JUNE 1977 $1.25*
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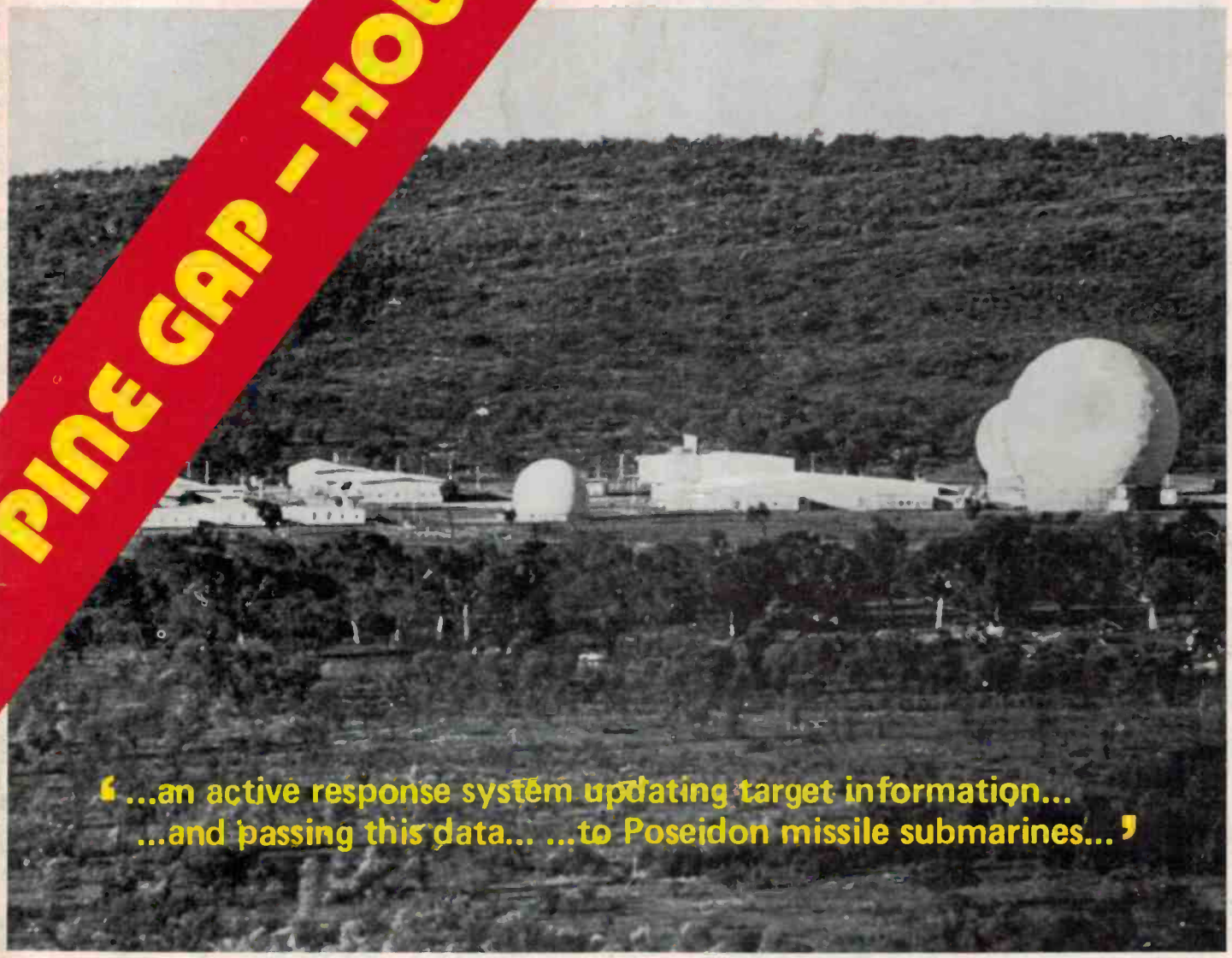
PINE GAP - HOW SECRET?



'...an active response system updating target information...
...and passing this data... ...to Poseidon missile submarines...'

Registered for posting as a publication — Category C

12 VOLT 100 W AMPLIFIER
GRAPHIC EQUALISER
TELEPHONE BELL EXTENDER
CB POWER SUPPLY

WHY YOUR NEXT CASSETTE SHOULD BE A MAXELL UD

3 THE SHELL — Even the best tape can get mangled in a poorly constructed shell. That's why Maxell protects its tape with a precisely constructed shell, made of lasting heavy-duty plastic.

No fixed guide posts are used. Instead Maxell uses nylon rollers on stainless steel pins thus eliminating the major cause of skipping, jumping and unwinding.

A tough teflon (not waxed paper) slip sheet keeps the tape pack tight and flat. No more bent or nicked tape to ruin your recording.

Maxell doesn't use a welded seal, but puts the cassette together with precision screws. Result — Maxell doesn't jam.

ULTRA-DYNAMIC UD

1 THE RESEARCH — More than twenty years ago, Maxell produced their first reel of magnetic tape. At that time, Maxell made a commitment to produce and sell only the finest magnetic products their technology could create.

That commitment still stands today.

2 THE TAPE — This continuous research has lead to the development of the Maxell UD (ultra dynamic) cassette. A tape that has a coating of super-fine PX gamma ferric oxide particles with an extra smooth mirror-finish surface.

All of this adds up to high output, low noise, distortion free performance and a dynamic range equaling that of open reel tapes.

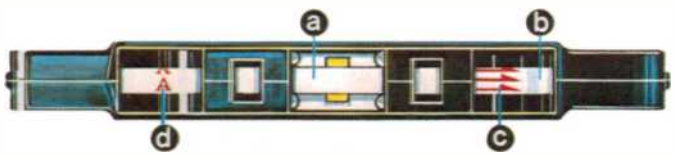
4 THE LEADER — A leader tape that has a four function purpose.

a) Non-abrasive head cleaning leader (cleans recording head for 5 secs.).

b) 5 second cueing line (recording function starts 5 seconds after the line appears).

c) Arrows indicating direction of tape travel.

d) A/B side mark (indicates which side is ready for play).



Now you know why your next cassette should be a Maxell UD (ultra dynamic).

maxell®

The sound expert's cassette. UD available in C60, C90 and C120.
Distributed by **Hagemeyer (Australasia) B.V.** Branches in all States.

WT GD 127M

electronics TODAY INTERNATIONAL

A MODERN MAGAZINES PUBLICATION

JUNE 1977, Vol. 7. No. 6

Editorial Les Bell
Publisher Collyn Rivers

NEXT MONTH'S READER OFFER SIDEBAND CB RIG SCIENTIFIC CALCULATORS

COVER: The Pine Gap satellite receiving station near Alice Springs, as photographed from an aircraft over 30 km away.

*Recommended retail price only

PROJECTS

FEATURES

NEWS & INFORMATION

Free Inside... CB Australia reviews SSB transceivers

The new 63cm and 53cm Luxor colour televisions feature interference free 'infra-red' remote control. Simulated picture.

Introducing Luxor interference free 'Infra-Red' Remote Control colour television to Australia. 26" (63cm) and 22" (53cm)

With self seeking Automatic Station Tuning – giving perfect channel selection at the touch of a button eliminating fine tuning.

Following the advances of Luxor 'modular circuitry' colour television, Luxor now introduce interference free 'infra-red' remote control to Australia with automatic self seeking station tuning, based on the most modern transmitting techniques available to the electronics industry.

Automatic self seeking station tuning

At the touch of a button, the set automatically seeks the strongest signal in your area from the television station and tunes in perfectly to that frequency. The result is extremely stabilized reception.

The remote control with the interference free 'infra-red' eyes

Interference free 'infra-red' remote control

From the remote control hand-set you can control all of the advanced Luxor features from a comfortable viewing distance. On, off, sound, pause control, channel selection, colour, brilliance, volume, tone (both bass and treble) and automatic colour contrast. Plus instant on at any selected channel.

Luxor's Magic Box

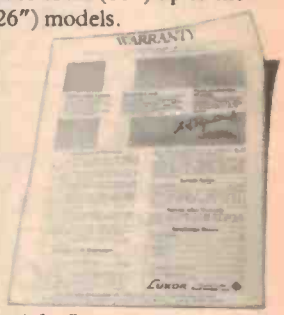
Advanced 'modular circuitry' design

The Luxor 'modular circuitry' system combines hundreds of individual components into 14 sophisticated modules. The serviceman simply connects The Luxor Magic Box to the circuit and within seconds locates the module in doubt. He then simply replaces it.

Luxor sets include the necessary modules for instant use of your video cassette recorder and incorporate VHF/UHF frequencies.

Swedish quality at its best

The more you know about Luxor colour televisions, the more impressive they become – from the compact 43cm (18") up to the range of 63cm (26") models.



The remarkable Luxor warranty

Luxor offer 3 years' protection on the tube. 1 year on all parts. 10 year parts availability.

See your nearest Luxor retailer or send the coupon below:

LUXOR

Swedish quality at its best

To: Luxor, P.O. Box 205, Glen Iris, Victoria, 3146. LUX195

☐ I would like to know more about the Luxor range of colour televisions, especially the new 'infra-red' remote control models.

Name _____

Address _____

_____ P/Code _____

Luxor, c/- 1396 Malvern Rd., Tooronga 3146.

News Digest

SINCLAIR STRIKES AGAIN

Last month in News Digest we mentioned the Sinclair Cambridge Programmable. Details have now come in and we can tell you a bit more about it. For those readers who recall the original Sinclair Programmable, this model is totally different. It is packaged in the time-proven Cambridge case, and offers a quite comprehensive range of facilities. The basic scientific functions include the usual trig. functions (yes, all of them), ln x, exp x, 1/x, square and square root, and algebraic logic, with parentheses. But the real power of the machine lies in its 36-step program memory, which can be written into through the keyboard to store programs, and edited to correct them. The program memory is line-number oriented, which makes possible a GO TO instruction, as well as a GO IF NEG conditional jump. The calculator comes complete with 12 sample programs, and a program library of 294 programs is also available. At a US price of only $29.95, it looks like Sinclair are on to a winner here!

D/A APPLICATION NOTE

Precision Monolithics, Inc., has published a new 8-page application "Differential and Multiplying Digital to Analog Convertor Applications." All of these applications make use of the DAC-08, an 8-bit low cost monolithic DAC available from several manufacturers. A tutorial section on multiplying DAC basics is given including 2-quadrant, 4-quadrant and AC-coupled types followed by detailed circuit examples.

Differential, true 4-quadrant ratiometric, and tracking type A/D converters are illustrated plus examples for nulling bridge transducers and for monitoring AC power faults. The application note, AN-19, ends with a list of 36 more potential applications covering A/D conversion, test systems, arithmetic operations, data control applications, and audio systems applications.

The new series of application notes are available from Cema Distributors, 21 Chandos Street, St. Leonards 2065, who stock the full range of PMI products.

CE-15 SPECTRUM MONITOR

The CE-15 Spectrum Monitor will help improve the efficiency of any radio workshop or laboratory and is designed to quickly provide an indication of proper radio performance on TX and RX. Not only do you see it, but you can hear it from the built in AM-FM receiver (.4μ V sensitivity) and internal speaker which tunes from 0-1000 MHz.

Level accuracy is ± 3dB display range on a 7 x 10 cm CRT with four scan widths from 10 KHz div to 10 MHz divisions down to 2 MHz. Other features include LED frequency display and simplified controls for easier operation. The Cushman range of equipment is distributed in Australia by N.I.C. Instrument Company; their Head Office phone number in Melbourne is 338-3111 and for further details ask for extension 243 - Electronic Instruments. Telex 31157.

HOUSEHOLD PET

Commodore Business Machines Inc is about to start marketing an assembled microcomputer designed for small office and home use. The PET (Personal Electronic Transactor) Computer 2001 contains a MOS Technology 6502 microprocessor, 9 inch CRT, 73-key keyboard, cassette player, and 4K bytes of RAM plus 12K bytes of BASIC and operating system ROM. The VDU can display 25 lines of 40 characters selected from a standard 64-character ASCII set, and a BASIC interpreter will be available. CBM's marketing forte lies in offering facilities originally developed by more advanced manufacturers but at a much lower price, and this unit is no exception – it is tied together by the Hewlett-Packard Interface Bus so that plotters, printers and floppy disks, etc. may be utilised. The crunch comes with the price: US$495.

DRAKE®

C-Line Amateur Equipment

$775.00

Drake R-4C

Solid State Linear permeability-tuned VFO with 1 kHz dial divisions. Gear driven dual circular dials. High mechanical, electrical and temperature stability.

Covers ham bands with crystals furnished. Covers all of 80, 40, 20 and 15 meters, and 28.5-29.0 MHz of 10 meters.

Covers 160 meters with accessory crystal. In addition to the ham bands, tunes any fifteen 500 kHz ranges between 1.5 and 30 MHz, 5.0 to 6.0 MHz not recommended. Can be used for MARS, WWV, CB, Marine and Shortwave broadcasts.

Superior selectivity: 2.4 kHz 8-pole filter provided in ssb positions. 8.0 kHz, 6 pole selectivity for a-m. Optional 8-pole filters of .25, .5, 1.5 and 6.0 kHz bandwidths available.

Tunable notch filter attenuates carriers within passband.

Smooth and precise passband tuning.

Transceive capability; may be used to transceive with the T-4X, T-4XB or T-4XC Transmitters. Illuminated dial shows which PTO is in use.

Usb, lsb, a-m and cw on all bands.

Agc with fast attack and two release times for ssb and a-m or fast release for break-in cw. Agc also may be switched off.

New high efficiency accessory noise blanker that operates in all modes.

Crystal lattice filter in first i-f prevents cross-modulation and desensitization due to strong adjacent channel signals.

Excellent overload and intermodulation characteristics.

25 kHz Calibrator permits working closer to band edges and segments.

Scratch resistant epoxy paint finish.

$685.00

Drake T-4XC

Solid State Linear permeability-tuned VFO with 1 kHz dial divisions. Gear driven dual circular dials. High mechanical, electrical and temperature stability.

Covers ham bands with crystals furnished. Covers all of 80, 40, 20 and 15 meters, and 28.5-29.0 MHz of 10 meters.

Covers 160 meters with accessory crystal. Four 500 kHz ranges in addition to the ham bands plus one fixed-frequency range can be switch-selected from the front panel.

Two 8-pole crystal lattice filters for sideband selection.

Transceives with the R-4, R-4A, R-4B, R-4C and SPR-4 Receivers. Switch on the T-4XC selects frequency control by receiver or transmitter PTO or independently. Illuminated dial shows which PTO is in use.

Usb, lsb, a-m and cw on all bands.

Controlled-carrier modulation for a-m is compatible with ssb linear amplifiers.

Automatic transmit-receive switching. Separate VOX time-delay adjustments for phone and cw. VOX gain is independent of microphone gain.

Choice of VOX or PTT. VOX can be disabled by front panel switch.

Adjustable pi network output.

Transmitting agc prevents flat-topping.

Meter reads relative output or plate current with switch on load control.

Built-in cw sidetone.

Spotting function for easy zero-beating.

Easily adaptable to RTTY, either fsk or afsk.

Compact size; rugged construction. Scratch resistant epoxy paint finish.

$265.00

Drake SSR-1

- **Synthesized**
- **General Coverage**
- **Low Cost**
- **Selectable Sidebands**
- **All Solid State**
- **Built-in Ac Power Supply**
- **Excellent Performance**

The SSR-1 Receiver provides precision tuning over the short wave spectrum of 0.5 to 30 MHz with capability of reception of a-m (amplitude modulated), cw (continuous wave) and ssb (upper and lower single side band) signals.

A synthesized/drift-cancelling 1st mixer injection system giving thirty tunable ranges from 0.5 to 30 MHz is derived from a single 10 MHz crystal oscillator providing frequency stability necessary for ssb operation.

A stable low frequency VFO tunes each of the 30 one-MHz ranges with a dial accuracy of better than 5 kHz which is sufficient to locate and identify a station whose frequency is known.

Separate detectors (product and diode) are used to provide for best performance whether listening to ssb or a-m signals. Narrow band selectivity for ssb and wide band selectivity for a-m reception is provided.

A manual tuned preselector provides for maximum sensitivity and maximum interference rejection.

Solid state circuitry throughout allows efficient operation from built-in ac power supply, internal batteries or external 12 V-dc source.

To receive a FREE Drake Full Line Catalog, please send name and date of this publication to:

Drake TVI Filters

provide more than 40 dB attenuation at 52 MHz and lower. Protect the TV set from amateur transmitters 6-160 meters.

Drake TV-300-HP
For 300 ohm twin lead **$13.00**

Drake TV-75-HP
For 75 ohm TV coaxial cable; TV type connectors installed
$16.50

Drake TV-3300-LP $32.00

1000 watts max. below 30 MHz. Attenuation better than 80 dB above 41 MHz. Helps TV i-f interference, as well as TV front-end problems.

Drake TV-5200-LP $32.00

200 watts to 52 MHz. Ideal for six meters. For operation below six meters, use TV-3300-LP or TV-42-LP.

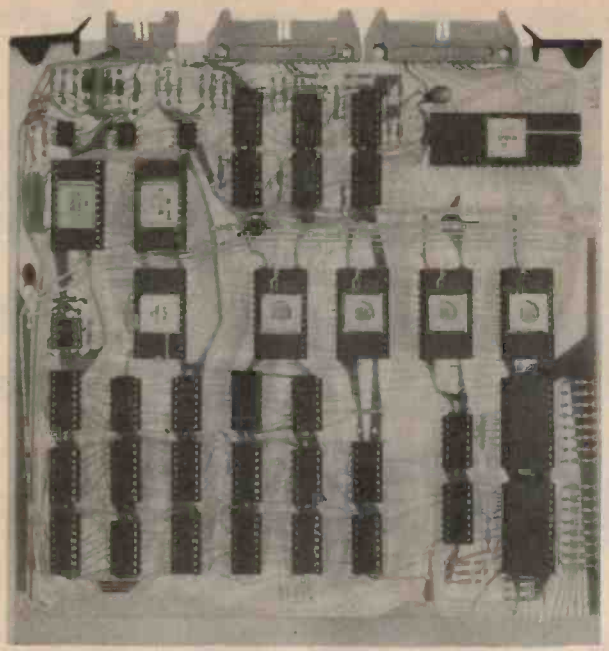
Drake TV-42-LP $19.00

Is a four section filter designed with 43.2 MHz cut-off and extremely high attenuation in all TV channels for transmitters operating at 30 MHz and lower. Rated 100 watts input.

ELMEASCO

Instruments Pty. Ltd.

P.O. Box 30 Concord, N.S.W., 2137, 736-2888
Melbourne: 233-4044; Adelaide: 42-6666;
Brisbane: 36-5061; Perth: 25-3144.



DUAL PROCESSOR MICRO

New from Fairlight Instruments Pty. Ltd. is the Quasar family of microprocessor products. The major feature of the system is the dual CPU board, which carries two 6800s both operating on the same bus, but using opposite phases of the clock so that both run at full speed. This gives a major increase in throughput, and powerful debugging facilities. A wide range of software is available, as well as advanced hardware, including floppy disk controller and graphics devices. Fairlight Instruments Pty. Ltd., 15 Boundary St., Rushcutters Bay, NSW 2011.

PHILIPS POST-GRAD OFFER

Each year Philips offer a number of scholarships to graduates of electrical engineering, physics or other related subjects, to study for a Master of Electronics Engineering at the Philips International Institute of Technological Studies in the Netherlands. The scholarships are for a period of one year beginning in January at a Philips manufacturing centre or research laboratory in Eindhoven. Course work involves lectures and experimental or design work in electronics and affiliated techniques. Financial assistance is offered and airfares to and from Europe will be paid by Philips. Applicants are drawn from all over the world but must be able to speak English and are normally under the age of 30. This is in line with Philips belief in assisting the younger talent to develop.

Applicants must possess a university degree or equivalent relevant to electronics engineering and illustrating a high level of achievement as only the very best will be chosen for this course. Applications close on September 1, 1977 and further information and application forms are available from Philips Research Manager in Australia, Dr. G. de V. Gipps at Philips Holdings Limited, P.O. Box 1138, North Sydney, N.S.W. 2060.

MICRO COURSE

The Royal Melbourne Institute of Technology, in conjunction with Technisearch Ltd., is holding a short course entitled "Using Microprocessors and Microcomputers", beginning on the 7th July. The lecturer is Dr. R.E. Hendtlass, of the RMIT Department of Applied Physics, and the course consists of seven two-hour lectures, an individual exercise and a workshop. The course material is slanted towards the professional engineer who will be engaged in developing systems and the fee of $108.00 makes applications by interested amateurs unlikely. However, if you can get yourself sponsored by your employers, further information and enrolment forms may be obtained from: Mr. E.W. White, Manager, Continuing Education Unit, Technisearch Limited, RMIT, on (03)341-2532

DICK SMITH CLOSES

Due to the annual stock-take, Dick Smith Stores will be closed for a day, but the days have been staggered so that there is always only one Sydney store closed and the other two are open. The days to miss are: Gore Hill store, Thursday 30 June; Bankstown, Friday 1st July; York St., Saturday 2nd; Melbourne and Brisbane branches, Thursday afternoon, 30th June.

QUADRAPHONIC CONFUSION

With the number of quadraphonic systems now available, and the amount of controversy over which is best, nobody is doing very well out of the situation. Of particular interest are the Nippon Columbia UD-4 system and the British NRDC's Ambisonic system. In view of the similarity between these systems, their principals have agreed to pool all patents and techniques into a system called 45J. Bear in mind though that UD4 and Ambisonics have not been heavily marketed so that when 45J is pushed into commercial production it will mean a fourth quad system to further the confusion.

Meanwhile, the BBC has put its considerable weight behind its own Matrix H system, and is already transmitting it, despite the fact that commercial decoders are not yet available. Where will it all end?

THE CASE FOR A DMM

Now available from Time Control Pty. Ltd. of 23 Warraba Road, North Narrabeen, NSW 2101, is this steel case which is ideal for containing that digital multimeter you've just finished building. It comes complete with a plain aluminium front panel and an aluminium handle is available as an extra. The cost is $25 + p&p.

2-WAY TV

In Columbus, Ohio, Warner Cable Corp. are trying an experiment in viewer-response TV using a simple calculator-type keyboard which is polled by a computer located at the cable TV company's offices. The 30 channel service offers games, educational materials, and local programs that allow the subscribers to vote. Previous attempts at two-way TV have failed because of the economics of providing complex keyboards, but the simplified keyboard used in this scheme is much cheaper, and is made in Japan by Pioneer using a custom LSI chip.

How to crack a highly paid job as an electronics technician.

We'll give you excellent training - as good as you'll get anywhere in Australia.

We'll give you free medical, dental and hospital treatment.

We'll provide plenty of good tucker and a comfortable place to stay.

We'll give you substantial leave, and on top of all that, we'll pay you well while you're training.

On your side, you'll give us a period of hard, but interesting and rewarding work. And, when eventually you leave us, you'll find yourself a fully qualified Electronics Technician. Not a bad thing to be, these days.

So, if electronics is your idea of a great career and you are (at time of entry) approx. 15 to 17 for apprenticeship and over 17 for an Adult Trainee, join the Navy, Army or Air Force.

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Write to either the Navy, Army or Air Force Electronics Technician Counsellor, GPO Box XYZ in your nearest State Capital City (please include your date of birth).

Learn Electronics with us.

Authorised by Director-General of Recruiting, Dept. Defence.
T.S.A.P.I.FP.37

IN-FLIGHT ENTERTAINMENT?

In order to show that their self-converging tube will stand up to the knocking and jarring that can occur in a household through cleaning or by children, EMI (Australia) Ltd took up a 48cm HMV set under the wing of a plane. This particular escapade is one of a series of TV adverts in which HMV sets are exposed to the rigours of various rough environments.

PULSE GENERATOR

A new, universal pulse generator, purpose-designed for use in most CMOS, TTL, other HNIL and in analog applications, has been added to the Philips Test & Measuring Instruments range. Fundamental design policy of the PM5716 has been concentrated on simplicity of operation and comprehensive circuit protection. All controls function independently and do not interact with others, allowing a "once-only" setting per operation.

Other features include a powerful 20V max. pulse amplitude and a wide range of transition times, continuously variable between 6ns and 100ms. This wide dynamic range is more than adequate for today's CMOS logic and with a 50MHz repetition rate, able to cope with any faster logic that may become available. It allows PM 5716 to be used not only with CMOS, TTL, RTL, DTL but also with analog devices such as operational amplifiers, etc.

The PM 5716 is available for immediate delivery from Philips Scientific & Industrial Equipment - Test & Measuring Instruments Department.

16K NOW IN VK

Mostek's TTL-compatible 16K dynamic RAM is now available on the Australian market from stock at Total Electronics. The new memory (MK4116P) is fabricated using Mostek's "poly 11" process, with a double level silicon gate process with ion implant, resulting says the company, in a 16K memory with performance equal to the fastest 4K device currently available.

Chip size of the MK4116P measures 122mm by 227mm, which is believed to be one of the smallest 16K memories in the industry, and putting it at less than twice the area of most 4K parts.

The memory uses the multiplexed address approach pioneered with Mostek's 16-pin MK4096 part. By replacing CS by A6, and using RAS or CAS to select the chip, the device can replace a 16-pin 4K part pin for pin, so allowing upgrades of systems using MK4096 and MK4027, with minimal artwork changes. Advanced circuit design techniques, used in the 4K MK4027 part, yield 16K parts with 150nS access times, while still having non-critical clock timing. The part can be operated with a 250nS cycle time if the system design calls for it. Considerable attention has been paid to noise-margin considerations, and the part has been designed to operate with plus or minus 10 per cent tolerance on all power supplies. Logic zero input level is specified at 0.8 volts, giving comfortable margins when using Schottky TTL.

For further information contact: Total Electronics, 239 Bay Street, 3186.

AILING OSCAR

Apparently, one of the NiCad cells in the Oscar 6 satellite is playing up and may fail completely. This means that it is imperative that all users comply strictly with the operating schedules, in order to keep that battery going.

FRENCH FOR ATA

The Australian Telecommunications Administration has signed a letter of intent with the Societe d'Applications Generale d'Electricite et Mecanique for the supply of 4,000 teleprinters over the next ten years. This ousts a previous agreement with Siemens.

CALCULATOR CONTEST

The winner of the April ETI/Unitrex Calculator Competition was Mr. M.G. Wagner of Para Hills, South Australia. His winning entry read as follows:

82526
19722
104

102352

For June the problem is:

While travelling in the outback a statistician's car ran out of petrol. After walking for some miles he came across a farmhouse.

When he asked for a gallon of petrol to get him to the nearest petrol station, the farmer refused him, but being a sporting type, offered the statistician the chance to win a couple of gallons. His rules for the bet were like this:

I've got two hats here, and I'm sure you've got ten one-dollar bills and ten two-dollar bills in your wallet. I'll let you split these, any way you want, between the two hats, I'll give them a shake, and then if you pick out a two-dollar bill, the petrol is yours. If not, then I keep the money. Go on, put the bills in the hats.'

Well, the statistician thought about it and figured out the best way to split the bills between the hats. Sure enough, he won the petrol, but he was in so much of a hurry to be gone that he forgot the money!

The question is, how did he arrange the money in the two hats, i.e. what is the arrangement that maximises the probability of drawing a $2 from 10 x $1 and 10 x $2? And secondly, what is that probability?

Send your answer on the back of an envelope, (don't forget your name and address), to ETI/Unitrex Competition (June), ETI Magazine, 15 Boundary Street, Rushcutter's Bay, NSW 2011. Closing date is 15th July 1977.

10W/CH STEREO AMP $27

Features:— VOL. BASS, TREBLE, PRESENCE Controls, H'phone, tape skts & slumber, loudness, rumble, scratch switches, all assembled on expensive looking blk. anodised panel. Dual STC TA-10B hybrid power amplifiers give max. 15w/ch in 8—15 ohms, 32v. supply. Ceramic cart. input. Transformer extra $6.50. Qty. 200.

SWR METER

June only special, SWR 300 normally $19, while stocks last at $14.00.

MAGNETIC MTG, WHIP ANTENNA

June only special, CA-70 normally $15.75, while stocks last at $12

CB RADIO POWERMATE

E.A. January issue 240V input, 13.6V DC output at 1.5A. Complete kit to power your CB radio at home.

Kit $16.50 ☐

New 2.5AMP model available

For those larger SSB sets, etc.

☐ **$21.50**

CB

ROYCE 23 CH AM/FM/CB

$179 ☐

De-luxe model, AM/FM stereo radio combined with a CB transceiver for in-dash mtg. Includes squelch, ANL, S/RFO meter, local/distant switch. "Gyro-Lock" circuit eliminates need for delta-tune, as receiver locks on centre channel of any signal.

SSB RIGS

GEMTRONICS 12W PEP.

$229

AM or SSB, 23 Ch. freq. synthesized operation, dual conversion on AM, 25W PEP input, 12W PEP RF output on SSB, 4W RF output on AM. Controls — SQUELCH, FINE TUNE, LSB-AM-USB, NB, PA, RF ATT, large S/PWR meter, 3months guarantee.

NEW DIGITAL CLOCKS

MA-1002, 12 HR or 24HR, $12. Transformer to suit $6. MA-1010, 12HR $17. Same as MA-1002 but large display.

MA-1003, 12HR CAR CLOCK 12V DC operation,includes xtal add only 3 switches, as in E.A. May issue.$27.50.

Digital clocks post free

JUMBO BAGS $3ea.

- ☐ 400 ¼W Asst. Resistors
- ☐ 500 ½W " "
- ☐ 300 1W " "
- ☐ 100 Asst. Semiconductors
- ☐ 100 Asst. Poly Caps 160—630V
- ☐ 150 Asst. various caps
- ☐ 60 Asst. Electrolytics

BONANZA JACKPOTS

For experimenters and constructors, a large assortment of new, high quality parts — samples, specials, end-of-line components incl. semiconductors.

JACKPOT No. 1

A 500gm (approx) Lucky-dip offer, all useable parts. Up to $25 worth for only $5.

JACKPOT No. 2

A 2Kgm (approx) assortment in a 315 x 270 x 160mm box includes relays, edge connectors, pots, switches, semis and many others too numerous to mention ONLY $10.

We've got RELAY-MANIA

Over 12,000 to be cleared at bargain prices.

BIG DISCOUNTS FOR QUANTITY BUYERS.

QTY			1-9	10-24	25-99	100+
CBA 4% 10 AMP CONTACTS — Solder Terminals						
☐ 6,12,24,50V	AC		2-50	2-00	1-80	1-66
☐ 115,220,380V	AC		2-65	2-12	1-90	1-76
☐ 6,12,24V	DC		2-50	2-00	1-80	1-66
☐ 48,110V	DC		2-65	2-12	1-90	1-76
☐ 220V	DC		3-05	2-44	2-20	2-02
CBZ 4% 10 AMP CONTACTS — Plug-in						
☐ 220V	AC		2-65	2-12	1-90	1-76
Socket for above			2-70	2-16	1-94	1-80
CF 4% 10 AMP CONTACTS — P.C. Terminals						
☐ 220V	AC		2-65	2-12	1-90	1-76
☐ 12,24V	DC		2-50	2-00	1-80	1-66
K.G. OPEN TYPE RELAYS						
☐ 12V	DC5A		1-86	1-48	1-33	1-24
☐ 12V DC 10A			2-00	1-60	1-44	1-33
KP PLUG-IN 8 PIN (2%) AND 11 PIN (3%) 10 AMP CONTACTS						
☐ 24V	AC	8P	2-30	1-84	1-65	1-54
☐ 220V	AC	8P	2-45	1-96	1-76	1-63
☐ 380V	AC	8P	2-80	2-24	2-01	1-86
☐ 220V	AC	11P	2-80	2-24	2-01	1-86
☐ 380V	AC	11P	3-10	2-48	2-23	2-05
☐ 12,24,110V	DC	8P	2-30	1-84	1-65	1-54
☐ 12,24V	DC	11P	2-60	2-08	1-87	1-74
☐ 110V	DC	11P	2-76	2-20	1-98	1-84
TP 3 c/o 25A CONTACTS — SPADE TERMINALS						
☐ 12 24 50V	AC		2-75	2-20	1-98	1-83
☐ 115,220V	AC		3-00	2-40	2-16	2-00
☐ 380V	AC		3-15	2-52	2-26	2-10
☐ 12,18 24,48V	DC		2-75	2-20	1-98	1-83
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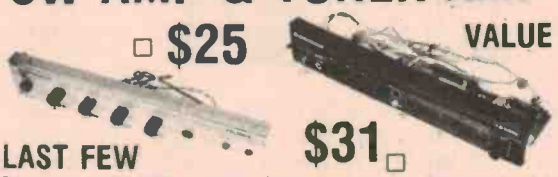

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Plugs, Connectors and Cables.

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PLA-2	Adaptor for PL-259 plug, for RG59/U cable	.28
PLA-3	Adaptor for PL-259 plug, for 75 ohm cable	.31
PLA-4	Adaptor for PL-259 plug, for 75 ohm cable	.31
SO-239	Panel Socket with flange, suit PL-259	$1.25
SO-239/A	Panel Socket without flange, suit PL-259	.98
PL-258	Cable joiner, double female, suit PL-259	$1.25
M-258	Cable joiner, double male, suit SO-239	$1.65
M-358	Cable joiner, "T" Connector (Double female and male)	$3.90
L-258	Lightning Filter and Arrestor (PL-259 plug to SO-239 socket)	$4.75
D-258	Dummy Load-with indicator lamp for transmitter power of 5 watts, 50 ohms impedance, PL-259 plug.	$3.00
PC-258	1 metre Cable Assembly — RG 58/V cable with PL-259 plug each end — suit SWR and other test meters etc	$4.30
MP-4	CB 4 pin microphone plug	$1.50
CC-2	Mic Cable-3 conductor, single shield curly-cord, colour black	$1.75
RG-58/V	Cable, 52 ohm low loss, black-per metre or per 100 metres	.45 $28.50

Accessories Part No	Description	Price
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K-815	Extension Speaker, 8 ohms 5 watts, with mounting brackets and ON-OFF	$13.50
MH-40	Microphone Holding Clip — magnetic mounting to car dash etc.	.75
MH-25	Microphone Holding Clip — with 2 self-tapping screws	.75
HL-1	"Hot-Line" Filter-reduces ignition interference — comprises choke and capacitor insert in 12V pos. lead	$3.10
SWR-300	In-Line SWR and Field Strength Meter Measures forward & reflected power by bridge method, SWR 1:1 to 1:3 Imp: 52 ohms, Accuracy 5%, indicates transmitter power output strength	$19.00
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CB Antennae		
CA-60	AM/FM/CB Lock-Down-Centre-loaded with splitter, cables and plugs, one for CB, one for AM/FM	$32.00
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For the technically minded, this unit has 19 transistors, 12 diodes and has 3 separate RF front ends! There are also 2 separate IFs (10.7MHz & 455kHz) and the CB band has dual conversion. It operates off internal batteries (4 x 'C' cells) or off external 6 volt power. It has controls for RF gain, tone and AFC as well as the usual volume and band switches This unit is designed and built in Japan to Australian specifications (not some back-yard operation in Hong Kong as many 'rubbishy' units).

Don't be fooled by other units you may see around — this has been designed from the ground up' as a radio direction finder. It is in no way an 'adapted' portable receiver. The extra bands were added to the DF as extra value.

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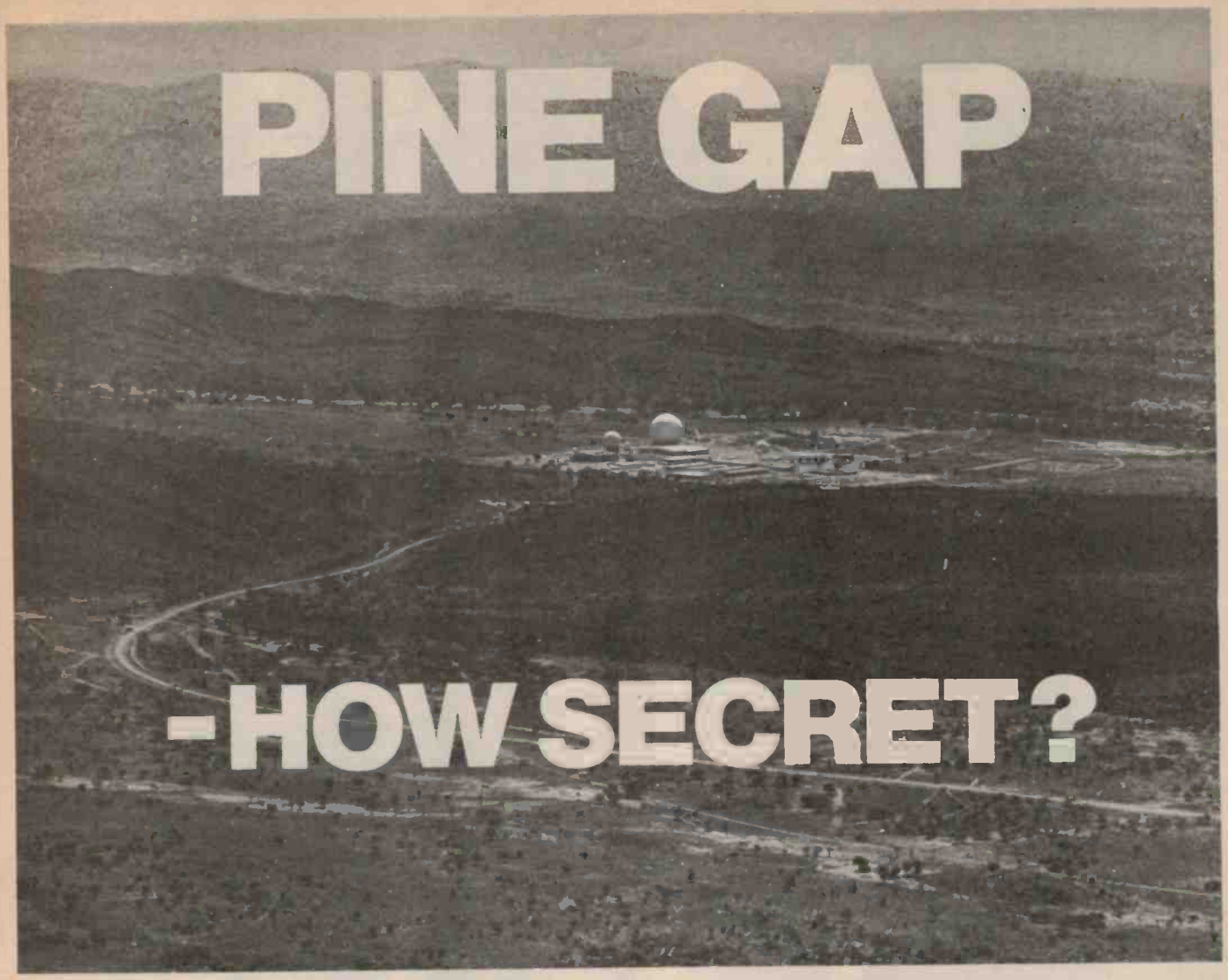
PINE GAP



- HOW SECRET?

What is the function of this isolated base in the centre of Australia?

'STORIES FED TO THE AUSTRALIAN PUBLIC over the last ten years — about the nature of these bases — has been deliberately misleading' — so reported the British publication 'Electronics Weekly'.

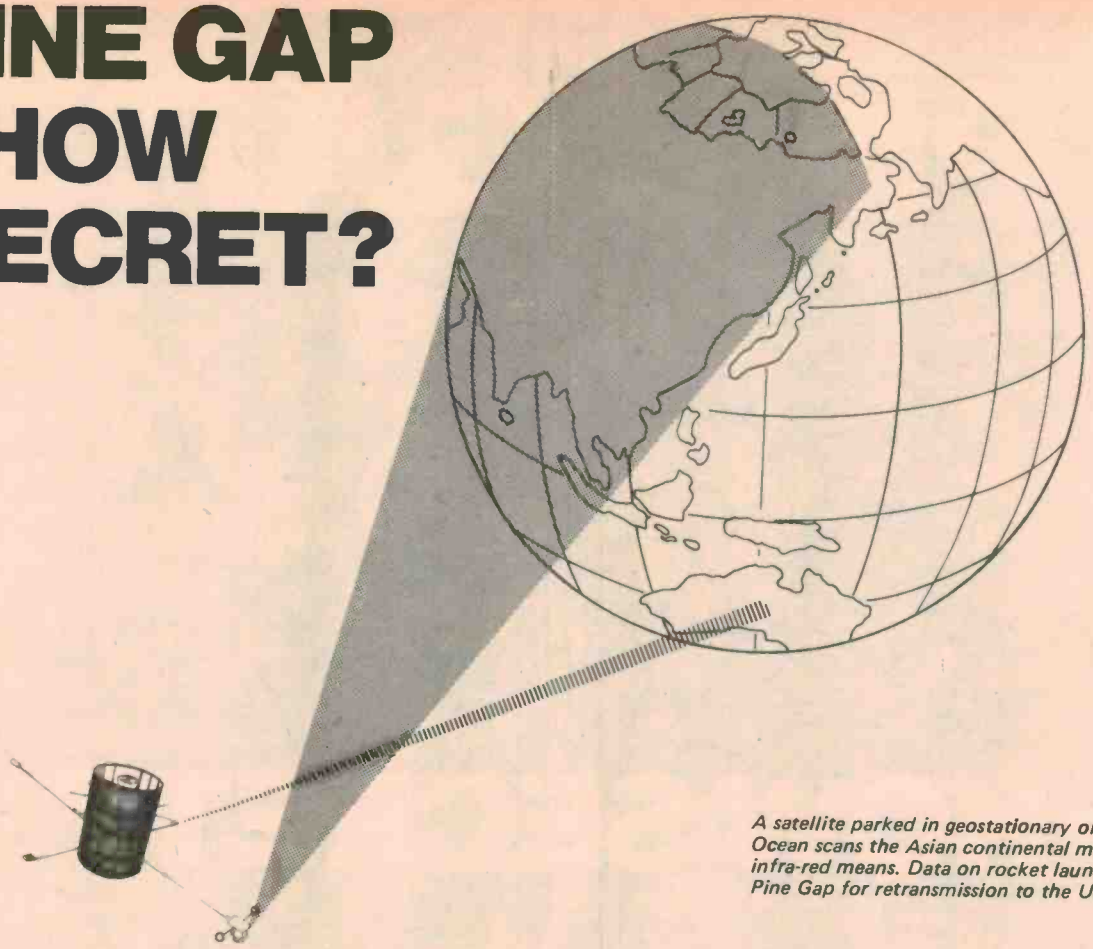
Another part of this report stated *'the function of one key base, Pine Gap, near Alice Springs, has changed from an inactive to an active role . . . '* and continued, *'Pine Gap's role has changed from that of a computing and relay centre to detect and interpret missile and rocket firings (within and from China), to that of an active response system updating target information from ICBM-monitoring satellites and passing this data, via the US Navy's VLF radio station at North West Cape, to Poseidon missile submarines operating in the Indian Ocean'.* The report also suggested that it was possible that the Pine Gap system *'provided course correction for Poseidon missiles during trajectory'.*

Once again these bases are in the news — this time because of allegations made during a trial, in the USA, of a man charged with espionage. Amongst a number of allegations was one that the CIA had deliberately misled the Australian government about the bases' true functions.

Whether or not this allegation is true it is a fact that within Australia neither the previous Liberal government, the subsequent Labor government, nor the present government will make any official statement concerning the bases' purpose.

One of the main election pledges of the Whitlam government was to disclose information about the bases. That pledge was broken. In 1973 Mr Whitlam stated that he was unable to make good that pledge, *'they are not Australian secrets'*, he said, *'I know now why the Americans don't want those secrets revealed. But I accept that they (the bases) are not parts of weapons systems and cannot be used to make war on any country. You can belive us or not — I will tell you that and I will tell you no more.'*

PINE GAP -HOW SECRET?



A satellite parked in geostationary orbit over the Indian Ocean scans the Asian continental mass by both visual and infra-red means. Data on rocket launchings is relayed to Pine Gap for retransmission to the USA.

Incredibly, on March 26th, 1973, Whitlam admitted that neither he nor his government knew of the purpose of the North West Cape facility. *'We don't know about this facility's operations but we are determined to find out'.*

WHY THE SECRECY?

Australian governments – both Labor and Liberal – have a penchant for not informing the population about matters such as these – or as in the early days of the OMEGA controversy – deliberately misrepresenting facts.

This is not the time nor place to resurrect the OMEGA controversy, but we would remind readers that we published a full report on that system and its uses in June 1971. This report was subsequently proven correct in all major details despite strong government denials at the time. Then, the McMahon government stated *'the OMEGA system is solely a civil navigation aid . . . it has no military function whatever'.* Yet at that very time the promotional material which was freely available from the US Navy's OMEGA Project Office stated in part *'OMEGA is the only navigational method that is as well-suited for submarines as for aircraft or surface vessels. Its low frequencies penetrate seawater to appreciable depths. They also travel through sea ice. Thus a completely submerged submarine may be guided by OMEGA through any seas . . . Only reception is required, so the submarine user does not reveal his position . . . '* That quotation came from the Booklet 'OMEGA a Worldwide General Purpose Navigational System for Air, Surface and Subsurface'. It was an official document of the US Navy and was freely available outside Australia virtually for the asking. (We obtained a copy simply by writing and asking for it via our London office). Yet for years successive Australian governments blatantly lied about OMEGA's military implications despite the USA's not only open admission of its uses for submarine guidance – but actual promotion of the system for that purpose!

Unlike OMEGA, information about Pine Gap, Nurrungar and North West Cape is not so freely available. Nevertheless a very great deal of material has been published – once again though, outside this country.

The main sources are the Swiss publications 'International Defense Review' and 'Interavia', and the American publication 'Aviation Week and Space Technology'. A further and very reliable, albeit rather surprising, source of information is India's 'Monthly Bulletin on Science and Technology' which is published by the Indian Institute for Defence Studies.

No one publication claims to have definitive details of any specific Australian base – but by piecing together various data it is possible to build up a fairly accurate picture of what these bases are probably about. We must however stress that our report is based on a mixture of known facts from official sources, probable facts from authoritative but non-official sources and a small amount of conjecture.

PINE GAP

The main role of Pine Gap is to provide early warning of possible ICBM launchings against the USA (and other targets) from the USSR. It is virtually certain that this is so.

The concept of such a system began in 1957 when it became increasingly obvious to US defence planners that

conventional radar systems would not provide sufficient warning of an ICBM attack. It was therefore deemed essential to develop a method of detecting ICBMs immediately after launching.

Initially the proposed method was to use satellites equipped with infra-red sensors. These would hopefully detect the radiation from the ICBMs' rocket exhaust. This project was not totally successful for as with similar experiments elsewhere it was found that Murphy's Law being what it is infra-red sensors tend to lock onto anything warm except the target itself. ETI's publisher recollects working on an early de Havilland missile sensing head which had the engaging habit of locking onto the local Chinese laundry! The US project described above was code-named 'Midas' – perhaps more appropriately than had been intended considering the fate dealt out to Midas by Tmolus – a pair of asses' ears – in place of his own.

The Midas concept was subsequently expanded to take in visual as well as infra-red sensing and a successfully working (experimental) satellite was launched from the USA's Vandenberg Air Force Base late in 1968.

The first satellite was subsequently shifted in orbit to enable it to observe USSR ICBM sites (and experimental launchings) in the vicinity of Tyuratam. A second, similar, satellite was launched in 1970 and a third put into geosynchronous orbit on May 6th 1971. These are facts and readily checkable. In 1962 the USA and USSR mutually agreed to report all satellite launchings to the United Nations. Launch details include a brief description of purpose and initial orbital characteristics. These details are published at frequent intervals.

The ex-Midas early-warning satellite system is now code-named Project 647 and the purpose of the Pine Gap base is to receive coded digital data, related to possible USSR missile launchings, from the 647 satellite (now parked in geostationary orbit 35,400 km above the Indian ocean) and instantaneously to retransmit this data to the North American Air Force Command, the Strategic Air Command etc.

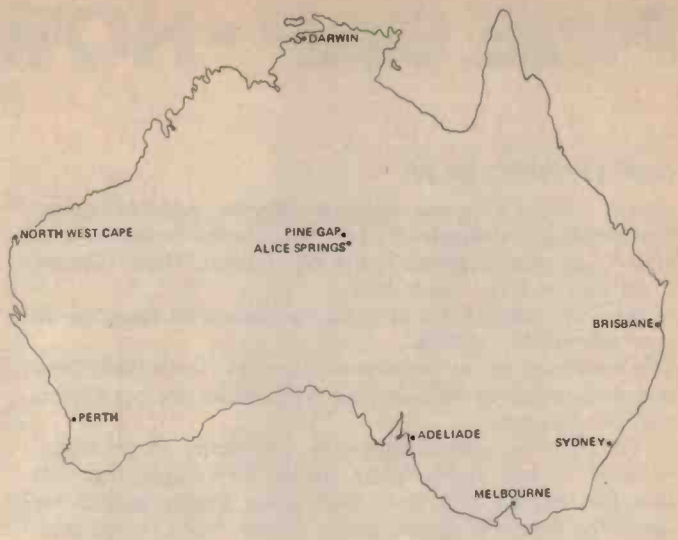
Reports back in 1973 indicated that Pine Gap's role had been extended to enable it to transmit data received from the 647 satellite directly to Poseidon-equipped submarines via the VLF facility at North West Cape.

It was further suggested that such facilities would be used on-line so as to update course directions for US Poseidon missiles. The latter part of this report is probably incorrect, because, unless the guidance philosophies have changed neither American nor Soviet ICBMs can be reprogrammed once launched – thus preventing deflection by opposing guidance systems.

It has also been suggested that the Pine Gap installation controls laser-equipped satellites whose role is to 'knock-out' the guidance system of ICBMs – again this is improbable at present. As far as can be ascertained the laser technology to do this is not yet available although it is most certainly being developed.

NURRUNGAR

The Nurrungar 'joint defence space station' is situated about 25 km south of Woomera in South Australia. Unlike Pine Gap, Nurrungar is run directly by the US Air Force. It is believed to complement the role of Pine Gap in receiving and retransmitting data from the 647 satelite. The International Defense Review reports *'Digital data is flashed in real-time (from the 647) to a ground computer complex in Australia . . . from tracking information coupled with data in the computer memory pertaining to exactly which missiles are launched from where, the computer predicts the target and in turn flashes this warning to the US mainland via a synchronous orbiting satellite known as Program 313.'*



Vast spaces and Australia's position relative to Russia and China make it a natural for stations like Pine Gap and North West Cape.

A second probable function of the Nurrungar base is to monitor and receive coded data from the USA's many 'search-and-find' satellites. The USA have a number of these satellites constantly circling the globe from an altitude of about 160 km. These satellites carry cameras having resolution of sufficient adequacy to detect the general characteristics of major installations – particularly of new installations or installations undergoing major changes.

Exposed film is processed on board the satellite. The resultant pictures are initially scanned on board and then transmitted in 'rough' form to the receiving bases/s. The material is then physically sent down to Earth by an ejection/parachute technique and recovered by US Airforce C130 aircraft operating off the Hawaiian group of islands. These pictures are finally scanned and transmitted in digital form via communication satellite links to the National Photographic Interpretation Centre in Washington.

BIG BIRD

The 'crude' reconnaisance satellites are backed up by a more sophisticated satellite system code-named 'Big Bird'. Big Bird is a combined 'search-and-find' cum close-up satellite. It's big as satellites go. About 10 000 kg and 20 or so metres long. It is believed to be capable of resolving objects less than one metre across from it's orbital altitude which varies from 160 km to approx 275 km.

Big Bird's role appears to be to act as a back-up to routine reconnaisance missions. As far as we can gather the photographic system processes films on-board, and these are then scanned, photo-electrically digitized, and transmitted by UHF radio link to a number of stations of which Narrunga is one. The received data is then re-transmitted to the USA. Stations which appear to be similar to Narrunga exist in the Seychelles, on Kodiak Island (Alaska), again at Guam, in New Boston, in Tanganyka and in Oahu in Hawaii, (the writer was recently in Oahu and as far as could be ascertained from a distant view the installation bears a remarkable resemblance to that at Nurranga).

PINE GAP - HOW SECRET?

NORTH WEST CAPE

This is a fairly easy one. There's only two possible reasons for a military authority to use frequencies below 14 kHz (the 'Cape uses frequencies around 10 kHz). That's because – (a) they're very hard to jam

– (b) Only frequencies this low can penetrate sea-water to any appreciable depth.

The existence of an installation such as North West Caoe and knowledge of its operating frequencies are not secrets that can be kept.

To transmit such frequencies one needs an enormous antenna – and that's what North West Cape has. It's just too big to hide and thus being totally visible the operating frequencies can easily be calculated – and measured with equal ease.

North West Cape's function is to enable US agencies to communicate with submerged submarines. This is not a matter of conjecture – it's virtually one of physics. The attenuation of sea-water is approximately 3.0 dB/metre at 11 kHz compared with 45 dB/metre at 2.0 MHz. Verbum Sapienti.

THE IMPLICATIONS

We have in this article presented what we believe is a realistic assessment of what Australia's 'secret' bases are about. We are not for a moment suggesting that this account is definitive – but it is probably correct in outline if not in absolute detail. It is quite possible that some of the functions we have assigned to Nurrunga are true of Pine Gap and vice-versa. But as far as we can ascertain from careful study and subsequent assembly of data from sources of known authority – the totality of this report is substantially correct.

One must ask whether or not the presence of these bases makes localized parts of Australia a nuclear target.

Our opinion is that this would not necessarily be so, for a pre-emptive strike against these bases must necessarily give the USA advance notice of what is to follow. It is far more probable that any pre-emptive strike would be against the 647 satellite itself – for at present there does not appear to be a back-up system. One would have to decide whether there has been an attack – or just an equipment failure. Hopefully it would be the latter.

Those then are the probable facts as we see them. We think the overall picture is basically correct. No doubt one day we'll be told.

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The new IC22S transceiver is a PLL synthesised rig with programmable ROM for any frequency multiple of 25 KHz from 144 to 148 MHz. Simplex, duplex or reverse achieved by a flick of a switch on the front panel. This fabulous new rig features ceramic discriminator, IDC, electronic Tx/Rx relay, full swr protection and VICOM 90 day warranty. Circuitary includes 34 transistors, 7 FETs, 13 ICs and up to 128 diodes. Receiver sensitivity better than 0.4 uV for 20 dB quieting. Your new IC22S comes complete with mic, mobile mounting bracket, plugs, cables, spare diodes for programmable matrix and English Instruction Manual.

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- Dual power 3 watts/40 mW
- Lighted dial and meter
- Crystals same as IC22 series

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Your new IC215 comes complete with 3 popular channels, mic, shoulder strap, connectors, batteries, English Manual and VICOM 90 day warranty.

QUALITY HANDY PORTABLES

IC202 $219 IC502 $219

The famous IC202 handy portable runs 3 watts pep with VXO control 144-146 MHz. Features noise blanker, RIT, lighted dial and meter, telescopic antenna and of course that ICOM quality! Comes complete with mic, carrystrap, dry cells, English manual and 90 day warranty.

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A licence is required for all transmitting equipment.

