by switch
* Wow and flutter of 0.018% Wrms (as measured by Denon with magnetic pulse wheel)

SPECIFICATIONS

Model DP-1200

Phono motor	
Drive system	Direct drive by AC servo motor
Speed control	Frequency detection servo system
Speed	33 1/3 rpm, 45 rpm
Speed adjustable range	over ±3%
S/N ratio	over 75 dB (DIN-B)
Starting time	less than 1.5 sec (33 1/3 rpm)
Turntable	Aluminum alloy diecast, 30 cm diam.
Tonearm	
Type	Static balance type (automatic arm lifter)
Effective length	244 mm
Overhang	14 mm
Tracking error	less than 2.5°
Stylus pressure adjustable range	0 – 2.5 g
Acceptable weight of cartridge	5 g – 11 g
Height adjustment range	39 – 43 mm
Cueing	oil damped system
General	
Power consumption	17W
Dimensions	485(W) x 163(H) x 396(D) mm
Weight	Aprox. 11 kg

DENON PROFESSIONAL AUDIO BRAND

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Hi-Fi Audio Equipment
AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED
554 Parramatta Road, Ashfield, NSW 2131 Phone 797 5757

Rotel RX1000 AM/FM receiver

"... a cleverly designed receiver. Whilst one might think from its price that performance would have suffered because of the innovatory design, this is not the case."

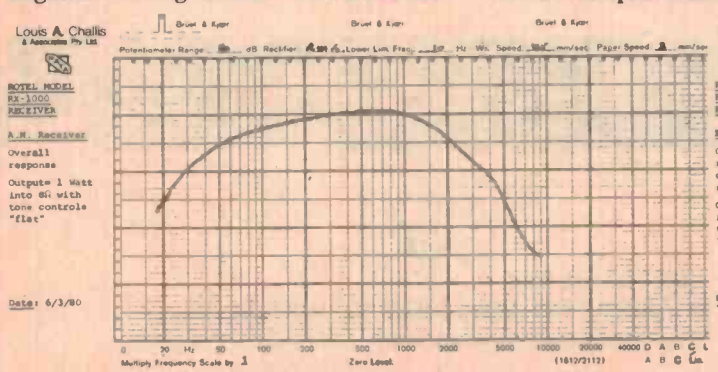
WHILST MANY of the receivers that we have reviewed in recent years have been bordering on the esoteric it is nice to be presented with a receiver where the features and construction tend to be at the other end of the spectrum. The Rotel RX1000 is a small and particularly neat receiver. The obvious underlying aim of the designers has been to achieve a unit offering the major features with a classical simplicity which is matched by the functional utility of the design. The nicest feature of the RX1000 is the front escutcheon. This features a painted, dark grey panel with white, silk screened lettering and neatly functional controls. As well as the name on the top line of lettering, the ubiquitous letters PLL and MPX, standing for phase locked loop and multiplex, stand out clearly.

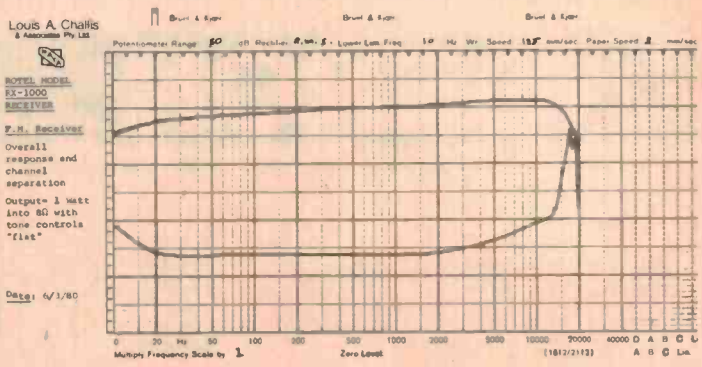
Description

The slide rule dial neatly shows station frequencies to a 1 MHz resolution on the FM band, and a lesser definition on the AM section. It also contains three other indicators in the form of a five level signal strength meter utilising bar-shaped light emitting diodes, a three-segment tuning "meter" with a red bar either side of a central green bar to indicate correct station tuning and a single red bar to indicate that stereo FM has been selected. To the right of the slide rule dial is a modestly sized tuning knob.

The bottom row of controls feature, from left to right, a power switch, a standard tip-ring-and-sleeve headphone socket, two push buttons for selecting speaker system A and/or B. Next to these are three neatly shaped controls, two of which are for bass and treble. These each provide +/− 10 dB of boost and cut at 50 Hz and 15 kHz respectively. The balance control which has a matching format provides better than +/− 10 dB offset. These three controls each feature a neat taper waisted end which is both attractive and very functional. The volume control, which is centrally located and slightly larger than the bass, treble and balance controls, also features mechanical indents coupled to a normal pair of coaxial attenuator pots. To the right of the volume control there are four push buttons for loudness, on/off, a subsonic filter on/off, a stereo mono mode switch and FM muting on/off switch. The function switch provides for selection of AM, FM, phono and auxiliary inputs whilst the final two switches on the front panel under the tuning control are for selection of tape recorders 1 and 2 which, when both switched, provide a facility for dubbing from tape recorder 1 through to tape recorder 2.

The rear of the receiver is functional but obviously not as attractive as the front! The first feature which catches one's eye is the ferrite loopstick antenna for AM reception. This consists of a space age type moulding featuring a ball socket connection on the back of the receiver. This allows for a wide range of adjustments without that unfinished look with dangling wires which have been a feature of most other similar loopstick antennas in the past. As well as a ground socket and a single pair of phono inputs for moving magnetic cartridge and auxiliary inputs, the tape connections have been simplified so that tape recorder 1 has normal coaxial input and output sockets whilst tape recorder 2 utilises a single DIN socket. The antenna connections are made by means of knurled terminals on an insulated escutcheon whilst the speaker connections are by neat but effective spring-loaded terminals into which one





inserts the bared wire ends. The normal American style switched and unswitched power sockets which have been built into the unit have been carefully covered with aluminium plates. Unlike many competitive units available at the moment, the chassis features an all galvanised steel construction which is solidly made. This is matched by the slotted perforated steel top cover which features a practical plastic finished grey exterior. The inside of the unit is in some respects more interesting than the outside. Rotel have used what can only be described as an "avant garde" approach to simplify the constructional techniques and keep costs down. The first feature which caught our eye was the use of a single, centrally located heatsink with both the main power amplification stages incorporated in one large scale integrated circuit clamped on to it. The associated printed circuit card merely contains the power supply, mains fuses, rectifier and a voltage regulator. This is neat, and as our measurements showed, subsequently quite effective. As a result of this simplification it has become possible to place the phono preamplifier stage right at the input terminals. This reduces hum pick up and a number of other possible problems. The largest printed circuit on the board, one of six, is the FM/AM tuner card. This has no RF stage for the AM but does have an RF stage for the FM. Whilst the phono preamplifier uses integrated circuit modules the tuner uses transistors plus two, dual integrated circuits both of which are in the FM, IF section.

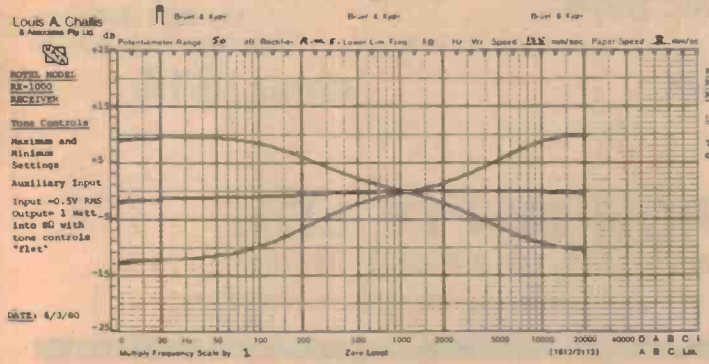
The other three printed circuits are connected to the front panel. One is used for the speaker switching and headphone amplifier; the second is a small satellite board to feed the light emitting diodes of the signal strength meter, tuning meter and FM stereo indication, whilst the third provides the circuitry for the bass, treble and volume control as well as interconnections for loudness, sub-sonic filter and mode switching. The internal wiring is conventional and the unit is designed for easy assembly and repair should this prove necessary.

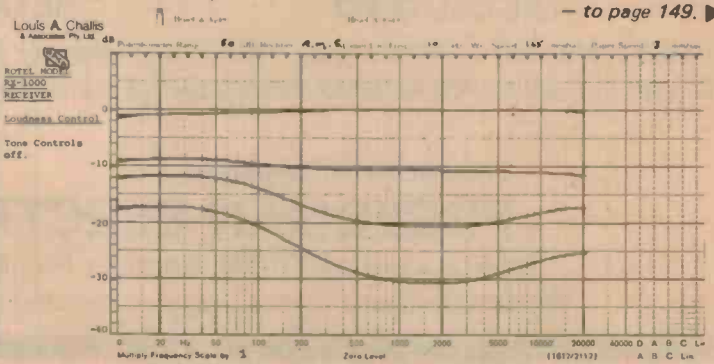
On test

The objective testing of the unit showed it to offer excellent performance in most of the key regions. The frequency response extends from 4.5 Hz to 57 kHz +/− 3 dB and the effect of the large scale integrated circuit power amplifier stage tends to show up in terms of a slight but inconsequential droop in the low frequency response of the amplifer. Harmonic distortion figures are slightly higher than claimed in the specification but are still quite acceptable with a maximum of 0.11% at 35 W output into 8 ohms.

