

# electronics

## TODAY

INTERNATIONAL

Electronics Today International  
is Australian owned & produced

**SPECIAL  
OFFER**  
**CB**  
**TRANSCEIVERS**



**ELCASET**  
**FIRST EVER**  
**FULL TECHNICAL**  
**REVIEW**

*555 circuits P75.*

Registered for posting as a publication — Category C.

**50W  
& 100W  
Power Amp**

**Micro-  
computer  
Terminal-  
The Keyboard**

# Well stacked in front



The new range of JVC front-loading cassettes is here. And if you think that's the only change, you're highly mistaken. Because, as usual, JVC brings in the range with a few unique additions which are going to make you think twice about any other brand.

For a start, the JVC ANRS sound reduction system is incorporated throughout, to make hi fi recording and playback as free of hiss as possible. And in some cases, even improving the dynamic range of normal cassettes.

Another exclusive is the JVC Sen-alloy head, and believe it or not, it offers you the clearest sound and longest wearing lifespan of any head available; originally designed solely for

professional use, this head is now incorporated in JVC cassette decks CD-S200 and CD-1970.

And yet another first: JVC is the only manufacturer to provide decks with 5 LED peak-level indicators so that your recordings are perfect at all times. These are featured on models CD-1920 and CD-S200.

Loading is, of course, simplified. The special compartment is air-damped and removable for uncramped head maintenance.

The JVC famous range of top-loaders is still available, offering you the very highest quality. All things considered, there is no other consideration.



the right choice

For details on JVC Hi Fi Equipment, write to: JVC Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033.

# electronics TODAY

INTERNATIONAL



A MODERN MAGAZINES PUBLICATION

DECEMBER 1976, Vol. 6 No. 12

Editorial  
Publisher

Steve Braidwood  
Collyn Rivers

Electronics Today International is Australian owned and produced. It is published both in Australia and Britain and is the fastest growing electronics magazine in each country.

**WIN A TRIP  
TO THE  
SOUTH POLE!**

**DICK SMITH WANTS  
YOU ON HIS  
CRAZY TRIP**  
— see page 13.

COVER: We review the Elcaset — and we believe that we, along with our sister magazine, *Hi-Fi Review*, are the first to ever review this new system.

\* Recommended retail price only

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*Senses over — or under-temperature*

## FEATURES

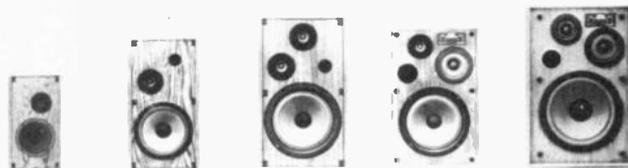
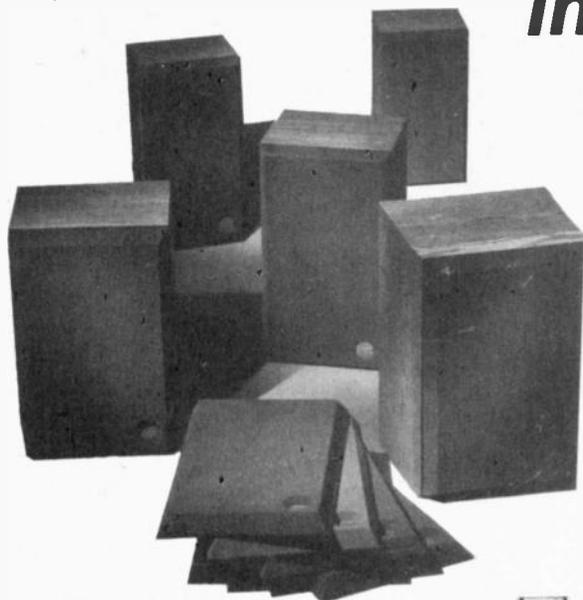
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# New from Altec ...

*elegant in design ... outstanding in performance*



MODEL ONE      MODEL THREE      MODEL FIVE      MODEL SEVEN      MODEL NINE

From the leader in Studio Monitors ... the new standard for the discriminating listener. All cabinets are natural North American hardwood veneers, hand-rubbed and oiled. Two-way and three-way systems. Choice of grille colours on selected models. For additional information, visit your local dealer or send for our catalogue.

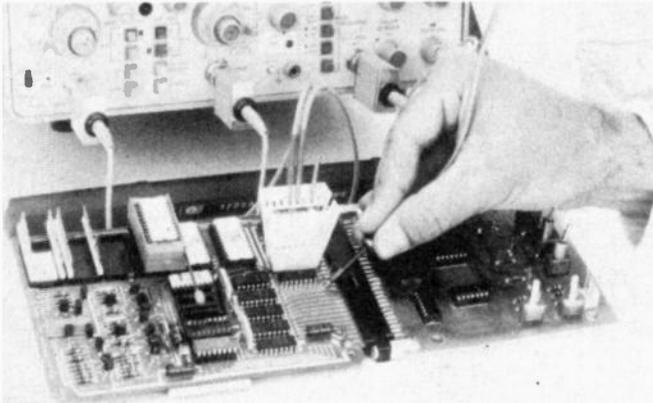
	MODEL ONE	MODEL THREE	MODEL FIVE	MODEL SEVEN	MODEL NINE
<b>SPEAKER COMPONENTS</b>					
<b>LOW FREQUENCY:</b>	8" bass driver	10" bass driver	12" bass driver	12" bass driver	12" bass driver
<b>MID FREQUENCY:</b>				6 1/2" frame cone driver	6 1/2" frame cone driver
<b>HIGH FREQUENCY:</b>	4" frame cone driver	4" frame cone driver	2 each 4" frame cone drivers	4" frame cone driver	5" frame cone driver
<b>NOMINAL IMPEDANCE:</b>	8 ohms	8 ohms	8 ohms	8 ohms	8 ohms
<b>CROSSOVER FREQUENCY:</b>	3000 Hz	1500 Hz	1500 Hz	850 Hz, 8 kHz	800 Hz, 7 kHz
<b>ENCLOSURE TYPE:</b>	Sealed	Vented	Vented	Vented	Vented
<b>FREQUENCY RESPONSE:</b>	50 Hz to 20 kHz	50 Hz to 20 kHz	45 Hz to 20 kHz	45 Hz to 20 kHz	40 Hz to 20 kHz
<b>OPERATIONAL POWER RANGE:</b>	12 watts to 75 watts 30 watts continuous	10 watts to 100 watts 35 watts continuous	12 watts to 150 watts 45 watts continuous	15 watts to 200 watts 50 watts continuous	12 watts to 250 watts 60 watts continuous
	Recommended for use with amplifiers between these levels				
<b>FINISH:</b>	Hand-rubbed oiled oak	Hand-rubbed oiled oak	Hand-rubbed oiled walnut	Hand-rubbed oiled walnut	Hand-rubbed oiled oak
<b>GRILLE:</b>	Acoustically transparent brown knit fabric mounted on removable frame	Acoustically transparent black knit fabric mounted on removable frame	Acoustically transparent black knit fabric mounted on removable frame	Acoustically transparent foam mounted on removable panel. Choice of black, brown, blue, or burnt orange	Acoustically transparent foam mounted on removable panel. Choice of black, brown, blue, or burnt orange
<b>DIMENSIONS:</b>	53.3cm H x 29.2cm W x 26.4cm D	60.9cm H x 31.8cm W x 29.2cm D	64.8cm H x 36.8cm W x 30.5cm D	63.5cm H x 40.6cm W x 35.9cm D	67.3cm H x 44.5cm W x 38.1cm D
<b>WEIGHT:</b>	10.4 kg	12 kg	14.5 kg	20 kg	25.4 kg

# KENT HI-FI

(WHERE THE BEST EQUIPMENT COSTS LESS)

410 KENT STREET  
SYDNEY  
ph: 29-2743

# NEWS DIGEST

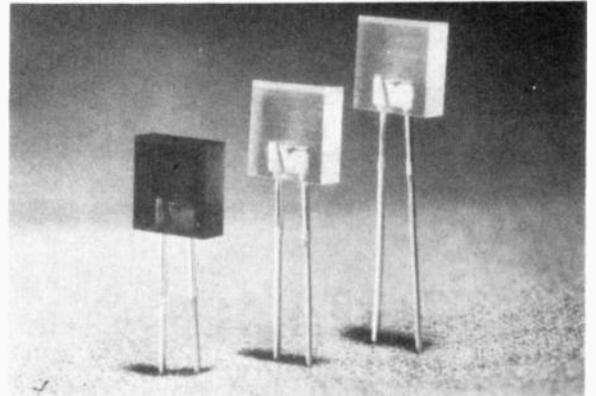


## IC PROBES

The first scope probes designed to connect readily to individual pins on modern DIPs without hazard of shorting are claimed by Hewlett-Packard.

HP's solution to the problem consists of a clip that encompasses an entire DIP and an ac-

companying set of demountable probes. The HP miniature divider probes are \$90 each. 1:1 probes are \$35. The companion 10024A IC Test Clip is \$15. Duty and sales tax are additional if applicable.



## FIRST RECTANGULAR LEDs

Ideal for flush mounted panel indicators and back-lighting for legends, these high-intensity solid state lamps are available in red, green and yellow. According to Hewlett-Packard, these indicators are the first available with a flat, high-intensity light-emitting surface. For prices contact Amphenol Tyree, on (02) 69-5264 or (03) 288-7099.

## CCD Exorciser?

Philips researchers in Holland are working on a CCD-based system which can cure multipath echo problems on TV. The system creates its own ghost and adds this, antiphase, to the video to cancel the interfering ghost.

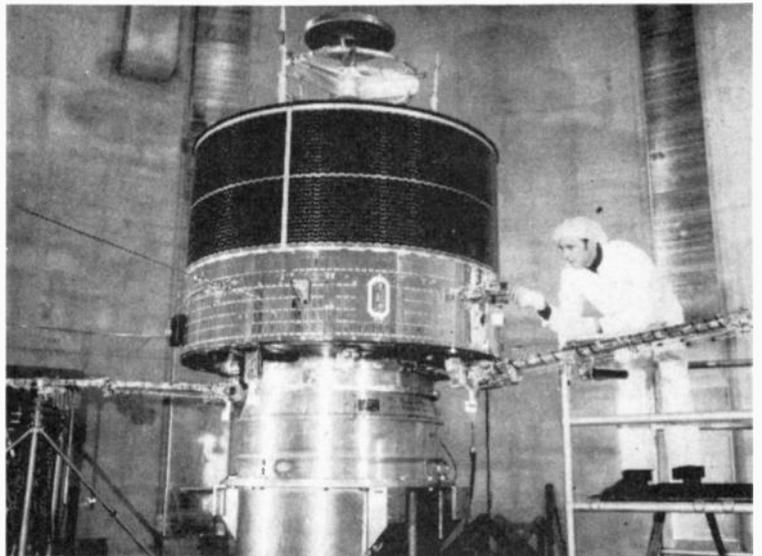
## VACATION JOB

An opportunity exists for an electronics student to work in the service department of Unitrex of Australia Pty Ltd, 105 Queen Street, Melbourne, for the vacation period. Please contact J. McFarlane or R. Stockdale on (03) 67 9121.

## Quad logic coming

Next year Signetics will introduce a family of non-binary logic devices which use integrated injection logic and current-mode thresholding for a four-level system (0,1,2,3). Later devices will be compatible with present binary logic devices.

Using these devices the information processing capability of bipolar LSI devices will increase 4 to 10 times (in theory the increase could be more like 1000 times!).



## SCIENTIFIC SATELLITE

Undergoing tests in an electro-magnetically 'clean' screened chamber at the Bristol space centre of British Aircraft Corporation in south-west England is GEOS — Europe's first geostationary scientific satellite. The satellite, due for launching from Cape Canaveral in April 1977, is being developed for the European Space Agency by the international STAR consortium of companies.

GEOS will carry seven experiments from the scientific centres of Europe and its mission will be to measure waves, fields and particles over a wide frequency and energy range in the Earth's magnetosphere. It will go into orbit more than 35 000 km above the equator and the information sent back from space will be distributed to scientists throughout the world. The 550 kg spacecraft is designed for a two-year working life.



**EMONA**  
enterprises

21 Judge St. Randwick  
NSW 2031 Ph. 399 9061

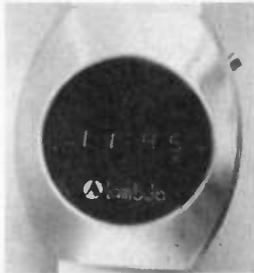
## SPECIAL XMAS OFFER

NEW ATTRACTIVE AND  
CHARMING ROOM MATE



**\$39.95**  
(P&P: Int. \$4.00,  
NSW \$2.50)

CR-102 is a 12/24 hour completely electronic digital clock radio — 100 percent solid state (MOS/LSI circuitry) with green tube display. Freq. range: AM= 530-1650 kHz, FM=86-110Mhz. Wake up to music or bird-sound alarm. It can be used as stop watch. Sliding tone, volume, alarm & brightness controls. Sleep and snooze button. AC power interruption indicator. Warranty 90 days.



FAMOUS  
"LAMBDA"  
SIX FUNCTION  
QUARTZ DIGITAL  
WATCH

Stainless Steel Case and Band

**\$39**  
(P&P \$1.00)  
Full 12 months  
manufacturer's warranty.

### CHARACTERISTICS

Crystal oscillation frequency: 32,768 Hz • Accuracy Monthly mean error  $\pm 5$  seconds when worn at normal temperature • Display system: Gallium arsenide phosphide LED display • Display capacity: Hour, minute, second, month, day and date ... by switching display • Calendar system: Auto calendar set to register 28 days for February • Set mechanisms: Time display mechanism & set mechanism • Main components: Quartz crystal oscillator & C-MOS-LSI • Battery: Silver oxide battery WL-11, RW-22 • Working temperature range: 10°C — 60°C (14°F — 140°F).

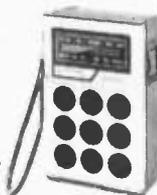


SC6010

**CALCULATORS**  
**ELCON RANGE:**  
scientific-statistic  
SC6010 — \$63.00 •  
Scientific SC44 —  
\$43.00 • **PANASONIC**  
• full scientific  
JE8410U — \$29.00  
• add 15 percent S.T. if  
applicable (P&P Inter.  
\$3.50 NSW \$2.00) • all  
calculators guaran-  
teed for 12 months.

**EMONA DHM-95 SOLID  
STATE**

**AM/FM  
POCKET  
RADIO**  
\$10.50  
(P&P \$1)



With large speaker — ex-  
cellent sound. Earphone  
and battery included.  
**Warranty 90 days.**

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Please supply ..... model/s  
My remittance for \$ ..... is enclosed  
Write, phone or call in

Name .....

Address .....

..... P/Code .....

# Disco Scene '76



SOUNDOUT Series III  
Inbuilt amplifiers in all models

To make your Disco alive, call the experts at

## CASHMORE SOUND

- \* 3 professional discotheque portable units
- \* Series III mono (170 watts)
- \* Series VI mono (170 watts)
- \* Series III stereo (2 x 170 watts)
- \* Mirror balls
- \* Motors
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- \* Colourtron Amplifiers
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- \* Strobes
- \* Smoke genies
- \* Bubble machines
- \* Projectors
- \* Jingle machines
- \* Speaker enclosures ) manufactured
- \* JBL-Altec-Etone
- \* Portable disco stands
- \* Microphones — Shure AKG, etc.
- \* Amplifiers — Crown, W/W, Bose, etc.

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Top D.J.s Available — Demonstration if required.



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SYDNEY AUSTRALIA

CASHMORE SOUNDOUT DISCOS

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Ph. (02) 798-6782, 798-5647. Dealers required in all states.  
FOR FREE CATALOGUE PHONE, WRITE, CALL.



Mr Paul Sangia, a blind Papuan-New Guinean, being trained at the Royal Blind Society of NSW on the latest STC Pentaconta PABX switchboard.

A combination of touch and sound enables a blind telephonist to operate this switchboard just as effectively as a sighted person.

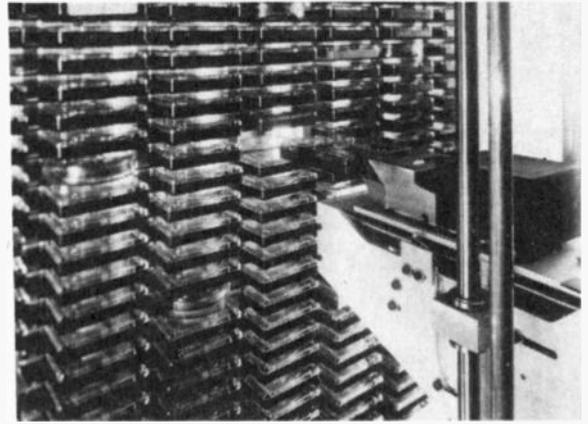
A tone sounds in the headset every time a call is received at the switchboard.

## CUERAC

The photo shows the Cuerac gripper arm selecting a cartridge from the five hundred stored in its library.

Cuerac is a fully automatic, microcomputer controlled, air-program storage and reproducer unit for radio broadcasting. It has a basic capacity of 500 pre-recorded magnetic tape cartridges, which can be randomly selected and is expandable to 2500 cartridges.

The photograph was taken at 3MP's studios in Frankston, Victoria. For further details contact Consolidated Electric Group, P.O. Box 21, Thornbury, Vic., 3071.



## COLOUR TV TUNER

This compact unit was designed and manufactured by Video Technics in Sydney to bridge a long-standing gap in the domestic video-tape recording market. Most video cassette recorders do not have a built-in tuner, which means that to record programmes off-air they have to be used in conjunction with a receiver-monitor. The use of a separate tuner allows off-air recording without using the TV set at all, so that the VCR can be busy recording one programme while another programme is being watched on the TV set. The programme can then be replayed on a conventional TV using an RF output

from the VCR.

To date we know of only one brand of TV tuner on the Australian market, the JVC, which is intended specifically for use with TVC video cassette machines. The Video Technics tuner was designed to be compatible with a variety of machines.

The Video Technics tuner does not include a clock for automatic recording but it does have facility for receiving UHF channels.

For further information contact: Video Technics, 2nd Floor, Telford Trust Building, 79-85 Oxford St., Bondi Junction, Phone 387-2555.



## LASER LABELS

Light can be used for marking, labelling and working materials such as metals and plastics using the Silamatik system developed by Siemens.

Numeric and alpha characters are programmed into a control computer and can then be called up using a keyboard or paper tape. Labelling is carried out by a YAG solid-state laser fitted with an optical deflection system comprising two mirrors. The laser beam burns the characters into the work-piece. The finished inscription is absolutely permanent.

## Addresses for Sabtronics

We have the following names from one of our advertisers, Sabtronics International of Dallas, who needs addresses before he can despatch any goods:

Allan R Sell of Coolangatta, Queensland.

R T Granger of Wangatatta, Victoria.

Mike Turonck, and also the person who sent a bank draft from the National Bank in Preston

# DON'T BE RIPPED OFF RIP THIS OUT FOR REFERENCE AND RIP OUT TO RAMSGATE

## Resistors:

All values to 1/4 & 1/2 watt. 3c each 100 up 2.5c each. Power: 5 watt.  
0.1 to 10 preferred values. 45c each.  
10 up 40c each.

## Capacitors:

Ceramics: All preferred values from 1 pf to 0.033 uF. 10c ea. 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	10ff	25 up
1	6.3 Axial	17c	15c
2.2	25 p.c.b.	12c	10c
3.3	25 p.c.b.	12c	10c
4.7	10 p.c.b.	12c	10c
4.7	25 p.c.b.	12c	10c
22	10 p.c.b.	12c	10c
22	50 p.c.b.	20c	17c
25	16 p.c.b.	12c	10c
33	6.3	13c	11c
33	16	14c	12c
47	10	16c	14c
47	25	18c	16c
47	50	20c	17c
100	10	18c	16c
100	25	20c	18c
220	6.3 Axial	23c	20c
220	16 p.c.b.	23c	20c
220	35 p.c.b.	30c	26c
470	6.3 Axial	30c	25c
470	25 p.c.b.	30c	25c
		<b>10 up</b>	
1000	10 Axial	42c	10c
1000	16 p.c.b.	45c	40c
1000	25 p.c.b.	56c	52c
1000	35 p.c.b.	56c	52c
1000	50 p.c.b.	99c	89c
2200	50 upright	\$2.00	\$1.80
3300	50 upright	\$2.30	\$2.05
3300	75 upright	\$3.00	\$2.70

## Semi-conductors:

T.T.L.	10ff	10 up
Digital		mixed
7400	40c	35c
7402	40c	35c
7404	40c	35c
7408	40c	35c
7410	40c	35c
7420	40c	35c
7430	40c	35c
7447	\$1.70	\$1.60
7451	40c	35c
7454	40c	35c
7474	\$1.00	95c
7490	\$1.00	90c
7492	\$1.00	90c
74107	\$1.00	90c
ULM 300S (Hall effect switch)		
	\$6.00	\$5.50

## C/MOS

4001	40c	35c
4009	\$1.25	\$1.20
4013	\$1.15	\$1.10
4017	\$2.50	\$2.35
4018	\$2.80	\$2.70
4023	40c	35c
74C00	45c	40c

LM301	10ff	10 up
LM307	70c	60c
LM304H	70c	60c
LM308	70c	60c
LM309K	\$2.30	\$2.10
LM319	\$2.80	\$2.60
LM324	\$3.20	\$3.00
LM339	\$3.20	\$3.00
LM377	\$2.80	\$2.50
LM382	\$2.45	\$2.30
LM3900	\$1.50	\$1.25
LM555	85c	75c
LM566	\$4.50	\$4.30
LM748	90c	80c
LM1458	\$1.50	\$1.30

## SCOOP!

**Radio Control Components**  
Famous Sevo mechanisms from U.S.A. with Mitsumi 5 pole motor & Bourn's feedback pot. Ready to assemble, just add amplifier.

These powerful fully contained units will suit circuitry of recently published projects. **\$13.00.**

Dual Axis control sticks for R/C transmitters. **\$22.00** incl. pots.

## PLUS

many other items — pots, switches, knobs, plugs, sockets, etc.

**TECHNICAL ADVICE  
FREELY AVAILABLE**

**OR RUSH REMITTANCE FOR OUR RAPID MAIL ORDER SERVICE (add \$1 P&P)**

(Min. mail order \$5.00, some items limited stock)

P.O. Box 38, Ramsgate, 2217

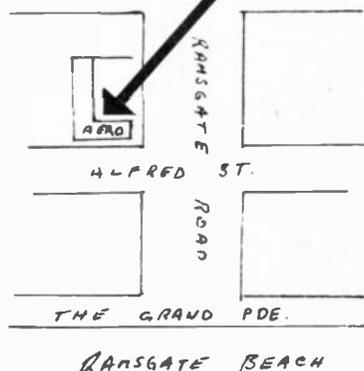
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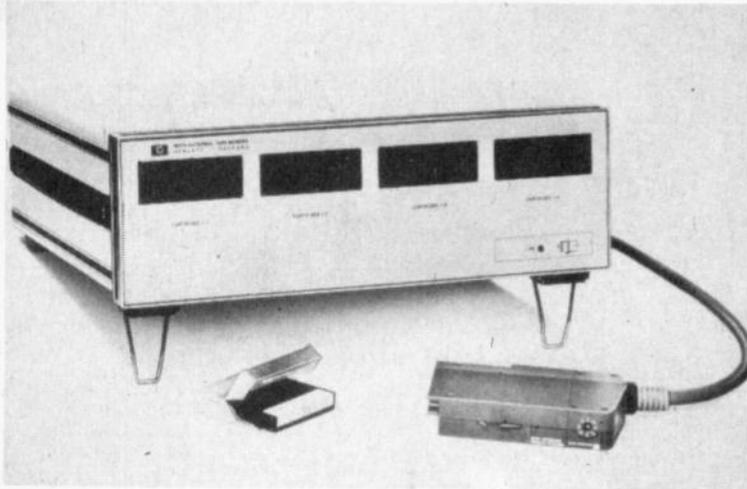
ELECTRONICS

Shop 13, 191 Ramsgate Road, Ramsgate.  
Phone (02) 529-7438



8.30 — 5.30 Mon-Fri.  
8.30 — 9.00 Thurs.  
8.30 — 12.30 Sat.





## CASSETTE MEMORY

The usefulness of the Hewlett-Packard 9825 desktop computing system has been enhanced with the introduction of an external tape memory to offer four tape drives in a single unit.

The new 9877A tape system provides 250 Kbytes of additional memory or up to 1 Megabyte with the four drive options.

An additional feature of the 9877 is its ability to duplicate tapes rapidly.

Prime uses of the 9825 equipped with a 9877 are in the fields of controlling, research and statis-

tics. In these application areas, the 9825's speed, interfacing abilities and computer-like features, coupled with the 9877's memory capacity, make it particularly well suited for use as the controller of an instrument system, for pilot process control application, remote data collection, production control and information management.

Prices for the 9877 are \$2340 for the one-cartridge version, \$3065 for the two-cartridge version and \$4330 for the four-cartridge version. Duty and sales tax are additional, if applicable.

## BWD SCOPE WINNER

The winner of the BWD504 oscilloscope, the prize in a contest in October ETI, is Mr. S. Michaels, of Shepparton, Victoria.

The following answers were accepted as correct: (1) C,D or E; (2) E; (3) E; (4) E. (5) E.

Although most entrants got the right answer we had a couple of queries about question 5. The circuit is a low-pass filter and, by altering the frequency of the input and the values of the components, a range of outputs is attainable. At one extreme you have a near replica of the input signal and after considering outputs with rounded corners and triangular waveforms you come to the other extreme where the signal is completely blocked by the filter.

The only acceptable answer shown on the entry form is the one representing this extreme case, shown in drawing E. From a distance drawing C looks like the triangle-wave you get between the two extreme mentioned above. But the short interval at zero volts in each cycle clearly rules this out.

This contest was very successful in the size of the entry — we had coupons returned from about ten percent of the magazines sold.

## VARIABLE PERSISTENCE SCOPE

A new variable persistence/storage oscilloscope from Hewlett-Packard includes a burn-resistant CRT and automatic storage control to make it easy to capture low rep-rate and single-shot waveforms for stored display. The 15 MHz bandwidth and 2 mV sensitivity make it ideal in education, medical and electromechanical applications.

## Japan's leading calculator exporter applies for bankruptcy

Systek Corp, who supplied calculator chips to companies like Adler, Olivetti, Lloyds, Unisonic, Royal, Rockwell, and Victor, as well as exporting video games and printing calculators, has applied for bankruptcy.

The failure of the company is said to be attributable to increased competition in low-priced calculators from Hong Kong and Taiwan.

Systek started in 1968 and had sales of over US\$100 million last year. Their reported deficiency is around US\$40 million.

## MICROCOMPUTERS

# IMSAI

ASSEMBLED OR KIT FORM  
AND

PROFESSIONAL DEVELOPMENT  
SYSTEMS WITH ENHANCEMENTS

# COMPUTER BITS

A DIVISION OF

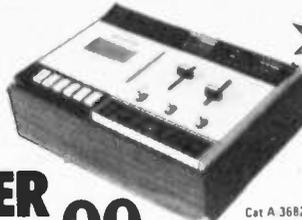
AUTOMATION-STATHAM PTY. LTD.

47 BIRCH STREET, BANKSTOWN 2200 Phone: 709 4144

# ULLO RE DAS ERES ARGO DI KIS AN TAH OHO HO \*

## FOR THE HI-FI'ER

A fantastic 'start up' deck to begin your hi-fi system... or a great 'dubbing' deck for serious audiophiles.



**NEW**  
\$27<sup>50</sup> ea.  
(or \$55 a pair)

## WATTMASTER

STEREO CASSETTE DECK WITH AUTO STOP

**\$99**

WHATEVER HAPPENED TO INFLATION. ITS DEAD!

This real beaut deck has slider level controls, three neat switches (tape select - normal or CrO2, noise cut, to eliminate hiss, and power on/off). Has piano key operation with auto stop feature. Microphone inputs (mics supplied) or phono jack inputs. Stereo headphone outlet! A fantastic deck for the price - limited quantities only! Cat A-3682 ..... \$99.00

LAST YEAR I SOLD SIMILAR DECKS FOR \$139.95. LOOK AT THE PRICE NOW!



Walnut veneer

## Fantastic Speaker Kit

HOW DO YOU JUDGE A SPEAKER?

The ultimate test of any speaker is how it sounds to you. After all, you're the one who has to live with it. These sound great with just about any speaker. But there are other considerations. Like how much room they will take up. Can they be fitted into a small space? These are small. How do they look. Will they tone in to the rest of my room? They look great. (You can change the colour of the baffle) And are they expensive? It's one thing to buy a good speaker, another to pay a month's wages for it! These are very reasonable. Some kits are hard to put together. Do you have to have a degree to put them together? These are dead easy. Okay, I'm convinced. Where do I see these fabulous speakers? Where else but a Dick Smith store or dealer.



\$16.75

\$7.50

You can please yourself what speaker you put in this box. But Dick has a couple which would be ideal! Cat C-2100: 28Hz - 20kHz response, 30watts rating. Dual impedance, 4 or 8 ohms. Huge 16oz magnet! Twin cone for optimum performance. Cat C-2012: Famous 8CMX, 10W (rms) 8 ohms, dual cone. Resp approx 30Hz 18kHz. Recommended.



\$17<sup>50</sup>



## HI FI CHANGER

IS YOUR OLD PLAYER CLAPPED OUT?

Did you know that it's easy to change to a brand new Garrard. Your records will love you for it! These fully automatic turntables can stack up to 6 records, they have a sapphire stylus in their ceramic cartridge, and have a cueing lift. Why put up with a worn out player any longer. Get one of these mighty Garrards today! Cat A-3036 ..... \$17.50

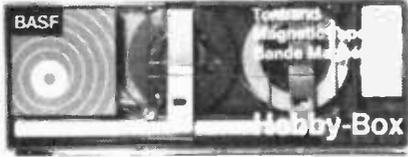
Don't forget Dick's full range of record accessories and equipment for that last-minute Christmas gift!

SANTA SMITH & STAFF WOULD LIKE TO WISH ALL CUSTOMERS AND FRIENDS A MERRY CHRISTMAS AND A SAFE AND PROSPEROUS NEW YEAR.

## BASF HOBBY BOXES



If you own a tape recorder or cassette deck, you'll need to splice tapes. Don't try to do it with a razor blade and sticky tape - join the professionals. Use a BASF hobby box.



REEL TO REEL HOBBY BOX \$7.75

Similar to the cassette hobby box, but has gear just for the reel to reel set. Like a marking pencil, splicer, tape, red, green & white leader tape, stop foil, spool labels, tape clips, etc. The complete editing kit! Cat. C-3502 ..... \$7.75

CASSETTE HOBBY BOX \$12.15

Contains all you'll need to properly look after your valuable cassettes! With splicing template, non-magnetic scissors & tweezers, very important for noise-free splices! Philips & flat screw drivers, splicing tape & dispenser, 10m of leader tape, clips, pressure pads and spare screws. Ideal for making party tapes, sound effects or special effects! Cat. C-3500 ..... \$12.15

Don't forget Dick's full range of tapes & accessories for that last minute Christmas gift that you forgot to buy!

## FOR THE LISTENER



ONLY \$19<sup>95</sup>

## AM-FM AC-DC

LATEST LOOK AM/FM RADIO

You can play it on the beach, you can play it in the home. Dual power for economy (240V mains or internal batteries) and dual band for versatility. AM for normal DJ & news stations, FM for fine music stations. Absolutely mad give away price for such a fine looker & good performer. It sounds as good as it looks! Cat A 4320 ..... \$19.95



\* Specialty designed for Australia \* Opens NEW listening realms \* Complete VHF coverage

NOW ONLY \$44.90

Cat D-2833

FREE: EXCLUSIVE V.H.F. STATION GUIDE ONLY FROM US

- 530 - 1600kHz: Normal AM broadcast band. All your normal local broadcast stations
- 54 - 88MHz: TV, Fire brigade, Ambulance, Police, Business Radios, etc
- 88 - 108MHz: New FM broadcast band
- 108 - 136MHz: AIR band: all aircraft (tiger moths to jumbos, tower, etc)
- 135 - 217MHz: Amateurs, marine VHF, harbour control, Taxis, Police, Road Patrols, etc etc.

## SPECIAL

VALUE PLUS! 'PACKSON' AM/FM ... WITH CASSETTE RECORDER ...

You can record direct from the radio - no leads or use the inbuilt condenser microphone. Cat A 4016

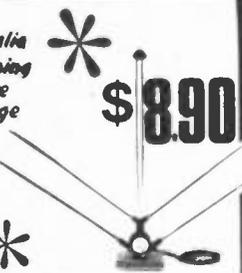


## LUXTONE AM/VHF RECEIVER

Same band coverage as above receiver, incredible value for such wide range. 'Luxtone' AM-FM VHF receiver operates on AC/batteries, smart appearance and comes complete with earphone and batteries. All solid state, robust construction. Cat D-2840 ..... \$29.90

\$29.90

\$49.90



LOOK & WORKS BETTER THAN RABBITS EARS  
Deluxe TV antenna for indoor use in primary reception areas. Ideal for colour or B&W use, standard connector. Cat L-4012 ..... \$8.90

## VHF AIRCRAFT RADIO WITH AM BAND \$12.50



Handy pocket radio allows you to listen to international aircraft band (110-136 MHz). You can hear the control tower, automatic weather & landing information, aircraft approach and departure instructions, aircraft etc. Ideal for flying students, flying schools etc. 9V DC powered. Has AM broadcast band too. Cat. D-2834 ..... \$12.50

## FOR THE TECHNICIAN



INCREDIBLY HANDY LITTLE DC VOLTMETER ... DIGITAL READOUT IN END OF PROBE ...

Ideal for service, developmental work etc, this fantastic little DC voltmeter has a 3 digit readout in the end. Ideal for working in close when you can't afford to take your eyes off the circuit - one flash and you're ash! 3 ranges, 20V 200V & 1000V. Battery powered. Cat Q-1445 ..... \$89.50

## SAVE 33 1/3%

50c HIGH SPEED STEEL MINIATURE DRILLS FOR PCB BOARDS. Just right for component leads, no 60 (04in) won't be too sloppy or too tight. Cat T4820 ..... \$0.50  
60c Or a little smaller, A no. 65 (033in) ideal for small leads (especially IC pins). Cat T-4825 ..... \$0.60

## SIGNAL INJECTOR

YOU CAN SERVICE ON THE CHEAP! Very economic service signal injector puts out harmonics way up into the RF region. An invaluable service tool (at twice the price)! Cat Q-1270 ..... \$4.75

\* Transfusion Photo readers, here's a go! Dick in Santa, Ho Ho Ho!

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Mail Orders: P.O. Box 747 Crows Nest, N.S.W., 2065.  
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- Hunts Electronics, Toowoomba, Qld. Ph 32-6944
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Mon - Fri: 9 to 5.30  
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\$5 to \$9.99	\$1.00
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\$50 to \$99.99	\$3.50
\$100 or more	\$5.00

FOR C.O.D. SEND \$7.40 EXTRA PLUS \$3.00 DEPOSIT. MINIMUM MAIL ORDER AMOUNT IS \$5.

Continued from page 9

## MAXAR

Motorola's new Maxar two-way radio aims to put the Australian small businessman on the air with a mobile communications system.

Maxar, offering 25 or 15 watt output, is the smallest, lightest, toughest and most powerful low-cost transceiver ever introduced by Motorola.

Selling at around \$600, Maxar can serve as either a mobile or desk-top base station.

An appealing feature with an unappealing name is the "Digital Private Line Coded Squelch". In other words, only messages concerning a given owner's own system come through loud and clear. Traffic from other systems using the same channel is eliminated.

## TV CONVENTION

We have just received a report from Terry O'Connor on the Seventh National Television Service Convention held recently in Perth. Lecturers at the convention discussed new techniques that will soon have to be mastered by service engineers — servicing video tape recorders was covered in one lecture and proposed teletext schemes in another. The service engineers hope to widen the membership of their association to include electronics technicians.

The eighth convention will be held in 1978 in Brisbane, but in the meantime there will be a TV Service Seminar at the West Point Casino in Tasmania in September 1977.

## Errata

In last month's CMOS Data Sheet the 4066, although placed correctly in the classification, was wrongly specified. This device is a quad bilateral switch. The Audio Phaser and the Audio Limiter projects in recent ETIs have used the 4049 CMOS hex inverting buffer in the linear mode. Some readers have had problems with these projects because they have used Philips devices — these devices will not operate in this mode and cannot be made to work in these projects.

## CONTEST CONTEST

We had considerable difficulty judging this contest despite the lengthy specifications of our criteria in the October issue. From the entries we have got many new ideas for contests but in selecting a winning entry we have concentrated on problems with unique solutions.

Our winner is G. Perry of Brisbane who sent in three problems. The winning problem we are using as this month's contest, but for interest we publish below one of his other entries. The solutions we be in the February and January ETIs, respectively.

We will also be sending Unitrex calculators to nine other entrants — these people sent in 'contests' that were so good that we will be using them in future ETIs. These readers are: John Broekstra, I Brown, Tim Cumpston, Gordon Dodd; Mathew Ford, BJ Joyce, N Kandasany, Ashim Roy and K Wallace.

This is the interesting puzzle sent in by G Perry with his winning entry, some of you might know it — it was first published in 1903 (and we must credit the inventor, Henry Ernest Dudeney): A spider is on the vertical midline of one wall of a room, one metre down from the ceiling. A fly is on the opposite wall, on the midline but one metre up from the floor. If the fly is paralysed and the walls are 12 m square and 30 m apart, what is the shortest distance the spider has to crawl to reach the fly? (The spider must crawl the complete distance — no spinning webs, jumping, etc.)

## Win a Unitrex Calculator

This puzzle is the winning entry in the 'Design a Contest' contest set in ETI October:

A salesman calls at a house to sell children's toys for Christmas. He asks the lady of the house if she has any children and she says she has three. The lady decides to have a bit of fun with the salesman so when he asks for the ages of the children she replies:

"The product of their ages is 36 and the sum of their ages is the same as the

number of the house next door!"

The salesman then goes to look at the number on the house next door but when reaches the gate she calls after him "Oh, by the way, you'll need to know that the eldest plays the piano".

If you can work out the three ages write them on the back of an empty envelope (with your name and address) and send it to ETI/Unitrex Contest (December) to reach us by the 5th of January 1977.

Permit number TC7585

## Cordless Soldering..

for electronic circuitry

With the Wahl  
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tools

Complete freedom from cords, transformers, power points, plugs. The Wahl ISO-TIP soldering tool is light (170g), slim, powerful: suitable for tag soldering, printed circuits & miniature components.

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\* Approval No. V/74394/7578

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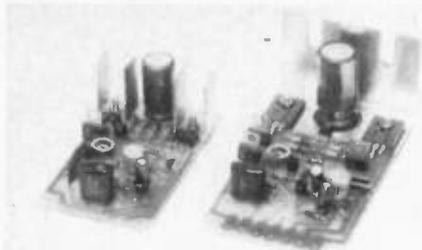
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\* Automatically  
recharges when  
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FOR HI-FI, INTERCOM, P.A. & HOBBYIST APPLICATIONS



These miniature versatile audio amplifiers are all silicon solid state with transformerless design for wide bandwidth and low distortion. Only the best quality components are used, MOTOROLA transistors, PHILIPS resistors and capacitors and professional grade FIBREGLASS P.C. They come complete with circuit diagram, wiring instructions and suggested uses. These modules are MADE IN AUSTRALIA and are available immediately from stock. The MPA-3 is a 3 WRMS unit and the MPA-15 will deliver 15 WRMS, both with 8Ω load maximum rated supply voltage — they can be powered by battery or DC power supply. Each unit has 2 inputs, HI & LO level for extra flexibility — built and tested.

### SPECIFICATIONS:

#### MPA-3

- Power outputs — 3WRMS
- Supply volts — 9-25 DC
- Distortion — less than 1 percent at full output 1 KHz
- Bandwidth — 30 Hz to 40 KHz at full power
- Sensitivity — 3 mV LO input 250 mV HI input

PRICE \$6.85 P&P 65c

#### MPA-15

- 15WRMS
- 9-40 DC
- Less than 1 percent at full output 1 KHz
- 20 Hz to 30 KHz at full power
- 3 mV LO input 250 mV HI input

PRICE \$13.50 P&P 65c

Sales tax is included

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HITACHI UD C90	\$2.50	\$2.40	\$2.30
MEMOREX FC 90	\$3.00	\$2.95	\$2.85
MEMOREX CC 90	\$4.30	\$4.00	\$3.25

All Cassettes play 45 minutes per side. Prices of larger quantities on applications.

