electronics today

INTERNATIONAL

SEPTEMBER 1979

50p

UPDATE YOUR WHEELS!
FOUR Projects for The Old Banger

Sony Pickup On Coils
Dynamic Noise Filter
LM 10 Revealed

ETI DOES IT AGAIN!
SEIKO CALENDAR WATCH
40% OFF

. . . NEWS . . . . PROJECTS . . . . ACCESSORIES . . . . AUDIO . . .

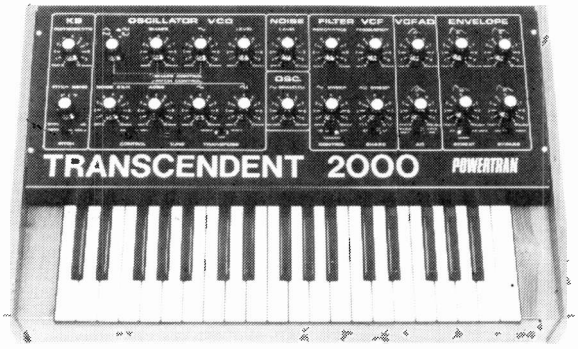
TRANSCENDENT 2000
SINGLE BOARD SYNTHESIZER

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 effective 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 contruction 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 between £500 and £700!

COMPLETE KIT ONLY
£172.00 + 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!



Cabinet size 24.6"x15.7"x4.8" (rear) 3.4" (front)

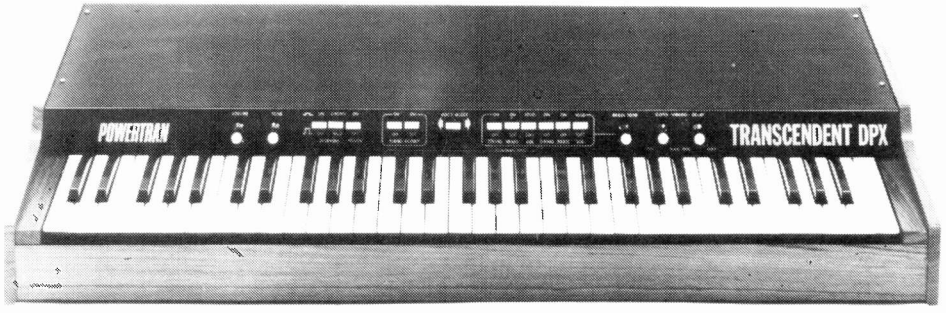
NEW!

BEING FEATURED THIS MONTH
Another superb design by synthesizer expert Tim Orr!

TRANSCENDENT DPX

DIGITALLY CONTROLLED, TOUCH SENSITIVE, POLYPHONIC, MULTI-VOICE SYNTHESIZER
Like all of our kits the TRANSCENDENT DPX really is complete — fully finished metalwork, solid teak cabinet, professional quality components (all resistors 2% metal oxide), nuts, bolts, etc — even a 13A plug! Being digitally controlled the DPX may be operated by computer and the kit also includes a COMPUTER INTERFACE SOCKET!

HARPSICORD
HONKY TONK
PIANO!
STRINGS!
BRASS!



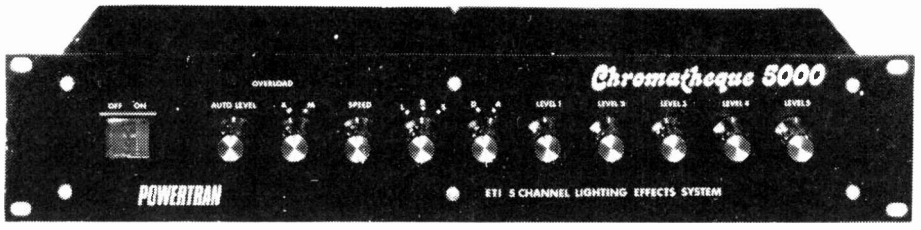
POWERFUL
DYNAMIC!
CHORUSING!
VIBRATO!
PHASING!

Panel size 19.0"x3.5". Depth 7.3"

COMPLETE KIT ONLY £365.00 + VAT!

CHROMATHEQUE 5000

5 CHANNEL LIGHTING EFFECTS SYSTEM



Cabinet size 36.3"x15.0"x5.0" (rear) 3.3" (front)

COMPLETE KIT ONLY
£49.50 + VAT!

This versatile system featured as a constructional article in ELECTRONICS TODAY INTERNATIONAL has 5 frequency channels with individual level controls on each channel Control of the lights is comprehensive to say the least You can run the unit as a straightforward sound-to-light or have it strobe all the lights at a speed dependent upon music level or front panel control or use the internal digital circuitry which produces some superb random and sequencing effects Each channel handles up to 500W and as the kit is a single board design wiring is minimal and construction very straightforward

Kit includes fully finished metalwork, fibreglass PCB, controls, wire, etc — Complete right down to the last nut and bolt!

POWERTRAN

ORDERING INFORMATION AND MORE KITS ON PAGE 8

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

electronics today

SEPTEMBER 1979 VOL 8 NO 9 INTERNATIONAL

Four for cars!

String along p. 62

Time on offer p. 30

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OFFER: SEIKO AT 40% OFF	10	You'll never believe it!
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INTERNATIONAL EDITIONS

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CAPACITORS

Electrolytic Axial Leads

−10% to +50% Tol

Order Code: Cap 015 + µF + V d.c.

µF \ V d.c.	16	25	40	63
1.0				8
1.5				8
2.2				8
3.3				8
4.7				8
6.8			8	9
10		7		9
15	7		8	10
22		7		12
33	7		8	
47		7	10	12
68	8			
100		8	12	
150	8	9		29
220	12		24	34
330			28	37
470		21	30	44
680	19	28	36	50
1000	23	28	55	
1500	32	36		
2200	39			

Tantalum Bead

±20% Tol

Order Code: Cap PR + µF + Volts

µF \ V d.c.	3.15	6.3	10	16	25	35
0.1						9
0.15						9
0.22						9
0.33						9
0.47						9
0.68						9
1						9
1.5						10
2.2					9	11
3.3					9	11	14
4.7					10	14	15
6.8		9			11	15	16
10		10	11	14	16	20
15		11	14	15	20	
22	11	14		16		
33		15	16	20		
47		16	20			
68	16	20				
100	20					

Electrolytic Can Type

Order Code: Cap HR + µF + Volts

High Ripple, IEC Grade 1, Low E.S.R.
Supplied complete with Vertical Fixing Clip

		Ripple 1A @ 85°C	1.4A @ 50°C	
2200 µF	16V	2.6A	3.6A	184
4700 µF	16V	5.8A	8.1A	222
10000 µF	16V	9.8A	13.7A	346
22000 µF	16V	1.3A	1.8A	175
2200 µF	25V	4.6A	6.4A	201
4700 µF	25V	8.0A	11.2A	264
10000 µF	25V	12.8A	17.9A	438
22000 µF	25V	0.9A	1.2A	168
1000 µF	40V	2.4A	3.3A	188
2200 µF	40V	5.6A	7.8A	231
4700 µF	40V	9.2A	12.8A	367
10000 µF	40V	1.8A	2.5A	190
1000 µF	70V	4.0A	5.6A	235
2200 µF	70V	7.5A	10.5A	376
4700 µF	70V	4.0A	5.6A	222
1000 µF	100V	7.8A	10.9A	346
2200 µF	100V			

Electrolytic Radial Leads

−10% to +50% Tol.

Order Code: Cap 034 + µF + Volts

µF \ V d.c.	6.3	10	16	25	35	40	50	63
.47								6
.68								6
1.0								6
1.5								6
2.2								6
3.3								6
4.7						6		7
6.8				6			7	8
10			6			7		8
15			6	7			8	10
22		6	7			8	10	
33			7	8		10		
47		7	8		10			
68			8	10				
100		8	10					
150		10						
220	10							

Miniature Low Value

Polystyrene, Axial, ±1% Tol., ≥ 63V D.C. Wkg — Order Code: Cap 424
Ceramic Plate, Radial, Low K, 1.8pF–8.2pF ± 25pF Tol, 10-330pF ±2% Tol, 100V D.C. Wkg — Cap 632
Ceramic Plate, Radial, Med K, ±10% Tol, 100V D.C. Wkg — Cap 630
Ceramic Plate, Radial, High K, −20% to +80% Tol, 63V D.C. Wkg — Cap 629
+ Value

pF	424	632	630	629
1				
1.2				
1.5				
1.8	5			
2.2	5			
2.7	5			
3.3	5			
3.9	5			
4.7	5			
5.6	5			
6.8	5			
8.2	5			
10	5			
12	5			
15	5			
18	5			
22	5			
27	5			
33	5			
39	5			
47	5			
56	6			
68	6			
82	6			

pF	424	632	630	629
100	16	6		
120	16	8		
150	16	8		
180	16	6		
220	16	6		
270	18	8		
330	18	8		
390	18		5	
470	18		5	
560	16		5	
680	16		5	
820	16		5	
1000	16		5	5
1200	16		5	
1500	18		6	
1800	18		6	
2200	18		6	6
2700	18		6	
3300	18		6	
3900	18		6	
4700	23		7	6
5600	23			
6800	23			
8200	23			

nF	424	632	630	629
10	25			6
12	26			
15	26			
18	27			
22	28			8
27	38			
33	41			
39	43			

Polyester Radial Leads

Order Code

Dipped Type, ±20% Tol, ≥ 250V D.C. Wkg, C280/352 Style — Cap 352
Moulded Type, ±10% Tol, ≥100V D.C. Wkg, 10.2mm Pitch Centres — Cap 360
Moulded Type, ±10% Tol; ≥100V D.C. Wkg 7.6mm Pitch Centres — Cap PHE280
+ Value

µF	352	360	PHE280
.001		5	6
.0015		5	6
.0022	5	6	7
.0033	5	6	7
.0047	5	6	7
.0068	5	6	7
.01	5	6	7
.015	5	7	8
.022	5	7	8
.033	5	7	8
.047	5	7	8
.068	6	8	9

µF	352	360	PHE280
.1	6	8	9
.15	7	9	
.22	8	10	
.33	10		
.47	12		
.68	15		
1.0	19		
1.5	27		
2.2	32		

Trimmers

250V D.C. Wkg. Film Dielectric, Miniature — Order Code

1.4 — 4.1pF	19	Cap 808 A
2 — 8pF	19	Cap 808 B
2 — 20pF	21	Cap 808 C
5.5 — 59.5pF	29	Cap 808 D

500V D.C. Wkg. C004 EA Tubular Type — Order Code

.8 — 3.8pF	46	Cap 802 3
.8 — 6.8pF	48	Cap 802 6
1 — 13pF	61	Cap 802 12
1.7 — 19.7	62	Cap 802 18

CASES

Small Desk Console — Boss Industrial Mouldings

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

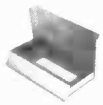
		Order Code
W161, D96, H39 (57)	186	Case BIM1005 OR
W215, D130, H47 (73)	268	Case BIM1006 OR

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	87	Case BIM2003 OR
L150 W80 D50	115	Case BIM2005 OR
L190 W110 D60	195	Case BIM2006 OR

Instrument Case — Boss Industrial Mouldings



Covers Manufactured from 14SWG Aluminium
Chassis Manufactured from 18SWG Mild Steel
Covers Finished Orange
Chassis Finished Matt Black

		Order Code
W250 D167.5 H 68.5 (Chassis 153mm Deep)	1480	Case BIM3000 OR

Plastic Boxes with Metal Lids — Boss Industrial Mouldings

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

		Order Code
L85 W56 D29	97	Case BIM4003 OR
L111 W71 D42	130	Case BIM4004 OR
L161 W96 D53	182	Case BIM4005 OR

Diecast Boxes — Boss Industrial Mouldings

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

		Order Code
L113 W63 D31	104	Case BIM5003 NA
L152 W82 D50	181	Case BIM5005 NA
L192 W113 D61	280	Case BIM5006 NA

VERO ELECTRONICS PRODUCTS

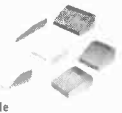
2.5" x 5" .1" pitch Veroboard	59	VERO 21069J
3.75" x 5" .1" pitch Veroboard	66	VERO 21072D
2.5" x 1" .1" pitch Veroboard (5)	70/Pack	VERO 21076C
3.75" x 5" .1" pitch Plain Board	56	VERO 21078E
5.82" x 2.9" .1" pitch V-Q DIP Board	111	VERO 21084E
Spot Face Cutter	89	VERO 21013A
Pin Insertion Tool for .040 type pin	122	VERO 21015F
DS Pins .040 (100)	38/Pack	VERO 21087G
SS Pins .040 (100)	38/Pack	VERO 21017B
6mm Board Standoff (100)	181/Pack	VERO 21321K
15mm Board Standoff (100)	215/Pack	VERO 21322G
19mm Board Standoff (100)	226/Pack	VERO 21323D
Verowire Kit (1-pen, 2 wire, 25-comb)	375/Kit	VERO 21341D
Verowire Combs (100)	407/Pack	VERO 21339F
Verowire Wire (4)	228/Pack	VERO 21340G
Flip Top Box, Small, Black	192	VERO 21317D
Flip Top Box, Large, Black	250	VERO 21319J

Small Desk Consoles — Boss Industrial Mouldings

Slope Front Console, Recessed Top
ABS Base, C/W Brass Bushes, In Orange
1mm Aluminium Top Panel Finished Grey
Ventilation Slots In Base

		Order Code
W105 D143 H32 (56)	206	Case BIM6005 OR
W170 D143 H32 (56)	271	Case BIM6006 OR
W170 D214 H32 (82)	375	Case BIM6007 OR

All Metal Desk Consoles — Boss Industrial Mouldings



Slope Front Console, Recessed Top
Two Piece All Aluminium Construction
Ventilation Slots In Rear and Base
Choice of 15° or 30° Sloping Front
Off White Top Panel, Blue Base

W102 D140 H28 (51)	15° slope	1018	Case BIM7151A
W165 D211 H33 (76)	15° slope	1350	Case BIM7154A
W254 D287 H33 (76)	15° slope	1572	Case BIM7156A
W356 D287 H33 (76)	15° slope	1823	Case BIM7158A
W102 D140 H28 (76)	30° slope	1018	Case BIM7301A
W165 D183 H28 (102)	30° slope	1202	Case BIM7303A
W254 D259 H28 (102)	30° slope	1572	Case BIM7306A
W356 D259 H28 (102)	30° slope	1823	Case BIM7308A

Eurocard Size Desk Console — Boss Industrial Mouldings

Slope Front Console
ABS Case, C/W Brass Bushes, In Orange
1mm Aluminium Top Panel, Finished Grey

		Order Code
W169 D127 H45 (70)	375	Case BIM8006 OR

HARDWARE

Order Code

D.I.L. Sockets

8 Pin Low Profile Socket Tin	11	DIL SKT 8
14 Pin Low Profile Socket Tin	13	DIL SKT 14
16 Pin Low Profile Socket Tin	14	DIL SKT 16
24 Pin Low Profile Socket Gold	66	DIL SKT 24
28 Pin Low Profile Socket Gold	78	DIL SKT 28
40 Pin Low Profile Socket Gold	127	DIL SKT 40

Heatsinks

Individual Type for 1 x T05 50°C/W	10	Sink 5F
Individual Type for 1 x T066 10.5°C/W	26	Sink TV2
Individual Type for 1 x T03 7.2°C/W	24	Sink TV3
Individual Type for 1 x T0126 17°C/W	23	Sink TV4
Individual Type for 1 x T0220 17°C/W	23	Sink TV5

P.C.B. Components

Data Pen, Blue Ink, Slow Drying	92	Pen 33PC

Fuseholders

Suit 20mm x 5mm fuses.

P.C.B. Mounting, Open Type	8	Fuse/H20B
Chassis Mounting, Open Type	17	Fuse/H20C
Panel Mounting, Screwdriver Slot	77	Fuse/H20PT
Panel Mounting, Finger Release	96	Fuse/H20P

Fuses

20mm x 5mm Glass.

Quick Blow, Range 100mA–5A	8	Fuse 20
Slow Blow, Range 250mA–5A	22	A/S Fuse 20

+ Rating

Lampholders, Panel Mounting

Similar In Style to Fuse/H 20P
Low Voltage Type Suits LES and M/F Bulbs.

Low Voltage, Red, Amber or Green	75	Lamp LV
Internal Neon 200/240V Red or Amber	95	Lamp N

+ Colour

Bulbs, Low Voltage, L.E.S.

6V, 0.36W; 6.5V, 1W; 14V, 0.75W.	22	Bulb LES

+ Voltage

RESISTORS

Carbon Film, Fixed

Order Code

0.25W, E24 Values (RD-10M, 5% Tol.	1.5 ea.	90p/100 (Mult 10/Value)	£7.90/1000 (Mult 100/Value)	Res RD¼
0.5W, E12 Values (RD-4M7, 10% Tol.	2 ea.	1.25p/100 (Mult 10/Value)	£10.10/1000 (Mult 100/Value)	Res RD½

+ Value

Metal Film, Fixed

0.5W, E24 Values, SRI-1M, 2% Tol.	6 ea.	3.80/100 (Mult 10/Value)	£32.40/1000 (Mult 100/Value)	Res MR30
2.5W, E12 Values 10R-27K, 5% Tol.	13 ea.	7.90/100 (Mult 10/Value)		Res PR52

+ Value

Metal Glaze, Fixed

0.5W, E24 Values, 1M-33M, 5% Tol.	10 ea.	5.40/100 (Mult 10/Value)	Res VR37

+ Value

Skeleton Presets, Miniature

Order Code

0.1W, E3 Values, 100R-1M, Lin. Vertical Mounting	7	Min Preset V
0.1W, E3 Values, 100R-1M, Lin. Horizontal Mounting	7	Min Preset H

+ Value

Skeleton Presets, Standard

0.3W, E3 Values, 100R-4M7, Lin. Vertical Mounting	10	Std Preset V
0.3W, E3 Values, 100R-4M7, Lin. Horizontal Mounting	10	Std Preset H

+ Value

Potentiometer, Rotary

0.5W, E3 Values, 1K-2M2 Lin.	34	Pot Lin
0.25W, E3 Values, 4K7-2M2 Log.	34	Pot Log

+ Value

DIGITAL INTEGRATED CIRCUITS

4000 Buffered C·MOS — High Speed

5–15V 'B' Series, Up to 20MHz

HEF4000	14	HEF4046	100	HEF4514	250	HEF4555	78
HEF4001	14	HEF4047	87	HEF4515	299	HEF4556	78
HEF4002	14	HEF4049	28	HEF4516	90	HEF4567	386
HEF4006	95	HEF4050	28	HEF4517	382	HEF4585	97
HEF4007	14	HEF4051	69	HEF4518	69	HEF4724	171
HEF4008	80	HEF4052	72	HEF4519	55	HEF40097	90
HEF4011	14	HEF4053	72	HEF4520	65	HEF40098	73
HEF4012	14	HEF4066	37	HEF4521	188	HEF40106	62
HEF4013	32	HEF4067	380	HEF4528	99	HEF40160	119
HEF4014	84	HEF4068	14	HEF4532	120	HEF40161	119
HEF4015	60	HEF4069	14	HEF4534	510	HEF40162	119
HEF4016	35	HEF4070	14	HEF4539	110	HEF40163	119
HEF4017	55	HEF4071	14	HEF4543	155	HEF40174	119
HEF4018	65	HEF4072	16	HEF4555	78	HEF40175	119
HEF4019	46	HEF4073	16	HEF4556	78	HEF40192	140
HEF4020	88	HEF4075	16	HEF4567	386	HEF40193	140
HEF4021	85	HEF4076	85	HEF4585	97	HEF40194	119
HEF4022	82	HEF4077	14	HEF4724	171	HEF40195	117
HEF4023	14	HEF4078	16	HEF40097	90		
HEF4024	45	HEF4081	16	HEF40098	73		
HEF4025	14	HEF4082	16	HEF40106	62		
HEF4027	32	HEF4085	64	HEF40160	119		
HEF4028	52	HEF4086	64	HEF40161	119		
HEF4029	60	HEF4093	50	HEF40162	119		
HEF4030	46	HEF4094	175	HEF40163	119		
HEF4031	200	HEF4104	166	HEF40174	119		
HEF4035	110	HEF4502	91	HEF40175	119		
HEF4040	68	HEF4505	571	HEF40192	140		
HEF4041	75	HEF4508	51	HEF40193	140		
HEF4042	54	HEF4510	70	HEF40194	119		
HEF4043	79	HEF4511	110	HEF40195	117		
HEF4044	84	HEF4512	98				

7400 T.T.L.

N7400N	9	N7444N	83	N74122N	39	N74192N	60
N7401N	11	N7445N	65	N74123N	37	N74194N	80
N7402N	11	N7446AN	62	N74125N	32	N74195N	79
N7403N	11	N7447AN	51	N74126N	32	N74198N	120
N7404N	12	N7448AN	44	N74128N	74	N74199N	139
N7405N	12	N7450N	13	N74132N	46	N74221N	160
N7406N	25	N7451N	13	N74145N	60	N74279N	116
N7407N	27	N7453N	15	N74147N	125	N74298N	200
N7408N	13	N7454N	13	N74148N	83	N74365N	150
N7409N	13	N7460N	13	N74150N	65	N74366N	150
N7410N	11	N7470N	26	N74151N	46	N74367N	120
N7411N	18	N7472N	22	N74153N	55	N74368N	150
N7412N	17	N7473N	23	N74154N	96		
N7413N	23	N7474N	23	N74155N	53	74LS	
N7414N	46	N7475N	28	N74156N	48	N74LS00N	15
N7416N	22	N7476N	26	N74157N	49	N74LS01N	16
N7417N	23	N7480N	43	N74158N	54	N74LS02N	16
N7420N	11	N7483N	63	N74160N	74	N74LS03N	16
N7421N	26	N7485N	65	N74161N	74	N74LS04N	16
N7425N	27	N7486N	23	N74162N	74	N74LS05N	23
N7426N	22	N7490N	30	N74163N	74	N74LS08N	16
N7427N	22	N7491AN	60	N74164N	65	N74LS09N	22
N7428N	30	N7492N	33	N74165N	65	N74LS10N	16
N7430N	11	N7493N	31	N74466N	93	N74LS11N	22
N7432N	21	N7494N	74	N74170N	134	N74LS12N	23
N7433N	30	N7495AN	48	N74173N	111	N74LS13N	38
N7437N	21	N7496N	46	N74174N	63	N74LS14N	74
N7438N	21	N74100N	88	N74175N	62	N74LS15N	24
N7439N	60	N74107N	25	N74180N	80	N74LS20N	16
N7440N	12	N74109N	42	N74181N	165	N74LS21N	22
N7442N	40	N74116N	148	N74182N	69	N74LS22N	24
N7443N	79	N74121N	23	N74192N	65		

N74LS28N	32	N74LS138N	85	N74LS253N	105		
N74LS30N	16	N74LS139N	85	N74LS257N	104		
N74LS32N	24	N74LS153N	76	N74LS258N	107		
N74LS33N	32	N74LS154N	122	N74LS260N	26		
N74LS37N	24	N74LS155N	80	N74LS261N	300		
N74LS38N	24	N74LS156N	80	N74LS266N	40		
N74LS40N	22	N74LS157N	54	N74LS273N	130		
N74LS42N	53	N74LS158N	60	N74LS283N	116		
N74LS51N	22	N74LS160N	120	N74LS290N	90		
N74LS54N	16	N74LS161N	78	N74LS293N	100		
N74LS55N	22	N74LS162N	130	N74LS298N	100		
N74LS73N	29	N74LS163N	78	N74LS324N	170		
N74LS75N	40	N74LS164N	90	N74LS365N	105		
N74LS76N	33	N74LS170N	200	N74LS366N	105		
N74LS78N	33	N74LS173N	100	N74LS367N	105		
N74LS83AN	97	N74LS174N	100	N74LS368N	105		
N74LS85N	70	N74LS175N	100	N74LS373N	150		
N74LS86N	33	N74LS181N	320	N74LS374N	150		
N74LS90N	45	N74LS190N	91	N74LS375N	100		
N74LS92N	70	N74LS191N	95	N74LS378N	160		
N74LS93N	45	N74LS192N	128	N74LS386N	35		
N74LS95BN	65	N74LS193N	130	N74LS390N	170		
N74LS96N	116	N74LS194N	150	N74LS393N	170		
N74LS107N	38	N74LS195AN	120	N74LS395N	180		
N74LS109N	38	N74LS196N	80	N74LS490N	130		
N74LS112N	40	N74LS197N	110	N74LS670N	170		
N74LS113N	38	N74LS240N	160				
N74LS114N	38	N74LS241N	160				
N74LS125N	40	N74LS242N	160				
N74LS126N	40	N74LS243N	160				
N74LS132N	60	N74LS244N	160				
N74LS136N	37	N74LS251N	90				

LINEAR INTEGRATED CIRCUITS

CA3011	92	NE592K	162
CA3018	75	RC4136	130
CA3020	191	TBA120S	79
CA3028A	86	TCA580	346
CA3046	76	TCA730	450
CA3048	245	TCA740	450
CA3080E	70	TDA1008	326
CA3089E	253	TDA1022	648
CA3130E	90	TDA1028	338
CA3140E	38	TDA1029	338
CA3189E	266	TDA1034B	217
LM301AN	30	TDA2581	266
LM308N	95	TDA2640	292
LM318N	200	TL081CP	75
LM319N	216	TL084CN	140
LM324N	70	UA709CT	46
LM339N	71	UA709CN	40
LM381N	110	UA710CN	41
LM381AN	180	UA711CN	65
LM382	120	UA741CT	42
		UA741CN	18
		UA747CN	50
		UA748CN	35
MC1458N	35		
MC1496N	97	Voltage Regulators	
NE531	119	LM309DA (K)	108
NE536T	216	UA723CN	38
NE540	225	UA7805CU	65
NE555N	25	UA7812CU	65
NE556N	60	UA7815CU	65
NE560N	351	UA7905CU	86
NE561N	427	UA7912CU	86
NE562N	461	UA7915CU	86
NE565N	120	UA78L05CS	32
NE566N	155	UA78L06CS	32
NE567N	170	UA78L12CS	32
NE570N	405	UA78L15CS	32
NE571N	459		

OPTO ELECTRONICS

		Order Code
Light Emitting Diodes, Individual		
.125" (3mm) Red	14	CQY54
Green	17	CQY95
Yellow	19	CQY97
Panel Mounting Clip to suit.	3	LED3 Clip
.2" (5mm) Red	15	CQY24A
Green	17	CQY94
Yellow	19	CQY96
Panel Mounting Clip to suit.	5	LED5 Clip
Light Emitting Diodes — 7 Segment Display		
.3" (7.6mm) C. Anode R.H. Decimal Pt. Red	160	XAN3061
C. Anode R.H. Decimal Pt. Green	199	XAN3051
C. Cathode R.H. Decimal Pt. Red, Low current drain	160	XAN3074
.6" (15.2mm) C. Anode L.H. Decimal Pt. Red	230	XAN6620
C. Anode L.H. Decimal Pt. Green	230	XAN6520
C. Cathode L.H. Decimal Pt. Red	230	XAN6640
Photoresistors		
ORP12	90	ORP12
ORP61	90	ORP61
Phototransistors		
OCP71	180	OCP71
BPX25	175	BPX25
BPX29	175	BPX29
Photocoupler		
FCD820	150	FCD820

SWITCHES

				Order Code
Miniature Toggle — Honeywell				
SPDT		2A/250V A.C., 5A/28V D.C.	58	SW 8A1011
SPDT	C/Off		67	SW 8A1021
SPDT	Double Bias To Centre		75	SW 8A1041
SPDT	Single Bias To Centre		75	SW 8A1051
SPDT	Bias		70	SW 8A1061
DPDT			86	SW 8A2011
DPDT	C/Off		92	SW 8A2021
DPDT	Double Bias To Centre		102	SW 8A2041
DPDT	Single Bias To Centre		102	SW 8A2051
DPDT	Bias		96	SW 8A2061
Miniature Push — C & K				
SP	Push To Make, Momentary	0.5A/250V A.C., 1A/28V D.C.	54	SW 8531
SP	Push To Break, Momentary		54	SW 8533
Slide — Switchcraft				
DPDT	Standard Actuator		36	SW 46206
DPDT	Slot Actuator, Voltage Change, Marked 110/240		43	SW 46206F

SEMICONDUCTORS

Diodes

IN827	193	IN4006	7	BB110G	61	OA202	9
IN914	4	IN4007	8	BY127	15		
IN916	5	IN4148	3	BY206	34		
IN4001	4	IN5402	15	BYX10	19	**Microwave**	
IN4002	4	IN5404	16	OA47	10		
IN4003	6	BAX13	5	OA90	7	BAW95D	1091
IN4004	6	BAY38	27	OA91	7	CL8960	2592
IN4005	7	BB106(4)	122	OA200	9	CXY11C	1280

Zener Diodes

400mW C4V7-C33 — 1.3W C7V5-C75

BZY88/BZX79 + Voltage — 8 — BZX61 + Voltage — 16

Transistors

2N929	37	2N4427	206	8C478	24	BSXB8	18
2N1893	30	2N4856	158	BC547	12	MJE340	48
2N2218A	28	2N4858	134	BC548	10	MPF102	32
2N2222	21	2N4860	122	BC548B	15	OC28	107
2N2369	19	2N5294	43	BC549	12	OC35	95
2N2369A	20	2N5416	108	BC549B	20	OC45	82
2N2646	42	2N5457	35	BC557	14	OCP71	180
2N2894	49	2N5458	30	BC558	14	TIP29A	41
2N2895	28	2N5459	32	BC559	17	TIP29C	53
2N2904	24	2N6258	432	BCY34	97	TIP30A	44
2N2904A	24	40673	80	BCY70	14	TIP30C	57
2N2905	22	AC188	22	BCY71	14	TIP31A	43
2N2905A	24	AD161	38	BCY72	15	TIP31C	58
2N2906	19	AD162	38	BD131	35	TIP32A	48
2N2907	22	BC107	10	BD132	35	TIP32C	63
2N2907A	25	BC107B	14	BD135	38	TIP41A	59
2N2918	330	BC108	10	BD136	37	TIP41C	69
2N2926G	11	BC108B	14	BD137	38	TIP42A	59
2N3053	17	BC108C	16	BD138	39	TIP42C	69
2N3054	50	BC109	10	BD139	35	TIP2955	68
		BC109B	17	BD140	35	TIP3055	54
2N3055	50	BC109C	18	BF115	28	TIS43	32
2N3055 Full ISB Test	88	BC147	7	BF180	37	ZTX109C	14
2N3340	30	BC148	9	BF181	37		
2N3442	141	BC149	8	BF257	35		
2N3702	8	BC157	10	BF258	32		
2N3703	11	BC158	9	BF259	36		
2N3704	8	BC159	11	BFR90	303		
2N3705	9	BC177	15	BFS21	428		
2N3706	9	BC178	15	BFX13	23		
2N3707	9	BC179	18	BFX84	26		
2N3708	9	BC182	10	BFX85	26		
2N3709	11	BC182L	11	BFX86	30		
2N3773	270	BC183	10	BFX87	22		
2N3819	20	BC183L	11	BFX88	26		
2N3820	39	BC184	10	BFY50	15		
2N3866	97	BC184L	11	BFY51	15		
2N3903	20	BC212	10	BFY52	18		
2N3904	8	BC212L	11	BFY90	97		
2N3905	12	BC213	10	BLX65	238		
2N3906	12	BC213L	11	BLY35	1889		
2N3962	95	BC214	10	BLY93A	2706		
2N4347	227	BC214L	11	BPX25	175		
2N4401	20	BC327	17	BPX29	175		
2N4403	20	BC328	15	BRY39	45		
2N4416	86	BC337	16	BSW69	33		
		BC338	14	BSX20	19		

SEMICONDUCTORS

Rectifier Bridges

		Order Code
1A 400V S.I.L.	93	BY179
1.4A 60V S.I.L.	84	BY164
1.5A 100V D.I.L.	33	VM18
1.5A 400V D.I.L.	35	VM48
1.5A 100V	45	W01
1.5A 400V	52	W04
2A 100V	89	VS148
2A 400V	109	VS448
6A 100V	143	VH148
6A 400V	183	VH448
10A 100V	172	VJ148
10A 400V	201	VJ448
15A 100V	215	VL148
15A 400V	226	VL448
30A 100V	242	VK148
30A 400V	260	VK448
S.C.R.'s		
4A 400V	54	C106D
12A 400V	108	TIC126D
Triacs		
10A 500V	124	BT138-500
15A 500V	177	BT139-500
23A 500V	492	BTW41-500

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

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

0-4.5V, 0-4.5V Secondaries	220	Trans 6VA	45
0-5V, 0-6V			60
0-12V, 0-12V			120
0-15V, 0-15V			150
0-20V, 0-20V			200

20VA — Clamp Type Construction

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

0-4.5V, 0-4.5V Secondaries	335	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

55VA — Clamp Type Construction

Approx. 10% Regulation F.C. 92, H64, W57

0-6V, 0-6V Secondaries	540	Trans 55VA	60
0-12V, 0-12V			120
0-15V, 0-15V			150
0-20V, 0-20V			200
0-30V, 0-30V			300

100VA — Frame Type Construction

Approx. 6% Regulation H87, W74, D64

0-25V, 0-25V Secondaries	825	Trans 100VA	250
0-40V, 0-40V			400

COMMUNICATIONS INTEGRATED CIRCUITS — PLESSEY

SL360C	242	SL641C	384								
SL362C	302	SL650C	865								
SL610	230	SL651C	786								
SL611C	230	SL652C	329								
SL612C	230	SL680C	230								
SL613C	394	SL701C	220								
SL620C	347										
SL621C	347	SL1610C	166	SL1623C	251	SL1680C	170	SP8629	446	SP8690	907
SL622C	854	SL1611C	166	SL1625C	225	SL6600C	890	SP8630B	1361	SP8760B	680
SL623C	629	SL1612C	166	SL1626C	251	SL6640C	401	SP8655B	1058	SP8790B	454
SL624C	321	SL1613C	193	SL1630C	166	SL6650C	378	SP8657B	1058	SP8794B	454
SL630C	218	SL1620C	225	SL1640C	193			SP8659B	907		
SL640C	384	SL1621C	225	SL1641C	193			SP8660B	907		

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POLYESTER CAPACITORS: Axial lead type. (Values are in μF).
400V: 0·001, 0·0015, 0·0022, 0·0033, 0·0047, 0·0068, 0·01, 0·015, **9p**; 0·018 **10p**; 0·022, 0·033, **11p**; 0·047, 0·068 **14p**; 0·1, **17p**; 0·15, 0·22, **24p**; 0·33, 0·47 **42p**; 0·68 **53p**, 1μF, **175p**.
160V: 0·039, 0·15, 0·22 **11p**; 0·33, 0·47 **19p**; 0·68, 1·0 **22p**; 1·5 **29p**; 2·2 **32p**, 4·7 **48p**.
DUBILIER: 1000V: 0·01, 0·015 **20p**; 0·022 **22p**; 0·047 **26p**; 0·1 **38p**; 0·47 **48p**.

POLYESTER RADIAL LEAD (Values in μF). **250V:** 0·01, 0·015, 0·022, 0·027 **5p**; 0·033, 0·047, 0·068, 0·1 **7p**; 0·15 **11p**; 0·22, 0·33 **13p**; 0·47 **17p**; 0·68 **19p**; 1·0 **22p**; 1·5 **30p**; 2·2 **34p**.

FEED THROUGH CAPACITORS 1000pF/350V **8p**.

ELECTROLYTIC CAPACITORS: Axial lead type (Values are in μF). **500V:** 1 **40p**; 4·7 **68p**; **250V:** 100 **65p**; **63V:** 0·47, 1·0, 1·5, 2·2, 3·3, 4·7, 6·8, 8, 10, 15, 22, **8p**; 47, 32, **11p**; 63, 100, **27p**; **50V:** 50, 100, 220, **25p**; 470, **32p** 1000, **50p**; **40V:** 22, 33, **8p**; 100, **12p**; 2200, 3300, **68p**; 4700, **85p**; **35V:** 10, 33, **7p**; 330, 470, **32p**; 1000, **50p**; **25V:** 10, 22, 47, **6p**; 80, 100, 160, **8p**; 220, 250, **13p**; 470, 640, **25p**; 1000, **27p**; 1500, **30p**; 2200, **45p**; 3300, **62p**; 4700 **74p**; **16V:** 10, 47, 68, **7p**; 100, 125, **8p**; 220, 330, **14p**; 470, **16p**; 1000, 1500, **20p**; 2200, **34p**; **10V:** 100, **6p**; 640, **12p**; 1000, **14p**.
TAG-END TYPE: 70V: 4700, **135p**; **64V:** 2200, **89p**, 3300 **99p**, **50V:** 10,000, **255p**; **40V:** 2500, **65p**; 3300, 4700, **70p**; 15,000 **299p**. **25V:** 4700 **74p**; 2000 **48p**; **40V:** 2000+2000 **95p**.

TANTALUM BEAD CAPACITORS
35V: 0·1μF, 0·22, 0·33, 0·47, 0·68, 1·0, 2·2μF, 3·3, 4·7, 6·8. **25V:** 1·5, 10. **20V:** 1·5. **16V:** 10μF **13p** each.
16V: 15, 22 **25p**. 47, 100, 220 **40p**.
10V: 15, 22, 33, **20p**; 100 **35p**.
6V: 47, 68, 100 **30p**; **3V:** 100 **20p**.

MYLAR FILM CAPACITORS
100V: 0·001, 0·002, 0·005, 0·01μF **6p**
0·015, 0·02, 0·04, 0·05, 0·056μF **7p**
0·1μF, **9p**. 0·2 **11p**, **50V:** 0·47μF **12p**

CERAMIC CAPACITORS 50V
Range: 0·5pF to 10,000pF **3p**
0·015μF, 0·022μF, 0·033μF **4p**
0·047μF **4p**; 0·1μF **6p**, 0·2μF **7p**

SILVER MICA (Values in pF) 3·3, 4·7, 6·8, 10, 12, 18, 22, 33, 47, 50, 68, 75, 82, 85, 100, 120, 150, 220 **9p** each
250, 270, 300, 330, 360, 390, 470, 600, 800, 820 **16p** each
1000, 1200, 1800, 2000 **20p** each

POLYSTYRENE CAPACITORS:
10pF to 1nF **8p**; 1·5nF to 47nF **10p**

MINIATURE TYPE TRIMMERS
2·5-6pF; 3-10pF; 10-40pF **22p**
5-25pF; 5-45pF; 60pF; 88pF; **30p**

COMPRESSION TRIMMERS
3-40pF 10-80pF 25-190pF **30p**
100-500pf **45p**

GAS & SMOKE DETECTORS
TGS 812 & 813 **415p**; Socket **25p**

POTENTIOMETERS: Rotary type
Carbon Track ¼W Log & ½W Lin. 470Ω, 680Ω, 1KΩ & 2KΩ (Lin only) Single, Gang **27p**
5KΩ-2MΩ Single Gang Log & Lin **27p**
5KΩ-2MΩ Single Gang D/P Switch **65p**
5KΩ-2MΩ Double Gang **78p**

SLIDER POTENTIOMETERS
0·25W log and linear values 60mm
5KΩ-500KΩ single gang **70p**
10KΩ-500KΩ dual gang **80p**
Self Stick Graduated Bezels **25p**

PRESET POTENTIOMETERS
0·1W 500Ω—5MΩ Miniature Vertical & Horizontal **8p**
0·25W 100Ω—3·3MΩ horiz. larger **10p**
0·25W 200Ω—4·7MΩ Vert. **10p**

RESISTORS — Erie make 5% Carbon Miniature High Stability Low noise

RANGE	VAL	1-99	100+
¼W 2·2Ω-4·7M	E24	2p	1p
½W 2·2Ω-4·7M	E12	2p	2p
1W 2·2Ω-10M	E12	5p	4p
2% Metal Film 10Ω-1MΩ		6p	4p
1% 0·5W 51Ω-1M	E24	10p	8p

100+ price applies to Resistors of each type not mixed values

THERMISTORS: VA1034, 1039, 1040, 1055, 1056, 1058, 1066, 1067, 1098, 1100 **20p** each.

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IL74	48p
TIL111/2	85p
TIL114	95p
TIL117	110p

TRANSISTORS

	p		p		p		p		p
AC125	20	BC212	9	BFX88	28	TIP34C	110	2N2222A	20
AC126	20	BC212L	10	BFY50	20	TIP35A	185	2N2303	45
AC127	20	BC213	9	BFY51	20	TIP35C	220	2N2368	21
AC128	20	BC213L	11	BFY52	20	TIP36A	220	2N2369A	15
AC141	38	BC214	9	BFY64	40	TIP36C	255	2N2483	28
AC142	24	BC214L	10	BFY71	20	TIP41A	63	2N2484	30
AC176	24	BC307B	20	BRY39	39	TIP41B	73	2N2646	48
ACY17	40	BC327	15	BSX20	18	TIP42A	64	2N2784	55
ACY18	40	BC328	15	BSX26	75	TIP42B	82	2N2904	22
ACY19	40	BC338	12	BSY95A	18	TIP2955	65	2N2905A	22
ACY20	40	BC441	36	BU105	140	TIP3055	60	2N2906	22
ACY21	40	BC461	36	BU205	190	TIS44	45	2N2907	22
ACY22	40	BC477	25	BU208	228	TIS45	45	2N2907A	22
ACY28	40	BC517	38	E5567	65	TIS46	45	2N2926G	10
ACY39	78	BC547	12	MD8001	158	TIS90	20	2N3011	24
ACY41	39	BC548	12	MJ491	160	TIS91	24	2N3053	20
ACY44	39	BC549C	13	MJ2955	105	ZTX107	12	2N3054	55
AD149	70	BC557	15	MJE340	54	ZTX108	12	2N3055	48
AD161	42	BC558	20	MJE370	58	ZTX109	14	2N3108	32
AD162	42	BC559	20	MJE371	60	ZTX300	13	2N3442	140
AF114	50	BCY70	15	MJE2955	99	ZTX301	16	2N3663	26
AF115	50	BCY71	20	MJE3055	70	ZTX302	20	2N3702	11
AF116	50	BCY72	20	MPF102	25	ZTX303	25	2N3703	11
AF117	50	BD131	45	MPF103	36	ZTX304	24	2N3704	11
AF118	55	BD132	45	MPF104	36	ZTX314	24	2N3705	11
AF139	35	BD133	43	MPF105	36	ZTX326	40	2N3706	11
AF178	70	BD135	38	MPF106	40	ZTX341	20	2N3707	11
AF186	50	BD136	40	MPSA05	25	ZTX500	15	2N3708	11
AF239	42	BD137	40	MPSA06	25	ZTX501	15	2N3709	11
ASZ21	60	BD138	50	MPSA12	42	ZTX502	19	2N3710	16
BC107	10	BD139	40	MPSA55	25	ZTX503	15	2N3711	12
BC107B	10	BD140	36	MPSA56	25	ZTX504	25	2N3771	275
BC108	10	BD144	198	MPSU06	56	ZTX531	25	2N3772	195
BC108B	10	BD145	198	MPSU56	60	ZTX550	25	2N3773	288
BC108C	12	BD205	110	OC26	170	40311	60	2N3819	22
BC109	10	BD378	65	OC28	150	40313	125	2N3820	45
BC109B	12	BD434	42	OC35	130	40315	55	2N3823	95
BC109C	12	BD517	65	OC36	130	40316	85	2N3866	90
BC117	20	BD695A	65	OC41	48	40326	52	2N3903	20
BC119	28	BD696A	65	OC42	48	40327	62	2N3904	18
BC140	35	BF115	34	OC43	55	40347	80	2N3905	18
BC142	30	BF167	30	OC44	31	40348	105	2N3906	17
BC143	30	BF180	35	OC45	28	40360	43	2N4037	52
BC147	8	BF194	12	OC70	28	40361	45	2N4058	17
BC147B	10	BF195	12	OC71	28	40362	48	2N4061	17
BC148	8	BF196	12	OC72	45	40408	70	2N4062	17
BC148B	10	BF197	14	OC74	55	40594	90	2N5172	25
BC148C	10	BF198	18	OC75	45	40595	98	2N5179	60
BC149	8	BF199	18	OC76	36	40603	65	2N5191	70
BC149C	10	BF200	32	OC77	76	40673	68	2N5305	40
BC153	27	BF224A	18	OC81D	50	2N697	25	2N5457	32
BC154	27	BF244B	30	OC82D	50	2N698	44	2N5458	32
BC157	10	BF256	60	OC83	48	2N699	54	2N5459	32
BC158	11	BF257	30	OC84	44	2N706A	19	2N5485	35
BC159	11	BF258	30	OC140	110	2N708	19	2N5777	45
BC160	42	BF259	30	OC170	85	2N918	40	2N6027	40
BC167A	11	BF3361	35	OC171	75	2N930	18	2N6109	50
BC168C	12	BF594	40	OC200	85	2N1131	22	2SD234	50
BC169C	14	BF595	38	TIP29	43	2N1132	22	3N128	112
BC170	18	BFR39	25	TIP29B	56	2N1303	50	3N140	112
BC172	11	BFR40	25	TIP29C	60	2N1304	50		
BC177	18	BFR41	28	TIP30	47	2N1305	28	**Matched Pair**	
BC178	17	BFR79	28	TIP30B	64	2N1613	23	**20p ea**	
BC179	18	BFR80	28	TIP30C	65	2N1670	150		
BC182	9	BFR81	28	TIP31A	52	2N1671B	215		
BC183	9	BFR98	105	TIP31C	66	2N2160	350		
BC184	9	BFX81	45	TIP32A	58	2N2217	43		
BC182L	10	BFX84	26	TIP32C	75	2N2218A	34		
BC183L	10	BFX85	28	TIP33C	105	2N2219A	22		
BC184L	10	BFX86	28	TIP34	85	2N2220A	26		
BC187	28	BFX87	28	TIP34A	85	2N2221A	23		

JACKSONS VARIABLE CAPACITORS

Dielectric 100-300pF	140p	0·2-365pF with slow motion Drive	325p
500pF	165p	00·208/176	285p
6·1 Ball Drive		with slow	
4511/DAF	115p	motion drive	325p
Dial Drive 4103		C804-5pF 10·15,	
6·1 36·1	650p	25·50pF	175p
Drum 54mm	30p	100·150pF	235p
0·1-365pF	245p	L 3×310pF	495p
00·2-365pF	275p	00·3×25pF	430p

RF CHOKES

1μH, 4·7, 10, 22, 33, 47, 100, 200, 470
750, 1mH, 2·5, 5, 10 **35p each**
43mH, 100 **60p each**

VEROBOARD

	0·1 (copper clad)	0·15 (plain)	0·15
2½ × 3¾"	48p	39p	24p
2½ × 5"	55p	50p	31p
3¾ × 3¾"	55p	50p	—
3¾ × 5"	62p	67p	43p
2½ × 17"	169p	135p	92p
3¾ × 17"	218p	180p	120p
4¾ × 17"	280p	—	183p
Pkt of 35 pins			22p
Spot face cutter			99p
Pin insertion tool			120p
DIP BOARD (0·166F)			268p
VQ Board			90p
Vero Group Board 1			60p
S Board			1285p

VERO WIRING PEN

Plus Spool **325p**
Spare spool (wire) **80p** Combs **7p** each

FERRIC CHLORIDE

1lb bag Anhydrous **70p** + 35p P&P

DALO ETCH RESIST PEN + spare tip **75p**

COPPER CLAD BOARDS

Fibre Glass	Single-sided	Double-sided	SRBP
6" x 6"	75p	90p	80p
6" x 12"	130p	175p	

SOLDERCON PINS
100 **50p**; 500 **200p**

OIL SOCKETS (TEXAS) Low Wire profile Wrap

8	pin	10p	25p
14	pin	12p	35p
16	pin	13p	46p
18	pin	16p	52p
20	pin	22p	65p
22	pin	25p	70p
24	pin	36p	78p
28	pin	39p	85p
36	pin		105p
40	pin	50p	109p

EDGE CONNECTORS:

Double type	1	15
2×10 way	—	85p
2×15 way	—	99p
2×18 way	115p	120p
2×22 way	130p	135p
2×25 way	149p	160p
2×30 way	170p	—
2×36 way	194p	—
2×40 way	210	—
2×43 way	232p	—

DIODES

	p
AA119	18
AAZ15	15
BY100	24
BY126	12
BY127	12
CR033	148
OA9	75
OA47	12
OA70	12
OA79	15
OA81	15
OA85	14
OA90	7
OA91	7
OA95	8
OA200	9
OA202	8
IN914	4
IN916	5
IN4001/2	5
IN4003	6
IN4004/5	6
IN4006/7	7
IN4148	4
IS44	20
3A/100V	15
3A/400V	20
3A/600V	27
3A/1000V	130

BRIDGE RECTIFIERS

(plastic case)	p
1A/50V	20
1A/100V	22
1A/200V	25
1A/400V	29
1A/600V	34
2A/50V	35
2A/100V	44
2A/200V	48
2A/400V	53
2A/600V	65
4A/100V	72
4A/200V	75
4A/400V	79
4A/600V	105
4A/800V	120
6A/100V	73
6A/200V	78
6A/400V	85
BY164	56
VM18 DIL	40

ZENERS

Range 2V7 to 39V 400mW **8p each**
Range 3V3 to 33V 1·3W **15p each**

NOISE

Z5J **180**

VARICAPS

MVAM115	140
BA1D2	25
BB104	40
BB105B	40
BB106	40

TRIACS

3A200V	49
3A400V	50
8A100V	54
8A400V	64
8A800V	108
12A100V	60
12A400V	70
12A800V	115
16A100V	240
16A400V	105
16A500V	120
25A500V	235
25A800V	295
T2800D	120

SCRs Thyristors

0·6A200V	30
0·8A100V	30
0·8A200V	35
1A100V	42
1A600V	70
5A100V	32
5A400V	39
8A300V	48
8A500V	58
8A600V	85
12A300V	59
12A500V	92
12A800V	120
8T106	150
8T116	150
C106D	38
TIC44	22
TIC45	25
2N4444	140
2N5064	35

DIAC

ST2	20

LINEAR ICs

702	75
709 14 pin	38
709C 8 pin	35
710	67
723 14 pin	38
733	99
741 8 pin	18
741 TO5	35
747C 14 pin	70
748C 8 pin	36
753 8 pin	150
810	159
AY-1-0212	680
AY-1-1313A	660
AY-1-1320	315
AY-1-5050	190
AY-1-5051	145
AY-1-6721/6	195
AY-3-1270	840
AY-3-8500	390
AY-5-1224A	260
AY-5-1230	450
AY-5-1315	560
AY-5-1317A	630
AY-5-2376	980
AY-5-3500	510
AY-5-3507	415
AY-5-3600	1090
AY-5-4007D	650
AY-5-8100	735
CA3011	100
CA3012	150
CA3014	137
CA3018	68
CA3020	170
CA3023	170
CA3028A	80
CA3035	240
CA3036	110
CA3043	190
CA3045	140
CA3046	71
CA3048	210
CA3075	175
CA3080E	70
CA3081	190
CA3085	95
CA3089E	210
CA3090AQ	398
CA3123E	200
CA3130	90
CA3140	70
F9440C	60
ICL7106	795
ICL7107	975
ICL8038CC	335
ICM7205	1150
ICM7215	1050
ICM7216B	1950
ICM7217A	790
ICM7555	89
LD130	452
LF356	98
LM10	450
LM301AP	30
LM308T	110
LM311	98
LM318H	205
LM318S	195
LM324A	68
LM339	70
LM348	90
LM349	125
LM373	290
LM379	375
LM380	80
LM381N	145
LM382	125
LM1458	50
LM3900	60
LM3909N	70
LM3911	125
LM3914	220
LM13600	125
M252AA	750
M253AA	795
MC663	275
MC1204	000
MC1301	79
MC1303	88
MC1304P	260
MC1310P	175
MC1312PQ	195
MC1488	85
MC1489	90
MC14433L	1250
MC1495	350
MC1496L	92
MC1596	000
MC3302	000
MC3340P	120
MC3360P	120
MC3401	52
MC3403	135
MEM780	205
MFC6040	97
MK50253	650
MK50362	650
MK50398	635
MM5303	635
MM5307	1275
MM57160	620
NE515	80
NE518	210
NE543K	210
NE544	185
NE555	22
NE556DD	60
NE560	325
NE561	395
NE562B	410
NE564	425
NE565A	120
NE566	160
NE567V	170
NE571	420
RC4136D	120
SAD1024A	1350
SAS560	195
SAS570	195
SG3402	295
SN76003N	170
SN76013	140
SN76013N0	130
SN76018	148
SN76023	140
SN76023N0	130
SN76033N	175
SN76115N	215
SN76131	110
SN76227N	115
SN76477	225
SN76660	90
TAA550	50
TAA960	320
TAA621AX1	228
TAA661A	155
TAA700	353
TAD100	159
TBA120S	70
TBA540Q	220
TBA550Q	330
TBA641-A12 BX or BX111	250
TBA651	180
TBA800	90
TBA810	95
TBA820	70
TBA920Q	260
TBA990Q	270
TCA270Q	220
TCA965	120
TDA1008	310
TDA1022	575
TDA1024	105
TDA2020	320
TL061CP	76
TL062CP	125
TL064CN	199
TL072CP	125
TL074CN	199
TL081CP	52
TL082CP	96
TL083CP	105
TL084CN	130
UAA170	198
UAA180	198
ZN414	90
ZN424E	130
ZN425E	415
ZN1034E	200

TTL 74 (TEXAS)

7400	11	7490	30	74182	35	27	28	173	105
7401	11	74S1	50	74184	135	28	48	174	106
7402	11	7492	30	74185	80	30	22	175	110
7403	12	7493	26	74188	275	32	27	181	398
7404	12	7494	48	74190	45	33	39	183	298
7405	13	7495	48	74191	45	37	39	190	140
7406	23	7496	45	74192	45	38	39	191	140
7407	30	7497	15	74193	45	40	28	193	130
7408	13	74100	85	74194	40	42	98	194	166
7409	14	74104	62	74195	40	47	63	195	136
7410	14	74105	62	74196	45	48	120	196	100
7411	14	74107	20	74197	45	49	120	197	140
7412	17	74109	30	74198	80	51	24	221	96
7413	21	74110	54	74199	000	54	28	240	236
7414	30	74111	60	74220	120	55	30	241	232
7416	26	74116	150	74221	132	63	150	242	232
7417	26	74118	70	74246	204	73	48	243	232
7420	14	74119	10	74247	204	74	41	244	155
7421	29	74120	79	74248	240	75	48	245	270
7422	19	74121	25	74249	204	76	40	247	190
7423	17	74122	31	74251	125	78	40	248	190
7425	16	74123	35	74265	63	83	115	249	190
7426	25	74125	33	74273	320	85	118	251	134
7427	18	74126	31	74278	220	86	43	253	142
7428	35	74128	60	74279	119	90	38	257	110
7430	15	74132	42	74283	173	91	104	258	110
7432	15	74136	60	74284	385	92	89	259	160
7433	40	74141	42	74285	395	93	89	261	450
7437	17	74142	169	74290	125	95	116	266	52
7438	17	74143	250	74293	150	96	116	273	244
7440	13	74144	250	74298	185	107	44	275	250
7441	65	74145	52	74365	128	109	55	279	66
7442	36	74147	110	74366	118	112	55	283	192
7443	80	74148	80	74367	115	113	50	290	128
7444	80	74150	50	74368	124	114	50	293	128
7445	80	74151	39	74390	184	122	70	295	185
7446	85	74153	50	74393	184	123	70	298	168
7447	43	74154	60	74490	198	124	180	324	240
7448	45	74155	45	75150	120	125	60	325	290
7450	16	74156	45	75450	84	126	60	326	294
7451	16	74157	36	75491	89	132	95	327	286
7453	16	74159	160	75492	94	136	55	347	148
7454	16	74160	55			138	85	348	186
7460	16	74161	55			139	85	352	228
7470	23	74162	55			145	108	353	228
7472	23	74163	55			147	170	365	65
7473	19	74164	60			148	173	366	65
7474	20	74165	60			151	96	367	65
7475	25	74166	75			153	76	368	66
7476	22	74167	150			155	96	373	180
7480	40	74170	95			156	96	374	180
7481	70	74172	350			157	76	375	160
7482	49	74173	65			158	95	377	212
7483	49	74174	50			160	128	378	184
7484	80	74175	55			161	98	379	215
7485	70	74176	50			162	138	384	86
7486	16	74177	45			163	102	390	230
7489	130	74178	60			164	114	393	230
		74179	000			165	75	395	218
		74180	50			166	226	396	215
		74181	118			170	288	398	276

74LS

00	11		
01	11		
02	13		
03	13		
04	14		
05	23		
08	22		
09	22		
10	20		
11	22		
12	23		
13	38		
14	75		
15	30		
20	20		
21	22		
26	48		

news digest.....

