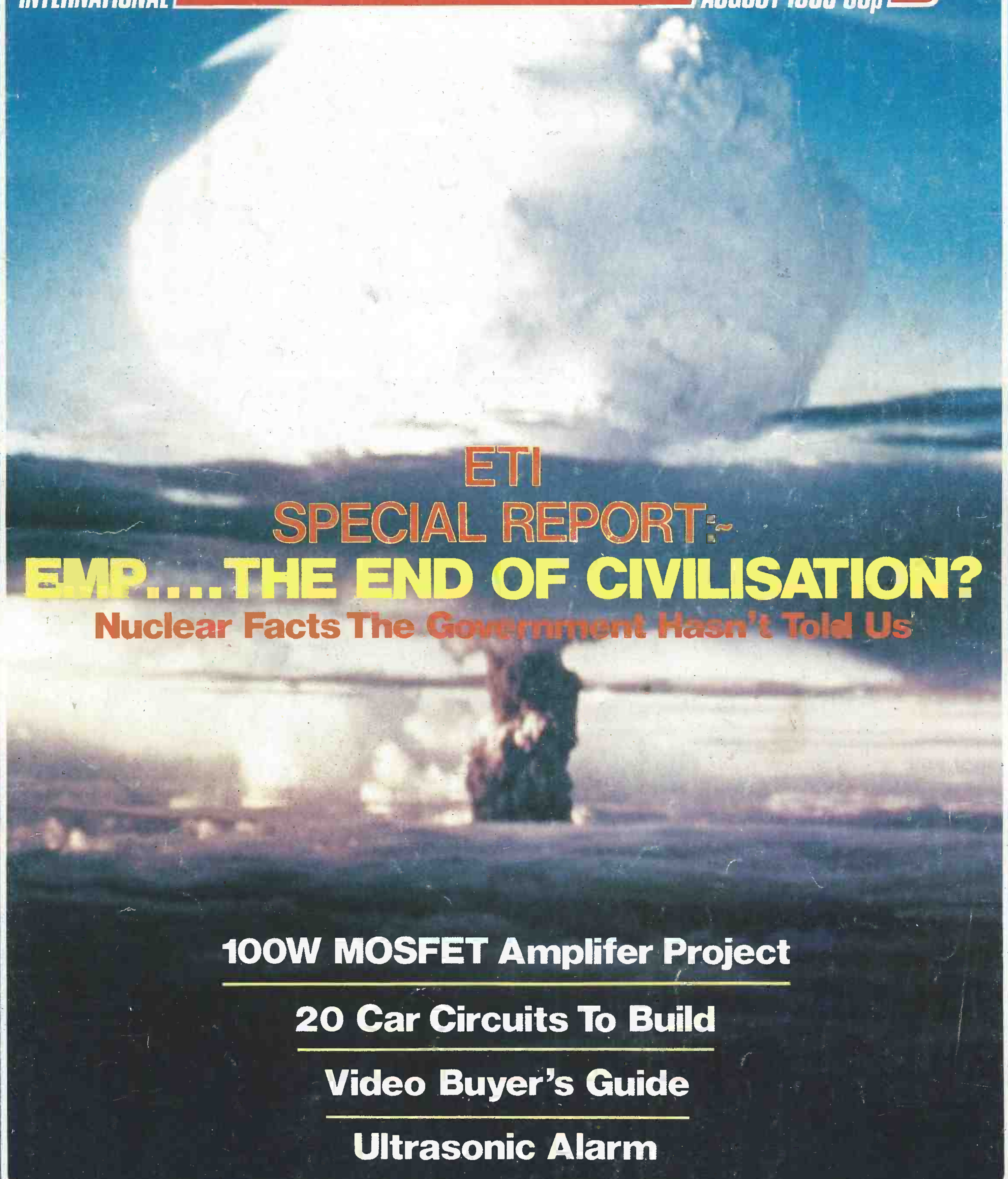
electronics today
INTERNATIONAL
AUGUST 1980 60p



ETI
SPECIAL REPORT:-
EMP....THE END OF CIVILISATION?
Nuclear Facts The Government Hasn't Told Us

100W MOSFET Amplifer Project

20 Car Circuits To Build

Video Buyer's Guide

Ultrasonic Alarm

...NEWS. . . .PROJECTS. . . .MICROPROCESSORS. . . .AUDIO. . .

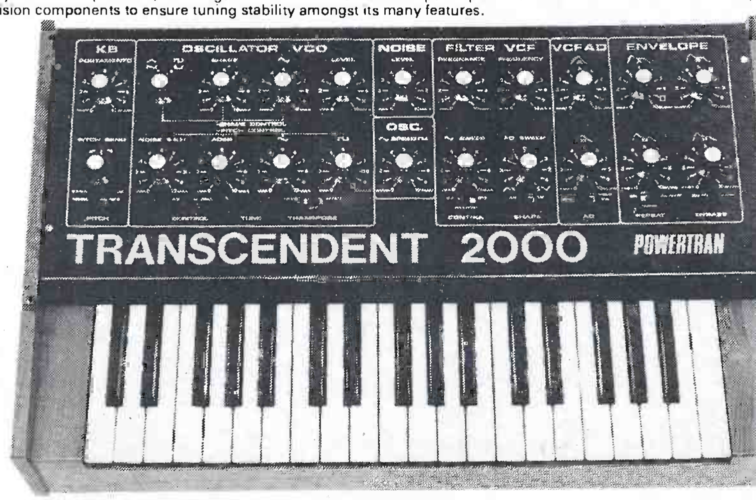
All kits also available as separate packs (e.g. P.C.B., component sets, hardware sets, etc.). Prices in FREE CATALOGUE.

TRANSCENDENT 2000
SINGLE BOARD SYNTHESIZER

LIVE PERFORMANCE SYNTHESIZER DESIGNED BY CONSULTANT TIM ORR (FORMERLY SYNTHESIZER DESIGNER FOR EMS LIMITED) AND FEATURED AS A CONSTRUCTIONAL ARTICLE IN ELECTRONICS TODAY INTERNATIONAL.

The TRANSCENDENT 2000 is a 3 octave instrument transposable 2 octaves up or down giving an affective 7 octave range. There is portamento, pitch bending, a VCO with shape and pitch modulation, a VCF with both low and high pass outputs and a separate dynamic sweep control, a noise generator and an ADSR envelope shaper. There is also a slow oscillator, a new pitch detector, ADSR repeat, sample and hold, and special circuitry with precision components to ensure tuning stability amongst its many features.

The kit includes fully finished metalwork, fully assembled solid teak cabinet, filter sweep pedal, professional quality components (all resistors either 2% metal oxide or ½% metal trim!) and it really is complete — right down to the last nut and bolt and last piece of wire! There is even a 13A plug in the kit — you need buy absolutely no more parts before plugging in and making great music! Virtually all the components are on the one professional quality fibreglass PCB printed with component locations. All the controls mount directly on the main board, all connections to the board are made with connector plugs and construction is so simple it can be built easily in a few evenings by almost anyone capable of neat soldering! When finished you will possess a synthesizer comparable in performance and quality with ready-built units selling for many times the price!



Cabinet size 24.6" × 15.7" × 4.8" (rear) 3.4" (front)

COMPLETE KIT ONLY £168.50 + VAT!

Comprehensive handbook supplied with all complete kits! This fully describes construction and tells you how to set up your synthesizer with nothing more elaborate than a multi-meter and a pair of ears!

WE'VE MOVED! NEW FACTORY UP! PRICES DOWN!

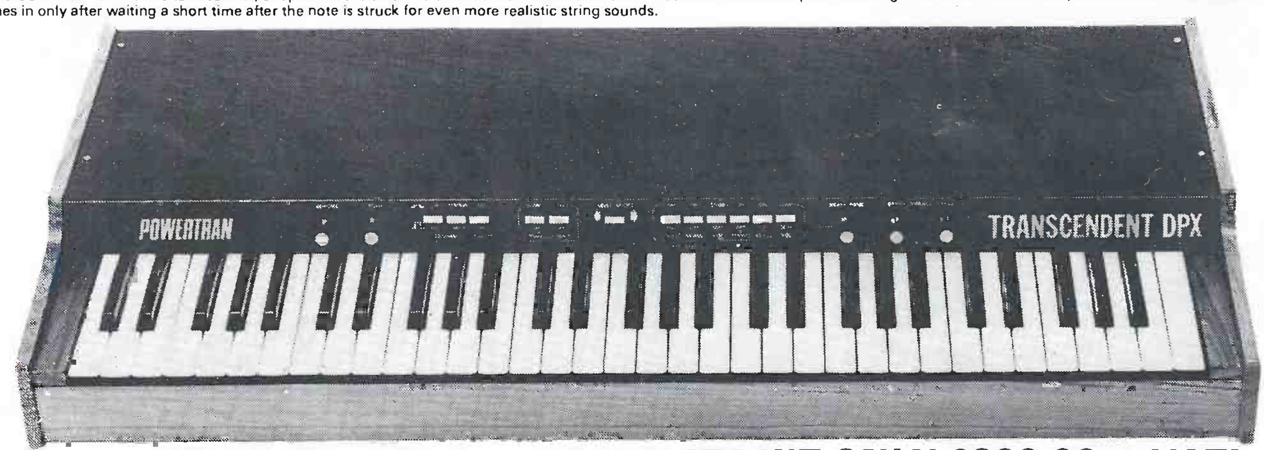
INCREASED CAPACITY AT OUR BIG NEW FACTORY MEANS MANY PRICES DOWN! ALL OTHERS FROZEN!

TRANSCENDENT DPX

DIGITALLY CONTROLLED, TOUCH SENSITIVE, POLYPHONIC, MULTI-VOICE SYNTHESIZER

ANOTHER SUPERB DESIGN BY SYNTHESIZER EXPERT TIM ORR — PUBLISHED IN ETI

The Transcendent DPX is a really versatile new 5 octave keyboard instrument. There are two audio outputs which can be used simultaneously. On the first there is a beautiful harpsichord or reed sound — fully polyphonic, i.e. you can play chords with as many notes as you like. On the second output there is a wide range of different voices, still fully polyphonic. It can be a straightforward piano or a honky tonk piano or even a mixture of the two! Alternatively you can play strings over the whole range of the keyboard or brass over the whole range of the keyboard or should you prefer — strings on the top of the keyboard and brass at the lower end (the keyboard is electronically split after the first two octaves) or vice versa or even a combination of strings and brass sounds simultaneously. And on all voices you can switch in circuitry to make the keyboard touch sensitive! The harder you press down a key the louder it sounds — just like an acoustic piano. The digitally controlled multiplexed system makes practical touch sensitivity with the complex dynamics law necessary for a high degree of realism. There is a master volume and tone control, a separate control for the brass sounds and also a vibrato circuit with variable depth control together with a variable delay control so that the vibrato comes in only after waiting a short time after the note is struck for even more realistic string sounds.



Cabinet size 36.3" × 15.0" × 5.0" (rear) 3.3" (front)

COMPLETE KIT ONLY £299.00 + VAT!

To add interest to the sounds and make them more natural there is a chorus/ensemble unit which is a complex phasing system using CCD (charge coupled device) analogue delay lines. The overall effect of this is similar to that of several acoustic instruments playing the same piece of music. The ensemble circuitry can be switched in with either strong or mild effects.

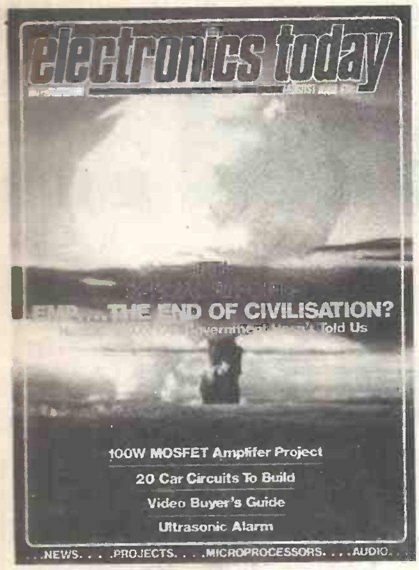
As the system is based on digital circuitry digital data can be easily taken to and from a computer (for storing and playing back accompaniments with or without pitch or key change, computer composing etc., etc.)

Although the DPX is an advanced design using a very large amount of circuitry, much of it very sophisticated, the kit is mechanically extremely simple with excellent access to all the circuit boards which interconnect with multiway connectors, just four of which are removed to separate the keyboard circuitry and the panel circuitry from the main circuitry in the cabinet.

The kit includes fully finished metalwork, solid teak cabinet, professional quality components (all resistors 2% metal oxide), nuts, bolts, etc., even a 13A plug — you need buy absolutely no more parts before plugging in and making great music! When finished you will possess an instrument comparable in performance and quality with ready-built units selling for over £1,200!

POWERTRAN

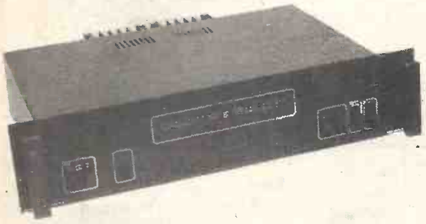
ORDERING INFORMATION AND MORE KITS INCLUDING THE BLACK HOLE ON PAGE 8



electronics today INTERNATIONAL

AUGUST 1980 VOL 9 NO 8

FEATURES



100MOSW? p.64

PROJECTS

Sound protection p.86

INFORMATION

OVERSEAS EDITIONS

AUSTRALIA : Roger Harrison Editor
CANADA : Halvor Moorshead Editor
GERMANY : Udo Wittig Editor
HOLLAND : Anton Kriegsman Editor

MODMAGS LTD

ABC Member of the Audit Bureau of Circulation

EDITORIAL AND ADVERTISEMENT OFFICE
145 Charing Cross Road, London WC2H 0EE. Telephone 01-437 1002/3/4/5

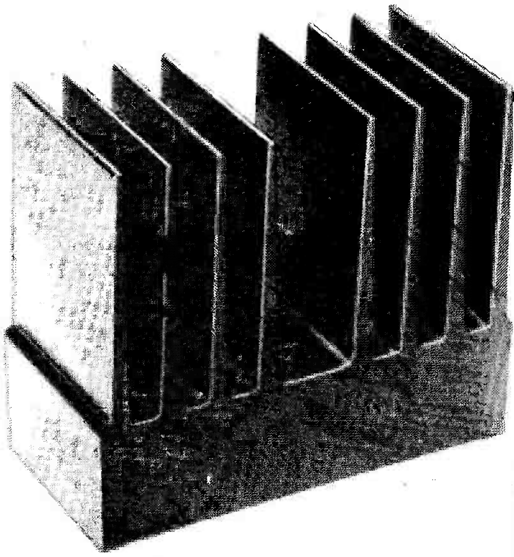
Ron Harris B.Sc.	Editor
Ian Graham B.Sc.	Assistant Editor
Tina Boylan	Editorial Assistant
Diego M. Rincon	Art Director
Paul Edwards	Drawing Office Manager
Ray Marston	Project Editor
Christopher Surgenor	Group Advertisement Manager
Steven Rowe	Advertisement Manager
T.J. Connell	Managing Director

PUBLISHED BY Modmags Ltd., 145 Charing Cross Road, WC2
DISTRIBUTED BY Argus Distribution Ltd. (British Isles) 12-18 Paul Street, London
Gordon & Gotch Ltd. (Overseas)
PRINTED BY QB Limited, Colchester

Electronics Today is normally published on the first Friday in the month preceding cover date.
Distributed by: Argus Distribution Ltd, 12-18 Paul Street, London. 01-247 8233.
Printed by: QB Printers Ltd, Colchester.

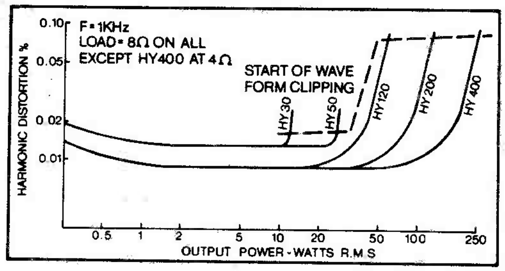
Subscription Rates : UK £10 including postage. Airmail and other rates upon application to ETI Subscriptions Service, PO Box 35, Bridge Street, Hemel Hempstead, Herts.

Simply ahead...



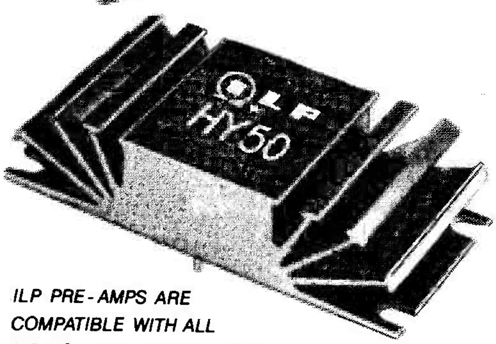
POWER AMPLIFIERS

ILP Power Amplifiers are encapsulated within heatsinks designed to meet total heat dissipation needs. They are rugged and made to last a lifetime. Advanced circuitry ensures their suitability for use with the finest loudspeakers, pick-ups, tuners, etc. using digital or analogue sound sources.



Model	Output Power R.M.S.	Distortion Typical at 1KHz	Minimum Signal/ Noise Ratio	Power Supply Voltage	Size in mm	Weight in gms	Price + V.A.T.
HY30	15 W into 8 Ω	0.02%	100 dB	-20 -0- +20	105x50x25	155	£6.34 + 95p
HY50	30 W into 8 Ω	0.02%	100 dB	-25 -0- +25	105x50x25	155	£7.24 + £1.09
HY120	60 W into 8 Ω	0.01%	100 dB	-35 -0- +35	114x50x85	575	£15.20 + £2.28
HY200	120 W into 8 Ω	0.01%	100 dB	-45 -0- +45	114x50x85	575	£18.44 + £2.77
HY400	240 W into 4 Ω	0.01%	100 dB	-45 -0- +45	114x100x85	1.15Kg	£27.68 + £4.15

Load impedance - all models 4 Ω - ∞
Input sensitivity - all models 500 mV
Input impedance - all models 100K Ω
Frequency response - all models 10Hz – 45KHz – 3dB



ILP PRE-AMPS ARE COMPATIBLE WITH ALL ILP POWER AMPS AND PSUs

POWER SUPPLY UNITS

ILP Power Supply Units with transformers made in our own factory are designed specifically for use with ILP power amplifiers and are in two basic forms – one with circuit panel mounted on conventionally styled laminated transformer, for smaller PSU's – in the other, for larger PSU's, ILP toroidal transformers are used which are half the size and weight of laminated equivalents, are more efficient and have greatly reduced radiation.

PSU 30 ± 15V at 100mA to drive up to 12 x HY6 or 6 x HY66 **£4.50** + £0.68 VAT

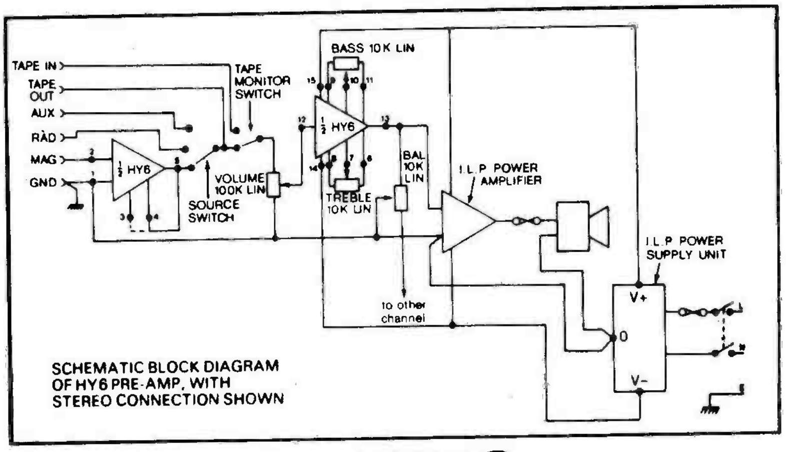
THE FOLLOWING WILL ALSO DRIVE ILP PRE-AMPS

PSU 36 for 1 or 2 HY30's **£8.10** + £1.22 VAT
PSU 50 for 1 or 2 HY50's **£8.10** + £1.22 VAT
PSU 60 with toroidal transformer for 1 HY 120 **£9.75** + £1.46 VAT
PSU 70 with toroidal transformer for 1 or 2 HY120's **£13.61** + £2.04 VAT
PSU 90 with toroidal transformer for 1 HY200 **£13.61** + £2.04 VAT
PSU 180 with toroidal transformer for 1 HY400 or 2 x HY200 **£23.02** + £3.45 VAT

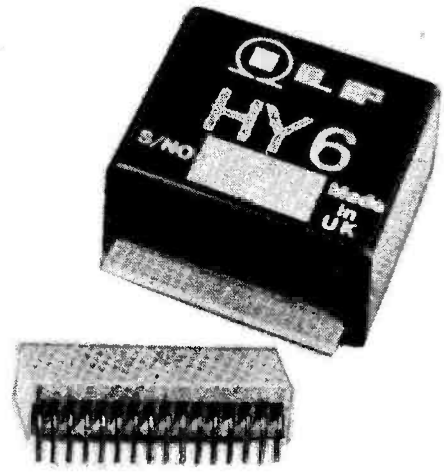
ILP

AVAILABLE ALSO FROM WATFORD ELECTRONICS, MARSHALLS AND CERTAIN OTHER SELECTED STOCKISTS.

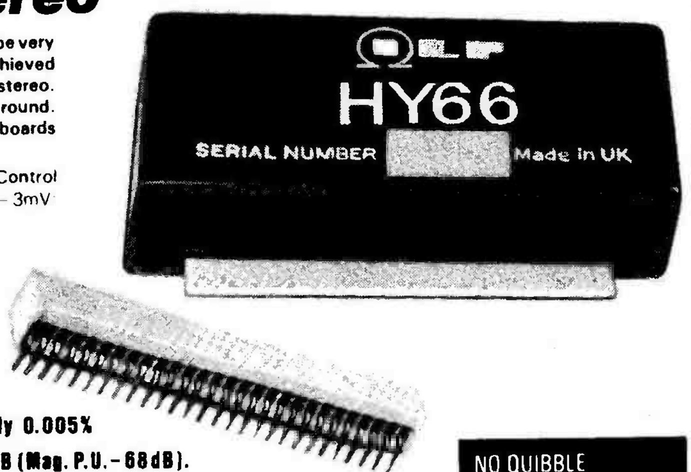
this time with two new pre-amps



SCHEMATIC BLOCK DIAGRAM OF HY6 PRE-AMP, WITH STEREO CONNECTION SHOWN



HY6 *mono* HY66 *stereo*



When ILP add a new design to their audio-module range, there have to be very special reasons for doing so. You expect even better results. We have achieved this with two new pre-amplifiers – HY6 for mono operation, HY66 for stereo. We have simplified connections, and improved performance figures all round. Our new pre-amps are short-circuit and polarity protected; mounting boards are available to simplify construction.

Sizes – **HY6** – 45 x 20 x 40 mm **HY66** 90 x 20 x 40 mm. Active Tone Control circuits provide ± 12dB cut and boost. Inputs Sensitivity – Mag. PU. – 3mV. Mic – selectable 1-12mV. All others 100mV. **Tape O/P** – 100mV. **Main O/P – 500mV**: Frequency response – D.C. to 100KHz – 3dB.

HY6 mono
£5.60
+ VAT 84p

HY66 stereo
£10.60
+ VAT £1.59

Connectors included

B6 Mounting Board
78p + 12p VAT

B66 Mounting Board
99p + 15p VAT

- **LOW DISTORTION - Typically 0.005%**
- **S/N RATIO - Typically 90 dB (Mag. P.U. - 68dB).**
- **HIGH OVERLOAD FACTOR - 38 dB on Mag. P.U.**
- **LATEST DESIGN HIGH QUALITY CONNECTORS.**
- **REQUIRE ONLY POTS, SWITCHES, PLUGS AND SOCKETS.**
- **COMPATIBLE WITH ALL ILP POWER AMPS AND PSUs.**
- **NEEDS ONLY UNREGULATED POWER SUPPLY ±15V to ±50V.**

NO QUIBBLE
5 YEAR GUARANTEE
7-DAY DESPATCH ON ALL ORDERS
BRITISH DESIGN AND MANUFACTURE
FREEPOST SERVICE
see below

★ *ALL U.K. ORDERS DESPATCHED POST PAID*

HOW TO ORDER, USING FREEPOST SYSTEM

Simply fill in order coupon with payment or credit card instructions. *Post to address as below but do not stamp envelope – we pay postage on all letters sent to us by readers of this journal.*

Please supply ....
.... Total purchase price £ ....
I enclose Cheque ☐ Postal Orders ☐ International Money Order ☐
Please debit my Access/Barclaycard Account No. ....
....
NAME ....
ADDRESS ....
....
Signature ....

ILP ELECTRONICS LTD.

FREEPOST 4 Graham Bell House, Roper Close, Canterbury, Kent CT2 7EP.
Telephone (0227) 54778 Telex 965780

DIGEST

Design Cadet

Racal – Redac has introduced an interactive PCB design aid which, they claim, should pay its way even if only five boards are designed every year.

The user selects the required component symbols, which are displayed on a VDU. The machine, called Cadet, then shows the shortest straight – line routes between the components. The operator can then move the components round to find the best position with Cadet checking for track crossover and automatically minimising interconnection length.

Cadet can store designs on cartridges, from which Redac can produce artwork and a prototype PCB. The system (screen, keyboard, electronic tablet and stylus) enables a designer to produce three times the number of PCB designs possible manually.

Cadet costs £20,000 from Racal – Redac, Tewkesbury, Gloucestershire GL20 8HE.

Rank Xerox, the first 21 years

Rank Xerox, the name synonomous with photocopiers, have just launched six new products to mark their 21st anniversary in the business. Twenty-one years ago, the 914, the world's first office copier, made its entrance. It still looks remarkably up – to – date. Indeed, a few are still in service.

The new models amply demonstrate that Rank Xerox make more than photocopiers. The 485 is a facsimile transceiver capable of transmitting documents all over the country (the world!) along the telephone lines, overcoming the expense and time involved in sending documents by post. Moreover, it's fully compatible with its forerunner, the 400.

The 850 word processing system is a step up from its predecessor, the 800. The 800 is capable of typing out 350 words a minute as a straightforward playback typewriter and can store its input on magnetic card or tape. The 850 will also display the text line by line (on a display on the typewriter itself) or page by page on a VDU.

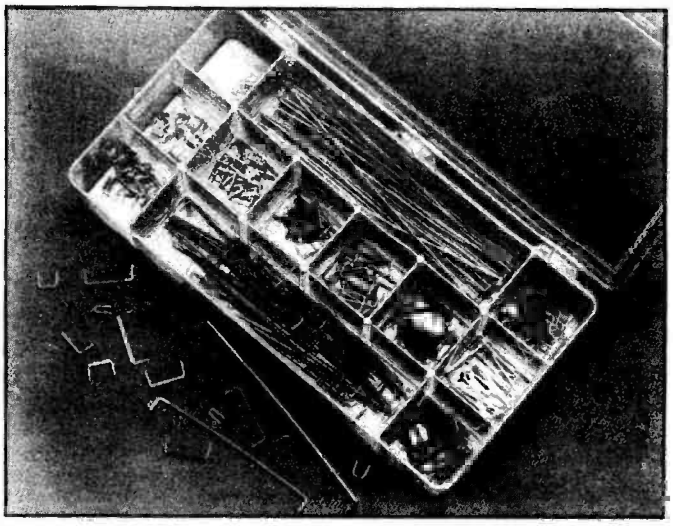
Even their new photocopiers are not just copiers. During a demonstration one model took a few dozen pages of text, turned each one over, copied it and returned it, in order, to a collection tray. The number of copies selected were then fed to a sorter and even stapled, if necessary.

Xerox are now working with the Digital Equipment Corporation and Intel to develop the Ethernet network. This will link most of the electronic information equipment of tomorrow's office together, from a mainframe computer or a micro to a word processor to an intelligent copier to a data terminal, etc. Ethernet will allow information exchange at ten million bits per second. Global information exchange should be complete with Xerox's work, with its subsidiary Western Union International, on satellite communication via the Xten network.

Happy birthday Rank Xerox.

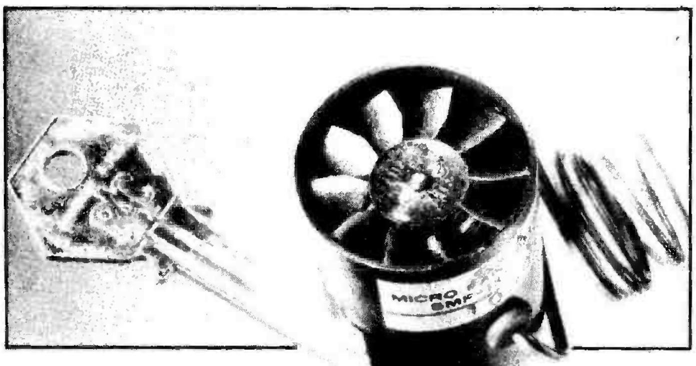
Fan-Tastic

Inspectron Limited of Foundry Lane, Horsham, West Sussex have announced their high performance, sub-miniature fan using a coreless motor, designed mainly for cooling electronic equipment. The fans are available to operate on 12 or 5 V DC with which fan motor speed is approximately 14,500 RPM, with an air flow of about 450 litres/minute. Current consumption is 150 mA and operation is virtually noiseless. The total weight of the fan is 56 g and two types of mounting are available; plain cylindrical for small ducts and rubber fixing brackets, and a flange fitting type for fitting direct to bulkheads or other flat surfaces.



High Jump

The new model WK – 1 wire jumper kit from CSC gives an easy means of linking up electronic components and circuits on test sockets, bus strips or solderless breadboard systems. The kit contains pre – cut, pre – stripped and pre – formed lengths of solid insulated wire (AWG 22) in 14 colour – coded lengths from 0.1 inch to 4 inches. Each length of wire has additional 0.25 inch ends bent at 90°. Twenty-five pieces of each length are supplied with a plastic compartmented case and the price is £5 excluding VAT plus postage and packing from Continental Specialties Corporation, Shire Hill Industrial Estate, Saffron Waldon, Essex CB11 3AQ.



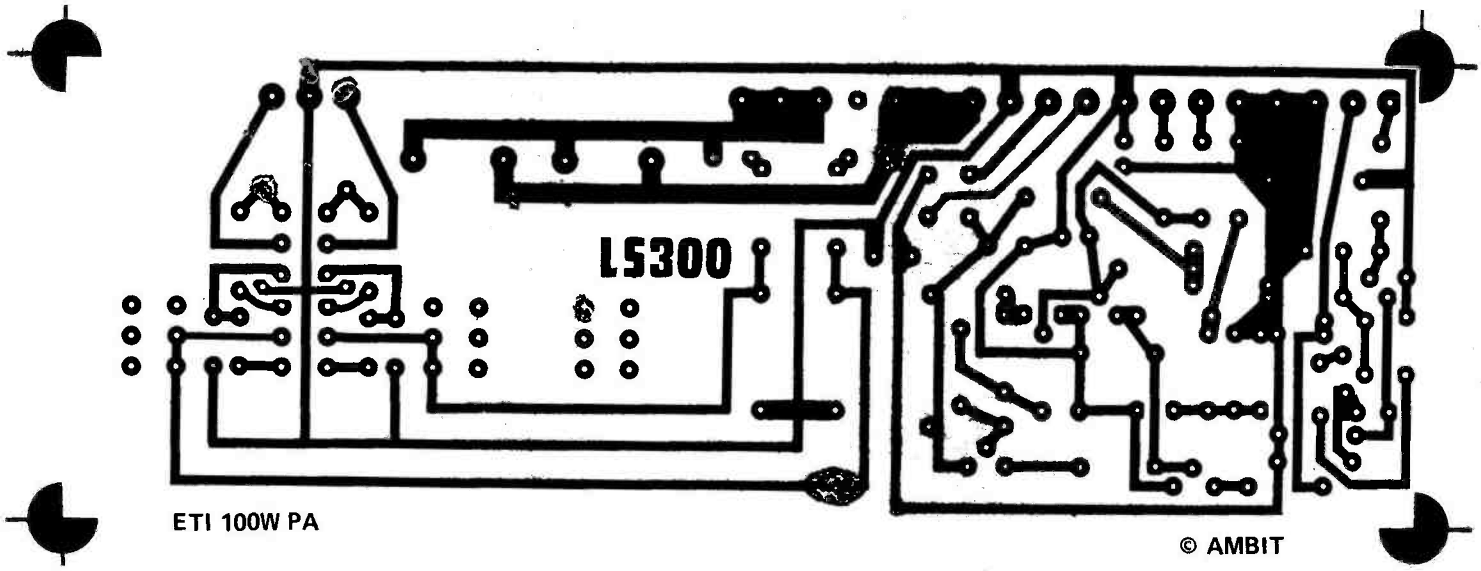
Thin Time for Watches

A new addition to the Concord Delirium range of wristwatches caused quite a stir at the Basle Fair. The Concord Delirium IV is the first watch to break the 1 mm barrier. It's 0.98 mm thick.

The Swiss design team have achieved the super thin profile by using a new battery (the world's smallest), a new motor and quartz tuning fork and microprocessor controlled time-setting. Accuracy is quoted at ten seconds per month. The new battery, only 0.8 mm thick, should power the watch for more than a year.

If, as the Director of Concord Watch Company believes, 'thinness always serves as an indicator of technical superiority in the watch industry' the Delirium IV should be hard to beat. However, we don't as yet have any news of the price. With a solid gold backplate and face (not to mention the world's smallest battery) this is one watch you won't throw away when the battery lies down and dies.

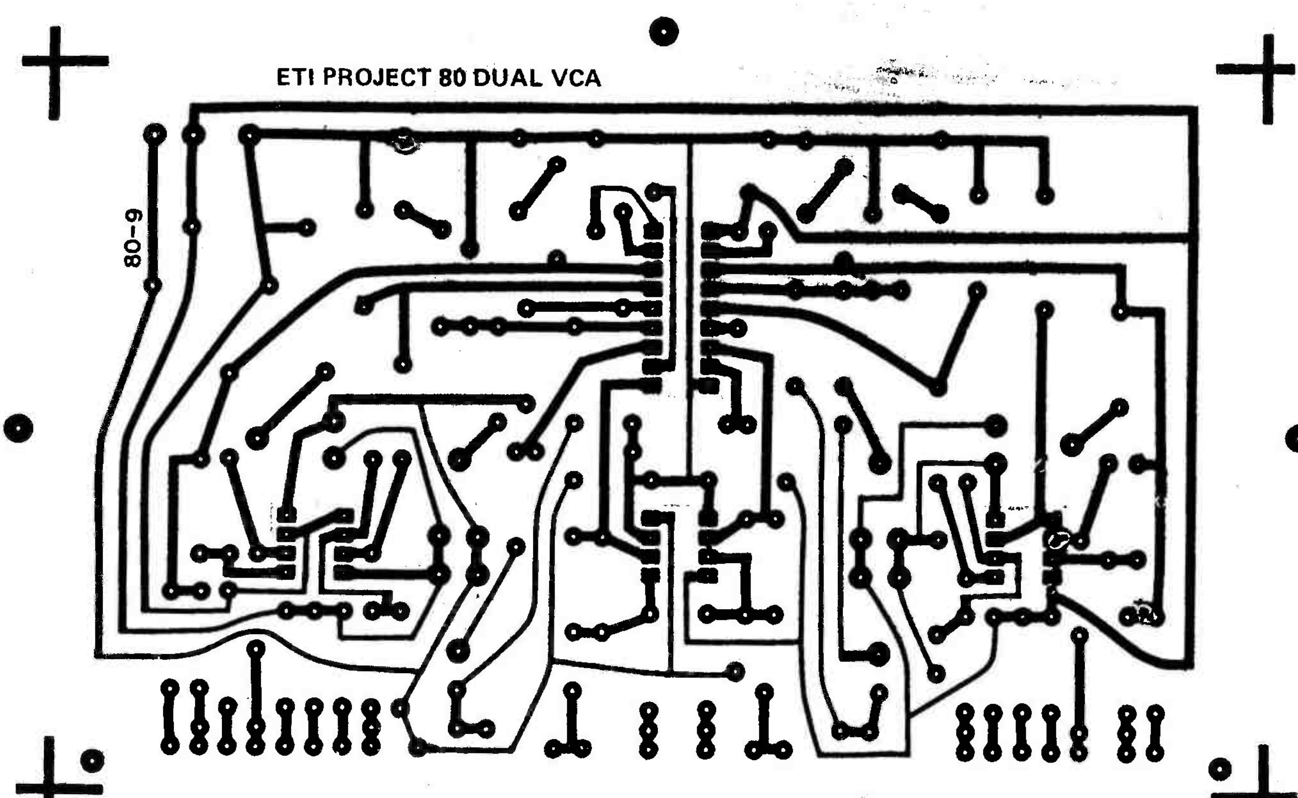
PCB FOIL PATTERNS



ETI 100W PA

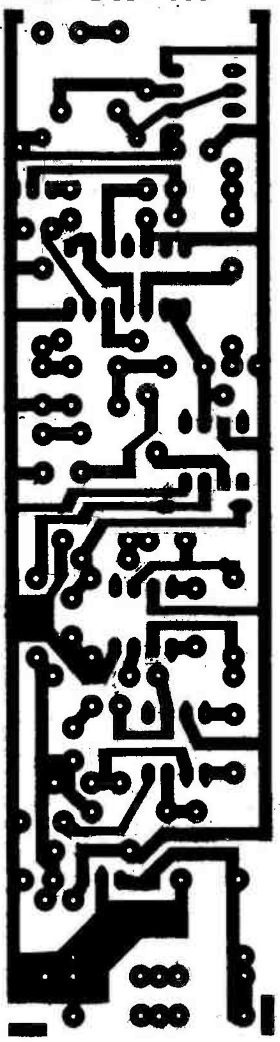
© AMBIT

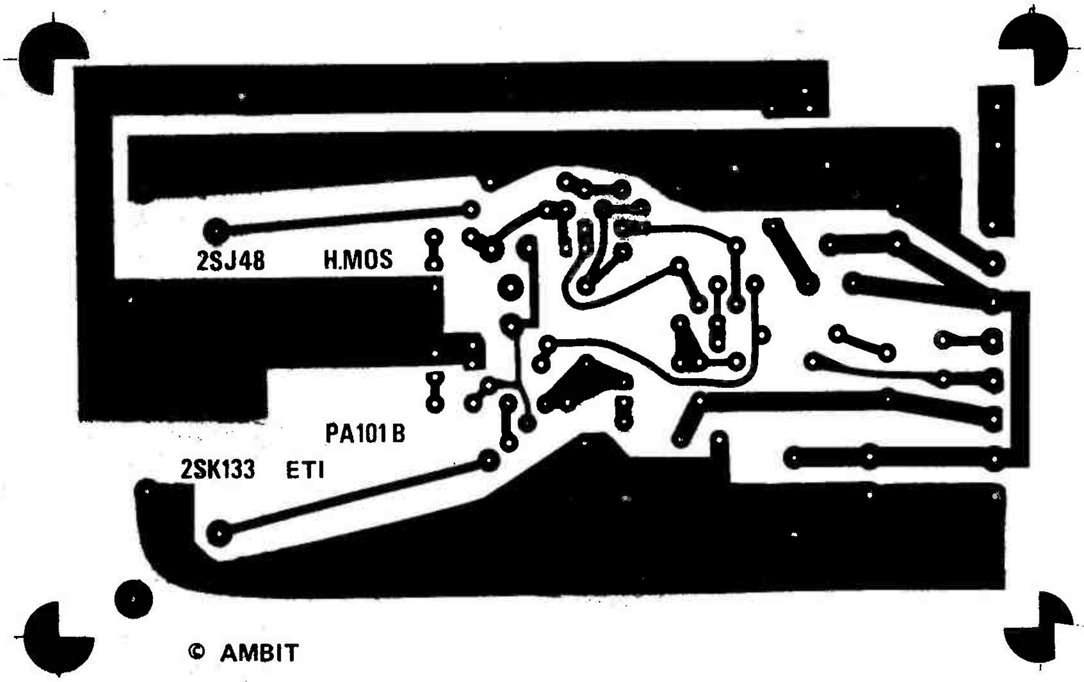
ETI PROJECT 80 DUAL VCA



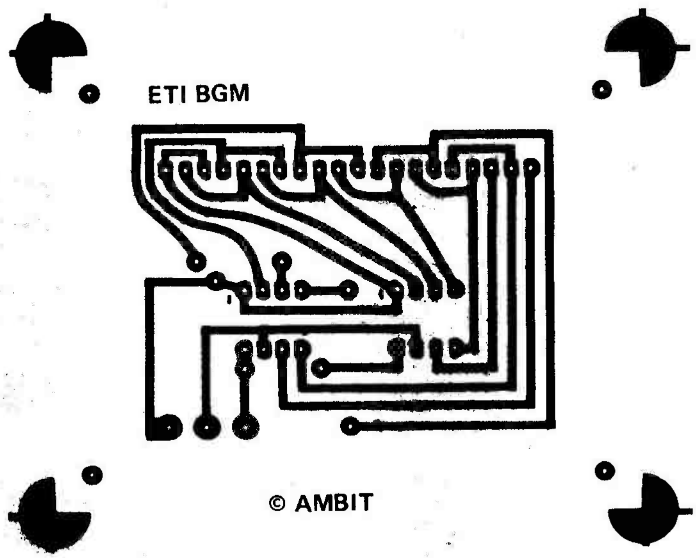
© DIGISOUND

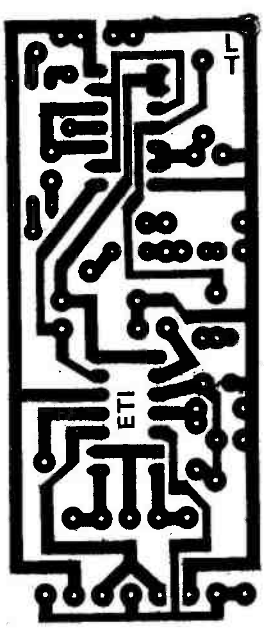
ETI alarm

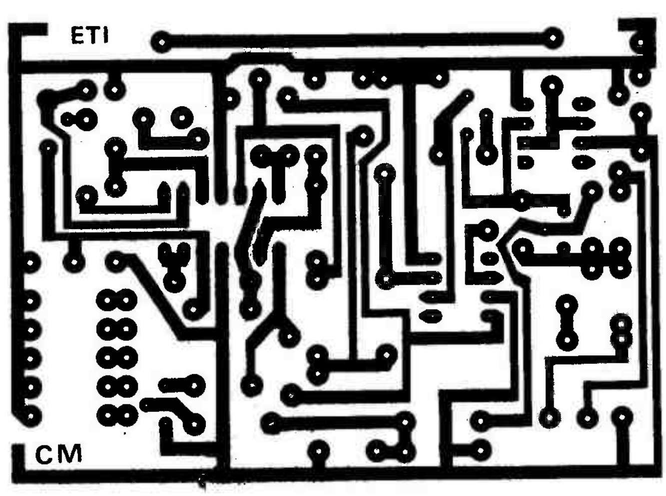




The Ambit Power Amplifier board (above) and Bar Graph Monitor board (below).







Foil Patterns for the Capacitance Meter (right) and the CMOS Logic Tester (left).

DIGISOUND

KITS AND SPECIAL PRODUCTS FOR ELECTRONIC MUSIC

I.Cs FROM SOLID STATE MICROTECHNOLOGY

SSM 2020 Dual Voltage Controlled Amplifier	**365p**
SSM 2030 Voltage Controlled Oscillator	**485p**
SSM 2040 Voltage Controlled Four Stage Filter	**485p**
SSM 2050 Voltage Controlled Transient Generator	**365p**

Complete set of Application Notes and Specifications for the above at 50p post paid, or 30p if added to an order for components. No VAT on data and stamps will be accepted in payment.

I.Cs FROM CURTIS ELECTROMUSIC SPECIALTIES

CEM 3310 Voltage Controlled Transient Generator	**400p**
CEM 3320 Voltage Controlled Four Stage Filter	**390p**
CEM 3330 Dual Voltage Controlled Amplifier	**400p**
CEM 3335 Dual Voltage Controlled Amplifier (Exp. only)	**380p**
CEM 3340 Voltage Controlled Oscillator	**600p**

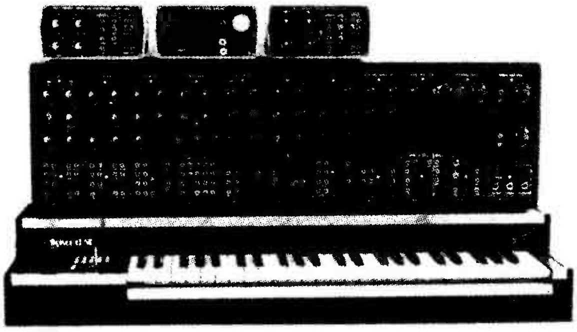
Complete sets of Application Notes and Specification for the above at 50p post paid, or 30p if added to an order for components.

TEL LABS Q81. 1k, 1% 3500ppm temperature compensating resistor **185p**

OTHER COMPONENTS (Prices in pence)

741-8	**23**	LF 351	**38**
723-14	**40**	TL 081	**38**
1458-8	**44**	MC 34002/TL 082	**65**
LF 347/TL 084	**130**	CA 3080E	**63**
LM 348	**90**	LM 13800	**125**

All other components used in our kits are available separately and these are listed in the current price list — sent with orders or on receipt of 15p in stamps.



KITS FOR ETI 80 MODULAR SYNTHESISER. Components as specified in the issue of ETI listed which also contains the constructional details for the kits. Glass fibre and roller tinned PCB I.C. sockets.

KIT 80-1 ± 15V Power Supply (Feb 1980)	**£16.70**
KIT 80-2 Voltage Controlled Oscillator (Feb. 1980)	**£16.10**
KIT 80-3 Voltage Controlled Low Frequency Oscillator (Feb. 1980)	**£16.10**
KIT 80-4 Voltage Controlled Mixer (March 1980)	**£21.10**
KIT 80-5 Processor (with full instructions)	**£5.20**
KIT 80-6 Voltage Controlled Filters (May 1980)	**£11.18**
KIT 80-7 V.C. State Variable Filter (July 1980)	**£17.18**
KIT 80-8 Single ADSR Envelope Shaper (July 1980)	**£8.25**
KIT 80-8 Dual ADSR Envelope Shaper (July 1980)	**£14.50**
KIT 80-9 Dual Voltage Controlled Amplifier (August 1980)	**£12.16**

PCBs SEPARATELY

KIT 80-1	**£1.60**	KIT 80-6 (all types)	**£1.60**
KIT 80-2/80-3	**£2.10**	KIT 80-7	**£2.35**
KIT 80-4	**£2.60**	KIT 80-8	**£1.75**
KIT 80-5	**£1.20**	KIT 80-9	**£2.30**

9 x 3 inch panels for modules 80-2 up to 80-8 (Dual) inclusive to the design shown in ETI and made from white plastic coated steel with black lettering are available at £2.50 each.

PLEASE ADD 30p P&P TO TOTAL ORDER AND THEN ADD VAT AT CURRENT RATE.

DIGISOUND LIMITED,
13 THE BROOKLANDS, WREA GREEN,
PRESTON, LANCS. PR4 2NQ
Tel.: 0772 683138 (MAIL ORDER ONLY)

HAND HELD GAMES

Supersonic Mastermind	**£21.00**
Galaxy Invaders	**£22.95**
Mattel Soccer	**£21.50**
ENTERPRISE 4 in 1 — 3 Games and calculator in one	**£24.95**
'Electronic Mastermind	**£12.90**
U.F.O. Master Blaster	**£24.95**
Amaze-A-Tron maze game	**£18.95**
Touch Me by ATARI (like Simon)	**£26.95**
Football (two players)	**£24.95**
ZAP missile game	**£11.95**
'DIGITS (like Mastermind)	**£14.95**

ALL GAMES HAVE SOUND EFFECTS EXCEPT '

The latest from the U.S.A.

PINBALL WIZARD

★ Still available ★
Featured in Nov. issue of E.T.I.
Home TV Game — B/W Kit

Basic Kit **£28.90**

Contains everything except box and controls

Box & Controls — **£6.50.** Mains Adaptor — **£3.90**

Play 7 games with 4 options on each game
4-Pinball games 2-Basket, 1-Breakout

Versatile car alarm kit **£18.90**
See review in Hobby Electronics November

CHROMA CHIME 24 tune door chimes kit **£10.75** Built **£15.95**

C.B. Aerials and Accessories

ATARI video computer £138

SPACE INVADERS CART	**£29.95**
STAR CHESS T.V. Game	**£63.35**
DATABASE Prog. T.V. Game	**NEW £89.95**
CHESSMATE 8 Level	**NEW £59.95**
CHESS CHALLENGER 7	**£99.00**
CHESS CHALLENGER 10	**£160.00**
VOICE CHALLENGER	**£219.00**
CHECKER CHALLENGER 2	**£54.00**
CHECKER CHALLENGER 4	**£90.00**
ZODIAC Astrology Computer	**NEW £29.95**
Snooze Alarm	**£14.90**
EL-MAC 5MHz Scope	**£139.90**
RADAT 10MHz Scope	**£169.00**

COMPUTERS — Home, Business etc.

PET 8K	**£550.00**
PET 16K	**£670.00**
SORCERER 8K	**£747.50**
SORCERER 16K	**£874.00**
SORCERER 32K	**£887.75**
SUPERBOARD II 4K	**£180.00**
UK101 Kit 4K	**£226.85**
Built 4K	**£286.35**
TRS80 Level 2 16K	**£409.40**
5¼" Floppy Drive	**£288.65**
Dual Drive	**£506.00**
NASCOM 2 Kit	**£339.25**
2 Built	**£396.75**
HEATH WH89	**£1,805.00**
HEATH WH14 Printer	**£586.50**
Softy Kit	**£115.00**
Softy Built	**£138.00**
Intelligent EPROM Programmer	

PRINTERS: FLOPPY DISC: BOOKS

S.a.e. Enquiries. Please allow up to 21 days for delivery. All prices inc. of VAT.

Buy it with Access

N.I.C

61 BROAD LANE, LONDON N.15 4DJ
Day 01-808 0377; Eve 01-889 9736

BARCLAYCARD

POWERFETS

Some day all power transistors will be made this way!

	CHAN	VDS max V	ID max A	PDISS max W	RDSON Type Ω	Case	Price
BD512	P	60	1.5	10	†(3.5)	T0202	**85p**
BD522	N	60	1.5	10	2.5	T0202	**80p**
VMP4	N	60	2.0	25	2.0	380-50E	**1250p**
VN10KM	'N	60	0.5	1.0	4.0	T092†	**55p**
VN64GA	N	60	12.5	80	0.3	T03	**750p**
VN67AF	'N	60	2.0	15	2.0	T0202	**75p**
2SJ49	P	140	7.0	100	1.0	T03	**395p**
2SK134	N	140	7.0	100	1.0	T03	**395p**

'I/p protected †our selection. VN/VM. 96-page Design Cat. **20p. Heat clips** T0202 **12p,** T092 **8p.**

MANUFACTURERS/DESIGNERS. We will be stocking Powerfets by IR, TI and Intersil as well as by Hitachi, ITT and Siliconix. We can advise you on applications and type selection, supply samples and quantities.

REMEMBER Powerfets need virtually no drive current, switch in nanoseconds, and are 2nd breakdown free, etc. etc.

CA3026	**70p**
CA3080E	**70p**
CA3140E	**38p**
DAC08	**250p**
DM2502	**555p**
LM308	**50p**
LM3900	**43p**
MC3401	**30p**
NE529	**145p**
NE555	**25p**
SAD1024	**1050p**
SD532	**30p**
TDA1022	**600p**
TL081	**29p**
TL082	**55p**
2102	**80p**
4011B	**17p**
709	**15p**
710	**25p**
733	**50p**
741	**18p**
78L05/12	**29p**

HI-FI ON TWO CHIPS
HA12017 (Preamp 0.001% distortion 83dB S/N in phono application) **99p**
HA1397 (Poweramp 20 watts in 8Ω, 0.02% distortion (typ) **195p**
Both with data and circuits

POWERFET AMPLIFIER semiconductor sets. High power designs offering very low distortions
'80 watt (†THD 0.008%) **£8.75**
'120 watt (†THD 0.004%) **£16.65**
(with circuits)
'into 8Ω †at all powers and all audio frequencies.

LED VU/PPM METER
Complete component set. Displays positive and negative peak levels, and average levels simultaneously on 10 number LEDs, with **3dB** resolution. With 10 reds **£6,** with 7 green, 1 yellow and 2 red **£6.40.**

SCOPE TRACE DOUBLER P.C.B.
Built. C/W shift, chan select, choprate controls and instructions. Useful display from DC to 10MHz. Runs from 9v battery **£8.95**

VCA High quality design offers attenuation from 0dB to −90dB. S/N 90dB, THD 0.01%, B.W. DC to 100KHz. Complete component set and circuit **£2.50.**

Volt controlled pan-pot. Spec. as above, complete. Complete set as circuit. **£3.25.**

2μS ADC chip set (DAL08, DM2502, NE529) with data **£9**
FX309 ("Single bit" A/D, D/A. Store speech in RAMs) with data **£7.50**

30p post and packing. Mail order only to

J. W. RIMMER
148 Quarry Street
Liverpool L25 6HQ
Tel. 051-428 2651

Technical enquiries to. 367 Green Lanes, London N4 1DY.
Telephone 01-800 6667

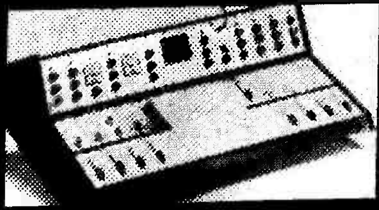
PLEASE MENTION ETI WHEN REPLYING TO ADVERTS

CLASSIFIED

FLEXIBLE — EXPANDABLE — BUDGETABLE

THE COMMUNITY MIXER KIT

Not just another Mixer — but designed specifically for Hospital Radio, Talking Newspapers and similar users.
Is there such a word as 'Budgetable'! Consult.



Partridge Electronics

56 Fleet Road, Benfleet, Essex SS7 5JN
or call (03745) 3256 for the answer
Barclay and Access welcome

SPEED — VERSATILITY — ECONOMY

Road Runner®

Designed originally for logic wiring applications, it is now accepted and used extensively throughout industry, education and research. ROADRUNNER is used by hobbyists, students, technicians, designers and engineers, to carry out work on:— *P.C.B. REPAIRS *ANALOGUE BREADBOARDING *SIMPLE LOGIC WIRING *COMPLEX INTERCONNECTING OF MICROS AND MEMORIES.

EURO INTROKIT **£14.84.** PROJECT INTROKIT **£8.27.** PENCIL WITH LOADED BOBBIN **£2.44.** WIRE DISTRIBUTION STRIPS:— GLUE FIX 20/pkt 6" LONG **£2.80.** ADHESIVE 0-36/TUBE. PRESS FIX 20/pkt 2" LONG **£2.92.** SINGLE EUROCARD HIGH DENSITY 3 PLANE (36x16 PIN DILS) **£4.50.** DOUBLE EUROCARD, WITH CAPACITY OF 84x16 PIN DILS **£7.25.** PROJECT CARD HIGH DENSITY S-SIDED 20x14 PIN DILS **£2.65.** BOBBINS - BLUE 4/pkt **£2.12** GREEN 4/pkt **£2.12** PINK 4/pkt **£2.12** GOLD 4/pkt **£2.12.** 1 OF EACH COL. **£2.20.** TINNED COPPER WIRE 4/pkt **£2.12.** RECOMMENDED SOLDERING IRON FOR ROADRUNNER HOBBYIST **£4.80.**

Please add 40p for p&p + 15% VAT to all orders.

FOR FURTHER INFORMATION ON ROADRUNNER PRODUCTS SEND LARGE S.A.E. TO:—

T.J. BRINE ASSOCIATES,
116 Blackdown Rural Industries
Haste Hill, Haslemere, Surrey

AIR BAND FREQUENCIES LIST. Approach, tower, air traffic control, weather, rescue, emergency, etc. £1. Send cheques, postal orders to: P.L.H. Electronics, 20 Vallis Road, Frome, Somerset BA11 3EH.

TV SOUND CONVERTER MODULE. Converts UHF TV band on to any FM radio (100 to 108MHz). Varicap tuned unit. £10.50. SAE data, lists. H. Cocks, Cripps Corner, Robertsbridge, Sussex. Tel. 058083 317.

MK14 CORNER. Interface Board, includes flag driven mains relays, LED Indicators for all Serial I/O, D/A and single step chips, and prototype area; also suitable for other Micro-computers; PCB and circuit £3.95. Replace calculator display with ½" FND 500s; PCD, filter, instructions £1.95. Ready-built replacement keyboard £11. Useful notes on MK14 75p. Rayner, "Kismet", High Street, Colnbrook, Bucks.

TIME WRONG?

MSF CLOCK is ALWAYS CORRECT — never gains or loses, self setting at switch-on, 8 digits show Date, Hours, Minutes and Seconds, larger digit Hours and Minutes for easy QUICK-GLANCE time, auto GMT/BST and leap year, also second-in-a-month STOP CLOCK and parallel BCD output — for your computer, alarm, etc., ideal for synchronising activities, receives Rugby time signals, 1000Km range, now get ABSOLUTE TIME, £54.80.

60KHZ RUGBY RECEIVER, as in MSF Clock, serial data output, built-in antenna, £15.70.

V.L.F.? EXPLORE 10-150KHz, Receiver £13.70.

SIG. GEN., 10Hz-200KHz, logic and variable sine and square wave outputs, rf harmonics, £12.80.

Each fun-to-build kit includes all parts, printed circuits, case, instructions, postage, etc., money-back assurance so SEND off NOW.

CAMBRIDGE KITS
45 (TH) Old School Lane, Milton, Cambridge

CLEARANCE PARCELS: Transistors, resistors, boards, hardware, 10lbs. only £5.80! 1,000 resistors £4.25, 500 capacitors £3.75. BC108, BC171, BC204, BC230, 2N5061, CV7497 Transistors, 10 70p, 100 £5.80, 2N3055, 10 for £3.50. SAE. Lists: W.V.E. (5), 15 High Street, Lydney, Gloucestershire.

BULK OFFER of 1N4148 specification silicon diodes. Top quality and beautifully packaged on bandolier strip, 500, 1,000, 5,000 for £3, £5, £20. D. Johnston, 12 Balgillo Road, Dundee DD5 3LU.

CLASSIFIED INFORMATION

Semi-Display:—
1-3 insertions — £6.00 per single column centimetre
4-11 insertions — £5.50 per s.c.c.
12 insertions — £5.00 per s.c.c.
Classified:—
23 pence per word (minimum 25 words)
Box number on application (Personal ads only)
£1.00 extra to cover 5 replies.

ALL ADVERTISEMENTS IN THIS SECTION MUST BE PRE-PAID
Closing date: 1st Friday in month preceding publication.

Advertisements are accepted subject to the terms and conditons printed on the advertisement rate card (available on request).

Please insert the advertisement below in the next available issue of Electronics Today International for . . . . insertions. I enclose Cheque/P.O. for £ . . . .
(Cheques and Postal Orders should be crossed and made payable to Electronics Today International

NAME . . . .
ADDRESS . . . .
. . . .

Send to : Margaret Hewitt
ELECTRONICS TODAY INTERNATIONAL
145, Charing Cross Road,
London WC2H 0EE.
Tel. 01 - 439 7449.

ADVERTISEMENT INDEX

COMPUKIT UK101

EUROPE'S FASTEST SELLING ONE BOARD COMPUTER

SPACE INVADERS PROG. £5 + VAT

★ 6502 based system — best value for money on the market. ★ Powerful 8K Basic — Fastest around ★ Full Qwerty Keyboard ★ 4K RAM Expandable to 8K on board. ★ Power supply and RF Modulator on board. ★ No Extras needed — Plug-in and go. ★ Kansas City Tape Interface on board. ★ Free Sampler Tape including powerful Dissassembler and Monitor with each Kit. ★ If you want to learn about Micros, but didn't know which machine to buy then **this is the machine for you.**

Build, Understand and Program your own Computer for only a small outlay

KIT ONLY **£199** + VAT NO EXTRAS NEEDED

AVAILABLE READY ASSEMBLED & TESTED READY TO GO FOR **£249** + VAT

Specially designed case for Compukit in orange/black. With room for accessories. **£29.50** + VAT

6502 Assembler/Editor for Compukit £14·90 + VAT

The **Compukit UK101** comes in kit form with all the parts necessary to be up and working, supplied. No extras are needed. Ater plugging in just press the reset keys and the whole world of computing is at your fingertips. Should you wish to work in the machine code of the 6502 then just press the M key and the machine will be ready to execute your commands and programs. By pressing the C key the world of Basic is open to you.

This machine is ideal to the computing student or Maths student, ideal to teach your children arithmetic, and is also great fun to use.

Because of the enormous volume of users of this kit we are able to offer a **new reduced price** of **£199** + VAT

NEW MONITOR FOR COMPUKIT UK101 ● In 2K Eprom 2716 ● Allows screen editing ● Saves data on tape ● Flashing cursor ● Text scrolls down **£22.00** + VAT

8MHz Super Quality Modulators	**£4.90**
6MHz Standard Modulators	**£2.90**
C12 Computer Grade Cassettes	10 for **£4.00**
Super Multi-rail P.S.U. +5 −5 +12v	**£29.50**
Anadex Printer Paper—2000 sheets	**£25.00**

THE ATARI VIDEO COMPUTER SYSTEM

£99 + VAT

Atari's Video Computer System now offers more than 1300 different game variations and options in twenty great Game Program™ cartridges! Have fun while you sharpen your mental and physical coordination. You can play rousing, challenging, sophisticated video games, the games that made Atari famous. You'll have thrill after thrill, whether you're in the thick of a dogfight, screeching around a racetrack, or dodging asteroids in an alien galaxy. With crisp bright colour (on colour TV) and incredible, true-to-life sound effects. With special circuits to protect your TV.

Cartridges now available
All at **£13.90** each + VAT
Basic maths, Airsea Battle, Black Jack, Breakout, Surround, Spacewar, Video Olympics, Outlaw, Basketball, Hunt & Score*, Space War, Sky Diver, Air Sea Battle Codebreaker*, Miniature Golf.

SPECIAL SCOOP
SPACE INVADERS CARTRIDGE £25. + VAT **Ex-Stock**

Extra Paddle Controllers — **£14.90** + VAT
*Keyboard Controllers — **£16.90** + VAT

NEW TV GAME BREAK OUT

Has got to be one of the world's greatest TV games. You really get hooked. As featured in ETI. Has also 4 other pinball games and lots of options. Good kit for up-grading old amusement games.

MINI KIT — PCB, sound & vision modulator, memory chip and de-code chip. Very simple to construct. **£14.90** + VAT **OR** PCB **£2.90** MAIN LSI **£8.50** Both plus VAT

NASCOM-2 MICRO-COMPUTER

only **£305** + VAT

With FREE 16K RAM Board Type B

Your choice of freebies with every Nascom 2 purchased from us

either FREE POWER SUPPLY
OR FREE GRAPHICS ROM
OR FREE VERO CASE TO TAKE NASCOM 2

Microprocessors Z80A, 8 bit CPU. This will run at 4MHz but is selectable between 1/2/4 MHz. This CPU has now been generally accepted as the most powerful, 8 bit processor on the market.
INTERFACE
Keyboard New expanded 57 key Licon solid state keyboard especially built for Nascom. Uses standard Nascom, monitor controlled, decoding.
T.V. The Iv peak to peak video signal can drive a monitor directly and is also fed to the on-board modulator to drive the domestic T.V.
I.O. On-board UART (Int.6402) which provides serial handling for the on-board cassette interface or the RS232/20mA teletype interface.
The cassette interface is Kansas City standard at either 300 or 1200 baud. This is a link option on the NASCOM-2.
The RS232 and 20mA loop connector will interface directly into any standard teletype.
The input and output sides of the UART are independently switchable between any of the options — i.e. it is possible to house input on the cassette and output on the printer.
PIO There is also a totally uncommitted Parallel I/O (MK3881) giving 16, programmable, I/O lines. These are addressable as 2 x 8 bit ports with complete handshake controls.
Documentation Full construction article is provided for those who buy a kit and an extensive software manual is provided for the monitor and Basic.
Basic The Nascom 2 contains a full 8K Microsoft Basic in one ROM chip with additional features like DEEK, DOKE, SET, RESET for simple programming.

only **£356** + VAT

TRS80 LEVEL 2 16K

Fully converted to UK T.V. Standard. Comes complete with easy to follow manuals. UK Power Supply — Cassette Leads — Sample tapes. Special box to enable you to plug into your own TV. Recommended for first time-buyers. Just plug in and go. Full Range of Software Available

NEW REDUCED PRICES

8K **£399**
16K **£499** + VAT
32K **£599**

RRP £795 for 32K

The PEDIGREE PETS

Very popular for home & business use. 8K Microsoft Basic in ROM. 8K Pet 32K & 16K with new improved keyboard. All with green screen.
Cassette deck **£55** extra.
Full range of software available.

video 100

12" BLACK & WHITE LOW COST VIDEO MONITOR

only **£79** + VAT

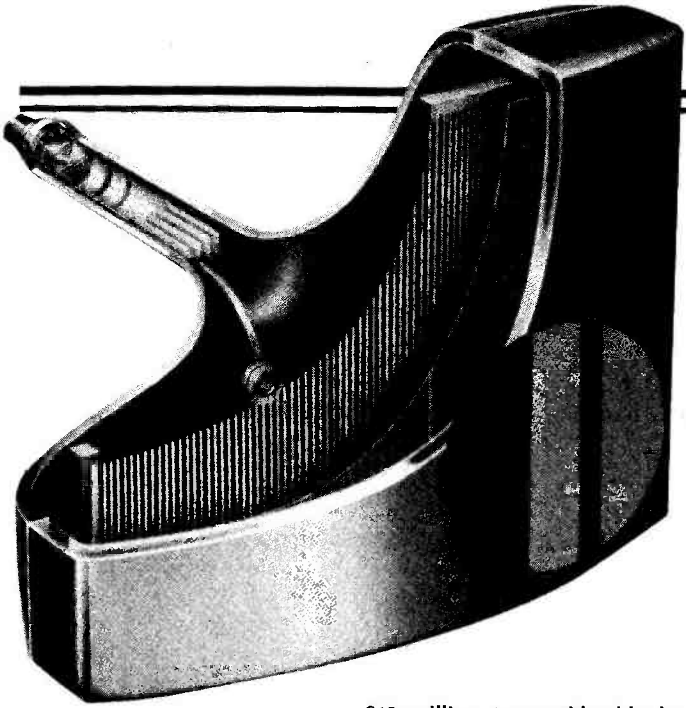
- Ideal for home, personal and business computer systems
- 12" diagonal video monitor ● Composite video input
- Composite video input ● Compatible with many computer systems ● Solid-state circuitry for a stable & sharp picture ● Video bandwidth - 12MHz + 3DB ● Input impedance -75 Ohms ● Resolution - 650 lines Minimum In Central 80% of CRT; 550 Lines Minimum beyond central 80%.