### Pack and Postage

1 or 2 50c throughout Australia; 3-6 70c throughout Australia; Sydney metrop. area all larger quantities 70c. N.S.W. all larger quantities \$1.10; Adelaide, Brisbane & Melbourne \$1.70 1st dozen, 25c extra dozen. S.A., QLD & VIC. \$2.00 1st dozen, 25c extra dozen. TAS., W.A. & N.T. \$2.25 1st dozen, 45c extra dozen.

Please send S.A.E. on all enquiries.

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# THE NAME OF THE GAME...

Ron Chapman's game is Hi-Fi and at Ron's store you'll find all the quality name brands, Pioneer, Marantz, Bose and many others. If you're after good sound, check out the names you know.



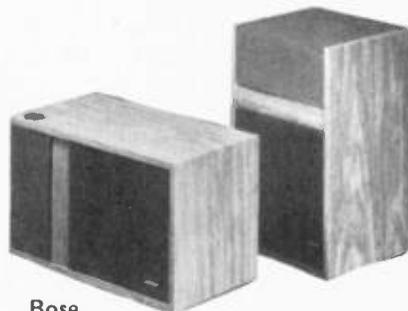
### Pioneer

Pioneer's Rondo 3000X, the successor to the very popular Rondo 3000.



### Marantz

The Marantz 6300 Direct Drive turntable.



### Bose

The Direct/Reflecting model 301. Innovation for exceptional value.

# RON CHAPMAN HI-FI

NEWCASTLE'S MAILORER SPECIALIST. — 880 HUNTER STREET, NEWCASTLE 2302. PHONE: 69 2733.

## WIN A SEAT ON DICK'S PLANE TO THE ANTARCTIC!

Join Dick Smith (The Electronics Nut) in a once-in-a-lifetime experience on a day trip to the Antarctic.

You will leave Sydney at 10.00 am on Sunday 13th February 1977 in a chartered Qantas aircraft. After a light lunch and an interesting talk on the Antarctic Continent, you will pass over Macquarie Island, then two hours later cross the Antarctic Circle and meet the Antarctic coastline near the Mawson Peninsula. Providing the weather is good (which it should be at this time of the year) your aircraft will descend to 10 000 ft and follow the Antarctic coast for over 200 miles.

The huge Ninnis and Mertz glaciers should be clearly visible. You will pass over Commonwealth Bay which, as well as being the windiest place in the world, is the place Sir Douglas Mawson made the first radio contact (in 1913) with the outside world.

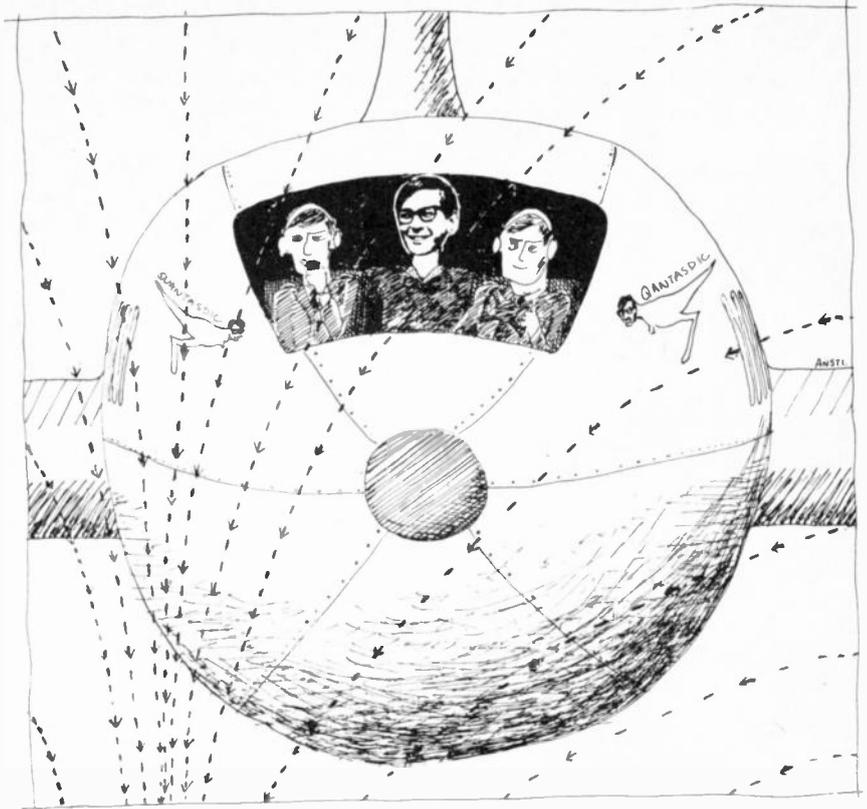
You will then track direct to the south magnetic pole and after rounding it (with full celebrations and champagne) you will have a multi-course dinner and head back to Sydney, landing at approximately 9.30 pm after an 11½ hour, 5,300 mile "once-in-a-lifetime" flight.

Total cost of the flight is \$230, but one lucky ETI reader will get a free seat\*.

Dick says this is an ideal trip for photographers, frustrated antarctic explorers, eccentric people and travellers who have been nearly everywhere. Just imagine — at the office on Monday morning you can casually mention that "You went to the South Magnetic Pole yesterday . . ."

We hear that Dick's first plane is fully booked but if you want to get a seat on another flight check with Dick Smith's Antarctic Antic, P.O. Box 747, Crows Nest, NSW 2065. Phone: 439-5311.

\*All you have to do to enter the contest for the ETI seat is to think up a humorous caption for the cartoon on this page (which is meant to show Dick in the cockpit of the plane as it passes the south magnetic pole). Write your entry, along with your name, address, and phone number, on the back of an empty envelope and send it to Up The Pole, ETI Magazine, 15 Boundary St., Rushcutters Bay, NSW 2011.



## CHARGE IT!

Now you can enjoy the convenience of long-lasting rechargeable batteries in your calculator, radio, cassette player, flash gun, etc. . . . and forget about those messy, unreliable dry cells.



### ARLEC PS314 NICAD CHARGING CARTRIDGE

- This low-cost battery cartridge enables you to charge 2 or 4 nickel-cadium batteries simultaneously.
- Takes (AA) penlite size batteries.
- Use with Arlec 6 volt plugpack or similar battery eliminator/charger—just plug in and charge.
- Quick loading.
- Fully guaranteed.

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5' Fibreglass Whip Antenna  
Complete with base.  
Mobile Type \$20.00  
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Sent Comet Freight Forward

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Magnetic Base Centre  
Loaded. Antenna 27" long  
designed to fit most cars.  
C/W Cable & PL259 Plug.  
Only—\$25.00. P&P \$3.

#### CO-AX CABLE

50 Ω CO-AX Cable 35c  
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#### PLUG

PL259 Plugs 95c each.



## NOW AT M.S.C.



TRANSMIT RECEIVER CRYSTAL  
SETS FOR TRANSCEIVERS Large  
Range Available at \$6.50/set.

HANSEN FS-5 POWER METER Compact  
yet measures SWR and power at once.  
Power 0-10-100W-SWR. Frequency  
response 3MHz to MHz. 50 or 75 ohm  
impedance. 70 x 98 x 100. \$29.80. P&P  
\$2.20.

### FAMOUS 'SIDEBAND' 1 WATT TRANSCEIVER NC310

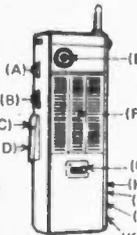
• Fully approved—max. power allowed by PMG • 3 channel capability/27.24MHz send and receive crystals fitted • Jacks for battery, antenna, etc.



The NC310 has a very sensitive dual conversion superhet receiver. It can be run off internal batteries or hooked up to a boat or car battery. A meter is built-in to show the state of the batteries. There's also a charging jack for use with Nicad batteries. The transmitter has a special "call" button to alert the other station. Receiver noise can be cut out with the "squelch" control so that the only sound from the speaker is when you are being called.

We selected this set because it is versatile and it is very rugged—the frame and control panel are die cast for extra strength. Also you can boost the range by connecting up an external aerial in place of the multi-section telescopic. All in all, a very popular set and excellent value at

(A) Squelch control knob (B) Volume/Power On-Off switch (C) Tone call switch (D) Push-to-talk switch (E) Battery checker (F) Speaker/microphone (G) Channel selector switch (H) External antenna jack (I) External speaker jack (J) External power jack (K) Battery charge jack



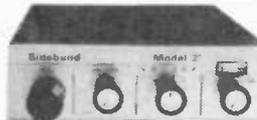
#### SPECIFICATIONS

Transistors	13
Channel Number	3, on 27MHz
Transmitter Frequency Tolerance	± 0.005%
RF Input Power	1 Watt
Tone Call Frequency	2000Hz
Receiver Type	Superheterodyne
Receiver Sensitivity	0.7µV at 10dB S/N
Selectivity	45dB at ± 10KHz
IF Frequency	455KHz
Audio Output	500mW to Ext. Speaker Jack
Power Supply	8UM-3 (penlite battery)
Current Drain	Transmitter: 120-220mA Receiver: 20-130mA
Accessory	Shoulder strap Battery UM-3, 8 pcs Instruction Manual

**\$49.95 P&P \$3.00**

### DELUXE 'SIDEBAND' 5 WATT TRANSCEIVER MODEL II

• Operates from 12V d.c. battery • 6 channel capability—27.88 MHz fitted • 5W output—Maximum power allowed by PMG • Squelch and Noise limiter in receiver.



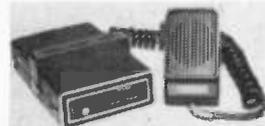
Here's a high performance set at a very low price. And it's really compact too!  
The Sideband Model II gives maximum legal output on up to 6 channels. Meters tell you incoming signal strength and your output (it's nice to know that you are putting out a signal!). The receiver is extremely sensitive, has a squelch-control to cut out noise between calls and has a built-in loudspeaker. The 14 transistor, 8 diode circuit also has ANL (automatic noise limiting) to reduce interference. We supply complete with microphone and mounting bracket and installation is extremely simple. Handbook and circuit included.  
Sideband Model II comes with one set of crystals.

#### SPECIFICATIONS

Channels	6-channel crystal-controlled
Size	4 1/4" W x 1 1/2" H x 6 1/2" D
Weight	2.4 pounds
Antenna	52-ohm coaxial
Power Source	Input voltage—13.8 VDC (EIA standard)
Circuitry	14 transistors, 8 diodes
RECEIVER	
Sensitivity	1µV or better for 500 mW output, 10dB S/N
Selectivity	40dB down at ± 10 KHz
Squelch	1µV
Sensitivity Audio Output	0.7 watt
Power Speaker	3" dynamic, 8-ohm
TRANSMITTER	
Frequency	27MHz
Frequency Tolerance	± 0.005%
Tolerance Spurious	Better than 50 dB
Suppression Bandwidth	Not to exceed
Power Input	5 watt

**\$95 P&P \$3.50**

### LOOK AT THIS FOR VALUE



### TENNA SINGLE CHANNEL 5 WATT TRANSCEIVER

#### SPECIFICATIONS

FREQUENCY	27 880 FITTED	Frequency Tolerance	± .005%
Receiver Sensitivity	Less than 5µV	Intermediate Frequency	—455 KHz
Channel	9	Dimensions	1 7/16 x 4 x 6 5/16
Power Supply	12V negative ground	Weight	2lbs.
Transmitter Power	5 watts DC input (maximum)	Fuse	2 amp

P.M.G. APPROVED

**ONLY \$62.50 P&P \$3.50**



### SEAGULL MODEL CB-801, 23-CHANNEL MOBILE SYNTHESIZED C.B. TRANSCEIVER

FEATURES: Automatic noise limiter (ANL), P.A. facility, squelch control, transmit lamp, S-RFO meter.

**ONLY \$126.00 P&P \$4.00**

NOTE: All transmitting equipment needs a P.M.G. licence.

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PLEASE PRINT YOUR NAME & ADDRESS ON  
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## COMPONENTS IN AUSTRALIA

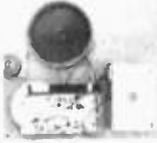
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### 7 TRANSISTOR + 2 DIODE RADIO BY BENOIX

Completely ready wired with volume control and switch. Large tuning dial and complete with 3 1/2" 8 ohms .6 watt speaker. Battery container included. (Batteries not included) - READY TO GO!!

M.S.C.'s CRAZY PRICE!!

\$3.85 each or 2 for \$6.50. P&P \$1.50.



**SPECIAL**  
FANTASTIC PRICE REDUCTION



### SPRING REVERB UNITS

Specs: Input current - 350 mA, Driving Coil Impedance - 165Ω, Pickup coil Impedance - 10kΩ, Frequency response - 100 to 3000Hz, Attenuation - 30dB, reverberation time - 25 to 30 msec, Dimensions - 253 x 36 x 26mm.  
**ONLY \$6.95 SAVE-SAVE-SAVE. P&P \$1.25**  
**ONLY FROM US AT THIS PRICE**

**NEW**

### MINIATURE MODEL MOTORS

12 v dc permanent magnet 'Lenco' motor, Italian manufacture with inbuilt centrifugal speed regulation originally used in record players. Complete with electromagnet shield and series inductor.  
Dimensions:  
Overall length 70 mm.  
Diameter: 35 mm.  
Spindle Length: 20 mm.  
M.S.C.'S PRICE:  
\$2.25 POST FREE.



### DIGITAL ALARM CLOCK

Pt. No. MA-1002B 12 HOURS

\$11.50

Pt. No. MA-1002D 24 HOURS

\$12.50

Transformer to suit: \$4.75 p&p 1.50.



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### OF 1,000,000 (ONE MILLION)

SEMI-CONDUCTORS. MUST BE CLEARED AT THE MOST STAGGERING PRICES EVER OFFERED - THESE DEVICES ARE MAINLY UNMARKED AND

SLIGHTLY BELOW SPECS, BUT ARE GUARANTEED USABLE. ALL EM SERIES DIODES ARE MARKED AND FULLY GUARANTEED. TAKE YOUR CHOICE WITH THESE SPECIAL PACS. POST & PACKING 50c per pack.

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SC. 10	50 EM404 Diodes, 400V 1 amp	\$3.75
SC. 11	50 EM406 Diodes, 600V 1 amp	\$4.00
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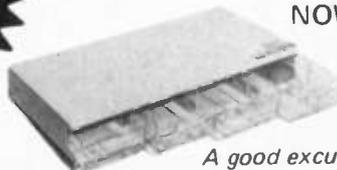
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JB4A Stackable Jiffy Bins with 4 drawers. Were \$2.99 NOW ONLY \$1.99!



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We have purchased from a manufacturer who has ceased the production of radio equipment due to the tariff reductions, their current stock of capacitors and transistors which we can offer at a fraction of original cost.

### FREE OFFER FOR DEC. & JAN.

No. 4 Pack of 100 capacitors (value \$3.50) with all orders of \$15.00 or over. Plus  
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All Transistors, Capacitors and Resistors are New & Branded.

TRANSISTORS: 12-2N3055-1 power transistors 24 BC108 general purpose audio, 6 BC109C low noise audio 6 TT770 NPN low level amp. 12 EM404 silicon rectifiers 400 volt 1 amp. Plus 20 mixed silicon transistors.

**68 TRANSISTORS FOR \$9.00  
PLUS 12 DIODES**

Mounting kits for 2N3055 (mica washers & bushes 9c ea.).

No. 1 PACK  
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TRANSISTORS: 24 BC108 general purpose audio, 6 BC109C low noise audio, 6 TT770 low level amp NPN, 12EM404 silicon rectifiers 400 volt 1 amp. PLUS 20 mixed silicon transistors.

**56 TRANSISTORS FOR \$4.80  
PLUS 12 DIODES**

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**40 TRANSISTORS FOR \$3.30  
PLUS 10 DIODES**

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P&P \$1.00

TRANSISTORS: 10-BC108 general purpose audio, 10-TT770 NPN low level amp. 10-EM404 silicon rectifiers 400 volt 1 amp. Plus 20 mixed silicon transistors.

**100 CAPACITORS FOR \$3.50**

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Post \$1.00

CAPACITORS: 100 comprising approx. equal quantities of Philips tubular polyester (315 series) Polyester film "greencap" & Styroseal in standard values to .47 mfd with a list price of over \$18.00.

**100 RESISTORS FOR \$1.00**

No. 5 PACK  
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RESISTORS: 100 mixed 1/2 and 1 watt Morganite, Ducon, and IRH, 15 different standard values.

**700 RESISTORS FOR \$2.80**

No. 6 PACK  
P&P \$1.00

These Morganite & I.R.C. resistors are mostly 1/2 watt 10 percent. Approx. 30 different standard values. (The leads on these resistors have been cut & formed for printed circuit board mounting).

### 2N3055 TRANSISTORS

Pack of 12 standard 2N3055 transistors \$7.20

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**3AMP 600 VOLT RECTIFIERS  
PACK OF 12 FOR \$3.60**

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Pack of 12 for \$3.60 I.T.T. 3 amp. 600 volt Silicon rectifiers type IN4723 (can be used for higher current if used with heatsink).

### NEW-ROLA SPEAKERS AT A FRACTION OF LIST PRICE

These new Rola C8MX twin coned speakers are available in 15 ohm, only, use two in parallel for 8ohm, operation giving a power rating of 18 watts. Also available the Rola C8MX/17 de luxe version in 8ohm, impedance.

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POSTAGE \$1.50 COVERS POSTAGE & PACKING ON ANY 3 PACKS. (EXCEPT SPEAKERS)

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# electronics

Volume 1  
-it's easy



# ELECTRONICS -it's easy!

Take the mystery out of electronics with ETI's simple to follow three-volume course.

Volumes 1 and 2 are available directly from Electronics Today, 15 Boundary Street, Rushcutters Bay, NSW. 2011 — price is \$3.00 each volume plus 40 cents postage (each volume)

Volume 3 will be published in November/ December this year



A MODERN MAGAZINES PUBLICATION.

# POCKET C.B.

ACTUAL SIZE

## \$59.95

PER UNIT.

## + \$3.80 P&P

PER PAIR.

## POCKETCOM TRANSCEIVERS

### POCKETCOM TRANSCEIVER SPECIFICATIONS

#### GENERAL

Nominal operating voltage	3 volts
Low voltage cut-off	2.1 volts
Receiver type	Superheterodyne
Intermediate Frequency	455 kHz

#### RECEIVER

Sensitivity	10dB S + N/N	< 1.0 $\mu$ V
Squelch Sensitivity	-	< 0.4 $\mu$ V
AGC Variation	1 $\mu$ V to 1000 $\mu$ V	6 dB
Audio Power Output	60% modulation	20 mW.
Distortion	60% modulation, 100 $\mu$ V	< 10%

Adjacent Channel Rejection	-	26 dB
----------------------------	---	-------

#### TRANSMITTER

DC Power Input	To final RF stage	100 mW.
Microphone Level	30% modulation	1 mV rms
Modulation Distortion	60% modulation	< 10%
Tone Frequency	-	approx 2 kHz
Tone Modulation	-	-90%, +85%
Modulation Capability	-	90%
Power Output	-	30 mW.

APPROVED BY  
P&T DEPT. for  
licensed service.

THE POCKETCOM is a 27240 kHz battery-operated transceiver suitable for two-way communication over a few kilometres (on a line-of-sight link with a clear channel). If a second channel is permitted you can plug in a crystal and switch to channel B.

Under present law it is not permitted to use PocketCom without a licence from the Postal and Telecommunications Department.

Each unit can be switched to standby (and can be left in this mode for weeks without flattening the batteries) ready to give a bleep tone when someone calls you on another PocketCom. Calling is achieved by simply pressing a button on the unit.

The PocketCom comes with standard batteries and features an LED low-battery indicator. Another special feature is the squelch control, normally found only on more expensive receivers. This control eliminates unwanted noise when no signals are present, and can be turned off to pick up weak signals.

To PocketCom Offer, ETI Magazine, 15 Boundary Street, Rushcutters Bay, NSW 2021.

Please send me a PocketCom system — two transceivers at \$59.95 each plus \$3.80 P&P = \$123.70. I enclose a cheque payable to ETI PocketCom offer. ALLOW 4-6 WEEKS FOR DELIVERY.

NAME .....

ADDRESS .....

..... POSTCODE .....

# Get a "Sleeping Dog" on your car!

HERE is the special offer to end them all. An electronic anti-theft alarm for your car for only **\$39.40!**

How do we do it? It's simple. We know a good deal when we see it, and you can share our wonderful discovery.

The 'Sleeping Dog' car alarm is a highly sophisticated (would you believe three integrated circuits?) alarm system that you can install (something to do next Saturday) or you can palm the job off to your friendly auto electrician. It's a simple operational procedure, but it will turn off most would-be car thieves. This 'dog' bites when roused.

It's got a flashing light (haven't they all?) and it's a compact 'blackbox' which is computer-tested before it leaves the manufacturers. They even give you a copy of the computer test printout sheet with each alarm (for those who can handle the heavy technical stuff).

The 'Sleeping Dog' protects the boot, bonnet and doors of your car, even trailers, caravans and bumper-mounted driving lights.

The 'Sleeping Dog' alarm does NOT use the 'voltage drop' sensing system like many others, thus it does not activate false alarms.

If you were to pay the full retail price for this little 'pet' then you'd probably fork out about \$58. But we know you're smarter than that, and understand you'll want to fill out the coupon below and make a real killing. **Remember it's \$39.40 complete — post and packing is only \$1.60.**

Get a 'Sleeping Dog' on your car — and keep it to yourself.



**Anti-Theft Protection costs you only \$39.40!**

Yes! I am a dog lover, so please send me .....

Sleeping Dog alarms, I enclose \$..... which includes \$1.60 p&p.

Send to "Sleeping Dog" offer, Modern Magazines (Holdings) Ltd., 15 Boundary Street Rushcutters Bay, NSW 2011

Alarm Options:

- Mercury Switch, connects in "loop", protects bonnet or boot. Tick  add \$3.00 each.
- Isolating Switch (toggle), defeats alarm operation. (Alternatively remove fuse when car goes in for service). Tick  add \$2.00 each.

Name: .....

Address .....

ET! ..... Postcode .....

# No. 1 rated!

In US by "Consumer Report"

# CORVUS

Thoroughly recommended in Australia by a major electronics publication. Electronic Concepts Pty. Ltd. is proud to introduce the exclusive Corvus 500.

With MOSTEK® single chip technology, the new Corvus 500 is the first non-Hewlett-Packard calculator with Reverse Polish Notation. 10 addressable memories, 4 level roll down stack to be introduced. If you compare the Corvus 500 feature by feature with the HP45, you will find striking similarities. There are also some important differences.

\*MOSTEK is one of America's advanced LSI (Large Scale Integration) chip manufacturers

	Corvus 500	HP 45
RPN (Reverse Polish Notation)	Yes	Yes
Memory Store and Recall 10 Registers	Yes	Yes
4 Level Stack, Rotate Stack	Yes	Yes
10 MEMORY EXCHANGE WITH X	Yes	No
Log LN	Yes	Yes
Trig (Sine, Cosine, Tangent, INV)	Yes	Yes
HYPERBOLIC (SINH, COSINH, TANH, INV)	Yes	No
HYPERBOLIC RECTANGULAR ↔	Yes	No
$y^x, e^x, 10^x, \sqrt{x}, 1/x, x^1/x, x \leftarrow y, \pi, CHS$	Yes	Yes
$\frac{1}{x}$ through INVERSE	Yes	No
GRADIANS	No	Yes
DEGREE-RADIAN CONVERSION	Yes	No
Degree Radian Mode Selection	Yes	Yes
DEG-DEG-MIN-SEC	No	Yes
Polar to Rectangular Conversion	Yes	Yes
Recall Last X	Yes	Yes
Scientific Notation, Fixed and Floating	Yes	Yes
Fixed Decimal Point Option 10 91	Yes	Yes
DIGIT ACCURACY	12	10
DISPLAY OF DIGITS	12	10
% → %	Yes	Yes
GROSS PROFIT MARGIN %	Yes	No
Mean and Standard Deviation	Yes	Yes
$\Sigma +, \Sigma -$	Yes	Yes
Product - Memories	Yes	Yes
C.F. DIRECT CONVERSION	Yes	No
F.C. DIRECT CONVERSION	Yes	No
LIT.GAL. DIRECT CONVERSION	Yes	No
KG.LB. DIRECT CONVERSION	Yes	No
GAL.LIT. DIRECT CONVERSION	Yes	No
LB.KG. DIRECT CONVERSION	Yes	No
CM-INCH DIRECT CONVERSION	Yes	No
INCH-CM DIRECT CONVERSION	Yes	No

As you can see, the Corvus 500 is a lot more calculator for \$95.

**Price \$95.00**  
**Mail charge \$2.50**  
**Sales Tax exempt \$85.00**

For sales tax exempt purchases, please supply number or certificate.

We have listed some of the many features, but let's amplify on some highlights:

1. RPN (Reverse Polish Notation) "COMPUTER LOGIC" and 4 LEVEL STACK.



Your problem is solved the way it is written, left to right sequence, eliminating restructuring, unnecessary keystrokes, and the handicap of having to write down intermediate solutions. And all information is at your disposal — just roll the stack (R) to any intermediate information desired. You arrive at your solution faster, more simply and, therefore, more accurately. Perhaps at this point we should address ourselves to the controversy between algebraic entry and RPN. One question we must ask is why proponents of algebraic entry always use an example of sum of products and never an example of product of sums:  $(2+3) \times (4+5) =$  Algebraic  $2+3 = MS5+4 = XMR =$  TOTAL 12 keystrokes (SR51, add 2 more keystrokes)  
 RPN: 2 Enter 3 + 4 Enter 5 + x  
 TOTAL 9 keystrokes

2. THE CORVUS 500 and HP-45 HAVE 10 ADDRESSABLE MEMORY REGISTERS, 4 LEVEL OPERATIONAL STACK, and a "LAST X" REGISTER (10th Mem. Reg.). With 10 addressable memories, you have access to more entries, or intermediate solutions; less remembering, or writing down. YOU have to do. And less chance for error. The stack design also permits X and Y register exchange, and roll-down to any entry to the display for review or other operation. The "last x" register permits error correction or multiple operations when a function is performed, the last input argument of the calculation is automatically stored in the "last

x" register, which can be quickly recalled to correct an error, or to perform another operation using the same number.

3. DIRECT HYPERBOLIC and HYPERBOLIC RECTANGULAR to POLAR, and INVERSE. For those of you electronic and computer science engineers who require access to this specialised application, the Corvus 500 solves "your" problems.

4. A WORD ABOUT CORVUS 500 12-DIGIT DISPLAY AND ACCURACY. Finally you have displayed 12 digit accuracy in business format and 10 + 2 in scientific notation. LED is manufactured by Hewlett Packard.

FOR THE FIRST TIME you can raise the number 10 to 199th power or calculate Factorial (x!) of up to 120. Unbelievable!

5. DIRECT FROM AND TO METRIC CONVERSION SAVES VALUABLE KEYSTROKES.

WHAT ABOUT CONSTRUCTION? With so many features, the next most obvious question must be in regard to the quality of the unit itself. We are proud to report the Corvus 500 to be double injected moulded, with "tactile" feedback keyboard. The compact, contoured case is 5 1/2" long by 3" wide by 1 1/4" high and weighs just 8 oz. The COMPLETE CORVUS 500 for \$95.00 includes:

- Rechargeable and replaceable Nickel Cadmium batteries. Optional 3AA batteries
- Adaptor/Charger.
- Owner's Handbook.
- Soft carrying case.

The Corvus 500 is warranted by the manufacturer against defects in materials and workmanship for one year from date of delivery.

For those of you who have the HP-21 or 45 or any other advanced calculator on order, aren't you glad you still have the opportunity to take advantage for the release of the Corvus 500 for \$95.00? Hurry! Order yours today.

#### AN INVITATION:

Electronic Concepts is proud to offer this exciting Corvus 500 as well as other Mostek based calculators and digital watches as exclusive importer of Corvus Brand products for Australia.

You, our discerning reader will no doubt recognise the tremendous price/performance value on offer. By mailing the order coupon today we can assure you of early delivery — and should you not be satisfied, you may return the unit to us with full money back guarantee within seven (7) days.

Or better, convince yourself of the real quality and value of our Corvus range, just visit our conveniently located showroom in Cambridge House, Clarence Street, just behind Wynyard exit (York Street), or phone 02-29-3755 for more information.

#### Other Corvus models on offer:

**Corvus 600 Financial Genius \$80.00**  
**Corvus 615 Business Statistician \$25.00**  
**Corvus Digital Watches** — but more about these in our next advertisement.



ELECTRONIC CONCEPTS PTY LTD

Ground floor, Cambridge House,  
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 (02) 29 3753-4-5

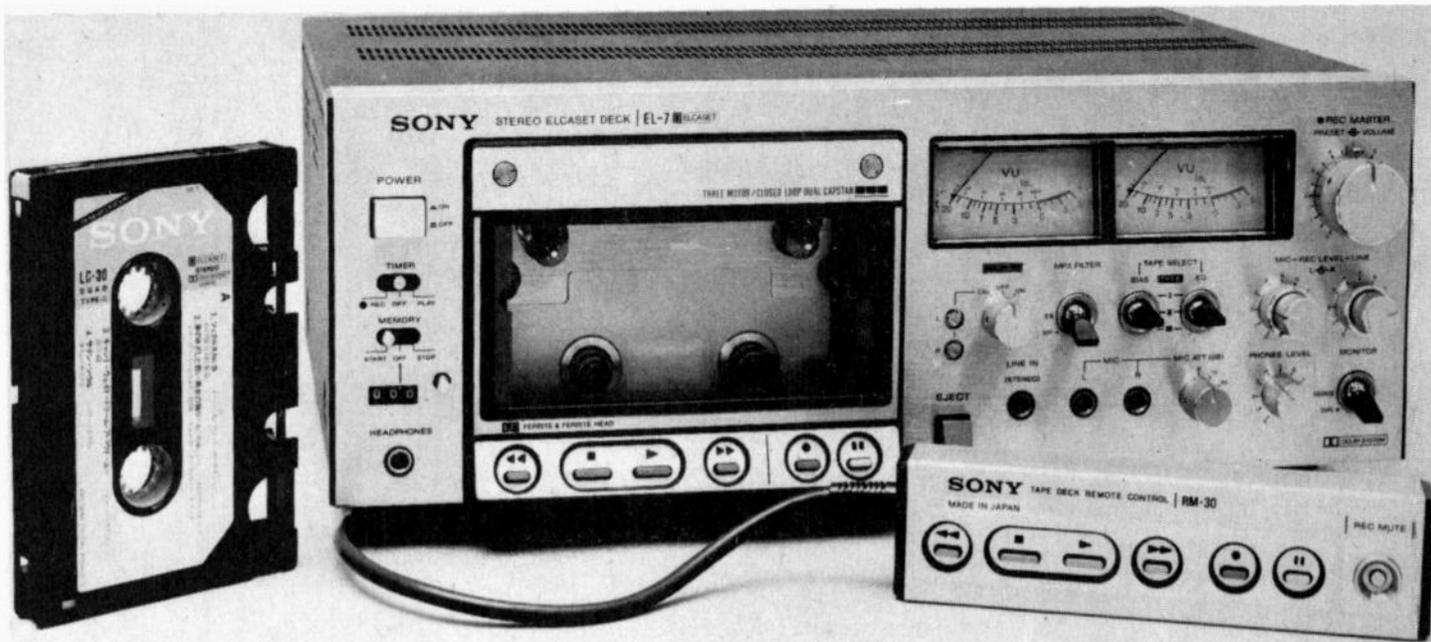
Yes! I'd like to try the Corvus 500 for 7 days  
 CASH payment: Cheque or money order enclosed. \$95 plus \$2.50 postage.

NAME .....  
 ADDRESS .....  
 POST CODE .....



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# THE ELCASSET

This new tape format combines the performance potential of open-reel with the convenience of the cassette. Whether it takes off or fails will depend on how much more product-updating the market can take.

THE COMPACT CASSETTE FORMAT introduced by Philips some years ago has been responsible for a number of remarkable developments in the field of tape recording. Major tape manufacturers have refined and improved oxide formulations and coating processes, equipment manufacturers have researched and developed new head designs using improved materials, and of course a number of noise-reduction systems have come into being.

Even so, the Compact Cassette has inherent restrictions. Even with the finest heads and tape, it is still not possible to record the highest audio frequencies on cassettes to give useful output levels; at extreme low frequencies problems still occur with replay equalisation and this gives audible performance deficiencies. It is clear the Compact Cassette is stretched to its performance limits at the present time, and whilst we can expect to see a continuation of the present trend of gradual improvement, it also seems unlikely that any major breakthrough is imminent that will solve the problems still remaining.

## MEASURED PERFORMANCE OF SONY ELCASET DECK MODEL EL-7

Frequency	+0		
	20 Hz to 20 kHz	-3 dB	(-10 VU)
Response:	+0 dB (0 VU)		
	20 Hz to 15 kHz	-3	
Total Harmonic Distortion	100 Hz	1 kHz	6.3 kHz
	0VU	0.6%	1.0%
Noise:	-10VU	<0.6%	<0.8%
	-52 dB (lin); -59 dB (A)	Dolby Out	
Wow & Flutter: (record to replay)	0.1% RMS		
	Unweighted		
Sensitivity: (for 0 VU)	Line	66 mV	Input Impedance
	Mic	0.205 mV	86 kΩ
Outputs:	Line	830 mV	Source Impedance
	Phones	2.6 V	3.3 kΩ
Crosstalk:	100 Hz	1 kHz	6.3 kHz
	-40 dB	-46.4 dB	-48 dB

Compact Cassettes therefore remain a definite 'poor relation' to other signal sources for listeners requiring highest reproduction quality. Yet cassettes are undeniably easier to use than records, in the sense they are less easily damaged by handling and playing, and this no doubt accounts for a great deal of their popularity. Realising this, a number of manufacturers have researched the possibility of producing a new format embodying the convenience of Compact Cassettes with the quality potential of open-reel. One such format, which seems to have fallen by the wayside, was BASF's Unisette. Another is the Elcaset, the result of intensive research by a consortium of interested Japanese manufacturers.

### The Elcaset

The Elcaset uses standard-width audio tape running at a speed of 19 cm/sec. Like the compact cassette and unlike open-reel, the quarter, track configuration is used to give mono compatibility — stereo pairs of signals are recorded on adjacent tracks, not alternate ones. The cassette itself looks basically similar to the familiar compact and miniature (dictating machine) types.

The differences, apart from size, are confined mainly to detail design aspects. For example, erase prevention is by means of retractable lugs rather than break-off tabs, the spooling hubs are

fitted with ratchet locks to prevent tape spillage when the cassette is removed from the recorder. The hubs are released by a recessed spring-loaded linkage operated by an appropriate bar fitted to the machine. Pressure pads are not used, tape being lifted out of the full-width aperture by moving guide posts.

The head assembly is fixed and, in the instance of the sample Sony EL-7 machine supplied for examination, uses a 'wrap-around' curved tape path. Tension on the tape is applied by two hinged guides on the cassette itself, working in conjunction with pinch roller/capstan assemblies to give intimate tape-to-head contact.

### The Sony EL-7

The drive system uses three motors, the Sony has incorporated its well-known closed-loop dual capstan system for constant-speed tape motion. All transport control functions are carried out using finger-touch push-buttons and use of servo-control enables a remote control unit to be added. Auto-stop, memory rewind and memory rewind/auto start facilities are incorporated and unattended automatic record and playback can be carried out using an optional timer control.

Outwardly, the review sample resembled a front-loading Compact Cassette unit. The obvious difference was

a larger cassette compartment, fitted with a hinge-down transparent window with damped movement applied by a mechanical governor. To the left of the compartment was the power on/off switch, a three position toggle for use in conjunction with the optional timer, a further three-position toggle covering memory rewind functions and the three-digit tape counter with push-button zero reset.

Transport controls were fitted to an angled projecting strip below the compartment.

The optional remote control unit, also supplied, duplicated all these functions but did not render the built-in controls inoperative. A feature of the remote control unit was a 'record-mute' pushbutton which, when depressed, reduced the level of a signal being recorded to zero — obviating the need for operation of the machine's master level control on completion of a recording.

The remaining controls were fitted to the area on the right of the cassette compartment. A pair of large VU meters, calibrated from -20 to +5 VU, were placed close to the top edge of the front panel and were bounded on their right by a master level control, effective on both channels simultaneously and fitted with an adjustable detent preset system. Below this were



*The Elcaset (shown here actual size) is more than twice the size of the Compact Cassette (and that's two-dimensionally — it's even bigger if we talk about volume).*

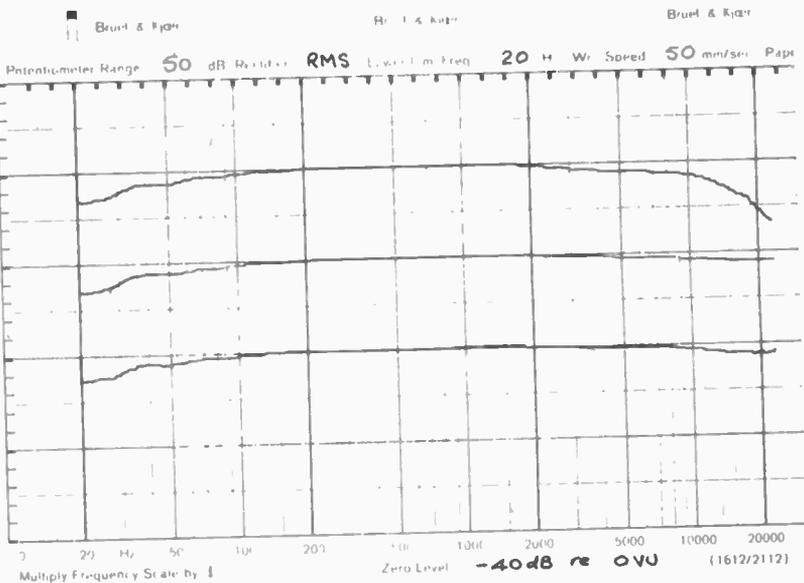
# THE ELCASET

Louis A. Challis  
& Associates Pty. Ltd.

RECORD TO REPLAY  
FREQUENCY RESPONSE OF  
SONY STEREO ELCASET DECK  
EL-7  
AT 0, -10,  
-20VU

LC-30 DUAD  
TYPE II  
TAPE.

Date: 14/10/76  
Sig: DFC



dual concentric level controls for microphone and line inputs, flanked to the left with a pair of three-position toggles for bias and equalisation adjustment.

Next was a further toggle controlling the multiple FM filter and alongside was a three-position rotary covering Dolby on/off and calibrate functions. Screwdriver presets were provided for Dolby record level calibration, using an inbuilt 400 Hz oscillator.

Remaining controls included a push-button for eject, a microphone attenuation control giving a choice of 15 or 30 dB reduction of level, an output level control for use with headphones and a tape/source monitor switch. Front panel sockets (standard jacks) were provided for microphone inputs (via tip and sleeve plugs) with an auxiliary line in socket and a headphone output — both using stereo tip, ring and sleeve plugs.

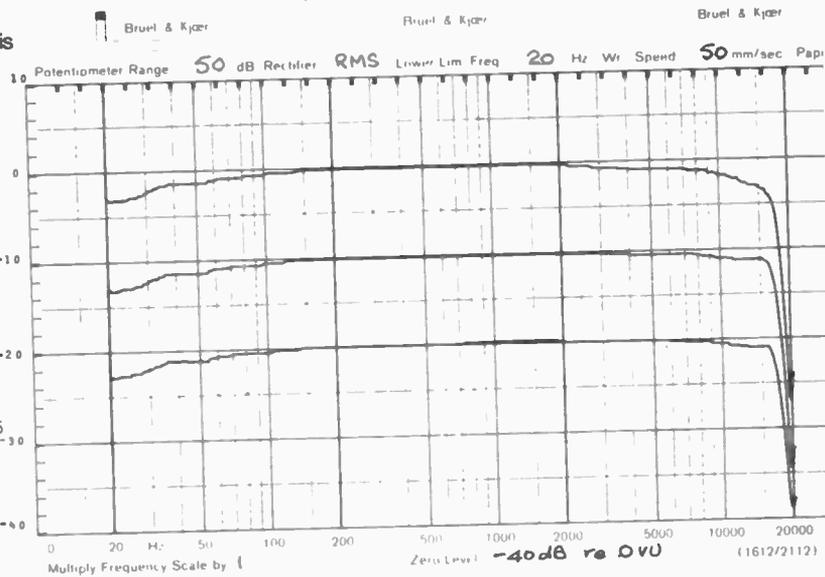
Rear panel complement included RCA-phono sockets for line inputs and outputs, a standard octal valve-base socket for connecting remote control or timer units, a pair of American-pattern AC outlets and an output level preset. A screw-type earthing post was also provided.