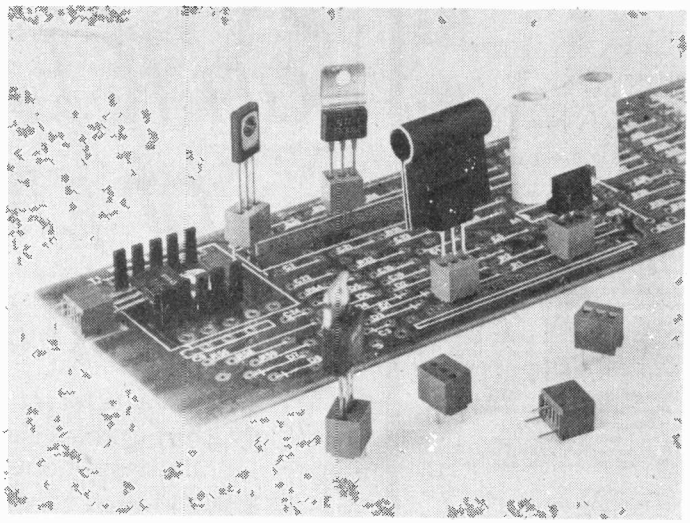
SOCKET TO ME

To simplify fault finding and component replacement for the commercial market, Winslow Component Systems have designed a transistor socket for TO220 and TO 202 power transistors.

Available in two versions, the W3416 has staggered contacts to stop it falling over during flow soldering, and the W3416S has in-line contacts.

The body of the socket is moulded in glass-reinforced polyester and the phosphor bronze contacts are available in both gold plated and bright acid tinned finishes.

For further information contact Winslow Component Systems Ltd, Southern House, Edenbridge, Kent.



CB SPECIAL

Price change — CB Special, from the publishers of Hobby Electronics, will cost 75 pence plus 25 pence postage. Just send a PO/ cheque for £1.00 to CB Special, 145 Charing Cross Road, London WC2H 0EE.

CASE STUDY

Having problems boxing your goodies? You might find what you want in the new releases from Vero and West Hyde Developments.

Vero's G-Series is a range of small metal instrument cases, which come in three standard sizes with satin anodized aluminium top cover, and front and rear panels and base in matt black PVC-clad steel.

When the case is assembled, there are no visible fixings. The cover can be removed by unscrewing the feet. The cases have a sloping vizor to protect light displays against glare.

The latest additions to the BOCON range from West Hyde are ten, two part cases with loose front and rear panels.

PCBs can be mounted on the bosses, the three middle sizes taking one and the three largest sizes taking two standard Eurocards on both top and base. Further pillars are also provided as intermediate mounts as are extra chassis, supports.

A useful feature of this range is that the four smallest sizes are available with battery compartments at one end to take 1V5 pencells or flat 9V types. The smallest case is intended for use with hand-held, battery instruments.

Further details of Vero's G-Series from Vero Electronics Ltd, Industrial Estate, Chandler's Ford, Eastleigh, Hampshire SO5 3ZR.

For information on the BOCON range, contact West Hyde Developments Ltd, Unit 9, Park Street Industrial Estate, Aylesbury, Bucks HP20 1ET.

Happy Boxing Day!

SERVO AMP

New from Ferranti, the ZN419CE is a precision IC servo amplifier for use in pulse width position servo mechanisms and motor speed control applications.

It features low quiescent current, high output drive capability, low external component count and can operate over a wide range of repetition rates and pulse widths.

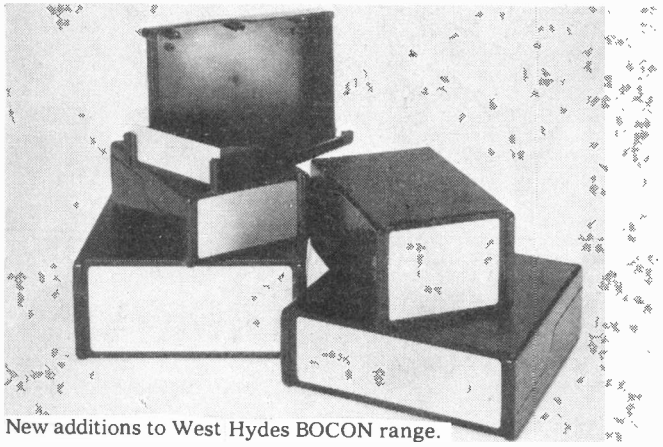
The device operates from a standard 1.5 mS pulse width with Schmitt trigger input shaping. The supply can be anything from 3.5 to 6.5V as the ZN419CE incorporates precision internal voltage stabilisation.

More information can be obtained from Ferranti Electronics Ltd, Fields New Road, Chadderton, Oldham OL9 8NP.

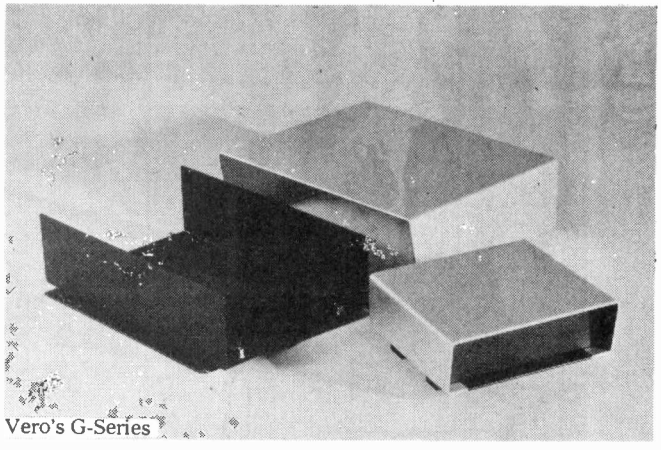
We've had several inquiries about errors in the System 8000 Tuner-amplifier project, which appeared in the June and July editions of ETI.

Unfortunately, we are unable to answer any technical queries on this project as the design from which Uni-Electric are producing their kit has been changed since we published the project.

In view of this, all inquiries on the System 8000 should be addressed to Uni-Electric Ltd, 182-184 Addington Road, South Croydon, Surrey. Tel. 01-657 4136.



New additions to West Hydes BOCON range.



Vero's G-Series

POWERTRAN

FOR ELECTRONIC KITS OF DISTINCTION

PSI 4002 STUDIO MODEL

cabinet size 17.2" x 17.2" x 6.7"

COMPLETE KIT ONLY £196.90 + VAT

200+200 watt AMPLIFIER

As featured in Electronics Today International

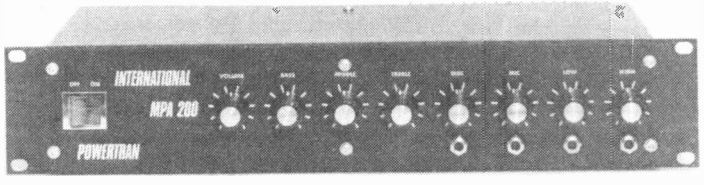
400W rms continuous — 800W peak!
0.03% THD at FULL power!
PLUS all the following features too!

- ★ Each channel totally independent with its own stabilised power supply driven by custom designed TOROIDAL transformers!
- ★ Inherent reliability — monster heat sinks for cool running at the hottest venues — electronic open and short circuit protection!
- ★ Ultra low feedback (an incredible low 14dB overall!), super high slewing rate (20V/μs), 200W rms. continuous to 4 ohm from EACH channel, input sensitivity 0.775V (0dB).
- ★ Professional quality components, sturdy 19" rack mounting chassis complete with sleeve and feet for free standing work too.
- ★ Easy to build — plenty of working space with ready access to all components, minimal wiring, extensive instruction suitable for both experience constructors and newcomers to electronics.
- ★ Value for money — quality and performance comparable with ready-built amplifiers costing over £600!

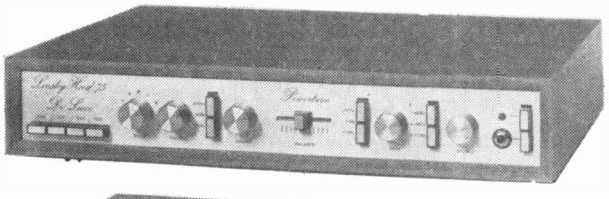
MPA 200 100 WATT (rms into 8–) MIXER/AMPLIFIER

COMPLETE KIT ONLY £49.90+ VAT

Featured as a constructional article in ETI, the MPA 200 is an exceptionally low priced — but professionally finished — general purpose high power amplifier. It features adaptable input mixer which accepts a wider range of sources such as microphone, guitar, etc. There are wide range tone controls and a master volume control. Mechanically the MPA 200 is simplicity itself with minimal wiring needed making construction very straigthforward.
The kit includes fully finished metalwork, fibreglass PCBs. controls, wire etc. — complete down to the last nut and bolt.



MATCHES THE CHROMATHEQUE 5000 LIGHTING EFFECTS SYSTEM PERFECTLY!



DE LUXE EASY TO BUILD LINSLEY HOOD 75W STEREO AMPLIFIER £99.30 + VAT

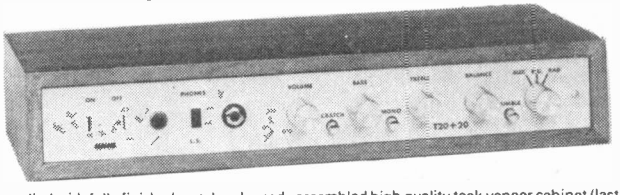
This easy to build version of our world-wide acclaimed 75W amplifier kit based upon circuit boards interconnected with gold plated contacts resulting in minimal wiring and construction delightfully straightforward. The design was published in H-Fi News and Record Review and features include rumble filter, variable scratch filter, versatile tone controls and tape monitoring whilst distortion is less than 0.01%.

WIRELESS WORLD FM TUNER £70.20 + VAT

A pre-aligned front-end module makes this Wireless World published design very simple to construct and adjust without special instruments. Features include an excellent a.m. rejection push-button station selection as well as infinitely variable tuning and a phase locked loop stereo decoder, incorporating active filters for "birdy" suppression.

LINSLEY-HOOD CASSETTE DECK £79.60+VAT

This design, published in Wireless World, although straightforward and relatively low cost provides a very high standard of performance. There are separate record and replay amplifiers and switchable equalisation together with a choice of bias levels are also provided. The mechanism is the Goldring-Lenco CRV with electronic speed control.



T20+20 20W STEREO AMPLIFIER £33.10+VAT

This kit, based upon a design published in Practical Wireless, uses a single printed circuit board and offers at very low cost, ease of construction and all the normal facilities found on quality amplifiers. A 30 watt version of this kit (T30+30) is also available for **£38.40** + VAT.

MATCHING TUNERS — SEE OUR FREE CATALOGUE!

COMPLETE KITS: Our complete kits really are complete. All of the projects shown on this page are supplied with fully finished metalwork, ready assembled high quality teak veneer cabinet (last 4 kits on this page), or professional quality rack mounting cabinet (first 2 kits on this page), cables, nuts, bolts, etc., and full instructions — in fact everything!

All of the kits shown on this page are available as separate packs for those customers who wish to spread their purchase or perhaps make their own cabinets or metalwork. Prices are given in our FREE CATALOGUE.

PRICE STABILITY: Order with confidence. Irrespective of any price changes we will honour all prices in this advertisement until October 31st, 1979, if this month's advertisement is mentioned with your order. Errors and VAT rate changes excluded.
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OUR CATALOGUE IS FREE! WRITE OR PHONE NOW!

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SEIKO

Memory Bank Calendar Watch (The 'Bond' watch from Moonraker)

This is the watch offer they said even ETI could never do. SEIKO at a 40% discount! After all no-one discounts Rolls Royce do they? Well here it is. A SEIKO Memory Bank Calendar watch which retails everywhere at £138 for only £79.50 inc VAT and Registered Post charges.

The watch itself is a different league to other timepieces. It shows day, date, month, hours, minutes and seconds continuously, and switches to display the full calendar, month by month, from January 1st 1930 to December 31st 2009 at the push of a button! Twelve or twenty-four hour display can be selected and changed at will! Up to ELEVEN dates in the forthcoming year can be set as "MEMO" dates in the memory bank, and upon the alloted day the watch keeps the word MEMO flashing on the display to remind you of whatever it was you forgot. No more forgetting birthdays, anniversaries or evenings out!

Battery life is a good two years and the watch carries the full SEIKO guarantee. (Although these watches are so reliable chances are you'll never find out how good that is!)

Operating the watch is simple and logical, and you don't need a pin to set it either! Even battery changing is facilitated by the 'hatch back' construction. You'll never see an offer like it again for a long long time, and even now we can't hold this price for long, so now's the time to get yourself the best there is in a watch, get a SEIKO and get it at ETI's prices!

Orders can only be accepted using the coupon below, and then in order to be fair to everyone, only one watch per coupon. Supplies at this price are limited, so forgive us for being so formal!

1 Only

To ETI Seiko Offer
145 Charing Cross Road
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I enclose cheque/P.O. for £79.50 payable to ETI for ONE Seiko Memory Bank Calendar Watch.

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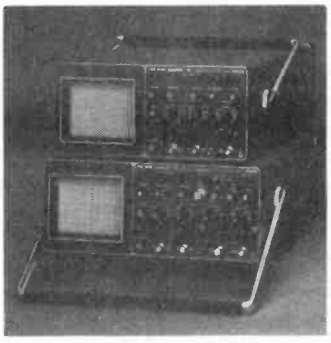
SOME DAY ALL WATCH OFFERS WILL BE DONE THIS WAY!

news digest



SCOPE FOR IMPROVEMENT

Philips have announced two new 35 MHz oscilloscopes to extend the facilities already found in the well-proven 25 MHz range.

In appearance, the new scopes, designated the PM3216 and PM3218, are very similar to their predecessors. Spot the new scopes in our photos. (The new models are below).

The main difference between the two new instruments is that the PM3216 is dual-trace, single timebase and the PM3218 is the dual-trace, dual timebase model. The PM3218 also features an alternate timebase so that both main and delayed timebase signals can be displayed for easy reference.

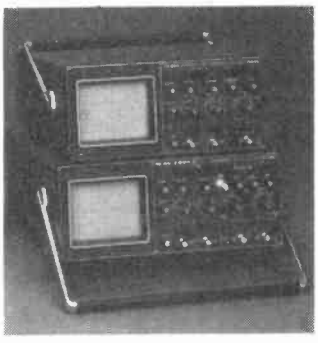
Sensitivity for both of the new models is 2mV over the full 35 MHz bandwidth, coupled with a trigger sensitivity of 1 div and an external trigger sensitivity of 200 mV. In addition a 10:1 attenuator on the external trigger provides a very wide dynamic range.

Z-input modulation makes the scopes ideal for logic analyzer applications.

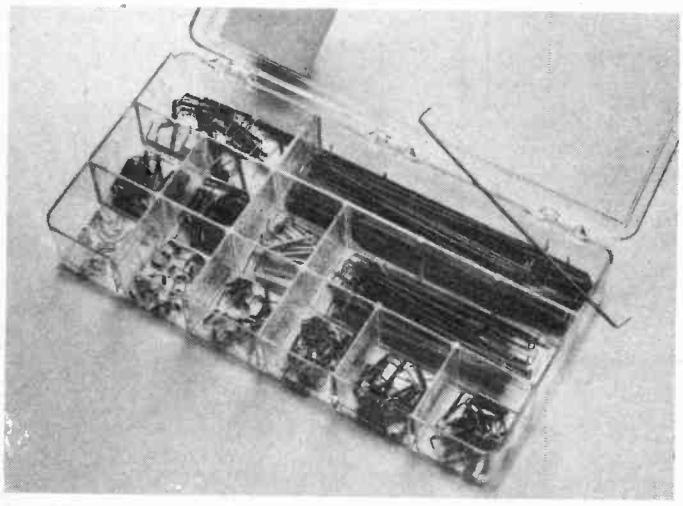
Both accuracy and ease of use are enhanced by means of double insulators which allows the instruments to be operated safely without an earth connection, thereby eliminating earth loop and hum problems.

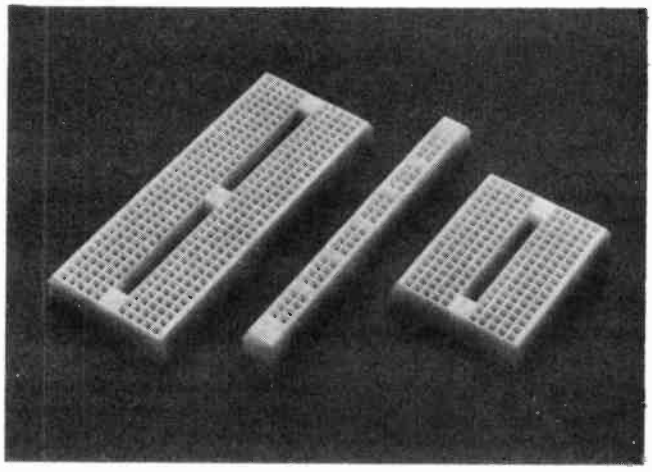
The new models can be operated almost anywhere, with possible mains supplies of 110, 127, 220 and 240V AC (± 10%) in the frequency range 46 to 440 Hz, and also 21 to 27V DC. An optional internal 24V battery supply makes the unit truly portable. Power consumption is 30 W.

Further information from Pye Unicam Ltd, York Street, Cambridge CB1 2PX.



news digest.....

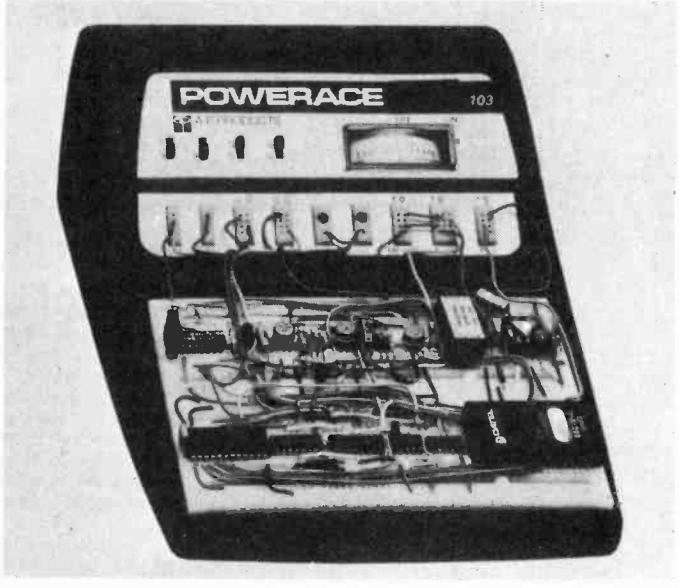




BUMPER BUNDLE FROM LEKTROKIT

We suspect that everyone at Lektrokit must be working 26 hours a day, 8 days a week. Every post seems to bring news of more goodies from them.

Let's start with the Powerace 103. No, it's not an electronic poker game. Lektrokit describe it as a circuit prototype construction aid. It's a complete, self-contained unit, enabling analogue and/or digital circuitry to be built without using one of those nasty, hot soldering irons.



The unit has its own internal power supplies to provide all necessary power rails for the circuitry under construction. DC voltage outputs of +5V (750mA), +15V (250 mA) and —15V (250 mA) are available. All DC supplies are regulated with ripple and noise of less than 10 mV and line and load regulation of less than 1%.

The matrix of 1680 solderless, plug-in tie points will accept all ICs and has the capacity to hold up to 18, 14 pin, DIL packages. A 15-0-15V meter on the front panel has accessible inputs, enabling supplies or circuitry to be monitored.

The front panel also carries two logic switches, two data switches and two buffered LED logic indicators.

Powerace is only 7.5×11.5×4 in, weighs in at 2.5 lbs and is mains powered.

Lektrokit is also to market three new units that together form a solderless breadboard system.

The 217L and 234L terminal strips and the 206R distribution strip offer 170, 340 and 48 pre-connected sockets respectively on a standard 0.1 in matrix. The three units can be fixed together in any configuration. Each has a self-adhesive backing for fixing to any flat surface and screw holes permit more secure fixing (they even give you free screws!).

When you have your breadboard, try to persuade granny to buy you a Lekrokit breadboard jumper wire kit. Each kit contains 350 wires with their ends already stripped and bent at right angles for instant use.

Fourteen different lengths are included, from the smallest pieces with a 0.1 in span, for linking adjacent holes on the 0.1 in matrix, to others with a span of five inches. Each length has its own distinct colour sleeving for easy identification. All the wires are solid, tinned 22 awg with PVC sleeving. The kit is presented in a smart, compartmentalised case.

That little lot should solve some of your Christmas stocking problems. If you want to know more about these Lektrokit products, contact Lektrokit Ltd, Sutton Industrial Park, London Road, Earley, Reading, Berkshire RG6 1AZ.

GIGAMPU COUNTER?

No, it doesn't count Gigampu's. It's an MPU-based frequency counter from Racal with a frequency coverage of 10 Hz to 26.5 Gigahertz.

The model 548 extends the standard range of the 54 series to 40 GHz with a resolution of 1Hz. Further options, to extend the range even further, are in the pipeline.

Standard features are high sensitivity to —30 dBm, input protection, easy to operate keyboard control and keyboard selected test and diagnostic functions. Options include power measurement, GPIB connection, remote programming/BCD output and digital to analogue converter output.

For further details contact Racal-Dana Instruments Ltd, Duke Street, Windsor, Berkshire SL4 1SB.

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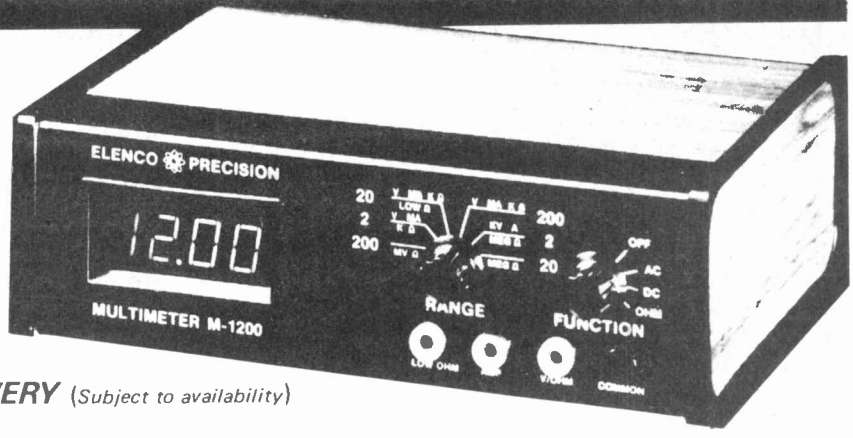

*EX STOCK DELIVERY (Subject to availability)

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- High input impedance 10 Megohm
- High accuracy achieved with precision resistors, not unstable trimpots
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- Mains (with adaptors not supplied) or battery operation-built-in charging circuitry for NiCads
- Overrange indication
- Hi Low power ohms, Lo for resistors in circuit, Hi for diodes

SPECIFICATIONS:

DC Volts	Range 200mV, 2V, 20V, 200V, 1000V Accuracy 1% ± 1 digit, Resolution .1mV Overload protection 1,000 volts max
AC Volts	Range 200mV, 2V, 20V, 200V, 1000V (Response 45Hz to 5KHz) Accuracy 1.5% ± 2 digits, Resolution .1mV. Overload protection 1000V max, 200mV scale 600V
DC Current	Range 2mA, 20mA, 200mA, 2amp. Accuracy 1% ± 1 digit, Resolution 1 Microamp Overload protection -- 2 amp fuse and diodes
AC Current	Range 2mA, 20mA, 200mA, 2 amp Accuracy 1.5% ± 2 digits, Resolution 1 Microamp Overload protection – 2 amp fuse and diodes
Resistance	Range 20, 200, 2K, 200K, 2 Meg. 20 Meg. Accuracy 1% ± 1 digit, Resolution .01 ohms
Environmental	Temp coefficient 0° to 30° C ± .025% °C Operating Temp 0° to 50° C Storage – 20° to 60° C
General	Mains adaptor: 6 - 9 Volts @ 200mA (not supplied) 4C size batteries (not supplied) Size 8¼ x 5¾ x 2¼ Weight 2½ lbs.

At £55, M1200B is the best buy among DMM's currently available. Its 0.01 ohms resolution allows you to detect shorted windings in coils, transformers or motors. It is also useful in checking low contact resistance in switches, relays or connectors. Poor solder connections can also be spotted. The low power ohms function permits accurate measurements of in circuit resistance without forward biasing semiconductor junctions.

You have been waiting a long time for a digital multimeter with all these features at a price like this. Now its yours.

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Z & I Aero Services, 85 Tottenham Court Road London W.1

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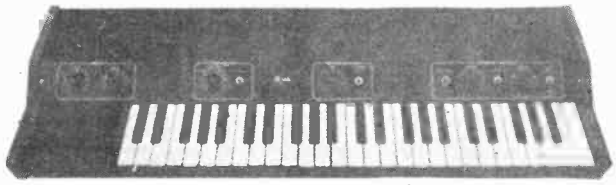
THE ARAK VIII POLYPHONIC KEYBOARD CONTROLLER



The Arak VIII is so named because it can handle up to eight* note polyphony, and that means that if you have a large enough synthesizer you can play eight notes at once, and each one can be set to sound totally different.
The Arak VIII is a controller in every sense of the word. For instance it has built in vibrato so you don't waste those precious V.C.O.s. You can instantly get back to that fat monophonic sound by flicking the unison switch. Just touch the keys with infinite sustain selected and the Arak VIII brings in a big power chord while you get on with playing another instrument. Memorising a chord is no problem using the memory bank facility. You can even sequence between two chords set in the memory banks and interact with them from the keyboard. We designed the Arak VIII to interface with just about anything, apart from the gate and control voltage outputs, which incidentally, can be scaled between zero and two volts per octave, there is an I/O so you can interface it to a computer. This allows a computer to take data from the Arak VIII or feed data in and control the synth.
The case is hand-built out of black anodised aluminium and is finished off with solid mahogany end cheeks. Legends are silk screened on the front and back so you know precisely what to twiddle and what to plug into.

Arak VIII kit **£248.39**
Arak VIII ready-built and tested **£382.22**
Prices include VAT

*Four more store / portamento circuits are needed to give the necessary number of control voltages.

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- ★ All Stainless Steel
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UMO 850CS

Perpetual calendar, day, date, month, 24 hour alarm with on/off indication, 1/10 second chronograph measuring set, lap and first and second place times. Dual time zone facility, backlight. 12 months guarantee

ONLY £39.95
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9mm thick

SOLAR LCD CHRONOGRAPH

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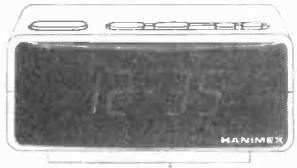

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BC107A	£0.09	BC338	£0.17	BFX87	£0.25	TIP41C	£0.55	2N3705	£0.08		
BC107B	£0.10	BC440	£0.35	BFX88	£0.25	TIP42A	£0.50	2N3706	£0.08		
BC107C	£0.12	BC441	£0.35	BFY50	£0.18	TIP42B	£0.52	2N3707	£0.09		
BC108A	£0.09	BC460	£0.44	BFY51	£0.18	TIP42C	£0.55	2N3708	£0.08		
BC108B	£0.11	BC461	£0.44	BFY52	£0.18	TIP2955	£0.69	2N3709	£0.08		
BC108C	£0.12	BC477	£0.23	BIP19	£0.44	TIS43	£0.25	2N3710	£0.08		
BC109A	£0.09	BC478	£0.23	BIP20	£0.44	TIS90	£0.20	2N3711	£0.08		
BC109B	£0.10	BC479	£0.23	BIP19/		UT46	£0.23	2N3819	£0.21		
BC109C	£0.12	BC547	£0.12	20MP	£0.92	ZTX107	£0.11	2N3820	£0.40		
BC147	£0.08	BC548	£0.12	BRY39	£0.51	ZTX108	£0.11				

74 SERIES TTL

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
7400	£0.10	7427	£0.27	7472	£0.23	74105	£0.43	74163	£0.71
7401	£0.12	7428	£0.29	7473	£0.28	74107	£0.27	74164	£0.78
7402	£0.12	7430	£0.12	7474	£0.28	74110	£0.41	74165	£0.78
7403	£0.12	7432	£0.25	7475	£0.33	74111	£0.66	74166	£0.89
7404	£0.12	7433	£0.34	7476	£0.28	74118	£0.92	74174	£0.74
7405	£0.12	7437	£0.25	7480	£0.50	74119	£1.35	74175	£0.71
7406	£0.25	7438	£0.24	7481	£0.97	74121	£0.27	74176	£0.66
7407	£0.25	7440	£0.13	7482	£0.78	74122	£0.44	74177	£0.66
7408	£0.14	7441	£0.57	7483	£0.66	74123	£0.46	74180	£1.72
7409	£0.14	7442	£0.46	7484	£1.01	74136	£0.59	74181	£0.66
7410	£0.12	7443	£0.80	7485	£0.78	74141	£0.63	74182	£0.80
7411	£0.19	7444	£0.80	7486	£0.25	74145	£0.63	74184	£0.80
7412	£0.17	7445	£0.74	7489	£1.95	74150	£0.78	74190	£0.78
7413	£0.27	7446	£0.69	7490	£0.36	74151	£0.55	74191	£0.71
7414	£0.57	7447	£0.55	7491	£0.73	74153	£0.55	74192	£0.69
7416	£0.26	7448	£0.64	7492	£0.40	74154	£0.94	74193	£0.66
7417	£0.26	7450	£0.12	7493	£0.34	74155	£0.57	74194	£0.71
7420	£0.12	7451	£0.12	7494	£0.86	74156	£0.57	74195	£0.69
7421	£0.23	7453	£0.12	7495	£0.57	74157	£0.57	74196	£1.20
7422	£0.18	7454	£0.12	7496	£0.57	74160	£0.66	74197	£1.20
7423	£0.24	7460	£0.12	74100	£0.87	74161	£0.71	74198	£2.12
7425	£0.21	7470	£0.28	74104	£0.44	74162	£0.71	74199	£2.12
7426	£0.26								

CMOS ICs

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
CD4000	£0.16	CD4015	£0.87	CD4026	£1.38	C04043	£1.01	CD4070	£0.19
CD4001	£0.17	CD4016	£0.48	CD4027	£0.57	CD4044	£0.94	CD4071	£0.19
CD4002	£0.18	CD4017	£0.86	CD4028	£0.78	CD4045	£1.61	CD4072	£0.19
CD4006	£1.05	CD4018	£0.97	CD4029	£0.97	CD4046	£1.49	CD4081	£0.19
CD4007	£0.19	CD4019	£0.48	CD4030	£0.55	CD4047	£1.00	CD4082	£0.20
CD4008	£1.05	CD4020	£1.03	CD4031	£2.30	CD4049	£0.48	C04510	£1.13
CD4009	£0.51	CD4021	£0.94	CD4035	£1.15	CD405D	£0.48	CD4511	£1.09
CD4010	£0.55	CD4022	£0.94	CD4037	£1.09	CD4054	£1.26	CD4516	£1.15
C04011	£0.17	CD4023	£0.17	CD4040	£1.01	CD4055	£1.15	CD4518	£1.15
CD4012	£0.18	CD4024	£0.74	C04041	£0.87	CD4056	£1.55	CD4520	£1.15
CD4013	£0.48	CD4025	£0.17	CD4042	£0.82	CD4069	£0.19	C04014	£0.92

LINEAR

Type	Price			Type	Price	Type	Price	Type	Price
CA3011	£0.92	CA3130	£1.06	MC1350	£1.38	UA710C	£0.46	SN76115	£218
C03014	£1.55	CA3140	£0.80	MC1352	£1.61	72710	£0.34	SN76660	£0.86
CA3018	£0.74	LM301	£0.33	MC1469	£3.59	UA711C	£0.36	SL414A	£2.24
CA3020	£1.95	LM304	£1.84	MC1496	£1.63	72711	£0.36	TAA550B	£0.46
CA3028	£0.92	LM308	£1.15	NE536	£3.85	UA723C	£0.52	TAA621A	£2.30
CA3035	£1.61	LM309	£1.72	NE550	£1.09	72723	£0.52	TAA621B	£2.67
CA3036	£1.15	LM320-5V	£1.72	NE555	£0.27	UA741C	£0.27	TAA661	£1.72
CA3042	£1.72	LM320-12V	£1.72	NE556	£0.69	72741	£0.27	TAD100	£1.49
CA3043	£2.12	LM320-15V	£1.72	NE565	£1.38	741P	£0.23	TBA540	£2.41
CA3046	£0.80	LM320-24V	£1.72	NE566	£1.38	UA747C	£0.69	TBA810S	£0.86
CA3052	£1.84	LM380	£0.97	NE567	£1.95	72747	£0.69	TBA810	£1.12
CA3054	£1.26	LM381	£1.86	UA702C	£0.52	UA748	£0.40	TBA820	£0.80
CA3075	£1.72	LM3900	£0.86	72702	£0.52	72748	£0.40	TBA9200	£2.67
CA3081	£1.72	MC1303L	£0.97	UA703	£0.28	748P	£0.40	TCA270S	£2.30
CA3089	£2.30	MC1304	£2.16	UA709	£0.28	SN76013N	£2.01	TBA800	£0.92
CA3090	£4.14	MC1310	£1.09	72709	£0.52	SN76023	£2.01		
CA3123	£2.18	MC1312	£2.16	709P	£0.28	SN76110	£1.72		

THYRISTORS

Volts No	Price	Volts No.	Price
50 THY1A/50	£0.29	50 THY7A/50	£0.55
100 THY1A/100	£0.32	100 THY7A/100	£0.58
200 THY1A/200	£0.36	200 THY7A/200	£0.65
400 THY1A/400	£0.43	400 THY7A/400	£0.71
600 THY1A/600	£0.51	600 THY7A/600	£0.89
800 THY1A/800	£0.66	800 THY7A/800	£1.05
Volts No.	**Price**	**Volts No**	**Price**
50 THY3A/50	£0.32	50 THY10A/50	£0.58
100 THY3A/100	£0.34	100 THY10A/100	£0.65
200 THY3A/200	£0.37	200 THY10A/200	£0.71
400 THY3A/400	£0.48	400 THY10A/400	£0.80
600 THY3A/600	£0.57	600 THY10A/600	£1.13
800 THY3A/800	£0.74	800 THY10A/800	£1.40
Volts No	**Price**	**Volts No**	**Price**
50 THY5A/50	£0.41	.50 THY16A/50	£0.62
100 THY5A/100	£0.51	100 THY16A/100	£0.66
200 THY5A/200	£0.57	200 THY16A/200	£0.71
400 THY5A/400	£0.65	400 THY16A/400	£0.88
600 THY5A/600	£0.79	600 THY16A/600	£1.03
800 THY5A/800	£0.93	800 THY16A/800	£1.59

SILICON RECTIFIERS

200MA		**10 Amp**	
IS920 50v	£0.07	IS10/50 50v	£0.21
IS921 100v	£0.08	IS10/100 100v	£0.24
IS922 150v	£0.09	IS10/200 200v	£0.26
IS923 200v	£0.10	IS10/400 400v	£0.40
IS924 300v	£0.11	IS10/600 600v	£0.48
1 Amp		IS10/800 800v	£0.58
IN4001 50v	£0.05	IS10/1000 1000v	£0.69
IN4002 100v	£0.06	IS10/1200 1200v	£0.79
IN4003 200v	£0.07	**30 Amp**	
IN4004 400v	£0.08	IS30/50 50v	£0.84
IN4005 600v	£0.09	IS30/100 100v	£0.79
IN4006 800v	£0.10	IS30/200 200v	£1.06
IN4007 1000v	£0.11	IS30/400 400v	£1.43
1.5 Amp		IS30/600 600v	£2.02
IS015 50v	£0.10	IS30/800 800v	£2.23
IS020 100v	£0.11	IS30/1000 1000v	£2.65
IS021 200v	£0.12	IS30/1200 1200v	£3.31
IS023 400v	£0.14	**60 Amp**	
IS025 600v	£0.16	IS70/50 50v	£0.86
IS027 800v	£0.18	IS70/100 100v	£0.96
IS029 1000v	£0.23	IS70/200 200v	£1.38
IS031 1200v	£0.28	IS70/400 400v	£2.01
3 Amp		IS70/600 600v	£2.58
IN5400 50v	£0.16	IS70/800 800v	£2.87
IN5401 100v	£0.17	IS70/1000 1000v	£3.45
IN5402 200v	£0.18		
IN5404 400v	£0.19		
IN5406 600v	£0.24		
IN5407 800v	£0.28		
IN5408 1000v	£0.34		

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SPM120/45 Stabilised power supply (45v) **£6.67**

SPM120/55 Stabilised power supply (55v) **£6.67**

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Stereo 30 complete 7 watt stereo amplifier board **£22.66**

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1503	125	YELLOW	£0.21
1504	2	RED	£0.11
1505	2	GREEN	£0.21
1506	2	YELLOW	£0.21
1509	2	CLEAR (III , Red)	£0.12

SUPER 'Hi-Brite' Type

1521	125	RED	£0.11
1522	2	RED	£0.11
1514	ORP12 Light dependent resistor		£0.63
1520	OCP71 Photo transistor		£0.40

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1508/125 pack of 5 — 125 clips **£0.17**
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DL707 RED 7 segment D P left (0 3" height) common anode, single digit O/NO 1510 **£0.92**

DL527 RED 7 segment D P left (50" height) common anode Two-digit reflector o/NO 1524 **£1.95**

DL727 RED 7 segment D P right (510" height) common anode Two-digit light pipe O/NO 1521 **£2.53**

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1720	18 pin DIL	£0.18
1721	20 pin DIL	£0.20
1722	22 pin DIL	£0.22
1614	24 pin DIL	£0.24
1615	28 pin DIL	£0.26
1723	40 pin DIL	£0.34
1616	TO18 transistor	£0.13
1617	TO3 transistor	£0.37
16117	TO5 transistor	£0.13
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LM 10—THE BASICS

The LM10 is a startling and exciting new type of op-amp. Ray Marston describes the new device in this first part of a 2-part feature.

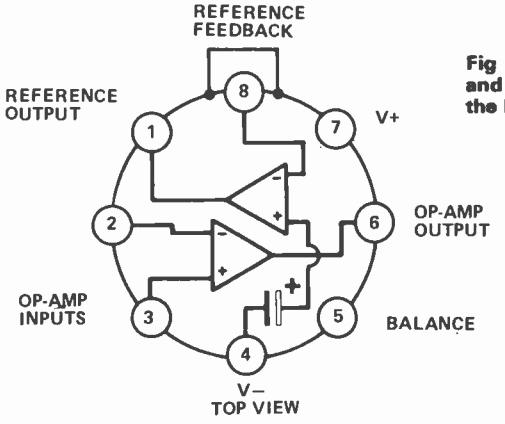
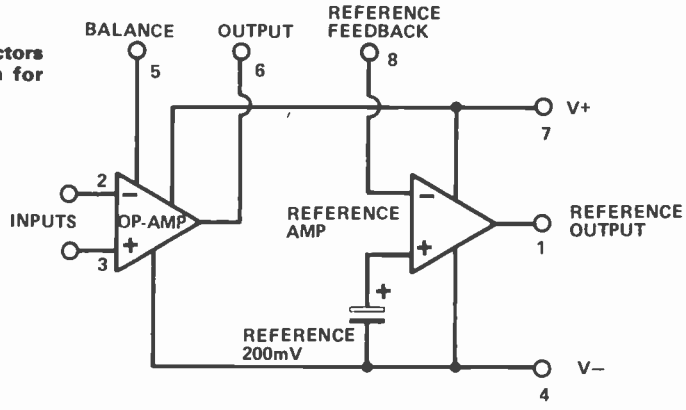


Fig 1. TO-5 can connectors and schematic diagram for the LM 10.



THE LM10 IS THE FIRST of a brand new and very exciting generation of highly versatile op-amp devices. It has been specifically designed to have a capability of working from single-ended supplies with voltages as low as 1V1 to as high as 40 V while giving a performance that is vastly superior to that of most of today's 'conventional' dual-supply op-amps.

The LM10 has been designed by Robert J. Widlar, the acknowledged 'Father of the op-amp' (he also designed the uA709, 710, 711, LM101, LM108, etc), and incorporates some brilliant design innovations. The device is being manufactured by National Semiconductors.

Parting With It

When we at ETI first heard about the device we reckoned it sounded pretty good, so we decided to run a one-part feature on the LM10. Since then, however, we've received actual samples of the IC!

In this month's part of the series we tell you what the device is, and describe some basic ways of using it. In next month's concluding part we'll show you a whole stack of practical applications.

The LM10: An Introduction

THE LM10 is a brand new and revolutionary type of monolithic op-amp. It draws a total quiescent current of only 270 uA over the entire voltage range, is capable of delivering tens of milliamps output current, and can operate from either fixed or fully-floating power supplies.

The op-amp has a PNP differential input stage that can accept input signals down to zero volts, and has a complementary class-B output stage that can swing within 50 mV of the supplies at 50 uA load current, or within 400 mV at 20 mA load current. The input is well protected via integrated current-limiting resistors against damage from excessive voltages and the output is protected by thermal overload and short-circuit detection circuitry.

The LM10 actually comprises three circuits, all housed in a single TO-5 8-pin package (see Fig. 1). The circuits comprise the op-amp, a 200 mV band-gap voltage reference and a reference amplifier. The reference is an ultra-precision device, with a temperature coefficient better than 0.002%/°C, and is externally available at the amplifier output. The reference output value can be adjusted over a wide range (200 mV to 39 volts) by trimming the amplifier feedback.

The LM10 Family

There are five members of the LM10 family. All the characteristics except the unity gain bandwidth (0.3 MHz) and the slew rate (0.15 V/uS) are exceptionally good (the device is clearly not designed for high frequency operation). The five devices in the range are categorised by their operating temperature ranges (LM10, LM10B, or LM10C) and also by their maximum supply voltage ranges of either 7 volts ('L' suffix) or 40 volts. The LM10C is a relaxed-specification 'commercial' version of the 40 volt unit and presently retails at over £6 in one off quantities.

The device is moderately complex (it incorporates 88 transistors, 81 resistors, and 16 capacitors), is fairly pricey, and is initially likely to be used only in unique (and until now 'impossible') applications for which no alternative solution is possible.

Several manufacturers are considering second-sourcing the LM10, however, and when they do the price of the device can be expected to drop significantly. This factor, combined with the certainty of spin-off devices based on the new circuit design techniques of the brilliant Bob Widlar, must mean that the LM10 and its derivatives will become classic IC devices, just like the 741 op-amp and the 555 timer, in the next couple of years. We at ETI vote the LM10 as IC of the year and Robert J. Widlar as design Superman of the decade.

Using The LM10: Power Supplies

The LM10 is a remarkably easy device to use. It can be powered from either fixed or floating single ended or dual supplies, and can use total voltages anywhere in the range 1V1 to 40 V. Figures 2 to 6 show a few ways of powering the device.

Figs. 2 and 3 show methods of powering the unit from dual supplies, for 'conventional' applications in which the inputs are referenced to the zero volts rail and the outputs can swing between the positive and negative supply line voltages. The Fig. 2 circuit uses two independent supply rails and the Fig. 3 circuit uses two rails derived from a single source.

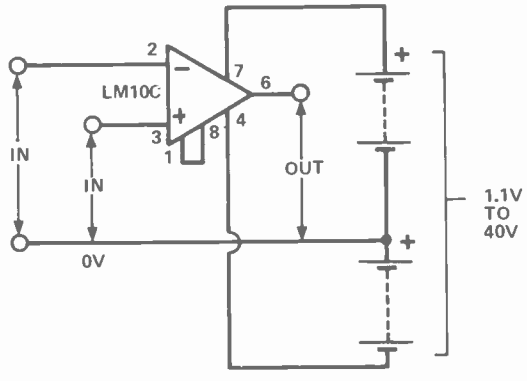


Fig 2 (above). Method of powering the LM 10 for conventional split-supply operation.

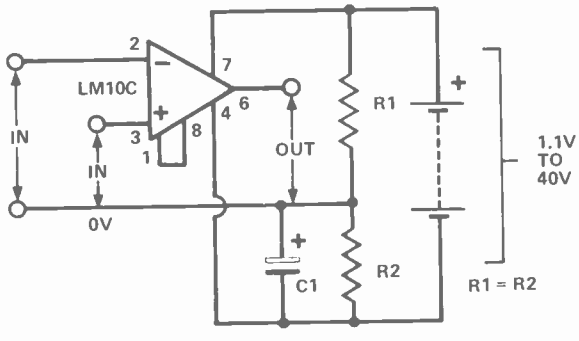


Fig 3. Method of powering the LM 10 for split-supply operation using a single supply source.

The Fig. 2 and 3 supply connections enable the LM10 to be used in all of the standard op-amp configurations, but with the quite remarkable advantages of using total supply voltages down to a mere 1V1 at total quiescent currents of only 270 uA and of having outputs that can swing within a few tens of millivolts of the supply rail voltages.

Fig. 4 shows the standard and self-evident method of powering the LM10 from a single pair of supply rails. The supply can again have any value in the range 1V1 to 40 V, and the op-amp output can again swing within a few millivolts of the zero and positive supply rails. An additional and rather pleasant surprise is that the op-amp can handle input signals right down to zero volts when used with a single power supply.

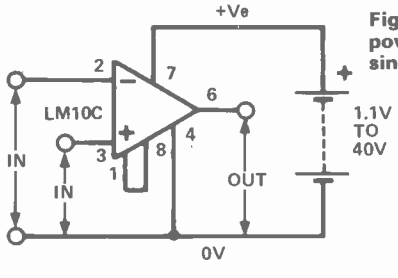
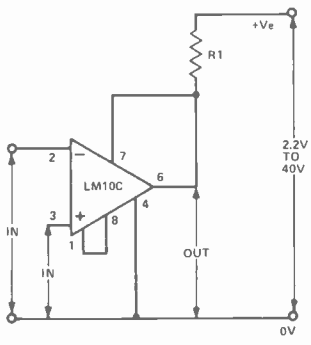


Fig 4. Standard method of powering the LM 10 from a single pair of supply rails.



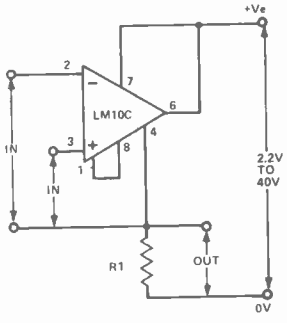


Fig 5 and Fig 6 (above). Two alternative methods of 'shunt' supplying the LM 10.

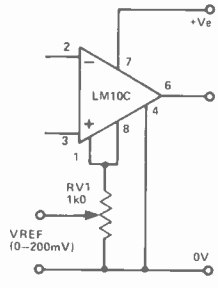
Finally, Figs. 5 and 6 show two quite unique and mind blowing ways of powering the LM10 from a single pair of supply rails. In these configurations the op-amp output terminals are shorted directly to the positive supply terminal of the LM10, so that the output 'shunts' the devices supply and a limiting resistor is wired in series with one of the supply leads.

The LM10 op-amp has an output drive current capability that is a couple of orders of magnitude greater than the device's normal quiescent current. This factor, combined with the device's excellent supply-voltage rejection figure of 96 dB and wide operating voltage range, enables it to operate quite happily in either the linear or the switching mode while at the same time using its own output to modulate its own supply voltage and current!

Thus, this 'shunt' method of operation can be used in two-wire remote-sensor applications, in which the two wires carry both the supply current and the resulting signal information. Note that the minimum supply voltage used in this application must be significantly greater than the normal 1V1 figure, to enable reasonable data amplitudes to be developed across R1 without reducing the LM10 voltage below its minimum working value.

Using The LM10: The Reference Amplifier

If you don't want to use the reference facility in a particular application, or wish to use it simply as a 200 mV reference, strap pins 1 and 8 of the IC together as shown in Fig. 7. That gives the reference amplifier ▶



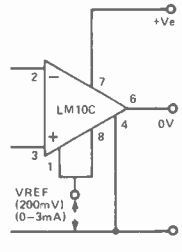


Fig 7 (right) and Fig 8 (left). Putting the LM 10 reference to work for its 200mV. Fig 7 makes it a straight 200mV, and Fig 8 makes it variable from 0-200mV.

something useful to do and makes a 200 mV 0-to-3 mA reference available between pins 1 and 4.