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Model M1 quality base loaded mobile whip, 40.5 inches long, 50 ohm impedance, vswr less than 1.5, includes roof mount and optional boot lid mount, spring and coax with PL259 plug. $27 + P&P
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HELICAL WHIP

Model HW-11S-6 6ft helical whip, covered in tough plastic, this top loaded (helical) is designed to give a perfect 52 ohm match. $22 + P&P
- spring base $13
- roof base $17.50

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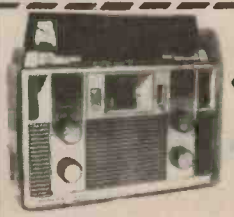
¼ wave high efficiency ground plane, solid 108 inch heat treated radials and radiator. Radials droop for 50 ohm match. Complete with S0239 socket. $35 + P&P $3

SWLs



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Model OB-330

SPECIFICATIONS

Model OB-330 DC 20000/V AC 8000/V
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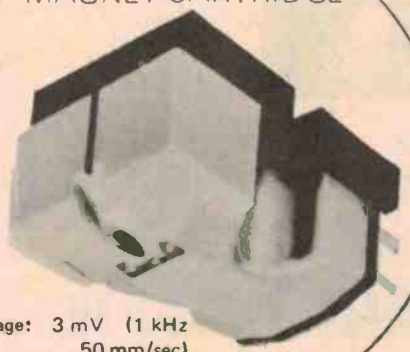

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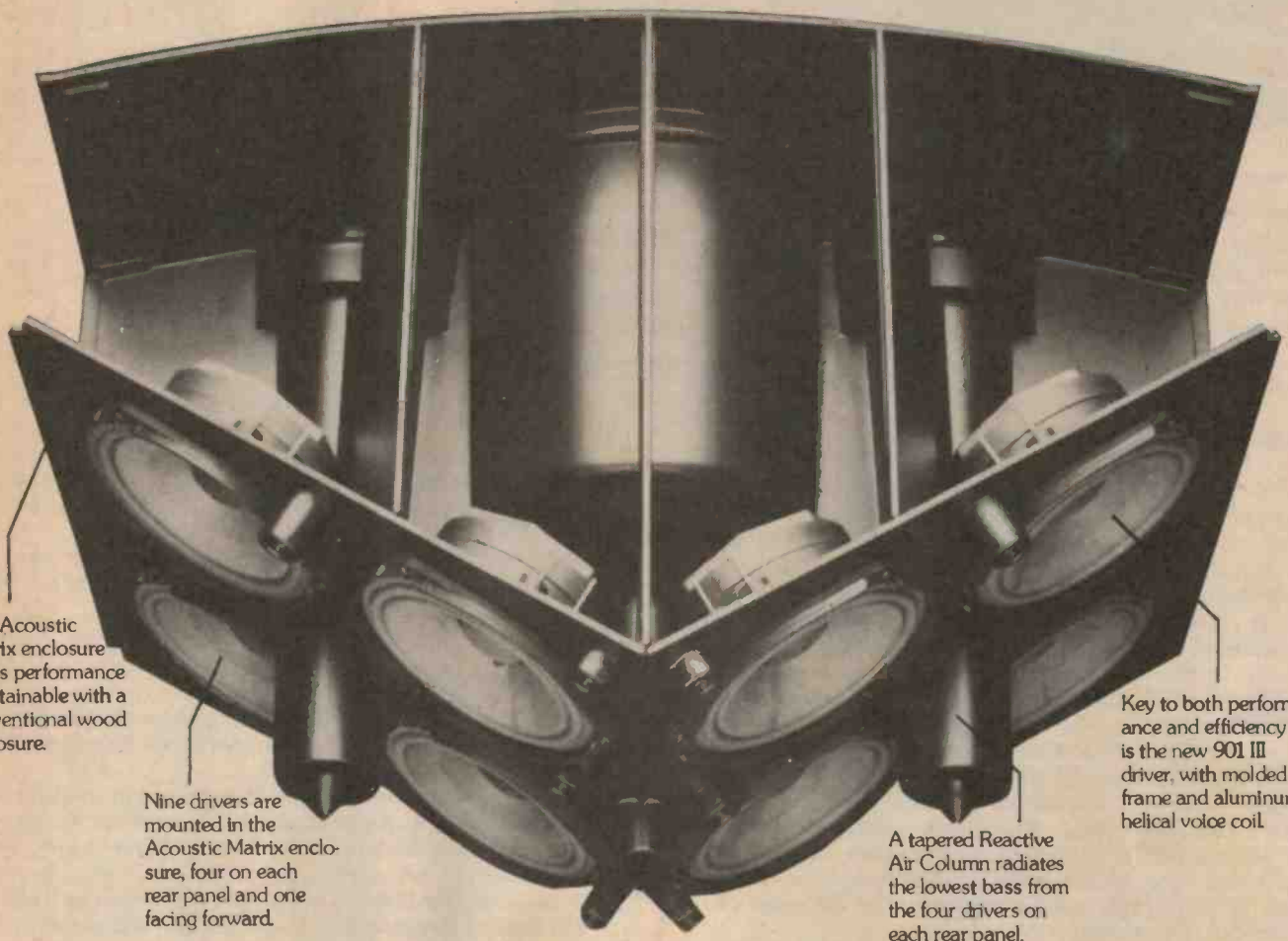

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SOUND

Since we introduced our Audio Facts column some months ago, innumerable readers have asked us to expand the present coverage we give to the technical side of audio and hi-fi.

In response, here is the first issue of our new hi-fi/audio section. Its make-up will vary from month to month, depending on what's afoot, but the emphasis will be on news of developments with outstanding technical interest and/or performance.

Another Noise, Another Reduction

No noise reduction system so far available has tackled the problems of impulse noise — clicks and pops from records, crackles from radio, etc. So far, emphasis has been on removing hiss, and in this respect the obvious system for home use is Phase-Linear's auto-correlator, which we intend examining in detail before long.

Soon to be introduced into Australia, however, is an impulse noise reduction unit by SAE. This was still unavailable for investigation at time of going to press, and so we are unable to give any first-hand idea of how well it works.

But the sales material from SAE sounds most convincing. Impulse noise is characterised by high amplitude and very short attack and decay times, and can be recognised and thus filtered out. Should such an impulsive noise be present in a signal, the SAE electronics simply remove the entire signal, leaving a 'gap' whose duration is of the order of one-thousandth of a second.

And what happens next? Well, the gap has to be filled, and this function is carried out by a sampling circuit which extropolates information either side of the gap, and having analysed what is likely to have been there, fills it. This is the only part of the operation which might seem to be hit-or-miss, although there would appear to be no more of a potential compromise than exists with the auto-correlator.

Probably the most flexible of noise-reduction systems would be both auto-correlator and impulse NR unit used together. Then, perhaps, one should also add a dynamic filter for any hiss that slips through, and of course a Dolby unit for tape (and future FM?) processing. It should be stressed, of course, that both auto-correlator and the SAE device are one-part systems, and are therefore independent of prior processing.

With record quality so often marred by clicks, pops and sundry impulsive noises, it seems the SAE unit has much potential.

Damping and SME

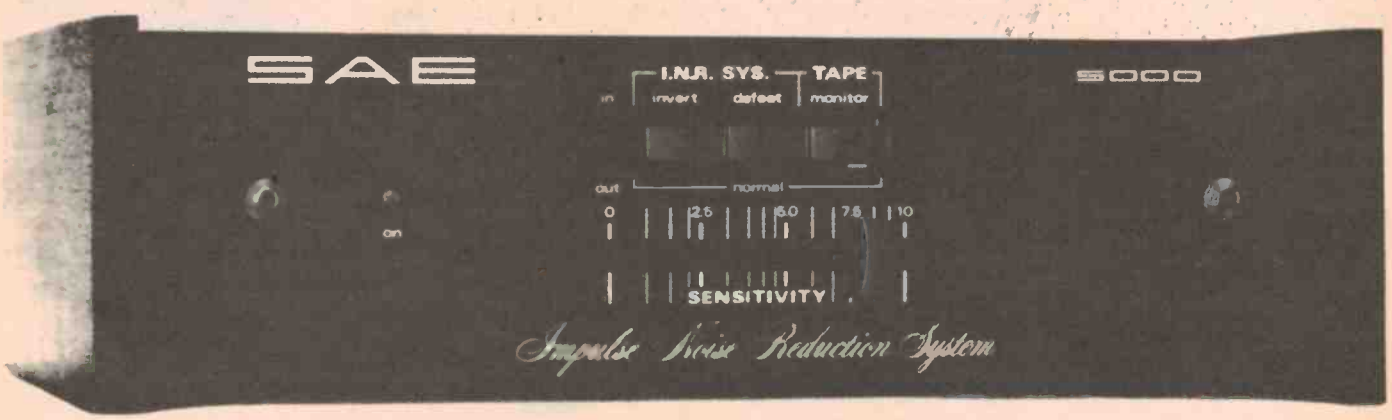
Latest news from SME, the pickup arm people in England, is that model 3009/II improved can be further improved — with the help of viscous damping.

Viscous damping is normally only found in unipivot arms (e.g. JH Formula 4, Keith Monks M9 etc) where its use is essential to provide stability. The Inertia unipivot arm, which was undamped, behaved rather strangely and anyone acquainted with that arm will know why damping is needed!

But viscous damping also helps suppress the pickup fundamental resonance, and recently, with the introduction of some extremely sensitive cartridges (the new moving-coils and Decca's Mk 6E for example) the need for damping has become audibly obvious.

The SME 3009, a low-mass design, was only partially damped by virtue of its cleverly decoupled counterweight. This decoupling, incidentally, is not damping in itself — its effect is simply to reduce the effect of the counterweight mass as a contributor to pickup system resonance.

Now SME has come up with FD200, a new accessory.



SAE has taken a new angle on the problem of impulse noise reduction with the smart 5000 Series unit.

It consists of a trough, containing the damping fluid which fits onto the body of the arm lifter, and a paddle, which clamps onto the arm tube just ahead of the pivot. SME claims that application of damping is more beneficial away from the bearing plane.

The new accessory should give audible improvement to bass performance of most cartridges, and would probably enable you to use a Decca 6E in your 3009, as well as giving greatly improved performance with many other cartridges. From the information so far to hand, it appears that the damping system reduces Q and at the same time, raises the resonance's frequency to around the optimum of 10 Hz.

This is, of course, big news for SME owners who want to use these more 'difficult' cartridges but who so far haven't been able to. At this stage, we are unable to say when the FD 200 will be available, but Audio Engineers, the distributors of SME products, should be able to advise before too long.

Nakamichi Spoken Here

Mr. Nakamichi recently paid a whirlwind visit to Australia, and took the opportunity to discuss recent and forthcoming developments from Nakamichi research.

He addressed a meeting of retailers at Convoy International's Woolloomooloo headquarters in Sydney. Convoy is the national distributor for Nakamichi.

Of interest to budget-conscious enthusiasts is the new 500 cassette unit, a top-loading machine with two heads and direct-acting mechanical, controls. This model is based on, but, according to Mr. Nakamichi, superior to the machines seen under Thorn and Sonab guises. Both these models were made for the principals by Nakamichi.

Another fascinating product is the series 400 amplifier. This is available as a separate pre-amp and power amp, and in these days of excessive control facilities and gadgets, it is refreshing to see a minimum of knobs and switches on the pre-amp. Mr. Nakamichi describes the design as "black box – no gingerbread" and the units are indeed black boxes. The power amplifier isn't unlike the Quad 405 in size or appearance, although its front-mounted heatsink fins are less obvious than the Quad's.

The pre-amp has all normal facilities such as tone controls and tape monitoring but little else – as basic as the dedicated audiophile, intent on listening to music and not on playing with equipment, could wish for.

Also seen and heard was a new tuner pre-amp model which looked very smart indeed. Mr. Nakamichi stressed the design aim behind this product – "it should feel good . . . the control must work well . . . ". He was referring to the tuning control, a large, circular dial centrally rotated via a reduction drive.

Here again is a similarity with a Quad product – the tuning indicator system uses lamps. The Quad FM3 uses only two lamps, however; Nakamichi's uses four plus, of course, a stereo beacon. The 630 tuner pre-amp is intended for use with other 600 series components, and can be incorporated into the System One rack mount.

We hope to be able to examine these new Nakamichi products before too long, and would like to investigate the MC-1000 moving coil pickup cartridge. This latter has enjoyed enormous success in Australia so far, despite its very high price. Performance is quite superb, putting the MC-1000 into our top five shortlist of cartridges.

Speakers . . . and Speakers

One often has the feeling that major Japanese manufacturers really aren't aware of how the audiophiles of the world regard their speakers. Mr. Nakamichi, however, seems to be an

(Continued Page 23)

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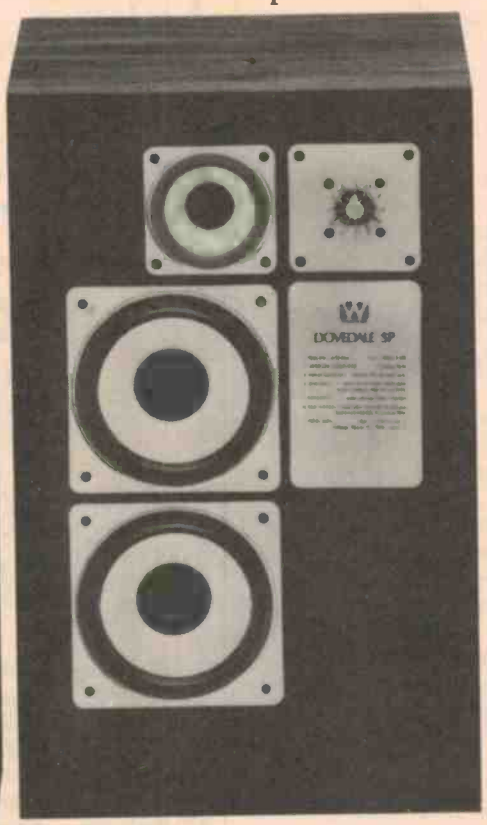

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(Not illustrated)

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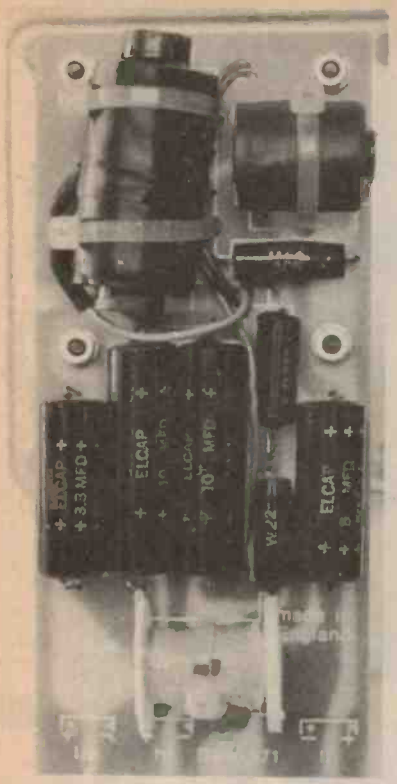


Latest KEF crossover improves the performance of that company's Model 104 speakers. It is available as a conversion kit from KEF dealers.

exception. Asked if his company would look seriously at the idea of high-quality speaker manufacture, Mr. Nakamichi stated somewhat discursively that he saw little point. He went on to imply that Japan's most popular speaker sounded decidedly 'commercial'.

He added that the two types of American speaker – East Coast and West Coast – both displayed distinctive characteristics. "The British", said Mr. Nakamichi – "Very funny people. They listen to more music. They know what music sounds like."

More Speakers . . .

Another recent visitor to Australia was Raymond Cooke of KEF. His busy itinerary included a number of talks in Sydney and Melbourne, and he also spared time to meet representatives of ETI and Hi-Fi Review in pleasantly informal surroundings over dinner.

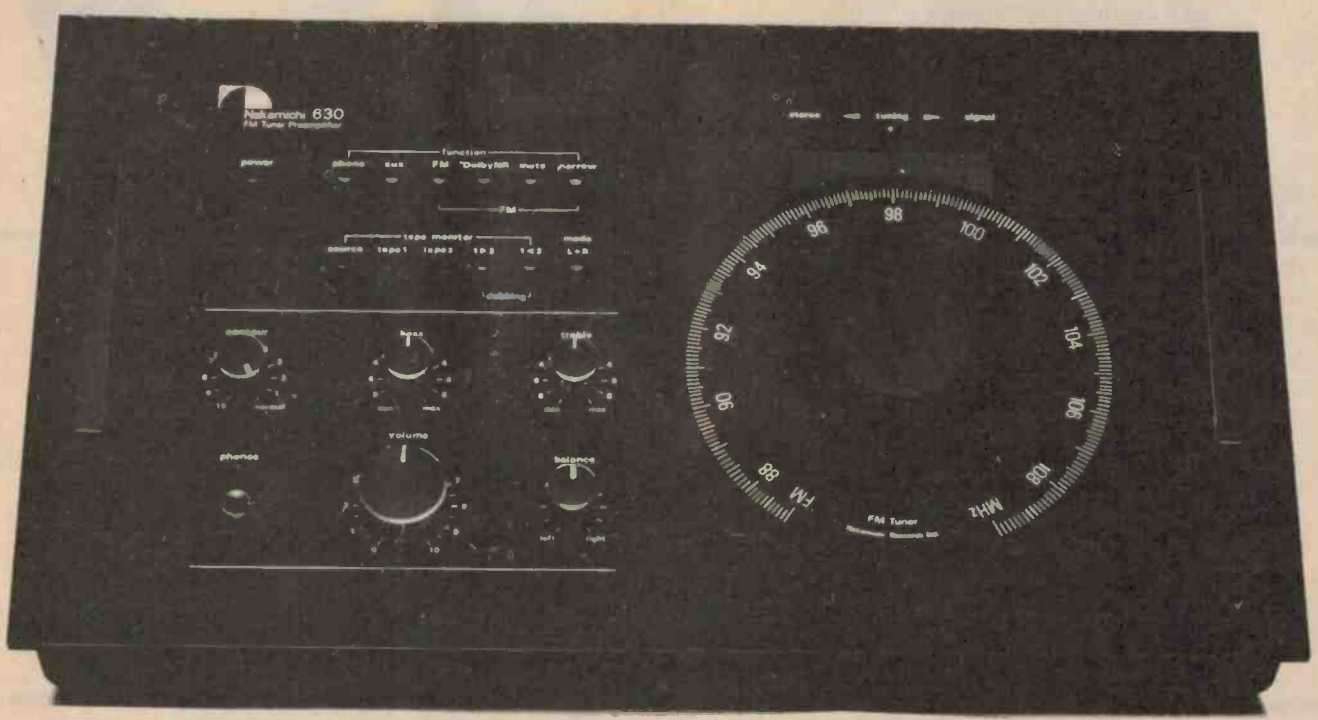
During our meeting, Mr. Cooke explained much about the recent design work at KEF which has resulted in new 'C' series loudspeakers. Positioning of midrange drive units, for example, has been altered to reduce colouration caused by proximity of the drive unit to the floor. Diffraction problems have also been studied, with the result that new flush front panels are used, together with surface-mounting grilles.

Mr. Cooke agreed that most speaker grilles caused audible problems, not so much by attenuation of high frequency information but by colouration as a result of the fabric being close and parallel to radiating surfaces. Such colouration was clearly audible and its influence tended to be greatest in the midrange region. He added that properly-designed grille frames had little adverse effect on sound quality, but that the fabric – acoustically transparent or otherwise – was the chief culprit. Reticulated foam was the best answer but there was one big problem – women disliked it because they believed it would be difficult to keep dust-free.

Further discussion revealed that the new 'deeper-than-wide' shape for the 'C' series was not simply a matter of jumping on a bandwagon but was fully intentional – again for

(Continued Page 25)

A feature of the Nakamichi 630 tuner pre-amp is the super-sized tuning control dial.



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reasons associated with diffraction. Not surprisingly, the subject of crossovers was discussed, and Mr. Cooke explained very clearly how resonances of drive units which fell into the stop-band of the associated crossover network could cause distortion and colouration, both within that stop-band and within the drive unit's pass-band. The latest KEF crossovers are the practical realisation of acoustic Butterworth filters, and are the result of exhaustive computer analysis of a large number of variables — in total the dynamic behaviour of a loudspeaker system.

. . . and More Yet

KEF isn't the only company to have looked carefully at crossover design. Closer to home, AMW in Sydney has stumbled across the same problem of unwanted resonances in stop bands. The audible effect of these resonances was, according to AMW, a reduction of clarity, most obvious in the upper midrange region. Colin Wait, AMW's technical director, has come up with a most elegant solution. He's added L/C/R tuned circuits to appropriate legs of the networks the effect being to suppress the offending resonances.

All AMW models have responded well to this treatment, and although the immediate impact is relatively small, prolonged listening shows how great the improvement is. AMW speakers have always sounded well balanced, tonally, and pleasantly non-fatiguing. They now sound even less fatiguing and more effortless. All AMW speakers of recent manufacture are fitted with the new crossover networks and AMW hopes to be able to provide a modification service through its national dealer network whereby older speakers may be updated at a nominal cost.

This virtually parallels the firm's arrangements for converting model 104's to superior-sounding 104ab's, although KEF supplies kits, the change being carried out by the owner. AMW insists that only authorised personnel should carry out the changes to its products — unauthorised attention nullifies the warranty. The company also plans introduction of at least one new model this year, hopefully in time for the Sydney CES in August. Rumours are rife about what this (these) new product(s) will be, although AMW is being very close-mouthed. We hope to receive more information soon.

SOUND BRIEFS

SONY MC CARTRIDGE

Sony have a **moving-coil** pickup cartridge, designated **XL55**, which looks as though it will become stiff competition for similar cartridges currently available. Also on its way, we understand, is a **head amplifier** which should also match other MC cartridges on the market.

DM6 MODIFICATIONS

Waggishly (and unofficially) designated 'The pregnant kangaroo', model DM6 by Bowers and Wilkins has undergone modifications designed to improve performance. The front panel is now made of a ribbed moulding to improve strength and **reduce colouration**, and the bass contour control has been omitted. Power handling capacity has been increased, and the new models should be arriving in Australia fairly soon.

KEF 105 DETAILS

Still to be introduced, the KEF 105 has been the subject of much rumour and anticipation. The reality is even stranger than we had imagined — a bass section with a **novel form of loading**, and separate enclosures for both midrange and treble units. The bass driver looks as though it will be the long-awaited B300 using a Bextrene diaphragm.

COMING SOON

Full details of how to build a truly magnificent pair of **transmission line speakers** - these are the one's we use ourselves for reference purposes. And for that purpose they have to be good!

DIGITAL TUNING

As 'digital tuning' now appears on professional and amateur communications equipment, the time is now long past due for comparable facilities to appear on hi-fi equipment. General Instruments have for some time been producing an LSI chip which provides both AM and FM digital frequency display and now they have released 'Stereomega', a new **phase-locked loop-bored tuning system** which features remote control, preprogramming of up to ten AM and FM stations, search and scan modes plus digital display of frequency. In addition, the Stereomega uses GI's EAROM which will remember stored programme information and a digital clock can be added if desired. Shouldn't be long before receivers start appearing which incorporate these facilities.

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This revised version of our earlier equalizer now uses gyrators to replace the inductors making construction easier.

GRAPHIC EQUALIZERS are popular with both the professional and domestic user alike. However until the presentation of our earlier equalizer (ETI 427) the cost of such a device was very high and this limited its wide use. We have now redesigned the equalizer to simplify the construction and it now has no coils and one additional filter has also been added.

The advantages of an equalizer are not generally well known but are as follows.

Firstly an equalizer allows the listener to correct deficiencies in the linearity of either his speaker system alone, or the combination of his speaker system and his living room.

As we have pointed out many times in the past, even the best speakers available cannot give correct reproduction in an inadequate room. It is a sad fact that very few rooms are ideal, and most of us put up with resonances and dips, sadly convinced that this is something we have to live with.

Whilst the octave equalizer will not completely overcome such problems, it is possible to minimize some non-linearities of the combined speaker/room system.

In a concert hall it is also possible to use the unit to put a notch at the frequency where microphone feedback occurs, thus allowing higher power levels to be used.

Thirdly, for the serious audiophile, an equalizer is an exceedingly-valuable tool in evaluating the deficiencies in a particular system. One adjusts the equalizer to provide a uniform response, the settings of the potentiometer knobs then graphically display the areas where the speaker etc is deficient.

There is a snag, however, one must have an educated ear in order to properly equalize a system to a flat response. It is not much use equalizing to your own preference of peaky bass etc in order to evaluate a speaker.

Ideally, a graphic equalizer should have filters at 1/3 octave intervals, but except for sound studios and wealthy pop groups, the expense and size of such units are too much for most people.

The equalizer described here has 10 octave spaced filters but if desired it could be modified to give 1/2 or 1/3 octave spacing as large values of inductance are easily obtained with gyrators (active inductors).

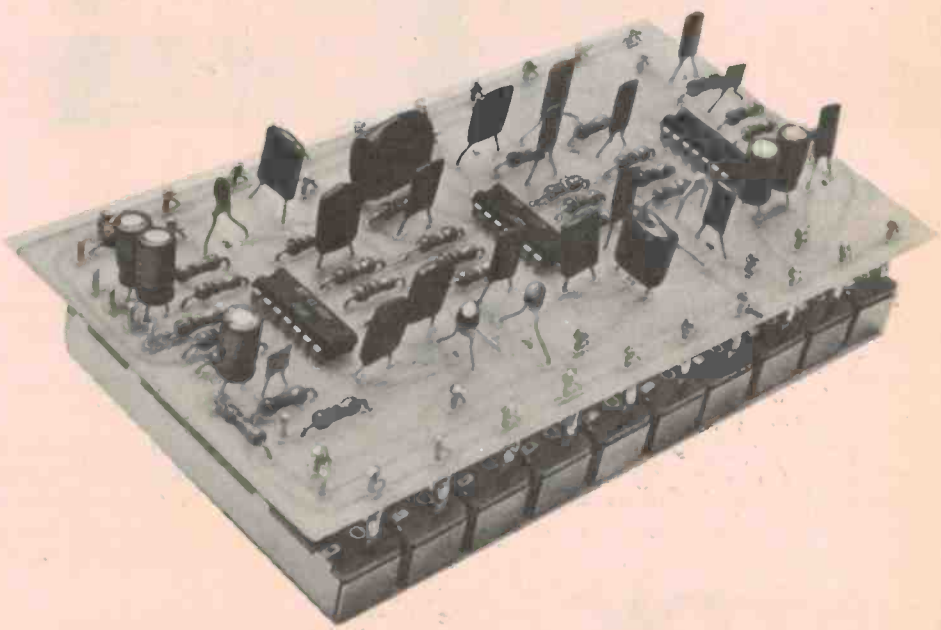
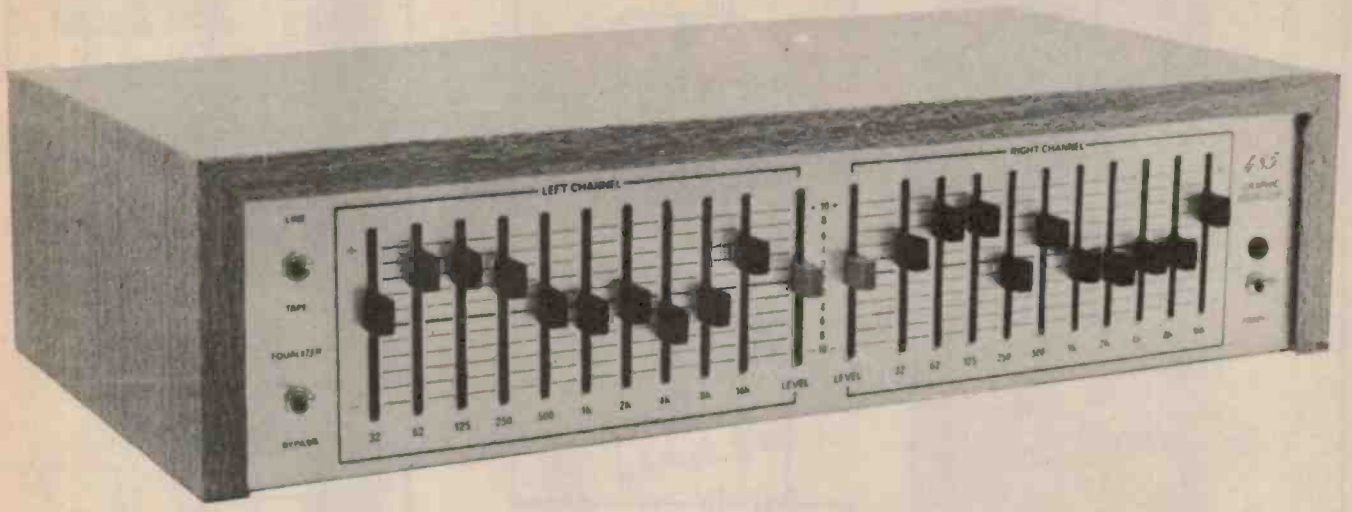


Photo showing one complete channel, less the volume control, removed from the chassis.



Construction

Assemble the PC board(s) with the aid of the overlay in fig 3 initially leaving off the potentiometers. Add pc pins for the external wires and the potentiometers connection points. Now double check the PC board soldering, the positioning and polarity of the components as once the potentiometers are in position changing components is difficult.

Now solder lengths, about 40mm, of tinned copper wire onto the end terminals of the potentiometers, and also onto one of the wiper contacts. Note that half the potentiometers use one wiper connection and the others use the other end. Now slide the wires through the holes provided such that the potentiometers are on the copper side of the board. Before soldering mount the potentiometers onto the support rails, space the board back about 10mm then twist the wire around the PC pins and solder the connections.

The volume controls can now be mounted and connected and the complete assembly mounted into the chassis using 12mm spacers. The power supply can be added along with the other components in the box and finally wire as shown in fig 6.

Third octave filters

While we have not built up a third octave unit we see no reason why it will not work. Additional stages can simply be added except that the Q of the circuits must be changed to narrow the band. At the moment the impedance of the capacitor and inductor (gyrator) is about 3000 ohms at the centre frequency and this should be increased to about 8000 ohms for the third octave unit. The capacitors and inductors can be calculated by

$$C = \frac{1}{2\pi f X_C} \qquad L = \frac{X_L}{2\pi f}$$

where $X_C = X_L = 8000\Omega$
and f = centre frequency

It is recommended to reduce loading IC1/2 that the potentiometers be increased to 10k.

SPECIFICATION ETI 485

Frequency response			
Equalizer out			Flat
Equalizer in and all controls at zero	10Hz – 20kHz		± ½dB
Range of controls			
Individual filters			± 13dB
Level control			+ 14dB – 9dB
Maximum output signal at <0.1% distortion			6 volts
Maximum input voltage			10 volts
Distortion			
at 2 volts out, controls flat	100Hz 0.02%	1kHz 0.02%	6.3kHz 0.04%
Signal to noise ratio re 2 volts out, controls flat			82 dB
Input impedance			47 k
Output impedance			100 ohms

GRAPHIC EQUALIZER

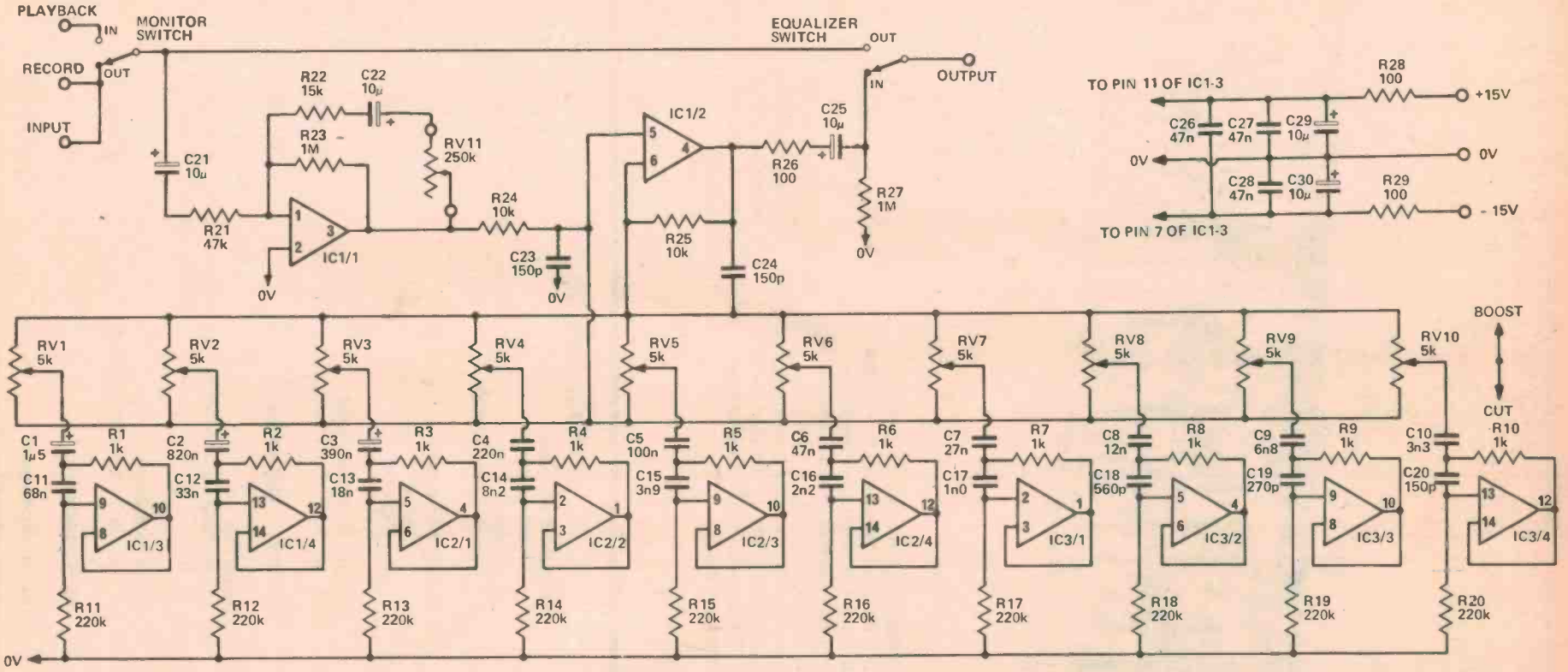


Fig. 1. Circuit diagram of one channel of the equalizer.

How It Works – ETI 485

This equalizer is basically similar to that used in the previous unit with the addition of an extra filter in each channel. The previous unit also used coils (inductors) – these have been replaced by gyrators to simplify construction. We will explain more about gyrators later but at the moment just assume that they are an inductor.

The equalizer stage is a little unusual in that the filter networks are arranged to vary the negative feedback path around the amplifier. If we consider one filter section impedance of the LCR network will be 1 k ohms at the resonant frequency circuit.

With the slider of the potentiometer at the top end (Fig. A) we have 1 k ohms to the OV line from the negative input of the amplifier, and 5 k between the two inputs of the amplifier. The amplifier, due to the feedback applied, will keep the potential between the two inputs at zero. Thus there is no current through RVA. The voltage on the positive input to the amplifier is therefore the same as the input voltage since there is no current through, or voltage drop across resistor RA.

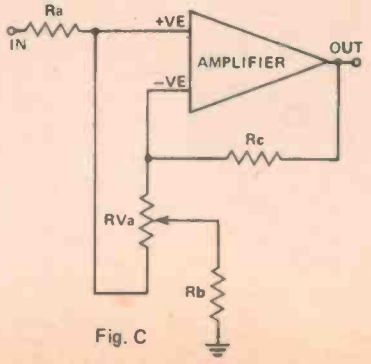
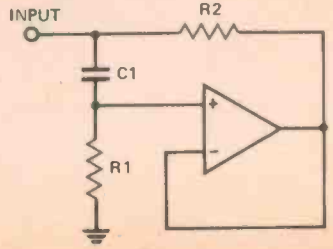


Fig. C

of the amplifier. The use of a second amplifier will increase the resistance to many megohms while the same formula holds for inductance.



of the network. At either side of resonance the impedance will rise (with a slope dependant on the Q of the network which is 3) due to the uncancelled reactance. This will be inductive above resonance and capacitive below resonance. We can therefore represent the equalizer stage by the equivalent circuit below.

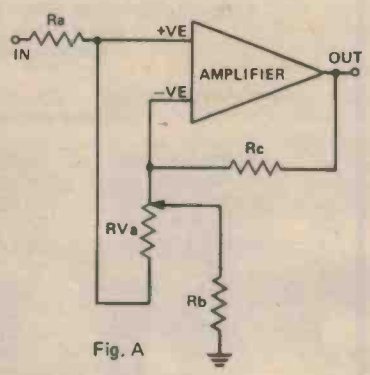


Fig. A

It must be emphasized that this equivalent circuit represents the condition with one filter only, at its resonant frequency. Additionally letters have been used to designate resistors to avoid confusion with components in the actual

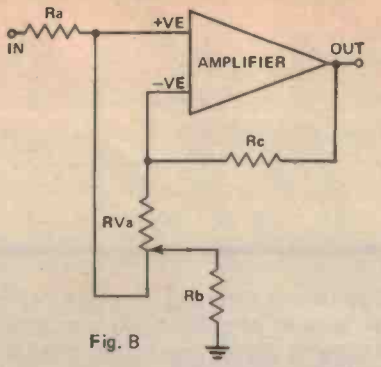


Fig. B

The output of the amplifier in this case is approximately the input signal times (10 000 + 1000)/100 giving a gain of 20 dB. If the slider is at the other end of the potentiometer, (Fig. B), the signal appearing at the positive input, and thus also the negative input is about 0.1 (1000/(10 000 + 1000)) of the input. There will still be no current of the potentiometer and in RC, thus the output will be 0.1 of the input. That is, there will be a loss of 20 dB.

If the wiper is midway, both the input signal and the feedback signal are attenuated equally, and the stage will have unity gain.

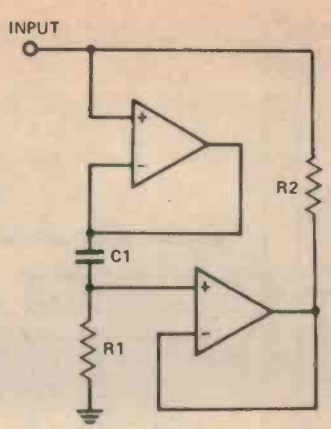
With all filter sections in circuit the maximum cut and boost available is reduced, but ± 14 dB is still available.

In the actual circuit we have used the first op-amp (IC1/1) as a buffer for the input and also as the overall gain control stage. With the values shown the gain is adjustable over a range of −9 to +14 dB. By replacing R22 by a link RV11 will act like a normal volume control. Now to the gyrator.

The only difference between an inductor and a capacitor – electrically, that is, not mechanically – is the phase relationship between the current and voltage. In the gyrator we use an op-amp to reverse the phase relationship of a capacitor and make it appear like an inductor. In the circuit below the inductance is given by the formula

$$L = R1 \times R2 \times C1 \text{ H where C is in Farads}$$

Like a real inductor there is a series resistance (winding resistance) or R2 and a parallel resistance R1 (in a coil this is due to winding capacitance). The lowest value of R2 depends on the amplifier used but for standard op-amps it would be about 100 ohms. At the high end the value of R1 is limited by input current.



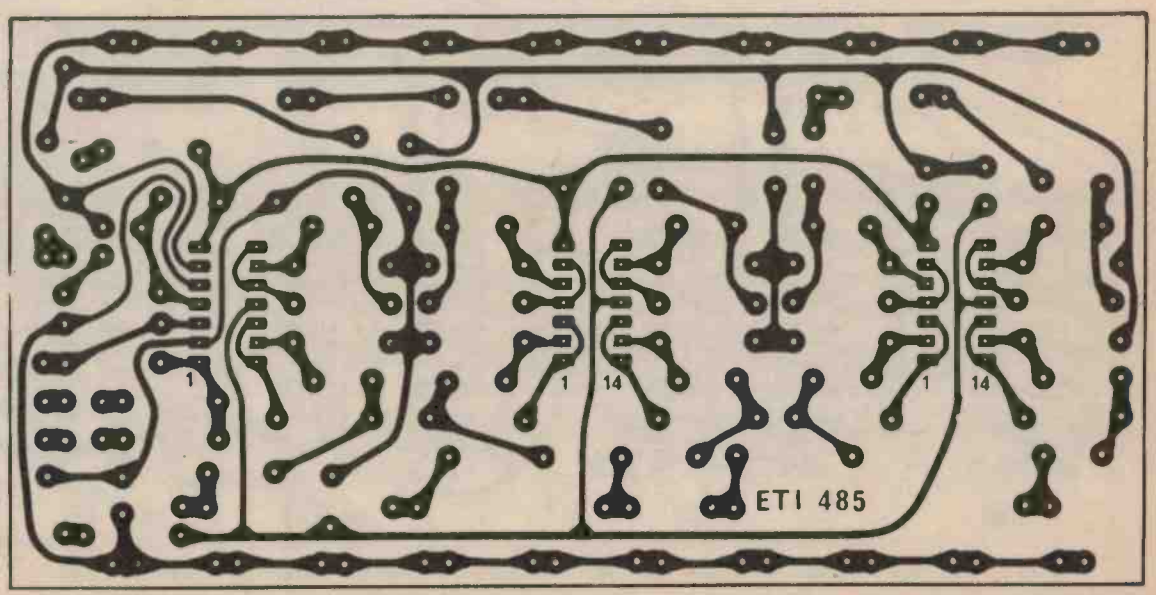


Fig. 2. Printed circuit layout. Full size 150 x 75 mm.

PARTS LIST – ETI 485

Resistors all ½W 5%

R1–R10	1k
R11–R20	220k
R21	47k
R22	15k
R23	1M
R24,25	10k
R26	100
R27	1M
R28,29	100

Potentiometers

RV1–RV10	5k lin 45mm slide
RV11	250k log 45mm slide

Capacitors

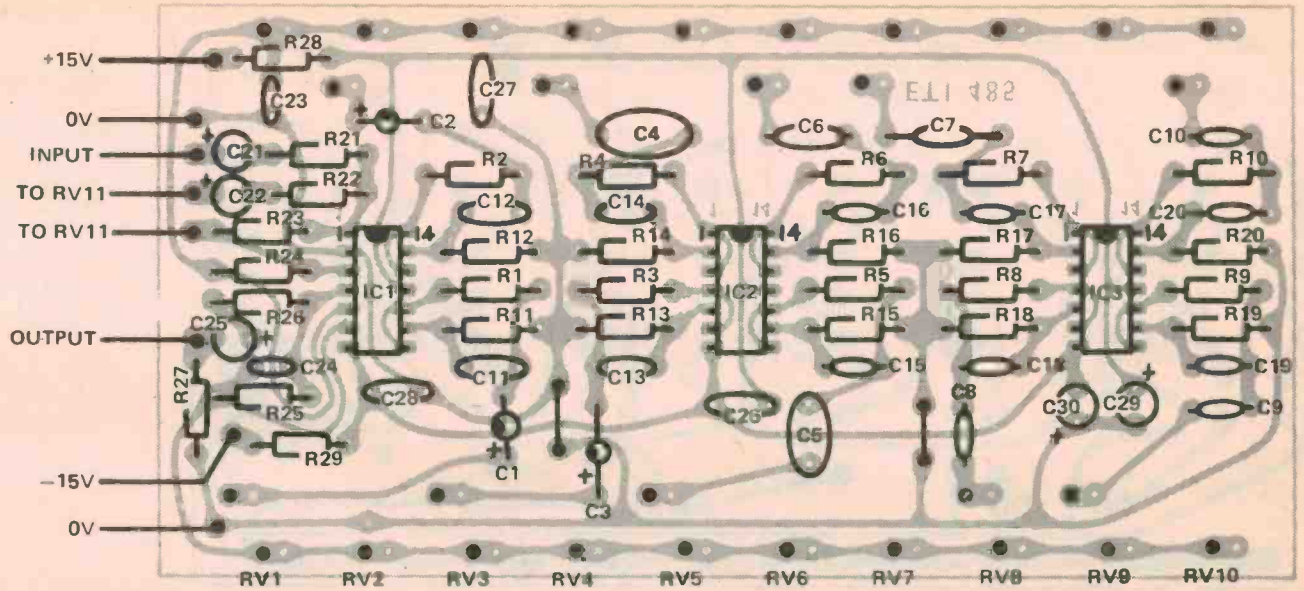
C1	1μ5 tantalum
C2	820n "
C3	390n "
C4	220n polyester
C5	100n "
C6	47n "
C7	27n "
C8	12n "
C9	6n8 "
C10	3n3 "
C11	68n "
C12	33n "
C13	18n "
C14	8n2 "
C15	3n9 "
C16	2n2 "
C17	1n0 "
C18	560p ceramic
C19	270p "
C20	150p "
C21,22	10μ 25V electro
C23,24	150p ceramic
C25	10μ 25V electro
C26–C28	47n polyester
C29,30	10μ 25V electro

Semiconductors

IC1–IC3	4136 Quad op-amp

Miscellaneous

PC board ETI 485
11 knobs McMurdo P/N 4093
For stereo operation twice the above components are required
Power supply ETI 581 (15V 40mA)
Box to suit (see diagram)
Three DPDT toggle switches
Two 4 way RCA sockets
Three core flex and plug
Cable clamp, terminal block



NOTE: RV1–RV10 ARE ON THE COPPER SIDE OF THE BOARD

Fig. 3 . Component overlay of the equalizer board.

Note

The 4136 amplifier is manufactured by Raytheon and is distributed in Australia by Soanar Electronics (who supplied us with samples). It is also supplied by Technico Electronics.

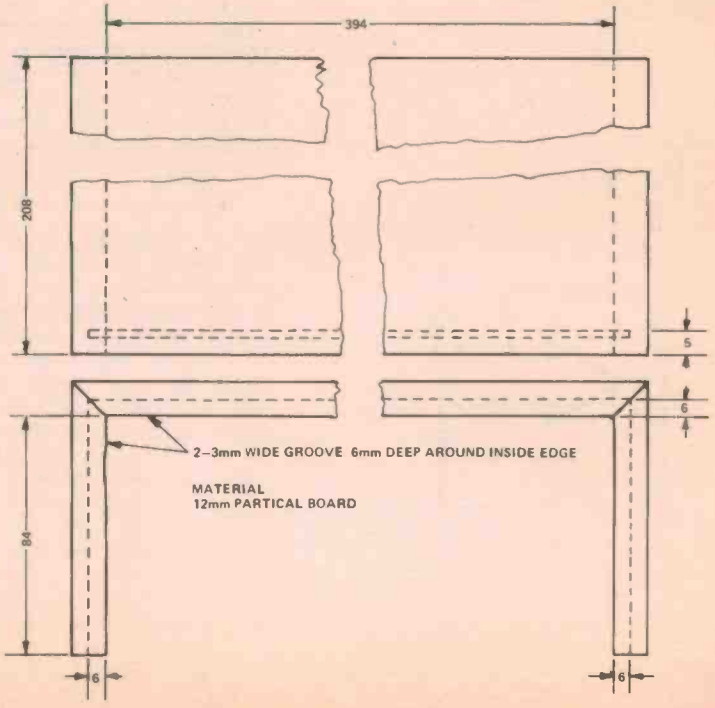


Fig. 4. Constructional details of the cover.

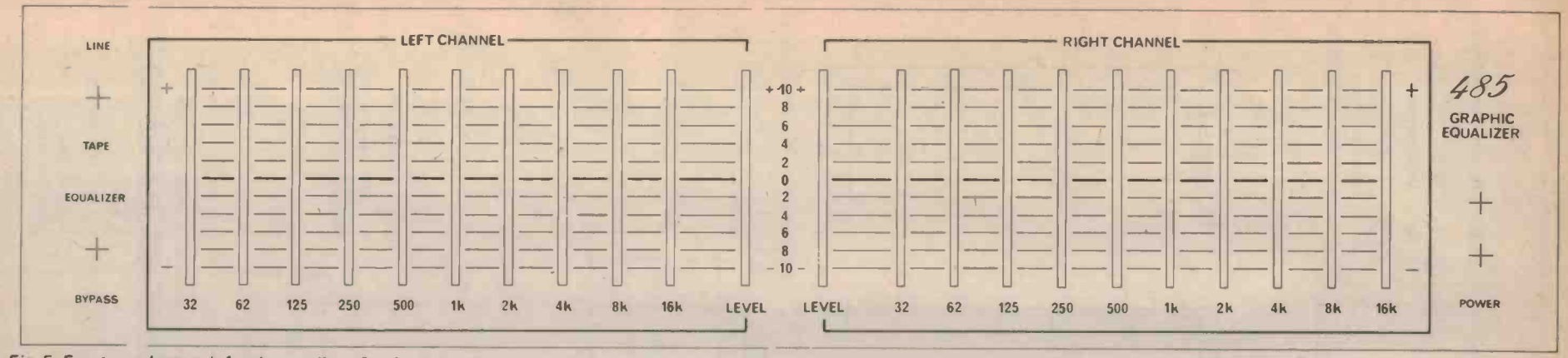


Fig. 5. Front panel artwork for the equalizer. See fig. 8 for dimensions.

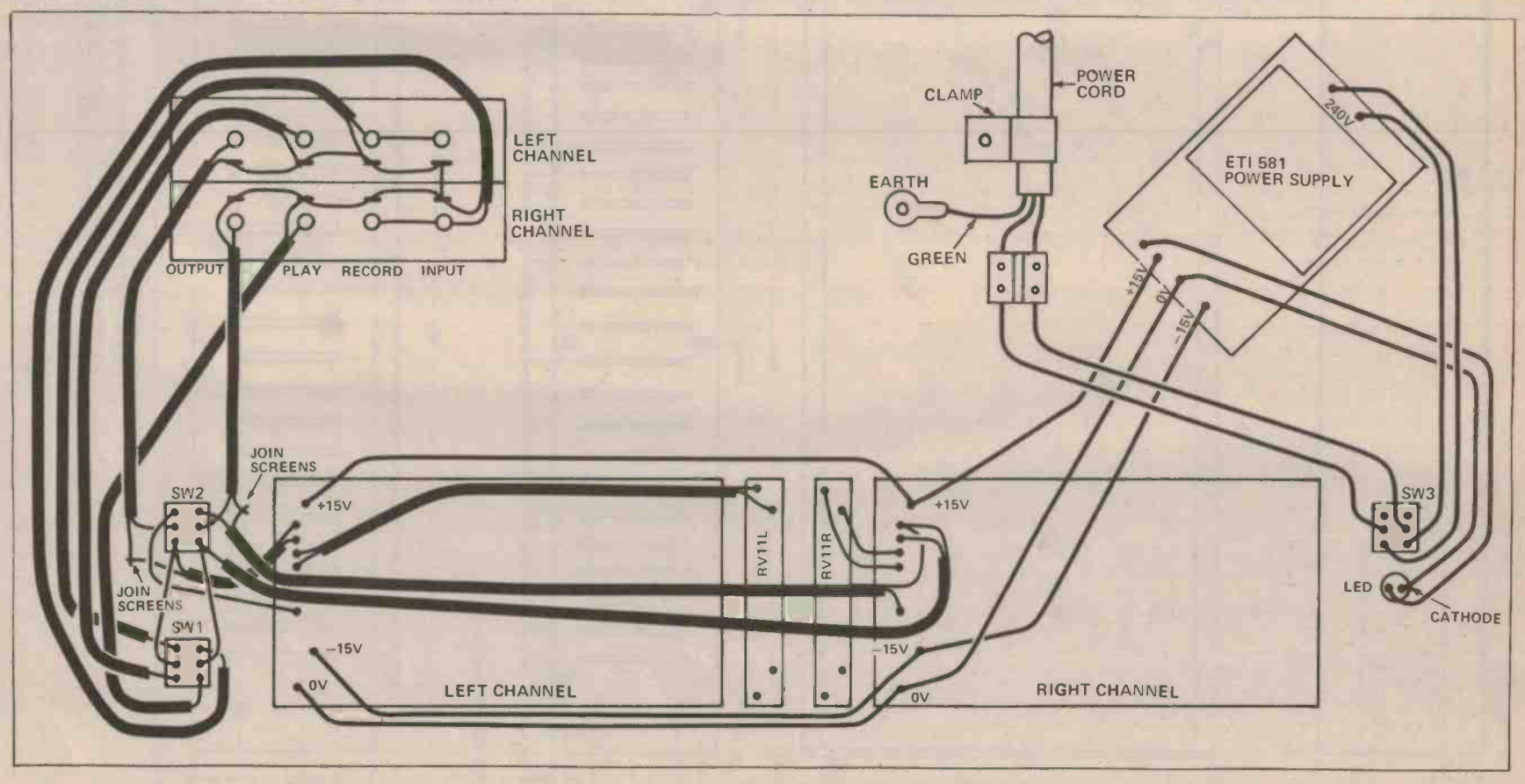


Fig. 6. Interconnection diagram for the unit.

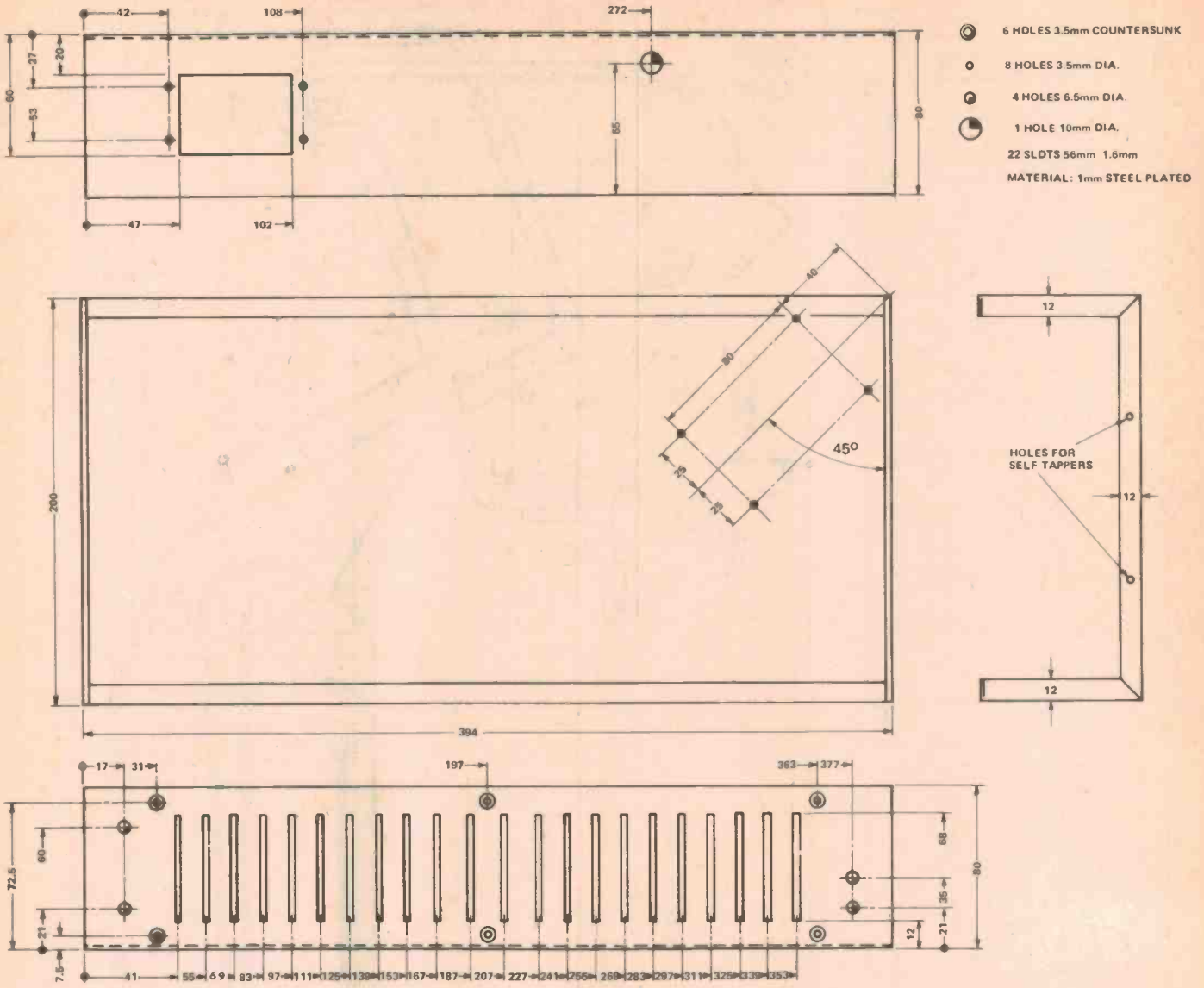


Fig. 7. Details of the chassis.

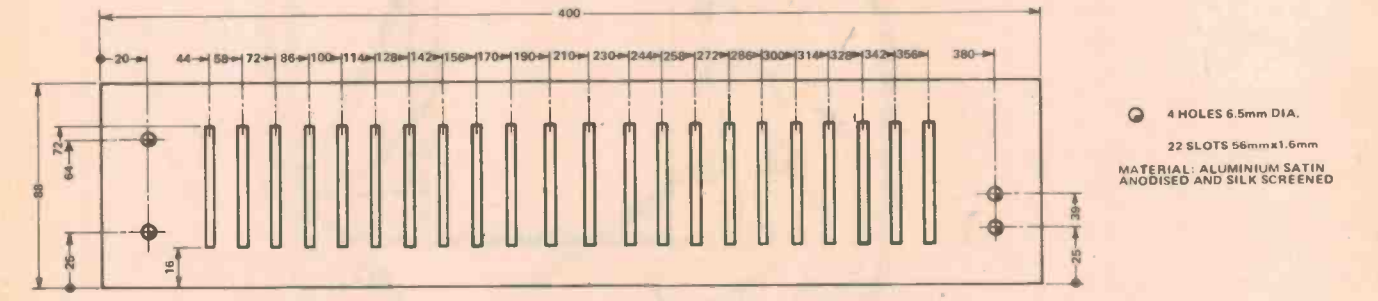


Fig. 8. Metalwork details of the front panel.