Standard of construction and finish appeared to be excellent, the front panel having a brushed aluminium overlay. The perforated metal cover was painted grey; removal of the cover revealed easily accessible circuit boards linked by slightly untidy wiring runs.

Louis A. Challis  
& Associates Pty. Ltd.

RECORD TO REPLAY  
FREQUENCY RESPONSE OF  
SONY STEREO ELCASET DECK  
EL-7 AT 0,  
-10, -20VU  
SHOWING  
EFFECT OF  
MULTIPLEX  
FILTER  
LC-30 DUAD  
TYPE II TAPE.

Date: 14/10/76  
Sig: DFC

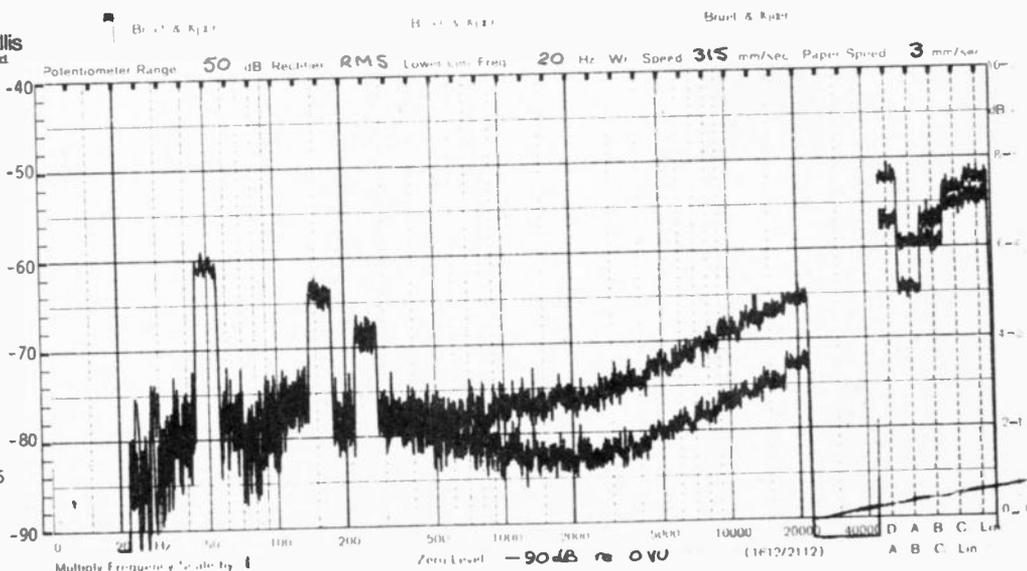


These graphs show the results of tests made in the laboratory of ETI's acoustical consultants.

Louis A. Challis  
& Associates Pty. Ltd.

1/3 OCTAVE ANALYSIS OF TAPE NOISE AFTER ERASURE BY SONY STEREO ELCASET DECK EL-7 SHOWING EFFECT OF DOLBY, LC-30 DUAD TYPE II TAPE.

Date: 14/10/76  
Sig: DFC



We were, however, impressed by the standards of construction and finish of the review sample.

One aspect needing clarification was the tape selector controls. Three types of tape were covered — type I, type II and type III. The sample tape supplied was dual-layer ferrichrome and was designated type II. We presume, therefore, but cannot confirm (no instruction manual or relevant literature was supplied with the machine) that type I refers to low-noise tape and type III to chromium dioxide.

The demonstration tape supplied was recorded on one side with the usual spectacular sounds we have come to expect from such tapes. The remaining tracks were left unrecorded.

Overall record/replay performance was considered excellent, subjectively. The Sony electronics performed extremely quietly and with little audible distortion. Recordings, by direct comparison with source signals using the source/tape monitor switch, seemed only marginally inferior to the originals. The chief characteristic was a slight and barely audible loss of high frequency detail — a deficiency which we feel could only be noticed by direct comparison. With Dolby switched out, tape hiss was negligible and audible only during silences between musical sequences. With Dolby in use, no tape hiss was audible at average volume levels although the sound became slightly but noticeably edgy.

Assuming this sort of performance to be typical, it would seem that Dolby noise reduction is superfluous with this machine; we preferred to tolerate the small amount of noise heard with Dolby switched out than the distortion heard with noise reduction switched in.

No obvious frequency non-linearities were observed during listening tests. Even at low and high frequency tonal balance was well maintained at all level except when incoming signals caused severe record overload. There was no evidence of diminished high frequency response when high record levels were used. Subjectively, the EL-7 returned marginally better results than an ageing Revox A77 running at 19 cm/sec.

The Sony EL-7 was judged to be a very good performer, and certainly convinced us that the Elcaset format is a welcome introduction to the hi-fi field. Combining the performance potential of good open-reel machines, and the operating convenience of cassettes, the Elcaset system is likely to have enormous appeal to critical hi-fi enthusiasts.



## FRG-7

### SYNTHESIZED RECEIVER



for  
Amateurs,  
Novices,  
and  
Short-Wave  
Listeners.

#### TECHNICAL DATA

- Electronic Band Changing.
- 0.5 — 29.9 MHz. Continuous Coverage.
- Uses Wadley Loop (drift cancellation circuit) to derive synthesized heterodyne oscillator signal.
- LSB, USB, AM and CW.
- Frequency Readout better than 10 KHz (readable to 5 KHz).
- Stability within 500 Hz during any 30 minute period after warmup.
- Better than 0.7  $\mu$ V for 10 dB S + N/NSS Band CW.
- Better than 2  $\mu$ V for 10 dB S + N/N AM.
- Selectivity  $\pm$  3 KHz at -6 dB,  $\pm$  7 KHz at -50 dB.
- Input Impedance, high 0.5 — 1.6 MHz. 50-75 Ohm 1.6 — 29.9 MHz.
- 234V AC 50-60Hz or 12V DC (external or internal 8 dry cell).
- Size 340 mm x 153 mm x 285 mm.

FRG-7 ..... \$279

Above prices include S.T. Prices and specifications subject to change.

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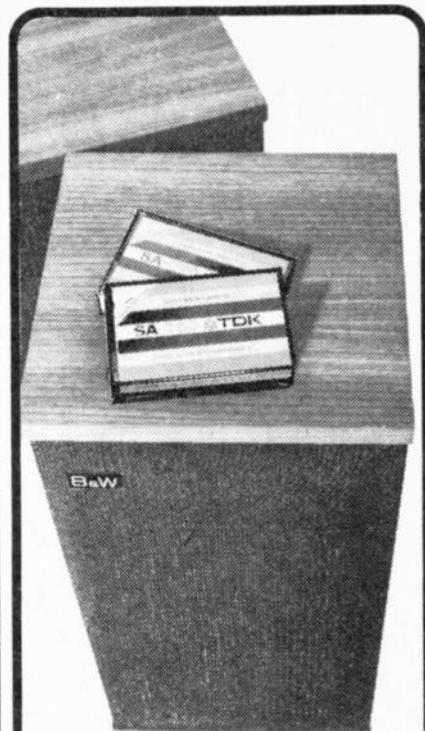
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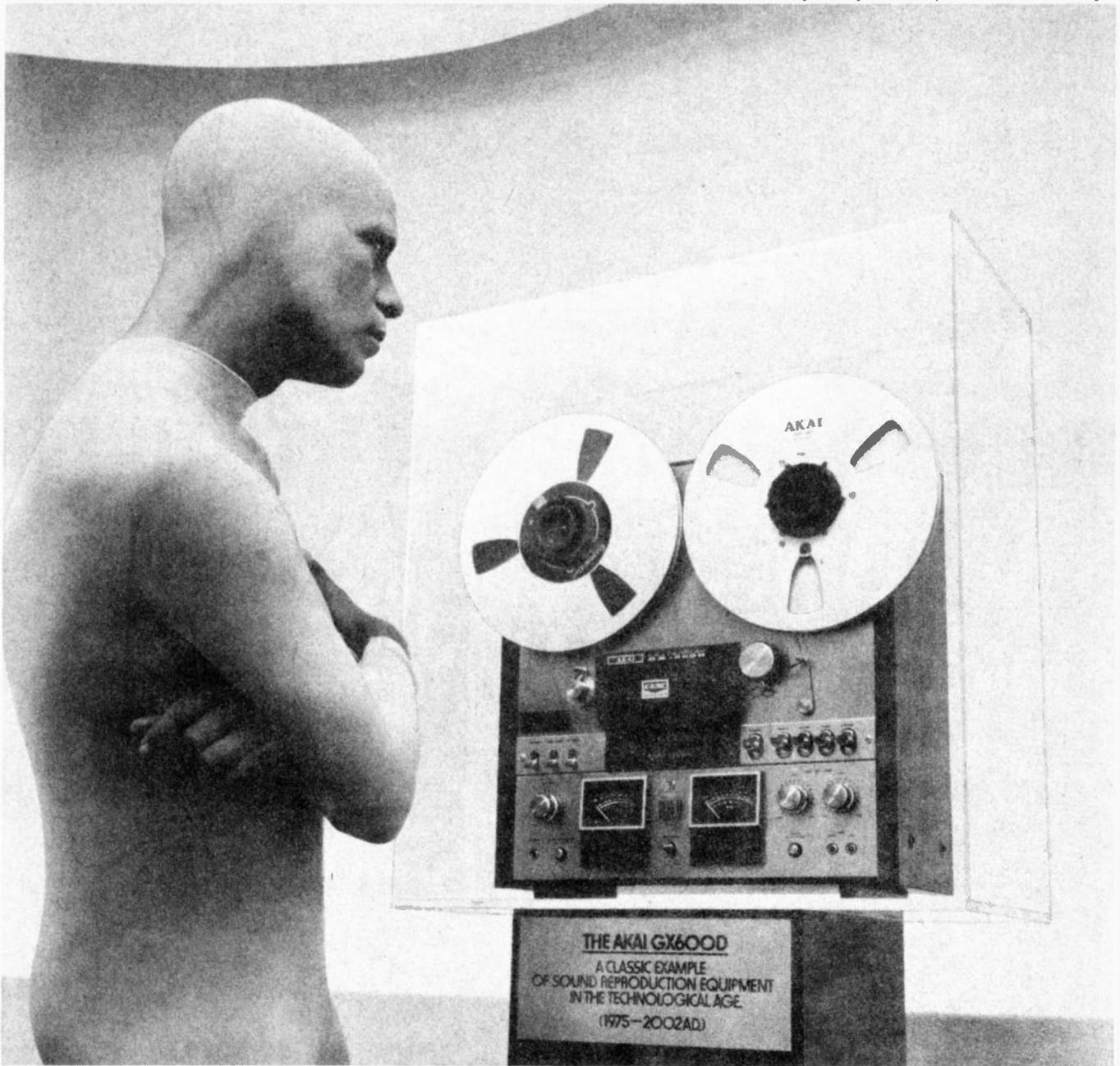


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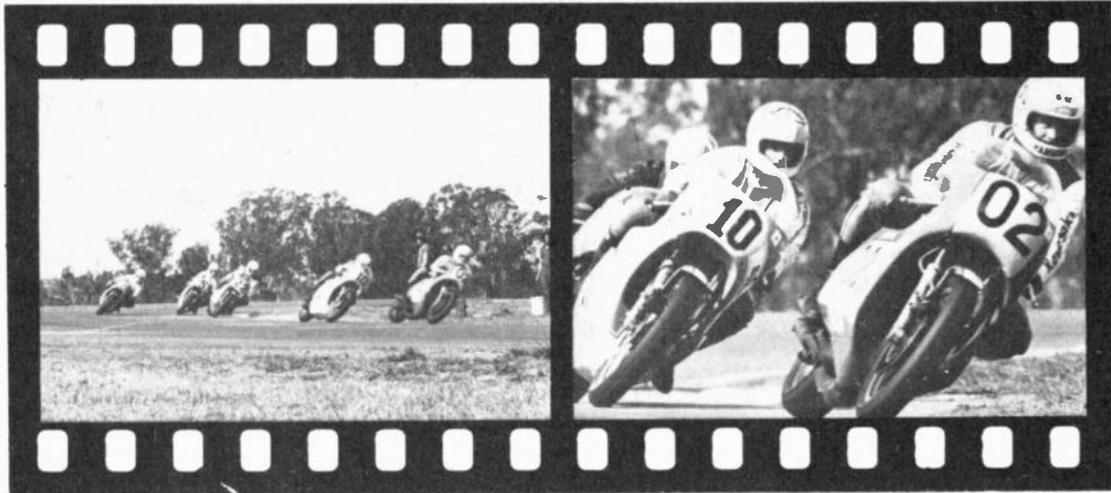
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TO  
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FROM  
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TO  
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## High voltage, high current supply

by B. R. Lewis & T. Hobbs, Dept. of Physics, University of Adelaide.

This is the first of several articles describing specific sections of colour TV circuitry. The circuit described here supplies 155 volts at a maximum continuous output current of 1.5 amps. The supply is fully protected against overloads and continuous short circuits — and has an output impedance of less than one ohm.

Sufficient details have been provided to enable the knowledgeable enthusiast to construct the circuits described. Further articles will cover digital varicap tuner control, infra-red remote control, etc.

INCREASED STRESSES IN THE deflection circuits of 110° colour television receivers place very great demands on the high tension power supply, especially if scan-derived low tension supplies are used. A typical large screen receiver draws some 200 watts using a 155 volt high tension rail supplying a mean current of about one amp.

Some commercial manufacturers have resolved this problem by designing switched-mode regulators operating at a frequency of the order of 20 kHz without using mains power transformers. These supplies are smaller in size and weight and can use cheaper filter capacitors, but they introduce problems in the form of radio frequency interference and portions of circuit which are floating at mains potential.

For the setmaker the choice between a switched-mode regulator and a conventional series regulator is fairly clear cut, most opting for the transformerless design on the grounds of economics, ease of mass production, smaller size and weight, and greater efficiency. For the private constructor however the problems are different. The relative lack of availability of published switched mode designs and ferrite E cores suitable for the high frequency

transformer, together with the increased safety and more familiar design techniques of a system with a mains transformer, combine to make a conventional series regulator more attractive.

Despite this conclusion, the design of a series regulator handling such high power at high voltage involves far more than merely rescaling a low voltage circuit, as will be seen:—

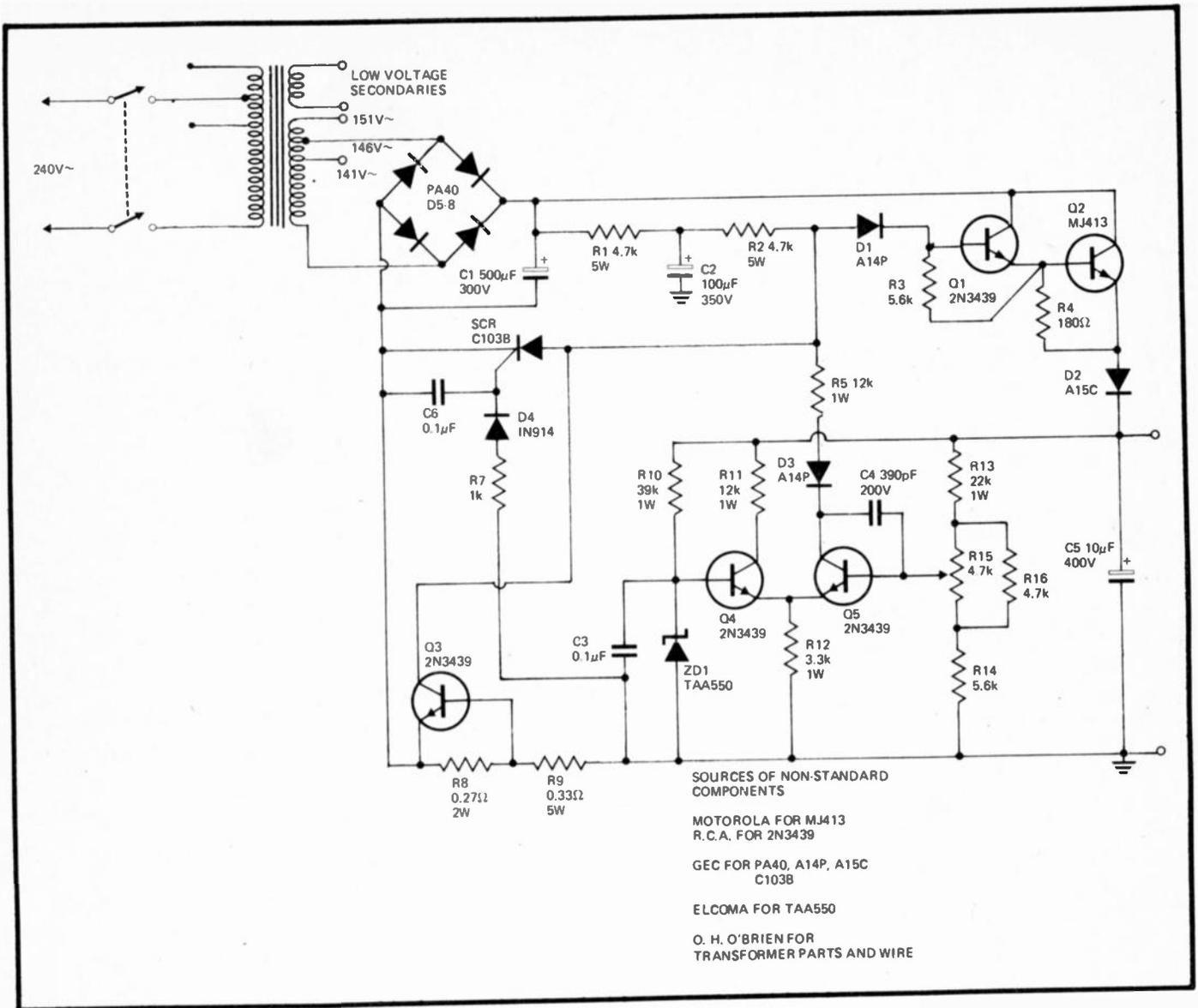
### THE CIRCUIT

The power transformer is non-standard, and constructional details will be given later. The main secondary winding provides about 150 Vrms off-load, and this is bridge rectified and applied to a capacitive filter. The bridge is rated at 12 A at 400 V P.I.V. and thus does not require a heatsink. The unregulated dc output varies from about 210 V without load to about 170 V with 13 V peak-to-peak ripple at full load current of 1.5 A.

The basic regulator consists of the Darlington series pass element Q1, Q2 with negative feedback applied from the output via the differential pair Q4, Q5 and voltage reference ZD. The high output voltage of 155 V allows the choice of a higher than normal reference voltage and this is supplied by an

integrated circuit (type TAA550) which gives a typical reference of 33 V at 2.5 mA with a typical temperature coefficient of  $-0.13 \text{ mV}/^\circ\text{C}$ , far superior to the normal zener diode type reference. This device stabilizes the output voltage against ambient temperature variations. In normal operation the bases of Q4 and Q5 are held at 33 V and thus the output voltage is determined by the resistive divider feedback chain R13-R16. The variable resistor R 16 allows the output voltage to be adjusted in a range  $\pm 15\%$  about the design centre value 155 V — although of course, with proper adjustment of the unregulated input voltage to minimize series pass power dissipation, there is no reason why other output voltages could not be chosen.

The series pass element receives its base drive via the network R1, R2, D1, and it is evident that this path is heavily decoupled by the large electrolytic capacitor C1. This gives a deliberate slow rise time to the drive and hence output voltage, consistent with the requirements of a supply powering a transistorized line output circuit which must be protected against switch-on surges. In practice the rise time is of the order of one second, but if this facility is not required C2 may be omitted.



Transistor Q1 has the following ratings:  $V_{CE0} = 350\text{ V}$ ,  $I_c(\text{max}) = 1\text{ A}$ ,  $P_D = 10\text{ W}$  at  $T_c = 25^\circ\text{C}$ , while those of Q2 are  $V_{CE0} = 325\text{ V}$ ,  $I_c(\text{Max}) = 10\text{ A}$ ,  $P_D = 125\text{ W}$  at  $T_c = 25^\circ\text{C}$ . It is thus clear that the Darlington pair is capable of holding off the unregulated input voltage of 210 V, and passing the maximum design output current of 1.5 A. For a normal mains input voltage, the maximum power dissipations for Q1, and Q2 are 1.5 W and 30 W respectively, and hence heatsinks must be used in each case. For Q1, a T05 metal header transistor, a substantial heatsink type LP5A1B (I.E.R.C.) is suggested, while Q2 requires a sufficient area of standard extruded type T03 heatsink to provide a thermal resistance around  $20^\circ\text{C/W}$ .

The main difficulty in designing a supply of this type lies in the provision of adequate overload and short circuit protection. Normal current limiting

would result in short circuit power dissipations in the series element of about 300 W, far exceeding device ratings. Foldback current limiting, while keeping the power dissipation within ratings under complete short circuit, invariably results in catastrophic destruction of Q2 due to traverses outside the safe operating areas during the foldback. This is of course due to secondary breakdown limitations rather than excessive average power dissipation. As an example the MJ413 can handle 0.8 A at 100  $V_{ce}$ , 0.15 A at 200  $V_{ce}$  and only 60 mA at 300  $V_{ce}$ , due to second breakdown effects. Thus any marginal static overload will always destroy the device. The only safe way to protect the regulator is by means of very fast dynamic overload sensing and protection.

This protection can be achieved by forcing the base of the series element to ground immediately a current overload

is sensed. This ensures that no current can then pass through Q1 or Q2 and that they merely have to hold off a maximum of 210 V under short circuit conditions. The bypassing of the drive to Q1 and Q2 is accomplished by an SCR triggered by the voltage across the current sensing resistors R8, R9, in the ground return. Diode D5 acts as a buffer to the input impedance of the SCR, allowing more reproducible triggering. Resistor R7, D5 and C6 give a time constant for triggering of some 100µS. From the safe operating area curves for the MJ413 it can be seen that 10 A, 100µS pulses are allowable at  $V_{ce} = 200\text{ V}$ . Transistor Q3 acts as an ultra fast current limiter in parallel with the SCR, limiting the current passed by Q2 to about 2 A during the 100µS period before the firing of the SCR, by sensing the voltage across R8. Thus the ratings of Q2 (and similarly Q1) are not exceeded under any circumstances.

# High voltage, high current supply

After an overload the regulator must be reset by switching off the mains.

Diodes D1 and D2 protect the emitter base junctions of Q1 and Q2 against reverse currents which occur if the SCR is inadvertently triggered while the output smoothing capacitor C5 still holds a charge. Diode D3 protects the collector-base junction of Q5 against forward bias in similar circumstances.

## PERFORMANCE

The nominal output voltage is 155 V, adjustable over a range of  $\pm 15\%$ . The output impedance of the regulator is less than  $1 \Omega$ , the output voltage dropping by less than 1.5 V over the full load current range of 0 to 1.5 A. At maximum output current the 100 Hz ripple in the output voltage is about 80 mV peak to peak. The regulator is fully overload and short circuit proof — one-shot protection coming into operation at load currents in excess of 1.5 A. The SCR has proved immune to spurious triggering, and, after months of operation in the authors' colour television receivers, not one case of false triggering has occurred.

## CONSTRUCTIONAL DETAILS

Layout is not critical and any standard method of construction may be employed.

As stated earlier Q1 and Q2 should have substantial heatsinks, and Q4 and Q5, which dissipate 300 mW or so, should also be fitted with small clip-on T05 type heatsinks. Apart from this, all other components may be free standing on the circuit board. The value of R9 may need slight trimming to set the overcurrent trip at exactly 1.5 A.

The main non-standard item of the supply is the power transformer. The authors' version was constructed according to the following specifications:

C cores	— 2 pairs HWR 90/24/12
frames	— 2 x 90/24
turns per volt	— 2.19
primary winding	— 548 turns 18 S.W.G. enamelled copper wire, tapped at 525 and 505 turns.
main secondary winding	— 330 turns 17 S.W.G. enamelled

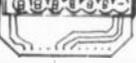
low voltage  
secondaries

copper wire,  
tapped at 320  
and 310 turns.  
— totalling 141  
turns 18 S.W.G.  
enamelled  
copper wire.

The primary and secondary windings are wound side by side, and in all about 0.8 kg of 17 S.W.G. and 2 kg of 18 S.W.G. wire are required, (less of course if the low voltage secondaries are not required).

With the C cores properly clamped, the primary magnetizing current is about 80 mA. The primary taps are at 230, 240 and 250 V, and the main secondary taps are at about 141, 146 and 151 Vrms. The low voltage secondaries may be wound as desired up to a maximum of about 150 VA.

It should be noted that the transformer is somewhat larger than might initially be thought necessary (total weight about 7 kg), but the authors are in favour of much smaller core temperature rises than currently seem in vogue with commercial manufacturers. ●

<h3>7 SEGMENT LED's</h3>  <table border="1"> <thead> <tr> <th>DEVICE NUMBER</th> <th>POLARITY C<sub>c</sub>, C<sub>e</sub>/C<sub>a</sub></th> <th>DIGIT HEIGHT</th> <th>1-9</th> <th>10-up</th> </tr> </thead> <tbody> <tr><td>FND-70</td><td>Com.Cath.</td><td>.250"</td><td>0.85</td><td>0.75</td></tr> <tr><td>FND-359</td><td>Com.Cath.</td><td>.357"</td><td>1.20</td><td>1.10</td></tr> <tr><td>FND-503</td><td>Com.Cath.</td><td>.500"</td><td>1.50</td><td>1.35</td></tr> <tr><td>FND-510</td><td>Com.Anode</td><td>.500"</td><td>1.60</td><td>1.47</td></tr> <tr><td>FND-800</td><td>Com.Cath.</td><td>.800"</td><td>3.95</td><td>3.65</td></tr> <tr><td>DL-33MB</td><td>Com.Cath.</td><td>.11"x3</td><td>1.45</td><td>1.30</td></tr> <tr><td>OL-747</td><td>Com.Anode</td><td>.600"</td><td>2.95</td><td>2.75</td></tr> <tr><td>MAN-74</td><td>Com.Cath.</td><td>.300"</td><td>1.65</td><td>1.48</td></tr> </tbody> </table>	DEVICE NUMBER	POLARITY C <sub>c</sub> , C <sub>e</sub> /C <sub>a</sub>	DIGIT HEIGHT	1-9	10-up	FND-70	Com.Cath.	.250"	0.85	0.75	FND-359	Com.Cath.	.357"	1.20	1.10	FND-503	Com.Cath.	.500"	1.50	1.35	FND-510	Com.Anode	.500"	1.60	1.47	FND-800	Com.Cath.	.800"	3.95	3.65	DL-33MB	Com.Cath.	.11"x3	1.45	1.30	OL-747	Com.Anode	.600"	2.95	2.75	MAN-74	Com.Cath.	.300"	1.65	1.48	<h3>CLOCK CHIPS</h3>  <table border="1"> <tbody> <tr><td>MM5314</td><td>4/6-digit, 12/24 hour, 50/60 Hz, stop/run, 24-pin dip.....</td><td>\$3.95</td></tr> <tr><td>MM5316</td><td>4-digit, Alarm, Snooze, Timer, 12/24 hour, 50/60 Hz, 40-pin.....</td><td>\$4.50</td></tr> <tr><td>MK50252</td><td>6-digit, Alarm, Snooze, 12 hour/60 Hz or 24 hour 50 Hz, 28-pin.....</td><td>\$3.95</td></tr> <tr><td>MK50381</td><td>4-digit Alarm, Snooze, Direct LEO drive, Radio timer, 40-pin.....</td><td>\$6.95</td></tr> <tr><td>F3817</td><td>4-digit Alarm, Snooze, Radio Timer, Direct LEO drive, Seconds, 40-pin.....</td><td>\$6.95</td></tr> <tr><td>PCB for MK50250</td><td>etched and drilled.....</td><td>\$3.95</td></tr> <tr><td>PCB for MK50381</td><td>etched and drilled, also takes 4 x FND-70 displays.....</td><td>\$3.96</td></tr> </tbody> </table> <p>All Clock chips supplied with data sheets.</p>	MM5314	4/6-digit, 12/24 hour, 50/60 Hz, stop/run, 24-pin dip.....	\$3.95	MM5316	4-digit, Alarm, Snooze, Timer, 12/24 hour, 50/60 Hz, 40-pin.....	\$4.50	MK50252	6-digit, Alarm, Snooze, 12 hour/60 Hz or 24 hour 50 Hz, 28-pin.....	\$3.95	MK50381	4-digit Alarm, Snooze, Direct LEO drive, Radio timer, 40-pin.....	\$6.95	F3817	4-digit Alarm, Snooze, Radio Timer, Direct LEO drive, Seconds, 40-pin.....	\$6.95	PCB for MK50250	etched and drilled.....	\$3.95	PCB for MK50381	etched and drilled, also takes 4 x FND-70 displays.....	\$3.96	<h3>CRYSTAL TIME BASE</h3> <p>Here's an excellent kit for converting your mains operated clock to DC operation. This unit has an output of 60 Hz, but is ideal for use with the MM5314, MM5316, MK50252, CT7001, F3817 and many other clock chips which have both 50 and 60 Hz inputs. Features include low power consumption (5mA typ.), 5-15 VDC operation, small size and .005% accuracy. Kit includes crystal, PCB, trimmer, caps, resistor and a 17-stage binary divider, oscillator IC. Complete with hookup information.</p> <p>ONLY \$5.95 ea. 10 for \$47.00. 100 for \$425.00</p>																													
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Mini Grn	2	0.80	1.50	13.50	120.00																																																																																												
Jumbo Red	3	0.80	1.50	13.50	120.00																																																																																												
Jumbo Yell	3	1.25	2.40	22.00	205.00																																																																																												
Jumbo Orng	3	1.25	2.40	22.00	205.00																																																																																												
Jumbo Grn	3	1.20	2.30	21.00	198.00																																																																																												
2N2222	NPN Transistors, Gen'l. purpose.	20/ \$1.00																																																																																															
2N2907	PNP Transistors, Gen'l. purpose.	20/ \$1.00																																																																																															
1N4148	Silicon switching diodes	40/ \$1.00																																																																																															
2N4443	SCR, 400V - 8 Amp SCR, (please specify cut leads otherwise we'll supply regular types at 65¢ ea.	3/ \$1.00																																																																																															
0.01uF	100V Ceramic Disc caps	30/ \$1.00																																																																																															
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## DIGITAL AUTO CLOCK



**KIT SI-20**  
ONLY  
**\$29.95**  
Plus \$2.95 Airmail  
post/registration

Let your car, van, boat, caravan, truck, aircraft or any other vehicle join the Digital Revolution with our new Digital Auto Clock.

### FEATURES

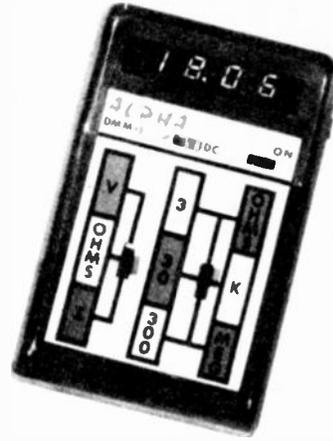
9-14 VOLTS AC OR DC OPERATION • TWO-WIRE NON-POLARIZED POWER INPUT • BRIGHT 27" RED LED DISPLAY • DISPLAY BLANKS WHEN IGNITION TURNED OFF • 12 OR 24 HOUR TIME DISPLAY • QUARTZ CRYSTAL ACCURACY TO WITHIN 002% (ADJUSTABLE) • HIGH-TEMP ABS PLASTIC CASE WITH MOUNTING BRACKET • CAN BE MOUNTED ON OR UNDER VEHICLE DASH • BATTERY BACK-UP FOR POWER FAILURE OR MOVING FROM HOUSE TO CAR ETC. • EASY TIME SETTING VIA HIDDEN SWITCHES IN FRONT OF CASE • VOLTAGE SPIKE AND NOISE SUPPRESSING CIRCUITRY

Complete kit includes all parts (circuit vs. etched and drilled PCB Boards, Case and mounting bracket, 1.55 9V transistor battery)

ALSO AVAILABLE WITH 36" DISPLAYS **KIT SI-204**

**\$33.95** (plus post/registration)

## ALPHA MODEL DMM-1ER DIGITAL MULTIMETER KIT



SAVE  
**\$5.00**

ONLY  
**\$64.95**  
Plus \$2.95 Airmail  
post/registration

### Measures:

- AC VOLTAGE
- DC VOLTAGE
- AC CURRENT
- DC CURRENT
- RESISTANCE

### specifications

<b>AC VOLTAGE</b> Range: 10, 100, 1000, 10000 Input Impedance: 10 MΩ Accuracy: ±1% Frequency Response: 50 Hz to 100 kHz	<b>DC VOLTAGE</b> Range: 10, 100, 1000, 10000 Input Impedance: 10 MΩ Accuracy: ±1% 300V, ±1% 1000V
<b>RESISTANCE</b> Range: 100, 1000, 10000, 100000 Accuracy: ±1%	<b>RESOLUTION</b> 1000000, 100000, 10000, 1000, 100, 10, 1
<b>CURRENT</b> DC Current: 10, 100, 1000, 10000 Accuracy: ±1% AC Current: 10, 100, 1000, 10000 Accuracy: ±1% AC Frequency Response: 50 Hz to 100 kHz	<b>GENERAL</b> Readout: 1000000, 100000, 10000, 1000, 100, 10, 1 Power Source: 1.55 9V Transistor Battery Indications: 1000, 100, 10, 1, 0.1, 0.01, 0.001 Polarity Indication: Yes Size: 110 x 110 x 30 mm Weight: 100g

TEST LEADS AND BATTERIES NOT INCLUDED

## 4-DIGIT DECADE COUNTER



The Decade Counter is a basis for a wide variety of instruments.

- On-chip internal oscillator for scanning speed
- Overflow and count exhibit outputs
- Transfer, reset, count, blanking and tri-complement control inputs
- Circuit board can be cascaded to 8, 12, 16 digits
- Kit includes all components, PCB's, LED displays (you select the size) and complete instructions

**KIT SI-12A** (with 0.27" displays) **\$23.95**  
**KIT SI-12B** (with 0.50" displays) **\$27.95**

## FM WIRELESS MIC.

Kit SI-36 is a complete new design in FM wireless transmitters. A unique PC foil layout eliminates the need for a wire wound coil. Use with any dynamic type microphone to broadcast over the FM band. Use as an Intercom, Baby Alert, Magic Shows, School Service, Project etc. Transmitter frequency adjustable via a trimmer cap.

Battery and microphone not included

Frequency Range: 80 MHz to 200 MHz  
Output Power: 100 mWatt with 9 volt  
Microphone Power: 1 watt with 50 volt  
Current Consumption: 10 mA at 50 volt  
Frequency Response: Maximum 22 KHz  
Size: 1.5" x 2.0"  
Material: PCB

**KIT SI-36 \$3.95**

## CRYSTAL TIME BASE 60KHZ OUTPUT



Here is the ideal kit for converting your AC powered digital clock to DC operation. This unit has a 60KHz output but is ideal for use with clock chips such as the MM5314, MM5316, CT7001 and others which have both 50 and 60KHz inputs.

Features include: Low power consumption (5mA typ.) 5-15 VDC operation, small size (1.1" x 2.1") adjustable accuracy to 0.05%. Kit includes all components, PCB and easy assembly and hookup instructions to interface with most MOS clock chips.

**KIT SI-62**  
**\$6.95**

### DISPLAY LED's



FND 70	C.C.	25 mm	0.85 ea.	5 \$ 3.95
FND 357	C.C.	36 mm	1.20 ea.	5 \$ 6.05
FND 503	C.C.	50 mm	1.50 ea.	5 \$ 7.35
FND 510	C.A.	50 mm	1.60 ea.	5 \$ 7.75
FND 800	C.C.	80 mm	3.45 ea.	5 \$ 18.75
FND 810	C.A.	80 mm	3.95 ea.	5 \$ 19.75
DL33MM8	C.C.	11 x 3	1.45 ea.	5 \$ 6.75
DL 747	C.A.	60 mm	2.95 ea.	5 \$ 14.75
XAN 654	C.C.	60 mm	2.95 ea.	5 \$ 14.75
XAN 664	C.C.	60 mm	2.75 ea.	5 \$ 12.95

\* Denotes they are high speed digital point

C.C. Common Cathode C.A. Common Anode

### DISCRETE LED's



Description	Fig	5	10	100
Sublim Red	1	0.60	1.10	10.00
Sublim Green	1	0.90	1.70	10.00
Sublim Red	2	0.60	1.10	10.00
Mini Green	2	0.80	1.50	13.50
Mini Red	3	0.80	1.50	13.50
Mini Orange	3	1.25	2.40	27.00
Mini Yellow	3	1.25	2.40	27.00
Mini Green	3	1.20	2.30	21.00

### CLOCK CHIPS



MM5114	6 digit 12.24 Hz 50/60Hz Multiplexed 24 pin dip	\$3.95
MM5316	4 digit 12.24 Hz 50/60Hz Alarm Szr 40 pin dip	\$4.50
MK50252	6 digit Alarm Szr 12 Hz 60Hz 24 Hz 50Hz 28 pin	\$2.95
MK50381	4 digit direct LED Alarm Szr Radio timer non multiplex 40 pin	\$1.95
PCB for MK50252	etched and drilled	\$1.95
PCB for MK50381	etched and drilled also accommodates 4 x FND70	\$3.95

All clock chips supplied with data sheets.

### LINEAR IC's



708	Micro Power Op Amp	1.00	10 \$ 9.00
380	2 Wire Audio Amp	1.00	10 \$ 9.00
555	Timer	0.59	10 \$ 5.50
765	Phase Locked Loop	1.75	10 \$ 16.00
567	PLL Tone Decoder	1.39	10 \$ 12.70
727	Voltage Regulator	0.65	10 \$ 4.95
741	Op Amp	0.25	10 \$ 2.25
709	Op Amp	0.25	10 \$ 2.25
1099	5V 1A V Regulator	1.00	10 \$ 9.50
7805	5V Regulator TO 220	0.95	10 \$ 9.00
7812	12V Regulator TO 220	0.95	10 \$ 9.00
7815	15V Regulator TO 3	1.25	10 \$ 11.50
7824	24V Regulator TO 3	1.25	10 \$ 11.50
2102	1K Static RAM	2.25	10 \$ 21.50

### SPECIAL CIRCUITS



MK5007	4 digit decade counter latch decoder 7 seg and BDC outputs 28 pin chip with data	\$12.50
MK5005	4 digit decade counter latch/decoder 7 segment output only 24 pin dip with data	\$ 9.50
MK5007	4 digit decade counter latch/decoder with BDC outputs only 16 pin dip with data	\$ 7.00

### OOOPS! WE RAN OUT OF SPACE....

to list many other kits and components. No worry, they are all in our flyers which are sent with every order. However, if you want the flyers only, send two International Reply Coupons and we'll rush them to you via Airmail!

### 9-DIGIT DISPLAY

Only super steaks. The only fault we found with them is that some digits may be slightly dimmer than others. All segments light. At 11 cents a digit you can't lose. Ideal for a mini digital clock or a watch or calculator. **COM. CATHODE**  
**SPECIAL — \$0.99 each 3 for \$2.60**

### LED DRIVER IC's



**75491** Quad Segment Driver **\$0.39**  
**75492** Hex Digit Driver **\$0.49**



All prices are listed in Australian dollars. Please add postage where shown. We pay Airmail postage on all other items. Remittance must be by Bank Draft (preferably) for an equivalent amount in US dollars or by International Postal Money Order (in which case original receipt should be enclosed with order).