If you want a precision reference in the range 0 to 200 mV, wire a fixed or variable potential divider between pins 1 and 4, strap pins 1 and 8 together and take the output from the potential divider junction or slider, as shown in Fig. 8.

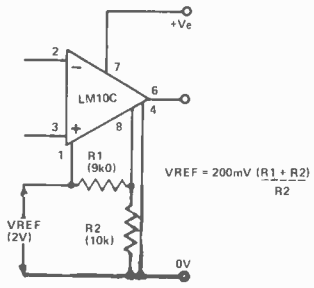
If you want a precision reference in the range 200 mV to 39 volts, use the connections shown in Fig. 9. In this configuration the reference amplifier is used as a non-inverting amplifier with an input of 200 mV and a voltage gain of (R1 + R2)/R2.

A useful point to note about the reference amplifier is that it has a typical unity gain bandwidth of about 500 kHz and can be gainfully employed in some special applications as an AC amplifier, if you use a little ingenuity in your circuit design.

A final point to note is that the reference amplifier can also be used as a simple voltage comparator that can be quite useful in some special applications (an ETI discovery). Fig. 10 shows the basic connections.

Using The LM10: The Op-Amp

The op-amp section can be used in a wide variety of basic configurations in the single-supply mode. Some of these configurations are shown in Figs. 11 to 24.



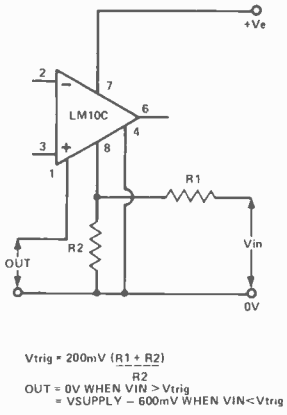


Fig 9 (left) and Fig 10 (right) give a circuit for getting the reference to behave as a 200mV-39V precision output and using the reference as a simple voltage comparator respectively.

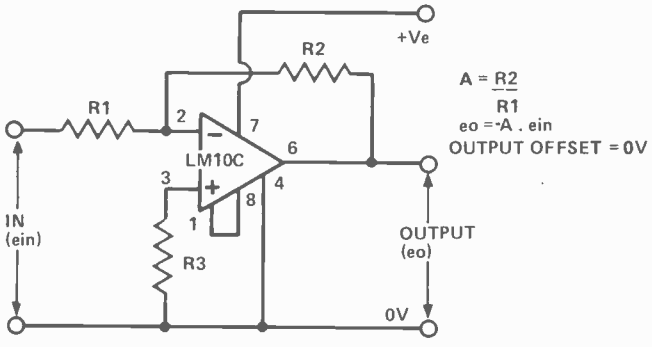


Fig. 11 shows the basic connections for using the op-amp as an inverting DC amplifier. Note here that the circuit can usefully accept input signals that are negative with respect to the 'zero' volts rail only.

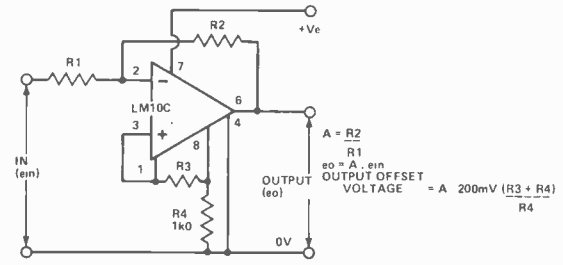


Fig. 12. If you want the circuit to accept positive DC input signals, you can do so by feeding an offset biasing voltage to the non-inverting terminal of the op-amp from the built-in reference amplifier.

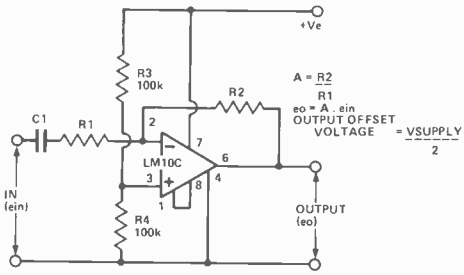


Fig. 13 shows the connections for making an inverting AC amplifier. The output is biased at half-supply volts, for maximum signal swing, by the R3-R4 potential divider.

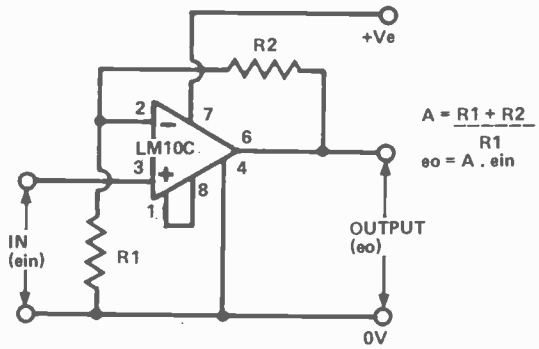
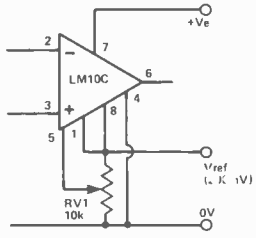
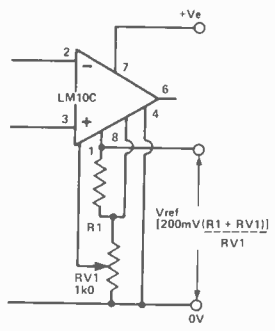


Fig. 14 shows how to use the LM10 as a non-inverting DC amplifier that will accept input signals down to zero volts. The circuit can be used as a unity-gain voltage follower by removing R1 and replacing R2 with a short circuit. The circuit can be used, in conjunction with the built-in voltage reference and amplifier, as a precision voltage regulator in this mode.

Figs. 15 and 16 show standard methods of applying offset adjustment or compensation to the op-amp, using the IC's built-in reference amplifier.





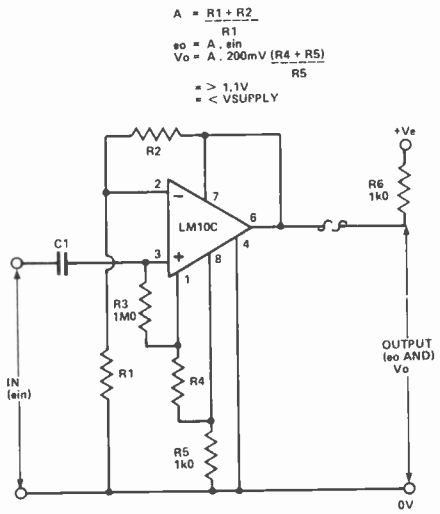


Fig. 17 shows how the LM10 can be used in a 'shunt' mode when connected as a non-inverting AC amplifier. Note that the output must be biased so that the quiescent output voltage (V_o) is part way between the positive supply value and the 1V1 minimum operating potential of the IC. Both the IC supply and signal currents flow through R6 in this mode of operation, thus enabling the IC to be used as a 2-wire (or single-wire if a common earth return is used) sensor or data transmitter.

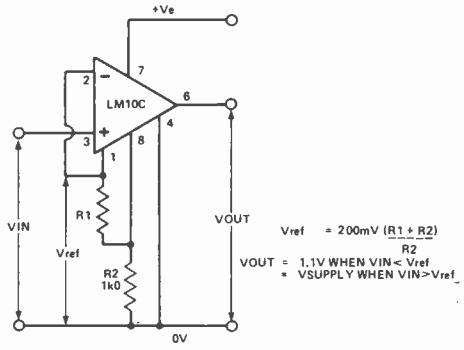


Fig. 18 shows how to use the LM10 as a precision voltage comparator, using the IC's built-in voltage reference and amplifier. The action of the circuit can be reversed, so that the output goes high when V_{in} falls below V_{ref} by transposing the op-amp pin 2 and pin 3 connections.

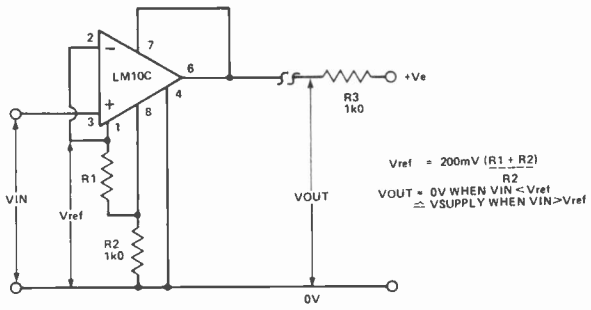


Fig. 19 shows how the voltage comparator can be used in the shunt mode.

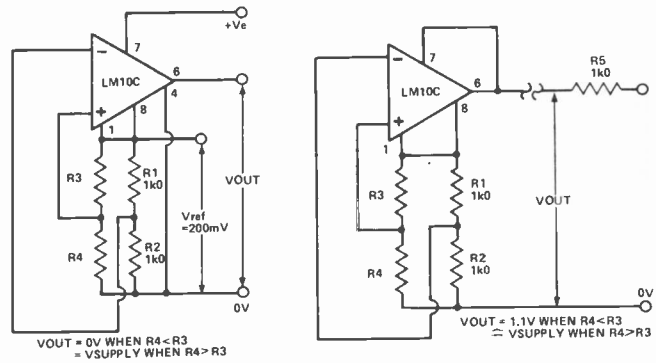


Fig. 20 (left) shows how the LM10 can be used as a resistance comparator, using the IC's built-in reference to power the test and reference resistors. The sensitivity of the circuit can be improved by raising the reference voltage above the basic 200 mV value. Note that the total output current of the reference must not be allowed to exceed 3 mA.

Fig. 21 (right) shows how the resistance comparator can be connected in the shunt mode. Note in this case that the reference voltage value should not exceed 1 V.

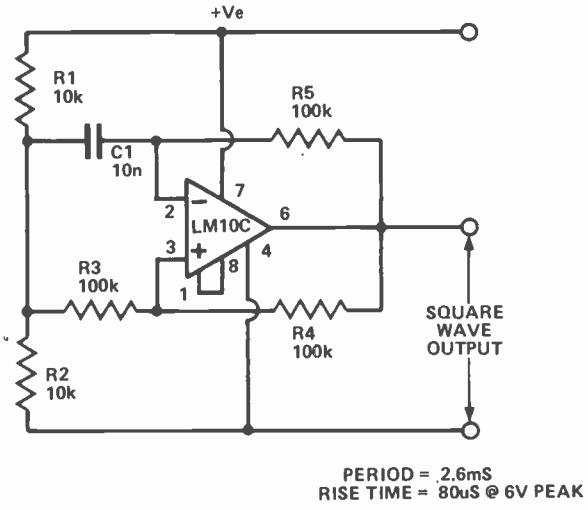


Fig. 22 is the basic astable circuit and is a fairly simple development of the standard 'dual supply' op-amp astable, with R1 and R2 acting as a potential divider that sets the 'common' point of the R3-R4 and C1-R5 networks at half-supply volts. Because of the poor slew-rate characteristics of the LM10, the circuit gives a pretty lousy square wave output, with typical rise and fall times of about 80 uS when used with a 6 V supply. The circuit is, nevertheless, very useful in low frequency applications (up to a couple of kHz) as a simple alarm-tone generator or LED flasher, etc.

Coming Soon

We'll show you a whole stack of practical applications in the final part of this series next month. All of these applications will be based on the LM10C version of the device. In the meantime, if you want to play with the LM10C yourself, it should be available from Marshall's, or Watford within a week or so of the publication this issue. ET

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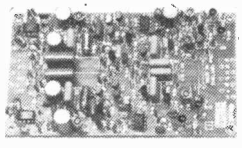

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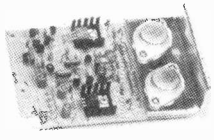

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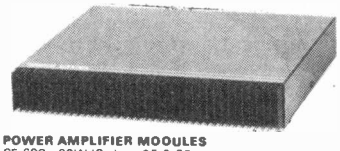

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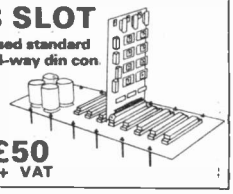

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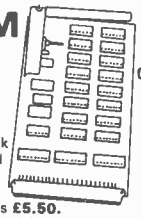

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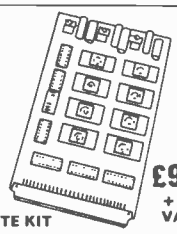

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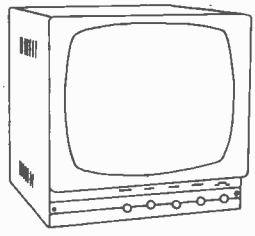

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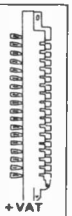

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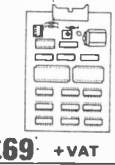

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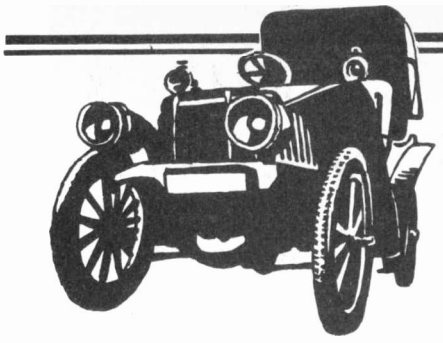


WARNING INDICATOR MONITORING SYSTEM

A unique design that gives a sophisticated audible warning when any of your car 'fault' lights switch on, or when your turn-indicators operate.

VIRTUALLY ALL MODERN CARS are fitted with panel-mounted fault indicator lamps that switch on when the voltage generator circuit packs up or when the engine oil pressure drops below a safe value, etc. Trouble is, most of these lamps are badly sited and in any case are almost impossible to read in bright sunlight. An apparently obvious answer to this problem is to couple up an audible alarm generator or 'repeater' to the warning lamps, so that you get both audible and visual indications of the fault condition. Unfortunately, however, the answer to the problem is not quite that simple: if it were, Ford and BLM would have fitted audible repeaters to all of their cars by now.

The real problem is that the audible repeater is required to draw the driver's attention to the fault, but not distract him from his driving or send him and his passengers mad by sounding continuously if he is unable to correct the fault for a long period of time. The system can not be fitted with a manual 'mute' switch, since that would negate the whole purpose of the repeater, which is to prevent the driver from forgetting about the fault. Also, the repeater must not activate when the ignition is first switched on, because the fault lamps always activate at that time anyway.

Warble Alarm

The ETI design team, being a fair bit smarter than the top brains of the motor moguls (we have an average IQ of nearly thirty-five), have come up with a neat solution to these problems. Our repeater sounds instantly when a fault occurs, generating a 30 second pulsed warble-tone signal that immediately attracts the driver's attention. The unit then generates 4-second 'reminder' tone bursts at intervals that initially occur once every 22 seconds, but which slowly expand to one 4-second burst every 2 minutes by the end of a twenty minutes timing period. After 20 minutes the reminder tones cease completely. The unit resets as soon as the vehicle's ignition is turned off, but is disabled for the first sixteen seconds after ignition switch-on, thus ensuring that the alarm doesn't sound at start-up, but does sound shortly afterwards if the fault-warning lights stay on.

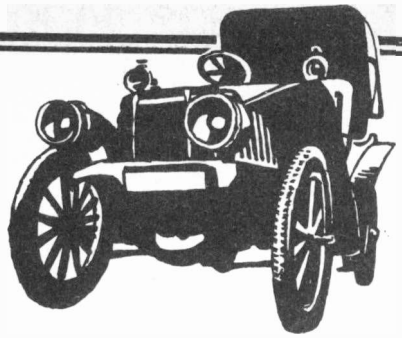
And that's not all that the unit can do. It also acts as an audible repeater for the car's turn-indicators and can accept a wide variety of auxiliary on/off inputs from devices such as low-fuel-level indicators and over-speed detectors, etc.

Cheap and Easy

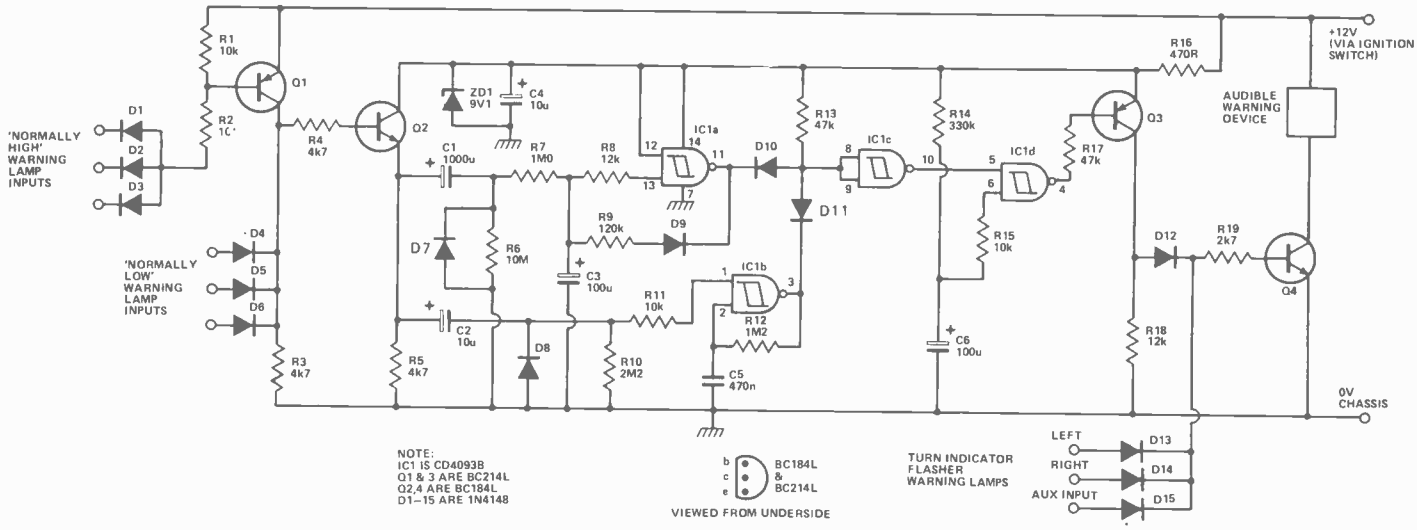
The ETI audible repeater circuit is reasonably inexpensive, and reasonably easy to install in most vehicles. The unit is designed for use in vehicles fitted with 12 volt negative ground electrical systems only.

Construction

All of the circuit (except the audible warning device) is wired up on a single PCB. Note that the PCB holds (amongst other things) fifteen diodes, one zener diode, four transistors and five electrolytic capacitors, so take great care to get the polarities of all these devices correct. When construction is complete, hook the audible warning device into place ▶



Circuit diagram of the Warning Indicator Monitoring System.



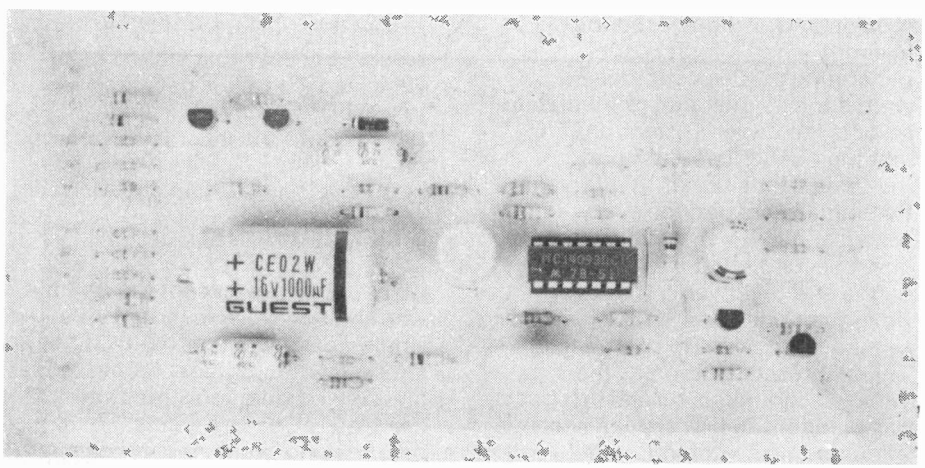
and give the unit a full functional check as follows:

(1) Temporarily short the input of D13 to the 12 volt positive supply rail and then connect the unit to the 12 volt supply. The alarm should operate as soon as the supply is connected and cease as soon as the temporary D13-to-supply short is broken. Repeat the test using diodes D14 and D15.

(2) Temporarily short the input of D1 to the zero volts line and connect the unit to the 12 volt supply. The alarm should activate about sixteen seconds after the supply is initially connected, should cease when the D1-to-zero connection is broken and should start again as soon as the D1-to-zero connection is re-made. Repeat the test using diodes D2 and D3.

(3) Temporarily connect the input of D4 to the 12 volt positive line and then connect the unit to the 12 volt supply. The results of the test should be similar to those obtained in test (2) above. Repeat the test using diodes D5 and D6.

(4) Temporarily short the input of D1 to the zero volts line and connect the unit to the 12 volt supply. Check that the alarm activates about 16 seconds after the supply is connected and then gives the full range of operation described earlier in this article, in which the alarm activates intermittently for about 20 minutes and then remains off.



The completed PCB. Note diode and capacitor polarities.

When the above tests are complete, the unit can be installed in the vehicle.

Installation

Before you start work on the installation, make up your mind as to exactly which lamps you want to monitor (usually the voltage generator, oil pressure and turn-indicator lamps) and then check the connections for these lamps.

Usually, you'll find that the voltage and oil indicator lamps have 'normally high' connections (they are activated by switches connected between the lamp and chassis) and the turn indicator lamp or lamps have 'normally low' connections (they are activated by switches connected between the lamp and positive supply line).

Once you've checked your diagram, installation is simply a matter of connecting the unit to the vehicle's battery via the chassis and the ignition switch and then making the appropriate connections between the vehicle's indicator lamps and the unit's input diodes.

When you install the unit (presumably under the dash panel), make sure that it is located away from areas of high local temperature (the vehicle's heating system, etc).

ETI

HOW IT WORKS

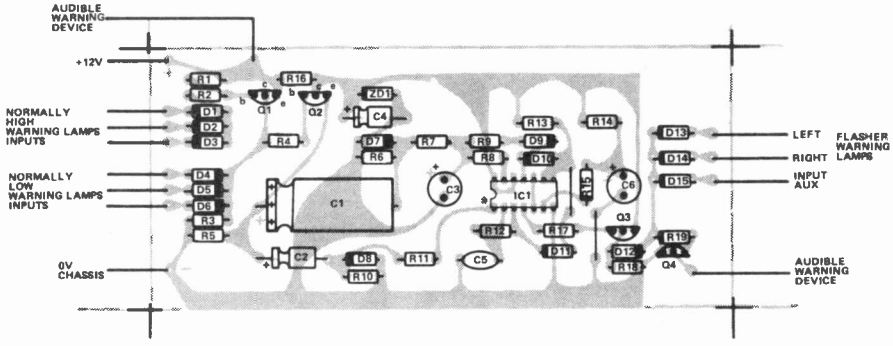
Q1 and Q2 function as a simple input conditioning network which converts OFF and ON lamp inputs to D1-to-D6 into zero and 9-volt levels respectively across R5. When the voltage across R5 switches high, time constant network C2-R10 gates on astable multivibrator IC1b for a maximum period of about 30 seconds (unless R5 switches low in the meantime) and the astable then pulses the unit's audible warning device on and off via D11-IC1c-IC1d-Q3-D12 and Q4 for this period.

Simultaneously, as R5 switches high it activates an asymmetrical voltage-controlled oscillator that is designed around IC1a and which operates as follows. At the moment that R5 switches high C1 is fully discharged (acting like a short circuit), so C3 immediately starts to charge towards the R5 voltage via R7 until, eventually, the R7-C3 junction voltage reaches the upper threshold of the IC1a Schmitt, which then triggers and discharges C3 via R9 and D9 until the R7-C3 junction voltage falls to the lower threshold of the Schmitt, which then reverts to its original condition and allows C3 to start to recharge via R7.

Initially, when the R5 voltage first goes high, IC1a generates a 4-second pulse once every 22 seconds, and this pulse is used to pulse on the unit's audible device via D10-IC1c-IC1d-Q3-D12 and Q4. As time progresses, however, C1 starts to charge up, with the result that C3 charges towards progressively lower and lower aiming voltages via R7 and thus takes progressively longer to charge in each cycle. These charging times finally expand to about 2 minutes after 20 minutes total operating time, after which the C3 voltage is unable to charge to the upper threshold of the Schmitt and the circuit ceases to oscillate.

The outputs of the IC1a and IC1b oscillators are used to activate the audible warning device via, amongst other things, transmission gate IC1d, which is disabled for the first sixteen seconds after initial power-up via C6 and R14, which ensure that the alarm doesn't sound when the vehicle's ignition is first switched on.

Note that the major part of the electronic circuitry is powered from a 9V1 supply via R16-ZD1-C4, which ensure reliable circuit operation under adverse power supply conditions.



Component overlay

PARTS LIST

RESISTORS

R1, R2, R11, R15	10k
R3, R4, R5	4k7
R6	10M
R7	1M0
R8, R18	12k
R9	120k
R10	2M2
R12	1M2
R13, R17	47k
R16	470R
R19	2k7

CAPACITORS

C1,	1000u 16V electrolytic
C2, C4	10u 25V electrolytic
C3, C6	100u 16V electrolytic PCB mounting
C5	470n polycarbonate

SEMICONDUCTORS

IC1	CD4093B
Q1, Q3	BC214L
Q2, Q4	BC184L
D1-D15	1N4148

BUYLINES

The audible warning device used in this project was rated at 12V, 15mA. This can be obtained from major mail order companies that advertise in this magazine, and all the other components are so common even Woolies might sell 'em!

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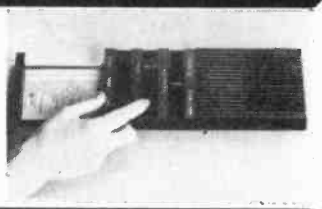

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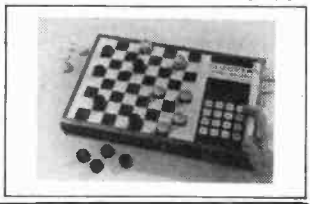
PLAY DRAUGHTS/CHECKERS AGAINST THE COMPUTER



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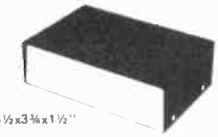

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2N2410	1.40	2N2904A	.31	2N3133	.50	40360	.55	40468A	.70	BC321	.19	BD242C	.62	BF177	.27
2N2411	.80	2N2905	.31	2N3134	.85	40361	.55	40513	1.60	BC322	.19	BD243A	.65	BF178	.27
2N2412	.80	2N2905A	.31	2N3135	.72	40362	.55	40514	1.60	BC327	.20	BD243C	.87	BF179	.33
2N2477	1.10	2N2906	.25	2N3136	.91	40363	1.45	40537	.66	BC328	.20	BD244A	.70	BF180	.37
2N2483	.30	2N2906A	.25	2N3232	1.50	40364	1.45	40543	1.50	BC337	.20	BD244C	.87	BF181	.37
2N2484	.30	2N2907	.25	2N3242	.68	40372	1.15	40b59A	.50	BC338	.20	BD245A	.69	BF182	.37
2N2491	2.40	2N2907A	.25	2N3242A	.90	40373	1.65	BF256/A/B	.29	BC347	.11	BD245C	.85	BF183	.44
2N2613	.90	2N2920	3.30	2N3250	.33	40374	1.65	BF257/A/B	.18	BC350	.11	BD246A	.72	BF184	.41
2N2614	.70	2N2923	.17	2N3251	.39	40389	.70	BF258/A/B/C	.18	BC382	.21	BD246C	.93	BF185	.37
2N2613	.90	2N2924	.17	2N3300	.45	40390	1.05	BF259/B/C	.19	BC382L	.21	BD249A	2.40	BF194	.16
2N2614	.70	2N2925	.19	2N3301	.45	40391	.90	BF260	.17	BC383	.19	BD249C	3.00	BF195	.16
2N2646	1.70	2N2926	.17	2N3302	.39	40392	.70	BF261/A/B	.25	BC383L	.19	BD250A	2.75	BF196	.16
2N2647	1.55	2N3010	1.10	2N3367	1.35	40394	.90	BF262/A/B/C	.26	BC384	.21	BD250C	3.40	BF197	.18
2N2696	1.35	2N3011	.37	2N3390	.50	40395	1.45	BF263/B/C	.28	BC384L	.21	BD433	.44	BF198	.19
2N2711	.30	2N3012	.37	2N3391	.40	40396	1.45	BC264	.65	BC407	.27	BD434	.46	BF199	.19
2N2712	.18	2N3013	.37	2N3391A	.45	40406	.73	BC266/A/B	.34	BC408	.27	BD435	.46	BF200	.38
2N2713	.25	2N3015	.47	2N3392	.17	40407	.57	BC300	.43	BD236	.44	BD436	.46	BF224J	.22
2N2714	.22	2N3019	.55	2N3393	.17	40408	.82	BC301	.43	BD237	.44	BD437	.55	BF225J	.27
2N2848	1.10	2N3020	.75	2N3394	.17	40409	.82	BC302	.37	BD238	.44	BD438	.55	BF238	.55
2N2865	2.20	2N3053	.25	2N3395	.19	40410	.82	BC303	.54	BD239A	.44	BD441	.44	BF240	.24
2N2890	2.50	2N3054	.72	2N3396	.19	40411	3.10	BC304	.60	BD239C	.59	BD442	.44	BF241	.24
2N2891	2.50	2N3055	.75	2N3397	.19	40412	.68	BC307/A/B	.16	BD240A	.49	BD529	.49	BF244A	.38
2N2892	10.00	2N3107	.55	40326	.60	40414	4.99	BC308/A/B	.16	BD240C	.59	BD530	.55	BF244B	.33
2N2894	.50	2N3108	.75	40327	.73	40422	2.20	BC309/A/B/C	.16	BD241A	.49	BD535	.70	BF245A	.44
2N2903	1.60	2N3109	.80	40348	1.10	40440	.70	BC317	.15	BD241C	.65	BD536	.70	BF245B	.44
2N2904	.31	2N3119	4.00	40349	1.45	40467A	1.05	BC318	.14	BD242A	.55	BD537	.74	BF246A	.82

BF246B	.82	BSX61	.53	ME1100	.22										
BF247A	.80	BSX76	.60	ME1120	.27										
BF247B	.80	BSX77	.60	ME3002	.27										
BF255	.26	BSY10	1.10	ME4001	.16										
BF256	.26	BSY24	.52	ME4002	.16										
BF257	.35	BSY25	.65	ME4003	.16										
BF258	.35	BSY26	.55	ME4101	.11										
BF259	.35	BSY27	.55	ME4102	.11										
BF262	.66	BSY28	.44	ME4103	.11										
BF263	.75	BSY29	1.10	ME4104	.11										
BR101	.55	BSY38	.33	ME6001	.16										
BRY30	.55	BSY39	.33	ME6002	.16										
BRY39	.55	BSY51	.33	ME6003	.16										
BRY56	.38	BSY52	.33	ME6101	.22										
BSW41	1.65	BSY53	.33	ME6102	.22										
BSW66	.90	BSY54	.36	ME8001	.22										
BSW67	1.09	BSY65	.45	ME8002	.22										
BSW70	1.65	BSY78	1.00	ME8003	.22										
BSX19	.35	BSY79	1.42	ME9001	.22										
BSX20	.35	BSY95A	.37	MR9002	.22										
BSX21	.35	ME0414	.22	MJ400	1.45										
BSX26	.88	ME0461	.27	MJ430	1.45										
BSX27	.82	ME0462	.27	MJ481	1.70										
BSX29	.53	ME1001	.17	MJ490	1.49										
BSX39	1.20	ME1002	.17	MJ491	2.10										
BSX60	.71	ME1075	.22	MJ901	2.45										

PRESET POTENTIOMETERS-TRIMMERS

PT10 SERIES (FULLY ENCLOSED) **13p**
PT10h (2.5) vertical mounting 0.15 watt at 40°C.
PT10V horizontal mounting 0.15 watt at 40°C.
Tol. 20%. Please specify horizontal or vertical.

PT15 SERIES (FULLY ENCLOSED) **15p**
PT15 Nh vertical mounting 0.3 watt at 40°C.
PT15 Nv horizontal mounting 0.3 watt at 40°C.
Tol. 20%. Please specify horizontal or vertical.

VALUES AVAILABLE: PT10 and PT15. 100R, 250R, 500R, 1k, 2.5k, 5k, 10k, 25k, 50k, 100k, 250k, 500k, 1M, 2.5M, 5M, 10M

CAPACITORS — 100s OF TYPES IN STOCK — see catalogue

POLYESTER MULLARD C352 (280) SERIES

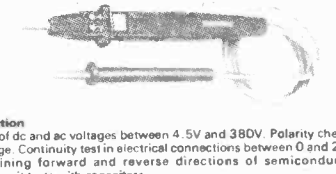
	Price		
UF		0.15	£0.08
0.01	£0.06	0.22	£0.09
0.015	£0.06	0.33	£0.13
0.022	£0.06	0.47	£0.14
0.033	£0.06	0.68	£0.20
0.047	£0.06	1	£0.24
0.068	£0.07	1.5	£0.36
0.1	£0.08	2.2	£0.37

LINEAR (See catalogue for full range)

TAA263	£1.35	TCA830S	£1.80	LM7018	£2.99	LM7815KC	£1.56
TAA300	£3.70	TCA900	£1.05	LM701C	£2.99	LM7824KC	£1.56
TAA521	£1.10	TCA910	£1.20	LM702C	£0.81	LM78L05CZ	£0.30
TAA522	£1.65	TCA940	£1.90	LM703LN	£1.15	LM78L12CZ	£0.30
TAA550	£0.48	TCA980	£3.19	LM709CN	£0.70	LM78L15CZ	£0.30
TAA611B	£2.30	TDA1002	£2.10	LM709-8	£0.50	LM78L24CZ	£0.30
TAA621	£2.50	TDA1004A	£3.33	LM709-14	£0.49	MC667P	£2.75
TAA661A	£1.65	TDA1005	£3.58	LM710CH	£0.67	MC671P	£1.75
TAA661B	£1.45	TDA1022	£7.50	LM710-14	£0.48	MC672P	£1.75
TAA790	£1.65	TDA1024	£1.24	LM711CN	£0.48	MC724P	£2.10
TAA700	£3.50	TDA1034	£4.75	LM716	£1.00	MC789P	£1.80
TAA930A	£1.45	TDA2020AD	£4.50	LM723CH	£0.62	MC790P	£3.10
TAA930B	£1.45	TDA2522	£3.50	LM723C-14	£0.45	MC798P	£2.20
TBA120	£0.80	TDA2530	£2.90	LM741CH	£0.50	MC799P	£2.28
TBA331	£0.90	TDA2540	£3.84	LM741C-8	£0.30	MC832P	£0.70
TBA341	£0.95	TDA2541	£3.30	LM741C-14	£0.60	MC833P	£0.70
TBA395	£1.80	TDA2560	£3.40	LM747CN	£0.78	MC836P	£0.82
TBA396	£1.20	TDA2571	£3.45	LM748-8	£0.50	MC837P	£0.82
TBA400	£2.20	TDA2581	£2.85	LM748-14	£0.50	MC838P	£2.35
TBA440	£1.80	TDA2590	£3.70	LM900	£0.50	MC840P	£1.65
TBA510	£1.76	TDA2600	£4.10	LM911	£0.50	MC844P	£0.70
TBA520	£2.60	TDA2610	£3.10	LM921	£0.50	MC846P	£0.70
TBA520Q	£2.70	TDA2611A	£1.80	LM923	£0.50	NTE6001N	£1.30
TBA530	£2.35	TDA2640	£2.70	LM1303N	£1.15	NTE6003N	£3.08
TBA530Q	£2.45	TLD80CP	£0.85	LM1304N	£1.52	NTE6008KE	£1.95
TBA540	£2.60	TLD81CP	£0.42	LM1305N	£1.52	NTE6013N	£2.04
TBA540Q	£2.70	TLD82CP	£0.80	LM1307N	£1.22	NTE6013NO	£1.72
TBA550	£3.60	TLD83CN	£1.10	LM1310N	£2.10	NTE6018KE	£1.90
TBA550Q	£3.80	TLD84CN	£1.45	LM1391N	£1.30	NTE6023N	£2.05
TBA560C	£2.95	LM339N	£0.60	LM1458N	£0.45	NTE6023NO	£1.72
TBA560Q	£3.00	LM340T-5	£0.88	LM1496N	£0.97	NTE6033N	£3.08
TBA570	£2.10	LM340T-12	£0.88	LM1800N	£1.94	NTE6110N	£1.30
TBA570Q	£2.20	LM340T-15	£0.88	LM1801N	£2.25	NTE6115N	£1.65
TBA641B	£3.00	LM340T-24	£0.88	LM1808N	£2.10	NTE6116N	£1.80
TBA651	£2.50	LM341P-5	£0.56	LM1812N	£6.20	NTE6131N	£1.30
TBA673	£3.20	LM341P-12	£0.56	LM1820N	£1.16	NTE6226N	£2.56
TBA700	£2.20	LM341P-15	£0.56	LM1818N	£1.90	NTE8227N	£1.60
TBA750	£2.35	LM341P-24	£0.56	LM1830N	£1.90	NTE6228N	£1.85
TBA750Q	£2.45	LM345K	£6.97	LM1845N	£1.50	NTE6477N	£2.30
TBA790A	£1.75	LM348N	£0.95	LM1848N	£1.98	NTE6530N	£1.50
TBA800	£1.30	LM350K	£6.50	LM1850N	£1.90	NTE6532N	£2.28
TBA810S	£1.30	LM358N	£0.60	LM1889N	£2.50	NTE6533N	£2.17
TBA820	£0.80	LM360N	£3.00	LM1890N	P.O.A.	NTE6544N	£1.88
TBA920	£2.99	LM370N	£3.30	LM2907N-8	£1.80	NTE6545N	£1.80
TBA920Q	£3.09	LM371H	£2.35	LM2917N-8	£1.80	NTE6546N	£1.88
TBA990	£2.75	LM373N	£3.35	LM3301N	£0.60	NTE6550-2	£0.57
TBA990Q	£3.00	LM374N	£3.35	LM3302N	£0.55	NTE6552-2	£0.57
TCA105	£1.49	LM377N	£1.80	LM3401N	£0.55	NTE6570N	£2.18
TCA150	£1.80	LM378N	£2.40	LM3900N	£0.68	NTE6620AN	£1.30
TCA160C	£2.66	LM379S	£4.25	LM3905N	£1.15	NTE6650N	£1.58
TCA220	£2.10	LM380N-8	£0.96	LM3909N	£0.78	NTE6660N	£0.87
TCA270S	£2.99	LM380N-14	£1.08	LM3911N	£1.10	NTE6666N	£0.99
TCA440	£1.65	LM381AN	£2.70	LM3913N	P.O.A.	SO41P	£1.35
TCA640	£3.45	LM381N	£1.69	LM3914N	£2.75	SO42P	£1.35
TCA650	£3.45	LM382N	£1.32	LM4250CH	£1.30	TAD100	£2.00
TCA6608	£3.45	LM384N	£1.55	LM78L05CH	£0.85		£0.90
TCA730	£3.80	LM386N	£0.88	LM78L12CH	£0.85		
TCA740	£3.80	LM387N	£1.10	LM78L15CH	£0.85		
TCA750	£2.60	LM388N	£1.00	LM78L24CH	£0.85		
TCA800	£3.75	LM389N	£1.00	LM7805KC	£1.56		
TCA800Q	£3.95	LM392N	£0.87	LM7812KC	£1.56		

UNIVERSAL VOLTAGE TESTER

The 2 pole combitester is a universal voltage and continuity tester with incorporated battery. This combitester allows testing of dc and ac voltages from 4.5V to 380V. Continuity tests of electrical connections between 0 to 20 kΩ can be performed by pressing the red button, built into the handle of the tester. Display is by means of LEDs. The Siemens combitester has been tested to VDE standard 0425/1.73 and has the VDE symbol.



Application
Testing of dc and ac voltages between 4.5V and 380V. Polarity check for dc voltage. Continuity test in electrical connections between 0 and 20 kΩ. Determining forward and reverse directions of semiconductors. Short-circuit tests with capacitors.
4.5 to 380V **Price £10.50**
Also available without battery as voltage tester only . . . . . **Price £4.75**

audiophile

How to begin reviewing a pickup and end up living in a Sony showroom. Ron Harris explains an easy way to turn an article into an epic.

A COUPLE OF LITTLE things to begin with. In fact *very* small things. Well actually even smaller than that. Micro in fact.

JVC have ('inevitably' did I hear from that man at the back?) entered the miniature hi-fi market in a big (small?) way. Their T-M1 and A-M1 (tuner and amplifier) measure only $3^{11}/_{16} \times 9^{1}/_{16} \times 10^{7}/_{16}$ — otherwise known as 93 × 230 × 259mm. Which means that stacked together they are smaller than this page.

Mini-Spec.

Their performance (on paper) looks very impressive. Fifty RMS watts for the AM-1 at 0.03% THD across 20-20kHz with excellent S/N ratio and overload figures. The T-M1 too has the zeros in all the right places on the spec. — IF rejection 90dB, separation (1kHz) 50dB, frequency response 30-15kHz (—1.0dB; THD 0.08%, sensitivity 0..9uV etc. It has digital tuning too.

All very impressive. I'm hoping to lay a hand — or more appropriately a finger or two — on these £306 matchboxes soon to see if they *sound* that good.

●

Caption Hold Up

Due to the state the postal services have been in lately, I decided to hold up closing the Audiophile caption competition, and publish the results next month instead. Entries are still coming.

With a bit of luck Felicity Kendal might enter.

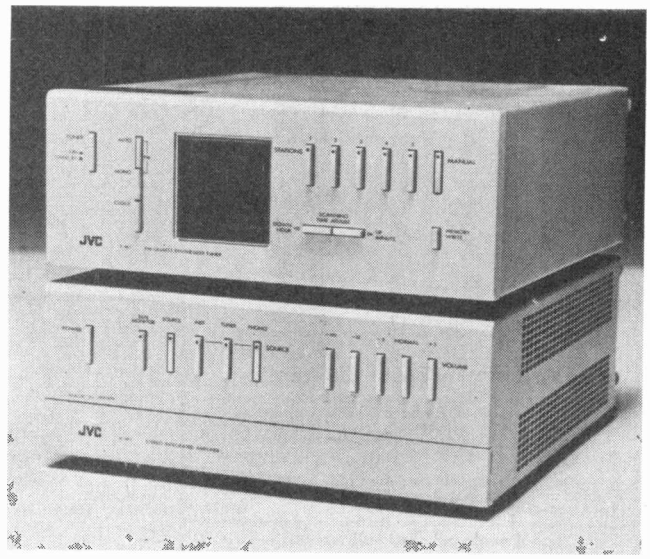
Apparently Marantz *were* at that show, and it was either that they hid when they saw us coming — or much more likely we couldn't see the wood for the trees. Sorry lads. Still, thanks to their press agency and their nice photo we got an amusing competition out of our blindness.

●

Some Sony Day

It all started out as a simple enough review job on the new XL-55 Pro moving coil cartridge. When the dust settled I'd got THREE moving magnet units, a very good turntable and a head amp to deal with — oh yes, and the XL-55 of course.

The more normal cartridges came about simply out of curiosity. Not having lent an ear to Sony pickups before I was interested to see how they'd compare to the more Western approach.



JVCs matchless matchboxes.

The record deck and head amp are utterly and totally the XL-55's fault. Or rather its designer. Anyone who designs a cartridge for this high a fi and then makes sure it won't fit into an SME, Hadock or Grace pickup arm wants his coils seeing to. Of course it fits Sony arms perfectly.

The connector is a standard SME type, but the cartridge DOES NOT come out of the headshell. It is part of it. Lunacy. Absolute Eastern lunacy. Mind you Sony UK were very nice about it:

Sony UK (being helpful): XL55 Pro for review? Certainly. What arm are you gonna use?

Me (confidently): No problems, SME Series III.

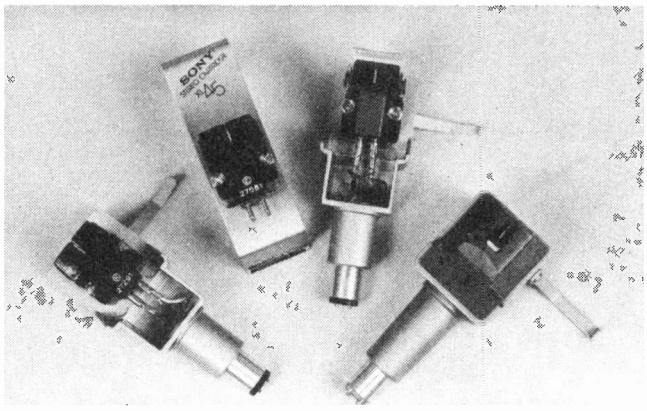
Sony UK (tactful and gently): Oh! That one? Only our XL55 doesn't fit that you see . . .

Me (still confident): But EVERYTHING fits an SME . . . doesn't it?

Sony UK (delivering punchline): Not the XL55. You see it's part of its own headshell. . . .

And so it came to pass that there was delivered unto Audiophile a PSX-60 and yet they knew not its virtue! (Never having heard of it before).

Below: the self sufficient PSX-60.



Four little pickups sitting in a row. On the right the massive XL55.

Tables Which Turned

So lets begin there. A paragraph or so on the PSX-60 is undoubtedly in order as it turned out a very satisfying piece of machinery to use. It possesses a deceptively low mass arm with good bearings and nice adjustment for bias and arm height. Both of these parameters simply 'dial on'.

The finish is immaculate (as usual) and the cover beautifully made, with the controls outside once closed. There is a repeat facility included but for the life of me I still can't see anyone ever using it.

My only gripe concerns the turntable itself. It produces a better ring than Bow Bell. The mat provided is very thick and suitably dense, but still contains those curious channels so beloved of manufacturers.

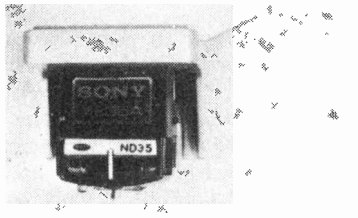
Once the mat is on the platter is reasonably damped — but how much better would it have sounded had it not been so resonant in the first place?

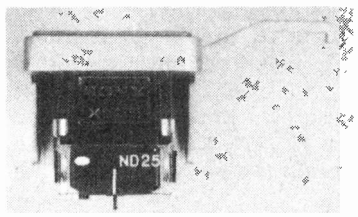
To combat those ribs I used the mat upside down all through, and in this admittedly curious manner the whole system turned in a very creditable subjective performance, managing to preserve detail exceptionally well for its price bracket and with a good solid bass. What a shame about that platter. . . .

The arm is good enough to take some excellent cartridges, but the mass is such that I cannot advise using anything with a compliance higher than 30cu else evil may befall you amid the LF!

This of course means the PSX-60 is ideal for moving-coil cartridges which is undoubtedly why Sony sent it to me! Inscrutable these Orientals.

Recommended then.





Moving Onto Moving Magnets

A quick glance down the specs table gives you a good idea of where these three cartridges lie in the market. All are low-compliance typesl to suit the Japanese passion for pickup arms you could dig gardens with no doubt.

In terms of frequency response all three manage 20-20 kHz ± 3dB, with the 45 being the tightest on a straight line. However all three do possess a 'suck-out' in the region from 3 kHz to about 15 kHz. Curious this, almost old fashioned in as much as most manufacturers eliminated this from their designs in the wake of Shure and their V15 III.

Best tracking performance (SME clad) was obtained at 1.3g (XL45), 1.7g (XL35), 1.7g (XL25). Line contact rules OK? Comparisons were made against the Shure V15 IV and Goldring G900SE II — still the best two moving magnet designs in my opinion.

After individual listening tests, all three were used to make up a tape on the EL7 Elcaset of various pieces of music, so that a long program of comparison was possible. Recording tracks, and alternating cartridges gives a much better 'instant answer' to what differences exist between units than laboriously playing the same piece over and over.

Besides which it is a hell of a lot easier and more pleasant — and I'm an *expert* in being lazy!

Impressions:—

XL 25

Came out sounding rather lifeless, I tend to think that upper-mid droop is showing a little! It is easy to listen to however, and would suit budget system well, maybe taking some of the 'sting' out of over enthusiastic speakers! Good bass.

XL35

Very nice overall really. Caught out by several 'difficult' tracks, suffering some break-up in the process. Well controlled lower octaves, maybe a bit edgy with high level treble, though only appeared so in direct comparisons. Excellent detail and imaging for its price. ▶

Below: specifications for the whole set of Sony pickups. Manufacturers figure

TABLE ONE

		XL55PRO	XL45	XL35S	XL25
TYPE		Moving Coil	Moving Magnet		
STYLUS		Elliptical	Line Contact	Elliptical	Elliptical
OUTPUT	(1KHz,5cm/sec)	0.2mV	3mV	3mV	4mV
COMPLIANCE	($\times 10^{-6}$ cm/dyne)	15	20	15	15
TRACKING FORCE		2g	1.5g	1.5g	1.5g
CHANNEL BALANCE	(at 1KHz)	<1dB	<1dB	<1dB	<2dB
SEPARATION	(at 1KHz)	>30dB	>30dB	>28dB	>20dB
WEIGHT		22g	5.5g	5.5g	5.2g
APPROX RETAIL PRICE		£90 (inc) (headshell)	£42	£35 (inc) (headshell)	£25

XL45

Good tracker. Very forward presentation appearing very detailed at first. Could be pushed into over-brightness by the recording very easily. Firm bass. Good if care taken regarding balance of supporting system. Too expensive!

All three are very competent designs, and were they priced some £10-£15 lower would get the Audiophile stamp of recommendation! At their present price though, I feel only the XL35s, complete with its headshell, represents good value. Sony have got the balance between price and performance slightly off centre I feel.

My thanks to Paul Edwards for his assistance with this report.

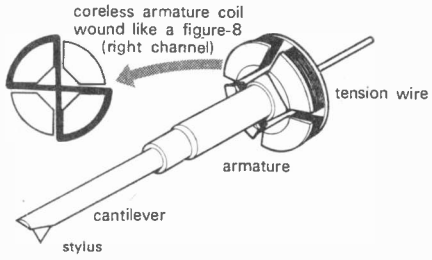
Long And Winding . . .

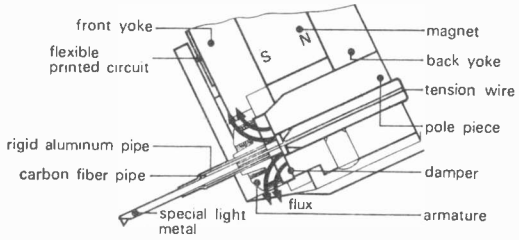
And so to the XL55 Pro itself. Setting this up in the PSX60 couldn't be easier. Literally it just pushes in! Since it weighs an arm-bending 22g including that integral (turtle)shell, Sony provide an extra counterweight to balance out the mass. Skylab had nothing on this. I shudder to think what the *effective* mass of this little lot must be.

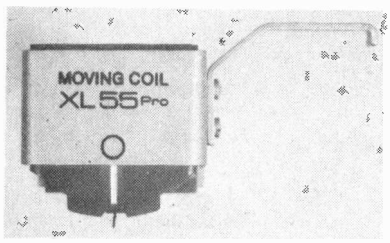
That headshell at least ensures a rigid mounting and hence resonance suppression to some extent, and with the compliance down at 15cu the mass is not a real problem in practice except if your records are warped, dished or otherwise liable to start this mass moving in a direction it shouldn't!

The cantilever itself is composed of beryllium, carbon fibre and aluminium in an attempt to control resonance modes within the structure, and as the drawing shows it is no simple construct.

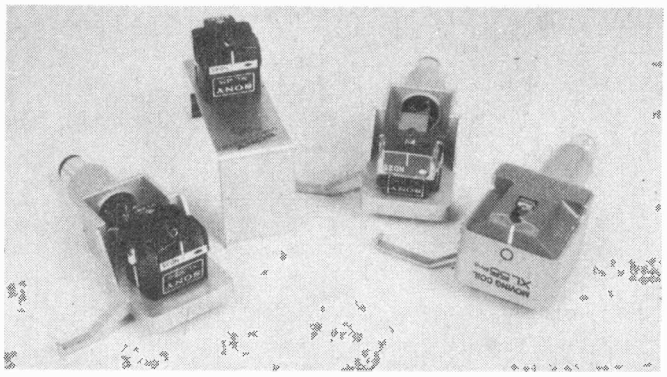
Witness also the novel coil configuration which Sony claim endows their baby with very low distortion. Interesting to see they've used a flexible PCB in there.