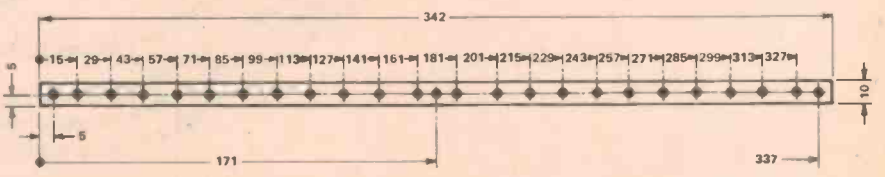


Fig. 9. Drilling details for the potentiometer support

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C/MOS

	1off		
4000	33	4016	58
4001	33	4017	1.33
4002	33	4018	1.33
4006	1.33	4021	1.33
4007	33	4022A	1.33
4008	1.40	4023A	33
4009	64	4024	1.03
4011	33	4027A	63
4012	33	4028A	1.03
4013	55	4030A	58
4014	1.33		

TRANSISTORS

BC547	20	BC640	30
BC548	20	BD139	59
BC549	20	BD140	59
BC559	20	BF180	59
BC639	30		

SEMI-CONDUCTORS

T.T.L. Digital	1off	10up
7400	40c	26
7402	40c	26
7404	40c	30
7408	40c	28
7410	40c	26
7420	40c	26
7430	40c	26
7447	$1.50	$1.26
7451	40c	26
7454	40c	26
7474	90c	26
7490	80c	65
7492	80c	65
74107	$1.00	45

LINEAR

	1off
LM301	50
LM307	70
LM308	1.30
LM309K	1.95
LM324	2.24
LM339	1.55
LM377	1.95
LM380	1.30
LM382	1.30
LM3900	1.10
LM555	57
LM566	2.29
LM709	45
LM723	55
LM741	45
LM1458	72

ELECTROLYTICS

Value	Voltage	1off			
1 uFd	6.3 Axial	13	100 uFd	25 p.c.b.	15
2.2 uFd	25 p.c.b.	8	220 uFd	6.3 p.c.b.	17
3.3 uFd	25 p.c.b.	8	220 uFd	16 p.c.b.	17
4.7 uFd	10 p.c.b.	8	220 uFd	35 p.c.b.	22
4.7 uFd	25 p.c.b.	8	470 uFd	6.3 p.c.b.	22
22 uFd	10 p.c.b.	8	470 uFd	25 p.c.b.	22
22 uFd	50 p.c.b.	15	1000 uFd	10 Axial	35
25 uFd	16 p.c.b.	8	1000 uFd	16 p.c.b.	36
33 uFd	6.3 p.c.b.	9	1000 uFd	25 p.c.b.	47
33 uFd	16 p.c.b.	10	1000 uFd	35 p.c.b.	47
47 uFd	10 p.c.b.	12	1000 uFd	50 p.c.b.	80
47 uFd	25 p.c.b.	14	2200 uFd	50 upright	$1.60
47 uFd	50 p.c.b.	15	3300uFd	50 upright	$1.75
100 uFd	10 p.c.b.	13	3300 uFd	75 upright	$2.40

DUAL POWER SUPPLY

This simple regulated supply is suitable for most projects requiring a dual voltage.

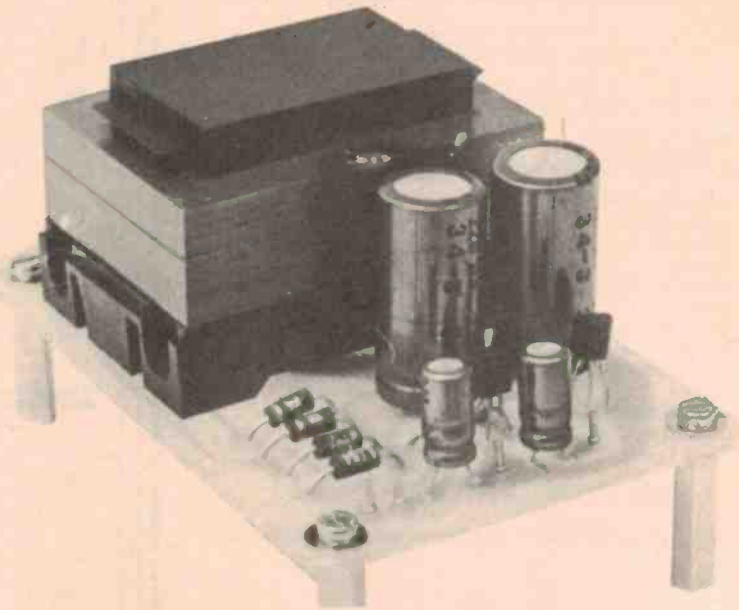
WITH THE PRICE of operational amplifiers being so low today, their use is becoming very popular among home constructors. These devices, however, normally need a dual power supply voltage, usually +15 and −15 volts.

A simple rectified and filtered supply suffers from the drawback that if it is designed to supply the correct voltage at a reasonable current, when a light load is connected the output may rise to an over-voltage condition. This problem is aggravated by variations in mains voltage. The regulated supply takes care of this problem, and also offers better hum rejection as the ripple voltage is also 'regulated'.

Most of the projects undertaken do not use more than 10 or so ICs and a high powered supply is not required. This simple supply has all the components mounted on the PC board including the transformer. Either of two regulators can be used giving either 40mA or 150mA outputs.

If a different output voltage is required regulators of the desired voltage can be used along with a different voltage transformer. If only a single output is required the unwanted components can be deleted.

To drive a power indicator LED we have provided a current limiting resistor R1. This comes from the unregulated supply so as not to load the regulator.



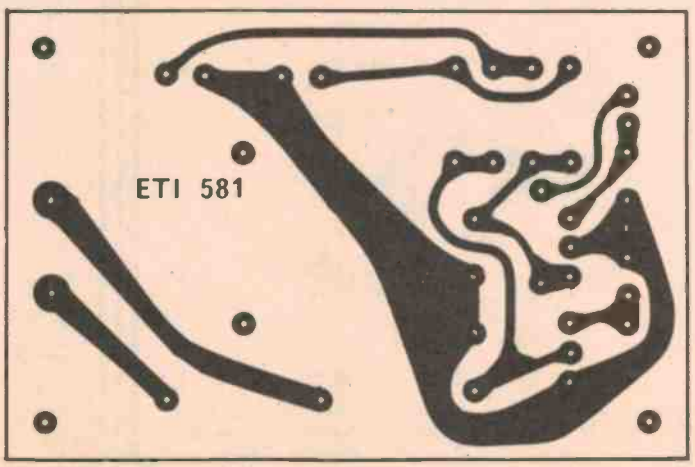


Fig. 1. Printed circuit layout. Full size 90 x 60 mm.

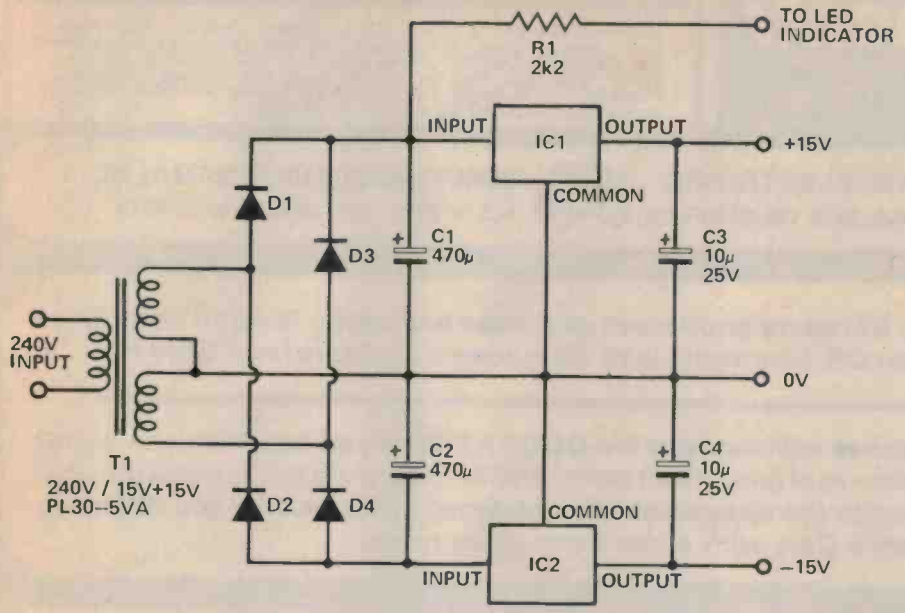


Fig. 2. Circuit diagram of the supply.

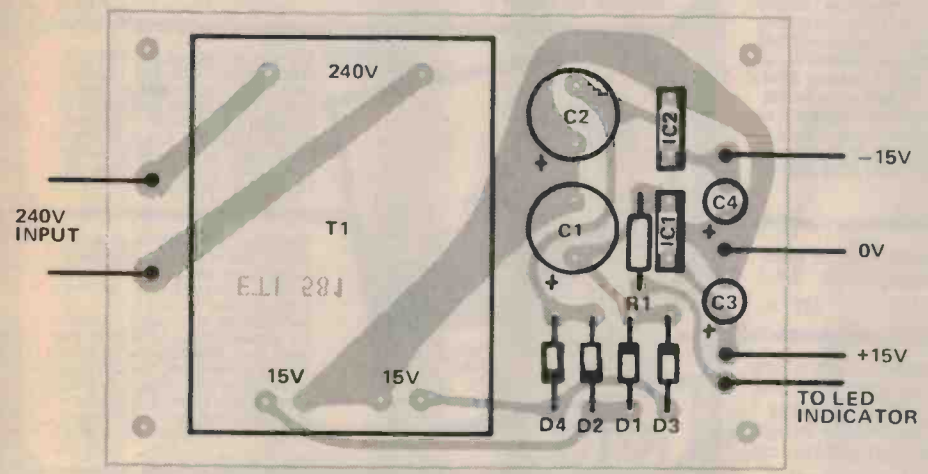
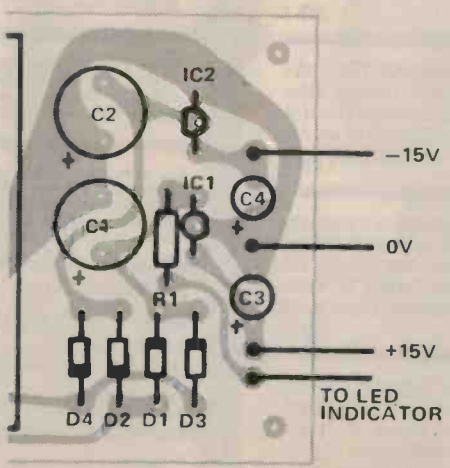


Fig. 3. Component overlay of the higher powered version.

Fig. 4. Changes in the overlay for the low power version.



PARTS LIST – ETI 581

R1	Resistor	2k2 ½W 5%
C1,2	Capacitor	470μ 35V electro
C3,4	"	10μ 25 V "
D1–D4	Diodes	1N4001
LED1	Indicator	
IC1	Regulator	7815 *
IC2	"	7915 *
T1	Transformer	PL30–5VA

* 78L15 and 79L15 can be used if less than 40mA is required

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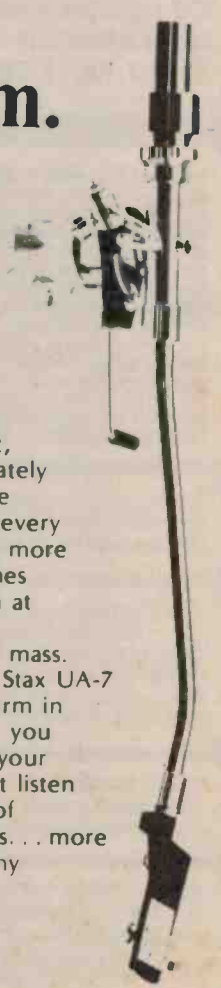

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Hi Buffs, Experimenters, CB'ers. Got some good news and some bad news. The bad news first – 'fraid Dick has lost one of his best CB, Electronic, and Component advisers from Gore Hill.

Gary Temple is now at our address as advisor. Now the GOOD NEWS. If you need advice – about CB rigs, antennas, or components – real facts, then come and see Gary. He will tell you the true facts even if it means sending you to the opposition till such times as he can tell you different, AND THAT'S THE TRUTH . . . Here's Gary with some more good news.

First some good news for experimenters. For me there's always been something lacking in kits on the market, and I finally have an inkling of what it is. They are all planned to the last detail and deny us that niggling need to add, to take from and to change them, they deny us the fun of throwing in our own two cents' worth. Most of them we build without really understanding just how they work so we can't readily change them, or they don't work at all. Well, I'm trying to change that. I'm getting some ideas into kits made up of cheap and easy-to-get components mounted into Veroboard. None are overly ambitious or made to serve a specialized function but are basics like oscillators, timers, triggered alarms, counters, frequency dividers. Some transistor, some TTL, some C-MOS, but complete with clear instruction how to build the basic kit and hints and ideas of its possible uses. Most will be worth four or five dollars. If you have trouble with any of these you won't have to cop that blank look from the counter boy when you take it back for help. You can come and see me personally. COME IN, & SEE THESE KITS NEXT TIME YOU'RE PASSING OUR WAY . . . GAZZA

Two transistor oscillator. Suit Continuity Tester. Morse Practise Oscillator. Audio Signal Generator. Switchable Low Frequency Marker. Small Capacity Tester . . . **Just $1.50** **KIT '1'.**

How about this two transistor (LDR) light triggered alarm kit. Suite simple games like, Rifle Shooting with light source, or Find The Bomb game. Just great for parties, try and find the kit in a dark room without activating it armed, only with a flashlight. Experiment with data transmission by light source. Hook it to relay and motor, open your garage doors with your car headlights. A thousand uses . . . **Just $2.50** **KIT '2'.**

Try this two transistor (LDR) darkness triggered alarm kit. Suit Poor Light Photo warning, feed it to a relay and Turn On The House Lights. Great Tail Light Failure warning kit. **Just $2.50** **KIT 3.**

Here's a handy two transistor (LDR) darkness triggered FLASHING, FLASHING, FLASHING alarm kit. Has real possibilities. For late fishermen, an after dark buoy MARKER. Put this kit on your dash and Find Your Car in a big car park after the show. Give clear flashing warning of any light source failure. Industrial applications by the score . . . **Just $2.60** **KIT 4.**

Now, a CB EXPERIMENTER'S KIT, a two transistor miniature transmitter. Works at CB frequencies, puts out about 15mW of tone or voice modulated carrier. Can be picked up by any 27meg receiver sixty to a hundred feet away if the wind's right. Fits into a matchbox. Perfect for tuning receive sections of CB marine units or hand helds, but you'll have to find your own 27meg crystal . . . **$4.50** **KIT 5**

Another CB experimenter's kit, a Constant Volume Output Preamp kit. Add it to telephone amps, intercom systems, PA amps, Tapedecks Cassette recorders, or work it into the audio stages of your short wave communications receiver to eliminate fading. How about; (If you're good, with the aid of our tiny metal film resistors) packing this into the mike of your CB or 144 portable to serve as a mike compressor.WHY PAY $48 for a compressor almost as big as the ARRL hand book when you can experiment with this little bottler for a lousy . . . **$4.75** **KIT 6.**

IS YOUR LIFE WORTH THE PRICE OF A KIT??? Any buff at all that uses mains power, (don't we all) can really find uses for this kit. It sniffs out the fifty cycle mains hum radiating from cable, switches, transformers, appliances with absolutely no physical contact. Very handy too for determining if 50cycle AC is about, even if transformed down to low safe voltages. With red diode warning light the kit's worth Just $3.00 KIT 8 P&P $1. But for greater sensitivity use the meter kit at only **$6.00. KIT 8A. P&P $1.** **KIT 8**

ALL KITS INCLUDE CLEAR AND COMPLETE INSTRUCTION AND POSSIBLE USES. THEY ARE PRIMARILY EDUCATIONAL KITS FOR THE EXPERIMENTER OR HOBBYIST. BACKUP REGARDING WIDER USES, OR CONSTRUCTION PROBLEMS WITHIN REASONABLE LIMITS MAY BE SOUGHT FROM OUR TOP ELECTRONICS ADVISOR.

Want to pay $15 or $18 for an antenna trimmer 'course you don't (who does?) but then if you don't know how to make a good one, then you havn't got much choice. But now you have a choice. Buy one simple kit. No it doesn't include a box or panel fittings for PL259s, who needs them! Most CB'ers would like to see their trimmer built into their rig or SWR meter, well you've got it, the kit and complete instruction on how to do it with less insertion loss than most commercial units . . . It'll cost you a lousy . . . **$2.50** **KIT 9**

Here's a couple of TTL kits for those of you breaking into ICs. A three IC counting unit, incorporating a 555, a 7490, and 7447. Simple enough for those already into TTL, but an IDEAL kit for the beginner and completely instructed to cater for the beginner. Not to mention a good run down of possible uses for the unit once working and understood by the constructor. This kit is complete with display, five volt regulation, veroboard, wire, solder, battery connections . . . **Just $8.30 plus P&P.** **KIT 10**

Another TTL kit. This one is very much like the one above but the final IC the 7447 is substituted for a 7441 making the kit an eleven led chaser with variable speed control and brightness. Once understood, this kit can be used to drive triacs at the mains for chasers at discos, dances, the local water hole. This kit is absolutely complete and worth just **$8.00 KIT 11 Plus P&P.** **KIT 11**

Ever wanted to build a frequency counter, but not sufficiently inclined or wealthy to come good for a minimum of $100 for the commercially produced kits just yet. Well, try our mini frequency counter kit. Good to about 100k and a lot of fun to build. If you fancy your self as compact experimenter, there's no reason why you can't get this kit into a mini-box of the buck twenty variety. The kit includes board, wire, solder display . . . **Just $26.95 KIT 12 plus P&P $1.** **KIT 12**

SUPER SPECIAL

MINI TRANSISTOR TESTER KIT.

So simple to use and to build yet will tell if a transistor is npn or pnp, which leg is which, leakage between collector and emitter. Even tests diodes. AND, FREE, EXTRA, BONUS. Fifty mixed transistors, marked and unmarked for you to test . . .
FOR THIS KIT JUST $10.00 p&p $1.00

PNP Car Radio. Transistors 2SB367 — VCE25c 1c 400mA. A $1 special elsewhere around town, but at MS.C. — **75c. A lousy $6.50 for 10.**

NOW SOME GOOD NEWS FOR THE CB'ERS. If you are passing our 10-20 and not on a 10-17 drop in and eyeball and let us give you a 10-9 on our latest. THE ROYCE 23CH CB UNIT.
Not only a 23ch CB but an AM/FM STEREO RADIO too. But it's handsome. GOT TO BE EYEBALLED TO BE BELIEVED. **Yours for $195 even.**

PRICE
$195

SPECIAL . . . SPECIAL . . . SPECIAL!!! C.B. Power Supply Kit. Provision for independent 9V bench supply @ 2.5 amp. Kit Consists of metal case, 3 tap H.D. Transformer . . . (20V-6.3V-117V) ready assembled bridge rectifier, filter capacitor and 2 transistors, etc. Complete with instructions. **Easy to build.** ONLY **$28.00.** P & P $3.00. **Limited stock only.**

And now for the road Knight's gear jamming eighteen wheelers. If you want to get above the advertised propaganda splashed every where about CB RIGS, if you want to see CB, talk CB and do it with some one that knows CB, not a counter-jumper, It'll be my pleasure if you drop in. I've sweated my butt off in front of a 22tonne load or two in my time, and hauled wheat back of Moree on dust roads so potted you could lose your spare tyre in some of the holes if it fell in. You tell me what you want out of CB and your driving conditions I'll tell you your best buy. If we haven't got what I reckon you need, I'll send you to who has, that's no bull-bar. Something I don't need is a 16 stone Interstate gear jammer after my butt cause I pointed him the wrong way.

NOTE . . . KNOBS . . . Knobs for your hi-fi equipment — CB and projects. We've got some beautiful solid aluminium machine turned knobs, all sizes all styles at fifty to eighty cents each. THESE ARE REALLY PRETTY.

And now just to come back for the final, we've got a range of antennas from helicals to baby gutter mounts, $29 to $19.95 all covered, RF signalizers at $42, extension horns and PA speakers around ten, eleven bucks, good quality PL259s at $1.95 and the CALCOM CB BOOKS, at about four bucks. If you can't get in right now, at least give me a bell on the land line. Well for now I'll back up and stand on the side, perhaps catch you on the co-ax . . . I'm gone.

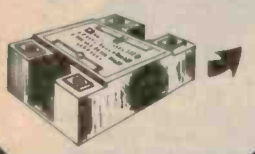
SNOOPER RADAR UNITS

Why settle for backyard brands. Sensitivity is not enough, nor looks, you need selectivity. What use is a RADAR DETECTOR, that detects everything from DC TO DAYLIGHT. BUY AMERICA'S BEST SELLER, THE "SNOOPER". Complete with full instructions, and get a Radar Detector not a BROADBAND RECEIVER. STANDARD **SNOOPER $115.00 and SUPER SNOOPER at $189.00 p&p $2.50.**

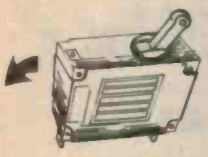
I found some solid state relays too. Anyone working with alarm systems will find use for these. They'll carry 5 amps and 250 V switch and need 3 to 32 V volts to work efficiently. They're about five by five centimetres by three deep, solid encapsulation. The weather won't hurt these . . . yours for **$3.50 each. Plus P&P $1.**

Bundles of hook up wire in all colours and lengths with pre-stripped ends. I figured if I mixed up the colours some and made up a fist size bundle of assorted lengths, with hook-up wire ten cents a meter off the roll now-a-days, a decent bundle would have to be worth a **$1.00.**

RESISTORS. Metal film, half watt (bout the size of normal one-eighths) for a lousy three cents each. Almost every popular value covered up to the meg range. **3c Plus P&P.**



Get started in Electronics Kit. That's right, a kit with . . . 200 resistors, 100 capacitors, 50 transistors, 25 diodes, 10 potentiometers, 10 assorted, trimpots hookup wire, solder, board, tag strips and FREE GIFT PACKAGE. Compliments of MSC, the cheapest parts dealer in town, and finally, INSTRUCTIONS, in how to complete 25 experiments and projects. **JUST A LOUSY $20.00 p&p $2.50. Same kit with a soldering iron and multimeter $42.00 p&p $4.00.**



I admit when it comes to speakers, turntables, crossovers and the like I'm done, out of my depth, just not my bag, but I couldn't help notice a new blank cassette in stock called G TAPE, C90. It's guaranteed to have a 20 to 20k response, screwed case, and written guarantee against faults in material and workmanship. Sounded good value to me at only **99c plus P&P.** What do you audio buffs think?

SUPER SPECIAL, JUST IN. **RF TRANSISTORS,** Good to 470megs, at two watts output, Photo copy of specs available for 20cents. Would be perfect as drivers for that FM LINEAR. Only four hundred in stock, and they will not last long at only $1.95 each.
2N5944

A SUPER EXTRA SPECIAL, 10 FOR ONLY $15.

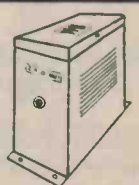
Found some Lag switches (circuit breakers) out back. Neat, small, one amp drop-out. Electricians, and you buffs working with power supplies will find good uses for these. **Just $2.00 each plus P&P.**

MSC QUICK LIST

S.W.R. Meters, three types in stock. Single meter, $16. ASAHI dual meters, $29. TOYO, model YM-IE dual meter only $31. Two PL259's, with 100cms co-ax inbetween, $3.00.

CURLY CORD for that mike $1.50. AMPHENOL PL259's, COMPLETE WITH REDUCING ADAPTOR. $1.95. Got ELBOWS, 'T' PIECES, and JOINERS to sell with our CO-AX do COME IN, SEE. PLEASE DON'T FORGET P/P IS EXTRA.

WE HAVE A REAL SPECIAL FOR THIS MONTH ONLY



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PAC No.	CONTENTS	PRICE
SC. 2	100 Assorted T018 & T05 NPN & PNP Silicon Transistors	$2.50
SC. 3	5 T066 (2N3054 Series) Transistors & 5 MS3055-1 (Marked) Power Transistors	$0.90
SC. 4	100 100V 3 amp Plastic Rectifiers	$4.50
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SC. 6	20 2N3055-1 (Unmarked) Power Transistors	$3.00
SC. 9	50 EM402 Diodes, 200V 1 amp	$3.00
SC. 10	50 EM404 Diodes, 400V 1 amp	$3.75
SC. 11	50 EM406 Diodes, 600V 1 amp	$4.00
SC. 12	50 EM408 Diodes, 800V 1 amp	$4.25
SC. 13	50 EM410 Diodes, 1000V 1 amp	$4.75

P&P 50c A PAC

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Capacitors:
Ceramics: All preferred values from 1 pf to 0.033 uF. 10c each. 25 up 8c ea. 0.047 to 0.1 uF. 17c ea. 25 up 15c ea. 0.47 uFd 30c ea. 25 up 25c ea.

ELECTROLYTICS:

Value	Voltage	1 off	25 up
1 µFd	6.3 Axial	15c	13c
2.2 µFd	25 p.c.b.	10c	8c
3.3 µFd	25 p.c.b.	10c	8c
4.7 µFd	10 p.c.b.	10c	8c
4.7 µFd	25 p.c.b.	10c	8c
22 µFd	10 p.c.b.	10c	8c
22 µFd	50 p.c.b.	17c	15c
25 µFd	16 p.c.b.	10c	8c
33 µFd	6.3 p.c.b.	11c	9c
33 µFd	16 p.c.b.	12c	10c
47 µFd	10 p.c.b.	14c	12c
47 µFd	25 p.c.b.	16c	14c
47 µFd	50 p.c.b.	17c	15c
100 µFd	10 p.c.b.	16c	13c
100 µFd	25 p.c.b.	18c	15c
220 µFd	6.3 Axial	20c	17c
220 µFd	16 p.c.b.	20c	17c
220 µFd	35 p.c.b.	26c	22c
470 µFd	6.3 Axial	25c	22c
470 µFd	25 p.c.b.	25c	22c
			10 up
1000 µFd	10 Axial	38c	35c
1000 µFd	16 p.c.b.	40c	36c
1000 µFd	25 p.c.b.	52c	47c
1000 µFd	35 p.c.b.	52c	47c
1000 µFd	50 p.c.b.	89c	80c
2200 µFd	50 upright	$1.80	$1.60
3300 µFd	50 upright	$2.05	$1.75
3300 µFd	75 upright	$2.70	$2.40

SEMI-CONDUCTORS:

T.T.L. Digital	1 off	10 up
7400	40c	35c
7402	40c	35c
7404	40c	35c
7408	40c	35c
7410	40c	35c
7420	40c	35c
7430	40c	35c
7447	$1.50	$1.40
7451	40c	35c
7454	40c	35c
7474	90c	85c
7490	80c	75c
7492	80c	75c
74107	$1.00	90c

ULM 3000S (Hall effect switch) $6.00 $5.50

C/MOS

	1 off	10 up
4000	40	35
4001	40	35
4002	40	35
4006	2-50	2-25
4007	40	35
4008	2-75	2-50
4009	80	70
4011	45	40
4012	40	35
4013	1-00	90
4014	2-25	2-05
4016	85	75
4017	2-25	2-05
4018	2-50	2-25
4021	2-30	2-10
4022A	1-90	1-70
4023A	45	40
4024	1-35	1-20
4027A	1-00	90
4028A	1-90	1-70
4030A	80	70

LINEAR

	1 off	10 up
LM301	70	60
LM304	1-30	1-20
LM305	1-20	1-10
LM307	70	60
LM308	2-30	2-10
LM309K	2-80	2-60
LM319	2-80	2-60
LM324	3-20	3-00
LM339	3-20	3-00
LM377	2-80	2-50
LM380	1-50	1-35
LM382	2-45	2-30
LM3900	1-50	1-25
LM555	85	75
LM566	4-50	4-30
LM709	45	40
LM723	1-00	90
LM741	45	40
8038	6-95	6-50
LM1458	1-50	1-30

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WITH BASE LOADED ANTENNA
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INCREDIBLE!
($2.50 P. & P.)

And the latest EXPO 23ch. AM. BOBCAT with delta tune. A.N.L. Squelch, P.A. 5W input. A beaut set for those who appreciate A.M. Great Value atonly $109.00. AND S.W.R. meters $28.50. Helical antennas complete with cable, plug and base, $28.50 and plugs, Coax, dummy loads, lightning arrestors, etc.

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Roll-Down Clear: clears one register at a time, last entry first.
Separate: Addressable, Accumulating Memory: with M ⅛, M-, M⅛x1.
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Operates on standard 9-volt transistor battery. (Optional AC Adapter available).
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TELEPHONE BELL EXTENDER

This simple project allows you to leave the phone unattended as you move about the house.

MANY TIMES WHILE you're working in the garden the phone may ring and by the time it is heard, if it is at all, it is often too late to reach the phone. While the PMG will install a remote buzzer for you it has to be rented and for people who are hard of hearing it may not be loud enough.

This bell extender will allow you to add, without touching the phone, an external bell, buzzer or speaker anywhere it is desired. When using a horn loaded speaker the sound level is high enough to be heard over high ambient noise making it ideal for the industrial environment.

Adjustment

There are two controls to be set, these being sensitivity and volume. The volume can be set first by rotating RV1 until the tone starts then adjusting RV2 to give the desired volume. To adjust the sensitivity first tape the sensor coil to the underside of the phone and then adjust RV1 until the sound stops. Note however that it should be rotated slowly as C3 gives a delay on switch off. Check that picking up and replacing the phone does not operate the alarm then have someone ring you to check that the phone tone does. It may be necessary to experiment with the position of the pickup coil to get the best results.

Construction

While any construction method could be used we recommend that the PC board be used and the overlay in Fig.3 be followed. The pickup coil was made out of 0.125 mm enamelled wire, although the gauge is not important,

with about 200 turns wound around a mandrel about 50 mm diameter. The mandrel can then be removed, the wires terminated to some thin plastic insulated wires (twin "bell" wire is ideal) and then the complete coil wrapped with plastic insulation tape.

We built our unit into a small plastic box using an external speaker. The unit can be mounted anywhere suitable, taking care however with the 240V wiring. The speaker used will depend on the volume required with a larger speaker producing more sound. If a horn speaker is used a very high sound level can be produced.

If it is required only to operate a buzzer the second IC can be altered to be an on-off device by deleting C5, R5, R6, D2 and RV2 and placing a link where C5 was.

TELEPHONE BELL EXTENDER

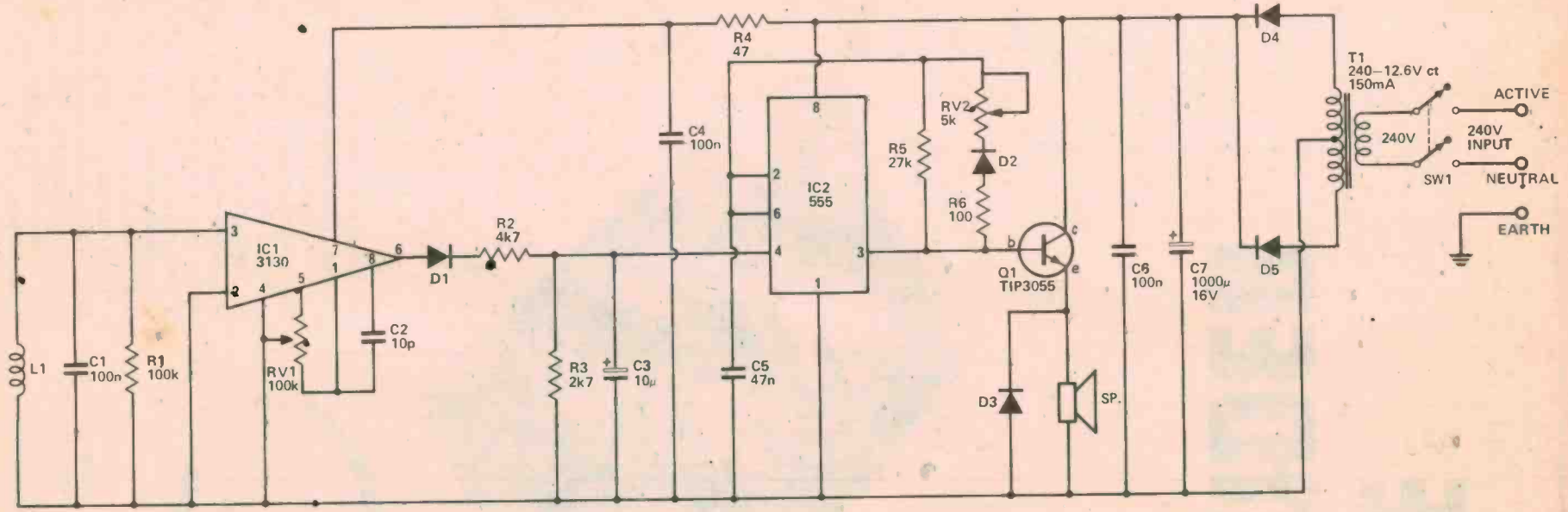

Fig. 1. Circuit diagram of the bell extender.

How It Works — ETI 547

Inside the telphone there is a solenoid which operates a striker which hits a pair of bells to give the ring tone. When it operates there is a high magnetic field generated and we detect this field to give the indication that the bell is ringing. To do this we use a coil wire under the telephone and use an IC to detect the presence of a signal. IC1 has its offset voltage adjusted by RV1 such that a slight positive voltage is needed to make the output go high. It is used in the open loop mode as a comparator only. The capacitor C1 is used to remove the unwanted higher frequency signals.

The oscillator used to operate the speaker is simply a 555 timer with a TIP3055 to buffer the output. The frequency is determined by C5 and the volume by RV2. Changing the volume does change the frequency slightly. Oscillation can however only occur if the voltage at pin 4 is greater than 0.6V. If the output of IC1 is low, R3 ensures that pin 4 is less than this voltage. However when the bell rings the output of IC1 oscillates high and low in time with the ring tone of the bell. This lifts pin 4 high, allowing IC2 to oscillate and C3 holds pin 4 for a short time to prevent the oscillator turning on and off at the ring tone frequency.

The power supply is a simple full wave rectifier with no regulation with IC1 being decoupled further by R4 and C4. Batteries could be used but the drain is reasonably high.

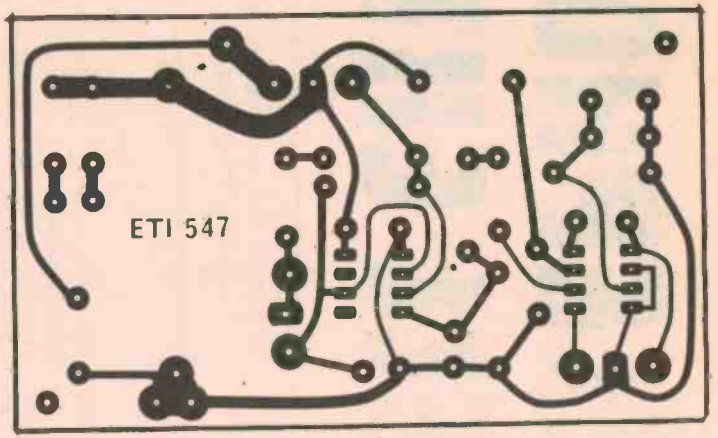

Fig. 2. Printed circuit layout.
Full size 91 x 53 mm.

PARTS LIST – ETI 547

Resistors all ½W 5%
R1 100k
R2 4k7
R3 2k7
R4 47
R5 27k
R6 100

Potentiometers
RV1 100k trim
RV2 5k trim

Capacitors
C1 100n polyester
C2 10p ceramic
C3 10µ 16V electro
C4 100n ceramic
C5 47n polyester
C6 100n ceramic
C7 1000 µ 16V electro

Semiconductors
IC1 CA3130
IC2 NE555
Q1 TIP 3055
D1-D5 1N4001

Miscellaneous
PC board ETI 547
Transformer 240V – 12.6 V ct
Mains switch, 3 core flex
Box, speaker, pickup coil

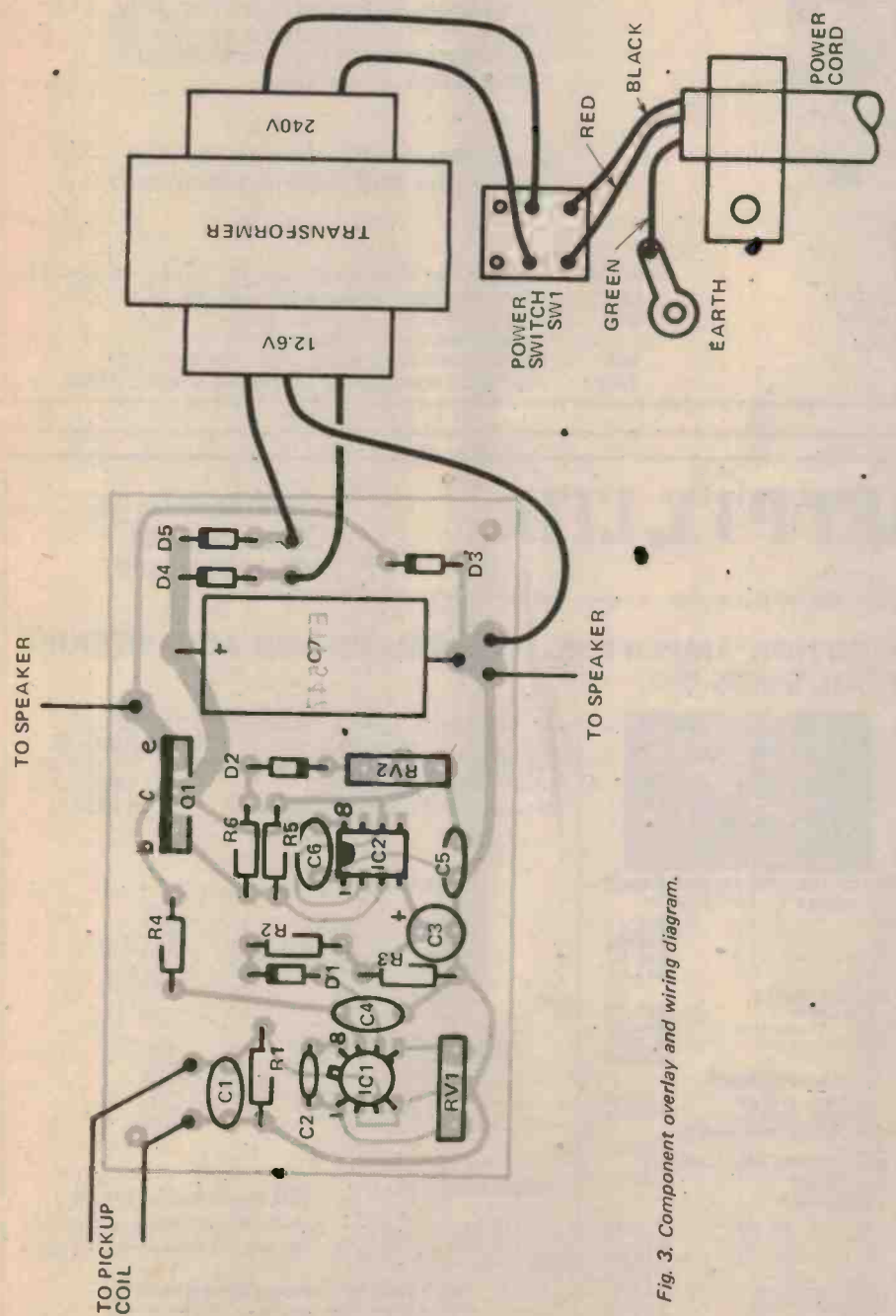

Fig. 3. Component overlay and wiring diagram.

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Slide Pots. 20K to 3meg. Singles 35c ea. Dual 60c ea.

Resistors. Most values ¼ to 1 Watt. 3c ea. Carbon Pots. Most values 30c ea. Duals 60c ea.

Skeleton Preset Pots 100Ω to 3 meg. 8c ea. Green Caps .001 to .022uF 5c ea. .033 to .22uF 10c ea. .47 to .68uF 15c ea.

Polystyrene Capacitors. Many Types 5c ea.

Disc Ceramics. Large Range. 5c ea.

Polyester Capacitors. Large Range. Up to 1.5uF 250V 10c to 25c ea.

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BC.107 and 109 Transistors 10c ea.

OA636 1000V 2A Fast Recovery Silicon Diodes – TV Type 25c ea.

Dual 100 Ω 3W Wire Wound Pots. $1.25 ea.

S.C.R. BT100A 300V 2AMP 60c ea.
Triacs. 2AMP 400V 60c ea.

2M3055, 90c ea. AD149, $1.00 ea. AY8110, 80c ea. OC912, $1.00 ea. AY8139 and 9139, 45c ea. IN914 diodes 10c ea. 5 amp AC panel meters $3.50 ea. 2500 uF 35V P/T electrolytics, 60c ea. 2200 uF 25V P/T electrolytics, 40c ea. Aluminium and plastic instrument boxes and ARLEC multimetres NOW IN STOCK.

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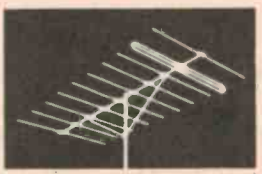

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555 TIMER APPLICATIONS

DESCRIBED BY R.M. MARSTON PART 3

In Part Three of this series we look at a variety of applications for the astable multivibrator.

MISCELLANEOUS ASTABLE APPLICATIONS

The 555 astable multivibrator has three outstanding advantages over other types of astable circuit. First, its frequency can be varied over a wide range via a single resistive control. Second, its output has a low impedance and can source or sink current up to 200 mA. Finally, its operating frequency can readily be modulated by applying a suitable signal to pin 5 of the IC. These features make the device exceptionally versatile, and it can be used in a vast range of practical applications of interest to both the amateur and professional user.

Morse Practice Oscillator

Figure 21 shows how the 555 timer IC can be used as a morse-code practice oscillator. The circuit acts as a normal astable, with frequency variable over the approximate range 300 Hz – 3 kHz via TONE control R3. The 'phone volume is variable via R5, and the 'phones can have any impedance from a few ohms up to megohms. The circuit draws zero quiescent current, since the normally-open morse key is used to connect the circuit to the positive supply rail, which can have any value in the range 5 volts to 15 volts.

Figure 22 shows how the 555 astable circuit can be used in LED flasher applications. This circuit operates at approximately 1 Hz, and has a single LED. The Fig 22 circuit has a single LED output, the dotted section shows how a second may be added, such that one LED is on while the other is off, and vice versa. Any types of LED's can be used in this circuit. Series resistors R1 or R4 determine the ON current of each LED.

Figure 23 shows how the Fig 22 circuit can be modified to

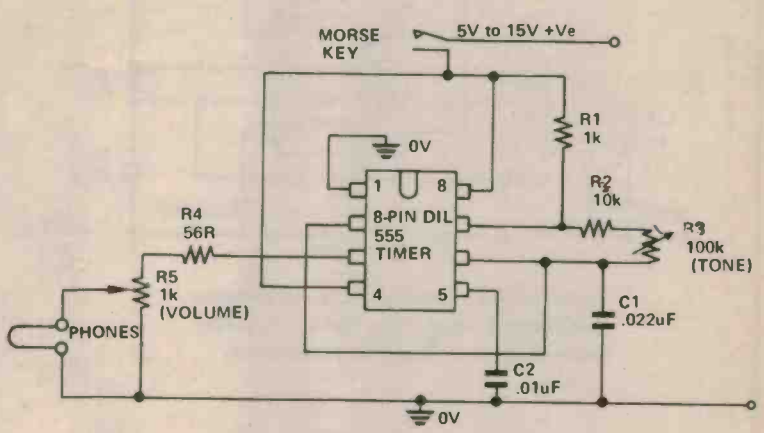


Fig.21. Code-practice oscillator with variable tone (300 - 3kHz) and variable volume.

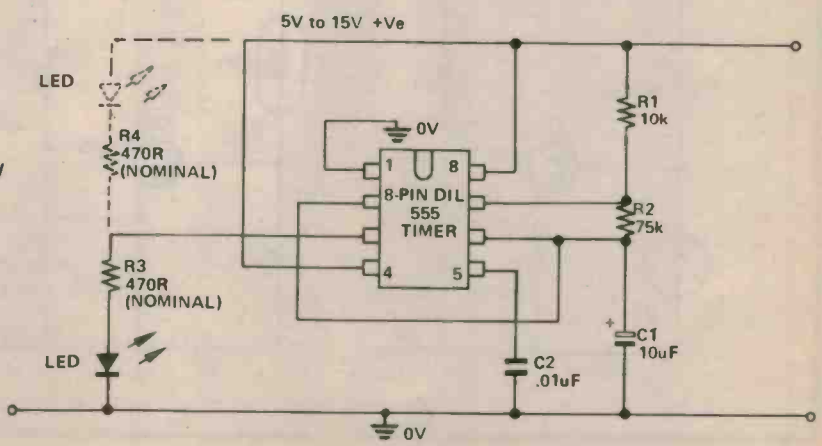


Fig.22. Single and dual output LED flashers give symmetrical 1 Hz outputs.

555 TIMER APPLICATIONS

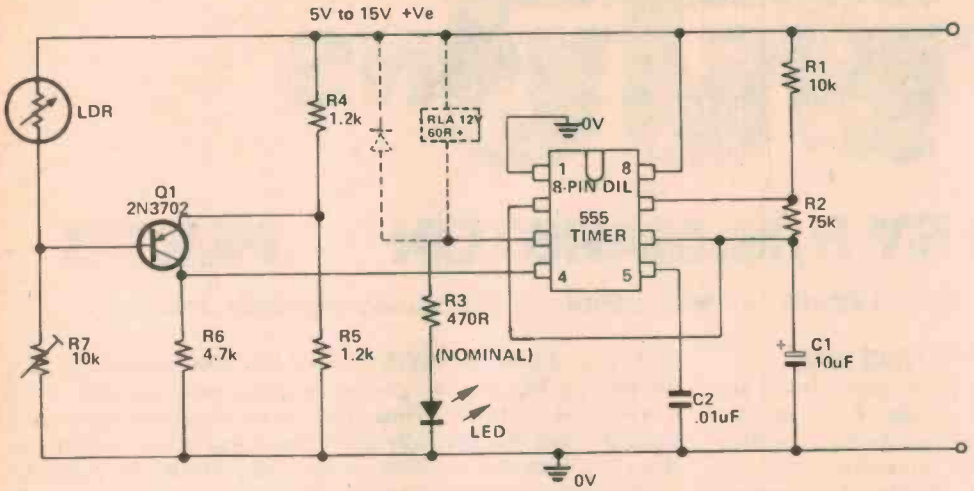
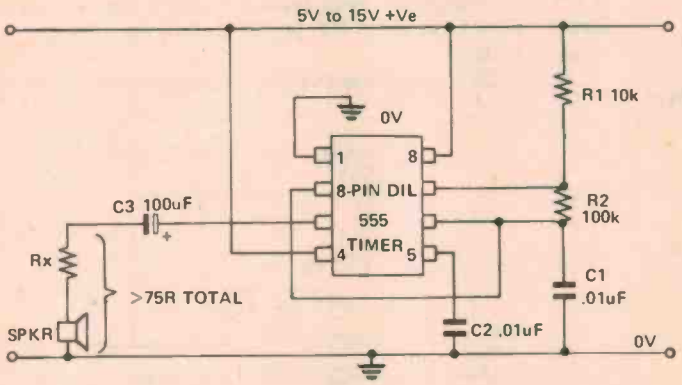


Fig.23. Automatic (dark-activated) flasher.



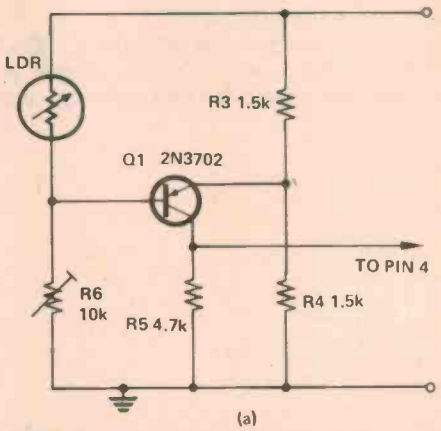
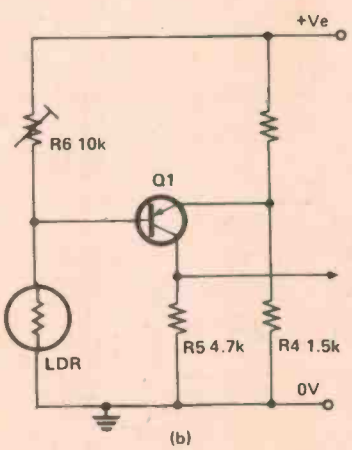
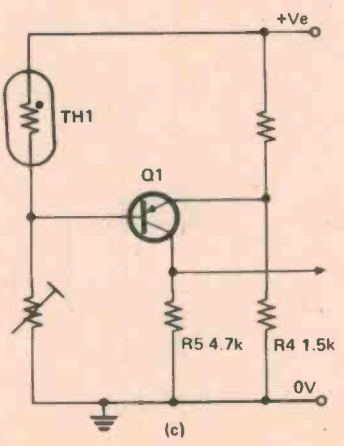
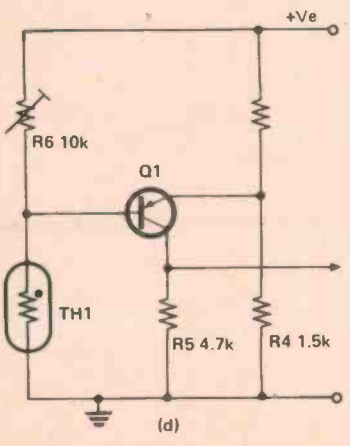


Fig.24. 800Hz monotone alarm call generator a) activated by dark, b) by light, c) by under-temperature, and d) by over-temperature.







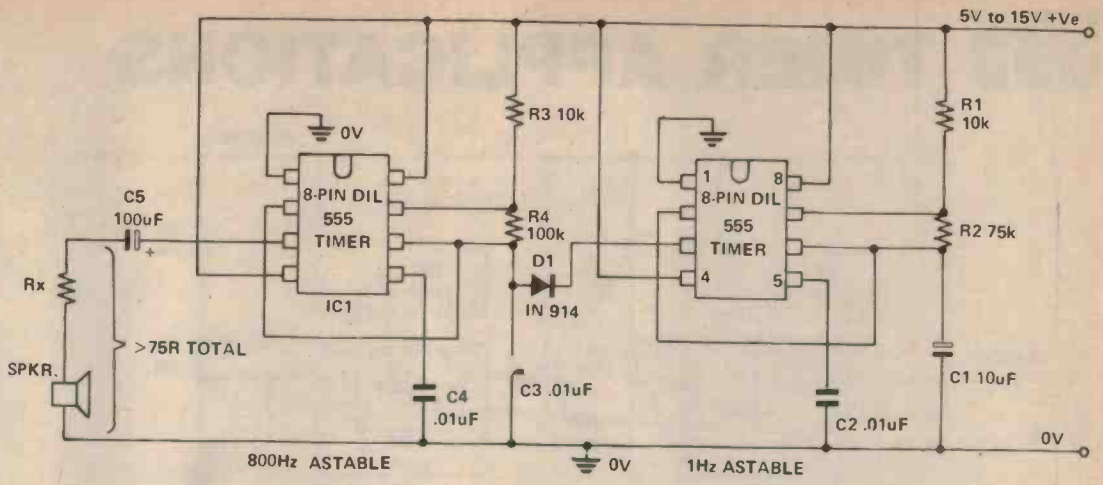


Fig.25. Pulsed-tone (800Hz) alarm call generator.

give automatic dark-activated operation. Here, R4 and R5 are wired as a fixed potential divider that sets 1/2 Vcc on the emitter of Q1, LDR and R7 are wired as a light-sensitive potential divider that applies a variable voltage to the base of Q1, and the collector of Q1 is taken to RESET pin 4 of the IC, which is normally biased to ground via R6.

In use R7 is adjusted so that the voltage to the base of Q1 is greater than 1/2 Vcc under 'daylight' conditions, so Q1 is cut off, but under 'dark' conditions Q1 base is biased below 1/2 Vcc, so it is driven on, thus, under daylight conditions Q1 is cut off, so the 555 astable is disabled, with its output driven low, by 4.7 kΩ resistor R6 which is wired between pin 4 and ground. Under 'dark' conditions, on the other hand, Q1 is biased on, so pin 4 is positively biased, and the astable operates normally and activates the LED.

The LDR used in the above circuit can be any cadmium-sulphide photocell that presents a resistance in the approximate range 470 Ω to 10 kΩ under the minimum 'dark' turn-on condition.

The dotted section shows how the 555 astable circuit can be used as a 12 volt relay pulser, which turns the relay on and off at a rate of one cycle per second. The relay can be any type with a coil resistance greater than 60 Ω.

Alarm Generator

Figure 24 shows the connections for making an 800 Hz monotone alarm-call generator. The circuit can be used with any supply in the range 5 to 15 volts, and with any speaker impedance. Note, however, that Rx must be wired in series with speakers of less than 75Ω impedance, and must be chosen to give a total series impedance of at least 75 Ω, to keep the peak speaker currents within the 200 mA driving constraints of the 555. The available alarm output power of the circuit depends on the speaker impedance and supply voltage used, but may be as great as 750 mW when a 75 Ω speaker is used with a 15 volt supply.

The above circuit can be modified so that it is activated by darkness (a), by brightness (b), by an under-temperature (c), or by an over-temperature (d). Pin 4 is disconnected from the + Ve supply, and connected to the triggering circuit, which is designed around Q1. This works in the same way as already described for the automatic (dark-activated) LED flasher. The LDR used in the light-activated versions of this circuit can be any cadmium-sulphide photocells that present resistances in the approximate range 470 Ω to 10 kΩ at the desired turn-on levels. The thermistors used in the temperature-activated versions of the circuit can be any negative-temperature-coefficient types that present resistances in the same range at the required turn-on temperatures.

Alarms and Sirens

The next four diagrams show a variety of useful alarm-call generator circuits. The Fig 25 circuit generates an 800 Hz pulsed tone alarm call. Here, IC1 is wired as an 800 Hz alarm generator, and IC2 is wired as a 1 Hz astable which gates IC1 on and off via D1 once every second, thus causing a pulsed-tone output signal to be generated.

The Fig 26 circuit generates a warble-tone alarm signal that simulates the sound of a police siren. Here, IC1 is again wired as an alarm generator and IC2 is wired as 1 Hz astable multivibrator, but in this case the output of IC2 is used to frequency modulate IC1 via R5. The action is such that the output frequency of IC1 alternates symmetrically between 500 Hz and 440 Hz, taking one second to complete each alternating cycle.

The circuit of Fig 27 generates a 'wailing' alarm that simulates the sound of an American police siren. Here, IC2 is wired as a low frequency astable that has a cycling period of about six seconds. The slowly varying ramp waveform on C1 of this chip is fed to pnp emitter follower Q1, and is then used to frequency modulate alarm generator IC1 via R6. IC1 has a natural centre frequency of about 800 Hz. The circuit action is such that the alarm output signal starts at a low frequency, rises for 3 seconds to a high frequency, then falls during 3 seconds to the low frequency, and so on ad infinitum.

Finally, to complete this quartet of alarm generator circuits, the Fig 28 circuit generates a siren alarm signal that is a simulation of the 'Red Alert' alarm used in the STAR TREK T.V. programme: This signal starts at a low frequency, rises for about 1.15 seconds to a high frequency, ceases for about 0.35 seconds, then starts rising again from a low frequency, and so on add infinitum. The circuit action is as follows:

IC2 is wired as a non-symmetrical astable multivibrator, in which C1 alternately charges via R1 and D1, and discharges via R2, thus giving a rapidly rising and slowly falling 'sawtooth' waveform across C1. This waveform is fed to pnp emitter follower Q1, and is thence used to frequency modulate pin 5 of IC1 via R6. Now, the frequency modulation action of pin 5 of the IC1 astable circuit is such that a rising voltage on pin 5 causes the astable frequency to fall, and vice versa; consequently the sawtooth modulation signal on pin 5 causes the astable frequency to rise slowly during the falling part of the sawtooth and collapse rapidly during the rising part of the sawtooth. The rectangular pin 3 output of IC2 is used to gate IC1 off via npn common emitter amplifier Q2 during the collapsing part of the signal, so only the rising parts of the alarm signal are in fact heard, as in the case of the genuine STAR TREK 'Red Alert'.