**NOTE: DUTY MAY BE PAYABLE ON GOODS IMPORTED**

**MINIMUM ORDER \$55.00 PLEASE**

**sabtronics**

PO BOX 64683 DALLAS, TX 75206, USA  
TELEPHONE (214) 369 7309



# ELECTRONIC COMPONENTS

BY POST

## IC SOCKETS

8 PIN	.30
14 PIN	.35
16 PIN	.40
18 PIN	.50
22 PIN	.90
24 PIN	.90
28 PIN	1.20
40 PIN	1.60
25 WAY STRIPS	

## CMOS

4000	.35	4046	2.75
4001	.35	4049	1.00
4002	.35	4050	1.00
4006	2.30	4051	2.50
4007	.35	4060	2.85
4008	1.90	4071	.40
4009	1.15	4081	.40
4010	1.15	4082	.45
4011	.35	4416	1.20
4012	.35	4426	3.50
4013	.85	4449	.40
4014	2.40	4511	2.65
4015	1.95	4518	2.45
4016	.85	4520	2.45
4017	2.20	14553	7.75
4018	2.45	74C00	.35
4019	1.25	74C02	.35
4020	2.60	74C04	.35
4021	2.60	74C08	.35
4022	2.20	74C10	.35
4023	.35	74C14	1.50
4024	1.80	74C48	3.30
4025	.35	74C73	.85
4027	1.20	74C76	.85
4028	1.95	74C90	2.35
4029	2.20	74C93	2.35
4030	1.00	74C192	2.95
4035	2.50	74C193	2.95
4040	2.65	74C221	2.35
4043	1.60	74C89	12.75
4044	1.60		

## TTL

7400	.35	7460	.35
7401	.35	7470	.50
7402	.35	7472	.60
7403	.35	7473	.90
7404	.35	7474	.90
7405	.35	7475	1.00
7406	.60	7476	.80
7408	.35	7480	1.70
7409	.35	7482	1.80
7410	.35	7483	1.40
7413	.85	7486	.60
7414	.60	7489	3.50
7420	.35	7490	.80
7426	.80	7491	1.20
7430	.35	7492	.80
7437	.60	7493	.80
7440	.35	74121	.60
7441	1.20	74123	.85
7442	1.00	74153	1.50
7447	1.50	74154	2.60
7448	1.50	74164	2.40
7450	.35	74165	2.40
7451	.35	74192	2.00
7453	.35	74193	2.00
7454	.35		

## LOW POWER SHOTTKY

74LS00	.39	74LS78	.51
74LS01	.39	74LS86	.67
74LS02	.39	74LS90	1.37
74LS03	.39	74LS92	1.37
74LS04	.43	74LS93	1.37
74LS05	.43	74LS95	1.84
74LS08	.39	74LS109	.61
74LS09	.39	74LS113	.61
74LS10	.39	74LS114	.61
74LS11	.39	74LS151	1.80
74LS13	.86	74LS157	1.71
74LS14	2.02	74LS163	2.86
74LS20	.39	74LS164	2.02
74LS21	.39	74LS174	1.84
74LS27	.43	74LS175	1.84
74LS28	.43	74LS181	4.59
74LS30	.39	74LS191	3.06
74LS32	.47	74LS192	3.06
74LS37	.47	74LS193	3.06
74LS38	.47	74LS194	1.84
74LS40	.43	74LS195	1.84
74LS42	1.53	74LS196	1.84
74LS73	.51	74LS221	1.74
74LS74	.61	74LS253	1.88
74LS75	.86		

## VOLTAGE REGULATORS

309K	(+5V, 1A) Regulator (TO3)	\$1.95
317K	(2-30V 1A) Adjustable Regulator (TO3)	3.50
317T	(2-30V 1A) Adjustable (TO220)	3.20
325	(± 15V 100mA) Regulator (DIP)	3.25
320-12	(-12V 1A) Negative Regulator	2.75
340-5	(+5V 1A) Regulator (TO220)	2.20
340-6	(+6V 1A) Regulator (TO220)	2.20
340-8	(+8V 1A) Regulator (TO220)	2.20
340-12	(+12V 1A) Regulator (TO220)	2.20
340-15	(+15V 1A) Regulator (TO220)	2.20
340-18	(+18V 1A) Regulator (TO220)	2.20
340-24	(+24V 1A) Regulator (TO220)	2.20
78L05	(+5V 100mA) Economy Regulator (TO92)	.85
78L12	(+12V 100mA) Economy Regulator (TO92)	.85
78L15	(+15V 100mA) Economy Regulator (TO92)	.85
79L05	(-5V 100mA) Economy Negative Regulator (TO92)	.85
79L12	(-12V 100mA) Economy Negative Regulator (TO92)	.95
79L15	(-15V 100mA) Economy Negative Regulator (TO92)	.95
723	(2-37V) General Purpose Regulator (DIP)	.95

Minimum Order \$5.00

Please add .75¢ towards Post & Packing



THE ELECTRONIC MAILBOX

P.O. BOX 355 HORNSBY 2077 PHONE 476 4758

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Offer expires January 31st, 1977.

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BC547, 548, 549) Choose your	
BC557, 558, 559) own mix	50 for \$5.25
301 OP AMP (WITH APPLICATIONS DATA)	5 for \$1.95
741 OP AMP (WITH APPLICATIONS DATA)	6 for \$1.95
555 TIMERS (WITH APPLICATIONS DATA)	5 for \$3.00
IN914 DIODES	20 for \$1.25
4001 CMOS QUAD NOR GATE	5 for \$1.20
4011 CMOS QUAD NAND GATE	5 for \$1.20
4017 CMOS DECADE COUNTER	2 for \$3.00
2102 1024 BIT STATIC RAM	2 for \$5.00
309K TO3 5V 1A REGULATOR	2 for \$2.75
LED PACK 8 RED, 1 YELLOW, 1 GREEN	\$2.20

## MICROPROCESSOR BITS

RAMS	
2101 256 x 4 MOS STATIC	\$6.95
2102 1024 x 1 MOS STATIC	\$3.25
2112 256 x 4 MOS STATIC	\$6.95

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82523 32 x 8 FUSIBLE LINK	\$5.75
825123 32 x 8 FUSIBLE LINK	\$5.75
1702A 256 x 8 E PROM	\$19.75
5203 512 x 4 E PROM	\$19.75
5204 512 x 8 E PROM	\$40.00

### CHARACTER GENERATORS

2513 ASCII 5 x 7 MATRIX	\$12.75
UART	
S1883	\$9.50

### INTERFACE

8T26 TRISTATE BUS TRANSCEIVER	\$3.75
81LS95 TRISTATE HEX BUFFER (TRUE 8 COM)	\$2.00
81LS96 TRISTATE HEX BUFFER (INV 8 COMM)	\$2.00
81LS97 TRISTATE HEX BUFFER (TRUE 4/4)	\$2.00
81LS98 TRISTATE HEX BUFFER (INV 4/4)	\$2.00
8544 QUAD SWITCH DEBOUNCER	\$1.75
8095 TRISTATE HEX BUFFER	\$2.50
8551 TRISTATE QUAD D FLIP FLOP	\$4.00
8833 QUAD TRISTATE TRANSCEIVER (TRUE)	\$3.00
8834 QUAD TRISTATE TRANSCEIVER (INVERTING)	\$3.00
8839 QUAD TRISTATE TRANSCEIVER (TRUE)	\$3.00

## DIODES

OA91	General Purpose Germanium	.15
IN914	General Purpose Silicon	.07
IN4004	400V 1A	.09
IN4007	1000V 1A	.18
A15A	100V 5A	.65
MD3501	100V Bridge	3.75
MD3504	400V Bridge	4.50

## ZENERS

.90	BZX79 Series All Voltages from 3.3 to 20V	.30
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**GENERAL PURPOSE — LOW PROFILE TRANSFORMERS FOR CONNECTING TO 240V 50HZ. DESIGNED TO COMPLY WITH CLAUSES 4,10,20(b) and 20(c) OF AUSTRALIAN STANDARD C126.**

**PRINTED CIRCUIT BOARD MOUNTING 5VA**

TYPE No.	SERIES CONNECTIONS	PARALLEL CONNECTIONS
PL6/5VA	6 volts at 0.83 amp	3 volts at 1.67 amp
PL9/5VA	9 volts at 0.56 amp	4.5 volts at 1.11 amp
PL12/5VA	12 volts at 0.42 amp	6 volts at 0.83 amp
PL15/5VA	15 volts at 0.33 amp	7.5 volts at 0.67 amp
PL18/5VA	18 volts at 0.28 amp	9 volts at 0.56 amp
PL24/5VA	24 volts at 0.21 amp	12 volts at 0.42 amp
PL30/5VA	30 volts at 0.17 amp	15 volts at 0.33 amp



Height . . . . . 32mm  
Width . . . . . 40mm  
Length . . . . . 53mm

**CHASSIS OR FRAME MOUNTING 20VA**

TYPE No.	SERIES CONNECTIONS	PARALLEL CONNECTIONS
PL12/20VA	12 volts at 1.67 amps	6 volts at 3.33 amps
PL15/20VA	15 volts at 1.33 amps	7.5 volts at 2.67 amps
PL18/20VA	18 volts at 1.11 amps	9 volts at 2.22 amps
PL24/20VA	24 volts at 0.83 amps	12 volts at 1.67 amps
PL30/20VA	30 volts at 0.67 amps	15 volts at 1.33 amps
PL40/20VA	40 volts at 0.50 amps	20 volts at 1.00 amps
PL50/20VA	50 volts at 0.40 amps	25 volts at 0.80 amps

**PL1.5-18/20VA**

Is provided with a multi tapped single secondary winding rated at 1.11 amps from which the following voltages are obtainable: 1.5V, 3V, 4.5V, 6V, 7.5V, 9V, 10.5V, 12V, 13.5V, 15V, and 18V. Additionally centre tap configurations are all obtainable e.g.- 9V-0-9V, 7.5V-0-7.5V, 6V-0-6V, 4.5V-0-4.5V, 3V-0-3V, and 1.5V-0-1.5V.

**CHASSIS OR FRAME MOUNTING 40VA**

TYPE No.	SERIES CONNECTIONS	PARALLEL CONNECTIONS
PL15/40VA	15v, 13.5v, 12v, 9v 3v at 2.67A	7.5v, 6v, 1.5v at 5.33A
PL30/40VA	30v, 27v, 24v, 18v, 6v at 1.33A	15v, 12v, 3v at 2.67A
PL50/40VA	50v, 45v, 40v, 30v, 10v at 0.8A	25v, 20v, 5v at 1.6A
PL30-9/40VA	30v at 0.5A with 9v at 3.0A	15v at 1.0A with 9v at 3.0A

**PL1.5-18/40VA**

Is provided with a multi tapped single secondary winding rated at 2.22 amps for which the following voltages are obtainable: 1.5V, 3V, 4.5V, 6V, 7.5V, 9V, 10.5V, 12V, 13.5V, 15V, and 18V. Additionally centre tap configurations are all obtainable e.g.- 9V-0-9V, 7.5V-0-7.5V, 6V-0-6V, 4.5V-0-4.5V, 3V-0-3V, and 1.5V-0-1.5V.

**CHASSIS OR FRAME MOUNTING 60VA**

TYPE No.	SERIES CONNECTIONS	PARALLEL CONNECTIONS
PL30/60VA	30v, 27v, 24v, 18v 6v at 2.0A	15v, 12v, 3v at 4.0A
PL50/60VA	50v, 45v, 40v, 30v, 10v at 1.2A	25v, 20v, 5v at 2.4A
PL80/60VA	80v, 70v, 60v, 50v, 20v, at 0.75A	40v, 30v, 10v at 1.5A

Height — 20VA & 40VA . . . . . 38mm  
Height — 60VA . . . . . 53mm  
Width . . . . . 60mm  
Length . . . . . 110mm



**SECONDARY RATINGS LISTED ARE STOCK TYPES, OTHER RATINGS MANUFACTURED TO ORDER.**

**PLUG ADAPTORS TYPE "PPA"**

are manufactured with AC or DC output rated up to 7VA, AC, and 4.5VA, DC depending upon filtering and regulation specified. They are provided with either flexible output leads, or quick connect terminals. Quick connect terminals are suitable only where output polarity is no consequence. Applications include: battery chargers for Nicad cells, battery savers for transistorised equipment (radio receivers, tape players, calculators, etc.) and any situation where low power and low voltage is specified. General purpose types with DC filtered output are stocked.



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# Metal film resistors

Following the last article on carbon film resistors this part now looks at metal film types. Next month we will continue with resistors by looking at metal glaze and wire-wound types and potentiometers.

THESE RESISTORS ARE MUCH THE same in appearance and size to deposited-carbon resistors. The resistive film is deposited on a ceramic or glass former by evaporating a metal or alloy in a vacuum, the metal condenses on the surface of the former, forming a hard, dense film. Nickel-chrome alloys are most commonly used. Some manufacturers use a chemical deposition process to coat a former with a nickel alloy. Packaging and protection for metal film resistors is similar to carbon film resistors.

The temperature coefficient of these resistors is superior to most other types with the exception of precision wire-wound resistors. The TC is typically  $\pm 100$  ppm/°C but they are available with a TC as low as  $\pm 20$  ppm/°C. The construction of these resistors makes it possible to supply them in controlled values of temperature coefficient over a wide range of values. Typical TC ranges for such types are as follows:—

0 $\pm$ 50 (ppm/°C)	0 + 50 (ppm/°C)
0 $\pm$ 100 "	0 + 100 "
0 $\pm$ 150 "	0 - 50 "
0 $\pm$ 200 "	0 - 100 "

The thickness of the film establishes the resultant temperature coefficient. This is positive for thick films; the magnitude decreasing with decreasing film thickness, passing through zero and then turns negative for thin films.

The noise level of metal film resistors is very low, being typically  $0.015 \mu\text{V/V}$  which is only rivalled by metal-glaze resistors. However, wirewound resistors are superior to all the others.

Stability of these resistors under ordinary use is generally better than 0.2% which is only bettered by precision wirewound resistors. As a consequence, metal film resistors are available in tolerances as low as  $\pm 0.25\%$  and  $\pm 0.5\%$ . Generally they are available in tolerances of  $\pm 1\%$ ,  $\pm 2\%$  and  $\pm 5\%$ .

Some types of metal film resistors are available in hermetically sealed glass envelopes. The envelope is filled with helium and this type of construction permits a substantial increase in rating. Operation at ambient temperatures as high as 150 to 200 °C at full ratings and up to 250 °C at one third rating is possible. These types also have stability equivalent to precision wirewound resistors.

Most types of metal film resistors have a hot-spot temperature of 150 or 155 °C and are derated from 100% load rating at 70 °C ambient. The derating curve is given in Figure 2. Miniature tenth watt and eighth watt metal film resistors produced by some manufacturers may have a hot-spot temperature of only 125 °C, but are still derated from 70 °C as shown in Figure 3. Mil-spec types are rated for full load operation to either 120 or 125 °C and may have a hot-spot temperature of 170 °C or as high as 200 °C from some manufacturer. Two typical derating curves are shown in Figure 4.

In general, metal film resistors offer all the advantages of deposited-carbon film resistors as well as exhibiting much

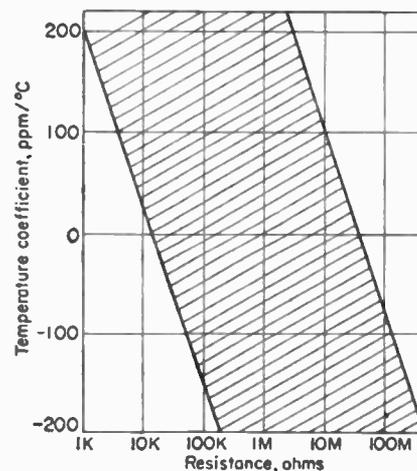


Fig. 1. Range of temperature coefficients available for various values of metal film resistors having controlled TC characteristics.

superior stability and temperature coefficient characteristics. They generate much lower noise in operation than most other types of resistors. Frequency characteristics are much the same as for carbon film resistors, the construction being largely the same. Metal film resistors are available in wattage ratings from 0.1 W to 1 W, generally, but higher power types are available.

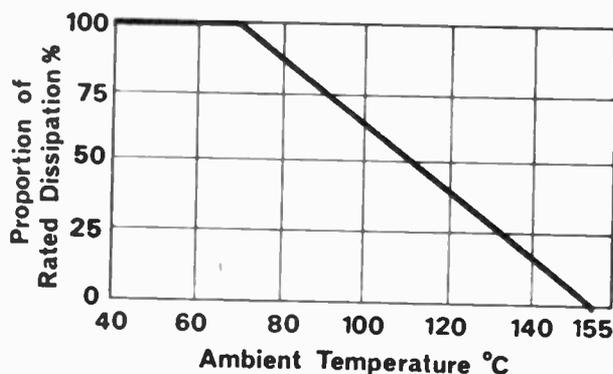


Fig. 2. Derating curve for common metal film resistors. It also applies to metal oxide film resistors up to 1 W rating.

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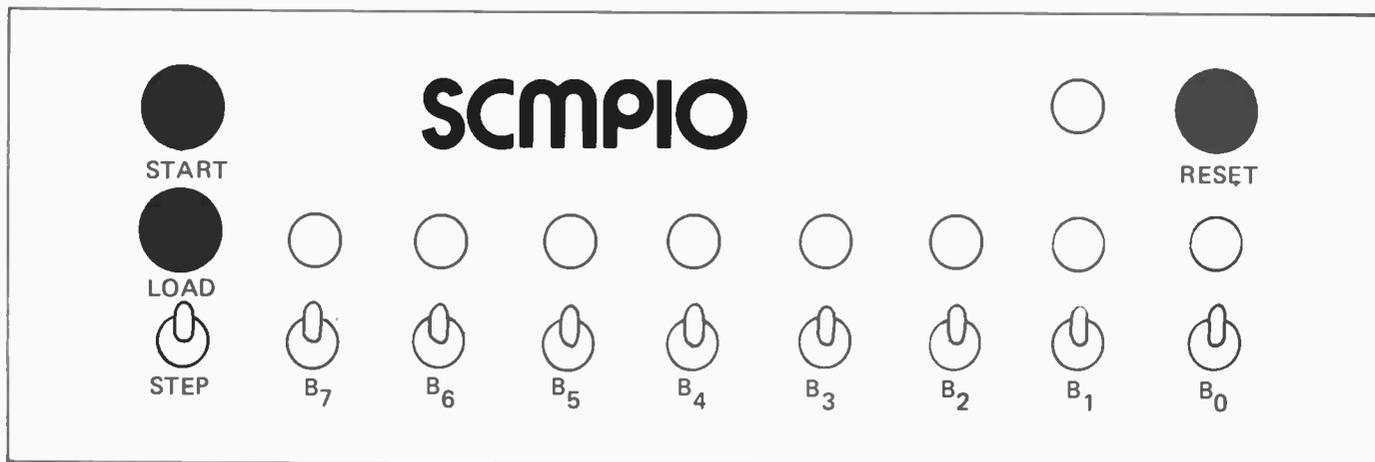
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# MICROPROCESSORS

## INTRODUCING SCMPIO

### LOW COST I/O KIT FOR SC/MP



The SCMPIO kit now provides SC/MP Introkit users with a low cost input/output capability. This is a great kit if you don't have ready access to a Teletype. It is an ideal teaching aid, learning and development tool for hobbyists, professors, students and electronics entrepreneurs at all levels.

The heart of SCMPIO is a UART which interacts with the SC/MP CPU to generate serial ASCII under hardware control. SCMPIO retains the use of the KITBUG ROM and acts as a general purpose serial interface operating at 110 BAUD. Only very minor changes to the basic Introkit are required.

SCMPIO consists of a mother board which accepts the SC/MP PCB socket and interfaces with a user access front panel. Data can be entered via front panel toggle switches and output is displayed using LEDs. Additional controls include CPU RESET, SINGLE STEP OR CONTINUOUS OPERATION, CHARACTER STROBE, RUN. Using these facilities it is an easy matter to execute programs, to examine or modify the contents of memory and the SC/MP registers and to monitor program performance.

SCMPIO can be readily expanded if required. Provision has been made to fit an additional 72 way PCB socket (for extra RAM cards etc) and external voltage regulators if required. A HEX or ASCII encoded keyboard can be easily fitted (the ET1631 encoder is ideal). The output can be read into other modules including the ET1630 ASCII - HEX display and the soon to be published ET1633VDU.

The SCMPIO kit is supplied with all components, fibre-glass PCB, prepunched metalwork, hardware, solder and full assembly instructions. Also included is our own exclusive handbook "A beginners guide to programming SC/MP" together with sample programs for you to run.

SCMPIO KIT **\$49.50** plus \$2.50 post, pack and insurance.

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SC/MP INTROKIT **\$129.50**  
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SCMPIO

#### ETI 631 KEYBOARD ENCODER

As described in the December Issue of ETI this encoder delivers parallel ASCII output for the full 128 character set together with user defined special function keys. This is an ideal encoder for any single contact keyboard and provides professional features such as 2 key rollover. Ideal input unit for the SCMPIO KIT.

Complete kit of all components as set out in the parts list including our own doublesided fibre-glass PCB, socket for the HDO165 encoder and assembly instructions.  
\$29.50 plus \$2.50 post, package and insurance.

#### ETI 630 ASCII - HEX DISPLAY

This neat decoder unit is probably the simplest readout peripheral yet described. Works perfectly with the SCMPIO kit and greatly simplifies programming. Complete kit including all components and fibreglass PCB.  
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#### TECHNICAL SUPPORT SERVICE

As an exclusive service we have now introduced a PCB checkout facility. If you are unable to get your SC/MP introkit or SCMPIO operational you can now return it for checkout at a nominal fee. Full details and service entitlement certificate supplied with each kit. We regret that we are unable to repair kits purchased from other retailers.





# HOBBY KITS

## ENJOY YOURSELF-BUILD A HOBBY KIT FOR XMAS



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Based on the Playmaster Twin 25 published in Electronics Australia these amplifiers have become one of our most popular HOBBY KITS ever. We supply a really good looking 10 gauge brushed front panel, top quality fibreglass printed circuit board with screened component overlay, prepunched and plated metal chassis and all components even including solder and adhesive labels for the back panel. With our step-by-step assembly manual construction is a real breeze.

If you wish we can also supply a preassembled PCB module or even a fully assembled amplifier made to order.

Other options include a timber sleeve and speaker protection unit.

TWIN 40 40W RMS/CHANNEL PM40K	\$99.50
TWIN 25 25W RMS/CHANNEL PM25K	\$85.00
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PREASSEMBLED & TESTED PCB TO BASIC PRICE ADD	\$15.00
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ET1740K FM TUNER	\$120.00
ET1740A ASSEMBLED & TESTED	\$155.00
AM200A AM TUNER OPTION	\$20.00

### STOPWATCH/CAUCULATOR

We still have some stocks of the popular ET1534 stopwatch. This is an ideal project for beginners.

ET1534 STOPWATCH	\$16.75
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### 804 SELECTA GAME

As described in the November Issue of ETI this is a most spectacular kit. We supply full instructions, fibreglass PCB, punched and screened front panel, pre-wound coils and a 28 PIN socket for the IC. We expect to have 200 games left at the time of publication.

ET1804 SELECTA GAME	\$49.50
post, packaging and insurance	\$3.50

### NEW RELEASE

RIFLE OPTION FOR SELECTA GAME

We have a kit of all electronic components and PCB to build the rifle option for the 804 SELECTA GAME. Why not build this into a toy rifle and enjoy target practise and clay pigeon shooting on your home TV.

804 RIFLE OPTION	\$5.50
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\*NOTE Amplifiers and Tuners will be forwarded via road freight collect Price includes packing

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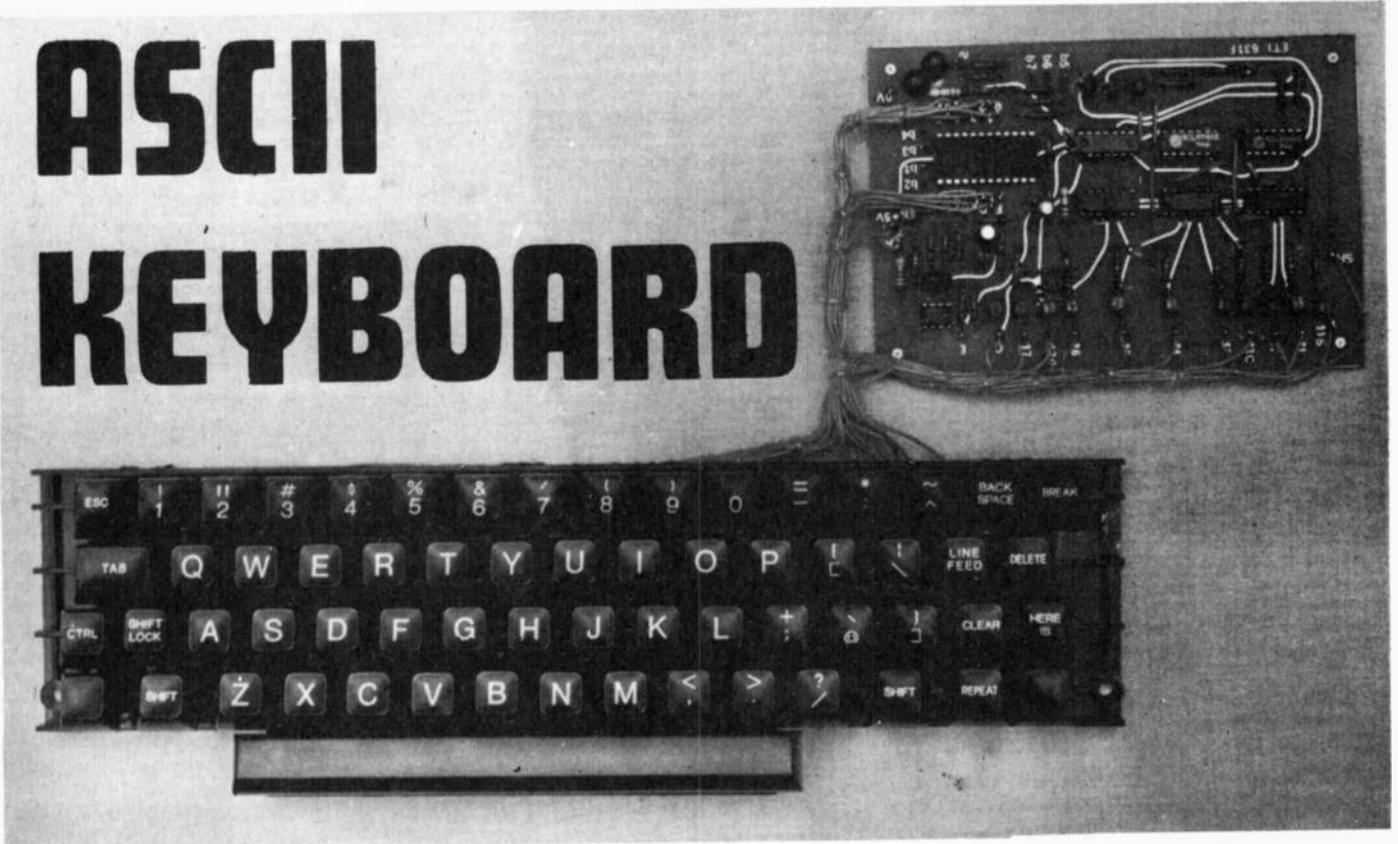
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# ASCII KEYBOARD



This simple and inexpensive keyboard encoder gives full ASCII output, has keyrollover facility and can be used with almost any keyboard.

## COMPUTER TERMINAL PROJECTS

TO COMMUNICATE WITH A computer you need some sort of input device and some sort of output reader. The input unit can be a series of switches on which you set up the required code and press a button to enter each character. While this is economical in parts it is not economical in time.

This encoder project is designed to allow very easy access to the computer whilst being reasonably economical. It is very flexible and allows for almost any keyboard to be used. Control functions can be activated by a single key if desired and lower case letters can be eliminated at the flick of a switch.

The output from the keyboard is in the form of a parallel bus and the data has to be serialised to provide a universal input which will then communicate with any computer designed to work with a teletype. For two-way communication you will also need an output device. We will be publishing a Video Display Unit project and a parallel-serial-parallel converter in future issues.

### Design Features

When we first looked at a keyboard encoder we intended to use a single chip device to simplify design. However, looking at the devices available and their limitations (and cost and availability) it was decided to compromise and use the HD0165 keyboard encoder. This IC has been available for many years and we use it to decode the first 4 lines. For the other three lines we decided to use discrete components. The eighth line is not used at this stage (it is used for a parity check after serialisation).

Initially the use of a 16 x 3 matrix was contemplated. Then we would use the shift and control keys to get the other outputs. However not all keys with the same three-line code (b5, 6, 7) are upper case (or lower case). On our keyboard 0 1 ... ; are lower case, and = ? are upper case; yet all have an output code 3. The same applies to other rows and the matrix has thus expanded to 16 x 7. To get the control functions

a control and the function key have to be pressed simultaneously which is inconvenient for commonly-used functions (such as space or line feed).

Consequently an additional three lines are used and this allows any of the control functions to be activated by a single key.

Most VDUs or microcomputer operating systems cannot handle lower-case letters and therefore outputs are provided which can be linked to ensure that a shift command is given automatically when any key from A-Z is pressed.

When connecting to the keyboard we had to decide how to wire the contacts. The easiest and neatest way is to use a double-sided pc board with plated-through holes. Using such a board it is hard to solder the other side when it is against the keyboard! This approach would add an extra 20 or so dollars to the cost and would suit only a single style of keyboard.



## How it Works

The Harris HD0165 IC is a 16-line keyboard encoder; if any one of its 16 inputs is taken high (+5V) an output code appears on the 4 output lines. At the same time another output (pin 4) goes low indicating a key has been pressed. If two or more inputs are taken high (+5V) an invalid code is generated and another output (pin 24) goes low to indicate this.

In this project we use this IC to generate the least-significant four bits (b1, b2, b3 and b4) of the 7 bits we need to represent the complete character.

To decode the other three bits we used discrete transistors and CMOS gates. Each key joins one of inputs of the HD0165 to one of the points 11-17. If the enable line is low (i.e., 0V) Q14 will be hard on and we will have 5 V (less a little) on the emitter of Q2, 3, 5, 6, 7, 8 and 13. The input to the HD0165 appears as a resistor of about 500-600 ohms, to 0V. Therefore, connecting (say) point 14 to point 3, we turn on Q6 giving +5V at its collector and also the HD0165 gives an output corresponding to three (0011).

The high output from Q6 gives a high on the inputs of IC 2/2 and IC3/2 causing the outputs of these gates to be low. The other gates, IC1/1, IC2/1 and IC3/1 have high outputs. If the control or shift key is not pressed, we have a "0" at the input of IC4/1 and IC4/2 giving a high output from these gates and hence a low output from IC4/3 and IC4/4. This enables IC5/1, IC5/3 and IC6. These ICs are simply electronic switches with a resistance of either 300 ohms (on) or infinity (off).

Therefore Q9 will be on as IC2/1 is high, Q10 will be off as IC2/2 is low and Q12 will also be off as IC3/2 is low. This gives a total out-

put of 110 0011 which represents 63 (hex) or lower case c.

We will leave you to work out the other combinations. If the shift key is pressed IC5/2, IC5/4 and IC6 are enabled selecting a different code (upper case C is 43 hex) and if the control key is pressed Q10 and 11 are turned on by IC4/3 and Q9 is controlled by IC1/1 and IC2/1 ('control C' is 03 (hex), representing ETX).

When a key is pressed the output (pin 4) of the HD0165 goes low and C3 is discharged via R23. After about 10 ms the gates IC1/2,3, which are connected as a schmitt trigger, operate and the output (IC1/3) goes low. This is coupled via C4. Q17/18 act as a monostable giving a negative-going pulse of about 200  $\mu$ s wide. When one key is pressed about 0.4 volts is developed across R20, not quite enough to turn on Q15. If a second key is pressed in a different row, the addition current in R20 will forward-bias Q15 which will then turn on Q16. This holds C3 charged, independent of the HD0165. If two keys are pressed in the same row on output (pin 24) of the HD0165 detects this and goes low and Q16 is again turned on disabling the strobe pulse.

If the repeat button is pressed IC7 oscillates at about 10 Hz and the pulsing alternately turns Q16 on and off generating strobe pulses at about 10 per sec.

The output of Q6 (A-O) and Q17 (P-Z) are diode ORed and if the "upper case only" link or switch is closed it automatically gives a shift command. For the control functions additional inputs are used in Q1, Q4 and Q12. If the input to one of these transistors is connected to one of the HD0165 inputs it still turns on the transistor associated with it and also lifts either the control or shift inputs as required.

### TABLE 1 ETI 631

FUNC TION	ACCESS	ASC II CODE				HEX	FUNC TION	ACCESS	ASC II CODE				HEX							
		b7	b6	b5	b4	b3			b2	b1	CODE	b7	b6	b5	b4	b3	b2	b1	CODE	
NUL	CTRL @	0	0	0	0	0	0	@	SHIFT @	1	0	0	0	0	0	0	0	4	0	
SOH	CTRL A	0	0	0	0	0	0	1	SHIFT A	1	0	0	0	0	0	0	1	4	1	
STX	CTRL B	0	0	0	0	0	0	1	SHIFT B	1	0	0	0	0	0	1	0	4	2	
ETX	CTRL C	0	0	0	0	0	0	1	SHIFT C	1	0	0	0	0	0	1	1	4	3	
EOT	CTRL D	0	0	0	0	0	1	0	SHIFT D	1	0	0	0	0	1	0	0	4	4	
ENQ	CTRL E	0	0	0	0	0	1	0	SHIFT E	1	0	0	0	0	1	0	1	4	5	
ACK	CTRL F	0	0	0	0	0	1	0	SHIFT F	1	0	0	0	0	1	1	0	4	6	
BEL	CTRL G	0	0	0	0	0	1	1	SHIFT G	1	0	0	0	0	1	1	1	4	7	
BS	CTRL H	0	0	0	0	1	0	0	SHIFT H	1	0	0	0	1	0	0	0	4	8	
HT	CTRL I	0	0	0	0	1	0	0	SHIFT I	1	0	0	0	1	0	0	1	4	9	
LF	CTRL J	0	0	0	0	1	0	1	SHIFT J	1	0	0	0	1	0	1	0	4	A	
VT	CTRL K	0	0	0	0	1	0	1	SHIFT K	1	0	0	0	1	0	1	1	4	B	
FF	CTRL L	0	0	0	0	1	1	0	SHIFT L	1	0	0	0	1	1	0	0	4	C	
CR	CTRL M	0	0	0	0	1	1	0	SHIFT M	1	0	0	0	1	1	0	1	4	D	
SO	CTRL N	0	0	0	0	1	1	1	SHIFT N	1	0	0	0	1	1	1	0	4	E	
SI	CTRL O	0	0	0	0	1	1	1	SHIFT O	1	0	0	0	1	1	1	1	4	F	
DLE	CTRL P	0	0	1	0	0	0	0	P	SHIFT P	1	0	1	0	0	0	0	0	5	0
DC1	CTRL Q	0	0	1	0	0	0	0	SHIFT Q	1	0	1	0	0	0	0	1	5	1	
DC2	CTRL R	0	0	1	0	0	0	1	SHIFT R	1	0	1	0	0	0	1	0	5	2	
DC3	CTRL S	0	0	1	0	0	0	1	SHIFT S	1	0	1	0	0	0	1	1	5	3	
DC4	CTRL T	0	0	1	0	0	1	0	SHIFT T	1	0	1	0	0	1	0	0	5	4	
NAK	CTRL U	0	0	1	0	0	1	0	SHIFT U	1	0	1	0	0	1	0	1	5	5	
SYN	CTRL V	0	0	1	0	0	1	0	SHIFT V	1	0	1	0	0	1	0	0	5	6	
ETB	CTRL W	0	0	1	0	0	1	1	SHIFT W	1	0	1	0	0	1	1	1	5	7	
CAN	CTRL X	0	0	1	0	0	0	0	SHIFT X	1	0	1	0	0	0	0	0	5	8	
EM	CTRL Y	0	0	1	0	0	0	1	SHIFT Y	1	0	1	0	0	0	1	0	5	9	
SUB	CTRL Z	0	0	1	0	0	1	0	SHIFT Z	1	0	1	0	0	1	0	0	5	A	
ESC	CTRL [	0	0	1	0	0	1	1	SHIFT [	1	0	1	0	0	1	1	0	5	B	
FS	CTRL \	0	0	1	0	0	1	0	SHIFT \	1	0	1	0	0	1	1	0	5	C	
GS	CTRL ]	0	0	1	0	0	1	1	SHIFT ]	1	0	1	0	0	1	1	1	5	D	
RS	CTRL ^	0	0	1	0	1	1	0	SHIFT ^	1	0	1	0	1	1	0	0	5	E	
US	CTRL DEL	0	0	1	0	1	1	1	SHIFT DEL	1	0	1	0	1	1	1	1	5	F	
SP	SHIFT 0	0	1	0	0	0	0	0	SHIFT @	1	1	0	0	0	0	0	0	6	0	
!	SHIFT 1	0	1	0	0	0	0	1	SHIFT A	1	1	0	0	0	0	0	1	6	1	
"	SHIFT 2	0	1	0	0	0	0	1	SHIFT B	1	1	0	0	0	0	1	0	6	2	
#	SHIFT 3	0	1	0	0	0	0	1	SHIFT C	1	1	0	0	0	0	1	1	6	3	
\$	SHIFT 4	0	1	0	0	0	1	0	SHIFT D	1	1	0	0	0	1	0	0	6	4	
%	SHIFT 5	0	1	0	0	0	1	0	SHIFT E	1	1	0	0	0	1	0	1	6	5	
&	SHIFT 6	0	1	0	0	0	1	0	SHIFT F	1	1	0	0	0	1	1	0	6	6	
'	SHIFT 7	0	1	0	0	0	1	1	SHIFT G	1	1	0	0	0	1	1	1	6	7	
(	SHIFT 8	0	1	0	0	0	1	0	SHIFT H	1	1	0	0	0	1	0	0	6	8	
)	SHIFT 9	0	1	0	0	0	1	0	SHIFT I	1	1	0	0	0	1	0	1	6	9	
*	SHIFT :	0	1	0	0	0	1	0	SHIFT J	1	1	0	0	0	1	0	0	6	A	
+	SHIFT ;	0	1	0	0	0	1	1	SHIFT K	1	1	0	0	0	1	0	1	6	B	
,	SHIFT <	0	1	0	0	0	1	0	SHIFT L	1	1	0	0	0	1	0	0	6	C	
;	SHIFT =	0	1	0	0	0	1	1	SHIFT M	1	1	0	0	0	1	0	1	6	D	
<	SHIFT >	0	1	0	0	0	1	0	SHIFT N	1	1	0	0	0	1	1	0	6	E	
=	SHIFT ?	0	1	0	0	0	1	1	SHIFT O	1	1	0	0	0	1	1	1	6	F	
>	SHIFT /	0	1	0	0	0	1	1	P	SHIFT P	1	1	1	0	0	0	0	0	7	0
0	SHIFT 0	0	0	1	1	0	0	0	SHIFT Q	1	1	1	0	0	0	0	1	7	1	
1	SHIFT 1	0	0	1	1	0	0	0	SHIFT R	1	1	1	0	0	0	0	1	7	2	
2	SHIFT 2	0	0	1	1	0	0	0	SHIFT S	1	1	1	0	0	0	0	1	7	3	
3	SHIFT 3	0	0	1	1	0	0	0	SHIFT T	1	1	1	0	0	0	0	1	7	4	
4	SHIFT 4	0	0	1	1	0	0	0	SHIFT U	1	1	1	0	0	0	0	1	7	5	
5	SHIFT 5	0	0	1	1	0	0	0	SHIFT V	1	1	1	0	0	0	0	1	7	6	
6	SHIFT 6	0	0	1	1	0	0	0	SHIFT W	1	1	1	0	0	0	0	1	7	7	
7	SHIFT 7	0	0	1	1	0	0	0	SHIFT X	1	1	1	0	0	0	0	0	7	8	
8	SHIFT 8	0	0	1	1	0	0	0	SHIFT Y	1	1	1	0	0	0	0	1	7	9	
9	SHIFT 9	0	0	1	1	0	0	0	SHIFT Z	1	1	1	0	0	0	0	1	7	A	
:	SHIFT :	0	0	1	1	0	0	0	SHIFT [	1	1	1	0	0	0	0	1	7	B	
<	SHIFT ;	0	0	1	1	0	0	0	SHIFT \	1	1	1	0	0	0	0	1	7	C	
=	SHIFT =	0	0	1	1	0	0	0	SHIFT ]	1	1	1	0	0	0	0	1	7	D	
>	SHIFT ?	0	0	1	1	0	0	0	SHIFT ^	1	1	1	0	0	0	0	1	7	E	
/	SHIFT /	0	0	1	1	0	0	0	SHIFT DEL	1	1	1	0	0	0	0	1	7	F	

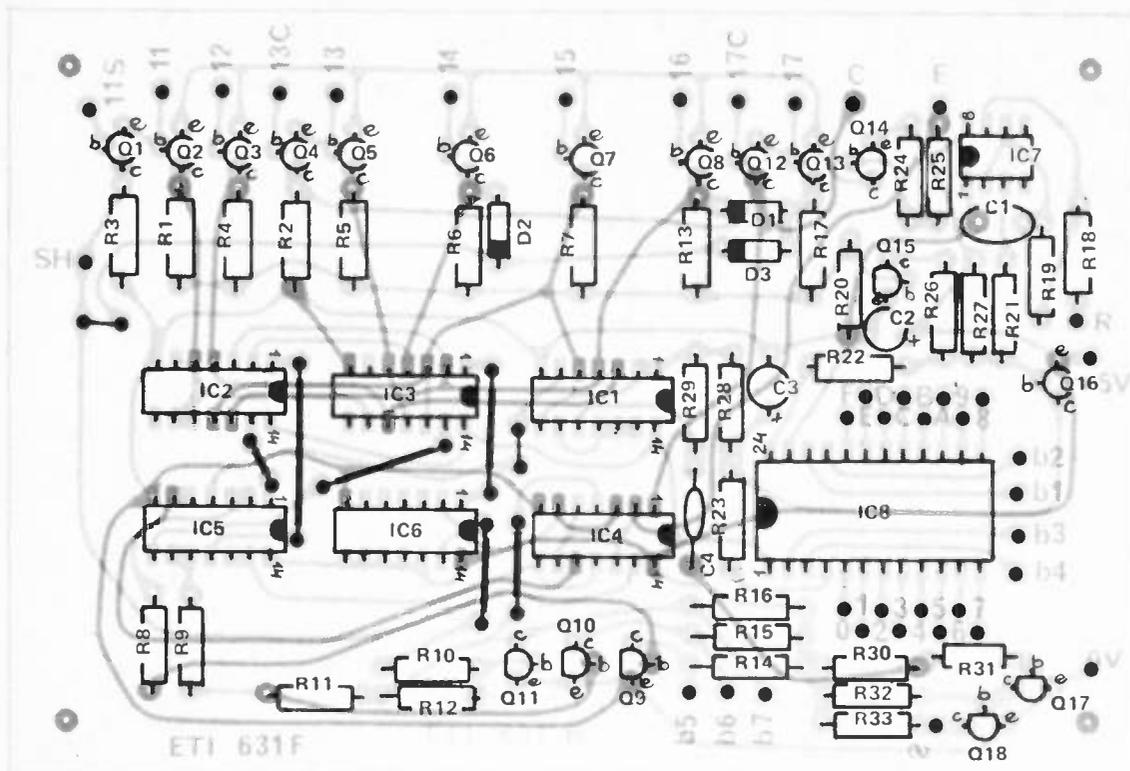
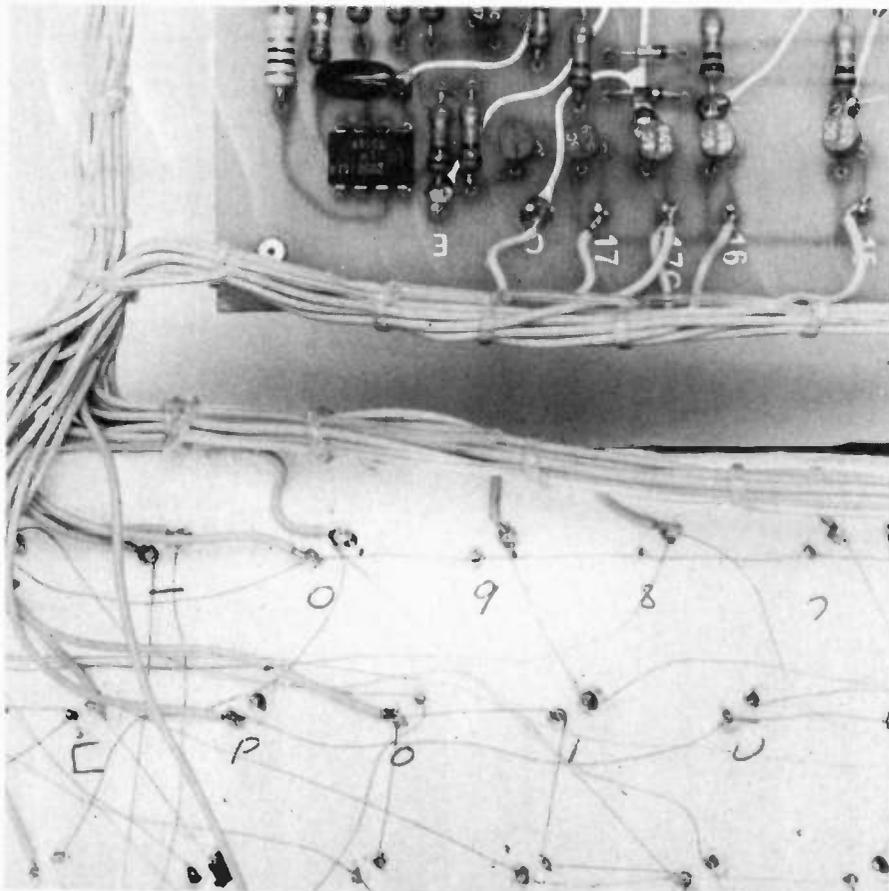


Fig.2. Component overlay of the encoder.