COMP SHOP LTD
"Europes Largest Discount Personal Computer Store"

Please add VAT to all prices — Delivery at cost, will be advised at time of purchase. Please make cheques and postal orders payable to COMPSHOP LTD., or phone your order quoting BARCLAYCARD, ACCESS, DINERS CLUB or AMERICAN EXPRESS number.
CREDIT FACILITIES ARRANGED — send S.A.E. for application form.
14 Station Road, New Barnet, Hertfordshire, EN5 1QW Telex: 298755 TELCOM G
Telephone: 01-441 2922 (Sales) 01-449 6596
OPEN - 10 am - 7 pm — Monday to Saturday
Close to New Barnet BR Station — Moorgate Line.
✱ **NOW in IRELAND at:** 80 Marlborough St., Dublin 1. Tel: Dublin 749933

COMP COMPUTER COMPONENTS (Part of the Compshop Ltd. Group)

DINERS CLUB INTERNATIONAL · AMERICAN EXPRESS · ACCESS · BARCLAYCARD VISA



In the Tube

Sony (UK) Ltd. has just received the Queen's Award for export for export for its Bridgend manufacturing plant which produces 125,000 Trinitron television sets per year, 50% of which are exported. Bridgend employs over 720 people and this factory already represents a £10 million investment for Sony. They have now decided to invest a further £10 million to considerably increase their production facilities at Bridgend which will include a 27" picture tube manufacturing plant, the first in Europe (the other one outside Japan is in San Diego). The workforce will be increased to around 1,000 and production is expected to be 150,000 a year once the new annexe is completed in 1982. This means that a possible 90% of components for Trinitron sets manufactured in Bridgend will be supplied from Great Britain.

Pye on CB

Following the recent Government statement on CB Pye Telecommunications has just reissued this statement, explaining the company's position.

"At a time when more and more interest is being shown in Citizens Band Radio (CB) and when more and more discussions and articles are appearing in the media, Pye Telecommunications Limited, Europe's largest supplier of Mobile Radio, feels that now is the appropriate time to make known its views on one aspect of C B .

In the event of H M Government deciding in favour of CB, Pye Telecommunications feels very strongly that the UHF frequency band would be the most appropriate.

The reasons for this recommendation are:

(1) UHF is more suitable for the high population density of the UK.
(2) Use of narrow deviation FM modulation at UHF allows more users in less spectrum, due to increased re-use of channels by the suppression of weaker signals — 'Capture Effect'.
(3) The use of UHF prevents interference with Hi Fi, television, radio and other electronic devices.
(4) It would avoid the poor grade of service which results from congestion experienced on 27 MHz CB (USA) resulting from long range propagation ('Skip Effect').
(5) UHF will avoid harmonic interference into other users of the spectrum, Police, fire, ambulance services, etc.
(6) Selection of the UHF Band would avoid the problem of the re-allocation of existing users, which would make 27 MHz CB slow and costly to implement.
(7) UHF has predictable range and channel re-usability.
(8) UHF has high quality transmission and reception.

If any confirmation of the points listed above is needed, one has only to look at Australia, where the introduction of UHF CB has established the above principles."

Touch Dimmer (April 1980)

For size and availability we made R1 a 1W carbon type. If you find that this gets warm in use, replace it with a 2.5 W wirewound (or vitreous wirewound) type, but make sure the type you choose will fit before you part with any pennies.

Army Exhibition

Four Plessey businesses will be exhibiting a wide range of equipment at the British Army Equipment Exhibition in Aldershot on June 23–27. Plessey Avionics and Communications will display their complete range of multi–combat radios and a selection of other defence communications products. There will be over 50 Plessey tactical radios in use or on display at the exhibition, either on Plessey stands or incorporated in other manufacturers' vehicle displays as working vehicle systems. Plessey Aerospace will show a wide range of military engine–driven generator sets ranging from 0.3 kW DC for battery charging applications up to 20 kW for communications equipment. Plessey Radar will exhibit products primarily concerned with upper air observations and windfinding radar. Plessey Defence Systems, formed in 1979, has current projects including the 'Ptarmigan' Tactical Trunk Communications System and 'Wavell', a military ADP system for battlefield command and control, a staff cell mock–up of which will be featured at the indoor site together with a cine–film. Both these systems have been developed for the British Army.

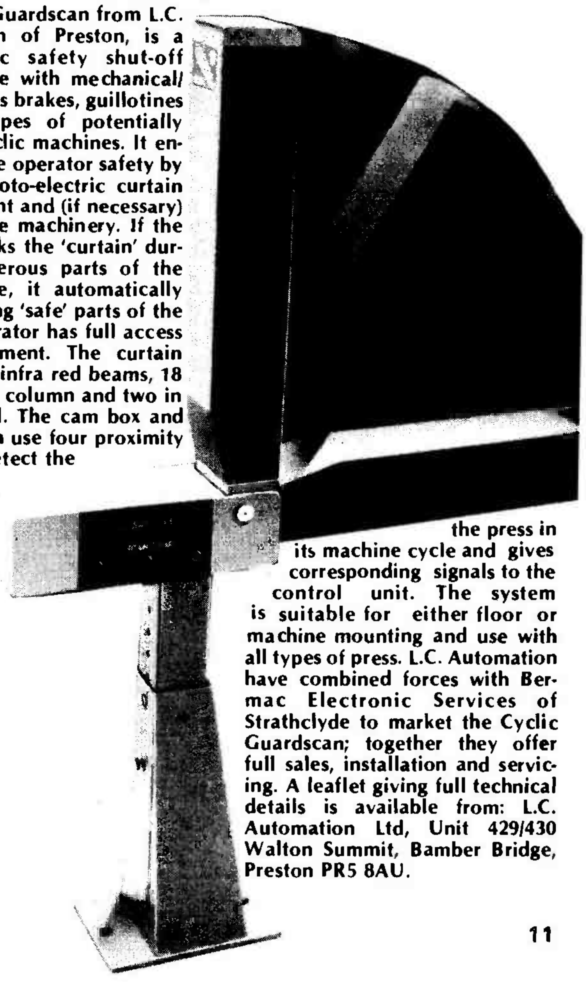
Flying High

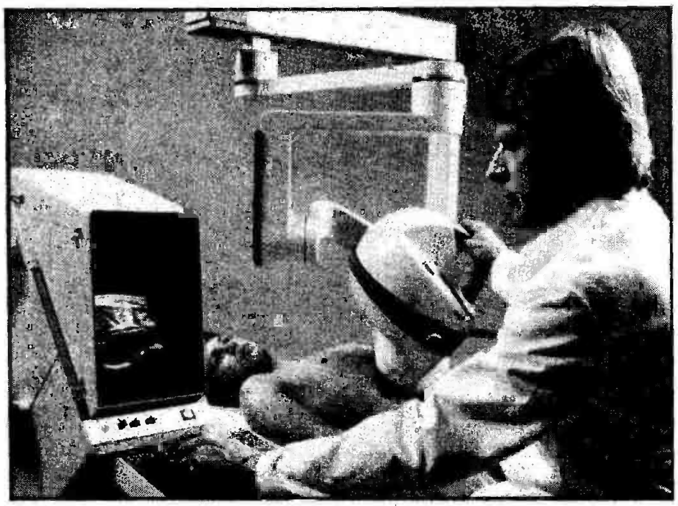
Part of the Civil Aviation Authority's £100m re-equipment programme has now been finalised. It is for the replacement of the radar systems for the National Air Traffic Services, the total cost of which is estimated to be £24.5m, 30% of which will be met by the Ministry of Defence and at the conclusion of the programme more than half the total value will have been contracted or sub-contracted to British firms.

Delivery of the new radars are required progressively from 1981 to 1983. The timing of the setting up is critical if the National Air Traffic Services are to provide an effective and safe air traffic service. The radars currently in use need to be replaced as they are not compatible with the radar data processing systems in use and being developed by the London Air Traffic Control Centre. If these radars are not replaced by 1983, there could be a situation where civil flights would have to be delayed, re-routed or cancelled and military flights adversely affected. £14.5m worth of contracts have already been placed and a further £10m are still to be let principally in the UK for buildings, radar towers and associated works.

Safety First

The Cyclic Guardscan from L.C. Automation of Preston, is a photo-electric safety shut-off system for use with mechanical/hydraulic press brakes, guillotines and other types of potentially dangerous cyclic machines. It ensures complete operator safety by creating a photo-electric curtain across the front and (if necessary) the rear of the machinery. If the operator breaks the 'curtain' during the dangerous parts of the machine cycle, it automatically cuts off. During 'safe' parts of the cycle the operator has full access to the equipment. The curtain consists of 20 infra red beams, 18 in the vertical column and two in the horizontal. The cam box and the linear cam use four proximity switches to detect the position of the press in its machine cycle and gives corresponding signals to the control unit. The system is suitable for either floor or machine mounting and use with all types of press. L.C. Automation have combined forces with Bermac Electronic Services of Strathclyde to market the Cyclic Guardscan; together they offer full sales, installation and servicing. A leaflet giving full technical details is available from: L.C. Automation Ltd, Unit 429/430 Walton Summit, Bamber Bridge, Preston PR5 8AU.





Invasion Of The Body Scanners

Siemens have introduced an improved version of their Vidoson 735 ultrasonic body scanner. The Vidoson 735 SM has a resolution of 4mm over the whole image. It uses an ultrasonic frequency of 3MHz and a parallel beam which penetrates to a maximum depth of 18cm.

Small structural features (inside organs, for example) can be displayed on the screen by a finely graded grey scale. This new system allows the wide dynamic range of echo signals to be adapted automatically to the picture tube characteristics, giving the optimum grey scale display. The picture is clearer and contours are sharper because small echoes can be suppressed by an adjustable signal threshold.

The system incorporates an electronic measuring device. Two marks can be positioned anywhere on the screen. The distance between them is then displayed digitally on the ultrasonic image. Thus, any long term change in the size of organs, for example, can be monitored over several scans, months apart perhaps.

Budding Dr.Kildares can get more information on the Vidoson 735 SM from Siemens Ltd, Siemens House, Windmill Road, Sunbury-on-Thames, Middlesex TW16 7HS.

Smart Heaters

A new type of heating element from Salford Electrical that can decide when it's too hot and regulate its temperature - and all without a single moving part. It isn't even microprocessor-controlled. It must be about the only thing that isn't these days, apart from Digest writers.

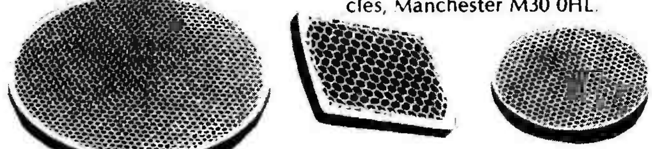
Designed for blown-air applications, PTC Honeycombe Heaters depend for their operation on the thermal properties of doped barium titanate, whose resistance increases sharply above a certain temperature - the switching temperature.

The elements are available in round or rectangular shapes, with a honeycombe structure to facilitate air flow over a large surface area. Electrical connection is made to electrodes coated onto the two flat surfaces.

Low initial resistance means rapid warm-up at switch-on. Air blown through the element reduces its temperature and, therefore, its resistance, which increases the input power. Thus the temperature of the block is maintained at the switching temperature. Heating power can be varied by controlling the air flow.

The two overwhelming advantages are safety (if the air flow stops, the heater limits itself to the switching temperature) and the elimination of radio frequency interference which occurs in conventional thermostatically controlled elements.

The new elements are available in a wide range of sizes, power ratings and switching temperatures. Further details of PTC Honeycombe Heaters from Salford Electrical Instruments Ltd, Peel Works, Barton Lane, Eccles, Manchester M30 0HL.



Drum Synth (June)

Three wire links are shown on the component overlay of the function board (p.89 Fig.9). The bottom link is an error and should not be fitted. Also the pad at the right hand end of the link (as seen on the component overlay) should be removed to stop it shorting the tracks on either side. The pad is also shown on the foil pattern and ETI PRINT, which will have to be corrected too.

The resistor numbering in Fig.7, p.88 is incorrect. R34-41 should be labelled R30-37. Resistor numbering on the circuit diagram and parts list is correct.

Image Co-ordinator

There is an error on the component overlay shown in Fig.4 on page 72. On the top right edge of the board the power connections should read (from the top) 0V,-Ve, +Ve, to match the connections to the board shown in Fig.5 on page 73. The interboard connections are shown in the photograph on page 72.

Sun Spots

The concept of harnessing solar energy to power the national grid is now showing signs of becoming a reality. The Department of Industry has funded a six month study into the implications of British Industry of such a project. ERA and Marconi Space are assisting British Aerospace in this, and RAE, Farnborough are representing the Department of Industry.

This concept is already receiving attention in the USA by NASA, the Department of Energy and the aerospace industry in general, through a 20 million dollar programme. Although this is an entirely American effort, international co-operation would be expected. The proposed satellite for harnessing the sun's energy would measure something like 5 km by 10 km, with a 1 km diameter phased array microwave antenna pivoted at one end of the surface to convert the electricity into microwave energy for transmission back to earth. The ground receiving antenna (rectenna) would convert the microwave energy back into electricity. The microwave beam would need to be designed to produce no harmful effects outside the rectenna. This, including its surrounding safety zone could occupy an elliptical site of 150-230 square kilometers. The energy delivered would be in the region of 5000 MW. The implications of this idea extend beyond the aerospace industry, into the possibility that Britain, at least, could obtain part of its electrical supply from this system during the 21st centry.

OK Cases

OK Machine & Tool's latest directory of packaging technology (catalogue of cases) recently reached us. The cases, by PacTec, come in over fifty models with all manner of variations available. They're made from impact-resistant ABS to stand up to rough treatment in service. Each case has a system of internal mounting bosses, vertical card guides and mounting rails with optional accessories available, producing a very flexible packaging system for your projects.

The range includes instrument cases with or without tilt stands, suitable for counters, timers, generators, etc. and a useful series of miniature cases, ideal for hand-held projects. Optional extras include ABS or metal front panels, special bezels and RFI shielding for the instrument cases and a belt clip, wrist strap and RFI shielding for the miniature cases.

For your free copy of OK's PanTec Catalogue, write to OK Machine & Tool UK Ltd., Dutton Lane, Eastleigh, Hants S05 4AA.

GMT ELECTRONICS

Freepost Birmingham B19 1BR

021·233·2400

- FREEPOST ON ORDERS
- VAT INCLUSIVE PRICES
- ADD 30p P&P
- 24 HR PHONE ANSWERING SERVICE

● ACCESS ● VISA ● CASH ● CHEQUE

ALL PRICES IN PENCE EACH UNLESS OTHERWISE STATED

CAPACITORS

Electrolytic Axial Leads — −10% to +50% Tol. — Order Code: Cap 018 + µF + V d.c.

µF \ V d.c.	16	25	40	63
1.0				9
1.5				9
2.2				9
3.3				9
4.7				9
6.8			9	10
10		8		10
15	8		9	11
22		8		13
33	8		9	
47		8	11	13
68	9			
100		9	13	
150	9	10		31
220	13		26	36
330			30	40
470		23	32	47
680	21	30	39	54
1000	25	30	59	
1500	35	39		
2200	42			

P.C.B. Components

Dalo Pen. Blue Ink, Slow Drying. 98 — Pen 33PC

Miniature Low Value — Order Code

Polystyrene, Axial, ±1% Tol., >63V DC Wkg. — Cap 424
Ceramic Plate, Radial, Low K, 100V DC Wkg. — Cap 632
Ceramic Plate, Radial, Med K, 100V DC Wkg. — Cap 630
Ceramic Plate, Radial, High K, 63V DC Wkg. — Cap 629
+ Value

pF	424	632	pF	424	632	630	nF	424	629
1			100	18	7		10	27	8
1.2			120	18	9		12	29	
1.5			150	18	9		15	29	
1.8		6	180	18	9		18	31	
2.2		6	220	18	9		22	31	9
2.7		6	270	20	9		27	42	
3.3		6	330	20	9		33	45	
3.9		6	390	20		6	39	50	
4.7		6	470	20		6			
5.6		6	560	20		6			
6.8		6	680	20		6			
8.2		6	820	20		6			
10		6	1000	20		6			
12		6	1200	20		6			
15		6	1500	20		7			
18		6	1800	20		7			
22		6	2200	20		7			
27		6	2700	20		7			
33		6	3300	20		7			
39		6	3900	20		7			
47		6	4700	25		8			
56		7	5600	25					
68		7	6800	25					
82		7	8200	25					

Polyester Radial Leads — Order Code

Dipped Type, C280/352 Style — Cap 352
Moulded Type, 10.2mm Pitch — Cap 360
+ Value

µF	352	360	µF	352	360
.001		7	.1	7	9
.0015		7	.15	8	10
.0022	6	7	.22	9	11
.0033	6	7	.33	11	
.0047	6	7	.47	14	
.0068	6	7	.68	17	
.01	6	8	1.0	21	
.015	6	8	1.5	30	
.022	6	8	2.2	35	
.033	6	8			
.047	6	8			
.068	7	8			

Tantalum Bead — 20% Tol. — Order Code: Cap PR + µF + Volts

µF \ V d.c.	10	16	25	35
0.1				12
0.22				12
0.47				12
1				12
2.2		12		12
4.7		15	22	16
10	16	22	28	28
22		28		34
47	34			

RESISTORS

Order Code

Carbon Film, Fixed

0.25W, E24 Values 1R0-10M, 5% Tol. — 2 each — 100/100 (Mult 10/Value) — Res RD¼
0.5W, E12 Values 1R0-4M7, 10% Tol. — 3 each — 150/100 (Mult 10/Value) — Res RD½
+ Value

Metal Film, Fixed

0.5W, E24 Values, 5R1-1M, 2% Tol. — 8 each — 400/100 (Mult 10/Value) — Res MR30
2.5W, E12 Values, 10R-27K, 5% Tol. — 16 each — 800/100 (Mult 10/Value) — Res PR52
+ Value

Metal Glaze, Fixed

0.5W, E24 Values, 1M-33M, 5% Tol. — 16 each — 800/100 (Mult 10/Value) — Res VR37
+ Value

Skeleton Presets, Miniature

0.1W, E3 Values, 100R-1M, Lin. Vertical Mounting — 8 — Min. Preset V
0.1W, E3 Values, 100R-1M, Lin. Horizontal Mounting — 8 — Min. Preset H
+ Value

Skeleton Presets, Standard

0.3W, E3 Values, 100R-4M7, Lin. Vertical Mounting — 11 — Std. Preset V
0.3W, E3 Values, 100R-4M7, Lin. Horizontal Mounting — 11 — Std. Preset H
+ Value

Potentiometer, Rotary

0.5W, E3 Values, 1K-2M2 Lin. — 39 — Ro Pot Lin
0.25W, E3 Values, 4K7-2M2 Log. — 39 — Ro Pot Log
+ Value

Potentiometer, Slider

0.5W, E3 Values, 2K2-470K Lin. — 45 — Sl Pot Lin
0.25W, E3 Values, 1K0 - 1M0 Log. — 45 — Sl Pot Log
+ Value

C-MOS (BUFFERED)

HEF4000	22	HEF4044	105	HEF4512	138
HEF4001	22	HEF4046	133	HEF4514	313
HEF4002	22	HEF4047	109	HEF4515	374
HEF4006	119	HEF4049	57	HEF4516	127
HEF4007	22	HEF4050	57	HEF4517	478
HEF4008	100	HEF4051	87	HEF4518	118
HEF4011	22	HEF4052	90	HEF4519	69
HEF4012	22	HEF4053	90	HEF4520	118
HEF4013	57	HEF4066	62	HEF4521	235
HEF4014	105	HEF4067	475	HEF4528	124
HEF4015	100	HEF4068	22	HEF4532	150
HEF4016	57	HEF4069	22	HEF4534	638
HEF4017	100	HEF4070	22	HEF4539	138
HEF4018	100	HEF4071	23	HEF4543	194
HEF4019	58	HEF4072	23	HEF4555	98
HEF4020	112	HEF4073	23	HEF4556	98
HEF4021	107	HEF4075	23	HEF4557	458
HEF4022	103	HEF4076	130	HEF4585	122
HEF4023	22	HEF4077	22	HEF4724	214
HEF4024	78	HEF4078	23	HEF40097	113
HEF4025	22	HEF4081	23	HEF40098	92
HEF4026	244	HEF4082	23	HEF40106	78
HEF4027	57	HEF4085	80	HEF40160	149
HEF4028	89	HEF4086	80	HEF40161	149
HEF4029	113	HEF4093	63	HEF40162	149
HEF4030	58	HEF4094	219	HEF40163	149
HEF4031	250	HEF4104	208	HEF40174	149
HEF4035	138	HEF4502	114	HEF40175	149
HEF4040	107	HEF4505	714	HEF40192	149
HEF4041	94	HEF4508	230	HEF40193	175
HEF4042	83	HEF4510	135	HEF40194	149
HEF4043	100	HEF4511	157	HEF40195	149

74LS

74LS00	19	74LS83A	106	74LS174	141	74LS373	173
74LS01	19	74LS85	104	74LS175	119	74LS374	173
74LS02	19	74LS86	39	74LS181	306	74LS375	117
74LS03	19	74LS90	59	74LS190	117	74LS378	155
74LS04	27	74LS92	76	74LS191	117	74LS386	56
74LS05	27	74LS93	76	74LS192	119	74LS390	196
74LS08	27	74LS95B	82	74LS193	119	74LS393	196
74LS09	27	74LS96	126	74LS194	161	74LS395	207
74LS10	19	74LS107	41	74LS195A	119	74LS490	143
74LS11	26	74LS109	45	74LS196	132		
74LS12	26	74LS112	45	74LS197	132		
74LS13	48	74LS113	45	74LS240	206		
74LS14	74	74LS114	45	74LS241	206		
74LS15	26	74LS125	53	74LS242	206		
74LS20	19	74LS126	53	74LS243	206		
74LS21	26	74LS132	78	74LS244	206		
74LS22	26	74LS136	49	74LS251	117		
74LS28	35	74LS138	99	74LS253	117		
74LS30	19	74LS139	99	74LS257	117		
74LS32	27	74LS153	88	74LS258	117		
74LS33	35	74LS154	138	74LS260	29		
74LS37	35	74LS155	93	74LS261	321		
74LS38	35	74LS156	93	74LS266	54		
74LS40	27	74LS157	93	74LS273	143		
74LS42	60	74LS158	97	74LS283	117		
74LS51	27	74LS160	129	74LS290	112		
74LS54	27	74LS161	117	74LS293	119		
74LS55	27	74LS162	144	74LS298	149		
74LS73	35	74LS163	117	74LS365	121		
74LS75	44	74LS164	119	74LS366	121		
74LS76	46	74LS170	220	74LS367	121		
74LS78	39	74LS173	132	74LS368	121		

Plessey I/C's

SL440	331
SL445	182
SL610	245
SL612	245
SL620	369
SL621	369
SL622	910
SL624	342
SL630	232
SL640	409
SL680	245
SL1610	177
SL1611	177
SL1612	177
SL1621	239
SL1626	267
SL1630	177
SL1640	208
SL1641	208
SL6640	270
SP8629	475

LINEAR

CA3046	84
CA3080E	77
CA3130E	99
CA3140E	48
CA3189E	293
LM301AN	34
LM339N	78
LM380N	104
LM381AN	198
LM3900N	75
MC3403P	156
NE531	131
NE536T	259
NE555N	28
NE556N	68
NE566N	171
NE570N	485
NE571N	505
RC4136	146
TBA120S	88
TDA1022	713
TDA1034B	239
TL081CP	84
TL084CN	156
UA741CN	20
UA741CT	47
UA748CN	39

400mW C4V7-C33 BZY88/BZX79 + Voltage 9

Voltage Regulators

LM309DA(K)	119
UA723CN	42
UA7805CU	78
UA7812CU	78
UA7815CU	78
UA7912CU	97
UA7915CU	97
UA78L05CS	38
UA78L12CS	38

SEMICONDUCTORS

IN914	5	2N3705	10	BC182L	12	BFX85	29
IN4001	5	2N3773	297	BC184	11	BFY50	17
IN4002	5	2N3819	22	BC184L	12	BFY51	17
IN4004	7	2N3820	39	BC212	11	BFY52	20
IN4007	9	2N3904	9	BC212L	12	BLX65	262
IN4148	4	2N5457	39	BC214	11	BRY39	50
IN5402	15	2N5459	35	BC214L	12	BSX20	21
2N2218A	31	40673	88	BC547	13	CL8960	2850
2N2369	21	AD161	42	BC548	11	MPF102	36
2N2646	46	AD162	42	BC549	12	OA91	8
2N2926G	13	BC107	14	BC557	15	OC28	118
2N3053	19	BC108	14	BC558	15	OC35	105
2N3054	55	BC108C	18	BCY70	15	TIP31A	48
2N3055	55	BC109	14	BCY71	15	TIP32A	54
Full ISB Test	95	BC109B	19	BD131	39	TIP41C	76
2N3442	155	BC109C	20	BD132	39	TIP42C	76
2N3702	9	BC148	10	BD139	39	TIP2955	75
2N3704	9	BC158	10	BD140	39	TIP3055	60
		BC177	17	BFR90	333	TIS43	36

OPTO ELECTRONICS

Light Emitting Diodes, Individual

.125" (3mm)	Red	16	CQY54
	Green	18	CQY95
	Yellow	20	CQY97
Panel Mounting Clip to suit		3	LED3 Clip
.2" (5mm)	Red	16	CQY24A
	Green	18	CQY94
	Yellow	20	CQY96
Panel Mounting Clip to suit		5	LED5 Clip

Photoresistors

ORP12 95
ORP61 95

Phototransistors

OCP71 220
BPX25 195
BPX29 195

Photocoupler

FCD820 165

Plastic Boxes — Boss Industrial Mouldings

Moulded Box and Close Fitting Flanged Lid
ABS Box, C/W Brass Bushes, and Lid In Orange

		Order Code
L112 W62 D31	99	Case BIM2003 OR
L150 W80 D50	131	Case BIM2005 OR
L190 W110 D60	223	Case BIM2006 OR

Plastic Boxes with Metal Lids

Recessed Top Box
ABS Base, C/W Brass Bushes, In Orange
1mm Aluminium Top Panel Finished Grey

		Order Code
L85 W56 D29	112	Case BIM4003 OR
L111 W71 D42	150	Case BIM4004 OR
L161 W96 D53	208	Case BIM4005 OR

Diecast Boxes

Diecast Box and Flanged Lid
Aluminium Box and Lid in Natural Finish

		Order Code
L113 W63 D31	124	Case BIM5003 NA
L152 W82 D50	216	Case BIM5005 NA
L192 W113 D61	334	Case BIM5006 NA

SWITCHES

Miniature Toggle — Honeywell — Order Code

SPDT		67	SW 8A1011
SPDT	C/Off	81	SW 8A1021
SPDT	Double Bias To Centre	90	SW 8A1041
SPDT	Single Bias To Centre	90	SW 8A1051
SPDT	Bias	84	SW 8A1061
DPDT		99	SW 8A2011
DPDT	C/Off	111	SW 8A2021
DPDT	Double Bias To Centre	123	SW 8A2041
DPDT	Single Bias To Centre	123	SW 8A2051
DPDT	Bias	116	SW 8A2061

Miniature Push — C & K

SP	Push To Make, Momentary	62	SW 8531
SP	Push To Break, Momentary	62	SW 8533

D.I.L. Sockets

8 Pin Low Profile Socket Tin	12	DIL SKT 8
14 Pin Low Profile Socket Tin	14	DIL SKT 14
16 Pin Low Profile Socket Tin	16	DIL SKT 16

MAINS TRANSFORMERS

Order Code

Secondaries may be connected in series or parallel to give wide voltage range
Primaries 0-220, 240V

6VA — Clamp Type Construction 235 each

Approx. 18% Regulation F.C. 54, H36, W35

0-4.5V, 0-4.5V Secondaries	Trans 6VA 45
0-6V, 0-6V	60
0-12V, 0-12V	120
0-15V, 0-15V	150
0-20V, 0-20V	200

20VA — Clamp Type Construction 360 each

Approx. 16% Regulation F.C. 70, H48, W46

0-4.5V, 0-4.5V Secondaries	Trans 20VA 45
0-6V, 0-6V	60
0-12V, 0-12V	120
0-15V, 0-15V	150
0-17.5V, 0-17.5V	175
0-20V, 0-20V	200

VERO ELECTRONICS PRODUCTS

2.5" x 5" .1" pitch Veroboard	71	200-21069J
3.75" x 5" .1" pitch Veroboard	79	200-21072D
2.5" x 1" .1" pitch Veroboard (5)	85/Pack	200-21076C
3.75" x 5" .1" pitch Plain Board	68	200-21078H
5.82" x 2.9" .1" pitch V-Q DIP Board	135	200-21084E
Spot Face Cutter	107	203-21013A
Pin Insertion Tool for .040 type pin	147	203-21015F
DS Pins .040 (100)	44/Pack	200-21087G
SS Pins .040 (100)	44/Pack	200-21017B
Verowire Kit (1-pen, 2-wire, 25-comb)	454/Kit	200-21341D
Verowire Combs (25)	109/Pack	200-21339F
Verowire Wire (2)	109/Pack	200-21340G

Heatsinks

Individual Type for 1 x TO5 50°C/W	12	Sink 5F
Individual Type for 1 x TO66 10.5°C/W	28	Sink TV2
Individual Type for 1 x TO3 7.2°C/W	26	Sink TV3
Individual Type for 1 x TO126 17°C/W	26	Sink TV4
Individual Type for 1 x TO220 17°C/W	26	Sink TV5

G.M.T. ELECTRONICS KITS.

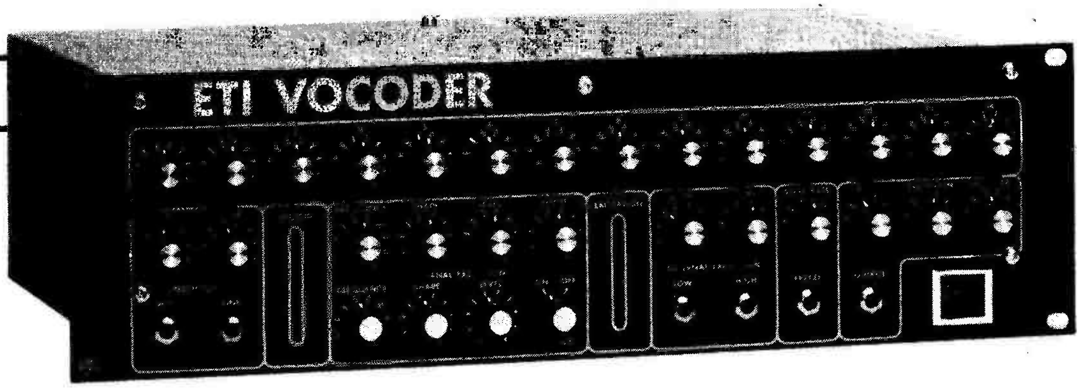
FULL TELETEXT KIT (Free-standing unit- no internal connection to T.V.)	£199-90
TELETEXT DECODER + REMOTE CONTROL KIT (For wiring into existing television)	£135-90
PAL ENCODER/MODULATOR KIT	£ 22-90
DOPPLER RADAR ALARM KIT	£ 44-90
F.E.T. POWER AMPLIFIER OUTPUT MODULE KIT	£ 27-50
ONE AMP POWER SUPPLY MODULE KIT - FIVE VOLTS	£ 6-00
ONE AMP POWER SUPPLY MODULE KIT - TWELVE VOLTS	£ 7-50
MODEL INERTIA CONTROLLER MK I - SLOT RACER	£ 30-00
MODEL INERTIA CONTROLLER MK II - TRAIN (HAND UNIT)	£ 25-00
MODEL INERTIA CONTROLLER MK III - TRAIN (CONSOLE UNIT)	£ 25-00

PUBLIC ADDRESS EQUIPMENT

A55	20W AC/12vDC MOBILE AMPLIFIER	£ 69-00
A56	50W AC/12vDC AMPLIFIER	£117-30
A70	175W AC/24vDC PROFESSIONAL AMPLIFIER	£276-00
L78	20W WEATHERPROOF HORN SPEAKER, 8 OHM & LINE	£ 41-40
L83	16W MEGAPHONE (SEPARATE MICROPHONE)	£ 69-00
L110	40W CABINET SPEAKER 8 OR 16 OHMS (SPECIFY WHICH) (c/w black 'vynide' covering, metal corners and overall cover)	£ 89-70
M21	UNI-DIRECTIONAL ELECTRET CONDENSOR MIKE, 600 OHM	£ 19-32
M30	BALL WINDSHIELD DYNAMIC CARDOID MIKE, 600/50K OHM	£ 28-98
M104	SIX CHANNEL STEREO MIXER AND PRE-AMPLIFIER (accepts high and low imp mikes, and has RIAA input)	£ 62-10
M124	FLOOR TYPE MICROPHONE STAND, EXTENDS TO 60"	£ 14-49

ETI NEXT MONTH

Vocoder



Now you can make your own synthesiser or guitar or even your cat speak or sing to you. This design uses 14 channels and has all the goodies like LED PPM meters, slew rate control, voiced/unvoiced detector and very versatile internal excitation! What more could you ask for? The ETI Vocoder's got the lot.

TV Sound Amplifier

You've read the book and seen the film. Now hear the TV version AS IT REALLY IS! Yes folks true glorious hi-fi sound from your telly! Broadcast sound is of an incredibly high standard and TV sound circuits are of an incredibly LOW standard. What a waste.

Improve your viewing and give your ears a treat by playing Crossroads in high fidelity. No messy wiring into the set either, its all self contained — complete with monitor amp — and is easily constructed.

Survival

The time interval is getting shorter and the ladder higher. Your opponent has turned up the skill level to maximum — one tiny slip and you're gonna hit the bottom and hard. Can you make it to the top? Can you survive? Good game, Good game!

Very Low Level Circuit Design

An absorbing article on the obstacles to be overcome at signal levels of a few microvolts and less. How do you minimise noise problems, when the amplitude of the noise is comparable to the amplitude of the signal? How about obtaining a decent gain without increasing hum pickup? An unusual and intriguing subject well explained.

Digital Test Meter

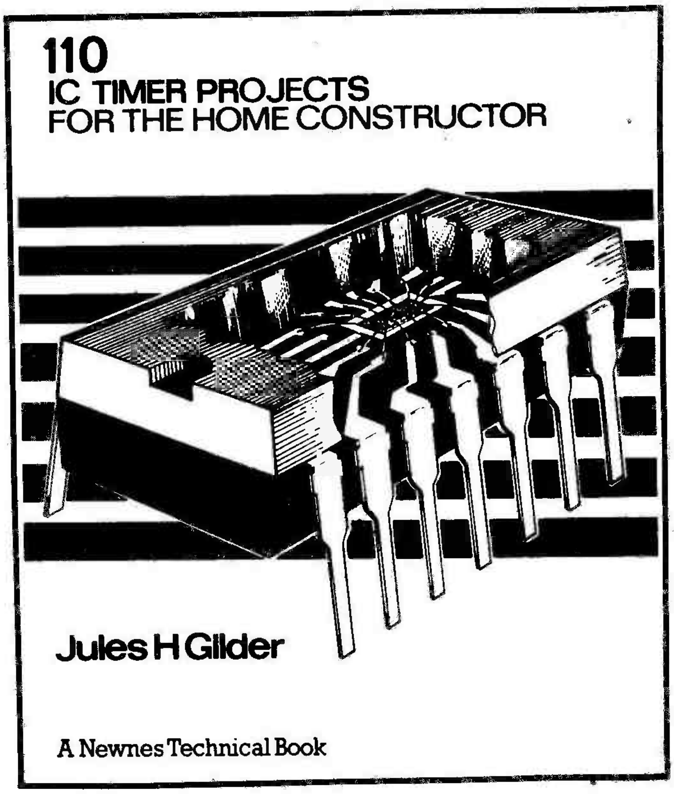
If we told you that next month we are running what is probably the ultimate digital meter project would you believe us? Probably not — but try anyway, because its true! You name it, this box will measure it — accurately. Frequency, voltage, resistance, current etc etc. It has an LCD display and costs a lot less to build than you think.

Articles mentioned herein are in an advanced state of preparation. However, circumstances may dictate changes to the final contents.

555 APPLICATIONS

In this chapter from his new book, Jules H. Gilder provides twenty circuits for the motorist employing the ubiquitous 555 timer

Our thanks to Newnes Butterworth for their kind permission to reproduce this extract from their book. The chapter is shown exactly as it appears in the original and gives a good indication of the high standards throughout the book.



6.1 electronic ignition system*

A capacitive-discharge automobile ignition system can be built with commonly available components. The system (Fig. 6-1) employs a 555 timer, which operates in an asynchronous square-wave mode, to drive the system's converter section. Thus, a common 6.3-V center-tap filament transformer of good quality can be used as the converter transformer. The rectified output of the converter transformer charges C2 to approximately 500 V dc.

When the points open, a positive-voltage pulse is coupled through R10, CR6, and C4 to the gate of the 2N4444 SCR. When the SCR fires, C2 discharges through the spark coil and starts to recharge with the opposite polarity. This polarity reversal provides a negative charge through R8 and CR8 to the SCR gate to prevent its retriggering after the SCR turns off.

When the points close, they discharge C4 through R9 and R10 so the SCR can be retriggered. The time required for this discharge provides delay to prevent erratic SCR firing caused by point bounce at high engine rpm.

This circuit is in actual use and has been bench-tested to an equivalent of 15,000 rpm on an eight-cylinder engine. With careful shopping, the entire system can be built for less than $15.

6.2 voltage regulator†

A 555-type IC timer, in combination with a power Darlington transistor pair, can provide low-cost automotive voltage regulation. Such a regulator can even make it easier to start a car in cold weather.

* Morgan, L. G., "Electronic Ignition System Uses Standard Components," *Electronic Design*, Nov. 22, 1974, p. 198.

† Fusar, T. J., "IC Timer Makes Economical Automobile Voltage Regulator," reprinted from *Electronics*, Feb. 21, 1974; copyright © McGraw-Hill Inc., 1974. All rights reserved.

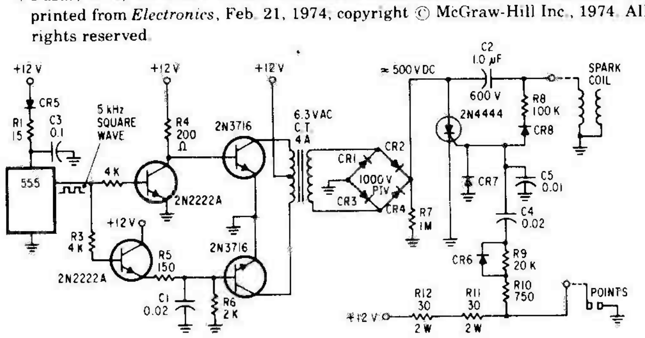


Fig. 6-1. Electronic ignition system.

As Fig. 6-2 shows, the circuit requires very few parts. The value of resistor R1 is chosen to prevent the timer's quiescent current, when the timer is off (output, pin 3, low), from turning on the Darlington pair.

If battery voltage becomes too low, the timer turns on, driving its output high and drawing a current of about 60 mA through resistor R2. This causes a sufficient biasing voltage to be developed across resistor R1 and the Darlington turns on supplying the energizing current to the field coil of the car's alternator. Diode D1 suppresses the reverse voltage of the field coil when the Darlington pair is turned off.

The regulator's low-voltage turnon point is fixed by setting the voltage at the timer's trigger input (pin 2) to approximately half the reference voltage existing at its control-voltage input (pin 5). The high-voltage turnoff point is set by making the voltage at the timer's threshold input (pin 6) equal to the reference voltage at pin 6. At 77°F, the turnon voltage is typically 14.4 V, and the turnoff voltage is typically 14.9 V. These voltage levels, of course, should be set to match the charging requirement of a given car's specific battery-alternator combination.

The value of the reference voltage is established by the diode string D2 through D5; here, it is approximately 5.9 V. The output voltage has a negative temperature coefficient of −11 mV/°F.

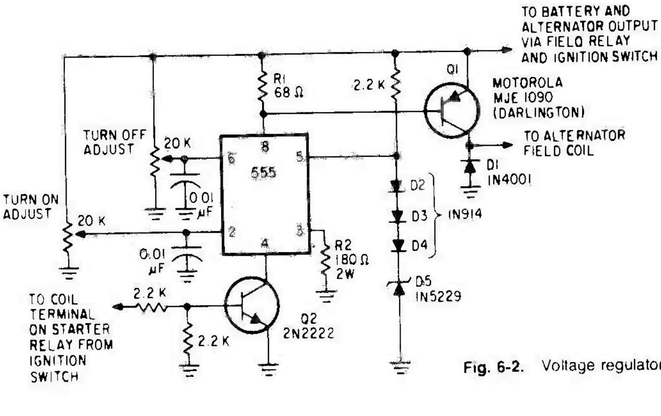


Fig. 6-2. Voltage regulator.

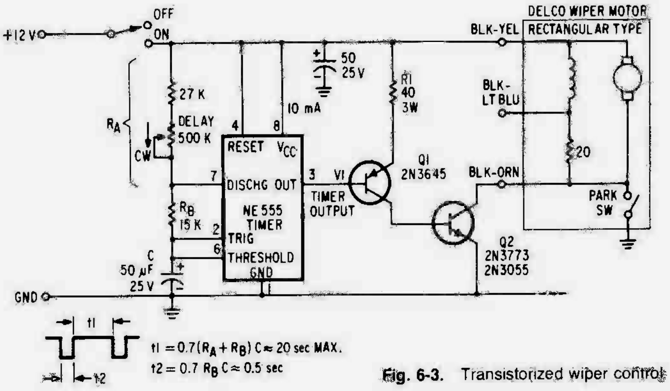


Fig. 6-3. Transistorized wiper control

A transistor and a couple of resistors can be added to the circuit for better cold-weather starting. During starting, the transistor holds the timer in its off state lightening the load on the car's cranking motor. (And to prevent radio interference, a 10-μF capacitor can be connected from the Darlington emitter to ground.)

6.3 transistorized wiper control*

An all-solid-state automobile wiper-control circuit allows the windshield wiper to sweep at selected frequencies from once a second to once every 20 sec. The circuit (Fig. 6-3) uses one IC, two silicon transistors, and seven discrete components.

Circuit timing is determined by a 555-timer IC and its external parts, R_A, R_B, and C. Transistor Q1 is switched on when V1 goes low, and npn transistor Q2 also turns on. The mechanical park switch takes over and conducts the motor current until one cycle of wiper motion is complete. At wiper park, the park switch opens and stops the wiper.

* Galluzzi, P., "Circuit Provides Slow Auto-Wiper Cycling with One to 20 Seconds Between Sweeps," *Electronic Design*, Dec. 26, 1974, p. 108.

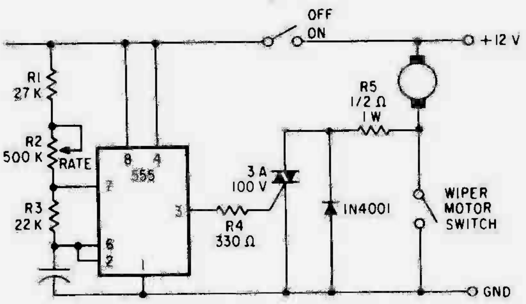


Fig. 6-4. Thyristor-switched wiper control

Transistors Q1 and Q2 conduct for only about 0.5 sec. They do not conduct again until the next timer pulse. The delay between pulses is adjusted with the 500-kΩ delay resistor.

Resistor R1 limits the current into Q1 and the base of Q2. The peak collector current into Q2 is about 3 A. Since the duty cycle is normally very low, little heating occurs.

This circuit is in use on a GM-Delco rectangular-motor wiper system.

6.4 thyristor-switched wiper control

As in the previous circuit, the delay in this unit is adjustable from about 1–20 sec. The major difference between this wiper control (Fig. 6-4) and the earlier one is that this one uses a thyristor to do the switching. Like circuit 6.3, it is meant for cars in which the switch for the wiper motor breaks a connection to ground.

Diode D1 (1N4001) is included to prevent the back emf that is produced when the wiper opens at the end of a cycle from retriggering the thyristor and switching it on again without waiting for the delay. The diode can do this because it has a zener breakdown that is lower than that of the thyristor.

The addition of resistor R5 is to ensure that the current through the thyristor falls enough for it to switch off when the wiper contact closes. It may be necessary to increase the value of it a bit if this does not happen.

6.5 relay-switched wiper control

This wiper control (Fig. 6-5) is a more deluxe version of the two preceding ones. It uses a relay to perform the switching for the wiper and is meant for wiper motors whose switch breaks a connection to the

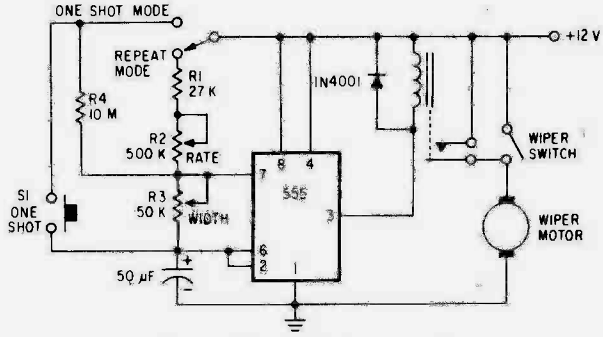


Fig. 6-5. Relay-switched wiper control

positive supply rail (that could be changed by simply connecting the relay contacts to another spot).

The 555 astable drives a relay with a frequency that is adjustable by R2. A feature of this unit, which was not on the others, is that it has a variable-width control, so that the amount of time that the relay is on can be adjusted.

Another feature of this wiper control is that it offers two modes of operation: the normal cyclical mode and a one-shot mode. In the one-shot mode, the wipers can be activated for one cycle by pressing button S1 momentarily. If the button is not pressed again, in about 5.5 min the unit will itself activate the wipers for one cycle. This can serve as a reminder that it is still on.

6.6 seat-belt alarm

For those of you who like to wear seat belts in the car and have trouble convincing others that they should too, this circuit is ideal. It is an astable multivibrator whose output is connected to a power amplifier and a speaker (Fig. 6-6).

The loud wail that this circuit produces (about 5 W) should convince anyone to put on his seat belt, because that's the only way to stop it. It works like this: a magnetic reed switch that is normally open when there is no magnet near it is connected to the base of transistor Q1. So is R3. As long as the reed switch is open, R3 supplies current to the base of Q1 and turns it on. Q1 in turn permits current to flow to the astable circuit and the unit screams.

As soon as a magnet is brought near the reed switch, its contacts close, R3 is shorted to ground, Q1 turns off, and the oscillator turns off. All this takes place only if S2 is on, which occurs when someone sits in the seat. The reed switch and the magnet should be glued or

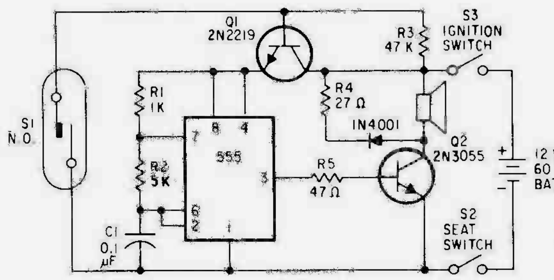


Fig. 6-6. Seat-belt alarm.

taped to the seat-belt buckle in such a way that when the seat belt is properly secured, they are in close proximity to one another.

6.7 seat-belt reminder

This circuit, unlike the previous one, does not force you to wear the seat belt when you are in the car. Rather, it reminds you that you should put it on, but obediently shuts up if you tell it to.

Once again, we see that the astable connection of the 555 is the one that comes in handy. Like the former circuit, this one (Fig. 6-7) uses a power amplifier on the output, to make sure you don't overlook the signal.

The hot lead for the circuit is connected to a point in the electrical system of the car that receives electricity only when the ignition switch is on. In most cars, a connection can be made to the supply lead for the radio. The ground lead for the timer circuit is connected to the anode

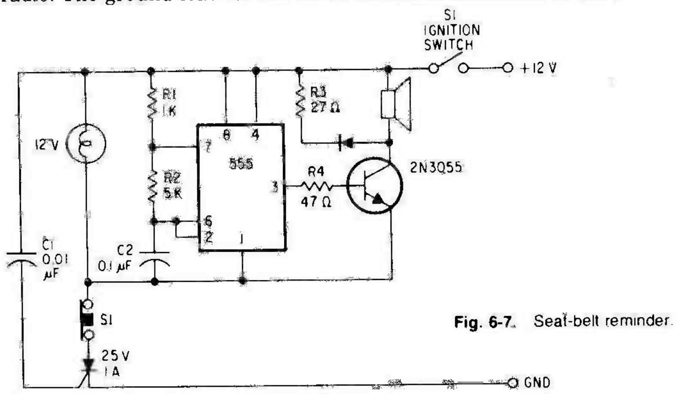


Fig. 6-7. Seat-belt reminder.

of an SCR via pushbutton S1. As long as the SCR is not triggered, the oscillator will not operate.

However, when the ignition is turned on, a pulse passes through capacitor C1 to the gate of the SCR, because for an instant, the capacitor behaves as a short circuit. The capacitor, however, quickly charges up and will prevent further triggering of the SCR. In the meantime, the SCR has been turned on by the trigger pulse and it acts as a short circuit so that now the astable starts to oscillate. The astable will remain on until the SCR is turned off. This is done by simply pressing on the pushbutton switch for a moment, to break the circuit.

The lamp in the circuit can serve a dual purpose. First, it is there to insure that enough current flows through the SCR so that it will remain in conduction. If the current is too low, as it might be with the astable circuit alone, the SCR would be starved and would not latch. Second, if the lamp is part of the switch assembly for S1, then it will be very easy to locate the shutoff switch at night, when the interior of the car is dark.

6.8 low-battery alarm

What's the condition of your car battery? Is it low? Have you ever checked it? Chances are you cannot answer any of these questions satisfactorily. And if not, then you need this circuit. It is a low-battery indicator that will sound a tone when the voltage on your battery drops below 10 V.

As seen in Fig. 6-8, a zener diode is chosen whose zener voltage is equal to the low-limit voltage of the battery under test.

In this case, it was decided that if the car battery voltage dropped to below 10 V, the alarm should go off. So a 10-V zener was selected. With the zener connected as it is, 10 V is dropped across the zener and 2 V is placed on the junction of R1 and R2. This causes transistor Q1 to conduct, which in turn prevents Q2 from conducting, hence no alarm.

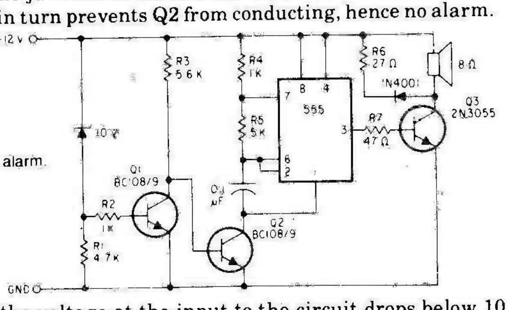


Fig. 6-8. Low-battery alarm.

However, if the voltage at the input to the circuit drops below 10 V, the zener diode will stop conducting and Q1 will turn off. This will cause Q2 to turn on, and will supply a ground return for the 555 oscillator, resulting in a tone being generated.

6.9 back-up alarm

Backing out of a long driveway can be dangerous, especially if there are small children around who cannot easily be seen. With this little circuit (Fig. 6-9), an audible warning tone will be sounded as soon as you put the car in reverse. The sound will stay on until you take the car out of reverse gear.

Basically, the device is an amplified oscillator whose output is used as the warning signal. For cars that have a separate set of back-up lights that turn on when the car is in reverse, connecting the unit to the car is extremely simple. In that case, the components inside the box are not needed and point A gets connected to the hot lead of the back-up lamp, while points B and C get connected together and are both connected to the chassis of the car (ground). Now whenever the car is put in reverse gear, the alarm, whose speaker should be mounted in the rear of the car so it can be heard, goes off.

But not all cars have separate back-up lights. Some of them turn on the blinker lights when the car is in reverse. In this case, the components in the box are needed and the circuit is constructed exactly as it appears in Fig. 6-9. In this case, points A and D are connected to the right and left rear blinker lights. Point A supplies power to the

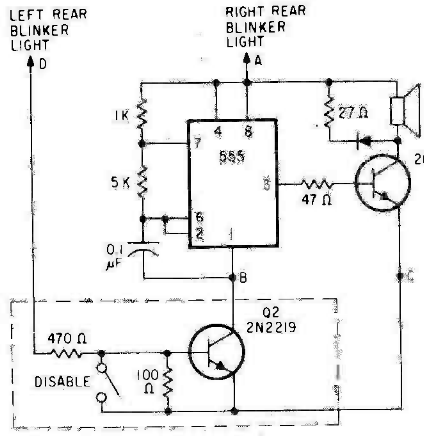


Fig. 6-9. Back-up alarm.

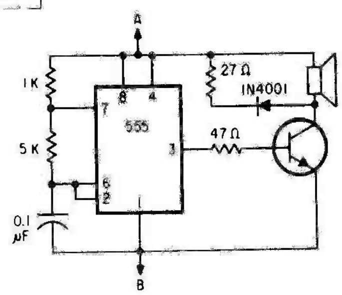


Fig. 6-10. Turn indicator.

oscillator as normal and point D supplies power to the base of transistor Q2. This turns the transistor on and effectively shorts it to ground, causing the oscillator to work.

Remember, this happens only when both of the rear blinker lights are on at the same time. Thus, if your car has a hazard flasher that flashes the front and rear lights together, the back-up alarm will also turn on intermittently with the lights. To prevent this from happening, a disable switch has been included. This switch grounds the base of Q2 and prevents it from turning on.

6.10 turn indicator

Have you ever driven behind a person who had his turn indicator on but goes on for blocks on end without making a turn? It has probably happened to most of us at one time or another. The reason for this is that when the signal is turned on to indicate a lane change, or when one pulls away from the curb, the rotation on the steering wheel is not always enough to cause the mechanical return of the indicator switch. In addition, the clicking sound produced by the flasher inside the car is not always heard.

By using this circuit, which is very similar to the previous one, a loud flashing tone will be produced when the turn signal indicator is turned on, and turned off when the turn indicator goes off.

In the circuit shown in Fig. 6-10, point B is normally connected to the chassis of the car (for negative-ground cars). Point A has to get connected to a point that goes positive for each flash of the turn lights.

In some cars, where there is only one indicator light on the dashboard, it is only necessary to connect point A to the hot side of the light bulb. In most cars, however, there are two turn signal indicators on the dashboard. In that case, point A should be connected to one of the terminals on the flasher module that goes on with each flash.

6.11 headlight extinguisher

An automatic headlight extinguisher (Fig. 6-11) will allow you to turn off the car's ignition and still have a light to open the door by at night. After a predetermined period of time, which can vary from 10 sec to 1 min, the headlights will automatically shut off. Not only does this give you enough light to find your key in the dark, it also prevents you from accidentally leaving the lights on and finding a dead battery in the morning.

It operates like this. When the car ignition is turned on, current flows through resistor R3 and diode D1 to the relay. The relay then pulls in and makes it possible to turn on the headlights. When the ignition switch is turned off, a negative-going pulse is generated and applied to the trigger input of the timer (pin 2). Since the timer is configured to operate in the monostable mode, the pulse causes the output of the timer to go high for a period of time determined by $t = 1.1(R1 + R2)C1$. In this case, the pulse width is adjustable from about 10 sec to 1 min. The output of the timer is connected to the relay so the relay stays high for the additional period of time after the ignition is turned off.

It should be noted that the headlights will stay on only if the headlight switch is not shut off: In addition, you must remember to turn off the headlight switch the next morning, or you'll be driving around all day with your lights on.

6.12 light alarm

This alarm unit is a handy accessory to use with the headlight extinguisher in the previous section. As in most of the alarm-type

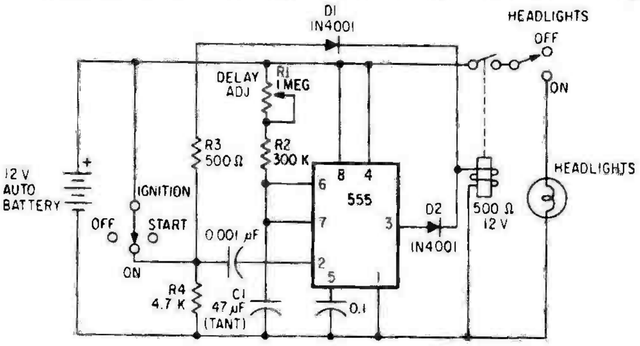


Fig. 6-11. Headlight extinguisher.

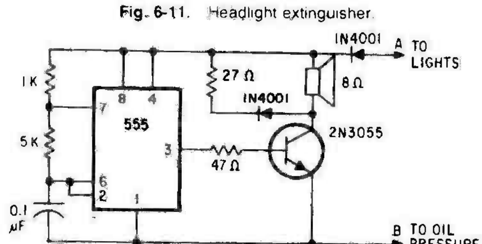


Fig. 6-12. Light alarm.

circuits, this one (Fig. 6-12) is composed chiefly of an amplified astable multivibrator. In addition, there is a diode in the positive power lead to protect the circuit from reverse voltages. Operation is very simple. When the ignition is on and the headlights are on, both point A and point B have +12 V applied to them, and the circuit has zero voltage drop across it so it does not operate.

When the ignition is turned off, however, the oil-pressure switch shorts to ground, and if the headlights are on, they supply power to the oscillator and a warning sound is generated.

6.13 automobile burglar alarm

With car theft on the rise, a good burglar alarm can be a useful thing to have. In Fig. 6-13 is a circuit for a simple alarm that uses a single 555 in the astable mode.

The alarm is connected to the already existing door switches that turn the dome light on when the door is opened. When the key switch, which is located on the fender of the car, is on, and one of the car doors is opened, a triggering voltage is applied to the gate of the SCR. This turns the SCR on and causes it to latch. The SCR thus applies power to the astable circuit, which oscillates at a frequency of about 1.5 Hz.

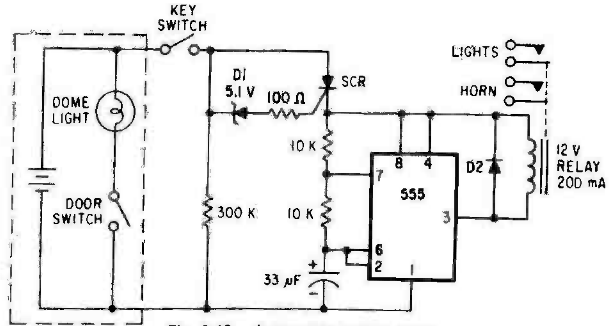


Fig. 6-13. Automobile burglar alarm.

The output of the oscillator drives a relay. Diode D2 is used to prevent the timer from latching on due to the back emf generated by the relay coil. If a double-pole relay is used, the circuit can turn both the horn and the headlights on and off. The horn blowing will surely scare away any potential thief, and the flashing headlights will indicate to passersby which car is being tampered with.

The SCR is used to latch the circuit on so that, even if the thief closes the car door right away, the alarm will stay on until it is shut off with the key switch.

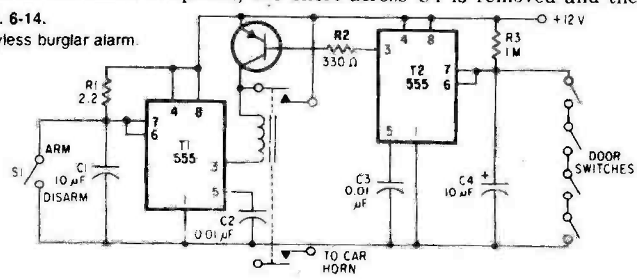
6.14 keyless burglar alarm

A big disadvantage of the alarm in the previous section is that it requires that a key switch be mounted outside of the protected area, generally on the fender of the car. But by adding another timer, or using a dual timer such as the 556, an alarm circuit can be built that can be armed with a hidden switch that is located somewhere inside the car.

What makes this possible is the second timer, which introduces a time delay before it arms the alarm. As long as you leave the car and close the door before this delay period expires, you'll have no problems.

This circuit (Fig. 6-14) requires that special switches be installed at each door, because it cannot use the existing one. All of the switches must be connected in series and are all normally closed when the doors are shut. The door switches short out the timing capacitor of T2. When one of the doors is opened, the short across C4 is removed and the

Fig. 6-14.
Keyless burglar alarm.



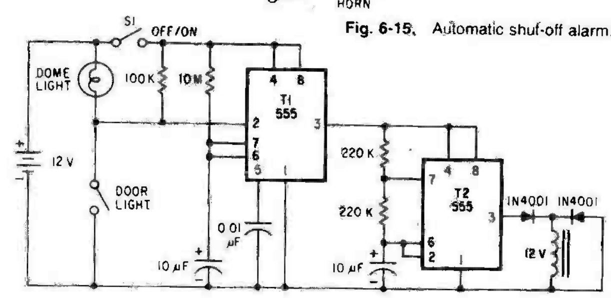


Fig. 6-15. Automatic shut-off alarm.

capacitor starts to charge up. This will take about 11 sec with the components shown. After 11 sec, the output voltage on pin 3 of T2 drops, and causes the transistor to turn on.

If the voltage at the output pin of T1 is low, the relay, driven by the transistor, will close. This does two things. It closes the contacts that are used to operate the car's horn and it also latches the relay on via a second set of contacts. Thus, the relay will remain on, and the horn will sound, as long as the output of T1 is low.

S1, the hidden switch, is used to arm and disarm the alarm and can be hidden somewhere inside the car. When S1 is closed, timing capacitor C2 is shorted and the voltage at the output of T1 is almost at 12 V. Thus, the relay will not close when S1 is in this position. And if the alarm has been triggered, it may be silenced by closing S1.

To set the alarm, S1 is opened. You then have 25 (t = R1C1) sec to close all of the doors before the horn will sound. On returning to the car, you will have 11 sec (t = R3C4) to disarm the unit before the alarm sounds.

6.15 automatic shut-off alarm

A nice feature that neither the two previous alarm circuits has is automatic shutoff. This alarm (Fig. 6-15) uses two timers. T1 is set up as a monostable, which once triggered provides power to T2 for almost 2 min. T2 is set up as an astable that turns the relay on for 3 sec and off for 1, as long as it gets power from the monostable. After the monostable pulse ends, the alarm shuts off and is ready to be triggered again.

A big advantage of this circuit is that it uses existing door switches. And a key switch isn't absolutely necessary, although it does improve security. Here's how it works. S1 is the arming switch; it can be a key switch or simply hidden somewhere externally on the car. Once the alarm is triggered, it can only be shut off by opening S1. To turn the alarm circuit on, you get out of the car and lock all of the doors. Then turn on S1. Anyone who now opens a door will trigger the alarm, which will stay on for only 2 min unless the door remains open. In that case, the alarm continues to blow the car horn until 2 min after the door is shut or until S1 is opened.

6.16 engine immobilizer

An alarm alone is not sufficient protection from auto theft, especially if an experienced thief is involved. Generally, it's a good idea to have other obstacles in the way of the potential thief. One that is quite effective is an engine immobilizer.

Some immobilizers simply consist of a single-pole, single-throw (SPST) switch that is connected in parallel across the points in the distributor. When the switch is hidden, it does a fair job of making things difficult for a thief. But even they have discovered how to quickly recognize a switch of this type and can disconnect it in a matter of seconds.