The distortion figures at the lower power levels are somewhat better with a maximum of only 0.042%. The transient intermodulation distortion is very slightly higher than other top line amplifiers and receivers but at 0.19% is still very acceptable. By keeping the phono and auxiliary input preamplifers at the input terminals the hum and noise levels in terms of both the un-

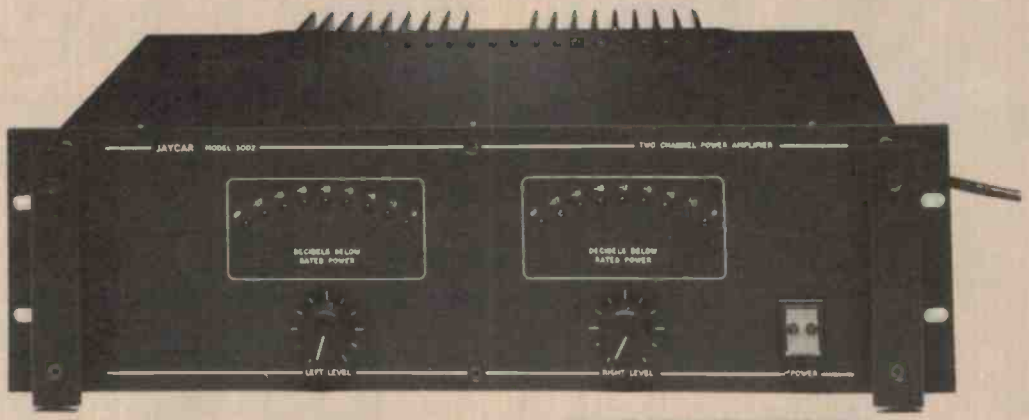
— to page 149. ▶





PROFESSIONAL AUDIO EQUIPMENT

MODEL 3002 — 2 CHANNEL POWER AMPLIFIER



FEATURES

- 300 Watts per channel.
- Massive rear mounted heatsinks.
- Multiple speaker protection circuits.
- Peak output power meters.
- Constructed to withstand the tortures of 'On the road' use.
- Standard 19" rack mounting.
- Separate power supplies for each channel.
- Dual RCA input sockets to allow bridging to other amplifiers.
- Equally suited to Hi Fi use or P.A./Disco situations.

BRIEF SPECIFICATIONS

Output Power — 300 watts/channel into 8 ohms.
200 watts/channel into 4 ohms.
Frequency Response — 20Hz to 20kHz ±0.5dB.
Hum and Noise — 105dB below rated output.
Harmonic Distortion — Less than 0.05% to 80 watts.
Less than 0.15% at rated power.
Input Sensitivity — 1.0 volts for rated output.
Dimensions — 482mm x 133mm x 340mm.
Weight — 20 kgs.

MODEL 2801 — ⅓OCTAVE EQUALISER

The 2801 is a single channel graphic equaliser that divides the audio spectrum into twenty-eight one third octave bands. Each frequency segment is controlled by a slider that provides up to ± 10 dB of adjustment in standard ISO steps.
The 2810 was designed primarily to compensate for any deficiencies in the linearity of speaker systems, acoustic peculiarities of the hall or listening room, and inadequacies of program source quality. In P.A. application the equaliser may be used to improve sound quality and increase intelligibility by attentuating problem frequencies that cause ringing, boominess, or other disruptive resonances that occur in acoustically difficult rooms. The 2801 allows sound systems to be "tuned" according to the special acoustics of a room, to maximise output and minimise feedback. As a creative tool in sound recording or re-recording the 2801 allows complete freedom in contouring response over the complete audio spectrum from 31.5 Hz to 16 KHz.

MODEL 2021 — 2 CHANNEL EQUALISER

The 2021 is a two channel graphic equaliser featuring ten adjustable controls on octave centre frequencies (independent for each channel). Each control provides up to ± 14dB of adjustment. Each channel is also equipped with a level match control giving an overall gain of adjustment of ± 14dB.

The functional versatility of the 2021 equaliser is unsurpassed. Eight modes of operation are available from the push button switches on the front panel.

Included amongst these are the ability to equalise both recording and playback when dubbing tapes.

The 2021 has been designed to be compatible with all commercially available equipment and is ideal for use in a Hi Fi system or P.A. system.

For further information, please send a 35c stamp for full specification sheets, or call at our showroom for a demonstration.

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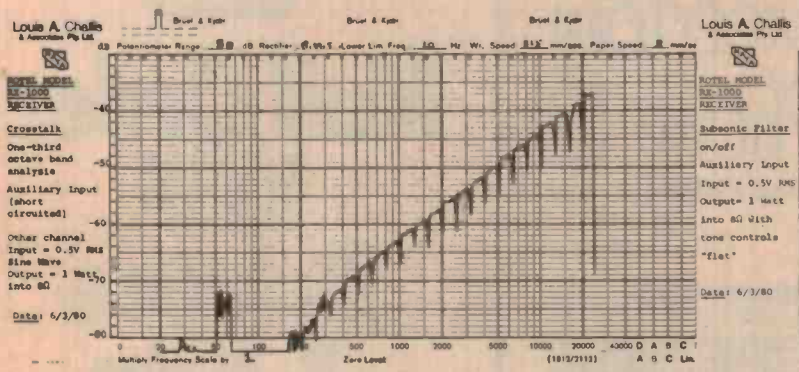
the Australian magazine dedicated to the art and craft of sound

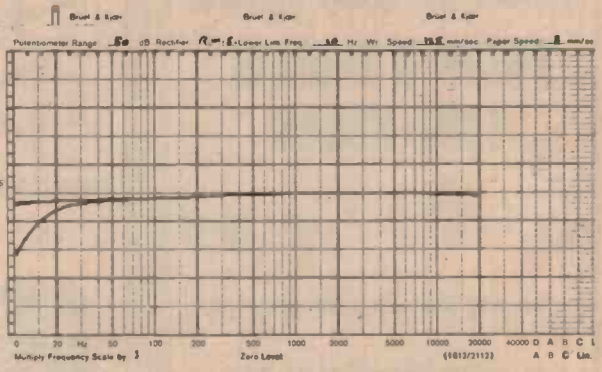
Sonics is a magazine for everyone who has an interest or involvement in music or musical electronics. Published quarterly, in March, June, September and December, each issue contains features, equipment reviews, construction projects, distributor and brand index and much, much more.

Sonics June 1980 line-up:

FEATURE – Ibanez MC-500 guitar reviewed
RIGS – Fleetwood Mac: the sound of the band
HOMEGROWN – Jands: how a small lighting company became one of Australia's biggest PA system operators.
SOUNDPROOF – Mediasound studios: improving the style of a sound reputation
HARDWARE – Yamaha's CS-20M and Roland's Promars Compuphonic synthesizers reviewed
PROFILE – Charles Fisher of Trafalgar studio
SHINE ON – Latest products and news in the lighting game
PLUS – extra features, a B.I.Y. project or two, and all the news, views and happenings in music and electronics. Rendezvous with Sonics in June!

Also available . . . . . Sonics 1980 Yearbook is Australia's first comprehensive directory of electronic musical equipment, featuring articles on keyboards, guitar pick-ups, amplifiers, speaker systems and microphones. The Yearbook is still available from most newsagents, or direct from Sonics, 4th Floor, 15 Boundary St, Rushcutters Bay, NSW 2011 – Price $4.35 plus 75 cents post and packaging.





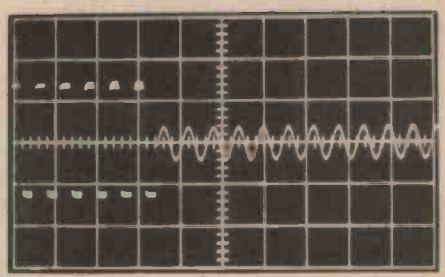
weighted and A-weighted levels are well controlled at −76 dB(A) for the auxiliary and —74 dB(A) for the phono input. The maximum power output at the clipping point is 52W and this provides a dynamic headroom of 1.8 dB.

It is interesting to note that this unit has been designed to comply with the American FCC Rule 15 and thus the power output claimed for the unit is quite modest compared with the peak power handling capacity of the amplifier's output stage.

The transient overload recovery test showed that the unit has quite stable performance and that the circuit designers have achieved a commendable performance.

The radio frequency stage of the receiver is just as good as the audio stage and the FM receiver has a frequency response extending from 18 Hz to 17 kHz, +/− 3 dB. The FM channel separation is a modest 25 dB from approximately 30 Hz to 2 kHz and this is only comparable with a modest phono cartridge. The FM distortion is commendably low and we were unable to fault the FM stage performance. The FM sensitivity is reasonably good being 2.3 microvolts for 6 dB signal-to-noise ration on mono, and 7.8 microvolts on stereo. The 50 dB quieting sensitivity on mono is 5.7 microvolts and 58 microvolts on stereo.

The AM tuner stage exhibits the same desultory frequency bandwidth which we have come to expect from virtually all the receivers on the market, extending from 45 Hz to 2.4 kHz + 0.5 dB, − 6 dB. The AM tuner sensitivity is modest and only suitable for local reception.



Transient overlaod recover test results for the RX1000. Overload of 10 dB re rated power into 8 ohm load, both channels driven. Overload duration: 20 ms; rep. rate: 512 ms.

— to page 151.

Louis A Challis and Associates Pty Ltd

MEASURED PERFORMANCE OF
ROTEL MODEL RX-1000 RECEIVER
SERIAL NO. 21062

FREQUENCY RESPONSE:
(-3dB re 1 watt, 0.5V Input to Aux.)
Tone Controls Centred
Left 4.5Hz to 57kHz
Right4.2Hz to 57kHz

SENSITIVITY:
(for 1 watt in 8Ω)

	Left	Right
Aux.	24mV	24mV
Tuner	-	-
Tape	24mV	24mV
Phono M/M	400uV	410uV
Overload M/M	255mV	250mV

INPUT IMPEDANCE:
(@ 1kHz)

	Left	Right
Aux.	47kΩ	47kΩ
Tuner	-	-
Tape	47kΩ	47kΩ
Phono	49kΩ	49kΩ

OUTPUT IMPEDANCE: = 107 milliohms (@ 1kHz)

TRANSIENT INTERMODULATION DISTORTION 0.19%
(3.15kHz square wave and 15kHz sine wave mixed 4:1 @ 30w equivalent output)

HARMONIC DISTORTION:

(A) (At rated power of 35 watts into 8Ω = 16.7 volts)

	100Hz	1kHz	6.3kHz
2nd	-63.7	-62.5	-62.5dB
3rd	-64.2	-61.9	-63.4dB
4th	-	-87.9	-88.8dB
5th	-84.5	-82.1	-
THD	0.09	0.11	0.1 %

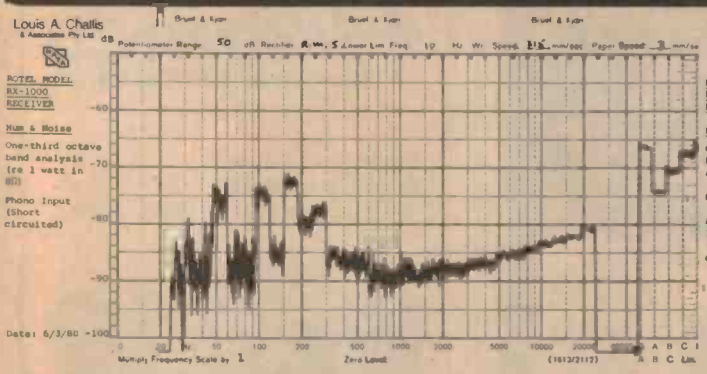
(B) (At 1 watt into 8Ω)