555 TIMER APPLICATIONS

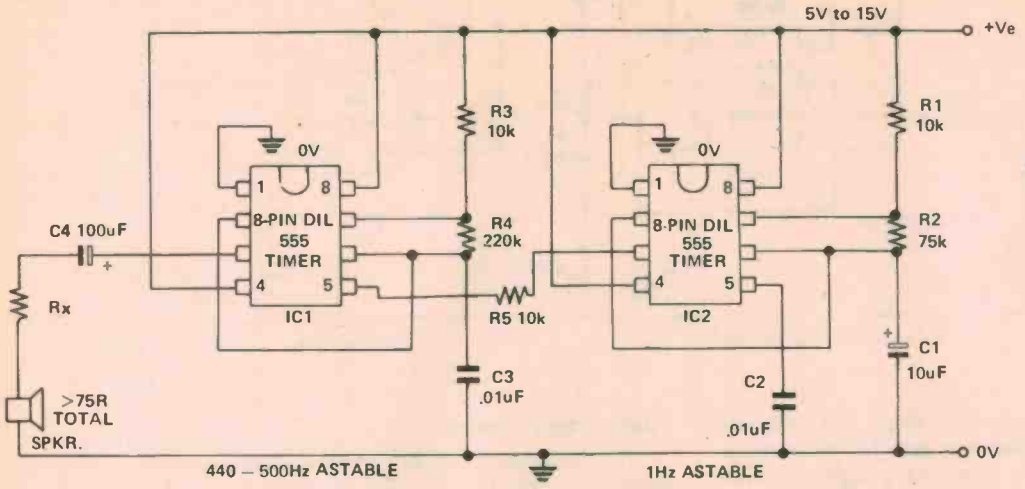


Fig.26. Warble-tone alarm call generator simulates British police siren.

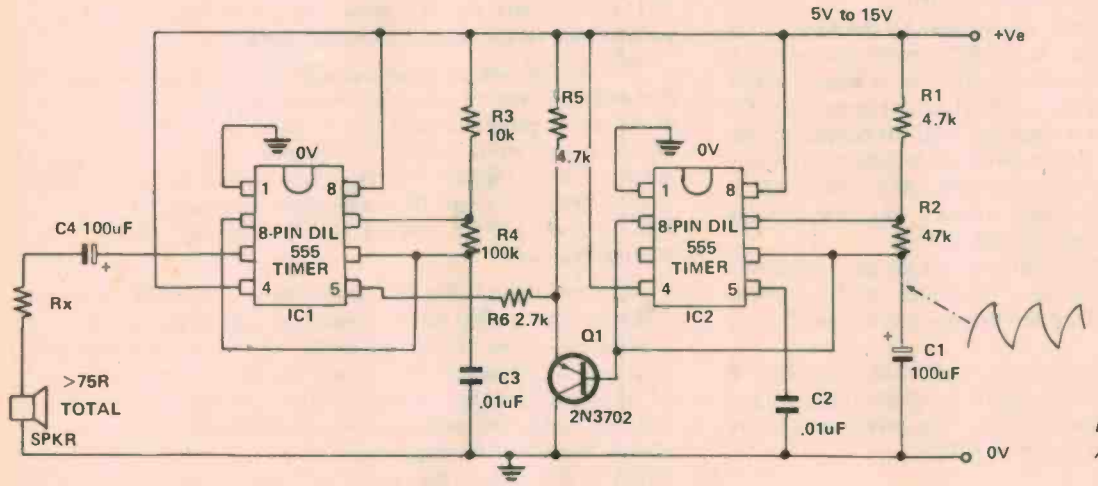
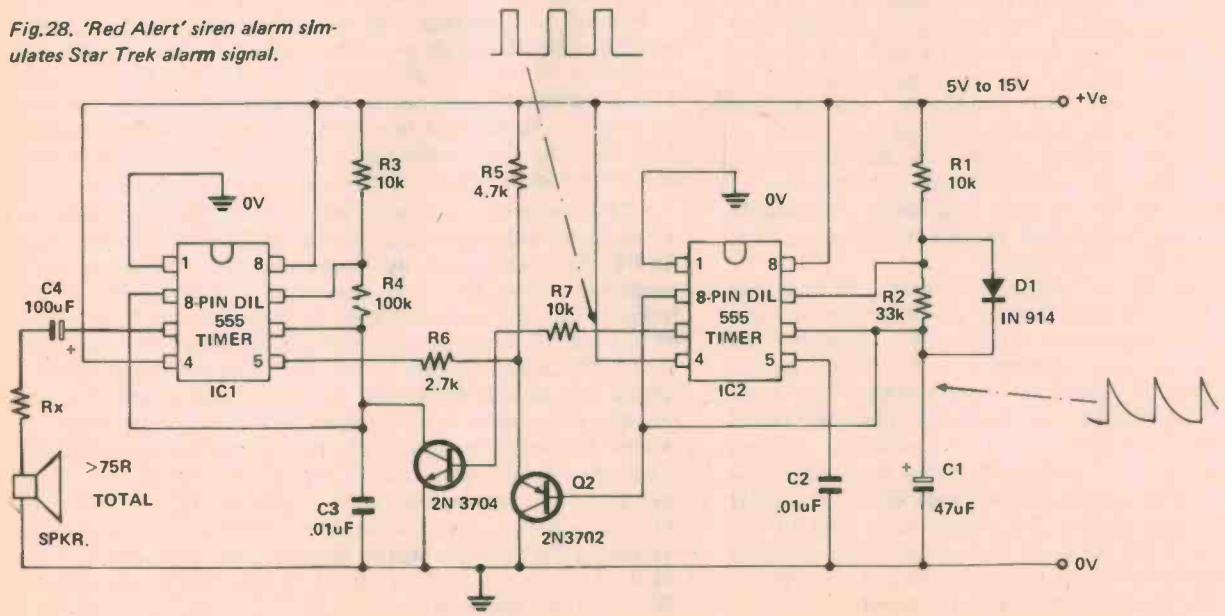


Fig.27. 'Wailing' alarm simulates American siren.

Fig.28. 'Red Alert' siren alarm simulates Star Trek alarm signal.



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CA3035	5.20	CD4078	.55	LM387N	2.75	SL641C	10.60	7404	.48
CA3039	2.10	CD4081	.55	LM395K	6.90	SL645C	12.60	7405	.48
CA3046	LM3046	CD4082	.55	LM555CN	1.20	SL9018	3.90	7406	1.09
CA3053	1.70	CD4085	1.65	LM555H	1.95	SL9178	6.50	7407	1.09
CA3059	8.40	CD4086	1.65	LM556N	2.95	SL1310	1.60	7408	1.09
CA3060	8.40	CD4093	1.80	LM562B	10.90	SL3046	1.20	7409	.48
CA3079	4.40	CD4502	2.70	LM565N	3.50	SP8505	8.60	7410	.48
CA3080	2.10	CD4503	1.40	LM566CN	2.50	SP8515	12.90	7411	.54
CA3081	2.70	CD4510	3.20	LM567CN	3.50	TAA300	2.90	7413	1.15
CA3082	2.70	CD4511	3.30	LM709N	.95	TBA750	2.90	7414	2.70
CA3083	2.90	CD4514	6.50	LM710CN	1.25	TBA700	4.90	7416	1.00
CA3086	LM3086	CD4515	6.50	LM710CH		TBA810A	4.90	7417	1.15
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CA3090Q	6.90	CD4518	2.85	LM723N	1.25	TCA220	2.25	7422	1.95
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CA3127E	4.50	CD4528	1.80	LM733N	2.50	TCA580	6.50	7427	.66
CA3128E	9.90	CD4539	1.98	LM741CH	1.20	TCA730	6.90	7430	.48
CA3130T	2.25	CD4555	1.80	LM741CN	.75	TCA740	6.80	7432	.66
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CA3600	3.30	CD4720	12.60	LM747CN	2.50	UAA170	3.25	7438	.90
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CD4006	2.30	CD40174	2.90	LM1458N	2.50	ULN2208	2.45	7445	2.60
CD4007	.55	CD40175	2.90	LM1488N	6.90	ULN2209	2.45	7446	2.60
CD4008	2.35	CD40192	2.90	LM1489N	5.75	ULN2111	2.10	7447	2.60
CD4009	1.50	CD40194	2.90	LM1496N	1.90	74C00	.55	7448	2.60
CD4010	1.50	CD40195	2.90	LM1808N	3.90	74C02	.80	7450	.48
CD4011	.55	DM8097	1.90	LM3028	CA3028	74C04	.55	7451	.48
CD4012	.55	HEF see CD		LM3046	3.60	74C10	.65	7453	.48
CD4013	.90	LH0070	6.20	LM3086	3.75	74C14	2.80	7454	.48
CD4014	2.40	LM114H	4.90	LM3900	1.75	74C20	.75	7460	.48
CD4015	2.40	LM301AN	.95	LM3905	3.90	74C85	3.90	7470	.85
CD4016	.90	LM301CN	.95	LM3909	1.50	74C86	2.00	7472	.75
CD4017	2.25	LM304H	3.80	MC1035P	2.90	74C90	2.50	7473	.80
CD4018	2.25	LM305AH	3.80	MC1312P	4.80	74C154	5.70	7474	.95
CD4019	2.25	LM307N	1.60	MC1314P	6.90	74C160	3.60	7475	1.35
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CD4023	.55	LM311A	3.60	MC1454G	5.40	74C901	1.95	7483	2.30
CD4024	1.75	LM311H	3.60	MC1458	LM1458	74C925	16.70	7485	2.95
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CD4030	.95	LM320K	6.90	MC1648P	4.90	OL31	.90	7493	1.20
CD4031	4.70	LM320T	4.50	MC4044P	4.90	RL4484	.39	7494	2.20
CD4035	2.35	LM322N	4.50	OM802	3.20	RL5023	.35	7495	1.65
CD4040	2.50	LM323K	7.90	SAJ110	2.50	FND357	3.50	7496	2.15
CD4041	2.50	LM324N	4.50	SAK140	2.50	FND500	3.50	74100	3.65
CD4042	1.95	LM325N	4.50	SD305DE	1.30	9001	1.80	74107	.95
CD4043	2.25	LM326H	4.50	SD306DE	1.50	9368	3.85	74121	1.20
CD4044	2.25	LM339N	3.70	SL415A	2.70	9601	2.90	74122	1.20
CD4045	3.20	LM340K	4.95	SL425A	1.80	NSN71	2.90	74123	1.40
CD4046	3.20	LM340T	2.70	SL437D	3.60	NSN74	2.90	74132	1.90
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CD4052	2.25	LM372H	7.50	SL610C	7.25	2513N	17.50	74153	1.95
CD4053	2.25	LM372N	4.50	SL612C	7.25	S1883		74145	3.20
CD4066	1.45	LM373N	4.70	SL613C	12.50	S50242	15.00	74157	2.20
CD4068	.55	LM374N	4.90	SL620C	9.50	MA1002	13.50	74160	2.75
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AC126	1.80	BC639	1.20	MPF103	.85	2N3054	1.70	2N5459	MPF105
AC127	1.80	BC640	1.20	MPF104	1.10	2N3055	1.35	2N5485	MPF106
AC128	1.80	BD131	1.20	MPF105	.65	2N3564	.65	2N5590	MPF603
AC132	1.50	BD132	1.60	MPF196	1.15	2N3565	.55	2N5591	11.30
AC187	1.50	BD139	1.20	MPF121	1.60	2N3566	.95	2N6027	1.35
AC188	1.50	BD140	1.20	MRF603	6.90	2N3568	.95	2N6084	21.00
AD149	2.60	BD237	1.80	TIP31C	1.20	2N3569	.50	BA102	.80
AD161/62	4.50	BD238	1.80	TIP32C	1.30	2N3638	.55	OA47	.60
AS322	.18	BD437	2.80	TIP120	3.20	2N3638A	.60	OA90	.35
AT118	2N301	BD438	2.80	TIP125	3.30	2N3642	.55	OA91	.35
ASY17	2.65	BF173	1.25	TIP141	4.70	2N3643	.55	5082-2800	3.20
BC107	.35	BF180	1.20	TIP2955	1.70	2N3694	.65	40440	2N3731
BC108	.35	BF194	.85	TIP3055	1.70	2N3731	5.95	40637A	2.85
BC109	.35	BF200	1.30	TT800	2N4037	2N3819	1.35	40673	1.95
BC177	.40	BFY50	1.20	TT801	1.20	2N3866	2.75	40822	2.90
BC178	.40	BFY51	1.50	2N301	2N2869	2N4037	1.25	40841	1.90
BC179	.40	BPX25	4.90	2N706A	1.20	2N4249	.65	BZX61	.75
BC182	.40	BSX19	.75	2N918	1.60	2N4250	.65	BZX70	1.50
BC212	.50	BU126	3.85	2N2222A	1.20	2N4355	.65	BZY91	12.50
BC327	.55	MFE131	1.95	2N2646	2.50	2N4356	.65	PA40	5.85
BC337	.55	MJ802	8.90	2N2869	2.70	2N4360	.95	PB60	6.50
BC547	.55	MJ2955	2.60	2N904A	1.50	2N5245	.75	MEL12	1.40
BC548	.55	MJ4502	8.90	2N2905	1.20	2N5457	MPF103	FCD820	1.90

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NEW! A Complete Range of Solid State VHF Power Amplifier Kits for FM or SSB Service, powers from 3W to 40W. Pre-Devaluation Prices!

Our PA kits use the top of the line CTC series of 12V VHF RF power transistors which are rated to withstand infinite VSWR at all phase angles at rated power output from a 16V supply.

PA3-12

If you have/will/are built/building your own 2m transmitter or transverter then this kit is just right for you. Specified to give 3W output from 300 mW drive, it generally requires only about 100 mW. Suitable for FM or SSB. Constructs on our 'standard' RF PA board (PA-3) which measures only 50 mm x 75 mm! Efficiency around 62% (class C), draws approx. 400 mA at 12.6V; bandwidth 7 MHz. Uses CTC B3-12 transistor.

Basic Kit only, includes transistor, board, components — $15 plus $2 cert. post & pack.

PA12-12

This Kit is intended as a booster amp. for 2m SSB/FM low power or hand-held transceivers. Diode Tx/Rx switching included. Typically gives 13W to 15W output from 1.5W to 2.5W drive, efficiency better than 65%, draws 1.4A at 12.6V and has a bandwidth of about 7 MHz. Also constructs on our 50 x 75 mm PA board (PA-3). Uses CTC B12-12 transistor. Just the thing for your Ken, Standard or IC2021

Basic Kit, includes transistor, board, components — $21 plus $2 cert. post & pack.

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PA40-12

This Kit features Stripline Construction and is intended as a booster amp. for 10W 2m SSB/FM Transceivers; it includes Diode Switching for Tx/Rx — replaces our ETI-710 kit. This new design provides more consistent results, simpler construction and alignment and presents a low SWR to the driving source. Constructed on a double-sided fibreglass PC board. Delivers 40W-50W output (class C) from 8W-12W drive, efficiency greater than 60%, draws 5.5A at 12.6V, excellent linearity on SSB. Minimum gain 5.5 dB. Uses B40-12 transistor.

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B3-12	$6.50
B12-12	$8.50
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RESISTORS

PHILIPS FIXED RESISTORS AND THEIR USES

Two basic versions of film resistors are available from Philips: namely, **Carbon film resistors** and **Metal film resistors**. Nomograms are freely published for both types.

Carbon Film Resistors

The most general purpose resistors used if moderate demands are made for stability, temperature coefficient and tolerance. They generally surpass the performance characteristics of Carbon Composition types, whilst maintaining low unit cost.

They are ideal for use in a great variety of electronic circuits, from hearing aids to computers, telecommunications equipment to portable radios.

Metal Film Resistors

These resistors have been developed for applications in which precision, stability and low temperature coefficient are demanded.

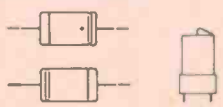
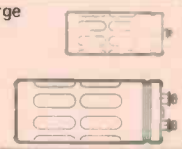
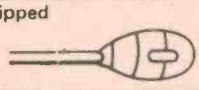
They are ideal for use in computers, telecommunications equipment, industrial and scientific measuring apparatus and electronic devices for medical application.

In addition to the film resistors, Philips also make available **Wire Wound Resistors**. These are a high-power device which can be used in circuits where extremely high voltage spikes are likely to be encountered.

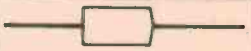
FIXED RESISTORS SURVEY

resistor type	resistance range	tolerance (%)	dissipation at (°C)	dissipation (W)	type number or basic catalogue number
Carbon film	1Ω to 1 MΩ	5, 10	70	0, 2	CR16
				0, 33	CR25
				0, 5	CR37
		5		0, 67	CR52
				1, 15	CR68
				2	CR93
Metal film, t.c. 50 to 200 ppm/°C	4, 99 Ω to 1 MΩ	1, 2, 5	70	0, 4	MR25
				0, 5	MR30
		1		0, 75	MR52
Metal film, temp. coeff. 50 ppm/°C	49, 9 to 681 kΩ	1	70	0, 4	MR24
				0, 5	MR34
Metal film, according to MIL-R-10509F	10 Ω to 1 MΩ	0, 1, 0, 25	125	0, 1	MR24E, MR24C
		0, 5, 1		0, 125	MR34E, MR34C
				0, 25	MR54E, MR54C
				0, 5	MR74E, MR74C
			70	0, 125	MR24D
				0, 25	MR34D
				0, 5	MR54D
				0, 75	MR74D
Power metal film	10 Ω to 27 kΩ	5	70	1, 6	PR37
				2, 5	PR52
High voltage 2500 V (r.m.s.) 7000 V (r.m.s.)	1 MΩ to 68 MΩ	5	70	0, 5	VR37
				1	VR68
Cemented wirewound	5, 6 Ω to 16 kΩ	5	70	4	WR0617
				7	WR0825
				9, 5	WR0842
				15	WR0865
Enamelled wirewound	6.8 Ω to 100 kΩ	5	70	7	WR0825E
				11	WR0842E
				17	WR0865E
Rectangular wirewound	0, 15 Ω to 12 kΩ	5, 10	40	5	2306 330
				8	2306 331
				10	2306 332
				15	2306 333
Low-ohmic wirewound	0, 1 to 10 Ω	10	70	2	2322 326
Pin-head carbon	33 Ω to 180 kΩ	10, 20	70	0, 05	2322 120

ELECTROLYTIC AND SOLID CAPACITORS

TYPE	CAPACITANCE RANGE	VOLTAGE RANGE	SERIES NO. 2222 . . . .
Aluminium Electrolytic Types			
Miniature/Small 	0.33 to 2200 µF	4 to 400 V	015 016 017 040 108
Large 	680 to 150 000 µF	6.3 to 100 V	071 073 106 107
Solid Aluminium Types			
Small 	0.1 to 68 µF	6.3 to 40 V	122
Solid Tantalum Types			
Subminiature Resin Dipped 	0.01 to 68 µF	1.6 to 40 V	146

PAPER AND FILM CAPACITORS

TYPE	CAPACITANCE RANGE	VOLTAGE RANGE	SERIES NO. 2222. . . .
 paper a.c. capacitors	1-25 µF	250 – 600V R.M.S.	240 241
 metallised polyester and polycarbonate film capacitors ("mepolesco")	0.001-4.7 µF	100 – 1600 V	341
 metallised polyester and polycarbonate film capacitors ("nugget")	0.01 – 6.8 µF	100 – 400 V	344
 metallised polyester film capacitors (f.f.c.)	0.01-6.8 µF	100 – 630 V	342
 polyester film/foil capacitors ("p.p.c.")	0.0022-1 µF	100 – 630 V	347

PHILIPS Electronic Components and Materials

Vol. 1 No.5 60c*

CB AUSTRALIA

How to get into CB Radio

SSB TEST REPORT

CB GEAR TO WIN!

CB

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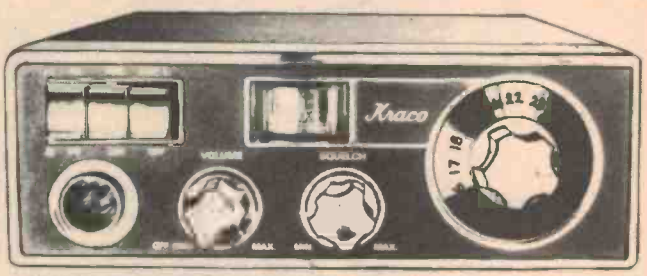

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This exciting American style CB Transceiver is loaded with features. Apart from its smart black all metal cabinet it has a functional and attractive chrome control panel surround. Heavy duty control knobs with finger grips. Positive push button controls for automatic noise limiter. Public address. A most useful map lite is also incorporated. Illuminated channel indicator, variable squelch etc. 29 semiconductors plus I.C. dual conversion. FOR NOVICE OR HAM USE.

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CB AUSTRALIA

Vol.1 No 5.

How to get into CB Radio

CB AUSTRALIA *How to get into CB Radio*

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Collyn Rivers

This, the fifth issue of CB Australia, has been edited and produced by the staff of Electronics Today. It is presented free within the June 1977 issue of Electronics Today, and will also be available at the (recommended) price of 60 cents from all newsagents.

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A MODERN MAGAZINES PUBLICATION
15 Boundary Street, Rushcutters Bay, NSW 2011

COVER:
Some of the SSB rigs we bench tested, see page 17.

THE CONTINUING SAGA OF.....

AS THIS ISSUE goes to press, the Minister of Posts and Telecommunications, Mr. Robinson, has informed Parliament that he will lay a submission before them on the subject of CB sometime during the month of June. At the moment, it seems that he will propose an 18-channel set-up based on the US band, with a licence fee of $20 per year, and possibly a short examination in operating procedures.

The 'ether' is a natural resource, and so we all own a small share in it; there is no objection to its users paying a nominal fee to a Government department to monitor and police abuses of that resource; but $10 should be more than adequate to cover all administrative costs. Asking us to pay over the odds for the use of something we already own is a bit much.

And why an examination in operating procedures? We are not, I hope, talking about an amateur band where contacts will be made under difficult conditions, or where large nets of stations have to be controlled. The only group of CB'ers we can envisage having any need for rigorous operating procedures are CREST groups, who may have to handle emergency messages with both speed and accuracy. Allowing for the simplicity of operation of CB rigs, anyone who is not mike-shy and can speak distinctly can deal with any situation using plain English, whereas the use of 10-code, for example, could be misunderstood. The last thing we want on a band to be shared equally by everyone is groups of elitist small boys (of all ages) playing at being 'radio operators'.

Especially if we have to pay $20 for the privilege of putting up with them.

CONTENTS

MS COMPONENTS

guess the number contest

WE'VE filled this beautiful old jar chock full of diodes - you've got to guess how many diodes are in the jar.

Here's a few clues . . . .

All diodes are identical - we've shown one standing on a coin to give you some idea of size. The jar is totally full.

The jar's about 270mm. in diameter. It's spherical except for the base which is flat and a small concavity at the top where the lid fits on.

TO ENTER -

Simply fill in your name and address on the coupon printed at the bottom left of this page and place it in a sealed envelope addressed to 'CB Contest', 15 Boundary Street, Rushcutters Bay, NSW 2011.

Then write your estimate of the number of diodes on the outside back flap of that envelope - you're allowed three guesses only per envelope. If you want to send in more entries you may, but you'll have to send in another coupon and envelope for every three guesses.

Forms are also available at MS Components.

Remember the closing date - July 31st, 1977.

Entry Coupon - This coupon must be enclosed in the envelope on the back of which is written your entry.

Name .....

Address .....

Post Code .....

If you'd like to have a closer look, the jar will be displayed at MS Components during the contest period.

MS Components are at 164-166 Redfern Street, Redfern.

Yes, the jar is for sale — the owner's asking about $75 (we seem to be in the wrong business!). If you're interested ring our publisher, Collyn Rivers, on 33 4282.

CONTEST RULES

This contest is open to all readers of ETI and CB Australia with the exception of members of the staff of Modern Magazines (Holdings) Ltd., MS Components, Wilke & Co., and Australian Consolidated Press.

Entrants may submit as many entries as they wish but each entry must be written on a separate envelope and accompanied by the entry voucher printed on the bottom left-hand corner of this page.

Entries should be addressed to CB Contest, Electronics Today International, 15 Boundary Street, Rushcutters Bay, NSW 2011. Closing date is July 31st 1977.

A count of the barrel's contents will be made as soon as possible after July 31st 1977. The count will be made in the presence of Mike Sheridan, Managing Director of MS Components, and Collyn Rivers, Publisher of Electronics Today International and CB Australia.

The winner will be that person whose entry comes closest to the actual determined amount. Runners-up will be those entries which came closest in order of correctness. In the event of a tie the winning order will be made by a draw.

The winner of the first prize will be notified by telegram, runners-up by letter. The names of the winners together with the actual diode count will be published in the News pages of Electronics Today International and CB Australia at the earliest possible opportunity.

Permit number TC9288

CB GEAR TO WIN!!!

Here's a chance to win a superb Sidewinder III CB mobile transceiver. There's further prizes for the runners up. Second prize is an RF signaliser (that's a device for boosting those border-line signals) – third prize is a Kaiser 20,000 ohms/volt multimeter and there's a further couple of gift vouchers for fourth and fifth.

* 1st prize – Sidewinder III CB mobile transceiver
* 2nd prize – RF Signaliser
* 3rd prize – Kaiser multimeter
* 4th prize – $15 gift voucher (MS Components)
* 5th prize – $10 gift voucher (MS Components)

MS Components have agreed to exchange any prize for other goods of equivalent value if desired.

Sidewinder

SIDEWINDER III – the best of the range

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Other 23 Channel 5 Watt Units Available A.M.

● "Pace" CB143 23 Channel Mini Rig. P.A. Squelch $69.95 ● "Shigma" SR76 23 Channel A.M. PA/ANL Meter. Squelch $79.95 ● "TASC" AM 23 Channel ANL S/G Meter. CB/PA. $109.00 ● "Asahi" AS500 Delta-Tune AM/ANL/PA. Meter., etc. $89.00 ● "Beta" 2000. As above. Features 23 Channel. Mobile $95.00 ● "Cougar" 23B Top Quality AM version of Panther SSB. $159.00

This month's special "XTAL" $79

23-CHANNEL MOBILE CITIZENS BAND TRANSCEIVER

MODEL XCB-7

● "XTAL" XSSB10. 12W P.E.P. Clarifier Control, etc. $239.50 ● Gemtronics 2325 AM/SSB 12W P.E.P. $210 ● 12 volt regulated power supply for above units $39.50

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● "Sideband" NC310 1 Watt 3 Channel. Ext. Power. Antenna Connections. $44.95 each. ● "Sanyo" TA395 5 Watt. Hand Held Separate Speaker & Mike. $79.50 each. ● 12 Volt/Amp Regulated P/Supply for above units. $18.50

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● Gutter Mount Aerial Centre loaded $22.00 ● Boot Trunk Mount, Base Loaded 12' Coax & PL259 $20 ● 5' Helical Fibreglass with Base, etc. $25

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COME-ON

We Hand The Mic To Our Readers...

Hon. E.L. Robinson M.P.,
Minister for Posts & Tele-
communications & Minister Assisting
the Treasurer,
House of Representatives,
CANBERRA, A.C.T. 2600.

Dear Sir,

Having read the national Citizens Radio Association submission to your Department dated April 1977, I believe that for the service to be of real value to the community and to satisfy the present need, CB radio should be low cost and without unnecessary restrictive government control. The licence to register a set should be relatively easy to obtain and without a prerequisite of belonging to clubs and associations.

The National Citizens Radio Association, in its Summary of Recommendations, recommends that the Federal Government:

"Phase out AM only sets and ban import of AM sets."

This is contrary to the concept of CB radio in making them unnecessarily expensive and would not satisfy the community need. Hand held AM 2-channel sets sell for $47.50. The cheapest SSB set available sells for $275. Hand held units are particularly important for distress and emergency use as statistics show that hand held units have been responsible for saving life and protecting property to a far greater extent than mobile or installed units.

The submission ignores that hand held and 4-channel units are only available in AM. Hand held units are not available for SSB and to manufacture these specifically would be enormously expensive.

SSB sets, as recommended by the N.C.R.A. submission, would cost a minimum of $275. Well outside the means of many potential users who would most benefit from the introduction of a CB service.

AM sets, based on the US 23-channel service, are available for less than $100, and would therefore satisfy the community need.

In paragraph 8.9A, the N.C.R.A. suggest that the units should be the same as the 23-channel US allocation and to the January 77 F.C.C. specification. It seems ludicrous that N.C.R.A. make this recommendation when no such sets exist at present, and would have to be specifically manufactured for the Australian market at enormous cost.

"A licensing testing scheme to be adopted."

This would create unnecessary expense - people are not required to pass a licence test to operate marine 27 MHz sets or VHF sets, and therefore, it would be unwarranted for CB radio.

It would seem that the N.C.R.A. is trying to create a compromise solution and further its own interests as the "national self-regulating, self-disciplining body."

The N.C.R.A. further recommend that a licence issuing authority be set up similar to a Drivers' Licence issuing authority. This would be enormously expensive as the N.S.W. Department of Motor Transport spends $31.6 million on administration costs alone through 70 offices and employs 3085 people.

I believe that the user should be able to obtain his licence at the point of sale to overcome the need for unrealistic government control. A yearly licence fee could then be paid at a post office and this would further obviate the need to create an administrative body as recommended by the N.C.R.A.

"The Department evaluates technical parameters with a view to drafting realistic standards"

These standards already exist in the U.S. The F.C.C. has many years of technical expertise in setting the necessary standards for CB radio.

"Introduce an automatic transmitter identity signal"

The introduction of an automatic transmitter identity signal is not necessary in the U.S.A. or any other country.

"The Government should hold a Royal Commission into spectrum management."

Unnecessary expense and completely unwarranted.

The submission does not make any mention of the hospital paging systems near channels 2 and 21, and the interference to the Marine (27.88 MHz) distress frequency. For a report to overlook this important point would appear irresponsible. It is estimated that it would cost well over $100,000 to move these frequencies.

I suggest that the N.C.R.A. represents a minority of people who see CB radio as a way to further their own ends and create employment for their organisations.

Gerald Nolan

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Features

- Special level instructions
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- 23 Channels

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23 CHANNEL 'Mecoa' — $95
Well known MECOA. Price includes antenna. Model BCB6.

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'XTAL' brand. Model SSB 10. All the features. Price includes antenna.

23 CHANNEL 'ROYCE' — $150
23 channels CB, plus AM/FM/MPX. Set only $150, antenna $12 extra. Note speakers not included.

OTHER C.B. ITEMS
"THE BEST BOOK ON C.B.", covers the lot, 192 pages, $6.25, plus $2 post and pack. Power supplies 240W to 13.8V, while they last $37.95. Antenna, base loaded mobile, boot or roof top mount $12. Gutter clip, centre loaded $12. Stereo lock mounts $5. Note — All the above sets will be sent to your nearest rail station.

FOUR WHEEL DRIVES
304 Middleborough Road,
Blackburn South, Vic. 3130. Phone 89-0509
G.S.

CB NEWS

STRATO GAINS FOUR NEW AGENCIES

Terry Brown from STRATO Communications scraped back into Sydney just before the recent air traffic controller's strike following a trip to Japan. While over there he secured agencies for the latest CB gear from four of the top-line manufacturers. Strato now stocks directly from the factory the TRAM Diamond 80, the complete COBRA range of transceivers, the Super PANTHER range from PEARCE-SIMPSON, the SBE range and the HY-GAIN range. All equipment is designed to meet 1977 FCC specifications. Strato offer after sales service on all their equipment and stock appropriate spares – even for equipment they stocked many years Ago!

JUNE CB-AMATEUR RADIO SEMINAR

A three day seminar for CB and amateur operators is to be held over the Queen's Birthday weekend (11th, 12th, 13th June) at Hill End. The theme for the seminar will be "An introduction to the hobby of Radio Transmitting".

The seminar is being jointly organised by the Bathurst and Orange CB clubs, the Orange Radio Club (amateur) and the Four-Wheel CB club from Sydney. The seminar construction for the beginner, radio operating procedure, how to organise Novice Amateur courses in CB clubs, radio theory for the beginner etc and encouracing CB-Amateur discussion. Those attending the seminar will be able to operate amateur equipment under the supervision of licensed amateurs to enable Cbers to get a 'taste' of what amateur radio is all about. Amateurs will be able to get an idea of what CBers intersts are.

The idea of the seminar came from a previous meeting in April, held at Hill end. A 27MHz to 1.7MHz link operated that weekend provided some interesting contacts as a demonstration to Bathurst-Orange area CBers. An on-air conversation over theOrange 2-metre repeater between the President of the Orange Amateur Radio Club and the president of the OrangeCB club concluded with arrangements for a meeting between the two groups.

The seminar at Hill End will be a camping trip and more details may be obtained from Gus in Sydney on 80-3200 or by writing to Sam Voron VK2BVS at 2 Griffith St, East Roseville, 2069.

CB TECHNOLOGY JUMP

Regulár readers of ETI will have noticed that there are two areas of interest in hobby/consumer electronics today: CB and microcomputers. Well, it was only a matter of time, and now it's happened. Texas Instruments (of watch and calculator fame) have introduced two new CB transceivers which incorporate advanced technology in the form of microprocessors and charge-coupled devices.

The SM-172 is an AM/SSB mobile rig and the SM-173 is an AM/SSB base station. Both radios incorporate two TMS1100 microcomputers; one in the handset and one in the transceiver body. The handset incorporates a five-digit LED display, 20 keys for channel and mode selection and two rocker switches for volume and squelch. The use of a microcomputer makes possible a wide range of facilities: selective calling capabilities, including the ability to store the numbers of other units and 'dial' them at the push of a button;automatic channel scanning; automatic clarifier control on SSB (more later); automatic SWR measurement and shutdown; channel memory; and digital channel readout.

For simplified SSB reception, the transceivers use a CCD filter under control of a microcomputer which adjusts the filter's bandpass frequency and bandwidth automatically. This means that instead of manually adjusting the clarifier control to resolve SSB, the rig automatically locks onto the signal. The pricing is a contrast to TI's policy on watches: they've gone for the top of the market at top-of-the-market prices – US$325 for the SM-172 and US$375 for the SM-173.

ERRATA

We recently ran an item in CB AUST. regarding the Licensing and Regulating Department of the P.M.G. quoting a telephone number 654 4400. This is the number of Sanyo-Guthrie who are being inundated with telephone calls from people trying to contact the licensing and Regulating Department. The correct number should be 42 3721.

CB MARKETPLACE

SANYO 5W 6 channel Hand-held withxtals for 4 channels, power meter, sockets, antenna pwr,earphone, PA.$90. Ring Michael 366659.

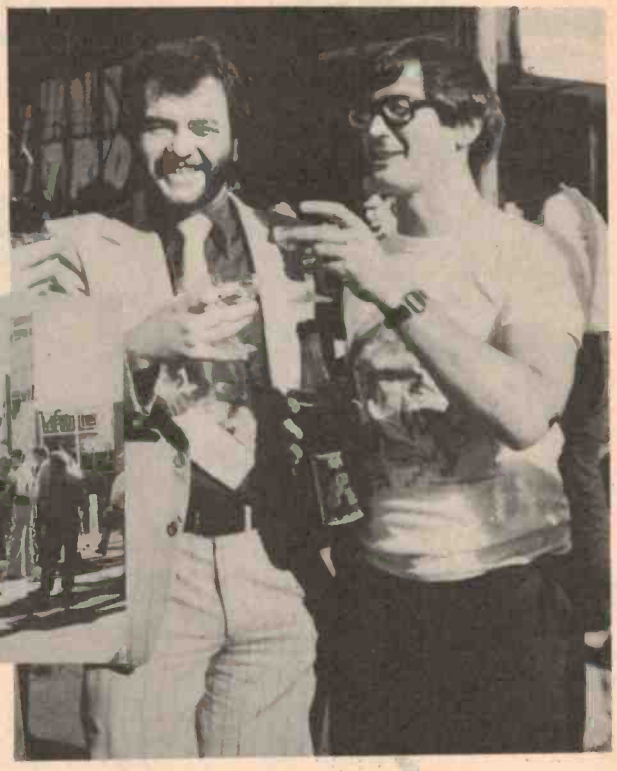
One TRC 101B Realistic handheld Ch 23 A1 condition, box etc. $85.00 Ph 317128 075 Purchased April 1977.

For sale: 1 Electronics, 3 channel, 1 watt hand held CB transceiver, 3 months old. (All crystals included) $40. 913 9634 (narrabeen, NSW)

Darwin: Midland 882C rig, good nick $140 o.n.o. Box 40428, Casuarina N.T.

LEGAL CB?

This page was going to deal with Submissions but it looked a bit boring; so when Mr. Robinson announced that CB would be legalised and Tricky Dickey threw a commemorative champagne bash the next day, CBA was there to record the event for posterity. Although Mr. Robinson has said that he will place a proposal before Parliament this month, we are still not sure how many channels will be used or any other details. There are mutterings of a shift to UHF in 5 years — for further info on this and other CB happenings, see next month's CB Australia.

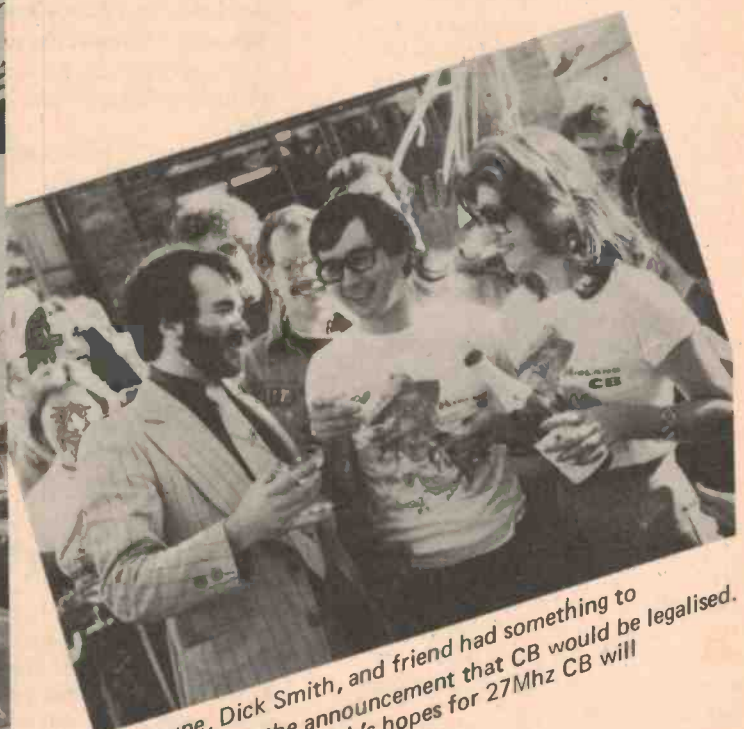


▲ *Bill Payne, Dick Smith*

The crowd gathered, and there was wine, women, laughter and the day after.... ▶

◀ *CBA's Simon Bracken (glass in hand as always) attempts to scrounge some more champagne.*

▲ *Enough said!*



Bill Payne, Dick Smith, and friend had something to celebrate with the announcement that CB would be legalised. It looks as though Dick's hopes for 27Mhz CB will be realised.

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WANER C.B. 777 SOLD OUT
100 per cent sell out
MAIL ORDERS TEMPORARILY CLOSED
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Some stocks available still at our dealers – see list

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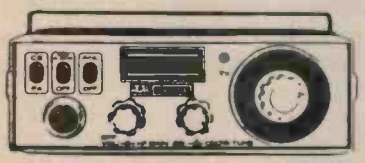
PACE 23 Channel, Delta Tuning, Automatic Noise Limiter



PACE 144
PRICE
$149

SPECIFICATIONS
Transmitter Compliance FCC No 42248, part 95 4 Watt legal power average Modulations minimum 90 per cent T.V. interference — 65D.B.

SIMULTANEOUS RELEASE WITH U.S. OF A.
300 Units Available Only.

IF YOU WANT THE BEST IN S.S.B., AND YOU ARE PREPARED TO PAY A LITTLE MORE TO GET IT, THEN YOU MUST INSIST ON

CHEROKEE SILTRONICS A23

25Watt-5Watt

PRICED AT $295

SPECIFICATIONS
AM/5watt Double Conversion Superheterodyne. Hum & Noise below 40DB of Signal. SSB/524 watts Single Conversion superheterodyne. Modulation by filter method and 3rd order distortion below 20Db.

AMERICAN REVIEW: This new model Cherokee A23 from Siltronics is there BEST YET. It will OUTSELL all other models and continue to lead the field for some time yet. Like all fine quality products, it costs a little more but in this case, it is well justified.

ONE OF THE FEW TOP BRANDS THAT BY FAR EXCEEDS THE REQUIREMENTS OF THE NEW FCC RULES.

MAIL ORDER DEPARTMENT Guarantees discretion to all customers. Cash receipts available on request. Prompt despatch as always.

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SSB UNIT **$289** p&p $3·50

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Sideband Electronics Sales

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ASTRO - 200 digital solid state 200 W.P.E.P.	P.O.A.
TRIO KENWOOD model TS520-D-AC only 10 to 80 M.	$590
TRIO KENWOOD model 520 AC-DC 10 to 80 M.	$650
TRIO KENWOOD model TS-820S AC only 160 to 10 M with digital readout.	$980
TRIO KENWOOD model TS-820 AC only 160 to 10 M.	$850
TRIO KENWOOD model MC-50 Microphone.	$ 49
TRIO KENWOOD model TS - 700 - A FM-AM-CW-SSB transceivers. Full 144-148 MHz coverage, 10-Watt output, VFO controlled, self-contained, AC-DC operation.	$650
TRIO KENWOOD model TS-600-A FM-AM. SSB transceiver full 50-54 MHz coverage 10 Watt output variable from 1 Watt to full power. VFO controlled AC-DC operation. Styling as TS-700-A.	P.O.A.
TRIO KENWOOD model TR-7400 2 meter FM tranceiver 10 to 25 watts output. Frequency range 144.00 to 147.995 MHz No. of channels 800, Double conversion super-heterodine sensitivity better than 0.4 UV for 20 DB.	$385
KYOKUTO 2 M FM 15 W output transceivers with digital read-out and crystal synthesized PLL circuitry now with 800 transmit and 1000 receive channels 5 KHz apart, covers all of 144-148 MHz, receive to 149 MHz. No more crystals to buy. Includes simplex, repeater and anti-repeater operation. only	$310

NOVICE OPERATORS

All above HF transceivers will be modified for low cost to suit novice. Requirements 27 MHz conv. x-tals in stock now for Kenwood models.

IT IS HERE AGAIN, the well known SE-501 in new style case 15 Watt pep 23 AM SSB for as low as	$215
Same model with AC built in supply and DC built in SWR power meter and many goodies.	$260

ICOM

VHF TRANSCEIVERS SSB

ICOM model IC-202 2 M SSB portable transceiver 144-144.4 MHz	$215
ICOM model IC-502 6 M SSB portable transceivers 52-53 MHz.	$215

KLM SOLID STATE POWER AMPLIFIERS

(MHz)			
144-148	PA10—80BL	80	OUTPUT (watts)
"	PA10—140BL	140	"
"	PA10—160BL	160	"
"	PA2—70BL	70	"
400-470	PA10-70CL	70	"

FDK MULTY QUARTZ with 24 channels 10 sets of crystals supplied 10 Watts, new style.	$265
YAESU MUSEN model FT-101-E AC-DC transceivers 10 to 160 M with speech processor	$800
YAESU MUSEN model FT-301.	$960
YAESU MUSEN model FT 301 - D	$1140
YAESU MUSEN model FT - 301 - S	$660
YAESU MUSEN model FL-2100-BLineal Ampl.	$525
YAESU MUSEN model FP - 301	$165
YAESU MUSEN FR 6-7. Uses Wadley loop princ.	$300

FREQUENCY COUNTERS

YAESU MUSEN model YC-500-E-S-J	P.O.A.

HY - GAIN ANTENNAS

14AVQ 10-40M. verticals, 19' tall, no guys	$ 65
18AVT-WB 10-80 M. verticals, 23' tall no guys	$ 95
TH3JR 10-15-20 junior 3 el. Yagi 12' boom	$160
TH3MK3 10-15-20 senior 3 el. Yagi 14' boom	$220
TH6DXX 10-15-20 senior 6 el. Yagi 24' boom	$250
HY-QUAD 10-15-20 cubical quad Yagi 8' boom	$250
TIGER ARRAY 204BA 20M4 el. Yagi 26' boom	$250
BN-86 balun for beam purchases only	$ 25

MARK MOBILE ANTENNAS

HW-80, 6' long for 80 M.	$ 28
HW-40, 6' long for 40 M.	$ 25
HW-20, 6' long for 20 M.	$ 23
Swivel mounts & chrome-plated springs for all	$ 13

CUSH CRAFT ANTENNAS

A144-11 11 Element 2M-Yagi	$ 45
A147-11 11 Element 2 M Yagi	$ 45
A147-20 combination horizontal vertical 2 M	$ 70
A144-20 combination Yagi with matching harness circular polarization	$ 75

ANTENNA ROTATORS

Model CDR Ham-11 for all hf beams except 40 M	$200
Model CDR AR-22 L junior rotator for small beams	$ 65
KEN model KR-400 for all medium size hf beams with internal disc brake	$110
KEN model KR-500 for vertical control of satellite tracking	$110
All models rotators come complete with 230-volt AC indicator-control units.	
6-conductor cable for KR-400-500	65 cents per metre

COAX CABLE CONNECTORS

PL-259	$1.20
SO-239 Chassi Mount	$1.20
Male to male joiner	$1.20
Female to female joiner	$1.20
Angle connector	$1.70
T-connector	$2.00

COAX CABLE

RG - 8 - U foam filled	per metre	$1.20

SWR METER

Twin meter model: Y.M. - I.E. 3.5 to 145 MHz prof quality	$ 28
DRAKE TV - 3300 TV I lowpass filter	$ 31
SSR-1 Receivers	$270
CRYSTAL FILTER, 9 MHz, similar to FT-200 ones. With carrier crystals.	Soon Available

All prices quoted are net SYDNEY, N.S.W., on cash-with-order basis, sales tax included in all cases, but subject to changes without prior notice. ALL-RISK INSURANCE from now on free with all orders over $100; small orders add 50c for insurance. Allow for freight, postage or carriage; excess remitted will be refunded.

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* ANTENNA ROTATORS * COAX CABLE CONNECTORS * S.W.R. METERS.

TS-820 SERIES

HF TRANSCEIVER

TRIO KENWOOD model TS - 820 AC only
160 to 10 M.

KENWOOD

TS–820 PERFORMANCE SPECIFICATIONS

Frequency Range	160 meter band ... 1.8 to 2.0 MHz
	80 meter band ... 3.5 to 4.0 MHz
	40 meter band ... 7.0 to 7.3 MHz
	20 meter band ... 14.0 to 14.35 MHz
	15 meter band ... 21.0 to 21.45 MHz
	10 meter band ... 28.0 to 28.5 MHz
	28.5 to 29.0 MHz
	29.0 to 29.5 MHz
	29.5 to 29.7 MHz
	WWV 15.0 MHz (receive only)
	A.J.X band
Mode	CW, USB, LSB, FSK
RF Input Power	SSB 200 Watts PEP
	CW 160 Watts DC
	FSK 100 Watts DC
Antenna Impedance	50 to 75 ohms, unbalanced
Carrier Suppression	Better than 40 dB (Mod. freq. at 1.5 kHz)
Side Band Suppression	Better than 50 dB (Mod. freq. at 1.5 kHz)
Microphone	High impedance (50 kΩ)
AF Response	400 to 2,600 Hz
Spurious Radiation	Harmonics Less than -40 dB
	Others Less than -60 dB

Receiving Sensitivity	S/N 10 dB or better at 0.25 μV
Image Ratio	160 to 15 meter band. Better than 60 dB
	10 meter band Better than 50 dB
IF Rejection	Better than 80 dB
Frequency Stability	Within ± 1 kHz during one hour after one minute of warm-up, and within 100 Hz during 30 minute period thereafter
Receiving Selectivity	SSB 2.4kHz (-6 dB)
	4.4 kHz (-60 dB)
	CW: 0.5kHz (-6 dB), with optional CW filter
	1.5 kHz (-60 dB), with optional CW filter
AF Output Power	More than 1.5 watts (with less than 10% distortion) into an 8 ohms load
Audio Output Impedance	4 to 16 ohms (speaker or head phone)
Tube and Semiconductors	3 tubes (2 x S2001A, 12BY7A)
	5 ICs
	30 FETs
	74 transistors
	165 diodes
Power Requirements	120/220VAC, 50/60Hz
Power Consumption	Transmit: 280 watts
	Receive: 26 watts (with heater-off)
Dimensions	13-1/8 (333) wide x 6-0 (153) high x 13-3/16 (335) deep inch (mm)
Weight	35.2 lbs (16kg)

* Specification and designs are subject to change without prior notice.

KENWOOD

DG - 1 Digital Display
YG. 88C Crystal Filter
SP. 520 - 820

DS 1 DC Converter
VFO - 820

TS-520 SERIES

TS-520.....Specifications

Frequency Range	80 meter band - 3.50 to 4.00 MHz
	40 meter band - 7.00 to 7.30 MHz
	20 meter band - 14.00 to 14.35 MHz
	15 meter band - 21.00 to 21.45 MHz
	10 meter band - 28.00 to 28.50 MHz
	28.50 to 29.10 MHz
	29.10 to 29.70 MHz
	WWV - 10.00 MHz (Receive only)
Mode	USB, LSB, CW
Input Power	160 watts on 80 to 15 meter band, 140 watts on 10 meter band
Antenna Impedance	50 to 75 ohms, unbalanced
Carrier Suppression	40 dB
Unwanted Sideband Suppression	40 dB
Harmonic Radiation	- 40 dB
AF Response	400 to 2,600 Hz (-6 dB)
Audio Input Sensitivity	High impedance (50 kΩ) 0.5 μV for 10 dB (S+N)/N on 80 to 15 meter band
	1.0 μV for 10 dB (S+N)/N on 10 meter band
Selectivity	SSB: 2.4 kHz (-6 dB)
	4.4 kHz (-60 dB)
	CW: 0.5 kHz (-6 dB)
	1.5 kHz (-60 dB) (with optional CW filter)
Frequency Stability	100 Hz per 30 minutes after warm-up.
Image Ratio	50 dB
IF Rejection	50 dB
AF Output Power	1 watt (with 8 ohms load and 10% H.D.)
AF Output Impedance	4 to 16 ohms (Speaker or Headphone)
Tube and Semiconductor Complement	3 tubes (2 x S2001, 12BY7A), 1 IC, 18 FET's, 44 transistors, 84 Diodes
Power Requirements	120/220 VAC, 50/60 Hz
	Transmit: 280 watts
	Receive: 26 watts (with heater-off) or 13.8 VDC
	Transmit: 15 Amp.
	Receive: 0.6 Amp.
Dimensions	333 (13.11) wide x 150 (5.91) high x 335 (13.19) deep mm (inch)
Weight	16 kg (35.2 Lbs.)

24 KURRI STREET, LOFTUS HEIGHTS. N.S.W. 2232 AUSTRALIA. PH.:521-7573
Postal Address P.O. Box 184, SUTHERLAND. 2232

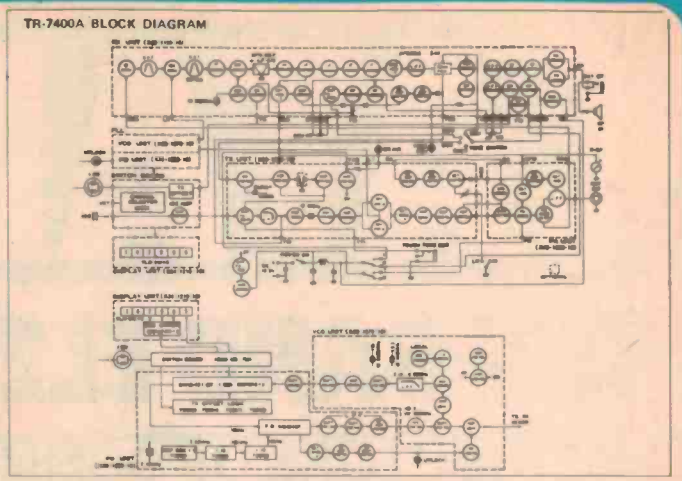
KENWOOD

TR-7400A

TRIO KENWOOD model TS - 700 - A FM-AM-CW-SSB transceivers. Full 144-148 MHz coverage, 10-Watt output, VFO controlled, self-contained, AC-DC operation.

TRIO KENWOOD model TS-600-A FM-AM. SSB transceiver full 50-54 MHz coverage 10 Watt output variable form 1 Watt to full power. VFO controlled AC-DC operation. Styling as TS-700-A.

TR-7400A BLOCK DIAGRAM



SPECIFICATIONS

GENERAL

Semiconductors:	Transistors	50	
	FETs	7	
	ICs	18	
	Diodes	63	
Frequency Range	144.000 to 147.995 MHz		
Mode:	FM		
No. of Channels:	800		
Operating Temperature	−20 to +50 degrees C		
Power Voltage	11.8 to 16.0V DC (13.8V DC nominal)		
Grounding Polarity:	Negative ground		
Antenna Impedance:	50 Ohms		
Current drain	Less than 1A in receive with no input signal Less than 8A in transmit (HI) Less than 4.5A in transmit (LOW) at 13.8V DC		
Dimensions		182 mm (7-3/16") wide 270 mm (11 - 5/8") deep 94 mm (3-7/8") high	
Weight:		Approximately 2.8 kg (6.2 lbs.)	

TRANSMIT SECTION

RF Output Power	High: 25 Watts Low: 5 Watts (approximately)
Modulation:	Variable reactance frequency shift
Frequency Deviation	±5 KHz
Spurious Radiation	Better than -60dB
Tone Burst Duration	0.5 to 1.0 sec
Touch Tone input impedance.	600 Ohms
Microphone	Dynamic microphone with PTT switch, 500 Ohms

RECEIVE SECTION

Receive System:	Double conversion superheterodyne
Intermediate Frequency	1st IF: 10.7 MHz 2nd IF: 455 kHz
Sensitivity:	Better than 0.6 uV for 20 dB quieting Better than 1 uV for 30dB S/N
Squelch Sensitivity:	Better than 0.25 uV
Selectivity:	12kHz at −6dB down 40 kHz at −70dB down
Image Rejection:	Better than −70dB
Spurious Interference:	Better than −60dB
Audio Output:	More than 1.8 watts across 8 Ohms load 10% distortion
Intermodulation:	Better than 68 dB

Circuits and ratings may be subject to change without notice due to development in technology.

KYOKUTO DENSHI CO.,LTD.

MODEL FM144-10SXR II

SPECIFICATIONS

KYOKUTO MODEL FM144-10SXR II

FREQUENCY COVERAGE:	Receive.....144.000 - 148.995MHz Transmit..... (a) 144.000 - 145.995MHz, or (b) 146.000 - 147.995MHz All above in 5KHz increments.
TYPE OF EMISSION:	F-3
ANTENNA IMPEDANCE:	50 ohms, unbalanced feed.
COMMUNICATION MODE:	Simplex and Duplex 1600KHz offset.
TEMPERATURE RANGE:	0°C to +50°C
POWER SOURCE:	DC 13.5 volts ±10%, negative ground
CURRENT CONSUMPTION:	Max 4A transmit, receive .8A standby, max 1A
DIMENSIONS:	2 1/8 x 6 1/2 x 7 1/2 in. (54 x 165 x 195 mm)
NET WEIGHT:	41bs 10oz, body only (2.1kgs)
SHIPPING WEIGHT	Approximately 6lbs 10oz (3.0kgs)

TRANSMITTER

OUTPUT:	10 watts or better (13.5V) high power 1 watt low power by switch on microphone
OSCILLATOR CIRCUIT:	IC (MC1648) voltage controlled oscillator
FREQUENCY STABILITY:	0.002%
MODULATION SYSTEM:	Direct frequency modulation of VCO
VCO FREQUENCY:	fvco = fchan ±16.9MHz (duplex 1600KHz)
DEVIATION:	±5KHz (adjustable to max ±15KHz)
SPURIOUS RADIATION:	Less than 60db below carrier

RECEIVER

RECEIVER CIRCUIT:	Double conversion superheterodyne
INTERMEDIATE FREQUENCY:	1st - 16.9MHz, 2nd - 455KHz
FREQUENCY STABILITY:	0.002%
SENSITIVITY:	-6dB (0.5uV) for 20db quieting or better
SQUELCH SENSITIVITY:	-10dB (0.1uV) or better
SELECTIVITY:	16KHz at 6db down, ±12KHz at 60dB down
IMAGE REJECTION:	Better than 60dB
AUDIO OUTPUT:	4 watts, 4 ohm load, less than 10% distortion

STANDARD ACCESSORIES

DYNAMIC MICROPHONE:	600 ohms, press-to-talk, with "HI-LO" switch
POWER CABLE:	With 2 conductor connectors and fuse holder, 5A
SPARE FUSE:	5A
EXTERNAL SPEAKER PLUG:	Miniature phone plug type
AUTO MOUNTING BRACKET:	With mounting screws, nuts and wing-bolts, etc.
INSTRUCTION MANUAL:	With circuit diagram, etc.