Rear of the keyboard showing how the inter connections are made.

The alternative, and the approach we chose, is to link the underside of the keyboard using "solderable" enamelled wire and normal hookup wire to the control card. This takes a little time to wire but is much cheaper and is universal. Although we used a double-sided board for the control logic we don't require plated-through holes, as both sides can be easily soldered.

### Construction

Assemble the pc board with the aid of the overlay in Fig 2. When soldering the components use a small iron and make sure *all* connections on the component side are soldered as well as those on the copper side. The links on the component side must be insulated where they cross copper tracks, to prevent shorting.

Because you have to solder on both sides of the pcb you cannot use ICs sockets (unless they are wire-wrap types). The exception here is the HD0165 where all connections are on the copper side. Note also that the HD0165 is not CMOS or MOS and requires no special handling.

To make wiring easier mark the keys on the underside of the keyboard, to indicate what functions they represent. Now using "solderable" enamelled wire join the points as given

## Parts List – ETI 631

Resistors all 1/2 W 5%

R1-R7	1 k
R8-R12	10 k
R13	1 k
R14-R16	2k2
R17	10 k
R18	1 M
R19	220 k
R20	82
R21-R28	10 k
R29	100 k

R30	220 k
R31	100 k
R32	10 k
R33	2k2

Capacitors

C1	100 n polyester
C2	4μ7 25 V electro
C3	1 μ 25 V electro
C4	1n0 polyester

Semiconductors

D1-D3	1N914
Q1-Q8	BC558
Q9-Q11	BC548
Q12-Q14	BC558

Q15	BC54B
Q16	BC558
Q17, 18	PN3643

Integrated Circuits

IC1	4025 (CMOS)
IC2, 3	4002 (CMOS)
IC4	4001 (CMOS)
IC5, 6	4016 (CMOS)
IC7	NE555
IC8	HD0165

Miscellaneous

PC board ETI 631
Hookup wire
"Solderable" enamelled wire (24-30 B&S)
Keyboard
40 pc pins

in Table 2. The connection from the control board is also given and this should be made using normal hookup wire. The control functions can be wired between the points given either by taking two wires back to the control board or finding the same wire, if previously used, on the keyboard and linking across.

We have not described a housing for the unit as it will probably be mounted along with the VDU and UART (possibly under a TV set).

However, the control card can mount under the keyboard by spacing it up slightly. It may be necessary to have a piece of metal (Alfoil, etc.) under the keyboard/control card, connected to 0 V (To prevent 50 Hz pickup into the wiring to the keyboard). The effect of this is unwanted outputs from the strobe or non-operation of the strobe output.

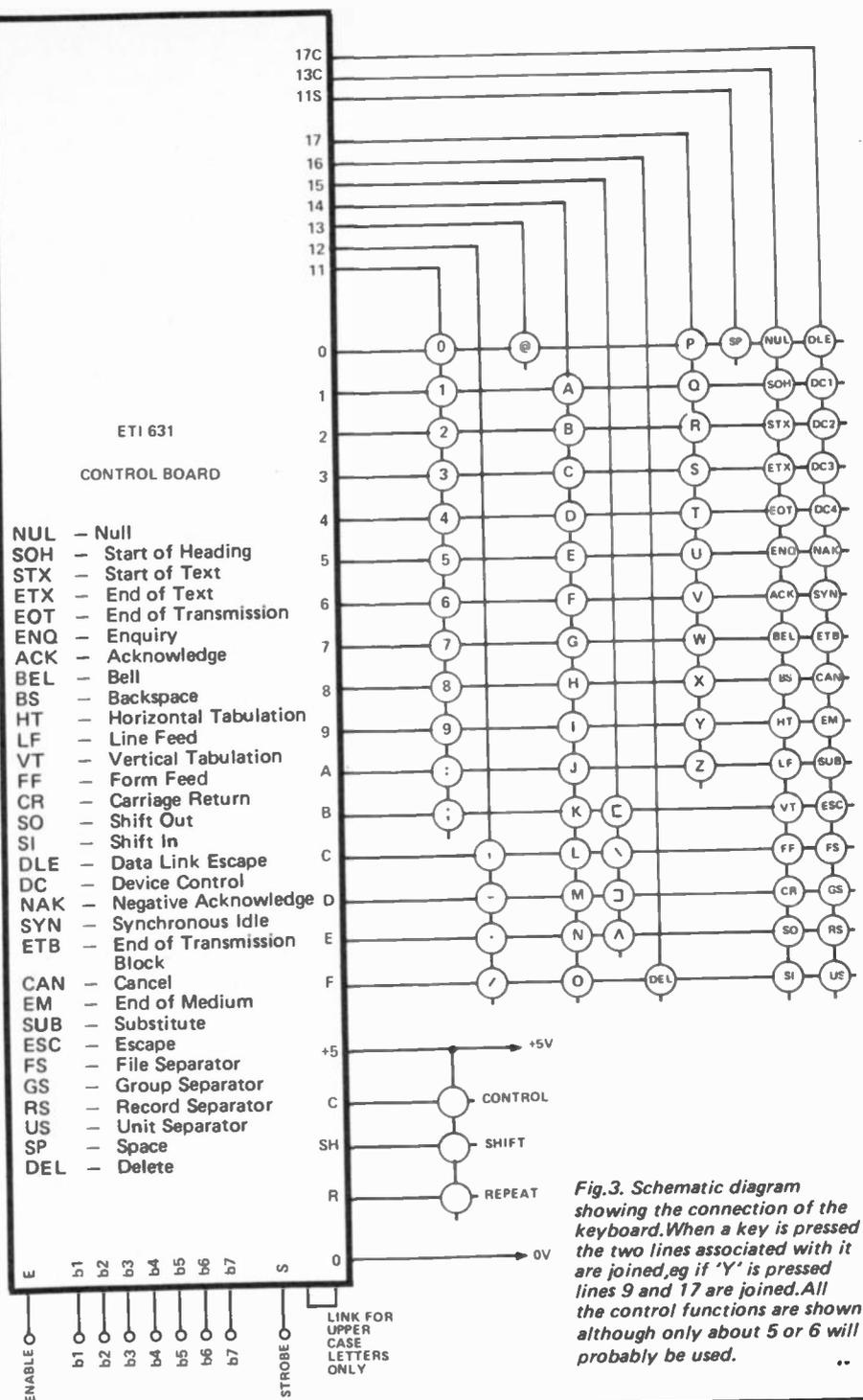


Fig.3. Schematic diagram showing the connection of the keyboard. When a key is pressed the two lines associated with it are joined, eg if 'Y' is pressed lines 9 and 17 are joined. All the control functions are shown although only about 5 or 6 will probably be used.

CONTROL CARD	KEYBOARD SEQUENCE	CONTROL CARD	KEYBOARD SEQUENCE
0	0 P @ SP	11	: ; 0 9 8 7 6
1	1 Q A	12	5 4 3 2 1
2	2 R B	13	- / .
3	3 S C	14	@
4	4 T D U	15	L O I K J M N
5	5 E F V	16	H B G F C D E A
6	6 G W	17	^ \ [ ]
7	7 H X BS		DEL
8	8 I Y TAB		P U Y T R V X
9	9 J Z LF	11S	Z S W Q
A	: ; K ESC	13C	SP
B	[ \ L	17C	BS TAB LF CR
C	- _ M		ESC
D	^ . N		
E	^ . N		
F	DEL 0 /		

TABLE 2 ETI 631  
How to wire up the keyboard

# Project 631

## Operation and Testing

To supply the unit 5 V at 50 mA is needed. To enable the keyboard a low (0V) is needed on that input. The data output are positive logic (i.e., "1" is +5V) and the strobe output is active

low .

Connecting the keyboard to the hex display (ETI 630) gives an easy check that all wiring is correct. The list in Table 1 gives the character the access,

the ASCII code, and the hex code. Alternatively 7 LEDs can be connected (cathode to 0V) across the outputs and the code checked against the ASCII code.

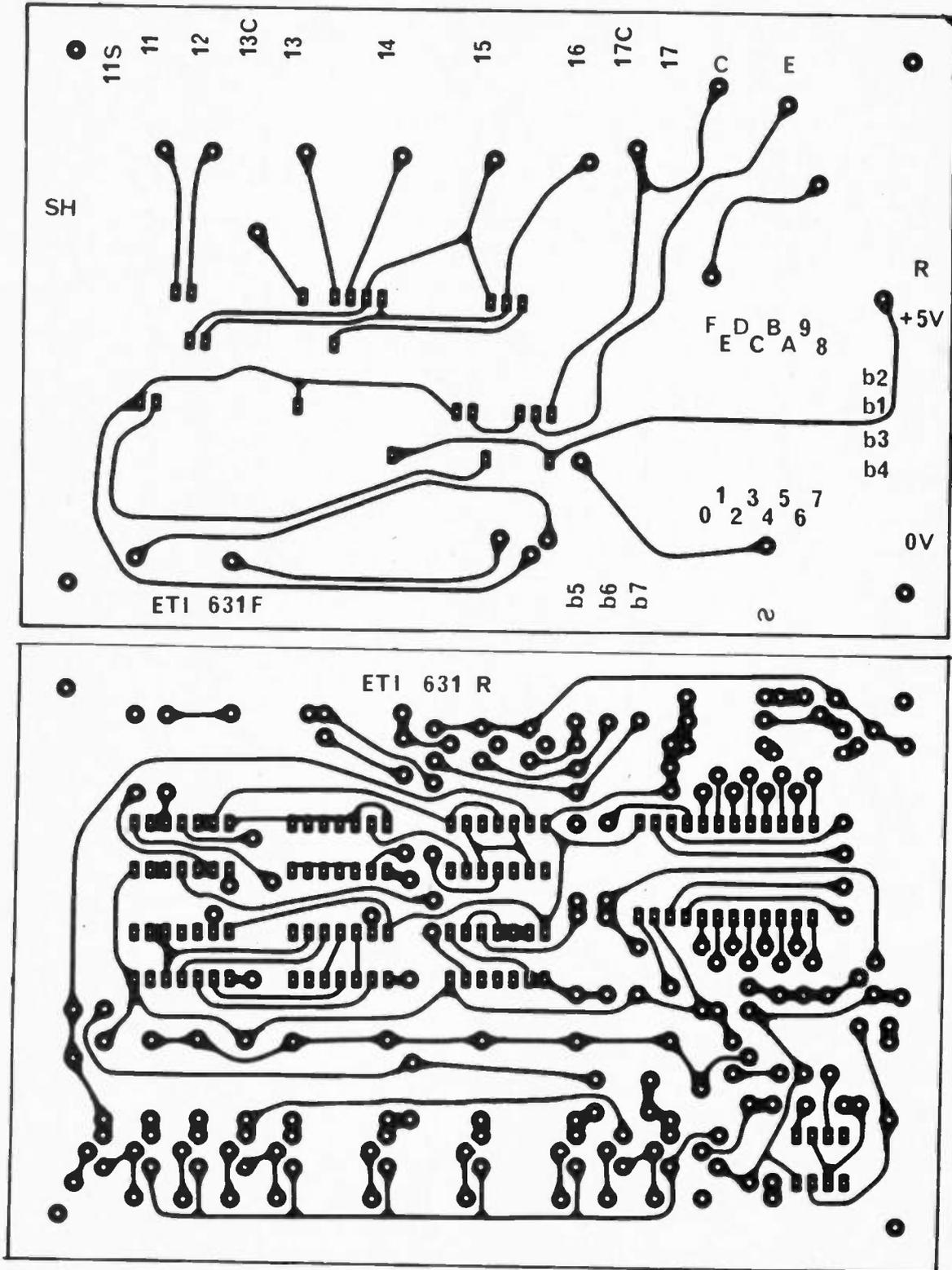


Fig.4. Printed circuit layout(both sides) Full size 150 x 100 mm.

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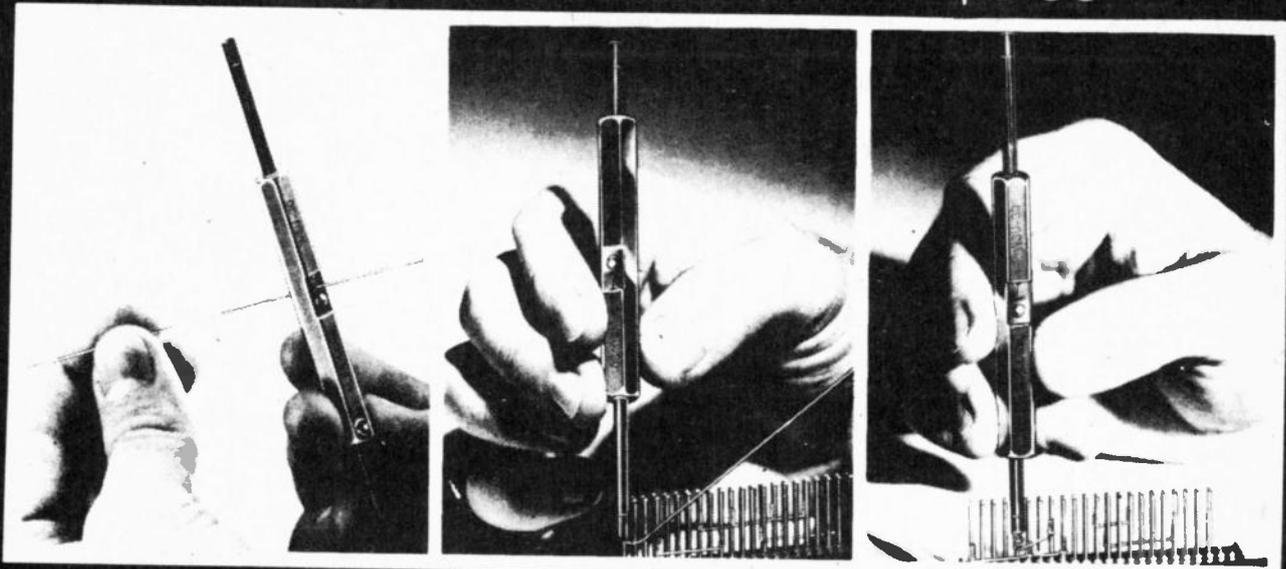
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10uF	6c	7c	8c	10c
22uF	7c	8c	9c	11c
33uF	8c	9c	10c	13c
47uF	9c	10c	11c	14c
100uF	11c	12c	13c	17c
220uF	13c	17c	15c	20c
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.015	8c
.022	8c
.033	8c
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# 50 - 100 WATT AMPLIFIER MODULES

This is our very reliable 422 amplifier redesigned for simplicity in construction.

THE MOST POPULAR AMPLIFIERS we have ever published are the 100 W guitar amplifier (ETI 413) and the 50 W stereo amplifier (ETI 422). These amplifiers have proved very reliable for the many hundreds of readers who have built them.

Both of the amplifiers are, however, a bit fiddly to build (as are most power amplifiers) because the power transistors must be mounted on a heat sink which therefore needs wiring to the control board. Whilst this module has the same electrical design as the 422 the layout has been greatly simplified.

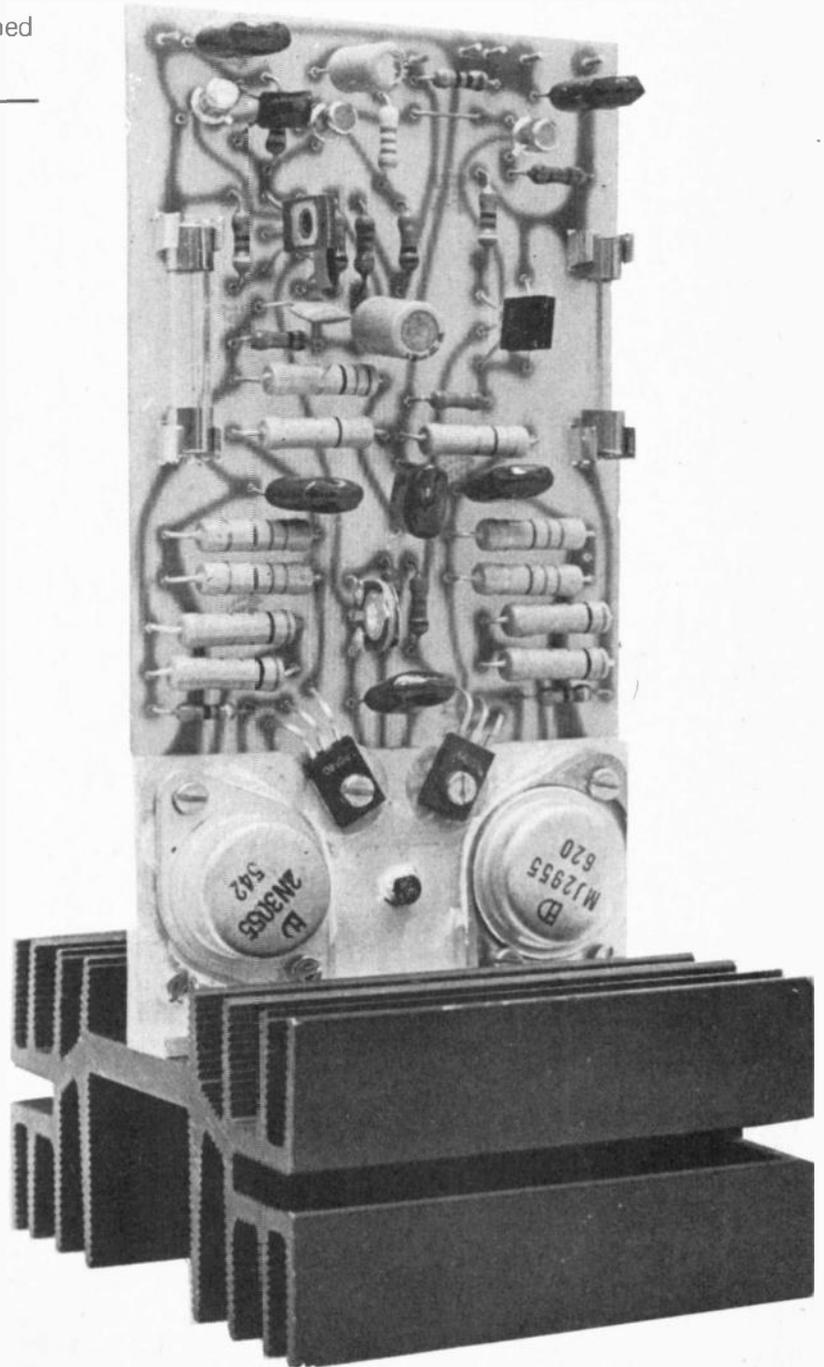
The new design was originally a replacement amplifier for the 422. We hope to publish the complete details next month. We soon realised that by adding two transistors we had a replacement for the 100 watt amplifier as well.

Both versions are very easy to build and set up with all the components, including the power transistors, on the pc board (eliminating another source of possible errors).

## Construction

Assemble the module, less the heatsink components, with the aid of the overlay in Fig. 5. Now mount the heatsink bracket on the component side of the board with two 6 BA screws making sure the other holes line up with those in the pc board.

Mount the power transistors and the BD139/140 using insulating washers and silicon grease. If the amplifier is to be run continuously at full power we recommend you use beryllium oxide washers rather than mica ones. This will lower the junction temperature about 10°C.



The screws holding the 2N3055/MJ 2955 should also be insulated where they pass through the heatsink bracket. The BD 139 and BD 140 do not need any insulation other than the mica, provided 6 BA (or 3 mm) screws are used. In the 100 W version the addition transistors are mounted on the heatsink bracket outside the pc board area.

The heat sensing transistor Q6 should be inserted into the bracket using silicon grease, bend the lead flat against the pc board and solder to the pads provided. When installed, the transistor should be in the centre of the heatsink.

The recommended power supply is shown in Fig. 3. This supply gives about 40 V on no load, dropping to about 32 V on full output. This allows re-production of transients beyond 50 W (or 100 W) whilst providing a degree of protection for the output transistors. If a regulated supply is used it should not be higher than  $\pm 35$  V.

If no preamp is to be used, a couple of chassis-mounting capacitors (4700  $\mu$ F) with the diodes wired across the terminals will suffice. If the pc board is used there is facility for building the preamplifier regulator and fitting a dethump relay (if required). The power amplifier itself does not produce any thump.

### Alignment

The only adjustment you have to make is to set the current using RV1. The bias current for the 50 W version should be 20–25 mA and for the 100 W version it should be 30–35 mA. The figures are for the amplifier running cold. These currents increase about 50% when the amp gets hot.

To measure the current we recommend soldering a 100 ohm  $\frac{1}{2}$  W resistor across each fuse holder and removing the fuses. With no load connected and no input adjust RV1 until there is about 2.5 V (3.5 V for 100 W version) across the resistors. There may be a slight voltage difference between the two resistors, so just take an average. It's not that critical. This method of measuring current is much easier on your testmeter should there be a fault in the amplifier.

## SPECIFICATION\* ETI 480

	50 W version	100 W version
Output power	50 W into 8 ohms	100 W into 4 ohms
Frequency response at rated power	5 Hz – 50 kHz +0 dB –3 dB	5 Hz – 50 kHz +0 dB –3 dB
Input Sensitivity	500 mV	1 V
Distortion	see Fig. 1	
Signal to noise ratio	100 dB	100 dB
Protection	1.5 A fuses	3 A fuses
Damping Factor	25	20
Power Requirement	33 V @ 1.2 A	33 V @ 2.4 A

\* Measured performance of prototype

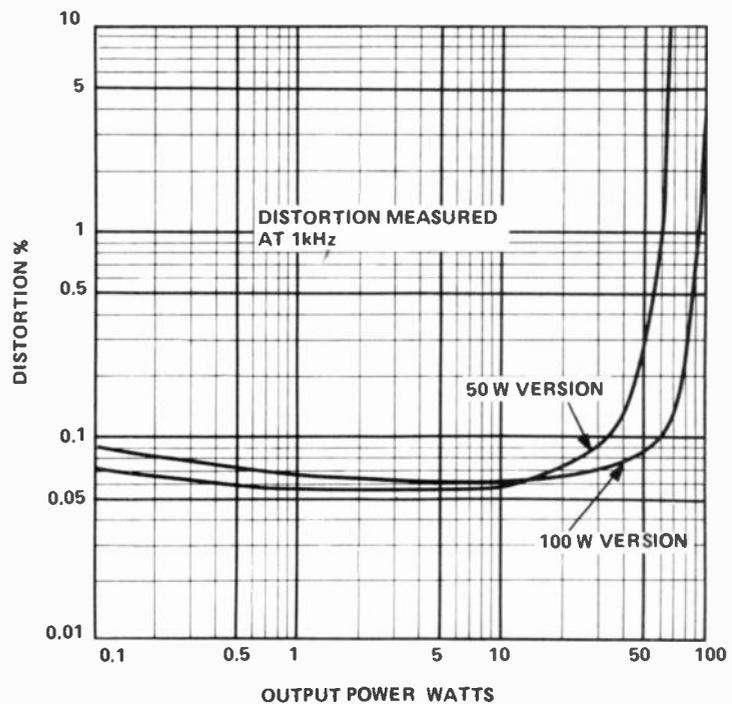
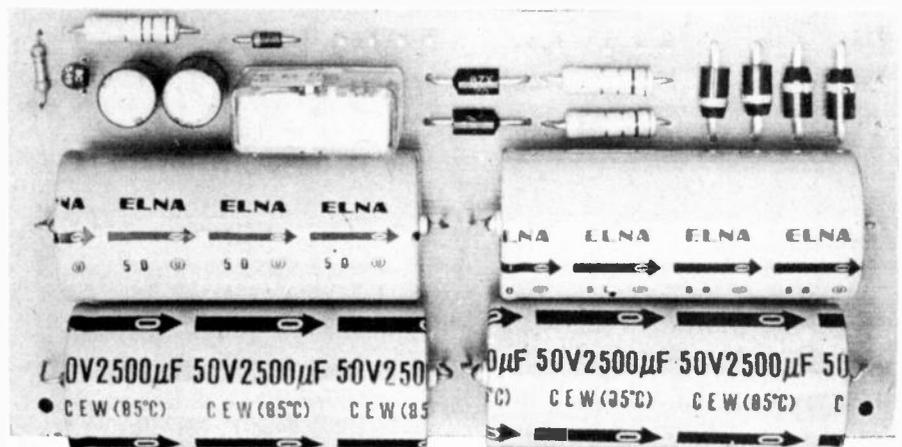


Fig. 1. Graph showing relationship between output power and distortion.



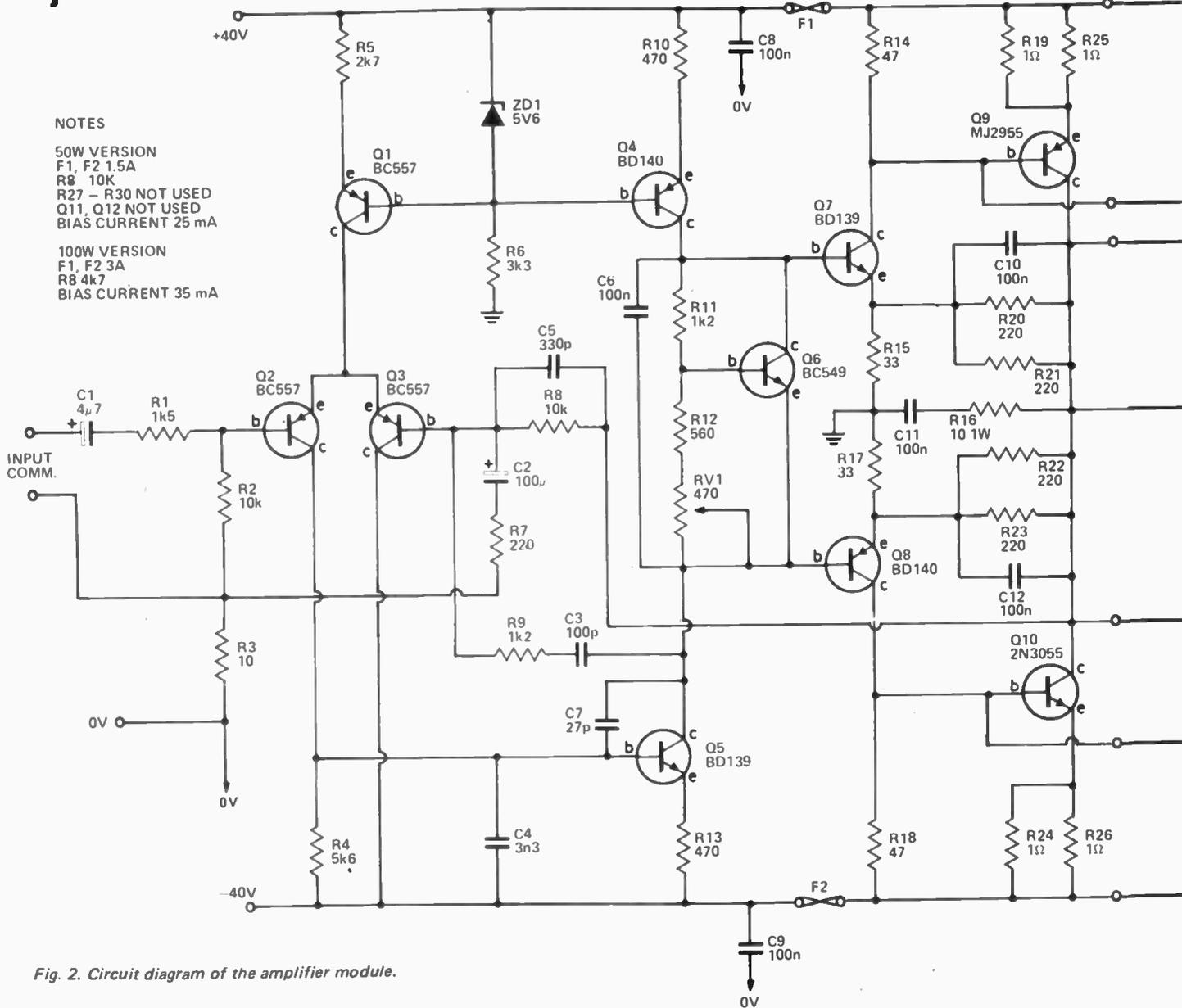


Fig. 2. Circuit diagram of the amplifier module.

## How it Works ETI 480

The input signal is fed via C1 and R1 to the base of Q2 which, with Q3, forms a differential pair. Transistor Q1 is a constant-current source supplying about 2 mA. This current is shared by Q2 and Q3. Transistor Q4 is also a constant-current source supplying about 10 mA which, if no input signal exists, flows through Q5 and Q6. The differential pair controls Q5 and thus the voltage at its collector.

The resistors R11 and R12 together with potentiometer RV1, control the voltage across Q6 and

maintains it at about 1.9 V. But as Q6 is mounted on the heatsink, this voltage will vary with heatsink temperature. Assuming that the voltage on the bases of Q7 and Q8 is equally spaced about zero volts (i.e., 0.95 volts) the current will be set at about 12 mA through Q7 and Q8. The voltage drop across the 47 ohm resistors (R14, R18) will be enough to bias the output transistors Q9 and Q10, on slightly to give about 10 mA quiescent current in these transistors. This quiescent current is adjustable by means of

potentiometer RV1.

Local feedback is applied to the output stage by the network R20-R23, giving the output stage a voltage gain of about four. The overall feedback resistor, R8, gives the required gain control.

Protection to the amplifier (against shorted output leads) is provided by fuses in the positive and negative supply rails to both amplifiers.

Temperature stability is attained by mounting Q6 on the heatsink and this transistor automatically

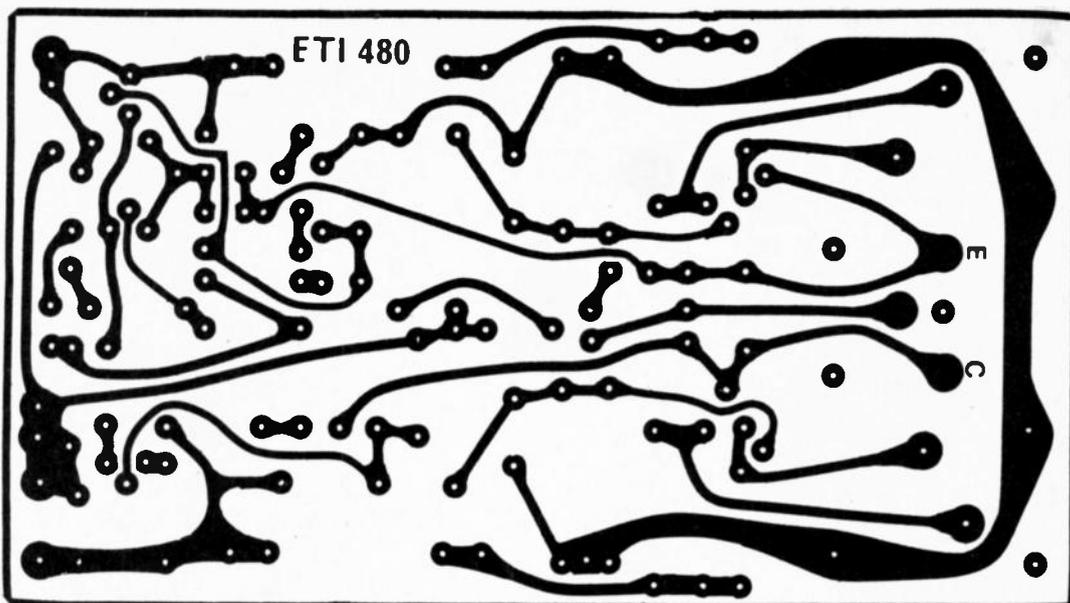
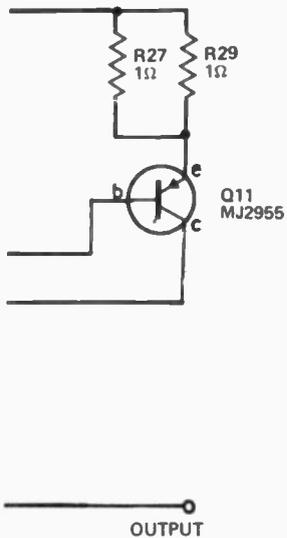


Fig. 4. Printed circuit layout of the amplifier. Full size 140mm x 76mm.

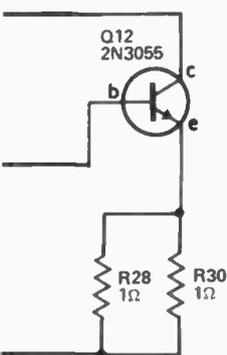
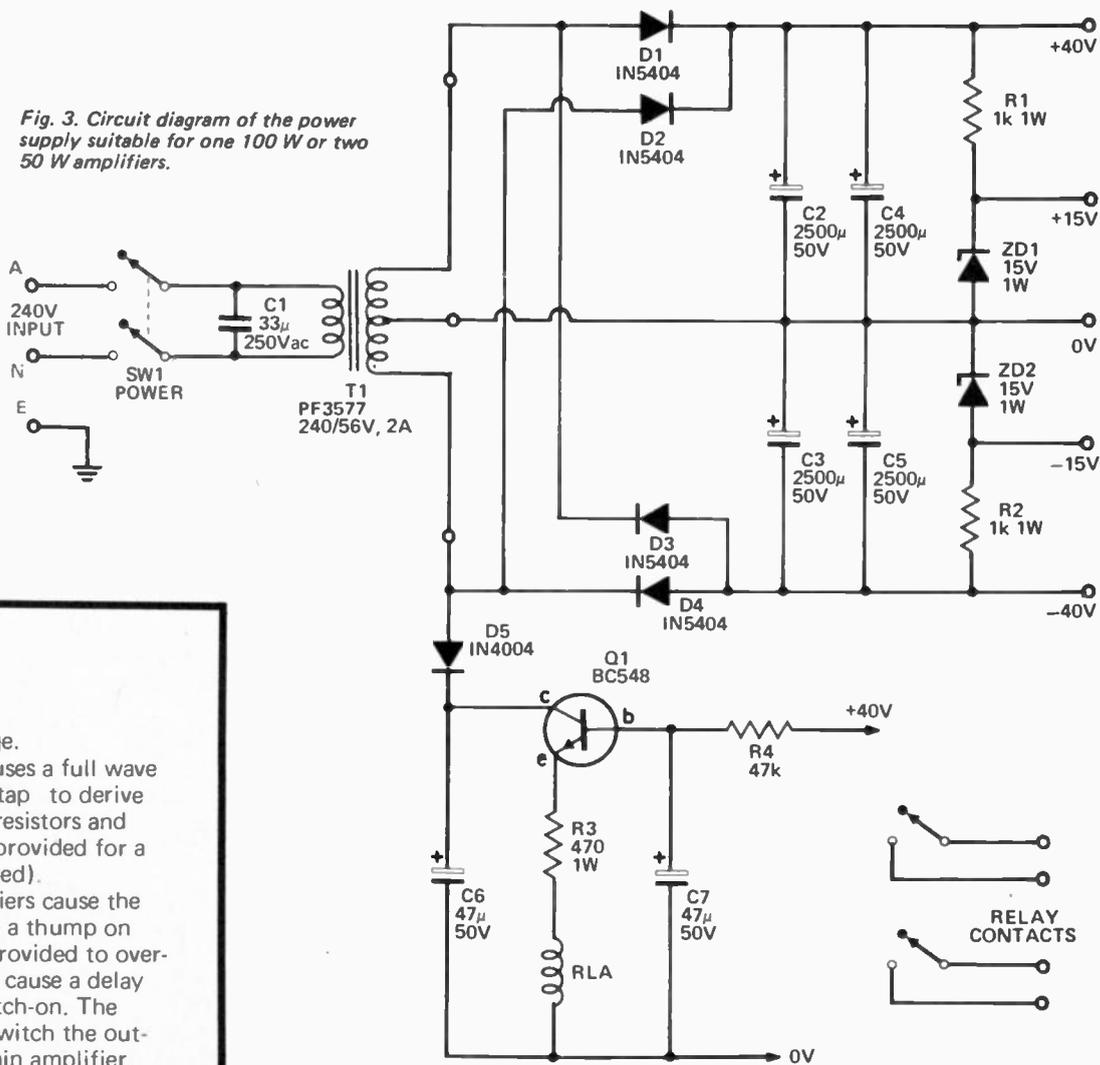


Fig. 3. Circuit diagram of the power supply suitable for one 100 W or two 50 W amplifiers.



adjusts the bias voltage.