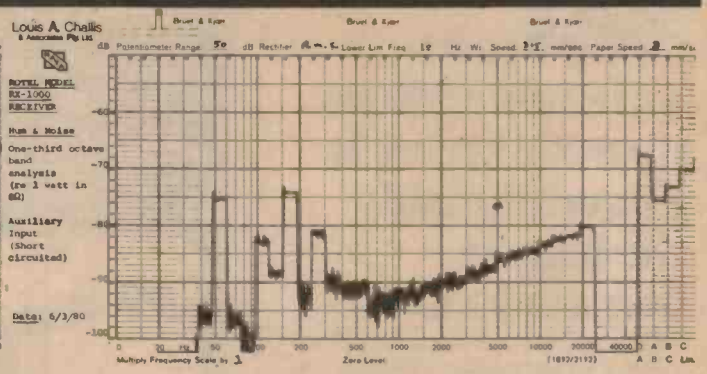
	100Hz	1kHz	6.3kHz
2nd	-69.2	-69.3	-68.8dB
3rd	-73.9	-72.8	- dB
4th	-90	-	- dB
5th	-87	-	- dB
THD	0.04	0.042	0.036 %

NOISE & HUM LEVELS:
(re 1 watt into 8Ω)
(with volume control set for 1 watt output with:
0.5V input (Aux.)
5 mV input (Phono M/M)

AUX.	-69dB(Lin)	-76dB(A)
PHONO M/M	-66dB(Lin)	-74dB(A)

MAXIMUM OUTPUT POWER AT CLIPPING POINT:
(1HF -A - 202)
(20mS burst repeated at 500mS intervals) 58 V P-P
= 52.6 watts
∴ Dynamic Headroom = 1.8 dB (re 35 watts)





Subjectively

Our subjective impressions of the unit are generally quite favourable. The receiver quite happily picks up FM signals in the absence of any aerial and with an aerial can provide very clean reception with no trace of distortion. The AM section of the receiver also provides clean reception, but this does depend on the signal and presence of interference. The audio stage *is a credit to the designers*. Even though it is based on integrated circuits, which the purists will tell you do not lead to quality amplification, this particular receiver tends to belie that statement. With inputs from a wide range of moving magnet cartridges the quality of sound is excellent and better than we would have expected.

Summary

The RX1000 is a cleverly designed receiver. Whilst one might think from its price that performance would have suffered because of the innovatory design, but this is not the case. I think that the designers have achieved above average results without sacrificing performance and most important with an appearance which is both simple and attractive. ●

ROTEL RX1000 AM/FM STEREO RECEIVER

Dimensions: 430 mm wide x 80 mm high x 290 mm deep
Net Weight: 7.7 kg Price: $359 rrp.
Manufactured by The Rotel Company Limited, Tokyo, Japan

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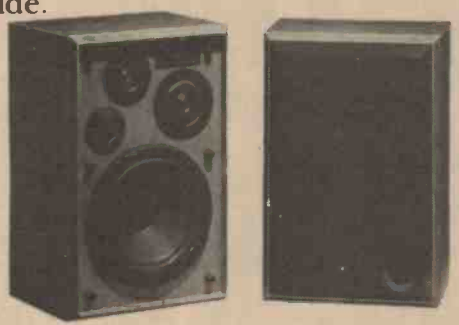

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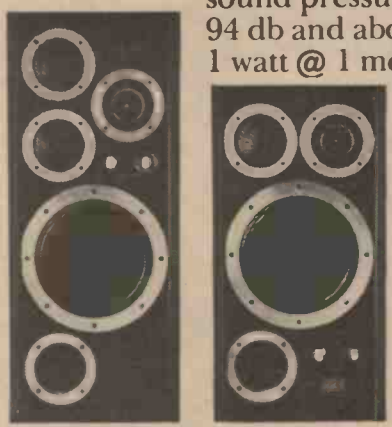

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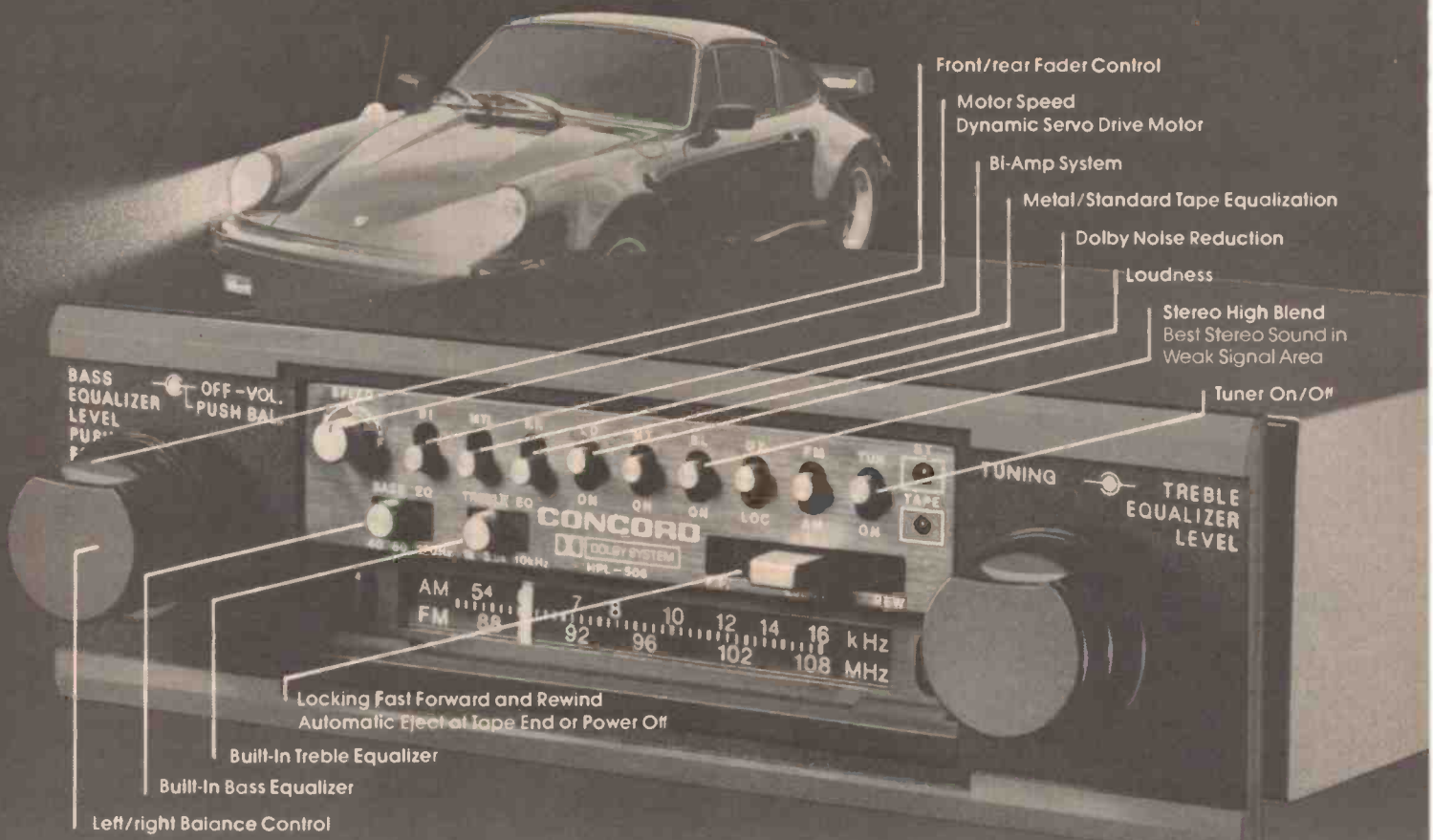

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The Concord range of auto high fidelity equipment includes hi-fi car stereo amplifier, 5-band graphic equaliser and a range of speakers.

CONCORD®

SPECIFICATIONS

● High fidelity power: 25 watts RMS per channel into 2 ohms (18 watts into 4 ohms) both channels driven 20-20000 Hz at less than 0.3% T.H.D. ● Tape signal-to-noise ratio (Dolby on) 56 dB ● Tape frequency response—standard tape 30-15000 Hz ± 2 dB—metal tape 30-20000 Hz ± 2 dB ● Tape Wow and Flutter—0.08% WRMS ● FM tuner sensitivity at 30 dB S/N—1.0 Microvolt (11.2 dBf) ● FM S/N ratio—68 dB ● AM tuner sensitivity—11 microvolts ● AM S/N ratio—50 dB

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Dick Smith model A2375 mini speakers

When space is limited, these compact little units could be just what you need. Louis Challis discusses their merits and deficiencies.

WHEN CAR STEREO started to become a big market in the U.S.A. a number of speaker manufacturers created a new concept. They confounded the theoreticians (who said it couldn't be done) and achieved a reasonable bass response from 'mini' speaker systems that were almost 'pocket-size'.

The most successful of these minis achieved an almost flat frequency response from 80 Hz to 15 kHz and were a talking point for anyone who heard them. It didn't take long for imitators to realise that the automobile isn't the only place where a mini speaker system has tremendous market potential. The average apartment in New York or Tokyo suffers from exactly the same space limitations.

Today, some ten years later, there must be close to 500 different descendants of that first generation of mini speakers. Like the originals, virtually all of these are designed around a die-cast cabinet. Many have an integral back and separate front panel containing a complement of mini woofer and domed tweeter. Perforated steel grilles have also been religiously adopted by each new manufacturer.

The Dick Smith compact speaker system is a typical example of this speaker concept. Each unit has a 75 mm diameter flexible surround woofer and a 25 mm domed tweeter in a cabinet which is almost as small as any manufacturer could reasonably hope to achieve. Each speaker is protected by a strong and durable perforated steel grille set back into an aluminium coloured plastic trim which surrounds the front edge of the cabinet. The back of the cabinet is a separate panel glued into the sides. The woofer features a lightweight steel supporting frame for the ferrite magnet assembly whilst the tweeter has an integral back, which avoids the need for separate enclosure.