YAESU

FRG-7 THE RADIO FOR WORLD WIDE LISTENING

The model FRG 7 is a precision built high performance communication receiver designed to cover the band from 0.5 MHz–29.9 MHz. Its state of the art technology offers an unprecedented level of versatility.

The Wadley Loop System (drift cancellation circuit) coupled with a triple conversion super heterodyne system guarantees an extremely high sensitivity and excellent stability.

It provides complete satisfaction to amateurs as well as BCL's with superb performance and many features such as RF attenuator, selectable tone, and automatic noise suppression circuit.

- Type of Mode
  A.M. SSB (USB, LSB) C.W.
- Frequency range
  0.5 MHz–29.9 MHz
- Sensitivity
  SSB/CW better than 0.7μV for 10 db S/N at 30% modulation
- Selectivity
  3 kHz–6 db
  7 kHz–50 db
- Frequency stability
  Within 500 Hz during any 30 minute period after warm-up
- Input Impedance
  0.5 MHz–1.6 MHz High impedance
  1.6 MHz–29.9 MHz 50–75 Ohm unbalanced
- Output Impedance
  4 Ohms
- Audio Output
  More than 2 watts
- Power requirement
  A.C. 117 V 50/60 Hz
  D.C. 13.5 V Negative ground
  Battery Type UM-1 x 8
- Dimensions
  340(W) x 153 (H) x 285(D) mm
- Weight
  7 kg without batteries

- Semiconductors

I.C.	AN214	1
	SN76514N	1
FET	3SK40M	3
	2SK19GR	6
TR	2SC372Y	8
	2SC784R	4
	2SD313	1
Ge diode	1N60AM	9
Si diode	1S1555	2
	V06B	3
Zener	WZ110	1
	BZ091	1

YAESU MUSEN

Deluxe Mobile/Base Station

FT-101E/EE

Specifications

GENERAL

Frequency Range: 1.8–2.0 MHz, 3.5–4.0 MHz, 7.0–7.5 MHz, 14.0–14.5 MHz, 21.0–21.5 MHz, 27.0–27.5 MHz (receive only), 28.0–29.9 MHz, WWV 10.0–10.5 MHz (receive only)
Mode: Selectable USB, LSB, CW or AM
Frequency Stability: Within 100 Hz during any 30 minute period after warm up. Not more than 100 Hz with 10% line voltage variation.
Calibration Accuracy: 2 kHz maximum after 100 kHz calibration.
Backlash: Not more than 50 Hz.
Antenna Impedance: 50 to 75 Ohm unbalanced nominal.
Circuitry: 40 Transistors, 3 Integrated Circuits, 38 Diodes and 3 Tubes.
Power Requirement: 100/110/117/200/220/234 V AC, 50/60 Hz, 350 Watts maximum, or 13.5 V DC nominal, 5 A for standby, 0.5 A for receive (Heater OFF) and 20 A for transmit.
Size: 340(W) x 153(H) x 285(D) m/m.
Weight: 15 kg.

RECEIVER

Sensitivity: 0.3 μV for 10 dB Noise plus Signal to Noise Ratio on 14 MHz.
Selectivity: 2.4 kHz nominal bandwidth at 6 dB down, 4.0 kHz at 60 dB down on SSB, CW and AM. 600 Hz nominal bandwidth at 6 dB down, 1.2 kHz at 60 dB down with optional CW filter.
Harmonic & Other Spurious Response: Image Rejection better than 50 dB. Internal Spurious Signal below 1 μV equivalent to antenna input.
Automatic Gain Control: AGC threshold nominal 3 μV. Attack time 8 milliseconds and release time 1800 milliseconds.
Audio Noise Level: Not less than 40 dB below 1 watt.
Audio Output: 3 Watts to internal or external speaker at 4 Ohm impedance.
Audio Distortion: Less than 10% at 3 Watts output.

TRANSMITTER

Input Power: 260 Watts PEP on SSB, 180 Watts on CW at 50% duty cycle and 80 Watts on AM except for 160 meter. (Slightly lower on 10 meter.)
Microphone: 50 K Ohm dynamic type
Carrier Suppression: –60 dB.
Sideband Suppression: –50 dB.
Spurious Radiation: –40 dB.
Distortion Products: –30 dB.
Frequency Response: 350 to 2700 Hz ±3 dB.
Final Tube: 6JS6C x 2

YAESU MUSEN

FT-301D

GENERAL

Frequency Range: 1.8–2.0 MHz, 3.5–4.0 MHz, 7.0–7.5 MHz, 14.0–14.5 MHz, 21.0–21.5 MHz, 27.0–27.5 MHz (receive only), 28.0–29.9 MHz, WWV 5 MHz (receive only).
Mode: SSB (selectable USB or LSB), CW, AM or FSK.
Frequency Stability: Within 100 Hz during any 30 minute period after warm-up. Not more than 100 Hz with 10% line voltage variation.
Calibration Accuracy: 2 kHz maximum after 100 kHz calibration.
Backlash: Not more than 50 Hz.
Antenna Impedance: 50 ohm unbalanced nominal.
Circuitry: 24 FETs, 47 Transistors, 27 Integrated Circuits and 94 Diodes.
Power Requirement: 13.5 V DC nominal 11 A (digital type) and 0.9 A (dial type) for receive and 21 A for transmit.
Size: 280(W) x 125(H) x 370(D) m/m.
Weight: Approx. 9 kg.

RECEIVER

Sensitivity: 0.25 μV for 10 dB Noise plus Signal to Noise Ratio on 14 MHz.
Selectivity: 2.4 kHz nominal bandwidth at 6 dB down, 4.0 kHz at 60 dB down on SSB, CW and AM. 600 Hz nominal bandwidth at 6 dB down, 1.2 kHz at 60 dB down with optional CW filter, 6 kHz nominal bandwidth at 6 dB down, 12 kHz at 60 dB down with optional AM filter.
Harmonic & Other Spurious Response: Image Rejection better than 50 dB. Internal Spurious Signal below 1 μV equivalent to antenna input.
Automatic Gain Control: AGC threshold nominal 3 μV. Attack time is 8 milli seconds and release time is selected from 3500, 1500 and 200 milli second on front panel.
Audio Noise Level: Not less than 40 dB below 1 Watt.
Audio Output: 3 Watts to internal or external speaker at 4 ohm impedance.
Audio Distortion: Less than 10% at 3 Watts output.

TRANSMITTER

Input Power: 200 Watts PEP on SSB, 200 Watts on CW at 50% duty cycle and 50 Watts on AM and FSK. (Slightly lower on 10 meter and 160 meter bands.)
Microphone: 500 ohm dynamic type
Carrier Suppression: –40 dB.
Sideband Suppression: –50 dB.
Spurious Radiation: –40 dB.
Distortion Products: 31 dB
Frequency Response: 300 to 2700 Hz ±3 dB.
Final Transistor: S2535 x 2.

YAESU MUSEN model FT - 301 - S
YAESU MUSEN model FP – 301
YAESU MUSEN FR 6-7. Uses Wadley loop principal
YAESU MUSEN model FT - 301
YAESU MUSEN model YC-500

ICOM

144MHz FM
HANDY
TRANSCEIVER

IC-212

144MHz SSB CW 3W TRANSCEIVER

IC-202

YAESU MUSEN

FT-221R 2 Meter Transceiver

● Solid State Ultimate 2 Meter Transceiver with Versatile SSB FM CW AM Operation

Here is a compact, versatile transceiver designed for the active 2 meter enthusiast. The FT-221R features all mode operation—SSB/FM/CW/AM—with repeater offset capability. Advanced phase lock loop circuitry offers unsurpassed stability and clean spurious free signals. Modular, computer type construction offers reliability and ease of service. Preset pass band tuning provides the optimum selectivity and performance needed on today's active 2 meter band. Join the fun on FM, DX, or OSCAR, with the FT-221R transceiver. Another winner from the world's leader in amateur communications equipment.

GENERAL

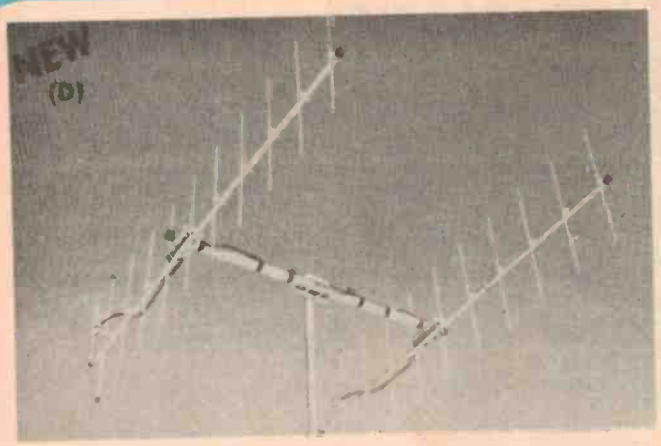
Frequency Range: 144.00 to 148.00 MHz in eight 500 kHz segments.
Mode: SSB (selectable USB or LSB), AM, FM or CW.
Frequency Stability: Within 100 Hz during any 30 minute period after warm-up. Not more than 20 Hz with 10% line voltage variation.
Calibration Accuracy: 1 kHz maximum after 100 kHz calibration.
Backlash: Not more than 50 Hz.
Antenna Impedance: 50 ohm unbalanced nominal.
Power Requirement: 100/110/117/200/220/234 V AC, 50/60 Hz, 100 VA maximum or 13.5 V DC, 3A transmit maximum (11.5 - 16.5 V DC).
Size: 280(W) x 125(H) x 295(D) m/m.
Weight: 8.5 kg.

RECEIVER

Sensitivity: 0.5 μV for 10 dB Noise plus Signal to Noise Ratio on SSB/CW. 1.0 μV for 10 dB Noise plus Signal to Noise Ratio with 400 Hz 30% modulation on AM. 0.75 μV for 20 dB quieting on FM.
Selectivity: 2.4 kHz nominal bandwidth at 6 dB down, 4.1 kHz at 60 dB down on SSB/CW/AM, ±6 kHz nominal bandwidth at 6 dB down, ±12 kHz at 60 dB down on FM. (8 kHz or 15 kHz filter is available on request.)
Harmonic & Spurious Response: Image Ratio better than 60 dB.
Audio Output: 2 Watts to internal or external speaker at 4 ohm impedance.
Squelch Threshold: Less than 0.3 μV.
I.F. Frequencies: SSB/AM/CW 10.7 MHz, FM 10.7 MHz and 455 kHz.

TRANSMITTER

Spurious Radiation: –60 dB.
Frequency Response: Balanced SSB 300 to 2700 Hz ±3 dB. Low power AM better than 60%. Variable reactance FM ±5 kHz maximum.
Carrier Suppression: –50 dB.
Sideband Suppression: –50 dB.



cushcraft

D-POWER PACK The big signal (22 element array) for 2 meter FM, uses two A147-11 yagis with a horizontal mounting boom, coaxial harness and all hardware. Forward gain 16 dB, F/B ratio 24 dB, ½ power beamwidth 42°, dimensions 144" x 80" x 40", turn radius 60", weight 15 lbs., 52 ohm feed takes PL-259 fitting.

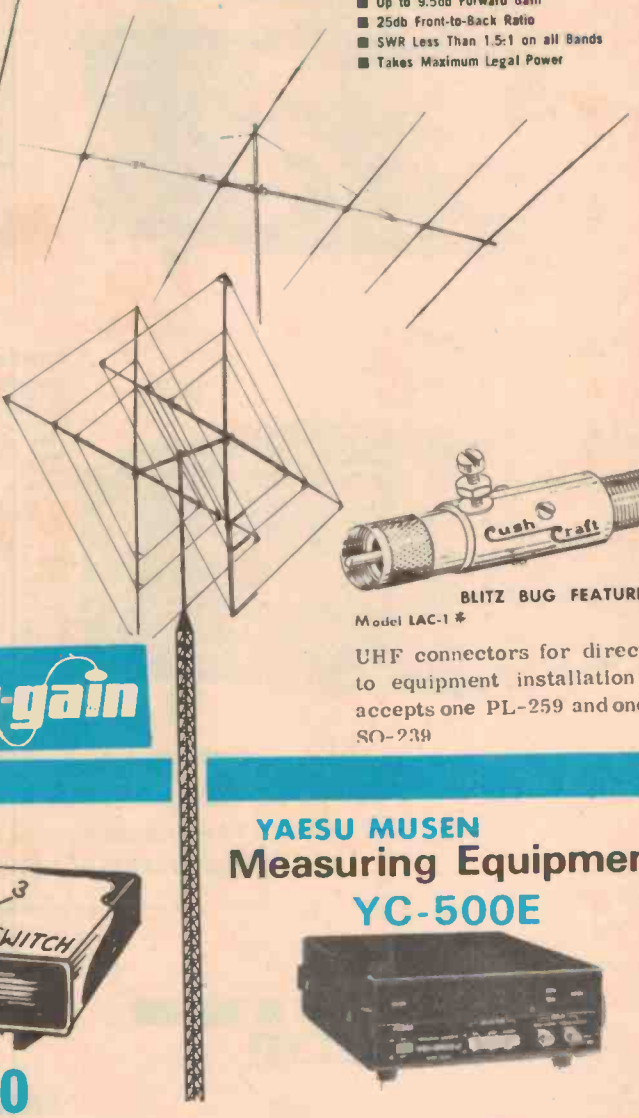
A147-22 146 - 148 MHz, 1000 Watts, wind area 2.42 sq. ft.

CUSH CRAFT ANTENNAS
A144-11 11 Element 2M-Yagi
A147-11 11 Element 2 M Yagi
A147-20 combination horizontal vertical 2 M
A144-20 combination Yagi with matching harness circular polarization

ALL NEW 6-Element SUPER THUNDERBIRD DX

Model TH6DXX

- New "Hy-Q" Traps
- Up to 9.5db Forward Gain
- 25db Front-to-Back Ratio
- SWR Less Than 1.5:1 on all Bands
- Takes Maximum Legal Power



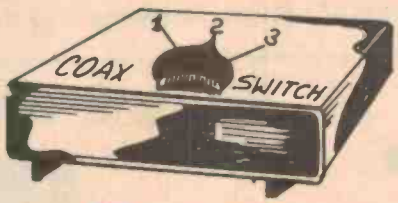
BLITZ BUG FEATURES

Model LAC-1 *

UHF connectors for direct to equipment installation, accepts one PL-259 and one SO-239

hy-gain

NOW...A GREAT NEW WIDE BAND VERTICAL
for 80 through 10 Meters



APOLLO

Hy-Gain's 18AVT/WB

Take the wide band, omni-directional performance of Hy-Gain's famous 14AVQ/WB, add 80 meter capability plus extra-heavy duty construction—and you have the unrivalled new 18AVT/WB. In other words, you have quite an antenna.

- Automatic switching, five band capability is accomplished through the use of three beefed-up Hy-Q traps (featuring large diameter coils that develop an exceptionally favorable L/C ratio).
- Top loading coil.
- Across-the-band performance with just one furnished setting for each band (10 through 40).
- True 1/4 wave resonance on all bands.
- SWR of 2:1 or less at band edges.
- Radiation pattern has an outstandingly low angle whether roof top or ground mounted.

CONSTRUCTION . . . of extra-heavy duty tapered swaged seamless aluminum tubing with full circumference, corrosion resistant compression clamps at slotted tubing joints . . . is so rugged and rigid that, although the antenna is 25' in height, it can be mounted without guy wires, using a 12" double grip mast bracket, with recessed coax connecter.

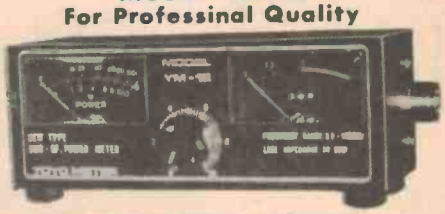
Order No. 386

ANTENNA ROTATORS
Model CDR Ham-11 for all hf beams except 40 M
Model CDR AR-22 L junior rotator for small beams
KEN model KR-400 for all medium size hf beams with internal disc brake
KEN model KR-500 for vertical control of satellite tracking
All models rotators come complete with 230-volt AC indicator-control units.
6-conductor cable for KR-400-500

HY – GAIN ANTENNAS
14AVQ 10-40M. verticals, 19' tall, no guys
18AVT-WB 10-80 M. verticals, 23' tall no guys
TH3JR 10-15-20 junior 3 el. Yagi 12' boom
TH3MK3 10-15-20 senior 3 el. Yagi 14' boom
TH6DXX 10-15-20 senior 6 el. Yagi 24' boom
HY-QUAD 10-15-20 cubical quad Yagi 8' boom
TIGER ARRAY 204BA 20M4el. Yagi 26' boom
BN-86 balun for beam purchasers only

YAESU MUSEN
Measuring Equipment
YC-500E

SWR & POWER METER
MODEL YM-1E
For Professinal Quality



COAX CABLE CONNECTORS
PL-259
SO-239 Chassi Mount
Male to male joiner
Female to female joiner
Angle connector
T-.connector

COAX CABLE
RG - 8 - U foam filled

DRAKE TV - 3300 TVI lowpass filter
SSR-1 Receivers

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NEW – MINI CASSETTE RECORDER-DICTATING MACHINE

$45.00 (p&p $2.00).

Grip-size multi-functional Cassette Tape Recorder Featuring:
o Built-In Condensor Microphone o One-touch multi-functional bar for (1) Record, (2) Play, (3) Stop and (4) Phase Control (Push-Push type) o Instant Replay key for Review and/or Rewind use o Instant Pause mechanical control o Automatic Level Control Device.

CR-102, ALL SOLID STATE AM/FM 12/24 HOUR DIG. CLOCK RADIO. SLIDING BRIGHTNESS, VOLUME & TONE CONTROLS, ETC EXCELLENT VALUE.

Warranty: 90 days
$45.95 (p&p Int. $4.00; NSW $2.50)

ALSO AVAILABLE o **EMONA E-4** stereo FM/AM 24 HOUR DIG. CLOCK RADIO. **$79.95** (P&P Int. $4.50. NSW $3.50). o **EMONA E-2**, All solid state AM/FM 24 HOUR DIG. CLOCK RADIO. **$49.95** (P&P Int. $4.00, NSW $2.50).

INTRODUCING!

NEW 100W (AM) 250W PEP (SSB) 10-80M LINEAR AMPLIFIER!

HF-10-100L AMPLIFIER
Frequency Range: 3-30 MHz
Input Power: 10 W Nom., 5-20 W PEP range
Output Power: 100 W Nom., ± ½ dB across band, 200-250W PEP output
Input Impedance: 50 Ω nom. adjustable to match exciter range under 2:1 across band
Output Impedance: 50 Ω nom. up to 3:1 VSWR acceptable with little degradation
Current Drain: 16 A nom, 20 A supply recommended at 13.6 VDC
Power Supply: 13.6 VDC recommended for best results, 11-14 VDC acceptable positive or negative ground
Pre-amp: 18 dB nom gain across entire HF band, 15 dB typ at 50 MHz, 3-4 dB NF
Size: 19.1 x 16.5 x 8.9 cm wt 1½ Kg

OUR SCIENTIFIC CALCULATORS

The famous **ELCON's:**
- SCIENTIFIC — STATISTIC (10 memory, rechargeable battery & adaptor), SC6010 — $39.00
- **SCIENTIFIC SC44F** (rechargeable battery & adaptor) — $32.50
- **PANASONIC — SCIENTIFIC JE8401U** — $25.00 adaptor optional **$6.00**

Warranty: 12 months

CS-6010

To above prices add 15 percent S.T. if applicable (P&P Inter. $3.00, NSW $2.00).

EMONA DHM-95 SOLID STATE — (9 transistors)

AM/FM POCKET RADIO

$12.50 (P&P $1)

With large speaker — excellent sound. Earphone and battery included.
Warranty 90 days.

ALSO: 80w, 144 – 148 MHZ, FM, SSB LINEAR AMPLIFIER 2M10 – 80L

ALSO AVAILABLE:

- YAESU FRG-7 GENERAL COVERAGE RECEIVER-WADLEY LOOP SYSTEM
- YAESU FT-101E TRANSCEIVER
- KENWOOD TS-520 TRANSCEIVER

KENWOOD TS 820 H.F. TRANSCEIVER
KENWOOD TS-520 H.F. TRANSCEIVER
KENWOOD TR-7400A 2M DIG. TRANSCEIVER
- CHECK OUR STOCK ON OTHER YAESU AND KENWOOD AMATEUR RADIO EQUIPMENT

ALL AMATEUR RADIO EQUIPMENT IS AVAILABLE ON 10 PER CENT DEP. TO APPROVED BUYERS!

AR-145 AM SHORT CHASSIS PUSH BUTTON CAR RADIO

$38.00 (P. & P. Int. $3.50, NSW $2.30)

HAM-WORLD TIME CLOCK

Battery operated. New design from Japan.

$28.00

(P. & P. Int. $3.50, NSW $2.50)

EMONA, MODEL 12, BATTERY ELIMINATOR

9V, 150mA

$5.00

(Incl. postage)

C3-11 STEREO CAR CASSETTE

$59.00 (P. & P. Int. $4.50, NSW $3.50)

Complete with round flush mount or convertible type speakers. Supply: 12V Neg ground. Excellent value!

C.B. THE DE-LUXE 23 CHANNEL 5 WATT SEIKI, HA-23C

0.5uV for 10db S/N 6dB bandwidth selectivity, 50db minimum spurious rejection/Features local/Dist. switch, PA facility, Squelch etc.

As low as $79.00!
(P. & P. Int. $4.00 NSW $3.50)

C.B. Aerials & accessories available.

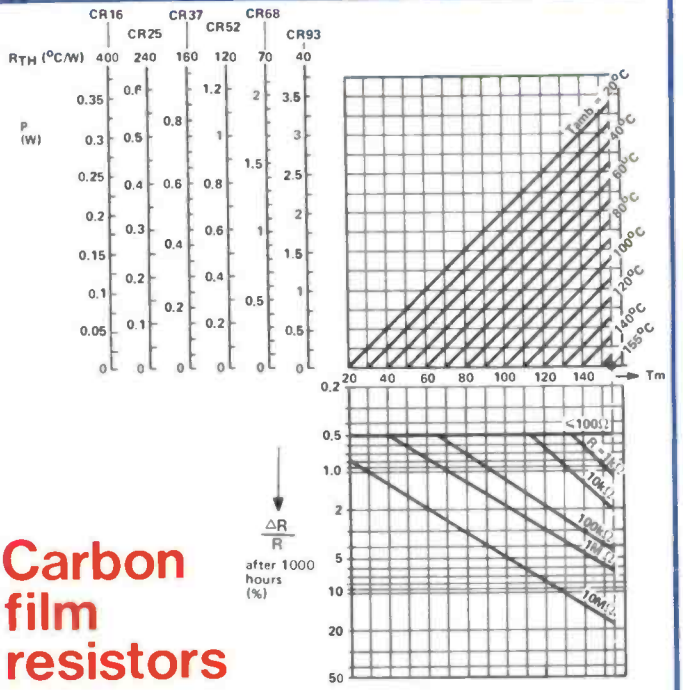
CAR RADIO LOCK IN AERIALS $4.50 (P. & P. $1.00)

WRITE, PHONE OR CALL IN!

MAIL ORDERS: Box 188, COOGEE, NSW, 2034

PHILIPS COLOUR CODE FOR

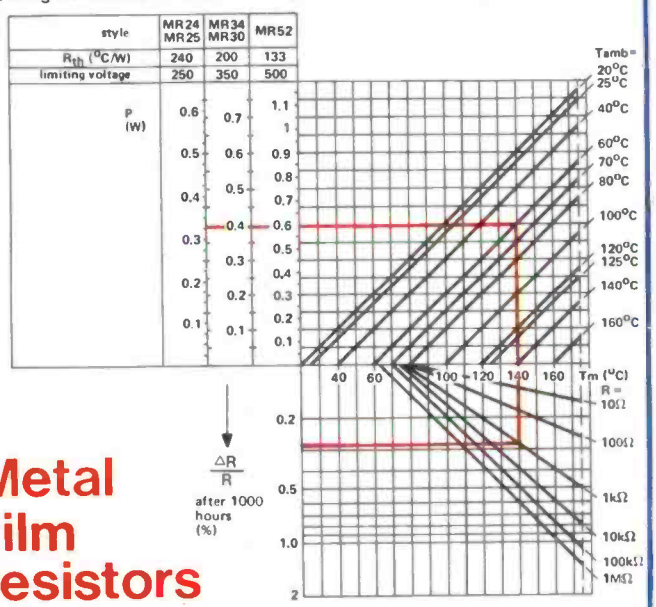
NOMOGRAMS TO FIND STYLE OR STABILITY



Carbon film resistors

Example

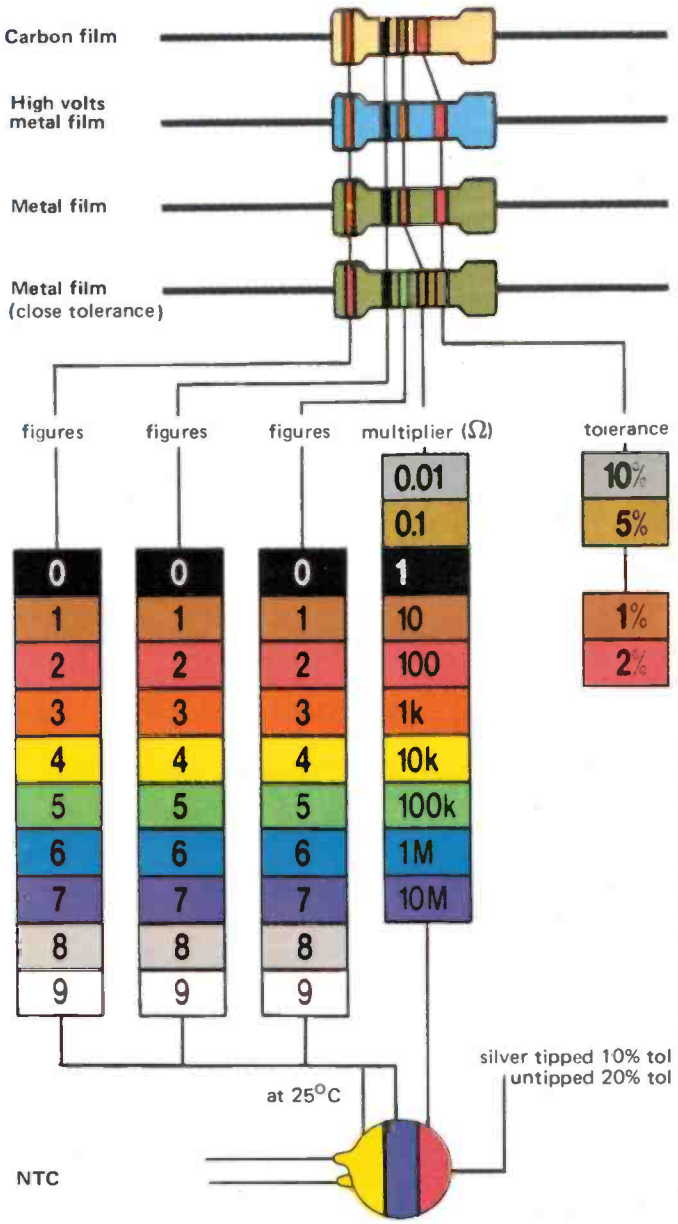
What is the stability of a 1 kΩ metal film resistor, style MR25, operating at 0.33 W in an ambient of 60°C? Take a horizontal line on the nomogram from 0.33 W to where it intersects the 60°C ambient line. Then vertically down to where it intersects the 1 kΩ line and horizontally to the stability calibration column, showing a stability of 0.28% change over 1000 working hours.



Metal film resistors

PHILIPS Electronic Components and Materials

RESISTORS



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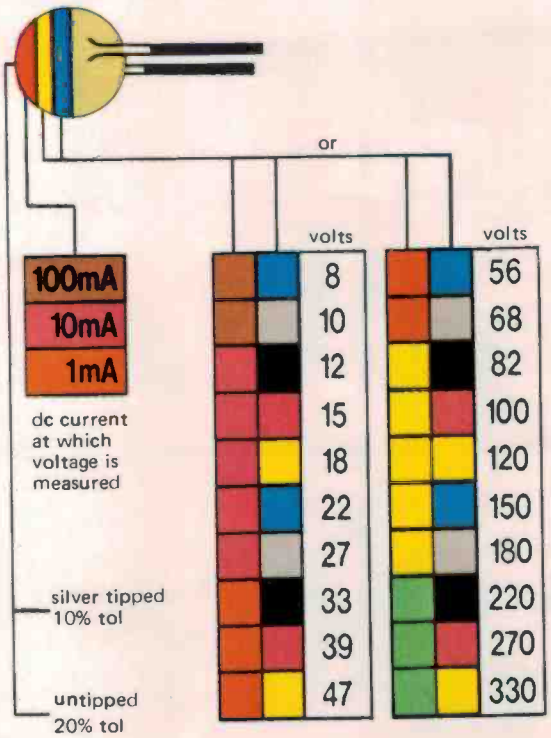
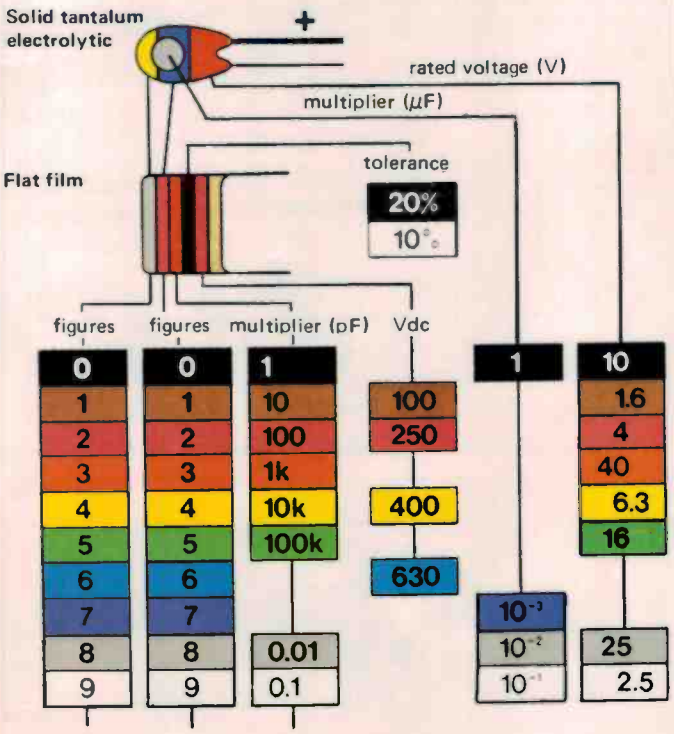
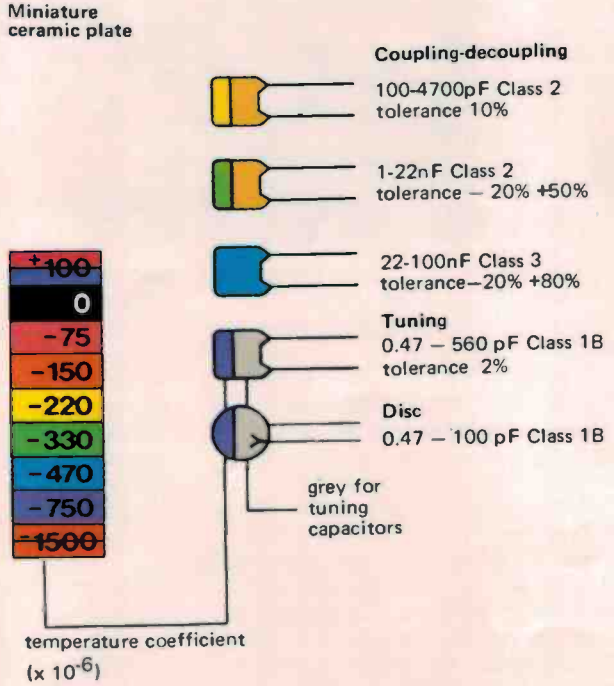
RESISTORS & CAPACITORS



CAPACITORS





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PHILIPS

Why would you put a highly sensitive tuner with a tough, powerful amplifier.

Strange as it may seem, those two concepts complement each other beautifully. And, of course, Pioneer planned it that way.

Normally, when choosing a tuner, *sensitivity* is of foremost importance because it determines the unit's ability to pull in weak or distant stations. You see, FM is subject to the same physical laws as TV. While distance is a major consideration, steel reinforced buildings, mountains or other terrain features may also reduce or partially block signals. In low-lying valleys, reception is usually difficult. These and other factors present considerable problems for clear, accurate reception. Which brings us to the Pioneer TX-9500II.

Usable sensitivity is 8.8dBf (1.5μV). What this means in your listening room is that the TX-9500II is capable of reaching out and capturing an electronic signal of incredibly weak proportions. And then holding it while it's fed into the amplifier. Naturally, the resultant increase in tonal quality will be immediately discernible by your equally sensitive ears.

All speaker systems demand power (some more than others) to produce sound. So now that you've got your broadcast locked in, an amplifier tough enough to stand up to heavy speaker requirements is vitally necessary.

May we suggest our SA-9500II. Continuous power output is 80 watts per channel, min. RMS at 8 ohms from 20 to 20,000Hz with no more than 0.05% total harmonic distortion. Inputs hardly measurable are analyzed and processed into precise impulses of acoustical energy that will ultimately reproduce every musical nuance of the original performance. The delicate and the deafening.

But, sensitivity and sheer power are only two features that contribute to exceptional performance in a tuner/amp combination. Pioneer is offering a wide line of five amplifiers and four tuners. Something for everybody. Why not stop in for a demonstration and hear about such things as a SAW filter that scrubs out distortion or a tone control system that offers 5,929 different tonal characteristics. Strange as it may seem, you can be sure it won't sound that way.

Pioneer Electronics Australia Pty, Ltd.
178-184 Boundary Road, Braeside, Victoria 3195 Phone: 90-9011, Sydney 93-0246, Brisbane 59-7457, Adelaide 433379, Perth 24-9899.

PIONEER
leads the world in sound.

SSB TRANSCEIVERS REVIEW

by Roger Harrison

WE ASKED LOCAL AGENTS to submit a sample of their 'top-of-the-line' SSB transceivers for review, which would include technical checkouts on the bench as well as looking at them from an operator's point of view.

Well, we ended up with ten sets, covering nine different manufacturers. They were, in alphabetical order:—

GEMTRONICS GTX3325 (from Bail Electronics Services)
HY-GAIN HY-RANGE V (from Mobile One)
JOHNSON VIKING 352 (from E.F. Johnson Aust)
MIDLAND 13-895 (from Dick Smith)
PACE EXPO 1000M (from Aero Electronics)
PEARCE-SIMPSON PANTHER (one from Vicom and another from Strato)
TOKAI TC1001 (from Peter Shalley)
TRAM DIAMOND 60 (from Mobile One)
UNIVERSE SSB-224M (from Stratos)

. . . . which is a pretty fair sprinkling of what's on the market. They are all 23 channel SSB transceivers that were designed to meet FCC specifications prior to the introduction of the U.S. 40 channel system in January this year. The 1977 U.S. CB specifications for transceivers are somewhat more stringent now and it is fairly obvious from the tests that few of the units tested would meet the required specification. However, test results on a particular unit are not necessarily indicative of the 'line' of transceivers as a whole. The regulation authorities (FCC in the U.S., P & T in Australia) generally require a manufacturer or his agent to submit a number of units of particular type for type-approval testing. Nevertheless, having done the tests personally, one wonders . . . .

TECHNICAL TESTS

The complete specifications of each transceiver were not tested . . . . otherwise I'd still be at it! The tests that were performed were those generally considered to be most important from the technical performance point of view (RF power output, spurious emissions etc, receiver sensitivity, IF and image rejection etc), as well as a few from the operational point of view (squelch threshold, clarifier range, adjacent channel rejection).

Six tests were carried out on each transmitter:

RF POWER:	AM (carrier)
	Modulation
	SSB (PEP output)
SPURIOUS EMISSIONS:	Harmonic emission
	Other Spurious emissions
	SSB Carrier Suppression

In addition, the frequency tolerance on both transmission and reception was checked for each transceiver. In all cases it was found to be within the ± 0.005% specified.

The opposite sideband suppression and transmitter modulation frequency response etc were not checked as these are time consuming and of only secondary importance.

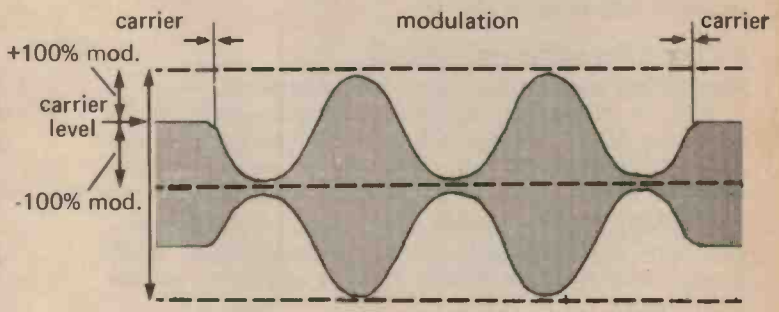

Fig 1: AM mode, 100% modulation

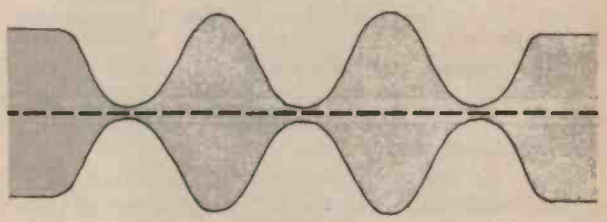

Fig 2: AM from the transceivers reviewed looked more like this. About 10-20 % upward modulation, and 100% downward modulation.

Seven basic tests were carried out on the receiver sections of each unit:

SENSITIVITY:	AM sensitivity
	SSB sensitivity
	Squelch Threshold
REJECTION OF UNWANTED SIGNALS:	IF Rejection
	Image Rejection
	Adjacent Channel Rejection
	plus Clarifier Range.

Receiver sensitivity figures were obtained for a standard signal plus noise to noise ratio ((S + N)/N) of 10 dB. The output level of the signal generator was adjusted until this ratio was achieved and the level noted. The AM signal was modulated 30% by a 400 Hz sine wave. Only carrier was used on SSB, offset 600 Hz to 1 kHz.

Crossmodulation measurements are time-consuming to set up and measure so I substituted adjacent channel rejection measurements as these give some indication of how the receiver performs when confronted with strong signals on an adjacent frequency.

For the record, the following equipment was used to perform the tests:

Spectrum Analyser, Hewlett Packard	85538
RF Power Meter, Bird 'Thru-Line'	with 5W/25-60 MHz and 25W/ 25-60 MHz plug-ins

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Oscilloscope, Tektronix 422
Signal Generator, Hewlett Packard — digital readout, phase-locked.

The transceivers were all powered from a variable, regulated supply set at 13.8 V.

EXPECTED PERFORMANCE

What sort of performance figures are acceptable?

Well, as far as the transmitter is concerned, a carrier power on AM of between 3 W and 4 W is perfectly acceptable. It makes little real difference to range or signal strength. In fact, none of the transceivers tested gave less than 3.0 W of carrier on AM and one set – the Universe – gave over 7 W! On SSB a 'Peak Envelope Power' (PEP) output of between 9 W and 12 W is acceptable for the same reasons.

On AM, the modulation percentage is of interest as it is a major factor in determining how 'loud' you sound to the station receiving you. Now, 100% modulation of a carrier should look like Figure 1, (like, if you whistle into the mike).

One hundred percent upward modulation (I've written it + 100% for simplicity) will raise the RF to twice the carrier level, 100% downward modulation (–100% mod.) will reduce it to zero.

Now, all the transceivers tested exhibited very little upward modulation, usually 10% to 20%, but all were capable of at least 80% downward modulation, and most could give 100% downward. It looks like Figure 2. I have been unable to find out why this is so.

If the carrier is *overmodulated*, the downward peaks of modulation will cut the carrier off for a short period. Now, this is not very good as the process produces some very nasty distortion causing the transmitter to radiate 'rubbish' on frequencies either side of the transmitter frequency. Not nice. Doesn't help you to be understood by the station receiving you either. Moral – don't shout into the mike.

All spurious emissions should meet the applicable specification or the manufacturer's specification (which is usually equivalent to the required FCC specification in any case – these transceivers being made for the US market). For these tests, that meant –50 dB (that's one/one hundred thousandth the power of the carrier!). It looks impressive when you put it that way but it's not such a tall order really. Only three sets made the grade though!

Receiver sensitivity presents a bit of a difficulty. Urban and city electrical noise levels (mostly man-made) are pretty high, and there is a natural peak for noise between 25 MHz and 30 MHz in any case. But, it ain't always necessarily so – as they say in the classics. A reasonable sensitivity figure on AM would be 1 μV. This would more or less ensure that communications would be largely determined by the prevailing noise level. A lower figure would be better in low noise circumstances. For SSB, a figure of 0.5 μV would apply. As for the squelch threshold, if it opens on a signal equivalent to the sensitivity figure then it's doing the job you want. The sensitivity figures represent a pretty weak signal which would be difficult to copy anyway.

To my way of thinking, the clarifier range should be roughly equivalent to the frequency specification. i.e.: ± 0.005%. This is about ±1.35 kHz. However, that's really covering extremes and something less, say ± 1 kHz, would be acceptable. Different manufacturers have different ideas on this it seems, from the test results.

As the IF frequencies employed in these transceivers are in the HF range (generally around 8 MHz or 11 MHz), where powerful shortwave transmitters operate, the IF rejection should be quite good. A figure of 70-80 dB would be a minimum acceptable.

The 'image' of the frequency channel selected is 2 x IF frequency above or below the channel frequency. I discussed these images in Vol.1., No.1. in describing double-conversion receivers. As the image frequency may fall on other occupied frequencies, these unwanted signals may be received along with the desired signal. Additionally, as all the 23 channel transceivers reviewed employed crystal synthesizers which select the desired channel by mixing the frequencies of three crystal oscillators, there arise a number of possible image frequencies – some within the 27 MHz band!

It seems that a reasonable image rejection would be about 60 dB, although many manufacturers only quote 50 dB. It depends whether you can live with it – obviously, many do, but probably out of ignorance.

A strong signal in a channel either side of the channel selected can be heard if if is sufficiently strong – even on top of a signal you may be copying. This problem is inherent in the circuitry, however, some receivers are better able to cope with this situation than others. A reasonable figure for adjacent channel rejection would appear to be about 60 dB.

Few manufacturers include a specification for this – only the TRAM Diamond 60 had it listed in the specs.

REVIEWING THE RESULTS

Leaving aside the technical results for the moment, let's look at how the transceivers shaped up operationally.

Most of the units reviewed suffered from a number of major disabilities. The control knobs on six units were round and very small in diameter making them difficult to operate for a start and poor indicators of the 'status' of the particular control. Concentric knobs of small diameter are the worst on a crowded panel. In addition, they were also poorly positioned on the front panel, adding to the inherent difficulties in operating a small knob. Thumb-and-finger knobs are by far the best where space is limited. Full marks to the GTX-3325, HY-Range and Panther.

Five rigs had meters that were too small to be of much use. A meter is potentially a very useful device; a meter too small to be reasonably visible from the operator's position, or at arm's length say, is really a waste. A lamp would give better indication. The Pearce-Simpson Panther makes good use of an 'edgewise'-mounted meter which gives a lengthy scale for the amount of panel space it occupies. Meter illumination is a must: some sets change colour of the meter illumination to indicate Tx or Tx condition.

Layout of the front panel was poor on some transceivers, making operating the controls a problem as one tended to knock adjacent controls when adjusting one. The two linear controls on the Tokai TC1001 are awkward to

operate at the best of time and could be bad news in a mobile situation. Some also suffered from markings which were difficult to see except in good light, looking directly at the front panel. The Gemtronics GTX-3325, the Hy-Gain Hy-Range V, the Johnson Viking 352 and the Pearce-Simpson Panther had the best panel layouts of the sets reviewed. The Midland 13-895 and the Tram Diamond 60 had a proliferation of knobs and switches – which is great I suppose if you're into that style of operating, but panel layout was not good, cramped in fact, and using the controls presented some problems.

Looking at the technical tests, there are some interesting results!

Only five met the specification for transmitter spurious emissions! The worst offender here was the Pace Expo 1000M – it grossly exceeded its specification. Others were quite close and would probably meet the spec. if operated on a lower voltage. There was a curious difference between the two Panther sets.

None of the transmitters gave less than 3.0W output on AM. Curiously, the Universe produced 7.3 W! All units except the Midland 13-895 gave 100% downward modulation.

Upward modulation ranged from 0% (13-895 again) to 30%, most sets giving 10-20%. The two Panther sets and the Tram Diamond 60 could overmodulate on negative peaks.

PEP output on SSB ranged from 5W (Viking 352) to 12W, seven delivering over 9W.

Receiver performance ranged from very good overall (Hy-Range, Panthers, Tram Diamond 60) to average (Midland 13-895, Pace Expo 1000M and Johnson Viking 352). All sets had noise limiters for AM and noise blankers for SSB. The effectiveness of these was subjectively tested – some appeared to work quite well, others had barely any effect.

The clarifier range on the Midland 13-895, the two Panther sets and the Tram Diamond 60 was somewhat restricted, as I explained previously. Some had a wide range that was a little 'skewed' – more shift on one side of the channel than the other. Several sets had a centre-detent clarifier control which is very useful.

Most handbooks supplied with units were satisfactory – some only barely so. The Viking 352 has a rather skimpy handbook, whereas the Hy-Range V had an excellent handbook complete with photographically illustrated installation instructions.

Of the transceivers reviewed, two types stand out for performance and operability. These are the Hy-Gain Hy-Range V and the Pearce-Simpson Panther. They are followed closely by the Gemtronics GTX-3325 and the Johnson Viking 352.

GEMTRONICS GTX-3325

TEST	MEASUREMENT	SPECIFICATION	COMMENTS
TX			
RF power output			
AM (carrier)	3.8W	4W	
Mod. %	–100%, +10%		
SSB (PEP output)	10W	12W	
Harmonic emission	–48 dB (2nd) –44 dB (3rd)	–50 dB or better	*Does not meet FCC spec.*
Other Spurious emissions	–47 dB	–50 dB or better	*Hum and noise quoted as better than –40 dB down on full output.*
SSB Carrier Suppression	–52 dB		
RX			
Sensitivity			
AM	1 μV	–	
SSB	0.1 μV	–	
Squelch Threshold	0.15 μV	–	
Clarifier Range	+ 900 Hz, –2.4 kHz	–	
IF Rejection	80 dB	Spurious responses	
Image Rejection	50 dB	are quoted as better	
Adjacent Channel Rejection	60 dB	than 50 dB down.	

General Comments

A compact, easy to operate set with controls well-placed for mobile operation. The channel selector switch is smooth to operate but has a positive detent at each position. The panel had a large (by mobile transceiver standards), easy to see meter and Tx/Rx indicators. All controls operate smoothly. The receiver appears to have adequate sensitivity and the noise blanker on SSB has adequate effect (some other sets are a little better). Noise limiting on AM reception appears to be effective to some extent and is all I would really expect for this type of equipment. The transmitter audio is quite 'clean' with a good balance between 'highs' and 'lows' on both SSB and AM. The handbook supplied with the equipment has concise, but clear, operating, connection and installation instructions. It does not include any basic theory of operation as some handbooks do but some very clear block diagrams are included along with a complete circuit. Pre-sales and after sales service is provided by the agent, Bail Electronics Services.

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HIGH GAIN HY-RANGE V

TEST	MEASUREMENT	SPECIFICATION	COMMENTS
TX			
RF power output			
AM (carrier)	3.0 W	4W	
Mod. %	−100%, +30%		
SSB (PEP output)	10 W	15W (input)	
Harmonic emission	−50 dB	−50 dB	*Meets FCC*
Other Spurious emissions	53 dB	−50 dB	*specifications*
Carrier Suppression (SSB)	−40 dB	−40 dB	
RX			
Sensitivity			
AM	0.95 μV	1 μV	
SSB	0.08 μV	0.25 μV	
Squelch Threshold	2 μV		
Clarifier Range	+1 kHz, −1.3 kHz	±800 Hz	
IF Rejection	80 dB		
Image Rejection	60 dB		
Adjacent Channel Rejection	70 dB		

General Comments

I thought this transceiver outstanding in functional design and operation, and this is reflected in the engineering as it readily achieved the required specifications. Construction is robust and the controls had the best 'feel' of all the units reviewed. The panel layout was obviously designed for left-hand drive vehicles but, as the controls are all easily accessible and have 'thumb-and-forefinger' grip this should present no problems. I found the *Hy-range* easy and convenient to operate with either hand. The channel selector switch operates smoothly with a positive detent. The meter is of adequate size for its purpose and the Tx/Rx indicators easy to see at a glance. Audio quality on transmit, SSB and AM is excellent.

On reception, audio quality appears particularly 'sharp' giving good, clear sound and both the ANL (for AM) and the noise silencer (NS-for SSB) or noise blanker are effective. The handbook is particularly informative. It includes four pages of photographically illustrated installation instructions as well as clear, well written operating and connection instructions. Also included are basic details on suppressing noise interference in vehicle illustrated with diagrams. A circuit diagram is included with the book.

JOHNSON VIKING 352

TEST	MEASUREMENT	SPECIFICATION	COMMENTS
TX			
RF power output			
AM (carrier)	3.2W	4W	
Mod. %	−100%, +10%	80%	
SSB (PEP output)	5W	12W	
Harmonic emission	−52 dB	−50 dB	
Other Spurious emissions	−58 dB	−50 dB	
SSB Carrier Suppression	−44 dB	−40 dB	
RX			
Sensitivity			
AM	0.7μV	0.5μV	
SSB	0.16μV	0.35μV	
Clarifier Range	−1.0 kHz +1.1 kHz	±1.35 kHz max.	
IF Rejection	60 dB		*Spurious rejection*
Image Rejection	50 dB		*given as 50 dB by*
Adjacent Channel Rejection	70 dB		*manufacturer.*

General Comments

The *Viking 352* has a muted, 'low key' appearance with good accessability to all controls. However, the front panel styling and colour makes it difficult to see control markings under low light. The indicator lights and channel number are however, quite visible. The meter is a little small to be of much use. The channel selector was quite stiff and required quite a grip to operate it. The squelch was a little 'soft' in operation for my liking in that the actual threshold was spread over a small portion of the control rotation rather than 'cutting off' at a well-defined spot. The receiver sensitivity on AM did not meet the manufacturer's specification but was nevertheless adequate as the urban RF noise level on 27MHz is quite high and is generally the limiting factor. SSB sensitivity was excellent. Audio quality on reception was quite clean and well balanced.

Transmit audio quality was good on both SSB and AM although close talking to the mike gave a somewhat muffled sound. Noise blanker on SSB reception was quite effective. The AM noise limiter seemed to cope as well as could be expected, much the same as in the other sets reviewed. The clarifier control has a convenient centre-detent enabling the operator to return to the exact channel frequency when required. An unusual feature not seen on any other transceiver (by this writer anyway) is the location of the mike socket on the back panel of the unit. The operating mode lights (AM,USB, LSB) are colour coded – a useful feature. The handbook is a little brief but clear pictures of all the controls and connections are shown together with a brief explanation of their function.

MIDLAND 13-895
Serial No. 0034559

TEST	MEASUREMENT	SPECIFICATION	COMMENTS
TX			
RF power output			
AM (carrier)	3.5W	3 to 4W	
Mod. %	–90%		
SSB (PEP output)	8W	12W	
Harmonic emission	–47 dB	–50 dB	*Does not meet*
Other Spurious emissions	–46 dB	–50 dB	*FCC spec.*
SSB Carrier Suppression	–54 dB	–40 dB	
RX			
Sensitivity			
AM	0.75 µV	1 µV	
SSB	0.35 µV	0.5 µV	
Squelch Threshold	0.6 µV	0.7 µV	
Clarifier Range	–400 Hz +700 Hz	±350 to ±800 Hz	
IF rejection	80 dB	80 dB	
Image rejection	50 dB	50 dB	
Adjacent Channel rejection	50 dB		

General Comments

All the knobs and switches makes the *13-895* a megalomaniac's delight! This transceiver may be operated from either 110V AC or 12V DC and is hence suitable for either a base or a home station or as a mobile rig. It is more suited as a base station as the operator really has to pay attention to the controls to make the most of the *13-895*. The channel selector operates smoothly and the channel number is easily seen. The meter is a little small to be of much use – like on most other transceivers, however, I guess it does give some indication. The TONE HI-LOW switch could be dispensed with; it is unnecessary really. The noise blanker, while reducing ignition and other impulse noise is not as effective on this unit as was noted with some others. Audio quality on both AM and SSB reception is quite good.

Audio quality on transmit is also good but on SSB the transmitter will distort ('flat-top') when the mic. gain is wound up approaching half-way. Modulation on AM seemed a little 'thin' or 'light-on'. Accessability of the controls is not good, unless you have slim, delicate fingers. Operation of the squelch control was quite awkward, knocking the mic. gain or the RF gain while trying to adjust the squelch was a constant hazard. The receiver was prone to overload and was noticeably troubled by strong signals in adjacent channels which would interfere with the signal being copied. While the transmitter did not meet FCC specs (for this type of Tx?) at its rated supply voltage, operation from a lower voltage improved the situation, although power output was reduced somewhat.

PACE EXPO 1000M
Serial No. 711108033

TEST	MEASUREMENT	SPECIFICATION	COMMENTS
TX			
RF power output			
AM (carrier)	3.3W	4W	
Mod. %	–100%, +20%		
SSB (PEP output)	9W	12W	
Harmonic emission	–42 dB (2nd & 3rd)	–50 dB	*Differs greatly from FCC spec.*
Other Spurious emissions	–46 dB	–50 dB	
SSB Carrier Suppression	–46 dB	–40 dB	
RX			
Sensitivity			
AM	0.52 µV	1 µV	
SSB	0.08 µV	0.5 µV	
Squelch Threshold	0.3 µV	1 µV	
Clarifier Range	±1 kHz		
IF Rejection	50 dB		
Image Rejection	50 dB		
Adjacent Channel Rejection	60 dB		

General Comments

The *Pace* has rather flashy styling with chrome, silver and blue trimmed front panel and bright indicator lights. I found the channel selector to be a little 'light' to the touch, giving the feeling that I wasn't sure I was actually on channel. The channel numbers however, are easily read. The controls are not very conveniently positioned, unless you have a left-hand drive vehicle or stay on one channel and one mode most of the time. All the controls operate smoothly but the concentric squelch and volume controls are a little awkward to operate. The centre-stop clarifier is a very handy feature. The meter is not much use really, same as most other transceivers I'm afraid. Audio quality on both AM and SSB reception was good although lacking some bass. Transmit audio quality on

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both modes was quite OK. Modulation on AM was good. The noise blanker was not particularly effective.

The harmonic and other spurious emissions from this transmitter were the worst of the group of transceivers tested. The unit would certainly not meet FCC specifications. Spurious products from the crystal synthesiser appeared on other, nearby channels and could cause problems to other band users. The high harmonic level could contribute to TVI and interference to other services. The handbook is quite reasonable and gives clear directions on operating the controls and connections to the set but only minimal installation instructions are included. The handbook includes a circuit diagram.

PEARCE-SIMPSON PANTHER (No.1.)