The power supply uses a full wave rectifier and a centre tap to derive  $\pm 40$  V dc. Dropping resistors and zener diodes are also provided for a preamplifier (if required).

As some preamplifiers cause the main amplifier to give a thump on switch-on, a relay is provided to overcome this. R4 and C7 cause a delay of about 3 sec on switch-on. The relay can be used to switch the output leads from the main amplifier.

# Project 480

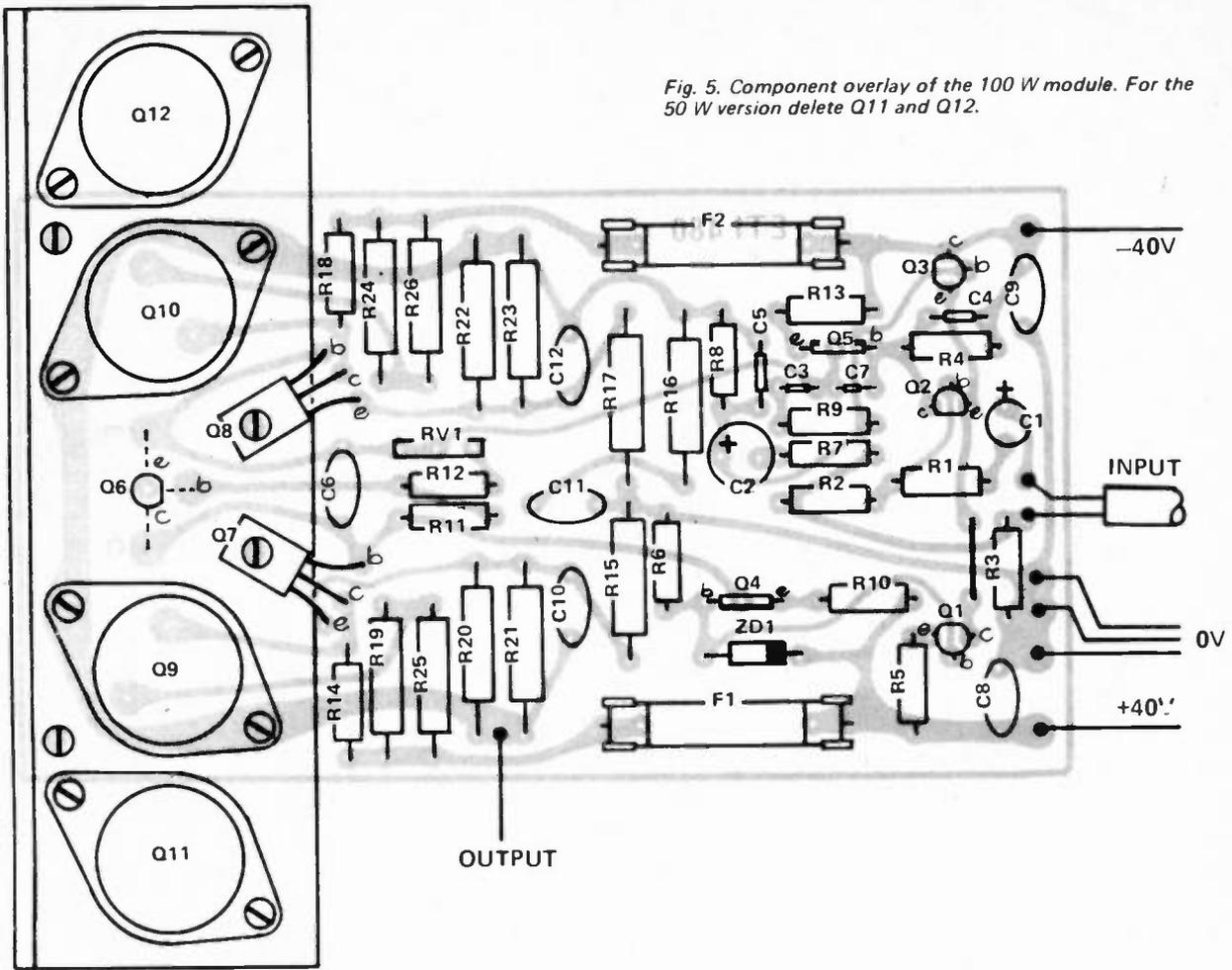


Fig. 5. Component overlay of the 100 W module. For the 50 W version delete Q11 and Q12.

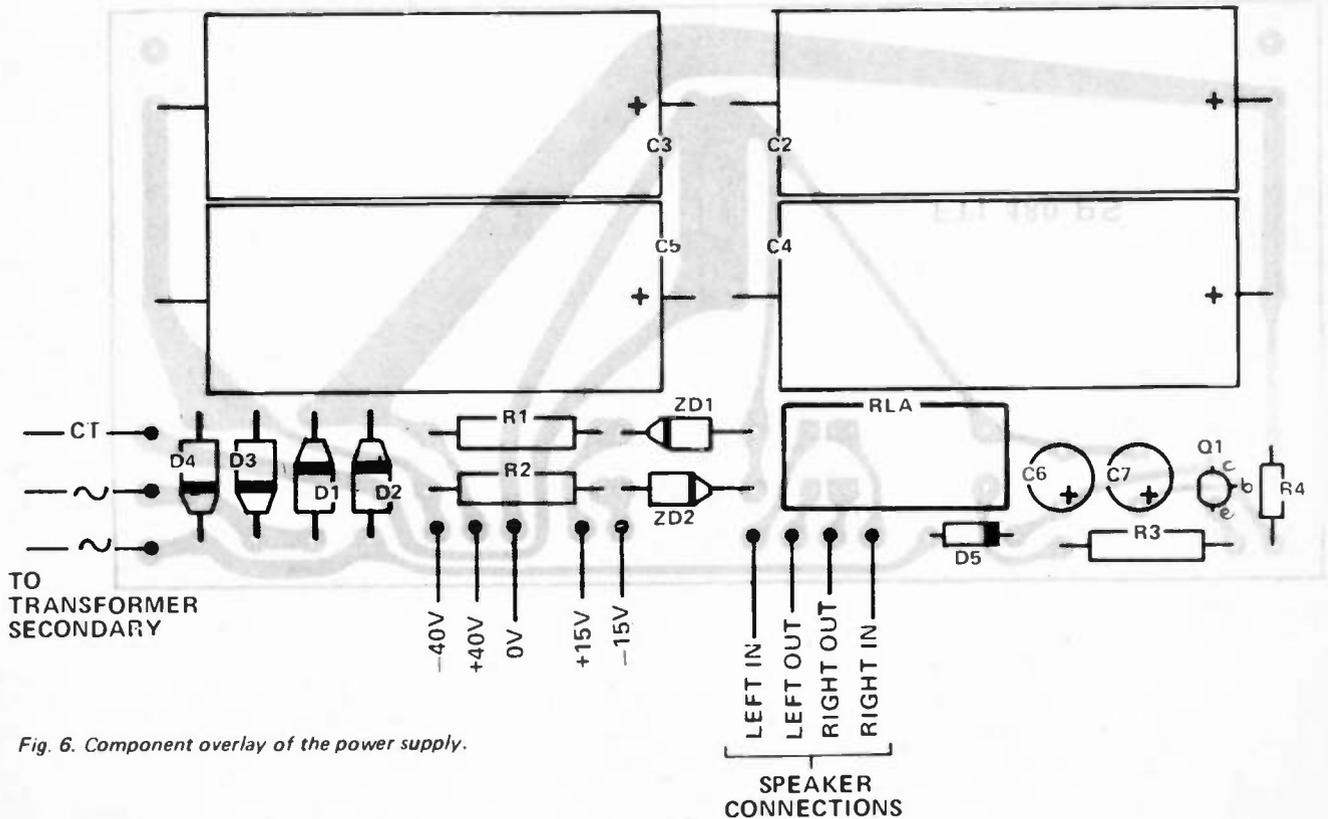


Fig. 6. Component overlay of the power supply.

## PARTS LIST – ETI 480

Resistors all ½ W 5% unless noted

R1 1k5 ½ W 5%  
 R2 10 k  
 R3 10  
 R4 2k7  
 R5 2k1

R6 3k3  
 R7 220  
 R8\* 10 k  
 R9 1k2  
 R10 470

R11 1k2  
 R12 560  
 R13 470  
 R14 47  
 R15 33 1 W

R16 10 1 W  
 R17 33 1 W  
 R18 47 ½ W 5%  
 R19 1 Ω 1 W  
 R20–R23 220 1 W

R24 R26 1 Ω 1 W  
 R27 R30\*

Potentiometer  
 RV1 470 trim type

Capacitors  
 C1 4 μF 25 V electro  
 C2 100 μF 16 V electro  
 C3 100 p ceramic  
 C4 3n3 polyester  
 C5 330 p ceramic  
 C6 100 n polyester  
 C7 27 p ceramic  
 C8–C12 100 n polyester

Transistors  
 Q1–Q3 BC557  
 Q4 BD140  
 Q5 BD139  
 Q6 BC549  
 Q7 BD139  
 Q8 BD140  
 Q9 MJ2955  
 Q10 2N3055  
 Q11\*  
 Q12\*

Zener diode  
 ZD1 5.6 V 400 mW

Miscellaneous  
 PC board ETI 480  
 Four PC mounting fuse clips (FC1)  
 Two fuses 1.5 A\*  
 Heatsink bracket to Fig. 9\*  
 Insulation kits for Q7–Q12.

\* For 100 W version  
 R8 is 4k7 ½ W  
 R27–R30 are 1 Ω 1 W  
 Q11 is MJ2955  
 Q12 is 2N3055  
 Fuses are 3A  
 Bracket is to Fig. 8.

## PARTS LIST – ETI 480 PS

Resistors

R1, 2 1 k 1 W 5%  
 R3 470 1 W 5%  
 R4 47 k ½ W 5%

Capacitors

C1 33 n 250 V ac  
 C2–C5 2500 μF 50 V electro  
 C6, 7 47 μF 50 V electro

Diodes

D1–D4 1N5404  
 D5 1N4001

Transistor

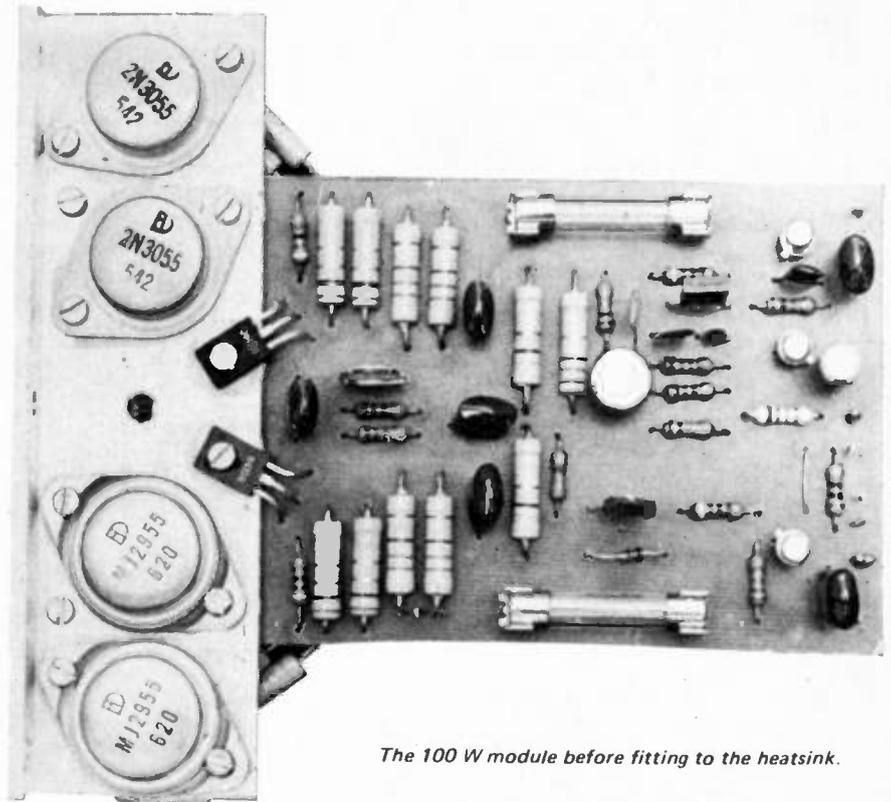
Q1 BC 548

Zener diodes

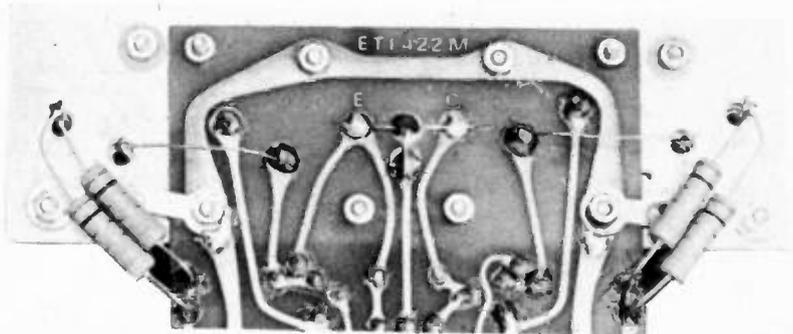
ZD1, 2 15 V 1 W

Miscellaneous

PC board – ETI 480 PS  
 Relay 2 pole 280 ohm coil  
 Transformer PF3577 or similar



The 100 W module before fitting to the heatsink.



Rear view of the 100 W module showing the links and resistor which are external to the pc board.

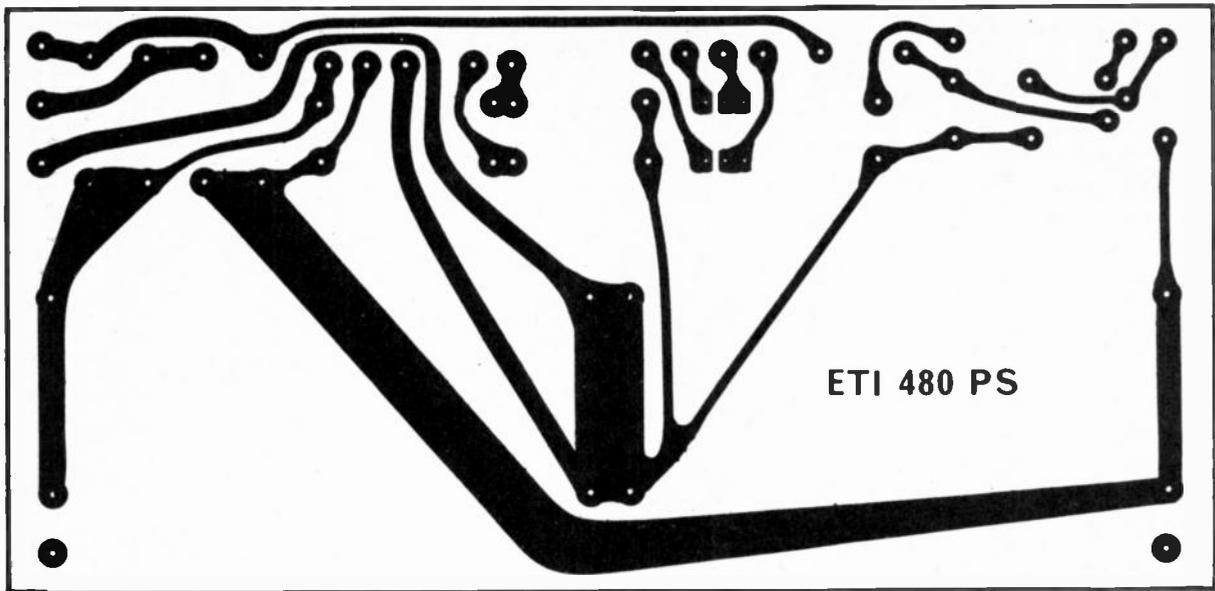


Fig. 7. Printed circuit layout of the power supply. Full size 160mm x 76mm.

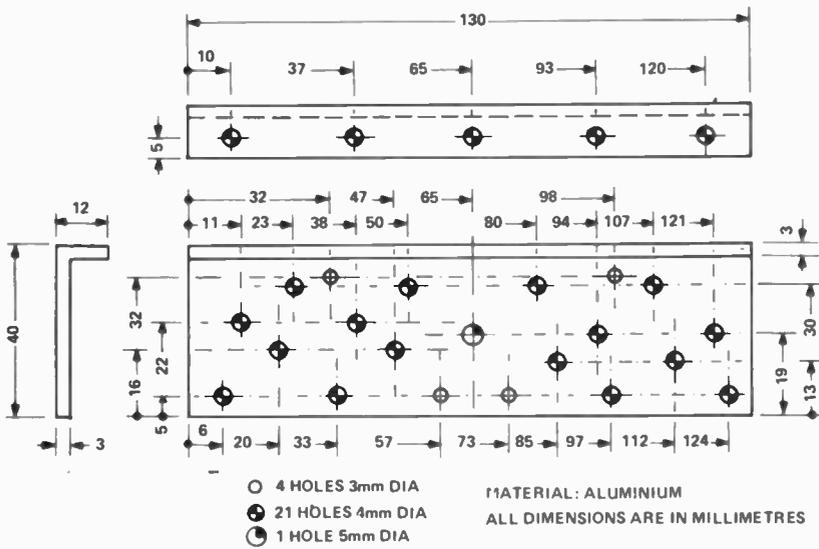


Fig. 8. Heatsink bracket for the 100 W module.

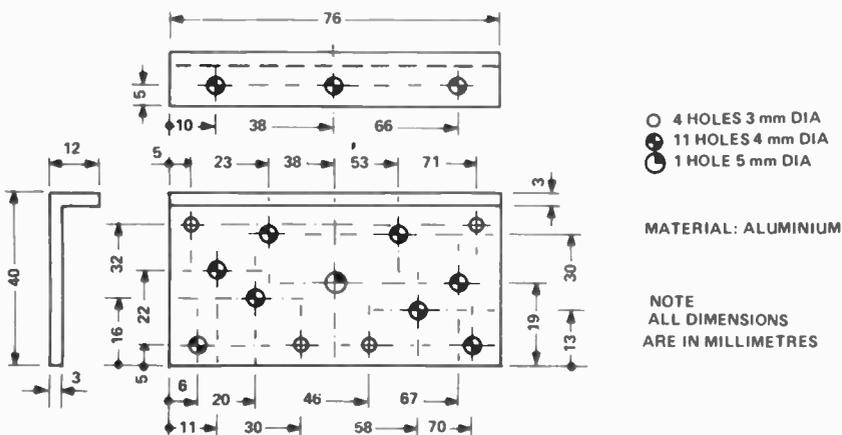


Fig. 9. Heatsink bracket for the 50 W module.

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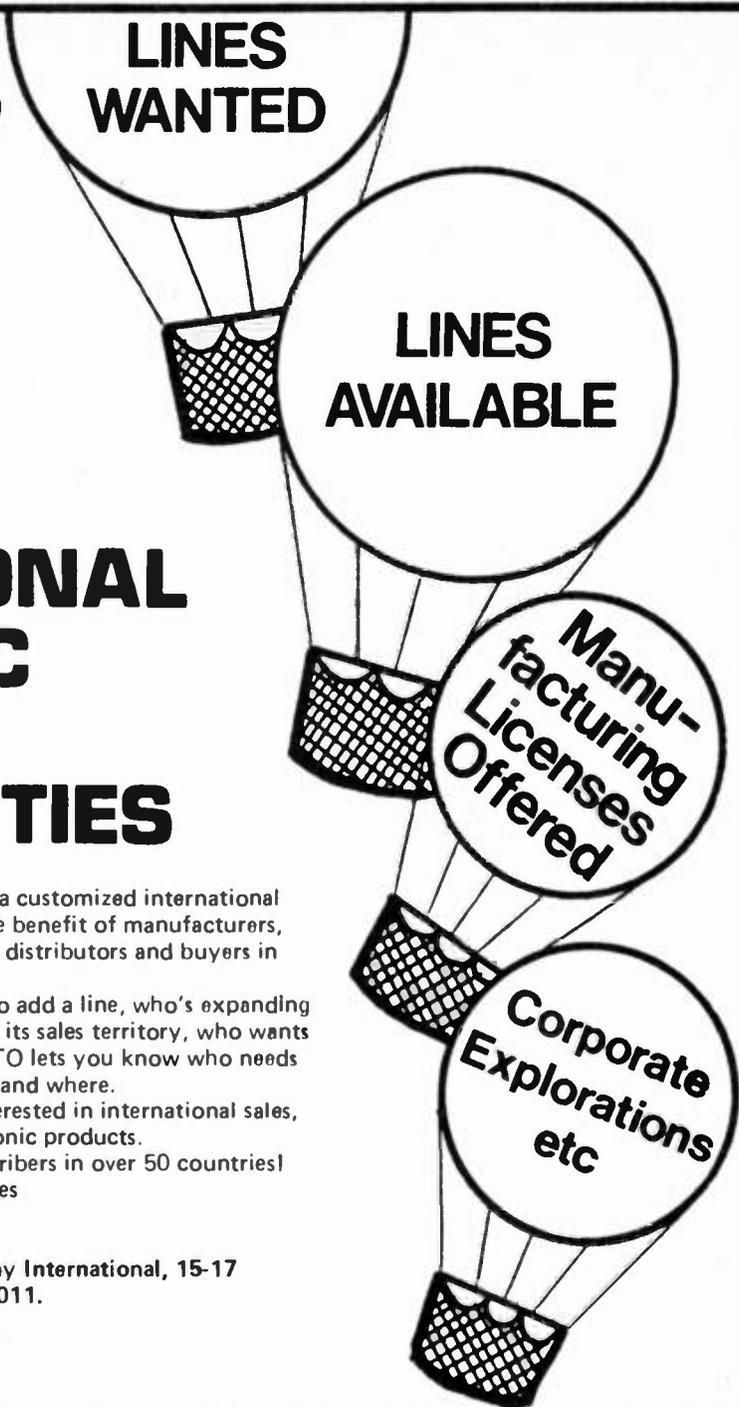
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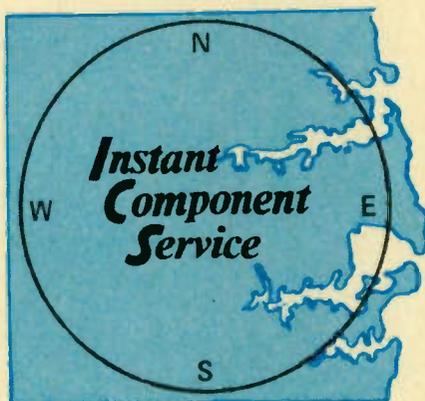
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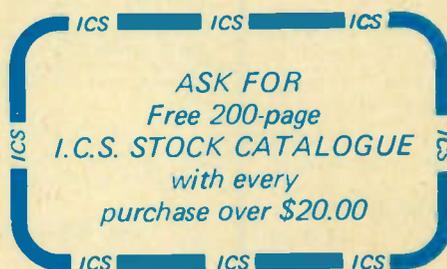
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# TEMPERATURE ALARM

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This simple project uses a 555 and a few other components to sound an alarm when a preset temperature is sensed.

THIS IS A SIMPLE BUT VERY versatile temperature monitor which can be used in three different ways:

1. To warn if temperature exceeds a preset level.
2. To warn if temperature falls below a preset level.
3. To control temperature.

The unit may be used to monitor temperature in fish tanks, laboratory ovens and/or water baths, incubators, cooking vessels, etc.

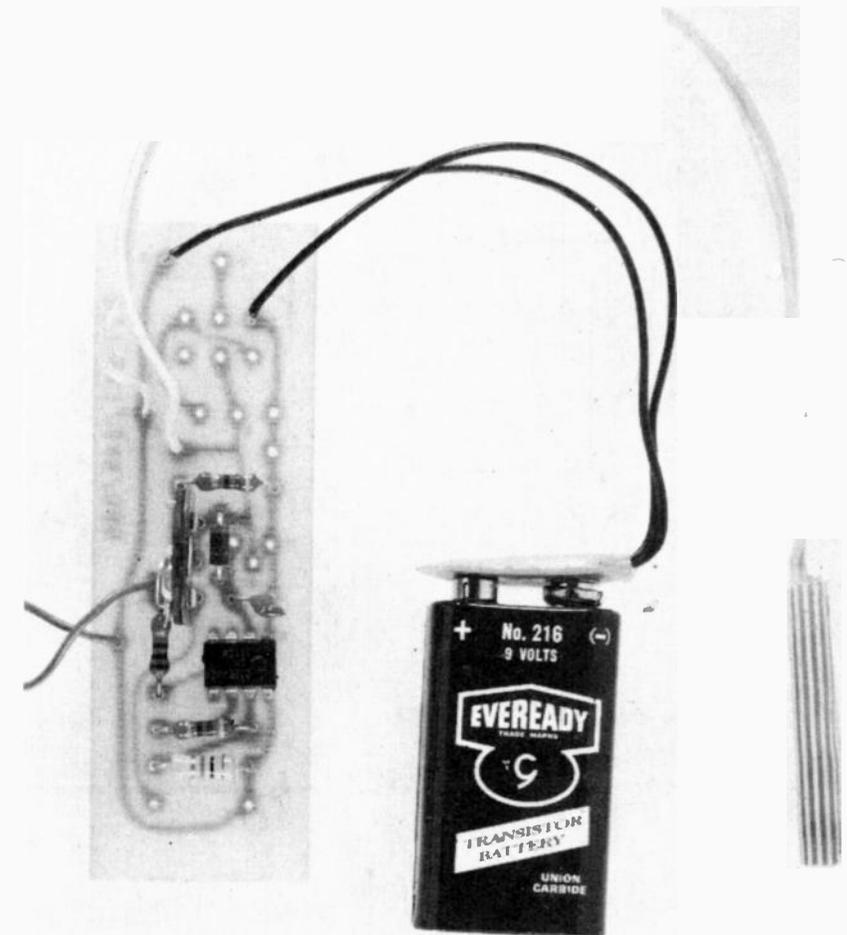
The temperature at which an alarm is given is adjustable over a range predetermined by the combined values of the components RV1 and R1. RV1 is a potentiometer which is used to adjust the final 'set point' (the temperature at which the alarm is given).

Actual temperature sensing is done by a device called a 'thermistor'. This is basically a resistor in which the resistance value varies with changes in temperature. Thermistors are obtainable in innumerable shapes, sizes and temperature ranges.

The unit may be built so that a small loudspeaker provides an audible warning when the set limit is reached (Fig. 1) or alternatively a relay may be connected which in turn switches the controlled heating load's electrical element on and off — thus producing a simple temperature control system (Fig. 2).

Either unit may be constructed so that the warning (or relay action) takes place as temperature *exceeds* the set limit — or so that the warning (or relay action) takes place as temperature *falls below* the preset level.

All that is required to convert either unit from one mode of operation to the other is simply to change over the position in the circuit of the thermistor and



the combination RV1 and R1.

Figure 1 shows the unit with loudspeaker set up to warn if the temperature exceeds the limit preset by RV1. Figure 2 shows the circuit converted for relay output operation, set up so that the relay coil is energized when

the temperature falls below the preset limit. Thus if an associated heating element is connected via the relay contacts the element will be energized when temperature drops, and will be switched off when the preset temperature is reached.

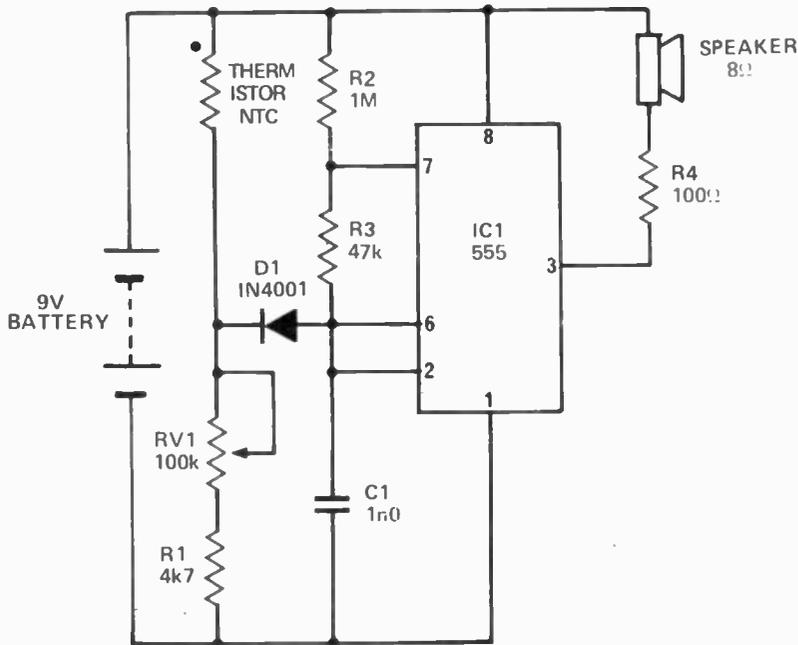


Fig. 1. Basic circuit provides audible warning if temperature exceeds set point adjusted by RV1. See text if opposite operation is required.

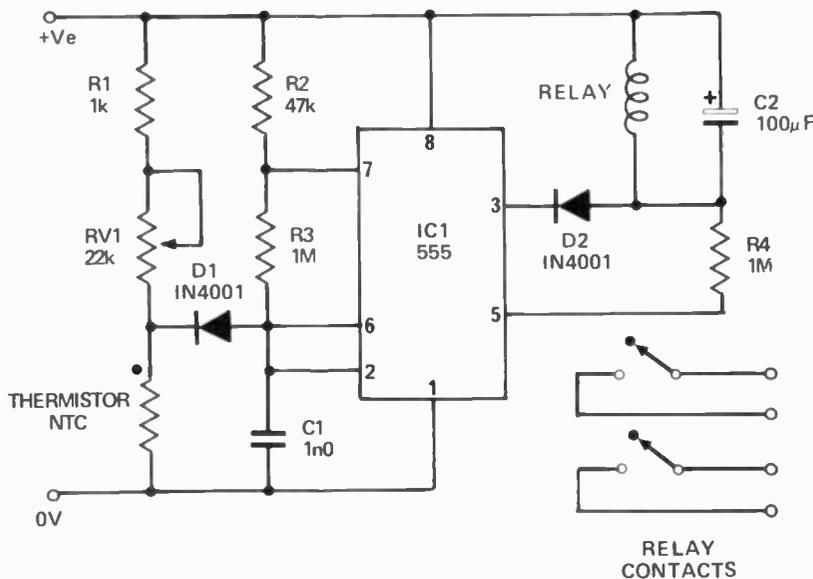


Fig. 2. Unit set up for relay operation. Relay coil is energized when temperature falls below set point.

## PARTS LIST ETI 066

### Over-alarm

R1	Resistor	4k7	½ W	5%
R2	"	1 M	"	"
R3	"	47 k	"	"
R4	"	100 M	"	"

RV1 Potentiometer 100 k Trim type

Thermistor 47 k (25 °C) Philips type 2322 642 11473

C1 Capacitor 1n0 polyester

D1 Diode 1N4001

IC1 555 Timer

Speaker 8 Ω

PC board ETI 066 or Veroboard 3.3 x 1.1" 9 V battery

## HOW IT WORKS ETI 066

Temperature is sensed via a thermistor. This is a resistor which varies its resistance as temperature changes. The one chosen for this application is a NTC (negative temperature coefficient) type in which resistance falls as temperature rises. The resistance at 25 °C is about 47 k falling to about 3 k at 100 °C. This thermistor forms a voltage divider with RV1 and R1.

The familiar 555 IC is the basis of the unit. The IC will oscillate if pins 2 and 6 are allowed to exceed approximately 2/3rds of the supply voltage, however the voltage divider along with diode D1 can prevent this and while it does so the alarm will be off.

As temperature increases thermistor resistance falls and the voltage begins to rise at the junction of D1, the thermistor and R1. When the voltage reaches 2/3 V<sub>s</sub> - 0.6 V the 555 begins to oscillate and causes the loudspeaker to sound (at about 1.2 kHz). If an 8 ohm speaker is available then R4 must be included. However if an 80 ohm speaker is available then R4 may be left out - the sound will then be much louder.

Figure 1 shows the unit set up to sound an alarm as temperature exceeds the set point. If an alarm is required as temperature falls below the set point then the position of the thermistor, and the combination of RV1 and R1 should be reversed - i.e., so that the thermistor is connected to the negative supply rail.

The circuit may be arranged so that a relay is actuated rather than an alarm. Figure 2 shows how this is done. Here diode D2 and capacitor C2 rectify the output of the 555 IC. Resistor R4 is added to ensure that there is some overlap between pull-in and drop-out set points. The lower the value of R4 the greater the difference there will be between these two points (this effect is known technically as 'hysteresis').

Figure 2 is set up so that the relay coil is energized when temperature falls below the set point. As with Figure 1 opposite action may be obtained by reversing the position of the thermistor and the combination of RV1 and R1.

## Building the unit

Constructional method is not at all critical — we show the unit made up on Veroboard and also on a printed circuit board for those who wish to use this simpler and more elegant method.

The thermistor should be mounted in the end of a short length of thin-walled glass tube and sealed with epoxy resin. Thermistors can actually be bought commercially already mounted in this way — but they're expensive.

There are two reasons for sealing the thermistor in the manner described above. Firstly, if the thermistor is not sealed electrolytic action will very quickly dissolve the thermistor leads — our's lasted just one day! Secondly, if the thermistor is used to monitor the temperature of an open element such as a heating jug there is a very real danger of the thermistor or its leads contacting mains voltage. If the thermistor is used solely for monitoring air temperatures then no sealing is of course required.

As outlined above, the combined values of R1 and RV1 determine the temperature at which the unit triggers. Table 1 shows roughly what the combined resistance should be for various triggering temperatures. Thus for the unit to operate at high temperatures the 100 k potentiometer and the 4k7 resistor specified will enable the set point to be adjusted from about 20 °C to about 82 °C.

If finer control is required then the 100 k potentiometer could be replaced by a 25 k potentiometer and R1 increased from 4k7 to 75 k.

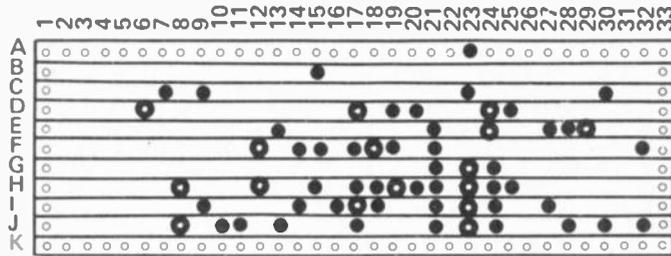
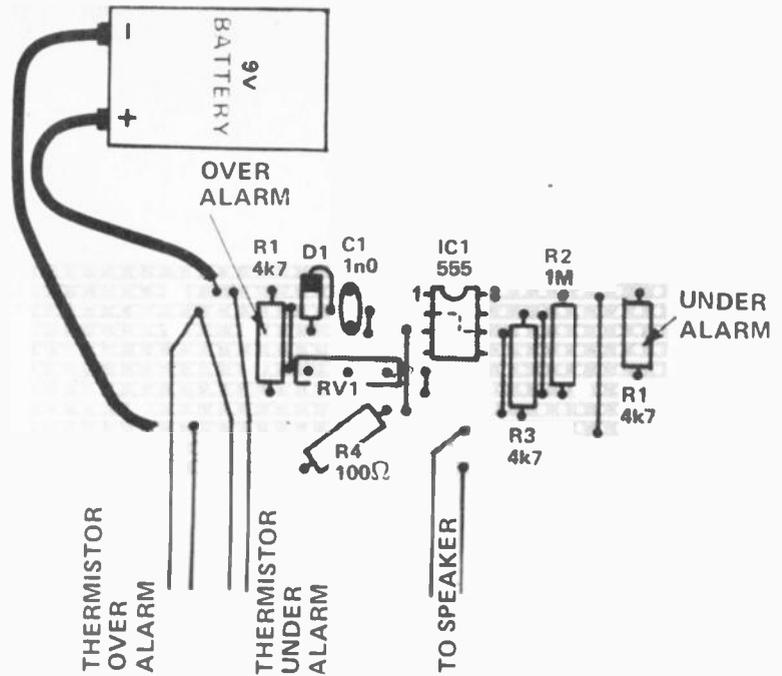
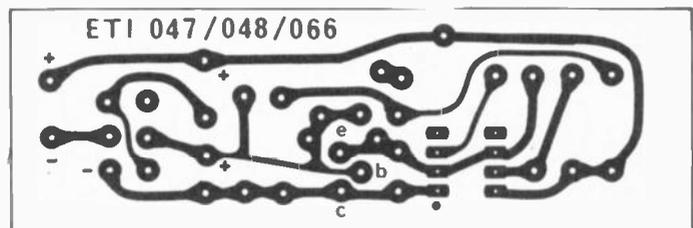
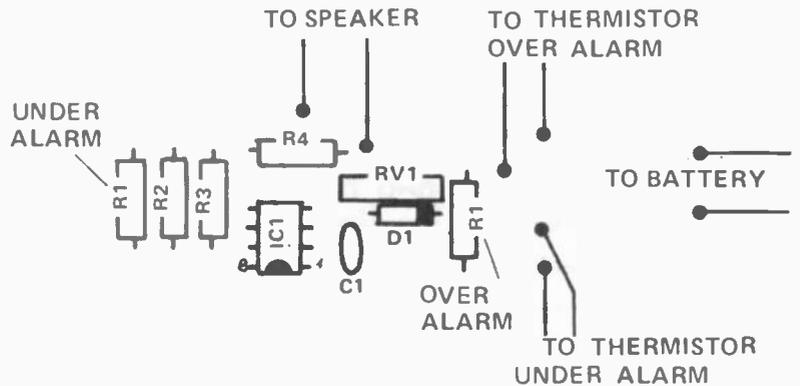


TABLE 1 ETI 066

APPROXIMATE VALUES OF R1 + RV1 FOR DIFFERENT TEMPERATURES

TEMP. °C	OVER ALARM	UNDER ALARM AND RELAY OUTPUT
25	75 k	22 k
35	50 k	15 k
45	30 k	10 k
55	18 k	7k5
65	10 k	5k2
75	6k5	3k8
85	4 k	2k7
95	2k5	2 k



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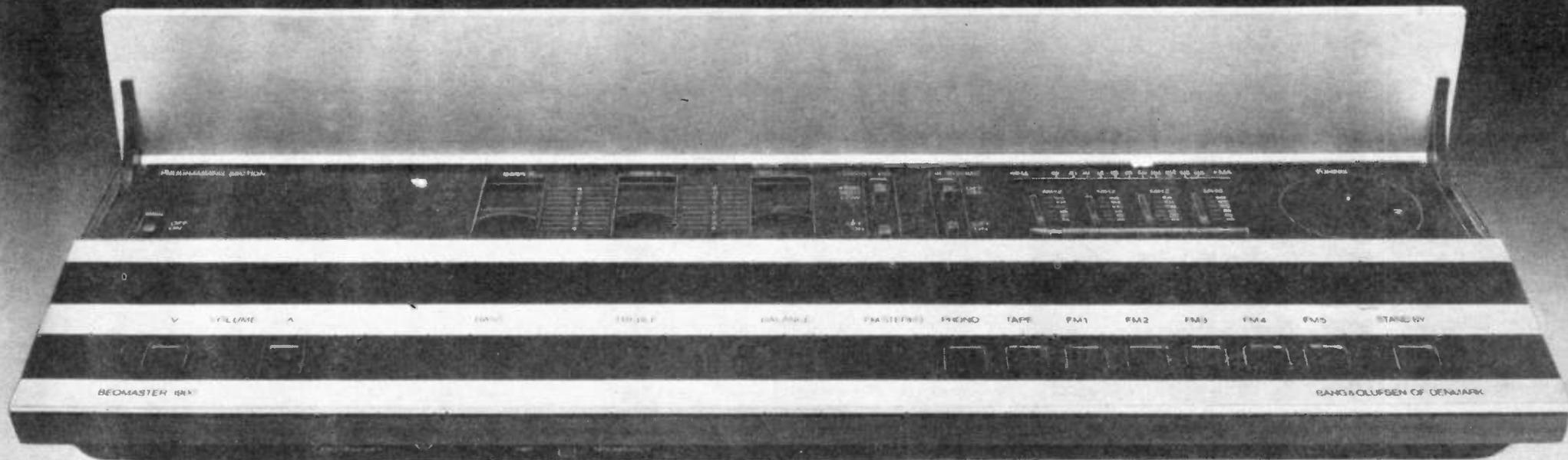
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# ICS

**This is Bang & Olufsen's new Beomaster 1900.  
Its beauty is not only skin deep.**



**It contains the most sophisticated control system available.**

**Nothing to flick, click, twist or tug—  
just a finger-tip touch activates  
any major function.**

## Beomaster 1900—the beginning of a new chapter in the history of sound reproduction.

New high fidelity amplifiers are coming on the scene all the time. But this one will probably make all the really big Hi-Fi manufacturers wonder why it was Bang & Olufsen of Denmark and not themselves who came up with these remarkable ideas.