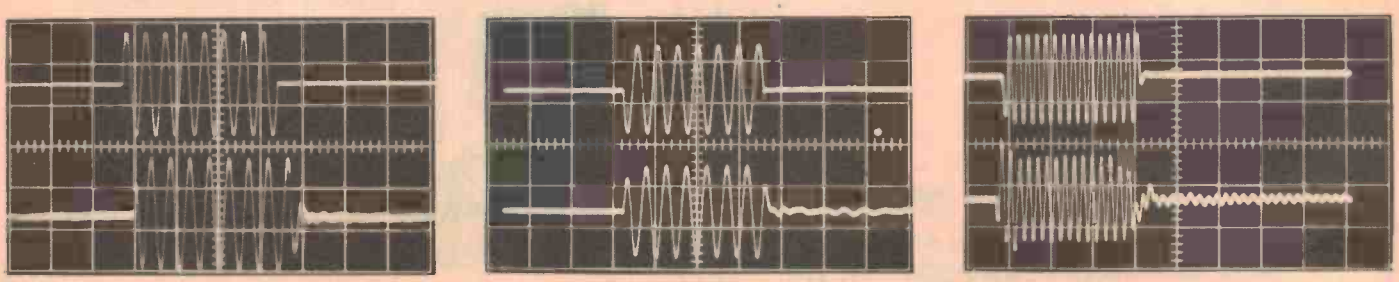
Electrical connections are simple — two screw terminals accept the bared ends of the speaker leads. The makers provide a pair of universal support brackets to facilitate hanging the units on a wall or bulkhead.

Evaluation

The objective testing of these units showed that they have been designed to achieve a pronounced presence in the 500 Hz to 7 kHz region. The fundamental resonance of the woofer occurs at 130 Hz and the non-vented enclosure volume of 1.3 litres provides a small peak in the response at 180 Hz.

The on-axis response measured in an anechoic chamber is generally acceptable, although it is not nearly as flat as that of the original 'minis'. Crossover between the woofer and tweeter is undetectable and the high frequency output of the tweeters extends all the way to 20 kHz.

The impedance curve is particularly flat, but as it dips below 8 ohms over the most significant portion of the frequency range it is apparent that the intending user would have to be careful when paralleling these units with other speakers also having low input impedance. The phase response is reasonably smooth and tends to indicate that the crossover frequency is in the



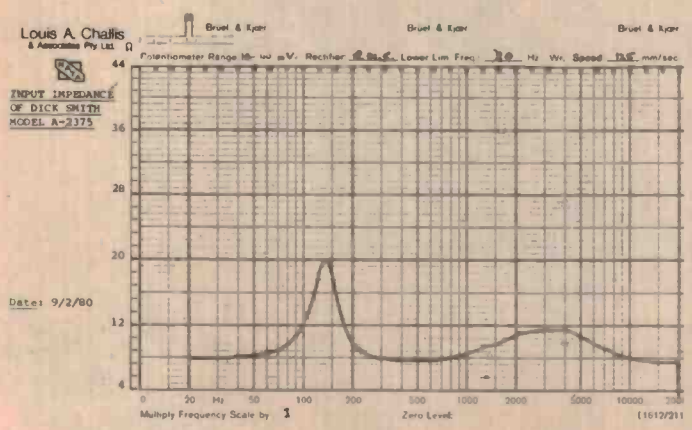
Tone burst response oscillographs of the Model A-2375 loudspeakers, measured with respect to 90 db steady-state spl at 2m on axis, LEFT: at 100 Hz, (20 ms/div, 80 dB spl). CENTRE: at 1 kHz (2 ms/div) and RIGHT: at 6.3 kHz (0.7 ms/div).

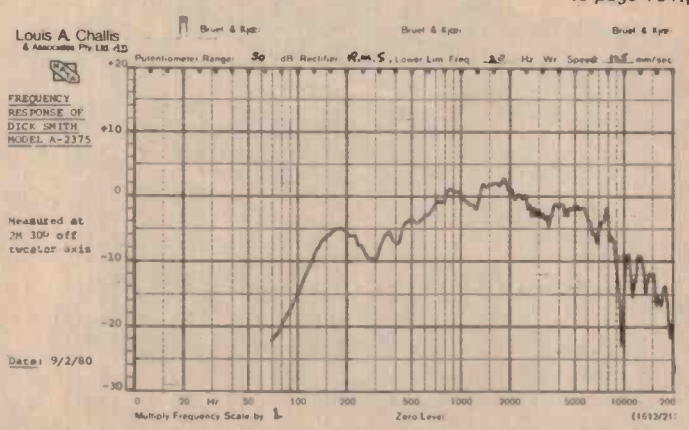
3-4 kHz region. The relative positions of the woofer and tweeter achieve a more than acceptable phase balance, which does enhance the quality of reproduction as subsequent subjective testing showed.

Tone burst testing revealed that at frequencies above 100 Hz the speaker performs moderately well, although at 6.3kHz and 100 Hz the quality fell short of what we would have liked. The distortion characteristics of the speaker are generally adequate at high frequency but not at 100 Hz. At this frequency the system can't cope with our standard test of 90 dB at two metres and even with 80 dB output it produced a hefty 5.6% distortion.

The sensitivity of 6.8 W input to achieve 90 dB on axis at 2m is reasonably good and only a small amplifier with a 20-30 W rating would be needed to produce a healthy output in a small or medium sized room.

– to page 161.▶





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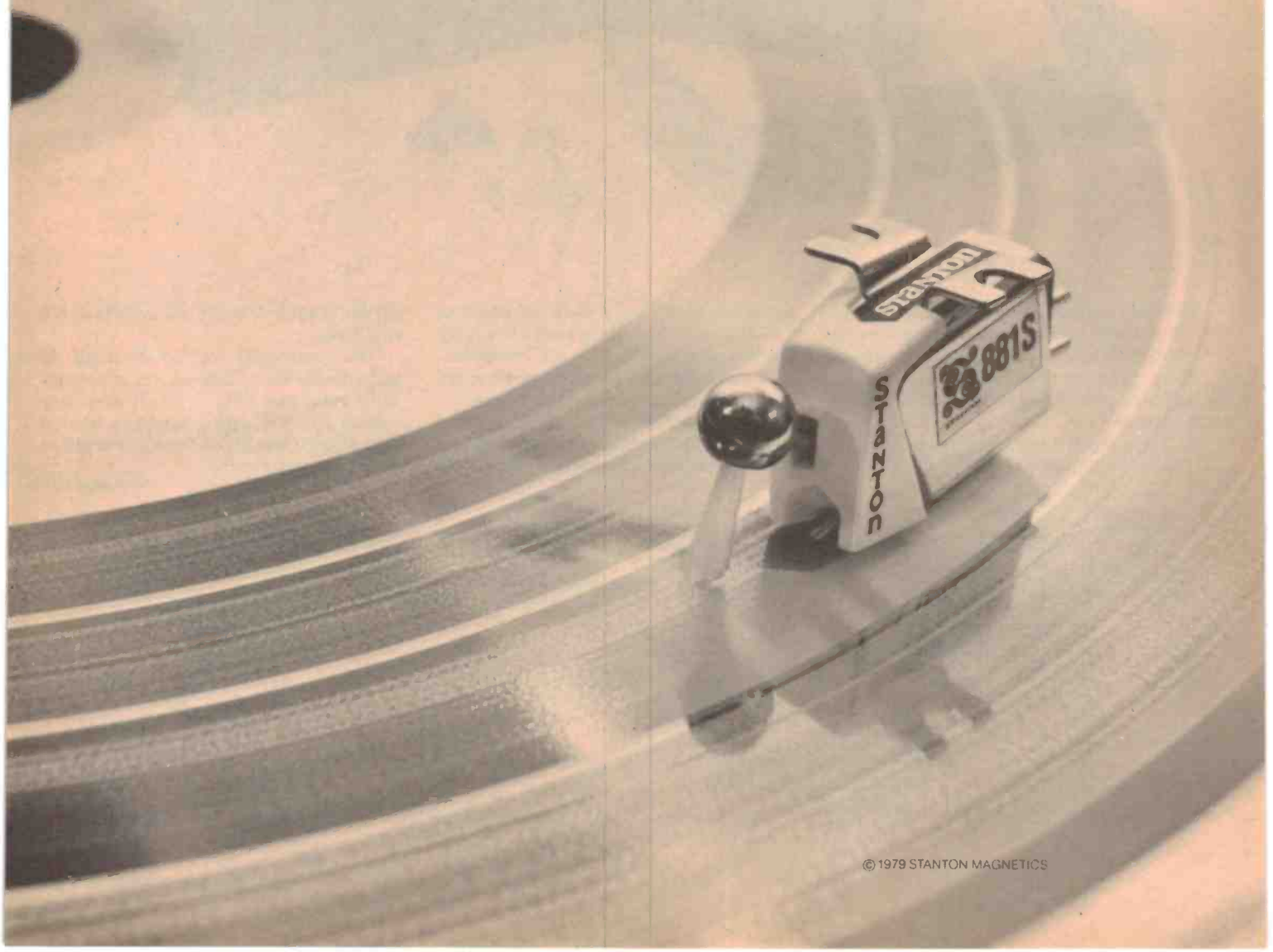

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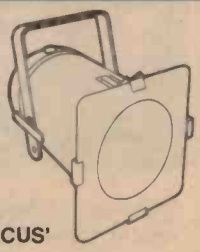
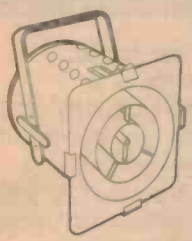


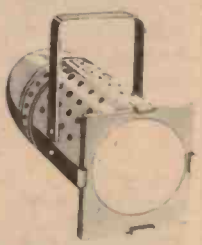
PAR 56 'POLE FOCUS'

300 watt, 240 volt sealed beam lamp. Available in either narrow or medium flood lamps with a remarkable 2,000 hours lamp life. APPLICATIONS: Stage lighting from overhead or sides; stage lighting from front of house using optional barn doors. Colour Wheel available.



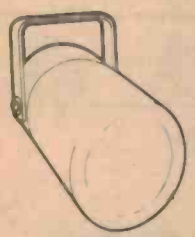
ROCKBEAM 'POLE FOCUS'

1000 watt, 240 volt beamlight.
Projects narrow, intense beam suitable for long throws of up to 30 metres. Standard T11 tungsten halogen lamp is used, giving 800 hours lamp life. APPLICATIONS: Long throw stage lighting; "Specials" lighting and pin spotting.