Top: coil configuration is a novel figure of eight.
Above: internal details of the cartridge.



Those cartridges again! Note the XL55 is part of its head shell.

Above and right: the excellent HA55. Witness the very high standard of construction.

Up In Arms

Set up in the PSX60 the XL-55 tracked best at 1.9g above which no improvement could be obtained. A fairly high bias setting was required.

None of the moving-coil flock are particularly brilliant trackers anyway, and the XL-55 sets no world records here — albeit a very competent performer which was only caught out once or twice by tortuous modulation levels.

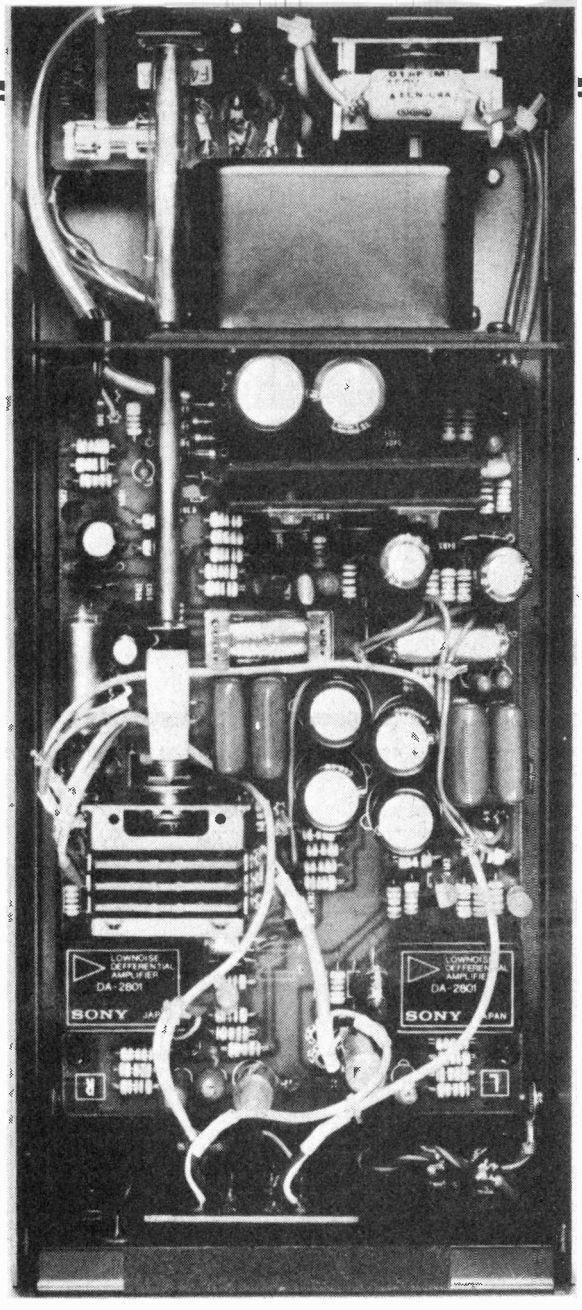
First auditions were carried out with a Lentek head amplifier — and sounded absolutely awful! The image never really existed, bass was loose and ill-defined and there was about as much detail in the sound as there is news in the Sun.

Something somewhere does not match something somewhere else. Accusing fingers surround the Lentek which is promptly banished, and enter the HA-55 (Sony). (By now my living-room looks like a Sony showroom gone berserk.)

Set the HA-55 to 40 ohm input, switch on and — at last — smooth detailed sound from the XL-55 Pro! This is definitely more like it. Being of a naturally warped mind though I couldn't leave it there. If the Sony cartridge doesn't match the Lentek amp, will the Entré 1 cartridge behave with Sony amp?

More changing of leads, screws and cusses proved that it does. So does the Coral 777EX. In fact both these units sounded more open through the Sony than they did with their own step-up devices.

Draw your own conclusions.



Gone Home?

By now I wouldn't blame you for having given up all hope of ever finding out anything about the XL-55. For those brave souls still with me (and awake), however, it sounds very good.

Comparing it to both the G900SE II and the Entré shows it to be excellent in the upper-mid range and good at the top, but to lack an extended bass. The bass that is there is well defined, and nicely controlled, but against the others I felt slightly cheated of that gut-moving last octave.

This didn't seem to bother anyone else who heard it, and it certainly did not spoil my enjoyment of the music. Indeed unless you have excellent loudspeakers of room-dominating dimension, you're not gonna miss much.

Overall I rate the XL-55 one of the best moving-coil units I've heard, and certainly well worth its price. I feel it does not outperform say the Entré for example, but it is well worth shortlisting along with the more publicised names, which it *does* better, if you're shopping in this market.

The HA-55 gets five gold stars and an asterisk all to itself, for an absolutely amazing noise performance and a superbly transparent sound. ETI

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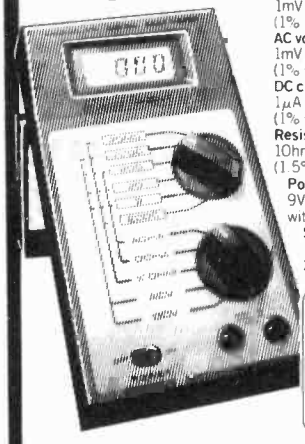
22–198



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AC volts:
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DC current:
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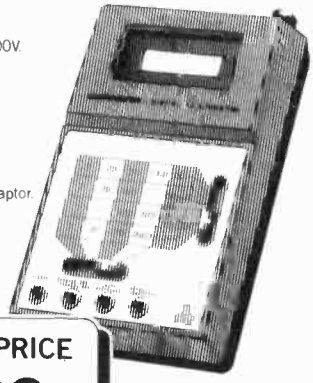
2000 KOHM.
Power source:
9V battery or AC adaptor.
Size:
37 x 85 x 130 mm.
22–197



PRICE 39.93

COMPONENTS AND PARTS

CAT No.	DESCRIPTION	PRICE
276–032	LED	4 for 69p
276–033	LED	2 for 48p
276–034	LED	2 for 59p
276–142	Infra-Red Emitter Detector Pair	£1.37
277–1003	12V DC Automotive Digital Clock Module	£17.52
276–9110	6 pin edge connector for 277–1003	40p
276–1373	Power Transistor Mounting Hardware	50p
276–1363	TO–220 Heat Sink	60p
276–1364	TO–3 Heat Sink	81p

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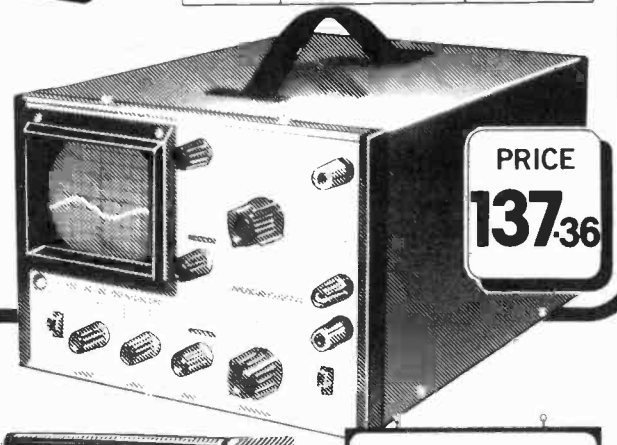

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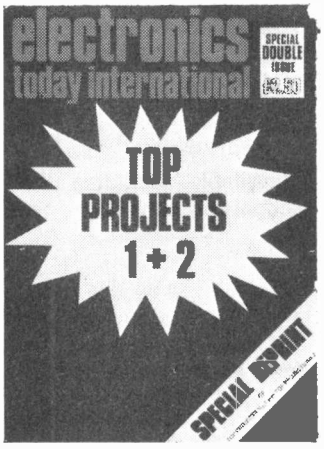

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Book 4: £1.00 + 25p P&P.

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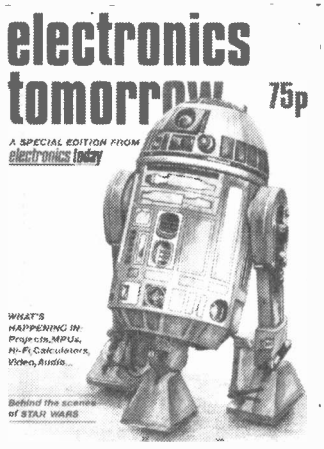

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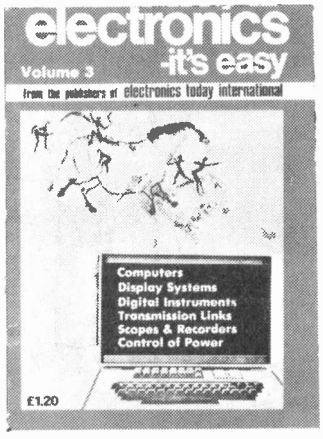

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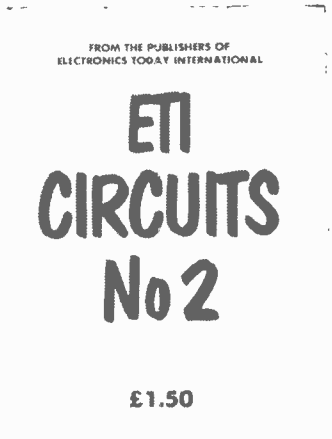

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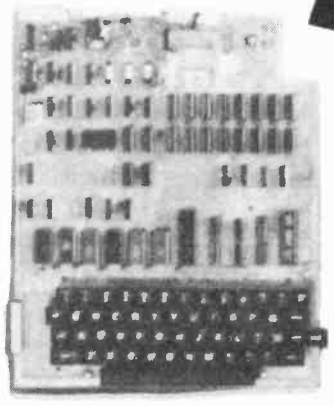

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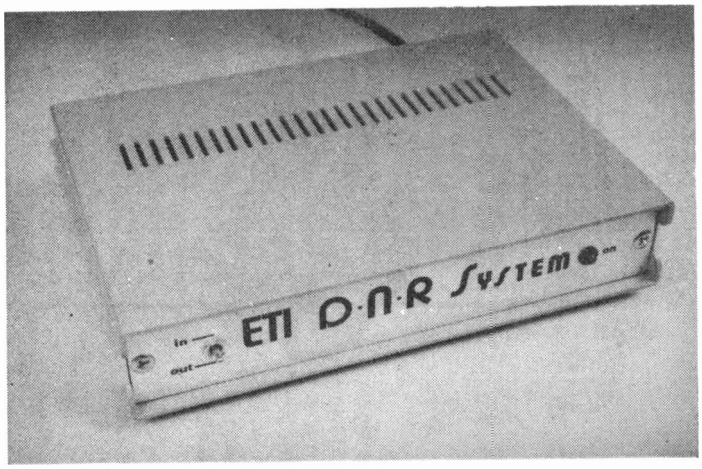
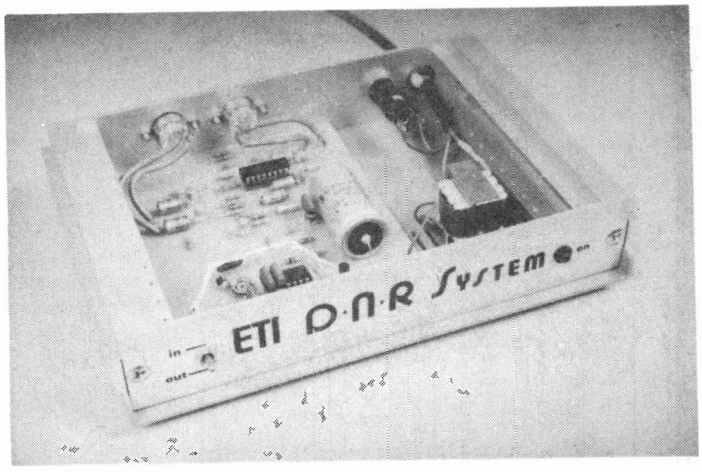
DYNAMIC NOISE FILTER

Not content with eliminating record clicks as if by magic — the project boys have now found a neat way of reducing tap hiss.





THE HUMAN BRAIN IS a funny thing really! Its connections to the outside world are via the five senses and it relies on these senses to transmit reliable and accurate information about the outside world. However, as you are probably aware, this information can quite often be distorted (think of the countless optical illusions).

Missing Links.

It is not so often that audio illusions are in the news, probably because they are harder to detect, but that doesn't mean they don't exist, eg. The fact that the ear cannot detect small gaps, say 5 mS, in a passage of music allowed us to build the click eliminator. Every time a click (which always have a duration of less than 5 mS) is detected, the sound is automatically cut out for about 5 mS. The final effect being one of apparent continuity of music without the gaps or clicks.

Hissed Up.

Our tape hiss reduction system functions on the principle that on a continuous passage of music the difference between the music and the hiss (signal / noise ratio) is so great that we cannot hear the hiss for the music. All well and good. On a more spasmodic piece of music, where there are gaps of more than say 50 mS between signals, then these gaps have (apparently) a much lower signal / noise ratio, not because the noise level has gone up, but because the signal level has gone down. This means that the hiss is more pronounced.

During these time intervals our device filters out the high frequency tape noise using a current controlled filter (CCF) — immediately allowing high frequency sound through again when a signal comes along. (The illusion of one type of sound covering up another of about the same frequency is called masking.)

Construction

Printed circuit board construction should be relatively straightforward. We suggest a step by step approach be adopted and testing of each stage be undertaken before construction of the following stage. The main reason for this is that the circuit, although having few components, is quite tricky in operation and this makes fault-finding difficult in cases of malfunction.

First, build up the on-board power supply section (D3, D4, C17, C18, IC3, R28 and LED 1). Check with a voltmeter for 12 V DC at its output ie, between the output of IC3 and ground. If the LED lights up it is a good indiciation that the supply is working correctly.

Next the buffer amplifiers and associated components (C1, C2, R1, R2, R3, R4, R20, R21, C11, Q1 and Q2) should be inserted. If a signal source and scope are available put signals at the inputs to the circuit and observe the signals at the emitters of ▶

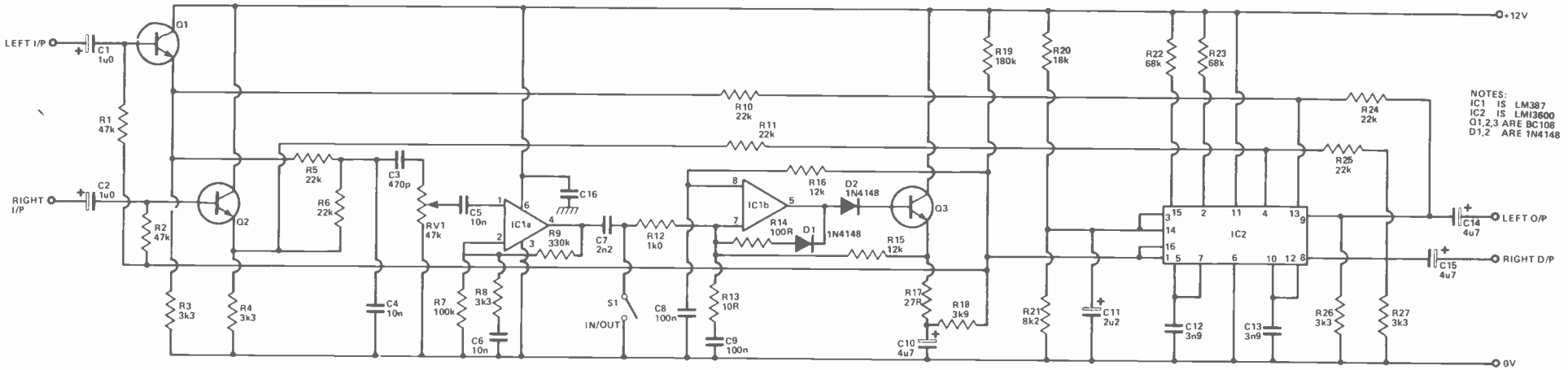
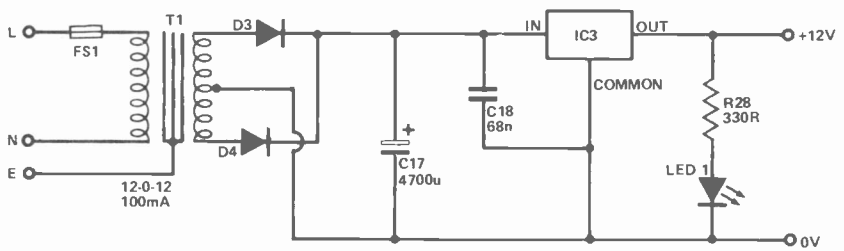


Fig. 1. Circuit diagram of the dynamic tape noise reduction system.

Fig. 2. The power supply.



Q1 and Q2. They should be the same as the transistors are operating as non-inverting buffers.

Following this, the control circuitry (consisting of R5, R6 through to Q3, R17 and C10 on the circuit diagram) should be soldered in place and this tage now tested. With RV1 at mid-position and a high impedance voltmeter or a scope in DC mode connected across C10, it should be seen that the voltage across the capacitor varies with varying signal input. If an audio waveform from, say, a cassette deck is used as a signal, then the voltage should be seen to increase with the higher frequencies (above about 7 kHz) but stay quite low for frequencies below this. Adjusting RV1 should adjust the overall voltage range across the capacitor.

Finally, IC3 and the rest of the components can be inserted and the complete board tested and set up. The signal at the output should be of tghe same amplitude as that at the input. ▶

HOW IT WORKS

The device consists of two buffer amplifiers, two current controlled low-pass filters and control circuitry to detect the presence of a signal. The current produced by the control circuit is used to vary the bandwidth of the CCF to allow the signal through ie when sufficient signal is present to be able to mask the noise, the lowpass filter frequency range covers the whole audio spectrum — however, when there is little or no signal and the noise appears louder then the filter's lowpass range is lowered to a minimum of approximately 1 kHz. The noise is effectively filtered out.

As soon as a signal in the same frequency range as the noise comes along (ie above 7 kHz) the control circuit detects it and applies current to the CCFs thereby increasing the frequency range, allowing the signal through.

The buffer amps are built around the two emitter follower transistors (high I/P impedance — low O/P impedance) and the CCFs around IC2, the LM 13600 which is a new National chip, a dual operational transconductance amplifier. Resistor R19 applies a fixed current to control pins 3 and 14 of the chip, fixing the minimum bandwidth at 1 kHz. The greater the current into these pins the greater the frequency bandwidth.

The control current itself is obtained from the voltage across C10 by connection via R18. As V_{C10} increases then by Ohm's law the current I_{R19} must also increase. The energy stored on C10 is provided from IC1b and Q3, etc. connected as a peak detector. AC into this part of the circuit gives DC out to C10. The values of R17 and C10 are chosen to allow a fast attack time (something under 1 mS) and a comparatively slow decay time (about 40 mS).

IC1a is a mixer, bandpass filter, amplifier. It mixes a sample of signal from both channels via R5 and R6, filtering out frequencies below about 7 kHz, so that only signals with the same general frequencies as that of tape noise will affect the CCFs, and amplifies the signal with a gain of 100.

RV1 adjusts for different noise levels, dependent on a particular tape unit.

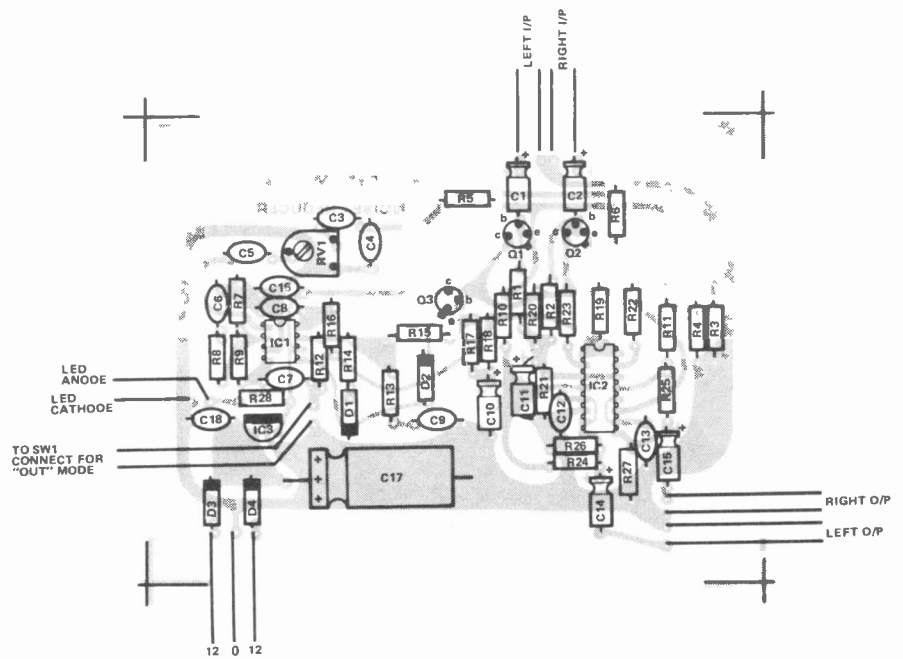


Fig. 3 (left): The component overlay for the Dynamic Noise Filter system.

Note that the power supply circuit as shown in Figure 2 is included on this board, and the input 12-0-12 comes straight from the transformer.

As the system is mainly based on just two IC's sockets are heavily recommended!

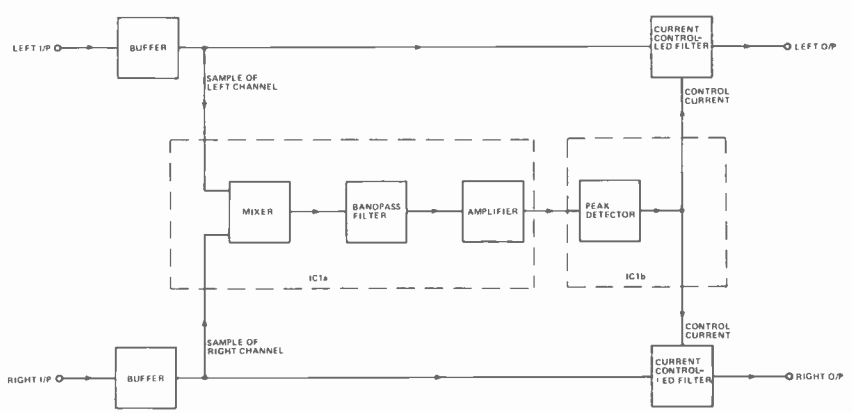


Fig. 4 (left): Block Diagram to the Dynamic Noise Filter project.

Not shown on this simplified diagram is the in/out (bypass) switching. This operates by grounding the output from the first stage.

Such operation will thus prevent the peak detector from operating the filter stage and thus leave a full bandwidth at the output regardless of input level.

PARTS LIST

RESISTORS 'all ¼W 5%'

R1, 2	47k
R3, 4, 8	3k3
R5, 6, 10, 11, 24, 25	22k
R7	100k
R9	330k
R12	1k
R13	10R
R14	100R
R15, 16	12k
R17	27R
R18	3k9
R19	180k
R20	18k
R21	8k2
R22, 23	68k
R26, 27	3k3
R28	330R

POTENTIOMETERS

RV1	47k

CAPACITORS

C1, 2	1u0 electrolytic
C3	470p ceramic
C4, 5, 6	10n polyester
C7	2n2 polyester
C8, 9, 16	100n polyester
C10, 14, 15	4u7 electrolytic
C11	2u2 electrolytic
C12, 13	3n9 polyester
C17	4700u electrolytic
C18	68n polyester

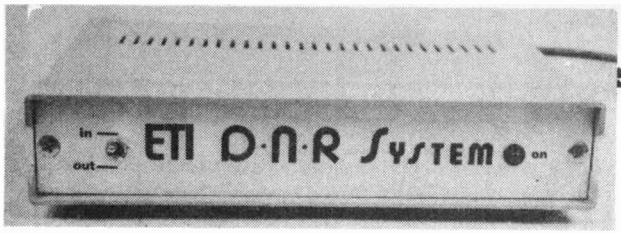
SEMICONDUCTORS

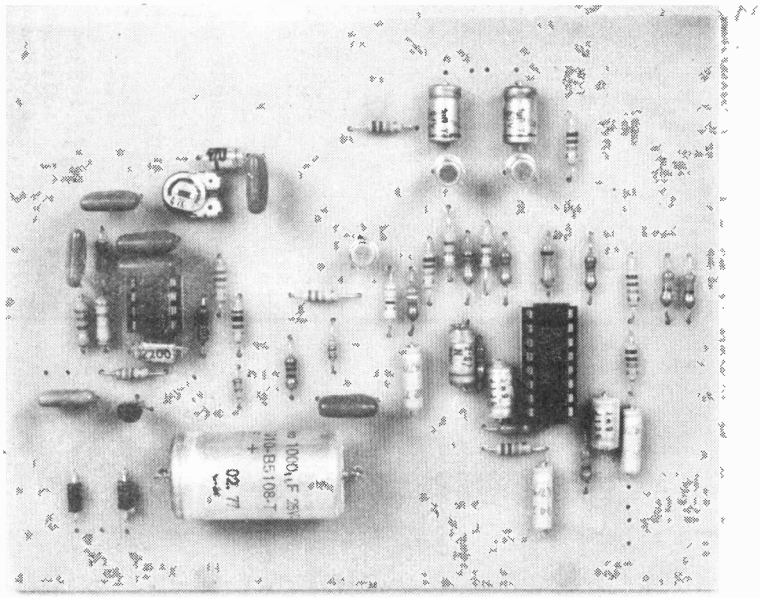
IC1	LM387
IC2	LM13600
IC3	78L12
Q1, 2, 3	BC108
D1, 2	1N4148
D3, 4	1N4001
LED	TIL220

MISCELLANEOUS

T1	12-0-12 c.t. secondary

FS1 + holder, spot toggle switch, case to suit.

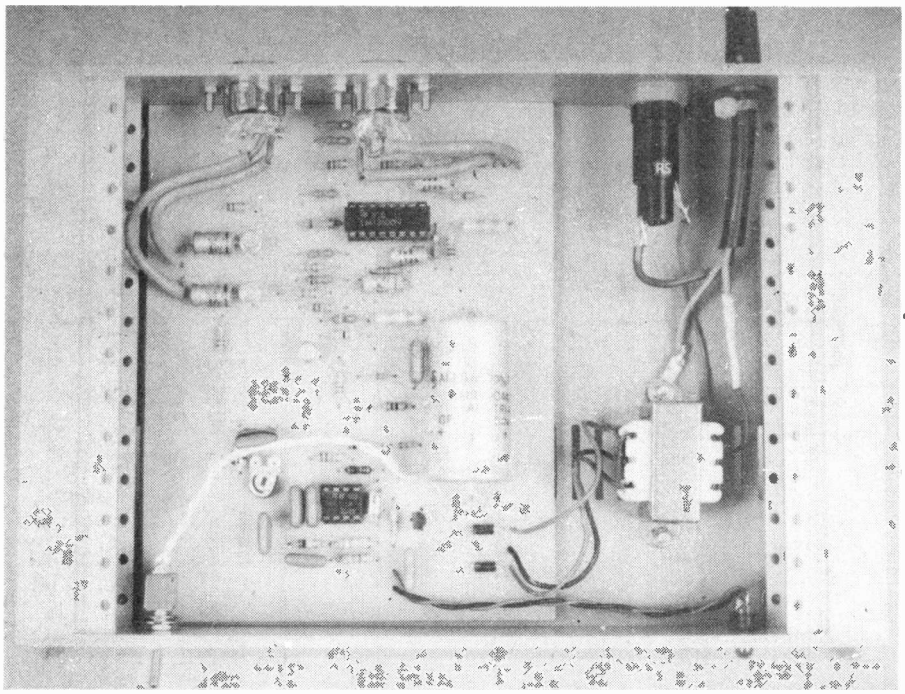




Right: Close-up on the board — the only board — for the Filter project.

Using this in conjunction with the component overlay shown overleaf should identify all the component positions, and make sure you don't get any polarised components in the wrong way round.

The holes are leadout positions, and if you're left with any over don't call us . . . .



Left: Where to put the board once you've assembled it!

Note that only the transformer is mounted off board. This may need turning from side to side to obtain that elusive minimum hum orientation!

Use screened leads to connect signal sockets to the printed circuit boards.

Setting Up

Once you are sure that everything is working correctly, then setting up is a very simple job. Erase a section of tape and play it back through the unit. Take the output from the unit and amplify it.

Turn RV1 completely anti-clockwise and listen. Slowly turn the preset clockwise until there is a barely perceptible increase in hiss noise. Then, step it back just a fraction, so that the hiss just goes. The device is now set for the tape unit and use with any other tape will require resetting.

A final setup test can be carried out, if necessary, with a signal generator plus an oscilloscope. With an input of about 500 mV, the bandwidth of the device should be up to about 25 or 30 kHz. However, an input of 50 mV should give an output bandwidth of only 6 kHz.

ETI

BUYLINES

Always on the lookout for new housing products we have come up with a really neat case for this project. Introduced by Lektrokit Ltd, Sutton Industrial Park, London Road, Earley, Reading, Berks, RG6 1AZ, and nicely priced at £8.53+20% VAT and P&P, type L20 from the Transistek range, this should house your system in style.

The two integrated circuits in the system should be available from any of the larger mail order firms advertised in ETI.

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SUPERSAVER 2 Hybrid Systems DAC 371-8 (8-bit) DIL packaged + data, ideal MPU users, brand new £2 price smash! now £1.75 each (fraction of original cost) p/p 20p.

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SUPERSAVER 4. RS338-383 miniature decade thumbwheel switch £1.35 p/p 20p.

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DATA

Note: In this section all data books are subject to 8% VAT. For postage see 'Terms' at top of page.

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c100 page CDP 1802 MPU User Manual [RCA]	£4.50
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c43 page COSMAC MPU Product Guide [RCA]	75p
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c70 page Understanding CMOS [RCA]	£1.50
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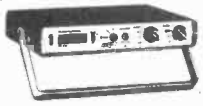

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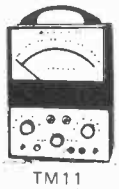

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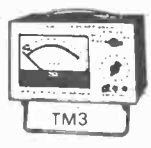

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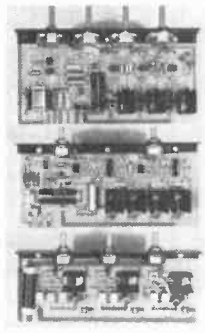

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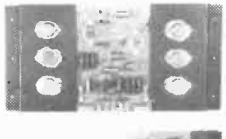

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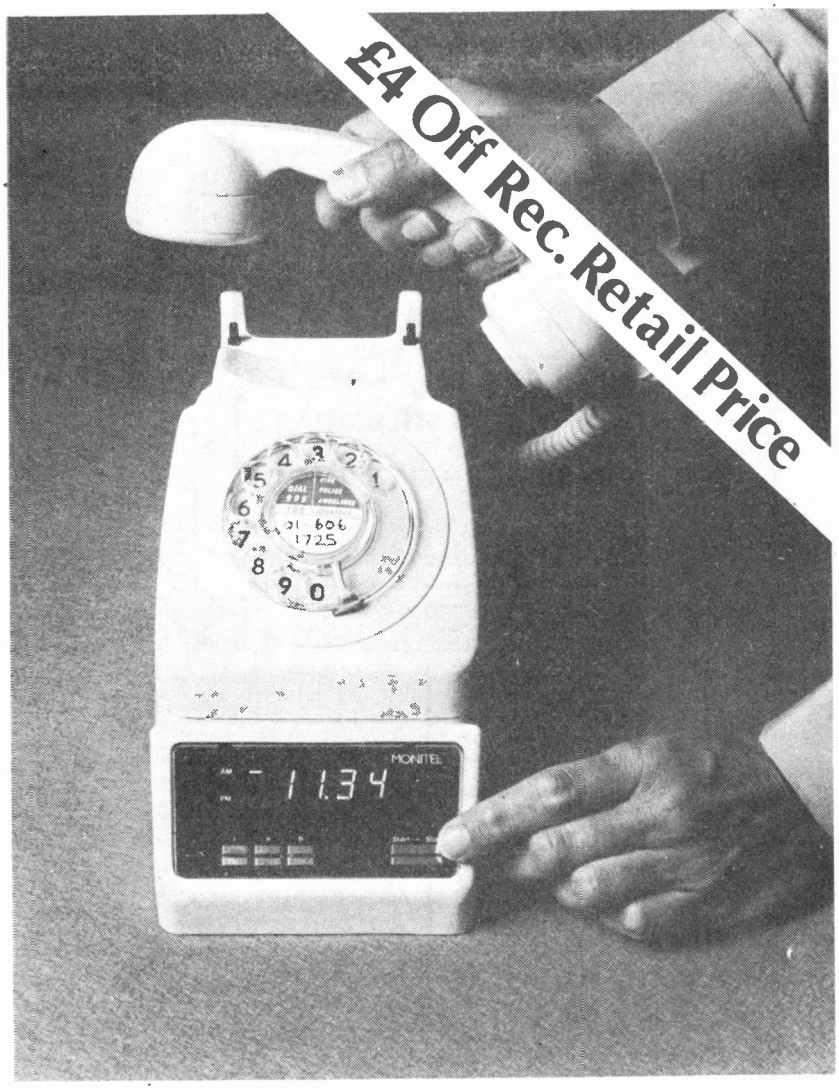

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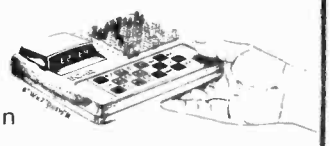

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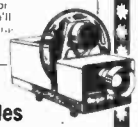

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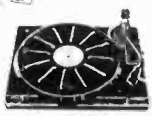

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MICROSENSE

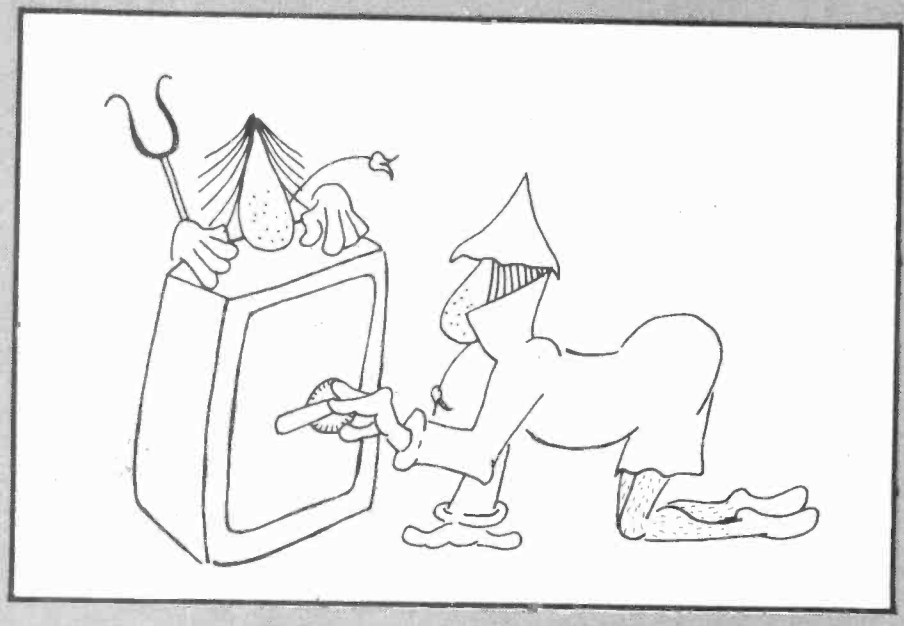
PART TWO: following on from last month's opening episode, John Miller Kirkpatrick's series gets around to programming a cardboard MPU, and begins to take note of the REAL world with a consideration of the SCMP processor. Read on . . .

FOLLOWING ON from last month's invention of the PC/MP — which you've made up by now of course — and the definition of the instruction set for our DIY processor, we can now write a program for the unit.

We will use our previous example of stock controlling overalls in a clothing depot. Instruction addresses and instructions are in Hex.

Address	Inst	What It Does
0001	00	Halt processing.
0002	0B	Load the next sequential address data into MAIN LATCH.
0003	01	Bit pattern 0000 0001, data for pevious instruction.
0004	0A	Exchange this value into DUAL LEFT.
0005	0A	DUAL is used as an address for a READ instruction as DUAL has just been loaded so that its upper byte is 0000 0001 the keyboard will be accessed and the data set up there will be copied into MAIN LATCH.
0006	01	Exchange this data into the 2ND LATCH.
0007	0B	Load next to MAIN.
0008	30	Bit pattern 0011 0000.
0009	0C	AND MAIN and 2ND, result to MAIN.
000A	12	IF MAIN is not all zeros jump over the number of instructions at 000B to instruction at 0012. If MAIN is all zeros then go to next instruction at 0000.
000B	06	Number of instructions to ignore.
000C	06	Save old value of MAIN in DUAL RIGHT.
000D	0B	Load next to MAIN.
000E	80	Bit pattern 1000 0000.
000F	0D	OR MAIN and 2ND, result to MAIN.
0010	01	Exchange MAIN and 2ND.
0011	06	Restore old value of MAIN from DUAL RIGHT.
0012	01	Exchange MAIN and 2ND.
0013	03	SHIFT RIGHT MAIN (which now contains old 2ND).
0014	03	Second time.
0015	03	Third.
0016	03	Fourth.
0017	03	Fifth.
0018	03	Sixth
0019	03	Seventh, the Male/Female bit is now at the right hand end of MAIN, all other bits are 0.
001A	05	ROTATE RIGHT MAIN.
001B	05	Again.
001C	0D	OR MAIN and 2ND, result to MAIN.
001D	03	SHIFT RIGHT MAIN.
001E	03	Second.
001F	03	Third.

0020	03	Fourth.
0021	01	Save MAIN in 2ND.
0022	0B	Load Next to MAIN.
0023	02	Bit value 0000 0010.
0024	07	Exchange this value to DUAL LEFT.
0025	01	Restore MAIN from 2ND.
0026	09	WRITE MAIN to address in DUAL (Display).
0027	0B	Load next to MAIN.
0028	00	Bit pattern 0000 0000.
0029	07	Exchange this value into DUAL LEFT.
002A	0B	Load next to MAIN.
002B	00	Bit pattern 0000 0000.
002C	06	Exchange this into DUAL RIGHT.
002D	08	Exchange DUAL and ADDRESS LATCH. Thus the ADDRESS LATCH will have the value 0000 0000 0000 0000. It will add 1 to this and fetch the next instruction from that address. The instruction at this address (Hex 0001) is the HALT instruction which is the start of this program. NB the value in the ADDRESS latch is automatically incremented by 1 at the end of each instruction.



On The Shelf

If you put this program through the PC/MP you should get a correct result (shelf number) being output to the display. The display is a seven segment digit with a decoder, the decoder and display work as follows:

Data Written to Display	Display shows
0000 0000	Digit zero
0000 0001	Digit one
0000 0010	Digit two
0000 0011	Digit three
0000 0100	Digit four
0000 0101	Digit five
0000 0110	Digit six
0000 0111	Digit seven
0000 1000	Digit eight
0000 1001	Digit nine
0000 1010	Letter A (upper case)
0000 1011	Letter b (lower case)
0000 1100	Letter C (upper case)
0000 1101	Letter d (lower case)
0000 1110	Letter E (upper case)
0000 1111	Letter F (upper case)

The decoder and display are thus able to show the Hex value of the lower half of the data byte written to it. The example of the overalls and shelves is an over simplification of a typical microprocessor application, such a microprocessor would be able to perform the above program about 2000 times each second.

To finish your education using PC/MP the more usual names for the 'pigeon holes' are REGISTERS, those in PC/MP should be renamed:

MAIN LATCH	Accumulator Register	AC
2ND LATCH	Extension Register	EX
STATUS LATCH	Status Register	ST
DUAL LATCH	Pointer Register number 1	P1
ADDRESS LATCH	Pointer Register number 0	P0
	or U	PC Program Counter Register

D A T A B S

The SC/MP Microprocessor

By now you should be used to mnemonics to understand that they can be used as a short form of identification for long words or complex descriptions. For instance from here onwards the word microprocessor may be replaced with the mnemonic MPU for MicroProcessor Unit. Other mnemonics will creep into the text initially with their meaning in

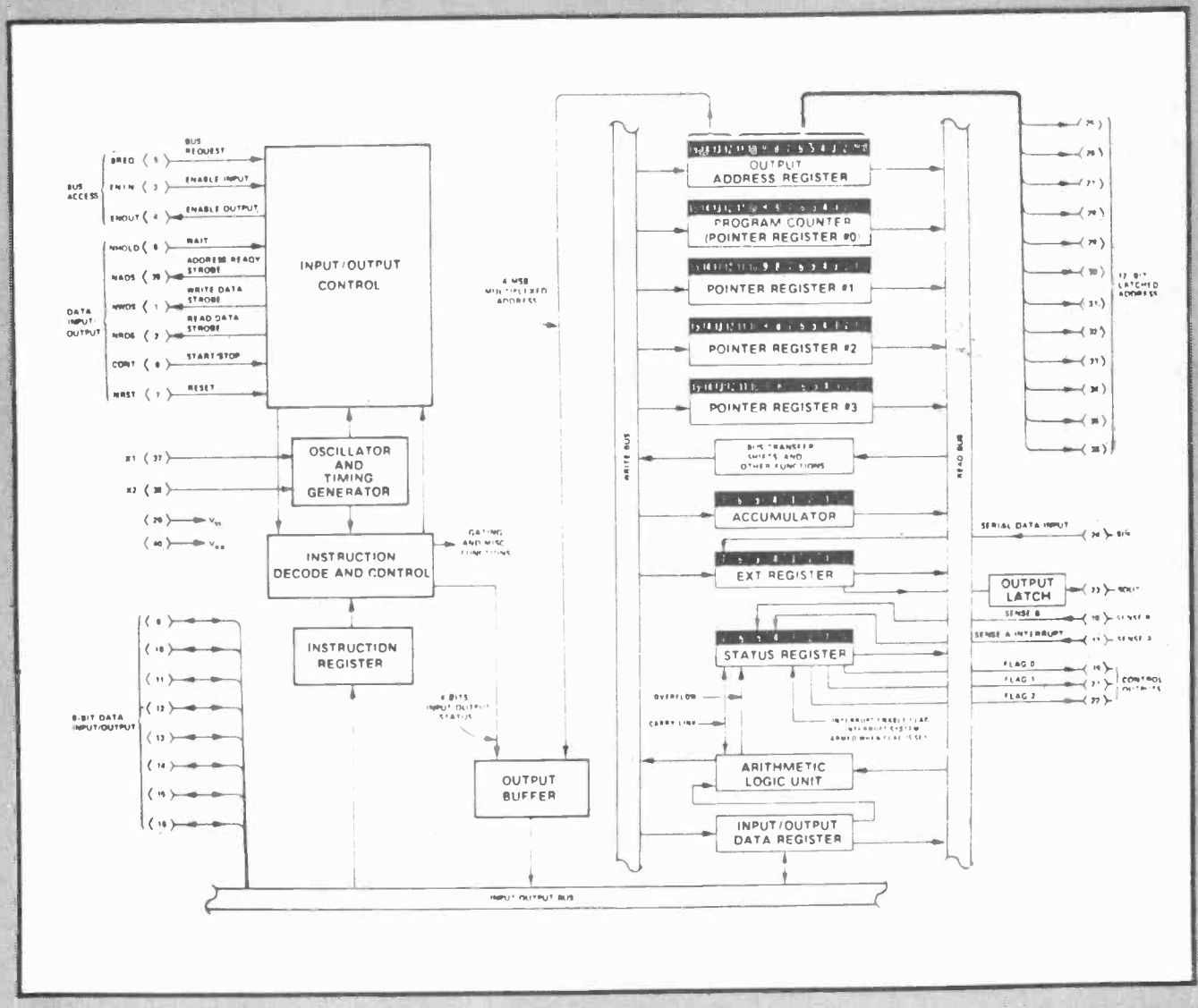


Fig. 1. The CPU architecture and pin-outs for the SC/MP chip.

brackets, or vice-versa. Now that you have grasped the basics of MPUs here is a real one to get to grips with. The SC/MP (Simple Cost effective MicroProcessor) is one of the simplest of all of the MPUs to understand, consider the SC/MP Functional Block Diagram and compare it to that of the PC/MP. You should be able to identify the OUTPUT ADDRESS Register and a separate PROGRAM COUNTER (PC) register and three other DUAL Registers called P1, P2 and P3. Also you should be able to see the INPUT/OUTPUT Register connected to the DATA BUS and the ACCUMULATOR, EXTENSION AND STATUS Registers. The SC/MP has internal units to handle Arithmetic and Logical operations, SHIFT operations, instruction recognition and control. On the left of the SC/MP block diagram you will find the SC/MP Input/Output (I/O) controller. This has NHOLD and CONT for the HOLD and CONTINUE options, RESET, READ line (NRDS), WRITE line (NWDS) and an output to indicate a valid external address (NADS). NADS is required because the SC/MP DATA BUS has a dual function, when NADS is at five volts (logic 1) the DATA BUS carries data, when NADS is at logic 0 the DATA BUS carries the upper four address bits plus some more indicator flags. The data on the DATA BUS at this time can be latched externally to increase the features of the basic SC/MP if required, in most applications they are not required.

The BUS REQUEST (BREQ), ENABLE INPUT (ENIN) and ENABLE OUTPUT (ENOUT) control lines are used in multiprocessor applications and in most basic applications can be ignored. For details of the operation of these signal lines refer to the SC/MP data sheet.

SC/MP also has the facility to SHIFT RIGHT the EXTENSION Register so that the value of the bit at the right hand end will appear at an output pin labelled SOUT (Serial OUT). At the same time the value at the SIN (Serial IN) pin will be loaded into the leftmost bit of the EXTENSION Register, this facility allows the SC/MP to handle high speed serial data rather than parallel data bits on the DATA BUS.

SC/MP Instruction Set

The SC/MP can handle something like 122 different instructions most of which are variations of the PC/MP instruction set. They can be broken down into groups of instructions.

EXTENSION REGISTER a set of eight instructions handling various operations concerning the EXTENSION Register and the ACCUMULATOR. Such operations being COPY, Exchange, Arithmetic and Logical.

SHIFT, ROTATE, SERIAL I/O. A set of five instructions that allow various forms of movement of bits RIGHT in the ACCUMULATOR or EXTENSION registers.

MISCELLANEOUS. A set of nine instructions including HALT, copy STATUS to or from ACCUMULATOR, DELAY, Enable and disable the automatic INTERRUPT function.

POINTER REGISTER. A set of instructions which allow the exchange of 16 bit pointer registers P1, P2 and P3 with the Program Counter (PC). The upper and lower bytes of the Pointer registers can also be exchanged with the ACCUMULATOR.

TRANSFER. A set of instructions which allow program logic transfer to an address specified as a number of bytes offset from one of PC, P1, P2 or P3. The Jump may be conditional on the value in ACCUMULATOR or unconditional (Jump Always).

MEMORY REFERENCE. A set of instructions which act on the ACCUMULATOR and the data at a memory location offset from one of the pointer registers or from the program counter. A subset is similar to the 'Load next to MAIN' instruction on the PC/MP. The subset is the IMMEDIATE instruction subset. The set of memory reference instructions include READ, WRITE AND, OR, XOR, and arithmetic operations.

MEMORY INCREMENT. This is really another subset of the above set. The data at the address being accessed is loaded into the ACCUMULATOR and then has the value 1 either added or subtracted and the new value is then stored back at the original address.

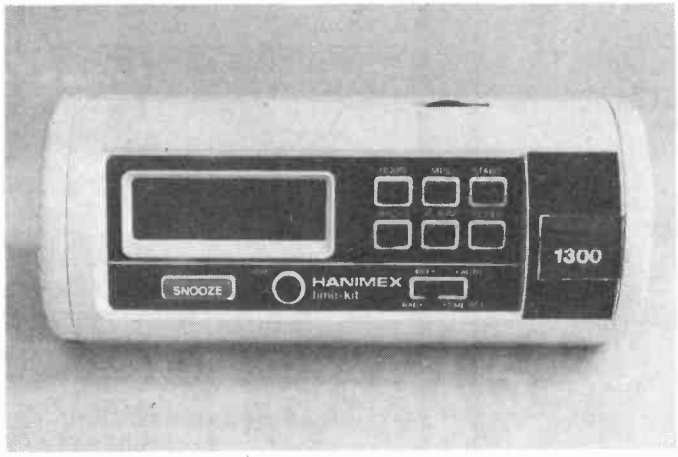
Further details on SC/MP II are available in the manufacturers data sheet.

Next Month: RAM, ROM and the escaped vicar. In other words the stuff that memories are made of!

In Computing Today this month: a program to tax James Hunt (retired), an extended basic for Triton, reports from no less than THREE computer shows, an article all about understanding your neighbour (speech recognition) and how to make micro-music!!

ETI MARK

CLOCK RADIO



A bit different this one. How about a round clock radio which can double as a very smart desk clock — as our staff can testify!

To tune the radio one end of the cylinder rotates displaying the frequency you have selected. Most of the functions are controlled by a keyboard style pad, and the display is a nice large LCD affair.

Made by Hanimex the radio comes in any colour you like — so long as it's white! It will lull you to sleep and then turn itself off an hour later — or awaken you to the sound of Radio One or music if you prefer.

An example of this Clock Radio can be seen and examined at our Charing Cross Road offices.

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THIS IS THE THIRD digital alarm clock that we are offering (we regret the earlier versions are no longer available). We have sold thousands and thousands of these and our buying power enables us to offer a first rate branded product at a really excellent price.

The Hanimex HC-1100 is designed for mains operation only (240V/50Hz) with a 12 hour display, AM/PM and Alarm Set indicators incorporated in the large display. A switch on the top controls a Dim/Bright display function.

Setting up both the time and alarm is simplicity itself as buttons are provided for both fast and slow setting and there's no problem about knocking these accidentally as a 'locking' switch is provided under the clock. A 9-minute 'snooze' switch is located at the top.

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ET PLACE

LCD CHRONO

We feel we've got to tell you carefully about this offer

Why? Because our price is so enormously lower than anywhere else you may suspect the quality.

The display is LCD and shows the seconds as well as the hours — and minutes — press a button and you'll get the date and the day of the week.

Press another button for a couple of seconds and you have a highly accurate stopwatch with hundredths of a second displayed and giving the time up to an hour. There is a lap time facility as well — and of course a back light.

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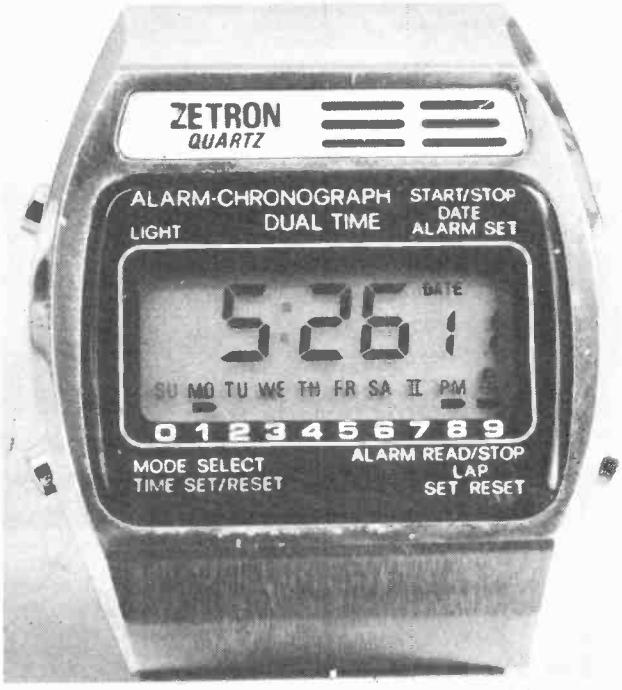
ALARM-CHRONO LCD



This new addition to our unbeatable selection of bargains is no ordinary LCD watch. It's a slim, multi-function, dual time chronograph alarm watch, no less.

This model will show hours, minutes, seconds, date, day of the week, stop watch, split time, alarm and alternate dual time zone — not all at once, of course. There is also a night light.

Hours, minutes, seconds and day of the week are displayed continuously, while the date will appear at the touch of a button. The day of the week is indicated by a flag. When used as a stopwatch, the maximum count is 0.1secs. short of thirteen hours.