But if the idea of an immobilizing switch is combined with a 555 timer, a good antitheft device can result. In Fig. 6-16 is the circuit of just such a device. The 555 is operated in its monostable mode, as a power-up monostable. That means it prevents power from being applied to the load until a certain time period (t = 1.1R1C1) has elapsed.

For our immobilizer, the monostable is connected to the 12-V supply via an arming switch, and the ignition switch. If the arming switch is closed and the ignition is turned on, current will flow to the monostable. The instant the timing capacitor starts to charge up, the output of the 555 goes high. Since the relay, which is connected to the timer's high output, is also connected to the positive 12-V supply, there is no voltage drop across the relay and it remains inactivated. Thus, the relay contacts remain open and the engine can be started.

The output of the timer remains high for 30 sec and therefore the car can be started and will run fine, but for only 30 sec. At that point,

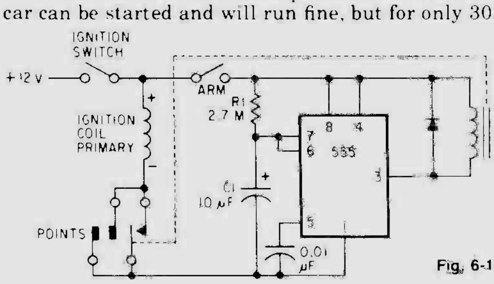


Fig. 6-16 Engine immobilizer

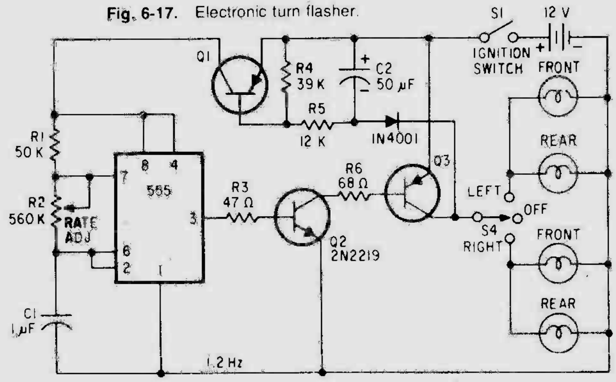
the output of the timer will go low again and the relay will turn on, shorting out the points and cutting off the ignition circuit.

If the car is restarted, it will again run for 30 sec and stop. After two or three tries, any thief will abandon this troublesome car for one that is easier to move.

6.17 electronic turn flasher

An all-electronic alternative to the conventional turn-signal flasher is shown in Fig. 6-17. It offers the advantage of having an adjustable flash rate via R2 and overall higher efficiency. The flashing

Fig. 6-17. Electronic turn flasher.



is produced by a 555 astable, but the most important part of the circuit is the circuitry that adapts the one-pole, three-position switch normally found in cars for operation with this circuit, which would ordinarily need a two-pole, three-position switch.

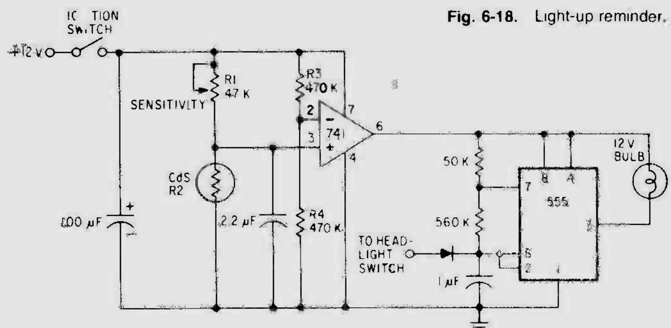
When the turn signal switch S2 is moved from the off position, it permits capacitor C2 to charge via the diode, and the base of transistor Q1 is held on via R5. This turns on Q1 and provides power to the astable. Q3 is prevented from discharging C2 by the diode.

As soon as the direction signal switch is returned to the normally off position, the bulbs stop flashing and shortly thereafter C3 becomes discharged and power is removed from the astable circuit.

6.18 light-up reminder

How often do you ride around in early evening and forget to turn your headlights on? If that happens to you, then this light-up reminder circuit is just what you need. By way of a flashing light in the car, it will tell you when the available light is low enough so that you should

Fig. 6-18. Light-up reminder.



switch on your headlights. And, if you replace the astable circuit with a monostable and a relay, you can even have it turn the lights on for you automatically.

The circuit in Fig. 6-18 uses an operational amplifier as a comparator in a bridge circuit. R1 and R2 comprise one side of the bridge, while R3 and R4 make up the other. The inverting input of the op-amp is held at half the supply voltage by the R3R4 voltage divider. The voltage at pin 3, the noninverting input, is determined by the R1R2 divider. When the cadmium sulfide (CdS) photocell is brightly lit, its resistance is low and the voltage on pin 3 of the op-amp remains below that of pin 2. Under these conditions, the output of the op-amp will be a voltage that is very close to zero.

When darkness falls, the resistance of the CdS cell increases, thus raising the voltage at the noninverting input. When the voltage reaches the point where it is greater than the voltage on pin 2, the op-amp rapidly amplifies that small positive difference and produces a signal at its output that is close to 12 V. This is the signal that turns the warning circuit on.

The 555 timer is connected to the output pin of the 741 op-amp so that when its output goes high it receives power to cause it to oscillate. The oscillator can be used to drive a warning bulb, flashing it on and off.

Once you turn the lights on, you don't want the flashing light to bother you any more. This problem can be solved in one of two ways. Either you can place the photocell in such a way that it will be able to detect the light produced by the headlights as well as the ambient, or you can sense the voltage that is applied to the headlights.

Sensing the voltage is really quite simple. All that is necessary is to connect a diode to the junction of pins 2 and 6 and the timing capacitor. The anode of the diode gets connected to the light switch, so that when voltage is applied to the headlights it is applied to the anode as well. What this does is to keep the timing capacitor constantly charged, and prevents the 555 from oscillating.

6.19 bad-light indicator

Many times you can drive your car without ever knowing that one or more of your lights isn't working. After all, who checks lights unless it's time to have the car inspected? Not many people, because it means you have to go in the car and turn the lights on then run around the car to make sure they're all working. And if you want to check your brake lights, you have to get another person to help you. One of you has to step on the brakes, while the other checks to see if the lights are on.

Well, checking your car lights can now be as simple as turning a knob. With the circuit in Fig. 6-19, all you have to do to check out all the lights on the car is to sit in the driver's seat and select the proper photocell to connect into the circuit.

In this case, the 555 is being used as a comparator. The photocell array and R1 and R2 compose a voltage divider. If a light is good, it illuminates one of the photocells and the resistance of that cell will drop. This will cause the voltage applied to pins 2 and 6 to rise. R2 is adjusted so that the voltage rise is above $2/3 V_{cc}$. When that condition is met, the output of the 555 goes low and the voltage drop across the LED is close to zero. The LED doesn't light.

When a lamp is bad, the resistance of the photocell will be high. This causes the voltage at pins 2 and 6 to drop below $1/3 V_{cc}$ and the output of the timer goes high, turning on the LED.

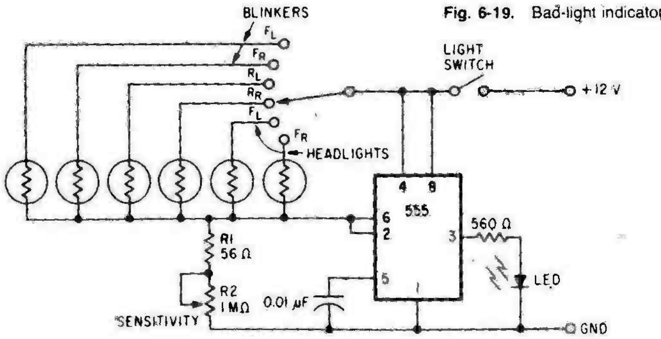


Fig. 6-19. Bad-light indicator

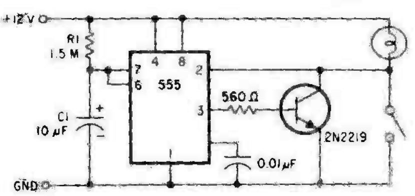


Fig. 6-20. Dome-light delay

6.20 dome-light delay

By configuring a monostable multivibrator so that it drives the line it senses, you can make a little device that will come in very handy: a delayed-extinguish dome light. This will be useful when you enter your car at night and have to fumble around until you find the ignition keyhole.

The circuit in Fig. 6-20 will keep the dome light on for an additional 15 sec before it turns it off. The time delay is figured out just like it is for a conventional monostable. The output drives a transistor that is connected across the door switch of the car and also to the trigger input.

When the door is opened, the switch shorts to ground and turns the light on. At the same time, it applies a negative spike to the trigger input and starts the monostable cycle. The output of the monostable goes high and stays high for the period $t = R1C1$. The high output turns on the transistor, which keeps a short across the door switch and keeps the dome light on.

Reprinted from '110 IC Timer Projects For The Home Constructor' by Jules H. Gilder, published by Newnes Technical Books, Borough Greeen, Sevenoaks, Kent TN15 8PH at £3.95. **ETI**

PRIME COMPONENTS LOW PRICES

Also our micro chips are at micro prices. Don't be fooled by low prices. We do not offer for sale, surplus, sub-spec or rebranded devices. All our parts are guaranteed new, first quality, factory prime, full spec deviced. It is also our policy to offer you the best of new devices that become available and these are featured regularly. Prices are exclusive of p&p and VAT — please refer to "Ordering Information" before ordering. Official orders from Schools, Colleges, Universities and Gov. Authorities accepted.

DTL

930	55p
935	65p
937	55p
944	65p
946	55p
957	55p
962	55p
9099	90p

7400

7400	11p
7401	12p
7402	12p
7404	13p
7405	17p
7409	18p
7410	16p
7412	18p
7513	28p
7420	16p
7430	18p
7432	25p
7440	16p
7442	68p
7448	75p
7473	32p
7474	32p
7475	40p
7476	40p
7490	35p
7492	50p
7493	50p
7496	45p
74121	35p
74123	45p
74154	90p
74157	55p
74122	45p
74125	50p
74195	100p
74196	100p
74283	140p
74290	120p
74365	90p
74366	90p

74LS

74LS00	18p
74LS01	12p
74LS04	15p
74LS08	20p
74LS10	19p
74LS11	30p
74LS12	30p
74LS14	60p
74LS15	38p
74LS20	19p
74LS30	19p
74LS32	25p
74LS40	26p
74LS42	56p
74LS47	78p
74LS48	85p
74LS49	99p
74LS73	30p
74LS74	30p
74LS75	39p
74LS86	39p
74LS90	40p
74LS107	40p
74LS123	69p
74LS125	50p
74LS132	79p
74LS138	69p
74LS151	75p
74LS153	75p
74LS155	65p
74LS161	78p
74LS163	90p
74LS164	90p
74LS168	190p
74LS174	99p
74LS175	99p
74LS195	87p
74LS221	110p
74LS244	375p
74LS245	325p
74LS251	120p
74LS257	110p
75LS290	95p
74LS293	120p
74LS366	57p
74LS373	170p
74LS374	170p
74LS375	140p
74LS377	188p
74LS393	135p
74LS490	140p
74LS670	260p

CMOS

4001	19p
4002	19p
4006	75p
4007	19p
4008	80p
4009	35p
4010	45p
4011	24p
4012	24p
4013	38p
4014	70p
4015	75p
4016	35p
4017	75p
4018	76p
4019	42p
4020	88p
4021	100p
4022	88p
4023	22p
4024	50p
4025	20p
4026	130p
4027	45p
4028	75p
4029	80p
4030	50p
4031	195p
4033	145p
4035	104p
4036	290p
4037	105p
4038	110p
4039	290p
4040	99p
4041	75p
4042	73p
4043	86p
4044	88p
4045	160p
4047	99p
4048	56p
4049	38p
4050	40p
4051	69p
4052	75p
4053	73p
4054	111p
4055	121p
4056	121p
4059	560p
4060	112p
4063	112p
4066	56p
4067	422p
4068	19p
4069	19p
4070	28p
4071	25p
4072	25p
4073	25p
4075	20p
4076	88p
4077	23p
4078	29p
4081	23p
4082	25p
4085	86p
4086	68p
4089	130p
4093	68p
4094	225p
4095	99p
4096	325p
4098	110p
4099	180p
4501	25p
4502	112p
4503	68p
4507	52p
4508	288p
4510	76p
4511	125p
4512	75p
4514	250p
4515	290p
4516	109p
4518	99p
4520	99p
4521	230p
4526	105p
4527	130p
4528	99p
4529	140p
4531	150p
4532	125p
4538	150p
4543	160p
4556	70p
4560	225p
4569	240p
4572	46p
4584	79p
4585	125p

74C

74C20	30p
74C76	60p
74C85	145p
74C97	125p
74C98	125p
74C107	100p
74C160	110p
74C161	145p
74C162	145p
74C163	145p
74C192	175p
74C193	175p
74C194	175p
74C195	175p
74C903	45p

MEMORIES

2114 450NS	250p
2114 300NS	275p
4116 200NS	300p
4116 150NS	395p
4315 (4K x 1) CMOS 450NS	995p
6514 4K (1K x 4) CMOS 450NS	795p

EPROMS

1702A	450p
2708 450 NS	425p
2716 5V 450 NS	1095p
2532 32K 450 NS	£39.95

UARTS

AY-5-1013A	298p
AY-3-1015D	350p
IM6402	350p

CHARACTER GENERATOR

RO-3-2513 UC	450p

KEYBOARD ENCODER

AY-5-2376	795p

FLOPPY DISK CONTROLLERS

FD1771 B-01 Single density IBM Compatible	£29.95
FD1791 B-01 Dual density IBM Compatible	£59.95

CPU'S

6502	795p
6504	795p
6505	795p
6800	695p
6802	995p
8080A	525p
8085A	1095p
Z80	795p
Z80A	995p
Z8001	12500p
Z8002	9500p
WD9000B	19900p
28000D4	£10.99

SUPPORT DEVICES

6520	495p
6522	795p
6532	895p
6551	1095p
6810	375p
6820	425p
6821	425p
6850	425p
6852	425p
8212	395p
8214	450p
8216	395p
8224	395p
8228	395p
8251	495p
8253	1125p
8255	495p
8257	1050p
8259	1325p
MC14412VL	797p
Z80 PIO	595p
Z80 CTC	595p
Z80A PIO	695p
Z80A CTC	695p
Z80 DMA	1995p
Z80A DMA	2495p
Z80 SIO/0	2995p
Z80A SIO/0	3495p
Z80 SIO/1	2995p
Z80A SIO/1	3495p
Z80 SIO/2	2995p
Z80A SIO/2	3495p

SHIFT REGISTERS

3341 PCFIFO 700KHZ	495p
3341 APC FIFO 1MHZ	550p
3342 PC 64 bit shift register	495p
3347 PC 80 bit shift register	495p

DIL SWITCHES

4 pole	99p
6 pole	115p
8 pole	140p

VOLTAGE REGULATORS

7805/7812	55p
7905/7912	65p
78H05SC	575p
78HGKC	625p

LINEAR IC's

AY-3-1350	795p
AY-3-8910	825p
709	30p
723	33p
741	18p
ICL7106	595p
ICL7107	695p
ICL8038	295p
ICM7216A	1875p
ICM7216B	1675p
ICM7555	80p
LM301AN	30p
LM311	50p
LM318	75p
LM324	45p
LM339	45p
LM380	65p
LM1496	65p
LM1871	550p
LM1872	550p
LM3900	50p
LM3914	225p
LM3915	225p
LM13600	125p
NE555	18p
NE556	50p
RC4136	85p
SN76477N	175p
TBA8100AS	85p
TL071	55p
TL074	130p
TL082	75p
TL084	110p
TL490	175p
XR2206	325p
XR2207	375p

INTERFACE LINEAR

DM8123	125p
75150	125p
75154	125p
75182	195p
75322	250p
75324	325p
75325	325p
75361	350p
75365	295p
75451	50p
75491/2	75p
8T26	175p
8T28	175p
8T95	175p
8T97	175p
LEDs	
TIL209	9p
TIL211	13p
TIL212	15p
TIL220	12p
TIL222	15p
TIL224	18p
DISPLAYS	
FND500	80p
FND510	80p
FND567	125p
DL704	85p
DL707	85p
MV57164	225p
ISOLATORS	
ILD74	120p
ILQ74	325p
MCT6	90p
TIL111	75p

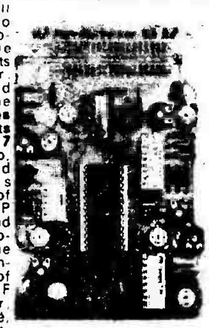
INTERSIL CHIPS ARE DOWN

Due to bulk purchase we are able to offer unbeatable prices on INTERSIL CHIPS. Compare our prices below distributors!

ICL7106CPL	595p
ICL7107CPL	695p
ICL8038CCPD	295p
ICM7216AIJI	1875p
ICM7216BIPI	1675p
ICM7555IPA	80p

SE 01 Sound Effects Kit

NEW

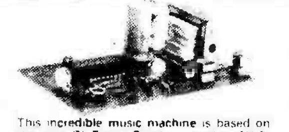


The SE-01 is a complete kit that contains all the parts to build a programmable sound effects generator. Designed around the new **Texas Instruments SN76477** Sound Chip, the board provides banks of MINI DIP switches and pots to program the various combinations of the SLF Oscillator, VCO, Noise, One Shot, and Envelope Controls. A Quad Op Amp IC is used to implement an Adjustable Pulse Generator, Level Comparator and Multiplex Oscillator for even more versatility. The 3¼" x 3" PC Board features a prototype area to allow for user added circuitry. Easily programmed to duplicate **Explosion, Phaser Guns, Steam Trains,** or almost an infinite number of **other sounds.** The unit has a multiple of applications. The low price includes all parts, assembly manual, programming charts, and detailed 76477 chip specifications. It runs on a 9V battery (not included). On board 100MW amp will drive a small speaker directly, or the unit can be connected to your stereo with incredible results! (Speaker not included.)

COMPLETE KIT ONLY £14.99
P&P 67p + VAT

UNIVERSAL SCR

C106D 400V/5A Sale **30p**



This incredible music machine is based on the new GI Tunes Synthesizer chip AY-3-1350 which has a set of 25 different popular and classical tunes. In addition there are three different chimes. Use it for a musical door bell (up to 4 doors), mobile horn, toy or music box. Super easy to build. Tunes include STAR WARS, BEETHOVEN'S 5th and 9th, JINGLE BELLS, YANKEE DOODLE, CLEMENTINE, GOD SAVE THE QUEEN, WESTMINSTER CHIME and DESCENDING OCTAVE CHIMES plus many more. Envelope control gives piano or organ quality and there is facility for playing all the tunes in a Sequence! Works from 12V AC or DC or from mains via 240V transformer (not supplied).

LED BAR GRAPH AND ANALOG METER DRIVER

New from National LM3914. Drives 10 LED directly for making bar graphs, audio power meters, analog meters. LED Oscillators, etc. Units can be stacked for more LEDs. A super versatile and truly remarkable IC.
Special price: Only **£2.25**
12 page data 25p
Matching red bar display MV57164 **£2.25**
Data 25p

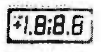
LOW PROFILE SOCKETS BY TEXAS

SALE

8 pin	7p	18 pin	15p	24 pin	22p
14 pin	9p	20 pin	18p	28 pin	25p
16 pin	10p	22 pin	20p	40 pin	28p

LIQUID CRYSTAL DISPLAY

- **High Contrast Ratio**
- **Wide Viewing Angle**
- **0.5 in. Digit Height**
- **ULTRA Low Power Consumption**



LCD106 .... £6.45

4K CMOS (1K x 4) 450NS
ONLY £7.95

FEATURES

- ★ Low Power Dissipation
- ● 10pW/BIT (TYP.) @ 3.0V (STANDBY)
- ● 10W/BIT (TYP.) @ 5.0V (OPERATING)
- ★ Data Retention Voltage 2V to 5.5V
- ★ Single 5V Power Supply
- ★ 18 PIN Plastic Package
- ★ Full Static Operation
- ★ Three State Output
- ★ Input/Output TTL Compatible
- ★ Fast Access Time 450NS

From Toshiba. The TC5514P (industry type 6514) is a full static read write memory organised as 1024 words by 4 bits using CMOS technology. Because of ultra low power dissipation, the TC5514P can be used as battery operated portable memory system and as a nonvolatile memory with battery back up. The TC5514P operates from a single 5V power supply with a static operation, so that the no refresh periods are required. This simplifies the power supply circuit design.

The three state outputs simplify the memory expansion making the TC5514P suitable for use in a microprocessor peripheral memory. Since the minimum data retention voltage is 2V, the battery back-up system needs only simple circuit. By using Toshiba's original C2MOS technology the device circuitry is not only simplified but wide operating margin and noise margin are also realised.

The TC5514P is moulded is a dual-in-line 18-pin plastic package 0.3 inch in width.

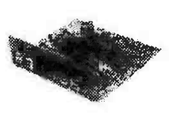
X-RATED CLOCK!

NEW

ZULU II CLOCK KIT

WITH CALENDAR AND NOXtm CIRCUIT

ONLY **£19.99**
Custom high impact moulded case with ruby lens, **£4.99**
P&P 82p + VAT



X-TRA VALUE: All the components and high quality plated G-10 PC Boards are provided.
X-TRA CARE IN DESIGN: No wires between readout board and clock board. Large open layout.
X-CELLENCE IN IDEAS: 5 years of designed products for the amateur radio market.
X-CELLENCE IN INSTRUCTIONS: Clear step-by-step instructions with quality illustrations. The assembly manual is not a read-between-the-lines afterthought!
X-TRA FEATURES: There has never been a clock kit with so many features — at any price!

- Unit operates on either **12 VAC** or **12 VDC.**
- On board **QUARTZ XTAL TIMEBASE.**
- Automatic **BATTERY BACKUP*.** Never worry about power failures again!
- Reads true **24 HOUR TIME** and **31 DAY CALENDAR.**
- Unique **NOXtm CIRCUIT** activates readouts with a handclap or they can be turned on constantly.
- When used mobile readouts blank iginition is off.
- Special **NOISE SUPPRESSION** and battery reversal circuits.
- Bright ½" LED's show hours, minute and seconds.

Just clap your hands and the time appears for 5 seconds followed by the date for 4 seconds. A low cost 9V transistor battery provides stand by power in the event of power failures up to 4 hours. With the addition of a low cost 12V 300 MA transformer, the unit will work on AC.

ULTRASONIC SENDER RECEIVER KIT

NEW

TOTAL SECURITY! Completely invisible ultrasonic (23KHZ) Sound beam works like a photoelectric beam but is unaffected by light, heat or noise. Separate Transmitter and Receiver can be used from 6 inches to 25 feet! A solid object breaking the beam causes an output to go low that will sink up to 150 MA to Drive a Relay, TRIAC, etc. Complete electronics are provided. Works on 12VDC (unregulated) and draws less than 100 MA. Use it for **burglar alarms, object counters, automatic door openers, automatic door bells, electronic rat trap(?) and more.**

ONLY £19.93 P&P 67p + VAT

WARBLE ALARM KIT

NEW

A fun EASY kit to assemble that emits an ear piercing 10 watt dual tone scream. Resembles European siren sound. Great for alarms or toys. Operates from 5-12VDC at up to 1 amp (using 12VDC ● 8 ohm speaker). Over five thousand have been sold. All parts including PC board, less speaker. **ONLY £4.99** P&P 67p + VAT

AY3-8910 PROGRAMMABLE SOUND GENERATOR
The AY3-8910 is a 40 pin LSI chip with three oscillators, three amplitude controls, programmable noise generator, three mixers, an envelope generator, and three D/A converters that are controlled by 8 BIT WORDS. No external pots or caps required. This chip hooked to an 8 bit microprocessor chip or Buss (8080, Z80, 6800 etc.) can be software controlled to produce almost any sound, it will play three note chords, make bangs, whistles, sirens, gunshots, explosions, bleets, whines, or grunts. In addition, it has provisions to control its own memory chips with two IO ports. The chip requires +5V @ 75ma and a standard TTL clock oscillator. A truly incredible circuit. Only **£8.25.**
60 page manual with S-100 interface instructions and several programming examples **£2.25 extra** (No VAT).

LM1871 RC ENCODER/TRANSMITTER
LM1872 RC RECEIVER/DECODER

NEW

New from National. The LM1871 is a complete six-channel digital proportional encoder and RF transmitter intended for use as a low power, non-voice unlicensed communication device at carrier frequencies of 27 MHz or 49 MHz with a field strength of 10,000 uV/meter at 3 meters. In addition to radio controlled hobby toy and industrial applications, the encoder section can provide a serial input of six words for hard wired, infra-red or fibre optic communication links. Channel add logic is provided to control the number of encoded channels from three to six, allowing increased design flexibility. When used with the LM1872 RC receiver/decoder, a low cost RF linked encoder and decoder system provides two analog and two ON/OFF decoded channels. Super versatile chip. Just out. Just look at the features — low current 9V battery operation — on-chip RF oscillator/transmitter — one timing capacitor for six proportional channels — programmable number of channels — regulated RF output power — external modulator bandwidth control — on-chip 4.6V regulator — up to 80 MHz carrier frequency operation.
LM1871 £5.50 LM1872 £5.50 Pair £10.50.
Data sheets 25p each.

Intersil 8 Digit - 10 MegaHertz Universal Counter Kt

Kit Includes:

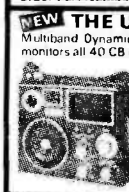
- **ICM7226AIDC IC**
- **10 MHz Quartz Crystal**
- **(8) 7 Segment .3" LED Displays**
- **PC Board**
- **Resistors**
- **Capacitors**
- **Diodes**
- **Switches**
- **IC Socket**

Order Part Number ICM7226AEV/Kit ..... Only £49.95

THE ULTIMATE RECEIVER

NEW

Multiband Dynamic Sound Portable Radio. It's a monitor too — monitors all 40 CB channels, TV (VHF), PB, and WB.



MODEL 724C. ONLY £39.95 p.p. £4.95
8-Vand Receiver
STAR FEATURES: AM - CB1 - CB2 - TV1 - FM - PB - WB - TVs. Swivel Telescopic Antenna. Tuning & Battery Indicator. AC/DC Switch Control DC: 6V UM-1 (Size D) x 4. AC. 220V. AFC Switch Control. Tone Control. Nylon Shoulder Strap or Plastic Handle. 4" PM Dynamic Speaker. Dimensions. W 230 x H 22 x D 90mm.

NEW TUNES SYNTHESIZER

The AY3-1350 is a MOS microcomputer synthesizer of preprogrammed tunes for applications in toys, music boxes and door chimes. The standard device has a set of 25 different popular and classical tunes. In addition there are 3 chimes making a total of 25 tunes.

FEATURES

- ★ Minimal external componets.
- ★ Automatic switch-off signal at end of tune for power saving.
- ★ Envelope control to give organ or piano quality.
- ★ Sequential tune mode.
- ★ 4 door capability when used as door chime.
- ★ Operation with tunes in external PROM if required (2708).
- ★ Single supply (+5V) operation.
- ★ Tunes include: STAR WARS, BEETHOVEN'S 9th & 5th, JINGLE BELLS, YANKEE DOODLE, STAR SPANGLED BANNER, CLEMENTINE, GOD SAVE THE QUEEN, O SOLE MIO, WESTMINSTER CHIME and DESCENDING OCTAVE CHIME PLUS MANY MORE! with detailed specs. and instructions

£7.95

JAPANESE TRANSISTOR SUBSTITUTION MANUAL

An invaluable Japanese to Japanese substitution guide for approximately 3,000 transistors.

- Covers the 2SA, 2SB, 2SC and 2SD series
- Introduction includes a guide to understanding Japanese transistors

Only £3.95

JAPANESE TRANSISTOR SPECIFICATION MANUAL

This fantastic new specification manual covers.

- Specs on VCBO, VEBO, IC, TJ, ICBO, HFE and more!
- Includes mechanical drawings that illustrate case styles and sizing of each transistor

Only £4.90

PROGRAMMABLE DUAL OP TRANSCONDUCTANCE AMPLIFIER

NEW

New from National Semiconductor, the LM13600 is a programmable dual operation transconductance amplifier designed to be used as a fundamental building block in current controlled amplifiers, filters and oscillators. It can also be used in multiplexers, timers and even sample and hold circuits. It is well suited for use in electronic organs and music synthesizers, because it can modulate waveshapes with ease. The 16 pin LM13600 is programmable over six decades, allowing it to function as a basic building block in a broad range of electronically programmable resistors and filters. A truly remarkable circuit. **ONLY £1.25** + VAT. Data 25p.

From T.I.: **TL490 BAR/DOT DRIVER IC.** Drives 10 LEDs with adjustable analog steps. Units are cascadable up to 10 (100 steps). Drives LEDs directly. Great for **voltage, current** or **audio displays.** Similar in features to LM3914 with specs and circuit notes.

ONLY £1.75

NEW!

Matching red bar display MV57164 **£2.25**
Data 25p

Ordering information. Unless otherwise stated, for orders under £50 add 50p p&p. Add 15% VAT to total. All items are subject to prior sale and therefore subject to availability. Prices are subject to change without notice.

Micro Circuits
4 Meeting Street, Appledore, Nr. Bideford, North Devon EX39 1RY.
Tel. Bideford (02372) 79507.
Telex: 8953084

EMP (ELECTROMAGNETIC PULSE)

Nuclear war has never been a more real threat to humanity. Should the inconceivable occur — and an exchange take place — how well prepared are we in Britain to survive? This disturbing article from Graham Packer points out what appears to be a major weakness in Britain's defensive thinking.

Relations between the super-powers are deteriorating rapidly and with the ever growing 'nuclear club' of nations the possibility of such weapons being used in anger in the not too distant future is very real indeed.

It would appear that one major effect of such use is largely unknown by the general public and is, to say the least, being dealt with too lightly by the authorities. It is an effect that has catastrophic consequences for solid state communications and computing equipment and which could reveal any well laid plans to cope with "the Bomb" to be futile and mis-guided.

I, the author, am a freelance writer, principly upon the topics of communications and amateur radio. All the information has been gleaned from normal technical publications and text books and can be freely obtained by any member of the public who cares to look.

Besides the well publicised phenomena associated with the detonation of a nuclear device (i.e. blast, heat and light) there is the ELECTROMAGNETIC PULSE (EMP) to contend with. Since the first weapon trials in 1945 the 'radio flash', as it was then known, has been obseved and documented. Only in recent years, however, have the full implications of the EMP become apparent. Damage to most radio, landline and computer equipment, up to a maximum range of 2500 k, from ground zero (the point of detonation), is not just possible, but *probable*.

Mechanisms That Produce EMP

There are three situations where an EMP can occur at high enough strengths (See Fig. 1.) to be deadly to electronic communications.

1. A WEAPON BURST AT GROUND LEVEL OR BELOW 100 m ABOVE GROUND LEVEL.
2. A VERY HIGH AIR-BURST AT THE TOP OF THE ATMOSPHERE.
3. AN EXO-ATMOSPHERIC BURST

In cases 1 & 2 the EMP appears to be caused by Compton electrons, produced by the initial, high energy, gamma flux radiating from the point of detonation. These cause a vast outward current flow — the pulse of energy known as EMP.

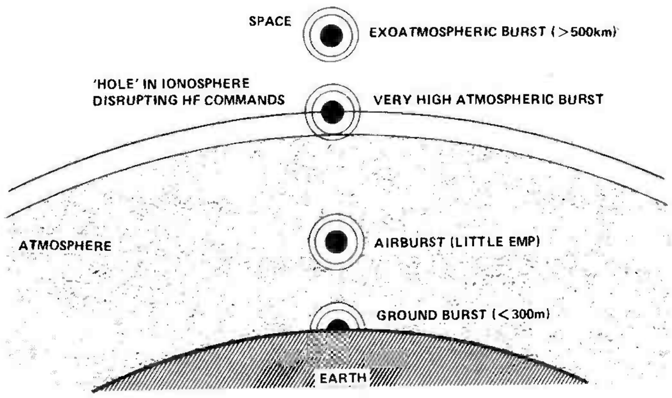


Fig. 1. The different methods of detonation of a nuclear device. Note that an airburst will maximise damage to surrounding environments physically but minimize EMP.

In the case of a ground burst an assymetric condition exists and the energy is radiated upwards in electromagnetic form, away from the ground.

If a very high air burst occurs the reverse happens (as there are electrons to be excited only in the atmosphere and not in space). In this case the electromagnetic energy is radiated downwards in a particularly crippling manner.

If the weapon is 'air-burst' however, (between 10 m & 10 km say) the outward current flow is symetrical and almost self cancelling. Fortunately, from an EMP point of view anyway, air bursts are the most efficient militarily, maximising heat and blast, and would probably consitute the majority of strikes in a major nuclear exchange.

An exo-atmospheric blast at, say, 1000 km altitude is the 'worst case'. With no absorbitive medium surrounding the device, the energy from the weapon, mainly in the form of gamma and X-rays, reaches the upper atmosphere over a wide area simultaneously. Interaction with the electrons there causes a vast pulse of energy to be radiated downward over a huge area. EMP with a vengeance.

Effects Of The EMP

Neither the 1950 or 1957 issues of 'Effects of Nuclear Weapons' contain any reference to EMP. It is first mentioned in 1962 where a fairly brief description mentions that EMP is "of considerable interest". The 'interest' shown was in the results of the Johnstone Island exo-atmospheric test in 1958. This test produced failures to street lighting systems (presumable fed via overhead wiring) in Hawaii *1000 km away.*

Unfortunately as the intensity of the effect was unexpected, no meaningfull measurements of field strength were made.

Further tests were carried out and Fig.2 shows the field strengths to be expected from a one Megaton ground burst weapon, at various distances from ground zero.

Detonating that same weapon as an exo-atmospheric burst produces several thousand volts per metre over an area limited only by the curvature of the Earth! Figure 3 shows the areas in Europe that such a blast over the North Sea would encompass - producing widespread disruption to Europe's communications.

Whilst not violating any particular country's territorial integrity, (there being no blast or fall out associated with an exo-atmospheric blast) such a strike could well be a final 'sabre-rattling' excercise prior to commencement of more direct hostilities.

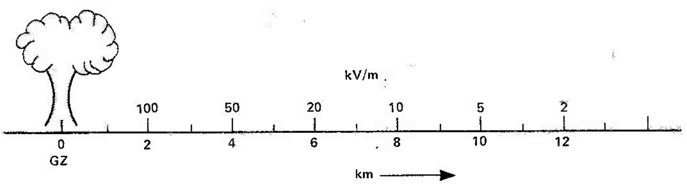


Fig. 2. The field strengths produced by detonating a one Megaton bomb. Remember too that a 20 Megaton warhead is very commonplace today — and to be expected in combat.

Of course Europe is not the only place that such a burst could be used and perusal of an atlas shows that there are other 'theatres' where an EMP could be generated such that 'innocent' countries (including perhaps the UK) would be subjected to its effect.

Rise Time

Figure 4 compares EMP to lightning. By comparison lightning can be seen as a very sluggish phenomena indeed! Rise times of 20 ns (20×10^{-9} seconds) have been reported, resulting in considerable energy up to several hundred of MHz. Radio amateurs and home computing enthusiasts need no reminding of the effects of large field strengths on their beloved electronics.

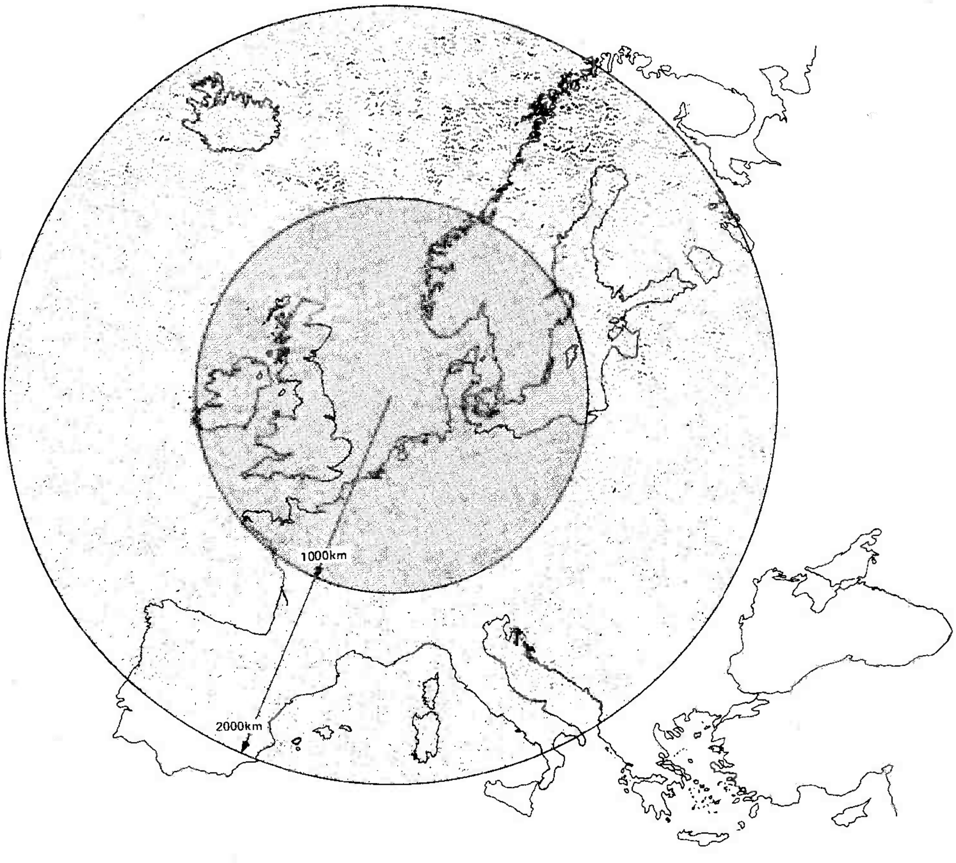


Fig. 3. A sketch of the European theatre, showing the level of effect from a one Megaton detonation over the North Sea. Such a blast does not actually infringe any single country's border intgegrity but affects all those shown.

The inner circle represents the radius of expected serg damage to equipment and the second circle is that within which some detrimental effect is to be expected.

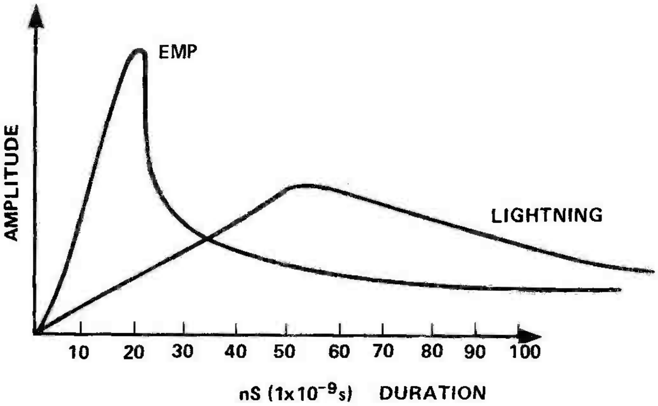


Fig. 4. Comparative rise-times of an EMP from a 1 Mt. bomb and an average lightning flash. Note that the EMP is many times faster.

Not for nothing do modern military receivers have POWER transistors and 2 W of local oscillator power present in the front ends! Don't entirely beleive the sales talk about "large signal handling characteristics" that's just a spin off!

The interest shown in professional computer circles in 'line conditioners', 'transorbs' and RFI sheilding has its roots in the military's requirements for protecting their data processing hardware.

EMP Collectors

HF aerials are of course text-book EMP 'collectors' and the increased use of broadband mixers and power output stages place this equipment especially at the risk from EMP.

However VALVE equipment is substantially immune to EMP — or can at least withstand levels of field strength orders of magnitude greater than solid state — rumour has it there could still be a place for '19' sets in World War III! (Russian and Warsaw Pact forces still employ valve equipment in quantity.)

Telephone lines, extending overhead for serveral kilometers at a time, are extremely vulnerable. They are being increasingly terminated in electronic exchanges, or transistor amplifiers WHICH ARE NOT EXPECTED to survive an EMP. Exit telephone communication.

Overhead power-lines are likewise excellent aerials and although the transient nature of EMP is unlikely to damage motors, tungsten lamps etc. etc, many pieces of electronic equipment, domestic, amateur and professional will be destroyed.

Table 1 gives items that are expected to survive or succumb to an EMP attack and should be carefully studied for the implicit effect upon Civil Defence communication after nuclear attack.

TABLE 1

EQUIPMENT NOT EXPECTED TO SURVIVE EMP ATTACK

1. Fluorescent lights.
2. HF transistor transmitters and receivers, especially broadband.
3. VHF mobile equipment with long whip aerials.
4. VHF broadcast-band recievers with aerials extended.
5. All landline communications, especially electronic telephone exchanges.
6. Land "repeaters", which account for 90% of radio communication.

RELATIVELY IMMUNE EQUIPMENT

1. Tungsten lamps (or other filament).
2. Valve transmitters and receivers.
3. Electronic motors (NOT solid-state speed control)
4. Medium Wave portable with ferrite rod aerials.
5. SHF link equipment, AS LONG AS the feeder or waveguide does not conduct EMP to other parts of the equipment.

Study the table above carefully. It has far reaching implications. Ask yourself if a stable society could be set up, given the destruction of all viable long distance communications as a starting point.

Radio Propagation

Little information seems to be available in the 'open' literature on radio propagation after a nuclear exchange. It is virtually certain that the ionosphere as we know it will be destroyed temporarily. The maximum usable frequency will probably be lowered dramatically (hence the vast low frequency, very low frequency and extremely low frequency military installations throughout the world) and it is assumed that most satellite communications will cease. This will come about either as a direct result of the nuclear exchange, the 'satellite - killing' capability of the super-powers, or the 'neutralisation' of the satellite ground stations.

Conversely highly ionised patches could well result in sporadic 'E' beyond the wildest dreams of 2 m DX enthusiasts.

Conclusions

From the preceding it may be seen that deliberate detonation of a nuclear weapon to maximise the EMP effect could and probably would occur in a future conflict. This could effect this country even if the U.K. was not directly involved in the conflict itself.

Some possible measures to counteract the effects of EMP are given in Table 2, although without concerted action at a high level, Britain will remain very vulnerable to this type of attack.

TABLE 2

1. Disconnect all electronic equipment from aerials and power sources during that period.
2. Use Radio equipment 'on sked' for the minimum possible time.
3. Use high 'Q' ATU on HF or 'cavity' on VHF to reduce acceptance bandwidth to a minimum.
4. Earth all screens, coax outers etc. Treat as for massive TVI case.
5. Solder reverse parallel diodes across receiver front ends as for normal burnout protection.
6. Keep a supply of spare vital components such as front end transistors, diodes etc. in a screened container.
7. Consider the use of VALVE radios!

DEATH BY NEGLECT?

It seems strange that such a potentially crippling product of nuclear warfare has received such little exposure to the public eye. Much has been made of late, by both press and TV, of the Soviet superiority in conventional, and indeed nuclear, materials and the effect upon this country of employing such forces against the West. It is to be hoped that such debate will bring with it much needed increases in the defence spending of this country.

Our Civil Defense programme could be well described as minimal, with little or no interest until recently in improving it. Compared to countries such as Sweden, Switzerland and - more significantly -the USSR, our efforts are nothing short of laughable.

Picture now some highly probable effects of an EMP upon our already pitiful survival resources. Telephone communications will be knocked out in most, if not all, parts of the country. Landline and repeater equipment used for the majority of communications in Britain, will be destroyed or rendered inoperative. All double frequency radio communication (i.e. anything using repeaters) will be impossible. All VHF broadcast receivers, with aerials extended, and mobile VHF equipment will have their front-ends severely damaged. HF transistor and receiver units will no longer operate, especially the widely used broadband radio and radar equipment.

In essence then, electronic communication in this country will *cease to exist* in its present form once a blast which produces a significant EMP has taken place. This is not a temporary blackout - as popular opinion supposes - *but a widespread and immediate destruction of equipment*, which will take extensive repairs to correct. Difficulties such as this would normally cause will be compounded many times in a shattered and disjointed community desperately struggling to regain some cohesion in the face of hideous adversity.

Result? Small isolated groups will be unable to communicate effectively with each other. People alone in their houses, following government instructions - such as contained in the "Protect and Survive" leaflet, will be completely cut-off unless they have a *medium wave* portable, which was not in use at the time of the attack. VHF receivers will be dead and in need of extensive repair.

We have been through the government literature covering nuclear warfare and its effects. There is no reference anywhere to EMP. It seems from this angle as though this is yet another case of "head-in-the-sand" defense. If so, then it is simply not good enough and it will cost lives we can ill afford.

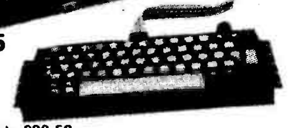
We have sent copies of this article to the Home Office, Ministry of Defense and even the Prime Minister's Office and await an answer to the vital questions posed herein. ETI will carry the full text of such a reply as soon as we receive it and a page is reserved in our next issue especially for this purpose. I have a cold certain feeling it will be blank.

Ron Harris
Editor

ETI

NASCOM-2 MICRO-COMPUTER

FREE 16k RAM Board
New improved RAM B

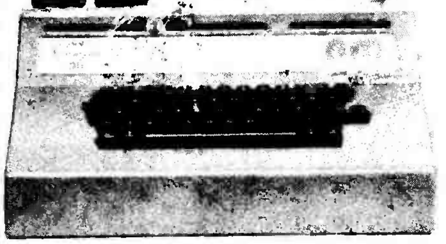


only **£335**
+ VAT
IMMEDIATE DELIVERY

Power supply £29.50
Z80A 8 bit. This will run at 4 Mhz but is selected between 2/4/Mhz.
On-board, addressable memory. 2K
2K Monitor — Nas-sys 1. 1K Video RAM (MK 4118). 1K work space/User RAM (MK 4118) (8K Microsoft Basic) (MK 3600 ROM) (8K Static RAM/2708E).

Microprocessors Z80A, 8 bit CPU. This will run at 4MHz but is selectable between 2/4 MHz. This CPU has now been generally accepted as the most powerful 8 bit processor on the market.
INTERFACE
Keyboard New expanded 57 key Licon solid state keyboard especially built for Nascom. Uses standard Nascom, monitor controlled, decoding.
T.V. The lv peak to peak signal can drive a monitor directly and is also fed to the on-board modulator to drive the domestic T.V.
I.O. On-board UART (Int. 6402) which provides serial handling for the on-board cassette interface or the RS232/20mA teletype interface.
The cassette interface is Kansas City standard at either 300 or 1200 baud. There is a link option on the NASCOM-2 for 2400 Baud.
The RS232 and 20mA loop connector will interface directly into any standard teletype.
The input and output sides of the UART are independently switchable between any of the options — i.e. it is possible to have input on the cassette and output on the printer.
PIO There is also a totally uncommitted Parallel I/O (MK 3881) giving 16, programmable, I/O lines. These are addressable as 2 × 8 bit ports with complete handshake controls.
Documentation Full construction article is provided for those who buy a kit and an extensive software manual is provided for the monitor and Basic.
Basic The Nascom 2 contains a full 8K Microsoft Basic in one Rom chip with additional features like DEEK, DOKE, SET-RESET for simple programming.

SYSTEM 80 KITS from £225



Microprocessor board* (Nascom 2)
4MHz Z80 CPU; TV or Video + 1200 baud Kansas City + Serial RS 232 printer Interfaces; Keyboard; 128 character ASCII plus 128 Graphics in 2 × 2K ROM; free 16-way parallel port; 8k BASIC; NAS SYS operating monitor. £280 built and tested.

Firmware & MOS ICs
Zeap Assembler (4, 1K×8 EPROMS) £50
Nas Pen text editor (2, 1K×8 EPROMS) £30

Floppy disc system
Double sided, double density 5¼in disc giving 280K bytes formatted, including controller board/PSU/Housing and interconnects. £480. Controller board £127.50. Second Disc £240. CP/M £80.

System 80 housing
High strength GRP moulding
Accepts 12×8 Nascom 2 CPU board, four 8×8 expansion boards. £85 incl. frame racking, interconnects and motherboard.

Expansion Boards* (in kit form)
16K RAM £127.50 ● 32K RAM £175
48K RAM £220
High Resolution Programmable Graphics £90
Colour Board Kit £140
High Resolution Colour add on £37.50

All prices subject to VAT (add 15%)

No more slaving over a hot soldering iron. The Nascom 1 is now supplied BUILT!
Britain's biggest small system is available fully constructed for you to slot into your own housing for the ridiculously low price of £140 plus VAT (kit price still only £125 plus VAT).

nascom-1

12" × 8" PCB carrying 5LSI MOS packages, 16 1K MOS memory packages and 33 TTL packages.
There is on-board interface for UHF or unmodulated video and cassette or teletype.
The 4K memory block is assigned to the operating system, video display and Eprom option socket, leaving a 1K user RAM.
The MPU is the standard Z80 which is capable of executing 158 instructions including all 8080 code.

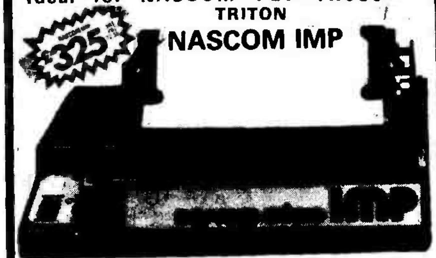
NASCOM-1 £125 +VAT P&P £1.50

NASCOM PRODUCT LIST + VAT

I/O board kit less I/O chips	45.00
UART + BAUD rate generator + crystal for I/O board	16.00
CTC — MK3882 multiple interrupt driven clock generator for I/O board	8.25
P/IO — MK3881 + interconnect for I/O board	8.50
P/IO interconnect only (for I/O board)	3.80
Econographics kit for additional 128 characters (N1 only)	30.00
2708/2716 Programmer suitable for N1 and N2 under NAS-SYS	20.95 + VAT
Nascom 19" rack mounting card frame for N1 and N2	32.50
Nas-DA disassembler 3 EPROM for Nas-sys	37.50
MK36271 8K BASIC in 8K × 8 ROM	40.00
Naspen VS in 2 EPROM	30.00
Nas-sys monitor in 2 EPROM	25.00
NASBUG T2 1 × EPROM	12.50
Nasbug T4 2 × EPROM	25.00
Tiny Basic 2 × EPROM	25.00
Super Tiny Basic 3 × EPROM	37.50
Super Tiny Basic upgrade 1 × EPROM	12.50
Tape Software	
ZEAP 1.2 tape and documentation for N1	30.00
ZEAP 2 tape and documentation for Nas-sys	30.00
8K BASIC tape and documentation for N1	15.00
MEMORIES Discounts 10% for 4, 15% for 8, 20% for 16	
MK3880 (Z80) for N1	7.50
MK3880-N4 (Z80A) for N2	7.95
MK4116 16K × 1 dynamic RAM	7.50
MK4027 4K × 1 dynamic RAM	2.25
2102 1K × 1 static RAM	1.00
4118 1 K × 8 static RAM	12.75
Unprogrammed 2708	7.50
Unprogrammed 2716	19.95
IM6402 UART	4.50
2114 1K × 4 Static RAM	3.95
8080A	5.25

Ideal for NASCOM—PET—TRS80—TRITON

NASCOM IMP



PLAIN PAPER PRINTER

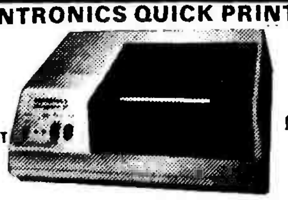
Fully built and housed in a stylish enclosure for just **£325** plus VAT

Interfaces with all micro computers
The Nascom IMP (Impact Matrix Printer) features are
● 60 lines per minute. ● 80 characters per line. ● Bi-directional printing. ● 10 line print buffer. ● Automatic CR/LF. ● 96 character ASCII set (including upper/lower case, $, £). ● Accepts 8½" paper (pressure feed). ● Accepts 9½" paper (tractor feed). ● Tractor/pressure feed. ● Baud rate from 110 to 9600. ● External signal for optional synchronisation of baud rate.
IDEAL FOR WORD PROCESSING

COMPUTER KEYBOARDS

TASA 56 key touch sensitive keyboard. All ASCII characters including control keys. Parallel output with strobe. Shift lock. Keys coded in 3 colours to indicate function. 18 V DC at 35 mA. 15" × 6.25" × 0.385" thick. Black resin encapsulated.
£49.50 +sVAT
Star Devices Mk III 71 key touch sensitive keyboard. With numeric pad. All ASCII characters including control keys. Auto key repeat. Parallel output with strobe. Shift lock with indicator LED. Built in 'beeper' with level control. 5 V DC at 300 mA 15" × 7" × 1.25". Grey case with white keys on blue.
£48.50 + VAT
Carter 57 key ASCII keyboard. Conventional keyboard. 128 ASCII characters including control keys. Parallel output with strobe. Shift lock. + 5V and −12 V DC. 12" × 5.5" × 1.5". Black keys with white legends.
£39.34 + VAT.
FERRANTI — "SIZE 14 × 6 × 3" SLOPING FRONT
55 Key ASCII Coded in steel case. Complete with Plug and Cable with circuit to convert to T.T.L. levels.
In good condition at only **£25** + VAT. P/P £2.50

CENTRONICS QUICK PRINTER



LIST PRICE £459.00 INCL. VAT

OUR PRICE £195.00 +VAT

EXCLUSIVE TO HENRY'S
50% OFF MAKER'S PRICE
for: TANDY, PET, NASCOM
● Software selectable 20, 40 and 80 column using 120mm aluminium-ised paper. 1 roll supplied.
● 150 lines per minute.
● Centronics parallel data interface for Nascom, Tandy, etc.
● 240 volt mains input. ASCII character set
● Paper feed, and on/off select switches 'BELL' signal Weight 10lbs Size: 13" x 10½" x 4½"
● New, boxed and fully guaranteed
POST PAID **Price £195.00** + VAT
See *COMPUTING TODAY* Recommendations March/May issues

TANGERINE

COMPUTER SYSTEMS LONDON STOCKISTS

Microtan 65 Kit, Inc VAT	£79.35
Microtan 65 Assembled, incl. VAT	£90.85
Tanex (min. con) Kit, incl. VAT	£49.45
Tanex Assembled, incl. VAT	£60.95
Lower case pack, incl. VAT	£10.90
Chunky Graphics Pack, incl. VAT	£7.50
20 Way Keypad, incl. VAT	£11.50
Mini-mother board, incl. VAT	£9.95

Complete Tangerine range available

SEND FOR COMPLETE COMPUTER BROCHURE FREEPOST TO ADDRESS BELOW

Your London & National Nascom Distributor.
Export Orders deduct VAT, but add 5% carriage
Official Export & Educational Orders welcome
Our Telex 262284 Mono Ref. 1400 Transonics

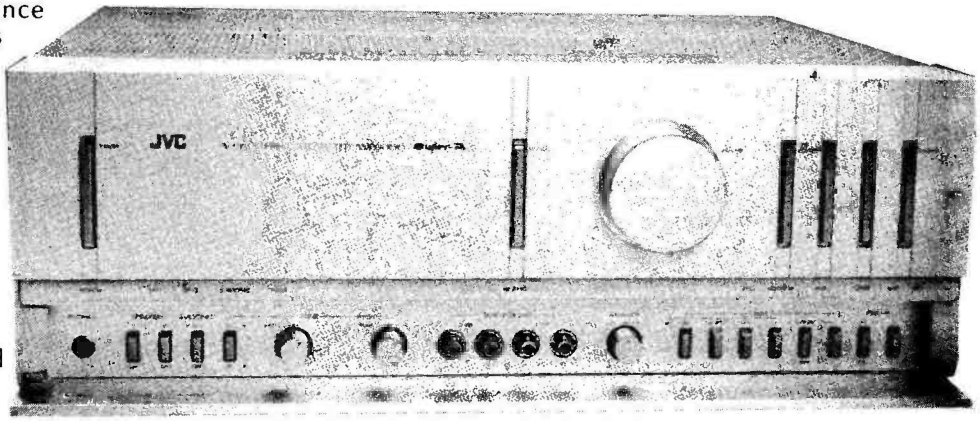
ADD VAT 15% TO YOUR ORDER EXCEPT WHERE STATED

HENRY'S
Computer Kit Division
404 Edgware Road, London W2 1ED, England I.E.D.
01-402 6822

AUDIOPHILE

Opposite ends of the scale this month with a super-fi, super-heavy amp from JVC and a tiny portable player with hi-fi asperations. Ron Harris reports.

I could tell it was going to be a *different* month right from the start. Two days gone since our last issue went to the printers at six-thirty on a Monday morning, and here I am, opening my flat door to the sight and sound of a little red-faced delivery man, sitting on a box barely smaller than him, perspiring freely and moaning in a high voice of the effect this job has had upon his hopes of an active married life.



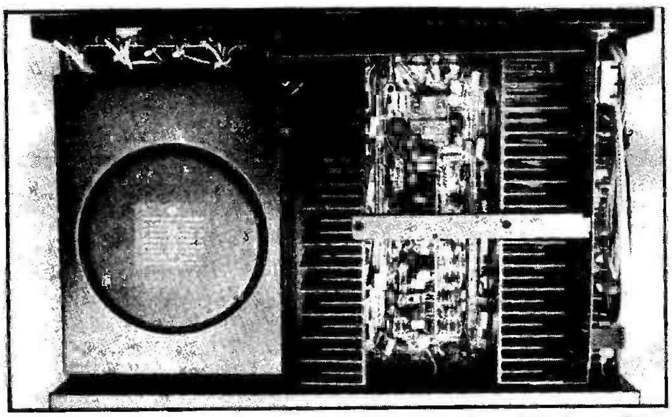
After placating said tradesman — palms crossed with silver make up for more than I thought — and dragging this huge piece of hernia hi-fi into my living room (I understood his problems more fully now), only to find the box sealed with a tape possessed of a higher tensile strength than steel, it began to look like this month and me were not destined to get on very well. A view reinforced very rapidly by the complete absence of tea from my kitchen. Six-thirty on a Monday is NO time to discover such things.

Hospitals should have special emergency units set up to deliver intravenous shots of Tetleys for moments like that. National Health, (what's left of it) take note.

Super A or Eh!

It was two days and many cups of tea later that I finally obtained sound from the beast — a JVC A-X9 amplifier — having been held up slightly by the structural alterations required to sustain such mass. (Don't forget that what follows has all been made possible by that little man who sacrificed future generations in order that you may read this test report!)

The A-X9 takes its place at the head of JVC's new amplifier range and employs their new variable bias circuit, which is claimed to allow class A operation at much higher powers than has hitherto been possible by increasing the efficiency of power transfer.



Note the massive PSU on the left and those huge heatsinks down the centre. This is one HEAVY amp.

Normal class A amps — in which the output transistors are continually passing current — manage only about 25% efficiency. This would mean that a 100 W audio output requires some 300 W of heat to be dissipated. Great for musical evenings around the family heatsink in winter, but not a great deal of use otherwise.

Class B, on the other hand, runs around 75% efficient and the difference has meant that over 90% of output stages resting in hi-fi equipment cases today are either Class B or AB, the closely related derivative designed to defeat cross-over distortion.

The major drawback of the currents is their liking for odd-harmonic distortion components, mainly generated by the switching on and off (or nearly!) of the output transistors. Class A has long been held as a potentially better method of amplification. But how to employ it, at a realistic power level, without inventing the portable infinte heatsink? Ah, there lies the rub!

JVC's solution is to make the bias circuit signal dependent. The output stage is run in Class A normally, but the bias current is reduced down to an absolute minimum when there is no signal present to be amplified. Resulting efficiency is claimed to be around 70%, making the use of Class-A viable for high powers.

PSU 2, TIM O

Other refinements in the circuits include the use of a separate supply for the output stages and a tone control configuration which is in the feedback network of the POWER amp — as opposed to being a separate gain stage in the pre-amp.

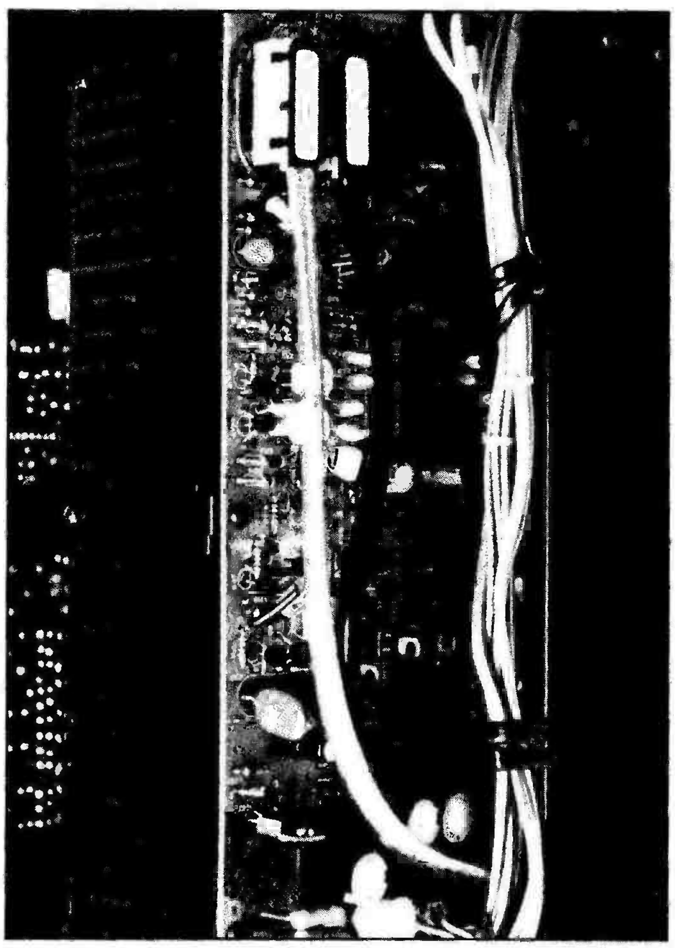
In common with most Oriental designers, JVC have gone for an incredible power bandwidth — in this case somewhere close to 200 kHz (maybe they can hear things we cannot?) and this coupled with ultra-fast slew-rate leads a claim of ZERO TID (transient intermodulation distortion). Either variety of cartridge type can be accommodated and a switch is present on the front panel to switch from the MM to MC (from moving-magnet to moving coil). This is a mechanical operation at the panel, with a flexible drive transferring the command to PCB mounted switches close to the input sockets.

Taping facilities are comprehensive with three sets of input sockets, one hidden on the front panel, with which you can record onto either deck from source, or other tape machine.

All That Glitters . . . ?

So much for the principles, what of the appearance? By far the most striking feature of the A-X9 is its sheer size. It measures almost 9" (h) x 18" (w) x 17" (D) and weighs 37 lbs. Impossible to ignore, but beautifully made and with a confidently solid feel to it. All the "never used" controls, like tone and speaker switching, are hidden under that flap on the front, but so as you cannot forget that which you have operated, small legends light up on a chrome strip when the buttons are used. Very smart indeed. The volume control is nicely massive and smooth in operation and the tone and balance are "click-stopped" for convenience.

Overall the A-X9 is brilliantly made and a dream to use. No possible complaints there.



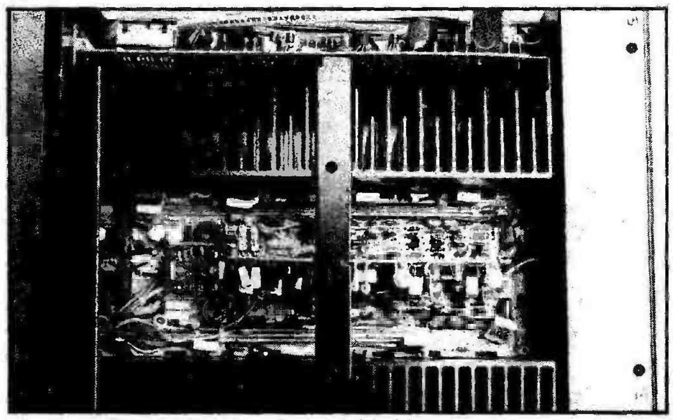
Pickup amplifier board. The tubes carry a sliding metal strip which operates the moving coil/magnet selector, at the top centre of the PCB.

. . . Is Not Gold?

Trying to measure performance on a machine like this is silly, it betters specification and/or measuring equipment on all parameters, so I give only a selection from the results below — chosen for reasons which I hope will become apparent.

Marvellous engineering this and I moved on to have a good long listen with interest. My usual limit first, measure later policy having been defeated by the logistics of moving a 37 lbs cube of metal around . . .

Frankly I was very, very disappointed. I had expected great things from the A-X9— judging by book covers I suppose, well built or not, and was let down. This machine retails at around £530, putting it in direct competition with a whole host of excellent British units — Lecson, Meridian, Quantum and Crimson, to mention but a few.



Close up of the highly complex variable bias circuit.

I Auditioned the JVC directly against a Lecson AC1/AP3 II and the Quantum 102/204 combination reviewed last month. Both delivered a superior performance in my opinion. The JVC seemed to lack punch and masked mid-range detail sufficiently to be immediately identifiable in A-B comparisons.

The signal-to-noise *was* better with A-X9, on all inputs, and it performed much better with tape or tuner as a source. This tends to point the finger at the disc input rather than the clever power amplifier and a second test confirmed this.

Slipped Disc?

I used the Quantum pre-amp as a "head amplifier" and fed the signal from this into the JVC's tape input, comparable with the Lescon set-up as reference. A different picture entirely now. Most of the missing detail is back and, allowing for the lower power output, a much more credible performance resulted.