Serial No. 605437

TEST	MEASURMENT	SPECIFICATION	COMMENTS
TX			
RF power output			
AM Carrier power	3.3 W	4W	
Mod. %	−100%, +20%	100%	*Will overmodulate on negative peaks on AM causing 'splatter'.*
SSB (PEP output)	12 W	12 W	
Harmonic emission	−64 dB (2nd) −52 dB (3rd)	−50 dB	*Compare these spurious emission results with Panther No.2. results.*
Other spurious emissions	−52 dB	−50 dB	
SSB Carrier Suppression	−52 dB	−40 dB	
RX			
AM	0.34 µV	0.8 µV	
SSB	0.1 µV	0.3 µV	
Squelch Threshold	0.12 µV	0.5 µV	
Clarifier Range	−400 Hz, +800 Hz	±600 Hz	
IF Rejection	110 dB		*Rejection measured at 7.8 MHz; 455 kHz rejection not measured.*
Image Rejection	60 dB		
Adjacent Channel Rejection	60 dB		

General Comments

The *Pearce-Simpson Panther* is a compact transceiver having a well laid-out front panel; the controls are well-sited and easy to use regardless of whether the manner of installation would require the operator to use his left or right hand. The channel selector is easy to use, having a large circular knob with a diameter almost equal to the height of the front panel. The channel number is back lighted and readily visible. The clarifier control (or 'slide-o-tune' as they call it) features a thumb-and-forefinger grip knob as does the mode switch. The volume and squelch controls are concentric, which makes things a little awkward. The meter is an edge-mount type which has a reasonably sized scale, making the best of the space available on the front panel.

No RF gain control is provided, a 'DX-LOCAL' switch being substituted. Full receiver gain is available when switched to DX, the gain being reduced for strong local signals when in the LOCAL position. The noise blanker seems reasonably effective on ignition noise. The receiver performs very well indeed, however, some extra range for the clarifier would be useful – note also that it is a little 'skewed', there being more range on the high frequency side than the low frequency side of the centre frequency. This may be caused by an out of tolerance crystal. Audio quality on reception is well balanced and sounds good. On transmit the audio quality on both AM and SSB is excellent. However, the transmitter will overmodulate on AM causing annoying distortion to spillover into adjacent channels.

PEARCE-SIMPSON PANTHER (No. 2).

Serial No: 6044150

TEST	MEASUREMENT	SPECIFICATION	COMMENTS
TX			
RF power output			
AM Carrier power	4.0 W	4W	
Mod. %	−100%, +10%	100%	*Overmodulates on negative peaks as previously noted.*
SSB (PEP output)	12W	12W	
Harmonic emission	−48 dB	−50 dB	*Harmonic suppression and spurious emissions do not meet 1976 FCC specifications, for this particular unit*
Other Spurious emissions	−42 dB	−50 dB	
SSB Carrier Suppression	−50 dB	−40 dB	
RX			
Sensitivity			
AM	0.37 µV	0.8 µV	
SSB	0.075 µV	0.3 µV	
Squelch Threshold	0.2 µV	0.5 µV	
Clarifier Range	−500 Hz, +600 Hz	±600 Hz	
IF Rejection	60 dB		
Adjacent Channel Rejection	60 dB		

The major difference between this unit and the first one is in the harmonic suppression and other spurious emission levels. It appears that some adjustment of the output filter circuitry of this unit would improve the situation in regard to the harmonic suppression. Some realignment of the crystal synthesizer mixer circuitry would appear to be necessary to reduce the levels of the spurious emissions generated here.

It is curious that two sets from the same manufacturer should produce such a large difference in these parameters. It would appear that pre-sales checking would be necessary if transceivers were to meet a given specification anything similar to the 1976 FCC specifications for 23 channel 27 MHz equipment. As far as the rest of the equipment performance is concerned this unit behaved in a very similar fashion to Panther No. 1. and all other comments apply here.

The handbook supplied with the Panther is well written, clear and informative. Instructions on the function and use of all controls is clear and concise. A large (by CB equipment handbook standards!) circuit diagram is included on a fold-out page.

TOKAI TC-1001

Serial No. 114200

TEST	MEASUREMENT	SPECIFICATION	COMMENTS
TX			
RF power output			
AM Carrier power	3.5W	5W input	
Mod. %	−100%, +10%		
SSB (PEP output)	7.5W		
Harmonic emission	−70 dB (2nd) −62 dB (3rd)	more than 50 dB	
Other Spurious emissions	−60 dB		
SSB Carrier Suppression	−64 dB		
RX			
Sensitivity			
AM	0.9 μV	Specification of 0.5 μV does not indicate AM or SSB mode	*It appears that the AM IF-stage is a little noisy resulting in a slightly degraded signal to noise ratio.*
SSB	0.08 μV		
Clarifier range	−800 Hz, +1.1 kHz	±600 Hz	
IF rejection	−60 dB		
Image rejection	−70 dB	−50 dB	
Adjacent Channel Rejection	−50 dB		

General Comments

The *Tokai* transceiver in most technical aspects is quite a good performer but the front panel design detracts from this. For a start the meter is impossibly small – better left off if a larger one could not be fitted. The clarifier and mode switch are cramped against the channel selector knob. The squelch and volume controls are linear slide types and are especially difficult to operate in mobile situations. They are placed quite close together and I would often knock one while trying to adjust the other. The channel selector knob is a little small for my liking for a circular knob. However, the switch operates smoothly with a positive detent and the back-lighted channel numbers are clear and easily read.

The noise blanker appears to handle ignition noise quite satisfactorily. On reception, audio quality was good but the signal to noise ratio on AM was affected by an apparently noisy IF stage. This may be peculiar to this particular unit. The adjacent channel rejection was not high, or not as high as some of the other sets reviewed, and some problems were evident in use. The transmit audio quality on both AM and SSB was clear and well-balanced. The handbook provided with the equipment is quite straightforward and contains a very good description of SSB for non-technical or semi-technical users. A circuit diagram is included in the handbook.

TRAM DIAMOND 60

Serial No: 32445

TEST	MEASUREMENT	SPECIFICATIONS	COMMENTS
TX			
RF power output			
AM Carrier power	3.2W	3.75W	
Mod. %	−100%, +10%	95% to 100%	*Will overmodulate on negative peaks.*
SSB (PEP output)	11W	8W	
Harmonic emission	−54 dB	No spurious emission spec. given.	
Other Spurious emissions	−64 dB		
SSB Carrier Suppression	−52 dB		
RX			
Sensitivity			
AM	0.8 μV	0.3 μV gives more than 1W output	*This was measured on standard test. For the conditions listed in the spec. the figure of 0.35 μV was obtained.*
SSB	0.09 μV	0.1 μV	
Squelch Threshold	0.35 μV		
Clarifier Range	−500 Hz, (SSB) +1 kHz ±1.5 kHz (AM)	±800 Hz ((SSB) ±1.5 kHz (AM)	
IF Rejection	70 dB	60 dB	
Image Rejection	110 dB	50 dB	*See general remarks.*
Adjacent Channel Rejection	60 dB	60 dB	

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The *TRAM* has more front panel controls than the *Midland 13-895!* Of necessity, six are combined in concentric controls on three shafts. These are; the volume and RF gain, SWR calibrate and Transmitter Tone Control (TTC), Clarifier and Squelch. Like most of these transceivers, intended for the US market, the front panel is laid out for use in left-hand drive vehicles. The control knobs, with the exception of the channel selector, are small and present some difficulty in operation. The channel selector works smoothly, if a little stiff, but has a positive detent at each position. All indicators are easily seen. The meter is of reasonable size and functions as an SWR indicator apart from the usual S-meter and power output monitoring functions.

An unusual feature is the Transmitter Tone Control (TTC). This control allows the transmit audio to be 'tailored' to suit individual voice characteristics — a useful idea! Its effect is apparent on transmit and good quality audio on both SSB and AM can be obtained. On receive, the noise blanker seems reasonably effective and audio quality is quite good on both AM and SSB reception. The image rejection was much greater than expected although possible images close to the 27 MHz band (a result of the crystal synthesizer mixing method) were not investigated due to lack of time. The handbook supplied with the TRAM is quite good, the explanation of the controls etc being quite clear. No circuit diagram is included.

UNIVERSE SSB-224M

Serial No. 09000008

TEST	MEASUREMENT	SPECIFICATIONS	COMMENTS
TX			
RF power output			
AM Carrier power	7.3WI		*Exceeds 1976 FCC specifications*
Mod. %	−100%, +10%		
SSB (PEP output)	9.5W		
Harmonic emissions	−47 dB		*Does not meet 1977 FCC specification.*
Other Spurious emissions	−52 dB		*Meets above spec.*
SSB Carrier Suppression	−38 dB		*Does not meet above spec.*
RX			
Sensitivity			
AM	0.8 μV		
SSB	0.12 μV		
Squelch Threshold	1.1 μV		*A little high.*
Clarifier Range	±1.3 kHz		
IF Rejection	?		*IF frequency unknown.*
Image Rejection	?		
Adjacent Channel Rejection	70 dB		

General Comments

A handbook would have come in handy! None was included in the transceiver packaging but I presume one is available. Deduct ten marks if no handbook supplied. The *Universe,* although an attractively presented rig, suffers all the ills of compact rigs — small, awkward to operate knobs, a too small meter etc. I found the channel selector on this unit stiff and somewhat difficult to operate but this may not be indicative of all units. Receiver performance is quite good, especially the adjacent channel rejection — it was as good as the Hy-Range V and the Viking 352. For a change, a reasonable clarifier range is provided. Audio quality on reception was good but on transmit it sounded a little thin — lacking in bass perhaps, especially on AM.

It is curious that the power output is more than double (WOW ... 3dB!) that of most of the other rigs, exceeding the FCC specification. The harmonic emission does not meet spec. but this may be a result of the increased AM carrier power. However, it was the same on SSB which tends to suggest that there is some circuit maladjustment. It would be interesting to test another *Universe* or two. The squelch threshold was a little high at the most sensitive setting but 1μV at the antenna is quite a weak signal. Carrier suppression, although only 2dB above the required spec., was poor when most other transceivers can achieve around 50dB. The figure should improve with some circuit alignment. Noise limiting and blanking on reception seemed adequate.

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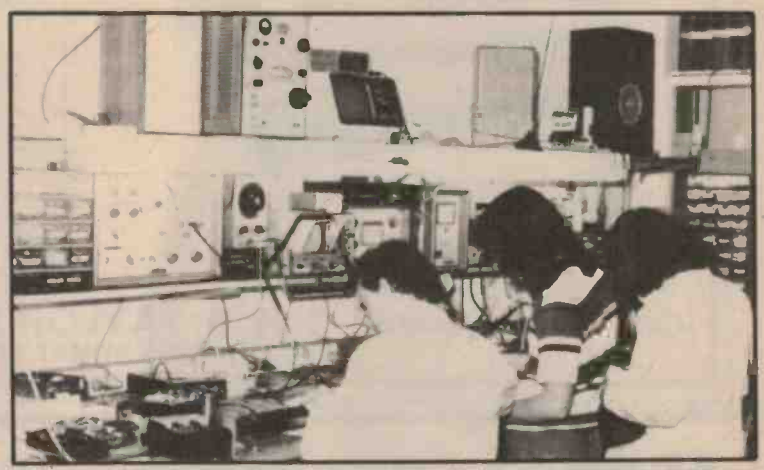

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2M10-80L	144-148 MHz	10	80	12 A	7.1x10.2x16.5cm	1.0 Kg
1.3M10-70L	220-225 MHz	10	70	9 A	7.1x10.2x16.5cm	1.0 Kg
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Dealer prices may be higher due to transport costs.

DSE 4 ET 67

CAPACITORS

PHILIPS CAPACITORS AND THEIR USES

(1) **Aluminium Electrolytic Capacitors**

Ideal for use in filtering or smoothing rectified A.C.-energy storage as in Power Supplies. Also used for bypassing and coupling in audio applications and the timing element for non-critical circuits.

(2) **Solid Aluminium Capacitors**

These provide the highest reliability and longest life alternative to the Aluminium Electrolytic Capacitor. For professional application – as in Telecommunications.

(3) **Solid Tantalum Capacitors**

Similar application to that of the Solid Aluminium, but offers a size advantage. Also available are micro-miniature forms for such applications as in hearing aids and hybrid circuits.

(4) **Ceramic Capacitors**

Offer low cost and high capacitance in a small physical volume. There are generally two types:

Application 1 or tuning grade:	For tight tolerance and high stability in radio frequency (RF) tuned circuits, including mobile UHF and VHF transmitters.
Application 2:	Bypass capacitors in RF circuits – are now finding increased application in digital circuits for spike suppression and power supply filtering.

Other types of capacitors fall into two categories: Those with solid aluminium electrodes, or aluminium film electrodes.

Solid Aluminium electrode types are generally used where a fast charge and discharge rate are required. For example: Television deflection circuits and switch mode power supplies, (inverters and converters).

Film electrode types are generally used in all other areas of application because they offer a feature of "self-healing properties".

The electrodes are generally separated by a plastic-style material, the composition of which determines the temperature coefficient of the device. Such capacitors fall into the following headings:

Paper Capacitors

An original construction of capacitors for use in A.C. circuits. Still used for power factor correction in mains supply applications. For example in Lighting and electric motors.

(6) **Polyester Capacitors**

Lowest cost, most widely used for general purpose application.

(7) **Polycarbonate Capacitors**

Offer low temperature coefficeint and lower dielectric losses at high frequency. Most often chosen for its temperature stability characteristics.

(8) **Polystyrene Capacitors**

Usually chosen for applications requiring tight tolerance coupled with high stability. Predictable temperature coefficient used in conjunction with particular ferrite coils makes highly stable tuned circuits or oscillators. Used, for example in telephone applications.

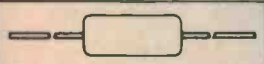
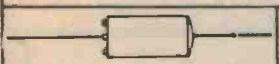
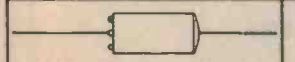
(9) **Polypropylene Capacitors**

Offer very low dielectric losses rivalling polystyrene. Suitable for high power inverters and converters and T.V. deflection.

(10) **Dual Dielectric Capacitors**

These offer the feature of double insulation using two materials of different characteristics for increased reliability. Ideal for interference suppression of domestic appliances.

Paper and Film Capacitors (continued)

TYPE	CAPACITANCE RANGE	VOLTAGE RANGE	SERIES NO. 2222 . . . .
Polypropylene Capacitors			
 polypropylene film/foil capacitors (potted type)	0.039 – 0.82 µF	250 V	357
Polystyrene Capacitors			
 polystyrene film/foil capacitors (micropoco)	51– 162000 pF	63V– 500V	424 to 431
 interference suppression capacitors, dual dielectric, single section type – paper – PETP film	4.7 – 330 nF	250 V (R.M.S.)	276
 dual dielectric capacitors for flyback purposes.	1.5 – 27 nF	750 – 2000 V(P)	278

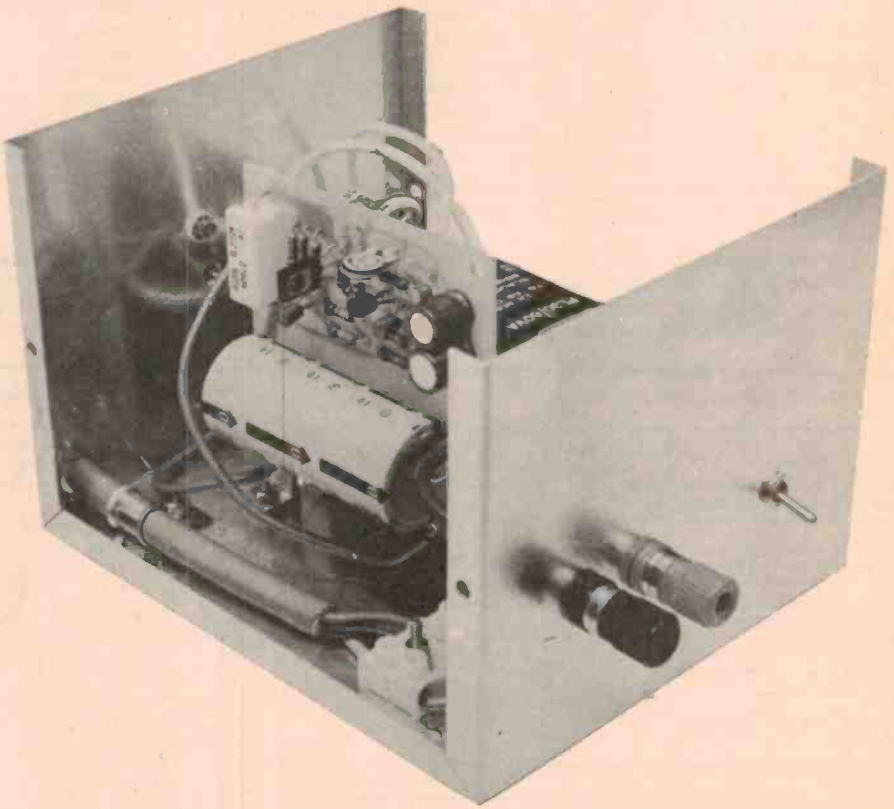
CERAMIC CAPACITORS

VERSION	APPLI–CATION	CAPACITANCE	RATED DC VOLTAGE	CAPACITOR SERIES
Plate 	1 2	0.47 – 100 000pF	500 V 6 V	631–632 638 641–643 650 629 630 640 655 675
Disc 	1 2	0.47 – 3900 pF	400 V 2000 V	625 626 627 659 660 661
Feed-through 	2	2.5 – 4700 pF	350 V	700 702
Chip 	1 2	10– 470 000 pF	50 V	851–856

PHILIPS

CB POWER SUPPLY

Here's the answer if you want to run the mobile rig off the mains as a base station.



WITH THE EXPLOSION in the popularity of CB radio and its imminent legalization there is a growing demand for a power supply designed to operate mobile transceivers as a base station. In the mobile situation these operate off a 12V battery but while a battery can be used for the base station the problem of keeping it charged is a nuisance. Some people have tried simply a transformer, rectifier and filter capacitor but have run into problems with hum.

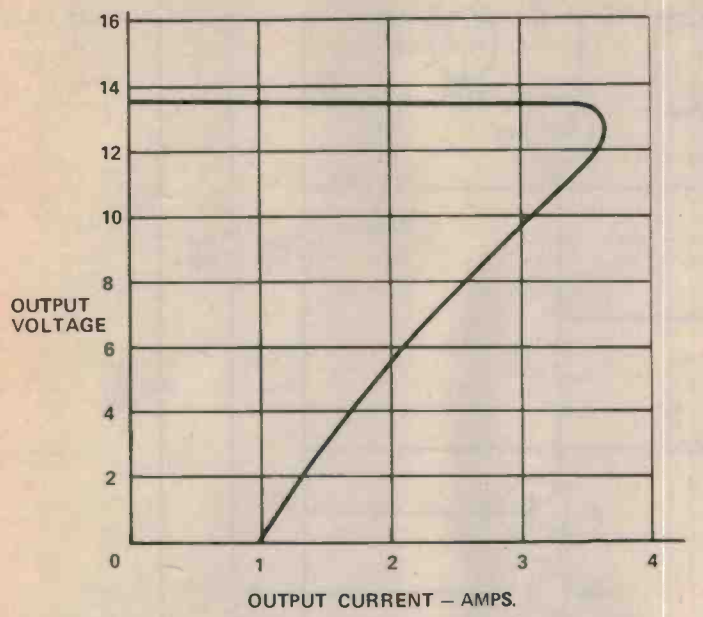
This power supply has been designed to operate the base station and can supply up to 2.5A at 13.5V of well regulated and filtered power. While it has been designed for CB use it is a good general purpose fixed voltage regulator. By changing a few components voltages from 5 to 50 volts at up to 3 amps can be achieved. Current protection is of the foldback type which gives less current into a short circuit than at the nominal output voltage so giving more protection to the output transistor without affecting normal operation.

Design Features

While we could have designed this supply using a special voltage regulator IC such as the 723, we decided to use transistors as the availability is better, it allows a wider range of input – output voltages and from an educational point of view it is more worthwhile. By changing the value of R11 the output voltage can be altered provided the input voltage is suitable. We chose foldback current protection as it minimises the power dissipated if the output is shorted, reducing the need for a large heatsink.

SPECIFICATION ETI 712

Nominal output voltage	13.5 volts
Adjustment range	12V – 14.5V
Nominal output current	0 – 2.5 amps
Load regulation 0 – 2.5 A	150mV
Ripple @ 2 A	0.8mV
Short circuit current	1A



Graph showing relationship between output voltage and current. Note that the current into a short circuit is less than that available at 13 V.

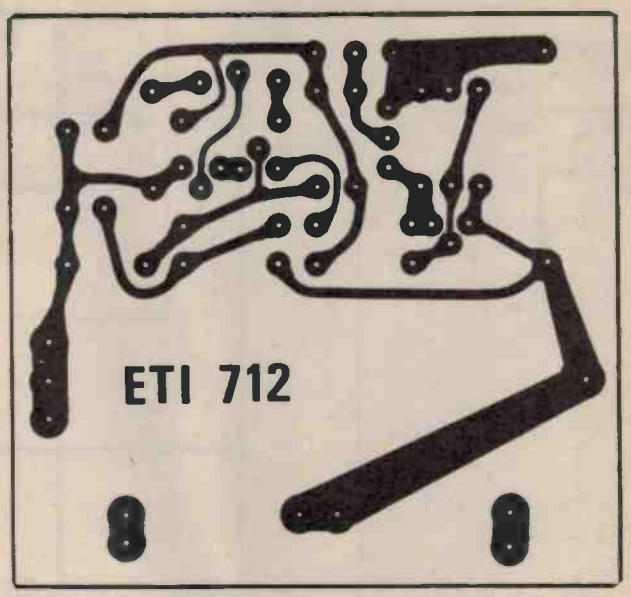


Fig. 2. Printed circuit layout. Full size 80 x 75 mm.

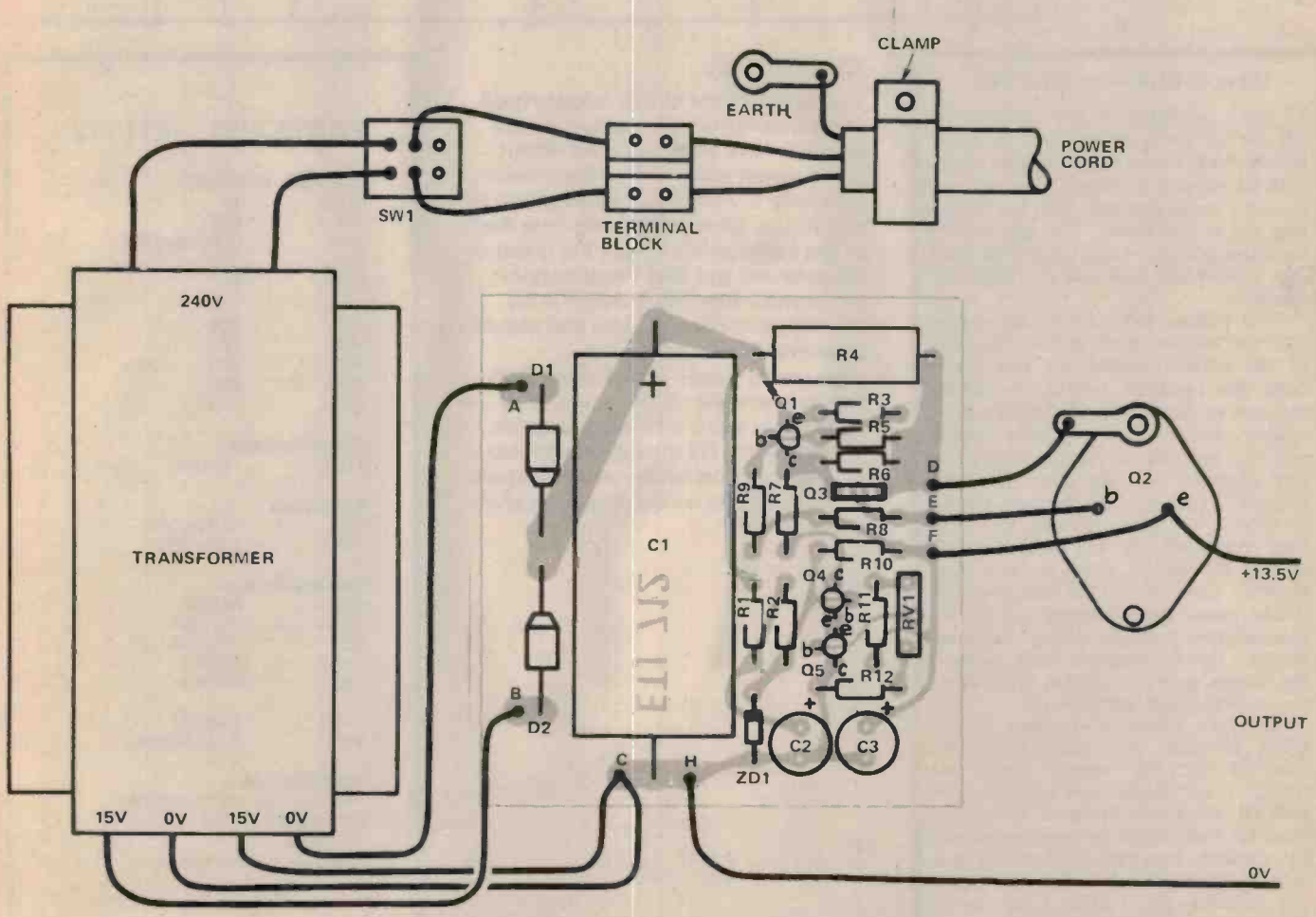


Fig. 3. Component overlay and wiring diagram.

Project 712

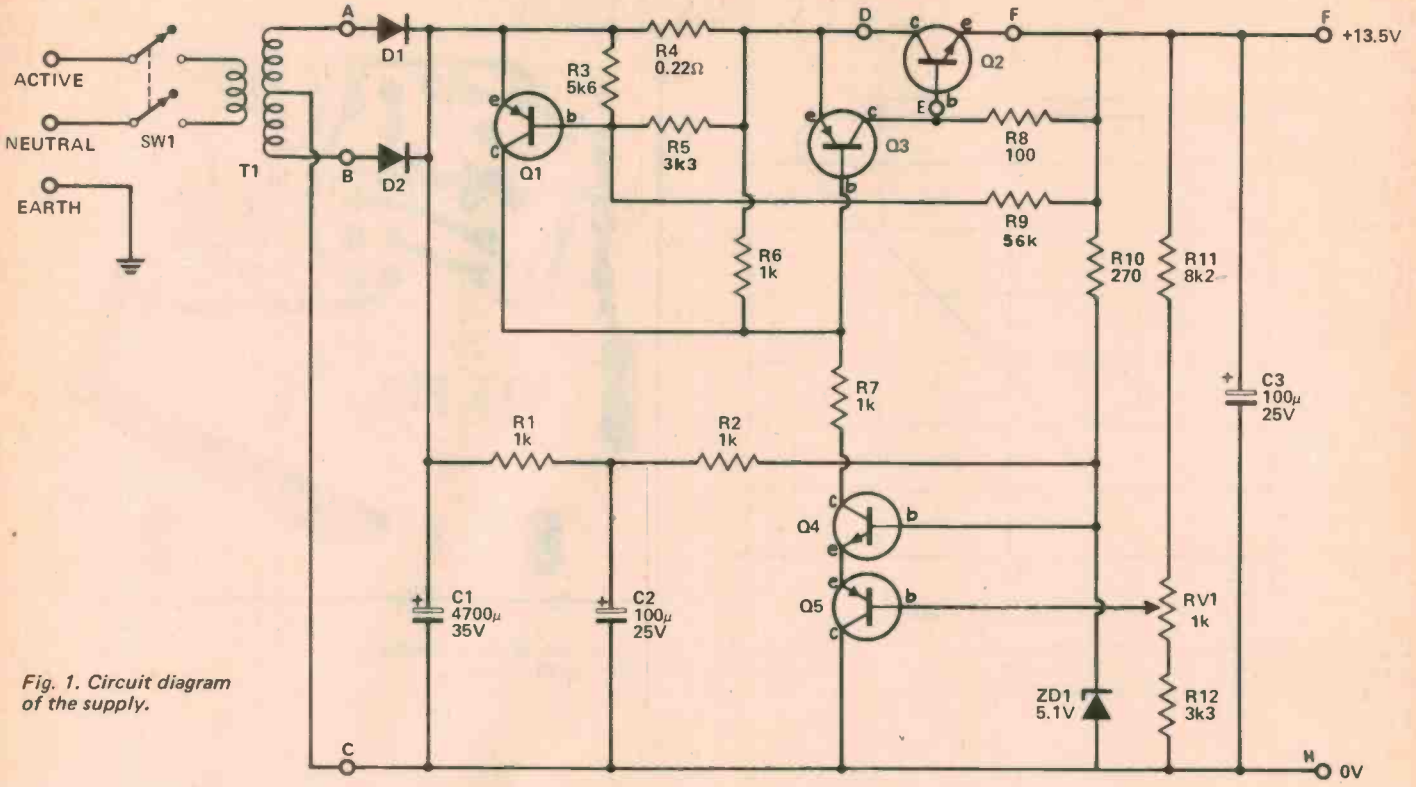


Fig. 1. Circuit diagram of the supply.

How It Works – ETI 712

As high regulation is not required for CB use or most applications, we deliberately chose not to use a high gain circuit with its stability problems. The regulator is of the series pass type with Q3 dissipating the excess power. The gain of this transistor is increased by Q2 and the Q2/3 pair appears as a high gain (> 1000) PNP transistor.

The voltage reference in the supply is a 5.1 V zener diode and the majority of the current needed for this comes from the regulated output. To enable the unit to start R1 and R2 supply some current from the unregulated supply and C2 provides additional filtering to help eliminate 100 Hz ripple from the reference voltage. The output voltage is divided by R11, 12 and RV1 and then compared to the reference voltage by Q4 and Q5 which act as a comparator. There is a 1.2V difference between these two voltages due to the base emitter junctions of the two transistors. The comparator then controls the output stage Q2 and Q3 maintaining the output voltage within limits.

Overload protection is given by Q1 which measures the voltage across R4 (current) and the voltage across the transistor and if the sum exceeds a set level Q1 will bypass some of the current from the base of Q2 so limiting the output current. This technique allows high output currents at normal output voltages but reduces the current, and power dissipation, if the unit is shorted.

Construction

The layout of the circuit is not critical and any construction method can be used. We have given a printed circuit board layout which will make it easier especially if you are not experienced in electronics. When assembling note that all the components except the resistors are polarised and that the orientation of the small transistors shown is for the Philips or Siemens type and should be reversed for other brands.

We used a simple folded aluminium box to house the supply as anything more fancy was a lot more expensive. The transistor Q3 should be mounted on a heatsink preferably on the outside of the box. The wiring diagram is given in Fig. 3.

PARTS LIST – ETI 712

Resistors all ½W 5%

R1,2	1k
R3	5k6
R4	0.22 ohm 5W
R5	3k3
R6,7	1k
R8	100
R9	56k
R10	270
R11	8k2
R12	3k3

Potentiometers

RV1	1k trim

Capacitors

C1	4700μ 35V
C2,3	100μ 25V

Semiconductors

Q1	BC558
Q2	BD140
Q3	2N3055
Q4	BC548
Q5	BC558
D1,2	1N5404
ZD1	5.1V 300mW

Miscellaneous

Transformer PL30–60VA
PC board ETI 712
Heatsink
Case, 3 core flex and plug

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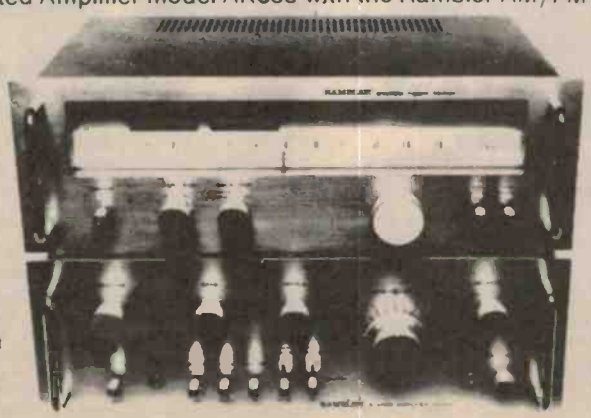
TK600
This tuner is brushed silver finish, to match the AK635 Amp, features rack style handles, variable output control, 75 ohm coaxial cable terminal, PLL-MPX demodulator, FET front end, High blend switch.

AK635
This amplifier features 40w x 40w (8 ohms), Multi-Speaker switching. Bass and Treble dual control, separate volume and balance controls, stereo head-phone output, mike input and mike mixing, 2 tape system for dubbing, separate pre and main Amp operation, rack style handles, subsonic filter.



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Project 481

HIGH POWER PA / GUITAR AMPLIFIER

Revised version of the ETI 413 guitar amplifier uses our new ETI 480 power amplifier with a new tone control/mixer board and any of our existing peramplifier modules. It can be powered either by the mains or 12 volt dc.

AS THE ETI 480 amplifier module is so much easier to build than the 413 guitar amplifier and has the same power rating we have had many requests to describe it as a complete amplifier. Although this article does not specifically describe that unit, it shows how to interconnect modules which have been published in the past, along with a new mixer board described in this issue, to make an amplifier to suit your particular need. The new mixer board has two out of phase outputs to allow two 100 watt modules to be connected in a bridge configuration to give 200 watts into eight ohm loads. Note however that loads less than eight ohms cannot be used while in bridge and if the load can be broken into two separate four ohm loads this should be done and the amplifiers used separately.

Constructional Hints

Due to the various requirments of different groups we are not giving formal constructional details but will just give general procedures and things to watch for.

The first thing to decide is what arrangment of modules is needed. The various modules available are as follows;

Power modules

ETI 480/50W	50W into 8 ohms
ETI 480/100W	100W into 4 ohms
2xETI480/100W	200W into 8 ohms

Power supply

1xTransformer	240V in 100W out
2xTransformer	240V in 200W out
1x ETI 480PS	12Vdc in 100W out
1x ETI 480PS +1 Transformer	12V/240V input 100W output

Mixer / tone controls

ETI 481M

Preamplifiers

ETI 445	two channel preamp. for for magnetic pickups.
ETI 446	two channel limiter suitable for high level microphones.
ETI 449	balanced mic. amplifier for low level microphones up to 500mV max.output

Options

ETI 438 audio level meter

The box we used was supplied to us by Applied Technology and is suitable for rack mounting. If this box is used the heatsink bracket of the amplifier(s) should be the same as described for the 12V power supply to allow it to clamp directly onto the heatsink/ sides of the box. While this box looks large, when two power modules, power supplies and the preamps are fitted it becomes more crowded. Therefore layout all the boards before drilling any holes.

With the 12V supply we used a 15A

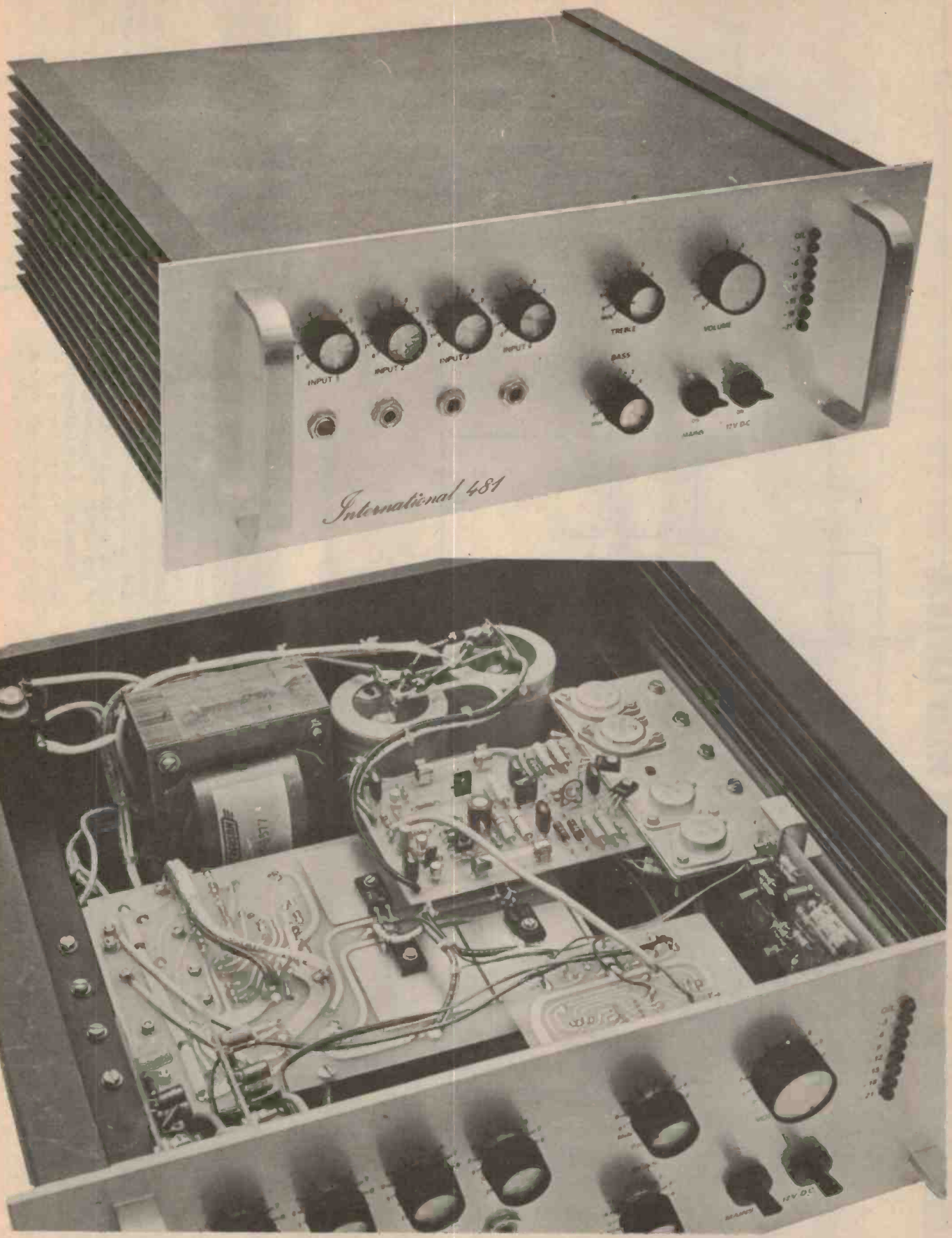
Text continued on page 62

SPECIFICATION ETI 481

Unit built using two 100 watt modules connected in bridge with ETI 449 balanced microphone preamplifiers.

Output power	
into 8 ohms at < 1% distortion	200 watts
Frequency response	
controls flat, +0dB, −3dB	15Hz – 30kHz
Tone control range	
bass at 100Hz	+10dB −11dB
treble at 10kHz	+11dB −12dB
Sensitivity	3mV
Maximum input voltage *	500mV

* limit due to preamplifier clipping.



Internal view of the 12V / 240V 100W unit

HIGH POWER PA / GUITAR AMPLIFIER

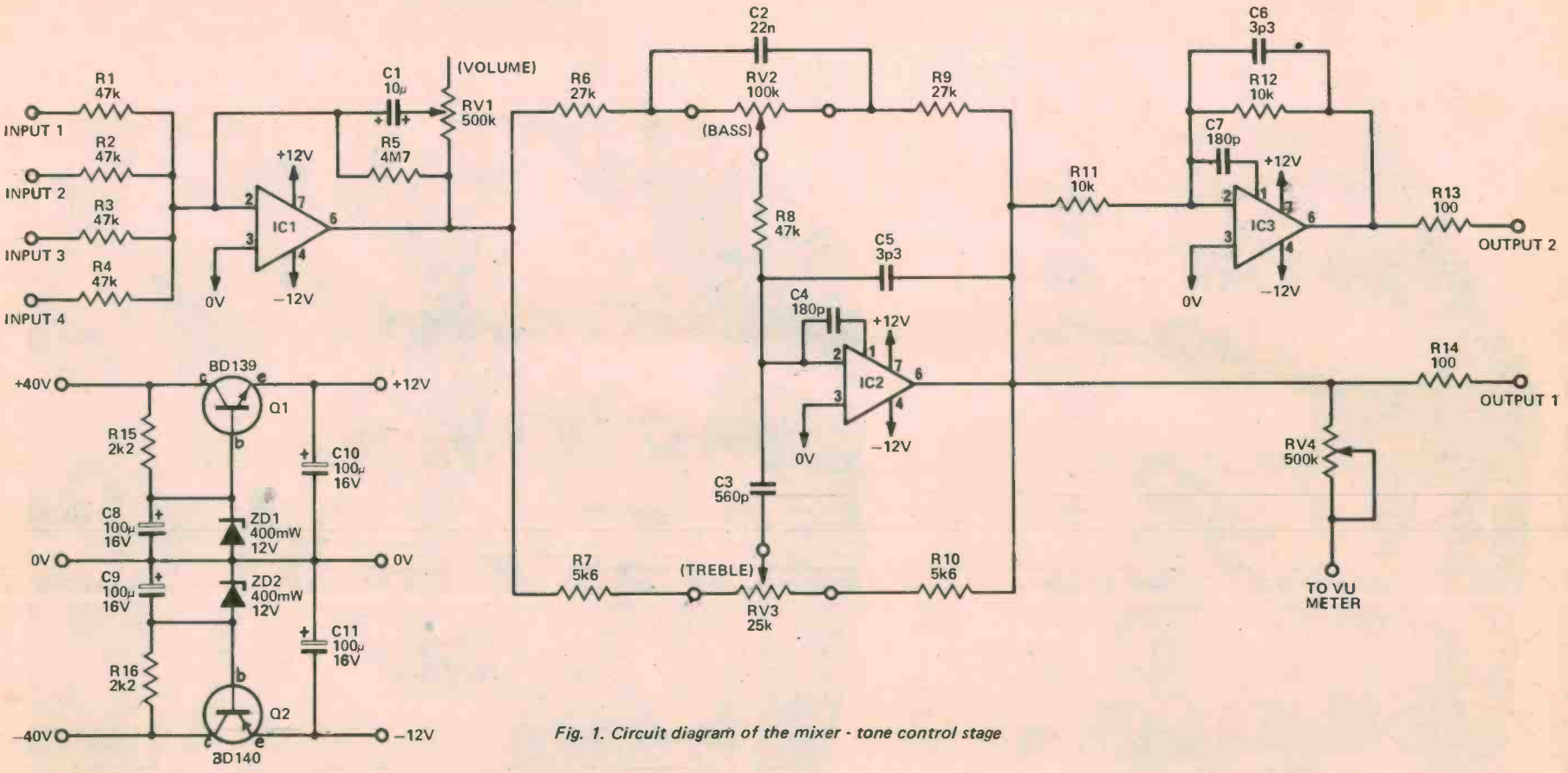


Fig. 1. Circuit diagram of the mixer - tone control stage

Continued from page 60

fuse in series and a large automotive type diode (cathode to +Ve) across the 12V after the fuse so that the fuse will blow if the supply is the wrong polarity. The output of the 12V converter and the output of the 240V rectifier can simply be paralleled allowing the two supplies to be used separately or together without damage. The wiring on the 12V side carries 15 amps and should be a reasonable gauge.

For connecting in bridge two separate transformers (or a larger one) are needed, separate rectifiers should be used and larger filter capacitors or paralleled capacitors (we used 6800µ 50V) should be used. When connecting the power modules the +40V, 0V and −40V connections between the modules should be short.

Most of the preamplifier modules need a dual 12V supply and this is available from the 481M board. In the audio level meter the diode D3 should be replaced by a 680 ohm resistor to lower the +40V to less than the 32V allowed. It should be connected as a VU meter with R5 as 220k. The unit can be calibrated on the mixer board.

We mounted the preamplifiers, mixer and VU meter on small brackets which were held on by the potentiometers. For the balanced microphone inputs we used stereo phone jacks as they are economical and also allow an unbalanced microphone to be used. The level control potentiometers on the microphone inputs were 10k log and are on the output of the preamplifier.

We had some hum pickup into the mixer board from the wiring to the power switch and we have moved it more to the right since the photos were taken to help this problem.

How It Works — ETI 481M

The mixing is done by IC1 where the gain is set by RV1 and is variable from zero to 10 (20dB) and for dc biasing R5 is used. Due to the high value of R5 we have used a FET op-amp (CA3140) for IC1. The tone controls are a standard network around IC2. The output of IC2 is inverted by IC3 to give the second output needed. The frequency compensation used on IC2 and IC3 is called 'feed forward' and extends the frequency response of the IC.

The power supply reduces the ± 40V to ± 12V and has enough power to drive the preamplifiers as well.

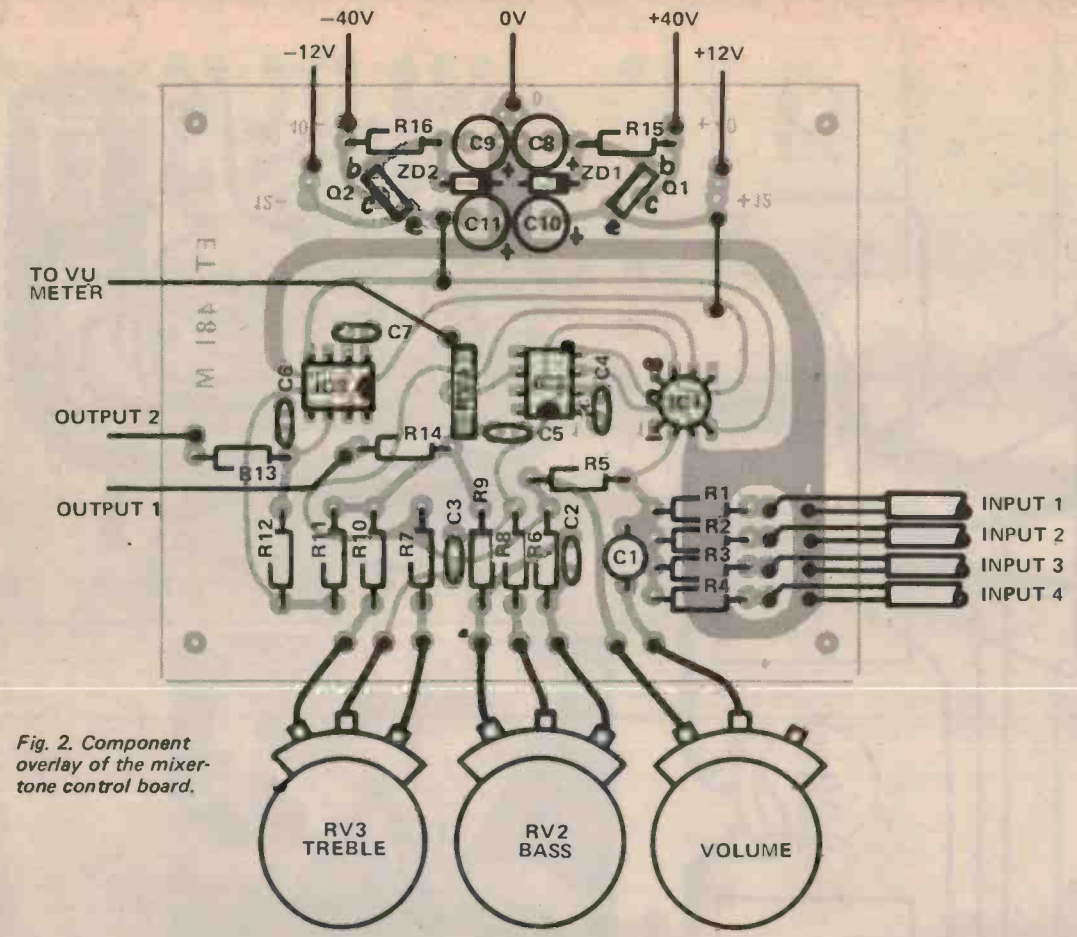


Fig. 2. Component overlay of the mixer-tone control board.

PARTS LIST — ETI 481M

Resistors all ¼W 5%

R1–R4	47k
R5	4M7
R6	27k
R7	5k6
R8	47k
R9	27k
R10	5k6
R11,12	10k
R13,14	100
R15,16	2k2

Potentiometers

RV1	500k log rotary
RV2	100k lin "
RV3	25k lin "
RV4	500k trim

Capacitors

C1	10µ non polarised electro
C2	22n polyester
C3	560p ceramic
C4	180p "
C5,6	3p3 "
C7	180p "
C8–C11	100µ 16V electro

Semiconductors

IC1	CA3140
IC2,3	LM301A
Q1	BD139
Q2	BD140
ZD1,2	12V 400mW

Miscellaneous

PC board ETI 481M

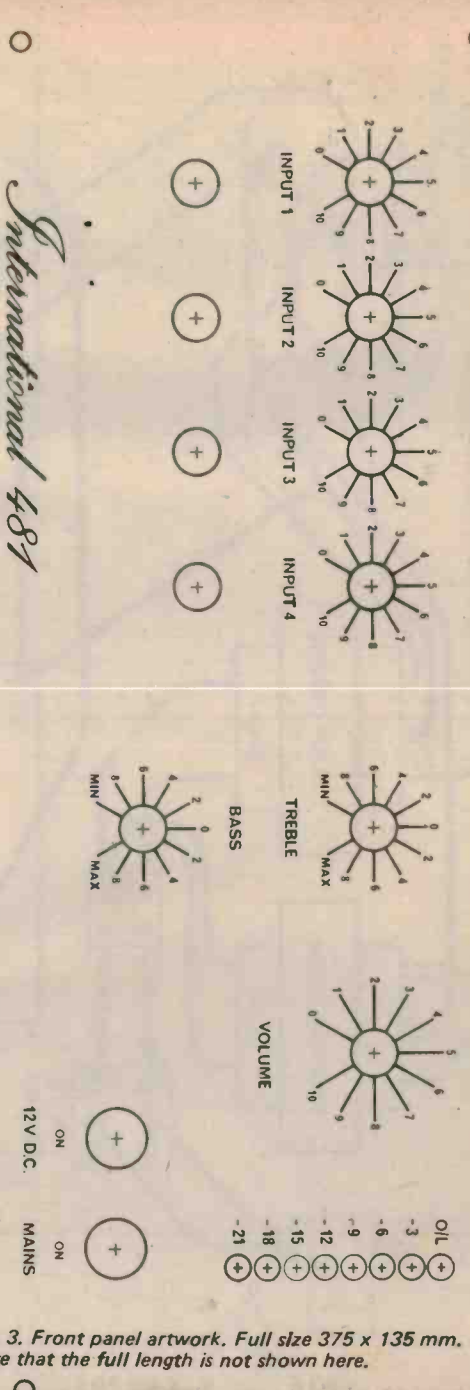


Fig. 3. Front panel artwork. Full size 375 x 135 mm. Note that the full length is not shown here.

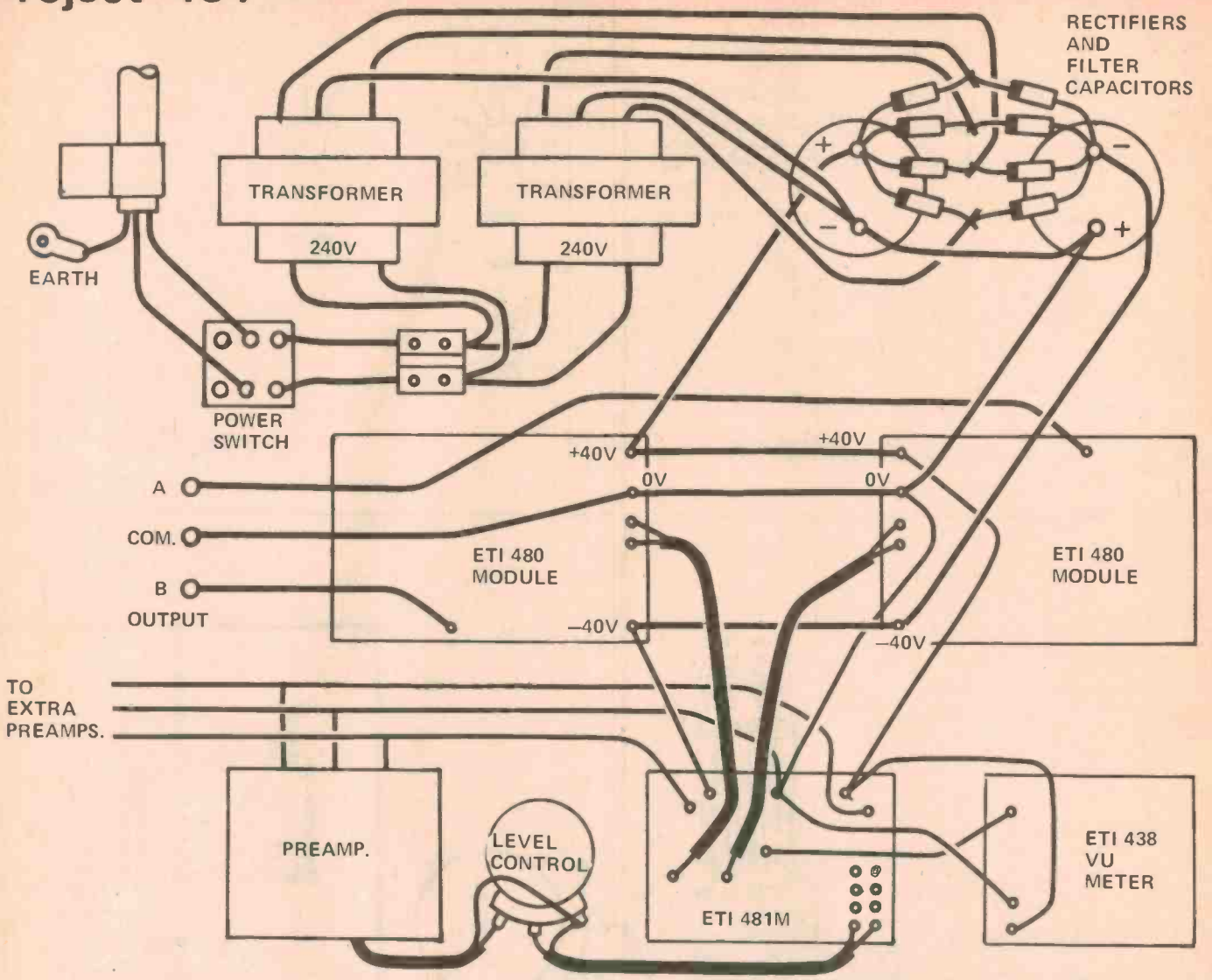


Fig. 4. Wiring diagram for the 200W bridge amplifier.

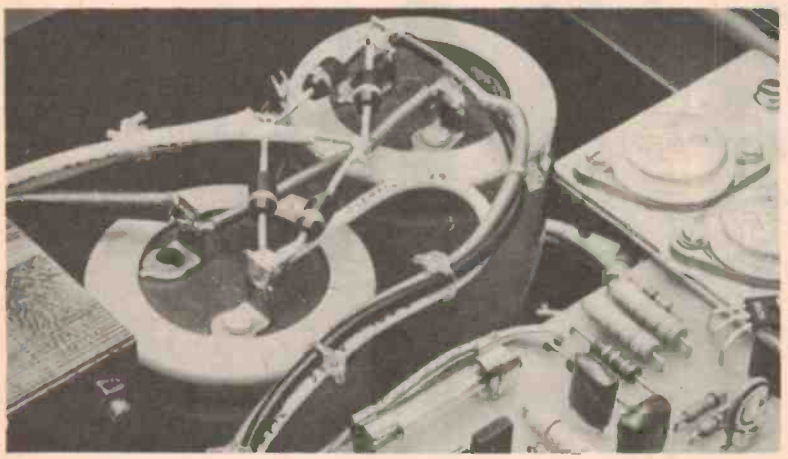


Photo showing how the rectifier diodes are connected. This is on the 12V / 240V version where a single transformer and rectifier are used.