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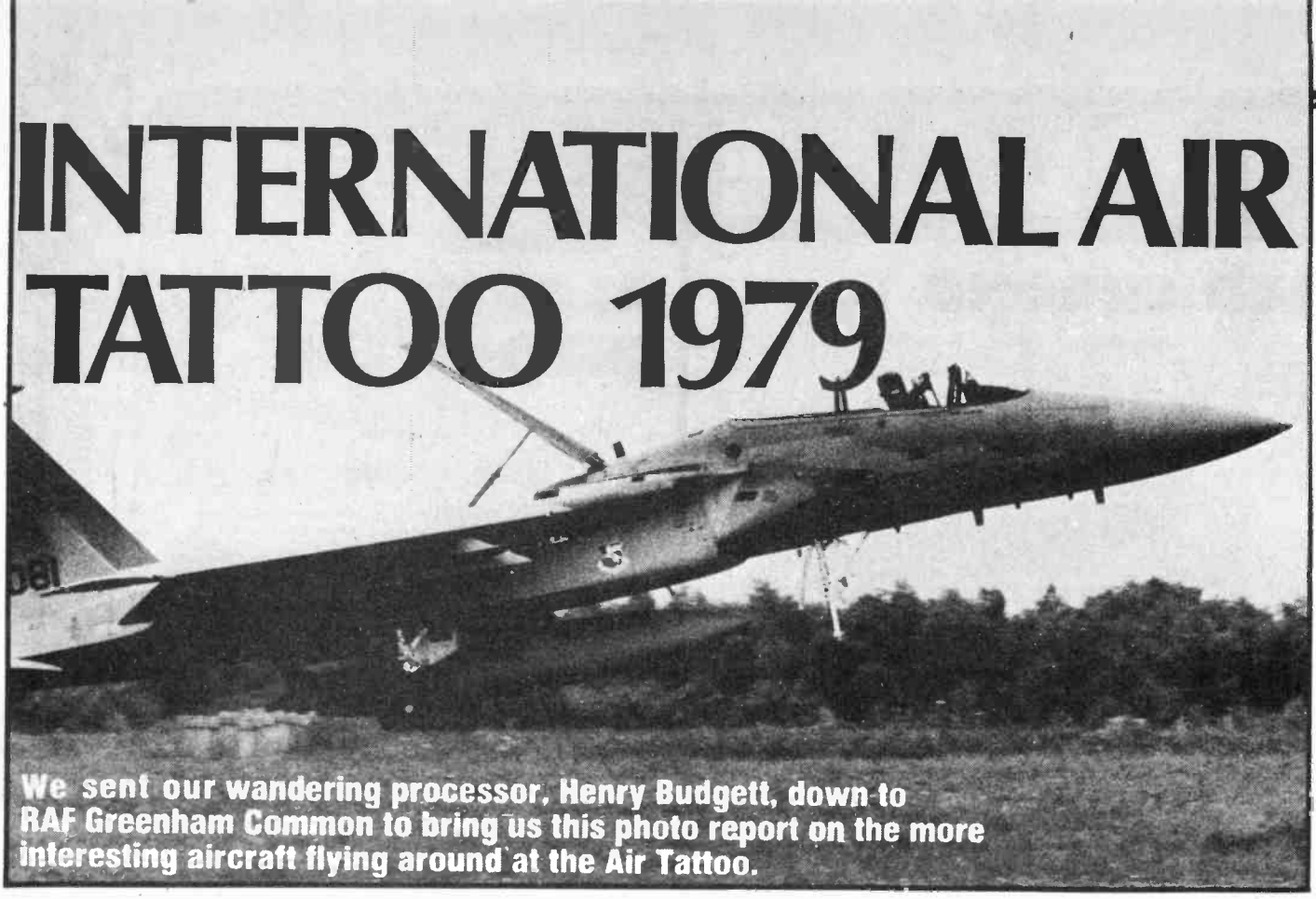
INTERNATIONAL AIR TATTOO 1979

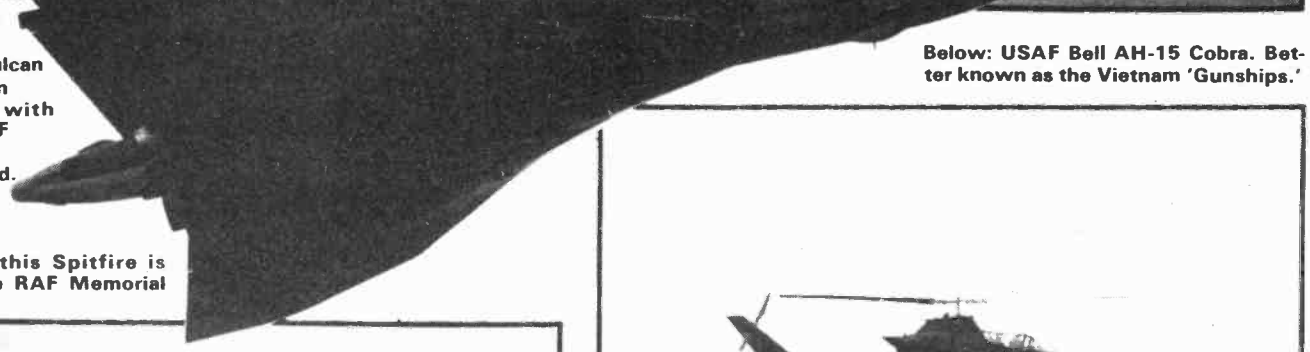


We sent our wandering processor, Henry Budgett, down to RAF Greenham Common to bring us this photo report on the more interesting aircraft flying around at the Air Tattoo.

Right: an RAF Shackleton AEW3 flies in. This is an 'early warning' electronic warfare craft. The type is being replaced by Nimrods.

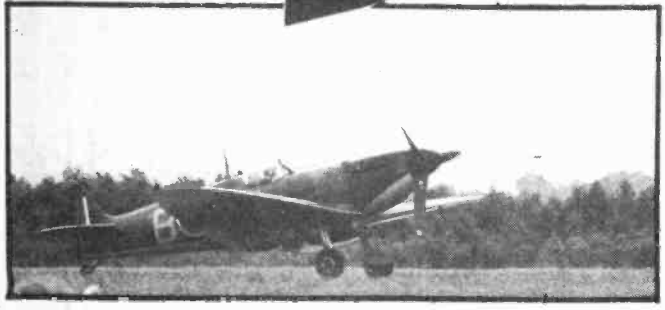
Left: a Phantom FRG2. This fighter is still NATO's main combat craft, although the F15s and F16s are growing in numbers rapidly.

Right: Vulcan B2 still in service with the RAF Strike Command.



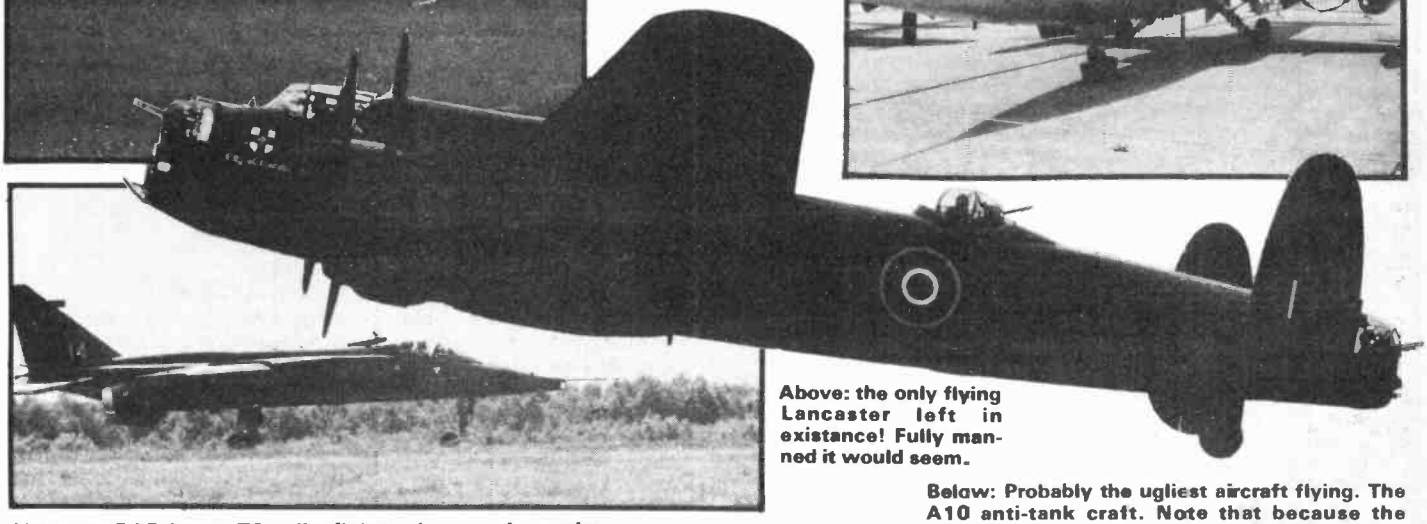
Below: USAF Bell AH-15 Cobra. Better known as the Vietnam 'Gunships.'

Below: this Spitfire is from the RAF Memorial Flight.



Right: the infamous Starfighter. For long enough Europe's main plane!

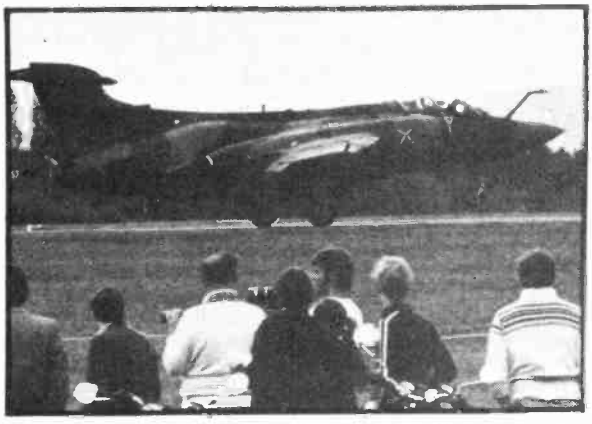
Left: an USAF OV10A Bronco. One of the more unusual ECM aircraft!



Above: the only flying Lancaster left in existance! Fully manned it would seem.

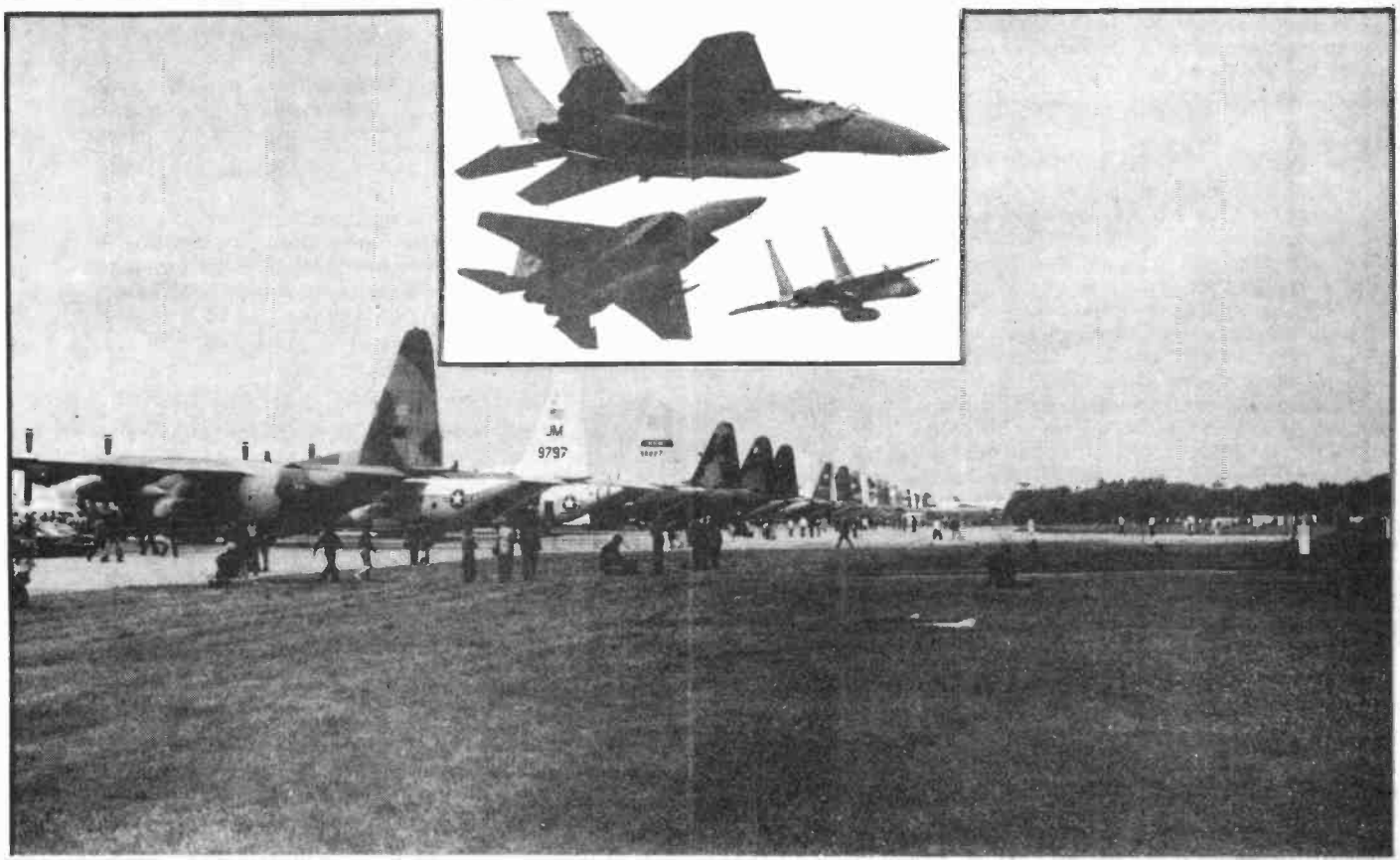
Above: an RAF Jaguar T2 strike fighter about ready to take off.

Below: Probably the ugliest aircraft flying. The A10 anti-tank craft. Note that because the engines are where they are from the ground they are hidden from next seeking missiles.



Left: RAF Buccaneer. Been around a while, but still a useful strike machine.

Below: the almighty Eagle. Undoubtedly the best military airplane in the world. Note the ECM pod slung beneath the plane. The heading photo shows this amazing machine in more detail. In any future conflict NATO would be expecting a lot from its Eagle squadrons.



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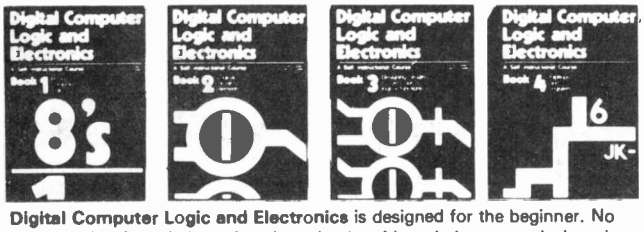

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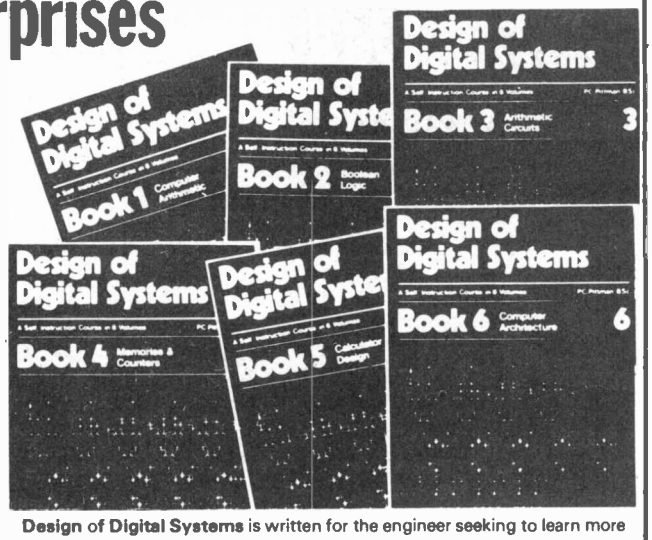

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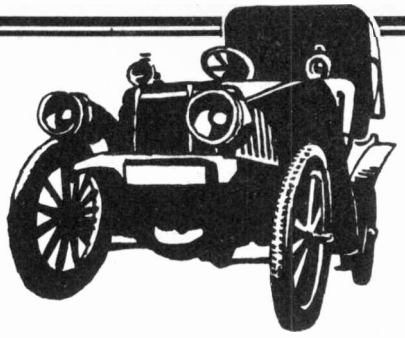


FUEL LEVEL MONITOR

ETI's medically approved ulcer generator. It's designed to make you WORRY for half an hour before you finally get stranded through lack of fuel!

THE ETI LOW-FUEL-LEVEL ALARM is designed for use in modern vehicles fitted with 12 V electrical systems only. It is driven from the vehicle's existing fuel gauge system, and activates when the fuel level falls below a pre-set value.

When the alarm activates, a LED and a low-frequency oscillator switch on. The output of the oscillator can be used to activate the unit's own audible warning device, or to activate the alarm generator of the 'audible repeater' project described elsewhere in this issue.

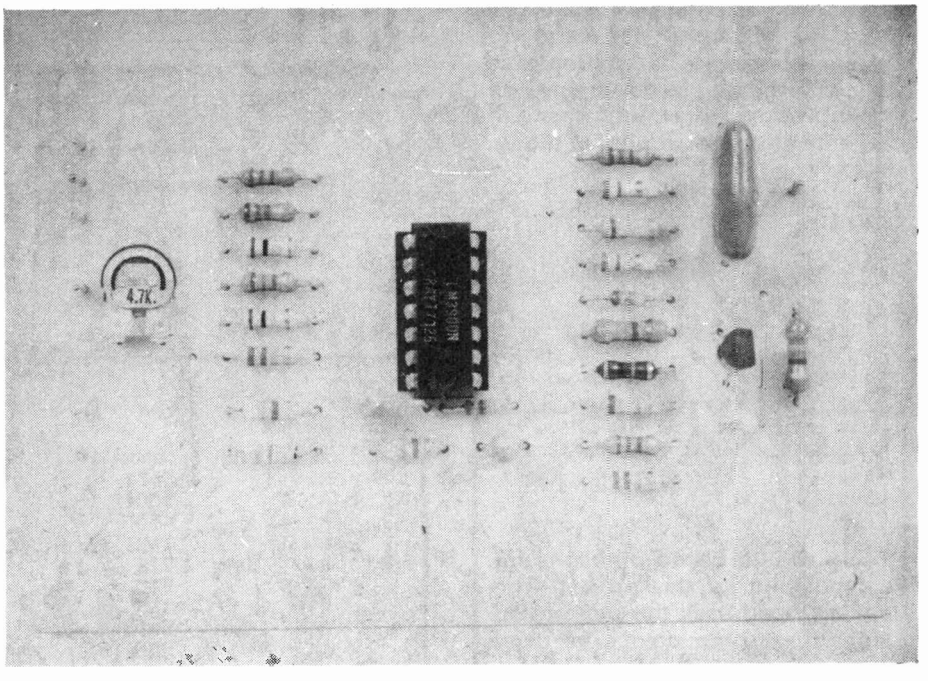
The alarm system is provided with a mute switch, which lets you disable the low-frequency oscillator 'warning' circuit, but not the LED circuit, once the alarm has been activated. The mute switch automatically turns off when the vehicle's ignition is first switched on.

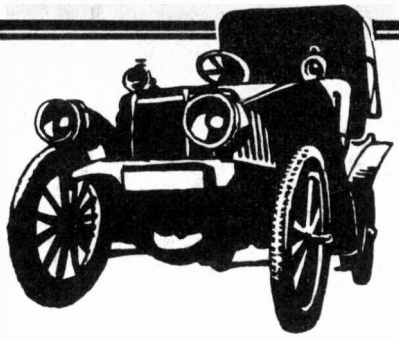
The Low-Fuel-Level Alarm is a genuinely useful unit to have in any vehicle and is inexpensive and easy to construct. The unit is, however, fairly difficult to fit into most modern cars, typically taking 2-3 hours to install. Installation usually involves the partial dismantling of the vehicle's instrument panel. (You have been warned!).

Construction

Construction of the unit is perfectly straightforward and should present no problems. Note that the PCB is provided with Veropin terminals for making external connections, including those to the off-board mute switch and the LED.

The load that is fitted in series with Q1 emitter can take a variety of forms, but must have an impedance greater than 100R. It can, for example, be a relay or a self-contained audible warning device. Alternatively, if the unit is to be used in conjunction with the 'audible repeater' project described elsewhere in this issue, the load can simply be a 4k7 resistor, and Q1 emitter can be connected to the auxiliary input (D15) of the repeater. ▶





Installation

Installation is, in theory, simply a matter of connecting the unit's zero volt line to chassis, point 'A' to the +12V side of the vehicle's instrument regulator, point 'B' to the output of the instrument regulator and point 'C' to the junction of the vehicles fuel gauge and transmitter unit, as shown in the main circuit diagram.

In practice, the implementation of these connections will probably involve the removal of the vehicle's instrument panel, and perhaps the PCB that is attached to the back of that panel. Make sure you disconnect the vehicle's battery before starting the installation work.

When using the alarm unit, note that, because the fuel in the tank tends to slop around a fair bit under actual driving conditions, and thus generate a fluctuating voltage across the tank's transmitter, the alarm system will operate intermittently as the fuel level approaches the pre-set 'mean' warning level, thus giving the driver an advance warning of the danger condition.

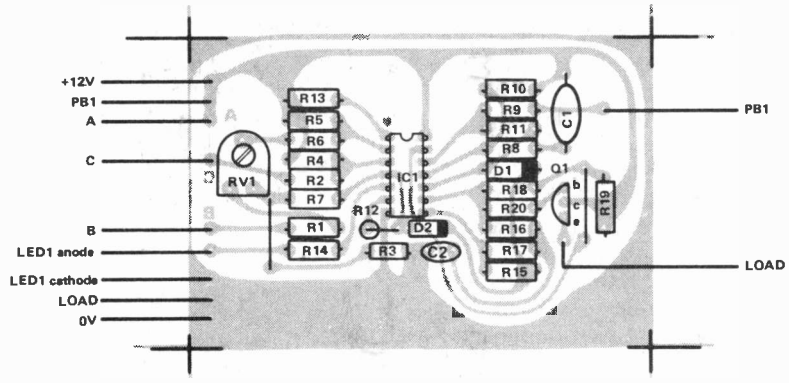
HOW IT WORKS

The fuel-level indicating system of a modern car consists of a float-driven rheostat 'transmitter' in the fuel tank, which governs the magnitude of current flow through a hot-wire type of meter that is used as the fuel gauge: to ensure calibration reliability, the voltage supply to the system is controlled by a simple regulator (see main circuit diagram). A characteristic of this system is that the voltage across the transmitter rheostat increases as the fuel level falls, typically reaching 3 to 4 volts when the tank is emply.

The ETI Low-Fuel-Level Alarm works by monitoring the voltage across the transmitter rheostat (at one side of the fuel gauge), and activating an LED and a low-frequency oscillator when this voltage rises above a pre-set value (when the fuel level falls below a pre-set value). The oscillator can be used to drive a variety of types of load, including an audible warning device. The circuit is provided with a 'mute' facility which can be used to disable the oscillator but not the LED circuit. The 'mute' system turns off automatically when the vehicle ignition is first switched on. A brief resume of the circuit's elements is as follows.

IC1a is wired as a voltage comparator, with a small degree of regenerative hysteresis applied via R7 and R3. The trigger level of the circuit can be pre-set via RV1, which is driven from the same 'regulated' supply as the fuel gauge. The output of IC1a is normally high, but goes low when the input voltage rises above the pre-set trigger level. Under this condition LED 1 is driven on via IC1c and astable multivibrator IC1d is enabled via D2-R15. The output of the astable is fed to an external load via emitter follower Q1.

IC1b is wired as a simple bistable, which is automatically set to the output-low state at ignition turn-on via C1-R8. The output can be latched high, thus disabling the astable multivibrator (and hence the external load) via D1-R15 by momentarily closing MUTE switch PB1.



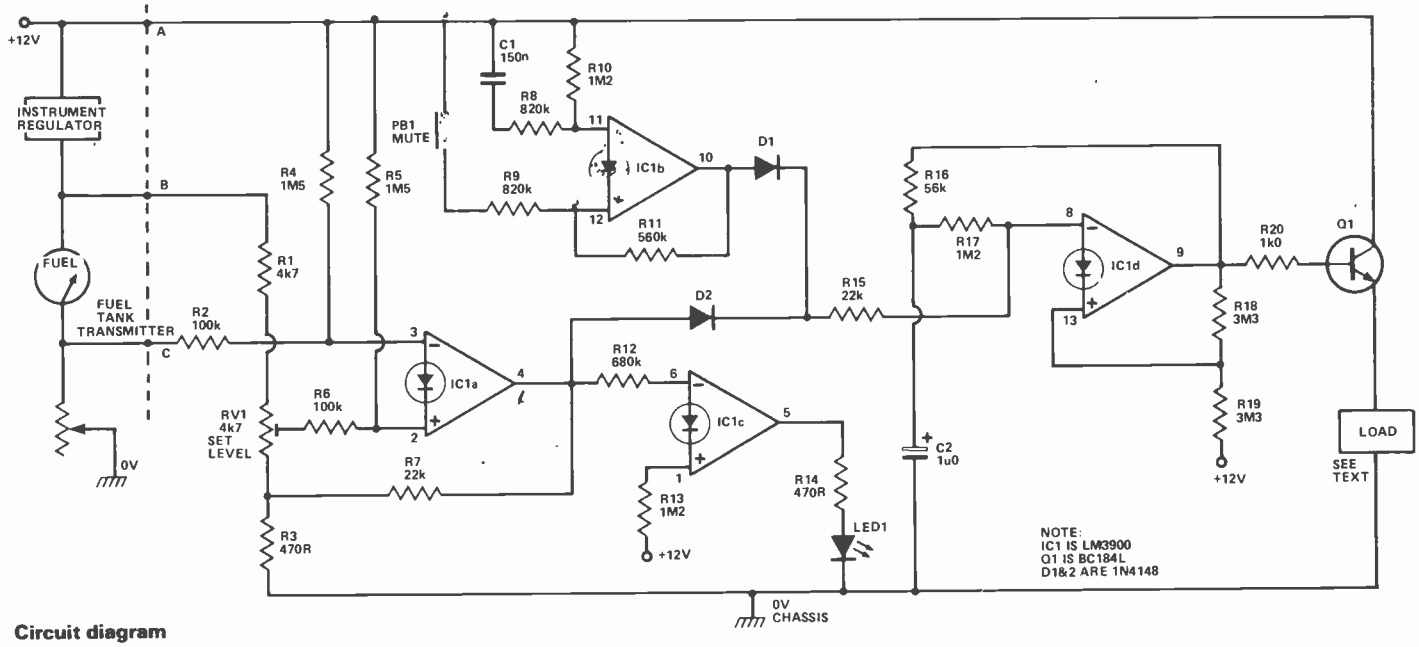
The component overlay

BUYLINES

There should be no problems for components for this project. The optional load uses the same rated audible warning device as used elsewhere in this months ETI !

PARTS LIST

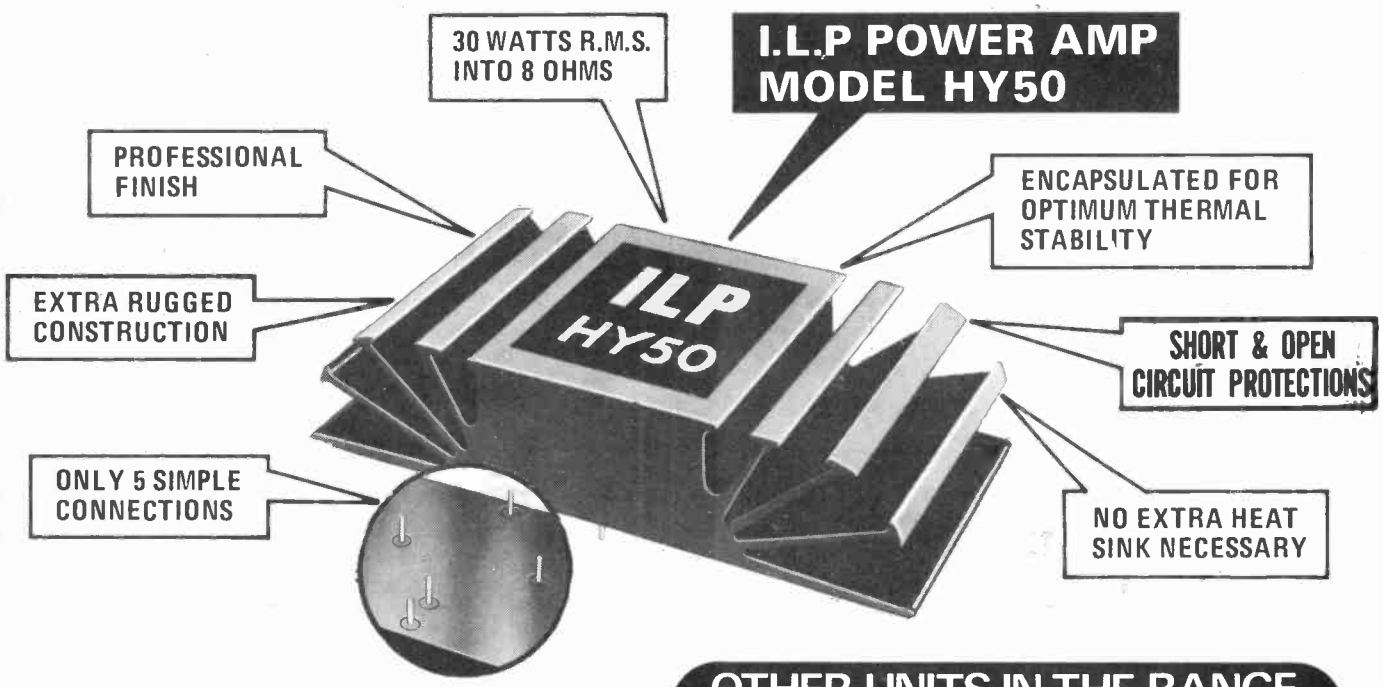
RESISTORS	
R1	4k7
R2, 6	100k
R3, 14	470R
R 4, 5	1M5
R7, 15	22k
R8, 9	820k
R10, 13, 17	1M2
R11	560k
R12	680k
R16	56k
R 18, 19	3M3
R20	1k0
POTENTIOMETERS	
RV1	4k7 Preset
CAPACITORS	
C1	150n polyester
C2	1u0 tantalum
SEMICONDUCTORS	
IC1	LM3900
Q1	BC184L
D1, 2	1N4148



Circuit diagram

Simply ahead!

HIGH PERFORMANCE MODULAR UNITS BACKED BY NO-QUIBBLE 5 YEAR GUARANTEE



Of all the purpose-built **power** amplifier modules by I.L.P., the HY50 is understandably the most popular with those wanting to build new or up-grade an existing hi-fi system, run a small high quality P.A. system, amplify a musical instrument (say for practice or small range use) or use it for lab work. Its useful 30 watts RMS output into 8 ohms, its rugged construction and freedom from heatsink worries make it the ideal all-purpose quality power amp — and it is unconditionally guaranteed for five years! Tens of thousands are in regular use throughout the world.

. . . and a spec that means just what it says!

Encapsulated power amp with integral full-rated heatsink.
Input — 500mV.
Output 30 watts RMS/8Ω.
Load Impedance — 4 to 16Ω.

S/N Ratio 75dB
Distortion — 0.02% from 100mW to 25 watts at 1KHz into 8Ω.
Supply Voltage ± 25V. Size 105 x 50 x 25mm.

Inc. VAT and postage in U.K. **£8.33**

Nothing has been overlooked in the design and manufacture of I.L.P. Modular Units. Heavy duty heatsinks, encapsulated circuitry, no-compromise production standards and true professional finish ensure world leadership in their field for I.L.P. Now we have ***up-graded*** output ratings and ***down-graded*** prices to bring I.L.P. within easier reach of all who want the best with which to build with. Prices reduced by an average around 20%.

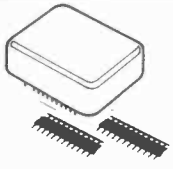
Guaranteed 7-day despatch on all products

FREE POST — No stamp required when sending your order or enquiry for information sheets.

ILP ELECTRONICS LTD.

FREEPOST 4, Graham Bell House, Roper Close, CANTERBURY Kent CT2 7EP. Phone (0227) 54778. Telex: 965780

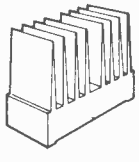
OTHER UNITS IN THE RANGE



All prices inc. VAT at 15% and postage in the U.K.

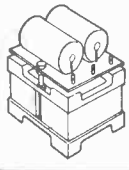
HY5 PRE-AMPLIFIER
Compatible with all I.L.P. power amps and P.S.U.s. In a single pack, needs external pots and switches. Multi-function equalization. Mag./Ceramic/Tuner/Mic./Aux. inputs. High overload margin. Active tone controls; 500 mV out. Distortion at 1 KHz — 0.01%. Two HY5s connect easily for stereo.

£5.34



THE POWER AMPS
With heatsinks, full load line and thermal protection.
Distortion typically 0.05% at 1 KHz.

HY120	60 Watts RMS/8 Ω	114 x 50 x 85mm	**£17.48**
HY200	120 Watts RMS/8 Ω	114 x 50 x 85mm	**£21.21**
HY400	240 Watts RMS/4 Ω	114 x 100 x 85mm	**£31.83**



THE POWER SUPPLY UNITS
(Split line outputs to suit I.L.P. power units and HY5).

PSU 50	for 1 or 2 x HY50	**£9.32**
PSU 70	for 1 or 2 x HY120	**£15.85**
PSU 90	for one HY200	**£15.85**
PSU180	for one HY400 or 2 x HY200	**£26.47**

★ NOW-PRICES DOWN BY 20%

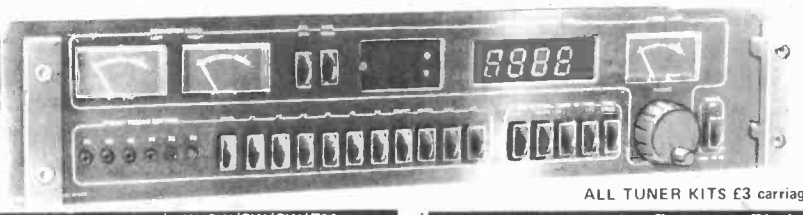
Please supply .....
Total Purchase Price .....
I enclose Cheque ☐ Postal Orders ☐ Money Order ☐
Please debit my Access/Barclaycard Account number.
Name and address .....
.....
Signature .....
E.P.48

Tecknowledgey for sale.

The Mark III FM Tuner

DIY Hi-Fi will never seem the same again. Ambit's Mark III tuner system is electrically & visually superior to all others. Some options available, but the illustrated version with reference series modules:
£149.00 + £18.62 VAT

With Hyperfi Series modules
£185.00 + £23.12



ALL TUNER KITS £3 carriage

Features of the system

- Precision construction & design of all parts
- Time frequency display
- State of the art performance with facilities for updates, using modular plug in systems.
- Deviation level calibrator for recording
- All usual tuner features

Digital Dorchester All Band Broadcast Tuner: LW/MW/SW/SW/SW/FM stereo

A multiband superhet tuner, constructed using a single IC for RF/IF processing - but with all features you would expect of designs of far greater complexity. The FM section uses a three section (air gang) tuned FET tunerhead, with ceramic IF filters and interstation mute; AM employs a double balanced mixer input stage, with mechanical IF filters - plus a BFO and MOSFET product detector for CW/SSB reception. Styled in a matching unit to the Mark III FM only tuner, employing the same degree of care in mechanical design to enable easy construction. MW/LW reception via a ferrite rod antenna.

Electronics only (PCB and all components thereon) £33.00 + £4.12 VAT
Complete with digital frequency readout/clock-timer hardware £99.00 + £12.37 VAT
Complete with MA1023 clock/timer module with dial scale £66.00 + £8.25 VAT

Hardware packages are available separately if you wish to house your own designs in a professional case structure. Please deduct the cost of electronics from complete prices.

LW/MW/FM LCD Digital Frequency Display - July PW feature

Update your old radio, or build this into a new design. Or use it as a servicing aid - this low power unit with LCD display reads direct frequency in kHz/MHz, or with usual AM/FM IF offsets for received frequency. Low power LCD means no RFI - 15-20mA at 9v even with the divide by 100 prescalar. FM resolution is 100kHz, AM 1kHz. Sensitivities better than 10mV.

Complete kit £19.50 +*£1.56 VAT. Built and tested version £24.00 +*£1.92 VAT

Various other DFM systems described in our catalogue part 2 - including a one chip solution to providing digital display of FRG7 kHz dial, combined with clock/timers etc.

PW SANDBANKS PI METAL LOCATOR

Maintaining our professional approach to home constructor kits, we offer the pulse induction 'Sandbanks'. Now with injection molded casing for greatly improved enviromental sealing. £37.00+ *£2.96vat.

VHF MONITOR RX WITH PLESSEY IC

4/9 channel version of the PW design - but using standard 3rd OT crystals, and TOYO 8 pole crystal filter with matching transformers. Coil sets from our standard range to cover bands from 40 to 200MHz. Complete module kit £31.25 +£3.90vat.

ETI - REMCON RADIO CONTROL

A tried and tested RC system with a full set of supporting hardware from a well known manufacturer. Please send for details - and watch our ads for further news of developments in RC products.

Radio and Audio Modules : The biggest range/ best specs:

EF5801/3/4 6 stage varicap tunerheads with LO feed and various levels of sophistication. New 5804 include pin AGC loop 'on board'. 5801:£17.45+£2.18vat - 5803:£19.75+£2.47vat - 5804:£24.95 +£3.18vat. *Frequencies in 40-180MHz on appcn.*

EF5402 4 stage varicap with TDA1062, compound FET/Bipolar input stage, low noise, balanced mixer, pin agc, osc output. A worthy successor to the 5400. £10.75+£1.34vat

The 5402 is available centred on a wide range of frequencies from 30MHz to 180MHz. Non standard units £14.75+£1.84 - 3 weeks.

8319 4 stage varicap tunerhead from Larsholt using MOSFET RF and mixer stages. New temperature compensated oscillator for wide ranges of ambient temperature £13.45+£1.68vat

7252 Complete Larsholt FM tuner less stereo decoder. £26.50+£3.31vat

7253 Stereo FM tunerset from Larsholt with FET head. (as 7252)

944378 Hyperfi stereo decoder. The very best. £19.95+£2.49vat

911223 Pilot cancel stereo decoder, priced to make the MC1310 as obsolete as it now deserves to be.£12.50+£1.56vat

Inotec 1-A fully DC tuned and switched LW/MW/FM stereo tuner to interface with syntheiser control etc.A first! Details O/A

COMPONENTS for Radio and Audio ICs, HMOS etc.

The list is too long to attempt here, but AMBIT specializes in all types of semiconductor for radio reception, including devices operating from DC to 5GHz. New low cost SBL1 diode ring mixers (equiv case MD108 etc) -first with HMOS fets, now with a PCB for DC amplifier, and offset sense and protection relay for speakers. See catalogue and updates for most info, pse send an SAE for information on anything you cannot find in catalogues.

Radio ICs	cost + vat		Stereo ICs	cost + vat		AF power ICs	cost + vat	
CA3089E	1.94	24	MC1310P	1.50	19	LM380N	1.00	12
CA3189E	2.45	30	uA758	2.20	27	TBA810AS	1.09	14
HA1137W	2.20	27	CA3090A	2.75	34	TDA2002	1.95	24
SN76660	0.75	9	HA1196	3.95	49	TBA820M	0.75	9
TDA1090	3.35	42	HA11223	4.35	54			
TDA1083	1.95	24	KB4437	4.35	54			
TDA1220	1.40	17	KB2224	2.75	34			
SL6640	2.75	34	Preamp ICs/switches					
MC3357	3.12	39	TDA1028	3.50	44			
HA1197W	1.40	17	TDA1029	3.50	44			
MC1496	1.25	16	TDA1074	4.14	52			
LM373/4	3.75	49	KB4438	2.22	28			

from the general list:
LEDs:all colours and low prices
2SJ48/2SK134 HMOS
9.90 +£0.80 vat(Pair)
Signal fets/transistors and TOKO COILS & FILTERS!

OSTS: Remember all OST$ stocks are obtained from BS9000 approved sources - your assurance that all devices are very best first quality commercial types. Some LPSN TTL is presently in great demand, so please check by phone before ordering.

TTL:Standard AND LP Schottky

All prices listed in pence *

	'N'	'LSN'		'N'	'LSN'		'N'	'LSN'		'N'	'LSN'		'LSN'
7400	13	20	7455	35	24	74126	57	44	74185	134		74377	124
7401	13	20	7460	17		74128	74		74188	275		74378	93
7402	14	20	7463		124	74132	73	78	74190	115	92	74379	130
7403	14	20	7470	28		74133		29	74191			74368	37
7404	14	24	7472	28		74136		40	74192	105	180	74390	140
7405	18	26	7473	32	38	74138		60	74193	105	180	74393	140
7406	38		7474	27	38	74139		60	74194	105	187	74395	139
7407	38		7475	38	40	74141	56		74195	95	137	74396	133
7408	17	24	7476	37	38	74142	265		74196	99	110	74398	180
7409	17	24	7478		38	74143	312		74197	85	110	74399	150
7410	15	24	7480	48		74144	312		74198	150		74445	92
7411	20	24	7481	86		74145	65	97	74199	160		74447	90
7412	17		7482	69		74147	175		74247		90	74490	140
7413	30		7483A		110	74148	109	191	74248		90	74668	110
7414	51		7484	97		74150	99		74249		93	74670	249
7415		24	7485	104	99	74151	64	84	74251		90		
7416	30		7486		40	74153	64	54	74253		105		
7417	30		7489	205		74154	96		74257		108		
7420	16	24	7490	33	90	74155	54	110	74258		153		
7421	29	24	7491	76	110	74156	80	110	74259		420		
7422	24	24	7492	38	78	74157	67	55	74260		153		
7423	27		7493	32	99	74158		60	74261		353		
7425	27		7494	78		74159	210		74266		40		
7426	36	27	7495A	65	99	74160	82	130	74273		124		
7427	27	29	7496	58	120	74161	92	78	74275		312		
7428	35	32	7497	185		74162	92	130	74279		52		
7430	17	24	74100	119		74163	92	78	74283		120		
7432	25	24	74104	63		74164	104	130	74290		90		
7433	40	32	74105	62		74165	105		74293		95		
7437	40	24	74107	32	38	74166			74295		120		
7438	33	24	74109	63	38	74167	20		74298		100		
7440	17	24	74110	54	54	74168			74324		157		
7441	74		74111	68		74169		200	74325		242		
7442	70	99	74112		38	74170	230	200	74326		247		
7443	115		74113		38	74172	625		74327		237		
7444	112		74114		38	74173	170		74352		100		
7445	94		74116	198		74174	87	120	74353		100		
7446	94		74118	83		74175	87	110	74362		715		
7447	82	89	74119	119		74176	75		74365		49		
7448	56	99	74120	115		74177	78		74366		49		
7449		99	74121	25		74180	85		74367		43		
7450	17		74122	46	57	74181	165	150	74368		49		
7451	17	24	74123	48	73	74182	160		74373		77		
7453	17		74124		137	74183		210	74374		77		
7454	17	24	74125	48	44	74184	135		74375		60		

ALL PRICES EXCLUSIVE OF VAT — VAT AT 15%

VOLTAGE /PSU REGULATORS

7800 series	95p
7900 series	£1
78M series	90p
(TO220 pack)	
78LCP series	35p
78MGT2C	175p
79MGT2C	175p
723C	65p
NE550A	73p
L200	195p

MAINS FILTER

1Amp IEC	4.83
6Amp IEC	5.83
5A w/rein	3.87
All BS approved	

Requests for the next issue of the catalogue now being "booked" for dus patch immediately it is ready (about November). Please send 50p to reserve a copy. (Part 3)

IMPORTANT: ALL OSTS PRICES EXCLUDE VAT - CURRENTLY 8% - BUT MAY BE CHANGED BY THE TIME YOU READ THIS. PLEASE REMEMBER TO ADD VAT, and 25p POSTAGE !!

CD4000 CMOS

4000	17p	4059	563p	4522	149p		
4001	17p	4060	115p	4527	157p		
4002	17p	4063	109p	4528	102p		
4006	109p	4066	53p	4529	141p		
4007	18p	4067	400p	4530	90p		
4008	80p	4068	25p	4531	141p		
4009	58p	4069	20p	4532	125p		
4010	58p	4070	20p	4534	614p		
4011	17p	4071	20p	4536	380p		
4012	17p	4072	20p	4538	150p		
4013	55p	4073	20p	4539	110p		
4014	95p	4075	20p	4541	141p		
4016	52p	4076	90p	4543	174p		
4017	80p	4077	20p	4549	399p		
4018	80p	4078	20p	4553	440p		
4019	60p	4081	20p	4554	153p		
4020	93p	4082	20p	4556	74p		
4021	82p	4085	82p	4557	386p		
4022	90p	4086	82p	4558	117p		
4023	17p	4089	150p	4559	388p		
4024	76p	4093	50p	4560	218p		
4025	17p	4094	190p	4561	65p		
4026	180p	4096	105p	4562	530p		
4027	55p	4097	372p	4566	159p		
4028	72p	4098	110p	4568	281p		
4029	100p	4099	122p	4569	303p		
4030	58p	4160	90p	4572	25p		
4031	250p	4161	90p	4580	600p		
4032	100p	4162	90p	4581	319p		
4033	145p	4163	90p	4582	164p		
4034	200p	4174	104p	4583	84p		
4035	120p	4175	95p	4584	63p		
4036	250p	4194	95p	4585	100p		
4037	100p	4501	23p				
4038	105p	4502	91p				
4039	250p	4503	69p				
4040	83p	4506	51p				
4041	90p	4507	55p				
4042	85p	4508	248p				
4043	85p	4510	99p				
4044	80p	4511	149p				
4045	150p	4512	98p				
4046	130p	4513	206p				
4047	99p	4514	260p				
4048	60p	4515	300p				
4049	55p	4516	125p				
4050	55p	4517	382p				
4051	65p	4518	103p				
4052	65p	4519	57p				
4053	65p	4520	109p				
4054	120p	4521	236p				
4055	135p						

Micromarket

6800 series		8080 series		8216	1.95	2114	£10
6800P	6.50	8080P	6.30	8224	3.50	2708	£
6820P	£6	8212	2.30	8228	4.78		
6850P	2.75			8251	6.25	**Development**	
6810P	£4			8255	5.40	MEK6800	£220
6852	3.65			**MEMORIES**		TK80	£306
				2102	£1.70	AMI, Signetics	
				2112	£3.40	TI, Intersil,	
				2513	£7.54	Harris etc	OA
				4027	£5.78		

MISC. LSI/Scalars/DVMs

NE555 30p NE556 78p NE558 180p
LM3909 72p 9368DC /320MHz /80p
11C90DC /650MHz £14.00
ICM7216BIPI 8 decade 10MHz DFM/timer with direct LED drive and all counter features £19.82
ICM7217AIBI 4 decade programmable cntr £9.50
ICM7207 clock pulse generator IC " £4.95
ICM7208 7 decade counter/display driver " £14.95
ICM7106CP LCD DVM IC (3½ digit) " £9.55
ICM7106CPK LCD DVM KIT " £24.80
ICM7107CP LED DVM IC " £9.55
ICM7107CPK LED DVM KIT " £20.65
SP8629 divide by 100 200MHz scaler £4.20
MSL2318 divide by 100 to 175MHz min
divide by 10 to 45MHz min £4.20

PLEASE REMEMBER TO ADD 8% VAT TO ITEMS LISTED UNDER OSTS

LINEARS non consumer

BIMOS			LM374N	71p
CA3130E	84p		LM339N	66p
CA3130T	90p		LM348N	186p
CA3140E			LM3900N	60p
CA3140T	72p		709HC to5	64p
CA3160E	90p		709PC dil	36p
CA3160T	99p		710HC to5	65p
Op amps			710PC dil	59p
LM301AH	65p		723CN	65p
LM301AN	30p		741CH to5	66p
LM308H	121p		741CN 8dil	27p
LM308N	97p		747CN	70p
LM318H	279p		748CN	36p
LM318N	224p		NE531T	120p
			NE531N	105p

OPTO 7 seg displays

0.43" High Efficiency HP:

5082 7650	red CA	233p
5082 7653	red CC	
5082 7660	yellow CA	
5082 7663	yellow CC	
5082 7670	green CA	
5082 7673	green CC	

0.3" Standard HP

5082 7730	red CA	147p
5082 7740	red CC	

0.5" Fairchild

FND500	red CC 150p
FND507	red CA 150p

Current news: Work continues apace on our HMOS PA kit, and by the time this is published - we expect to be about to launch the product in a style that matches the Mark III system. The unit uses separate transformers and power supplies, and includes a DC offset sensing circuit combined with slow switch-on using a relay. We introduce the HyperFi FM IF with this advert - and a separate leaflet is available on request with an SAE. All new pricelist revision also available with an SAE. The Mullard DC controlled tone/volume and switch ICs with a 'more than HiFi' specification are in stock at last - together with reams of data (over 50 pages now). Also, RC enthusiasts will be interested to learn that we are supplying parts for various kits now.

Terms: CWO please. Account facilities for commercial customers OA. Postage 25p per order. Minimum credit invoice for account customers £10.00. Please follow instructions on VAT, which is usually shown as a separate amount. Overseas customers welcome - please allow for postage etc according to desired shipping method. Access facilities for credit purchases.

Catalogues: Ambit. Part 1 45p, Part 2 50p 90p pair. TOKO Euro shortform 20p. Micrometals toroid cores 40p. All inc PP etc. Full data service described in pricelist supplements.

Hours/phone: We are open from 9am -7pm for phone calls. Callers from 10am to 7pm. Administrative enquiries 9am to 4.30pm please (not Saturdays). Saturday service 10am to 6pm.

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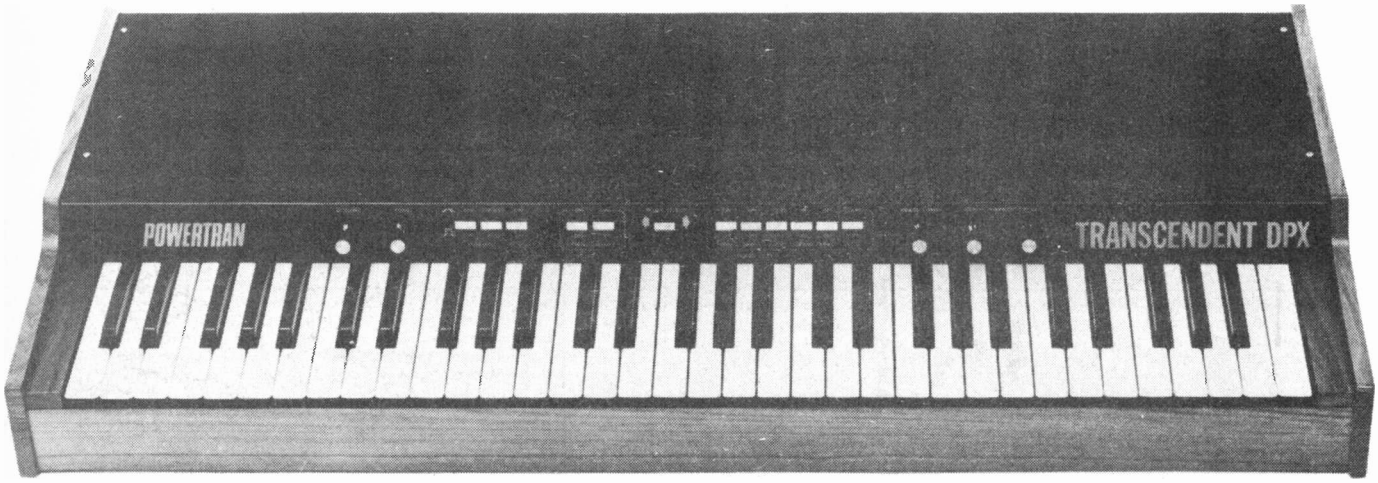
AMBIT catalogues are guaranteed to contain the most up-to-date and best informed comment on modern developments and advances in the field of radio and audio. There is no competetive publication that even approaches the broad range of parts/information on modern techniques.

2 Gresham Road, Brentwood, Essex.

STRING THING



We continue this month with Part 2 of the String Thing Saga (Son of Part 1) from Tim Orr. For those of you who missed Part 1, String Thing, otherwise known as the Transcendent DPX, is a digital, polyphonic, multi-voice keyboard instrument. (We suspect it probably makes marvellous coffee too.)