Much as I would like to exonerate the main amplifier completely, I'm afraid I cannot do so. Overall the A-X9 is very 'edgy' on difficult signals, such as strings, and lacked the peak power 'headroom' to portray dynamics properly. At this price level, therefore, I must regretfully mark the A-X9 down.

It is so beautifully finished and presented, however, that provided you are not searching for absolute performance, it may well still appeal on ergonomic and engineering grounds.

●

Sound quality is undeniably good, in fact its in a different class entirely to any portable recorder you've ever heard up to now. Biasing for prerecorded tapes is the only thing they could have done and it works well. I tried making up some tapes, both on Sony AHF and TDK formulations and was returned good results from both.

Winding Up

Frankly I can't see how this little thing can fail. Good quality sound anywhere you want it for around £90. Not a lot these days, if you say it quickly. Battery life is around three hours with standard cells and rechargeable packs are available, as are connectors to the mains and car batteries. Well thought out, you see.

The one I had on loan sat on my desk top playing away for hours, making me blissfully unaware of the clamourous call of telephone and outside world.

I think you're going to see a lot more of the Stowaway in the future — so next time someone bumps into you in the street have a look see if he's wearing MDR 3's before swearing at him — you could be wasting your breath.

ETI

Left: is this not the *worst* publicity photo you have ever seen? I'm convinced Sony did it on purpose it's so bad. In fact I think this deserves a good caption so I hereby declare the Second Audiophile Caption Contest open. The funniest caption to this photographic fiasco wins a year subscription to ETI. Please mark your envelope "Audiophile Contest" and send to our 145 Charing Cross Road address. Closing date is 31st August, 1980. Sharpen your wit (and pencils) and let's hear from you.

Stowaway Where?

Something pretty neat — but weird. Did I not tell you it was gonna be one of those months? First the world's heaviest amp — now the world's *smallest* stereo cassette. Called the Stowaway, or TPS-L2, it comes from Sony (again) who claim to be selling them abroad with an ease which makes me think they're giving free photos of Felicity Kendal away with every machine. Put me down for a dozen.

I reproduce Sony's handout shot here for two reasons. Firstly because it is so awful as to be a model of how *not* to do these things. Secondly because I didn't get to attend the press launch with Hot Gossip and this is as good a way as any of exacting revenge upon Sony's PR.

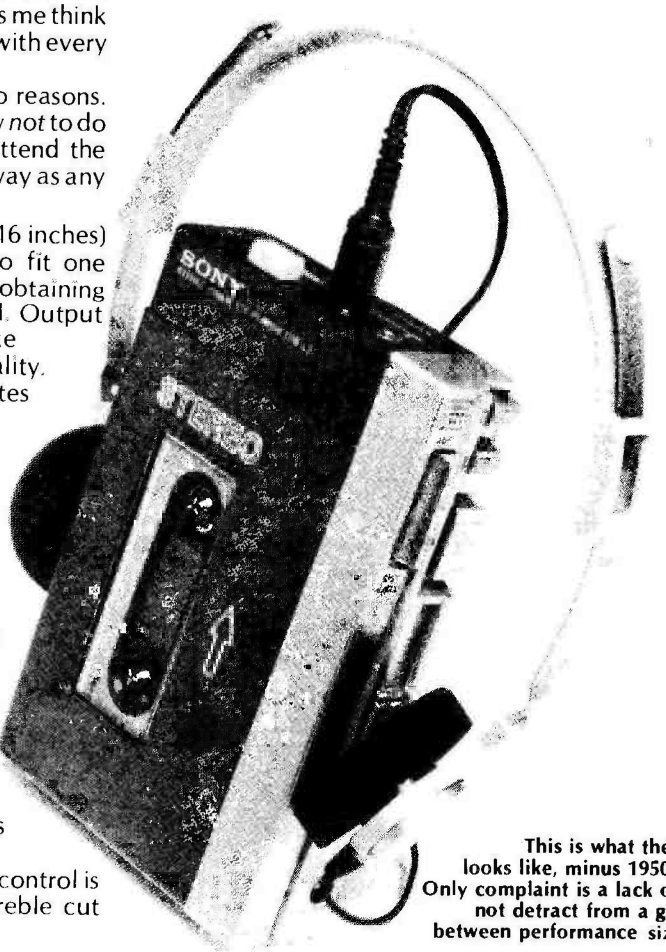
The machine really *is* small (3½ x 5 5/16 x 1 7/16 inches) and weighs well under a pound. The idea is to fit one to your belt, or use the carrying strap, thus obtaining a truly portable source good quality sound. Output is via those MDR-3 headphones of which I spoke a while back, resulting in a surprising sound quality. Intended source material is pre- recorded cassettes (no record facility) but the Stowaway is happy to play home recordings, as long as you use plain, ordinary non-chrome, non-metal tapes to do it.

Head For Success

Sockets exist for two pairs of MDR-3's to be used simultaneously and there is even a method of communication between sets. A built-in microphone will pick up sound upon depression of the "Hot Line" button and quiet the music to relay what it hears to the users.

With the MDR-3's though, there is little need to use the microphone — once the music is muted you can hear perfectly well anyway.

Fast wind in either direction leaves the heads in place, so that you can skip back and forwards to find the bits you want. A definite pop facility. Tone control is a switch, you have it or you don't. (It's only a treble cut circuit).



This is what the Stowawayreally looks like, minus 1950'steenage kitsch. Only complaint is a lack of Dolby B. Does not detract from a good compromise between performance size and price.

MICROFILE

. . . . And as Henry Budgett sinks slowly in the West, we wish a fond farewell to Microfile. It's the last one folks.

After a year or so of producing this monthly column Microfile is taking off for pastures new. This is the last time these articles will appear in this format. More later, but first the news. Seldom does a week or even a day pass without a new computer or allied peripheral appearing on the market. Some are destined to survive, others disappear without trace. We first heard news of the new Sharp hand-held system some months ago in the form of a typical murmur from the depths of a Press lunch. Reality has arrived rather sooner than we expected in the top pocket of a South African visitor to our offices. Here is a brief taster of what the machine has to offer plus a couple of photographs to tantalise.

Sharp's PC 1211 — the shape of things to come?

Sharp Pointed?

At first glance the PC 1211 looks not unlike a conventional pocket calculator, until you let your eyes roam the keys and find a full alpha set and several other definitely non-standard items like a 20 characters wide display. Inside are two very well packed PCBs, the three silver oxide cells and a piezo sounder that bleeps maddeningly when you make stupid mistakes! Marks out of ten for packaging and useability are about 9½. Perhaps they could have made the key idents on the 'shifted' functions a little bolder.

The user has at his disposal a conventional four function calculator with the added bonus of a full Microsoft type BASIC and the capability to store the programs on cassette. The cassette cradle plugs into the left hand side of the machine and increases the length by about one third. This then connects directly to a conventional audio cassette. Program storage is slightly slow but adequate. One interesting point is that the system produces the sound of the data tones through the bleeper whilst loading or dumping — a good reassurance that at least something is happening.

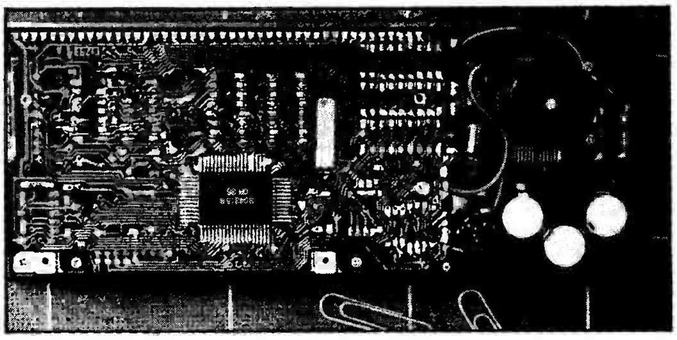
The memory capacity is sufficient for about 1 to 2Ks worth of normal program, which is quite sufficient when looked at in terms of pure calculations, but the use of text in copious quantities is obviously going to reduce this.

Pocketability

The unit comes complete with expansive notes, manuals and programming examples, apparently of better quality English than previously encountered from Sharp.

Some of the BASIC command set is totally unexpected on a machine of this size. You can write to and read from files on tape, you have all the usual scientific functions such as sines and logs, you have PRINT USING for neatly formatted displays and you even have a debug mode. By this time many of you will be thinking that this souped-up, hand-held version of your programmable calculator will cost you a fortune and why replace your calculator anyway?

The expected UK cost of the system, complete with the cassette cradle, is between £125 and £130 and they are to be launched onto the market in late July. This is far more than a grown-up programmable calculator, for one thing it can work interactively. This means that when you run your programs after a few months writing them you can quickly remember what it did. You can, after all, name your programs when you store them — just try doing that with a conventional programmable! It has been reported that the system took on, and beat, an HP 41C to the considerable chagrin of that August company — we didn't have time to test this claim but would love to try and run a "Benchmark" type trial between this, the TI 58/59, the HP 41C and the Casio 501/2.



The PC 1211's PCB. Sometimes it sits and thinks, sometimes it just sits.

Overall, then, it is a very impressive piece of kit, certainly another strong indication of the way that things are moving, with new customised chips taking over from boards full of TTL and CMOS, rather like a miniature version of the HP 85. The owner of the machine that we borrowed was a mining engineer who was mainly involved in electronic control design, etc and after three months of use he had yet to find a job that was too big to fit into its memory.

The question left in my mind is "If the calculator killed the slide rule stone dead will this do the same to the programmable market?". If that sounds a little strong just try it against one and see!

Club Call

Some final entries into the list of computer clubs this month. Anyone into the TRS-80 and living in the North East of England might be interested in a new User Group. Acting as a sub-group of the Newcastle upon Tyne Personal Computer Society they hold meetings every third Wednesday in Room A 102 of the Polytechnic and cater for both the hardware and software enthusiast. Anyone interested in joining or receiving further details should contact Dr Stan Tetlow on Washington 462552 or Mr Barry Dunn on Stanley 30184.

Owners of the ZX80 may like to know of a National Users Club that has been formed. The main output will be a bi-monthly newsletter and a software bank as well as the provision of technical support. Membership fees have been set at £6 for the UK and £10 for overseas. Further information can be obtained from ZX80 Users Club, PO Box 159, Kingston upon Thames, Surrey KT2 5UQ, but please enclose an SAE.

Video What?

Microfile is currently trying to achieve the impossible dream and get connected to Prestel. Why the impossible dream? Well, we've tried two sets and had the PO connection re-wired three times so far without a great deal of success! The story of our mis-fortunes carries on and on, but — eventually — we got connected. This tale of woe is by no means unique and is a very sad state of affairs. We do have a considerable lead in the Viewdata field in this country, two years of operational experience, but we appear to be in considerable danger of throwing it all away because people won't buy something they can't rely on. It is not the fact that the database computers fail sometimes (you do generally have a spare anyway) but that the people who install the PO lines and the people who make the sets and, worst of all, the people who sometimes install the sets all talk different languages. The sooner the PO put together a crack team of engineers who understand the equipment and use them and only them to install the necessary equipment the better off we'll all be.

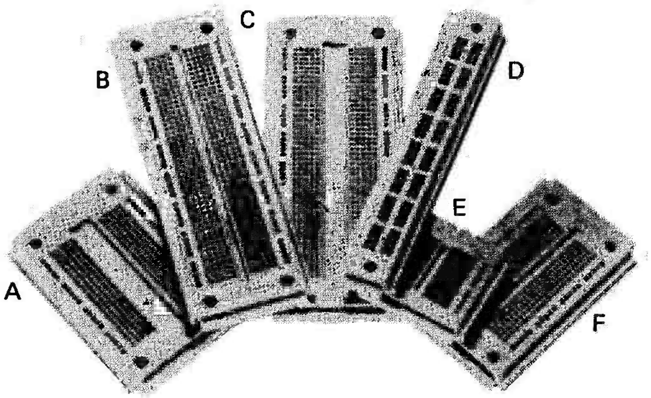
This country is, for once, leading the world in one area of computer-based technology. It would be a great shame to see that lead lost because no-one could rely on the competence of the people who come to fit it. You wouldn't, after all, ask a TV repairman to fix your washing machine or an electrician to install your central heating. No-one is knocking the concept of Viewdata, but it is in severe danger of strangling itself with its own telephone wires!

69999 PRINT"END":END

The death of this column has been stimulated by the production of a new series for ETI on the fundamentals of computers. It is intended to start next month with an article on how technology has developed to give rise to the micro and the whole series will be orientated towards the hardware. It is also hoped that the material will be followed by some constructional features based on the developing microprocessor technology. So, until next month under a new heading it's farewell from Microfile . . . . . .

ETI

IT'S AS EASY AS A,B,C...



- A **EXP 650** For microprocessor chips. **£3.60**
- B **EXP 300** The most widely sold breadboard in the UK; for the serious hobbyist. **£5.75**
- C **EXP 600** .6" centre channel makes this the Microprocessor Breadboard. **£6.30**
- D **EXP 4B** An extra 4 bus-bars in one unit. **£2.30**
- E **EXP 325** Built in bus-bars accepts 8, 14, 16 and up to 22 pin ICS. **£1.60**
- F **EXP 350** 270 contact points, ideal for working with up to 3 x 14 pin DIPS. **£3.15**
- G **PB6** Professional breadboard in easily assembled kit form. **£9.20** (Not illustrated.)
- H **PB 100** Kit form breadboard recommended for students and educational uses. **£11.80** (Not illustrated.)

& IT'S AS EASY AS 1,2,3 with THE EXPERIMENTOR SYSTEM

SCRATCHBOARD
-BREADBOARD
-MATCHBOARD

1. EXP 300PC which includes one item. A matchboard pre-drilled PCB – £1.32
2. EXP 302 which includes three items. Three 50-sheet scratchboard workpads – £1.68
3. EXP 303 which includes three items. Two matchboards and an EXP 300 solderless breadboard – £8.60.
4. EXP 304 which includes four items. Two matchboards and EXP 300 breadboard and a scratchboard workpad – £9.30

The above prices do not include P&P and 15% VAT

TOMORROWS TOOLS TODAY

CONTINENTAL SPECIALTIES CORPORATION

C.S.C. (UK) Limited, Dept. 900,
Unit 1, Shire Hill Industrial Estate,
Saffron Walden, Essex CB11 3AQ.
Tel: Saffron Walden (0799) 21682
Telex: 817477

NAME ____________________

ADDRESS ____________________

____

I enclose cheque/PO for £ ____________________

or debit my Barclaycard, Access, American Express card

No. ____________________ Exp. date ____________

or Tel: (0799) 21682 with your card number and your order will be in the post immediately.

A EXP 650 £5.00	Qnty. Reqd.	B EXP 300 £7.76	Qnty. Reqd.
C EXP 600 £8.39	Qnty. Reqd.	D EXP 4B £3.50	Qnty. Reqd.
E EXP 325 £2.70	Qnty. Reqd.	F EXP 350 £4.48	Qnty. Reqd.
G PB6 £11.73	Qnty. Reqd.	H PB 100 £14.72	Qnty. Reqd.

Experimentor System

1 EXP 300 PC £2.38	Qnty. Reqd.	2 EXP 302 £2.79	Qnty. Reqd.
3 EXP 303 £11.04	Qnty. Reqd.	4 EXP 304 £11.86	Qnty. Reqd.

Boxed prices include P & P and 15% VAT
If no dealer in your area contact CSC direct.

FREE catalogue tick box ☐

Continental Specialties Corporation, (U.K.) Limited, Dept. 900,
Unit 1, Shire Hill Industrial Estate, Saffron Walden, Essex. Tel: (0799) 21682

...ASK OUR DEALERS.

AITKEN BROTHERS,
35 High Bridge, Newcastle Upon Tyne, NE1 1EW.
Tel: 0632 26729.

ARROW ELECTRONICS LTD.,
Leader House, Coptfold Road, Brentwood, Essex.
Tel: 0277 226470.

BASIC ELECTRONICS LTD.,
18 Epsom Road, Guildford, Surrey, GU1 3JN.
Tel: 0483 39984.

BI-PAK SEMICONDUCTORS,
P.O. Box 6, Ware, Herts.
Tel: 0920 3442.

F. BROWN & CO.,
45 George IV Bridge, Edinburgh, EH1 1EJ, Scotland.
Tel: 031 225 3461. Telex: 922131.

THE CHILDRENS SHOP & TACKLE BOX.,
73-75 High Street, Ryde, Isle of Wight.
Tel: 0983 63437.

CUBEGATE LTD.,
301 Edgware Road, London, W2 1BN.
Tel: 01 724 3565.

ETESON ELECTRONICS,
15b Lower Green, Poulton-Le-Fylde, Blackpool, FY6 7JL.
Tel: 0253 885107.

H. GEE ELECTRONIC SUPPLIES,
94a Mill Road, Cambridge, CB1 2BD.
Tel: 0223 358019.

LEEDS AMATEUR RADIO,
27 Cookridge Street, Leeds, LS2 3AG.
Tel: 0532 452657.

MARSHALLS,
108A Stokes Croft, Bristol.
Tel: 0272 426801.

85 West Regent Street, Glasgow, G2, Scotland.
Tel: 041 332 4133.

325 Edgeware Road, London, W2.
Tel: 01 723 4242.

40 Cricklewood Broadway, London, NW2 3ET.
Tel: 01 452 0161.

RASTRA ELECTRONICS LTD.,
275-281 King Street, Hammersmith, London, W6.
Tel: 01 748 3143. Telex: 24443 RASTRA G.

SHUDEHILL SUPPLY COMPANY,
53 Shudehill, Manchester, M4 4AW.
Tel: 061 834 1449.

SPECTRON ELECTRONICS (M/C) LTD.,
7 Oldfield Road, Salford, M5 4NE.
Tel: 061 834 4583.

SWANLEY ELECTRONICS,
32 Goldsel Road, Swanley, Kent, BR8 8EZ.
Tel: 0322 64851.

TECHNOMATIC LTD.,
17 Burnley Road, London, NW10 1ED.
Tel: 01 452 1500. Telex: 922800.

TOMORROW'S TOOLS TODAY

Also ask your local stockist.
If no dealer in your area, contact CSC direct.

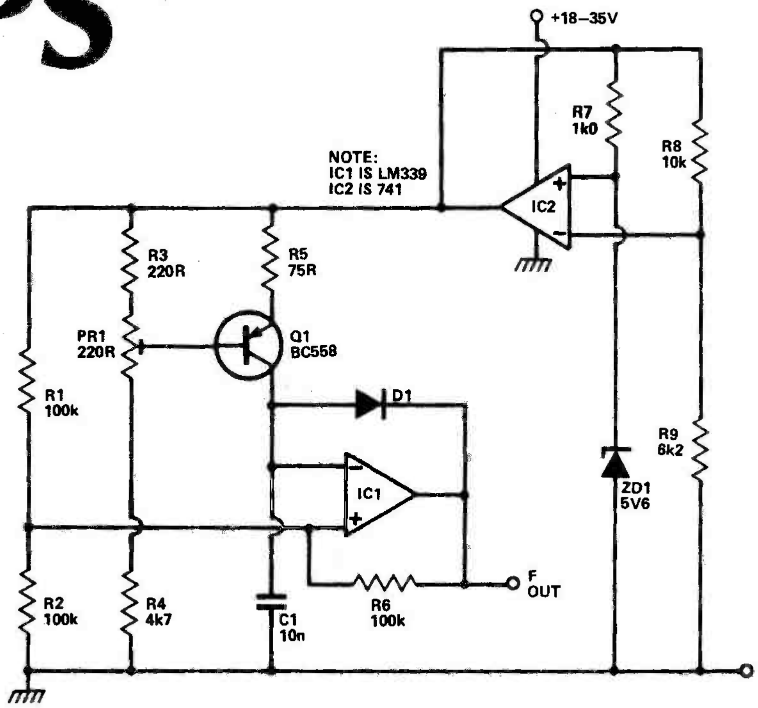
CONTINENTAL SPECIALTIES CORPORATION

C.S.C. (UK) Limited, Dept. 900,
Unit 1, Shire Hill Industrial Estate,
Saffron Walden, Essex CB11 3AQ.
Tel: Saffron Walden (0799) 21682
Telex: 817477

TECH TIPS

Linear Temperature To Frequency Transconducer

J.P. Macaulay, Crawley



This circuit provides a linear increase of frequency of 10 Hz/°C over 0-100°C and can thus be used with logic systems, including microprocessors.

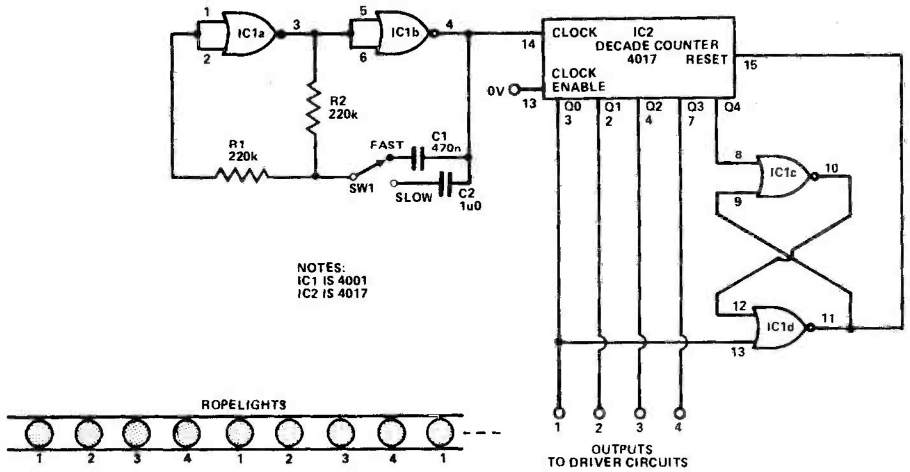
The heart of the system is the temperature probe Q1 whose Vbe changes at 2.2 mV/°C. Since this transistor is incorporated in a "constant" current source circuit it follows that a current proportional to temperature will be available to charge C1.

The circuit is powered via the temperature stable reference voltage supplied by the 741.Comparator IC1 is used as a Schmitt trigger, the output of which is used to discharge C1 via D1. To calibrate the circuit Q1 is immersed in boiling distilled water and PR1 adjusted to give 1 kHz output.

The prototype was found to be accurate to within 0.2°C against a Comark thermocouple meter.

Ropelights Sequencer

G.J. Phillips, Durham



This circuit produces signals for the "travelling lights" disco ropelights effect. IC1a and b are connected as a standard CMOS astable. The frequency and hence speed of the travelling lights can be selected by SW1.

The output of the astable is fed to the clock input of the CMOS decade counter IC2. This counter has the advantage of having a built-in decoder giving a logic 1 at each output in turn. Reliable reset is provided at the count of four by the bistable formed by IC1c and d.

Outputs 1,2,3,4 must be connected via drive circuits which can be simply power transistors for low voltage lamps or triacs for series-connected mains operated lamps. The outputs of the driver circuits are connected to the lamps in groups as shown.

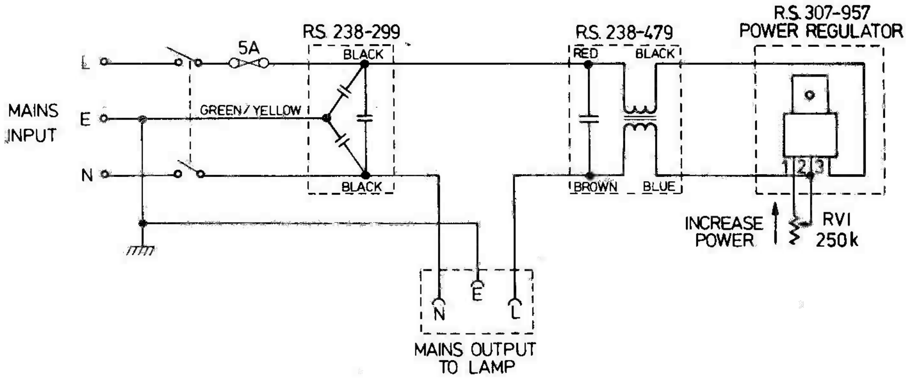
Tech-Tips is an ideas forum and is not aimed at the beginner. We regret we cannot answer queries on these items.
ETI is prepared to consider circuits or ideas submitted by readers for this page. All items used will be paid for. Drawings should be as clear as possible and the text should preferably be typed. Circuits must not be subject to copyright. Items for consideration should be sent to ETI TECH–TIPS, Electronics Today International, 145 Charing Cross Road, London WC2H 0EE.

Dimmer With RFI Suppression

D. Wedlake, Cardiff

The circuit shows how a mains power regulator can be used to control a 1 kW tungsten lamp with good radio interference suppression. It was built primarily for photographic applications but can be used with many other types of loads such as heaters or AC motors, providing the maximum rating is not exceeded. However, if used to control motors or any inductive loads, it will be necessary to connect a snubber network between terminals 2 and 3. A 100 R resistor in series with a 100 nF 250 V AC capacitor (eg RS 238-463) would be suitable.

The IC regulator used is a solid-state AC mains power three-terminal device which, when used with the external 250 k potentiometer, RV1, controls the power to the load by varying the phase angle of the applied AC potential. The typical control conduction angle is 0-155°



which corresponds to a maximum power transfer of approximately 98% for a resistive load. The graph shows how the output voltage varies with various values of R V 1. When used at full load current, the device should be mounted on a heat sink having a thermal rating of 4°C/watt (eg RS 401-497). Alternatively, as the tab is electrically isolated, it may be fixed directly to the chassis for heat dissipation.

Note that as the slider of RV1 is at Mains Potential the potentiometer should have an insulated shaft.

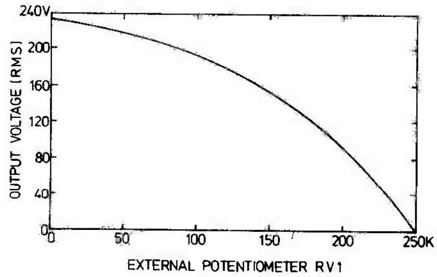
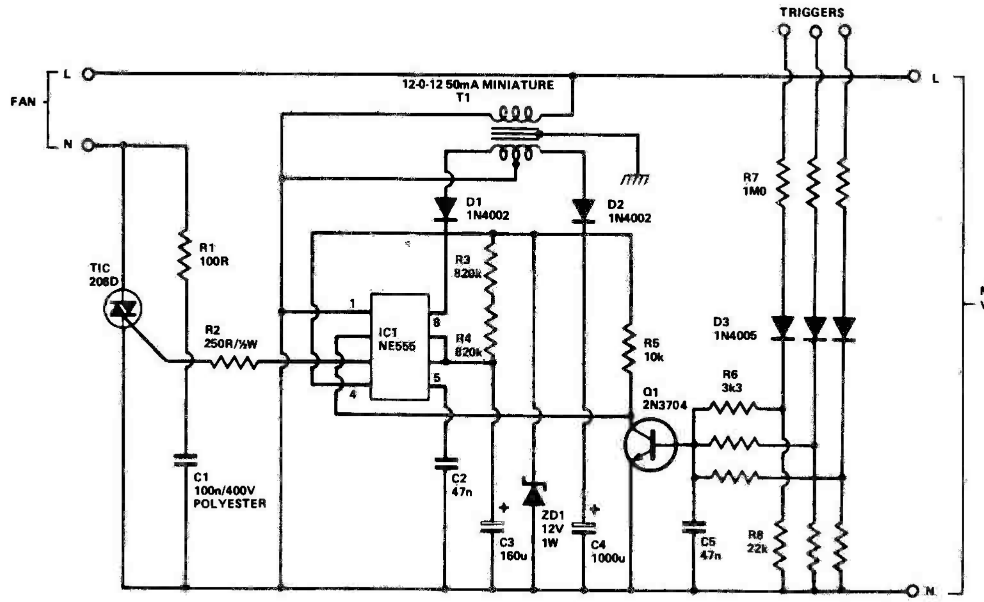


Fig. 2 Variation of output voltage with RV1 (input voltage = 240RMS)



Extractor Fan Controller

B. Carrol, Aldershot

This timer is useful for controlling a bathroom extractor fan, if your family forgets to use it or leaves it running indefinitely. The trigger or triggers are connected to the live side of one or more lights, which, when switched on, cause Q1 to conduct and trigger IC1. This is a monostable which gives a pulse period of about four minutes and its output gates the triac so that the fan runs. R1, C1 protect the triac against reswitching; C2, C5 protect against mains transients.

If the light is still on at the end of the timing period, the IC is retriggered, but, because C3 has not been fully discharged, the next pulse is less than four minutes. Thus, the fan runs for four minutes or the period the bathroom light is on plus two minutes, whichever is greater.

Note: Careful insulation of the PCB from the case is necessary.

Super Bass Excavator

J.P. Macaulay, Crawley

The main problem with small infinite baffle speaker systems is that the bass response rolls off rather sooner than their larger brothers. This circuit overcomes this problem by boosting the deep bass response of the power amp driving the speakers. Certainly this is not an altogether new idea as regular readers of this magazine well know but this particular circuit does the job rather better than most and the audible improvement is well worth the time and money spent.

The circuit is based around the well known quad op amp LM324. This device contains four independent op amps of the 741 type. Before any purists hold up their hands in horror it should be noted that these are capable of delivering 2 V RMS of 20 kHz sine wave without slew rate problems and that is more than enough to drive 99.99% of all known power amps into clipping.

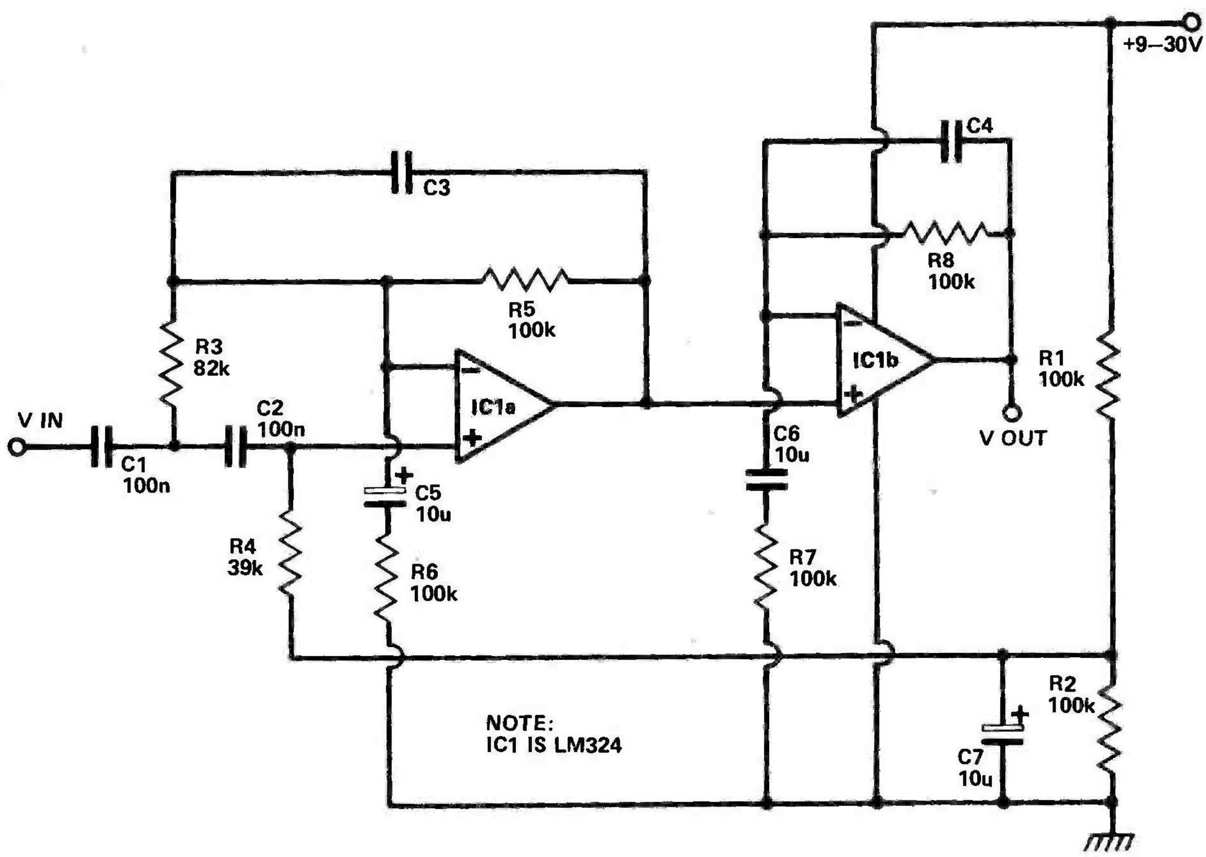
In order to overcome the crossover distortion problems of these op amps the output stage of each is biased into class A by R7 and R10. C1, C2, R3 and R6 form a Butterworth second order filter which removes any signals below 20 Hz thus preventing amplifier overload from record warp signals. R5 and C2 in conjunction with R8 and C4 produce a shelf in the circuit's response below the frequency determined by the reactance of the capacitors.

Now it so happens that the rate of roll-off of infinite baffle enclosure is 12 dB per octave and the slope of the filters is the same. Thus, by the simple expedient of choosing the capacitor values to be equal in value and by matching the quoted -3 dB point of the speakers with the +3 dB values in the table one extends the lower -3 dB limit of the speakers by half an octave.

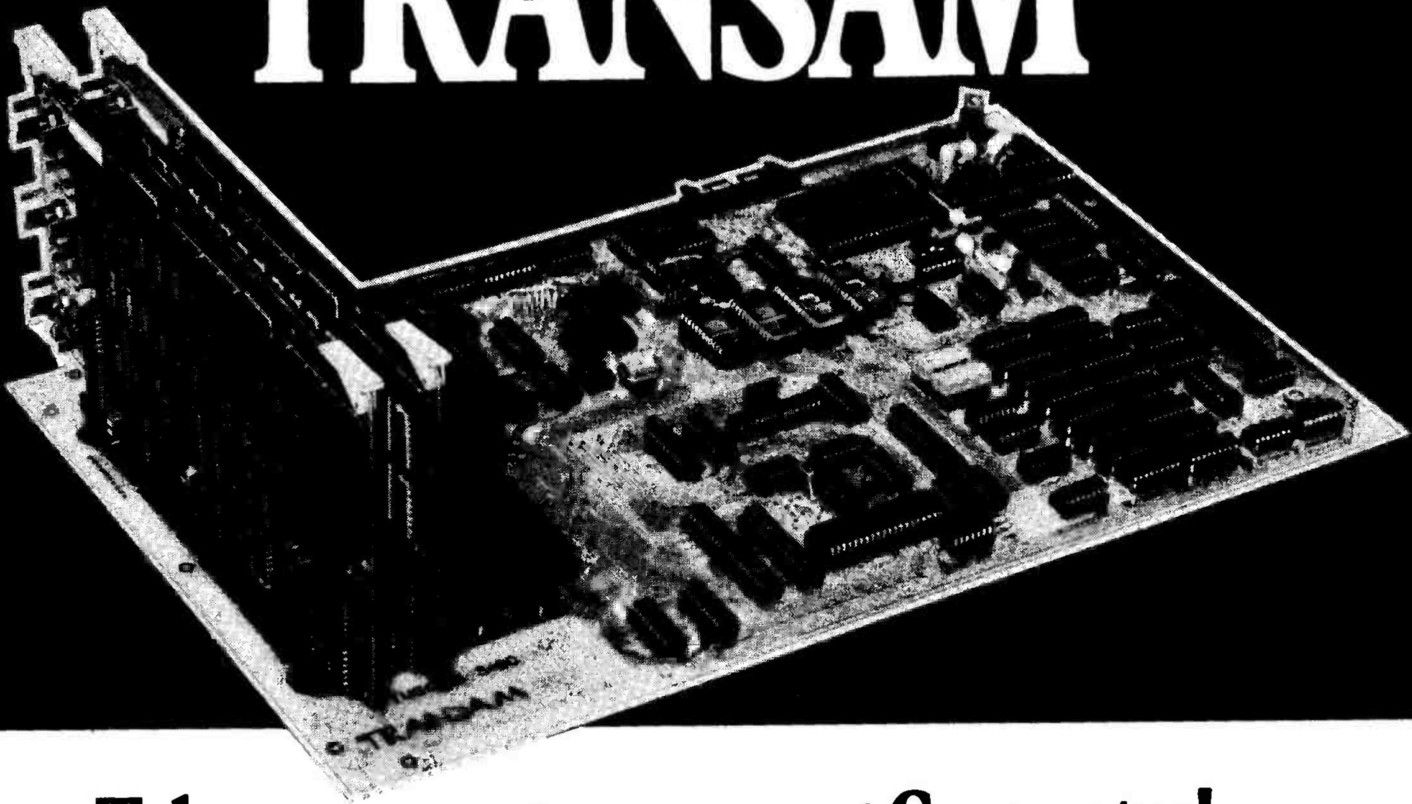
The device must be inserted between the pre and power amplifiers and has a unity gain except in the bass. The maximum gain has been set at 6 dB to prevent amplifier overload.

(+3 dB)

NEW CUTOFF –3 dB POINT	OLD CUTOFF –3 dB POINT	C3,C4
38 Hz	50 Hz	47 nF
45 Hz	60 Hz	39 nF
52 Hz	70 Hz	33 nF
60 Hz	80 Hz	27 nF
68 Hz	90 Hz	22 nF
75 Hz	100 Hz	18 nF



'TUSCAN' FROM TRANSAM



Take a step up to your next Computer!

THE CONCEPT

How many ways are there to build an S100 system? Not many, and all expensive. TUSCAN changes all that.

Five S100 boards on one single board—just for starters. Plus five extra slots for future expansion.

What a combination! Z80 and S100 with the TRANSAM total package of system and applications software.

How do we do it? Our prices start at £195 and you can build up in easy stages to a fully CP/M compatible disc based system. Something to think about!

THE HARDWARE

The first Z80 single board computer with integral S100 expansion. British designed to the new IEEE (8 BIT) S100 specification, the TUSCAN offers total system flexibility. A flexibility available now.

The board holds the equivalent of a Z80 cpu card, 8k ram, 8k rom video and I/O cards with 5 spare S100 expansion slots and offers a price/performance ratio which is hard to beat.

Just compare our price with a commercial S100 ten slot motherboard with this specification.

THE SOFTWARE

TUSCAN offers the user the choice of system monitor, editor, resident 8k basic, resident Pascal compiler or full CP/M disk operating system. All options are upwards compatible and fully supported with applications software. Both 5¼" and 8" drives are supported in double density.

THE PACKAGE

TUSCAN is available in kit form or assembled. With several hardware and software options to suit your requirements and budget. Attractive desk top case also available holds 2 x 5¼" Drives.

TRANSAM

NOBODY DOES IT BETTER!

Send to Transam Components Ltd,. 12 Chapel Street, London NW1

I am interested in the TUSCAN Z80 based single board computer with S100 expansion and enclose a S.A.E. for further details.

Name ____________________

Address ____________________

____

Telephone ____________________

TRANSAM COMPONENTS LTD., 12 CHAPEL STREET, LONDON NW1. TEL: 01-402 8137. TELEX: 444198

EDDY CURRENTS

A.S.Lipson brings you the life story of Eddy Current, last known to be circulating in the region of discs and transformers.

The branch of physics now known as electromagnetism can be said to have been born in 1819. It was in that year that Professor Oersted of the University of Copenhagen discovered that electricity and magnetism are related — that a current flowing in a conductor produces a magnetic field in the close neighbourhood of the conductor. Later, around the 1830s, the reverse effect — that an electrical current can be produced in a conductor by a changing magnetic field — was discovered simultaneously, and quite independently, by Faraday in England and Henry in America.

Both of these effects are used, for example, in the transformer; an alternating current in a coil creates a changing magnetic field, which, in turn, is used to produce an EMF (and hence a current, should a circuit be conected) in another coil. However, rather less people are aware of another, very closely related, and extremely interesting, effect — the phenomenon of eddy currents . . .

What's In A Name

Magnetic fields are not usually quite as selective as we would like them to be. A changing magnetic field will not only produce an EMF in any coils in its vicinity, but it will also produce EMFs, and hence currents, in any conductor around — even any old lumps of metal that may be just hanging about. These currents don't actually go anywhere — they just circulate round and round within the conductors, like eddy currents in a liquid. Hence the name — eddy currents.

Since eddy currents are the result of induced EMFs in conductors and because resistances within conductors can be very small, the currents can on occasion be quite sizeable, and so the effects produced by them can be very significant. In fact, eddy currents are far more than just a scientific curiosity. Depending on exactly where they are, and what they are doing, they can be either a curse or a blessing. However you view them, though, they are an interesting phenomenon, and can produce some fascinating effects, not all of which are totally useless!

Counting Your Blessings. . .

One of the more striking experiments on eddy currents is shown in Fig. 1a. A horseshoe magnet is suspended on a thread, above an aluminium disc which is itself free to turn about its centre. If the magnet is now spun round, the aluminium disc starts to rotate with it (although it never quite catches up with the magnet). Similarly, if you spin the aluminium disc, the magnet above it also starts to turn. This obviously cannot be due to ordinary magnetic effects — aluminium is non-magnetic, and if you try to pick up the disc with the magnet, you will find that you are unable to. It is apparent that something funny is going on. (No, air currents aren't dragging the disc round when the magnet rotates — you can put a sheet of paper between the two, and the effect still works!)

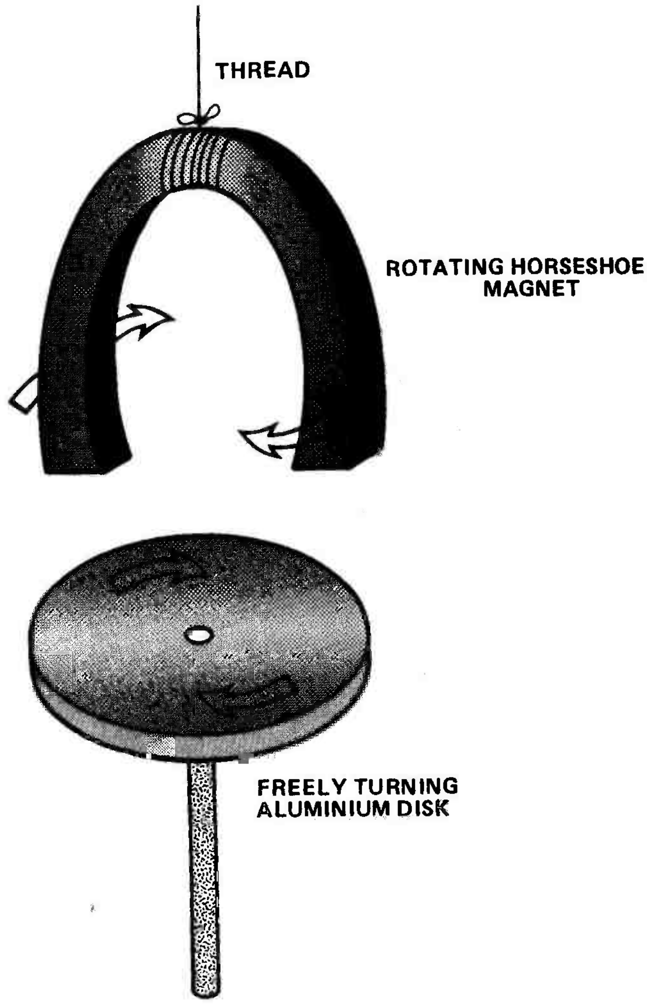


Fig.1a. The rotating magnet induces eddy currents in the aluminium disc .

Field Study

The relative movement between the magnet and disc is inducing eddy currents in the aluminium. These, in turn, create other magnetic fields, and it is these that cause the magnet and disc to move together — the magnetic field of the magnet interacting with the fields caused by the eddy currents (sounds a bit like pulling yourself up by your bootstraps, but it's correct) An interesting follow-up to this experiment is to replace the disc with one cut as shown in Fig. 1b. The slots tend to get in the way of the eddy currents and prevent them from flowing, so such a disc is not dragged round so easily by a magnet (which is another way of showing that air currents don't do the work — the slots shouldn't make any difference to them).

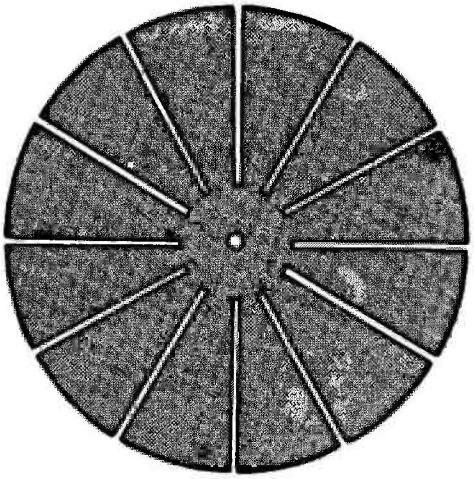


Fig.1b. If the disc in Fig.1a is replaced with one cut like this, the drag effect is greatly reduced, or even stopped.

Interestingly enough, this apparently insignificant effect actually has some practical application. It is used, for instance, in the normal car speedometer! The rotation of the wheels is transmitted, by various means, to a magnet, which itself rotates, with a speed proportional to that of the wheels. This rotating magnet induces eddy currents in an aluminium disc, (or its equivalent) and tries to drag it round. However, a spring is used to hold the disc, so it is unable to turn very far. The faster the car goes, though, the faster the magnet rotates, the greater the eddy currents, and the further round the aluminium disc is pulled. By attaching a little red or orange needle to this disc and seeing how far this needle rotatees, we can work out how far the disc has turned, and hence the speed of rotation of the magnet. Thus, we find out the speed of the car. Yes, I wish I'd thought of it first, too.

Cutting Your Losses

Besides being useful, though, eddy currents can also be very annoying. They could justly be called be called the transformer designer's nightmare. The transformer is, basically, two coils, close together. However, in the middle ther's a dirty great lump of metal (the core) and it doesn't ust sit there doing nothing, with all those magnetic fields about.

No prizes for guessing what happens. It might not seem that eddy currents in the transformer core would be much of a problem, but they are, for two main reasons. Firstly, the eddy currents mean a loss of power in the transformer and hence reduced efficiency. It stands to reason that if power is being used to drive currents around in the core, then that much less power is going to be available for use from the secondary coil. The second problem is no less serious, especially in large-scale transformers. The power being wasted in the core, driving eddy currents round, quite naturally ends up as heat, and consequently transformers are liable to get very hot. Indeed, large transformers, such as those on the national grid, may be oil-cooled, to prevent overheating.

It is obvious that, in transformers at least, eddy currents are not wanted. So what can be done about them? Well, if you've ever taken an old transformer apart for the wire, or even just out of curiosity (naughty, naughty), you will probably have noticed that the core is not just one solid lump; it is built up of flat metal laminations. This is not because they make the cores out of flattened baked bean tins. The laminations are separated by varnish or paper or some other insulator and this greatly increases the internal resistance of the cores, reducing eddy currents. Hence, both the loss of power and the unwanted heating are reduced.

Even the heating effect of eddy currents can be put to use, though. It is used in the production of pure crystalline samples of conductors like metals or semiconductors — germanium, for example. The impure sample of the material is passed, in a crucible, through a coil, which has passing through it a high frequency alternating current. The magnetic field produced by this current induces eddy currents in the specimen and the heating effect is great enough to melt it! As the sample passes through the coil, the molten zone within it is carried to one end (Fig. 2). Impurities within the sample are accumulated in the molten zone and hence get taken to one end of the specimen. This end is later removed. What is left is a very pure, crystalline sample of the substance. So eddy currents can be surprisingly useful!

Footnote

There is one final point which must be at least mentioned in connection with eddy currents. This is the induction motor, an indispensible servant of industry. It depends for its operation on eddy currents . . .full explanation of that, though, is another story altogether.

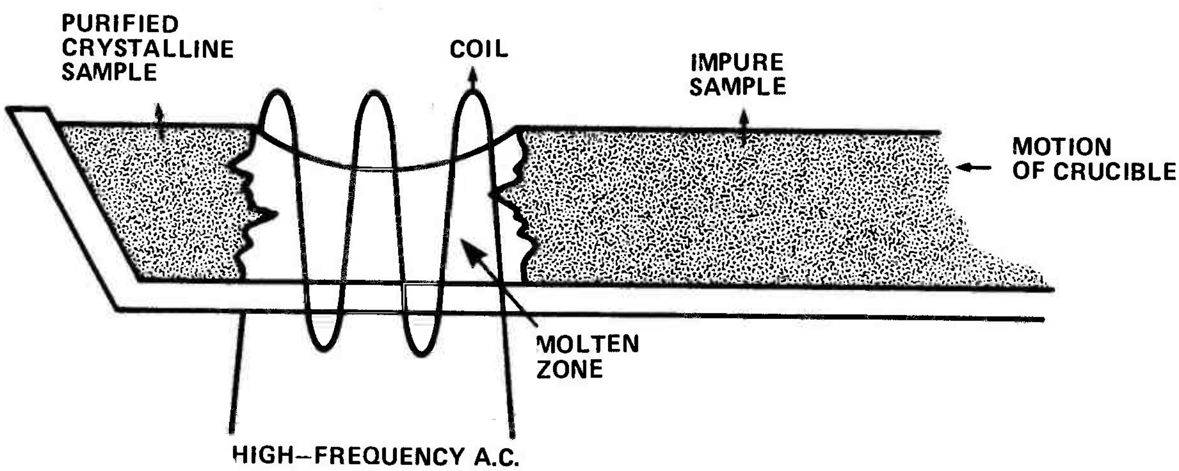


Fig.2. The heating effect of high frequencey AC can be put to good use in semiconductor material manufacture.

ETI

Mail Order Protection Scheme

If you order goods from mail order advertisers in this magazine and pay by post in advance of delivery, this publication *Electronics Today International* will consider you for compensation if the advertiser should become insolvent or bankrupt, provided

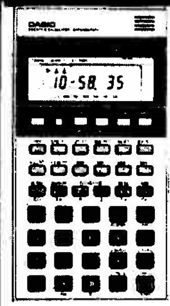
1. You have not received the goods or had your money returned; and
2. You write to the publisher of this publication *Electronics Today International* explaining the position not earlier than 28 days from the day you sent your order and not later than 2 months from that day.

Please do not wait until the last moment to inform us. When you write, we will tell you how to make your claim and what evidence of payment is required.

We guarantee to meet claims from readers made in accordance with the above procedure as soon as possible after the advertiser has been declared bankrupt or insolvent to a limit of £1800 per annum for any one advertiser so affected and up to £5400 p.a. in respect of all insolvent advertisers. Claims may be paid for higher amounts, or when the above procedure has not been complied with, at the discretion of this publication *Electronics Today International*; but we do not guarantee to do so in view of the need to set some limit to this commitment and to learn quickly of readers' difficulties.

This guarantee covers only advance payment sent in *direct* response to an advertisement in this magazine (not, for example, payments made in response to catalogues, etc., received as a result of answering such advertisements). Classified advertisements are excluded.

Casio's new SUPERCALC!   TRIO   HAMEG



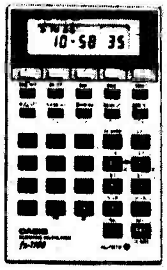
CASIO FX-8100

46 scientific functions, clock calendar, alarm, countdown alarm, interval alarm timer, hourly chimes, 1/100 sec stopwatch

ONE YEAR BATTERY LIFE (approx. used continuously). LC Display, 8 digit mantissa plus 2 digit exponent. 5 level parenthesis, full access memory. Trigs, logs, hyperbolics, standard deviations, co-ordinate conversions, sexagesimal to decimal conversions, fractions, percentage, cube roots, sign change, register exchange, Pi entry etc. **CLOCK** displays hours, minutes, seconds, am/pm and day. **CALENDAR** pre-programmed to 1999; day, date, month and year, 24 hour **ALARM**, hourly chimes. Countdown **ALARM TIMER**, interval (repeater), **ALARM TIMER** or 1/100 second **STOPWATCH** measuring net, lap and first and second place times to 10 hours. 6.6x70x129mm (¼x2¾x5⅛ inches). Leatherette wallet. RRP £27.95

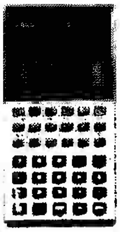
Only £24.45

Mini SUPERCALC! FX-7100



1 YEAR BATTERIES 30 scientific functions. As FX-8100 but 8 digits, without hyperbolics, fractions and calendar. Only 1 countdown alarm timer (repeat) or stopwatch function. Alarm and hourly chimes. 3/16x2⅛x3½". Leatherette wallet (£27.95) R.R.P.

£24.45



83QS-41B Alarm Chronograph

S/S encased. Mineral glass. Water resistant. **3 YEAR BATTERY.** Hours, minutes, seconds, date, am/pm, or hours, minutes, alpha day, date am/pm. 24 hour alarm, hourly chimes. Stopwatch from 1-10 second to 12 12 hours; net lap and 1st and 2nd place. Nightlight.

ONLY £24.45
R.R.P.
(£27.95)

NEW SCIENTIFICS

Casio FX-100
LCD, 10 digits, 44 scientific functions as FX-8100 above but with 6 levels ( ), FIX, SCI, NORM, ENG, RND and RAN in lieu of hyperbolics, % 7,500 hours battery ¼x3x5⅞ inches

£15.45
(£17.95 R.R.P.

C-80 Calculator Watch

(Finger-touch keyboard) Hours, minutes, seconds, am/pm, day, date, month auto calendar pre-programmed to 2009. Professional 24 hour stopwatch; net, lap, 1st & 2nd place to 1/100 sec. Dual time: 8 digit calculator. Nightlight. Water resistant. Glass. Black resin case/strap. R.R.P. (£29.95). **Only £24.45**

LADIES CASIO WATCHES from £12.45

Send 20p for full details of all Casio watches and calculators

FX81 **£12.45** FX-330 **£16.45** FX510 **£19.45** FX-2600 **£19.45** FX-3200 **£21.45** FX501P **£62.45** FX502P **£72.45** FA-1 **£19.45**

TERMS OF BUSINESS: Please note all Casio items **PRICE INCLUDES** VAT P&P and insurance. Please send cheques or P.O.s or quote Barclaycard or Access No. to: **B. BAMBER ELECTRONICS, 24 HOUR PHONE SERVICE. (0353) 860185** Callers welcome Tues., Sat. 9.00 am-5.30 pm.

TRIO CS1566 20MHZ triggered sweep oscilloscope £339.00
TRIO CS1562A 10MHZ triggered sweep oscilloscope £259.00
HAMEG oscilloscope HM307 LPS triggering bandwidth d.c. to 10MHZ component tester, timebase 0. ZUS — 0, 2 S/CM £149.00
HAMEG HZ36 switchable probe for HM307 £11.00
DACTRON PX40Z 13.8 d.c. 3 amp continuous 4 amp max, fully stabilised power supply with overload protection £19.95
DACTRON PH5000 13.8 d.c. 5 amp continuous £39.50
DIN PANEL METERS DIN7510 0-5 amps DIN 715 0-150 volts DIN 730 0-300 volts DIN 750 0-500 volts 72 x 72mm range £8.00
EAGLE DD7 paging microphone. Impedance 600 ohm or 50 Kohms, sensitivity 2.25mV at 50 Kohms. Frequency response 300-9000Hz. Desk or wall mounted. £14.85 + VAT
EAGLE MULTIMETER EM50 50,000 OPV DC volts: 0-1200 volts, AC volts: 0-1200 volts. DC current 0-6A, resistance 0-10 meg ohms £19.95 + vat
DRAPER SUPER CHROME ¼in sq drive socket sets. 38 piece 9AF. hexagon. 3 AF, bi-sq sockets. 11mm hexagon sockets. 9 B.A. hexagon sockets and 6 accessories. £12.75 + VAT
SPIRALUX metric nut spinner sets. Contains 8 nut spinners. 4, 4.5, 5, 5.5, 6, 7, 8, 9, 10mm. Packeted in plastic wallet £7.35 + VAT
WELLER TCP3 irons, 24 volt series, 3 wire power units. For application requiring earthed tip. Also PU3D power units TCP3 £13.84 + VAT PU3D £24.12 + VAT
WELLER INSTANT HEAT GUNS model no 8100D £13.21 + VAT
WELLER CORDLESS model no WC100 £25.47 + VAT
SUPA servisol switch cleaner £0.72 + VAT
MARYPLASS storage boxes. SP2 combination draw pack (contains 1x600, 2x201, 5x10) interlocking storage boxes. Per Pack £4.40 + VAT
ORYX DE-SOLDER TOOLS model SR3A, desoldering pump with built-in safety guard. Price £6.30 + VAT
IC TEST CLIPS, clip over IC while still soldered to pcb or in socket. Gold plated pins. Ideal for experiments or service engineers. 28 pin DIL £1.75, 40 pin DIL £2. Or save by buying one of each for £3.50
IC AUDIO AMP PCB output 2 watts into 3 ohms speaker. 12 volt DC supply. Size approx 5½"x1½"x1" high, with integral heatsink, complete with circuits £2 each + VAT

CALL IN AND SEE US OUR NEW SHOP IS OPEN

CATALOGUE 1980 send 40p and you will receive our 104 page catalogue products by Eagle, Yaesu, Standard, Trio, Hameg, Microwave models, Amtron kits and boxes, Vero, Draper, Spiralux, Knipex, Weller, Servisol, Jaybeam, Books by Barnard & Babani-Newnes and many more.

TERMS OF BUSINESS: Cheques, P.O.s or phone Access or Barclaycard No. 24-hr. Phone Service. Please add VAT AT 15% on all above goods. **CARRIAGE** and packing charges for all orders under £5.00 nett invoice value, add 75p orders over £5.00 and under £20.00, add 50p orders over £20.00 carriage free. Callers welcome 9.00am-5.30pm Tues-Sat (0353) 860185.

We welcome Access

B. BAMBER ELECTRONICS

DEPT: ETI, 5 STATION ROAD LITTLEPORT CAMBS CB6 10E

BARCLAYCARD VISA

The finest amplification kits from Crimson Elektrik

CPR 1 — THE ADVANCED PRE-AMPLIFIER. The best pre-amplifier in the U.K. The superiority of the CPR 1 is probably in the disc stage. The overload margin is a superb 40bB, this together with the high slewing rate ensures clean top, even with high output cartridges tracking heavily modulated records. Common-mode distortion is eliminated by an unusual design. R.I.A.A. is accurate to 1bB; signal to noise ratio is 70dB relative to 3.5mV; distortion <005% at 30dB overload 20kHz.
Following the stage us the flat gain/balance stage to bring tape, tuner, etc. up to power amp. Signal to noise ratio 86dB; slew-rate 3V/uS; T.H.D. 20Hz — 20kHz<008% at any level. F.E.T. muting. No controls are fitted. There is no provision for tone controls. CPR 1 size is 138 × 80 × 20mm. Supply to be ± 15 volts.

MC 1 — PRE-PRE-AMPLIFIER. Suitable for nearly all moving-coil cartridges. Send for details.

X02: X03 — ACTIVE CROSSOVERS. X02 — two way, X03 — three way. Slope 24dB/octave. Crossover points set to order within 10%.

REG 1 — POWER SUPPLY. The regulator module, REG 1 provides 15-0-15v to power the CPR 1 and MC 1. It can be used with any of our power amp supplies or our small transformer TR 6. The power amp kit will accommodate it.

**** NEW ISSUE 5 ****

POWER AMPLIFIERS. Our new issue 5 power amplifier modules have automatic shut-down that will not allow serious overloads for more than 0.1 sec — thus vastly increasing reliability at elevated temperatures. Other improvements to the circuitry have improved the subjective qualities which keeps CRIMSON even further ahead of the field.

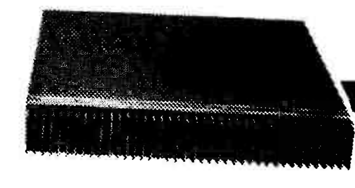
POWER SUPPLIES. We produce suitable power supplies which use our superb TOROIDAL transformers only 50mm high with a 120-240 primary and single bolt fixing (includes capacitors/bridge rectifier).

PRE-AMP KIT

This includes all metalwork, pots, knobs, etc., to make a complete pre-amp with the CPR 1 (S) module if required.

All prices shown are U.K. only and include V.A.T. and post. C.O.D. 90p extra £100 limit. Export is no problem, please write for specific quote. Send large S.A.E. or 3 International Reply Coupons for detailed information.

POWER AMPLIFIER KIT. The kit includes all metalwork, heatsinks and hardware to house any two of our amp modules plus a power supply. It is contemporarily styled and its quality is consistent with that of our other products. Comprehensive instructions and full back-up services enable a novice to build it with confidence in a few hours.



POWER AMPLIFIER MODULES
CE 608 **£21.00**
CE 1004 **£24.50**
CE 1008 **£27.50**
CE 1704 **£35.00**
CE 1708 **£36.00**

HEATSINKS
Light duty, 50mm, 2 C/W **£1.70**
Medium power, 100mm, 1.4 C/W **£2.70**
Disco/group, 150mm, 1.1 C/W **£3.50**
Fan mounted on two drilled 100mm heatsinks 2×4 C/W 65 max. when used with two 170W modules **£36.00**

THERMAL CUT-OFF, 70C **£1.90**

TOROIDAL POWER SUPPLIES
CPS1 for 2x CE 608 or CE 1004 **£19.50**
CPS3 for 2x CE 1004 or 1/2 x CE 1008 **£23.50**
CPS6 for 1/2 CE 1704 or 1/2 CE 1708 **£30.00**

POWER AMP KIT **£38.80**

PRE-AMP KIT **£39.80**

PRE-AMPS
These are available in two versions — one uses standard components, and the other (the S), uses MO resistors where necessary and tantalum capacitors
CPR 1 **£34.00**
MC1 **£26.00**
CPR 1S **£44.50**
MC 1S **£37.50**

ACTIVE CROSSOVER
XO2 **£19.00**
XO3 **£28.35**

POWER SUPPLY
REG1 £9.30 TR6 £2.50

BRIDGE DRIVER, BD1
Obtain up to 340W using, 2x170W amps and this module
BD1 **£7.25**

U.K. — Please allow up to 21 days for delivery
Write for free literature or send 50p for application/users' manual.

Crimson Elektrik

1a STAMFORD STREET, LEICESTER LE1 6NL.
Tel. (0533) 553508

ETI BOOK SERVICE

How to order: Make cheques payable to ETI Book Service. Payment in sterling only please. Orders should be sent to: ETI Book Service, Modmags Sales Office, 145 Charing Cross Road, London WC2. All prices include P&P. Prices may be subject to change without notice.