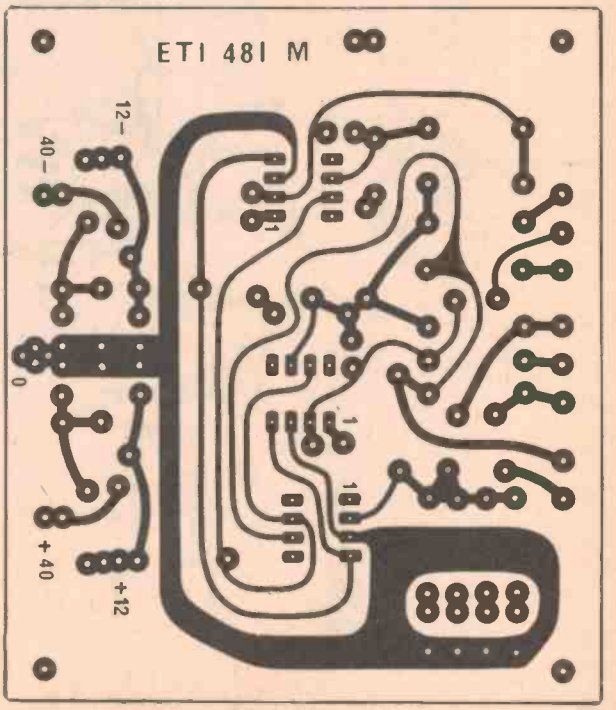


Fig. 5. Printed circuit layout. Full size 92 x 78 mm.

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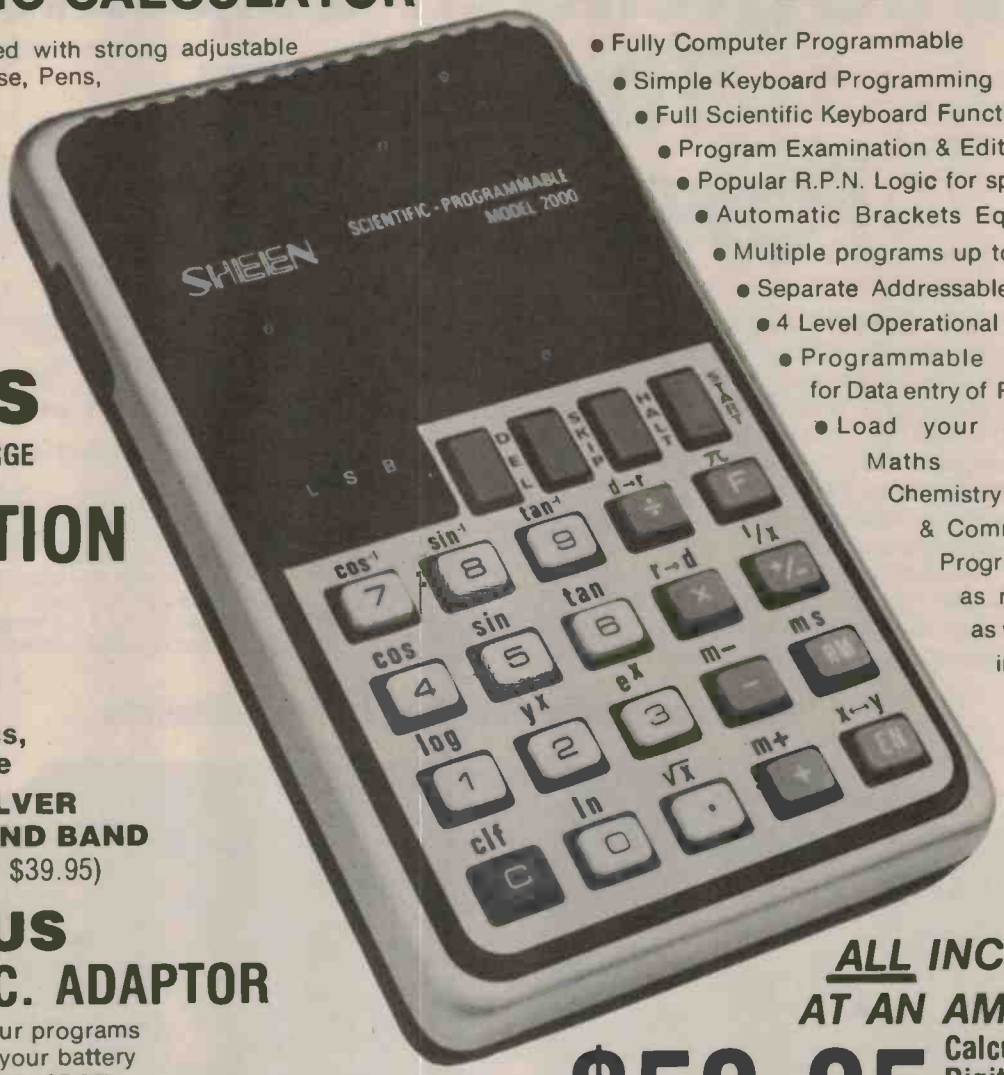

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Specifications

Power Output: Min. RMS, both channels driven, from 20 to 20,000Hz, with no more than 0.05% total harmonic distortion 170 watts per channel into 4 and 8 ohms.

Power Bandwidth: 20 to 20,000Hz at or below rated min. RMS power output and total harmonic distortion.

Total Harmonic Distortion: Overall (from AUX) less than 0.05% at or below rated min. RMS power output.

Intermodulation Distortion: (70Hz:7,000Hz = 4:1 SMPTE method). Overall (from AUX) less than 0.05%.

Frequency Response (at 1 watt):
Overall (AUX to power output)
10 to 50,000Hz + 0dB, −1.0dB
Power Amplifier Only
10 to 70,000Hz + 0dB, −1.0dB

Damping Factor: approximately 80 to 8 ohm load

Channel Separation at rated output 1,000Hz:
Phono 1–better than 55dB
(at 3mV sensitivity)
Phono 2–better than 55dB
(at 3mV sensitivity)
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ETI data sheet

MC 14490 HEX BOUNCE ELIMINATOR

The MC14490 is constructed with complementary MOS enhancement mode devices, and is used for the elimination of extraneous level changes that result when interfacing with mechanical contacts. The digital contact bounce eliminator circuit takes an input signal from a bouncing contact and generates a clean digital signal four clock periods after the input has stabilized. The bounce eliminator circuit will remove bounce on both the "make" and the "break" of a contact closure. The clock for operation of the MC14490 is derived from an internal R-C oscillator which requires only an external capacitor to adjust for the desired operating frequency (bounce delay). The clock may also be driven from an external clock source or the oscillator of another MC14490.

CHARACTERISTICS

The single most important characteristic of the MC14490 is that it works with a single signal lead as an input, making it directly compatible with mechanical contacts.

The circuit has a built in pullup resistor on each input. The worst case value of the pullup resistor is used to calculate the contact wetting current. If more contact current is required, an external resistor may be connected between V_{DD} and the input.

Because of the built in pullup resistors, the inputs cannot be driven with a single standard CMOS gate when V_{DD} is below 5V. At this voltage, the input should be driven with paralleled standard gates or by the MC14049 or MC14050 buffers.

The clock input circuit (pin 7) has Schmitt trigger shaping such that proper clocking will occur even with very slow clock edges, eliminating any need for clock preshaping. In addition, other MC14490 oscillator inputs can be driven from a single oscillator output buffered by an MC14050.

The MC14490 is TTL compatible on both the inputs and the outputs. When V_{DD} is at 4.5V, the buffered outputs can sink 1.6 mA at 0.4V. The inputs can be driven with TTL as a result of the internal input pullup resistors.

OPERATION

To understand the operation, we assume all bits of the shift register are loaded with 1's and the output is at a 1 or high level.

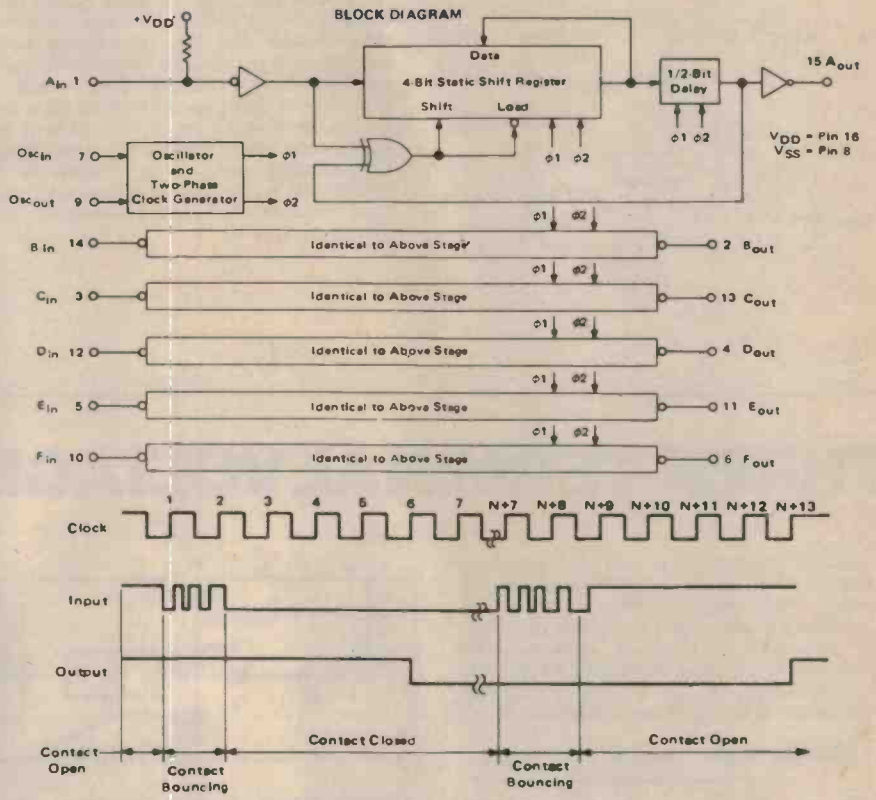
At clock edge 1 the input has gone low and a 0 (low level) has been loaded into the first bit or storage location of the shift register. Just after the positive edge of clock 1 in input signal has bounced back to a logic 1. This causes the shift register to be reset to all 1's in all four bits — thus starting the timing sequence over again.

During clock edges 3 to 6 the input signal has stayed low. Thus a logic 0 has been shifted into all four shift register bits and, as shown, the output goes to a 0 during the positive edge of clock pulse 6.

It should be noted that there is a 3½ to 4½ clock period delay between the clean input signal and output signal. In this example there is a delay of 3.8 clock periods from the beginning of the clean input signal.

After some time period of N clock periods, the contact is opened and at N+7, a 1 is loaded into the first bit. Just after N+7, when the input bounces low, all bits are reset to 0. At N+8 nothing happens because the input and output are low and all bits of the shift register are 0. At time N+9 and thereafter the input signal is a high (1) clean signal. At N+13 the output goes high (1) as a result of four 1's being shifted into the sift register.

Assuming the input signal is long enough to be clocked through the Bounce Eliminator, the output signal will be no longer or shorter than the clean input signal plus or minus one clock period.



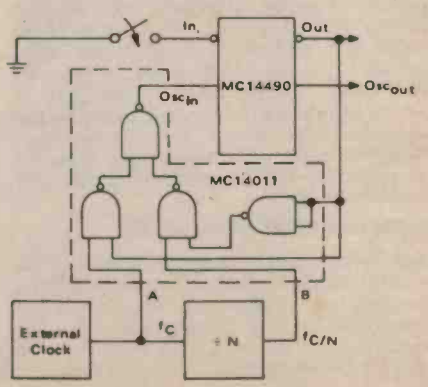
CLOCKING

The only requirement on the clock frequency in order to obtain a bounce free output signal is that four clock periods do not occur while the input signal is in a false state.

If the user has an available clock signal of the proper frequency, it may be used by connecting it to the oscillator input (pin 7). However, if an external clock is not available the user can place a small capacitor across the oscillator input and output pins in order to start up an internal clock source. The clock signal at the oscillator output pin may then be used to clock other MC14490 Bounce Eliminator packages. With the use of the MC14490, a large number of signals can be cleaned up, with the requirement of only one small capacitor external to the Hex Bounce Eliminator packages.

ASYMMETRICAL TIMING

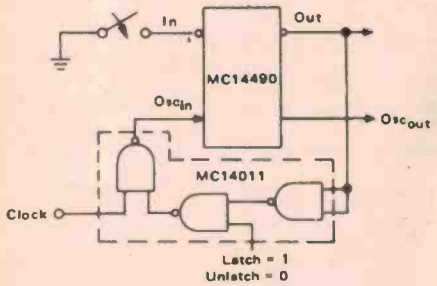
In applications where different leading and trailing edge delays are required (such as a fast attack/slow release timer.) Clocks of different frequencies can be gated into the MC14490. In order to produce a slow attack/fast release circuit leads A and B should be interchanged. The clock out lead can then be used to feed clock signals to the other MC14490 packages where the asymmetridal input/output timing is required.



ETI data sheet

LATCHED OUTPUT

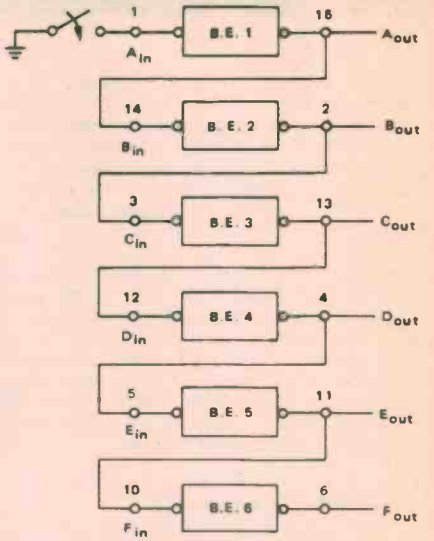
The contents of the Bounce Eliminator can be latched by using several extra gates. If the latch lead is high the clock will be stopped when the output goes low. This will hold the output low even though the input has returned to the high state. Any time the clock is stopped the outputs will be representative of the input signal four clock periods earlier.



MULTIPLE TIMING SIGNALS

Bounce Eliminator circuits can be connected in series. In this configuration each output is delayed by four clock periods relative to its respective input. This configuration may be used to generate multiple timing signals such as a delay line, for programming other timing operations.

One application of the above is where it is required to have a single pulse output for a single operation (make) of the push button or relay contact. This only requires the series connection of two Bounce Eliminator circuits, one inverter, and one NOR gate in order to generate the signal AB. The signal AB is four clock periods in length. If the inputs to the NOR gate are interchanged the pulse AB will be generated upon release or break of the contact. With the use of a few additional parts many different pulses and waveshapes may be generated.



THREE TERMINAL VOLTAGE REGULATORS

Voltage regulator use can be expanded beyond that of the simple three-terminal fixed voltage regulator. Some of the circuits which are practical and useful are described in this section. Pertinent equations are included rather than providing fixed component values as the circuits are equally applicable to all regulators within a family.

POSITIVE REGULATORS

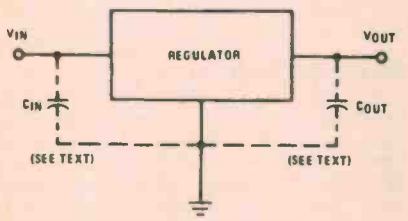


FIGURE 1 Basic Regulator Connection

If the regulator is located more than two inches from the supply filter capacitor, a supply bypass capacitor is required to maintain stability (much as is the case with op-amps). This should be a 0.22 µF or larger disc ceramic, 2 µF or larger solid tantalum, or 25 µF or larger aluminium electrolytic capacitor. Transient response of all the regulators is improved when output capacitors are added. To minimize high frequency noise, an 0.1 µF output capacitor is recommended on the LM78LXX and LM3910 series.

HIGH CURRENT REGULATOR

This current circuit takes advantage of the internal current limiting characteristics of the regulator to provide short-circuit current protection for the booster as well. The regulator and Q_1 share load current in the ratio set between R_2 and R_1 if $V_D = V_{BE(Q1)}$

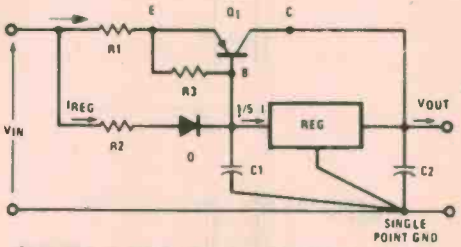


FIGURE 2 High Current Regulator with Short Circuit Limit During Output Shorts.

$$I_1 = \frac{R_2}{R_1} I_{REG}$$

During output shorts

$$I_{1(SC)} = \frac{R_2}{R_1} I_{REG(SC)}$$

If the regulator and Q_1 have the same thermal resistance θ_{JC} and the pass transistor heat sink has R_2/R_1 times the capacity of the regulator heat sink, the thermal protection (shutdown) of the regulator will also be extended to Q_1. Some suggested transistors are listed below.

ADJUSTABLE OUTPUT VOLTAGE

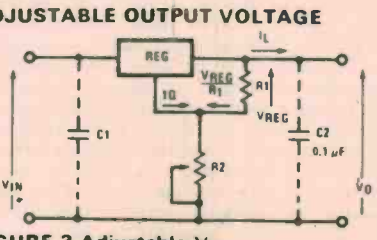


FIGURE 3 Adjustable V_{OUT}

A fraction of the regulator current V_{REG}/R_1 is used to raise the ground pin of the regulator and provide through voltage drop across R_2, an adjustable output voltage.

$$V_O \quad V_{REG} + R_2(I_Q + \frac{V_{REG}}{R_1})$$

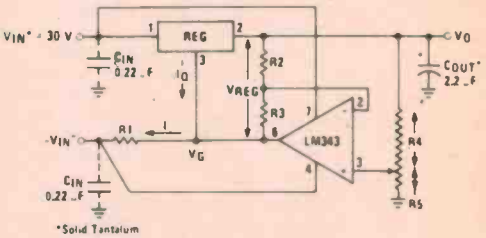


FIGURE 4 Variable Output Voltage of 0.5 - 28V

A wide range of output voltages can be obtained with the circuit of Figure 4. A 0.5- to 20-volt supply can be built using a 30-volt supply and a conventional op-amp, such as the LM143. If

$$R_2 + R_3 = R_4 + R_5 = R, \quad \text{and} \quad R_2/R_3 = 1/10,$$

$$\text{then } V_O \quad V_{REG}(\frac{R_2}{R_4}) = V_{REG}(\frac{1}{11})(\frac{R_4 + R_5}{R_4})$$

Since V_O is inversely proportional to R_4, low output voltages can be very accurately set. The required R_1 is

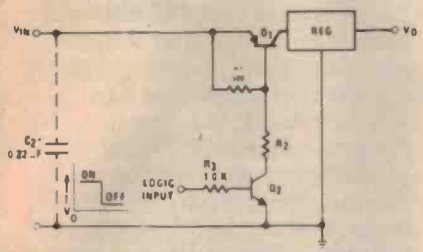
$$R_1 = \frac{V_{IN}}{I_Q}$$

The $V_{O(MAX)}$ is dependent on V_{IN} and $V_{dropout}$, provided that the amplifier can source the current required to raise V_G to $V_O - V_{REG}$.

Example:

V^-_{IN} = -15 V	R_1 = 2K2
V^+_{IN} = +30 V	R_2 = 910R
V_O = 0.5-28 V	R_3 = 9K1
LM340K-05	$R_4 + R_5$ = 10K

ELECTRONIC SHUTDOWN



* Required if regulator far from power supply filter

FIGURE 5 Electronic Shutdown Circuit

Electronic shutdown in three-terminal regulators is done by simply opening the input circuit using a transistor switch. Q_1 operates as the switch which is driven by Q_2. The control voltage V_C can be TTL compatible with the use of R_3 = 1K. R_1 is a biasing resistor, and R_2 can be calculated as

$$R_2 = \frac{V_{IN} - .1\,V}{I_O} \cdot \beta_{SAT(Q1)}$$

Figure 6 illustrates a short-circuit-dependent power shutdown circuit with reduced heat sink requirements under short-circuit conditions.

When the power is first applied, Q_2 turns ON and saturates Q_1. The regulator output ramps up to turn Q_3 ON, which turns Q_2 OFF (V_C should be $> V_A$), thus maintaining Q_1 in the ON state.

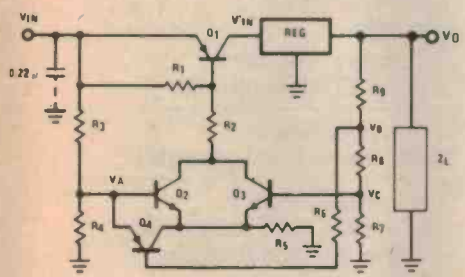


FIGURE 6 Output Electronic Shutdown on High Voltage Regulator

When the output is shorted, Q_3 turns OFF, Q_4 turns ON to clamp Q_2 OFF. Q_1 loses base drive and so opens to isolate the regulator from V_{IN}. When the short circuit is removed, Q_4 loses some base drive and enables Q_2 to re-start the regulator. Q_1 always operates as a switch and needs no heat sinking. Q_2 and Q_3 need not be matched. Q_4 may be any small signal PNP transistor. The entire circuit (less regulator) fits easily on a one-inch squre PC board.

Example: LM340K-24

V_{IN} = 36V	R_1 = 500R
V_O = 24V	R_2 = 250R, 2W
I_O = 1A	R_3 = 3K3
V_A = 2.5V	R_4 = 240R
V_B = 8V	R_5 = 62R
V_C = 4.8V	R_6 = 2K
Q_1 = NSD32	R_7 = 1K
Q_2 = 2N4141	R_8 = 680R
Q_3 = 2N4141	R_9 = 3K3
Q_4 = 2N2906	

NEGATIVE REGULATORS

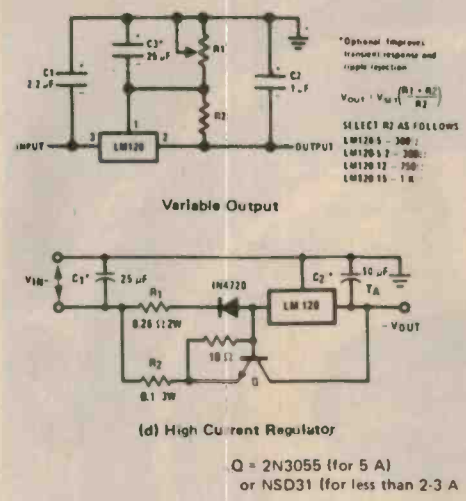


FIGURE 7 Negative Regulator Circuits

All the applications circuits for positive regulators can be used with the polarities inversed for the negative regulator LM320/345 series (e.g., reverse the sense of the diodes, replace PNP's with NPN's etc., etc.).

BASIC DUAL POWER SUPPLY

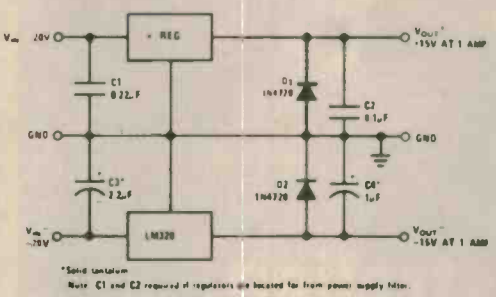


FIGURE 8 Dual Power Supply

A positive regulator can be connected with an LM320 to form a non-tracking dual power supply. Each regulator exhibits line and load regulation consistent with their specifications as individual devices. Protective diodes D_1, D_2 allow the regulators to start under common load. They should be rated at the regulator short circuit current.

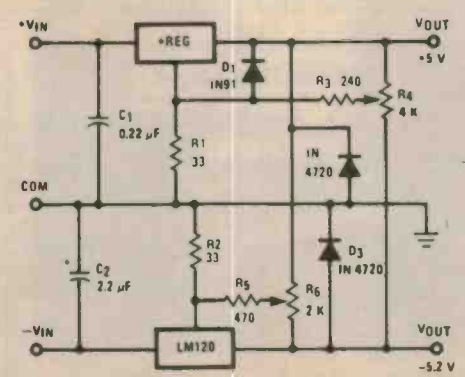
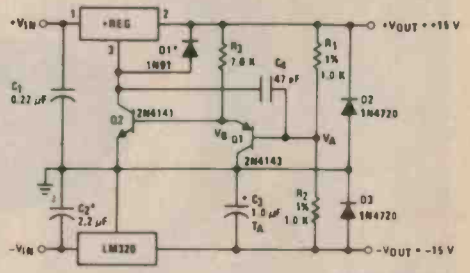


FIGURE 9 Trimmed Dual Supply

TRIMMED DUAL SUPPLY

Figure 8 may be modified to obtain a dual supply trimmed to a closer output tolerance. The trimming potentiometers are connected across the outputs so positive or negative trimming currents are available to set the voltage across the R_1 (R_2) resistors. R_3, R_5 are included to linearize the adjustment and to prevent shorting the regulator ground pin to opposite polarity output voltages.

Tracking Dual Supply



* Solid Tantalum

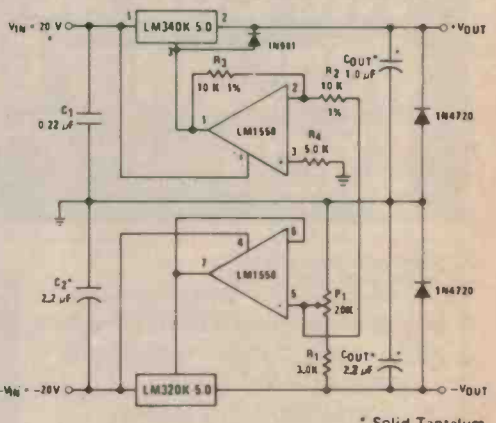
FIGURE 10 Tracking Dual Supply

A tracking supply can be built as in Figure 10 where the positive regulator tracks the negative regulator. V_A is a virtual ground under steady state conditions. Q_2 conducts the quiescent current of the positive regulator.

If $-V_{OUT}$ falls, V_A follows forward biasing collectorbase junction of Q_1. V_A falls, thus raising the collector voltage of Q_2 and $+V_{OUT}$ to restore V_A to desired voltage. Germanium diode D_1 may be needed to start the positive regulator with a high differential load.

Example: +15V, 1A tracking dual supply: LM340T-05, LM320T-15.
The 340 will track the LM320 within 100 mV. D_2, D_3: IN4720.

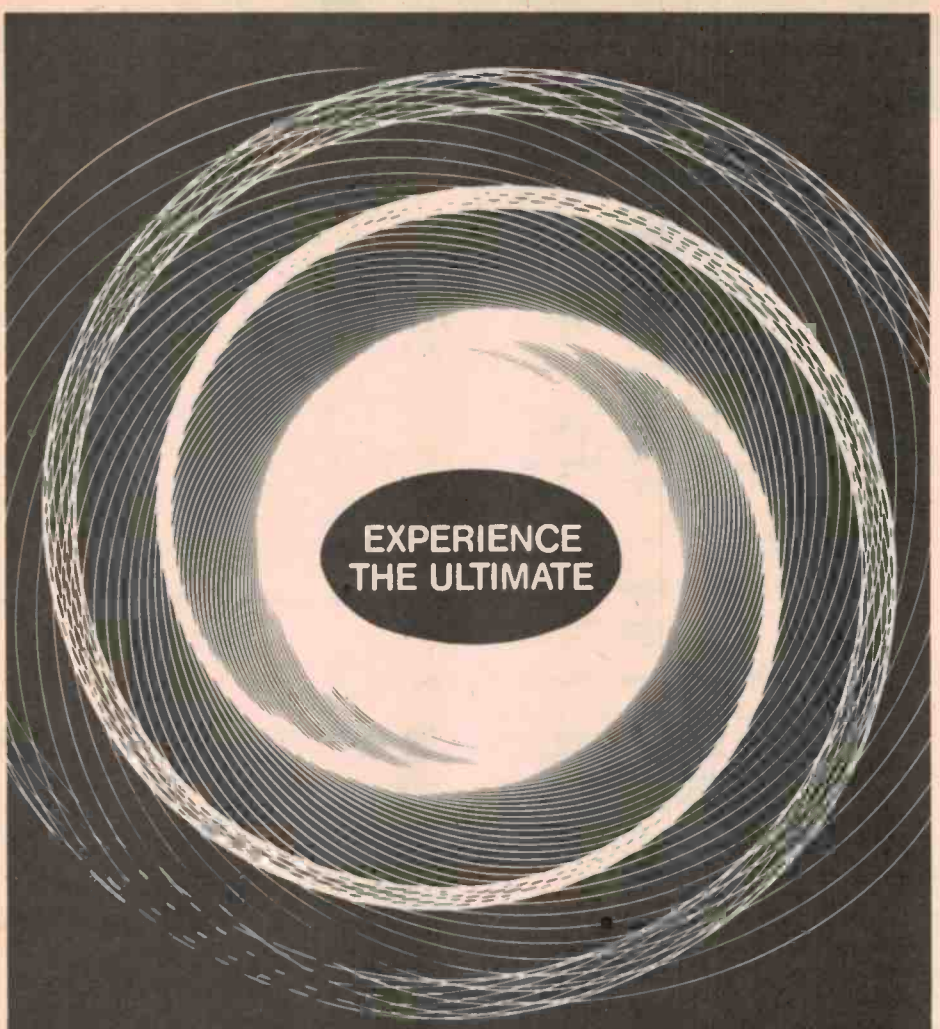
VARIABLE TRACKING DUAL SUPPLY



* Solid Tantalum

FIGURE 11 Variable Tracking Dual Supply ±5.0 V— ± @ 18V

The ground pins of the negative regulator and the positive regulators are controlled by means of a voltage follower and an inverter, respectively. The positive regulator tracks the negative to within 50mV over the entire output range if R_2 is matched to R_3 within one per cent.



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WP1121

PART 4

ELECTRONICS IN THE YEAR 2000

EVOLUTION OR REVOLUTION

By Peter Sydenham

THE USE OF ELECTRICITY FOR medical purposes dates back to the Ancient Greeks who used the electric eel to treat various maladies. In 1759 Wesley collected case histories of the use of electricity. The first recorded use of electricity for treatment in a hospital in London was in 1767.

Not quite 200 years ago, in 1786 to be precise, Professor Luigi Galvani – an anatomist at the University of Bologna, Italy – discovered by chance that the muscles of a dead frog contracted under the influence of an electrical quantity.

He wrongly assumed that animal electricity stored within the muscle caused this to happen. It was, in fact, the result of dissimilar metals forming a primary electric cell which energised the nerves of the muscle. Volta of the University of Paris proved it and subsequently gave the world the voltaic battery, in 1800.

Fig. 1. Artist's idea of Galvani experimenting with frogs' legs in the 1780s. Note the friction electrostatic generator on the left and the Leyden jar on the right (Funk and Wagnells).

The contribution of these two men provided, in the simple primary cell, a workable basis for using electricity in

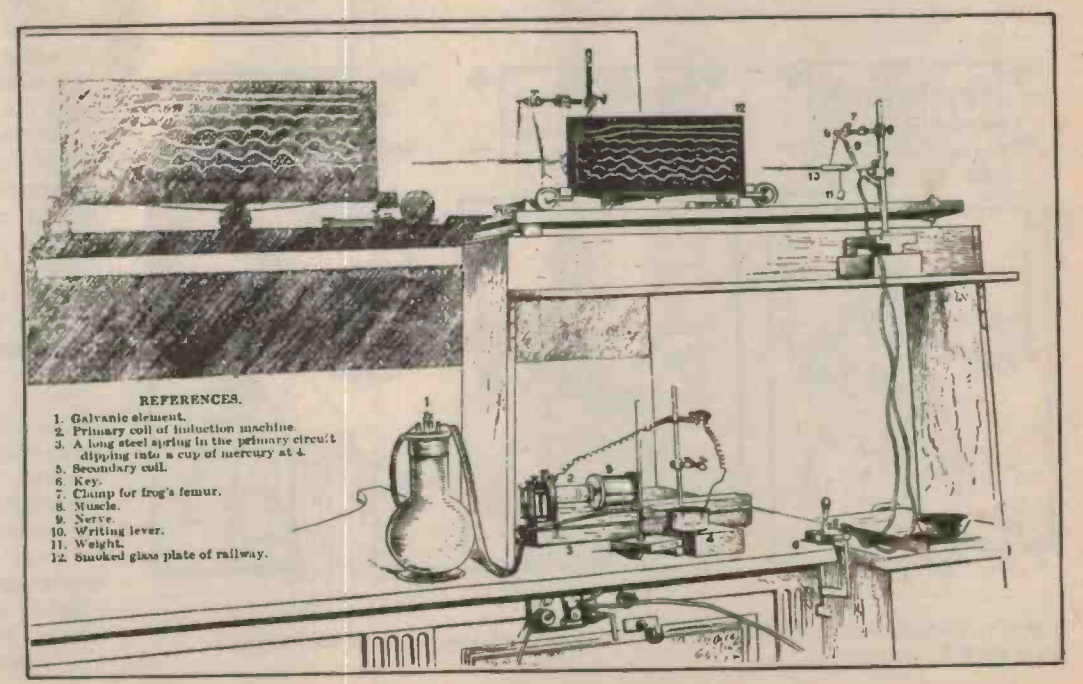

Fig. 2. Apparatus used by McKendrick to give lectures on life in motion to Royal Institution, London, audiences around 1890.

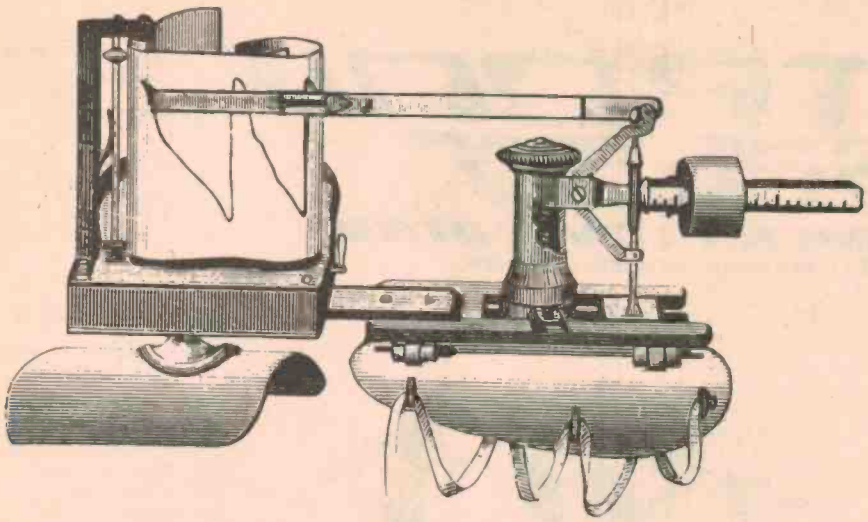

Fig. 3. Verdin's apparatus of the 1890s for recording action of the pulse.

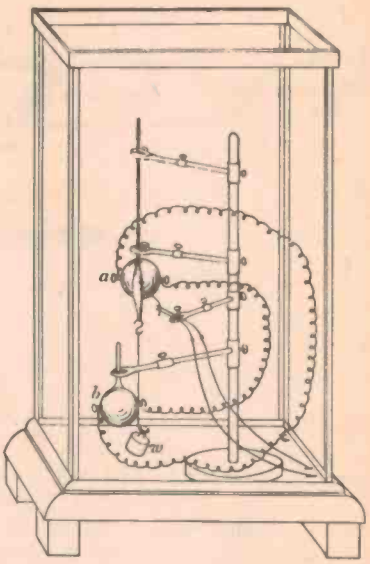

Fig. 4. Schematic of McKendrick's 1891 method for measuring heat generation in muscle.

practical ways not previously possible with the electro-static form of electricity. Galvani's work on "animal fluid" was amongst the earliest electro-medical studies. The apparatus he used was crude by today's standards – see Fig 1.

Research into physiological electric quantities gradually became more sophisticated as the 19th century passed. This development, however, had to wait for suitable experimental inventions such as the electro-magnetic galvanometer which became available in its crudest form around 1830. A typical laboratory electro-medical instrumentation set-up of the 1890's is shown in Fig 2. A smoked glass plate moved steadily across the end of a mechanical pen secured to the end of a frog's leg muscle. The muscle was energised by high-voltage generated from a vibrating induction coil which was energised by a chromate primary single cell of the Grenet kind. Smoked screen recorders are still in use today in some medical research measurements, blood flow parameters being one example.

The sphygmometrograph (as a pulse measuring instrument, was known in that time) was originated by Marey in 1860. A later design by Verdin is shown in Fig 3. Electronic method was little used in medicine in early times, as powerful electric signal amplification was not obtainable until the beginning of the 20th century – when the thermionic valve was invented by Fleming (in 1904).

Figure 4 shows experimental equipment for measuring heat production of muscular contraction around 1880. Thermocouples, forming a thermopile, drive the crude galvanometer.

Another aspect of medicine where electricity is used is for therapeutic treatment. Since the very early 1800s output of the various kinds of electric current generator, namely the Faraday induction coil, the galvanic chemical battery, the sinewave rotating generator and the friction statical generator have been applied to appropriate parts of the body to provide a cure for all sorts of ailments. The bath shown in Fig 5 was in use around 1910 in conjunction with equipment such as, perhaps, the hand-cranked generator shown in Fig 6. Electronic forms of this equipment are still being designed and used today.

X-ray equipment was born in 1895 when Roentgen discovered X-rays in a chance situation using photographic plates. There is probably no case in instrument history where application

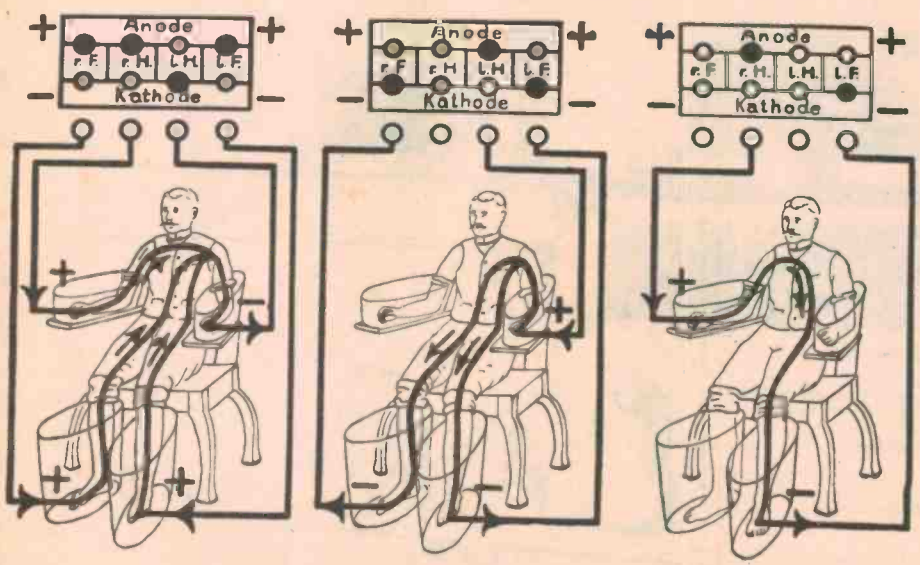

Fig. 5. Anyone for an electric bath? Contemporary sketch of routine therapeutic practice around 1910.

was more rapid. Edison, and others, had equipment in use in hospitals within months. Figure 7 shows contemporary American X-ray plant of 1899.

Measurement and recording of heart performance also began around 1900. Professor Einthoven of Holland devised a rapid response, high sensitivity detection instrument in 1903 — the string galvanometer. Soon after this was coupled to a photographic recording system, by the Cambridge Instrument Co., to produce an electrocardiograph. The first installation of this was made in 1909. By 1945 cardiographs were available in portable form. Figure 8 shows the interior of a 1930's Both Brothers portable electro-cardiograph invented and made in Adelaide, South Australia — possibly one of the first portable units devised anywhere. It used a loud speaker drive unit (right) to mark a rotating smoked disk. The record was viewed by the physician using an optical magnifier. Amplification to drive the stylus from skin electrode signals was obtained by thermionic valves.

As with all disciplines, electronic method opened the door to new accomplishments. In medical electronics it happened from the 1920s onward. Equipment for researching physiology at Oxford University, in 1949, is shown in Fig 9. This unit, advanced for its time, incorporated amplifiers, a temperature control unit, stimulators to induce responses, a time base and a cathode ray tube display unit.

Electronic equipment used in medicine has come a long way during the past 50 years. This can be seen by comparing the apparatus pictured above, which covers the 1800s to 1930's period, with modern equipment such as that used in pathological testing and nuclear medicine as was discussed in Electronics Today International issues of July and August, 1975.

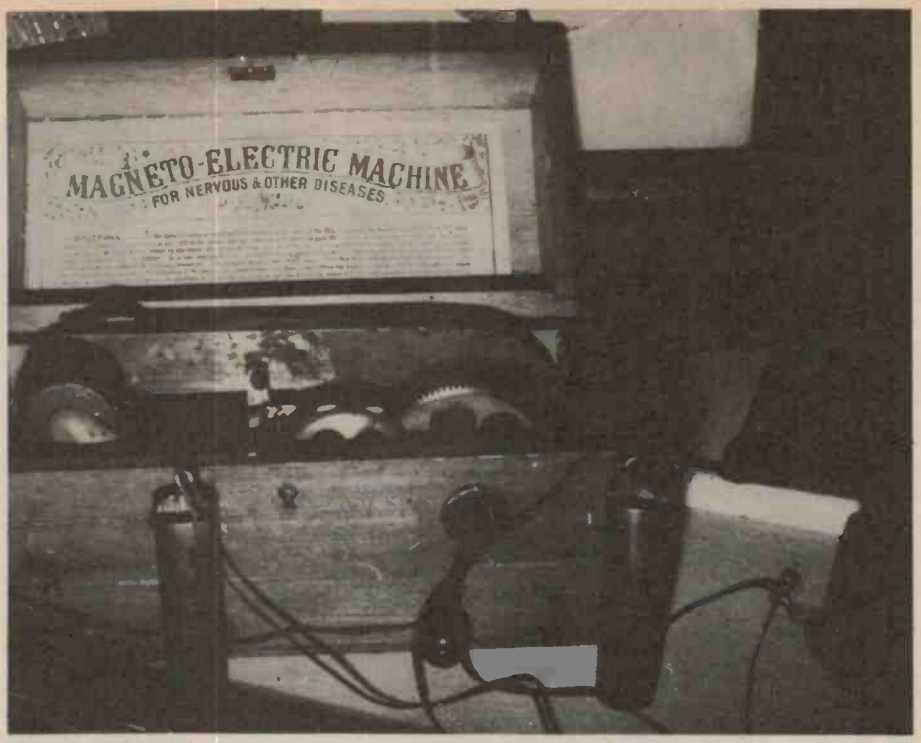

Fig. 6. In medical sine-wave generators a bobbin of wire is rotated in front of a permanent horse-shoe magnet. The design is almost identical with Clarkes 1830's original design and was still current around 1900.

Fig. 7. Complete X-ray apparatus in use in America around 1900. Note the lack of safety devices and precautions.

Against this background let me now suggest developments we can expect to experience over the next quarter century.

Monitoring

The largest proportion of electromedical equipment is concerned with measurement; for detection of abnormal states. At present comparatively few of the incredibly great range of medical measurements needed can be made in situ on the body and without disturbing its functions. Samples of tissue, blood, urine, etc. are removed for analysis in the pathological laboratory. This process, although performed faster today than ever before, can still take several hours before a diagnosis is available to the physician in order that he or she can decide corrective action. Analysers now exist that handle many measurements of a sample entirely automatically once the sample is loaded into the analyser.

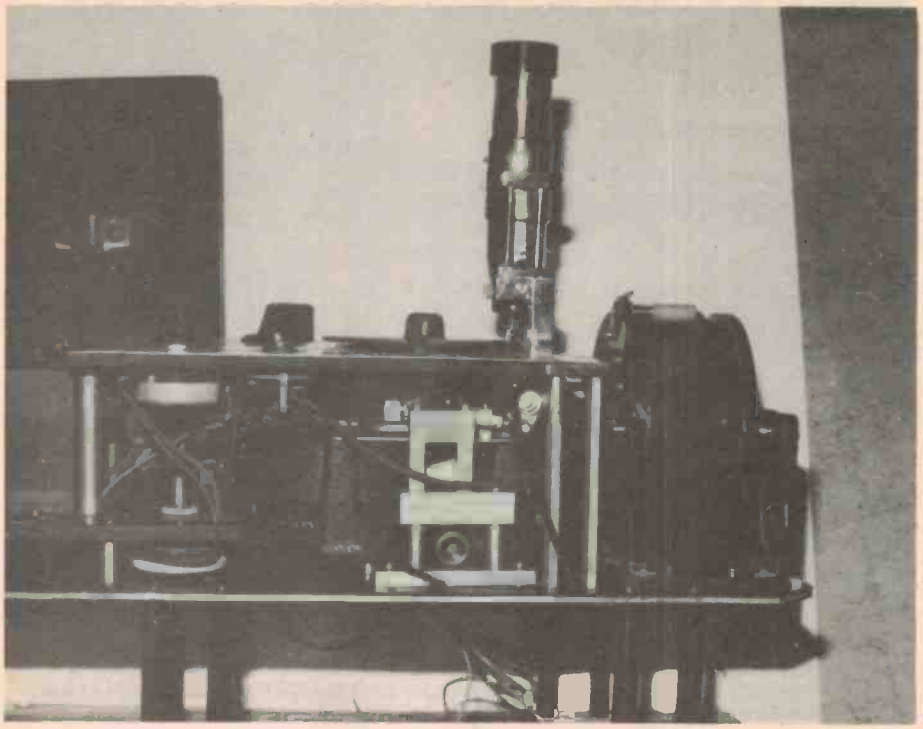

Fig. 8. Interior view of a Both portable electrocardiograph machine made in Adelaide around 1930.

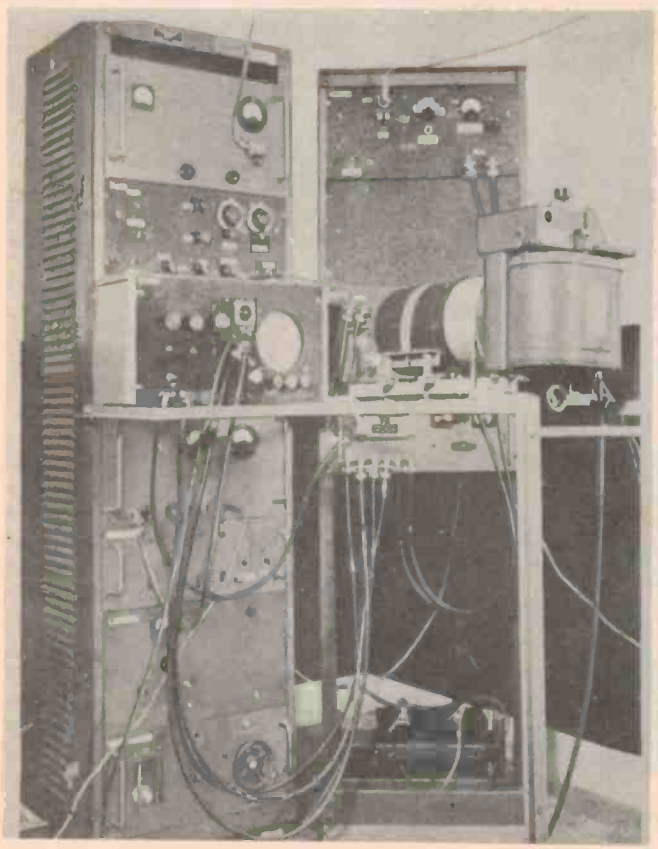

Fig. 9. Electrophysiological research equipment used by Dickinson at Oxford University in 1949.

But the sample must first be extracted from the body and then be transported to the machine, processes which consume time and in some circumstances alter the sample from its original state.

It is realistic to expect the transport step to be eliminated in the future with most local clinics having their own units for analysis of samples. The next stage in progress will come about by the invention of units that measure parameters such as blood count, albumin, etc. by contact externally to a suitable vein or artery. Direct measurement like this would also provide more accurate measurement as the blood would be in its normal working state. Furthermore, it would then be possible rapidly to optimize drug dosage and to investigate changes in parameters as they happen. The concept of in-situ measurement will apply to numerous other tests.

In special cases some people have already been equipped with sensors of critical body parameters. The outputs are telemetered to a remote observer. Examples of this are in space-medicine, in fitness studies and in a few heart disease cases.

Considering the low-cost data processing power already available, and coupling this with inexpensive microminiature sensors we can expect to see developed in the future, it is possible that individuals will one day be able to obtain self-monitors that provide warning when body parameters exceed allowable limits.

Better measurement always leads to better control. As an example, respiratory tract problems, such as hay fever and asthma, are hard to combat effectively because of the lack of detailed data about each individual's characteristics in the various circumstances encountered. Not all people are allergic to the same pollens — we could benefit greatly if an easy way existed that determined the allergic pollens involved.

At present, a pollen count is usually taken by drawing the ambient air over a sticky surface for many minutes — hours sometimes. The surface is then observed with a microscope, the technician counting all pollen grains together to obtain the total pollen count. This process is now sometimes carried out using computer-controlled video tv camera systems, but the systems are still barely able to group the various kinds of pollen grain. (They are typically a micrometre in diameter or smaller — counts of a few grains per

cubic metre can cause unwanted symptons).

A development that could help is a sensor that provides a virtually instant count of the individual kinds of pollen grain present – a real-time sampling analyser. With such a device the sufferer could test for the hostile situation *before* symptoms arise and take remedial action in time. Technologically such an instrument appears feasible. It is, however, cost and physical size that holds up its development and its practical everyday use at present.

A likely parallel already existing is the Coulter counter that analyses the size and number of cells in a blood sample. Blood-cell counting of several years ago required the blood to be smeared on a microscope slide and the cells counted by eye under a microscope. Today the machine makes the measurements in a few seconds by counting particles as they pass a small orifice – but it is neither portable nor inexpensive. Figure 10 shows a Coulter counter installation as used in the larger pathological laboratories.

Development of personal monitors will almost certainly pass first through a telemetry method in which a central computer processes the data, perhaps with the help of the trained physician to begin with. A direct self-contained method will then be developed in which the specific data processing requirements that have emerged from experience, are integrated into the unit.

Replacing the Sensors and Actuators of the Body

The human body is a vastly complicated chemical process plant. It has sensors feeding information to the brain for central processing. In turn, the brain sends signals to actuators – the muscles which cause the body to function and to do work. Nerves are the hardwired data channels for receiving and sending control information.

Slight deficiencies in the senses of sight and hearing have been aided using instruments – spectacles and hearing aids. The latter began as acoustic horns which provided sound pressure gain without active amplification. The advent of the telephone led to amplifierless hearing aids in the 1900's which used several mouthpieces coupled to the ear pieces (Fig 11). Then came electronic units which provided active signal gain from miniature thermionic valves. Today we have integrated semiconductor circuitry. We have still a

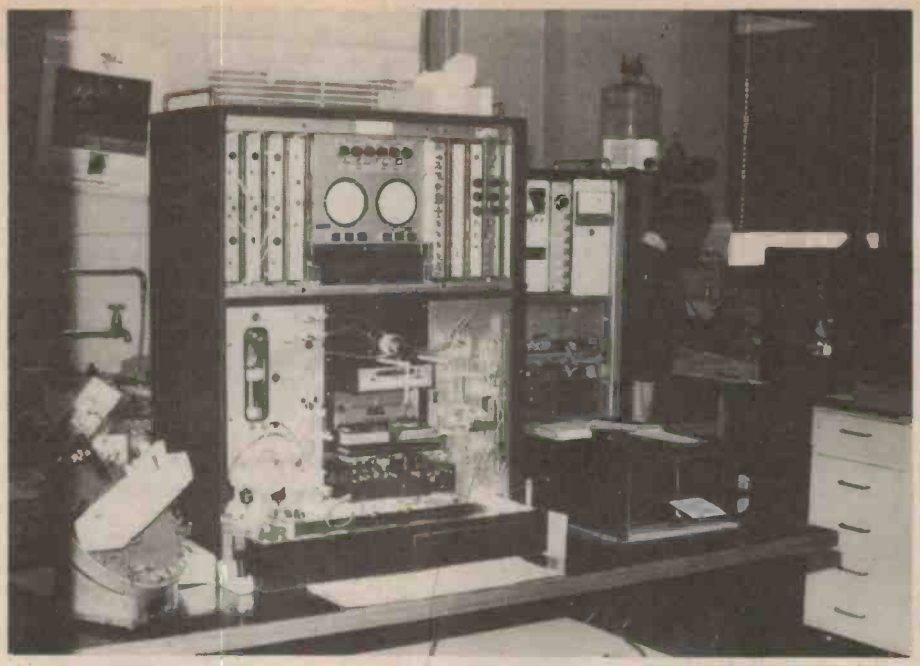

Fig. 10. Coulter counter unit of today that analyses blood sample particles providing a print-out (IMUS, Adelaide).

Fig. 11. 1900's hearing aid. The three receivers, which fit into the case, provide signal to the two earpieces. No active amplifier was involved. (Birdwood Mill Museum, S.A.)

way to go, however, before we are able to compensate for a failed action of the inner ear mechanisms.

Vision, until very recently, was aided only by optical lens compensation. But this applies only where the eye is still largely operative as an optical-to-electrical transducer. Quite recently experiments have been reported in which a miniature video camera provides electronic signals that drive cells in the brain to provide illusion of sight. The method is still crude compared with the performance of natural process. Given time for research it seems reasonable to assume that quite compact and useful artificial eyes will soon be available for blind people. Bionic man is not so fantastic! Interestingly, once the bionic eye is developed it is an easy matter to provide greater than natural visual acuity and to offer sensitivity to other than the visible light band – infra-red for instance.

Providing electronic replacements for the sense of smell will most likely be a much later development. We know too little about the olefactory senses and have no really compact and cheap smell sensors at this time to expect great progress to occur in the near future. Animals, such as dogs, possess a sense of smell vastly much more sensitive than humans. Ants track each other by a scent trail! Yet man has not yet produced small and inexpensive chemical analysers (smell is a largely chemical process) that can meet the complex sensing requirements of smell detection.

Mathematical Modelling of Body Functions

Medicine is basically a discipline of analysis in which the physiological functions are slowly analysed as their operation becomes better known. Once the parameters of the situation are discovered, control can be brought about by synthesis of man-made chemicals and structures. Much of medical knowledge is the result of experimental observation and trials.

A more recent approach, added to the methods used, makes use of mathematical models. These models are block-diagrams, generated by the operator, in which suitable mathematical equations define the input-output relationship of the black boxes thought to be a suitable realisation. As models are raised, they are tested overall by entering input data and equation constants and comparing the output to the real-life situation. Interaction of equation forms and constants continue until close agreement with reality results.

Many complex processes, especially in medicine, are only measurable at various points in the process. For example, the effect of an administered drug is known in terms of certain output behaviours. But there are points within the physiological process that are not measurable due to the nature of the process. Mathematical modelling is valuable here because the data within the model, that is equivalent to the real process, may be available. It is not quite as easy as that for within the model the operation, although analogous, may not be quite the same in nature. Nevertheless, information learned about the interior structure of the model may provide useful insight and even suggest other parameters than *can* be measured on the living body.

At present, considerable research is being undertaken on such models as those of the respiratory system – oxygen input, oxygenated blood output; and on the sugar-urine process involving kidney action. In areas such as these we find multi-disciplinary teams at work – mathematicians, process engineers, measurement systems analysts, chemists and medical practictioners.

Far into the future we should possess computers with vast memory holding a mammoth mathematical model of the human body. Unusual complaints will be studied painlessly and safely by operating upon the model, not the patient, and at a speed in which the computation process speed is vastly faster than the real-time effects in the body.

Scanners

X-ray and nucleonic diagnostic methods have the valuable feature that certain internal structures of the body can be seen. But all such methods lack the spatial resolution we obtain by visual examination with the unaided eye or through a microscope. A nuclear radiation source set-up within the body provides a rather diffuse output picture. Resolution is improved by increasing the number of individual elements at the sensing stage. The gamma camera, for example, provides two-dimensional pictures using over thirty scintillometers connected in such a way as to provide many more picture elements. The latest development senses the body area by scanning multiple sensors thereby collecting yet more data in a given time. Sophisticated processing is then used to provide video screen outputs which contain much more useful information than ever before. Similar techniques apply to X-ray, nucleonic and ultrasonic signal transmission. Now that vastly more powerful data processing capability exists the future development will be to incorporate many more sensors of the same kind and make more effective use of three-dimensional data. Other variables, such as, say, thermal emission will also be incorporated along with systematic experience gained into the processing, all this to providing data conversion for a more meaningful measurement process.

Surgery

Electrical methods in surgery traditionally include endoscopes with which to see into inaccessible places and cauterizing probes for sealing blood flow, cutting and destroying cells where need be. The recent introduction of the laser as a cutting tool has most valuable properties. Selection of the appropriate wavelength decides which kind of body tissue will be cut. For example, it is possible to weld the retina of the eye through the pupil without need for surgery. The radiation is only absorbed be retinal material, the pupil and fluid of the eye ball being transparent to the wavelength used.