### 1. Newly developed electronic controls

The “Sensi-touch” electronic controls provide completely silent operation of volume and mode selections—no thuds, bumps or crackles as you switch from one to the other. Electronic control of primary functions guarantees there’s no wear and tear whatsoever—provides greater reliability than traditional mechanical control systems—which, of course, rely on moving parts.

The principle behind the Bang & Olufsen system is that the finger acts as part of a condenser—the moment your finger touches the panel, the circuit is completed and the selected function activated. Only a light touch without force or movement is sufficient.

### 2. Totally electronic volume control = perfect volume regulation

The technology inside Beomaster 1900 is just as untraditional as the exterior. For instance, if a volume control needing only a light finger touch is required, a motor driven potentiometer or an electronic device can be used—B & O chose the latter.

This system—the most reliable in existence—is based on four photo resistors (called light dependent resistors—or LDRs) located around a light source controlling the adjustment of both channels. When you touch “volume up” the light given off is reduced and resistance (volume)

increases—the opposite occurs when you “touch” the sound down.

A binary counting circuit triggers off to “count” as long as your finger is touching the panel. This ensures a smooth, precise regulation of volume.

Such simple operation requires less fiddling and adjustment—thus adding hours of extra listening pleasure.

### 3. FM reception—crystal clarity and less need for adjustments

The phase-lock loop stereo decoder (a new integrated circuit) replaces all the usual circuits and capacitors found in other receivers. It gives long term accuracy in stereo FM reception—less requirement for servicing—less need for adjustments. B & O’s special muting circuit makes sure there’s no tuning noise between stations. Four FM stations can be pre-set so their selection is then entirely electronic, and they are kept constantly in tune by the AFC control.

### 4. Beneath the sturdy aluminium lid, all secondary functions are easy to find!

- Apart from the pre-set FM stations, others can be selected with the manual tuning “spinner”.
- A “loudness” function emphasizes the frequency ranges you would normally miss when playing at a low volume.
- Treble, Bass and Balance are adjusted by means of large sliding potentiometers—any adjustments are instantly indicated on the light-panel so that you always know what’s happening.

Even in this area of secondary function there’s no “flick, click, twist or tug”—just gentle slide, roll or spin movements make all adjustments with absolute precision.

### 5. “Pre-set” volume adjustment—another unique feature

This device, which can be pre-set to “High, Medium or Low”, makes sure the initial volume level will be the same whenever you turn the set on, no matter what the volume was the last time you turned it off. No other stereo amplifier offers practical convenience like this!

### 6. A computer test-bed “monitors” Beomaster 1900 for 48 hours

Every function of Beomaster 1900 has been calibrated and adjusted on a computer test-bed.

The computer successively measures 178 functions. When this is completed, the 1900 enters a testing station where power load is alternated between full output and zero for 48 hours. Sophisticated testing like this makes sure the Beomaster 1900 is always ready to give the performance you would expect from such advanced technology.

### There are three kinds of people who will buy Beomaster 1900

Some will buy the Beomaster 1900 because it has the most sophisticated electronic control system available—so simple to operate and yet more reliable than “mechanical” amplifiers.

Others, however, will be impressed by its performance. The new FM tuning section with excellent receiving capacity combined with a powerful amplifier (2 x 30 watts RMS and less than 0.07% distortion at

full power) provides the very best in sound quality.

The third type of B & O buyer will want a Beomaster 1900 as part of a completely matched audio system. Illustrated below is Beogram turntable at \$255; Beovox S45 loudspeakers at \$398 a pair and Beomaster 1900 at \$570 . Beomaster 1900 a touch above the rest.

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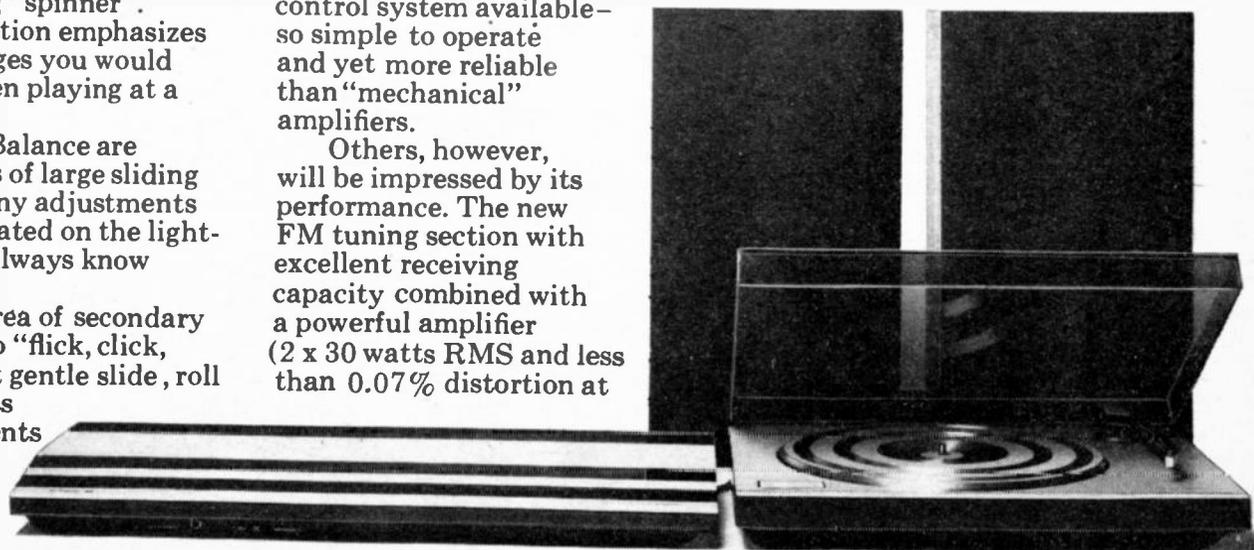
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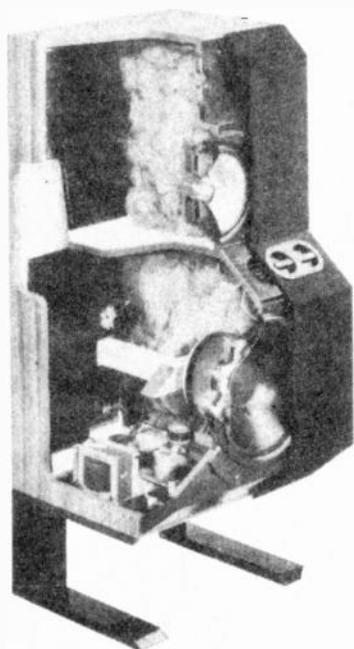
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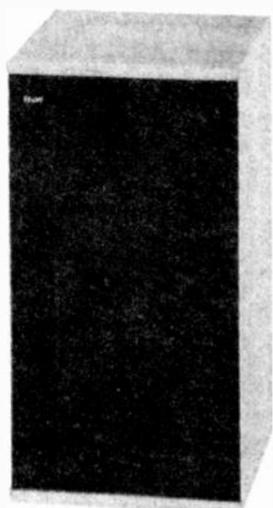


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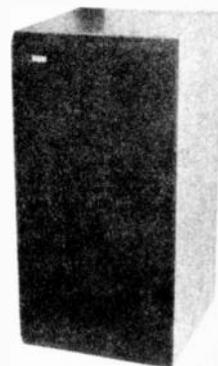
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This is ETI's new section for all computer enthusiasts.

This month Les Bell starts off his article on the internal workings of the microprocessor. He looks at the Motorola 6800 but the article is written to give the reader an understanding of the workings of any microprocessor.

We also print the first readers' contributions in this issue: an I/O port for the SC/MP and an additional I/O for the Motorola 6800 evaluation kit.

And we have more advice for those who are about to buy their first microprocessor, although we advise newcomers not to rush into this field until they have looked at the requirements for terminals, etc.

THE BIG NEWS THIS MONTH IS the keyboard project on page 55 of this issue. The encoder board will give all 128 possible seven-bit codes from any keyboard with 48 keys or more. A useful feature on the ETI 631 keyboard is an 'upper case only' switch which automatically selects the upper-case for alpha characters but doesn't affect other characters.

The ETI 630 was originally conceived as a simple device for testing the keyboard, for those of you who don't have an output device. It is a handy little project for all aspects of computer experimenting and it can be used as the basis for a simple terminal.

Next month the series of terminal projects will continue with the first VDU boards. We hope to finish the whole terminal in the February issue — having published five VDU boards and the UART board. The VDU boards are (1) Video board, this will generate the sync pulses and will be used in future ETI video projects, (2) Memory board, this will be a basic design for a 2Kx8 memory card but in the VDU we will

use only 1K, (3) Character Generator board, this will be connected between the memory board and the video board, (4) VDU Control board, this will load characters into the correct place in memory, and take them out for display at the right time, (5) Power Supply board, this will power the VDU and the keyboard.

??????????

In Print-Out this month we have the first hobbyists' contributions: dealing with I/O for the MEK and the SC/MP. This section is *your* section and we will pay for contributions (around \$20 each). We have not picked a name for this section yet — it is your section so how about you picking the name? Bear in mind that we are not limiting the section to hardware contributions — any useful information from general advice through to software will be acceptable.

### The Rockwell PPS 8

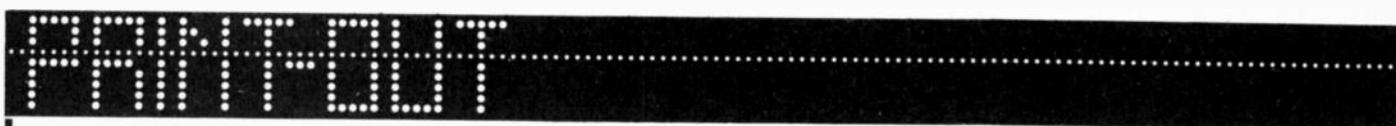
In our October issue we mentioned the Rockwell PPS 8 but there was a mistake

in the quoted specification: the Rockwell processor can directly address 16K bytes of RAM plus 16K bytes of ROM.

The Rockwell device has a 16-bit address bus but using 'bank switching' 32K RAM words plus 32K ROM words can be addressed without the need for any external decode logic. The Rockwell chips are available from the Collins Radio Company, PO Box 200, Lilyvale, Victoria, 3140.

### The Club Scene

There have been problems in getting the Australian Microcomputer Club organised. Most of the people who are writing in have little experience in the hobby and we are now looking for people who can organise initial meetings in the state capitals. By the time this issue gets into the newsagents the first NSW meeting will have been held and the results of that meeting will be reported in Print-Out next month. In the near future enthusiasts in other states should be hearing about initial meetings planned for them.



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# CHOOSING A SYSTEM

The word 'system' has been used in place of computer a lot lately, and has probably resulted in confusion for some readers. This is unfortunate because the concept is very important to anyone about to buy or build a computer. What then is the significance of 'system'?

Short for 'computer system', a 'system' is what you have when you add one or more peripherals to the basic computer. A cassette recorder and its interface would be one such peripheral. A CRT operator's terminal would be another.

People who buy or build computers should do so with a good idea of how they are going to use them. After all, a computer on its own is limited to only a few rather uninteresting applications perhaps a calculator, a clock, or a set of flashing lights, at its best. But add some extra memory and a general purpose interface board or a cassette recorder interface and the number of possible uses skyrockets. Your computer has now become a system!

Unlike the commercial computer system designer who knows what the end requirements are to be, the hobbyist generally does not have a clear picture of what his system will end up doing. Unless you have a specific requirement to meet (or experience in computing), it makes sense to leave open as many options as you can when you commit yourself to a microprocessor chip (and to the design that implements the computer).

## Selection Criteria

The factor that seems to influence computer-buyers the most is cost. Cost has the most effect at two distinct times: once when you decide which microprocessor chip to use, and again when you make a decision about the design of your computer, and how it limits your system (e.g., in the size of the memory).

## Which Microprocessor?

Once the cost of the chip was a valid consideration when faced with this decision. It still is important to the commercial user who buys in thousands, but fortunately competition has forced prices to fall dramatically over the last 12 months. The difference in price

now between the most powerful and the least expensive chip is less than twenty dollars. In terms of the cost of the minimal system this is less than 10%, while in terms of improvement in performance this represents almost an order of magnitude change.

So for the computerist who is not too sure what he will end up doing with his computer it is certainly worth considering spending that extra few dollars and going for a high performance processor.

Quite often the low figure on the price tag is an indication of how much a manufacturer has left out. Many of those who have bought evaluation kits have come to realise this and are now having to add to their kits to get them to do the jobs they had in mind.

Evaluation board kits have a place and a purpose in the electronics industry and at the very least they must be called successful. But they are products engineered to a price and so they suffer the consequences.

## Effective Cost Saving

One effective cost-saving technique is to use the modular approach. For example, a minimum system might consist of two p.c. boards — a CPU board and a front panel board. To keep the cost low, the CPU board can connect to the front panel board by a cable, and the two boards, plus a power supply, then form a minimum function system.

Later, this system can be expanded by adding a mother board. The CPU and front panel boards can be plugged into this, and there would be room for expansion by the addition of other pc boards (modules). Such additional boards could be a 4K RAM board, an I/O board or a cassette interface board.

## Buffering — the Key to system expansion

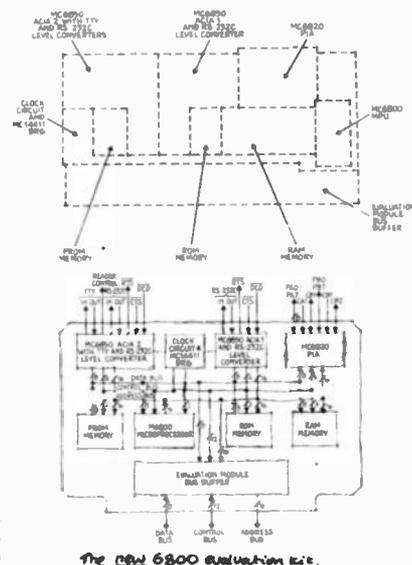
Most system expansion will require access to the computer's data and

address buses. The microprocessor can, at the most, only handle one TTL load on these buses, so it's worth checking out to see if any signals are buffered on the CPU board. Most add-on boards load the buses by one TTL load and if your system is not adequately buffered you will have to add extra chips to overcome this.

This problem is now being tackled by some of our readers who bought evaluation kits without buffering.

A future article will look at the criterion of "complexity" — another dark area to the hobbyist. There are two types of complexity — one in terms of parts counts, the other in terms of number of instructions. Read PRINTOUT next month to find out more . . . ●

## Know what's new in microcomputers?



Read **PRINTOUT NEWS** ... p101

# I/O FOR THE MEK

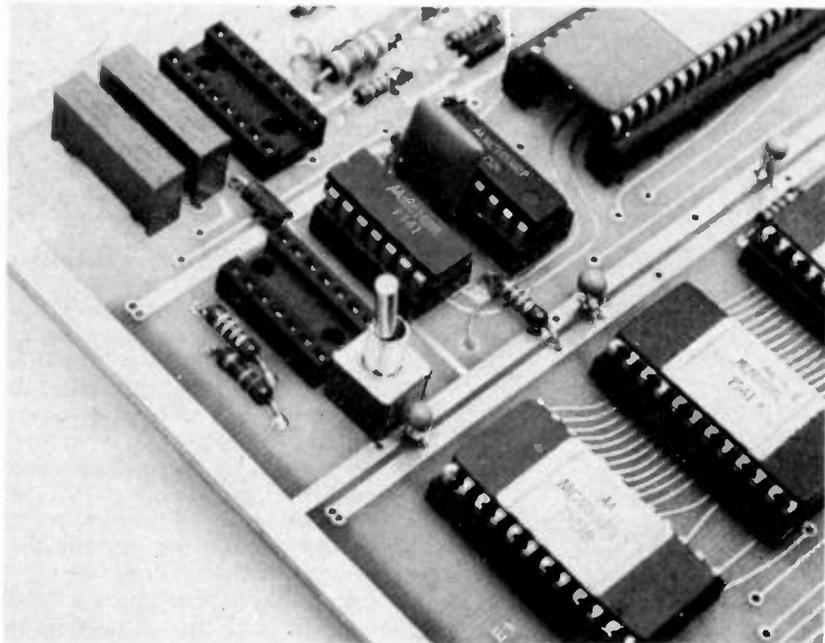
From B.K., Croydon.

If you need more I/O ports on your Motorola evaluation board or if you would like a no fuss way to try out the ACIA, try this simple modification.

Although the 6800 evaluation board comes with two PIAs it is only possible for your program to use one of them conveniently because four of the ports on the second PIA are used a part of the TTY interface. These four connections interface with the effective use of the remaining 12 ports. One way around this difficulty is to fit a switch that allows the operator to disconnect the PIA from the TTY interface thereby freeing the PIA for use with your program.

Unfortunately between giving control of the computer to your program and disconnecting the TTY interface there is an overlap period when your program has control and the TTY interface is still connected (unless you are quick enough to operate a switch in about 20 microseconds).

This problem can be overcome with a timing loop, but it is a rather tedious approach. Also with the TTY interface



How the double pole switch is mounted on the MEK board.

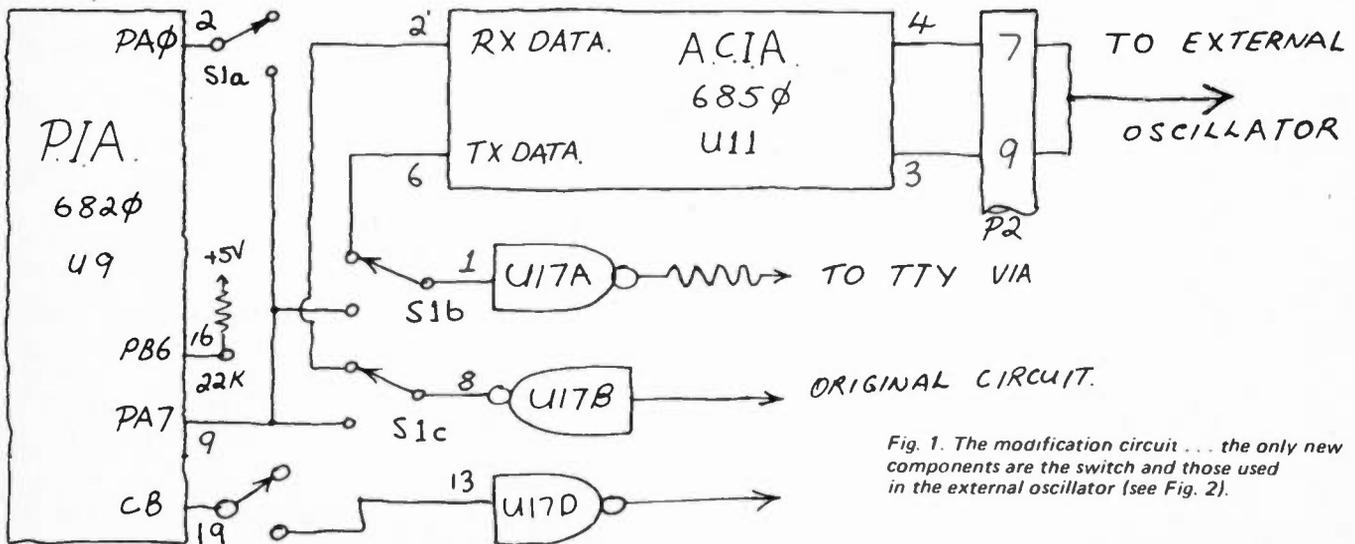


Fig. 1. The modification circuit . . . the only new components are the switch and those used in the external oscillator (see Fig. 2).

disconnected, your program can no longer talk to the TTY.

### There is a better way

Instead a simple and effective method is to use the switch to disconnect the TTY interface from the PIA and connect it instead to the ACIA. Now the PIA is free for any other use and your program can talk to the TTY via the ACIA. And the overlap can be easily taken care of by your program by waiting for a particular character to be received from the TTY via the ACIA before continuing.

### Extra Bits needed

As well as a switch and a couple of lengths of wire, the ACIA will need an external clock signal. I built a suitable oscillator on a small piece of veroboard and connected it to pins 7 and 9 of P2. This uses a 555 timer IC in the circuit shown in Fig. 2. Note that the time constants are chosen for a centre frequency of 1760 Hz, or 16 times the transmission rate (you will need to know this when you go to the ACIA control word). For different transmission rates change the value of the 0.022  $\mu$ F capacitor.

### Implementation

The modified circuit is shown in Fig. 1. To get the modification going as quickly as possible I mounted the switch on the evaluation module's pc board. This is shown in the photograph. The switch is secured by bending over the solder tags

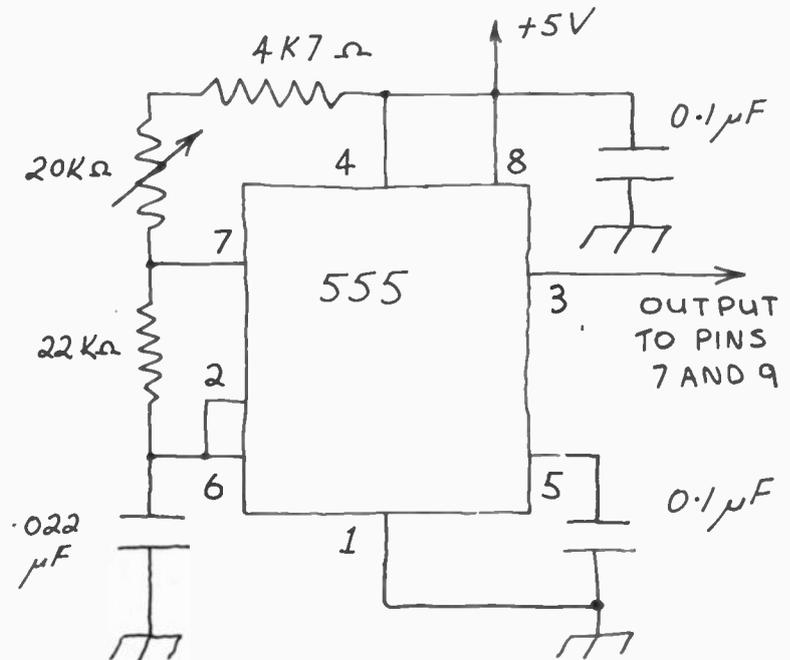


Fig. 2. Circuit diagram of the external oscillator.

and filling in their holes with solder. See photo. Next I cut the pc board tracks going to pins 2, 9 and 19 on the PIA (U9). Then I also cut the tracks going to pins 1, 8 and 13 and ran leads as shown in the circuit, Figure 2.

Then I wired up the oscillator and connected it to pins 7 and 9 on P2. The oscillator was set up by looking at its output on a CRO and setting the frequency to 1760 Hz.

However, if you don't have a CRO it should be possible to have your

program continuously output a single character, say an A, and then you can adjust the oscillator frequency until the TTY displays only the A.

To save switch poles, PB6 was taken to supply via a 22 k resistor. Since it is MOS input the PIA considers it a ground connection and acts accordingly.

If you have any trouble first check where the two resistors, R30 and R31, are going to. If they are going to ground, then go back and check the ACIA's control word.

There are many applications for a computer which require a parallel 8-bit data port. There is no such facility on the SC/MP evaluation board and this text shows how you can modify the board to allow you to interface directly onto the data bus and use the I/O as a memory location. This method was used in preference to serial transfer via the extension register because of the speed advantage.

From B.K., Croydon.

# AN I/O PORT FOR THE SC/MP part one

First I made a check on memory addresses to see if any were used — it turned out there weren't any free. To keep the evaluation board simple, National have used a design where only the address bits 0 through 9 are decoded while the address bits 10 through 15 are ignored. This means that all the 1024 different states of bits 0 through 9 select RAM or ROM — irrespective of the states of bits 10 through 15.

This presented a problem, and I

decided to tackle it by first adding logic to the evaluation board to decode the memory addresses. This gives many spare addresses which are not used for the RAM and ROM on the board, and these addresses can be used for our I/O interface.

After checking my components drawer to see what IC's were available I decided to try the circuit shown in Figure 1.

**It works like this:**

IC1 is one-of-eight decoders that decodes the three address lines AD9, AD10 and AD11 into eight lines, S0 through S7.

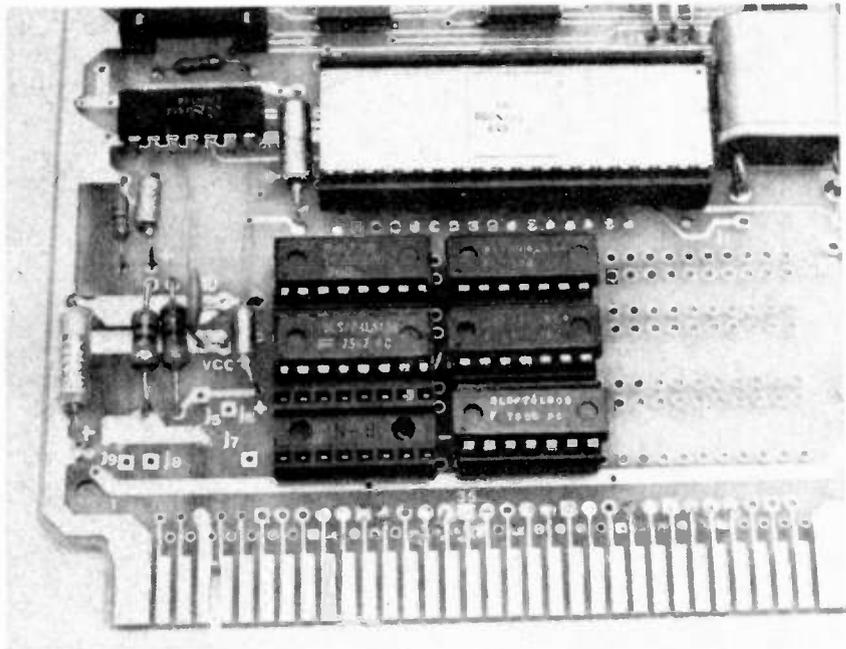
Then for each one of these decoded outputs S0 S7, the other address bits, AD0 through AD8, can address 512 words. By doing this I have broken memory into eight pages of 512 words each. One page is used for ROM (page S0) and pages S1 and S7 are used to address RAM.

RAM is only 256 words, so why have I used two pages? Well the monitor program, Kitbug, maintains a memory stack in RAM starting at location FFFF hex and consequently it expects to see RAM at that location. Since the evaluation kit has only one RAM and I had a collection of programs already written that require RAM at starting location 0200 hex, I have arranged that my RAM should respond to two sets of addresses. One starts at 0200 hex and the other at FF00 hex.

In actual fact the RAM has four sets of addresses, starting at 0200, 0300, FE00 and FF00 hex. This happens because the decoder makes pages of 512 words and the RAM is only 256 words. If you want to add another RAM and fill the page then use address bit AD8 to enable that RAM. This, however, adds complexity. I have found that this minor amount of memory folding has not (as yet) caused any problems.

**Now for the subtle bits**

Only when RAM or ROM has a valid



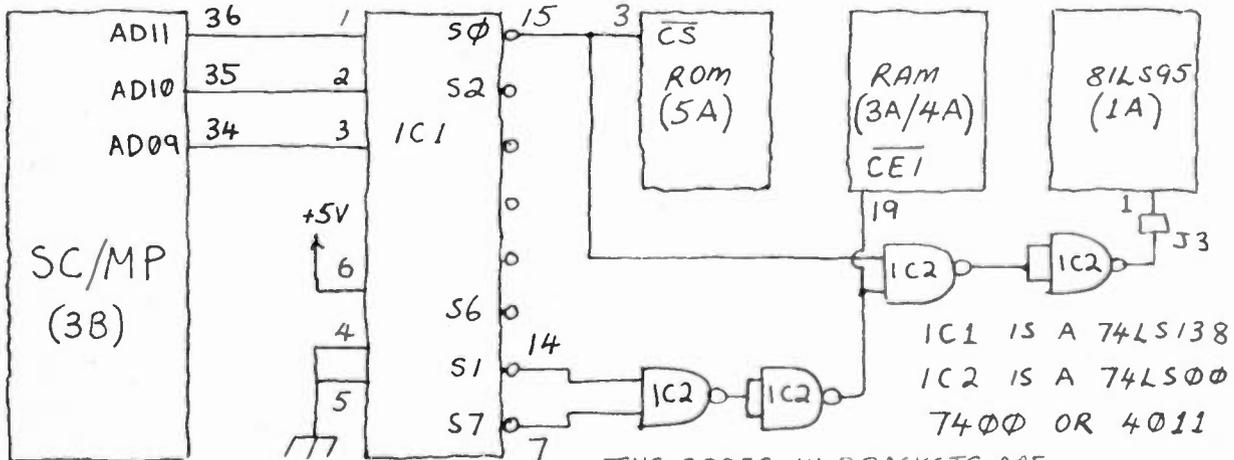
There is provision on the SC/MP board for mounting the extra ICs.

address do we need to feed back their outputs to the SC/MP data bus. I have arranged this by gating a control signal onto pin 1 of the 81LS95. Thus IC2 puts a low on to pin 1 whenever S0, S1 or S7 goes low. So whenever S2 through S6 go low instead, a high is placed from 1 and the 81LS95 goes tri-state. This allows another device to feed data (if it's a read operation, of course) onto the SC/MP's data bus. The enabling of this other device is controlled by one of the decoder outputs, S2 through S6.

Note that the decoder chip is an LS device. This means that it only loads the

address bus by one quarter the value of a normal TTL load. Since the address bus can only drive one TTL load this leaves some spare drive capability. Other decoders could be used. You could, for example, use the 74L42 with its A3 input left low, or you could use a CMOS decoder (but if you do IC2 will also have to be a CMOS to stay within the loading rules).

Next month we will publish the final part of this contribution. This gives a circuit for gating incoming data on to the SC/MP data bus and a latch to store outgoing data.

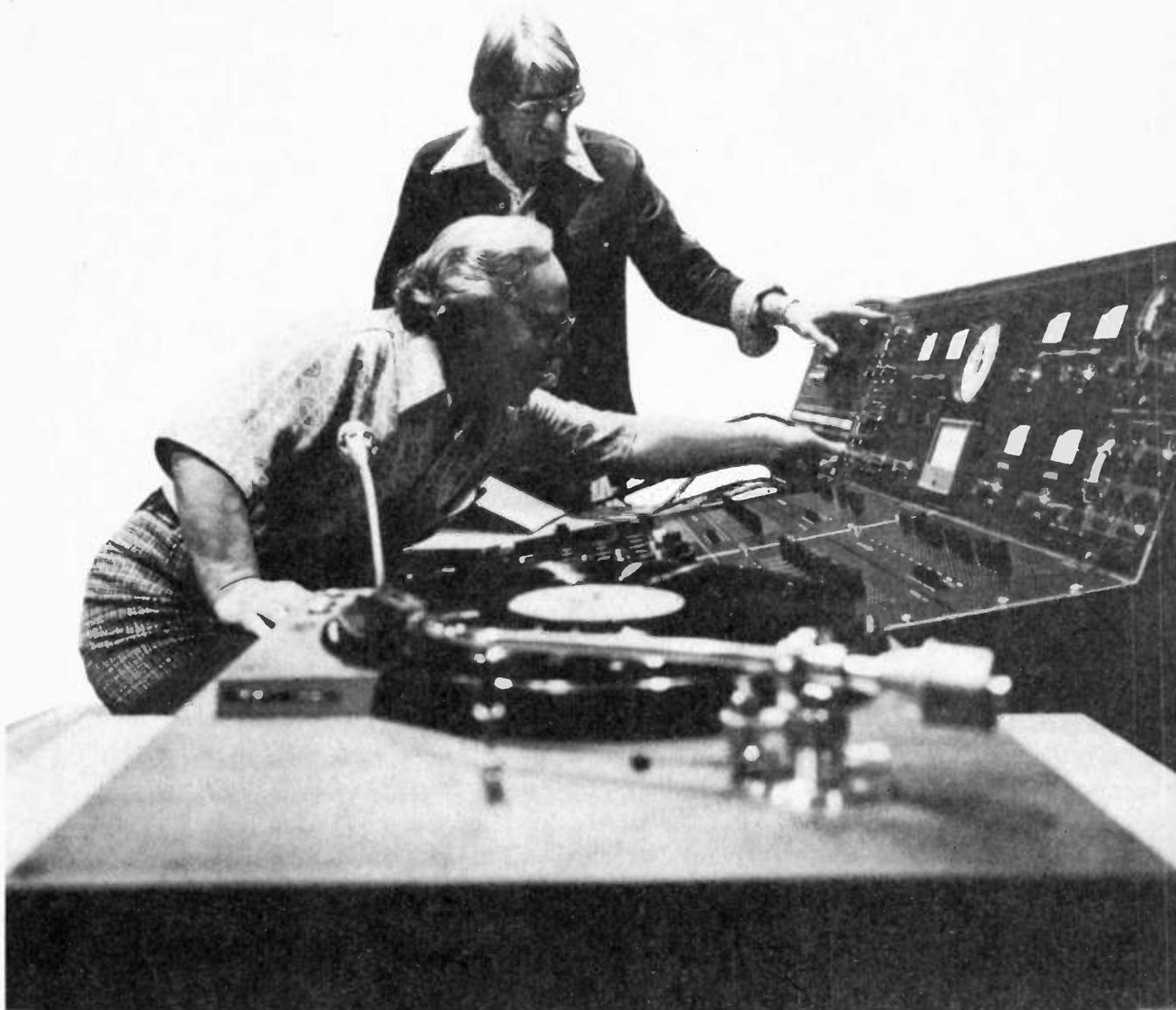


IC1 IS A 74LS138  
 IC2 IS A 74LS00  
 7400 OR 4011

THE CODES IN BRACKETS ARE NATIONAL PART NUMBERS.

Circuit diagram of the SC/MP modification.

# Creation of the new Calibration Standard filled a need...the acceptance of Stanton's 681 TRIPLE-E is unprecedented!



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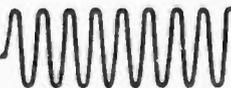
Each 681 TRIPLE-E is guaranteed to meet its specifications within exacting limits and each one boasts the most meaningful warranty possible. An individually calibrated test result is packed with each unit.

As Julian D. Hirsch of Hirsch-Houck Labs wrote in Popular Electronics Magazine in April, 1975: "When we used the cartridge to play the best records we had through the best speaker systems at our disposal, the results were spectacular".

Whether your usage involves recording, broadcasting, or home entertainment, your choice should be the choice of the professionals... the STANTON 681 TRIPLE-E.



Sole Australian Distributors.



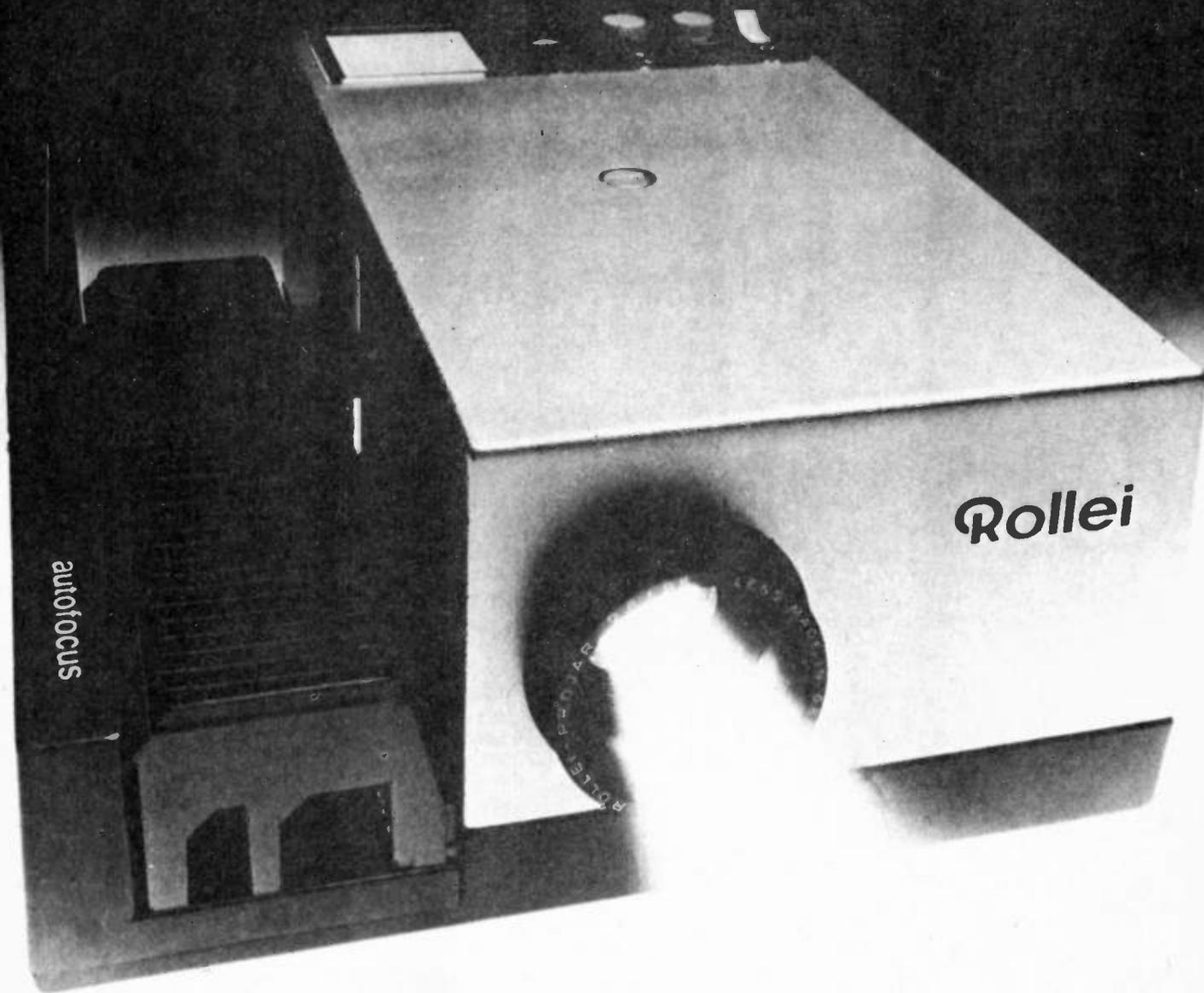
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# microbiology

## The internal operation of a microprocessor. Les Bell looks at the Motorola 6800.

THE M6800 MPU is a 40 pin DIL integrated circuit which contains roughly ten thousand components. The NMOS technology used permits a very high gate density and generally speaking makes the whole thing possible.

If you part with around \$30 of your cash to buy a 6800 micro you are getting around 3000 logic gates which is pretty cheap, if you ignore the fact that they won't do anything without quite a lot of other hardware, not to mention *software* (programs). This must be value for money and if by 1980 the price drops to the expected \$5 mark you just won't buy CMOS or TTL for most projects!

Obviously, circuitry on the actual lump of silicon is extremely complex — the only sections the programmer can actually get at are the six registers which are connected to the data and address buses, and via certain pins he can 'get at' some parts of the logic to handle interrupts and data transfers etc. Most of the logic is inaccessible: for example the arithmetic circuitry around the accumulators in 'transparent'; instruct the MPU to add and it will do so, automatically and there is no way that the function can be modified. Fortunately, one would almost never

wish to alter the way in which the MPU operates. It is completely a 'general purpose' chip and instructions are built into it to handle everything you could reasonably wish.

The six registers mentioned above are the most important part of the MPU. They are:

- 1 *Accumulator A (ACCA)*. One of the two 8-bit working registers of the MPU.
- 2 *Accumulator B (ACCB)*. The other 8-bit working register.
- 3 The *Condition Codes Register (CCR)* which contains various bits of information about the contents of the accumulators. It is an 8-bit register but only 6-bits are actually used.
- 4 The *Program Counter (PC)* is a 16-bit register which usually gives the address of the instruction the MPU is currently executing.
- 5 The *Stack Pointer (SP)* is used in setting up areas of memory for storage of intermediate results and also in handling interrupts. Also 16-bit in length.
- 6 The *Index Register (IX)* is used in special addressing modes to let the MPU jump around in memory to subroutines etc. Again, this is a 16-bit register.

By means of various instructions one can shift data into, and out of the accumulators and memory, alter data, add numbers, and test results of operations. At this point, the CCR becomes of importance. It contains six bits, HINZV & C, as shown in Fig. 1. H is a half-carry bit which is set when a carry is generated from bit 3 of the accumulator and is of special relevance in BCD calculations.

The 1 bit is an Interrupt mask bit, which is set if the MPU is to ignore interrupt requests from other devices.