BEGINNERS

Beginners Guide to **Electronics** Squires £3.45
Beginners Guide to **Transistors** Reddihough £3.45
Electronics **Self Taught** Ashe £4.60
Beginners Guide to **Integrated Circuits** Sinclair £3.45
Understanding Electronic Circuits Sinclair £4.20
Understanding Electronic Components Sinclair £4.20
Beginners Guide to **Radio** King £3.45
Beginners Guide to **Audio** Sinclair £3.45

COOKBOOKS

TV Typewriters Cookbook £7.75
CMOS Cookbook £8.20
Active Filters £11.30
IC Timer Cookbook £7.50
IC Op-Amp Cookbook £10.00
Video Cookbook £7.00
TTL Cookbook £7.55
The Basic Cook £4.00 inc. p/p
IC Converter Cookbook £9.50

APPLICATIONS

. ire and Theft **Security Systems** B. Weis £2.15
How To Build Electronic **Kits** Capel £2.35
110 Electronic **Alarm** Projects R. M. Marston £3.95
110 **Semiconductor** Projects for the Home Constructor R. M. Marston £3.95
110 **Integrated Circuit** Projects for the Home Constructor R. M Marston £3.95
110 **Thyristor** Projects Using SCRs R. M. Marston £3.95
110 **Wave Form Generator** Projects R. M. Marston £3.95

COMPUTING & MICROPROCESSORS

What is a Microprocessor? 2 cassette tapes plus a 72-page book £12.00
Beginners Guide to Computers and Microprocessors with Projects C. Adams £6.05
Basic Computer Games Ahl £6.05.
Basic for Home Computers A self-teaching guide. B. Albrecht £6.15.
Illustrating Basic D. Alcock £3.00
Intro to Microprocessors Aspinall £6.55
Z-80 Microcomputer Handbook W. Barden £7.75
How to Program Microcomputers W. Barden £7.25
Introduction to Microcomputers and Microprocessors A. Barna £8.60
Microprocessors in Instruments and Control R. J. Bibbero £13.00
Basic Basic J. S. Coan £7.80
Advanced Basic J. S. Coan £7.30
Getting Acquainted with Microprocessors L. Frenzel £7.25
Beginners Guide to Microprocessors C. M. Gilmore £4.90
Beginners Guide to Home Computers Grossworth £4.50
Beginning Basic R. E. Gosling £4.75
Microprocessor Programming for Computer Hobbyists N. Graham £7.15
Miniprocessors from Calculators to Computers Heiserman £5.00
Microcomputers, Microprocessors, Hardware, Software and Applications J. L. Hilburn £17.40
Basic Programming J. G. Kemeny £7.25
Microprocessor Systems Design E. Klingman £17.00
Intro to Microprocessors Leventhal £17.00
Microprocessors — Technology, Architecture & Applications D. R. McGlynn £10.55
Interactive Computing with Basic Monro £3.65
Basic with Style P. Nagin £4.25
Software Design for Microcomputers Ogdin £7.20
Microcomputer Design Ogdin £7.25
Microcomputer Base Design Peatman £5.70
Hands on Basic with a PET Peckham £9.55
Basic — A hands on method Peckham £6.95
6800 Software Gourmet Guide and Cookbook Scelbi £8.90
8080 Software Gourmet Guide and Cookbook £8.90
The 8080A Bugbook: Microcomputer Interfacing & Programming P. H. Rony £8.35
8080/8085 Software Design Titus £7.60
57 Practical Programs & Games in Basic Tracton £6.65
Microcomputer Primer M. Waite £6.50
Your Own Compqer Waite £1.60
Microprocessor/Microprogramming Handbook Ward £6.20

LOGIC

Logic Design **Projects** Using Standard ICs J. Wakerly £7.15
Practical Digital Design Using ICs J. Greenfield £16.00
Designing With **TTL Integrated Circuits** Texas Instruments £9.35
How To Use **IC Circuit Logic Elements** J. Streater £3.80
110 **COSMOS Digital IC** Projects for the Home Constructor R. M. Marston £3.95
Understanding **CMOS Integrated Circuits** R. Melen £4.15
Digital Electronic **Circuits and Systems** R. M. Morris £3.65
MOS Digital ICs G. Flynn £5.25

TEST INSTRUMENTS

The **Oscilloscope** In Use Sinclair £3.10
Working with the **Oscilloscope** A. Saunders £4.25
Servicing with the **Oscilloscope** A. King £6.65
Radio Television and Audio Test Instruments King £7.00

OP-AMPS

Applications of Operational Amplifiers Graeme (Burr Brown) £8.45
110 **Operational Amplifier** Projects for the Home Constructor R. M. Marston £3.95
Designing With Operational Amplifiers Burr Brown £18.35
Operational Amplifiers **Design and Applications** G. Tobery (Burr Brown) £7.55
Op-Amp Circuit **Design & Applications** J. Carr £4.15

COMMUNICATIONS

Communication Systems Intro To **Signals & Noise** B. Carlson £7.65
Digital Signal Processing Theory & Applications L. R. Rabiner £24.40
Electronic Communication Systems G. Kennedy £8.75
Frequency Synthesis. Theory & Design Mannassewitsch £25.00
Principles of Communication Systems H. Taub £8.40

THEORY

Introduction to **Digital Filtering** Bogner £10.60
Transistor **Circuit Design** Texas Instruments £9.75
Modern Electronic **Maths** Clifford £6.95
Foundations of **Wireless Electronics** M. G. Scroggie £5.25

REFERENCE

Electronic Engineers Reference Book (Ed. 4) L. W. Turner £34.50
Electronic **Components** M. A. Colwell £2.70
Electronic **Diagrams** M. A. Colwell £2.70
International **Transistor Selector** T. D. Towers New update £10.20
International **FET Selector** T. D. Towers £4.35
International **Op-Amp Linear IC Selector** Towers £7.65
Radio Valve **and Semiconductor Data** A. M. Bell £3.60
Radio, TV and Audio **Technical Reference** Amos £30.40

MISCELLANEOUS

Electronic Fault Diagnosis Sinclair £3.55
Integrated Electronics J. Milman £8.20
Practical Solid State DC Supplies T. D. Towers £6.40
Practical Triac/SCR Projects for the Experimenter R. Fox £2.35
Printed Circuit Assembly Hughes & Colwell £2.70

Fallen behind recent advances?
Just starting out?
Need a decent reference book?
ETI Book Service provides an easy way of getting your hands on the right title.

CHROMASONIC electronics

56 FORTIS GREEN ROAD, MUSWELL HILL, LONDON N10 3HN
TELEPHONE 01-883 3705, 01-883 2289

YOUR SOUNDEST CONNECTION IN THE WORLD OF COMPONENTS

PETS

2001-8N (8K RAM)
£399

2001-16N (16K RAM) £499

2001-32N (32K RAM) £599

ALL WITH NEW KEYBOARD AND GREEN SCREEN

PERIPHERALS

Service & Assistance available.
Interfaces available are:
X-Y Plotters, Analogues to Digital Converter external cassette deck suitable 16 channel interfaces. Bi-directional interfaces etc.

FOR ALL PETS **£55**

UK101

£199 IN KIT FORM

£249 READY BUILT & TESTED

£275 COMPLETE IN CASE

No extras required — 8x2114 **£22.50**

- ★ Free sampler tape
- ★ Full Querty keyboard
- ★ 8K basic
- ★ Ram expandable to 8K on board (4K inc)
- ★ Kansas City tape interface
- ★ NEW MONITOR ALLOWS FULL EDITING & CURSOR CONTROL

ASSEMBLER EDITOR TAPE £14.95

LATEST STOP PRESS AND PRICE LIST

Send sae or phone for up-to-date **PRICES** of all our range of items stocked

CASES

Available for U.K. 101, Superboard Nascom,
Appx. DIM. 17" x 15"
435 × 384 mm

PRICE £24.50

P. packing £1.50.

TAPES

Unique stackable tape storage unit. Interlocking drawers.
45 drawers each containing 2 C12 tapes

10 drawers **£9.50**
5 drawers **£5.25**
Single drawer **£1.10**

MEMORY EXPANSION KIT

Suitable for UK101, Superboard expansion using 2114's each board has 16K ram capacity kit contains:

- ★ On board power supply
- ★ 4K Eprom expansion
- ★ Fully buffered for easy expansion via 40 pin socket
- ★ 8K kit **£99.95**
- ★ 16K kit **£139.90**

PRINTERS

TX-80 £395

EPSON TX-80 £395
Dot-matrix printer with Pet graphics Interface: Centronics parallel, options: PET, Apple and serial.

MEMORY

D.RAMS	£ p
4027	2.75
4050 (350NS)	2.35
4060 (300NS)	2.39
4116	4.35
S. RAMS	
2102A	1.09
2102A2	1.09
2112A	2.25
21L02	.98
2114-4045	2.95
4035	1.07
4044-5257	6.93
BULK PURCHASE	
8.2114	22.50
8.4116	29.95
8.21L02	7.00
BULK PURCHASE	
16 2114	39.95
16 21L02	13.00
32 21L02	25.00
64 21L02	45.00

EPROMS

2708	4.95
2716 (5v)	13.95
2532	39.95

ROMS

2513 (UC)	5.95
2513 (LC)	5.95

CPUS

6502	9.50
8080	4.75
9900	25.95
6800	5.90
Z80	8.95

BUFFERS

81LS95	1.25
81LS96	1.25
81LS97	1.25
81LS98	1.25
SN74365	.52
SN74366	.52
SN74367	.52
SN74368	.52
8T26	1.75
8T28	1.75
8T95	1.57
8T96	1.57
8T97	1.50
8T98	1.57

BAUD RATE GENS

MC14411	8.75
MM5307	8.75

WARTS

AY-5-1013	3.45
AY-3-1015	3.98
MM5503	4.75
6011	3.55

BARCLAYCARD VISA

Please add VAT 15% to all prices. Postage on computers, printers and cassette decks charged at cost, all other items P&P 30p. Place your order using your Access or Barclaycard (Min. tel order £5). Trade and export enquiries welcome.

We welcome Access

VIDEO TODAY

Richard Dean, editor of Television and Home Video, takes a look at the history and future of Home Video.

In the beginning there was television — Baird and all that. After many years of either broadcasting live or filming off a 405-line monochrome TV monitor, television output was mostly a 'here now, gone later' medium, until Ampex came up with the Quadruplex format in 1956-still the prime system in broadcasting today. It used 2 in tape travelling at 15 IPS, 'chopped' by four rotating video heads, producing segmented picture tracks vertical to the tape motion.

From these humble beginnings we can wind swiftly on to the start of 'Home Video', scanning only briefly the rise and fall of the BBC's VERA (Vision Electronic Recording Apparatus) and the Nottingham Electronic Company's Telcan. Both of these British developments used fixed-head scanning as opposed to today's helical scan. Ironically Japan's Toshiba corporation and the German tape giant BASF have resurrected this technique in prototype — nowadays called LVR or Longditudinal Video Recording, (scheduled for production next year as a home video recorder).

The early seventies saw Sony's U-Matic format using ¾ in tape encased in a plastic cassette. Although this was originally intended for the home market, various factors — the main one being cost — came into play, aiming the format toward the industrial sector, in which it holds an ubiquitous position today.

The first real domestic recorder came in 1972 with Dutch electrical giant Phillips' (helical scan) N1500 video cassette recorder. The machine contained the domestically essential timer — albeit a crude one — and an off-air tuner. For the first time viewers could programme a machine to record in their absence. The format was called VCR — logical at the time but destined to cause confusion as the term gained popularity as a general description for home video recorders.

And Then There Were Six

VCR uses co-axially mounted spools containing ½ in tape and, as with all video recorders at the time, guard bands separated video tracks to prevent crosstalk. In 1977 Phillips' pulled off another first — at least in Phase Alternation Line (PAL) territory — by introducing a longer playing version of VCR called VCR-LP (N1700 series machines). This increased the capacity of its coaxial cassettes from one hour on a VCR format machine to two and a half hours using a technique called "tilted azimuth recording".

Phillips technique, patented by a Japanese professor in 1959, has the two heads in the recorder's head drum tilted 14° relative to each other, or $\pm$ 7° from true azimuth.

This eliminated the need for guard bands with an attendant increase in tape capacity. All subsequent helical scan formats were to adopt this technique.

In 1978, PAL versions of Sony's Betamax appeared, followed swiftly by JVC's VHS (Video Home System) — attempts at a common Japanese format had by this time been abandoned. The final format was Grundig's own variation of the Phillips' VCR (which it had been manufacturing under licence), the SVR (Super Video Recorder). Betamax and VHS impressed the trade with their compact, co-planar cassettes and longer playing time (three and a half hours Betamax, three hours VHS).

Grundig's SVR used the original Phillips VCR/VCR-LP cassette, but used a more critical tape formation to cope with a 4 hour capacity. The format didn't catch on in the face of a ruthless marketing onslaught by VHS, and to a lesser extent Betamax and Phillips.

Grundig was already suffering from the saturation of its home market by TVs, and decided to combine with Phillips to combat the Japanese threat. Recently the fruits of their association, the Video 2000 (eight hours a side) co-planar cassette format has been launched onto the PAL market. During this combat Phillips' original VCR format has ironically remained fairly intact — for the moment — because of its high initial penetration of education and institutional markets.

And It Came To Pass. . .

But where does this leave us today? Certainly VHS has scored a major success in the world market, nowhere more so than in Britain where there are as many as 75% of users with VHS machines. Worldwide JVC seems to have persuaded a greatest number of manufacturers toward VHS.

But Sony remain hopeful. The recently launched, feature-packed, C7 is evidence of the company's determination to win support from upgrading, as well as from first time buyers.

If you've been watching the video scene so far you may conclude that the last thing a manufacturer should contemplate is halving the scanned tape width. Well Phillips *has* managed to get away with it — borrowing a technique called Dynamic Track following (DTF) from the industrial sector.

The Sanyo VTC 5500P

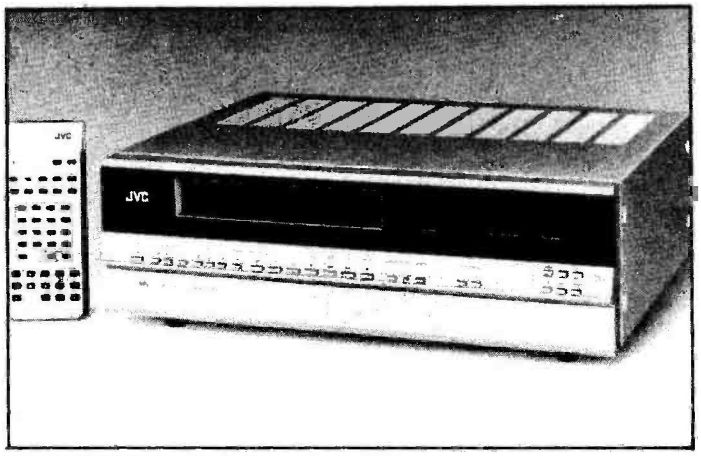
DTF involves mounting the video heads on a piezo-electric crystal base and recording four guide tones — which are combined with the video information — over four video tracks in turn.

On replay, beat frequencies generated by either head mistracking, causes a microprocessor to output 'up' or 'down' pulses to the respective head bases. If both heads are hopelessly out, the transport servo is adjusted. In this way tracking accuracy — essential to such a compact system of storage — is guaranteed. Phillips' claim that contemporary replay quality will be maintained. So far, nobody is prepared to refute this claim.

Instant Replay

However, the future format war will be — as it is at this moment — fought on features. Here Phillips Video 2000 is in a good position, as fast wind with vision, slow motion and still frame are theoretically easy to perform with DTF.

Initial models from Phillips (VR-2020) and Grundig (V2 x 4) are not equipped with any of these features. Many



The JVC HR 7700E with full remote control.

observers see these first Video 2000 products as "too little, too late".

The Sony C7 was launched to the sound of £1 million worth of promotional trumpets; as the 'King Of The Format Jungle'. Its main claim to fame is the machine's feature repertoire, in particular the "cue and review" facility. This allows you to flip through a tape in forward (review) or rewind (cue), still in vision. The speed at which you can do this is inevitably reduced by the required intimacy of heads to tape — although Betamax format remains laced during winding modes — and on the C7 this varies from about x4 to x15 play speed, according to the diameter of the spool driving the tape.

Panasonic have used a new compact design to achieve lacing during winding modes, with the added elegance of a servo control on cue or review maintaining a constant x9 play speed.

The Cold War

There's more to come from the VHS faction, however. Not only is Dolby B noises reduction being introduced to the format's soundtrack, but Panasonic's NV-7000 incorporates back space, or pre-roll, editing. This directly counters Sony's improvements in editing performance and indeed substantially surpasses it. While Sony has tightened up the gap tolerance in pause mode, Panasonic borrows a technique used on professional gear. When 'record' mode is selected, the tape is wound back 1½ seconds in real time. When pause is cancelled, the transport moves the tape forward at play speed in the usual way, but the servo 'listens' to the sync. track on the edge of the tape and gets it in step with the incoming pulse chain. So when the original cue point is reached and recording begins, the picture instability is not just reduced, it is eliminated. This has far-reaching implications for home movie makers and straightforward perfectionists alike.

In addition, VHS has a 4 hour tape waiting in the wings to combat Phillip's 4 hour capacity. The Betamax format uses thinner tape anyway, and so does not have the capability to pack more tape in without reducing tape thickness to a precariously low dimension.

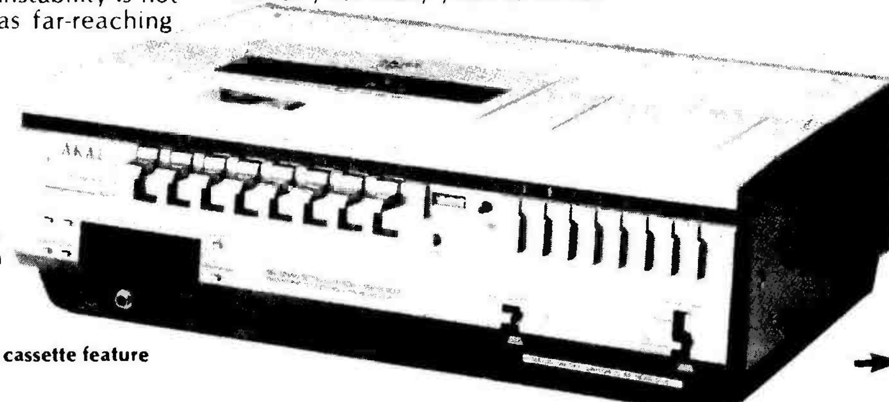
Strictly Off The Record

The first video *disc* to arrive on the scene is almost certain to be Phillips VLP. But following in its tracks will be JVC's VHD/AHD (Video High Density/Audio High Density) and RCA's Selectavision.

Phillips' system uses a miniature laser inside the player to scan video sync. and reference signals encoded on a 10 in transport disc. Light bouncing off the disc's protectively coated surface reaches a photo-cell moving with the laser transmitter under servo control from the centre of the disc. Thirty minutes of information can be stored on each side using a constant rotational speed. But with development Phillips claims it could increase this to one hour per side. The main obstacle to the system is the critical conditions under which the disc must be pressed. However, its advantages are considerable. A frame or chapter indexing facility makes it the trick-play fanatic's dream, and, more importantly renders it ideal for educational and data retrieval applications. Another advantage is the discs ability to withstand mususe. You can put thumbmarks on it, pour beer on it, or even scratch it — up to a point — because the information lies beneath a transparent coating, such misuse never reaches the information. Minor scratches are, quite simply, so massive compared to the data that the photo cell ignores them.

JVC's VHD/AHD system poses a formidable threat to VLP. Thorn-EMI has just announced its backing for this format, which uses a grooveless capacitive disc in a protective sleeve. Thorn has a massive chunk of the rental and retail market in consumer electronics, and its EMI arm will become a ready-made software provider. Thorn-EMI chose VHD/AHD — which offers one hour per side with indexing and trick-play — on the basis of the player's ease of servicing and the disc's ease of pressing. Discs can be manufactured on conventional presses, after mastering on a lathe which, 'cuts' a photo sensitised glass plate. Phillips has meanwhile begun to equip a special VLP pressing plant in Blackburn, Lancashire.

So summarising on what is increasingly appearing to be a massive video game, there are some exciting moves to be made in the future. The stakes are indisputably high; and the outcome will reverberate through most of the electronics industry for many years to come.



Right: The Akai VS9800 VHS deluxe home video system

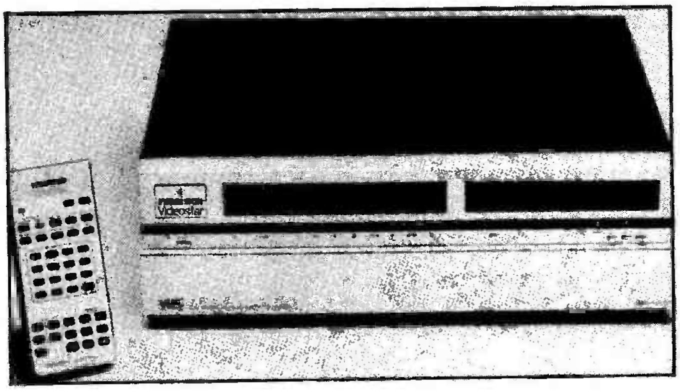
Left: The Grundig 2x4 Video 2000 with front loading cassette feature

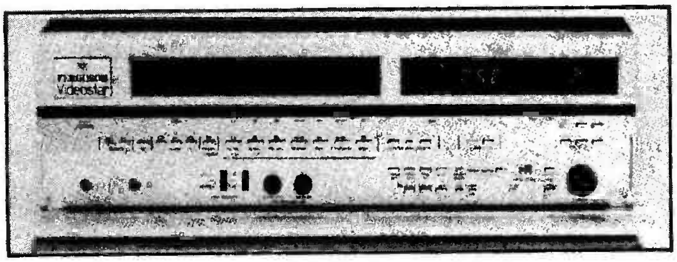
	GRUNDIG VIDEO 2 X 4 V2000	PANASONIC NV 7000 VHS	PHILLIPS VR 2020 V2000	FERGUSON VIDEOSTAR 3V23 and JVC HR7700 FERGUSON and VIDEOSTAR 3V23	AKAI VS 9800 VHS	HITA VT 50 VI
Typical Price:	£690 guide price	£650 approx.		Under £700 (available in Autumn 1980)		£539
Maximum Recording Time:	2 x 4 hours	3 hour	2 x 4 (flip Over)	3 hours	3 hours	3 Hours
Timer:	10 day/ 4 programme	14 day/ 8 programme	16 day/ 5 programme	14 day/ 8 programme	8 day	10 day
Remote Control:	Optional extra	12 mode supplied	Full function Optional Extra	Full function supplied	6 function included	Pause control only. Optional
Still Frame:		Yes		Yes and Frame Advance	Yes	Yes
Variable Speed Playback:		Double and half speed		Normal and double speed with sound	Double or slow motion	Single frame advance
Review Feature:				Yes		
Audio Dub:		Yes		Yes	Yes	Yes
Automatic Tuner:	Yes		Automatic Search Tuner	Yes		
Portable Recorder Available:				3V24	VP7100	
Camera:	FAC 1800	Socket included	V100 or V200	3V20	VC 30	VKC 500
Extra Features:	Dynamic Track Following Automatic Programme finding Dynamic Noise Suppression	Dolby Noise Reduction	'Go To' function Automatic Rewind Dynamic Noise Suppression	Dolby Noise Reduction 1 Hour Battery Back-Up in Power Failure Edit Start Control		Free Cassette

CHI 0 ER S	JVC HR 3660EK VHS	SONY C7 BETA	SANYO VTC5500P BETA	SHARP VC 6300H VHS	HITACHI 5500E VHS	MITSUBISHI HS 300G VHS
	£582	£649	£500	£650	£599	£650
	3 Hours	3½ hours	3¼ hours	3 hours	3 hours	4 hours
	8 Day	14 day/ 4 programme	7 day/ 5 programme	7 day/ 7 programme	7 day/ 5 programme	7 day/ 6 programme
	Playback only. Supplied	12 mode supplied	9 Function Optional Extra	Wired supplied		Wireless or wired (optional)
	Yes	Yes		Yes and Frame Advance	Yes and Frame advance	Yes and single frame advance
	Double and Slow motion	5 alternative speeds		6 speed		half and sevenfold
		Cue and Review				
	Yes	Yes	Yes	Yes	Yes	Yes
		Yes			Automatic Channel Lock (during recording)	
	HR4100	SL 3000P				
	GL4100	HVC 2000P	VCC 545P	XC—35H	VK C500E or VK C750E	
		Picture Search		Automatic programme Locater	Automatic Programme Search Battery back-up for short power failures	Low power consumption

VIDEO VIEWPOINT: Tina Boylan examines the Video Recorder Marketplace.

The long awaited video disc, although perched firmly on the horizon of home video, will take a considerable time to descend to the plane of the general consumer as a viable mass market product. Even then the existing tape system will hold an unchallengable position in home entertainment, taking over where the cine-camera leaves off. At present manufacturers are improving facilities for home-movie making with high quality cameras, improved edit facilities, portable recorders and better sound reproduction — already available as peripherals to the higher quality machines. Even the newest and most advanced of the recorders, with 'the sky's the limit' facilities, are becoming something of an enigma. It seems that almost every month a new system is launched, which claims new and better features: An eternal game of manufacturers' leapfrog.





The new Ferguson Videostar 3V23 due for launch in the Autumn

To Buy or Not to Buy...

However, the resultant cost of research and development, coupled with high manufacturing costs, (precision playing an important part in production) are inevitably relayed to the customer, despite the considerable drop in price of video equipment generally. This can, to a certain degree, leave manufacturers with marketing difficulties. In the final analysis, selling high price luxury items during an economic recession is tough going. Many machines are tentatively priced at 'around £700', which to Joe Public represents a considerable investment with so many other, and more economically justifiable, items monopolising his income. He needs considerable persuasion to embark upon this type of financial undertaking, and even having decided that he wants or needs a video recorder, finding a way around that price tag is going to hinder him further.

With a mere 1% penetration of the TV market in Britain, (225,000 recorders in 20 million TV-owning homes) today's video company can see all too clearly a large market waiting to be tapped, if it can discover how. Recently a number of them have done just that, focusing their attention on an already well established method — TV rentals.

Easy Access

The TV rental shop came into its own during the 1960's, as the price of traditional black and white television was coming down, and the more advanced colour models were arriving on the market. Its presence heralded the age of widespread TV ownership, as it enabled the average household to afford the most advanced and reliable sets available, without the subsequent financial responsibility for repairs and servicing.

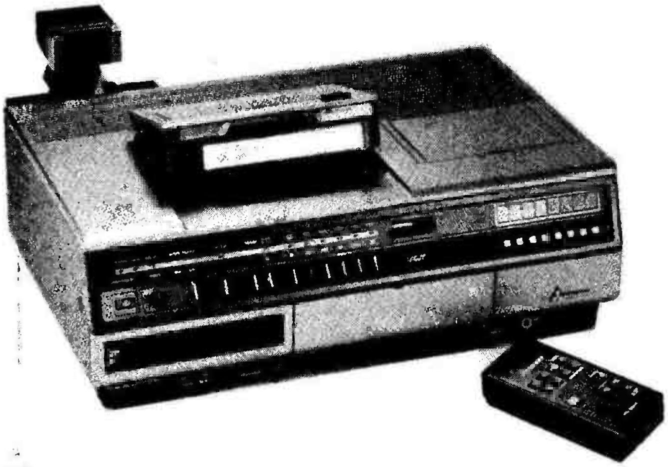
Since then, chains of rental shops have appeared and prospered considerably, with most high streets in England boasting at least one well known name in television rentals — and it is here that the video industry has found an outlet.

Many of the large manufacturers are either directly affiliated to chain rental stores, (Ferguson to Thorn-EMI, through DER, Radio Rentals, Multi-Broadcast, Rumbelows and Rediffusion) or have made agreements with them — for example JVC has found outlets through Thorn-EMI. Sony too will now have rental access through its agreement with Telefusion, (a wise move) in order to market its innovative new creation, the C7.

Video For Everyone

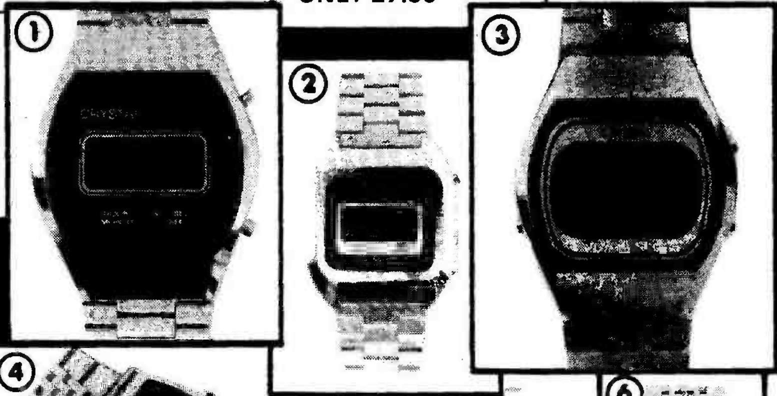
These new developments through the rental industry, will not only allow the already interested consumer to obtain a video recorder at a reasonable price, but will also draw the attention of the remainder of the public to their existence. A prominent shop window display of video recorders is now on view to anyone walking down the high street who cares to glance toward the brightly lit interior of the, already familiar, rental shop.

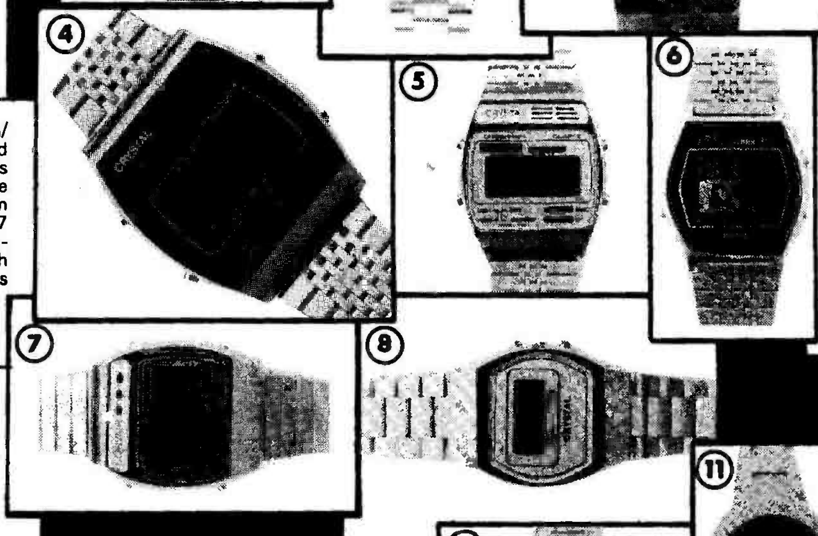
Here, it seems, is the basis for a growth in home video, comparable perhaps to hi-fi during the past decade. Indeed it could well become an integral part of home entertainment, with a range of equipment as varied as can be found in stereo systems today, its impact will certainly effect the leisure industry far into the future.

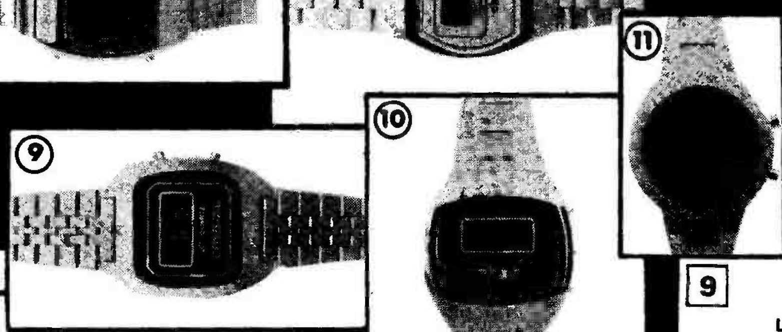


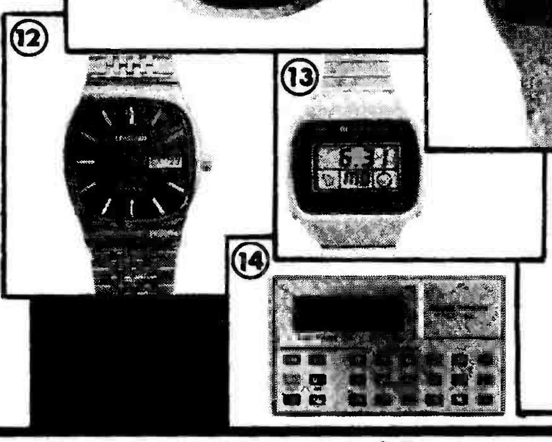
The Mitsubishi MS 300.

ETI









OLIVETTI PRINTER & KEYBOARD type Te 300
with PUNCH & READER. Upper case ASCII with V24 Interface. 240 volt operation.
£125 each

INFRA RED IMAGE CONVERTER type 9606 (CV 144)
1¾" diameter. Requires single low current 3KV to 6KV supply. Individually boxed. With data
£12.50 each P&P 75p — Infra Red Lamps also advertised

709 DIL 14 PIN OPERATIONAL AMPLIFIERS
at **8p each**
100 off 25% discount

MINIATURE KEYBOARD
Push contacts, marked 0-9 and A-F and 3 optional function keys. **£1.75 ea.** P&P 65p

BLUE THERMAL PAPER
430ft. roll, 8½" wide
£2 per roll. P&P £1.75

CONVERT THIS UNIT TO A SUPER BATTERY CHARGER
Attractive green ministry quality case with removable top & bottom plates — heavy duty power switches—high powered resistors to control current — good quality centre mounted Amp Meter — strip of wing nut terminals on front panel which can be used for connecting leads.
ALL THIS FOR £3.50. P&P £2.
FOUR UNITS FOR £12. Carriage £5.

STEPPING MOTORS
200 steps — 20 oz./in. torque
12/24 volt input, 4 wire
£12 each P&P £1.50

STEPPING MOTORS
200 steps. 20 oz./in. torque
120 volt operation, 3 wire.
£4 each P&P £1.50

STEPPING MOTORS
North American Philips. 5 volt 3.3 amp operation. 2 wire. PPS 0-200 revs per min. 0-250 used. Tested.
£16 each P&P £1.50

STEPPING MOTORS
6/12 position with additional where the rotor is coils. Device can be used as a tacho. Diagram supplied. Will actually work on 5 volts. 12/24 recommended.
£1.50 each P&P 75p **or 5 for £5** p&p £1.50.

RXs
770R used **£120**
730/10 used **£85**
Limited quantity only

MUST CLEAR POLARAD SPECTRUM ANALYSER
5" Display. These are supplied with STU 2 plug-in. 1 to 45 GHZ.
£85 each

LARGE QUANTITY OF PHOTOMULTIPLIERS
all with information. British approx. 2" window **£2 ea.** British approx. 5" window **£3.50 ea.** American approx. 2" window **£4 ea.** Special American version by RCA **£6 ea.**
P&P all photomultipliers **£1.50 ea.**

BC172	**5p**	MC4001	**15p**	TIS92	**10p**	BC337	**8p**
BZY884V7	**10p**	MC4012	**15p**	TIS93	**10p**	BC327	**8p**
BZY8813V	**10p**	MC4020	**75p**	2N3704	**8p**	BC251	**5p**
2N3006	**5p**	74C20	**25p**	2N5447	**5p**	BC171A	**5p**
1N4305	**5p**	74C08	**25p**	2N5449	**5p**	BFT60	**5p**
BZX79C12	**10p**	74C1D	**20p**	2N3053	**15p**	4013	**30p**
BC212B	**5p**	MC4049	**35p**				
SN76550	**5p**						
IC 7451	**10p**						

REGULATORS — all at **45p each**. MC7805, 7812, 7815, 7912, 7915
MC1496L **70p**
16 pin DIL Socket **10p**. 14 pin DIL Socket **8p**
LED type TIL 209 Red with holder **10p each**
SLOTTED OPTO SWITCH supplied with data — normally over £2. OUR PRICE **75p** each
ROCKER SWITCHES 2 pole c/o — **15p** each
Spring Action TERMINALS — normally over **30p** ea. OUR PRICE **15p** each
TOROIDAL TRANSFORMER 0-115V-230V Input 13.5V — 0 — 13.5V rated 8VA output **£1.70** each. P&P 75p
Sub-min TRANSFORMER 0-120-240V Input. 12V-0-12V rated 4VA Output **75p** each P&P 50p
L.E.D.s
Standard White 12p, Standard Yellow 15p, Small White 8p.

TRANSISTOR INVERTER
115V AC, 1.7Amp Input. Switching is at 20KHZ. Output windings from Pot Core. Can be rewound to suit own purpose or unit can be broken for host of components. Circuit supplied.
£1.25 each P&P £2

KEYBOARD PAD
Size 3 x 2½ x 2" high with 12 Alma Reed Switches. Blue keys marked in green 0-9 and a star with one blank.
£4 each P&P £1
or **5 for £15** P&P £2

RXs
770R Mk. II
940
24V INVERTOR VERSION
SPECIAL GOVT. QUALITY
VGC
VERY FEW OF THESE PRICE ON APPLICATION

We still have a large quantity of
TEST GEAR, OSCILLOSCOPES, SIGNAL GENERATORS ETC, and they are priced to move.
Callers welcome or write or Better Still PHONE for details

MAGNETOS NEW BOXED
Originally for 14 cyl-gipsy
Very adaptable
£4.75 each

TANTALUM BEAD CAPACITORS. 4.7uf 25V. 10 off **£1**; 100 off **£7.50.**
TEXAS Low Profile 40 pin IC Sockets **45p each.**
SMALL TRANSFORMER. 240V Input. Output 2 windings 12V & 24V 1 amp. **£2 each.**

SO SIMPLE — SO SAFE
Fit a push button CIRCUIT BREAKER. Small compact. 3 ratings 0.8; 1.8 & 10AMP. State which one when ordering. **75p each.**

AMP METER 2½" dia. Scaled 0-60. Basic 75MV FSD. Complete with external 60Amp Shunt. **£2.50 each**; P&P £1.50.

DIODES
All new full spec. devices. IN3063; BAX 13; IN4148; IS44. 100 off **£1.50** — 1,000 off **£10.**

VARIACS EX Equipment Good condition 8 Amps — **£25 ea.**
20 AMPS — **£35 ea.**
Some 3 phase available. Please enquire

CRYSTALS
19.2KHZ FLAT METAL CASE — **50p each.**
10 MHZ B7G **50p each.**

LOUD HAILERS
Transistorised, hand held, no leads — standard internal batteries supplied. Howl switch.
£20 each. P&P £2

TRANSFORMERS Standard Mains input
Secondary outputs
6KV 0.125A **£15 ea.**
3440V 0.66A with matching 40H Choke **£30** the pair
3KV 50MA **£8 ea.** 4 Volts 250 Amps **£10 ea.**
18KV 30MA **£60.**
22.5KV 110MA **£50 ea.** 5KV 300MA **£15.**
60KV 0.0273 **£150.** 12KV 30MA **£20.**
MULTI PURPOSE MAINS TRANSFORMER 4 windings each winding 0.10-110.125 at 48A **£15 ea.**
425V 50HZ 2 Wire input. Output 8.5KV 2.55KVA. Could be run on 240V at ½ rating **£15 ea.**
STEP DOWN ISOLATING TRANSFORMER Input 220-250V 50HZ Output 115V 1.8KVA. BRAND NEW. These are very conservatively rated **£20 ea.**
CAPACITORS
2mfd 5KV **£4 ea.** — 0.5 mfd 10KV **£4 ea.**
0.5 mfd 5KV **£4 ea.** — 8 mfd 2.5KV **£4 ea.**
CARRIAGE on these units will be charged at cost

INFRA RED QUARTZ LAMPS. 240v 620 Watts. Size 13½" x ⅜" dia. **£1.50.**
BRIDGE RECTIFIER. 2 Amp **50p ea.**
PHOTODIODE DETECTOR 1" fly leads. **25p ea.**
AMPHENOL. 17 way chassis mount edge connectors 0.1 spacing. **15p ea.**
I.E.C. Standard **MAINS LEAD.** Moulded (3 vertical flat pins centre offset) **60p ea.**
FANS. 115V 13 Watts. Size 3½ x 3½ x 1½". BRAND NEW **£4.50 ea.** Secondhand **£2.50 ea.**

Miniature **MOTORS** 12V with geared wheel (8 teeth 3/16" dia) Size 1¼ x ¾" dia. New **30p ea.**
MOTOR 12V DC with pulley and integral semiconductor. Speed Control. New **£1 ea.**
LEDEX ROTARY SOLENOIDS. 115V DC. No switch assembly **15p ea.**
DIAMOND H CONTROLS ROTARY SWITCH. Single pole 10-way. Printed Circuit Mount. New **10p ea.**
DELAY LINE. 50 nanosecs. 3 connections. ground-in-out. Size 2 x 7/16 x 16". New **25p ea.**
PULSE TRANSFORMER. Sub min. Size ½ x 5/16 x ¼". Secondary centre tapped. New **20p ea.**
MOTOR by Inland Motor Corp. DC High Torque. Reversible. Usable torque at 5V. Max voltage 24V **£2.50 ea.** P&P £2
REMO TV TYPE MULTIPLIER. Two high voltage outputs and focus. **£1 each.**
DON'T TAKE CHANCES. Use the proper EHT CABLE. **10p per metre or £7.50 per 100 metre/drum.** P&P 1½
MOTOR by Eastern Air Devices Inc. 125V reversible with toothed shaft (10 teeth ¼" dia). Size 2⅛ x 2⅛" dia **75p ea.** P&P £1
PHOTOGRAPHIC LAMPS. Pearl 230V 500 watt. Screw cap **75p ea.** Box of 12 £5.50. P&P £1.50
MYSTERY IC PACK. Some 40 pin — good mixture — all new devices. **25 ICs for £1.** P&P 50p. You find out what they are and we will buy the information from you
VACUUM PUMPS — TRAPS, ETC. Send for list
DECOUPLING CAPACITORS. 0.05mfd 10V. 0.01mfd. 0.1mfd 50V. 0.047mfd 250V. All values 100 for **£1.**
E.H.T. CAPACITORS 500pf 8KV **20p each.**
10-WAY MULTI COLOUR RIBBON CABLE. New. **40p per metre. 10 metres for £3.**
GEC UHF 4-button tuner **£1.50 each.**
CENTAUR 115V FANS 4½ x 4 x 1½" **£4.50 ea.**
EX-USED equipment. tested. **60p each.**
POTTER & BRUMFIELD TIMER RELAY, 115V AC. Heavy duty. 7 pole c/s with 2 second delay. Charge R & C for different timing **50p each.**
SPEAKERS 2½" 50 ohm 0.2W. New **40p each.**
RAPID DISCHARGE capacitors 8mfd 4kV **£5 each.** P&P £2
BIG INCH Motor. 110V AC 3 rpm 50 cycle. Very small. **50p each.**
CONTACTORS. Heavy Duty 24V DC 5 make **£1 each.**
GEC UHF. VHF 6 button tuner **£2 each.**
DIGITAL 24-HOUR CLOCK with built in alarm as used in Braun Digital clocks. Silent running. Large illuminated numerals. AC mains. Size 6½ x 2¼ x 2½". **ONLY £3.75 each.**
931A PHOTO MULTIPLIER in stainless steel container with window and built-in resistor network. **£2 each.** P&P £1
SLIVER CONTROL 500W. Log. Single track. Complete with knob. Length 3". **25p each.**
RANCO 250V 18A THERMOSTATS with Control knobs calibrated 50-200 degree C **£2.50 each.**
SOLID STATE UHF TUNERS. 30 ars **£1 each.**
BRAND REX blue wire wraps. 30 metres for **£1.**
5in **SOLID RUBBER RINGS** (1" dia. rubber). Keep the kids (or dog) happy. **4 for £1.** P&P £1.50

TRANSFORMERS
AUTO 240V input 115 V. 1 Amp output **£1.25 each.** P&P £1.25
240V input. Soc. 6V. 1.86A 8kw. Size 2½ x 2 x 2". Good quality. **£1.50 ea.** P&P £1
240V input 8ac. 12V 0.92A. Size 2½ x 2 x 2". Good quality. **£1.50 ea.** P&P £1
240V input 12V 100MA. Size 60 x 40 x 42mm. **50p each.**
240V input. Soc. 12-0-12V 50MA. Size 53 x 45 x 40mm. **£1 ea.**
115V input. Soc. 5V 250MA. Size 1 11/16 x 1.5 x 1¼" **2 for 50p.**

SEMICONDUCTORS 1N4005 — **5p;** 1N4003 — **3p.**
At 5p each:
3BC147, BC148B, BC157, BC158, BC237, BF197, OA90, OA81, BA154, BA243
At 25p each: TIP31, TIP41A, 2N5E96, AF139, 2TX341
BY127 **10p.** BF181 **20p;** BD239 **49p;** BD241 **40p;** MA343AT **40p;** BD228 **50p;** BD233 & BD234 Comp Pair 25W — **80p per pr. at 50p each.**
REGULATOR TBA625 8 to 20V in — 5V out 100MA TO5 Con **50p each** BF256C **20p.** TV AMPLIFIER TBA 120 **20p each.**

Integrated Circuits

7453	**5p**	74H74	**12p**	75325	**£1**
7451	**5p**	74H51	**7p**	SN15862	**4p**
7402	**12p**	74538	**10p**	MC4028	**69p**
7476	**20p**	74502	**12p**	7417	**14p**
7495	**35p**	74154	**70p**	7441	**40p**
74122	**12p**	74C02	**16p**	74C86	**50p**
74C00	**17p**	74C04	**18p**	74C161	**24p**
		74C74	**18p**		

MOTOROLA DUAL in Line 6 pin Opto Coupler **30p each.** Gold plate tester version **50p each.**
EPROMS 2708 **£5.50 each.**
TELEPHONES 706 style black or grey **£5.50 each.** 746 style black or grey **£7.50 each.** Older style black **£2.50 each.** P&P £1.50 per telephone
Honeywell humidity controllers **50p each.**
THYRISTOR TIMER. Solid State. 15 secs adjustable (reset) in plastic relay case. Standard 7-pin base. Series delay **50p each.**
MINIATURE PC MOUNT SLIDE SWITCH. Single pole 3-way **10p each.**
VARIACS. 2 amp Standard 240 Volts **£10 each.** P&P £2
ELECTROSTATIC VOLTMETERS. 7.5KV **£8 each.** P&P £1.50
Other ranges available. Please enquire
TRIMMERS. Sub min. 0.25 to 1.25pf. to to 4.5pf. 7 to 45pf. **All at 6p each.**
CROWN replacement MOTOR for IBM GOLFBALL TYPEWRITER 115Volt 50HZ 1350 rpm. **£4.50 ea.** P&P £2
SMITHS encapsulated transistorised AUDIBLE WARNING DEVICES 4V-12V. Can be driven from TTL **65p each.**

MINIMUM ORDER £3 VALUE OF GOODS. MINIMUM P&P £1 — where P&P not stated please use own discretion — excess refunded. CARRIAGE ALL UNITS £5. P&P or CARRIAGE and VAT at 15% on total MUST BE ADDED TO ALL ORDERS.
CALLERS VERY WELCOME STRICTLY BETWEEN 9am-1pm and 2-5pm Monday to Saturday inc.
BARCLAYCARD (VISA) and ACCESS taken. Official orders welcome.

CHILTMEAD LTD
NORWOOD ROAD, READING — **TELEPHONE NO. READING 669656**
(2nd turning left past Reading Technical College in King's Road then first right — look on right for door with Spoked Wheel)

Superboard II 8k MICROSOFT BASIC 4k RAM

At these prices why waste time and money on unauthorised kit copies? Just a little more in price than Sinclair for a whole lot more and fully expandable !

READY BUILT £159.95

NOW ON SHOW IN THE SCIENCE MUSEUM

610 Expansion Board 8k RAM **ONLY £159.95** + VAT

IP CD3P Minifloppy Disc, Cased, PSU, 2 copies Dos **ONLY £289**+VAT

Set of 4k RAM (Superboard users only) **ONLY £28** + VAT

Plastic Case, Beige **ONLY £26**+VAT

Challenger IP-Metal Cased, Superboard, PSU modulator **ONLY £208** +VAT

NEW 50Hz version - NO FLICKER

Super Print 800

80 COLUMN HIGH PERFORMANCE IMPACT PRINTER

The ideal companion for PET, APPLE, TSR80, Exidy, Superboard, Compukit, Ohio Challengers and most micro's

Rugged metal enclosure makes it ideal for home computing, small business systems, data logging etc.

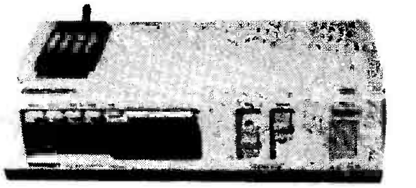
NEW

**RS–232, 20mA, IEEE 488 and Centronics I/O*
**16 Baud Rates to 19,200*
**60 Lines per minute - Bidirectional*
**5 print densities 72,80,96,120 or 132 Chr/Line*
**Self Test Switch *2k Buffer*
**Tractor and Fast Paper Feed/Graphics*

Model 800 MST **ONLY £399** + VAT

Radofin Teletext Decoder

Get more out of your TV

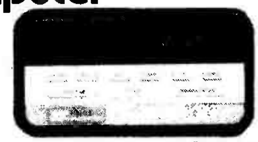


ONLY £149.95 + VAT

Works on any TV (RF in/RF out), remote control unit, Teletext colours, CEEFAX and ORACLE via 6 preset tuner, enlarge facility, Time on, Time off facility, reveal button - for quiz games hold button.

ZT Driving Computer

ADD A NEW DIMENSION TO YOUR CAR WITH COST EFFECTIVE FUEL MANAGEMENT



**Miles per gallon - Instant *Miles per gallon - Average *Miles per hour - Instant *Miles per hour - Average *Gallons used since fillup *Miles to empty *Elapsed Time *Time to empty *Time on trip *Miles on trip*

Accuracy: Time: ± 30 secs/month
Speed: ± 0.5 mph - Instant
± 0.005 mph - Average
Fuel Used: + 3%

Takes only about 2 hours to fit

ONLY £77.50 + VAT

Mighty Micro

Please add VAT at 15%. Carriage extra, will advise at time of order. Official orders welcome. Product details on request. Trade and export enquiries welcome.

CALLERS - 33 CARDIFF ROAD, WATFORD, HERTS. Tel: (0923) 38923
MAIL ORDER - P.O. BOX 17, BASINGSTOKE, HANTS. Tel: (0256) 56417
Close to Watford Football Ground. Nearest Station B.R. Watford

BUY IN CONFIDENCE In the event that we are unable to deliver your goods within 7 days, we do not bank your remittance until such time we have the goods to despatch. If on receipt of your order the goods do not meet with your satisfaction, return within 7 days for full refund. All goods covered by manufacturers guarantee

LB ELECTRONICS

TTL CMOS 74LS LEDS LINEAR RAMS EPROMS SURPLUS

TELEPHONE: UXBRIDGE 55399

PCB OFFERS

(1A) 100 bit shift register PCB, 115mm×94mm containing 9×7491, 6×7496 and 1×7441. Terrific bargain 85p, p&p 30p.
(1B) Audio amp PCB (LM380) 9-18v d.c. output 2½ watts into 8 ohm with heatsink. 1.25 watt 4ohm without heatsink. **£1.50** p&p 25p.
(1C) PCB 215mm × 290mmmm 12×TMS 3122J (or sim.) Hex 32-bit Shift Reg. + 39 ICs. **£2.** + 50p p&p (limited stocks).

MPU CORNER

2122 (200ns), **£3.** 2114 (450ns) **£4.50.**
1702 **£2.50.** 2708 (400ns) **£4.50.**
2716 (Single Rail) **£9.95**
74125 for **£1** + p&p 25p.
MK 1002P (dual 128 bit Shift Reg) **35p.**
LM711CH (Voltage Comparator) **30p.**
MM5240 Character Generator + Data 2560 Bit (64 × 8 × 5) **£3.50,** p&p 25p.
(All Full Spec)
2526 Character Generator (64 × 9 × 9) **£2.95** + data & p&p 25p.

D TYPE CONNECTORS

15 Way: wirewrap plugs only **75p.**
25 Way: ribbon plugs **£1.20.**
25 Way: sockets (solder) **£1.00.**
50 Way: skt (wirewrap) **£1.65.**
50 Way: skt **£1.45,** p&p 25p.

COVERS

37 Way: **80p.** (plastic) p/p 25p.
25 Way: **65p.** (plastic) p/p 25p.

DISPLAYS

HP 5082 4 digit DIL display full spec **£1.50 each** p&p 25p. Large quantities POA
MAN 72 7 seg CC **£1.25** p&p 25p.
Burroughs Panaplex 9 Dig. + skt and bezel **£1.00,** p&p 25p.
LED 3 Digit DIL **55p,** p&p 25p
Bowmar 9 digit 1in LED with red bezel. (As used in calculators) **£1.00** + 25p p&p.

SUPERSAVER

Ribbon Cable Headers 16 DIL Jermyn, gold plated, with cover **45p,** p&p 25p.

SUPERSAVER 2

Tantalum Capacitors 25 volt. 4.7 uF, 14 for **£1.00,** p&p 25p.

SUPERSAVER 3

PRICE SMASH FND 500 .5in. LED displays, full spec **50p each,** p&p 25p, large quantities POA

SUPERSAVER 4

HYBRID SYSTEMS DAC 371-8 8 Bit, Dil packaged, ideal MPU users with data, **£2.95,** p&p 25p.

SUPERSAVER 5

LM 323K Voltage Regulator, 5 volt 3A, **£4.50,** p&p 25p.

SUPERSAVER 6

RS 338-383 Miniature Decade Thumbwheel Switch. **£1.65,** p&p 25p.

SUPERSAVER 7

SN74116 Dual 4 Bit letch **75p,** p&p 25p.
SN7418 Arithmetic Logic Unit, **80p,** p&p 25p.
SN74194 4 Bit Register, **50p** p&p 25p.
SN74198 8 Bit Shift Register, **75p** p&p 25p.

SUPERSAVER 8

BC 108b **8p** each or 100 for **£7.** P&P 25p.

SUPERSAVER 9

4 Digit 7 segment LED Bubble Display. NSA 1540A Ex equipment, 5 for **£1,** p&p 25p.

SUPERSAVER 10

9 way male/female connector, ELCO 8129. 0.1 inch pitch, gold-plated PCB mounting, ideal, for bussing two PCBs together. Superb value, **35p,** p&p 25p.

SUPERSAVER 11

STAR OFFER. Dynamic hand microphone 200 ohm with lead and 5 pin plug. **£1.25** (unrepeatable) p&p 30p.

SUPERSAVER 12

TMS 3128NC Static shift register, **£1.50,** p&p 25p.

SUPERSAVER 13

PL259 (UHF) Elbow Connectors, **£50p** each, p&p 25p.

SUPERSAVER 14

1S423 Stud mounting rectifiers, 440v, 10A, giveaway price, 10 for **£2,** p&p 25p.

SUPERSAVER

20K Painton multiturn trimpots, PCB mounting, per box of 14 **£2.50,** p&p 25p.

SUPERSAVER 16

Yet another star bargain. Astec UM111E36 modulator **65p each,** p/p 25p.

LEDs (Full spec).

TIL209, red **10p.** 0.2in, red **12p.** 0.2in. green **28p.** 0.2in, yellow **28p.**
RL54 red Axial lead. **15p.**
P&p on all above 25p.
VERNITRON Ceramic filters type FM4 10 7MHz **45p,** p&p 25p.
TRANSISTORS, BD236 **40p,** BC183L **10p,** BF195 **10p,** SGS 2N3055 **30p,** p&p on all 25p.
TBA 810S, with data. **85p,** 4-way Dil switches, **75p.** MC1303 Dual Stereo preamp with data, **£1.25.** 7in. Nylon cable ties 100 for **£1.50.** All p&p 25p.
NEW SN76477 (Yes, back in stock). Sound Generator IC (Train, plane, explosion, laser gun etc.). with data **£3.25,** p&p 25p.
PCB KEYBOARD, 65mm × 82mm, 18 key Clickers less Key tops, ideal Hexadecimal use **35p,** p&p 25p.
CAPACITOR SCOOP. 1,600uF at 10v, 160uF at 25v. Axial lead. 2 dozen for **£1** + 25p p&p.
PAPST min-fans 80mm × 80mm (approx) 220V 50Hz Brand new **£8,** p&p £1 (limited stocks).
Pewec Boxer. As above but 115v at **£4.50** + p&p.
IEC mains chassis plug **75p** suitable socket **35p**, p&p 25p.

GIVEAWAY

22 pin low profile dil socket, gold plated

12p EACH
p&p 25p

WE STOCK PETs

8K version **£599.** SAE for the PET SORCERER solftware lists at discount prices.
We can also offer a 48-hour repair service for out of warranty PETs. Telephone for details. PET edge connector 40×04 **£1.40 each** p&p 25p.

IC HOLDERS (Low-profile)

8 Dil **12p**	14 Dil **15p**
16 Dil **17p**	18 Dil **20p**
22 Dil **28p**	24 Dil **35p**
28 Dil **45p**	All p&p 35p

WE STOCK a vast range of TTL, CMOS some 74LS. MINIATURE TOGGLES, etc.
PSUs. We have a large stock of power supplies at very realistic prices (callers)

RELAYS

ITT 700 ohm Single pole changeover. **45p.** BANOR resettable double pole changeover 12V **£1.** Both p&p 25p.

CIRCUIT BREAKERS

4450v AC 65v DC 0 5A **50p;** ditto 7A **80p,** p&p 25p
ALLEN KEYS, 7/16in **5p;** 12 for **50p;** p&p 25p.
ASR33 (with tape punch reader), generally overhauled **£225** inc. of VAT.
Centronics secondhand printers, various types (o/h), phone for your requirements

MEMOREX 651 dual disk drives complete with power supplies and format electronics (sorry, no data as yet), **£350** each inc. of VAT.
Recordacall telephone answering machines (GPO) line matching transformer removed) sold as is from **£2** to **£10** depending on condition. Fitted with very nice standard cassette deck. With circuit diagrams. SORRY BUT FOR CALLERS ONLY.

Terms cash with order (official orders welcomed from colleges, etc). All enquiries s.a.e. please. All prices inclusive of VAT, unless otherwise stated. **Postage** as shown per item.
FOR THE PROFESSIONAL USER. CP Clare Keyboard switches with buttons (blank) **65p** each p&p 25p.
Gould PMA 47/10 015V 3A Brand new **45p** p&p £3.50. Many more in stock but in small numbers. Please phone for requirements.
PLEASE DO NOT ORDER GOODS FROM OLD ADVERTS. PHONE BEFORE ORDERING.

SURPLUS STOCKS PURCHASED FOR CASH

LB ELECTRONICS
11 HERCIES ROAD
HILLINGDON, MIDDLESEX
UB10 9LS, ENGLAND

All enquiries s.a.e. please

New retail premises, now open Mon, Thurs Fri, and Sat, 9.30-6.00. Lunch 1-2.15 weekdays. Closed all day Wednesday. We are situated just off the A40 Opposite Master Brewer.

Buy it with Access

BARCLAYCARD

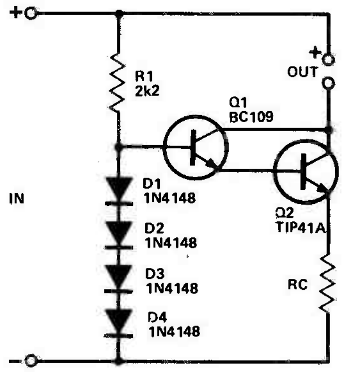
UXBRIDGE 55399

All components full spec.

SPOT DESIGNS

A new series featuring some tried and tested circuits for you to build as you please!

Nicad Current Generator

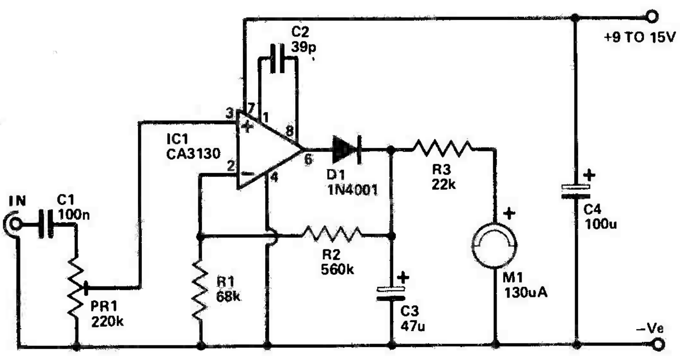


This simple add-on circuit enables a DC bench power supply to be used as a Ni-Cad charger. These cells have a low internal resistance and can be damaged if a charge current significantly higher than the figure recommended by the manufacturer is used. Furthermore, the cell voltage increases as charging progresses, making it necessary to steadily increase the charge voltage as charging progresses, if the charge current is to be maintained.

This unit is a constant current generator circuit which limits the current fed to the Ni-Cad cell(s) to an acceptable level. In effect, the unit automatically adjusts the charge voltage to just the right level to give the desired charge current. The circuit is a standard constant current generator configuration with R1 and D1-4 being used as a sort of low voltage zener stabiliser. About 0V7 is developed across each of the four forward biased silicon diodes, giving a total zener voltage of about 2V8. Q1,2 are used as a Darlington pair and, therefore, have a very high combined gain, so that quite high output currents can be produced by the fairly low drive current available. About 0V65 is dropped across the base-emitter terminals of both Q1 and Q2, giving about 1V5 across emitter resistor RC. The emitter current can be controlled by RC. The collector current of Q1,2 is virtually identical to the emitter current and is actually just fractionally lower as the emitter current is equal to the sum of the base and collector currents. Thus, provided a low impedance load (such as Ni-Cad cells) is present at the output, the current fed to the load can be set by giving RC the appropriate value.

The value of RC is equal to 1,500 divided by the required output current in milliamps and would, for example, be 10 R for rapid charge Ni-Cads requiring a charge current of 150 mA (1,500 divided by 150 = 10 R).

The input voltage should be 3-6 V more than the total voltage of the cells being charged. The cells should be connected in series across the output. Of course, the power supply must be capable of supplying the charge current drawn by the cells plus the additional few milliamps drawn by the current generator circuit itself. For charge currents of more than about 100 mA it will probably be necessary to fit Q2 with a small finned heatsink to prevent it from overheating.



Peak Reading VU Meter

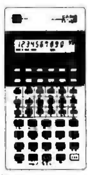
The type of VU meter normally employed in tape decks and other items of audio equipment is the average reading type. These can give misleading results on signals that have a pulse-like waveform of relatively low average amplitude for the peak amplitudes involved. This can lead to overloading and consequent distortion on signals of this type eg piano and percussions. One way around this problem is to use a peak reading VU meter. This type of circuit has a fast attack and slow decay time so that it responds properly to brief and intermittent signals. The normal response times for a unit of this type are 2.5 mS attack and 1 S decay. This unit roughly adheres to these figures.

IC1 is an operational amplifier which is used in the non-inverting mode. R1,2 form a negative feedback network which sets the closed loop voltage gain of the circuit at a little under ten. D1 is included at the output so that IC1 can supply an output current, but a current cannot flow into the output of IC1. The feedback is taken from the junction of D1, R2 etc., so that the input voltage appears here amplified by about ten times and the feedback overcomes the non-linearity of D1. C3 is rapidly charged to the peak output voltage as it is fed from the fairly low impedance of IC1 and D1. Its only discharge paths are through the much higher impedances of R3-R2 and R4-M1. This gives the circuit the required fast attack and slow decay times. M1 responds to the voltage across C3, which is, of course, proportional to the peak positive input level (the circuit is a halfwave type and does not respond to negative going inputs). The VU meter movement used in the prototype had a FSD value of 130 uA, but the circuit should work with any type having a sensitivity of between about 50 and 200 uA.

R1 biases the non-inverting input of IC1 to the negative rail and also enables the sensitivity of the circuit to be adjusted to the correct level. At maximum sensitivity, less than 1 V peak to peak is needed for FSD of M1. Current consumption is only about 400 uA.

CALCULATORS

CENTRAL PROGRAMMABLES



FX 501P 10+2 digit, 128 step, 11 memories	£43.43
FX 502P 10+2 digit, 256 step, 22 memories	£60.83
FA1 Adaptor cassette interface	£17.35
FX501P+FA1	£57.35
FX 502P+FA1	£74.74
*TEXAS TI51-111 32 step 10 memory	£25.17
TEXAS TI53 Lcd 32 step constant memory	£22.57
*TEXAS TI57 50 step 8 memory	£23.44
*TEXAS TI58 480 step 60 memory	£58.22
*TEXAS TI58C as above with prog retention	£73.87
*TEXAS TI59 960 step 100 memory mag card	£150.39
TEXAS PC100C Printer for 58/58C/59	£136.48
TEXAS PC100C IF ORDERED WITH 58/58C/59	£130.39

*INCLUDES: — rechargeable battery pack/adaptor/charger

PROGRAMME LIBRARIES FOR TI58/58C/59

APPLIED STATISTICS	£22.57
BUSINESS DECISIONS	£22.57
ELECTRICAL ENGINEERING	£22.57
MATHS/UTILITIES	£22.57
LEISURE	£33.00
STRUCTURAL ENGINEERING	£54.74
SURVEYING 11	£54.74
PC100C PAPER ROLLS TEXAS TP30250 10 OFF	£19.09
BATTERY PACKS state model or BP number	£6.04

SCIENTIFICS 8 DIGIT Lcd

CASIO FX68	£16.48
CASIO FX80	£12.13
CASIO FX81	£11.26
CASIO FX330	£13.87
CASIO FX2600	£16.48
CASIO FX7100	£20.83
SHARP EL503	£11.26
TEXAS TI25 or TI35	£16.48
TEXAS TI50	£19.96

SCIENTIFICS 10 DIGIT Lcd

CASIO FX100	£13.00
CASIO FX510	£16.48
CASIO FX3200	£18.22
CASIO FX5000 10 MEM	£24.30
CASIO FX8100	£20.83
SHARP EL5806 (8+2)	£15.61
SHARP EL5808 (8+2)	£13.87
SHARP EL5812	£16.48
NATIONAL NS108	£15.61

*TEXAS TI42 M.B.A. 32 step 12 memory finance/stats	£35.61
*TEXAS TI PROGRAMMER	£43.43
TEXAS TI44 Lcd constant memory statistical	£25.17
TEXAS LITTLE PROFESSOR	£11.26
TEXAS DATAMAN	£17.35
TEXAS SPEAK AND SPELL	£38.22
CASIO FX5000EP mains printer. List £196.48	£136.48

CLOCK CAULCULATORS

CASIO MQ6 micro card watch in leather case	£17.35
CASIO PW81 hourly chime/alarm	£13.00
CASIO ML81 hourly chime/2 alarm/timer/date/musical	£19.09
CASIO ML71 card version of ML81 with 1 alarm	£19.09
CASIO AQ1500 day/date/stopwatch	£13.87
CASIO AQ2200 hourly chime/alarm/calendar/stopwatch	£17.35
CASIO MQ12 card version of above	£17.35
TELEPHONE ANSWERING MACHINES twin cassette	£147.78

PRICES EXCLUDE V.A.T. PLEASE ADD 15% PACKING & DELVERY FREE

CALCULATOR SALES & SERVICE
Arrow Works, Arrow Road, Redditch B98 8NN
Tel. Redditch (0527) 43169

Buy it with Access

— CLEF KITS —

High Quality Electronic Musical Instruments under the personal supervision of Specialist Designer A. J. BOOTHMAN.

JOANNA 72 & 88 PIANOS

Six and 7¼ Octave Electronic Pianos with unique Touch Sensitive Action as used in the P. E. JOANNA, which electronically simulates piano key inertia — a feature not available in any other design. Build this widely acclaimed professional instrument, for either Domestic or Stage use, from our top quality Component kits.

SIX OCTAVES— **£207**
7¼ OCTAVES— **£232**

P.E. STRING ENSEMBLE

The versatile String Synthesizer with a fantastic sound at an economic price. Split Keyboard facility with a range of impressive voices.

COMPONENT KIT— **£169**

Back up TELEPHONE advice is available from the designer to supplement the clear instructions included with the above Kits.