PAR 64 'POLE FOCUS'

1000 watt sealed beam lamp, available in narrow spot or medium flood. The Par 64 is an American 120 volt lamp and the lanterns are operated in pairs, giving series operation to 240 volts. 2,000 hours lamp life. APPLICATIONS: Stage lighting from any position; optional barn doors offer beam shaping facilities.



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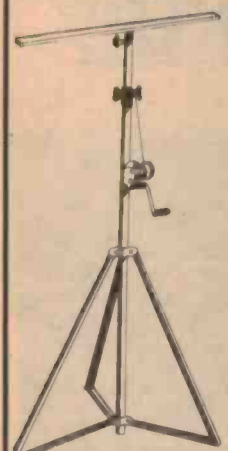

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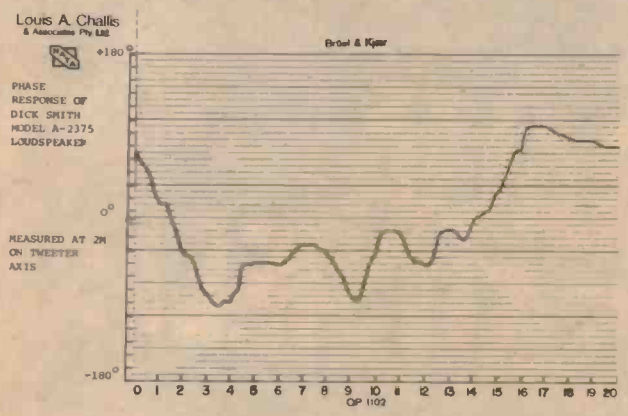

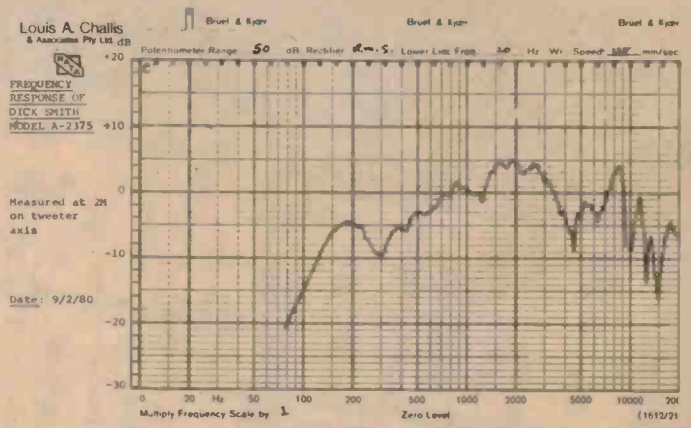

Subjectively

The subjective testing of these speakers highlighted a number of features which the objective testing did not. The first of these was the pronounced presence that they possessed. This presence colours speech and provides a most unnatural sound. The second feature was the irremediably poor response at low frequencies.

Soft rock, drums, vibes or even guitar sounds are not reproduced in such a way as to maintain a natural or acceptable sound. While guitars in general may sound reasonable, violins acceptable and a piano almost normal, speech and vocals have a quality and timbre which disturbed me and would disturb most musicians.

I took the opportunity to try out a number of records especially designed for speaker testing but because these speakers have such a very small volume I mainly chose passages which didn't call for a high quality bass response. Nevertheless I found that the test records tended to highlight the lack of bass response, although the system did perform adequately on some passages.

Summary

Mini speakers have their problems. Although they can sometimes reproduce with surprising fidelity, their small enclosures impose severe limitations at the lowest frequencies. The Dick Smith A2375 speakers provide a passable performance for such a petite envelope and may well be suitable for a first speaker system. But they will not satisfy young people looking for a reasonable bass response, nor the majority of 'oldies' who aspire to a sound of better quality than a shoe box system. ●

THE DICK SMITH MODEL A2375 MINI SPEAKER SYSTEM

Dimensions: 190 mm H x 120 mm W x 120 mm D

Weight: Approx 3 kg. *Price: $99.50 a pair*

Manufactured in Taiwan

Louis A Challis and Associates Pty Ltd

MEASURED PERFORMANCE OF

DICK SMITH LOUDSPEAKER MODEL A-2375

FREQUENCY RESPONSE: 100Hz to 12kHz ± 10dB

CROSSOVER FREQUENCIES: Not detectable

SENSITIVITY:

(for 90dB average at 2m) 7.4 VRMS = 6.8 Watts (nominal into 8Ω)

HARMONIC DISTORTION:

(for 90dB at 2m)

(except at 100Hz which was measured at 80dB)		100Hz	1kHz	6.3kHz
	2nd	-26	-40.5	-36.8 dB
	3rd	-33.3	-50.5	-45.8 dB
	4th	-45.4	-56.9	-55.2 dB
	5th	-39	-61.7	-
	THD	5.6%	1.1%	1.5%

INPUT IMPEDANCE:

100Hz	12	Ω
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6.3kHz	9	Ω
Minimum at 20kHz	7.5	Ω

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SELL: Six hundred LPs, mostly baroque, classical and early romantic. Reason for sale — taping the lot. Enquiries to Henry Smith, P.O. Box 21, Latrobe, Tasmania 7307.

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SELL: Playmaster 25W RMS per channel stereo amplifier and graphic equaliser in perfect condition. $95 each. Phone Iain Burry (02) 798-5656 (8 a.m. - 4.30 p.m.).

SELL: ETI 4600 Synthesizer 85% completed in cabinet, works 100%, $750 o.n.o. 4/9 Finchaven St, Herne Hill, Geelong, Vic 3218.

BOSE 901 speakers series IV unused still in cartons, only $1090, o.n.o. Philips Motional Feedback Speakers 60w rms unused, $690. o.n.o. Phone (02) 46-5451 a.h.

COMMUNICATIONS

SELL: Yaesu FT200 TXCVR in excellent condition. Also IC 22A 2m FM TXCVR. Camberwell Grammar School, P.O. Box 151, Balwyn, Vic 3103. Phone (03 836-6266 ext. 237.

DX160 receiver 150 kHz to 30 MHz works like new but no speaker, scungy exterior, $80. Also three morse cassettes $10. Phone John (02) 502-4863 after 4 p.m.

YAESU FT901DM SSB transceiver with CW and AM filters factory installed, Yaesu microphone, FV901DM external scanning 40 memory VFO, equipment brand new in unopened boxes, surplus to my requirements $1450.00. James VK2JO, Phone (02) 799-5566 or (02) 36-7756, G.P.O. Box 5076, Sydney, NSW 2001.

CB RADIO — Bengal SSB/AM base station with 18ft ringo, separate SWR meter, and approx 30ft coax with plugs. $250. Write to H. Saharinen, 5 Bartoman St, Batlow, NSW 2730.

AUSTRALIAN Radio Dx Club for shortwave, mediumwave Dxers, for a sample copy send one 22¢ stamp to P.O. Box 79, Narrabeen, NSW 2101 mentioning this ad.

SELL: Communications receiver TRIO model 9R59DS in spotless condition, and very little use. Will sell for $120, P. Theodore, 26 Waratah St, Canterbury, NSW 2193.

SELL: Teletype Model 19. Good condition $60 o.n.o. Write to R. Antaw, P.O. Box 333, Coonabarabran, NSW 2857. Phone (068) 42-1470 a.h.

COMPUTERS

HORIZON II system dual SSDD disk 32K matrox alphanum and graphics boards. ASR33 and monitor. Software Basic, Pascal, 2D and 3D graphics. Details D. Cowie, 21 Dublin St, Clayfield, Qld 4011. (07) 262-3957.

WANTED: Mini scamp computer, complete or kit set. Details and price to Box 177, Woden, ACT 2606.

P.E.T. CBM Minicomputer as new. Ample software including assembler/editor/disassembler. Full documentation — manuals, circuit diagrams, memory maps, diagnostics — worth $2000 new, $1250 ono. Phone Chris (02) 419-4424.

SORCERER Computer, 16k RAM and cassette recorder, $950. Also Development pac $99; 50bd teletype, $50. Glen Grigg, 2/22 Hill St, Campsie, NSW 2194. (02) 787-1096 a.h.

BLACK BOX printer 10 CPS 80 column tractor feed, including harnesses and power supply for TRS 80 operation with or without expansion interface $475. Lew Nyeholt (09) 364-7385.

SELL: 2708 EPROM programmer board with software driver and full details, $100. 1200 baud cassette interface with connection and operating details, $100. W. Geary, Koolan Island, WA 6733.

SELL: Ithica Audio 4 MHz Z80 Processor, three 8k 250 ns. RAM cards DG 640 VDU card. $130 ea. $600 the lot. 18 slot mother board 10 connectors $80. Keith Dick (02) 359-2384 b.h., (02) 665-2044 a.h.

SELL: "DREAM 6800" ICs 2x2708 programmed chips $11 each, 1xMC6800L $9, 1x6820 $5, all working, will separate. C. Rogers, 8 Buchanan Rd, Berwick, Vic 3806.

WANTED: Plans for computer for beginner (photocopies, etc). D. Howe, 7 Royston Place, Gladstone Park, Vic 3043. (03) 338-6010.

2650 mini computer, VDU, 4k RAM, x-tal CLK, keyboard, cassette interface, BASIC, lots software, manuals etc. $400 o.n.o. Phone Paul (VK3YRS) (03) 336-7471.

SELL: DREAM 6802, with power supply in cabinet, plus programs, no bugs. $170. R. Patterson (08) 258-8647. 20 Donegal St, Salisbury Downs, 5108.

S2650 PIPBUG — compatible machine language programs. Program relocator, clock & day calculator, noughts and crosses. Listings and instructions. $4 each. Phone Chris (02) 411-3618 after 6 p.m.

SELL: 57 key ASCII keyboard. As new — unused $90 o.n.o. D. Stuart-Smith, 98 Grasmere Rd, Cremorne, NSW 2090. (02) 90-1473.

Baby 2650 unopened (still sealed) chassis, 3 books and keyboard. Also partly built encoder ETI April '77, including 10 ICs. J. Crooks, (02) 95-1683.

TRS-80 "Keyboard Music" program lets you play music directly using your TRS-80 keyboard. Send $12 (inc P&P) to J. Zelnik, 14/446 Pacific Highway, Artarmon, NSW 2066. (02) 427-5982 after 7 p.m.