The selective property of narrow-band radiation will enable some highly precise surgical operations in the future. An operation might go as follows: a rigid framework holds the patient fixed with respect to an x-y-z translating pulsed laser operating head. Wired to the control unit of the translator are electrodes fixed to the body. These sense when low-power sensing pulses are energising the specific part of the body required to be operated upon. The unit scans until sensing signals (operated by a non-cutting wavelength source) verify the location of the beam. Once at such a point the laser is switched to full cutting power continuing to cut as the time-multiplexed sensing signals indicate position is satisfactory.

Looking back, electro-medical apparatus has only been with us for a mere 50 years. In the last 10 years of that time we developed inexpensive and very powerful data processing methods. The next 25 years are likely to unfold undreamed of aids to medicine many of which we would regard as miraculous if we heard about them today.

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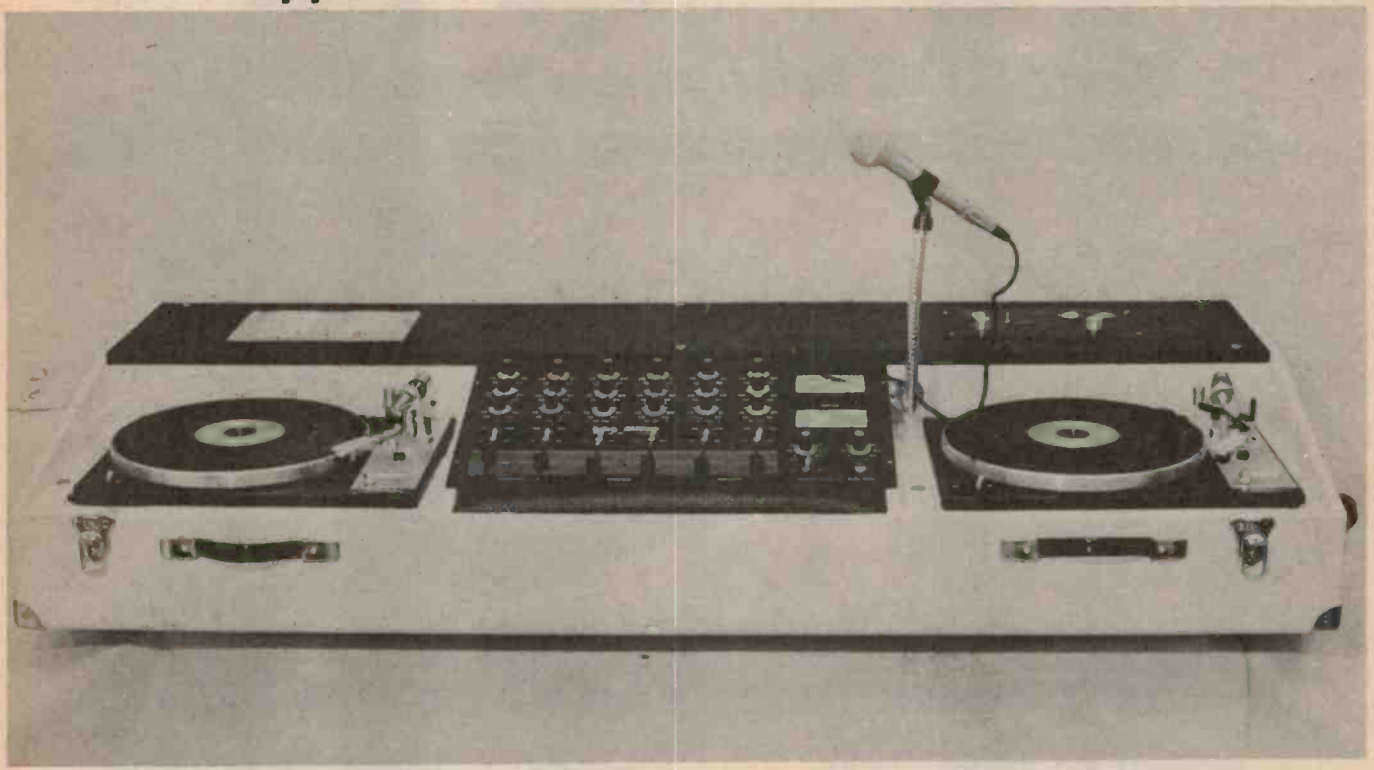

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74C10	.35	74C154	3.15	74C195	2.26
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THROUGH THE GRAPEVINE

Rumour going about through the industry is that Heathkit who thus far haven't shown much interest in micros, are preparing to release a micro-computer based on Digital Equipment Corp's LSI-11 microprocessor. Now, DEC are the world's largest and probably most experienced manufacturer of minicomputers, and the LSI-11 (which uses the same instruction set as their PDP-11 range of minis) is a really powerful machine with lots of software support. So, if Heathkit introduce a computer based on the LSI-11 the waves will be felt around the world for quite a long time.

COURTLY DANCING AIRS

Out come another round of marriages in the high society of micros: Motorola have successfully courted Mostek and will reportedly give birth to a new version of the F8. AMD, on the other hand, have decided against the F8 in favour of the Intel 8048, another single-chip MPU. Incidentally, we notice that Imsai have released a single-board computer based on the 8048, and designed for controller applications. More details later.

HOBBY COMPUTING CONFERENCE

'Microprocessors – A Rethink in Computing' is the title of a two-day conference being sponsored jointly by the Australian Computer Society and Canberra College of Advanced Education. Aimed largely at the personal computer hacker, whether hobby motivated or trying to do things in education, the conference will comprise a series of lectures, contributed papers and workshops with an attached exhibition and demonstrations. The fee for members of the ACS will be $15, and further details can be obtained from the Secretary, Ms. Sandra Harding on Canberra 470-544.

IMSAI 8048

The IMSAI 8048 control computer features an eight-bit CPU (i.e. the Intel 8048) with BCD arithmetic capabilities 1 k of ROM, 64 words of internal RAM, interrupt, oscillator and clock driver circuits and an internal timer and event counter. Two versions are available: one has the system monitor on 8048 itself, while the other has the monitor on an EROM, so that it can be altered. Also on the board (8½" x 10"), are 12 quasi-bidirectional I/O lines, with handshaking, 14 regular I/O lines, 5 heavy-duty relays, and a 9-digit LED display with keyboard. To complete the system there are 1K of RAM and a cassette interface. US prices are $249 with ROM and $399 with EROM.

FORTRAN FOR 8080

Microsoft, of Albuquerque, New Mexico, who originally wrote the Altair 8800 BASIC, have now introduced a Fortran IV compiler. As this is a very important factor in the small business systems market, Microsoft are being inundated with inquiries from one or two well-known microcomputer manufacturers, i.e. MITS, IMSAI, and Cromemco. But don't get too excited just yet; Fortran compilers just don't come cheap.

SIGNETICS INTERFACES

Philips are now sampling two advanced peripheral interface chips which match the 2650 MPU but will probably operate with most 8-bit micros. The 2651 is a universal synchronous/asynchronous data communications controller which contains a baud-rate generator, a modern controller, data transmit and receive buffers and support control logic. The baud-rate generator is software programmable and the 2651 will operate in full- or half-duplex modes.

The 2652 universal synchronous receiver/transmitter is an advanced data communications device which can handle three categories of protocols: *bit-oriented*, such as synchronous data link control (SDLC); *control character*, like IBM's Bi-Sync; and *byte count*, such as digital data communications message protocol (DDC MP). It offers a wide range of software controlled features, and is fully TTL compatible, operating from a single 5V supply.

Z-80 M.D.

A new arterial tonometer (a gadget for measuring and displaying arterial blood pressure) developed by Nicolet Instrument Corp. of Madison, Wisconsin, incoporates a microprocessor to give the device impressive control and display facilities. Previously, doctors have used a surgically-inserted catheter connected to a pressure transducer to display the pressure inside the artery, but this new machine uses a silicon transducer strapped to the wrist to measure the dilation of the artery wall, and displays the resultant waveform on the screen of a Tektronix scope. The inclusion of the Z-80 enables the tonometer to calculate blood pressures and heart rate. Definitely a machine for the faint of heart.

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The 8080 Instruction Set

IN MICROBIOLOGY THIS MONTH we finish our discussion of the 8080. In a previous issue we looked at the internal structure of the chip to try and gain an insight into how it works.

This month we look at the 8080 more from a programmer's point of view and examine the 8080's instruction set. By instruction set we mean the collection of instructions or commands that enable the 8080 to perform its many different tasks. As far as the 8080 is concerned these instructions are binary signals that flow into it via the data bus as different voltage levels. For convenience the manufacturer has given these instructions names such as MOV M,r or LDAX rp. Each instruction is different from all the other instructions and by grouping together an appropriate collection of instructions the programmer forces the 8080 to perform whatever task he wants it to do. Such a collection of instructions is called a program and the realm of the programmer is referred to as Software.

LOGICAL GROUPING

For convenience the basic instruction set of the 8080 can be broken into five groups. These are:—

Data Transfer Group — these instructions cause the contents of the 8080's internal registers to be moved around. For example the contents of one register (say the A register) are loaded into another (say the B register) or between a memory location and a register.

The Arithmetic Group of instructions cause arithmetical operations to be performed on data in the 8080's registers or in memory. For example such basic operations as ADD, SUBTRACT or INCREMENT are performed.

The Logical Group is like the arithmetic group except logical operations are performed instead of arithmetical operations. Such operations would be the AND, EXCLUSIVE OR and COMPLEMENT DATA operations.

The Branch Group are conditional and unconditional jump instructions, sub-routine call and return instructions. These are the instructions that are used by the 8080 as part of its decision making ability.

Stack, I/O and Machine Control Group include I/O instructions, Stack maintenance instructions and internal control flags.

A list of these instructions is shown in Fig.1. To better understand this list refer back to the block diagram of the 8080 included in the first part of this article and note in particular the sections referred to as the Register Array and Accumulator.

DETAILS

Now let's look at the structure of an instruction in more detail. Each instruction can be broken into two parts. The first part is referred to as the operation code (opcode for short) and the other part as the operand. The opcode tells the hardware part of the 8080 what it has to do, and the operand part is what the 8080 does it to.

Instructions acted upon by the 8080 are stored sequentially in memory and vary in length from one to three bytes. The op code is in the first byte and the 8080 will always process it first to decide whether it needs to access memory again to complete the current instruction.

Generally the operand part of the instruction is an address, the address of the data to be acted upon. Note also that while an instruction has only one opcode it can have more than one operand. Consider the example MV1 M, data. Execution of this instruction causes the content of the 2nd byte, that's 'data', to be loaded into the memory location whose address is in registers H and L. The operand part of this instruction involves 'data', H and L registers and a location in memory.

ADDRESSING MODES

The 8080 has four different modes of addressing the data stored in memory or in its registers. They are:-

DIRECT MODE — bytes 2 and 3 of the instruction contain the exact memory address of the data that is to be acted upon. For example, 'LDA addr'. Here the contents of the memory location whose address is specified in 'addr' (bytes two and three) is loaded into register A.

REGISTER INDIRECT — here the instruction specifies a register pair which contains the memory address where the data to be acted upon is located. For example, 'MOV M, B' causes the contents of register 'B' to be moved to the memory location whose address is in registers H and L.

Note that this instruction needs only one byte of memory to hold it, yet it is capable of operating on any one of the 64K possible memory locations of the 8080. Programs using this class of instruction are both compact and fast. The 8080 has a number of these instructions and for this reason is quite powerful.

REGISTER — here the instruction specifies the register or register pair in which the data is located. The instruction 'INR C' is an example of this type of instruction. Its execution causes the contents of register 'C' to be increased by 1.

IMMEDIATE instructions contain the data itself. This is either an 8 bit or 16 bit quantity. These instructions also contain an implied operand, for example execution of 'CPI data' causes the contents of the second byte of the instruction (i.e. 'data') to be compared to the A register and if they are equal, a flag is set to 1. Here the operands are 'data' and register A.

An important ability of a microprocessor is its ability to make branches in its program. Of particular importance is the conditional jump or branch instruction. These specify an operation to be performed only if certain conditions have been met, for example jump to a different part of the program if the result of the last operation was zero. These conditional instructions provide a program with decision-making capability.

Fig. 1 THE 8080 INSTRUCTION SET

r stands for register eg A register
rp stands for register pair, eg b and C registers
'data' means the contents of the second or second and third bytes of the instruction
M stands for memory whose address is in the H and L registers

DATA TRANSFER GROUP

MOV r1, r2	Move register to register
MOV M, r	Move register to memory
MOV r,M	Move memory to register
MVI r, data	Move immediate (to register)
MVI M, data	Move immediate (to memory)
LXI rp, data 16	Load immediate (to register pair or to stack pointer)
STA addr	Store direct (accumulator to memory)
LDA addr	Load direct (memory to accumulator)
XCHG	Exchange H&L with D&E registers
STAX rp	Store accumulator indirect (with address in registers B&C or D&E)
LDAX rp	Load accumulator indirect (with address in registers B&C or D&E)
SHLD addr	Store H&L direct
LHLD addr	Load H&L direct

ARITHMETIC GROUP

INR r	Increment register
DCR r	Decrement register
INR M	Increment memory
DCR M	Decrement memory
ADD r	Add register to A
ADC r	Add register to A with carry
SUB r	Subtract register from A
SBB r	Subtract register from A with borrow
ADD M	Add memory to A
ADC M	Add memory to A with carry
SUB M	Subtract memory from A
SBB M	Subtract memory from A with borrow
ADI data	Add immediate to A
ACI data	Add immediate to A with carry
SUI data	Subtract immediate from A
SBI data	Subtract immediate from A with borrow
INX rp	Increment register pair (or stack pointer)
DCX rp	Decrement register pair (or stack pointer)
DAA	Decimal adjust A (gives two BCD digits)
DAD rp	Add B&C, D&E or H&L to H&L

LOGIC GROUP

ANA r	AND register with A
XRA r	EXCLUSIVE-OR register with A
ORA r	OR register with A
CMP r	Compare register with A
ANA M	AND memory with A
XRA M	EXCLUSIVE OR memory with A
ORA M	OR memory with A
CMP M	Compare memory with A
ANI data	AND immediate with A
XRI data	EXCLUSIVE-OR immediate with A
ORI data	OR immediate with A
CPI data	Compare immediate with A
RLC	Rotate A left
RRC	Rotate A right
RAL	Rotate A left through carry
RAR	Rotate A right through carry
CMA	Complement A
STC	Set carry
CMC	Complement carry

BRANCH GROUP

JMP addr	Jump unconditional
Jcond addr	Jump on condition specified (carry, no carry, zero, no zero, positive, minus, even or odd parity)
CALL addr	Call unconditional
Ccond addr	Call on condition specified (see above)
RET	Return
Rcond	Return on condition specified (see above)
RST	Restart
PCHL	H&L to program counter

STACK, I/O AND MACHINE CONTROL GROUP

HLT	Halt
IN port	Input (from port to A)
OUT port	Output (from A to port)
PUSH rp	Push register pair on stack (in memory)
PUSH PSW	Push A and flags on stack
POP rp	Pop register pair off stack
POP PSW	Pop A and flags off stack
XTHL	Exchange top of stack with H&L
SPHL	Move H&L to stack pointer
EI	Enable interrupts
DI	Disable interrupts
NOP	No op

To this end the 8080 has five conditional flags that are affected by the execution of instructions. They are the Zero, Sign, Parity, Carry and Auxiliary/Carry flags and are each represented by a 1 bit register in the 8080 chip. Execution of certain of the 8080's instructions causes one or more of the flags to be set (forced to a 1 state) or reset (forced to a 0 state).

To illustrate how the flags are used consider the immediate class of instruction ADI 20. This instruction causes 20 to be added to the A register and if the result of this turns out to be zero, then the zero flag is set to 1, otherwise the zero flag is reset to 0. Should the addition result in the most significant bit of the A register becoming a 1, then the sign flag would be set to 1 (Modulo-2 representation of a negative number). This also demonstrates that one instruction can act on more than one flag.

All the instructions in the Arithmetic and Logic group shown in Fig. 1 affect the flags. There are some 39 different instructions (we count only once the instructions with the same operation code but different operand, i.e., INR A and INR C are counted only once).

Just toggling the flags is of little use on its own so the 8080 has a special group of instructions that can test a flag to see if it is set or reset. Then depending on the outcome of the test the 3080 goes one of two ways in program. Going one way the 8080 could, say, send a 1 to an output port and operate a relay to turn on a lamp, going the other way it would output a zero to the port and turn off the lamp.

BRANCHES

The instructions that check then respond to a test belong to the Branch group. Figure 1 shows that there are 8 instructions in this group, and three of these are conditional branch instructions, that's to say they are the ones that test the flags to decide whether or not to branch. Since these three instructions need to test only one flag and there are five flags the actual number of different instructions expands to 24. Why 24 and not 15? Well the 8080 tests a flag for two conditions not one, that is branch if

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flag is set, or branch if flag is not set. Six instructions are lost, however, because the test Carry and no Carry looks at both the Carry flag and the Auxiliary Carry flag combined.

The fifth in the grouping of instructions is the Stack, 1/0 and machine control group. This last group is used by the programmer to control communications between the 8080 and the outside world. Also in this group are instructions to manipulate the Stack.

STACKING THINGS UP

The Stack on the 8080 is a reserved area of the main memory and so is external to the 8080 chip. The 8080 keeps track of where the stack is by maintaining a Pointer register (called a Stack Pointer) that contains the address of the most recent stack entry. Having an external stack allows the processor virtually unlimited subroutine nesting (or at least until the memory is used up).

The stack is in fact a last in – first out memory used for temporary storage of data. Both the 8080's internal control logic and the programe can use the Stack. The 8080 uses it to save the return address when a call instruction is executed or an interrupt occurs.

The programmer can use the stack with the Push, Pop, XTHL and SPHL instructions. When you push data on to a stack it means you are storing data in the stack and popping data off a stack means you are getting data back from the stack i.e., data pops out. At a particular point in a program it might be necessary to use the A reg but it might already have data in it to be used later. Then to save that data the program executes a Push A and later when the data is needed again a Pop A is used to recover it.

Note also that the value of the stack pointer can be incremented, decremented or set to any value by instruction from the Data Transfer and Arithmetic group.

IN, OUT, IN, OUT . . .

Within the fifth group are the In and Out instructions. These two allow the transfer of data between the 8080 and the outside world. All data transfers using these instructions take place via the A register, with the 'data' being sent over the 8 bit data bus. These instructions are two bytes long with the second byte the operand. This allows the in/out instruction to specify any one of 256 different peripherals. So that the peripheral knows it has been selected, the value of the operand is sent out on the address bus where it can be interrogated by the peripheral.

Of course peripherals can also be set up to look like memory but this does not involve the use of the In and Out instruction and will not be looked at here.

STOP TALKING WHILE . . .

The remaining instructions in the fifth group control the interrupts. An interrupt occurs when an external device signals the 8080 that it requires attention. When the 8080 acknowledges the interrupt it suspends main program execution and automatically branches to a program that looks after the external device. This device could be a line printer or something much simpler, like a switch that operates when a window or door is opened.

To control the 8080 interrupt there are two instructions, EI and DI. The first enables or allows the 8080 to respond to an interrupt when it occurs while the other disables or prevents it from responding to the interrupt. A third instruction is the so-called software interrupt. This is a special one-byte Call instruction (the normal call or jump to subroutine instruction takes 3 bytes) and is called the Restart (RST) instruction. A variable three bit field contained in the one byte op code enables the interrupting device to direct a Call to one of eight fixed memory address. These addresses would have been loaded with the first instructions of a routine designed to service the requirements of the interrupting device.

This has been a very brief and limited description of the 8080. To those who would like to know and understand the 8080 better we recommend that you purchase a copy of the Intel 8080 Microcomputer Systems User's Manual.

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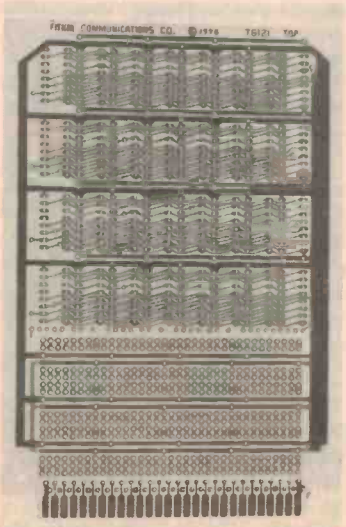

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74LS03	.45	74LS30	.45	74LS92	1.65	74LS181	2.30
74LS04	.45	74LS32	.51	74LS93	1.65	74LS192	2.95
74LS05	.45	74LS37	.51	74LS109	.75	74LS193	2.95
74LS08	.45	74LS38	.51	74LS113	.70	74LS194	2.40
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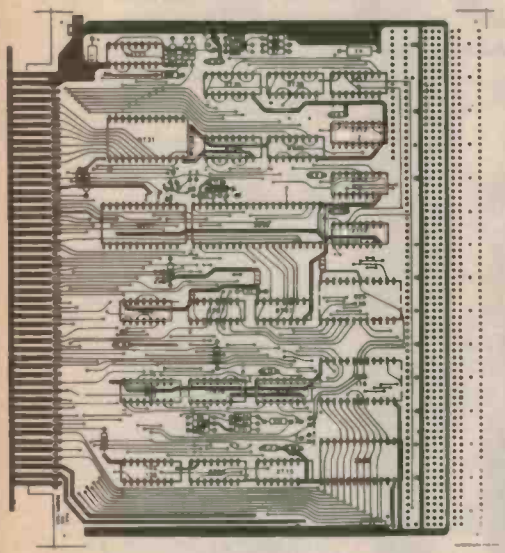
MICROPROCESSORS

2650: A VERY REAL HOME COMPUTER



"BYTE" Magazine recently described the 2650 as the "unsung hero of the hobby market". Osborne refers to the 2650 as the "most minicomputer like" device of all the microprocessors described in his classic book "Introduction to Microcomputers".

Software is rapidly becoming available. A resident assembler has now been released and we understand 2650 BASIC will soon be available for the 2650. Extensive program development in both USA and Europe has already produced a substantial software base.

Why the sudden interest in the 2650? It is easy to use, easy to program, efficient to program, very powerful, and readily available and now backed by the immense resources of Philips worldwide.

BABY 2650

If you have access to a terminal (VDU, teletype etc.) you can't beat this kit as an ideal starting point. Supplied with the 1K PIPBUG ROM and 256 BYTES of RAM the BABY 2650 is very easy to get running after a couple of hours assembly time. As an exclusive we supply sample programs to run and full programming documentation.

BABY 2650 KIT $75.00 post & pack $2.50

2650 EXPANDER KIT

Want to convert your BABY 2650 to a fully buffered CPU?

This kit enables you to transfer your components to a top quality plated through hole PCB with adequate provision for system expansion.

The kit includes a complete documentation package with detailed notes on

MEMORY ORGANISATION	OPTIONAL MEMORY CONFIGURATIONS
I/O PORT DECODING	BUS & CONTROL LINE BUFFERS
CLOCK REQUIREMENTS	MEMORY EXPANSION
STEP MODE OPERATION	I/O PORT INTERFACE DESIGN EXAMPLES

When fully equipped the ATI 2650 card provides 1 serial interface, 2 parallel 8 bit ports, 1K ROM, 1.5K RAM, full system buffering on all lines, 100 pin edge connector, 24K direct addressing capability and becomes a very useable CPU module.

2650 EXPANDER KIT (PCB, edge connector complete documentation) $45.00 plus $2.50 p & p

MINISCAMP-8

Based on John Kennewell's design in EA the Applied Technology MINISCAMP 8 is an ideal starting point for those who don't have access to a terminal.

The MINISCAMP-8 uses the new N top quality printed circuit boards logically laid out so the student can readily understand the operation. The board has PROVISION for MEMORY EXPANSION and a TELETYPE INTERFACE OPTION to simplify expansion.

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The MINISCAMP-8 uses the new IV Channel SC/MP and considerably simplifies the power supply requirements. Our EXCLUSIVE user manual and programming guide is supplied with each kit.

MINISCAMP-8 Complete kit with documentation package **$79.50**

POWER SUPPLY (5V) components **$11.50**

Please add $2.50 for certified p & p

CT750 CASSETTE INTERFACE

The CT750 is a complete cassette interface based on the KANSAS CITY standard adopted by the USA hobby market.

A major advantage of the design of the CT750 is that it can be readily used at other baud rates including 110 baud, 300 baud and even higher with careful adjustment.

The CT750 is supplied assembled and tested with full alignment instructions should you need to re check the performance at any time. Provision is made internally for

INTERNAL CLOCK
EXTERNAL CLOCK
RECOVERED CLOCK (preset for 4800Hz)

and LED status indicators considerably simplify the operation. The CT750 is ideally suited to the 2650 (with PIPBUG routines) and MINISCAMP with a suitable bootstrap loader program.

CT750 Cassette Interface assembled and tested **$39.50** P & p $2.50

PROJECT 632 VDU

This is an ideal terminal for a home computer system. As described in ETI this popular kit can be assembled by anyone with reasonable experience in electronics. You can now build the kit on a modular basis as described in the article or if you prefer we have now produced a slimline economy version which consists of the same component layouts on 2 large fibreglass boards (14" x 6") and requires all the various inter connections be made with direct wire links.

MODULAR VDU

PACK 1	632 A,B control logic $29.50	PACK 5	632 UART interface $21.75
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PACK 3	632 M 1K x 8 memory $32.50	PACK 7	632 PS power supply $ 7.50
PACK 4	633 SYNC with modulator $17.75	PACK 8	TRANSFORMER $ 8.50

ECONOMY VDU

632 C complete kit with full instructions $135.00

Please add $2.50 to cover packaging and certified post for one or more packs ordered at the same time.

SM4000 ECONOMY 4K x 8 BASIC RAM KIT

Here is a simple to use, low cost universal RAM module. Does your microprocessor need some more memory? Designated as the SM4000 this RAM is ideal for use with 2650, SC/MP and many other popular processors.

The SM4000 uses a 10" x 5" card size and gold plated 100 pin edge connector compatable with the S100 buss currently proposed as the Australian Standard. The ingenious feature of the design of the SM4000 is that it can be operated on separate data 1/0 bus or bidirectional data lines.

Electrically the SM4000 requires only a single +5V supply. Provision has been made to add on-card regulators if required although these are not supplied with the basic kit. All address lines are fully tristate buffered as are the data input and output lines. Full address decoding is provided so you can locate this memory module at any 4K boundary in your microprocessor memory space. A very useful write protect facility is also provided so you can protect the contents of memory against unwanted erasure.

The SM4000 RAM uses a double sided epoxy glass circuit board with gold plated edge connectors. Top quality low profile sockets are provided for all IC's and all interconnections between the memory IC's are pre-etched ready for soldering. The actual allocation of address, data, control and memory select lines are to be wired according to the specific requirements of the constructor.

The SM4000 is supplied as a complete kit including PCB sockets, 32 prime quality 650ns 2102 RAMS, buffers and logic together with full application details and assembly notes.

SM4000 4K x 8 RAM $99.95 (p & p $2.50)

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KITS FOR ETI PROJECTS

We get many enquiries from readers wanting to know where they can get kits for the projects we publish. The list below indicates the suppliers we know about and the kits they do.

Any companies who want to be included in this list should phone Steve Braidwood on 33-4282.

Key to companies:

- A Applied Technology Pty. Ltd. of Hornsby, NSW.
- C Amateur Communications Advancements, PO Box 57, Rozelle, NSW.
- D Dick Smith Pty. Ltd. of Crows Nest, NSW.
- E E.D. & E. Sales, Victoria.
- J Jaycar Pty. Ltd. of Haymarket, NSW.
- L Delsound Pty. Queensland,
- N Nebula Electronics Pty. Ltd. of Rushcutters Bay, NSW.
- O Appollo Video Games of Hornsby, NSW.
- P Pre-Pak Electronics of Croydon, NSW.

PROJECT ELECTRONICS

ETI 043	Heads or Tails	A
ETI 044	Two-Tone Doorbell	A
ETI 061	Simple Amplifier	A
ETI 064	Intercom	A
ETI 066	Temperature Alarm	A
ETI 068	LED Dice	A

TEST EQUIPMENT

ETI 101	Logic Power Supply	E
ETI 102	Audio Signal Generator	E,D
ETI 103	Logic Probe	E
ETI 107	Widerange Voltmeter	E
ETI 108	Decade Resistance Box	E
ETI 109	Digital Frequency Meter	E
ETI 111	IC Power Supply	E
ETI 112	Audio Attenuator	E
ETI 113	7-Input Thermocouple Meter	P,E
ETI 116	Impedance Meter	E
ETI 117	Digital Voltmeter	E,A
ETI 118	Simple Frequency Counter	E,A
ETI 119	5 V Switching Regulator supply	E
ETI 120	Logic Probe	L,E
ETI 121	Logic Pulser	L,E
ETI 122	Logic Tester	E
ETI 123	CMOS Tester	E
ETI 124	Tone Burst Generator	E
ETI 128	Audio Millivoltmeter	L,E
ETI 129	RF Signal Generator	L,E
ETI 131	General Purpose power supply	E,N
ETI 132	Power Supply	N

SIMPLE PROJECTS

ETI 206	Metronome	E
ETI 218	Monophonic Organ	E,D
ETI 219	Siren	E
ETI 220	Siren	E
ETI 222	Transistor Tester	E
ETI 232	Courtesy Light Extender	E
ETI 234	Simple Intercom	E
ETI 236	Code Practice Oscillator	E
ETI 239	Breakdown Beacon	E

MOTORISTS' PROJECTS

ETI 301	Vari-Wiper	E
ETI 302	Tacho Dwell	E
ETI 303	Brake-light Warning	E
ETI 309	Battery Charger	P,E
ETI 312	CDI Electronic Ignition	P,E
ETI 313	Car Alarm	E,D

AUDIO PROJECTS

ETI 401	Audio Mixer FET Four Input	E
ETI 402	Guitar Sound Unit	E
ETI 406	One Transistor Receiver	E
ETI 407	Bass Amp	E
ETI 408	Spring Reverb. Unit	E
ETI 410	Super Stereo	E
ETI 412	Music Calibrator	E
ETI 413	100 Watt Guitar Amp	P,L,E,J,D
ETI 413	x 200 Watt Bridge Amp	E
ETI 414	Master Mixer	E,J
ETI 414	Stage Mixer	E
ETI 416	25 Watt Amplifier	E
ETI 417	Amp Overload Indicator	E
ETI 419	Guitar Amp Pre-Amp	P,E,D
ETI 420	Four-channel Amplifier	L,E
ETI 420E	SQ Decoder	E
ETI 422	International Stereo Amp	L,E,D
ETI 422B	Booster Amp	E
ETI 422	50 Watt Power Module	E
ETI 423	Add-on Decoder Amp	E
ETI 424	Spring Reverberation Unit	L,E
ETI 425	Integrated Audio System	E
ETI 426	Rumble Filter	E
ETI 427	Graphic Equaliser	L,E,J
ETI 430	Microphone Line Amp	E
ETI 433	Active Crossover	E,J
ETI 435	Crossover Amp	E,J
ETI 438	Audio Level Meter	L,E
ETI 440	Simple 25 Watt Amp	L,E
ETI 441	Audio Noise Generator	L,E
ETI 443	Compressor-Expander	E,J
ETI 444	Five Watt Stereo	E,N
ETI 445	Preamp	J,E,D,A
ETI 446	Audio Limiter	J,E,A
ETI 447	Phaser	E,J,A
ETI 449	Balanced Mic Preamp	J,A
ETI 480	50W, 100W Power Amp	A,J,D
ETI 480 P	Power Supply	A,J,D
ETI 482A	Preamp Module	A
ETI 482B	Tone Controller	A

MISCELLANEOUS

ETI 502	Emergency Flasher	E
ETI 503	Burglar Alarm	E
ETI 505	Strobe	L,E,D
ETI 506	Infra-Red Alarm	E
ETI 509	50-Day Timer	E
ETI 512	Photographic Timer	E
ETI 513	Tape Slide/Synchroniser	E
ETI 514	Flash Unit — Sound Operated	E
ETI 515	Flash Unit — Light operated	E
ETI 518	Light Beam Alarm	E
ETI 522	Photographic Timer	E
ETI 523	Sweep Generator	E
ETI 525	Drill Speed Controller	E
ETI 526	Printimer	E
ETI 527	Touch Control Light Dimmer	E
ETI 528	Home Burglar Alarm	P,E
ETI 529	Electronic Poker Machine	E
ETI 533	Digital Display	L,E,A
ETI 534	Calculator Stopwatch	A,D
ETI 539	Touch Switch	E
ETI 540	Universal Timer	E
ETI 541	Train Controller	E
ETI 543	Double Dice	A
ETI 544	Heartrate Monitor	A

ELECTRONIC MUSIC

ETI 601 4600	Synthesiser	J
ETI 601 3600	Synthesiser	J
ETI 602	Mini Organ	E,A,D

COMPUTER PROJECTS

ETI 630	Hex Display	A
ETI 631	VDU Keyboard Encoder	A
ETI 632	VDU 1 k x 8 Memory Card	A
ETI 633	VDU Sync Generator	A

RADIO PROJECTS

ETI 701	TV Masthead Amplifier	E,D
ETI 702	Radar Intruder Alarm	D
ETI 703	Antenna Matching Unit	E
ETI 704	Crosshatch/Dot Generator	L,A,D,E
ETI 706	Marker Generator	E
ETI 707	Modern Solid State Converters	C,E
ETI 708	Active Antenna	E
ETI 710	2 metre Booster	C,E
ETI 711B	Single Relay Remote Control	A
ETI 711C	Double Relay Remote Control	A
ETI 711R	Receiver	A
ETI 711AR	Remote Control Transmitter	A
ETI 711DR	Remote Control Decoder	A
ETI 740	FM Tuner	A
ETI 780	Novice Transmitter	E

ELECTRONIC GAMES

ETI 804	Selecta-Game	O,A,D

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22uF	7c	8c	9c	11c
33uF	8c	9c	10c	13c
47uF	9c	10c	11c	14c
100uF	11c	12c	13c	17c
220uF	13c	17c	15c	20c
470uF	18c	23c	21c	32c
1000uF	24c	37c	31c	40c

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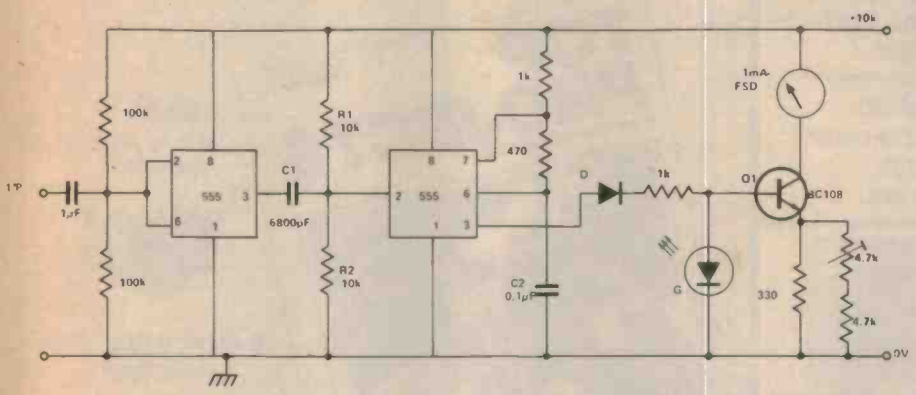
Ideas for experimenters

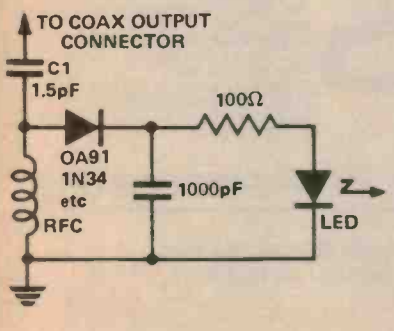
These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.
Electronics Today is always seeking material for these pages. All published material is paid for — generally at a rate of $5 to $7 per item.

SIMPLE ACCURATE FREQUENCY METER



This circuit provides a meter deflection that is strictly proportional to the frequency of the input signal over the range 10Hz — 300Hz. The first 555 timer IC is used as a Schmitt trigger, to convert the I/P signal to a fast-edge square wave. This is differentiated by the network C1, R1 and R2, and the resulting spikes used to trigger the second 555, which operates as a monostable, generating constant width pulses. These are used to turn on the constant-current source Q1, so that the average current in the meter movement is proportional to the number of pulses arriving per second. A green LED is used to bias the current source as this gives near-perfect temperature compensation; the 4k7 preset pot gives a fine adjustment for calibration purposes. When the 1 mA meter shown is used, fsd is given by 100 Hz. To extend the range, reducing C2 to .01μF gives an fsd of 1 kHz.

LED RF INDICATOR



An RF output indicator using a LED is very useful for monitoring the output of a transmitter. This circuit will give indication from a 5 W transmitter. The capacitor C1 and the RFC are chosen for the appropriate frequency. The RFC could be replaced by a resistor for wideband use. The sensitivity depends on the value of C1 and the resistor used if the RFC is replaced. For high power transmitters, C1 could be a small 'gimmick' capacitor.

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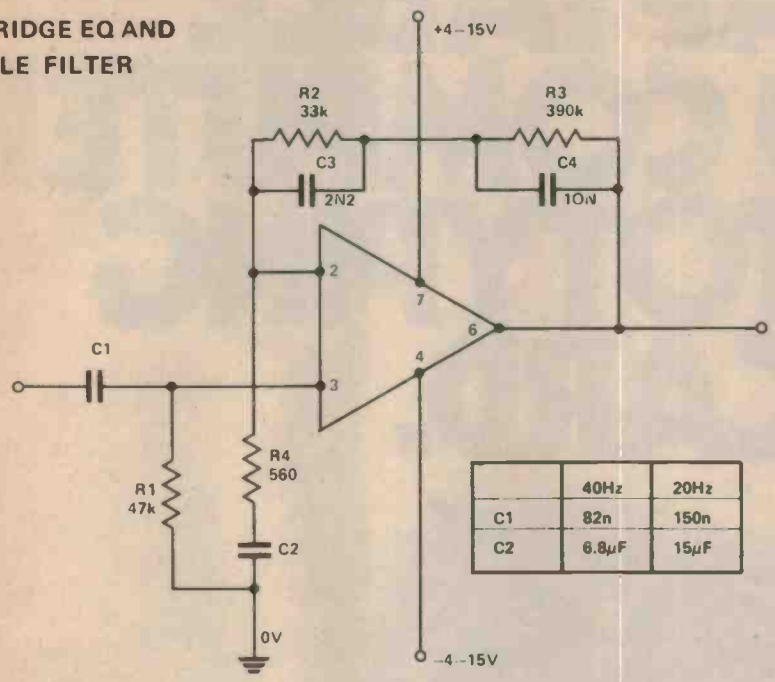
Ideas for experimenters

CARTRIDGE EQ AND RUMBLE FILTER



	40Hz	20Hz
C1	82n	150n
C2	6.8µF	15µF

In this circuit a 741 op amp is used to provide standard RIAA equalisation for a magnetic pick-up cartridge. The input signal is coupled via C1 into the non-inverting input of the IC. R1 damps the inherently high impedance at this point and provides the correct load for the cartridge. Feedback from the output, pin 6, is taken through the equalisation network R2, C3, R3 and C4 to the inverting input.

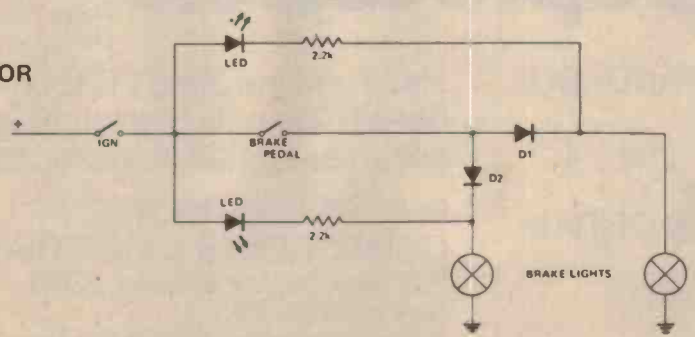
The ratio of R2 to R4 sets the mid-band gain at 65, 35 dB. C1 and C2 together form a steep cut rumble filter whose cut off point can be set at 20 or 40 Hz by selecting the appropriate component values in the table.

C2 also reduces the dc gain of the circuit to unity so that the output off-set voltage will be ±5 mV with reference to 0V.

One of the major disadvantages of discrete equalisers is overload distort-ion. Although the output of a magnetic cartridge may be only about 5 mV normally a musical peak may well force the cartridge output to 100 mV. Clearly unless a large signal swing is possible the sound emmanating from the speaker is not going to be Hi-Fi.

This circuit, operating from a ±15 V supply, has an overload factor of +35 dB referred to a nominal input of 5 mV, equivalent to a maximum input of 325 mV!

DC LAMP FAILURE INDICATOR



The very simple circuit here provides an on-if-good function for a lamp. D1 and D2 should be generously rated as they are outside the warning loop. On a car type D04 is recommended for mechanical support. If all the lights on a car are to be monitored the diodes can be mounted in blocks behind the lamp housing that the wiring harness reaches first. A 'line of light' type LED makes a convenient display.

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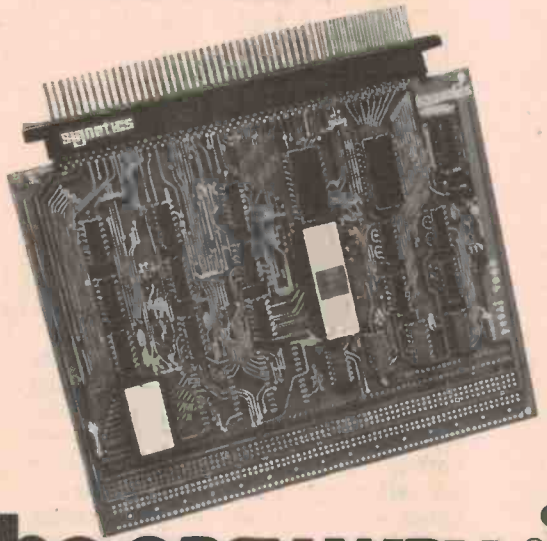

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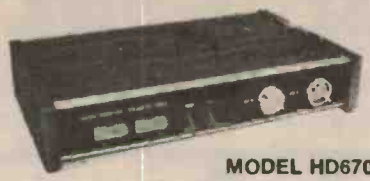

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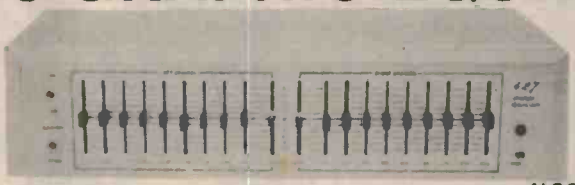

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WE MISSED SOME OUT!

Even though we held our catalog up by one month this year, some products were so new they missed the bus! Here are just a few of them, and some others which are really great value. If you haven't seen our catalog yet, they are available at our stores or dealers for just 75c per copy.

2 MEG ROCKS

Universally used as a reference source, these crystals are one of the most sought-after frequencies. Use for counters, marker generators, time & frequency standards, etc etc. They're Australian made (by Hy-Q) so they're top quality. Fill up your junk box — you never know when you'll want one! Cat. K-6028 .. .. $6.75

SAVE $3

$6.75

SAVE ON FORDS

Save over $10 by buying now! Last year's catalog price was $29.95. Now just $19.50! For a full scientific calc with mem. Ideal for taxation returns (you can claim it as a deduction!) Don't miss out, stocks are limited. Never again at this price!
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THE POSE MACHINE . . .
As well as being a high-performance CB to impress you, this beautiful wood-grain base/semi-mobile rig will be the envy of all your friends. You get the convenience of a dual supply rig, PLUS a digital clock, PLUS a built-in SWR meter — about $250 worth if bought separately. And it's only $30 more than the 882C! Fantastic value. (Licence required)
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Now $4.50 Save

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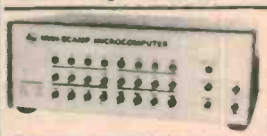
Multi 7 — Cat D-3007 .. .. $189.00
Don't forget to ask for the goodies!



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2SC1306
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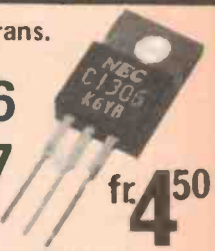

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Our stores will be closing for annual stocktake at the end of the financial year. Stores will close as follows:

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Melbn	Close 2PM	Open	Open
Brisbn	Close 2PM	Open	Open

We apologise for any inconvenience.

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See E.A. May 77 for project details.

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$254.00 PER PAIR

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DESIGNED BY NEVILLE WILLIAMS — EDITOR-IN-CHIEF OF ELECTRONICS AUST. MAGAZINE.

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$189.25

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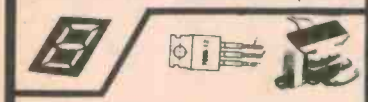

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.001, .0012, .0015, .0018, .0022,	9¢
.0027, .0033, .0039, .0047, .0056	9¢
.0068, .0082, .01, .012, .015,	11¢
.018, .022, .027, .033, .039, .04	11¢
.056, .068, .082, .1, .12, .15,	16¢
.18, .22	16¢

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.68, .82, 1.0,	55¢
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Greencap... 630 volt

.001, .0015, .0022, .0033, .0039,	13¢
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180, 220, 270, 330, 390, 470,	7¢
560, 680, 820, .001, .0012, .0015,	7¢
.0018, .0022, .0027, .0033, .0039,	7¢
.0047, .0056, .0068, .0082,	7¢

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2.2, 3.3, 4.7,	11¢	11¢
10, 22, 33,	13¢	15¢
47, 100,	18¢	22¢
220, 330, 470,	45¢	57¢
1000 uF	55¢	95¢

Electrolytics... Pigtail	25V	50V
2.2, 3.3, 4.7,	11¢	11¢
10, 22, 33,	13¢	15¢
47, 100,	18¢	22¢
220, 330, 470,	45¢	57¢
1000 uF	55¢	95¢

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DP8	Dalo resist pen	$2.38
FCA	500gm ferric chloride	$1.95
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TO4	20 yd .04 black tape	$1.60
TO8	20 yd .08 black tape	$1.60
TO6	20 yd .06 black tape	$1.60
D100	88 .1 x .031 donut	$1.45
D156	88 .156 x .031 donut	$1.45
T018	18 group of 3 leadouts	$1.45
TO5	18 group of 8 leadouts	$1.45
DIL14	16 groups of 14 pinouts	$1.45
DIL16	16 groups of 16 pinouts	$1.45
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formers-ferrites

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S195	Rf bandpass	$2.95
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F29	4mm to 30OMHz.	12¢
500	6mm to 10MHz.	10¢
900	6mm to 60MHz.	10¢
901	6mm to 200MHz.	10¢
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7101	722/4 can	16¢
DTV2	5000A can	30¢
DTV1	5000B can	35¢

PLESSEY

We are now disributors of Plessey components. Look at the selection!

WOOFERS

C300L05 (300 mm, 12 inch)
Nominal Impedance: 8 ± 15% (Ω)
Maximum Power: 50 (W)
Resonant Frequency: 25 ± 5 (Hz)
Effective Freq. Range: fo ~ 3500 (Hz
Sound Pressure Level: 92 ± 2 (dB/W
Flux Density: 6500 GAUSS

C250L07 (250 mm, 10 inch)
Nominal Impedance: 8 ± 15% (Ω)
Maximum Power: 40 (W)
Resonant Frequency: 32 ± 5 (Hz)
Effective Freq. Range: fo ~ 6000 (Hz)
Sound Pressure Level: 92 ± 2 (dB/W)
Flux Density: 8000 GAUSS

C200L04 (200 mm, 8 inch)
Nominal Impedance: 8 ± 15% (Ω)
Maximum Power: 30 (W)
Resonant Frequency: 46 ± 7 (Hz)
Effective Freq. Range: fo ~ 8000 (Hz)
Sound Pressure Level: 91.5 ± 2 dB
Flux Density: 9500 GAUSS

MID RANGE

C130M06 (130 mm, 5¼ inch)
Nominal Impedance: 8 ± 15% (Ω)
Maximum Power: 30 (W)
Resonant Frequency: 600 ± 90 (Hz)
Rated Freq. Range: 1200 ~ 15000 (Hz)
Sound Pressure Level: 94 ± 2 (dB/W)
Flux Density: 9000 GAUSS

D035M13 (35 mm, 1.4 inch)
Nominal Impedance: 8 ± 15% (Ω)
Maximum Power: 40 (W)
Resonant Frequency: 720 ± 110 (Hz)
Rated Freq. Range: 1500 ~ 18000 (Hz)
Sound Pressure Level: 89 ± 2 (dB/W)
Flux Density: 10000 GAUSS

C160M02 (160 mm, 6½ inch)
Nominal Impedance: 8 ± 15% (Ω)
Maximum Power: 80 (W)
Resonant Frequency: 220 ± 35 (Hz)
Rated Freq. Range: 500 ~ 6000 (Hz)
Sound Pressure Level: 91 ± 2 (dB/W)
Flux Density: 9200 GAUSS

TWEETERS

D025N15 (25 mm, 1 inch)
Nominal Impedance: 8 ± 15% (Ω)
Maximum Power: 30 (W)
Resonant Frequency: 1300 ± 240 (Hz)
Rated Freq. Range: 2600 ~ 22000 (Hz)
Sound Pressure Level: 88 ± 2 (dB/W)
Flux Density: 13000 GAUSS

HORNS

H016N06
Nominal Impedance: 8 ± 15% (Ω)
Maximum Power: 30 (W)
Resonant Frequency: 4000 (Hz) Max.
Rated Freq. Range: 5000 ~ 20000
Sound Pressure Level: 96 ± 2 (dB/W)
Flux Density: 10000 GAUSS

FOSTER

C300L05	$29.50	D035M13	$16.00
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Please Explain

Air-Powered Speakers

My grandfather says he remembers a loudspeaker enclosure driven by compressed air. Is he pulling my leg — or was there really such a device — and if so how did it work?

A.Y.P. Double Bay, N.S.W.

There were indeed such devices. We know of at least two! The basic principle was to modulate a stream of compressed air — generally at 20-25 psi via a gate valve upon which was impressed the audio information. The output was generally via a horn.

One system we know of was used mainly for public address systems and military installations — it was certainly in use in airfields as late as the 1940s.

Another device using this technique was an early gramophone called the Stentorphone. In this unit the tone arm mechanically modulated the gate valve. The air supply was via a rotary air compressor driven by a half-horsepower motor!

These air-powered speakers worked surprisingly well by the standards of their day. Output levels of well over 120 dB could be readily achieved and mid-range sound quality was very good. Harmonic distortion was pretty rough though unless the valve mechanism was very carefully adjusted.

Component Markings

I don't understand all the prefixes and suffixes used for marking electronic components — what's meant by 3k9 etc in a parts list. Does this mean the same thing as 3.9 k?

— J.M. Canberra, ACT

Suffixes 'k', 'm', 'M' etc after component values indicate a numerical multiplier or divider — thus

Multipliers
k = X 1000
M = X 1000 000
G = X 1000 000 000

Dividers
u = ÷ 1000 000
n = ÷ 1000 000 000
p = ÷ 1000 000 000 000

Where the numerical value includes a decimal point the traditional way of showing it was, for example, 4.7k. Experience showed that printing errors occurred due to accidental marks being mistaken for decimal points. The Standard now calls for the ex-suffix to be used in place of the decimal point. Thus a 4.7 k resistor is now shown as 4k7. A 2.2 μF capacitor is now shown as 2 μ2 etc.

TV Game

I'm having a great deal of trouble getting your TV game to work as it should. Apart from starting again from scratch with all new bits I don't know what to do. Have you any suggestions — several friends have built the thing and their's work perfectly.

K.G. Perth, WA

We have found that the TV game works more satisfactorily on nine volts rather than the five to eight volts suggested when the project was first published.

The local representatives (of the chip manufacturers) tell us that they have reason to believe that some of the chips sold for this project were factory rejects. They point out that no chips were obtained via their company. We have no evidence for this one way or the other but our experience is that in most cases 'faulty' games are usually cured by replacing the chip.

FERGUSON

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DIRECT CURRENT OUTPUT POWER POINT ADAPTORS TYPE "PPA"

- For connecting to 240V 50Hz mains supply.
- Manufactured to comply with Australian Standard C 126.
- Electricity Authority Approved.

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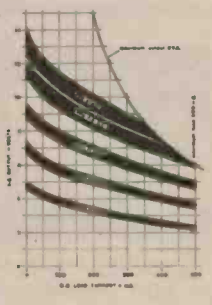
This range has been designed to provide filtered, unregulated D.C. suitable as battery replacements for small solid state equipment such as radio receivers, tape players, calculators, etc. with a power requirement not exceeding 3 V.A. (i.e. volts multiplied by amps).
The type numbers designate the voltage output at 300 Ma. However, the characteristics illustrated by the graph should permit the optimum selection to be made up to 500 Ma and 14 Volts within the above power limits.

HEIGHT 40mm
WIDTH 45mm
LENGTH 65mm
WEIGHT 0.3kg



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Metal BC197-8-9	15c
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Diodes 2.5A 50 V Glass	11c
2N3055	90c
Diodes 1A 400	11c

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½ W resistors 2 percent	8
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BOOKS

World transistor cross reference guide
Transistor specifications manual $5.60
Transistor data manual $2.80

SPEAKERS

All speakers freight on

Philips

AD 160/T81 dome tweeter 40W	$13.80
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Reasonable abbreviations, such as 25 Wrms, count as one word.

Private adverts only will be accepted. Please let us know if you find a commercial enterprise using this service.

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WANTED: Tape Equipment using discontinued RCA 4-track cartridge. Automotive player, preferably Pioneer TP60E. Recorder/player deck. Cartridges. I. Foran, Flat 1, 5/b Warburton St., Townsville 4810.

WANTED. Second-hand Ariunya colour pattern generator; 1A56057 AWA TV Calibrator. Condition and price G. E. Rand Electronics, 187 Tariton Street, East Devonport Tas. 7310.

For Sale E.A.130 receiver 3.5 to 7.5 MHz with E.A. 10 watt novice transmitter 3.5 MHz AM $200 Mr N. Mattick Hargraves 2850.

Farfisa Transicord. Electronic Organ Accordion with case and power supply unit. A1 condition $500 or best offer.Geoff McLean, 4 Pevensey St., Wendouree, Vic. Ph (053) 391178.

Hewlett-Packard HP65 programmable pocket calculator with Standard and Maths 1 program pacs. $400 or offer. R. Sanderson, 14/32 Flinders St. Mentone, Vic. 3194. Ph. 5501650

Sell, ETI 4600 synthesizer partially completed, worth $350, will accept $230. Must sell quickly. Contact Glenn Block, 19 Forfar Rd., H. Heights, Geelong 3215 Vic. 052-784884.

Wanted. Early American National communications Rx, NC100, NC240, or consider what you offer. Pse write Milton Woods, Unit One, 324 Mill Point Rd. South, Perth 6151.

Wanted to buy, two only 1mH audio frequency chokes. Contact L. Richardson, 2 Elberta St., Leeton, NSW. 53-3201.

Wanted to buy, two 2N277 transistors. Peter Wilkinson, 13 Wattle Terrace, Plympton Park 5038, SA.

SHARP EL1100 Full Scientific, trig, statistical functions, exponents, DMS conversion, memory. $29. M. Thomas, 4 Simcock Street, West Beach, SA. 356-9509 after 3pm.

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For Sale - Rambler 5 band radio. Good condition. Urgent Sale $40 o.n.o. with access. Contact G. Zerial, 65 Sherbrooke St., Ainslie 2602, Canberra. Ph. 477687

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Fexo-writer typewriter with full 8-hole dual readers and punches. Suitable, with conversion, for microprocessor. $150.00. Brian, 30 Kananook Ave., Bayview, NSW. Ph. 997-3547

Akai X-2000 S.D. 3-in-1 cass./cart./R to R player/recorder comp. with access, speakers, leads,etc. $800.00. S. Ethell, Bells Road, Grose Vale 2753. Ph (045) 721358

Wanted: Kitparts Ltd.(N.Z.) Homodyne HiFi tuner, as described E.A. July 1973. J. Thayer, 48 Alawa St., Waramanga, ACT 2611. Ph. (062) 881320 after hours.

Wanted: Directional Wattmeter, Bird or similar. State price and condition to Peter Birrell, VK5ZTT, Box 261, Mt. Gambier, SA 5290

Please urgently wanted two RCA No.3018 amp modules with data sheet if possible. L.Hollow, 844 Burke Road, Canterbury 3126 Vic.

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