P.A.'s — SPEAKERS — CABINETS

Units can be supplied to add to the Component Kits, including Domestic or Stage Cabinets and portable tubular legs.

NEW — ELECTRONIC ROTOR

Two-speed organ rotor simulator plus a three-phase chorus generator on a single PCB (8"x5"). Kit includes all components — IC sockets throughout — mains operation and stereo headphone driver PCB. Easily integrated with existing organ. Component kit **£89.00.**

KEYBOARDS

We believe that we have located the best manufacturer of square front Keyboards, as used in our Kits, and can also supply Keyswitch hardware including the industry standard soft plated contact springs.

49 NOTE C-C **£23.80**
73 NOTE F-F **£37.00**
88 NOTE A-C **£45.00**

All Keyboards are easily cut to provide your required length and compass. Quantity enquiries welcome.

BUILDING SERVICE

We are specialists in Electronic Piano Manufacture and can build your Piano for you — see lists.

INFORMATION
Please send S.A.E. quoting items of interest. Telephone BARCLAYCARD orders can be accepted, all prices include V.A.T., carriage & Insurance.

VISITS
Are welcome by appointment, otherwise Mail Order Only.

EXPORT
Enquiries welcome — in Australia please contact JAYCAR (Sydney).

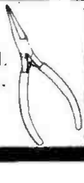
CLEF PRODUCTS (ELECTRONICS) LIMITED (Dept. E.T.I.)
16 Mayfield Road, Bramhall, Cheshire SK7 1JU. 061 439 3297

Marshall's

A. Marshall (London) Ltd., Kingsgate House, Kingsgate Place, London NW6 4TA
Industrial Sales: 01-328 1009
Mail Order: 01-624 8582
Also retail shops: 325 Edgware Road, London W2.
40 Cricklewood Broadway, London NW2. 85 West Regent St., Glasgow.
108A Stokes Croft, Bristol.

CAPACITORS:
Mullard Ceramic 63v range
1pF to 10,000pF E 24 range
all at £0.06 each
Siemens Ceramic 63v B37448/9
.01: .022: .033: .047mF @ £0.06
.068: .1mF @ £0.08: .22mF @ £0.11
CSF High Voltage Ceramic Discs
Prices £0.07 to £0.18 Range
100pF to 10.000pF
Voltage range up to 6Kv.
See catalogue for details.
Comprehensive range Siemens
Layer Polyester Caps: .001 to 3.3mF
Prices £0.07 to £0.63.
See catalogue for details.
Large range of Mullard/Siemens
Electrolytic Axial/Radial
Capacitance values 1.0mF to 10,000mF
Voltage ranges 25v: 40v: 63v: 100v:
Prices and types as catalogue
Also Mullard C280; Siemens B32231/4 and B32110. All prices net + VAT and postage/packaging.

TOOLS BAHCO



Side Cutter with Bezel.
Side Cutter without Bezel.
End Cutter without Bezel.
Vero Metal Shears.
Other items as catalogue.

BOXES & CASES
See catalogue for full range.
Aluminium boxes 13 sizes.
Rexine Covered boxes 7 sizes.
NEW RANGE TMEC CASES
Send S.A.E. for details & types
Price range. £14.04 to £17.00
ABS PLASTIC BOXES
3" x 2¼" x 1⅜"
3¾" x 2¾" x 1⅜" — Prices as catalogue
4½" x 3¾" x 1½"
8" x 4¾" x 3"
BAZELLI INSTRUMENT CASES
5 sizes.
Miscellaneous hardware including
Vero Board: Superstrips:
Vero Breadboard.
Vero boxes (see catalogue for full range).

Card Frames: Fliptop boxes: etc etc.

1980 CATALOGUE

U.K.: 65p post paid
Europe 85p post paid
Rest of World £1.25 post paid
Mail order: 01-624 8582

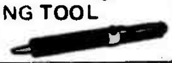
TTL see catalogue for full range

SN7400N	£0.14	SN7491AN	£0.54
SN7401N	£0.14	SN7492N	£0.31
SN7402N	£0.14	SN7493N	£0.32
SN7403N	£0.14	SN7494N	£0.80
SN7404N	£0.14	SN7495N	£0.55
SN7405N	£0.15	SN7496N	£0.34
SN7406N	£0.34	SN7497N	£1.80
SN7407N	£0.26	SN74100N	£1.10
SN7408N	£0.15	SN74107N	£0.21
SN7409N	£0.16	SN74118N	£0.76
SN7410	£0.15	SN74119N	£1.20
SN7411N	£0.15	SN74121N	£0.25
SN7412N	£0.20	SN74122N	£0.48
SN7413N	£0.28	SN74123N	£0.42
SN7414N	£0.47	SN74124N	£0.53
SN7416N	£0.22	SN74125N	£0.40
SN7417N	£0.22	SN74141N	£0.50
SN7420N	£0.15	SN74145N	£0.64
SN7423N	£0.18	SN74148N	£1.05
SN7425N	£0.19	SN74150N	£0.79
SN7426N	£0.19	SN74151N	£0.55
SN7427N	£0.19	SN74153N	£0.55
SN7430N	£0.15	SN74154N	£0.90
SN7432N	£0.17	SN74155N	£0.60
SN7437N	£0.21	SN74157N	£0.59
SN7438N	£0.21	SN74160AN	£0.70
SN7440N	£0.15	SN74161AN	£0.70
SN7441AN	£0.52	SN74162AN	£0.70
SN7442N	£0.40	SN74163AN	£0.70
SN7445N	£0.66	SN74164N	£0.80
SN7446AN	£0.48	SN74165N	£0.80
SN7447AN	£0.48	SN74167N	£1.20
SN7448N	£0.45	SN74174N	£0.80
SN7450N	£0.15	SN74175N	£0.63
SN7451N	£0.15	SN74176N	£0.74
SN7453N	£0.15	SN74177N	£0.73
SN7454N	£0.15	SN74180N	£0.70
SN7460N	£0.15	SN74181N	£1.65
SN7470N	£0.26	SN74182N	£0.83
SN7472N	£0.24	SN74184N	£1.29
SN7473N	£0.25	SN74185AN	£1.10
SN7474N	£0.25	SN74186N	£1.35
SN7475N	£0.31	SN74188AN	£1.84
SN7476N	£0.26	SN74189N	£2.26
SN7480N	£0.39	SN74190N	£0.74
SN7481N	£0.71	SN74191N	£0.79
SN7482N	£0.65	SN74192N	£0.79
SN7483N	£0.60	SN74193N	£0.79
SN7484N	£0.95	SN74196N	£0.74
SN7485N	£0.70	SN74197N	£0.74
SN7486N	£0.25	SN74198N	£1.09
SN7489N	£1.66	SN74199N	£1.09
SN7490AN	£0.33		

KNOBS & SWITCHES
Big selection as catalogue
Also Resistors; Presets; Pots;
Opto; Semiconductors etc.

SOLDERING EQUIPMENT
IRONS-ANTEX
15 watt C15 £3.95
15 watt CCN £4.20
17 watt CX17 £4.20
25 watt X25 £4.20
Stand £1.50

DESOLDERING TOOL



Solder £6.50

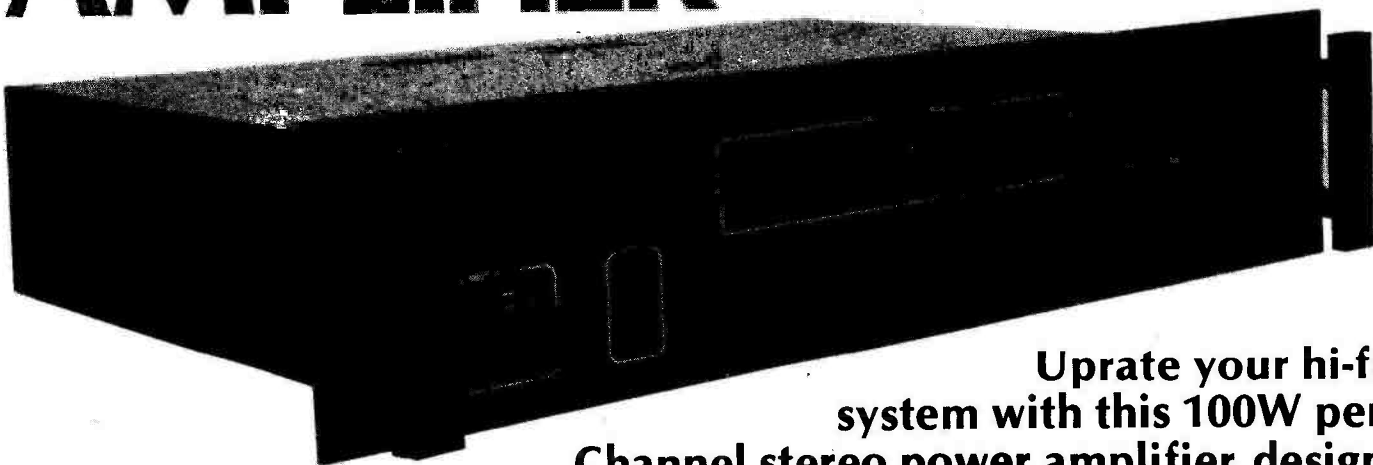
SINCLAIR INSTRUMENTS
Digital Multimeter
PDM35 £ 34.50
" " DM235 £ 52.50
" " DM350 £ 72.50
" " DM450 £ 99.00
Digital Frequency Meter
PFM200 £ 49.80
Low Power Oscilloscope
SC110 £139.00

CRIMSON ELEKTRIK HI FI MODULES

CE608	Power Amp	£18.26
CE1004	" "	£21.30
CE1008	" "	£23.91
CE1704	" "	£30.43
CE1708	" "	£30.43
CPS1	Power Unit	£16.96
CPS3	" "	£20.43
CPS6	" "	£26.09
CPR1	Pre Amp	£29.57
CPR1S	Pre Amp	£38.70

All prices + VAT + postage/packaging

100W POWER AMPLIFIER



Uprate your hi-fi system with this 100W per Channel stereo power amplifier design from Ambit International, featuring ultra-fast MOSFET output stage.

There is no shortage of audio amplifier designs appearing in the enthusiast press, so to be worthy of close attention, anything new has to justify its existence with a number of innovative features. The amplifier described here is a (nearly) indestructible 100 W RMS per channel unit, employing ultra fast Hitachi MOSFET output transistors, providing excellent amplifier performance. The drive circuitry is considerably less complex than similarly powerful bipolar designs and makes construction far more straightforward.

Like all MOSFETs, the nature of the device construction is such that it is not susceptible to the thermal runaway and secondary breakdown, which is probably the single most pernicious aspect of high powered amplifier designs using conventional bipolar techniques. This means that much of the protection circuitry associated with bipolar amplifiers is unnecessary — and since the current limiting technique in bipolar circuitry involves inserting resistance between the output transistors and the load — the damping factor of the output stage is not compromised.

Fail-Safe

The major problem area with any DC coupled amplifier is the potential for damage to the loudspeaker by large DC offsets at the speaker terminals. In this design, a separate control circuit has been used to monitor the output DC levels and switch off a fail-safe relay in the event of a potential hazard. The same relay is also driven from a 'thump' prevention circuit that only connects the loudspeakers to the output stage when a suitably stable DC condition has been maintained for a brief time.

Whilst the power supply is active, but the relay is being held open by the protection circuitry, a LED in the front panel will flash intermittently. Yet more LEDs are employed in a switchable 10 W/100 W logarithmic output level bar graph indicator that provides functional (peak) indications.

The MOSFET output stage is a source follower system, requiring only sufficient drive to overcome the gate capacitance effects and thus very little drive power is consumed. So little, in fact, that plastic encapsulated extended TO92 devices are quite sufficient to drive a single output pair.

Silence Is Golden

The amplifier input stages are designed using low noise high voltage devices from Hitachi. So low noise that this is one of the few amplifiers where it is completely impossible to tell if the mains is switched on. Both AC and DC input coupling are selectable from the front panel.

Power Supply

A well regulated power supply is an important feature of a high powered PA. The power output of an amplifier is usually limited by the capacity of the power supply (and the load impedance), so the output can be doubled by halving the load resistance, provided the PSU can supply the necessary current.

The PSU of this amplifier uses two entirely independent transformers, rectifiers and reservoir capacitors which all serve to reduce interchannel crosstalk, especially at low frequencies. It is desirable to achieve as little difference between the output voltage across the reservoir capacitors when the amplifier is operating at 10 W output, as it is when it is putting out full power. The design is specifically for transformers of 5-8% regulation, so that the DC supply voltage only moves between 47-55 V as the power varies. The use of a fully regulated PSU is not required, since factors such as the amplifier voltage gain are independent (or should be) of supply voltage. Separate windings and rectifier/reservoirs systems are used to power the DC offset and relay protection circuitry on one unit and the LED bar graph output indicator from the other channel transformer.

Earth Talk

Perhaps the single most vital aspect of high current amplifier design is the correct layout of the earthing paths of those sections carrying high current. The fact that an earth is not necessarily an earth unless it is 0R impedance has led to the downfall of many PA designs.

Real earth leads contain a finite resistance, so in the example shown the load current (I_L) will be far greater than the input bias current — so V_1 will follow the output voltage directly. Since the input current is basically feeding the (+) side of the amplifier — this is positive audio feedback and can very easily lead to complete instability, or at the very least, increased distortion. Thus the policy is to use single point earthing of all such systems wherever possible. The temptation to lump earths together for the sake of convenience must be avoided.

These considerations also apply around the PSU, where ripple current can cause some similarly inconvenient effects.

Taking Precautions

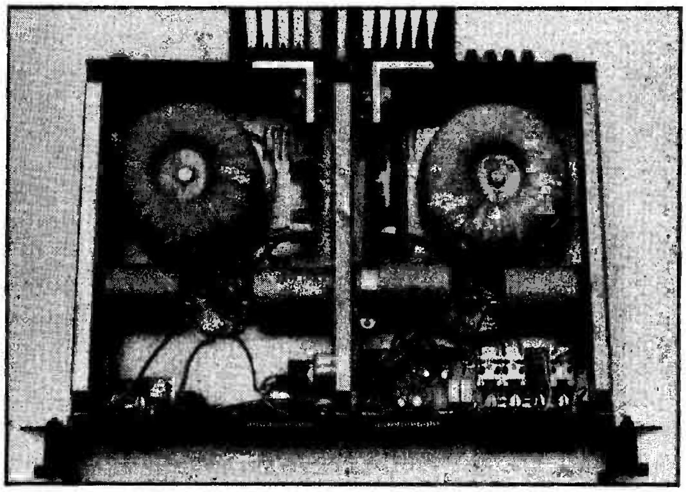
The DC condition of each channel output is monitored via a 100k resistor feeding the bases of a differential amplifier (Q101,Q201). A 22uF capacitor at this point determines the maximum frequency that will trigger the relay circuit, according to the time constant. Assuming all is well on switch-on, the DC offset circuit does not trigger, but the 100uF capacitor sandwiched between the collector of Q2 and the base of Q103 takes approx. five seconds to charge up, holding the relay open with Q104 still off. As long as the relay is off, the multivibrator formed by Q105 and Q106 can function and so the LED in the collector load of Q105 will flash.

As soon as Q104 turns the relay on and the speakers are connected, the base of Q106 is clamped and the multivibrator stops oscillating with Q105 held permanently on.

Red Alert

If a DC offset should occur, or (depending on the time constant of the input network) a large low frequency 'thump' be transmitted through the system by a noisy switch connection in the preamp or tuner, either Q101 or Q102 will turn on, instantly charging a 100uF and switching off Q104 again. The LED starts flashing and you know something is wrong somewhere. As soon as the DC offset has been removed, the 100uF discharges and normal service will be resumed with the LED permanently on.

For sheer simplicity, the AEG U257/U267 bargraph drivers are best. They are logarithmic units, which are used in cascaded form to provide a ten LED output (per channel) driven from the loudspeaker terminals. As well



Take the lid off the 100W PA at your peril - those power supplies mean business.

as providing instantaneous output power indication, the fact that the detector is right at the front of the circuit means that the output bargraph can also indicate the presence of an ultrasonic instability. (ie bargraph reads, with no audible output — assuming you have connected the speakers to the output terminals.) Do not use DIN two pin speaker sockets, as they are not substantial enough for the currents carried in 100 W systems.

A switched resistor network provides attenuation to set the peak reading the bargraph to the desired level (nominally chosen at 10 W and 100 W).

Construction And Testing

Take careful note of the earth layout in particular. The amplifier modules are mounted via right angle brackets to the output heatsink and care should be taken to use enough heatsink for the sort of use you envisage.

The heatsinks shown are proprietory Redpoint units, just about sufficient for 200 W RMS operation. Since the PSU is capable of driving the amplifier to 250 W in total, you should increase the radiating area of the heatsinks to cope with a heavy duty application such as disco usage, etc. Many commercial amplifier designs of the 'domestic' variety use outrageously inadequate heatsinks, on the basis that even the most dedicated audiophile only ever listens to an average level of 20 W. 100 W crescendos and peaks are then either dealt with by the reserve margin of the heatsink or the fuses blow.

The MOSFET amplifier will get progressively quieter as the drain resistance increases under overheating conditions, so even if you skimp on the heatsinks, the chances are that the worst that can happen will be enforced pianissimo.

If you want to demonstrate the 'screwdriver across the output' trick to your friends unlucky enough to suffer from bipolar amplifier problems, then bypass the relay, since in the authors' experience the first things to get fouled are the relay contacts, which inconveniently weld themselves together at the same time as a large molten pit mark appears on your screwdriver. The switch-on thump is not at all serious even without the relay protection circuit, but there is a very real danger of evaporating the costly voice coil in your loudspeakers if a fault should occur causing the output to slam hard over to one of the rails.

Use large gauge wire (15A will do) for anything like a power amp earth or supply connection and all output leads, etc, and do not forget to fuse the transformer

On Top Of Old Smokey

As a final precaution, ensure that you have the MOSFETs in the right places. Turn on to check the current consumption. Set for approx 35 mA using the cermet preset. If the current cannot be set sufficiently low, or smoke and other unpleasantness ensues, turn off and check all the connections.

If all is well, fit the loudspeaker, but keep the 8R series resistor and fuse in place as a further precaution. Turn on and listen to the output to make sure that obvious problems like excessive noise and hum are not present. If the input is unterminated, there will be extraneous hum pickup, but shorting the input socket should remove this completely. The only earth connection of the system should be via the PA and the input lead earths.

If all is quiet, but the LED bargraph is lit, then it is possible that there is an HF instability occuring in the PA. Check with an oscilloscope. The points to observe are usually around the output (Zobel) network, where any sustained HF instability will cause the series resistor in the Zobel network to warm up. Persistent HF instability may easily be due to incorrect earthing and a host of interactive problems, but the modular construction of the PCB and connection systems should avoid insurmountable problems.

Unduly distorted sound whilst the DC conditions appear to check out can be due to many problems, but here is a list of the ones the authors have encountered:

- Connecting the loudspeakers between the two outputs, not output and ground.
- Components around Q1 and Q2 being wrong values.
- Forward biasing electrolytic capacitors in the signal path (ie insertion the wrong way round) can lead to both distortion and noise.

On the assumptiion that your ears are likely to be as good a judge as anything, you can go aheadandconnect the loudspeakers directly. Keep the volume setting low if your speakers are not 100 W RMS rated. There is always the chance of high voltage spikes getting through and causing damage. You can artificially supress the gain by altering the gain setting resistors in the feedback loop, but the only certain way to limit the output power capability is to reduce the power supply voltage.

HOW IT WORKS

The whole circuit may be likened to a large 'op amp', with the (+) input being the main input, and the (−) input being used for the negative feedback connection — so the input will respond to DC equally as well as to AC and may thus be used for a very large form of servo control if so desired.

The gain of the amplifier is set at 22 according to the ratio of R8/R7 — so that an input of 1V RMS from the preamp will drive the output to 22V RMS, which by Ohm's law gives:
$V^2/R = 22^2/8 = 60.5$ W (assuming 8R load).
To achieve 100 W output, you need:
28/22 = 1V28v RMS input.

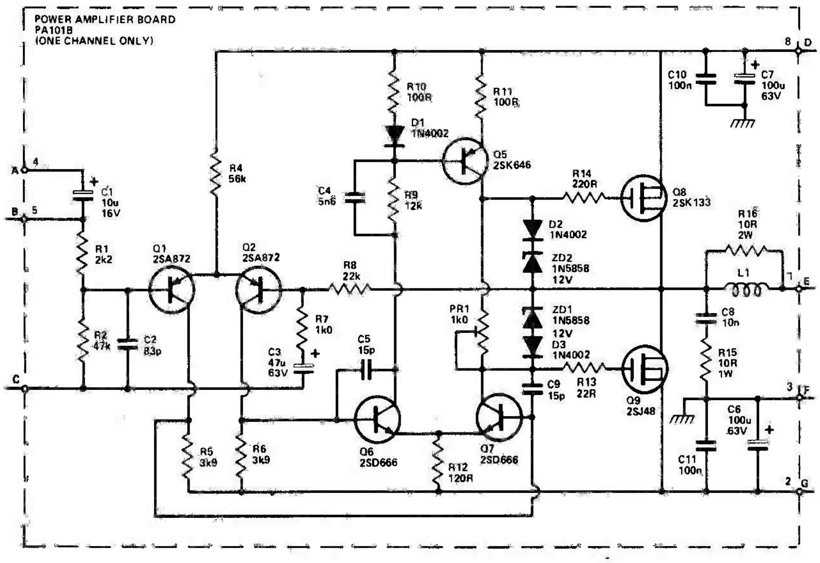
The two stages of differential voltage amplification use 120V transistors for maximum safety, with the collector of the driver stage being fed from a constant current source (Q5). This makes for exceptionally high open loop voltage gain in the overall system, so that very large amounts of negative feedback are applied. Some schools of thought feel that a lot of feedback in PA design is not a "Good Thing", but maybe they had not benefitted from the speed of the HMOSFET. The problem in bipolar designs has usually involved the delay when getting the feedback information round the works, leading to transient intermodulation distortion (TIM). The HMOSFET is sufficiently fast to cope with all this and not produce any TIM.

The 22k (R8) in the negative feedback loop from the output is not compensated in any way due to the ultra-high speed of the MOSFETs and comparison with a bipolar design will usually reveal a substantial phase correction here in the guise of a parallel capacitor.

A high quality cermet preset is used between the gates of the output devices to set the quiescent current at approx. 30 mA by developing a voltage between the two MOSFET gates. Since Q5 is a constant current source, the voltage across the gates is then simply $I_c \times R^{V}r$.

The gates are also provided with zener diode clamp protection to clip the drive voltage to below 14V (the maximum permissable). In normal use, the gate voltage never gets near 14V, so this is primarily a fault protection precaution and not any sort of general overload protection.

A Zobell network at the output is necessary to prevent HF instability, since, although MOSFET PA design is inherently more stable than bipolar design, it is still necessary to cope with problems associated with the high impedance inputs of the FETs and the uncertainties of finite earth path resistances. A choke coil in series with the output provides additional stability with particularly reactive loads — although it is debatable whether or not it is necessary in this design. Output protection is inherent in the HMOSFET, since as the temperature of the transistor rises, so the channel resistance increases, causing the maximum available output current to diminish. Rating this amplifier at 100 W is reasonably conservative, since with a correctly regulated power supply design (5%) as much as 160W RMS can be achieved — and still it is possible to short circuit the output without destroying the MOSFETS!



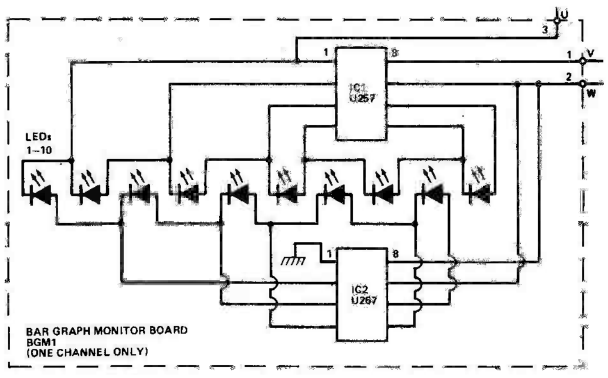


Fig.4. (left) Circuit diagram of the Power Amplifier.

Fig.5. (above) Circuit diagram of the Bargraph Monitor.

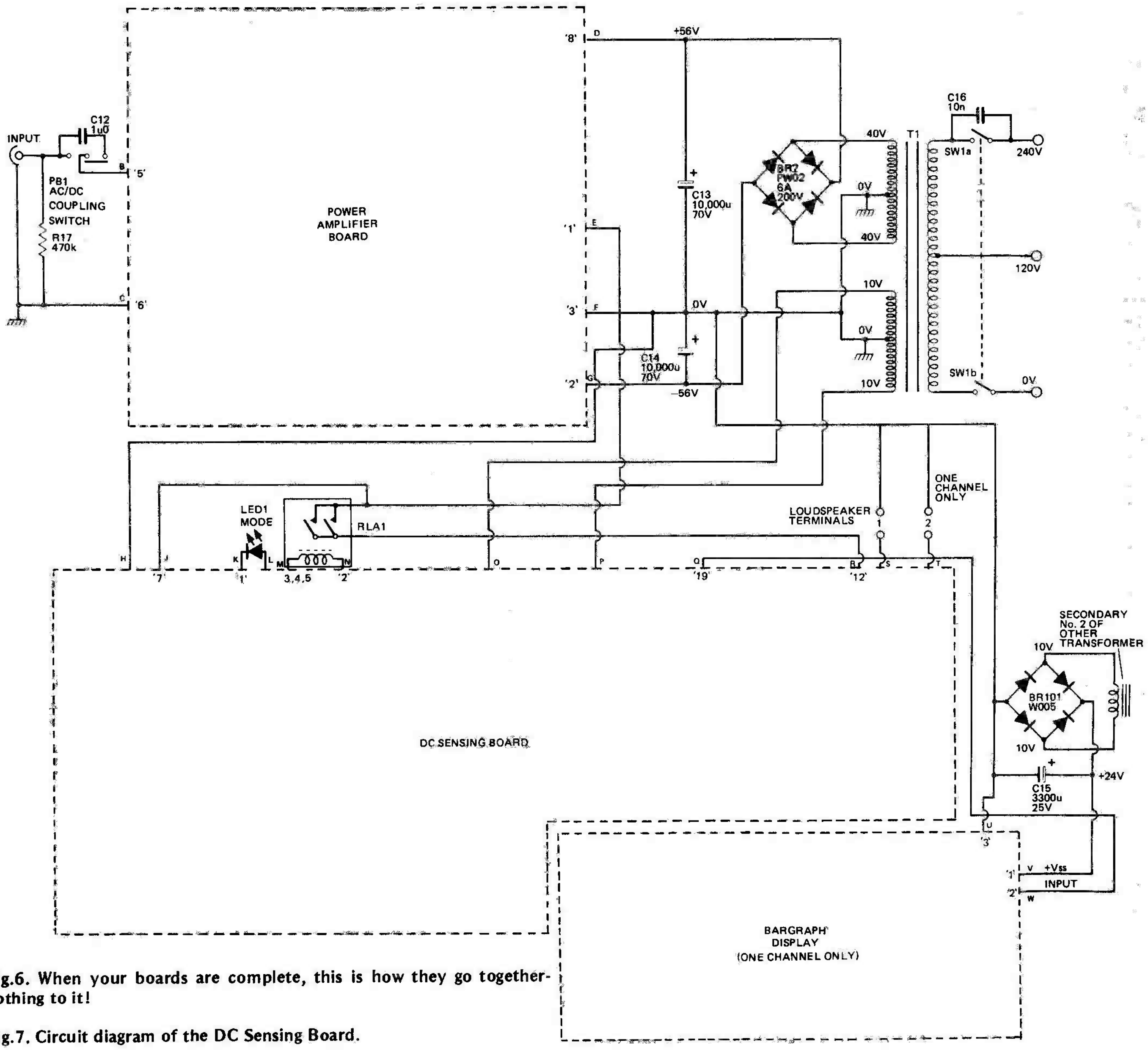
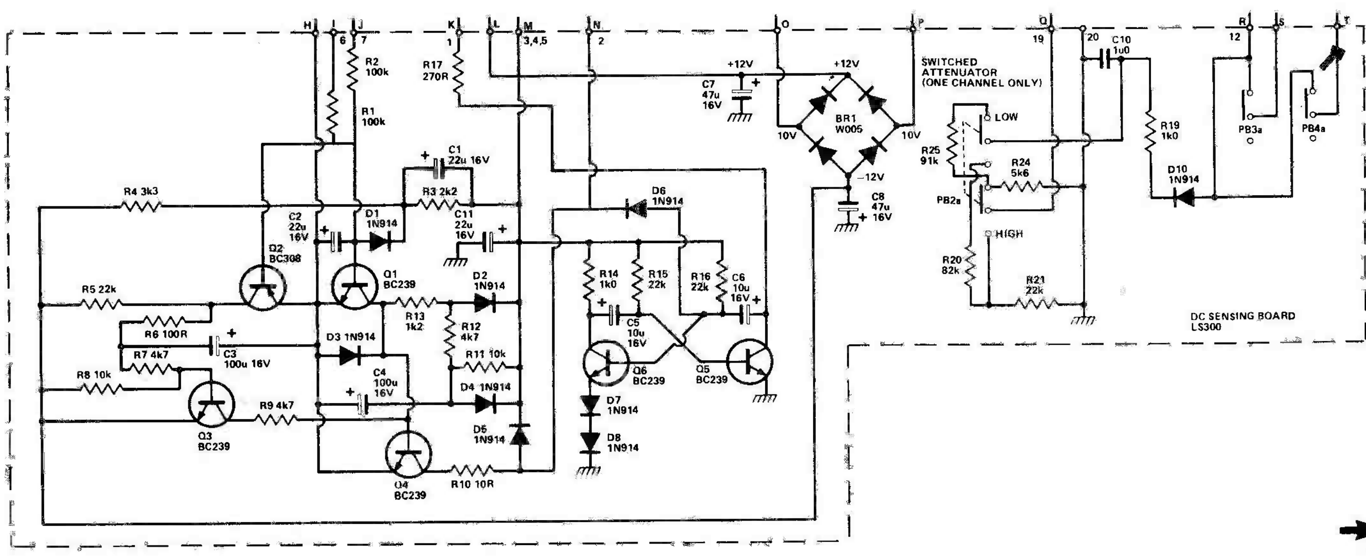


Fig.6. When your boards are complete, this is how they go together-nothing to it!

Fig.7. Circuit diagram of the DC Sensing Board.



PARTS LIST

POWER AMPLIFIER BOARD (one channel)
Resistors ¼W 5% unless specified

R1	2k2
R2	47k
R4	56k
R5,6	3k9
R7	1k0
R8	22k
R9	12k
R10,11	100R
R12	120R
R13,14	220R
R15	10R 2W
R16	10R 1W

(R3 has been deleted from this design)

POTENTIOMETER

PR1	1k0 linear preset

CAPACITORS

C1	10u 16V tantalum
C2	33p 160V polystyrene
C3	47u 63V electrolytic
C4	5n6 160V polystyrene
C5,9	15p 160V polystyrene
C6,7	100u 63V electrolytic
C8	10n 100V mylar
C10,11	100n 250V polyester

SEMICONDUCTORS

Q1,2	2SA872
Q5	2SB646
Q6,7	2SB666
Q8	2SK133
Q9	2SJ48
D1-3	1N4002
ZD1,2	1N5858

(Q3,4 have been deleted from this design)

MISCELLANEOUS
L1 12 turns 16 swg enamelled copper wire (around R17), PCB, 8 way 0.2" plug connector, 4 x 1¾" capacitor clips, 2 x 8 way flying lead sockets and 16 connector pins.

DC SENSING BOARD
RESISTORS All ¼W 5%

R1,2	100k
R3	2k2
R4	3k3
R5,15,16 21,22	22k
R6	100R
R7,20,23	47k
R8,11,27	10k
R9,12	4k7
R10	10R
R13	1k2
R14,19	1k0
R17	270R
R24	5k6
R25	91k

(R18,26,27 are on other channel)

CAPACITORS

C1,11	33u 16V electrolytic
C2	4u7 16V electrolytic
C3,4	100u 16V electrolytic
C5,6	10u 16V electrolytic
C7,8	47u 16V electrolytic
C9,10	1u0 100V electrolytic

SEMICONDUCTORS

Q1,3,4,5,6	BC239
Q2	BC308
D1-10	1N914
BR1	W005 1A 50V

MISCELLANEOUS
PCB, 21 way 0.2" plug strip (multiples of 14 and 7 way).

BAR GRAPH DISPLAY (one channel only)
SEMICONDUCTORS

IC1	U257
IC2	U267
LED 1-6	Flat LED, green
LED 7	Flat LED, yellow
LED 8-10	Flat LED, red

OFF-BOARD COMPONENTS
RESISTORS ¼W 5%

R17	470k

CAPACITORS

C12	1u0 250V polycarbonate
C13,14	10,000u 70V electrolytic
C15	3300u 25V electrolytic

SEMICONDUCTORS

BR2	PW02 (6A 200V)
LED 1	5 mm. red

MISCELLANEOUS

T1	40-0-40, 10-0-10, 250 VA mains transformer
RLA1	12V 4 pole Continental relay, 700R coil

¼" stereo jacket socket, spring-loaded terminals (4 red, 4 black), 2 x 3A fuses and chassis mounting holders, filtered (or unfiltered) 3A mains socket, stereo phono socket, 2 way 20mm SUF switch (input), mains on/off switch, 4 pole C/O push button switch, 3 x 2 pole C/O push button switches.

primaries. Under no circumstances should you ever rely solely on the fuse in the mains plug.

Check that the mains fuse is in place. Do not connect the circuit boards to their respective PSUs yet. Switch on, and check all the various DC voltages with a meter. And make sure that you have clearly marked the positive and negative connections, as reversing the low impedance power connection to the output modules is one of the most certain ways of destroying the whole lot. The main PSU capacitors should be carefully checked for correct polarity, as 10,000uF on the ceiling makes a very unpleasant mess. Remember to ground the centre point of the PSU's.

DC Offset Protection

The first part of the circuit to verify is the output protection unit and switch-on delay PCB. Connect this to the PSU and switch on.

The result should be a flashing LED, which extinguishes after 5 S to the accompaniment of the speaker relay clicking 'In'. You can verify this by placing an ohmeter across the relay terminals if you like. If not, ground the input to the offset detector (the connection from the amplifier output), since stray pickup could conceivably cause the failsafe to trip.

Failing this, an analysis of the circuit board construction and test voltages is the only solution. Make certain the diodes are in the correct way round, since this is one of the more frequent causes of trouble.

Assuming that a combination of sound construction/thorough debugging/luck leads to a correctly functioning circuit, check that the application of a DC offset to

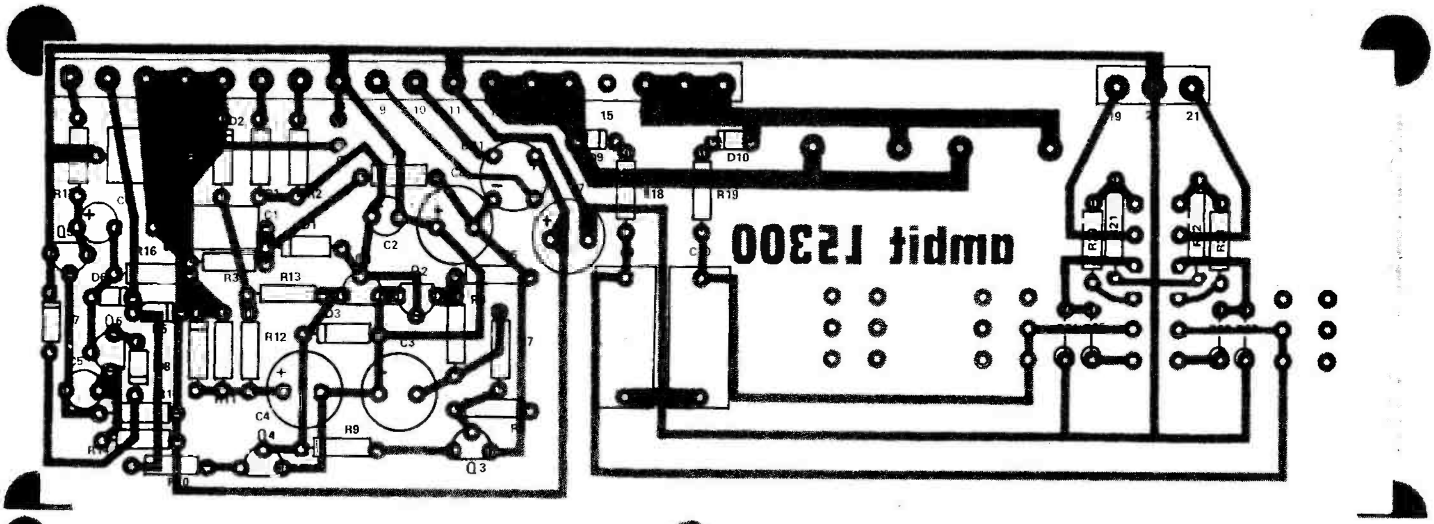


Fig.1. Component overlay of the DC Sensing Board. Note capacitor polarities.

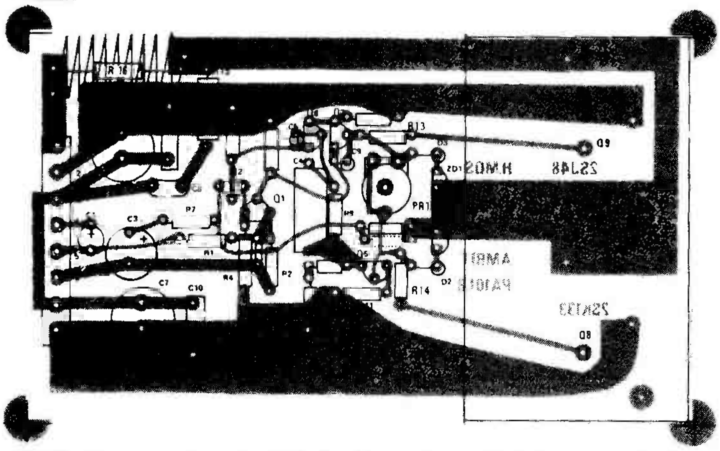


Fig.2. Component overlay of the Power Amplifier Board. Coil L1 is wound round R16.

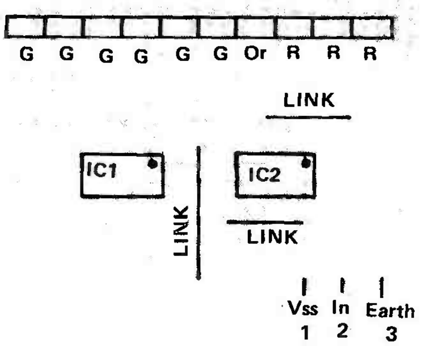


Fig.3. Component overlay of the Bargraph Monitor Board, using only two ICs.

BUYLINES

A complete kit for the HMOS Power Amplifier is available for £155 + VAT from Ambit International, 200 North Service Road, Brentwood, Essex. The PCBs, metalwork, etc can be bought separately. Contact Ambit for latest prices.

the input (via the limiting resistor) (from a 1V5 battery for example) causes the relay to drop out and the LED to start flashing again.

Make certain that the loudspeaker connections are wired via the normally open contacts, since the circuit is fail-safe ie if the power to the relay is cut, the speaker path is discontinued.

Output Bargraph

Connect the power to the output bargraph driver PCB. With no output from the power amplifiers, inject a signal from your finger onto the input of the bargraph board. Depending on your conductivity and the amount of hum about, some or all of the LEDs should light. The input attenuator switch selects a potential divider from the rectified output of each channel, nominally set for FSDs of 10 W and 100 W, but if you are proposing to use the amplifier with speakers rated at less than 100 W (and most of them are) then set the attenuator to read the appropriate FSD. Simply adjust the potentiometer ratios pro-rata. The U257/U267 use logarithmic steps, covering a 26 dB range.

Home Welding

Now comes the hairy bit. +60 V on the ends of 10,000uF reservoirs is not to be trifled with, so make certain the first connection you make to the amplifier modules is the correct one. Before attemptingthis, switch off and discharge the main PSUs via a suitable resistor, such as 2k/2 W.

A quick dab with the screwdriver across the terminals of 10,000uFs will lead to a damaged screwdriver and a fresh set of underwear.

Fit a milliameter in series with one of the supply leads (use one in each arm of the supply if you have two meters) and test one module at a time. Set the output quiescent preset to minimum resistance (minimum bias current) and connect the output to the DC offset sensing circuit. A load of 8R/10 W should be connected across the appropriate output terminals. Select the correct output via the panel switch. Do not connect direct to your favourite speakers at this stage. A 3 A fuse in series with the load is not a bad idea during testing. This should be removed once you are satisfied that all is well since the resistance of such fuses is a serious contribution to some of the distortions otherwise avoidable in high power audio amplifiers.

ETI

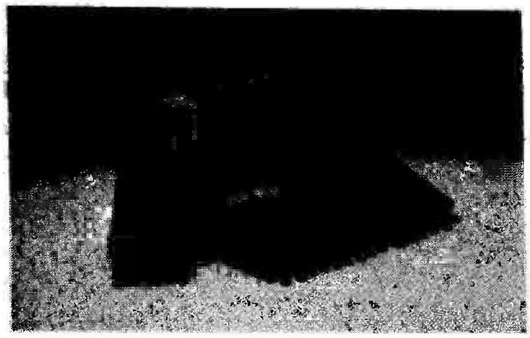
MICROTAN 65

£69 plus VAT

The Microcomputer that thinks it's a Mini

The MICROTAN kit has won widespread acclaim for it's super presentation.

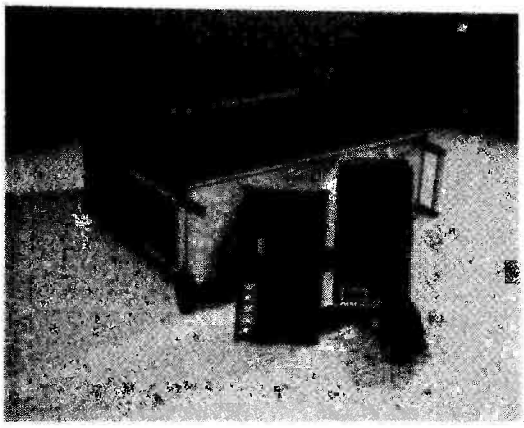
High quality, plated thru' hole printed circuit board, solder resist and component legends. Full set of I.C. sockets. 64 way D.I.N. edge connector. 6502 microprocessor. 1K monitor TANBUG. 1K RAM for user programme, stack and display memory. VDU alphanumeric display. Intelligent keyboard socket. A4 MICROTAN 65 system file binder. 136 page, bound, A4 size users hardware/software manual with constructional details and sample programmes. Logic and discrete components to fully expand MICROTAN 65.



TANEX from £43.00 plus VAT

Fully expanded TANEX offers; 7K RAM, 6K ROM, 8K MICROSOFT BASIC, 32 parallel I/O lines, two TTL serial I/O ports, a third serial I/O port with RS232 20mA, full modem control and 16 programmable baud rates, four 16 bit counter timers, cassette interface, data bus buffering and memory mapping.

Ready built the mini-mother board has two 64 way female connectors, a 4 way power supply connector and a reset switch on board. It is used to connect MICROTAN to TANEX, and will fit inside the mini system rack. **£10.00** plus VAT.



Full System Rack from £49.00 plus VAT

For the man that has everything! 19 inch wide system rack which accepts MICROTAN 65, TANEX, TANRAM, **NINE** FURTHER EXPANSION BOARDS, TANDOS AND THE SYSTEM POWER SUPPLY.
Available in many formats e.g. Individual module front panels, full width hinged front panel, back panel with or without connectors, etc.

We have produced a mini-rack which accepts MICROTAN 65 and TANEX, it has an integral power supply, just plug it into the mains and away you go! Finished in Black/Tangerine/Brushed aluminium, it gives your mini-system the professional finish. **£43.00 plus VAT**

Full ASCII keyboard £49.00 plus VAT

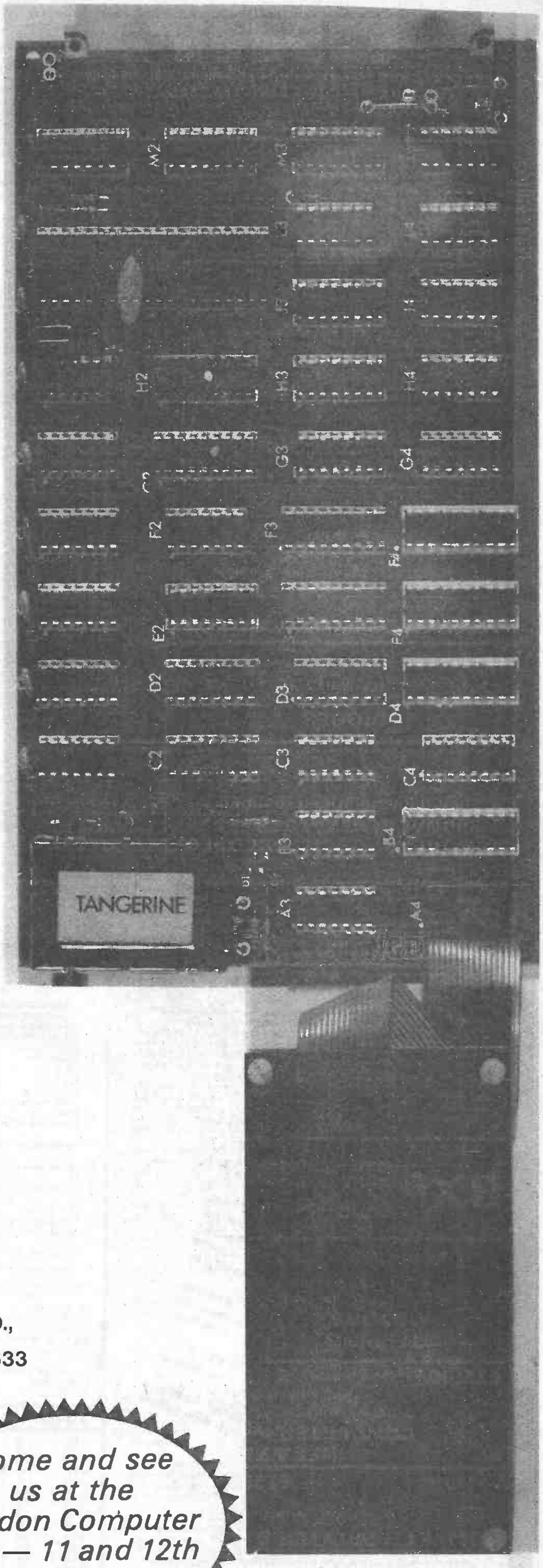
The ASCII keyboard includes a numeric keypad and ribbon cable connector. Available only as fully built and tested.

Cabinet available at **£20.00** plus VAT.

TANGERINE
COMPUTER SYSTEMS LIMITED

Extract from Mini Review in ETI *April 1980*

- An excellent kit
- The concept of TANBUG is excellent
- Rock steady VDU
- The extremely reasonable cost has not been achieved by skimping on design
- A gem of a product
- An excellent introduction to 6502 based systems



- A 6502 based microcomputer.
- Superb 1K monitor TANBUG.
- Expansion boards to make a full system.
- Fully socketed
- 1K RAM for user programme, stack and display memory
- 136 page software/hardware users manual, with example programmes and A4 size!
- Intelligent keyboard socket, accepts 20 key keypad or full ASCII keyboard
- Full alphanumeric video display on an un-modified domestic TV – makes programming much easier
- Optional lower case pack £9·48 + vat
- Optional chunky graphics pack £6·52 + vat

Access
We welcome Access

BROCHURE AVAILABLE
ON REQUEST, 12p stamp

BARCLAYCARD
VISA

TANGERINE COMPUTER SYSTEMS LTD.,
FOREHILL, ELY, CAMBS. Tel: (0353) 3633

NAME
ADDRESS

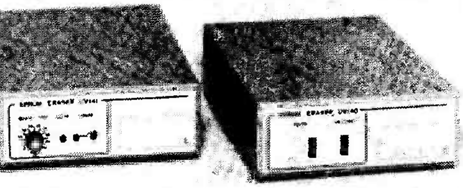
Come and see us at the London Computer Fair — 11 and 12th July

Greenbank
Greenbank Electronics
(Dept T8E) 92 New Chester Road, New Ferry
Wirral, Merseyside L62 5AG
(Tel 051-645 3391)

TERMS, VAT. CWO. Cheques etc payable to Greenbank Electronics and crossed. Add VAT to all prices at 15% except where stated otherwise. Post etc: UK 35p (+5p VAT = 35p) per order. Export: NO VAT but add 35p (Eire), 75p (Europe) and £2.50 elsewhere. Access. Barclaycard. Visa. telephoned orders accepted. (Polys. universities. govt depts. etc can telephone their orders for immediate despatch on account.)

BARCLAYCARD

UV EPROM ERASERS



Two easy to use units designed for both the professional and amateur UV-prom user.

Features:

- Can erase up to 14 proms.
- Special short wave ultraviolet tube.
- Erase time variable between 5 and 50 minutes in 5 minute steps (preventing pver exposure which may shorten prom life).
- Sliding tray carries proms on conductive foam.
- Safety interlock switch prevents the timing circuit from operating and switching on the tube with the tray open.
- "Mains on" and "Tube On" indicators.
- Smart textured case.
- Complete instructions supplied.

Supplied complete with mains plug and flex.

Model UV141. Price £77.70

Also available without timer as

Model UV140: Price £61.20

PROM WASHING SERVICE: 50p each prom

COMPUTER BOARDS

The following is an extract from our leaflet ref. 'MP4', which is available free on request (a 9" x 6" SAE helps, but is not essential). See Microprocessor section to the right for board prices.

For many people the wide choice of micro-processors now available presents a difficult choice. To understand any particular microprocessor in depth a development system is almost essential, however in the past to understand more than one several separate development systems have had to be purchased.

The reason that separate systems, one for each processor, have been necessary is due to the fact that individual microprocessors have their own individual features: in one case to access memory a separate read strobe and write strobe is required, in another a 'read/write' line is used in combination with a combined strobe called 'valid memory address and phi-2'. With some processors, the same address bus can be used for both memory and 'input/output ports', under the control of a 'memory request' or an 'input/output request' control line.

Naturally, if a development system takes advantage of any of the particular unique features of any particular microprocessor, this makes it more difficult to graft some other unrelated microprocessor onto the same bus at a later date.

A Universal Micro System provides a basic bus structure on which any one micro-processor can be connected. The system uses a CPU (Central Processor Unit) card which is separate from the rest of the system, and this allows the same memory and interfaces to be retained when a different MPU is used.

The basic system bus consists of data and address buses together with read and write strobes. By locating the data input (Keyboard) and output (VDU) in the memory space then such chips as the 8080/Z80 family, which normally use input/output ports, can now be used without any fundamental change to the bus (and as a bonus, users of these MPU's have all the ports entirely free for their own purposes).

The range of p.c.b.'s includes boards to implement a memory-mapped VDU, cassette interface, keyboard interface, PROM programmer, and a number of RAM and ROM cards. All the cards are of International Size 114×203mm (4½"×8") except for the larger power PSU A power supply card. This latter card is sized so that it can be bolted to the side of a standard 4" chassis module which is then compatible with the other cards. The cards have a standard 43-way edge connector, with one position used for polarisation.

We do not propose to defend the (relatively) small ... er of bus connexions (42), against such standards as the 'S100' ... bus. The S-100 bus, as it originated in America, is bigger ... re expensive. In the same way, a Ford 'Granada' ... rd 'Cortina', but it doesn't mean a Cortina ... ws — it may even be better value!

The Interr ... t '3U' 19" rack sys ... nd a variety of ... stomising their ... the firm 'R.S ... lty.)

T ... to compete w ... e purchaser of ...) assembly wo ... computer wor ... virtually iden.

The r ... ent. You choos ... will be used, ... e s..or indeed ... as not permit y ... re to offer guic ... your needs, in ...

As mentior ... he design of ... le arrangemen ... e obsolete ove ... have been pro ... pattern which ... Often these car ... decoding. An ex. ... regulator, or gat ... u Input/Output Re ... already have this facility.

Of course we know ... ould faint clean away at the thought of cutt... ...ding extra integrated circuits and bits of wire in th... ...ve, but it is not for these people that this sort of system has ...ned. We would like to think of this system as basis on which you ... build your own personal design, perhaps as an alternative to the use of 'Veroboard' or etching your own pcb's.

(Further sections give an outline of each card in turn. Although we have in mind all sorts of exotic future developments (e.g. high resolution graphics, floppy disc controllers, dynamic high-density RAM cards, programmable VDU formats, colour displays, Light pens, sound generators etc.) we prefer to keep quiet about them until they actually exist. All of the cards described actually exist, and at the time of writing (September 1979) most are in stock. (We plan it so they are all in stock, but people will insist on buying them, without caring what havoc they wreak in our stock control!))

NEW! 'ISBUS-1.1'

Low-cost commercial quality computer back board, 13"×4⅜" approx, for the International Standard (114×203mm) cards. Although intended for the 86-way double sided connector, it can be used with the 43-way connector specified for the computer boards we advertise. (Pin 37 is used for polarisation.) Takes up to 13 cards on 1" centres, and provides for 4 power rails, 58 parallel address/data etc. bus lines and 3 'daisy chains'. Epoxy glass, tinned, price £11.50 More details in our free leaflet 'ISB-1/1'. Existing enquirers: Note Leaflets have been delayed, but will follow soon

CMOS

These cut prices for Amateur Users and Export. Note: industrial users — quantity prices available. Mostly Motorola, RCA

4000	18p	4042	80p	4096	95p	4451	£3.81	4549	£4.38
4001	25p	4043	90p	4097	£3.40	4461	£3.93	4552	£14.85
4002	25p	4044	90p	4098	£1.20	4462	£4.41	4553	£4.50
4006	95p	4045	£1.45	4099	£2.00	4490FP	£4.20	4554	£1.38
4007	18p	4046	£1.10	40100	£2.20	4490VP	£3.14	4555	78p
4008	80p	4047	£1.00	40101	£1.32	4500	£6.95	4556	72p
4009	40p	4048	55p	40102	£1.80	4501	29p	4557	£3.86
4010	50p	4049	45p	40103	£1.80	4502	£1.20	4558	£1.25
4011	25p	4050	49p	40104	99p	4503	70p	4559	£4.38
4012	18p	4051	80p	40105	99p	4505	£5.71	4560	£2.50
4013	50p	4052	80p	40106	90p	4506	50p	4561	81p
4014	84p	4053	80p	40107	60p	4507	55p	4562	£5.60
4015	84p	4054	£1.50	40108	£4.70	4508	£2.90	4566	£1.59
4016	45p	4055	£1.25	40109	£1.00	4510	99p	4568	£2.38
4017	80p	4056	£1.35	40110	£3.00	4511	£1.50	4569	£2.50
4018	89p	4059	£6.00	40114	£2.50	4512	80p	4572	40p
4019	45p	4060	£1.15	40181	£3.39	4514	£2.65	4580	£4.77
4020	99p	4062T	£10.00	40182	£1.40	4515	£3.00	4581	£2.62
4021	£1.10	4063	£1.20	40192	£1.40	4516	£1.10	4582	£1.14
4022	£1.00	4066	55p	40193	£1.40	4517	£4.46	4583	90p
4023	27p	4067	£4.50	40194	£1.18	4518	£1.00	4584	90p
4024	50p	4068	27p	40257	£1.48	4519	80p	4585	£1.27
4025	27p	4069	27p	4160	98p	4520	£1.00	4597	£2.44
4026	£1.30	4070	30p	4161	98p	4521	£2.50	4598	£2.98
4027	50p	4071	25p	4162	98p	4522	£1.11	4599	£6.95
4028	84p	4072	25p	4163	98p	4526	£1.08	4700	£1.75
4029	99p	4073	25p	4174	90p	4527	£1.50		
4030	55p	4075	25p	4175	£1.15	4528	£1.20		
4031	£2.00	4076	£1.07	4194	£1.16	4529	£1.30		
4032	£1.31	4077	29p	4408	£9.37	4530	70p		
4033	£1.80	4078	29p	4409	£9.37	4531	£1.45		
4034	£2.00	4081	27p	4410	£8.55	4532	£1.30		
4035	£1.10	4082	27p	4411	£10.72	4534	£5.60		
4036	£2.95	4085	74p	4412VP	£14.93	4536	£3.69		
4037	£1.15	4086	72p	4415V	£5.24	4537L	£26.10		
4038	£1.20	4089	£1.38	4422	£5.66	4538	£1.20		
4039	£2.95	4093	80p	4433	£12.30	4539	97p		
4040	£1.00	4094	£2.50	4435V	£5.40	4541	£1.19		
4041	80p	4095	95p	4450	£3.81	4543	£1.80		

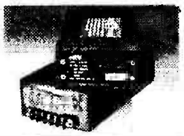
74C

		74C76	57p	74C163	£1.15	74C903	57p	74C925	£5.01
		74C83	£1.34	74C164	£1.08	74C904	57p	74C926	£5.01
		74C85	£1.34	74C165	£1.08	74C905	£7.53	74C927	£5.01
74C00	28p	74C86	67p	74C173	93p	74C906	57p	74C928	£5.01
74C02	28p	74C89	£4.62	74C174	93p	74C907	57p	74C929	£17.90
74C04	28p	74C90	89p	74C175	93p	74C908	£1.00	74C930	£17.90
74C08	28p	74C93	89p	74C192	£1.15	74C909	£1.69		
74C10	28p	74C95	£1.08	74C193	£1.15	74C910	£7.45	80C95	85p
74C14	90p	74C107	£1.27	74C195	£1.08	74C911	£7.39	80C96	92p
74C20	28p	74C150	£3.81	74C200	£7.46	74C912	£7.39	80C97	85p
74C30	28p	74C151	£2.55	74C221	£1.41	74C914	£1.46	80C98	92p
74C32	28p	74C154	£3.81	74C245	£2.98	74C915	£1.15	82C19	£6.20
74C42	95p	74C157	£2.29	74C373	£1.79	74C918	£1.10	88C29	£2.90
74C48	£1.43	74C160	£1.49	74C374	£1.79	74C921	£17.07	88C30	£2.90
74C73	57p	74C161	£1.15	74C901	57p	74C922	£3.78		
74C74	59p	74C162	£1.15	74C902	79p	74C923	£3.86		

MODULATORS

UM1111 E36 UHF Ch.36 Vision Modulator £2.50
UM1231 UHF Ch.36 Vision Modulator wide handwidth (for computers etc.) £4.70
UM1263 FM Sound Subcarrier Modulator £2.50

SWITCH MODE PSUs



AC 5221S 5V/10A £89.90
AC 9221S 5V/5A, 12V/1A, −12V/1A, −5V/0.1A £86.80
AC 5421S 5V/20A £99.20
AC 9421S 5V/10A, 12V/2A, −12V/2A, −5V/0.1A £126.50

MICROPROCESSORS

COMPUTER BOARDS
114 x 203 mm fibreglass, gold plated edge connector.

Buffered SC/MP CPU	£9.40
SC/MP Protoboard	£9.40
Z80 CPU card	£9.40
VDU 'A' } set	£8.90
VDU 'B' } of	£8.90
VDU 'G' } three	£9.40
EPROM Programmer (2708s)	£9.40
4k PROM board (5204s)	£9.40
8k PROM board (2708s)	£9.40
2k RAM board (2102s) 1k-2k	£9.40
8k RAM board (2114s) 1k-8k	£9.40
TAPE interface	£8.90
Keyboard Interface	£8.90
PSU 5v. +12v. −12v board	£8.90
PSU 5v. −12v board	£5.50

Further details on request

Z80

Z80 CPU (2½MHz)	£9.90
Z80-CTC (2½MHz)	£5.95
Z80-P10 (2½MHz)	£6.60

(Add £1 for the 4MHz version of any of the above 3 chips.)

SC/MP II RAM I/O

SC/MP II (4MHz)	£8.82
INS 8154 RAM I/O	£8.18

6800

6800 MPU	£6.55
6802 MPU	£9.95
6810 (128 × 8 RAM)	£2.97
68A10 (128 × 8 RAM)	£3.75
6820, 6821 PIA	£3.96
6850 ACIA	£3.08
MC6880	£2.64

6502

6502	£7.95
6520 PIA	£6.22
6522	£7.95

CMOS

COSMAC CDP 1802CE	£9.85
COSMAC CDP 1802E	£10.85
CDP 1864	£7.25

STATICS (Mostly 450nS)

2101—256 x 4	£2.25
2102—1K x 1	£1.20
2111—256 x 4	£1.95
2112—256 x 4	£2.25
2114/4045—1K x 4	£4.39
8 x 2114	£28.00
2114L—1K x 4	£5.50
4118—1K x 8	£15.50

DYNAMICS

MK 4116 16K 250nS	£4.95
MK 4816 2K x 8	£30.52

UV ERASABLES

2708 1K x 8	£6.75
2716/2516 2K x 8 single 5v	£17.95
2532 4K x 8 (5v)	£47.00

PROMWASHING each Prom 50p (+30p+VAT)

UV PROM ERASER

UV140	£61.20
UV141	£77.70

INTERFACE

81LS95/6/7/8	£1.40
75491 LED driver	50p
75492	92p
ZN425	£3.95
8T26/8T28	£2.64
IL74	48p

CRT Controller: Uarts

Thompson CSF SF.I96364E	£11.50
AY-5-1013 UART TR 1602	£4.00
AY-5-1013A	£4.70
AY-3-1014A	£5.60
AY-3-1015	£5.60

CHAR. GEN. KEYBOARD ENCODER

MCM 66760	£9.75
MK 2302	£15.29
RO-3-2513 (5v Uppercase)	£6.00
DM 8678 CAB/BWF	£14.27
AY-5-2376	£9.75

FIRMWARE

ZMON for Z80 (1 x 2708)	£19.95
2K Tiny BASIC for Z80 (2 x 2708)	£19.95
4K NIBL for SC/MP (4 x 2708)	£49.95
4K NIBL-MM for SC/MP (4 x 2708)	£49.95
1K Various, for SC/MP (1 x 2708)	£14.95

(Descriptive leaflet available on above, Ref SW4, 5)

1½K ELBUG (2 x 2708)	£35.00
1K ELEKTOR JUNIOR (1 x 2708)	£19.95
1K ETIBUG 1+2 (1 x 2708)	£19.95

Please enquire for firmware in 5204's

QUARTZ

32.768KHz (Watch)	£3.23
60 KHz	£9.95
100.0 KHz	£3.62
200.0 KHz	£3.92
204.8 KHz	£3.92
262.144 KHz	£3.92
307.2 KHz	£3.92
312.5 KHz	£3.92
455.0 KHz	£4.95
1.000 MHz	£3.62
1.008 MHz	£3.92
1.280 MHz	£3.92
1.8432 MHz	£3.62
2.000 MHz	£3.62
2.097152 MHz	£3.23
2.4576 MHz	£3.62
2.500 MHz	£3.92
2.56250 MHz	£3.62
3.000 MHz	£3.62
3.2768 MHz	£3.23
3.579545 MHz	£1.95
3.93216 MHz	£2.90
4.000 MHz	£2.90
4.032 MHz	£3.23
4.096 MHz	£3.23
4.194304 MHz	£3.23
4.433619 MHz	£1.25
4.608 MHz	£3.23
4.800 MHz	£3.23
4.915 MHz	£3.23
5.000 MHz	£3.23
5.0688 MHz	£3.23
5.120 MHz	£3.23
5.185 MHz	£3.23
6.000 MHz	£3.23
6.144 MHz	£3.23
6.400 MHz	£3.23
6.55360 MHz	£3.23
7.000 MHz	£3.23
7.168 MHz	£3.23
7.680 MHz	£3.23
7.86432 MHz	£3.23
8.000 MHz	£3.23
8.388608 MHz	£3.23
8.867237 MHz	£3.23
9.375 MHz	£3.92
9.800 MHz	£3.92
10.000 MHz	£3.23
10.245 MHz	£3.23
10.700 MHz	£3.23
10.92 MHz	£3.92
11.000 MHz	£3.92
12.000 MHz	£3.92
14.0 MHz	£3.92
14.31818 MHz	£3.23
16.000 MHz	£3.92
18.000 MHz	£3.23
18.432 MHz	£3.23
20.000 MHz	£3.62
20.1134 MHz	£3.23
27.0 MHz	£3.92
27.648 MHz	£3.92
38.6666 MHz	£3.23
48.000 MHz	£3.23
100.000 MHz	£3.23
116.000 MHz	£3.23

VEROBOARD
0.1" Pitch with copper strips

2½"×1" (pack of 5)	74p
2½"×3¾"	53p
2½"×5"	62p
2½"×17"	£1.86
3¾"×3¾"	62p
3¾"×5"	69p
3¾"×17"	£2.40
4.7"×17.9"	£3.14

0.1" Plainboard (no strips)

3¾"×2½"	38p
3¾"×5"	59p
3¾"×17.0"	£1.56
Terminal pins	£1.50/500
V-Q DIP board	£1.17
DIP breadboard	£2.91
Spot face cutter	93p
Pin insertion tool	£1.22

SOLDERCON PINS
100 50p 1000 £3.95

DIL SOCKETS
8/14/16 pin 10p/12p/13p
18/20/22 pin 18p/20p/25p
24/28/40 pin 30p/40p/50p
24 pin Textool lever type zero insertion force £8.50

TIMER ICs
NE555/556 29p/49p

OP-AMPS
(All Mini dips)

CA 3130E	84p
CA 3140E	35p
UA 741 (Texas)	22p

4 DIGIT LED DISPLAY
Multiplexed, common cathode, prime quality.
NSB 3881 (0.3") £4.25

LED DISPLAYS

DL-704E	99p
DL-727E/728E	£2.00
DL-747E/750E	£1.80
FND 500/560	£1.20

LIQUID CRYSTAL DISPLAY
4×0.5" Digits 40 pin DIL £9.95

CLOCK CHIPS

AY-5-1224A	£2.60
MK 50253	£5.50
MK 50366	£6.50

SIX DECADE COUNTERS

MK 50395/6/7	£9.90
MK 50398/9	£7.50

DATA

Note: In this section all data books are subject to 0% VAT. For postage see 'Terms' at top of page.