SELL: Centronics Microprinter P.1. As new, print 20, 40 or 80 characters per line. Parallel interface $350. Peter Wearne, Ellerslie, Vic 3265. (055) 99-6222.

WANTED: To buy or borrow — users manual for Percom LFD400 diskette system. Geoff Drury, 27 Cresiin Tce, Camden Park, 5038. (08) 295-2778.

CHESS COMPUTER, Chess Challenger level-10 $299. DG-640 VDU card with manual $100. ASCII encoded keyboard $70. All brand new, unused! 55 Ryan Place, Beacon Hill, NSW2100. (02) 938-5432.

WOLLONGONG Computer Club requires members. Phone Paul (042) 61-5451.

OSI SUPERBOARD II or Challenger 1P users in Adelaide, I would like some information please. Phone Mark 298-2549.

6800-9 SS50 BUS computer user would like to contact other users to exchange information ideas programs etc. Ray Evans (066) 46-6173, or P.O. Box 36, Iluka, NSW 2460.

SELL: EME-1, brand new, plus resistors, sockets, etc, plans, conversion tables and wires included. Will sell all from $25. Benjamin, 48a Malton Rd, Beecroft. (02) 848-8141.

SELL: Challenger 1P, 4K RAM $359. 4K expansion RAM $50. 610 expansion board for Challenger 1P $200. 21 Beltana St, Ryde. (02) 807-3951.

SELL: One only KTM2 VDU normally $400 will accept $350 o.n.o., or swap for Superboard II. Phone G. Dicker (08) 332-2389 b.h., (08) 278-7147 a.h.

JOIN the Ohio Superboard User Group. Send S.A.E. to "Ohio Superboard User Group", 146 York St, Nundah, Qld 4012 for full details and a free graphics chart.

SELL: Video terminal, has 63-key keyboard. Accepts serial or parallel data. Use with almost any micro. $250 o.n.o. (042) 55-8087.

MICROPOLIS Dual Drives Quad Density 630K Model 1053 as new with manuals/software 30 day warranty, suit Sorcerer or other S100 $1500 (02) 450-1716.

SELL: Data Entry Terminal Olivetti Model DE521, v.good condition, $800 o.n.o. Keith Dick (02) 359-2384 b.h., (02) 665-2044 a.h.

SELL: SYM-1, 8K RAM and 8K BASIC $380. KTM-2 keyboard/terminal $300. Power supply +5V@10A/+/−12V@1A $50. Dick Smith Video Monitor $125. B. Williamson, 216 Wirruna Av, Woomera, SA 5720.

SELL: TRS-80 16K memory. Level II BASIC computer includes video monitor, cassette recorder, keyboard, all original Tandy equipment, no cheapie upgrade. Included extensive range of software value $750. The lot $825. O. Fleming (075) 32-4810.

OLIVETTI TE300 Computer Terminal, 150 Baud, R5232, 120 character thirteen inch tractor feed paper, ASCII keyboard and numeric keypad, solid unit, $350. (03) 418-6337 b.h., (03) 288-2191 a.h.

TRS-80 Level II, 16K RAM recorder, monitor, keyboard software, as new $850. (03) 873-3820.

TRS-80 Level II inc. power supply manuals & cables $850, monitor $100, cassette recorder $30. (02) 939-1576.

NORTHSIDE computer owners and users. Our club meets on the 2nd Monday of the month at Manly Youth Centre, Kangaroo St, Manly, NSW.

WOLLONGONG Computer Club, wishes to exchange software etc with other individuals and clubs, CPUs involved 6502, 6800, Z80, 8085, etc. (042) 61-5451.

MISCELLANEOUS

SELL: Philips Video Recorder N1500 VHF playback $250 o.n.o. K. Dick 359-2384 b.h., 665-2044 a.h.

Valve and circuit tester Model University TST/2 complete with instruction manual and circuit. Phone (02) 46-5451.

WANTED: Unbuilt ETI-140 IGHz frequency meter — timer kit. Phone 7.30 - 9.30 p.m. 870-4017 or write Mark Barber, 8 Hillidale Close, Ringwood, Vic 3134.

TRANSFORMERS: 240 to 24 volts, 1 kva. In mounting boxes with circuit protection. Very cheap (02) 827-3778 (preferably mornings or late nights).

WANTED: Valves, new or s/h, 6M5 6A8. F. King, 161 Longueville Rd, Lane Cove, NSW 2066. (02) 427-2626.

WANTED: IC Chip AY-3-8760 for TV cycle game. Barry Moon, 26 Beaufort St, Mitcham, Vic 3132. (03) 874-3463.

Alternative Technology Co-operative. People interested and involved in the use of alternative technology and energy sources. Details A.T.Co-op, 366 Smith St, Collingwood, Vic 3066, enclose 30¢ stamp.

WANTED: Practical Wireless Jan 80 for collection. Will pay $2 and postage. Write B. McDonald, 46 Aberdare St, Kitchener, NSW 2325.

WANTED: Circuit diagram etc for Yunker Electronics Universal Counter Mod 185U. Will pay copying costs etc. J. Brown-Sarre, Box 82, Red Cliffs, Vic 3496.

Radio & Electronics Books

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• CMOS ICs are suitable for an extraordinarily wide range of applications, are cheap and easy to obtain. Here are a number of interesting and useful projects in four general categories: (1) Multivibrators, (2) Amplifiers and oscillators, (3) Trigger devices, (4) Special devices.

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225: PRACTICAL INTRO TO DIGITAL ICs
D.W.Easterling

• This book introduces the reader to digital ICs (mainly TTL 7400 series). Besides a number of simple projects, contents include details of a Logic Test Set which enables constructors to identify and test digital ICs. Also includes digital counter-timer.

80 pages **Price $2.85**

227: BEGINNERS GUIDE TO BUILDING ELECTRONIC PROJECTS
R.A.Penfold

• Enables total beginners to tackle practical electronic so he or she can confidently build electronics projects such as published in ETI and other magazines and books. Subjects include component identification, tools, soldering, various building methods, cases, legends etc. Practical basic projects are also included.

112 pages **Price $3.75**

BP1: 1ST BOOK OF TRANSISTOR EQUIVALENTS AND SUBSTITUTES
B.B.Babani

• Complete transistor equivalents guide. More than 25 000 transistors with alternatives and equivalents. Covers devices made in UK, USA, Japan, Germany, France, Europe, Hong Kong etc. See also BP 14 (below).

80 pages **Price $2.25**

BP 14: 2ND BOOK OF TRANSISTOR EQUIVALENTS AND SUBSTITUTES
B.B.Babani

• The second book contains data on devices not included in the first. This book supplements BP1, no data is duplicated.

208 pages **Price $3.50**

BP 24: 52 PROJECTS USING IC 741
Rudi & Uwe Redmer

• Originally published in German, this book achieved huge European sales. Now translated into English with copious notes, data and circuits, this book is a must for those interested in any way in this inexpensive and most versatile IC.

80 pages **Price: $2.85**

BP 33: ELECTRONIC CALCULATOR USERS HANDBOOK
M.H.Babani

• An invaluable book for all calculator users. Presents formulae, data, methods of calculation, conversion factors etc, often with examples. Includes way to use simple four-function calculator for Trig functions (sin,cos,tan); Hyperbolic functions (sinh,cosh,tanh), Logs, Square Roots & Powers.

Comprehensive conversion factors incorporated, including length, area, volume & weight through specialised conversions such as viscocity, illumination, cargo shipping measures etc. Also formulae for discounts and mark-up, currency conversions, interest, solutions of equations, binary and octal numbers, areas and volumes, stats and maths etc.

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BP 36: 50 CIRCUITS USING GERMANIUM, SILICON, ZENER DIODES
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• Relays, SCRs and Triacs have a wide range of applications — from motor speed control, dimming, heating, timers, light-sensitive circuits, warning devices, light modulators, priority indicators, circuit breakers etc. Book gives tried and proven circuits which will tolerate wide latitude of components and values allowing easy modification to suit special needs.

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• Equivalents and pin connections of a popular user-orientated selection of digital ICs. Shows details of packaging, families, functions, manufacturer and country of origin. Includes devices by Fairchild, Ferranti, Harris, ITT, Motorola, National, Philips, RCA, Signetics, Sescocem, SGS-Ates, Siemens, SSSI, Stewart Warner, AEG-Telefunken, Texas, Teledyne. Companion volume to BP 41 — Linear ICs.

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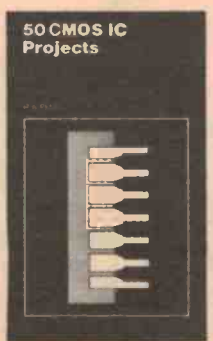

BP 41: LINEAR IC EQUIVALENTS AND PIN CONNECTIONS
Adrian Michaels

• Essentially similar in concept to above but deals with linear integrated circuits.

320 pages **Price $8.25**

BP 42: 50 SIMPLE LED CIRCUITS
R.N.Soar

• 50 interesting and useful circuits and applications using LEDs. A useful book for beginner and advanced enthusiast alike.

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E.A.Parr

• Every so often a device is made that is so useful one wonders how life went on before it! The 555 IC is one such. First made by Signetics it is now manufactured by almost everyone in the business. It is very cheap and readily obtainable.

Included in this book are basic and general circuits, motor car and model railway circuits, alarms and noise makers plus a section on the subsequent 556,558 and 559 devices.

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BP 45: PROJECTS IN OPTO-ELECTRONICS
R.A.Penfold

• Opto-electronic projects of interest to all electronics enthusiasts. Included are simple circuits using ordinary LEDs as well as more sophisticated designs such as infra-red transmitters and receivers, modulated light transmission and photographic projects.

112 pages **Price $3.75**

BP 47: MOBILE DISCO HANDBOOK
Colin Carson

• Most people who start mobile discos know little about equipment or what to buy. This book assumes no preliminary knowledge and gives enough info to enable you to have a reasonable understanding of disco gear.

128 pages **Price $4.15**

BP 48: ELECTRONIC PROJECTS FOR BEGINNERS
F.G.Rayer

• This book gives the newcomer to electronics a wide range of easily built projects. Actual component and wiring layouts aid the beginner. Some of the projects may be built without using soldering techniques.

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BP 49: POPULAR ELECTRONIC PROJECTS
R.A.Penfold

• A collection of the most popular types of circuits and projects covering radio, audio, household and test equipment.

144 pages **Price$4.35**

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M.K.Berry

• This book shows how electronic music can be made at home with simple and inexpensive equipment. It describes how sounds are created and recorded to build up a final composition. It shows how to build a small studio including mixer and various sound effects units.