N is a Negative bit and is set if the result of a calculation is negative. Z similarly, is set when the result is zero. V is set if the result overflows from the register as a result of calculation involving the 2's complement representation of negative numbers. C is a carry bit which is set if the result has greater than 8 bits.

The Stack Pointer and Index Register can be loaded, incremented, decremented, and stored by similar instructions. The Program Counter is altered by other instructions such as JSR (Jump to Subroutine). All of these instructions will be considered in detail when we discuss programming.

Continued next month . . .

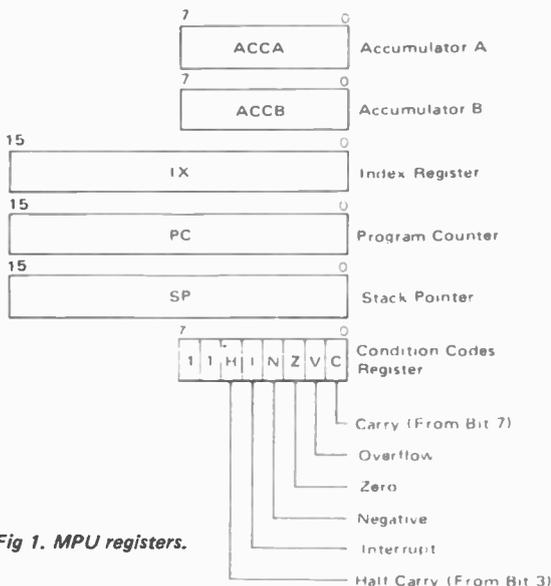


Fig 1. MPU registers.

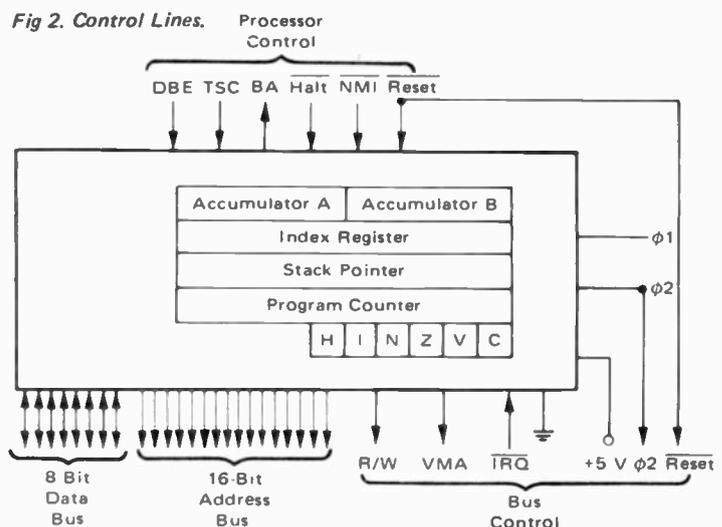
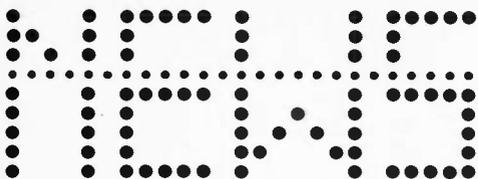


Fig 2. Control Lines.



## FAIRCHILD AND MOTOROLA SWOP MPU

Fairchild have granted Motorola rights to produce the F8 processor and Motorola have allowed Fairchild to produce the 6800. The exchange deal also includes Fairchild's low-power Schottky and two new memories, and Motorola's full range of peripheral chips and memories for the 6800. Although the 8080 is still ahead in numbers it seems that the 6800 is likely to retain second place for quite some time yet.

## MICROPROCESSOR FOR THE WIFE

A new sewing machine, the Singer Centurion, uses a custom microprocessor from AMI and Intel ROMs. The machine is self-programmable and can remember over 100 different steps and reuse any one at any time.

## COSMAC DRIVES CARS

RCA are developing a system which uses their Cosmac processor to monitor the operating conditions of a car and present the information (including data like fuel consumption and motor rpm) on an alphanumeric dash display. The work is part of a safety vehicle research program.

The system will use currently available sensors to predict the imminence of a collision and it can be used to apply the brakes automatically. This involves processing radar information on the car's speed and the speed and direction of other cars. The system can also be used for automatic cruise control.

## F8 VIDEO ENTERTAINMENT SYSTEM

Selling in the US for \$150 the VES sounds like the ultimate in

electronic toys: you get a set-top console and a couple of joystick controls and digital tape cartridges which program the system for the game of your choice. In reality it is only the beginning — we predict that by next year there'll be a series of games based on dedicated microprocessors all competing for the Christmas stocking.

## ZILOG Z-80 TO BE MULTI-SOURCED

Zilog Corp., of Los Altos, California, have announced that their Z-80 CPU chip is shortly to be second-sourced. With availability from more than one manufacturer the Z-80 becomes an attractive alternative to currently available second-generation microprocessors.

The Z-80 CPU is a 3rd generation single-chip microprocessor with unrivalled computational power, which is claimed to result in higher system through-put and more efficient memory utilization when compared to second generation MOS microcomputers. The Zilog component set includes all of the circuits necessary to build high performance micro-computer systems with virtually no other logic and a minimum number of low cost standard memory elements. In addition the Z-80 CPU is very easy to implement into a system because of single voltage requirements, and because all output signals are fully decoded and timed to control standard memory and peripheral circuits. On the CPU chip there is a 'Refresh' register which provides for automatic, totally transparent refresh of external dynamic memories.

At the same time I/O operations are enhanced by system architecture and use of the Z-80 PIO (Parallel I/O Interface Controller).

Zilog (Australia) (PO Box 95,

Mascot, 2020) say that Z-80 evaluation kits and chip-sets will shortly be available in this country, with full development system back up in service early next year.

## MOTOROLA'S IMPROVED EVALUATION KITS

This month Motorola launch new evaluation kits based on the 6800 processor; the kits have several features not on their previous design. The new kits don't need an external terminal: they include a hexadecimal keyboard and a seven-segment display. The monitor program, J-BUG, is an improved version of the old MIKBUG with several new commands.

For example up to five breakpoints can be setup and cleared; and there is a command to proceed from a breakpoint. Relative offsets between memory addresses can be calculated (and the result expressed in hex).

Since a Teletype is not needed Motorola have made provision for an alternative to the paper tape punch/reader. The software and hardware for storing and retrieving data on an audio cassette is part of the kit (using the Kansas City standard). The part number of the kit is MEK6800DL.

## MOTOROLA MICROMODULES

The first five of fifteen micro-modules are to be released by Motorola this month. They are designed to allow companies to make up custom computers by assembling standard micromodules — avoiding the cost of having their own boards designed and built.

Modules 1 and 1A are single-board self-contained computers. Module 2 is a CPU with the 6800, clock and bus drivers. Module 3 is an I/O board and module 4 is an 8K/16K PROM board.

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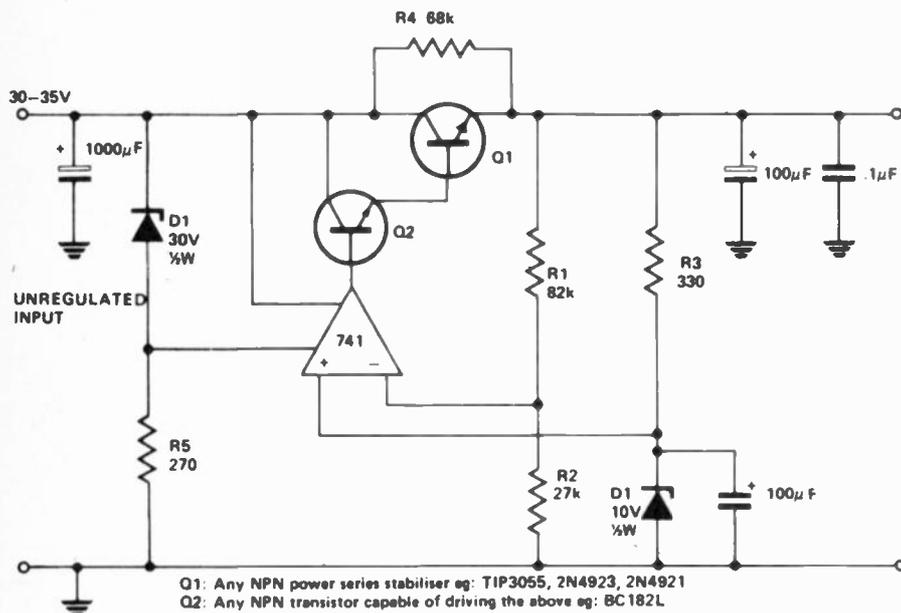
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# Ideas for experimenters

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.

## Stabilised power supply



The operation of the circuit is quite simple and straightforward, as regulated power supplies can be considered merely as special kinds of feedback amplifier. Here, the output signal is sampled by R1 and R2, and compared with a reference voltage supplied by D2. The resultant correction signal is fed back via the 741 to the series pass element Q1. Note that the stability of the circuit is improved by supplying the reference source R3-D2 from the stabilised output as opposed to from the unstabilised input as is usual. In order that the circuit operates when turned on, a leakage resistance R4 is put in parallel with the series pass element. This ensures that the feedback loop starts to operate. No regulation is lost

as a consequence of R4, because it is the overall output that is sampled by R1-R2, and so the effect of the ripple current flowing through R4 is corrected by the feedback.

The output may be made variable by replacing R1-R2 with a potentiometer, but in its present form, the circuit cannot be made to regulate below the zener voltage of D2. If continuous variation is required, the reference source R3-D2 must be supplied from the unregulated input, with consequent slight loss of stability.

The amount of power the circuit can deliver is limited chiefly by the current rating of Q1 and the rated output of the unregulated supply.

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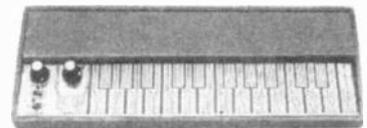
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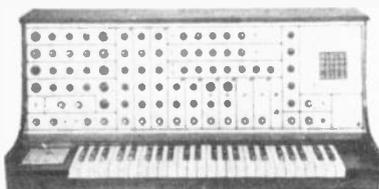
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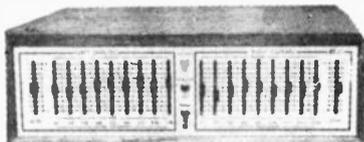
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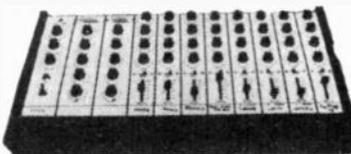
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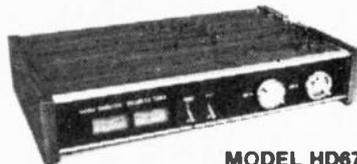


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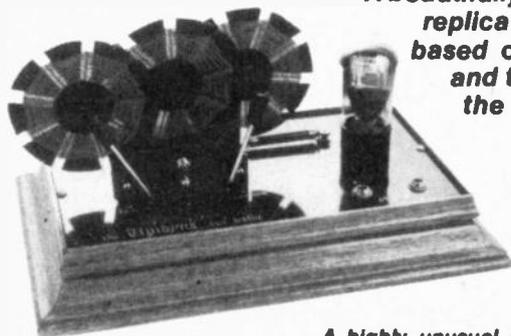
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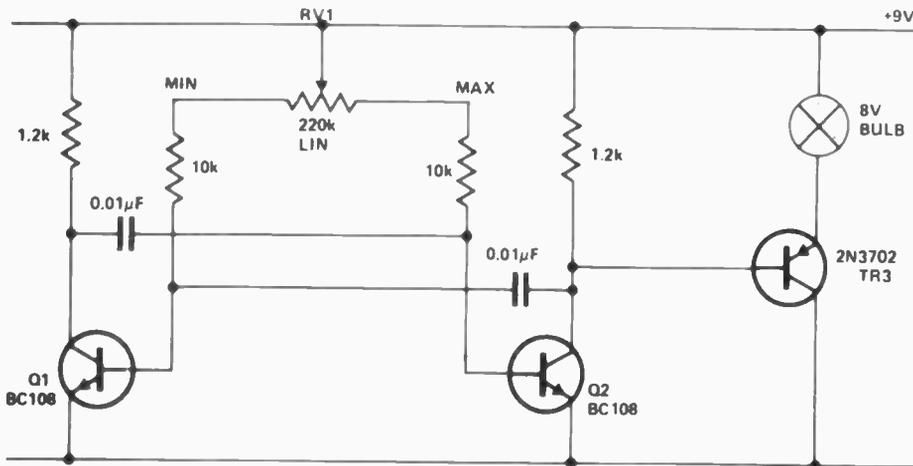
Free with each set — 2 reprints of wireless advertisements from the 1920's.

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# Ideas for experimenters

## Variable brilliance lamp for dc supplies



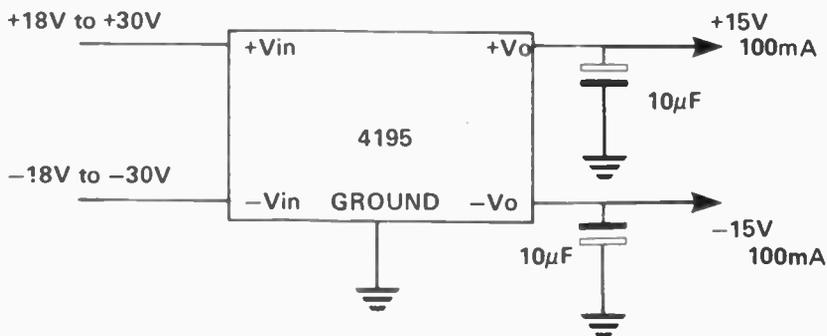
A simple and inexpensive unit for reducing the brilliance of a lamp and at the same time reducing the current drain, thus increasing battery life considerably. A power saving does not happen by merely inserting a resistor in series with the bulb, hence the reason for the above circuit.

Q1 and Q2 form an astable multivibrator, the RV1 varying the mark/

space ratio. The output from Q2 collector is fed to Q3 base, either saturating Q3 or turning it off. Varying the mark/space of the lamp.

A notable point is that as Q3 is either fully 'on' or 'off' it need not be a high wattage type. As an example, when Q3 is saturated,  $V_{ce} = 0.3$  V approx, and the lamp current is 0.2 A the power across Q3 is  $W = V \times I = 0.3 \times 0.2 = 0.06$ .

## Simple balanced regulator



When experimenting with operational amplifiers and other circuits, one often requires balanced positive and negative power supplies of about  $\pm 15$  V. One can, of course, employ two separate stabiliser circuits employing an integrated circuit voltage regulator.

A simpler solution is shown in which the new Raytheon 4195  $\pm 15$  V dual-tracking voltage regulator is employed. Only two capacitors are required in addition to the regulator device, so it is convenient to employ one of these regulators on each printed circuit board.

The circuit can supply up to 100 mA

from each output and is fully protected against short circuits. In addition, the device switches itself off if the temperature of the chip exceeds  $+175^\circ\text{C}$ , so there is no danger of thermal damage. The short circuit is typically 220 mA.

As the load current varies from 1 to 100 mA, the output voltages stay constant to 5 mV in a typical case. If the input voltage varies between the limits shown, the typical output voltage is 2 mV. The temperature coefficient of the output voltage is about 0.005% per  $^\circ\text{C}$ . The ripple rejection is about 75 dB and the output noise voltage 60  $\mu\text{V}$  rms.

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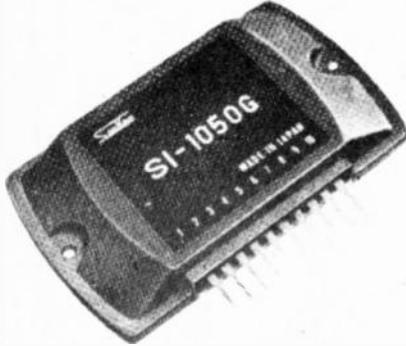
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Output Load	8 ohms	8 ohms
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Supply Current (ave.)	0.50A	0.72A
Protective Fusing	1A Quick Blow	1A Quick Blow
Harmonic Distortion at Full Output	0.5% max.	0.5% max.
Maximum Input Voltage (p.p)	10V	10V
Voltage Gain Full Feedback (P <sub>0</sub> = 1W)	30dB typ.	30dB typ.

Characteristic	S1 1030G	S1 1050G
Maximum rms Power	30W	50W
Output Load	8 ohms	8 ohms
Supply Voltage	54V or 27V	66V or 33V
Absolute Max. Supply Voltage	60V or 30V	80V or 40V
Supply Current (ave.)	0.86A	1.1A
Protective Fusing	1.5A Quick Blow	2A Quick Blow
Harmonic Distortion at Full Output	0.5% max.	0.5% max.
Maximum Input Voltage (p.p)	10V	10V
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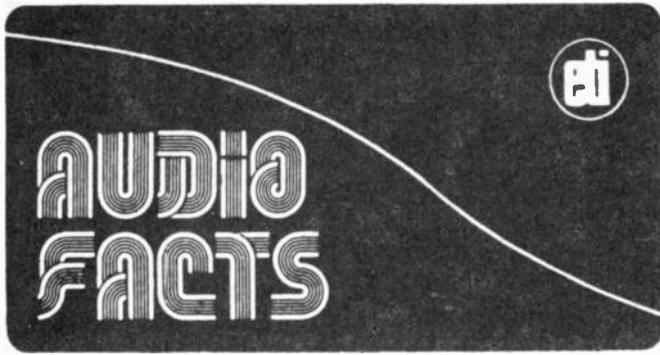
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## PLESSEY TO SELL FOSTER

The components division of Plessey Australia are now the sole Australian distributors of the internationally-known Foster and Fostex loudspeakers.

Foster has five plants in Japan and others in Singapore and Taiwan. The company produces loudspeakers — from paper pulp for the cones to the end product — ranging in size from 25 mm horn tweeters to 305 mm drivers for amplifying guitar music.

As well as Foster speakers for general purpose, hi-fi and on-stage music amplification, Plessey will also market the Fostex range designed for the serious hi-fi enthusiast.

Plessey will also soon introduce a new range of Garrard turntables and modules (available early in 1977) and improved versions of the complementary PE range of locally-assembled enclosed speakers.

*Audio Facts continues on page 113*

## COMPUTER-BUILT FM

Denmark's Bang and Olufsen company have achieved an enviable reputation for innovative design — their product's looks always matching their often advanced design.

The company have now extended this innovative approach to equipment manufacture and have developed a technique which we describe here in some detail as it lends itself to many other forms of electronic equipment assembly. The first units being built this way is B&O's new model 1900 FM receiver.

Located above each assembly station is an automatic projector with circular magazines. A mirror similar to the type employed on overhead projectors throws the slide images on to a small screen above the circuit board. Each slide carries a legend, for example: 8759 2k — 4 pcs. This tells the operator that now she is to mount four 2k resistors on the board. Four light spots projected on the circuit board show the precise points at which the resistors are to be inserted. Having done this, the operator steps on a pedal. Then another slide is projected, showing values and placement of further components.

The slide projector is synchronised with a system of small component trays which run below the assembly desk. When the slide "orders" a specific component mounted on the circuit board the right tray has already been run into position in a cutout in the desk directly in front of the operator.

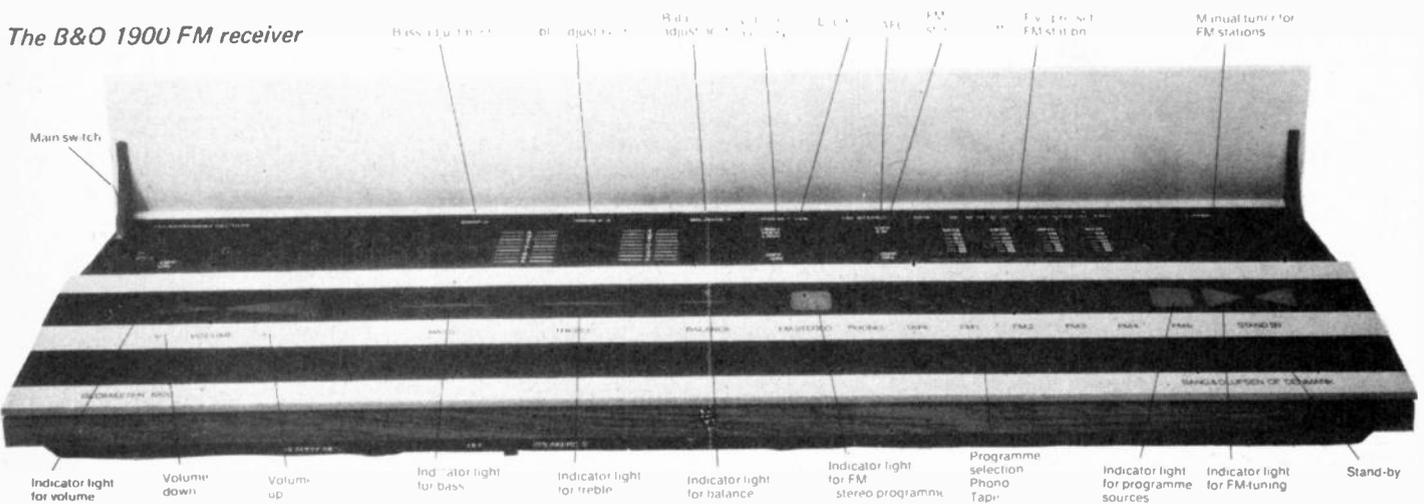
Testing is computer-controlled. A system of small contact pins automatically hits the desired test points on the circuit board; thereafter, the computer successively measures 178 functions. If one of them is wrong, it stops and gives a signal. Then the control station operator can repair the defect and continue the test.

When everything functions, the chassis are run to the heat testing station where, for 48 hours, they alternate between full output amplifier load and zero load. The check measurements are then repeated and new defects if any corrected.



*The slide projector is synchronised with a system of small component trays which run below the assembly desk.*

*The B&O 1900 FM receiver*



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O.S.A.B. Outside aerial balun (water proof)	3 81
6.5B 6ft. Balun Fly Lead	3 65
P.S.B. Plug and Terminal Balun	2 53
2 75 T/S 2-way 75 ohm Transformer Splitter	6 74
3 75 T/S 3-way 75 ohm Transformer Splitter	8 41
4 75 T/S 4-way 75 ohm Transformer Splitter	8 94
5 75 T/S 5-way 75ohm Transformer Splitter	12 66
2 3T 2-way 300 ohm Splitter box	4 48
3 3T 2-way 300 ohm Splitter box	5 86
4 3T 2-way 300 ohm Splitter box	7 12
Adjustable Low Band Attenuator Ch 2	5 33
10" diameter degaussing coil	24 00
Coaxial Plugs	46c

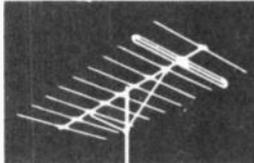
### TELEVISION AERIALS FOR COLOUR

#### CHANNELMASTER

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13el Colour Crossfire 3614A	49 72
17el Colour Crossfire 3613A	61 98
21el Colour Crossfire 3612A	71 40
24el Colour Crossfire 3617A	90 77
28el Super Crossfire 3617A	125 73
Super Colouray the 3111 Ghost Killing Aerial	38 17
2el Small Coloray 3110	25 42

#### HILLS E.F.C. RANGE 75 ohm

E.F.C. 1 75 ohm	\$28 58
E.F.C. 2 75 ohm	37 91
E.F.C. 3/24 75 ohm	55 13
E.F.C. 4/24 75 ohm	69 37



### HILLS THE NEW TELRAY RANGE— All Australia V.H.F. Channels & F.M.

6el	TL1	\$19 52
8el	TL2	26 84
9el	TL3	32 70
11el	TL4	39 70

#### HILLS AERIALS

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CA16 Phased Array	40 33
Extra Gain Lift els for CA16	4 56
8el 215	22 20

#### HILLS AMPLIFIERS

D5/26 Dist 26dB gain	\$67 10
D4/16 Dist 16dB gain	\$59 37
MH2/75 Mast Head 20dB gain 75 ohm	\$72 44
MH1/300 Mast Head 20dB gain 300 ohm	\$54 90

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Hills 2EL FM1	\$8 54
HILLS 3EL 353	12 71
Hills 3EL FM3	16 61
HI Q 4EL	17 05
HI Q Gutter clip	11 55
Matchmaster G2FM	17 54
Austenna FM3F	19 96

### COAXIAL CABLES

	Attenuation per 100ft at 200MHz	Reel Size	Price
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Belden 9248 Duofoil and Braid Aluminium	3 1 dB	500 ft	58 61
TVM1A Concordia Copper Screened	4 4 dB	100 metre	30.15
Hartland WH89 Copper Braid	3 3 dB	100 metre	36.92
Hartland WH87 Copper Braid	6 0 dB	100 metre	26 65-
Hartland WH86 Copper Braid	6 5 dB	100 metre	19.25
300 ohm Feeder Cable	1 8 dB	100 metre	8.80
Open wire line 300 ohm	1 5 dB	100 ft	9 90
Open wire line 300 ohm	1 5 dB	300 ft	29 90

### LAB GEAR AMPLIFIERS

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	Price
Mast head 22 dB 75 ohm	\$72 43
CM 6014/DA 20 dB	60 25
CM 6034/DA 4 outlets 8 dB each	54 90
CM 6036/DA VHF 30dB UHF 28dB	84 63
Televerta (VHF to UHF frequency converter)	67 48

### KINGRAY AMPLIFIERS

	Price
D15/500 m/V	\$48 80
D30/500 m/V	57 95
D40/600 m/V	79.30
D12/1500 m/V	67 10
MH 20 mast Head 300-75 ohm	64 63

### TELESCOPIC MASTS

#### CDE AR.22 Rotator \$79.00

20ft	18g steel in 10ft sections must be guyed.	\$19 30
30ft		\$30 81
40ft		42 00
50ft		54 42

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# A lot of Hi-Fi's are just heartless stereotypes.

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But what's really missing is the timbre.

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It's just that we have our priorities right, to give you good sound.

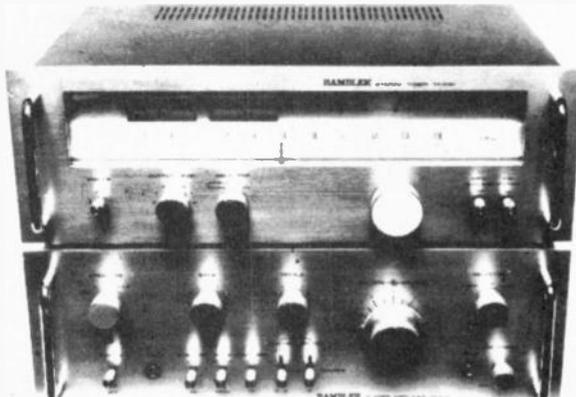
Without wasting money on gauche gadgetry. Which means you save money. Lend an ear to this Rambler Integrated Amplifier model AK635 with the Rambler AM/FM Stereo Tuner Model TK600.

#### 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

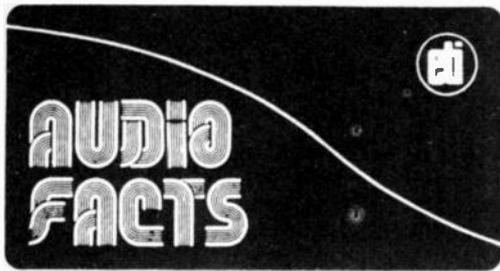
#### AK635

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



## RAMBLER

Backed by the Sun Electric Company Pty Ltd



Continued from page 111

## HIGH OUTPUT MOVING COIL CARTRIDGE

Many hi-fi enthusiasts claim that a moving coil cartridge will always outperform all other types. But they will usually admit that the inherently low output and corresponding tendency to pick up hum and other forms of noise is a major drawback.

Until recently, moving coil cartridges have required either a transformer or pre-pre-amplifier to boost the low level signal to that required by the average amplifier. A few amplifiers do actually have inbuilt extra-low input signal facilities for moving coil cartridges — but these are few and far between.

Now however Japan's Onlife Research Inc have produced a moving coil cartridge with an output comparable or higher than most conventional cartridges. Their Dynavestor series produce over 2 mV at 1 kHz (5 cm/sec) with a claimed frequency response of  $\pm 2$  dB from 20 Hz to 30 kHz.

The cartridge can therefore be connected directly into the usual phono input terminals of any hi-fi amplifier. The unit retails for less than \$100.

Details from Sonab Pty Ltd, 13 Rickard Rd, Narabeen NSW 2101.

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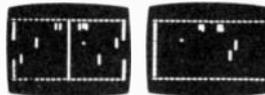
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C90	\$1.75	\$1.65	C90 SM	3.00	2.85
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UDC120	\$3.00	\$2.90	<input type="checkbox"/> Hitachi 7" 1800 ft. open reel.		
UDRC60	\$2.30	\$2.20	Ultra Dynamic	\$10.00 ea, or	
UDRC90	\$2.80	\$2.65	Low Noise	15 for \$44	
<input type="checkbox"/> Sony	1 doz.	3 doz.		\$8.00 ea, or	
C60	\$1.40	\$1.30		5 for \$35	
C90	\$1.90	\$1.75		Prices include postage	

Cassette Postage NSW \$1 30. VIC, SA, QLD \$2.00 plus 2c per tape. WA TAS NT \$2.00 plus 4c per tape.

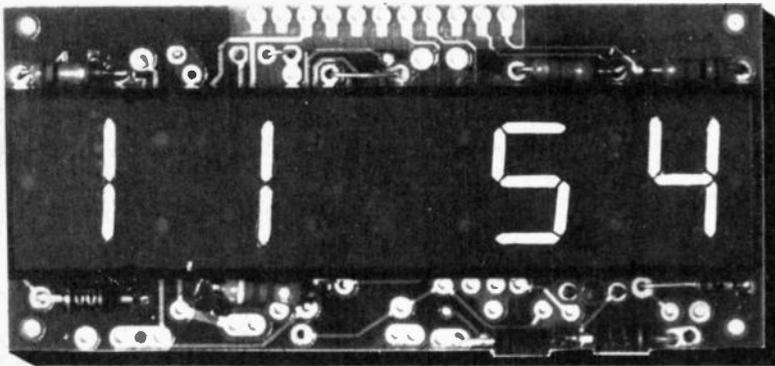
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MA1002F; 12 hour straight alarm/clock, on board oscillator feeds  
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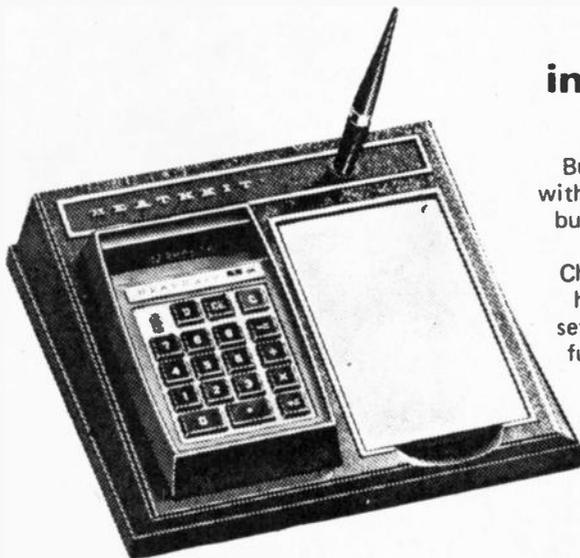
- Transformer to suit \$6.50 posted
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## 422 Power Amp

Having had the same sort of response as G.M. of Manly (see Please Explain, November 1976) in the early stages of building the 422, I suggest he tries the following:

Check the heatsink wiring and the PN3643 transistor for correct polarity. This could explain his trouble — it depends what he was supplied in the way of output transistors.

J.A.C., Christies Downs, SA.

P.S. Your comments about the BC548 in the November issue surely refer to the ETI 440 not to the 422!

## 422 Preamp

I have been working on two ETI preamps and I am having trouble with the magnetic cartridge preamps in each of them. On one the left-hand channel works and on the other only the right-hand.

J.A.C., Chrities Downs, SA.

This sounds like you have some transistors the wrong way round: even with collector and emitter reversed a transistor will work, but not properly (and it will be destroyed as soon as the base-emitter max. reverse-voltage is exceeded . . . at about 6 or 7 volts). So check the orientation of the transistors and check that all the associated components are soldered correctly in the right place.

## Wiring Up A Cartridge

There are four wires coming out of the back of a hi-fi cartridge, presumably the two on the left are for the left channel and the two on the right are for the right channel. But how do you know which wires in the headshell should connect to the pins? Presumably the colour of the wires tells you this, but what is the code?

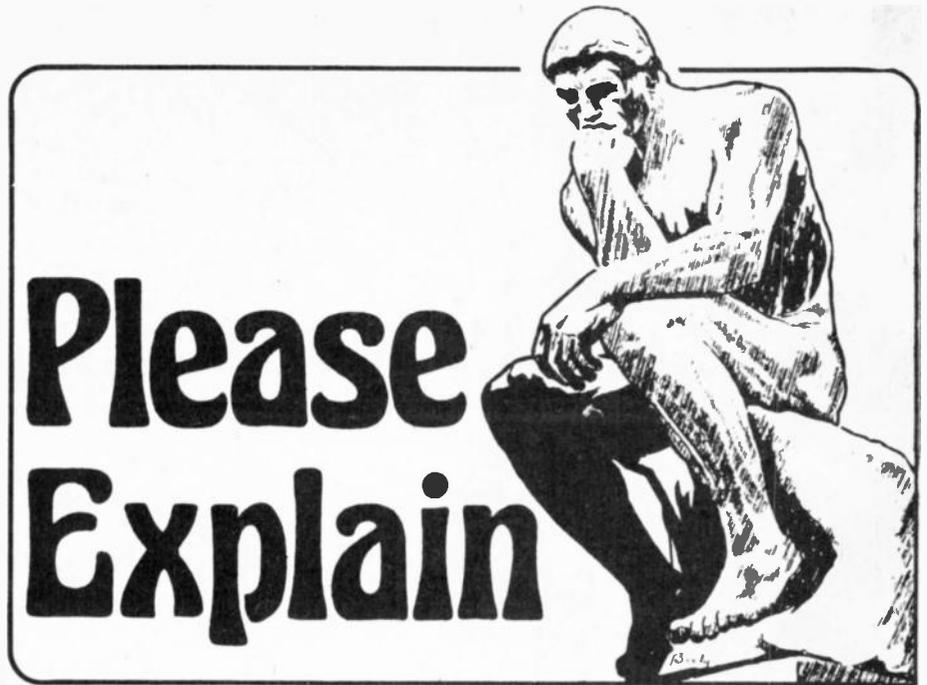
H.H., Griffith.

There is indeed a colour code and it goes like this:

RED - right channel live  
GREEN - right channel 'negative'  
WHITE - left channel live  
BLUE - left channel 'negative'.

## Trackability & Compliance

Trackability and compliance are common hi-fi jargon words — but what



This new feature is our response to the many requests we get from readers who want explanation or information on topics they read about in the magazine. If you have a question please send it to Please Explain, ETI Magazine, 15 Boundary Street, Rushcutters Bay, NSW. 2011.

do they mean (I tend to think of them meaning the same thing — how well the stylus follows the groove)?

A.R., Brisbane.

Trackability is the ability of the stylus to follow the groove of the record without bouncing — if it does bounce not only will you get distortion but you'll also get a damaged record.

Trackability is influenced by a number of factors, including the compliance of the cartridge, the mass of the stylus, the mass of the pick-up arm and its mechanical characteristics. Also the trackability is controlled by the setting of the tracking weight adjustment on the arm.

Compliance is the yielding property of the stylus suspension.

## 553 + 553

Is it possible to connect up two ETI 553 digital display modules to give a six-digit display? If it is possible how can I connect up the two modules?

K.R.M., New Zealand

It is easy to connect up ETI 553 displays to give a bigger readout, just connect the output (overflow) of one to the input of the next module.

## Stereo Thumps

I have an old refrigerator and every time the motor switches on or off there is a loud 'thump' through my stereo.

I have tried turning the fridge off when I listen to music but a couple of times I have forgotten to switch it back on! Is there any solution to this problem?

J.V.J., Broadview, SA.

The voltage transients causing the 'thumps' can usually be suppressed by wiring a 100 ohm resistor and a 0.1 $\mu$ F 360 V working capacitor in series across the refrigerator thermostat switch (or relay if one is fitted).

It would also be necessary to fit a transient suppressor in series with the power line to your hi fi equipment. These can be bought ready made or built up fairly easily.

## Cermet

What does cermet mean?

P.S., Paddington

Cermet is the name given to a class of materials made by bonding finely divided ceramics with a metal or an alloy. The derivation of the word is obvious.

Cermetts have high resistance to wear and are used in making electrical resistors (see ETI next month).

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7406	.20	7470	.30	74160	1.23
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7409	.19	7474	.28	74163	1.09
7410	.16	7475	.49	74164	.99
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7413	.43	7483	.68	74166	1.25
7414	.65	7485	.68	74170	2.10
7416	.35	7486	.40	74173	1.49
7417	.33	7489	2.25	74174	1.23
7420	.16	7490	.43	74175	.97
7422	.30	7491	.75	74176	.89
7423	.29	7492	.48	74177	.84
7425	.27	7493	.48	74180	.90
7426	.26	7494	.78	74181	2.45
7427	.29	7495	.79	74182	.79
7430	.20	7496	.79	74184	1.90
7432	.23	74100	.98	74185	2.20
7437	.25	74105	.44	74187	5.75
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7443	.73	74125	.54	74194	1.25
7444	.73	74126	.58	74195	.74
7445	.73	74132	.89	74196	1.25
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**6 Digit Clock Kit**

MM5314 with 6 NS71 .27" displays 2 P.C. boards — Display board may be remote. Internal or wall transformer can be used. 50-60 Hz, 12-24 hour. Includes all necessary transistors, resistors, capacitors, diodes, 3 switches and complete assembly instructions.

CK6-3 \$14.95

Optional case available for all of the above clocks. Unfinished redwood designed individually for each clock. Internal or wall transformers may be used.



**Temperature Transmitter Kit**

Portable, self-contained, solid state temperature transducer. Plugs directly into input jacks of most DVM's (1/2 centers) to convert DVM to high quality, direct-reading digital temperature meter with a temperature range of -50°C to +150°C and an accuracy of ±.25°C. Powered with an internal 9V battery and a self-contained battery test. Supplied with 1" DIA. Stainless steel probe 6" long with a 4 foot cable. Kit includes all necessary components — PC board, case, battery & assembly instructions.

\$54.95



**Mark I**

A six digit clock kit with one double sided P.C. board accommodates MM5314 clock chip and 6 FND359 .375" displays. 12-24 hour, 50-60 Hz. Contains all necessary components, 3 switches and complete assembly instructions with schematics. Connections for remote displays.

Mark I \$13.95

Mark I — 2 1/2" x 3 1/4" x 5"

CK6-3 — 2 1/2" x 3" x 4 1/2" \$6.95

CK4-2 — 3 1/2" x 3 1/4" x 3"



**4 Digit Clock Kit**

MM5312 and 4 NS71 .27" displays 12-24 hours, 50-60 Hz. One P.C. board accommodates clock, displays, and all necessary transistors, resistors, capacitors, diodes, 2 switches, complete instructions and schematics for assembly.

CK4-2 \$10.95

**Transformer**

230 VAC — 12 VAC 50 Hz 4W wall mount (suitable for clocks and games)

\$6.95

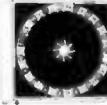


**AUTO CLOCK KIT**

6 digits .375" red led's Operates from 12V DC or AC Crystal control for high accuracy No polarity requirement Elapsed time option Pressure switch for time set Supplied with case & mounting bracket Contains internal 9V battery for operation of timing circuit (without display) when removed temporarily from power. Uses 5314 clock circuit Supplied with all necessary components and assembly instructions

\$33.95

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**Electronic Games**

A great gift idea or for your own family entertainment center. We have available in kit form Electronic Roulette and Electronic Craps. Both kits contain P.C. boards, LED's, all necessary components, case and instructions for easy assembly, (except transformer, 7-15 VAC 300 ma). Included with each kit is a 55 page booklet explaining the entire game.

**Electronic Roulette**

Dimensions 6 1/2" x 6 1/2" x 1 1/2" \$23.95

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Dimensions 6 1/2" x 3 1/2" x 1 1/2" \$14.95

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4007A	.26	4023A	.25	4072A	.35
4008A	1.52	4024A	.89	4073A	.39
4009A	.57	4025A	.25	4075A	.39
4010A	.54	4027A	.59	4078A	.39
4011A	.29	4028A	.98	4082A	.35
4012A	.25	4030A	.44	4518A	1.56
4013A	.45	4035A	1.27	4528A	1.56
4014A	1.27	4040A	1.39	4585A	2.10
4015A	1.27	4042A	1.47		
4016A	.48	4049A	.59		
4017A	1.01	4050A	.59		

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