LAST MONTH WE began Tim Orr's String Thing project with a general view of the whole system and circuit details of the keyboard multiplexer and chorus/ensemble board. Constructional details of the keyboard PCB were also included.

This month we look at the note generator and demultiplexer circuits, thus proving the well-known phrase or saying 'What goes multiplex must be demultiplexed' (ETI apologise for the quality of humour in this article).

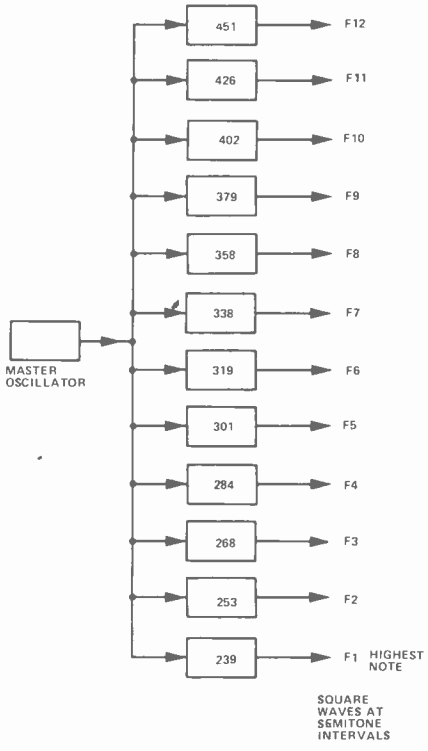
It is our normal practice to print PCB foil patterns for projects. However, in this case, all PCB foil patterns are copyright of Powertran Electronics, from whom you can buy a complete kit of parts for String Thing (see Buylines).

Part 3: We conclude String Thing next month with a description of the dynamics and voicing circuits. Also included are details of the power supply. Assembly and testing procedures round off the whole package.

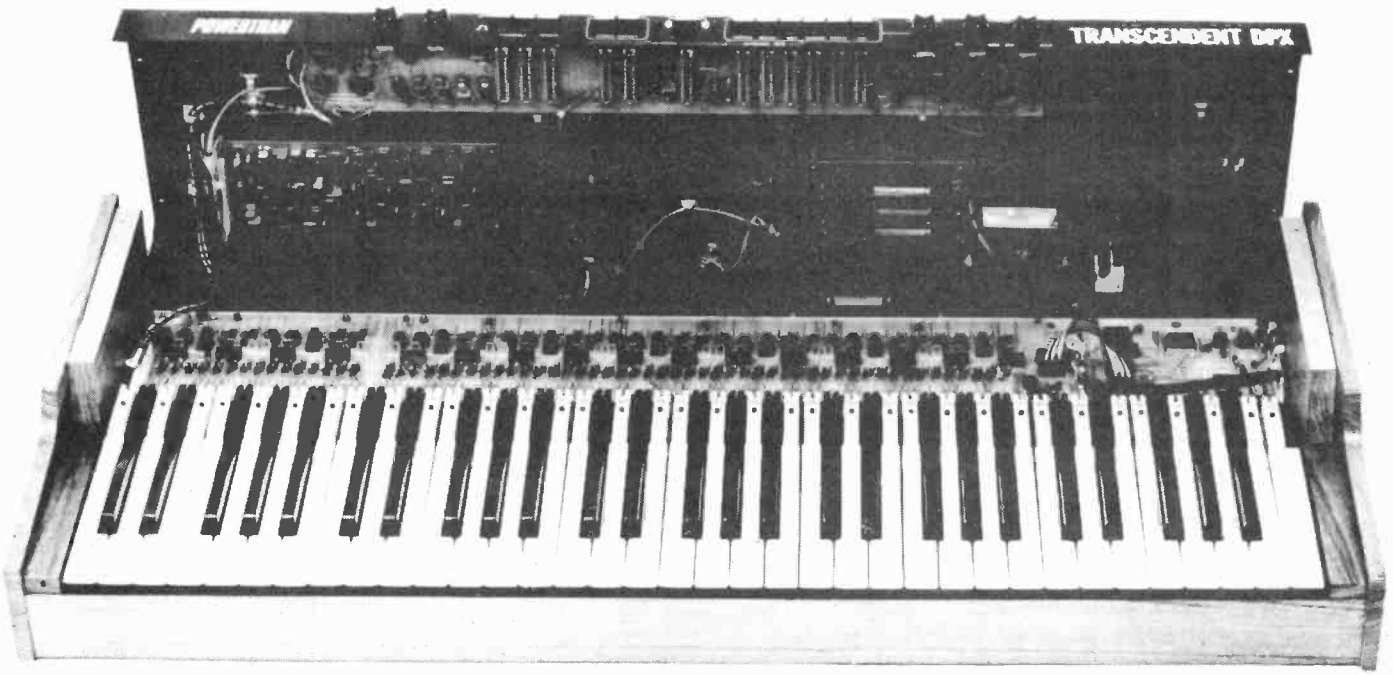
BUYLINES

Powertran Electronics are supplying a complete kit of parts for this project at £365+15% VAT. Delivery by Securicor is £2.50 extra. Everything is included in the kit, down to the last nut and bolt. They even give you a plug.

Powertran will also supply components, boards, etc separately. Please send an sae for details.



Below: String Thing with its top panel lifted up, revealing the control circuitry.



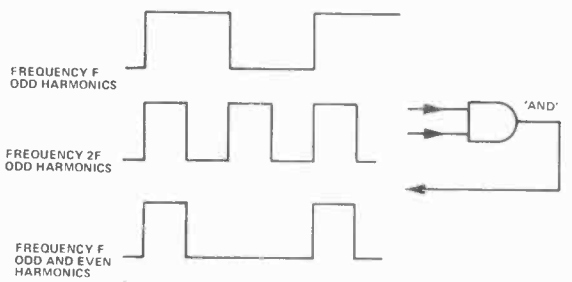


Fig. 2. (above) Waveshape Production. By ANDing frequency F (odd harmonics) with frequency 2F (odd harmonics), frequency F (odd and even harmonics) can be obtained.

Fig. 1. (left) Bock diagrams of the top octave generator, which derives different frequencies from one master oscillator.

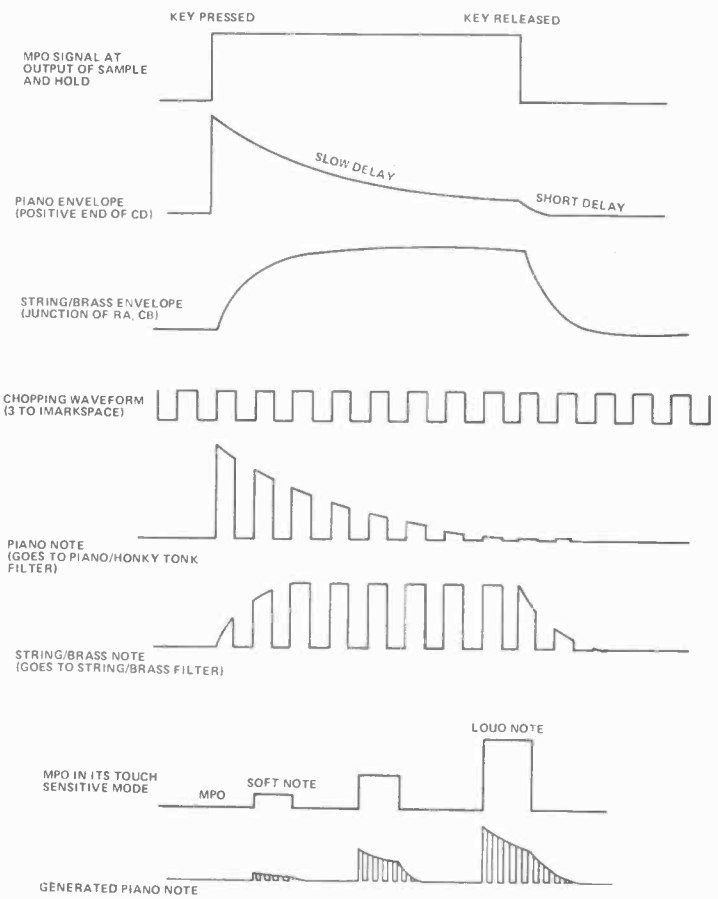


Fig. 3. (right) Note production, compare the piano waveform with the string/brass waveform.

HOW IT WORKS

Keyboard Demultiplexer

The MPO signal that the dynamics board generates is used to turn off and on the notes selected by the keyboard. However, the MPO signal is multiplexed and so a demultiplexing system must be used to route the MPO signal to the correct note generator. The demultiplexer is virtually the same as the circuit used for the keyboard multiplexer except that the signal can be considered as travelling in the other direction. When an MPO signal is generated it is routed through a switch selected by the current address count to the correct output. Here it is used to charge up a capacitor which forms part of a simple sample and hold circuit. The voltage on this capacitor is used to generate a note and so this voltage determines the amplitude of the note. So, when middle C is played on the keyboard, it is detected by the keyboard multiplexer which generates a signal (MPI) which it sends to the dynamics board.

The key velocity is computed and an MPO signal is generated, whose amplitude determines the volume of the note. The MPO signal is demultiplexed and the sample and hold circuit for middle C rises to the amplitude of MPO. The voltage from this sample and hold is then chopped with a squarewave at a frequency of middle C and hence the note is generated. The problem in using 4051's as demultiplexers is that the switches inside the device are 'make before break' in operation. This causes many of the switches to be connected together for a few hundred nanoseconds when the address changes. As a result of this, when middle C is played a few other notes turn on slightly. This problem is overcome by inhibiting the 4051 (with the OEN signal) for a short period when the address changes.

Note Generator

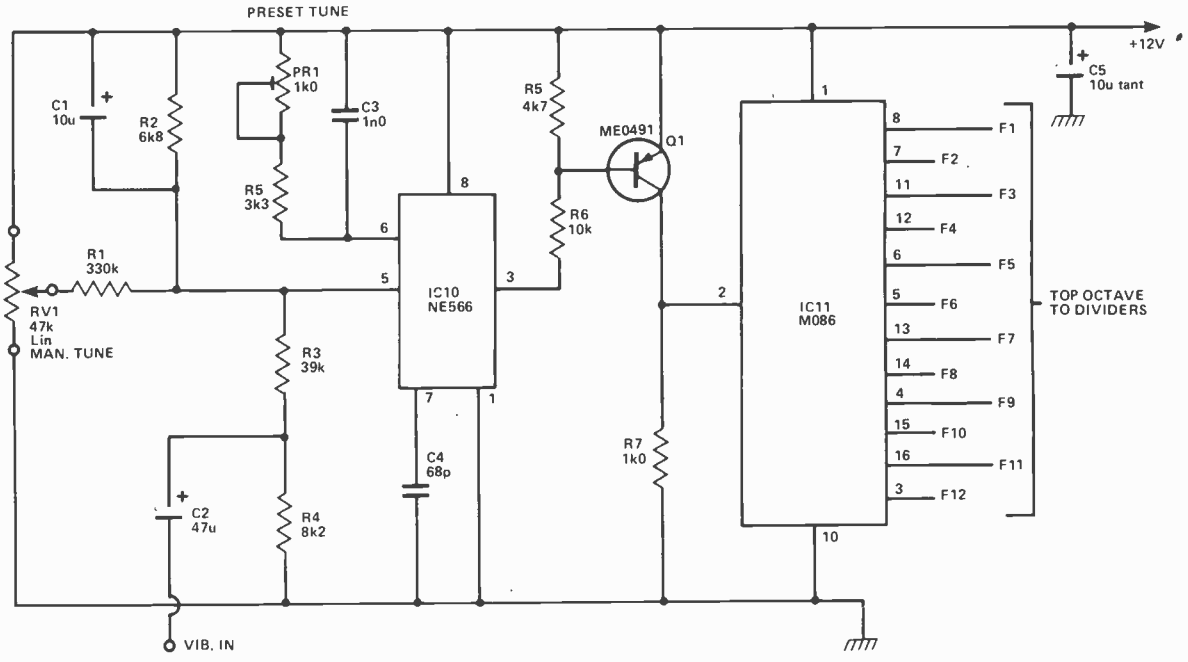
The waveform that appears at the output of the sample and hold when a note has been pressed is a squarewave, the amplitude of which is controlled by the velocity of the key depression. This squarewave is modified by two networks which produce two envelope contours that characterise the piano or the string/brass sounds. The string brass network is a simple RC, ie R_A, C_B, lowpass filter which gives the envelope a slow attack and decay contour. C_A is clamped to the clamp generator for this contour. The piano network is a slightly more complicated RC highpass filter. When the output of the sample and hold goes high, the negative end of C_A also goes high. This pulls C_B high (via D_B). The positive end of C_B is discharged to ground by the R_A resistors. Note that whilst the key is pressed both C_A plus C_B are discharged by the R_A resistors. When the key is released, the output of the sample and hold returns to OV and the negative end of C_A goes negative. Now D_B is reverse biased and so the envelope decay rate is more rapid because there is now only C_B to be discharged by the R_B resistors. D_A discharges C_A upon release of the key.

Chopping Volts

The selection of waveforms is performed with an electronic single pole switch. A mode control signal selects the envelope on all 61 generators. The notes are produced by chopping the envelope voltage with a single transistor chopper. Two square waves from the divider chain, an octave apart, are mixed and used to turn the transistor on and off. The mixture of these two waveforms turns the transistor on for 75% of the time and off for 25%. The resulting waveform is a series of pulses with an envelope contour of either the piano or string/brass shape. Diode D_C is

Fig 4 (Below) The circuit diagram for the master oscillator section of the note generator board.

(Right) The keyboard numbering system used for the note generators, and decoupling components circuit which is repeated for each IC from ten to twenty.



used to reduce background signal breakthrough and the notes are mixed together in octave blocks and sent to the voicing board for filtering.

Master Oscillator Top Octave Generator Divider Network

The top octave of the keyboard is produced by a tone generator IC, the MO86. This is a preprogrammed digital divider that divides a master high frequency oscillator by twelve integers ranging from 239 to 451. These twelve divisions produce squarewaves which are spaced at semitone intervals. Conventional keyboard tuning has twelve notes per octave, the interval between each note being a semitone, which is separated by the twelfth root of two from its neighbour. So the tone generator IC can produce the top twelve notes for the keyboard.

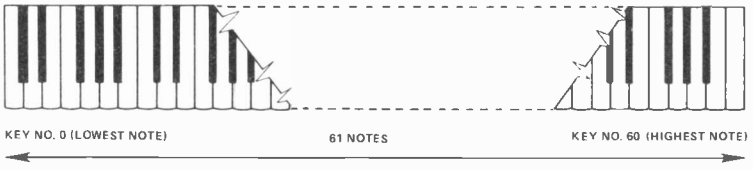
The lower octaves are produced by dividing down the top octave with divide by two flip flops. This would produce a separate squarewave for each note of the keyboard. However, squarewaves don't have a suitable harmonic structure for they contain only odd harmonics. The problem is overcome by 'ANDing' together two octave related notes to produce a pulse waveform with a one to three mark space ratio, which contains both odd and even harmonics. The resulting pulse has the frequency of the lower octave note, which means that for every note, a square wave one octave higher in pitch is needed to generate it. This is no problem for lower octave notes because the higher octave notes already exist. However, the top octave of the keyboard needs an extra stage of dividers, which means that the master oscillator must run an octave faster. If the highest note on the keyboard is 2.093 kHz then the master oscillator frequency is 239 × 2 × 2.093 kHz = 1000.45 kHz.

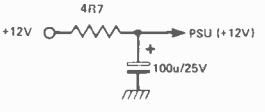
Master IC

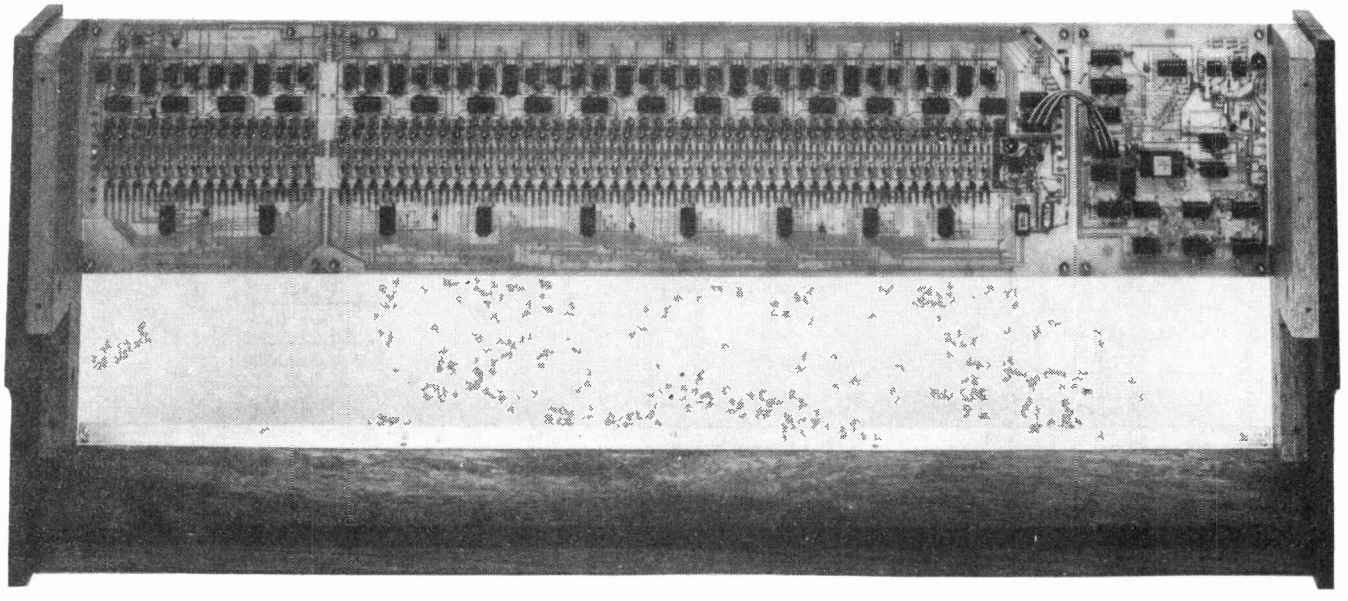
The master oscillator has to produce a 12V squarewave at 1000.45 kHz, which doesn't drift with temperature and which can be voltage controlled. This is realised using a function generator IC, the NE566, which is capable of 1 MHz operation and has a relatively low temperature coefficient. Voltages from this IC can be used to control the oscillation frequency so that manual tuning and vibrato effects are easily obtained. A transistor (Q1) is used to level convert the output squarewave from the NE566. This transistor is a fast switching PNP device. Ordinary transistors tend to saturate for about a microsecond, which is much too long a time for an oscillator running at this frequency.

Stage Division

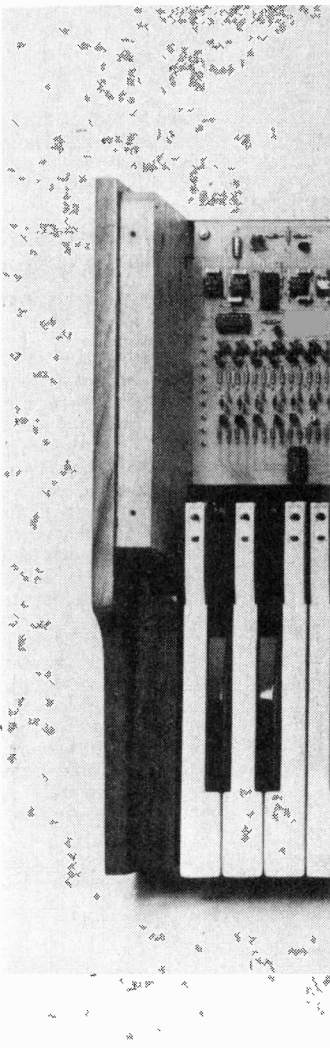
The dividers used are HBF 4727A which have been specifically designed for organ type divider systems. The IC contains seven divider sections which have been split up into two two-stage sections and three one-stage sections. The advantage of this is that you can put the dividers near to where you want them, that is, next to the notes that they drive. Some other designs have used a CMOS divider, the 4024. This will produce all the required six octaves of division but localised around the IC. Therefore, a five octave keyboard would need 72 wires or PCB tracks eminating from the divider section. However, by using the HBF 4727A it is possible to spread the dividers out along the length of the note generating board. This greatly reduces the wiring because all of it is done on the PCB with about 14 tracks. There are, of course, PCB wire links but these are very much easier to handle than a large wiring bundle.







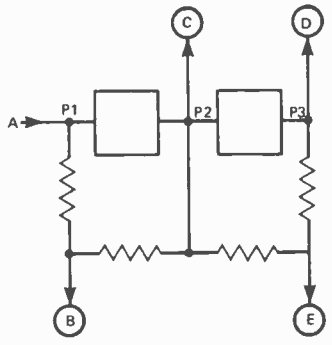
NOTE A	NOTE C	NOTE D		PIN NOS P1	P2	P3	KEYBOARD KEY B	E
F1	1B	1C	IC12	3	12	11	60	48
F2	2B	2C		2	14	13	59	47
F3	3B	–		4	10	–	58	–
F4	4B	–		5	9	–	57	–
F5	5B	–		6	8	–	56	–
F6	6B	6C	IC13	3	12	11	55	43
F7	7B	7C		2	14	13	54	42
F8	8B	–		4	10	–	53	–
F9	9B	–		5	9	–	52	–
F10	10B	–		6	8	–	51	–
F11	11B	11C	IC14	3	12	11	50	38
F12	12B	12C		2	14	13	49	37
3B	3C	–		4	10	–	46	–
4B	4C	–		5	9	–	45	–
5B	5C	–		6	8	–	44	–
8B	8C	8D	IC15	3	12	11	41	29
9B	9C	9D		2	14	13	40	28
10B	10C	–		4	10	–	39	–
1C	1D	–		5	9	–	36	–
2C	2D	–		6	8	–	35	–
3C	3D	3E	IC16	3	12	11	34	22
4C	4D	4E		2	14	13	33	21
5C	5D	–		4	10	–	32	–
6C	6D	–		5	9	–	31	–
7C	7D	–		6	8	–	30	–
10C	10D	10E	IC17	3	12	11	27	15
11C	11D	–		2	14	–	26	–
12C	12D	–		4	10	–	25	–
1D	1E	–		5	9	–	24	–
2D	2E	–		6	8	–	23	–
5D	5E	5F	IC18	3	12	11	20	8
6D	6E	6F		2	14	13	19	7
7D	7E	–		4	10	–	18	–
8D	8E	–		5	9	–	17	–
9D	9E	–		6	8	–	16	–
12D	12E	12F	IC19	3	12	11	13	1
1E	1F	1G		2	14	13	12	0
2E	2F	–		4	10	–	11	–
3E	3F	–		5	9	–	10	–
4E	4F	–		6	8	–	9	–
11D	11E	11F	IC20	3	12	11	14	2
8E	8F	–		2	14	–	5	–
9E	9E	–		4	10	–	4	–
10E	10F	–		5	9	–	3	–
7E	7F	–		6	8	–	6	–

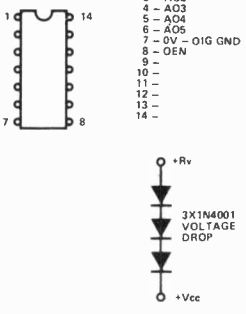


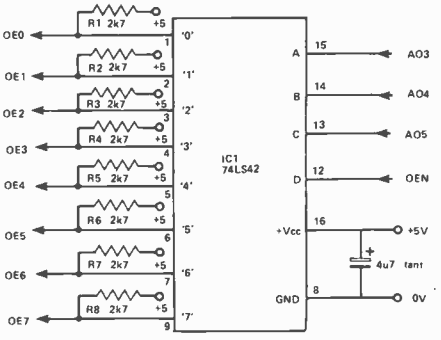
POWER FOR 4051B

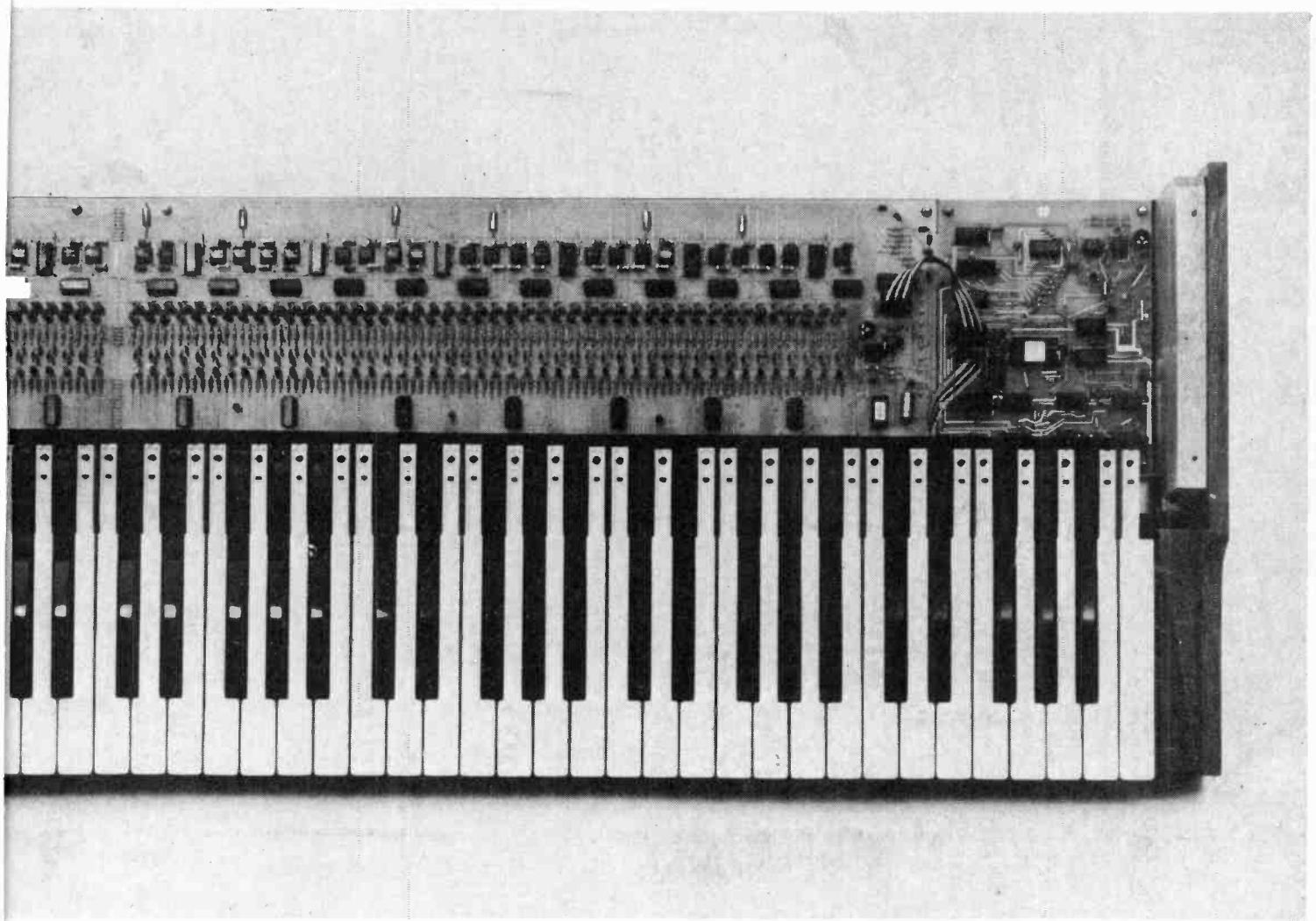
PIN 16 Vdd	PIN 8 Vcc	PIN 7 Vee
+Vcc	0V	0V

Above and below: connection details for IC12-20. The diagram below shows the annotations for the dividers, and the table gives the note, pin nos and connection points.









With the top panel removed, the two note generator boards can be seen.

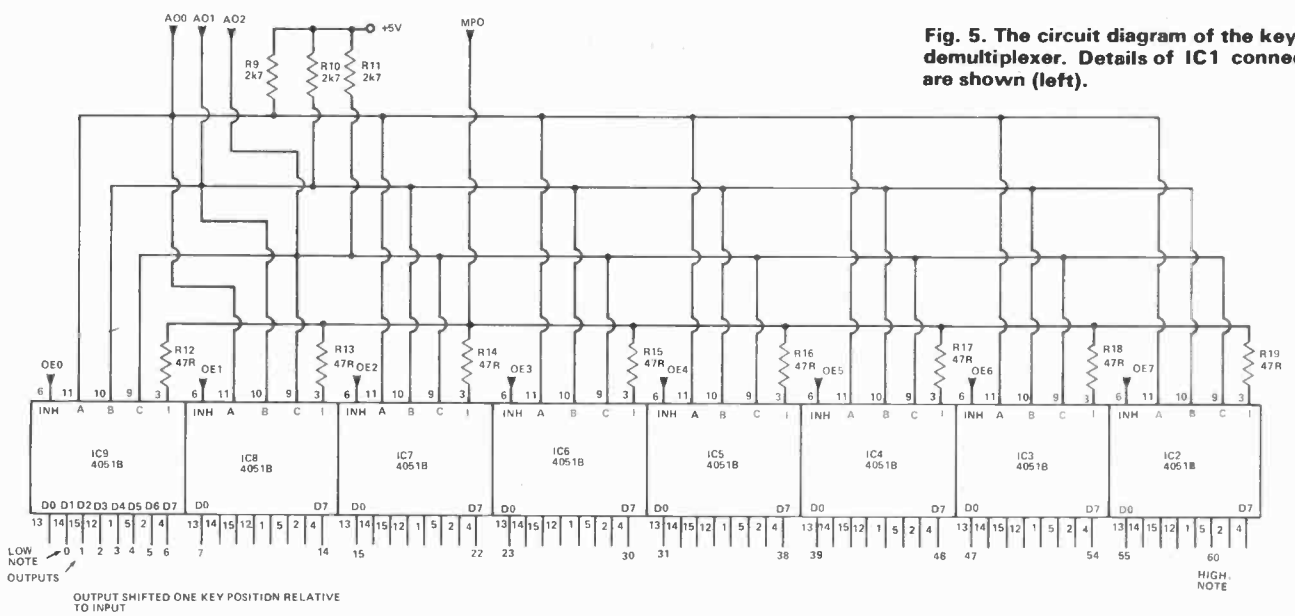


Fig. 5. The circuit diagram of the keyboard demultiplexer. Details of IC1 connections are shown (left).

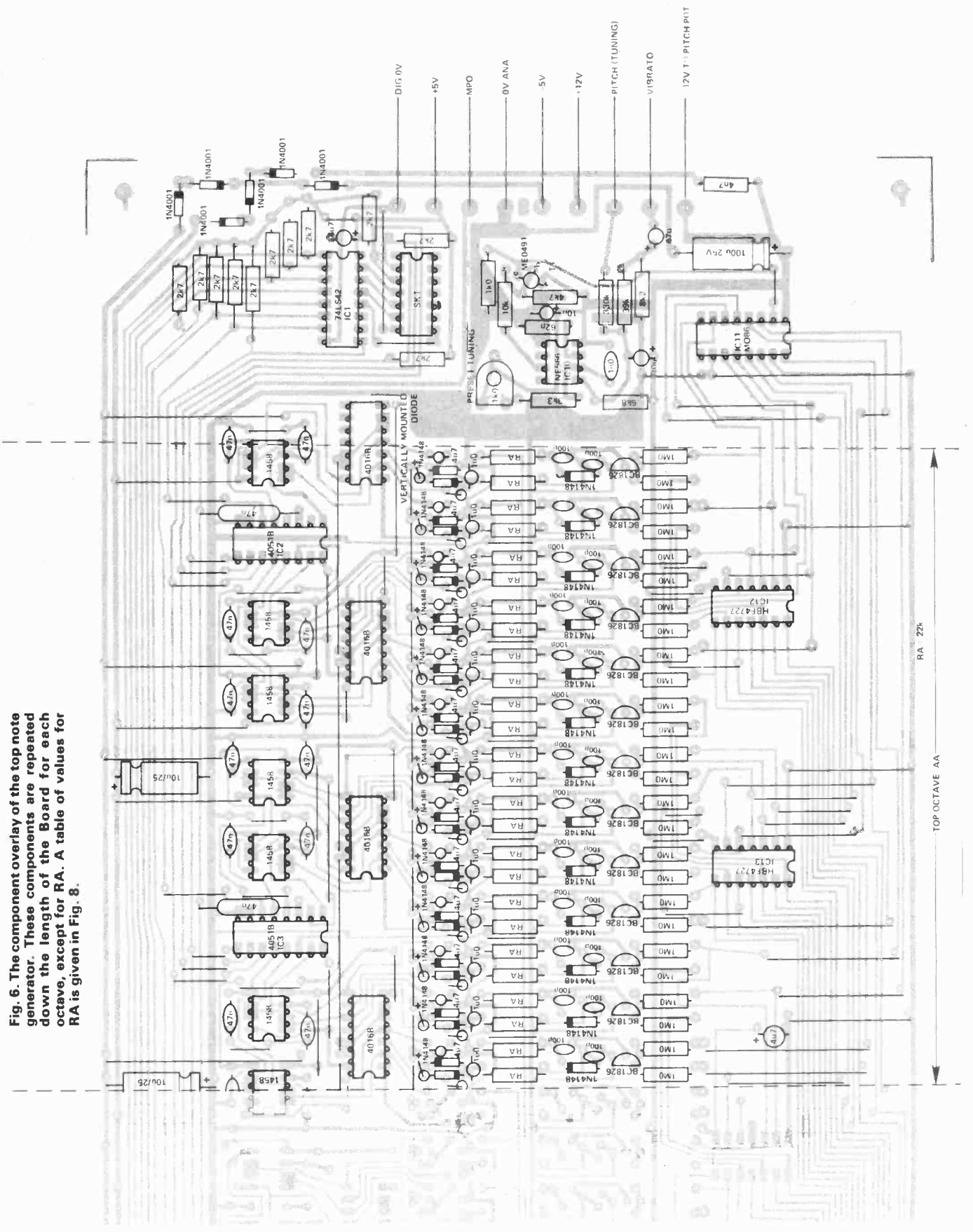
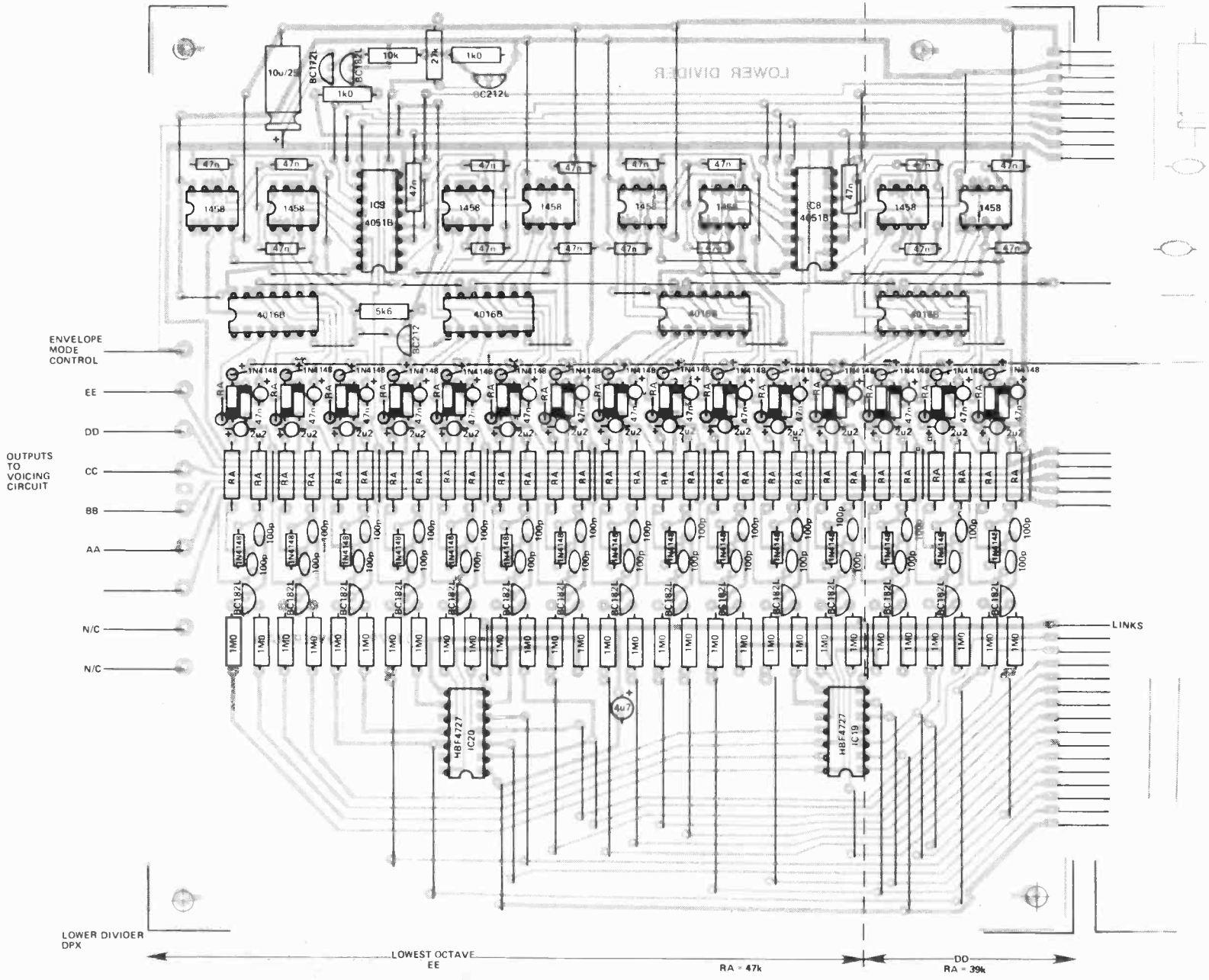


Fig. 6. The component overlay of the top note generator. These components are repeated down the length of the Board for each octave, except for RA. A table of values for RA is given in Fig. 8.

Fig. 7. Component overlay of the lower note generator.



PARTS LIST

KEYBOARD DEMULTIPLEXER

RESISTORS all 1/5th Watt 5%

R1-11	2k7
R12-19	47R

CAPACITOR

C1	4u7 tantalum

SEMICONDUCTORS

IC1	74LS42
IC2-9	4051B

NOTE GENERATOR BOARDS

Master Oscillator and Top Octave Generator

Component	Qty
RESISTORS (all 1/5W 5%)	
4R7	1
1k0	1
3k3	1
4k7	1
8k2	1
10k	1
39k	1
330k	1

Component	Qty
POTENTIOMETER	
1k0 preset	1
CAPACITOR	
1n0	1
68p polystyrene	1
0u47 tantalum	1
100u 25 V electrolytic	1
SEMICONDUCTORS	
MO86	1
NE566	1
MEO491	1
MISCELLANEOUS	
Top Note PCB	1
Lower Note PCB	1

Divider Section

Component	Qty
1MO 1/5 W 5%	122
4u7 16 V tantalum	4
HBF4727	9
14 pin DIL sockets	9

Envelope Section

RESISTORS (all 1/5 W 5%)	
1k0	2
5k6	1
10k	1
22k	39
27k	37
33k	36
39k	36
47k	36
CAPACITORS	
100p ceramic	122
47n (7.5mm pitch)	61
1u0 electrolytic	8
2u2 16 V tantalum	61
4u7 16 V tantalum	61
SEMICONDUCTORS	
TLMC1458C	31
4016B	16
BC182LA	61
BC182L	2
BC212	2
1N4001	6
1N4148	244
MISCELLANEOUS	
8 pin DIL socket	31
14 pin DIL socket	16

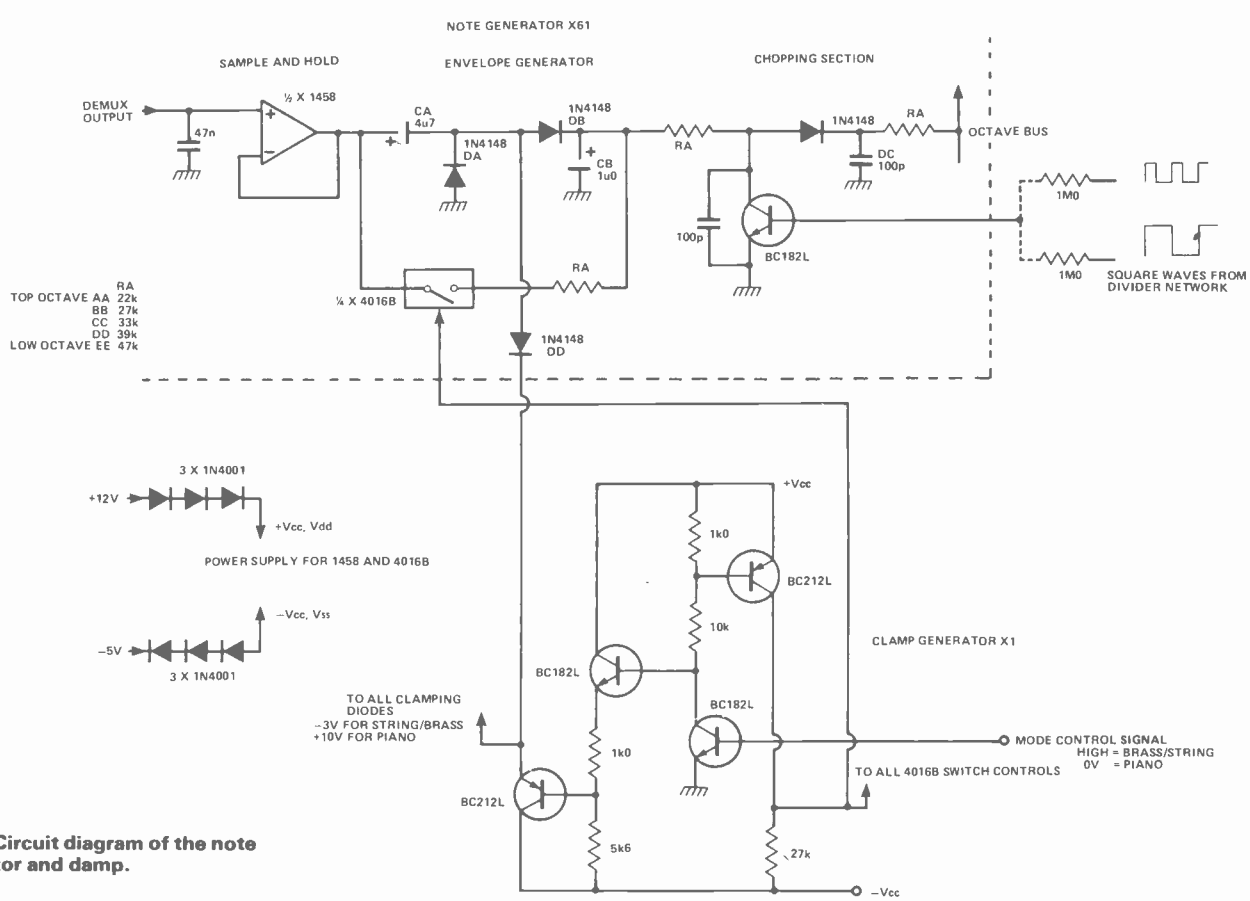


Fig. 8. Circuit diagram of the note generator and damp.

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LM 10 APPLIED

Next month Ray Marston attempts to fill the issue with applications — some of which you couldn't ever have dreamed of — for his new champion chip, the amazing LM 10. See how close he gets to making it in the October issue of ETI.

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The power amp produces over 60W at 0.04% THD with particular attention having been paid to "open-loop" performance such that TID is negligible. Hum and noise —110dB for the power amp. Listening tests played a huge part in settling the final design too.

The system is modular such that either the pre-amp or power amps can be utilised separately. Put them together and you have the best sounding magazine amplifier ever! Full details next month.

Analog delay

Since the advent of CCD (charge coupled devices) you could be forgiven for believing that all other methods of obtaining a time delay on a signal have curled up and died.

This is simply not so, and next month Tim Orr takes time off from String Thing to explain this largely unknown flourishing field.

RADIO CONTROLLED

Of course you've all built our radio control project out there haven't you? No? . . . Oh.

Well the reason why not could simply be that you haven't seen this article yet. Written by Geoff Chapman — one of the few real experts in the field, it illustrates the different types of model that can be operated by R/C and how to get them operational!

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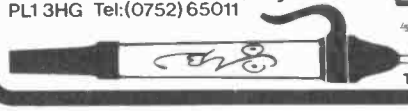

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★RCA 1861 video IC to display program on TV screen via the RF Modulator
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Interrup, DMA and ALU
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DESIGNER'S NOTEBOOK

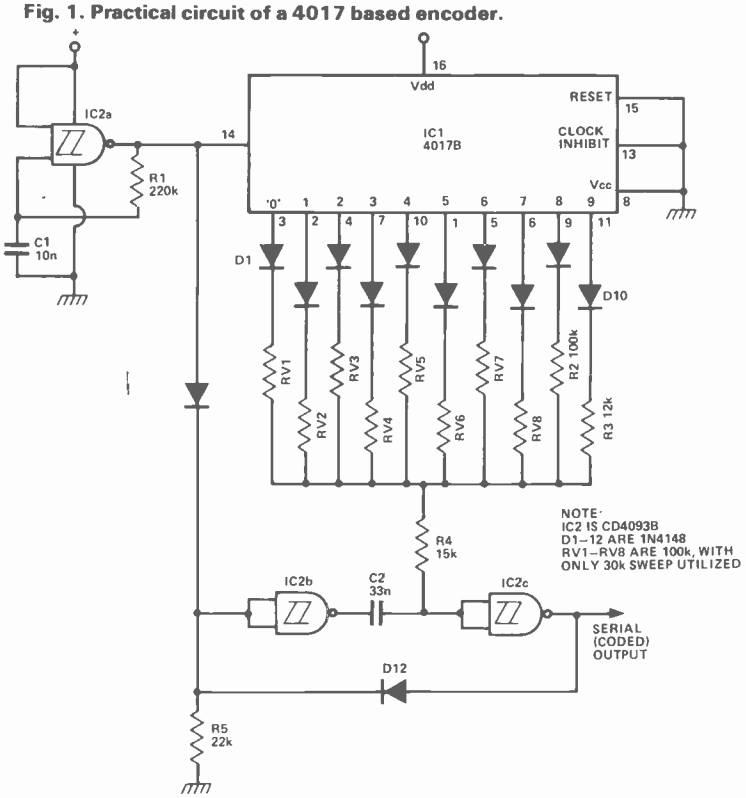
A monthly look at the notebook of ETI's chief design engineer, project editor Ray Marston.

SIMULTANEOUS multi-channel remote control systems, giving either fully proportional or simple on/off action (or a combination of the two) are widely used by the model 'plane, boat and car fraternities. Figure 1 shows the basic block diagram of an 8-channel version of the type of system in use.

In the transmitter, eight manually-actuated pots (in a proportional system) or switches (in an on/off system) are sequentially sampled at a fixed rate by an ENCODER circuit, which at each sample point generates a pulse with a width proportional to the state of the device being tested. The output of the encoder consists of a repeating series of 'frames' of eight width-controlled pulses followed by a synchronisation pulse, all presented in serial form.

Typically, in an 8-channel proportional system, the width of the controlled pulses may be variable from 0.5 mS to 1.5 mS (depending on the settings of individual control pots), the sync. pulse width may be 3 mS, the sample period 2 mS and the frame width 20 mS.

Fig. 1. Practical circuit of a 4017 based encoder.



Servo code

The serial output of the encoder is coupled via a suitable 'link' to the input of a decoder circuit that is located in the remote receiver. The link may take the simple form of two wires (or only one if a ground return is used), or the more complex form of a modulated radio, ultrasonic, infra-red, or magnetic signal, etc. The decoder circuit detects the sync. pulse in each frame, and then counts the individual controlled pulses in the frame and routes each one to its own output terminal. There it may be fed to an electronic switch or a servo-mechanism which will reconstruct the original mechanical control movement that took place at the transmitter.

The 'heart' of the remote control system described above is the encoder and decoder. As already mentioned, the actual 'link' can take any one of a variety of forms. The basic control system is highly versatile and has a vast number of untapped potential applications. The number of channels that can be simultaneously controlled can range from two to dozens (or even hundreds). In on/off applications, the outputs can easily be binary decoded to give non-simultaneous on/off control of a vast number of remote devices: an 8-channel system can, for example, control 256 devices, or a 12-channel system can control 4096.

The system can readily be adapted to give remote operation of lamp dimmers, volume controls, 'combination' locks and garage doors, or independent on/off control of hundreds of household fittings via signals pumped down the mains wiring. You can even, if it takes your fancy, use the system to remote control a full sized piano from the comfort of an armchair via a hand-held keyboard and an infra-red link!

An 8-Channel Proportional Control Encoder

Figure 1 shows the practical circuit of a 4017-based 8-channel encoder for use in simultaneous control systems. IC2a is a 500 Hz (2 mS) astable multivibrator that simultaneously feeds clock signals to the input of the 4017 and trigger signals to the input of the IC2b-IC2c monostable multivibrator. In any given clock cycle, the period of the monostable is determined by C2-R4 and by the resistance value in series with the relevant 'high' output of the 4017. In clock cycles '0' to '7' the pulse widths are determined by the settings of RV1 to RV8 respectively. In the '8' clock cycle the pulse has a width equal to the clock cycle period (2 mS), and in the '9' clock cycle the pulse is fixed at about 1 mS, thus ▶

giving a composite 3 mS sync pulse from the 8th and 9th cycles. The system is designed to give a fixed 20 mS frame width.

Note that, in conformance with normal practice, only one third (or less) of the sweep ranges of RV1 to RV8 are utilized. In practice, component values may have to be altered slightly to give precise ranges of coded output pulse widths.

An 8-Channel Proportional Control Decoder

Figure 2 shows the circuit of a decoder for use with the above system. The incoming 'coded' waveform is fed simultaneously to the clock terminal of the 4017 and to the trigger terminal (via C1-R1-D1) of the IC2c-IC2d monostable. IC2c of this monostable produces a negative-going pulse with a period slightly less than the 2 mS clock period (about 1.8 mS), and this negative pulse is ANDed with the positive clock signal by IC2a and IC2b to produce a reset output signal from the 3 mS input sync pulse, but not from the 'control' pulses, which all have periods significantly less than the 1.8 mS reference value.

Note that the value of R3 may have to be adjusted on test to set the correct reference period.

Outputs 1 to 8 of the 4017 are sequentially ANDed with the coded clock input signal once the counter has been reset by the sync pulse, so that each individual code pulse is routed to its own designated output terminal or channel. The individual outputs, which take the form of 0.5 mS to 1.5 mS pulses with repetition periods of 20 mS, can then be fed to suitable servos, etc, to convert the pulses into proportional mechanical movements.

An 8-Channel Simultaneous On/Off Encoder

Multi-channel simultaneous on/off coder/decoder systems are technically no easier to implement than full proportional systems. In fact they are often more difficult. Figure 3 shows a practical example of a simultaneous 8-channel on/off control encoder.