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BP 53: PRACTICAL ELECTRONIC CALCULATIONS AND FORMULAE
F.A.Wilson

• This book is for the practical person's workshop bench. It bridges the gap between technical theory and cut-and-tried methods which may work but leave the experimenter unfulfilled. There's a strong practical bias. Tedious and higher maths has been avoided where possible. Many tables are included. This one's a beauty!

256 pages **Price $6.75**

BP 56: ELECTRONIC SECURITY DEVICES
R.A.Penfold

• Simple and more sophisticated burglar alarms using light, infra-red and ultrasonics; also other types of alarm such as gas and smoke detectors, flood alarms, doorphone and baby alarms etc.

112 pages **Price $4.35**

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F.A.Wilaon

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• This series provides an inexpensive intro to modern electronics. Although written for readers with no more than basic arithmetic skills, the use of maths is not avoided — all the maths is taught as the reader progresses.

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• All projects in this book are simple to build and are based on a single IC. A few projects use one or two transistors in addition. A strip board layout is provided for each project together with special constructional points and setting up info. The five chapters are: Low level audio, Audio power amps, Timers, Op-amps, Miscellaneous circuits.

128 pages **Price $4.50**

BP 66: BEGINNERS GUIDE TO MICROPROCESSORS AND COMPUTING
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KITS for projects

WE GET MANY enquiries from readers wanting to know where they can get kits for the projects we publish. This list is a guide to suppliers of kits and components for ETI projects.

We have listed here most of the projects published over the last few years which are either available as kits or can still be made up by shopping around for components. Suppliers listed against a particular project will either stock it as a kit or stock the pc board plus the other components.

Printed circuit boards

Those suppliers listed against specific projects here are able to supply pc boards for those projects. Printed circuit boards for every project ever published in ETI are available through the following companies (to the best of our knowledge):

RCS Radio
651 Forest Rd
Bexley NSW

Radio Despatch Service
869 George St
Sydney NSW 2000

For current projects and a more comprehensive list of pc board suppliers refer to the Shoparound page in this and previous issues. This list will be updated roughly every four months.

Key to Companies

A Applied Technology Pty Ltd, 1A Pattison Avenue, Waitara, NSW 2077. Ph. (02) 487-2711.

B Bill Edge Electronic Agencies, 115 Parramatta Road, Concord (PO Box 1005, Burwood North 2134). Ph. (02) 747-6472.

C J.R. Components, PO Box 128, Eastwood, NSW 2122. Ph. (02) 85-3976.

D Dick Smith Electronics P/L, Cnr Waterloo & Lane Cove Roads, North Ryde, 2113. Ph. (02) 888-3200.

E All Electronic Components, 118 Lonsdale Street, Melbourne, Vic 3000. Ph. (03) 662-3506.

F Tasman Electronics, 12 Victoria Street, Coburg, Vic 3058. Ph. (03) 354-5062.

J Jaycar Pty Ltd, PO Box K39, Haymarket, NSW 2000. Ph. (02) 211-5077.

K S M Electronics, 10 Stafford Court, Doncaster East, Vic 3109. Ph. (03) 842-3950.

L Ellistronics, 289 Latrobe Street, Melbourne, Vic 3000. Ph. (03) 602-3282.

M Mode Electronics, PO Box 365, Mascot, NSW 2020. Ph. (02) 666-6324.

N Nebula Electronics Pty Ltd, 15 Boundary Street, Rushcutters Bay, NSW 2011. Ph. (02) 33-5850.

O Orbit Electronics, PO Box 7176, Auckland, New Zealand.

P Pre-Pak Electronics, 1A West St, Lewisham, NSW. Ph. (02)569-9797.

R Rod Irving, PO Box 135, Northcote, Vic 3070. Ph. (03) 489-8131.

V Silicon Valley, 23 Chandos Street, St. Leonards, NSW 2065. Ph. (02) 439-4655.

W Willis Electronics, 993 Hay Street, Perth, WA 6000. Ph. (09) 321-7609.

Y Trilogy, 40 Princes Highway, Fairy Meadow, NSW 2519.

Project Electronics

041 Continuity Tester ... W,R,D,B,Y,L
042 Soil Moisture Indicator ... R,B
043 Heads or Tails Circuit (Oct 76) ... W,R,D,E,A,F,B,Y,L
044 Two Tone Door Bell (Oct 76) ... W,R,D,E,O,A,F,B,Y,L
045 500 Second Timer ... W,D,E,A,B,Y,L
047 Morse Practice Set ... W,D,O,A,B,Y,L
048 Buzz Board ... W,D,A,B,Y,L
061 Simple Amplifier (Oct 76) ... W,R,D,E,A,B,Y,L
062 Simple AM Tuner (Mar 77) ... W,D,E,B,Y
063 Electronic Bongos ... R,D,A,B,Y,L
064 Simple Intercom (Nov 76) ... W,A,
065 Electronic Siren ... W,R,D,E,O,A,B,Y,L
066 Temperature Alarm (Dec 76) ... W,D,E,A,B,Y,L
067 Singing Moisture Meter ... D,B,Y
068 LED Dice Circuit (Oct 76) ... Y,W,R,D,E,A,B,L
070 Electronic Tie Breaker (Jan 77)
071 Tape Noise Limiter (Jun 78) ... R,E,F
072 Two-Octave Organ (Jun 78) ... W,D,B,Y
081 Tachometer (Mar 77) ... W,E,O
082/528 Intruder Alarm ... W,R,E,A
083 Train Controller ... Y,W,R,E,L
084 Car Alarm ... W,R,D,E,A,B,Y,L
085 Over-rev Alarm ... W
086 FM Antenna ... W
087 Over-LED ... Y,W,E
088 Hi-Fi Speaker ... W

Test Equipment

132 Experimenter's Power Supply (Feb 77) ... E,O
133 Phase Meter (Apr 77) ... E
134 True RMS Voltmeter (Aug77) ... E
135 Digital Panel Meter (Oct 77) ... E
136 Linear Scale Capacitance Meter (Mar 78)
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138 Audio Wattmeter (Nov 78) ... E,B
139 SWR/Power Meter (May 78)
140 1GHz Frequency Meter-timer (Mar 78) ... C
141 Logic Trigger (Jan 79) ... E
142 High Current Power Supply (Feb 79) ... W,E
143 Curve Tracer (Jan 79) ... W
144 Expanded-scale RMS Voltmeter (Jun 79) ... E
148 Versatile Logic Test Probe (Jul 79) ... E,L

Simple Projects

243 Bip Beacon (Apr 77)
244 Alarm Alarm (Feb 77) ... F
245 White Line Follower (Nov 77) ... F
246 Rain Alarm (Apr 78) ... F
248 Simple 12V to 22V Converter (Jul 78) ... W
249 Electronic Combination Lock (Apr 79) ... E
252 The Passionmeter (Aug 79)
253 Electronic Grenade (Hot Potato) (May 79)
254 Egg Timer (Jun 79) ... Y,W

Motorists' Projects

316 Transistor Assisted Ignition (May 77) ... W,E,O,K
317 Rev. Monitor Counter (Jul 77) ... E
318 Digital Car Tacho (Jul 78) ... W,E,K
319 Variwiper MK II (Sep 78) ... W,E,O
320 Battery Condition Indicator (Apr 79) ... Y,E,L

Audio Projects

448 Disco Mixer (Nov 76) ... W
449 Balanced Microphone Amp (Nov 76) ... W,D,E,J,F,Y
450 Bucket Brigade Audio Delay Line (Dec 77) ... W,E
451 Hum Filter (Jul 79) ... D,E,F
455 Class A Headphone Amp (Nov 78)
470 60 W Amp Module (May 79) ... Y,W,R,E,F,B,P,L,A,V
471 High Performance Stereo Preamp Control Unit (Jun 79) ... W,R,E,F,B,P,A,V,L
472 Power Supply — the Series 4000 Stereo Amp (Jul 79) ... W,R,E,F,B,V,L
473 Series 4000 Moving-coil Cartridge Preamplifier ... F,J
480 50-100 Watt Amp Modules (Dec 76) ... W,R,D,E,J,O,Y,L
481 12V 100 Watt Audio Amp (May 77) ... R,E
481 High Power PA/Guitar Amp (Jun 77) ... W
482 Stereo Amp (Jan 77) ... O,E
482 Stereo Amp Part 2 (Feb 77) ... O,E
483 Sound Level Meter (Feb 78) ... E
484 Simple Compressor Expander (Jul 77) ... E
485 Graphic Equaliser (Jun 77) ... Y,W,E,J,O
486 Howl-round Stabiliser (Nov 77) ... J
487 Audio Spectrum Analyser (Feb 78) ... E
489 Audio Spectrum Analyser 2 (Apr 78) ... E,J
490 Audio Compressor (Dec 78)
491 Simple Graphic Equaliser (Mar 79) ... W,E
495 Transmission Line Speakers (Aug 77)

Miscellaneous

546 GSR Monitor (Mar 77) ... W,E
547 Telephone Bell Extender (Jun 77) ... E
548 Photographic Strobe (May 77) ... W,E
549 Induction Balance Metal Detector (May 77) ... Y,W,D,E,L
550 Digital Dial (Aug 78) ... E,O
551 Light Chaser (Sep 78) ... W,E,O
552 LED Pendant (Sep 78)
553 Tape/Slide Synchroniser (Oct 78) ... E
556 Wind Speed/Direction Indicator (Dec 78)
557 Reaction Timer (Feb 79) ... E
558 Mast-head Strobe (Feb 79) ... E
559 Cable Tester (Mar 79)
575 Portable Fluorescent Light Wand for Car, Camping (Aug 79) ... W
577 General Purpose Power Supply ... J
581 Dual Power Supply (Jan 77) ... W,E,Y
582 House Alarm (Jul 77) ... W,E,O,A,
House Alarm — Installation Instructions (Aug 77) ... W
583 Marine Gas Alarm (Aug 77) ... D,E,M
585 Ultrasonic Switch (Sep 77) ... R,D,E,O,F
586 Shutter Speed Timer (Oct 77) ... E
587 UFO Detector (May 78)
588 Theatrical Lighting Controller (Nov & Dec 77 Jan & Mar 78) ... N
589 Digital Temperature Meter (PCB135) (Dec 77) ... E
590 LCD Stopwatch (Oct 78) ... O,N
591 Up/Down Presettable Counter (Jul 78) ... D,E
592 Light Show Controller (Aug 78) ... E
593 Colour Sequencer (Dec 78)
594 Development Timer (Apr 79) ... E
595 Aquarium Lamp Controller (May 79)