113 page Electronic Projects Index 72-77 (North Tyneside Libraries)	£1.50
c650 page COSMOS Databook (RCA)	£4.95
c31 page 'A Guide to SC/MP Programming' by Dr. Drury (Kemitron)	£3.75
c20 page 'A Guide to Kitbug' (Kemitron)	75p
c24 page NIBL Reference Guide (National)	£3.45
Data for 4118 (Mostek)	50p
c6 page data for Mk 4118	25p
16-page data for IMS 8154 (ISP-8A/650) (National)	50p
20-page data for SC/MP II (National)	50p
c100 page CDP 1802 MPU User Manual (RCA)	£4.50
c45 page Fixed Point Binary Arithmetic Routines for COSMAC	£4.50
c31 page Floating Point Arithmetic Routines for COSMAC (listings excluded)	£4.50
c43 page COSMAC MPU Product Guide (RCA)	75p
c15 page CDP 1802 Instruction Summary	25p
c70 page Understanding CMOS (RCA)	£1.50
1 page COSMOS Pocket Selection Guide (RCA)	25p
c21 page COSMOS Digital Integrated Circuits (RCA)	75p

Z80 DATA PACK £14.95
This contains all the data we can obtain on the Z80 CPU and related chips, and the Z80 Programming Manual. Depending on our own supplier, the data is either loose sheets, photocopies or bound volumes, or a combination of both. The weight of the set of data is about 1½ kilos, and some information on other processors, memories, and systems is often included.

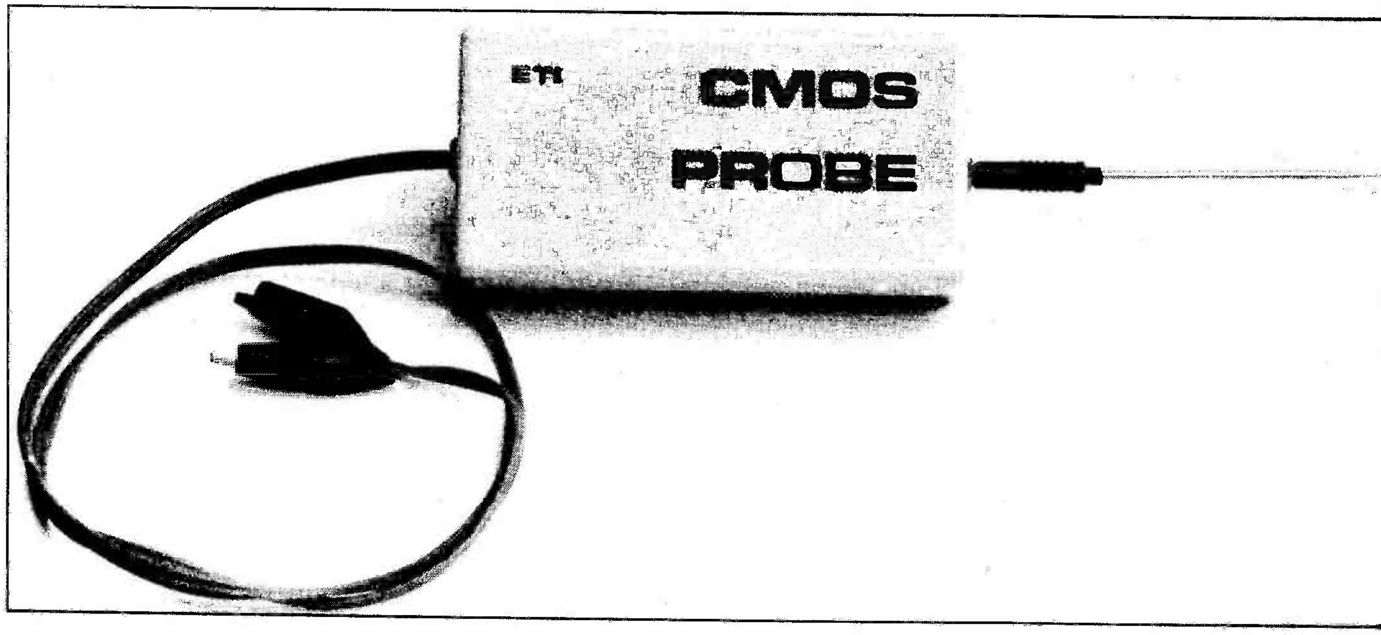
c50-page Finite State Fantasies (Cartoons putting programming on human level) (Matrix Press)	£2.00
c175 page Home Computers: Beginners Glossary and Guide by Miller and Sippl (Dilithium)	£4.95

74LS

		74LS27	28p	74LS76	40p	74LS125	60p	74LS163	£1.18	74LS240	£2.36	74LS283	£1.92	74LS375	£1.60
		74LS28	48p	74LS78	40p	74LS126	60p	74LS164	£1.14	74LS241	£2.32	74LS290	£1.28	74LS377	£2.12
74LS00	14p	74LS30	22p	74LS83	£1.15	74LS132	95p	74LS165	75p	74LS242	£2.32	74LS293	£1.28	74LS378	£1.84
74LS01	14p	74LS32	27p	74LS85	£1.18	74LS136	55p	74LS166	£2.26	74LS243	£2.32	74LS295	£1.85	74LS379	£2.15
74LS02	16p	74LS33	39p	74LS86	43p	74LS138	85p	74LS170	£2.88	74LS244	£1.70	74LS298	£1.68	74LS384	86p
74LS03	16p	74LS37	39p	74LS90	60p	74LS139	85p	74LS173	£1.05	74LS245	£3.50	74LS324	£2.40	74LS386	86p
74LS04	16p	74LS38	39p	74LS91	£1.04	74LS145	£1.08	74LS1748	£1.06	74LS247	£1.90	74LS325	£2.90	74LS390	£2.30
74LS05	20p	74LS40	28p	74LS92	89p	74LS147	£1.70	74LS175	£1.10	74LS248	£1.90	74LS326	£2.94	74LS393	£2.30
74LS08	22p	74LS42	98p	74LS93	89p	74LS148	£1.73	74LS181	£3.98	74LS249	£1.90	74LS327	£2.86	74LS395	£2.18
74LS09	22p	74LS47	90p	74LS95	£1.16	74LS151	96p	74LS183	£2.98	74LS251	£1.34	74LS347	£1.48	74LS396	£2.15
74LS10	20p	74LS48	£1.20	74LS96	£1.16	74LS153	76p	74LS190	£1.40	74LS253	£1.42	74LS348	£1.86	74LS398	£2.76
74LS11	22p	74LS49	£1.20	74LS107	44p	74LS154	£1.70	74LS191	£1.40	74LS257	£1.10	74LS352	£2.28	74LS399	£2.30
74LS12	23p	74LS51	24p	74LS109	55p	74LS155	96p	74LS192	£1.30	74LS258	£1.46	74LS353	£2.28	74LS445	£1.50
74LS13	38p	74LS54	28p	74LS112	55p	74LS156	96p	74LS193	£1.30	74LS259	£1.60	74LS365	65p	74LS447	£1.44
74LS14	75p	74LS55	30p	74LS113	50p	74LS157	76p	74LS194	£1.66	74LS261	£4.50	74LS366	65p	74LS448	£1.80
74LS15	30p	74LS63	£1.50	74LS114	50p	74LS158	96p	74LS195	£1.36	74LS266	52p	74LS367	65p	74LS668	£1.82
74LS20	20p	74LS73	46p	74LS122	70p	74LS160	£1.28	74LS196	£1.40	74LS273	£2.44	74LS368	65p	74LS669	£1.82
74LS21	22p	74LS74	41p	74LS123	70p	74LS161	98p	74LS197	£1.40	74LS275	£2.50	74LS373	£1.80	74LS670	£2.48
74LS26	48p	74LS75	48p	74LS124	£1.80	74LS162	£1.38	74LS221	96p	74LS279	66p	74LS374	£1.95		

CMOS LOGIC TESTER

Check you CMOS voltage levels with this economical piece of test gear.



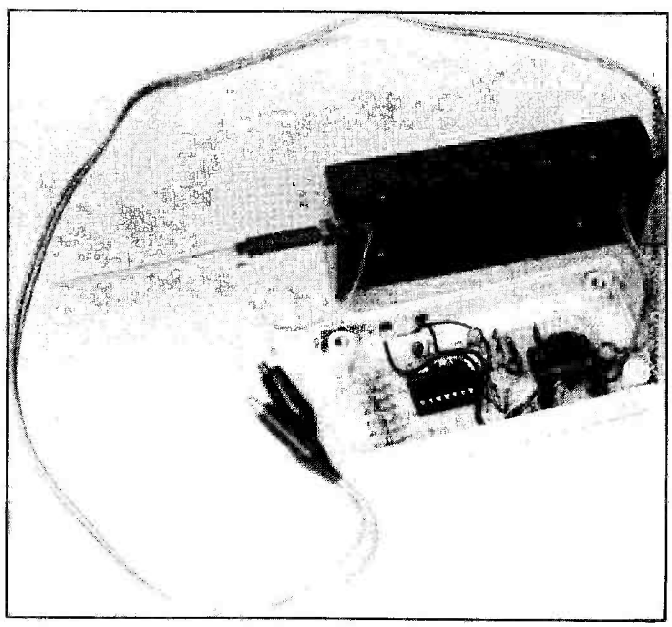
This unit, powered from the equipment under test, enables the voltage levels of CMOS circuitry to be checked to determine if they are within the valid logic range. Two LEDs are used to indicate high and low logic levels, invalid levels and open circuit conditions.

1, 0, Or Just Out To Lunch

With no input, the internal current source is held off and neither LED is illuminated. One of the two LEDs will light to indicate a valid input signal. When the input is between thirty and seventy percent (CMOS logic thresholds) of the supply voltage, both LEDs will illuminate. Both LEDs are also on for an oscillating input. Although no provision has been made to detect single pulses, a simple 555 monostable circuit would accomplish this. If triggered from pin 10, IC2, the unit would detect both positive and negative going transitions.

2 Chips, 2 LEDs

Use of a quad comparator and a Schmitt input quad NAND package enable sophisticated performance to be obtained from a handful of chips and transistors. Use the transistors specified, as they are chosen for their high minimum current gain. Any type or colour LEDs can be



The inside story - the tester's board exposed.

used. Note that the LED current is set by R14 which can be reduced if you require a brighter display. With the value specified, a current of between 10 mA and 15 mA flows depending on the supply voltage. The use of a 'constant current' driver stage avoids the problem of excessive drive current at high supply voltages.

Although CMOS is characterised to operate at 3 V, it was felt that the extra circuitry required to ensure reliable operation of the unit at this level would have been uneconomical. The prototype gave good results at a supply level of between 4V5 and 18 V.

If you use our PCB design, you can't go wrong. Of course, any method of construction may be employed. Keep connecting leads short, especially around the comparator inputs. We used tantalum capacitors for the higher values. They are small, efficient and worth the extra cost. Use 35 V working types.

We were able to fit our unit in a small verobox by removing one of the internal pillars. They come out quite cleanly if you snip around them with a stout pair of wire cutters. However you build it, the CMOS logic probe will soon become a valuable addition to your range of test gear and help you get your projects up and running in double quick time.

PARTS LIST

Resistors	
R1,4,6,11	120k
R2,3,5,7,8	100k
R9	470k
R10	1M0
R12	22k
R13,15,16	47k
R14	82R
Capacitors	
C1	10u 35V tantalum
C2	4u7 35V tantalum
C3	10n ceramic
C4	22u 35V tantalum
Semiconductors	
IC1	LM339
IC2	4093B
Q1	BC477
Q2,3	BC184L
D1-D4	1N4148
LED 1,2	any LED
Miscellaneous	
Verocase 202-21027E, PCB.	

HOW IT WORKS

Valid voltage levels for CMOS operation are below 30% and above 70% of the supply voltage. This circuit uses four comparators to determine whether or not an input voltage is within the valid ranges and its polarity. There is also circuitry to detect an open circuit condition.

Gate IC2d is connected as an oscillator running at between 1 kHz and 5 kHz, depending on component tolerances and supply voltage. Its output is capacitively coupled to diode pump D1,2. A voltage is developed across C1 about 3-15 V more positive than the positive supply voltage and this provides the positive supply for the LM339 quad comparator. IC1d is used to compare the voltage at the probe with a bias voltage slightly greater than the positive supply. When the probe is unconnected, IC1d's output is off. When the probe is connected to a voltage within the supply range, IC1d's output (an uncommitted collector) goes low, sinking current through R12 and turning on constant current source Q1. In summary, when the probe is unconnected Q1 is off and neither LED can light.

Comparators IC1a,c are connected as a conventional window comparator whose output is high when the probe input voltage is invalid. This signal, inverted by IC2a, causes IC2b,c to go high turning on Q2,3 and illuminating both LEDs. An oscillating unit will also cause both LEDs to illumminate.

With a valid input voltage, IC2a output will be high and LED 1 or 2 will light to indicate the polarity of the input signal. Comparator IC1b is used to determine input polarity, comparing it with a mid-supply voltage at the junction of R2,3. Note that when the probe is connected to a logic '0', the gate under test sinks about 50 uA max from the auxiliary positive supply and associated bias resistor, R9.

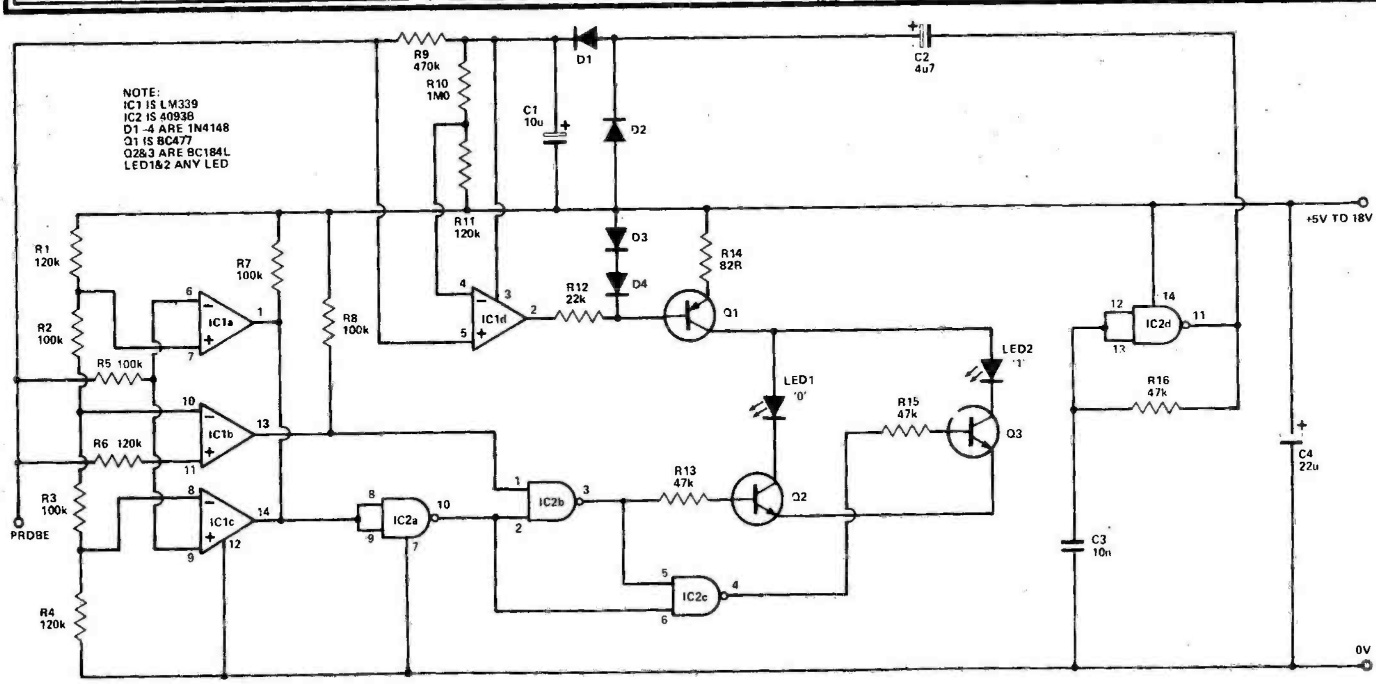


Fig.1. Circuit diagram.

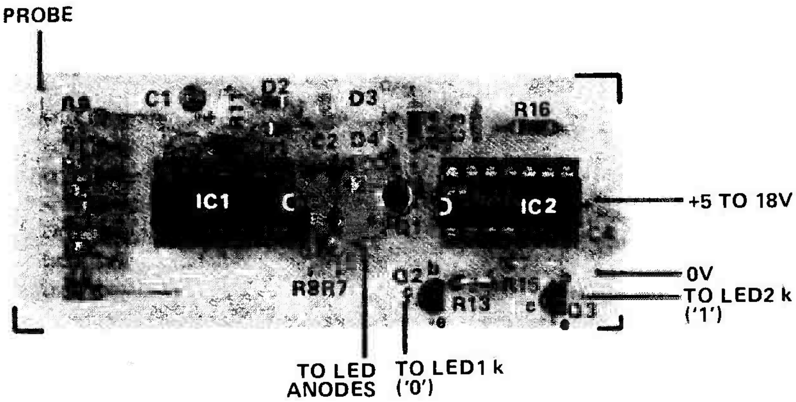
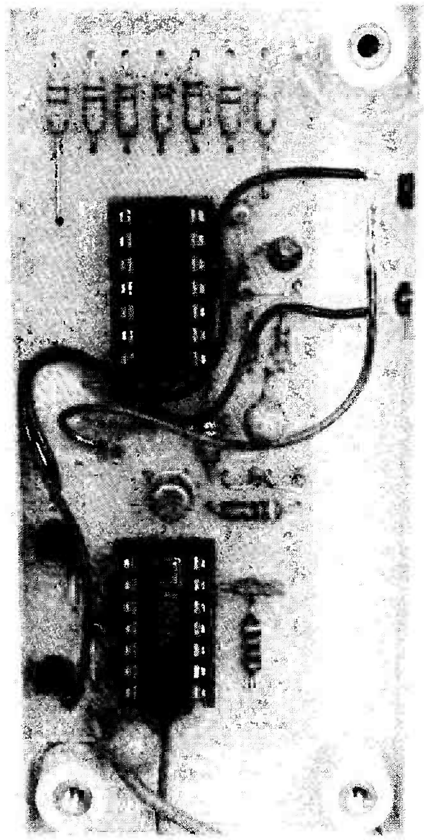


Fig.2. (above) Component overlay. Note the orientation of IC1 and IC2. Board construction is straightforward.



The completed board (right) installed in the case. The two LEDs push-fit into the side of the case.

BUYLINES

All the components should be readily obtainable. In case of difficulty, try Watford, Marshall's or Technomatic or check with other suppliers advertising in ETI.

ETI

EX-STOCK FROM US

J.V.C. BELT DRIVEN TURNTABLE

WITH STEREO MAGNETIC AUDIO TECHNICA CARTRIDGE

LIST PRICE OVER £50

J.V.C. Turntable supplied complete with Audio Technica AT10 stereo magnetic cartridge. Belt driven

- 'S' shaped tone arm.
- Modern design
- Full size 12" platter.
- Calibrated counter balance weight (0-3 grms).
- Anti-skate (bias) device.
- Size — 12¾" × 15¾" (approx)

LIMITED STOCKS AT ONLY **£25.99**

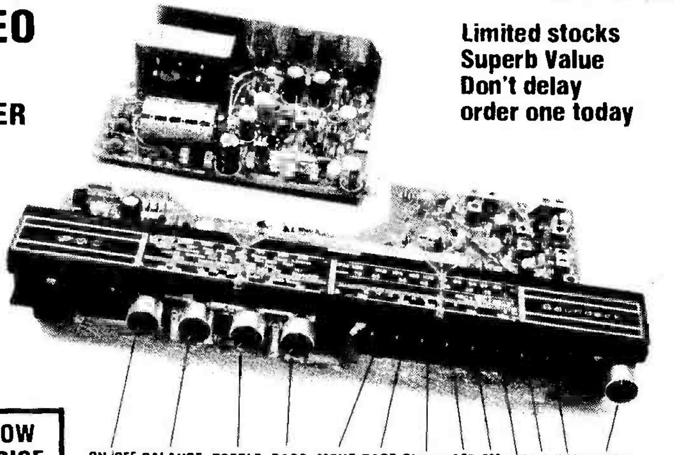
PLUS VAT £3.89 Post £2 50

GEC HIGH QUALITY STEREO

10 + 10 watt AMPLIFIER WITH AM/FM STEREO TUNER IDEAL FOR THE HOME

A cancelled export order brings you this offer from the world-famous firm of G.E.C.

AM/FM stereo Tuner Amplifier
Ready built. Comprising of a tuner/pre-amp. board and separate power supply/power amp. board with wiring diagram.
Rotary Controls: Tuning, on/off volume, balance, treble, bass. Stereo Beacon indicator.
Push-button Controls. Mono. Tape. Disc. A.F.C., F.M. (VHF). LW. MW. SW.



Limited stocks
Superb Value
Don't delay
order one today

ON/OFF BALANCE. TREBLE. BASS. MONO TAPE Phono AFC FM LW MW SW Tuning.
Volume

LOW PRICE OFFER

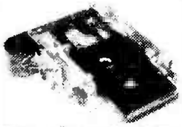
Power Output: 7 watts RMS per channel, at better than 2% THD into 8 ohms. 10 watts speech and music.
Frequency Response: 60Hz-20KHz within ± 3dB.
Tape Sensitivity: Output — typically 150 mv. Input — 300 mv for rated output.
Disc Sensitivity: 100 mv (ceramic cartridge)
Radio: FM (VHF) 87.5MHz-108MHz.
Long Wave 145KHz-265KHz
Medium Wave 520KHz-1620KHz.
Short Wave 5.8KHz-16MHz.
Size: Tuner — 2¼in. x 15in. x 7½in. Power Amp — 2in. x 7½in. x 4½in.

Fully Guaranteed Ex-Stock

SUITABLE SPEAKERS IN CABINETS PAIR 10 WATTS **£19.95** INC. VAT POST £2.50 Pair

ONLY **£19.95** + VAT £2.99 CARRIAGE £2.50

CAR STEREO CASSETTE MECHANISM



- ★ Front loading 12 volt transistorised
- ★ Speed & Voltage control
- ★ Ex-equipment — Tested O.K.
- ★ Takes standard C60 cassette

ONLY **£7.50** INC VAT POST 80p

5 + 5 Watt Car Stereo Amplifier made for Motorola

- ★ WITH pre-amplifier and M. & Long wave assembly.
- ★ Supplied as two built and tested units.
- ★ R.F. and I.F. stereo preamplifier and radio 4 x 2 x 1".
- ★ 5+5 watt stereo amplifier 12/14 volt 4 x 2 x 1"
- ★ Complete with circuit, data and connection diagrams.
- ★ Limited quantity available, ex-stock.

BRAND NEW Only £5 + VAT + VAT Post 50p

BRAND NEW ONLY £5 + VAT BRAND NEW

Buy it with Access

HENRY'S

Phone (01) 723 1008/9
404 Edgware Road, London W2, England I.E.D.

BARCLAYCARD welcome here

PRO M25 Professional capacitor boom-arm microphone by Eagle.
A graceful 60 cm boom-arm capacitor studio microphone using a cardioid capsule. A high standard of finish for in-vision use and yet robust enough to withstand long periods between maintenance. Supplied complete with 1 red and 1 black windshield and 6 metres of twin-screened cable terminating at the microphone end in an XLR connector.
Impedance: 600 ohms (floating). **Response:** 20-18.000 Hz. **Sensitivity:** – 70 dBV.
Cable: 6 metres two conductor shielded. **Connector:** XLR 3-11C. **Battery type:** HP7.

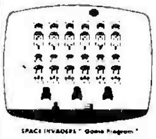
LIST PRICE £37 40
OUR PRICE **£19.95** inc VAT
POST £1 50

ATARI CARTRIDGES

BASIC PROGRAMMING Game Program

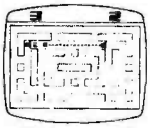
Atari Basic Programming. You'll get the basics of computer language and programming. What to say. And how to say it.

£34.50



SPACE INVADERS Game Program

SPACE INVADERS Game Program
The ultimate Game Programme with 112 game variations including Moving Shields, Zigzagging Laser Bombs, Fast Laser Bombs, Invisible Invaders and 1 & 2 Player Games! This superb cartridge uses the joystick controllers and costs only **£27.50** Incl. VAT plus 50p Post and Packing. Order Now!
Atari with space invaders. **£147.**



Slot racers™

It's you and your favourite adversary, pursuing one another through bleak big city streets. And blowing each other away with the bazookas on your hoods.
The first to blast his opponent twenty-five times is the winner.
So get set for the wildest action since cops discovered robbers. **£15.20.** Orders now taken.

GOLF Game Program

GOLF — Now you can play golf at home, even in stormy weather. There are nine tournament-quality holes on Atari's course, each with a designated par. Total par for this course is 36 points. When playing a one-player game, try to match or beat par. In a two player game, the winner is the player with the least amount of strokes. But swing carefully. There are the usual sandtraps, lakes and trees to avoid. The wrong play may cost penalty strokes.

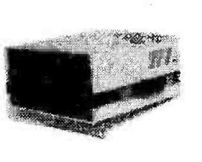
ADVENTURE Game Program

ADVENTURE — Adventure plays like the addictive Dungeons and Dragons fantasy role playing board game and includes the added dimension of video. A wicked magician has stolen an Enchanted Goblet and hidden it somewhere in the Kingdom. The object of the game is to rescue the Goblet and replace it inside the Golden Castle where it belongs — no easy task. Three deadly dragons and a black bat hinder your quest, but scattered throughout the Kingdom are objects to help you slay the dragons and outwit the evil magician. **£22.50** plus 50p P&P.

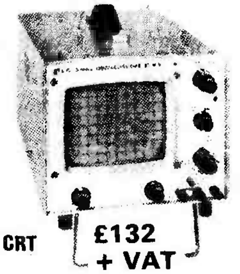
Also available: Air Sea Battle, Space War, Outlaw, Video Olympics, Breakout, Basketball, Surround, Blackjack, Chess, Backgammon, Bowling, Street Racer, Codebreaker, Hunt & Score, Braingames, Sky Diver.

COMPUTER GAMES

Free 10:1 Probe
Elex 5810 5" CRT (12.5MHz) £181.71 + VAT. Vertical axis. 1 deflection sensitivity. 10mV/div Bandwidth — DC DC 12.5MHz (between 3dB points). AC 2Hz 12.5MHz (between 3dB points). Rise time 20n sec. Input Attenuator — 12 step — 10mV/div to 50V/div in 1-2-5 sequence calibrated. Time Base — Sweep range 0 5μ sec/div to 0.1 sec/div in 12 steps, calibrated with <5 expansion. Fine control. Variable between steps includes TB calibration position



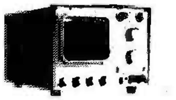
6MHz OSCILLOSCOPE 31068
10mV to 50V/cm in 12 calibrated steps. 0.5 × S to 0.1Sec/cm sweep range in 6 calibrated steps plus 12.1 Vernier. Magnifier ×5. Fully automatic trigger. DC to 1.5MHz horizontal bandwidth.
Our 31068 with 1.600v acceleration voltage. 10 mv/cm sensitivity. auto trigger for the full bandwidth and ×5 magnifier giving 1000NS/cm. Fastest sweep time (equivalent to 15 MHz oscilloscopes). SAE for brochure.
Rodal 3106C 10MHz 5" crt @ £148 + VAT. S.A.E. for details.



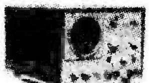
SAE for further details.

5" CRT

£132 + VAT



ELMAC 4810 CRT 5MHz scope £120 + VAT. **As recommended by ETI.** The best selling 5MHz 4" CRT scope in the UK. Time-base include sweep range — 100 msec/div to 1μ sec/div in 5 steps **3" also available. £99** + VAT. See picture below



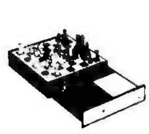
The OSC3C is a compact 3" oscilloscope suitable for general laboratory and educational use.

SINCLAIR SC110 (mini scope) £146.20.
PEM 200 £52.20. DM450 £102.46.
DM350 £76.99. PDM35 £34.50.
DM235 £55.80.

Kramer & Co., Dept. ETI 29, October Place, London NW4. Tel: 01-203 2473. Telex 888941. Attn:K7.
Visa, Access, Barclaycard & Company orders accepted. Orders by telephone/telex. Open Mon-Fri (Sunday by appointment only).

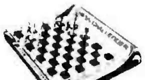
LOW COST SCOPES

AS RECOMMENDED BY ETI.
£270.



SARGON 2.5 MODULAR CHESS SYSTEM. Contact us for price ● Unparalleled strengths through entire game. ● Opening Book Library. ● Mate-in-two problems solved in two minutes. ● Seven computer strength levels. ● Instructional mode features. ● Plays by USCF & BCF Rules. ● Audio Alert System. ● Exclusive rank display and position verification. ● Position programming. ● Backspace control. ● Tournament timer. ● Move monitor. ● Battery extra. ● Position storage memory. ● Halt/hint control. ● Changing sides ● Alphanumeric display.

SUPER SYSTEM III ● LCD display of International symbols for all moves. ● Plays black/white or itself. ● Timed playing strength 0 secs to 100 hours. ● All International Chess Rules inc. Draw by 3 & 50 move rule. ● Move Counter. ● Set up your own position. ● Position verification. ● Illegal moves rejected. ● Automatic Castling & En-Passant. Computer does much more. **£154.95.**
This is the start of a system. To fit your needs optional extras include: Rechargeable Power Pack. LCD Chess Board **£106.95.** Memory Unit to store games for up to 1 year. Plus the world's first Electronic Printer to record moves. SAE for details and prices of accessories.
AS RECOMMENDED BY ETI



SENSORY CHESS CHALLENGER.
No keys to press. New sensory playing surface automatically tells the computer your every move.

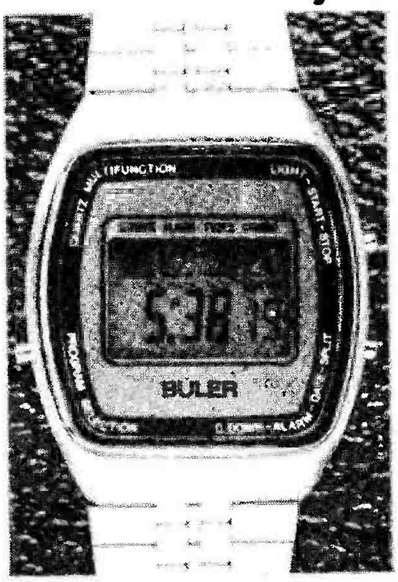
'7 LEVEL' Chess Computer at a realistic price. Plays black, white or itself. Seven levels of play from beginner to expert. Does not permit illegal moves. Castles, Kingside, Queenside, En Passant. Plays opening defences such as Sicilian, French, Ruy Lopez, Queens Gambit declined. Analyses as many as 3,024,000 board positions. Establish your own position and watch the computer react. Pawn promotion sides changeable in Mid-Game. Size 12½ X 8 X 1 inch. Mains powered. **VOICE CHESS CHALLENGER** available P.O.A.

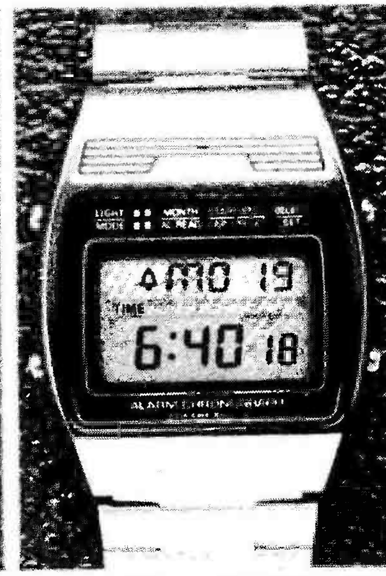
CHESS CHALLENGER

£83.95

We will match any lower price if competitor has stock. SAE for comprehensive chess reports on all the above.

Swiss watches are the finest in the world. Now you can see why.





Swiss watch manufacturers have always been famous for their quality, their design and their style.

And their watches are made to last a life-time.

No one would deny the Japanese their rightful place as the leaders of micro-miniaturisation. The quality of their products is beyond reproach and few can equal their speed and innovation.

But even the Japanese acknowledge the Swiss, the true masters of the art of recording the passage of time.

What better then than a famous Swiss watch company combining its skills and know-how with the electronics wizardry of the best Japanese silicon chip house, to produce, we believe, the best digital quartz electronic watch in the world.

BULER MULTI-FUNCTION DUAL TIME ALARM CHRONO WITH COUNT-DOWN

A sensational watch from the famous Swiss company, Montrès Buler SA of Bienne, a subsidiary of the giant 'Societé por L'Industrie Horlogerie' group which includes other famous names such as Omega, Tissot and Lanco.

This impressive watch is made from 100% stainless steel with a hard, mineral crystal lens and is water-resistant to 33ft of water. Yet, it is only 7mm thick.

There are 34 different functions in 5 separate modes of operation (Time 1; Time 2; Stop-watch; Alarm; Count-down) and amazingly all 5 modes can be operated independently and at the same time.

The alarm sound is an insistant and effective musical tone to get you up in the mornings, or to warn you your time has expired (count-down operation).

The stop-watch counts to 12 hours in second stops and has 1st and 2nd past the post split and lap timing modes.

The second time zone can be set to any part of the world.

There are 7 display indications and 6 digits.

The day of the week can even be in English, French, or German, whichever you prefer, and the strap is fully adjustable for all wrists. There is of course a back-light and the battery lasts for approximately 1½ years.

GUARANTEE

Like all products sold by Metac this fine Buler watch is guaranteed for one year. And, we even offer a 10-day money back offer.

24-HOUR DESPATCH

This is another unique Metac service.

Unlike other companies we don't believe you really want to wait 28 days for your watch, so we have opened a special 24-hour despatch centre.

Simply complete and return the coupon and this sensational new watch will be safely and securely on its way to you within 24-hours of your order being received.

Callers may buy from our shops in:
LONDON: 327 Edgware Road, W.2.
DAVENTRY: 67 High Street.
NORTHAMPTON: 11 St. Giles Square.
Credit Card Holders may telephone 03272-5983/4/5 or 01-723 4753.

Metac
ELECTRONICS & TIME CENTRES
47 High Street, Daventry, Northants.

Buler dual time multi-function alarm chrono with count-down.
Special Metac price. **£24.95**

Time 1. Hours, mins, secs, day and date	✓✓✓✓✓
Time 1 Automatic viewing of time, day and date	✓
Time 1. 12 · 24 hour AM · PM display	✓
Time 1 24 hour alarm	✓
Time 1 Day of week in English	✓
Time 1 Day of week in French and German as well	✓ ✓
Hourly chimes	
Time 2 Hours, mins, secs, day and date	✓✓✓✓✓
Time 2 Automatic viewing of time, day and date	✓
Time 2. 12 · 24 hour AM · PM display	✓
Time 2 24 hour alarm	✓
Time 2. Day of week in English, French and German	✓✓✓
Chronograph Measuring up to 12 hours in / sec	✓
Chronograph Measuring up to 24 hours in / sec	✓
Chronograph Split · lap timing modes	✓
Count down timer up to 100 minutes	✓
Count down timer up to 23 hours 59 mins	✓
Number of digits	6
Number of symbols	8
Slimness	7mm
Battery life	1½ years
Battery availability	most battery retailers
Stainless steel construction	✓
Quartz mineral crystal lens	✓
Water resistant to a depth of	99ft

Seiko alarm chrono.
Lowest retail shop price. **£42.95**

Time 1. Hours, mins, secs, day and date	✓✓✓✓✓
Time 1 Automatic viewing of time, day and date	✓
Time 1. 12 · 24 hour AM · PM display	
Time 1 24 hour alarm	✓
Time 1 Day of week in English	
Time 1 Day of week in French and German as well	
Hourly chimes	
Time 2 Hours, mins, secs, day and date	
Time 2 Automatic viewing of time, day and date	
Time 2 12 · 24 hour AM · PM display	
Time 2 24 hour alarm	
Time 2 Day of week in English, French and German	
Chronograph Measuring up to 12 hours in / sec	✓
Chronograph Measuring up to 24 hours in / sec	
Chronograph Split · lap timing modes	✓
Count down timer up to 100 minutes	✓
Count down timer up to 23 hours 59 mins	
Number of digits	10
Number of symbols	7
Slimness	8mm
Battery life	2 years
Battery availability	Seiko dealer only
Stainless steel construction	✓
Quartz mineral crystal lens	✓
Water resistant to a depth of	Yes, but not specified

To: Metac 24-hour Despatch Centre,
47 High Street, Daventry, Northants.
Please send me Buler watches at £24.95 plus 75p&p. I enclose cheque/PO for £

Barclaycard/Access No.

Name

Address

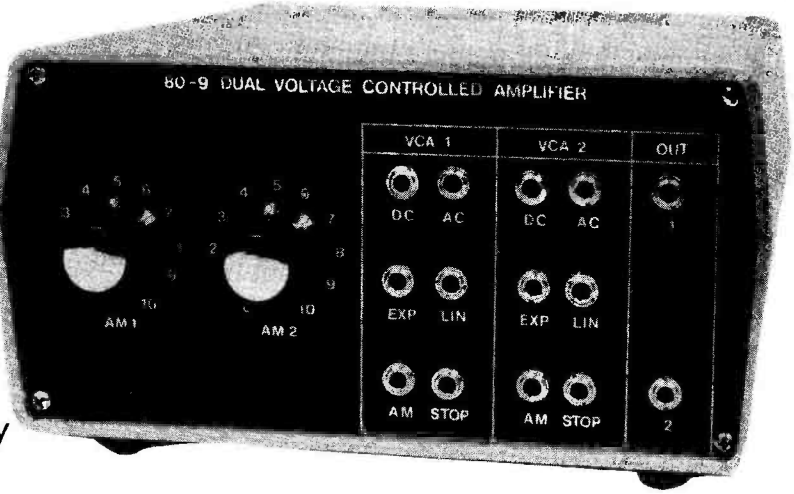
Please Complete

Name

Address

ET18

DUAL VCA



The Project 80 family grows. The latest addition-this Dual VCA design by R.C. Blakey

A voltage controlled amplifier (VCA) when used in conjunction with an envelope shaper provides dynamic control over the amplitude of signals. Although the advantageof customised ICs for electronic music has been demonstated in previous modules this dual VCA effectively illustrates their cost-performance benefits. It is a true dual VCA with each half having facilities for exponential or linear control; 0 to 100% linear amplitude modulation (tremelo); an external control of amplitude (expression). Furthermore, one can almost forget about overloading the VCAs and causing distortion, since they will accept $\pm$ 10 V signals and yet their low inherent noise is such that much smaller signal levels are acceptable. Each VCA also has a dynamic control range of some 80 dB using our standard 0 to +10 V control voltages.

Design Features

The design is based on the CEM 3330 Dual VCA IC produced by Curtis Electromusic Specialties, as used in Module 80-4 VCM.

A VCA is normally employed in conjunction with an ADSR envelope generator to provide the contour of sound dictated by this controller. Ideally the response to the envelope shaper voltage should be exponential since the human ear responds to loudness in a logarithmic manner. This facility is provided with a response of approximately 8 dB/volt. The overall response is such as to avoid problems arising from small levels of control voltage feedthrough from the envelope shaper. A linear control input is also included for other purposes but may be used with an envelope shaper to obtain a different type of response. In this instance, however, small amounts of control voltage feedthrough from the ADSR may be audible, although this can be cancelled out by applying an external positive voltage into the AM input. Increasing this voltage will bury the envelope voltage, that is, the attack and decay voltages will begin and end, respectively, at a voltage equal to the voltage applied to the AM input. The aural effect is more realistic since it effectively shortens the exponential decay time of the envelope — a technique adopted in some commercial synthesisers.

Another use of a VCA is for amplitude modulation (tremelo) and the design allows 0 to 100% amplitude modulation using any of the 0 to +10 V signals from the VCLFO (or VCO). The linear input or the linear AM input may also be used for loudness control, or expression, by using a foot pedal outputting a control voltage or by taking a control voltage from, say, the keyboard. Another feature incorporated into the linear control input is a 'STOP' facility. In live performance it can be disconcerting when the rest of the group stops sharply at the end of a piece and the synthesiser is still playing as the envelope shaper continues its decay time.

Normally the signal into the VCA will be AC coupled, but if the VCA is being used for electronic control over the amplitude of signals which are to be processed further then a DC input is useful. Signals up to $\pm$10 V may be used and *either* AC or DC coupled. Mixing of signals at the VCA is not included since other ETI 80 modules have ample facilities for mixing prior to the VCA. Likewise the gain is fixed at about 0.6 so as to retain a very high signal to noise ratio for signals which will undergo further treatment and in other circumstances the output can be attenuated at the input of the power amplifier. If necessary the gain may be adjusted by using external control voltages, as described above.

The CEM 3330, from Curtis Electromusic Specialties, contains two voltage controlled amplifiers each of which consists of a variable gain cell and a log converter. The gain cell is the current-in, current-out type with an exponential control scale. The log converter generates the logarithm of the linear control input current while transmitting the exponential control input unchanged to its output, thus providing simultaneous linear and exponential controls.

Only one VCA using pins 1 to 9 of the CEM 3330 will be described since the other VCA using pins 10 to 18 is identical. The exponential control input (pin 6 of IC1) has a scale sensitivity of 18 mV/−6 dB and an increasing positive control voltage decreases gain. To reverse the polarity, so as to accept the 0 to +10 V control voltages used in the ETI 80 modules, IC2b with R12 and R14 provide a unity gain inverting stage and the voltage is attenuated by R15 and R16 to acceptable levels. R13 connected to −15 V produces a nominal 253 mV at pin 6, which sets the minimum level, and a +10 V control voltage applied to R12 will result in about −16.5 mV for maximum gain. Thus the nominal control range at this input is about 90 dB.

The overall gain of the VCA is given by

$$A_V = \frac{R_F}{R_i} \times \frac{I_{CL}}{I_{REF}} e^{-V_{CE}/V_T}$$

where R_F is the value of the output resistor (R24); R_i the signal input resistor (R17); I_{CL} the linear control current developed across

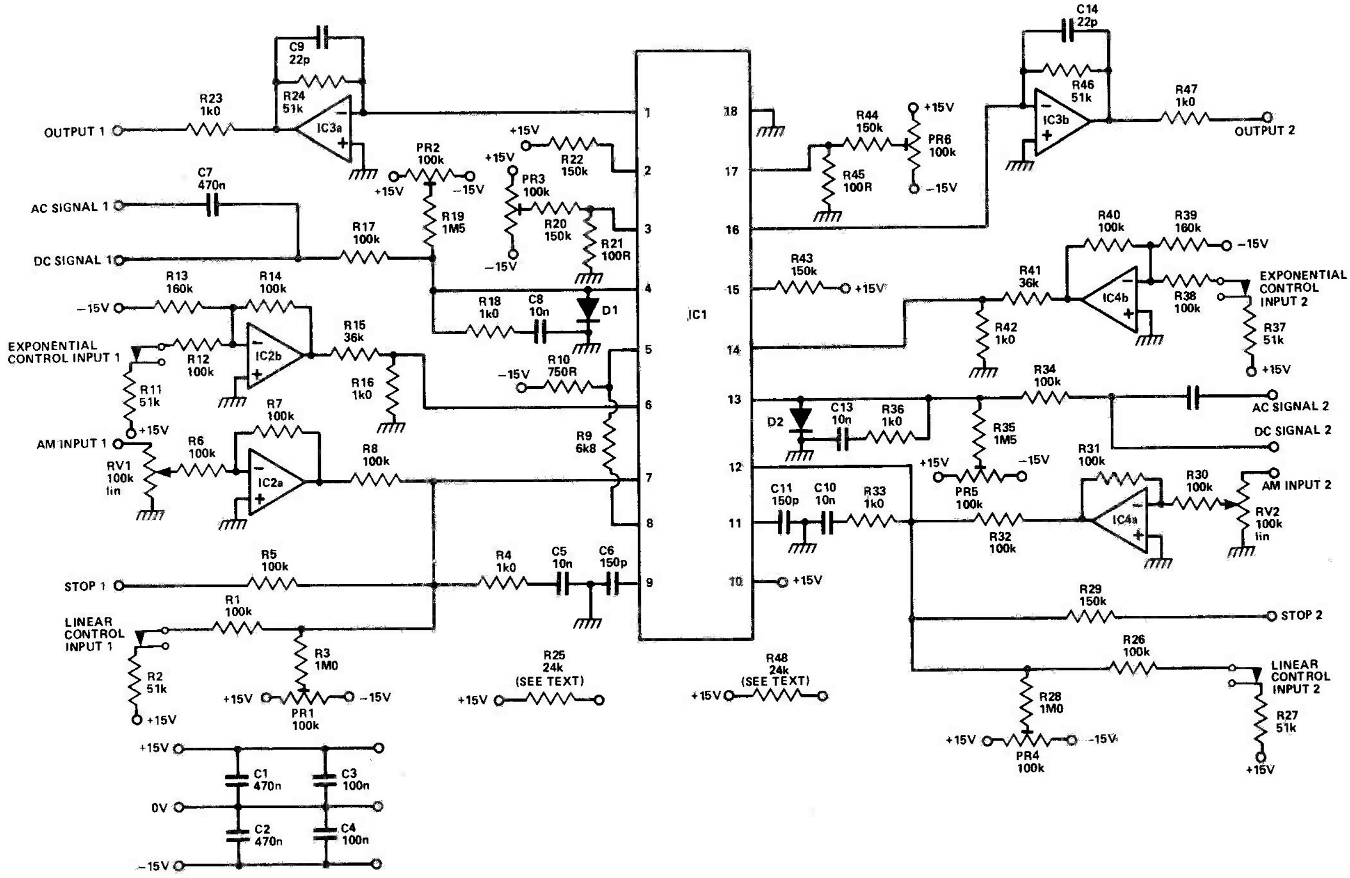


Fig.1. Circuit diagram of the Project 80 Dual VCA.

HOW IT WORKS

R1; I_{REF} the current input to pin 2 via R22 which has been set to 100 uA for best overall performance; and V_{CE} the exponential control voltage discussed above. Thus +10 V into pin 7 via R1 (100k) produces maximum gain. By using jack socket inputs to both linear and exponential controls and connecting these to +15 V via R2 and R11 respectively, the VCA is operating at maximum gain. With a signal applied via R17 and no jack plugs inserted into either control socket the signal will pass through at maximum gain (about 0.75), which is a useful facility when setting up or tuning the synthesiser. A 0 to +10 V control voltage applied to either control socket will attenuate the signal over the full control range and with the appropriate control characteristics. These same facilities can be obtained by switches and R25 is included on the PCB for this purpose; it is connected via a switch to both control inputs (R1, R12) so as to allow signals to pass through the VCA at maximum gain. Normally the exponential input is used in conjunction with an ADSR envelope shaper and the linear control input used for amplitude modulation (tremelo). 0 to 100% amplitude modulation is obtained from the linear input using any 0 to +10 V waveform applied via RV1 and the inverting stage built round IC2a. Thus +10 V with RV1 at zero resistance will result in 100% modulation of the control voltage applied to the exponential input. PR1 and R3 are provided to balance the control voltage applied to the linear input, via R1 and R2, with the voltage applied to the AM input. Also connected to the linear input is a 'STOP' facility via R5 which may be activated externally by push button or foot switch connected to −15 V. Since a negative current at this input cuts the VCA completely off the 'STOP' action is functional at all times and allows the synthesiser output to be stopped on demand. Alternatively, a foot pedal switch containing a 9 V battery (positive to jack socket ground) can be used if R5 and R29 are changed to 91k. Components R4 and C5 are for compensation purposes.

The signal input may be AC coupled via C7 and R17 or DC coupled direct to R17. R18, C8 and C6 are compensation components and D1 prevents latch up. PR2 and R9 allow trimming of control voltage feedthrough. The current output from pin 1 is converted to a voltage using IC3a and R24.

To operate the CEM 3330 from the standard ±15 V supply a current limiting resistor must be added between pin 5 and the negative supply, which in the present application may be calculated from the formula $R_{EE} = (V_{EE} - 7.2)/0.010$; which for −15 V supply requires a 750R resistor (R10).

One of the unique features of the CEM 3330 is that the operating point of the amplifiers may be set anywhere from Class A to Class B according to which parameters are most important in a particular application. The quiescent standby current of the signal carrying transistors is varied by placing a resistor between the I_{EE} pin (pin 5) and the idle current adjust pin (pin 8). For this VCA application the amplifiers are run Class AB with the 6k8 resistor (R9) providing a standby current of about 7 uA.

When operating the VCAs less than Class A, internal transistor mismatches will cause the gain during the positive portion of the input signal to differ from that during the negative portion, thus introducing even harmonic distortion — predominantly second. In this design the untrimmed distortion is typically less than 1%, at 1 kHz and 10 dB below clipping, but this can be improved by about a factor of ten if a small voltage is injected into the distortion trim pin (pin 3). R3, R20 and R21 provide an adjustment of ±10 mV for this purpose, if required.

By employing jack sockets for the inputs the VCAs are normally open, that is, a signal applied to the input of either will be present at the appropriate output at a level governed by the maximum gain of the VCA. As soon as a jack plug is inserted into either the linear or exponential control input then the VCA is under the control of the external voltage and with O V at either input the signal is completely cut off. The normally open VCA is useful while tuning the VCOs and setting up patches. This same facility may also be obtained using switches. The necessary resistors are incorporated into the PCB layout to cope with the different methods of construction.

Other advantages of having a true dual VCA incorporating the controls described above are:

(1) The ability to use the VCAs for auto panning by applying the signals to both (the same or different signals) and controlling pan by, say, a sawtooth wave into the linear control input of one and into the AM control of the other. Many panning variations are possible by using the exponential control, the inverted voltages from the 80-5 processor module, and so on;

(2) Taking the output from one VCA whose signal has been amplitude modulated and applying further modulation in the second VCA.

A truly versatile module.

Construction

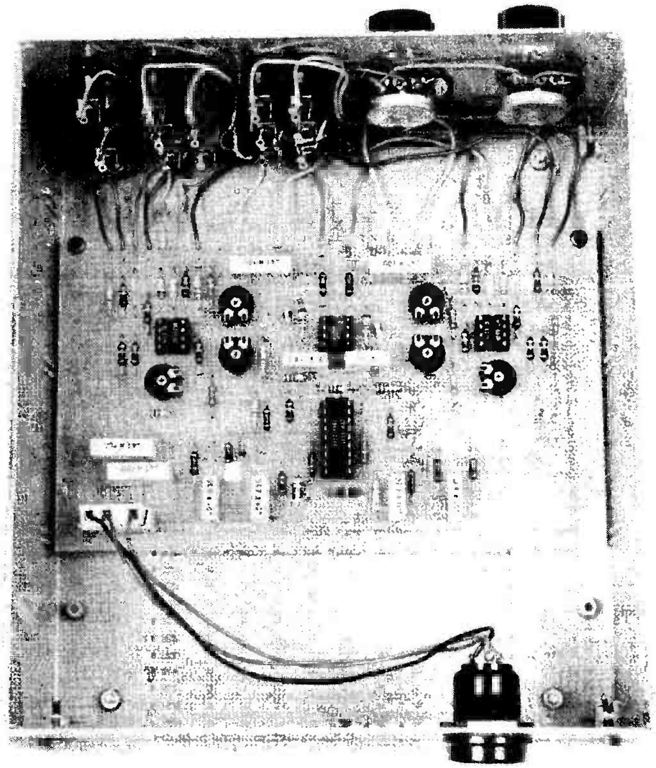
The module is designed for control voltages of 0 to +10 V and so if it is to be used in conjunction with ETI 80-8, whose peak voltage may reach +11 V, then resistors R11 and R37 should be replaced by 39k and R12 and R38 by 110k. This alteration is to prevent excessive output voltages and the substitute resistors are included in the kit of parts. R5 and R29 should also be changed to 91k if a footswitch with a 9 V battery is used to operate the 'STOP' control, as described in the previous section.

R25 and R48 need not be installed if jack sockets are used for the control inputs. With the latter method of construction R1, R12, R26 and R38 are wired to the jack socket connection which makes contact with a jack plug while R2, R11, R27 and R37 go to the respective socket connections which are disabled when a jack plug is inserted. If jack sockets are not used then a three position double pole slide switch may be employed for each VCA. For example, with VCA 1 the switch should be wired to connect R2 to R1 (position '1' to enable the exponential control); connect R11 to R12 (position '2' to enable the linear control); connect R25 to both R1 and R12 (position '3' to by-pass the VCA during tuning, etc.)

Calibration

Although there are three trimmers on each side the calibration can be carried out quickly with a minimum of equipment. During calibration the VCA must be in the open position, ie no jack plugs inserted into the control inputs (or R24/R48 switched to both control inputs). Set all trimmers to their mid position.

1. To balance the AM input control voltage against the voltage applied to the linear control input via R2 and R27. Turn the AM control, RV1 or RV2, fully clockwise (minimum resistance) and apply a 10 V VCO signal to the DC input. Apply exactly +10VO to the AM input, using a potentiometer as a voltage divider and either examine the output of the VCA being calibrated with an oscilloscope set to its maximum sensitivity or listen to the output by connecting it to an amplifier. Turn PR1 (PR4) so that the



The Dual VCA board fitted into the Teko Alba A23G case (available from West Hyde Developments).

PARTS LIST

RESISTORS ¼W 5% carbon film unless stated	
R1,6,7,8,12*,14,17, 26,30,31,32,34,38*, 40	100k
R2,11*,27,37*	51k
R3,28	1M0
R4,16,18,23,33,36, 42,47	1k0
R5,20,29,44	150k
R9	6k8
R10	750R
R13,39	160k
R15,41	36k
R19,35	1M5
R21,45	100R
R22,43	150k (1% metal film)
R24,46	51k (1% metal film)
R25,48	24k
*see text	
CAPACITORS	
C1,2,7,12	470n polyester
C3,4	100n polyester
C5,8,10,13	10n polyester
C6,11	150p polystyrene
C9,14	22p polystyrene
TRIMMERS	
PR1,2,3,4,5,6	100k carbon
POTENTIOMETERS	
RV1,2	100k linear
SEMICONDUCTORS	
IC1	CEM3330
IC2,4	LM1458
IC3	TL072CP
D1,2	1N4148

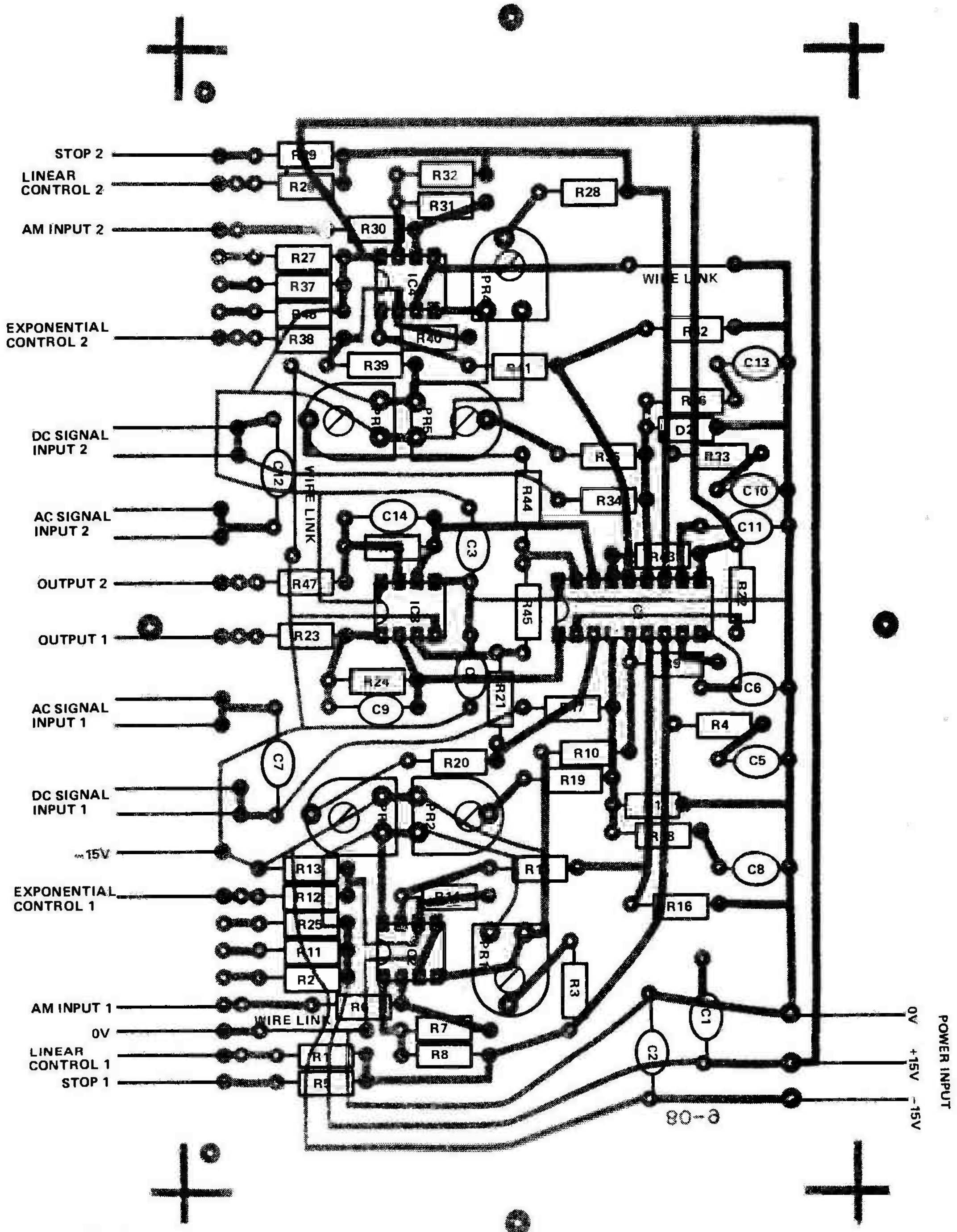


Fig.2. Component Overlay.

signal is seen (or heard) then reverse direction until the signal is *just* cut off.

2. Trimming distortion. Connect the output to a voltmeter and adjust PR3 (PR6) for zero output. Next connect a fresh 9 V battery to the DC signal input with the positive terminal to R17(R34) and the negative terminal to a ground point on the module. Measure the voltage at the output as accurately as possible. Reverse the battery leads and measure voltage again. Adjust PR3 (PR6) until the voltage obtained between +V applied and no voltage applied is exactly the same as that obtained with −V and no voltage. This difference must take into account any drift from zero output, with no voltage applied, as PR3 (PR6) is adjusted. The polarity reversal may have to be carried out several times to achieve the calibration step. NOTE: For those that find this step difficult or who are content with up to about 1% distortion then components PR3, R20 and R21 (PR6, R44 and R45) may be omitted and the PCB connections for R21 and R45 replaced by wire links. In this event only calibration steps 1 and 3 are required.

3. Trimming control voltage feedthrough. With no connections to any VCA inputs adjust PR2 (PR5) to give exactly 0V output.

ETI

BUYLINES

Britain's first complete computer kit.

The Sinclair ZX80.

£79.95

Price breakdown
ZX80 and manual: £69.52
VAT: £10.43
Post and packing FREE

Please note: many kit makers quote VAT-exclusive prices.

You've seen the reviews... you've heard the excitement... now make the kit!

This is the ZX80. 'Personal Computer World' gave it 5 stars for 'excellent value.' Benchmark tests say it's faster than all previous personal computers. And the response from kit enthusiasts has been tremendous.

To help you appreciate its value, the price is shown above with and without VAT. This is so you can compare the ZX80 with competitive kits that don't appear with inclusive prices.

'Excellent value' indeed!

For just £79.95 (*including* VAT and p&p) you get everything you need to build a personal computer at home... PCB, with IC sockets for all ICs; case; leads for direct connection to a cassette recorder and television (black and white or colour); *everything*!

Yet the ZX80 really is a complete, powerful, full-facility computer, matching or surpassing other personal computers at several times the price.

The ZX80 is programmed in BASIC, and you can use it to do quite literally anything from playing chess to managing a business.

The ZX80 is pleasantly straightforward to assemble, using a fine-tipped soldering iron. It immediately proves what a good job you've done: connect it to your TV... link it to an appropriate power source*... and you're ready to go.

Your ZX80 kit contains...
- Printed circuit board, with IC sockets for all ICs.
- Complete components set, including all ICs – all manufactured by selected world-leading suppliers.
- New rugged Sinclair keyboard, touch-sensitive, wipe-clean.
- Ready-moulded case.
- Leads and plugs for connection to domestic TV and cassette recorder. (Programs can be SAVEd and LOADed on to a portable cassette recorder.)
- FREE course in BASIC programming and user manual.

Optional extras
- Mains adaptor of 600 mA at 9 V DC nominal unregulated (available separately – see coupon).
- Additional memory expansion boards allowing up to 16K bytes RAM. (Extra RAM chips also available – see coupon).

*Use a 600 mA at 9 V DC nominal unregulated mains adaptor. Available from Sinclair if desired (see coupon).

The unique and valuable components of the Sinclair ZX80.

The Sinclair ZX80 is not just another personal computer. Quite apart from its exceptionally low price, the ZX80 has two uniquely advanced components: the Sinclair BASIC interpreter; and the Sinclair teach-yourself BASIC manual.

The unique Sinclair BASIC interpreter offers remarkable programming advantages:
- **Unique 'one-touch' key word entry: the ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST, etc.) have their own single-key entry.**
- Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately. This prevents entry of long and complicated programs with faults only discovered when you try to run them.
- Excellent string-handling capability – takes up to 26 string variables of any length. All strings can undergo all relational tests (e.g. comparison). The ZX80 also has string input – to request a line of text when necessary. Strings do *not* need to be dimensioned.
- Up to 26 single dimension arrays.
- FOR/NEXT loops nested up 26.
- Variable names of any length.
- BASIC language also handles full Boolean arithmetic, conditional expressions, etc.
- Exceptionally powerful edit facilities, allows modification of existing program lines.
- Randomise function, useful for games and secret codes, as well as more serious applications.
- Timer under program control.
- PEEK and POKE enable entry of machine code instructions, USR causes jump to a user's machine language sub-routine.
- High-resolution graphics with 22 standard graphic symbols.
- All characters printable in reverse under program control.
- Lines of unlimited length.

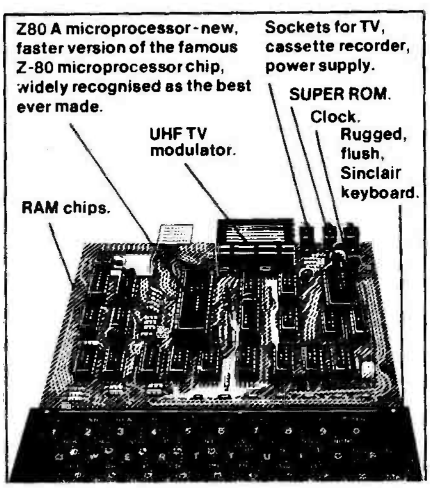
Fewer chips, compact design, volume production – more power per pound!

The ZX80 owes its remarkable low price to its remarkable design: the whole system is packed on to fewer, newer, more powerful and advanced LSI chips. A single SUPER ROM, for instance, contains the BASIC interpreter, the character set, operating system, and monitor. And the ZX80's 1K byte RAM is roughly equivalent to 4K bytes in a conventional computer – typically storing 100 lines of BASIC. (Key words occupy only a single byte.)

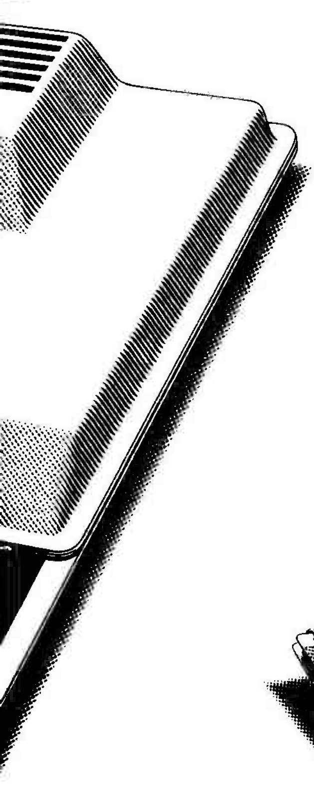
The display shows 32 characters by 24 lines.