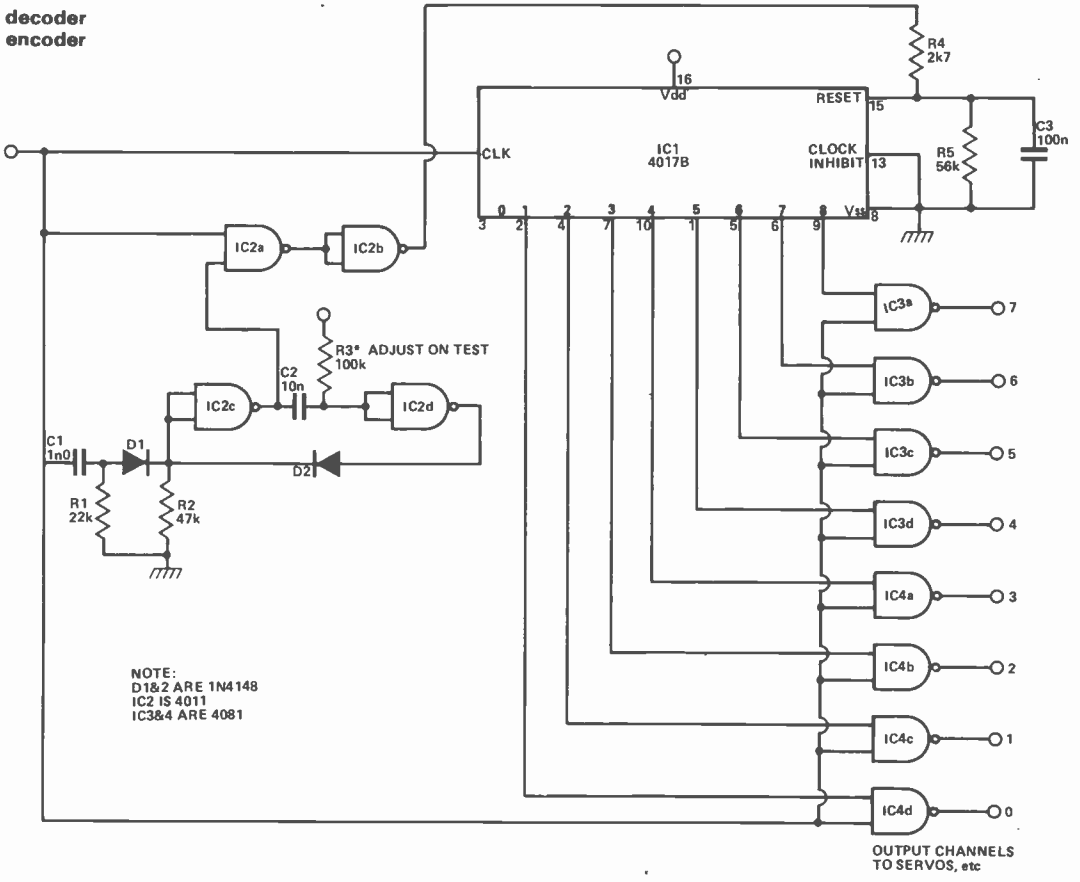
Here, astable multivibrator IC2a simultaneously feeds 500 Hz clock signals to the 4017, to the IC3a-IC3b 200 uS monostable multi, and to one input terminal of the IC2b-IC2c AND gate. The other input of the AND gate is sequentially taken from the '0' to '7' outputs of the 4017 via any of the PB0 to PB7 switches that are closed, and directly from the '9' output. The outputs of the AND gate and the 200 uS monostable, plus the direct '8' output of the 4017, are all ORed to produce the final serial coded output across R4.

The final output waveform comprises 200 uS pulses and 1 mS pulses to represent off and on switch states respectively, plus a 3 mS sync pulse spanning the 8th and 9th clock cycles.

An 8-Channel Simultaneous On/Off Decoder

Figure 5 shows a decoder circuit that is suitable for use with the above encoder. Here, the IC3a-IC3b-IC2a-IC2b network detects the input sync pulse and then resets the counter, and the IC3c-IC3d-IC2c-IC2d network detects 'wide' (1 mS) or 'on' code pulses and then ANDs the selected output of the 4017 via the IC4-IC7 array to produce a high potential on the appropriate output channel. Note that the purpose of the D-R-C network in each output channel is to convert a detected 'wide' pulse into a steady DC voltage that will remain high (or low) for greater than one frame period.

Fig. 2. Suitable decoder circuit to match encoder (Fig. 1).



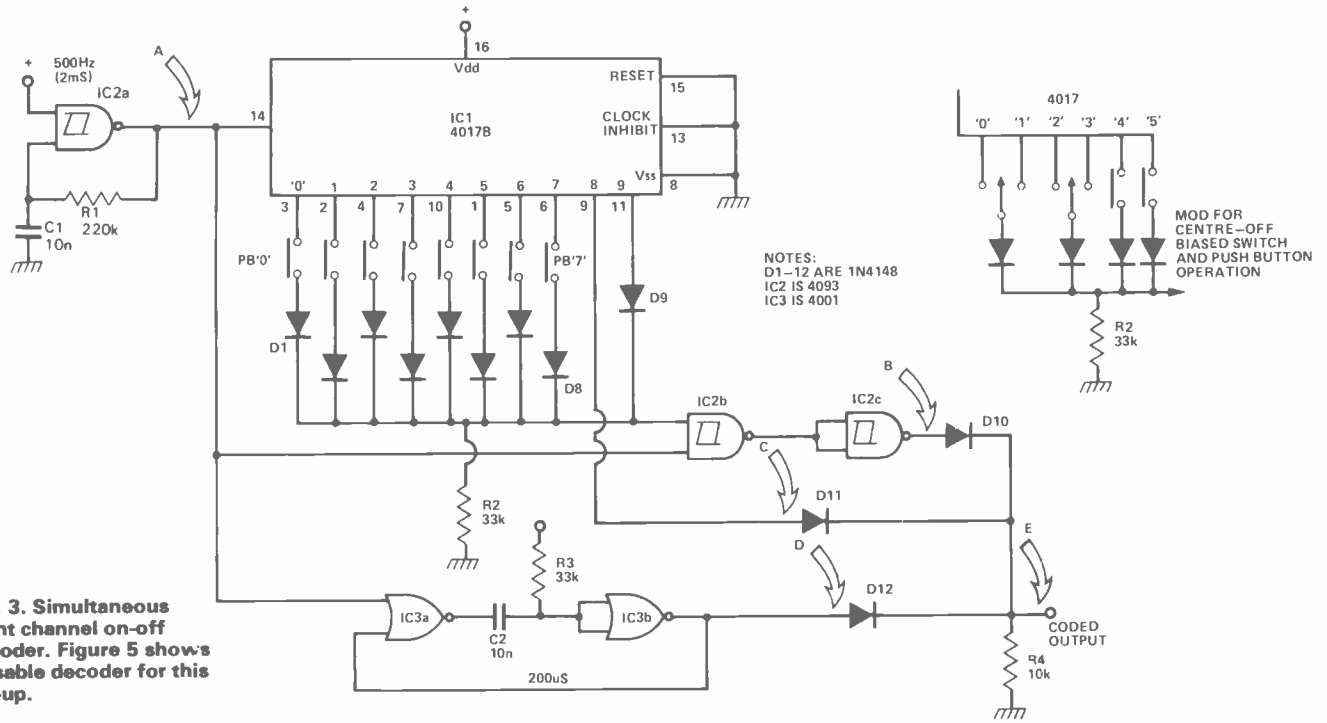


Fig. 3. Simultaneous eight channel on-off encoder. Figure 5 shows a usable decoder for this set-up.

Note that the steady (non-pulsed) outputs of the eight channels of this system can readily be binary decoded to make a-total of 256 non-simultaneous channels available.

Expanded Multi-Channel Control Systems

All of the coder/decoder circuits presented in this month's "Notebook" can be expanded to incorporate any number of channels (with appropriate increases in frame periods and miscellaneous timing component values) by using multi-stage 4017 counter networks (see the last Notebook) in place of the single counters shown here. If you want more information on this circuit and its brother decoder, you'll have to wait until the circuit reappears in an ETI project some-time later!

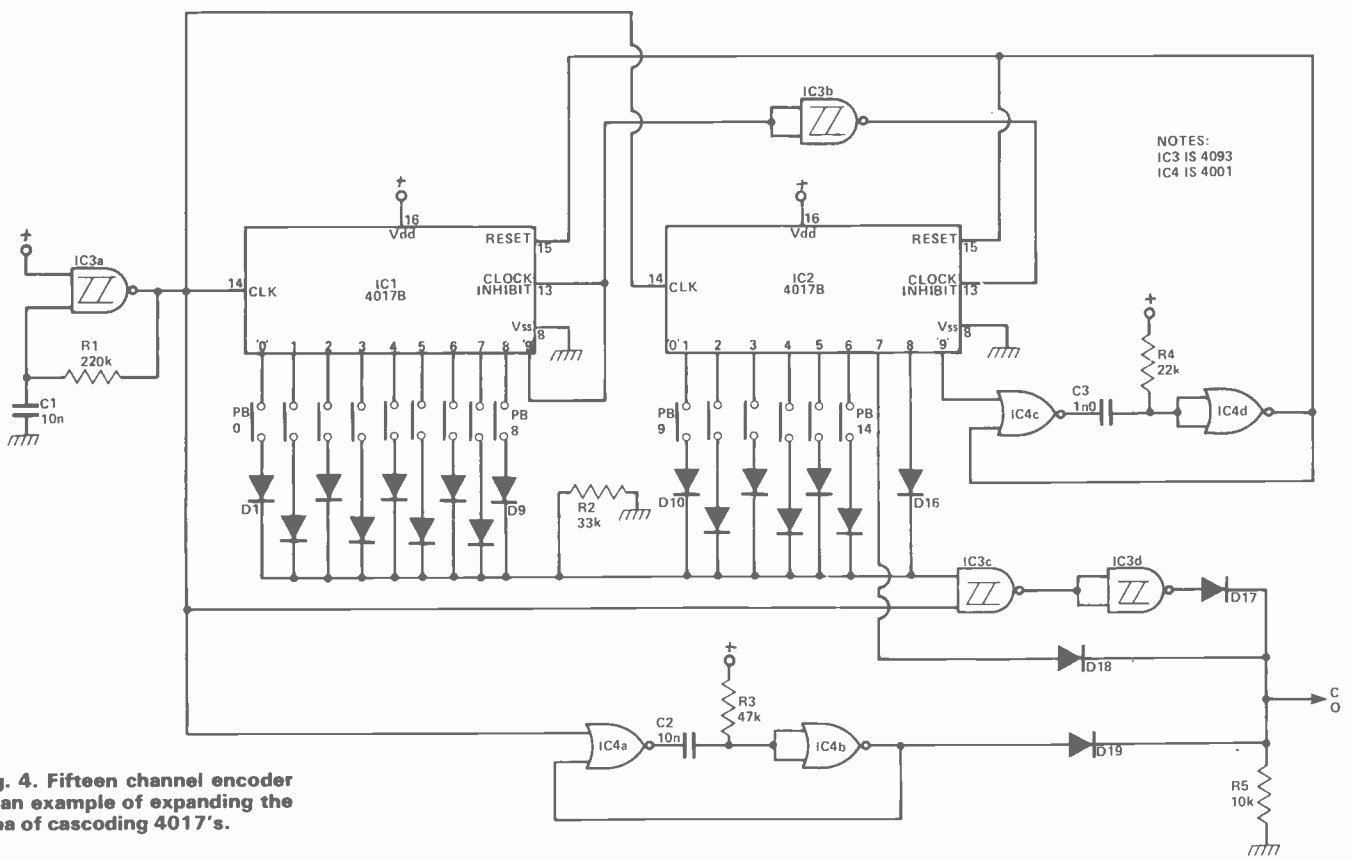


Fig. 4. Fifteen channel encoder — an example of expanding the idea of cascoding 4017's.

The Commercial Radio Control Scene

The commercial radio control scene is going through a world-wide boom at the present time. A big craze for radio controlled model or 'toy' cars is currently sweeping Japan, where manufacturers are planning to step up production from last year's 700,000 units to 2 million units in 1979.

At the back of this craze are some interesting new R/C ICs. Single IC 6-channel transmitters (coder plus RF stages) and 4-channel receivers (RF stages plus decoder) will soon be available in the UK. The ETI design team expects to get samples of these chips within the next few months, and may describe them in a future feature article. ETI

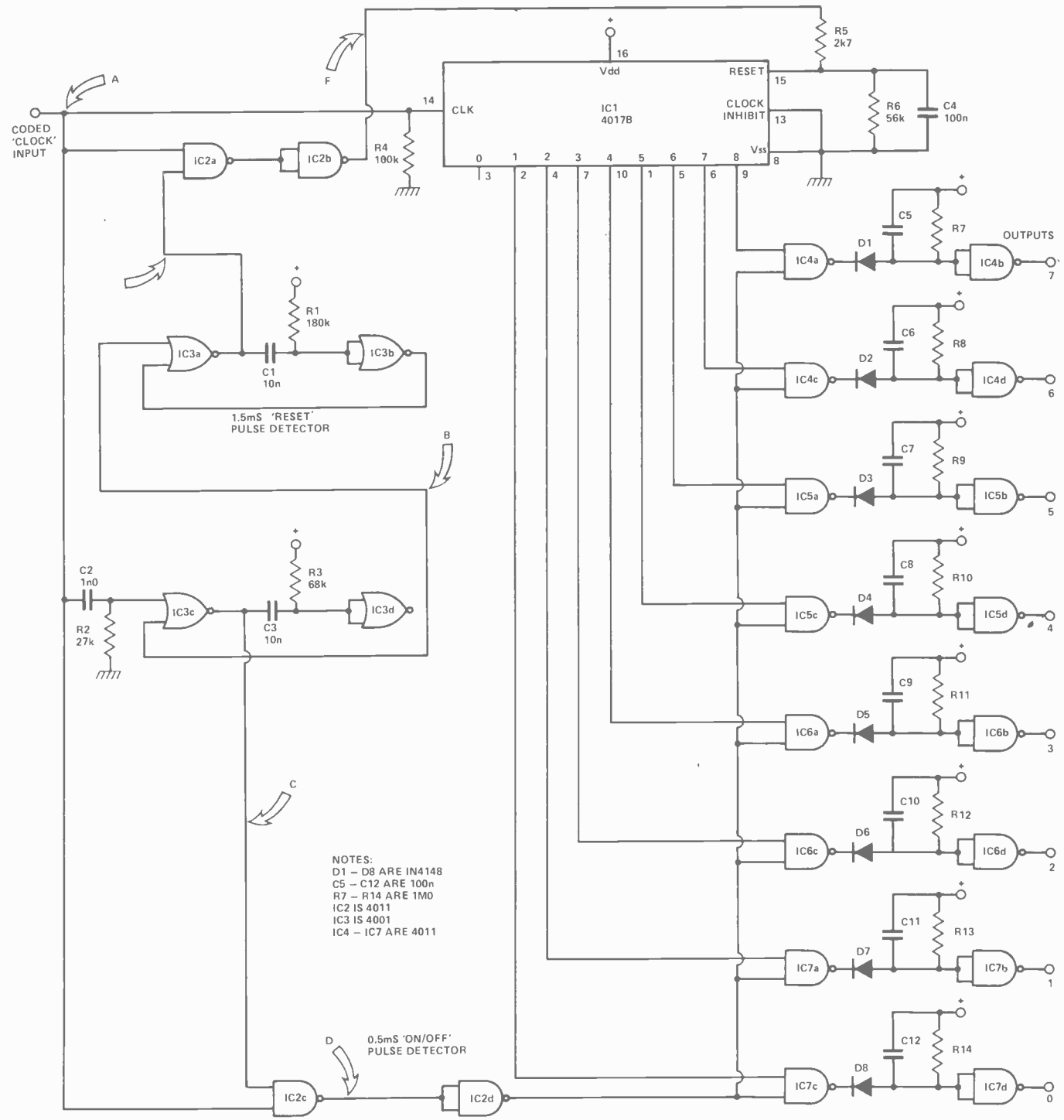


Fig. 5. Eight channel decoder which will operate as a system with either encoder (Figures 3 or 4).

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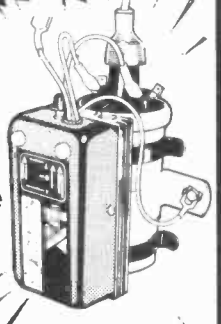
Sparkrite was featured by Shaw Taylor in "DRIVE IN"



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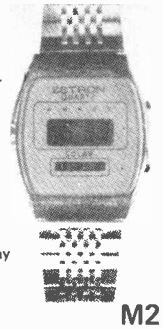

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Alarm.
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M7

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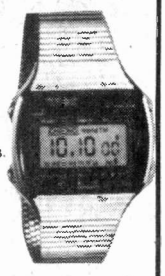

- ★ 6 digits, 5 flags.
- ★ 6 basic functions.
- ★ 8 further time zones.
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- ★ Back-light.
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M8

SOLAR QUARTZ LCD Chronograph

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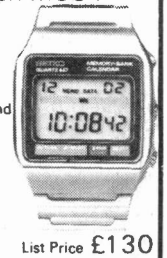

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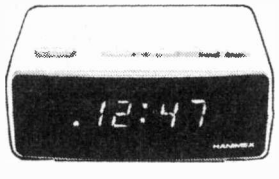

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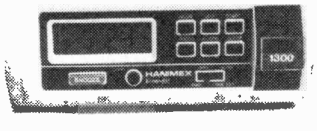

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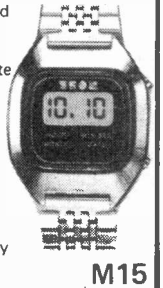

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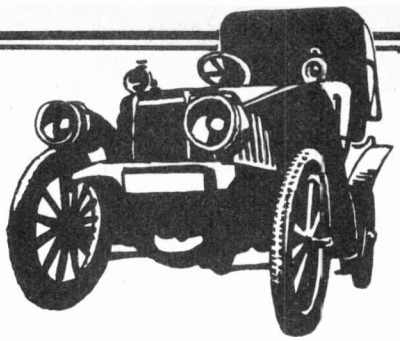


OVERSPEED ALARM

This unit activates when your vehicles engine or road speed exceeds pre-set limits. It can be used as a stand-alone project, or can be used in conjunction with the fault monitor described elsewhere in this issue.

THE ETI OVER-SPEED ALARM is designed for use in petrol-engined vehicles fitted with 12 volt negative-ground electrical systems only. It is driven from the engine's contact-breaker points, and can be used to activate when the engine RPM exceeds a pre-set limit, or when the vehicle's top-gear road speed exceeds one of four pre-set values.

The unit switches on a LED and energises an optional load, such as a relay or an audible warning device, when it is activated. If the unit is used in conjunction with the 'Fault-Light and Turn-Indicator Audible Repeater' project described elsewhere in this issue, the optional load of the Over-Speed Alarm can be omitted and the unit's auxiliary output can be used to activate the audible warning device that is built into the 'Repeater' unit.

The over-speed alarm is inexpensive, is easy to build and is quite easy to install in the vehicle.

Construction, Installation And Use

Before starting construction, note the following points and add or delete components to or from the design as appropriate.

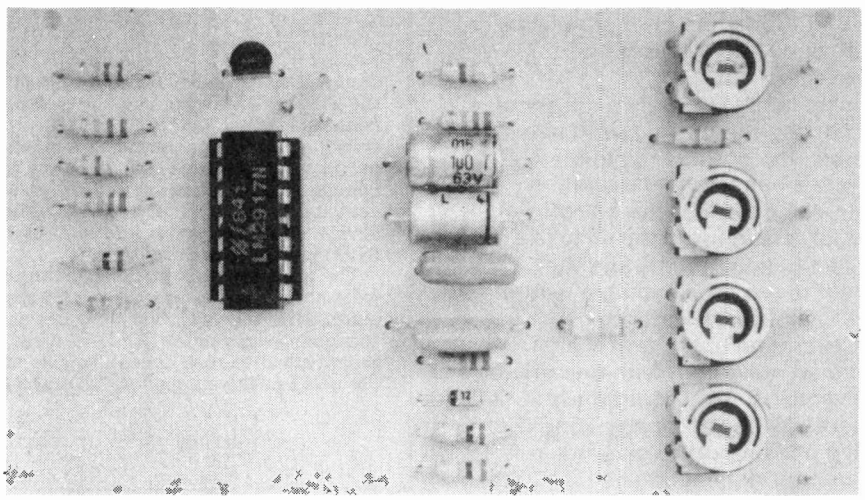
(1). If you intend to use the unit purely as a single-range excess-RPM alarm, delete SW1 and RV2 to RV4 from the circuit, and connect pin 3 of the IC to ground via RV1 and R6. In this case the circuit's positive supply rail can be taken to the vehicle's battery via the ignition switch, so that the system is permanently enabled when the vehicle is in use.

(2). If you are going to use the unit as a 4-range excess road-speed alarm, note that the system works on the assumption that you will always be in top gear when you exceed a speed limit and is thus designed to be effective only when the vehicle is in top gear. In this case, therefore, the unit's positive supply rail should be taken to the vehicle's battery via the ignition switch and an on/off switch. The on/off switch can either be a manually-operated type, or can be a microswitch that is activated by the vehicle's gear lever.

(3). If you decide to fit the unit with an optional load, such as a relay or an audible warning device, the load must have an impedance greater than 100R.

(4). If you decide to use the unit in conjunction with the 'Audible Repeater' unit described elsewhere in this issue, you can eliminate R7 and Q1 from the design and connect the auxiliary output terminal of the over-speed alarm to the auxiliary input terminal of the 'Repeater' unit.

(5). The C2 value of the circuit must be chosen to suit the required RPM trigger range of your vehicle. A value of 100n enables an RPM span of 1500 to 6000 to be covered on a 4-cylindered 4-stroke engine. If your vehicle is an 8-cylinder 4-stroke, or a 4-cylinder 2-stroke, halve the value of C2 to get the same RPM span. ▶



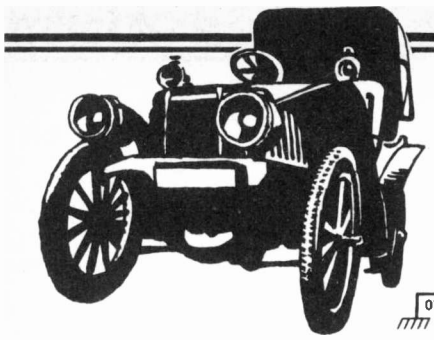


Fig. 1. Circuit diagram of the Overspeed alarm, showing the internal connections of IC1, an LM2917N.

One you've sorted out these five points, you can go ahead with the construction and installation of the unit. Construction is simplicity itself, and should present no problems.

Installation is simply a matter of connecting the unit's 0-volt line to chassis, the positive rail to the vehicle's battery via the ignition switch (and possibly an on/off switch), the input to the vehicle's contact-breaker points and the output to a suitable audible warning unit as already described.

Calibration of the unit is a two-man operation, with one driving the vehicle to the required trip speeds and the other adjusting the unit's pre-set pots to give the required trigger action!

HOW IT WORKS

The over-speed alarm works by detecting the engine RPM rate via the vehicle's contact breaker points, converting the resulting C-B frequency into a linearly proportional voltage and feeding this voltage to a comparator that trips and activates a LED and an audible warning device when the voltage (and thus the RPM) exceeds a pre-set value.

The assumption is made that the unit will only be used as an excess road-speed alarm when the vehicle is being driven in top gear (the engine RPM is directly proportional to road speed). In this case the unit's positive supply rail connection should be broken when the vehicle is not in top gear.

Most of the work of the unit is done by IC1, a frequency-to-voltage converter chip. Components R1-ZD1-R2-R3 and C1 'condition' the contact-breaker signal and make it suitable for driving the chip. C2 and RV1-RV4 and R6 determine the frequency-to-voltage conversion rate of the IC and C3-R4-C4 remove ripple from the resulting DC signal that is fed to one side of the IC's voltage comparator stage. The output of the IC is used to drive LED 1 and to switch on Q1, which is capable of providing a 120 mA load current.

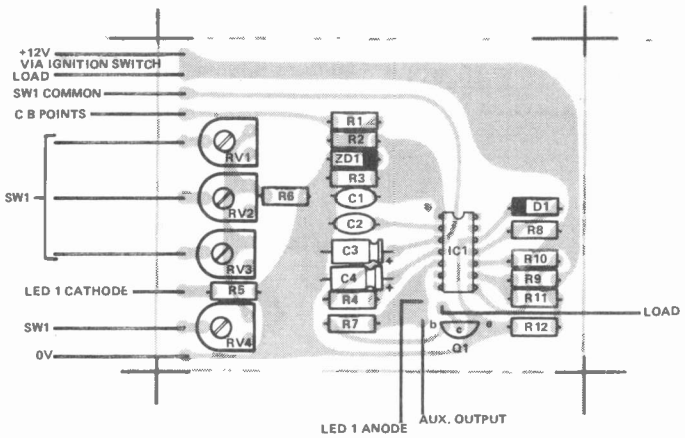
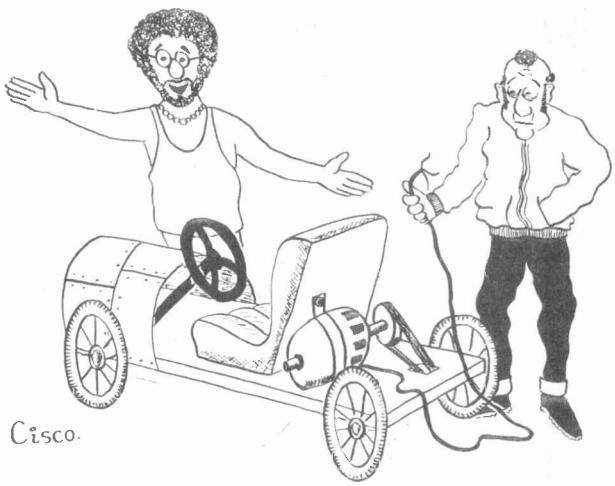


Fig. 2. Component overlay.



"At last! My energy saving car! All I need now is fifty-five miles of mains cable"

PARTS LIST

RESISTORS

R1, R2, R8	10k
R3, R4, R10	22k
R5	270R
R6	27k
R7	4k7
R9	470R
R11, R12	12k

POTENTIOMETERS

RV1-4	100k sub min presets

CAPACITORS

C1	22n polyester
C2	100n polyester (see text)
C3, C4	1u0 63V electrolytic

SEMICONDUCTORS

IC1	LM2917N
Q1	BC184L
ZD1	BZY88 12V
D1	1N4148
LED1	0.2" standard red LED

MISCELLANEOUS

SW1, single pole 4-way rotary switch.

BUYLINES

The LM2917N can be obtained from Maplin Electronics. The optional load uses the same rated audible warning device as this month's other car projects and the rest of the bits are available anywhere.

DIODES/ZENERS

QTY.			
1N914	100v	10mA	.05
1N4005	600v	1A	.08
1N4007	1000v	1A	.15
1N4148	75v	10mA	.05
1N4733	5.1v	1 W Zenner	.25
1N4749	24v	1W	.25
1N753A	6.2v	500 mW Zener	.25
1N758A	10v	"	.25
1N759A	12v	"	.25
1N5243	13v	"	.25
1N5244B	14v	"	.25
1N5245B	15v	"	.25
1N5349	12v	3W	.25

SOCKETS/BRIDGES

QTY.					
8-pin	pcb	.16	ww	.35
14-pin	pcb	.20	ww	.40
16-pin	pcb	.25	ww	.45
18-pin	pcb	.30	ww	.95
20-pin	pcb	.35	ww	1.05
22-pin	pcb	.40	ww	1.15
24-pin	pcb	.45	ww	1.25
28-pin	pcb	.50	ww	1.35
40-pin	pcb	.55	ww	1.45
Molex pins .01		To-3 Sockets		.35
2 Amp Bridge		100-prv		.95
25 Amp Bridge		200-prv		1.50

TRANSISTORS, LEDS, etc.

QTY.		
2N2222M	(2N2222 Plastic .10)	.15
2N2222A		.19
2N2907A	PNP	.19
2N3906	PNP (Plastic)	.19
2N3904	NPN (Plastic)	.19
2N3054	NPN	.55
2N3055	NPN 15A 60v	.60
T1P125	PNP Darlington	1.95
LED Green,	Red, Clear, Yellow	.19
D.L.747	7 seg 5/8" High com-anode	1.95
MAN72	7 seg com-anode (Red)	1.25
MAN3610	7 seg com-anode (Orange)	1.25
MAN82A	7 seg com-anode (Yellow)	1.25
MAN74	7 seg com-cathode (Red)	1.50
FND359	7 seg com-cathode (Red)	1.25

9000 SERIES

QTY.		QTY.	
9301	.85	9322	.65
9309	.50	9601	.30
		9602	.45

MICRO's, RAMS, CPU's, E-PROMS

QTY.	
8T13	2.50
8T23	2.50
8T24	3.00
8T97	1.75
74S188	3.00
1488	1.25
1489	1.25
1702A	4.50
AM 9050	4.00
ICM 7207	6.95
ICM 7208	13.95
MPS 6520	10.00
MM 5314	4.00
MM 5316	4.50
MM 5387	3.50
MM 5369	2.95
TR 1602B	3.95
UPD 414	4.95
Z 80 A	22.50
Z 80	17.50
Z 80 P10	10.50
2102	1.45
2102L	1.75
2107B-4	4.95
2114	9.50
2513	6.25
2708	11.50
2716 D.S.	34.00
2716 (5v)	69.00
2758 (5v)	26.95
3242	10.50
4116	11.50
6800	13.95
6850	7.95
8080	7.50
8085	22.50
8212	2.75
8214	4.95
8216	3.50
8224	4.25
8228	6.00
8251	7.50
8253	18.50
8255	8.50
TMS 4044	9.95

C MOS

QTY.		QTY.		QTY.		QTY.	
4000	.15	4017	.75	4034	2.45	4069/74C04	.45
4001	.20	4018	.75	4035	.75	4071	.25
4002	.25	4019	.35	4037	1.80	4081	.30
4004	3.95	4020	.85	4040	.75	4082	.30
4006	.95	4021	.75	4041	.69	4507	.95
4007	.25	4022	.75	4042	.65	4511	.95
4008	.75	4023	.25	4043	.50	4512	1.50
4009	.35	4024	.75	4044	.65	4515	2.95
4010	.35	4025	.25	4046	1.25	4519	.85
4011	.30	4026	1.95	4047	2.50	4522	1.10
4012	.25	4027	.35	4048	1.25	4526	.95
4013	.40	4028	.75	4049	.65	4528	1.10
4014	.75	4029	1.15	4050	.45	4529	.95
4015	.75	4030	.30	4052	.75	MC14409	14.50
4016	.35	4033	1.50	4053	.95	MC14419	4.85
				4066	.75	74C151	2.50

4-1-79

– T T L –

QTY.		QTY.		QTY.		QTY.	
7400	.20	7492	.45	74H20	.25	74LS76	.70
7401	.20	7493	.35	74H21	.25	74LS86	.95
7402	.20	7494	.75	74H22	.40	74LS90	.85
7403	.20	7495	.60	74H30	.30	74LS93	.85
7404	.20	7496	.80	74H40	.35	74LS96	2.00
7405	.35	74100	1.15	74H50	.30	74LS107	.90
7406	.25	74107	.35	74H51	.30	74LS109	1.50
7407	.55	74121	.35	74H52	.20	74LS123	1.95
7408	.20	74122	.55	74H53	.25	74LS138	2.00
7409	.25	74123	.55	74H55	.25	74LS151	.95
7410	.20	74125	.45	74H72	.35	74LS153	1.15
7411	.25	74126	.45	74H74	.35	74LS157	1.15
7412	.25	74132	.75	74H101	.95	74LS160	1.15
7413	.45	74141	.90	74H103	.55	74LS164	2.90
7414	.75	74150	.85	74H106	1.15	74LS193	2.00
7416	.25	74151	.95	74L00	.30	74LS195	1.15
7417	.40	74153	.95	74L02	.30	74LS244	2.90
7420	.25	74154	1.15	74L03	.35	74LS259	1.50
7426	.25	74156	.70	74L04	.40	74LS298	1.50
7427	.25	74157	.65	74L10	.30	74LS367	1.95
7430	.20	74161/9316	.75	74L20	.45	74LS368	1.25
7432	.30	74163	.85	74L30	.55	74LS373	2.50
7437	.20	74164	.75	74L47	1.95	74S00	.45
7438	.30	74165	1.10	74L51	.65	74S02	.45
7440	.20	74166	1.75	74L55	.85	74S03	.35
7441	1.15	74175	.90	74L72	.65	74S04	.35
7442	.55	74176	.95	74L73	.70	74S05	.45
7443	.45	74177	1.10	74L74	.75	74S08	.45
7444	.45	74180	.95	74L75	1.05	74S10	.45
7445	.75	74181	2.25	74L85	2.00	74S11	.45
7446	.70	74182	.75	74L93	.75	74S20	.35
7447	.70	74190	1.25	74L123	1.95	74S22	.55
7448	.50	74191	1.25	74LS00	.40	74S40	.30
7450	.25	74192	.75	74LS01	.40	74S50	.30
7451	.25	74193	.85	74LS02	.45	74S51	.35
7453	.20	74194	.95	74LS03	.45	74S64	.15
7454	.25	74195	.95	74LS04	.45	74S74	.70
7460	.40	74196	.95	74LS05	.45	74S112	.60
7470	.45	74197	.95	74LS08	.45	74S114	.85
7472	.40	74198	1.45	74LS09	.45	74S133	.85
7473	.25	74221	1.50	74LS10	.45	74S140	.75
7474	.30	74298	1.50	74LS11	.45	74S151	.95
7475	.35	74367	1.35	74LS20	.45	74S153	.95
7476	.40	75491	.65	74LS21	.45	74S157	.98
7480	.75	75492	.65	74LS22	.45	74S158	.80
7481	.85	74H00	.20	74LS32	.50	74S194	1.50
7482	.95	74H01	.30	74LS37	.45	74S196	2.00
7483	.95	74H04	.30	74LS38	.65	74S257 (8123)	2.50
7485	.75	74H05	.25	74LS40	.70	8131	2.75
7486	.55	74H08	.35	74LS42	.95		
7489	1.05	74H10	.35	74LS51	.75		
7490	.55	74H11	.25	74LS74	.95		
7491	.70	74H15	.45	74LS75	1.20		

I^2L, LINEARS, REGULATORS, ETC.

QTY.		QTY.		QTY.	
MCT2	.95	LM320K24	1.65	LM373	3.95
8038	3.95	LM320T5	1.65	LM377	3.95
LM201	.75	LM320T12	1.65	78L05	.75
LM301	.45	LM320T15	1.65	78L12	.75
LM308	.65	LM323K	5.95	78L15	.75
LM309H	.85	LM324	1.25	78M05	.75
LM309 (340K-5)	1.50	LM339	.75	LM380 (8-14 Pin)	1.19
LM310	.85	7805 (340T5)	1.15	LM709 (8-14 Pin)	.45
LM311 (8-14 Pin)	.75	LM340T12	.95	LM711	.45
LM318	1.50	LM340T15	.95	LM723	.40
LM320H6	.79	LM340T18	.95	LM725	2.50
LM320H15	.79	LM340T24	.95	LM739	1.50
LM320H24	.79	LM340K12	1.25	LM741 (8-14)	.45
7905 (LM320K5)	1.65	LM340K15	1.25	LM747	1.10
LM320K12	1.65	LM340K18	1.25	LM1307	1.75
LM320K15	1.65	LM340K24	1.25	LM1458	.65
				LM3900	.95
				LM75451	.65
				NE555	.45
				NE556	.85
				NE565	1.15
				NE566	1.25
				NE567	.95
				TA7205	6.95
				76477	2.95
				95H90	9.95

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STEVENSON
Electronic Components

TTL

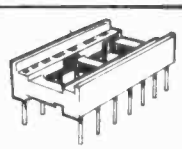
		7473	20p	74141	55p
		7474	22p	74145	55p
7400	10p	7475	25p	74148	90p
7401	10p	7476	20p	74150	55p
7402	10p	7485	55p	74151	40p
7404	12p	7486	20p	74154	65p
7406	22p	7489	135p	74157	40p
7408	12p	7490	25p	74164	55p
7410	10p	7492	30p	74165	55p
7413	22p	7493	25p	74170	100p
7414	39p	7494	45p	74174	55p
7420	12p	7495	35p	74177	50p
7427	20p	7496	45p	74190	50p
7430	12p	74121	25p	74191	50p
7432	18p	74122	35p	74192	50p
7442	38p	74123	38p	74193	50p
7447	45p	74125	35p	74196	50p
7448	50p	74126	35p	74197	50p
7454	12p	74132	45p	74199	90p

CMOS

		4020	50p	4050	25p
		4022	50p	4060	80p
		4023	13p	4066	30p
		4024	40p	4068	13p
4001	13p	4025	13p	4069	13p
4002	13p	4026	90p	4070	13p
4007	13p	4027	28p	4071	13p
4009	30p	4028	45p	4072	13p
4011	13p	4029	50p	4081	13p
4012	13p	4040	55p	4093	36p
4013	28p	4041	55p	4510	60p
4015	50p	4042	55p	4511	60p
4016	28p	4043	50p	4518	65p
4017	47p	4046	90p	4520	60p
4018	55p	4049	25p	4528	60p

FULL DETAILS IN CATALOGUE!

SKTS



Low profile by Texas

8pin	8p	18pin	14p	24pin	18p
14pin	10p	20pin	16p	28pin	22p
16pin	11p	22pin	17p	40pin	32p

Soldercon pins: 100:50p 1000:370p

PCBS

Size in.	VEROBOARD 0.1in.	0.15in.	
25 x 1	14p	14p	Vero Cutter 80p.
2.5 x 3.75	45p	45p	
2.5 x 5	54p	54p	Pin insertion tool 108p
3.75 x 5	64p	64p	
3.75 x 17	205p	185p	
Single sided pins per 100	40p	40p	

Top quality fibre glass copper board. Single sided. Size 203 x 95mm. 60p each.
'Dalo' pens. 75p each.
Five mixed sheets of Alfac. 145p per pack.

OPTO

LED's	0.125in.	0.2in	each	100+
Red	TIL209	TIL220	9p	7.5p
Green	TIL211	TIL221	13p	12p
Yellow	TIL213	TIL223	13p	12p
Clips	3p	3p		

DISPLAYS

DL704	0.3 in CC	130p	120p
DL707	0.3 in CA	130p	120p
FND500	0.5 in CC	100p	80p

RESISTORS

Carbon film resistors. High stability, low noise 5%.
E12 series. 4.7 ohms to 10M. Any mix:

	each	100+	1000+
0.25W	1p	0.9p	0.8p
0.5W	1.5p	1.2p	1p

Special development packs consisting of 10 of each value from 4.7 ohms to 1 Megohm (650 res) 0.5W £7.50. 0.25W £5 70.

METAL FILM RESISTORS

Very high stability, low noise rated at ¼W 1%. Available from 51ohms to 330k in E24 series. Any mix:

	each	100+	1000+
0.25W	4p	3.5p	3.2p

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TRANSISTORS

				ZTX500	16p
				2N697	12p
		BCY72	14p	2N3053	18p
AC127	17p	BD131	35p	2N3054	50p
AC128	16p	BD132	35p	2N3055	50p
AC176	18p	BD139	35p	2N3442	135p
AD161	38p	BD140	35p	2N3702	8p
AD162	38p	BFY50	15p	2N3703	8p
BC107	8p	BFY51	15p	2N3704	8p
BC108	8p	BFY52	15p	2N3705	9p
BC108C	10p	MJ2955	98p	2N3706	9p
BC109	8p	MPSA06	20p	2N3707	9p
BC109C	10p	MPSA56	20p	2N3708	8p
BC147	7p	TIP29C	60p	2N3819	15p
BC148	7p	TIP30C	70p	2N3820	44p
BC177	14p	TIP31C	65p	2N3904	8p
BC178	14p	TIP32C	80p	2N3905	8p
BC179	14p	TIP2955	65p	2N3906	8p
BC182	10p	TIP3055	55p	2N4058	12p
BC182L	10p	ZTX107	14p	2N5457	32p
BC184	10p	ZTX108	14p	2N5459	32p
BC184L	10p	ZTX300	16p	2N5777	50p
BC212	10p				
BC212L	10p				
BC214	10p				
BC214L	10p				
BC477	19p				
BC478	19p				
BC548	10p				
BCY70	14p				
BCY71	14p				

DIODES

1N914	3p	1N4006	6p
1N4001	4p	1N5401	13p
1N4002	4p	BZY88 ser.	8p

ITT Full spec product.
1N4148 – £1.40/100. £11/1000

LINEAR

THIS IS ONLY A SELECTION!

		LF356	80p	NE531	98p
		LM301AN	26p	NE555	23p
		LM308	60p	NE556	60p
		LM318N	75p	NE567	100p
		LM324	45p	RC4136	100p
709	35p	LM339	45p	SN76477	230p
741	16p	LM378	230p	TBA800	70p
747	45p	LM379S	410p	TBA810S	100p
748	30p	LM380	75p	TDA1022	620p
7106	850p	LM3900	50p	TL081	45p
7107	900p	LM3909	65p	TL084	125p
CA3046	55p	LM3911	100p	ZN414	80p
CA3080	70p	MC1458	32p	ZN425E	390p
CA3130	90p	MM57160	590p	ZN1034E	200p

CAPACITORS

TANTALUM BEAD

	each
0.1, 0.15, 0.22, 0.33, 0.47, 0.68, 1 & 2.2uF @ 35V	8p
4.7, 6.8, 10uF @ 25V	13p
22 @ 16V, 47 @ 6V, 100 @ 3V	16p

MYLAR FILM

0.001, 0.01, 0.022, 0.033, 0.047	3p
0.068, 0.1	4p

POLYESTER

Mullard C280 series

0.01, 0.015, 0.022, 0.033, 0.047, 0.068, 0.1	5p
0.15, 0.22	7p
0.33, 0.47	10p
0.68	14p
1.0uF	17p

CERAMIC

Plate type 50V. Available in E12 series from 22pF to 1000pF and E6 series from 1500pF to 0.047uF 2p

RADIAL LEAD ELECTROLYTIC

63V	0.47	1.0	2.2	4.7	10		5p
			22	33	47		7p
	100						13p
			220				20p
25V	10	22	33	47			5p
	100						8p
		220					10p
				470			15p
	1000						23p

CONNECTORS

JACK PLUGS AND SOCKETS

	screened	unscreened	socket
2.5mm	9p	13p	7p
3.5mm	9p	14p	8p
Standard	16p	30p	15p
Stereo	23p	36p	18p

DIN PLUGS AND SOCKETS

	plug	chassis socket	line socket
2pin	7p	7p	7p
3pin	11p	9p	14p
5pin 180°	11p	10p	14p
5pin 240°	13p	10p	16p

1mm PLUGS AND SOCKETS

Suitable for low voltage circuits, Red & black.
Plugs: 6p each Sockets: 7p each.

4mm PLUGS AND SOCKETS

Available in blue, black, green, brown, red, white and yellow. Plugs: 11p each Sockets: 12p each

PHONO PLUGS AND SOCKETS

Insulated plug in red or black	9p
Screened plug	13p
Single socket 7p Double socket	10p

LOUDSPEAKERS

56mm dia. 8ohms.	70p	64mm dia. 64ohms.	75p
64mm dia. 8ohms.	75p	70mm dia. 8ohms.	100p

Magnetic earpiece including 2.5 or 3.5mm plug. 15p each
Crystal earpiece including 3.5mm plug. 30p each

TRANSFORMERS

All 240V Primary.

0 – 6, 0 – 6 @ 0.5A or 0 – 9, 0 – 9 @ 0.4A.	175p
0 – 12, 0 – 12 @ 0.5A or 0 – 15, 0 – 15 @ 0.4A	235p
0 – 9, 0 – 9 @ 1.2A or 0 – 12, 0 – 12 @ 1A.	345p
0 – 12 – 15 – 20 – 24 – 30V @ 1.5A.	455p
0 – 20 – 25 – 33 – 40 – 50V @ 1A.	455p
0 – 20 – 25 – 33 – 40 – 50V @ 2A.	585p
0 – 20 – 25 – 33 – 40 – 50V @ 3A.	715p
Miniature type 6 – 0 – 6, 9 – 0 – 9, 12 – 0 – 12 @ 100mA.	95p

SOLDERING IRONS

ANTEX X25 (25W) or ANTEX CX (17W)	390p each
Reel of solder (39.6M)	240p each

POTENTIOMETERS

Single gang Log or Lin 5K – 2M2	28p each
Dual gang Log or Lin 5K – 2M2	80p each
Presets, sub min. type hor. or vert. 100Ω – 2M2	6p each

CONTROL KNOBS

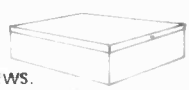
Ideal for use on mixers etc. Push on type with black base and marked position line. Cap available in red, blue, green, grey, yellow and black. 14p

SWITCHES

Subminiature toggle. SPDT 70p. DPDT 80p.
Standard toggle. SPST 34p. DPDT 48p.

Slide switches (DPDT) miniature or standard 15p.
Push to make switch. 15p. Push to break switch. 20p.
Wavechange switches: 1P12W, 2P6W, 3P4W, 4P3W. 43p

BOXES



Folded construction complete with screws.

3 x 2 x 1	52p	4 x 3 x 2	70p	6 x 4 x 3	95p
4 x 3 x 2	64p	6 x 4 x 2	77p	8 x 6 x 2	125p

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microfile

This month Henry Budgett treats us to the first lesson in the new science of Comparative Micrology. He prises the silver lining out of the micro supply cloud and even manages to squeeze in a club note.

Eight Versus Sixteen

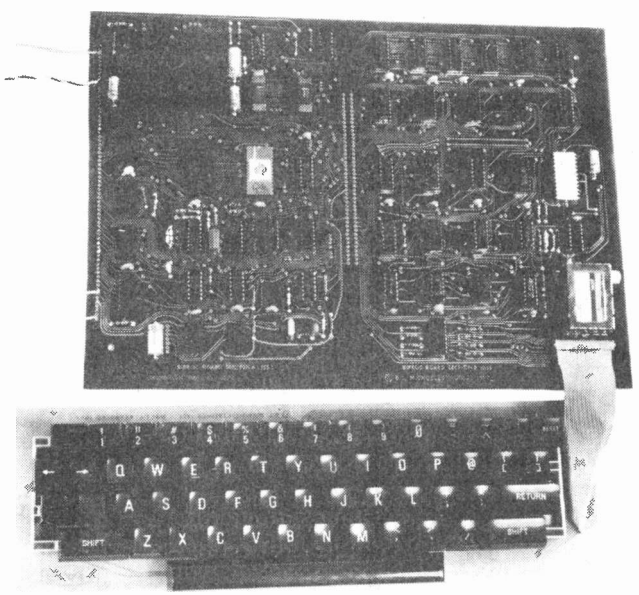
AUDIOPHILE LONG SEEMS to have had a monopoly on comparitive equipment tests, whereas in the micro world it is not easy to compare machines of varying types down to the CPU level. Well, to change all that a new board has been announced by a firm called BL Microelectronics. Engineered on a double, double Eurocard, that can be split in two, with an attendant full ASCII keyboard it will allow direct comparison of the Z80 and TMS 9980 microprocessors. The unit is supplied as a kit with either or both of the CPU's and their monitors and has a number of interesting features.

Buffered Buses

The TV interface section, the right hand Eurocard section, provides a memory mapped display of 16 lines, 64 characters long using an 8 by 5 matrix. The character generator is a 2708 allowing the user to supply his own character sets if required. A cassette interface is also available on-board with a 300 Baud rate. The standard is modified Kansas City and a choice of output levels are available. Also supplied as standard on the board is an RS232 interface with programmable Baud rates. All the bus lines are fully buffered and are available for user expansion, there are memory mapped I/O lines provided as well.

The system monitor is supplied separately for each CPU in a 2K EPROM and has six available commands allowing memory modification, inspection, dump and load, breakpoint insertion and program execution. However, the monitor also includes a microassembler so your programs may be loaded in mnemonic form as well as machine code, a very useful facility indeed.

By using the same monitor for each CPU in turn, the two may not be used at the same time for fairly obvious reasons, a direct comparison of the performance may be obtained. The price of the kit varies from £194 for the Z80 to £225 for both and further information can be obtained from BL Microelectronics at 1 Willow Way, Loudwater, Bucks.



The BIPROC 8/16 microcomputer board with no CPU and monitor installed. The board can be cut in two for rack mounting.

Club Roundup

I have received a few replies from our Club Survey in CT last month. It seems things have changed a bit since I compiled the information!

The Thames Valley Amateur Computer Club is now run by Brian Quarm (Hon Sec) who may be contacted on Camberley 22186 and the Meetings Organiser is Brian Steer. Membership fees have not yet been decided and the club is open to anyone with an interest in computers. They meet on the first Thursday of each month and you may obtain more details from the Publicity Secretary, Chris Wallwork at Oak Cottage, Ecchinswell, Nr Newbury, Berkshire. The second and rather more embarrassing slip up was the South Yorkshire Amateur Computer Club. Mr Beard has written to tell me that he never has run an ACC, because he's a newsagent! So if you have his name on a list of clubs, please cross it off.

Mailbag

Two club newsletters arrived during the month, both Nascom orientated. The INUC have produced a newsletter, although not as well produced as some I have seen. It does make interesting and informative reading. The cartoons are quite amusing as well. The other one is from INMC, the official one, and is their second. Well I never got to see the first, but it's also well produced with excellent software listings which I shall be trying out when our "2" arrives. Keep up the good work and let's hear from some other clubs as well. ▶

Supply And Demand

Many criticisms have been levelled at several firms in the micro business about the availability of product, both recently and over the past year. The earlier problem of Superboard II supplies has now been cleared and stock quantities are available from at least three suppliers, namely Lotus Sound, Watford Electronics and Videotime. The price is currently £229 + VAT.

The more current mysteries surrounding the supplies of the Apple II into the country are also clearing up. From conversations with several suppliers it now appears that Microsense are to be appointed UK master distributors by Eurapple and Keen Computers will be acting as distributors. Personal Computers, who previously held the distributorship are currently in the States clarifying their situation but stated that they are supplying to their dealerships. The new PAL card for the machine will shortly be available, after a long wait. The Apple is currently Black and White and selling at £830, the PAL card will be aevial input, cost in the range of £90. I hope this clears up any queries on the matter.

Chuckles

A couple of amusing tales have reached me concerning salesmen and systems. In one of London's computer shops, situated in the Hi-Fi jungle, a customer was heard to ask if he could implement COBOL on an ITT 2020. The reply? "No problem Sir. COBOL is just a better version of BASIC . . . Oh, you get machine code as well!" Uhh!

The second incident was related to us by a gentleman who had contacted an International Mainframe Business. He was offered a system with 8" VDU, ½ megabyte of disk store and a printer. The machine had 16K of RAM and a 4K BASIC. The BASIC, said the salesman, would handle numbers up to 40 decimal places and any number of strings. As if that isn't odd enough he then quoted a price, £11000! Well, it's a hard world these days.

Post Haste

News has just come in that Technalogics have received Post Office approval for their TECs computer system. This means that you can have a Teletext/Prestel/Basic system for around £2500 in its most complete form, the range starts at about £360. Sales will start in September, owing to PO restrictions, and Technalogics will convert any previously sold machine subject to test. For more information on the system see the review in CT May or contact Technalogics at 8 Egerton Street, Liverpool L87LY. Telephone 051-724 2695.

Foot Note

The Thames Valley ACC have just contacted me to say that they are having a "Junk" sale with bring-and-buy stalls at their meeting on the first Thursday in September. Phone Brian Quarm for venue details.

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.

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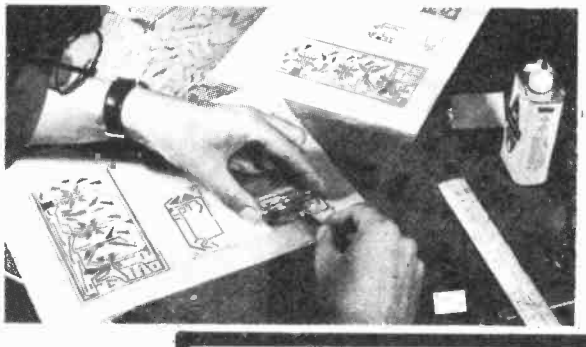
PARTS LIST

Shown below is the listing for the last year's ETIPRINTS.

Earlier sheets are available, ring Tim Salmon for details.

013	Amplifier Module	Book Six
	Amplifier PSU	
	Equaliser	
	Equaliser PSU	
014	Skeet Game	Project Book Six
	Sweep Oscillator	
	Burglar Alarm	
	GSR Monitor	
015	UFO Detector	July 78
	Torch Finder (twice)	July 78
	Etiwet (twice)	Aug 78
016	Stac Timer	Sept 78
	Xhatch Gen	
	Wheel of Fortune	
017	Complex Sound Gen	Oct 78
	Tele Bell Extender	
	Power Bulge	
018	RF Power Meter	Oct 78
	Proximity Switch	Oct 78
	Audio Oscillator (2)	Nov 78
019	Car Alarm (2)	Dec 78
	Wine Temp (2)	Dec 78
	Curve Tracer	Dec 78
020	Digital Tacho	Jan 79
	Module	Jan 79
	Digital Dial	Jan 79
021	Tape Slide Synch	
	Tape Noise Limiter	Feb 79
	Light Tacho	
022	Logic Trigger	
	Power Meter	Mar 79
	Headlight Delay (x2)	
023	Click Eliminator	
	Guitar Effects Unit	
	(2 boards)	
023A	Wind Speed Indicator	April 79
024A	Ambush (Boards 2 & 3)	
	Car Immobiliser	April 79
024B	Ambush (Board 1)	May 79
	Headphone Amplifier	
	Double Die	May 79
025	Metronome	
	Mains Seeker	
	Triton 8K Eprom Card	June 79
026	Motor Speed Controller	
	(2 Boards For Controller)	
	Battery Indicator	July 79
027	CCD Phaser	Project Book Seven
	Rev. Monitor	
028	Race Track, Spirit Level	Project Book Seven
	Egg Timer, Bongos	
	Bench Supply, Oscillator	
029	Bass Enhancer	Project Book Seven
	Digital Freq. Meter (4 boards)	
030	ETIWET, Continuity Tester	Project Book Seven
	Metal Locater, Light Dimmer	
	Ultrasonic Switch (2 boards)	
031	Tone Control	Project Book Seven
	House Alarm (2 boards)	
	Torch Finder	
032	LED Audio Display (2 boards) (underside pattern)	Aug 79
033	LED Audio Display (2 boards) (topside pattern)	Aug 79
	Bench Amp	
	NICD Charger	

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!