Electronic Music

602 Mini Organ (Aug 76) ... W,D,E,Y
603 Sequencer (Aug 77) ... W
604 Accentuated Beat Metronome (Sep 77) ... E
605 Temp Stabilized Log-exponential Converter (Sep 78)

Computer Projects

630 Hex Display (Dec 76) ... E,A
631 ASCII Keyboard (Dec 76) ... W,E,O,A
631 Keyboard Encoder (Apr 77) ... W,E,O,A
632 Video Display Unit (Jan 77) ... E,O
633 TV Sync Generator (Jan 77) ... E
634 8080 Educational/Prototyping Interface (Jul, Aug 78)
635 Microcomputer Power Supply (Sep 77) ... O
637 Cuts Cassette Interface (Jun 78) ... V,E,A
638 Eprom Programmer (Jul 78) ... W,E
639 Computerised Musical Doorbell (Mar 78) ... A
640 S100 VDU (Apr, May, Jun 78) ... W,O,A,V
641 S100 Printer (Sep 78) ... O
642 16k S100 RAM Card (Feb 79) ... K
650 STAC Timer (Nov 78) ... E,L
651 Binary to Hex Number Converter (Jun 79) ... E
680 Z-80 based CPU (Nov, 79) ... A

Radio Projects

712 CB Power Supply (Jun 77) ... W,E
713 Add-on FM Tuner (Sep 77)
714 VHF-Log-Periodic Antenna (Feb, Mar 78)
715 VHF Power Amplifiers (Nov 77)
716 VHF Power Amplifiers (Jan, Feb 78)
717 Crosshatch Generator (May 78) ... W,D,E,A,Y
718 SW Radio (Oct 78) ... E
719 RF Field Strength Indicator (Nov 78)
720 2m VMOS Power Amp (Jan 79)
721 Aircraft Band Converter (Mar 79) ... W,E
722 Antenna for Aircraft Band Converter (May 79)
724 Microwave Oven Leak Detector (Jul 79) ... D,E,B
725 Simple SSB Generator employs Polyphase Network using Standard Components (Aug 79) ... E,L
730 Get Going on Radioteletype (Aug 79) ... E,L

Electronic Games

804 Selectagame (Nov 76) ... O
804 Selectagame (Rifle Project) (Mar 77) ... O
805 Puzzle of the Drunken Sailor (Oct 77)
806 Skeet (Jan 78) ... O
810 Stunt Cycle TV Game (Jun 78) ... D,O
811 TV Tank Game (Oct 78) ... O
812 Wheel of Fortune (Dec 78)
813 Race Track Game (Jan 79) ... O
814 The 'Dinky-Die' (Aug 79)

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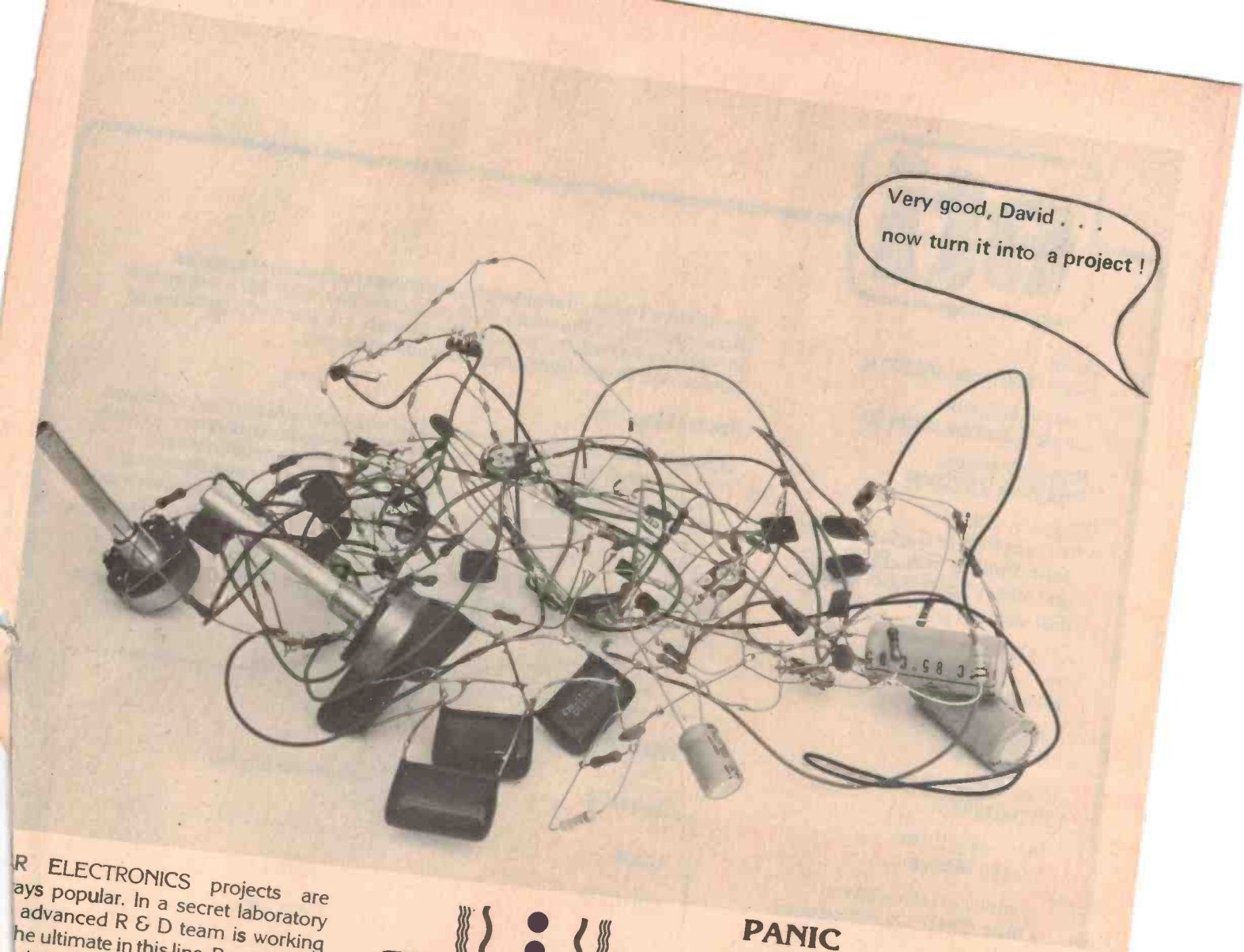

R ELECTRONICS projects are ays popular. In a secret laboratory advanced R & D team is working he ultimate in this line. Provisionally d the Electronic Back Seat Driver, ew device is aimed at overcoming problem of drowsiness on long y car journeys.

e EBSD uses the latest advances l technology to provide inter- t and unpredictable stimulation. croprocessor brain receives in- rom a tachometer, fuel line ter, pressure sensors in the seat and a random pulse or (to mention only a few) and s a speech synthesis chip to n appropriate sentence from a ertoire.

ms are being developed to e EBSD to say such things as wn, you're using too much r "Sit up straight — no u've got a bad back." The ulse generator will trigger like "What's that funny "Did you lock the back door?" We guarantee the EBSD's comments will be so irritating or alarming that no driver will fall asleep. In fact the designers have had to incorporate a special cutout that turns the device off and plays soothing music whenever the driver becomes so uptight that his or her competence is impaired.

The cutout makes use of the fact that people's skin resistivity alters when they are angry or upset. Two metal strips are inlaid into the rim of the steering wheel and the current flowing between them across the driver's palms is used to operate a transistor switch.

Wonder if it will sell?

PANIC

To pay for our skiing holidays, Dregs is planning go into the mail order business. We've noticed that some people will buy anything if it's described in the right way, so we'll shortly be advertising our Positional Analog Numerical Indicator and Calculator — the computing machine you can use anywhere.

The ad will stress PANIC's complete independence of any battery or mains supply and its outstanding stability in extremes of temperature and humidity. It will even work underwater, a feature we're sure none of our competitors can match. PANIC is rugged too — you can drop it onto concrete from a height of several metres without damaging the working parts. And instead of the boring old plastic that most calculators are housed in, we'll be offering PANIC in a real cedar wood case.

Gullible readers who send us the necessary fifty dollars will receive an old cigar box, a ball of string, several dozen plastic beads and instructions on how to assemble an abacus.

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Sounds Alive

Marking the 10th anniversary of the direct-drive turntable.

It has been 10 years since Technics introduced the world's first direct-drive turntable, the SP-10. When it was introduced this turntable had less wow and flutter and better speed accuracy than the cutting lathes used to make records. And because the drive system did not use rubber parts like belts and idler wheels, it insured that its excellent specifications would be retained for a long time.

Six years after the introduction of the SP-10, Technics brought out an improved version, with higher torque and quartz control. Today, more than 1500 of these SP-10MKII's are used by broadcasters in 27 countries around the world.

In the past two years, Technics has added quartz synthesizer control to various models, permitting the precision of quartz to be retained in speeds above and below the standard 33-1/3, 45 and 78 rpm.

More significant to the consumer, Technics has also developed direct-drive turntables which have a very high degree of precision, yet cost much less than the professional grade models. It is possible to get numerous Technics direct-drive turntables in the popular price range, yet with specifications that were obtainable only in very expensive equipment a few years ago.

With the SL-10, Technics continues to lead the industry in turntable innovation. This new turntable represents as radical a departure from conventional design as did the SP-10 ten years ago.

It has the same width and depth dimensions as an LP record jacket, yet within the compact package are an amazingly precise drive system, a gimbal suspended linear-tracking tonearm, a high-grade moving coil cartridge, plus extensive control systems which permit even a complete hi-fi novice to use the SL-10 without any problem. Nearly every operation is automated, with the upper and lower halves of the cabinet closed during record play. And the tonearm is designed so that the system can be stood vertically without any sacrifice in tracking accuracy. The SL-10 marks as great a step forward in convenience as did the development of cassette tapes versus the open-reel format. Yet there is absolutely no loss in reproduction quality. On the contrary, numerous factors in the SL-10's design will significantly enhance the sound from records.

Technics changes the face of turntable technology . . . again.

Technics

For further information contact The Technics Advisory Service,
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