And Benchmark tests show that the ZX80 is faster than all other personal computers.

No other personal computer offers this unique combination of high capability and low price.



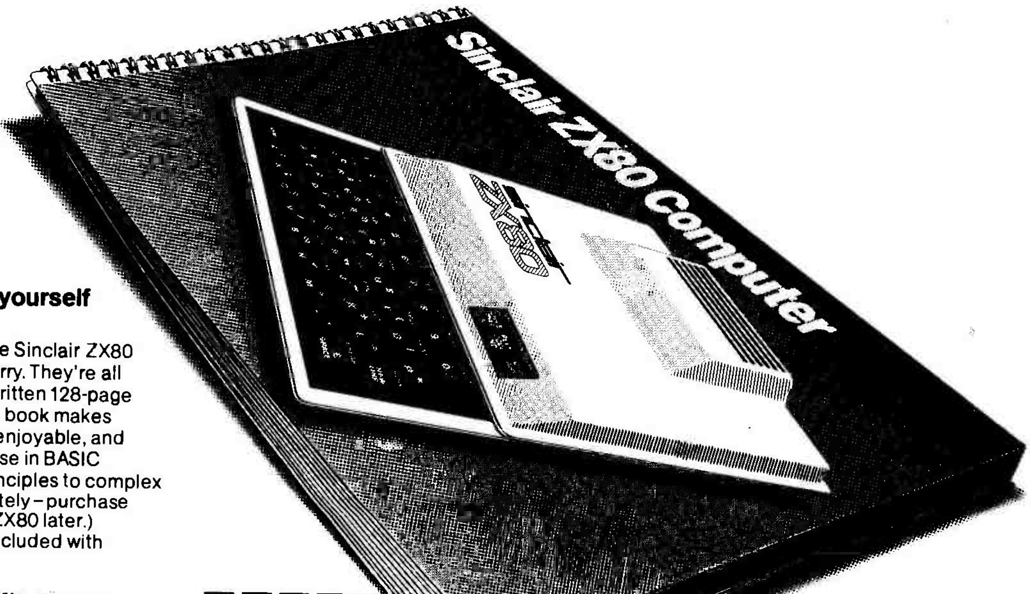
plete



ZX80 software – now available!

See the advertisements in Personal Computer World (June) and Electronics Today International (July).

New dedicated software – developed independently of Science of Cambridge – reflects the enormous interest in the ZX80. More software available soon – from leading consultancies and software houses.



The Sinclair teach-yourself BASIC manual.

If the specifications of the Sinclair ZX80 mean little to you – don't worry. They're all explained in the specially-written 128-page book *free* with every kit! The book makes learning easy, exciting and enjoyable, and represents a complete course in BASIC programming – from first principles to complex programs. (Available separately – purchase price refunded if you buy a ZX80 later.) A hardware manual is also included with every kit.

The Sinclair ZX80. Kit: £79.95. Assembled: £99.95. Complete!

The ZX80 kit costs a mere £79.95. Can't wait to have a ZX80 up and running? No problem! It's also available, ready assembled, for only £99.95.

Demand for the ZX80 is very high: use the coupon to order today for the earliest possible delivery. All orders will be despatched in strict rotation. We'll acknowledge each order by return, and tell you exactly when your ZX80 will be delivered. If you choose not to wait, you can cancel your order immediately, and your money will be refunded at once. Again, of course, you may return your ZX80 as received within 14 days for a full refund. We want you to be satisfied beyond all doubt – and we have no doubt that you will be.

sinclair ZX80

Science of Cambridge Ltd

6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Tel: 0223 311488.

ORDER FORM **To: Science of Cambridge Ltd, 6 Kings Parade, Cambridge, Cambs., CB2 1SN.**
Remember: all prices shown *include* VAT, postage and packing. No hidden extras.
Please send me:

Quantity	Item	Item price £	Total £
	Sinclair ZX80 Personal Computer kit(s). Price includes ZX80 BASIC manual, excludes mains adaptor.	£79.95	
	Ready-assembled Sinclair ZX80 Personal Computer(s). Price includes ZX80 BASIC manual, excludes mains adaptor.	£99.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	8.95	
	Memory Expansion Board(s) (each one takes up to 3K bytes).	12.00	
	RAM Memory chips – standard 1K bytes capacity.	16.00	
	Sinclair ZX80 Manual(s) (manual free with every ZX80 kit or ready-made computer).	5.00	

NB. Your Sinclair ZX80 may qualify as a business expense. **TOTAL £**

I enclose a cheque/postal order payable to Science of Cambridge Ltd for £ ______
Please print
Name: Mr/Mrs/Miss ______
Address ______
______ ETI

SUBSCRIPTIONS

This year we present a new twelve-part, fiction series — ETI 1980. . . . . available from your newsagent every month.

Forget to buy it this month, or is your newsagent sold out?

Why worry when ETI gets to the shop? Sit back and wait for it to come to you. Take out an ETI Subscription. For only £10.00 we'll send you twelve issues of ETI PLUS A free copy of ETI 1999, a chronicle of future times including the first report of World War III. You've never seen anything like it before.

To claim your FREE ETI 1999 (and a years' supply of ETI, of course) send your PO or cheque direct to

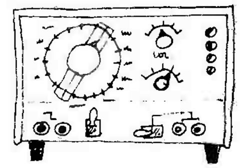
ETI Subscriptions
MAP Publications
PO Box 35
Bridge Street
Hemel Hempstead
Herts.

DORAM
a de boer company

MUSIC

Chorosynth (80060). A cheap mini-synthesizer **£57.90**
Elektor vocoder (80060). The first vocoder designed to be built from a kit with excellent features. It has 10 channels **£162.50**
Front panels for vocoder per channel **£1.25**
Analog reverberation unit (9973). Kit with 1 SAD 1024 . . . . **£27.70**
Piano. Excellent kit of an electronic piano with three voices.
- Master tone oscillator / generator . . . **£37.00**
- Octave PCB (9914) **£18.75**
- Filter PCB (9981) **£16.50**
- Power supply (9979) **£19.05**

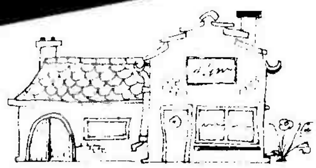
Digital reverberation unit main board **£67.20**
Extension boards **£46.30**



MEASURING

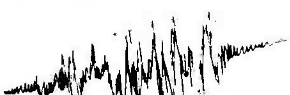
Digital thermometer (80045)
- LCD display (supplied without relay) **£28.95**
- LED display (supplied without relay) **£23.20**

Relay (two pole changeover) **£2.45**
AC millivoltmeter (79035). FET input meter circuit and audio generator **£6.30**
Universal digital meter (79005). Digital replacement for pointer instruments **£14.65**
Precision timebase (9448). Generates a precision 1 Hertz pulse **£13.10**
Power supply for timebase **£5.40**
Universal timebase (78100). Crystal controlled timebase **£18.70**
1/4 GHz counter (9887 1 + 2 + 3 + 4). Excellent kit count up to 250 MHz **£98.15**
Minicounter (9927). 1KNz 4 digit display **£27.70**
Audio analyser (9932). An analyser which can point the deficiencies in a particular audio chain or environment **£14.80**
Spot sinewave generator (9948). Programmable sinewaves with less than 0,0025% THD **£12.95**
Simple function generator (9453). Sine, square and sawtooth outputs **£27.70**
Sinewave generator (79019). Always sinewaves when you need them **£8.90**
TV scope basic version (9968 1/5). Produces display up to 1 KHz on TV **£34.50**
TV scope advanced version (9969 1/3). Converts basic scope to 100KHz bandwidth **£48.25**
Digiscope (9926) **£32.35**
Digifarad (79088). A digital capacitance meter with a wide range **£25.10**
Gate dipper (79514). Checks the resonant frequency of a circuit **£16.00**



HOME

Steam train and whistle (80019). Simulates the sound on steam and whistle **£6.50**
Clap switch (79026). You clap your hands and the light comes on **£6.60**
Elekdoorbell (79095). Program your own signature **£22.00**
Touch dimmer (78065). Room lighting controlled by single touch **£6.80**
TV sound modulator (9925) **£3.75**
Simple sound effects (79077) **£5.70**
Electronic nuisance (80016) **£3.85**
Ultrasonic transmitter (audio) (79510) **£7.65**
Ultrasonic receiver (audio) (79511) **£9.95**
DJ killer (79505) **£8.80**
Quiz master (79033) **£6.50**
Variable fuzz-box (9984) **£6.55**
Ioniser (9823). Produces a high concentration of negative ions **£9.55**
Oscillographics (9979). Random displays patterns on your oscilloscope **£11.25**
Cackling egg timer (9985). Times your egg, then clucks like a hen! **£7.20**
Pools forecaster (79053). Weighs up the odds and could win you a fortune **£8.15**
Loudspeaking telephone amplifier (9987). Amplifies signal without direct connection **£11.50**
Sensitive lightmeter (9886). Light measurement using silicon photodiode **£12.55**
Nicad charger (79024). Automatically prevents over charge of cells **£15.20**
Proximity detector (9974). Detects movement in a room (electric field change) **£9.80**
Central alarm (9950). Master station slave station **£10.85**
Alarm unit **£3.10**
Touch tuning FM preselect unit (79519). With digital display **£17.50**
Talk funny (80052). Deliberate electronic distortion of speech and music signals using a single IC, the 2206 . . . . **£9.60**
Colour generator (80027). Using coloured light for an effective display **£19.70**
Pools predictor (79053) **£8.15**



HIGH FREQUENCIES

Aerial amplifier (80022). Improves the sensitivity of an existing receiver specify VHF/UHF . . **£5.45**
UHF/VHF modulator (9976). Generates a carrier for TV signals **£6.25**
Mini shortwave receiver (9920). Interesting introduction to SW radio **£6.95**
FM IF strip (78087). Using the CA 3189 limiter demodulator IC **£13.05**
Stereo decoder (79082). Compatible with the FM IF strip **£15.10**
Digital tuning scale (80021). A sophisticated digital frequency indication **£46.30**
Ohm aerial (80076 1 + 2). A practical shortwave aerial for 1,8-30MHz **£10.30**

Buying one of our PROJECT PACKS will save you the frustration of tracking down those evasive components that hold up the completion of your project. Our packs include Printed Circuit Board, all the components listed in the article together with sockets and solder. Cases, knobs, etc., can be supplied as extra items if required. Ask for more information . . . !

NEW - NEW

★ **Battery protection (80109).** Forgetting to turn off the headlights need no longer be a motorist's nightmare. This project is designed to monitor the battery voltage and switch off the lights automatically in all kinds of motor vehicles **£5.15**

★ **Transistorignition (80084).** A system which combines the most significant advantages of other systems including the conventional system! **£20.45**

★ **Intelligent wiper delay (80086).** This wiper delay only needs to be told once what is required of it. It will then carry out your orders until you change them, which you can at any time, instantly **£15.85**

★ **Active car aerial (80018—1 + 2).** If there is one place to use a good aerial it is in a car . **£13.85**

★ **Stop thief! (80097).** There are all sorts of systems for protecting cars, but this one is unusual: it is deception, rather than protection . . . **£4.20**

★ **Battery voltage indicator (80101).** Only a few components are needed to obtain an optional indication of the battery condition: a single lamp that changes colour as the battery goes into the danger area **£6.85**

★ **Pest Pester (80130).** An electronic insect repellant. Confuses mosquitos with high pitch tone **£2.35**

★ **Morse Trainer (80072).** Can be preset to generate the morse alphabet for tuition purposes. Morse key required **£11.00**

★ **Luxury Transistor Tester (80077).** Not only checks that the device is functional but displays HFE group **£15.54**

NEW CATALOGUE

Send 40p for our new catalogue giving details of our project packs and component range.

AUDIO

Equaliser (9832). Single channel audio equaliser with slidepots **£17.70**
- with turnpots **£15.60**
- with preset pots **£13.95**

UAA180 LED meter (9817). A two-channel display meter with LEDs **£13.00**
Peak programme meter (9860). For use with UAA180 LED meter to give stereo audio display **£13.00**
Luminant (9949 1 + 2 + 3). A novel LED audio level indicator **£20.70**
Parametric equaliser (9897)
- filter section (9897-1) **£6.45**
- Tone control section (9897-2) **£5.20**

Audio analyser (9932). An analyser which can pinpoint the deficiencies in a particular audio chain or environment **£14.80**
Preconsonant (9954). A high-performance amplifier. **£5.75**
Consonant (9945). A complete audio control preamplifier **£34.65**
Toppreamp (80031). Mini preamplifier for Topamp or any other Hi-Fi poweramp **£34.30**
Topamp (80023). Hybrid audio power amplifier with OM 931 (output 30 watt) **£18.50**
- with OM 961 (output 60 watt) **£33.40**

Stentor (79070). A portable amplifier ideally suited for PA **£30.00**
Assistentor (79071). A preamp for use with Stentor **£7.00**
Elektornado (9874). A 2 × 50 watt or single 100-watt power amplifier **£19.50**
Electret microphone preamp (9866). Compact design that fits into the mike **£4.85**

HOW TO ORDER:

Send a cheque or postal order to **DORAM ELECTRONICS LTD., Fitzroy House, Market Place, Swaffham, Norfolk, PE37 7QH.** All our prices include V.A.T. Please add 40p for postage and packing.

Office hours: Monday-Friday, 9 a.m. to 5 p.m.
Telephone Swaffham (0760) 21627. Telex 817912.

Access
Buy it with Access

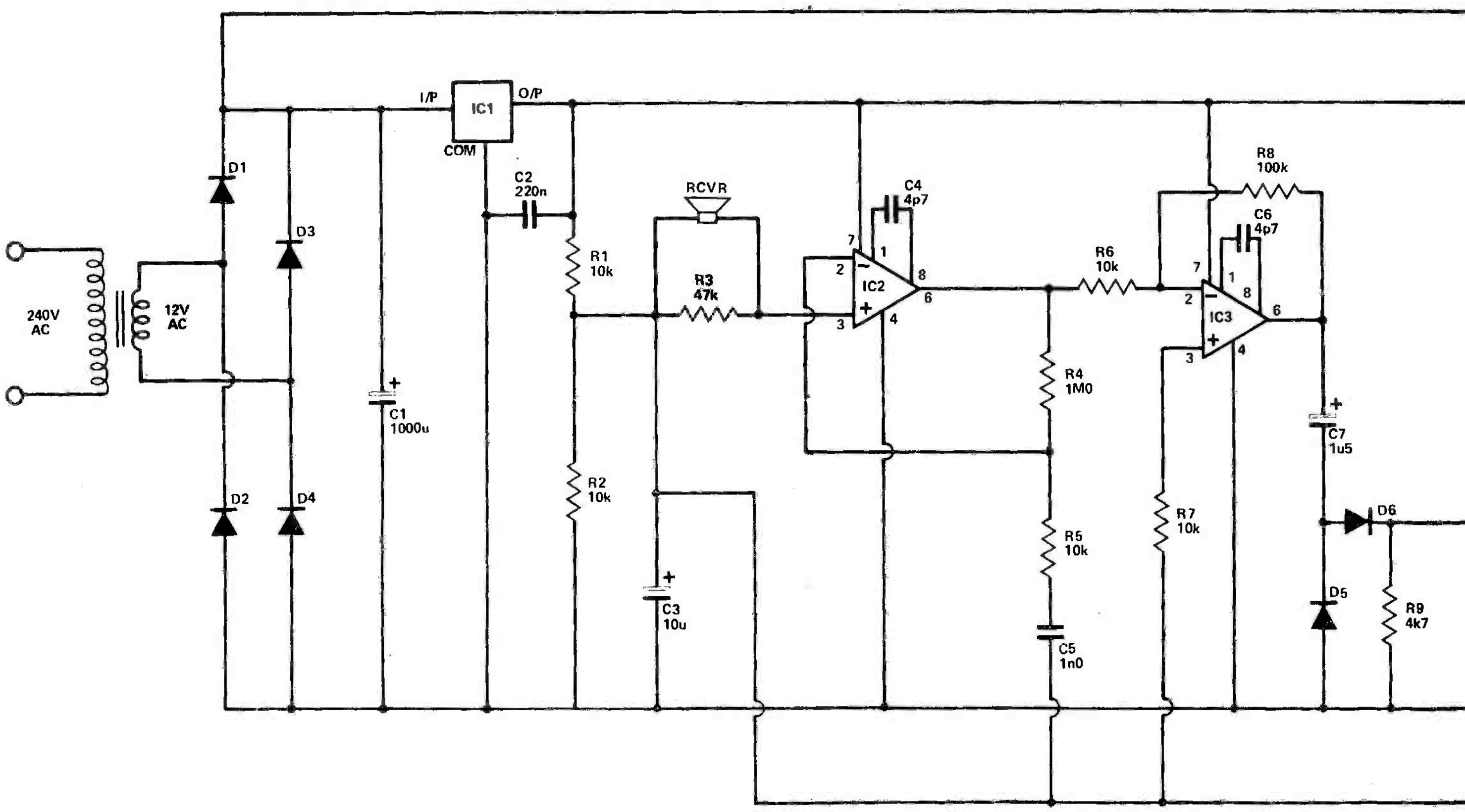
ULTRASONIC BURGLAR ALARM

Use our Doppler circuit movement detector to catch anything on the move. New design offers high sensitivity.

If you have even a passing interest in electronics, you'll know that there have been more than a few burglar alarm designs published — alarms set off when a switch opens or closes or when an invisible beam is broken or activated by a pressure mat. The permutations are endless. This project offers a novel movement detector based on the Doppler shift principle.

Super Shift

The unit consists of an ultrasonic transmitter radiating at about 40 kHz. Energy reflected from a moving target is shifted in frequency slightly. When mixed with the original signal, a heterodyne or 'beat' note is generated. This is detected by



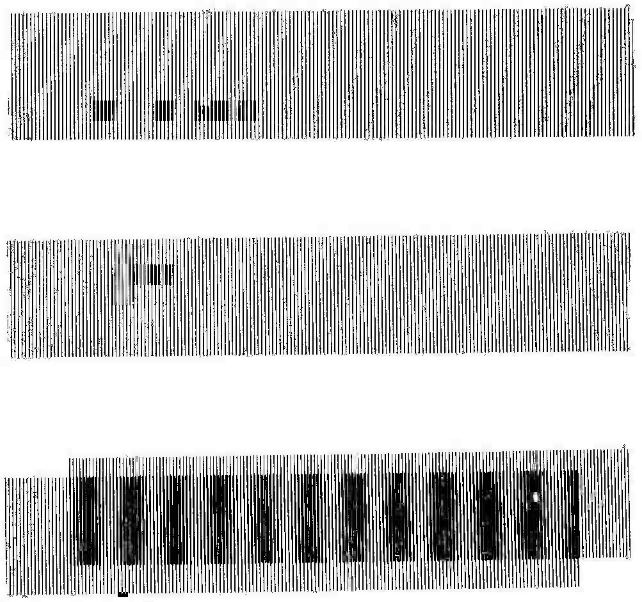


Fig.1. (above) When the received signal is mixed with the original signal, the slight difference in frequency produces a heterodyne or beat note.

Fig.2. (below) Circuit diagram.

HOW IT WORKS

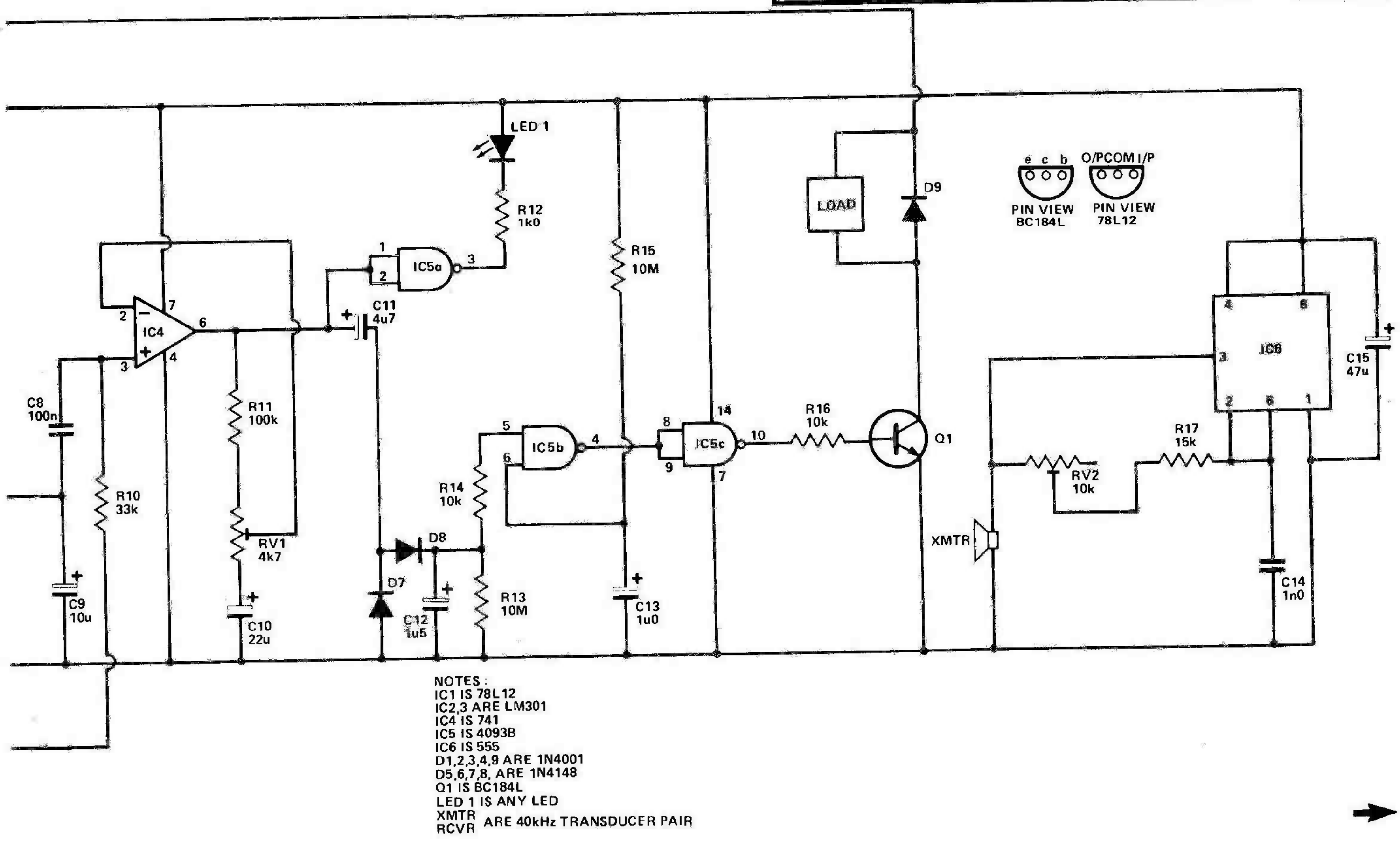
An ultrasonic drive signal is generated by IC6, a 555 configured as an astable oscillator. The circuit differs from the conventional design, as it has the timing resistor returned to the output and the internal discharge transistor (pin 7) is unused. This arrangement was chosen as it enables a 50% duty cycle to be obtained providing a better drive signal to the transmitter transducer. If close tolerance components are used then RV2 should tune the circuit between approximately 30 and 50 kHz, enabling the transmitter to be set up for most efficient operation. The power supply to IC6 is decoupled by C15 directly at the chip.

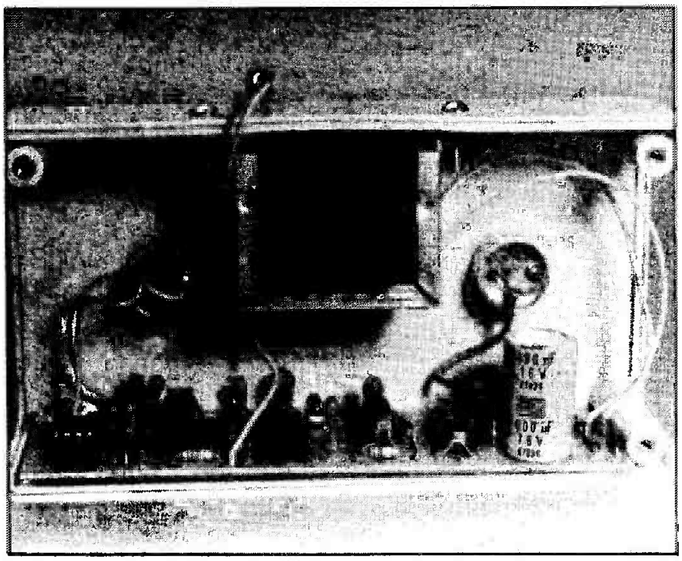
The reflected ultrasonic waves are picked up by the receiver transducer. Signals from this are coupled directly to the non-inverting input of op-amp IC2. The 'Q' of the transducer is lowered by the shunt resistance of R3, facilitating 'setting-up' the unit. IC2 is a non-inverting amplifier with a gain of 100 at 40 kHz. Gain versus frequency is tailored for best response by C4 and C5. IC3, directly coupled via R6, operates as an inverting amplifier with a gain of 10. Compensation is provided by C6. The low frequency signals resulting from Doppler shifts are demodulated from the 40 kHz signal by the network around C9. They are then amplified by IC4. The gain of this stage is made variable by adjustment of RV1, enabling overall sensitivity of the unit to be controlled.

The AC output from IC4 is integrated by C12 and the associated network. When the voltage across C12 exceeds the upper threshold of the IC5 input, transistor Q1 will be driven on and the load energised. One section of IC5 is connected directly to IC4's output and drives the LED which indicates the major excursions of IC4's output. This is of considerable use when 'setting-up' the unit. Components R15 and C13 provide a delay following switch-on before the alarm becomes active.

The values of C12,R13 and C13,R15 may be changed to suit your particular requirements. For some applications, IC5 and its associated components may not be required. In such a case, they may be omitted and an output taken directly from IC4.

The power supply for the unit is utterly conventional and needs no description here. Current consumption will depend on the load employed. The circuit draws only about 10 mA when unloaded.





A behind-the-scenes view of the ETI Ultrasonic Burglar Alarm. The two transducers can be held in place by a couple of spots of that well known contact adhesive. Note the use of the screened cable to connect the receiver transducer to the PCB. The single board contains power supply components together with transmitter and detector circuits, making the unit self-contained no-add-on-supplies or peripheral 'black boxes'. Note the use of IC sockets on the PCB. It's worth the expense. The board, transformer and transducers all fit neatly into a standard verocase (see Buylines).

demodulating the ultrasonic carrier. The frequency of the heterodyne depends on the speed of the moving target and its direction. Consequently the unit is most sensitive to objects moving directly towards or away from the sensors. A person walking directly towards the unit will normally produce heterodynes in the 0 to 30 Hz range. Higher frequencies are generated by the faster moving limbs, swinging arms and legs, for example.

A drawback with systems of this type is that they are sensitive to any movement, including swinging doors, fluttering curtains and even convection air currents from heating or air conditioning systems. However, by careful positioning of the unit, these problems can be largely overcome.

PARTS LIST

RESISTORS	
R1,2,5,6,7,14,16	10k
R3	47k
R4	1M0
R8,11	100k
R9	4k7
R10	33k
R12	1k0
R13,15	10M
R17	15k
POTENTIOMETERS	
RV1	4k7 miniature horizontal preset
RV2	10k miniature horizontal preset
CAPACITORS	
C1	1000u electrolytic
C2	220n polycarbonate
C3,9	10u tantalum
C4,6	4p7 ceramic
C5	1n0 ceramic
C7,12	1u5 tantalum
C8	100n polyester
C10	22u tantalum
C11	4u7 tantalum
C13	1u0 tantalum
C14	1n0 polystyrene
C15	47u tantalum
SEMICONDUCTORS	
IC1	78L12
IC2,3	LM301
IC4	741
IC5	4093B
IC6	555
D1,2,3,4,9	1N4001
D5,6,7,8	1N4148
Q1	BC184L
LED 1	any LED

MISCELLANEOUS
Ultrasonic transmitter-receiver pair, 12 V transformer, case.

Construction

Although any method of construction can be used, our PCB provides a convenient and practical solution. Use of a PCB helps to prevent possible problems with instability as the ultrasonic amplifier has considerable gain. Only one wire link is needed and this should be soldered into place first, followed by the IC sockets (use them! It doesn't cost much and it can save lots of time afterwards), resistors, capacitors and semiconductors. Watch out for the polarity of the capacitors and semiconductors.

Current consumption of the unit is low; most of the current used will be that required by the load and a suitable transformer rating can be calculated from this. Flying leads connect the transducers to the board. Use shielded cable for the receiver connection; it doesn't matter for the transmitter. Note that a wire lead is required to return the load to the unregulated supply. The specified driver transistor will sink in excess of 100 mA.

When connecting the transducers, take care not to overheat them. A quick soldered joint should not cause any problems. Although the transducers are sensitive to mechanical vibration, no special mounting precautions will normally be needed. We fixed ours to the case with a few dabs of contact adhesive and that worked fine.

Setting Up

If you have an oscilloscope, then setting up will be very easy. Even without one, it will not be too difficult; in fact a small screwdriver is all you need. With power applied, adjust RV2 for maximum indication of signal from pin 6, IC3. If you don't have a 'scope then connect a voltmeter across C9 and adjust for a maximum here. You will probably find two positions for RV2 which produce a high reading. Use either. This operation tunes the transmitter to about 40 kHz; the operating frequency of the transducers. The required sensitivity may now be set by adjustment of RV1. Too much sensitivity will lead to the unit being triggered by fluctuating air currents, low flying bats, etc and LED 1 has been included to indicate large signals at IC4's output. You will soon find the best operating position for your unit. Avoid placing the unit near fires, radiators, etc and keep the area near the sensors clear as this could otherwise severely restrict sensitivity. Overall range will depend on the target and the working environment. Hard, reflective surfaces are best.

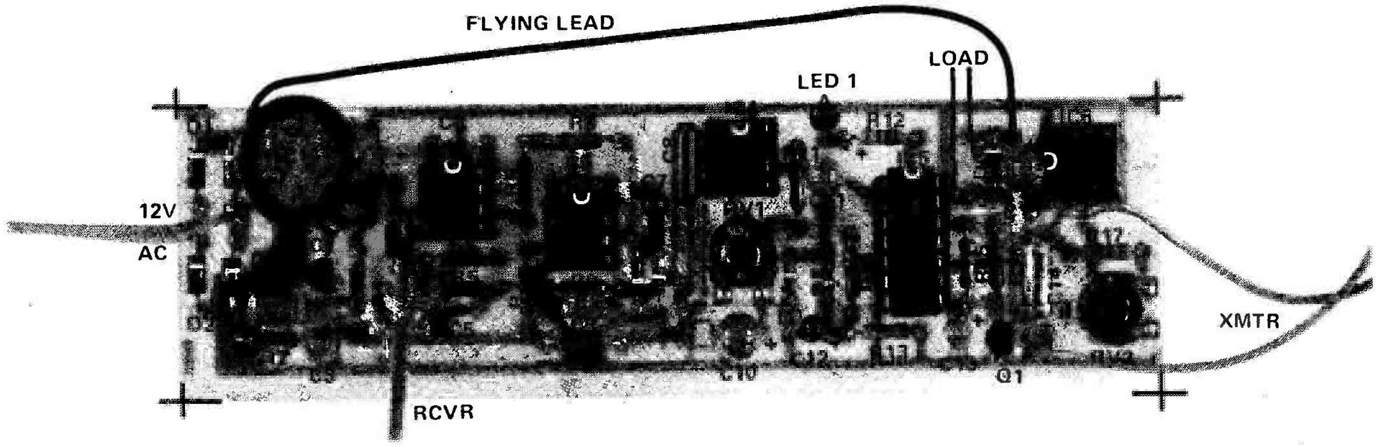


Fig.3. Component overlay.

Soft furnishings absorb the energising beam and fluttering curtains or swaying houseplants can generate considerable 'noise'. When first operating the unit, you may find it useful to connect an audio amplifier to the output of IC4 to monitor the 'noise'. A person's approach will be signalled by a rhythmic whooshing sound. We have not researched whether the unit is less sensitive to the gentler (and softer) sex. Why not build one and find out.

BUYLINES

We built our ultra-alarm in a verocase no. 202-21030K. Suitable ultrasonic transducers can be obtained from Dataplus Developments, 81 Cholmeley Road, Reading, Berks.

ETI

Wilmslow Audio

THE firm for speakers!

SEND 50P FOR THE WORLD'S BEST CATALOGUE OF SPEAKERS, DRIVE UNITS, KITS, CROSSOVERS ETC, AND DISCOUNT PRICE LIST.

AUDAX - AUDIOMASTER - BAKER - BOWERS & WILKINS - CASTLE - CELESTION - CHARTWELL - COLES - DALESFORD - DECCA - EAGLE - ELAC - EMI - FANE - GAUSS - GOODMANS - HARBETH - ISOPHON - I.M.F. - JORDON - JORDAN WATTS - KEF - LOWTHER - McKENZIE - MISSION - MONITOR AUDIO - MOTOROLA - PEERLESS - RADFORD - RAM - ROGERS - RICHARD ALLAN - SEAS - SHACKMAN - STAG - TANNOY - VIDEOTONE - WHARFEDALE.

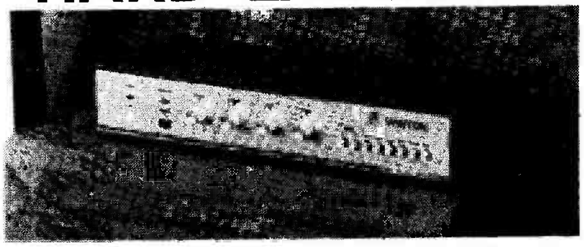
WILMSLOW AUDIO

**SWAN WORKS, BANK SQUARE
WILMSLOW, CHESHIRE SK9 1HF**

Tel. 0625-529599 FOR MAIL ORDER AND EXPORT OF DRIVE UNITS, KITS, ETC.

Tel. 0625-526213 (SWIFT OF WILMSLOW) FOR HI-FI AND COMPLETE SPEAKERS.

HARD LABOUR?



Not exactly, about 20 hours spent building the amplifier that was the success story of 1979, and has no peers in 1980.

The WINTON, 50+50 watts of real Hi-Fi using power Mosfet's and a specification and performance that is totally unprecedented in this price range.

You will find it an interesting and absorbing project, serve time and get your just deserts.

Act Now, send us a 12p stamp and we will send you a spec' sheet that will make you sit quietly for a while reflecting just how ordinary some amps really are, or get involved at once, send us your cheque for the best value in Hi-Fi kits around.

Power MOSFET's rule, ok?

COMPLETE KIT, of all parts necessary to build the P.W. WINTON **£133.50**

Order with complete confidence (C.W.O. only please) from:

T.&T. ELECTRONICS
Green Hayes, Surlingham Lane, Rockland St. Mary, Norwich, NR14 7HH. Telephone 05088 632

**PRICE INCLUSIVE OF V.A.T. & CARRIAGE.
Callers by appointment only**

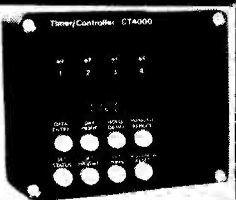
NEW

CT4000 CLOCK/APPLIANCE TIMER KIT

The CT4000 has been designed to preset the state (on or off) of four outputs at four times per day for up to 7 days in advance, enabling the unit to control tape recorders, appliances, central heating, lights, etc. The times are set on a 0 1" high red LED display by means of a keyboard and the output states are displayed on four LEDs. Each output can switch up to 20mA at 9V. For mains loads use our Solid State Relay Kit (MK2). The kit includes a PCB, keyswitches, IC, 4 digit LED display, transformer, plus all other components and a screen printed and drilled box which can also accommodate up to 4 Solid State Relay Kits

Size 10×12×4.5cms
Colour: Black

ONLY £25.25



D.V.M. THERMOMETER KIT

Based on the ICL 7106. This kit contains a PCB, resistors, presets, capacitors, diodes, IC and 0.5" liquid crystal display. Components are also included to enable the basic DVM kit to be modified to a Digital Thermometer using a single diode as the sensor Requires a 3mA 9V supply (PP3 battery). **£20.75**

MINI KITS

These kits form useful subsystems which may be incorporated into larger designs or used alone Kits include PCB, short instructions and all components.

MK1 TEMPERATURE CONTROLLER/ THERMOSTAT
Uses LM3911 IC to sense temperature (80°C max) and triac to switch heater
500W **£3.20** 1KW **£3.50**

MK2 SOLID STATE RELAY
Ideal for switching motors, lights, heaters, etc from logic Opto-isolated with zero voltage switching Supplied without triac Select the required triac from our range. **£2.60**

MK3 BAR/DOT DISPLAY
Displays an analogue voltage on a linear 10-element LED display as a bar or single dot Ideal for thermometers, level indicators, etc May be stacked to obtain 20 to 100 element displays Requires 5-20V supply. **£4.75**

MK4 PROPORTIONAL TEMPERATURE CONTROLLER
Based on the TDA1024 Zero voltage switch, this kit may be wired to form a "burst fire" power controller or a "proportional temperature" controller enabling the temperature of an enclosure to be maintained to within 0 5 C
1 5KW **£5.25** 3KW **£5.55**

MK5 MAINS TIMER
Based on the ZN1034E Timer IC this kit will switch a mains load on (or off) for a preset time from 20 minutes to 35 hours Longer or shorter periods may be realised by minor component changes Maximum load 1KW **£4.50**

TOUCH CONTROL LIGHTING KITS

These KITS replace light switches and control up to 300 Watts of lighting No rewiring, fit plaster depth boxes, insulated touchplates. Easy to follow instructions.

TD300K TOUCHDIMMER. Single touchplate with alternate action Brief touch switches lamp on and off, longer touch dims or brightens lamps Neon lamp helps find the switch in the dark. **£6.50**

TDE/K Extension Kit for TD300K for 2-way switching, etc. **£1.50**

TSD300K TOUCHSWITCH & DIMMER
Single touchplate, small knob controls brightness. **£5.50**

TSA300K TIME DELAY TOUCHSWITCH
Turns off after preset delay (2 secs to 3½ mins) **£4.30**

LD300K Conventional Lightdimmer **£2.90**

INTEGRATED CIRCUITS

555 Timer	**21p**
741 Op Amp	**19p**
AY-5-1224 Clock	**£2.60**
AY-5-1230/2 Clock/Timer	**£4.50**
AY-3-1270 Thermometer	**£8.20**
ICL7106 DVM (LCD drive)	**£7.00**
LM377 Dual 2 W Amp	**£1.45**
LM379S Dual 6W Amp	**£3.50**
LM380 2W Audio Amp	**80p**
LM382 Dual/low noise Preamp	**£1.00**
LM386 250mW low voltage Amp	**75p**
LM1830 Fluid Level Detector	**£1.50**
LM2907 f-v Converter (8 pin)	**£1.40**
LM2917 f-v Converter (14 pin)	**£1.60**
LM3909 LED Flasher/Oscillator	**55p**
LM3911 Thermometer	**£1.20**
LM3914 Dot/Bar Driver	**£2.10**
MM74C911 4 digit display controller	**£6.50**
MM74C915 7 segment-BCD converter	**96p**
MM74C926 4 digit counter with 7 seg o/p	**£4.50**
S566B Touchdimmer	**£2.50**
S9263 Touchswitch 16-way	**£4.85**

DO MAGAZINE REMOTE CONTROL PROJECTS MAKE YOU SEE INFRA RED?

How many times have you considered building a remote control project but were put off by the dozens of ICs, special coils, lenses and other hard to get components, not to mention the need for a well equipped lab. to set the unit up? T.K. ELECTRONICS have changed all that. Three ICs can build a sophisticated system that requires only a capacitor and resistor to set the clock frequency (which can drift up to 20% without affecting performance). Control radios, Hi-fi (including bass, treble and volume), lighting, toys, garage doors, etc. Still not convinced? Then look at the prices!

LD271 IR Emitting Diode	**36p**
SFH205 Photodiode Detector	**95p**
SL480 IC Pulse Amplifier	**£1.40**
SL490 Keyboard Controlled Encoder/Transmitter	**£2.40**
ML922 10-channel Receiver and 3 Analogue Outputs	**£4.20**
ML926 16-channel Receiver (4 Momentary binary outputs)	**£1.40**
ML928 16-channel Receiver (4 Latched binary outputs)	**£1.40**
Data sheets (per device)	**5p**

These ICs can also be used with ultrasonic and radio links, depending on range, cost and speed of operation For more details, why not give us a ring — we will be pleased to advise you.

NEW

If you do not require a sophisticated multi-channel remote control, we have developed a simple single-channel ON/OFF infra red transmitter and receiver. The transmitter unit comes complete with a hand held box and requires a PP3 (9V) battery. The receiver includes a triac capable of switching up to 500W at 240V a.c. and comprises a preamplifier, bistable latch and a mains power supply, making the unit completely self-contained The small size of the receiver enables the unit to be "built into" all kinds of equipment from lamps to tape recorders. The minimum range is 20 feet.

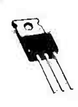
ONLY £12.00 (Order as RC500K)

INTEGRATED CIRCUITS

SN76477 Complex Sound Generator	**£2.52**
TBA800 5W Audio Amp	**58p**
TBA810AS 7W Audio Amp	**85p**
TDA1024 Zero Voltage Switch	**£1.20**
TDA2020 20W Audio Amp	**£2.85**
ZN1034E Timer	**£1.80**

All ICs supplied with data sheets
Data Sheets only 5p each device

TRIACS



400V Plastic Case (Texas)

3A	**49p**	16A	**90p**
8A	**58p**	20A	**165p**
12A	**85p**	25A	**190p**
6A with trigger			**80p**
8A isolated tab			**65p**
Diac			**18p**

SPECIAL OFFERS

orders must be received by 30.6.80

10×8pin sockets	**65p**	10×555	**£1.80**
10×14pin sockets	**£1.00**	10×741	**£1.60**
10×16pin sockets	**£1.15**	25×0 2" Red Leds	**£1.50**
10×18pin sockets	**£1.40**	ORP12	**50p**
100×Soldercon pins	**40p**	2N3055	**40p**

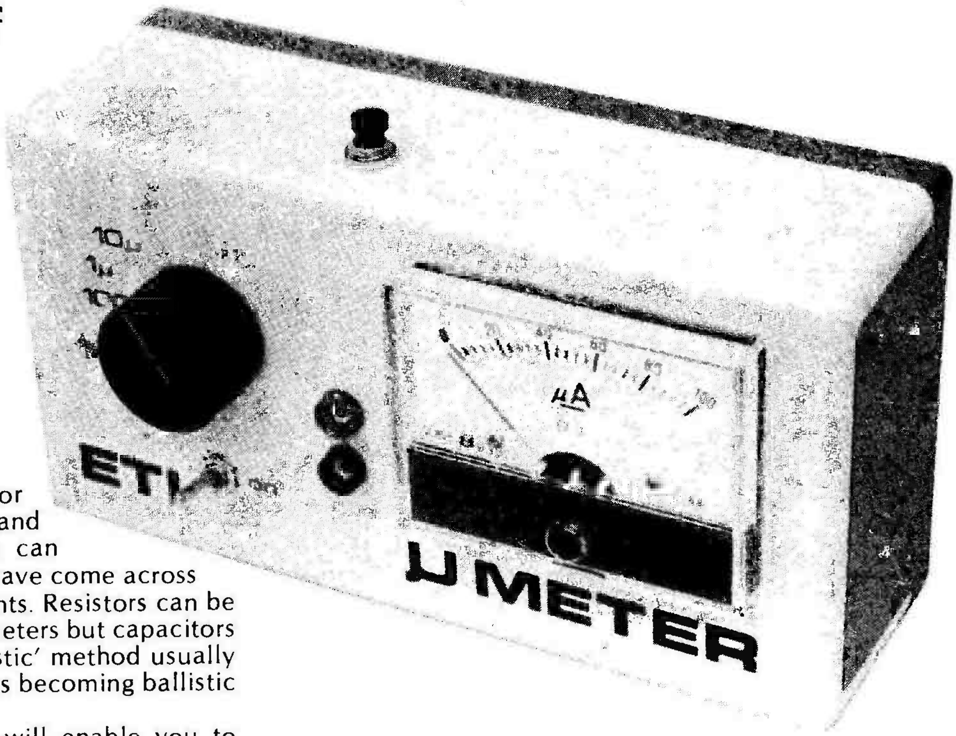
ALL COMPONENTS ARE BRAND NEW AND TO SPECIFICATION. ADD VAT AT CURRENT RATE TO ABOVE PRICES. 40p P&P MAIL ORDER — CALLERS WELCOME BY APPOINTMENT

TK Electronics

**(ETI), 106 STUDLEY GRANGE ROAD
LONDON W7 2LX. TEL. 01-579 9794**

CAPACITANCE METER

Take the huff out of measuring uFs with this cheap and handy piece of test gear.



If you are the kind of constructor who keeps a 'junk box' . . . and in this impoverished age who can afford not to . . . you are bound to have come across the problem of unmarked components. Resistors can be checked quite easily on most multimeters but capacitors pose more of a problem. The 'ballistic' method usually results in the mysterious components becoming ballistic missiles — straight in the bin!

This useful piece of test gear will enable you to measure values of capacitance from 10pF to 10uF in five decade ranges. A simple modification would enable an ordinary voltmeter to be used as indicator, though our prototype used a 100uA movement mounted in the case. Power for the unit is provide by two nine volt batteries which results in a voltage of up to 18V across the capacitor under test. This should be borne in mind when testing low voltage electrolytics or tantalum capacitors which may be damaged by this voltage.

Simple PCB

Use of a quad op-amp package keeps the component count to a minimum and simplifies the PCB design. IC2 is a BIFET device and contains MOSFET transistors, though these are adequately protected and no special handling precautions are required.

Cap Testing

In use the unknown capacitor is connected and PB1 is depressed. If you use 1% resistors for R5-9 then quite accurate readings can be obtained. Even with low tolerance resistors, the unit will find application in matching components for filter design, etc. Note that the meter will hold a steady reading for quite a few seconds before a slow drift may become evident. Current consumption of the unit is quite high (about 10mA) owing to the currents required for the zener diode voltage references.

Construction

Any method of construction may be employed but we think PCBs are best. A fair number of interconnections will be required whatever method is chosen and the circuit will tolerate quite sloppy wiring layout. If you use 1% resistors, you may want to use a large meter scale to take advantage of the extra accuracy obtained. Using the prototype, which features a miniature meter movement, we were able to correctly identify values of capacitance as low as 12pF. If desired, the power switching may be incorporated in the range switch though this necessitates a 3 pole 6 position switch.

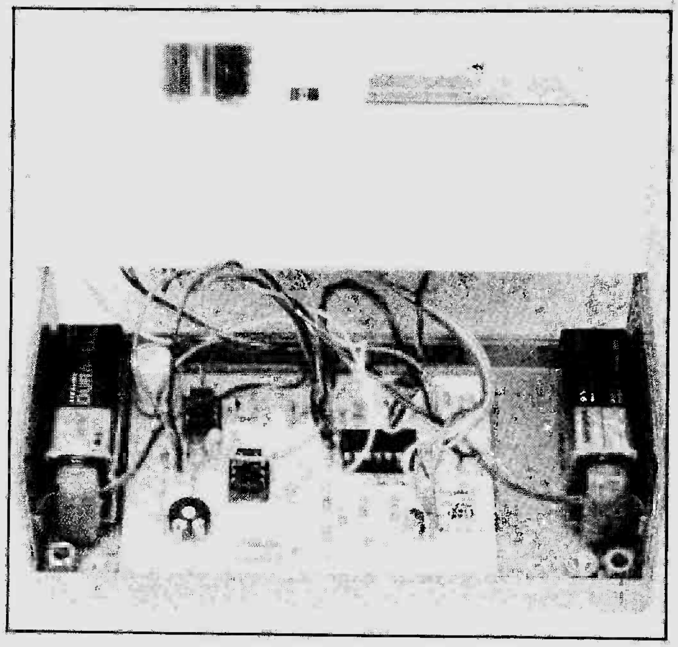
As mentioned above, an ordinary voltmeter may be used with the unit. One with a 3V FSD scaled 0-10 is required. As R23 and RV1 are not required, the full scale must be adjusted by trimming the current determining resistor R22. A value of about 5k0 should be right. Once you have built this unit, you'll wonder how you ever managed without it!

HOW IT WORKS

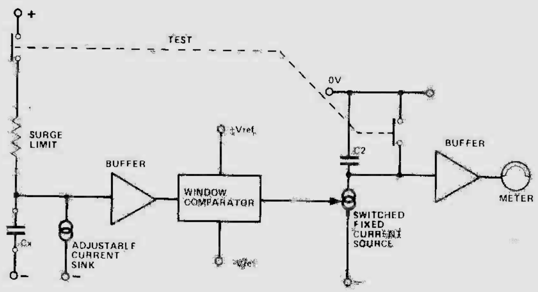
A glance at the block diagram will help you to understand operation of this unit. When the 'test' button is depressed (PB1 on the circuit diagram), the capacitor under test is charged to the positive supply and C2 is discharged. Upon releasing the pushbutton, Cx will discharge at a preselected rate (SW1 range switch determines this). Rate of change of voltage across Cx for a given constant discharge current is directly proportional to its capacitance. A measurement of this is obtained by timing the period during which the Cx voltage is between two reference voltage levels. For this period, a fixed current source is switched on by the output of the window comparator. Capacitor C2 thus develops a charge whose voltage is proportional to the value of the capacitor under test. As the unit produces a linear output, values may be read directly from a conventional meter scale.

The circuit blocks can be readily identified in the circuit diagram. IC1a, ZD1 and Q2 form the current sink. Values from 1 uA to 10 mA are obtained in decade steps by adjustment of SW1 range switch. The capacitor voltage is buffered by IC1b whose output drives the window comparator. Reference voltages are provided by the potential divider connected across ZD2. IC1c and IC1d together form the window comparator and their outputs are 'OR'ed and used to drive the switched fixed current source built around IC2. This section of the circuit is quite novel. The output of the 3140 op-amp used for IC2 can be strobed low by driving pin 8 close to the negative rail. This enables a very simple switched constant current source to be built using diode gating. A 741 op-amp is used to buffer C2. Potentiometer RV2 sets zero and RV1 sets full scale deflection.

Transistors Q1 and Q3 are switched on when PB1 is depressed to reset the circuit and initiate a new measurement. Reverse bias on Q3 is limited by D3. Overall decoupling is provided by C1.



Taking the lid off the Micrometer. We used two of those batteries that last longer than all the others.

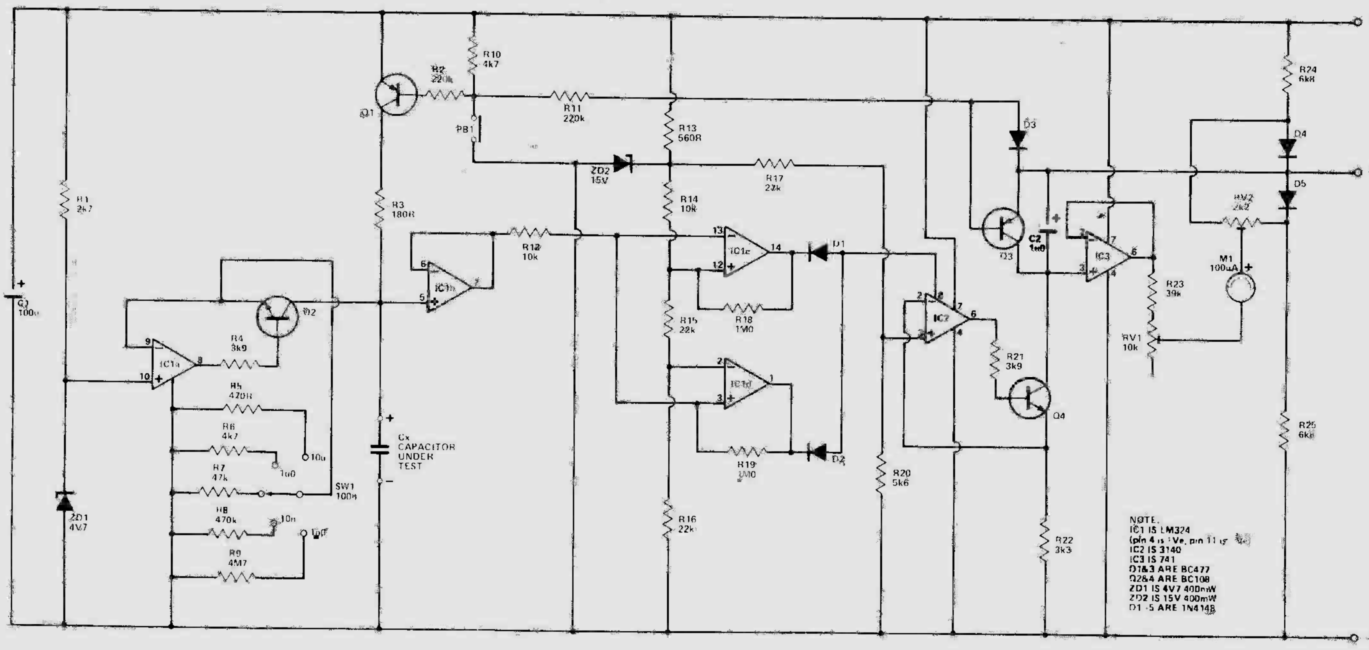


BUYLINES

Nothing out of the ordinary here. All the components should be readily available from the larger mail order companies.

Fig. 1. (left) Block diagram of the capacitance meter.

Fig.2. (below) Circuit diagram.



PARTS LIST

Resistors All ¼W 5% unless specified	
R1	2k7
R2,11	220k
R3	180R
R4,21	3k9
R5,10	470R
R6	4k7
R7	47k
R8	470k
R9	4M7
R12,14	10k
R13	560R
R15,16	22k
R17	27k
R18,19	1M0
R20	5k6
R22	3k3
R23	39k
R24,25	6k8
R5-9 should be 1% types for best accuracy.	
Potentiometers	
RV1	10k preset
RV2	2k2 preset
Capacitors	
C1	100u electrolytic
C2	1u0 tantalum
Semiconductors	
IC1	LM324
IC2	3140
IC3	741
Q1,3	BC477
Q2,4	BC108
ZD1	4V7 400mW zener diode
ZD2	15V 400mW zener diode
D1-5	1N4148
Miscellaneous	
Single pole 5-way switch, push button switch, 100 uA meter, PCB, Case, etc.	

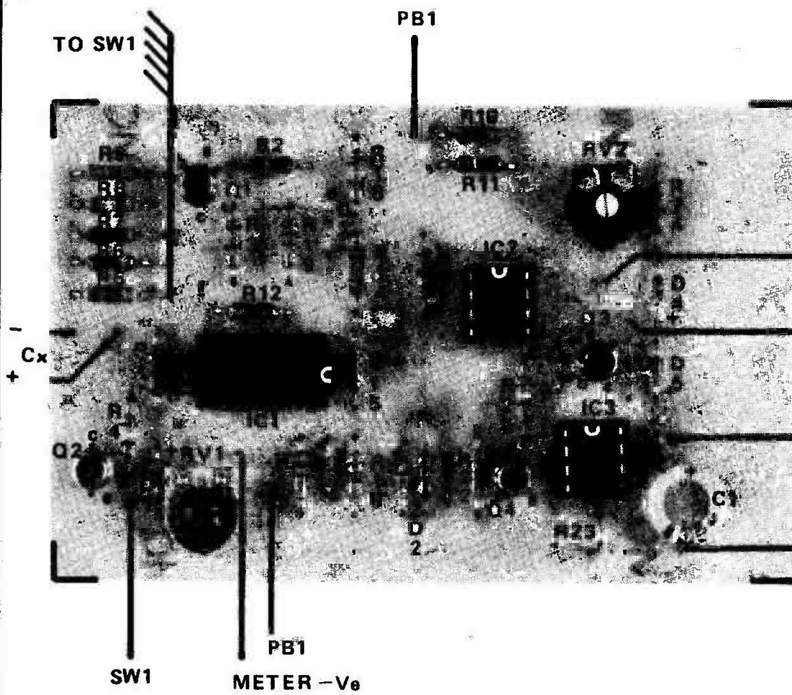


Fig.3. Component overlay. Note the orientation of the ICs. Insert them the wrong way at your peril.

ETI

ETIPRINTS

ETIPRINTS are a fast new aid for producing high quality printed circuit boards. Each ETIPRINTS sheet contains a set of etch resistant rub down transfers of the printed circuit board designs for several of our projects.

ETIPRINTS are made from our original artwork ensuring a neat and accurate board. We thought ETIPRINTS were such a good idea that we have patented the system (patent numbers 1445171 and 1445172).

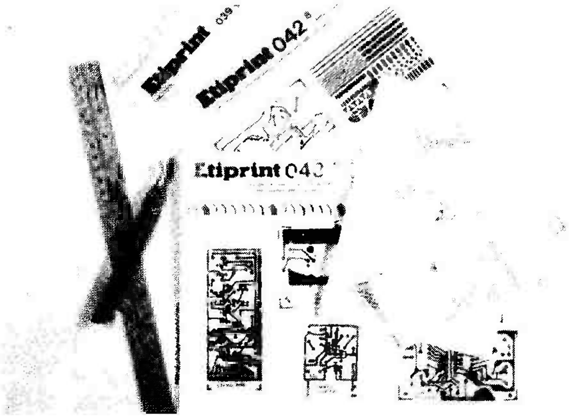
PARTS LIST

Shown below is the listing for the last year's ETIPRINTS.

Earlier sheets are available, ring Tim Salmon for details.

038	Buffer Moving Coil Preamp Process Controller	Jan 80
039A	Hum Filter Logic Probe	Dec 79
039B	Long Period Timer Rain Alarm Touch Switch Flash Trigger Pseudo Random Noise Gen	Dec 79
039C	Function Generator	Dec 79
040A	ETI 80 – VCO and VCLFO	Feb 80
040B	ETI 80 – PSU Tuning Fork Filter Coin Toss	Feb 80
041A	ETI Audiophile ETI VCA Signal Trace ETI HC Electromyogram	Mar 80
041B	VCM Heater Controller	Mar 80
042A	300W Amp Module	Apr 80
033	Fuel Level Monitor, Alarm, Screen Controller Dynamic Noise Reducer	Sep 79
042B	Touch Dimmer, Battery Charger RC Guardian (Top,Bottom) 1&2	Apr 80
043	IR60 preamp, Receiver, PSU, Servo Tester, VU–PPM	May 80
044A	IR60 Function Board (Top & underside) Control Circuit, Line Transmitter, Tape Response Meter Ohmmeter	June 80
044B	FM receiver PSU & Monitor Amp Drum Synth (function board)	June 80

HOW IT WORKS



Lay down the ETIPRINT and rub over with a soft pencil until the pattern is transferred to the board. Peel off the backing sheet carefully making sure that the resist has transferred. If you've been a bit careless there's even a 'repair kit' on the sheet to correct any breaks!

ETIPRINTS

BUY LINES

ORDER TODAY

Send a cheque or PO (payable to ETI Magazine) to

ETI PRINT, ETI MAGAZINE 145 Charing Cross Road, London WC2H 0EE.

Price £1.20p.

8K ON BOARD MEMORY!
5K RAM. 3K ROM or 4K RAM, 4K ROM (link selectable). Kit supplied with 3K RAM, 3K ROM. System expandable for up to 32K memory.

2 KEYBOARDS!
56 Key alphanumeric keyboard for entering high level language plus 16 key Hex pad for easy entry of machine code.

GRAPHICS!
64 character graphics option — includes transistor symbols! Only £18.20 extra!

MEMORY MAPPED
high resolution VDU circuitry using discrete TTL for extra flexibility. Has its own 2K memory to give 32 lines for 64 characters.

KANSAS CITY
slow error rate tape interface.

NEW FACTORY UP! PRICES DOWN!

Increased capacity at our big new factory means many prices down! All others frozen!

Cabinet size 19.0" × 15.7" × 3.3". Television not included in price

2 MICROPROCESSORS
Z80 the powerful CPU with 158 instruction, including all 78 of the 8080, controls the MM57109 number cruncher. Functions include +, —, *, /, squares, roots, logs, exponentials, trig functions, inverses etc. Range 10^{-99} to 9 x 19^{99} to 8 figures plus 2 exponent digits.

EFFICIENT OPERATION
Why waste valuable memory on sub routines for numeric processing? The number cruncher handles everything internally!

RESIDENT BASIC
with extended mathematical capability. Only 2K memory used but more powerful than most 8K Basics!

1K MONITOR
resident in EPROM.

SINGLE BOARD DESIGN
Even keyboards and power supply circuitry on the superb quality double sided plated through-hole PCB.

COMPLETE KIT NOW ONLY

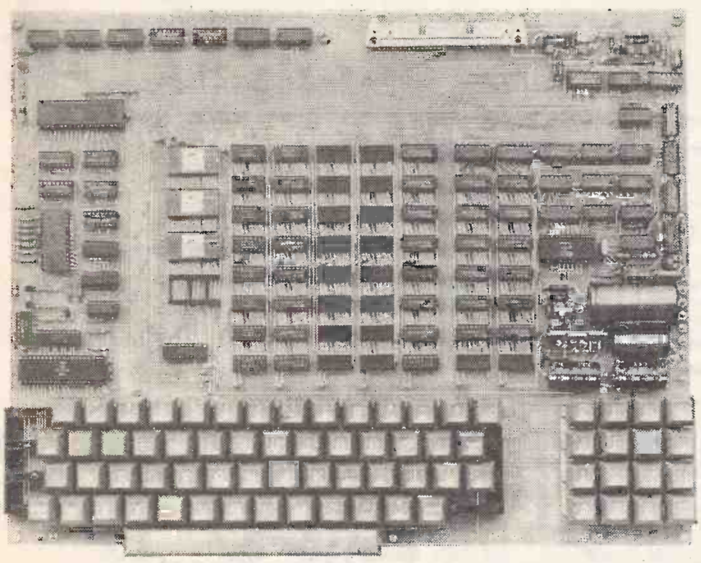
£225 + VAT

POWERTRAN

PSI Comp 80. Z80 Based powerful scientific computer Design as published in Wireless World

The kit for this outstandingly practical design by John Adams published in a series of articles in Wireless World really is complete!

Included in the PSI COMP 80 scientific computer kit is a professionally finished cabinet, fibre-glass double sided, plated-through-hole printed circuit board. 2 keyboards PCB mounted for ease of construction, IC sockets, high reliability metal oxide resistors, power supply using custom designed toroidal transformer. 2K Basic and 1K monitor in EPROMS and, of course, wire, nuts, bolts, etc.



KIT ALSO AVAILABLE AS SEPARATE PACKS

For those customers who wish to spread their purchase or build a personalised system the kit is available as separate packs eg. PCB (16" × 12.5") £43.20. Pair of keyboards £34.80. Firmware in EPROMS £30.00. Toroidal transformer and power supply components £17.60. Cabinet (very rugged, made from steel, really beautifully finished) £26.50. P.S. Will greatly enhance any other single board computer including OHIO SUPERBOARD for which it can be readily modified. Other packs listed in our FREE CATALOGUE.

PSI COMP 80 Memory Expansion System

Expansion up to 32K all inside the computer's own cabinet!

By carefully thought out engineering a mother board with buffers and its own power supply (powered by the computer's transformer) enables up to 3 8K RAM or 8K ROM boards to be fitted neatly inside the computer cabinet. Connections to the mother board from the main board expansion socket is made via a ribbon cable.

Mother board:	Fibre glass double sided plated through hole P.C.B. 8.7" x 3.0" set of all components including all brackets, fixing parts and ribbon cable with socket to connect to expansion plug	£39.90
8K Static RAM board	Fibre glass double sided plated through hole P.C.B. 5.6" x 4.8"	£12.50
	Set of components including IC sockets, plug and socket but excluding RAMs	£11.20
	2114L RAM (16 required)	£5.00
	Complete set of board, components, 16 RAMS	£89.50
8K ROM board	Fibre glass double sided plated through hole P.C.B. 5.6" x 4.8"	£12.40
	Set of components including IC sockets, plug and socket but excluding ROMs	£10.70
	2708 ROM (8 required)	£8.00
	Complete set of board, components, 8 ROMs	£78.50

Value Added Tax not included in prices

PRICE STABILITY: Order with confidence. Irrespective of any price changes we will honour all prices in this advertisement until September 30, 1980, if this month's advertisement is mentioned with your order. Errors and VAT rate changes excluded.
EXPORT ORDERS: No VAT. Postage charged at actual cost plus £1.00 handling and documentation.
U.K. ORDERS: Subsequent to 15% surcharge for VAT*. No charge is made for carriage. *Or current rate if changed.
SECURICOR DELIVERY: for this optional service (U.K. mainland only) add £2.50 (VAT inclusive) per kit.
SALES COUNTER: If you prefer to collect your computer from the factory, call at Sales Counter. Open 9 a.m.-12 noon, 1-4.30 p.m. Monday-Thursday.

New Factory on same Industrial Estate
Address and Telephone Number unchanged

UK Carriage FREE

POWERTRAN ELECTRONICS

PORTWAY INDUSTRIAL ESTATE ANDOVER
ANDOVER HANTS SP10 3NM (0264) 64455