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7402	12p	7481	85p	74162	100p	4016	45p	CA3046	70p	LM381N	150p	SL917B	650p	TBA920Q	290p
7403	12p	7482	75p	74163	100p	4017	80p	CA3060	225p	LM382	120p	SN76666N	100p	TCA270S	250p
7404	12p	7483	80p	74164	115p	4018	80p	CA3065	200p	LM391	170p	SN76003N	170p	TCA270Q	250p
7405	18p	7484	100p	74165	120p	4019	50p	CA3076	250p	LM555	25p	SN76013N	150p	TCA760	300p
7406	30p	7485	75p	74166	140p	4020	100p	CA3080	75p	LM565	125p	SN76013ND	130p	TCA4500A	300p
7407	35p	7486	35p	74167	200p	4022	95p	CA3084	250p	LM709C	40p	SN76023N	150p	TDA1004	300p
7408	18p	7489	200p	74170	200p	4023	25p	CA3085	80p	LM710T05	65p	SN76023ND	130p	TDA1008	320p
7409	18p	7490	35p	74173	120p	4024	55p	CA3086	50p	LM710DIL	65p	SN76033N	180p	TDA1022	600p
7410	12p	7491	80p	74174	90p	4025	20p	CA3088	185p	LM723T05	40p	SN76131N	115p	TDA1024	125p
7411	20p	7492	40p	74175	90p	4026	150p	CA3089	225p	LM723DIL	40p	SN76227N	150p	TDA1034	250p
7412	18p	7493	35p	74176	85p	4027	50p	CA3090AQ	400p	LM733	120p	SN76228N	160p	TDA2002	320p
7413	30p	7494	85p	74177	80p	4028	85p	CA3123E	200p	LM739	150p	SN7666ON	85p	TDA2020	320p
7414	50p	7495	70p	74178	160p	4029	100p	CA3130	100p	LM741	20p	TAA300	250p	TL081	50p
7416	30p	7496	60p	74179	140p	4030	60p	CA3140	70p	LM747	70p	TAA350	250p	TL082	100p
7417	30p	7497	190p	74180	95p	4032	100p	CA3161E	150p	LM748	40p	TAA550	35p	TL083	110p
7420	16p	74100	130p	74181	180p	4033	150p	CA3162E	450p	LM1303N	95p	TAA570	250p	TL084	130p
7421	30p	74104	65p	74182	90p	4040	100p	CA3189E	250p	LM1458	60p	TAA661B	150p	UAA170	200p
7422	18p	74105	65p	74184	140p	4043	95p	FX209	760p	LM3900	60p	TAA700	340p	XR320	250p
7423	30p	74107	35p	74185	140p	4046	120p	LD130	460p	LM3909N	70p	TAA790	340p	XR2003	150p
7425	30p	74109	55p	74188	320p	4047	100p	LF356	90p	MC1310P	150p	TAD100	150p	XR2206	400p
7426	40p	74120	115p	74190	100p	4048	60p	LF357	90p	MC1312P	160p	TAD110	130p	XR2207	400p
7427	30p	74121	25p	74191	100p	4049	45p	LM211H	240p	MC1314P	190p	TBA120A	60p	XR2208	590p
7428	35p	74122	50p	74192	100p	4050	50p	LM300T05	170p	MC1315P	230p	TBA120S	70p	XR2216	675p
7430	18p	74123	50p	74193	100p	4054	130p	LM301AN	30p	MK50398	650p	TBA120T	90p	XR2264	440p
7432	25p	74125	45p	74194	100p	4055	130p	LM301T05	45p	MM5314	380p	TBA480Q	190p	XR2265	440p
7433	40p	74126	60p	74195	100p	4056	135p	LM304	190p	MM5316	470p	TBA520Q	190p	XR2567	250p
7437	30p	74128	75p	74196	100p	4060	115p	LM307N	60p	NE529K	150p	TBA530Q	190p	XR4136	150p
7438	35p	74130	130p	74197	80p	4066	60p	LM308T05	100p	NE555	25p	TBA540	220p	XR4151	350p
7440	15p	74131	100p	74198	150p	4068	22p	LM308DIL	100p	NE556	70p	TBA550Q	250p	XR4202	150p
7441	70p	74132	75p	74199	150p	4069	20p	LM309K	140p	NE562B	420p	TBA560C	240p	XR4212	150p
7442	70p	74135	100p	74293	125p	4070	30p	LM310T05	150p	NE566	160p	TBA641A12	250p	XR4739	150p
7443	115p	74136	80p	74LS00	15p	4071	20p	LM311T05	150p	NE567	170p	TBA700	200p	ZN414	95p
7444	115p	74137	100p	74LS112	85p	4072	20p	LM317K	350p	SAD1024	1400p	TBA720Q	240p	ZN1034E	200p
7445	100p	74141	70p			4075	25p	LM324	70p	SAS560	155p	T8A750Q	200p	95H90	800p
7446	95p	74142	200p			4077	40p	LM339	70p	SAS570	150p	TBA800	90p	11C90	1400p
7447	60p	74143	300p			4081	20p								
7448	60p	74144	300p			4082	20p								
7450	18p	74145	75p			4093	80p								
7451	18p	74147	180p	**CMOS**		4501	20p								
7453	18p	74148	130p	4000	14p	4507	55p								
7454	18p	74150	100p	4001	14p	4510	100p								
7460	18p	74151	70p	4002	15p	4511	150p								
7470	30p	74153	70p	4006	90p	4516	120p								
7472	30p	74154	100p	4007	18p	4518	100p								
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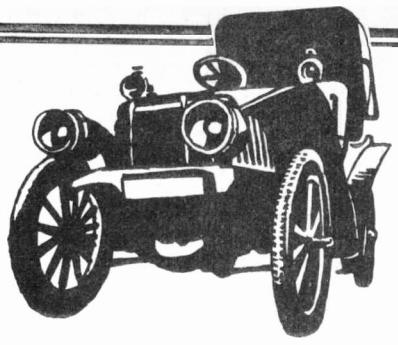


REAR SCREEN HEATER CONTROLLER

An inexpensive unit that gives push-button turn-on and time-controlled (3-30 minutes) auto-turn-off of your rear-screen heater.

ONE OF THE MOST useful fitments in a modern car is the rear-screen heater. It can clear an iced or misted-up rear window in a matter of minutes. The only problem is, of course, that you are supposed to remember to turn the switch off again once the window has cleared. The ETI rear-screen heater controller is designed to overcome this little problem, by turning the heater off automatically at the end of a period that is pre-settable from 3 to 30 minutes, (and by letting you turn the heater on in the first place via a pretty little push-button, rather than via a dirty great 15 amp rocker switch!)

The unit is easy to wire into the vehicle, using just two connections for it's power supply and two connections for the screen heater control. The timing periods of the unit can either be pre-set on the PCB, or can be made fully variable via a panel-mounted pot, which can be placed adjacent to the start push-button and an indicating LED.

Construction

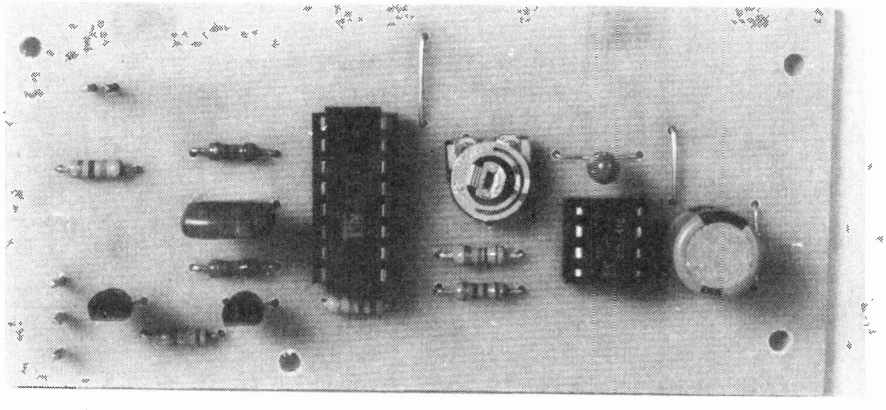
All of the electronics except the two relays, the push-button switch and the LED 'ON' indicator, are mounted on a single PCB. Construction should present no problems, so long as care is taken to observe the polarities of all semiconductor devices and electrolytic capacitors. If you decide to make the timing periods variable via a panel-mounted pot, omit RV1 from the PCB and wire the external pot in it's place via suitable connecting leads.

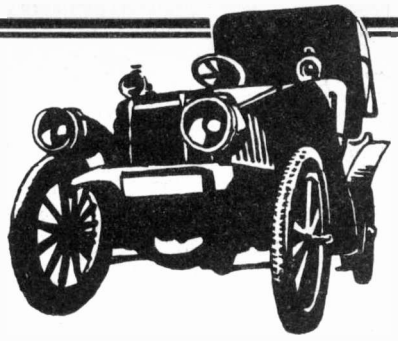
The completed PCB can be mounted on a suitable bracket or whatever, together with the two relays, LED 1 and PB1 (and also RV1 if you so desire). The type of mounting you use depends on your own tastes, and on the available space that you have in your particular vehicle. Note that RLA is a light-duty two-pole relay, and is used to 'slave' heavy-duty relay RLB, which must have contact ratings of at least 10 A.

Complete the interwiring of the PCB and relays, etc. and then give the circuit a functional check to see that everything is working OK.

Installation

The unit is designed to work in vehicles fitted with 12 V electrical systems only. The circuit diagram shows the connections for fitting the ▶





unit to vehicles with negative ground systems, in which the positive supply is fed to the unit via the ignition switch and the 'O V' line goes to the chassis: reverse these notations for positive ground vehicles.

The two output leads from contacts RLB/1 can be taken directly to the existing heater switch connections. The existing heater switch should be disabled or removed.

BUYLINES

The heavy duty relay is obtainable from Maplin Electronics, order no YB89W. The rating is for 12V coil, at 15A contact rating and coil resistance around 45R.

Nothing else here should prove difficult.

PARTS LIST

RESISTORS

R1	2k2
R2	10k
R3	1M0
R4	12k
R5	2k7
R6	270R
R7	470R

POTENTIOMETER

RV1	100k submin. Preset

CAPACITORS

C1	100u electrolytic
C2	1u5 electrolytic
C3	100n polyester

SEMICONDUCTORS

IC1	NE555
IC2	CD4020B
Q1	BC214L
D1	IN4001
ZD1	12V @400mW (BZY88)
LED1	0.2in. dia.

MISCELLANEOUS
RLA 12V 120R DPCO
RLB 12V 45R SPCO (10 A contact rating)
PCB, fixing mounts etc.

HOW IT WORKS

The basic action of the circuit is such that relay RLA turns on and energises heavy-duty relay RLB, which in turn completes the rear-screen heater connections, as soon as power is applied to the unit via start switch PB1. As RLA turns on, contacts RLA/1 close and thus maintain the power connections to the unit once PB1 is released. The unit enters a timing cycle as soon as power is applied and at the end of this cycle (3 to 30 minutes) both relays automatically turn off and disconnect the unit's power feed and break the connections to the rear-screen heater, thus completing the operating sequence.

The heart of the unit is IC2, a CD4020B 14-stage ripple carry binary counter. This IC is clocked by the IC1 type-555 astable multivibrator circuit and the output of IC2 is taken from its 14th binary divider stage. At the moment of switch-on a positive pulse is fed to the pin-11 RESET terminal of IC2, thus emptying the counter and driving output pin-3 low, thereby causing RLA to turn on via Q2 and Q1, and activating RLB via contacts RLA/2.

The 555 astable starts operating as soon as power is applied and feeds clock pulses to IC2. The output of IC2 switches high on the arrival of the 8192nd clock pulse, thus turning RLA (and hence RLB) off via Q2 and Q1 and completing the sequence of operations.

The operating period of the 555 clock generator is variable over the approximate range 22 mS to 220 mS via RV1, thus making output timing periods of 3 minutes to 30 minutes available from the circuit.

The voltage supply to the main part of the electronic circuitry is smoothed via C1 and is limited to 12 volts peak via ZD1 and R6, thus ensuring reliable operation even under adverse power supply conditions.

Note that two relays are used in this circuit. A two-pole relay is needed to give the desired auto-turn-off action, but the relay that is supplying the rear-screen heater needs a contact current rating of at least 10 amps. Since 10 amp two-pole relays are not readily available, it has been necessary to resort to the use of two relays to obtain the required circuit action when using a low-current switch in the PB1 position.

Fig. 1. Component overlay.

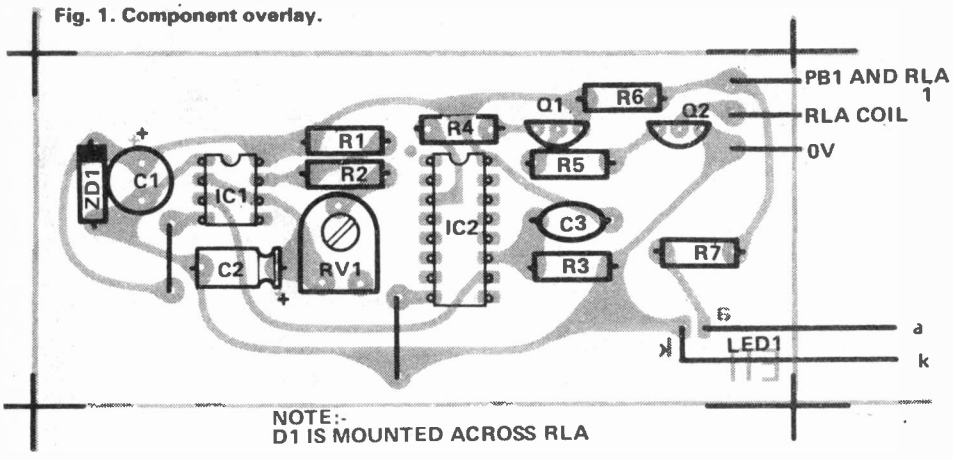
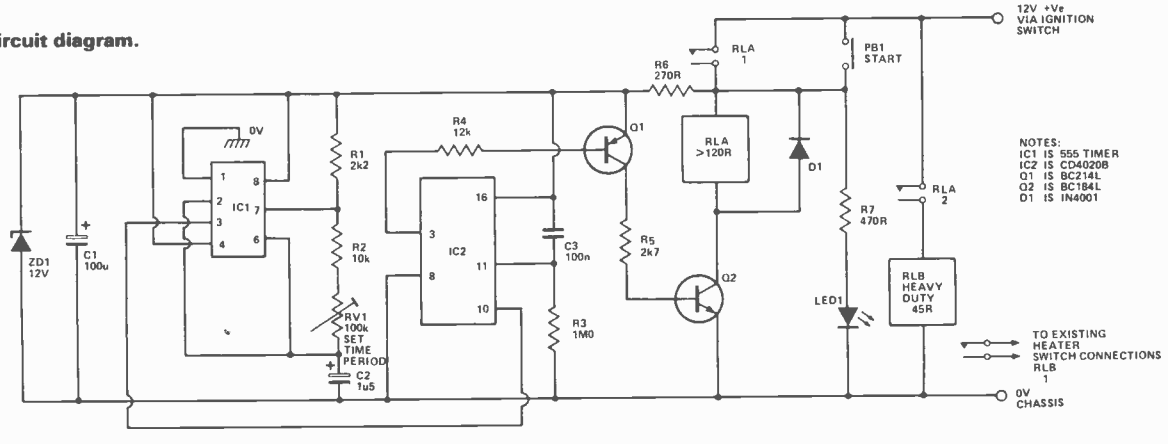
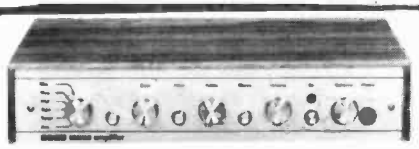


Fig. 2. Circuit diagram.





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OUR PRICE **£11.25** p&p £2.75

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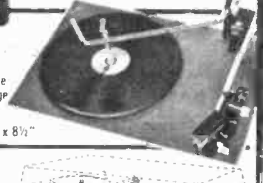

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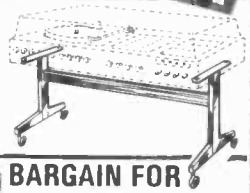

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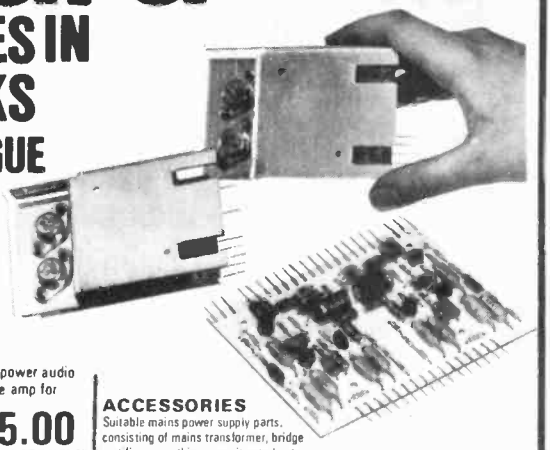

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AVAILABLE ALSO TO PURCHASERS OF THE 10 + 10 AMPLIFIER KIT.

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Comprising of two 8" x 5" approx. 4 ohm bass and two 3½" 15 ohm mid-range tweeter with two cross-over capacitors. **£4.05**

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Size approximately 19¼" x 8¾" x 4"

p&p £2.25 **£12.75**

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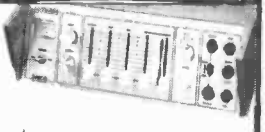
Size approx. 13⅜" x 5¼" x 6¾"

50 watts rms. 100 watts peak output. Big features include two disc inputs, both for ceramic cartridges, tape input and microphone input. Level mixing controls fitted with integral push-pull switches. Independent bass and treble controls and master volume.

100 WATT MONO DISCO AMP



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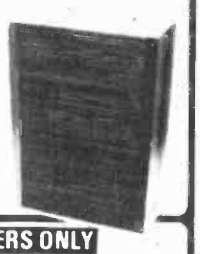

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RAVEN ON...

A new regular spot for David Raven of Metac Electronics. From his lofty perch above the commercial world of electronics he can see a lot happening that we can't. A monthly report from the lookout post!

CHANGES AT SINCLAIR Radionics indicate a new direction for a company that grew famous in the dawn of consumer electronic products. Equity totalling 73% of the shares were sold to the National Enterprise Board after heavy losses were incurred during the earlier attempts to manufacture Digital Watches. The company required investment capital to help develop and manufacture the world's smallest television set and to date the NEB have invested £4.45 million. The company's operations are now divided into three groups comprising Industrial Instruments, Consumer Products and Research & Development. Each division will operate under independent management with Clive Sinclair heading the R & D section.

The NEB is apparently not planning further investment in the company and they are also trying to find a new investor to take over production of the Microvision. Calculator production is also threatened as the company takes a hard look at its full range of products.

They will, however, continue to produce the programmable calculators for at least a further 6 to 12 months.

The future for British made calculators cannot be seen as rosy in the light of the new government's attitude to the NEB and loss making companies. There is always a ray of sunshine just around the corner (so the story books tell us) and what better way to view it than through a "Flat TV screen".

At first inkling Sinclair's latest venture could be *the* winner after the previous modest successes achieved with calculators, watches and TV's.

Plans are afoot to manufacture a 3 inch screen model slightly smaller than a paperback book, using a new patented technology. It is claimed that the definition is better than a comparable cathode ray tube four times the size. An automated factory is to be set up employing about 150 people to manufacture this new product, code named TV2, and it is envisaged that a partner will be introduced to help finance the operation. (Sinclair has received £750,000 from the National Research and Development Corporation to carry out development work into television technology). This joint venture project provided NRDC with a share in any future profits.

Deja Vu

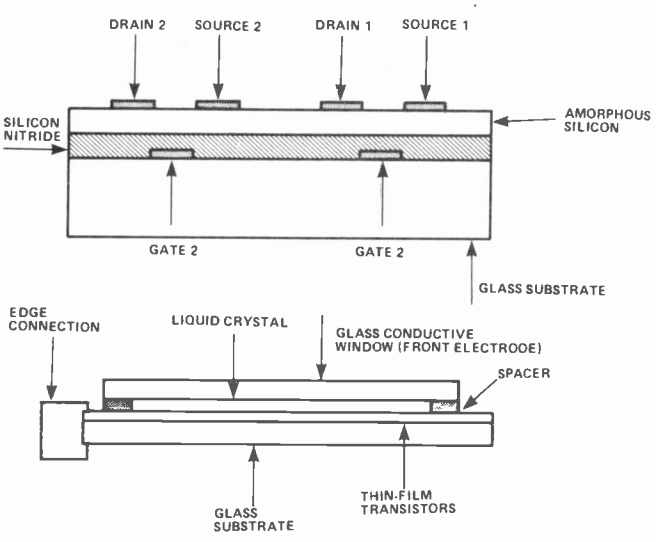
Work on flat screen TV's is not however new since reports were published in 1973 by Westinghouse Research Laboratory. The original aim was to produce a screen using liquid crystal (which is not the technique used by Sinclair). Attempts were made to produce a flat screen display using FET's and neumatic crystals, a screen size of 6 inches by 6 inches, 20 lines per inch and 14000 picture elements, each driven by a cadmium Selenide FET.

The main difficulties were, however, in controlling the two-component materials, Cadmium-Selenide used to produce the FET's. Research work at Dundee University has contionued in this field headed by Professor Walter E. Spear.

Amorphous-silicon insulated-gate field effect transistors (IGFET's) are being produced at Dundee that have encouraging electrical characteristics. To drive the liquid crystal elements the amorphous silicon IGFETs require an on-to-off-current ratio of 300, and an on-resistance of less than 9 M to allow sufficient rapid charging of the elements, also an off resistance greater than 3000 M to prevent escessive charge decay between scans. When assembled, the liquid crystal would be sandwiched between a glass substrate which contains the IGFETs fabricated on the surface in a matrix pattern and a conducting glass window. In an integrated display the IGFET is connected at each junction of the X-Y matrix and stored information is discharged onto each column in turn. Meanwhile a scanner turns on all transistors in an addressed row. As a result, voltage proportional to brightness would be applied to each liquid crystal element in that row. The applied voltage rotates the plane of polarization of the element, altering the light transmitted through it. Moves to scale the process up have gone well and long term device stability may be better than the group compounds used previously. Specimens stored at room temperature for several years have shown little change and reproducibility looks good.

Electronic Fuel Savers

With petrol shortages destined to be the order of the day it is some comfort to know that a contribution to saving fuel can be made using micro-electronics. Lucas Industries are producing a chip which will continuously check fuel consumption and vary supply according to second by second changes in speed. It is expected that microchip monitors will be standard in every car during the next decade, controlling, in particular, fuelling, ignition, combustion and analysis of exhaust fumes. Future electric cars are predicted to take on a hybrid form running on batteries for short trips and coupling on a trailer with petrol, diesel or methane gas to charge up on a long distance drive. There are no miracle batteries on the way. Problems with one recent innovation using sodium sulphur were caused by the battery heating up to 500°C and having a tendency to set fire to the car. If you reside in the country and have access to unused corn then it may be worthwhile fermenting this into alcohol which can then be used as an additive. They also say that old chicken dung can be quite good for producing methane gas.



The shape of things to come? Some day your telly screen could be made up from a relative of this device. It's an amorphous-silicon insulated-gate field effect transistor, known within the confines of Dundee University as an IGFET. Its encouraging electrical characteristics hold the promise of flat telly screens.

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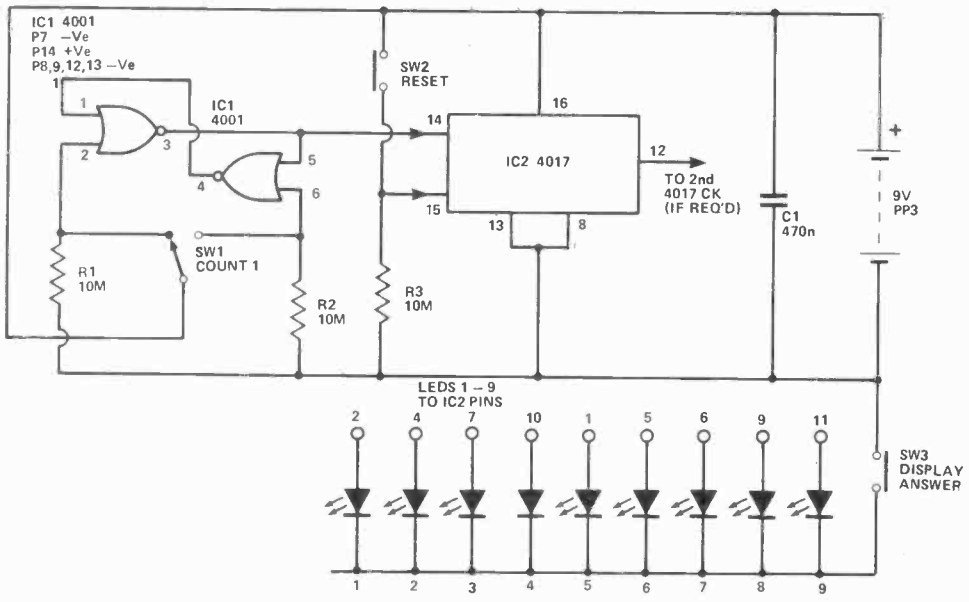


Pocket Calculator

S. Lamb

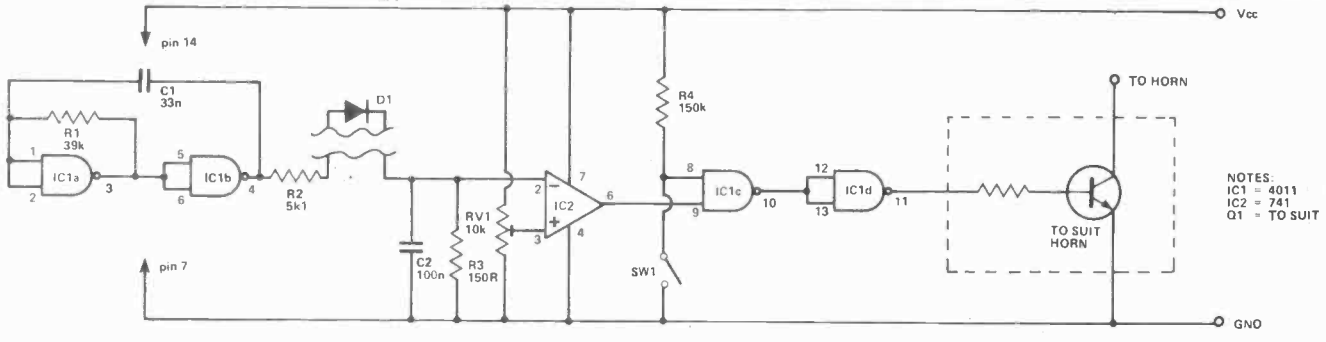
The diagram shows an inexpensive pocket calculator which will count up to nine pockets which can, by adding another IC count up to 99 pockets. Although it can be extended indefinitely I feel it is ludicrous to have more than 99 pockets.

To use press SW2 to reset IC2, place unit in each pocket in turn and press SN1 (use microswitch with definite click action to avoid miscounting). Two NOR gates eliminate switch bounce effects and IC2 is incremented once per operation of SW1. When all pockets have been accounted for press SW3 to display answer. The nine LEDs are labelled 1 to 9.

If the switches are suitably recessed the answer can be retained indefinitely because of the low current requirement of CMOS and SW3 can be pressed for an instant answer.

The prototype was built in a polythene soap dish (Boots). It should be realised that if the counter is not in the 'reset' position and SW3 is open-circuit that one of the LED anodes will be at about +9V and will reverse bias the other eight and may well exceed the typical maximum PIV of 3V. For extreme reliability put a silicon diode in series with each LED and a 100 k resistor in parallel with each LED (in case of leaky diodes).

The two unused gates of IC1 could be used to flash one LED as an 'overflow' indicator if required, or to construct a second counter perhaps for coat pockets.



Motorbike Protector

P. M. Jessop

Many of the accessories fitted to a motorbike can be quite valuable and easily removed by a thief. On a motorbike, a top-box may be lockable but can easily be removed complete.

This circuit will protect such accessories. Diode D1 is mounted *inside* the box or other accessory and two leads are run to the rest of the circuit which should be mounted near to the horn. Gates IC1a and IC1b form an oscillator which charges C2 through D1 and R2. The voltage on C2 (normally nearly V_{cc}; is fed to comparator IC2. If D1 is removed from circuit by cutting the leads, C2 discharges through R3 and the comparator is triggered. However, if an enterprising thief tries to bypass the alarm by shorting the leads, the voltage on C2 falls to about $\frac{1}{2}V_{cc}$ and again the comparator is triggered.

SW1 which should be well concealed, disables the alarm which will otherwise sound the horn if triggered.

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.

MOTORS 1-5 to vdc Model Motors. 22p. Sub. Min "Big Inch" Motors, 115vac 3rpm 32p. 12vdc 5 pole model motors 37p. 8 track 12vdc motors £1.35. Cassette motors vdc ex equip. 70p. Crouzet geared motor, 115vac 4rpm £1.05. Smiths clock motor, synch. 240vac 1 rev. per hour £1.05.

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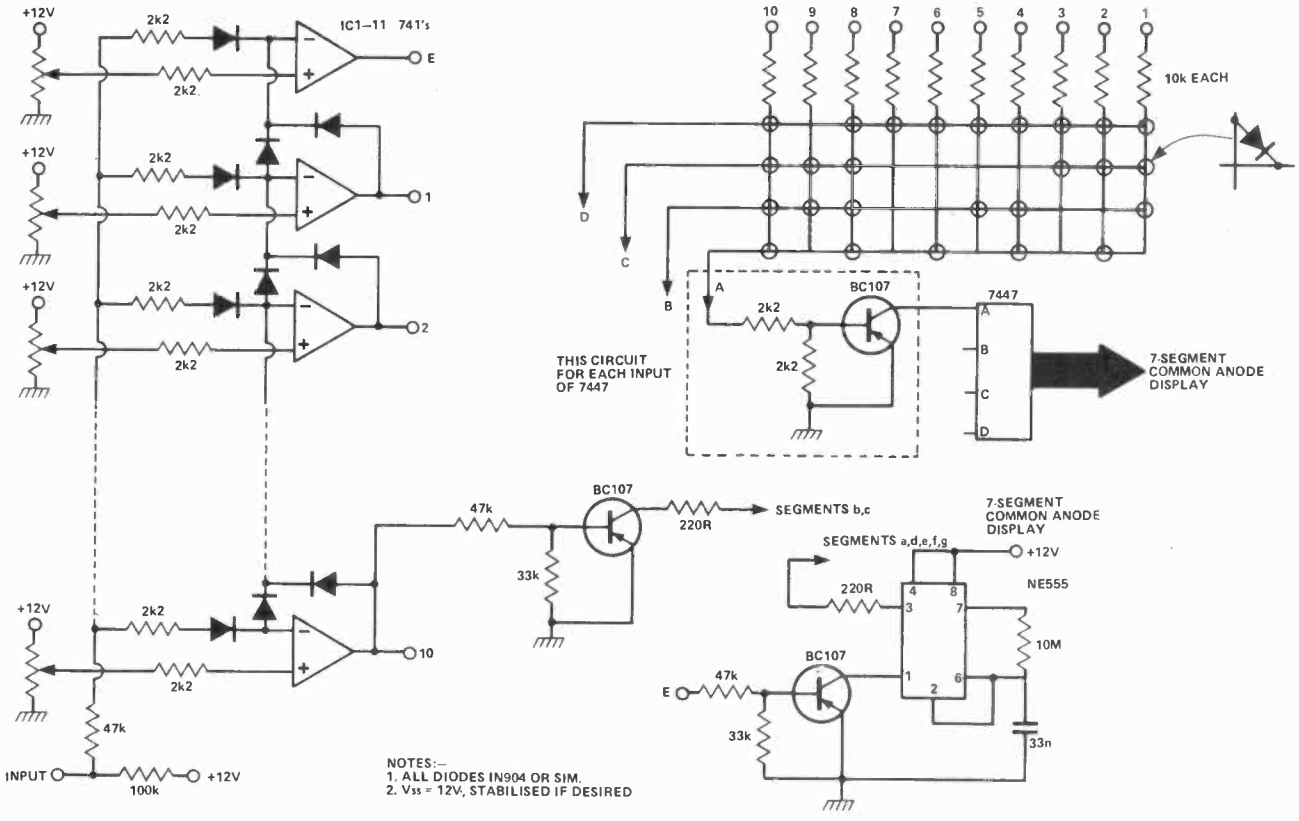
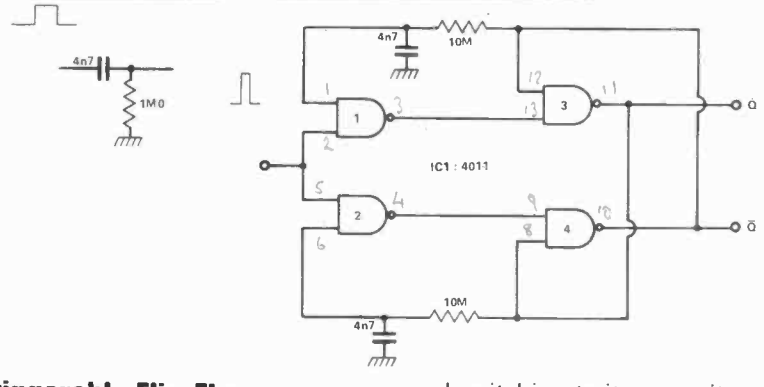


10 Gallon Digital Fuel Gauge

B. R. H. King

This circuit is based on the design published in ETI Circuits No 2, but has been extended to ten gallons without the need for the large number of diodes which would be required if the original circuit were used. Also incorporated is a flashing E when the tank is nearly empty.

The input is the voltage across the fuel-tank 'sender' which typically rises from zero at full tank, to about 5V when empty. As the voltage falls, the higher-numbered 741 comes on, extinguishing all the lower-numbered ones via the diode network. The outputs are fed to a decimal-to-BCD encoder (two pieces of veroboard with tracks at right-angles, with diodes sandwiched between). Each of the four outputs drives a BC107 to sink the inputs of a 7447 BCD-to-7 segment converter. This system is more economical in space and components than a discrete diode, decimal, 7 segment matrix. Output ten also provides drive to segments b and c of another display to give the figure one. This display is also used to show an E which is flashed by a 555 turned on by output from the E 741. A certain amount of trial-and-error is required to get values to suit individual cars, display types etc and the voltage divider at the input provides bias to compensate for the non-zero output of the 741's in their off-state. The circuit needs to be calibrated by filling the tank gallon by gallon and adjusting the 10 k presets. The prototype works very satisfactorily.



Retriggerable Flip-Flop

G. S. Wills

The following circuit was devised as a cheap retriggerable flip-flop using a single Quad-NAND chip (4011).

It is sometimes useful to have a single input flip-flop instead of the usual SET & RESET, this one being used on the end of an ultrasonic remote pause for a cassette recorder and switching to its opposite state for each received pulse.

Gates 3 and 4 are wired as a standard flip-flop configuration, their inputs going to gates 1 and 2 which steer the input pulse alternately.

The only requirement to remember is that the input pulse must be shorter than the CR constant of the circuit, but this is easily arranged by including a differentiator network (at the input) with a lower time constant.

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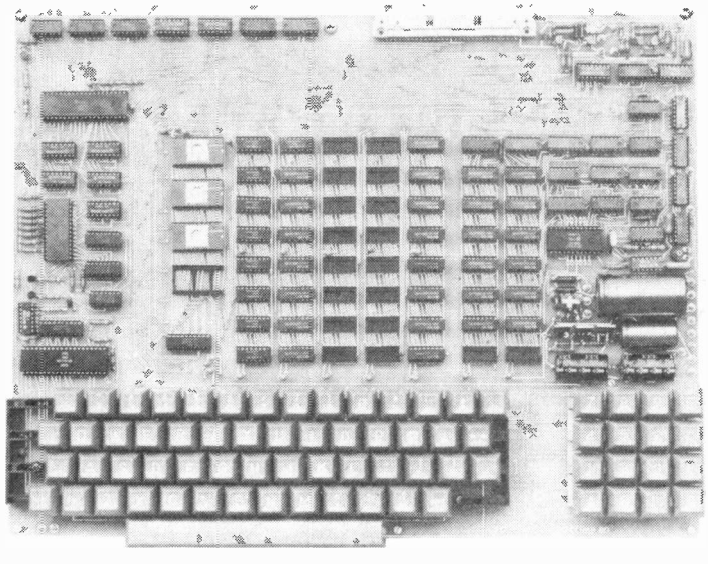

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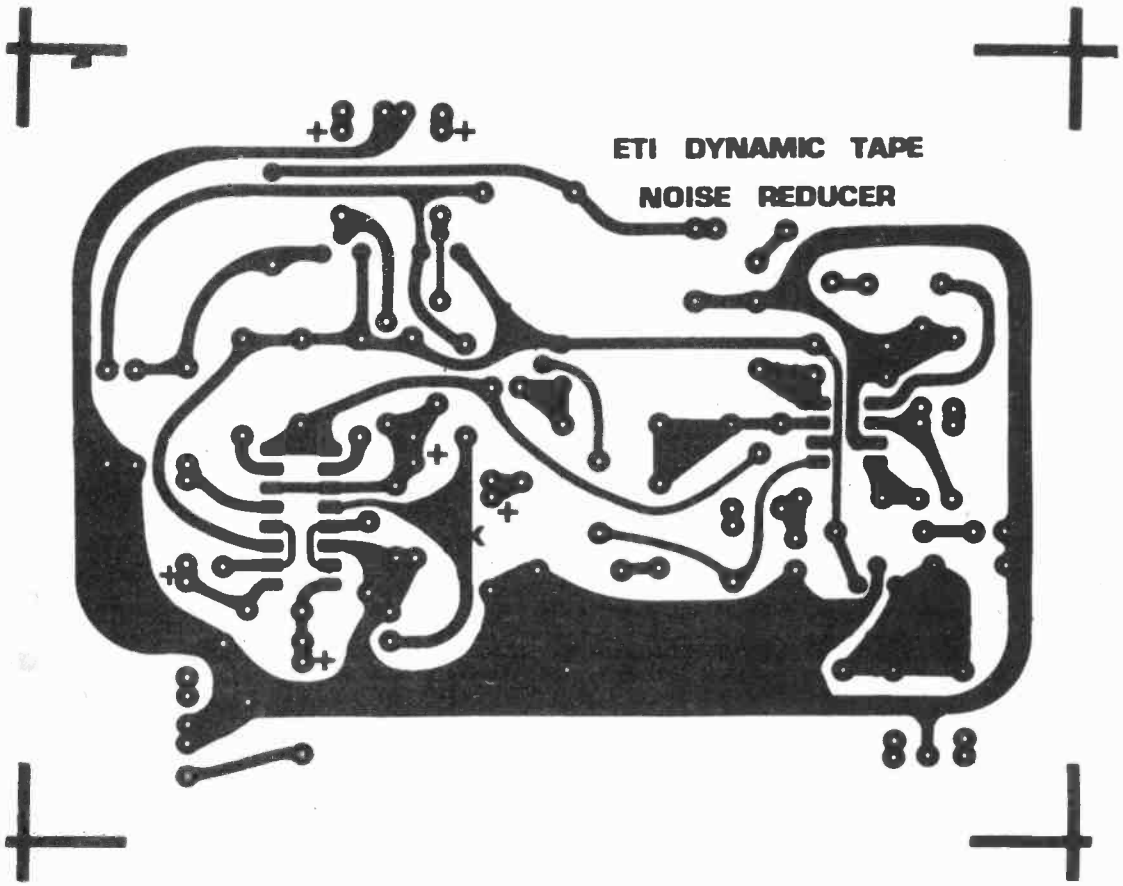
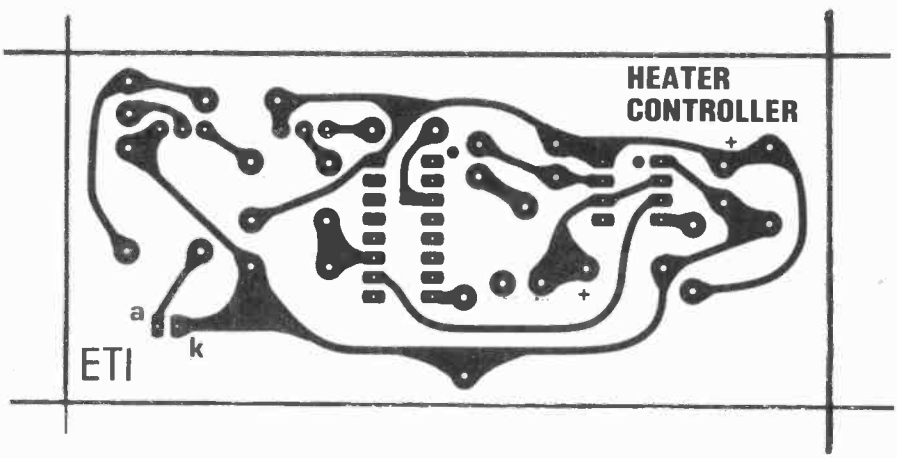
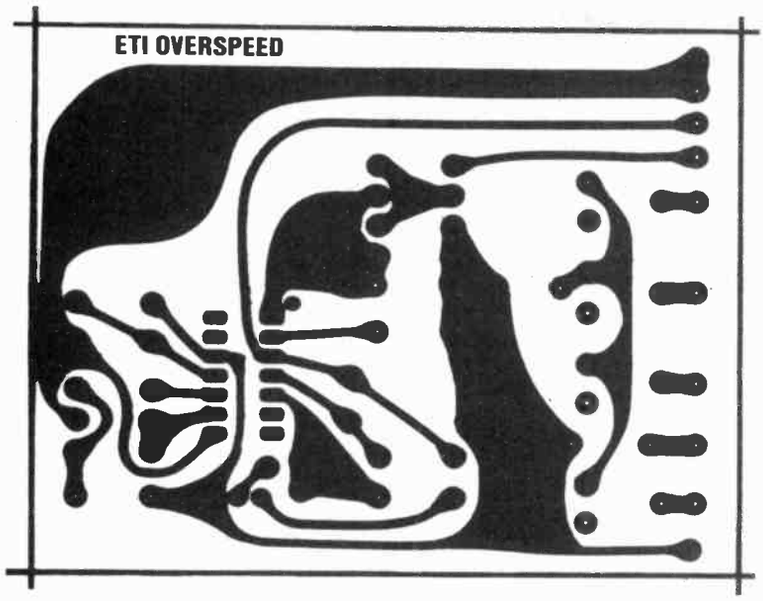


Above: dynamic noise filter foil pattern shown full size.

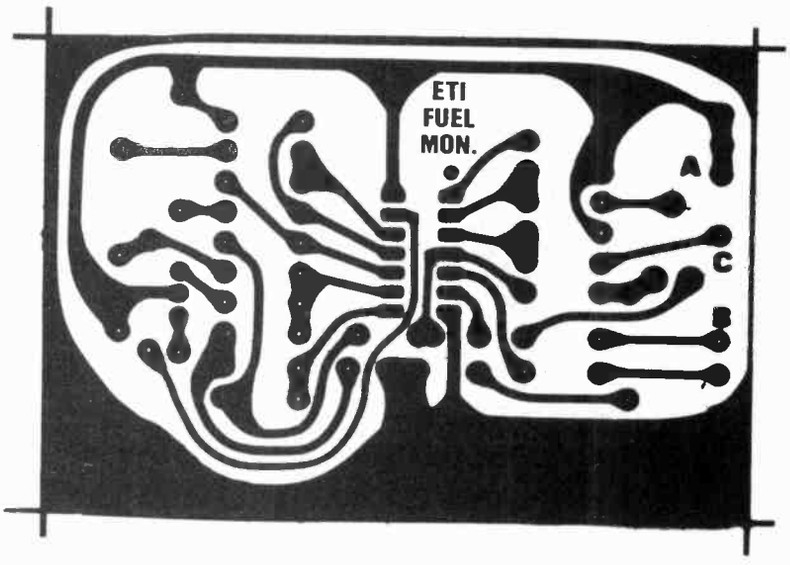
Below: full size foil pattern for the rear screen heater controller.



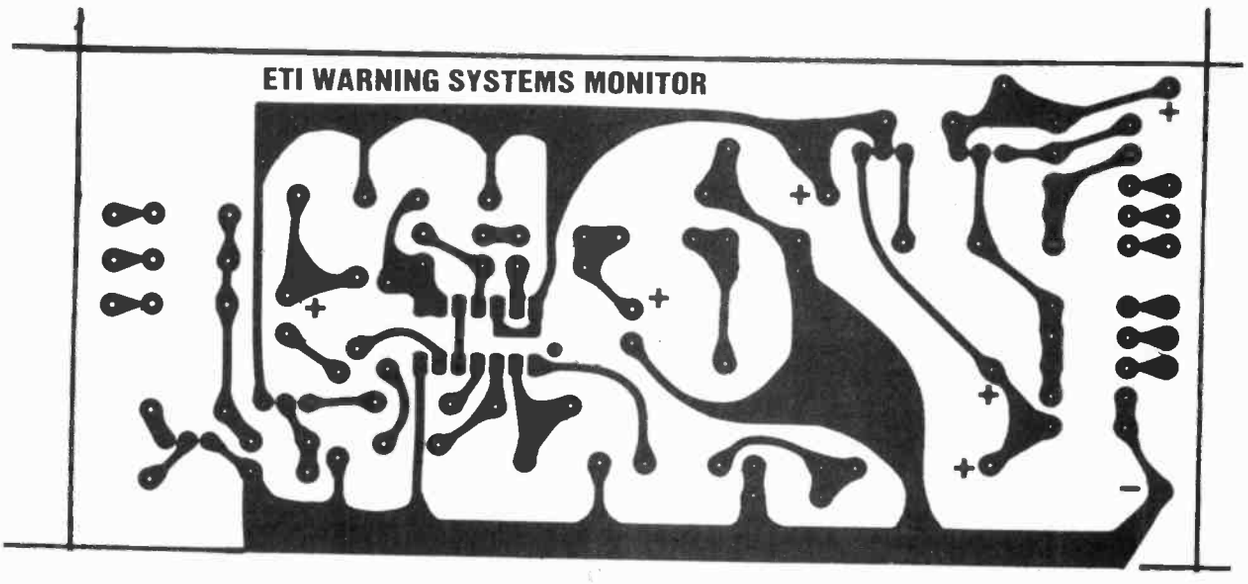


Left: full size foil side pattern for the overspeed alarm project.

Right: full size foil pattern for the fuel level monitor project



Below: full size foil pattern for the warning systems monitor project



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7401	14p
7402	14p
7403	14p
7404	14p
74S04	90p
7405	18p
7406	32p
7407	32p
7408	17p
7409	19p
7410	15p
7411	24p
7412	20p
7413	30p
7414	50p
7416	27p
7417	27p
7420	17p
7421	40p
7422	22p
7423	34p
7425	30p
7426	40p
7427	34p
7428	38p
7430	17p
7432	30p
7433	40p
7437	35p
7438	35p
7440	17p
7441	70p
7442A	60p
7443	112p
7444	112p
7445	100p
7446A	93p
7447A	60p
7448	60p
7450	17p
7451	17p
7453	17p
7454	17p
7460	17p
7470	38p
7472	30p
7473	34p
7474	24p
7475	38p
7476	35p
7480	50p
7481	100p
7482	84p
7483A	70p
7484	100p
7485	90p
7486	30p
7489	175p
7490A	30p
7491	80p
7492A	48p
7493A	30p
7494	84p
7495A	70p
7496	65p
7497	180p
74100	130p
74104	65p
74105	65p
74107	34p
74109	55p
74110	55p
74111	70p
74116	200p
74118	130p
74119	210p
74120	110p
74121	25p
74122	48p
74123	48p
74125	55p
74126	60p
74128	75p
74132	75p
74136	75p
74141	70p
74142	200p
74145	90p
74147	190p
74148	150p
74150	100p
74151A	70p
74153	70p
74154	100p
74155	90p
74156	90p
74157	70p
74159	190p
74160	90p
74161	90p
74162	90p
74163	90p
74164	100p
74165	130p
74166	100p
74167	200p
74170	240p
74172	450p
74173	120p
74174	85p
74175	85p
74176	75p
74177	75p
74178	160p
74180	93p
74181	150p
74182	90p
74184A	150p
74185	150p
74186	500p
74190	90p
74191	90p
74192	90p
74193	90p
74194	100p
74195	95p
74196	95p
74197	80p
74198	150p
74199	150p
74200	£10
74221	160p
74251	140p
74259	250p
74265	90p
74278	290p
74279	110p
74283	190p
74284	400p
74285	400p
74290	150p
74293	150p
74294	200p
74298	200p
74365	120p
74366	120p
74367	120p
74368	120p
74390	200p
74393	180p
74490	225p

74LS SERIES

74LS00	13p
74LS02	14p
74LS04	14p
74LS05	25p
74LS08	22p
74LS10	20p
74LS11	40p
74LS13	38p
74LS14	70p
74LS20	20p
74LS21	40p
74LS22	28p
74LS27	38p
74LS30	22p
74LS32	27p
74LS42	95p
74LS47	90p
74LS55	30p
74LS73	50p
74LS74	32p
74LS75	45p
74LS76	45p
74LS83	90p
74LS85	100p
74LS86	40p
74LS90	60p
74LS92	72p
74LS93	60p
74LS96	75p
74LS107	45p
74LS109	60p
74LS112	100p
74LS113	50p
75LS123	65p
74LS124	180p
74LS125	80p
74LS126	90p
74LS132	95p
74LS133	60p
74LS136	55p
74LS138	60p
74LS139	60p
74LS147	220p
74LS148	180p
74LS151	100p
74LS153	60p
74LS154	200p
74LS155	100p
74LS156	100p
74LS157	50p
74LS158	120p
74LS160	130p
74LS161	100p
74LS162	140p
74LS163	100p
74LS164	120p
74LS165	180p
74LS166	180p
74LS173	110p
74LS174	90p
74LS175	110p
74LS181	320p
74LS190	100p
74LS191	100p
74LS192	140p
74LS193	140p
74LS194	90p
74LS195	140p
74LS196	120p
74LS221	140p
74LS240	175p
74LS241	175p
74LS242	170p
74LS243	170p
74LS244	195p
74LS245	250p
74LS251	140p
74LS253	140p
74LS257	120p
74LS258	250p
74LS259	180p
74LS266	50p
74LS273	130p
74LS279	140p
74LS283	120p
74LS298	249p
74LS324	200p
74LS348	200p
74LS365	160p
74LS367	160p
74LS368	160p
74LS373	180p
74LS374	195p
74LS377	180p
74LS378	200p
74LS390	160p
74LS393	160p

FULL 74LS SERIES AVAILABLE

4000 SERIES

4000	15p
4001	17p
4002	17p
4006	95p
4007	18p
4008	80p
4009	40p
4010	50p
4011	17p
4012	18p
4013	50p
4014	84p
4015	84p
4016	45p
4017	80p
4018	80p
4019	45p
4020	100p
4021	110p
4022	100p
4023	22p
4024	50p
4025	20p
4026	130p
4027	50p
4028	84p
4029	100p
4030	55p
4031	200p
4033	180p
4034	200p
4035	110p
4040	100p
4041	80p
4042	80p
4043	90p
4044	90p
4046	110p
4047	100p
4048	55p
4049	40p
4050	49p
4051	80p
4052	80p
4053	80p
4054	150p
4055	125p
4056	135p
4059	600p
4060	115p
4063	120p
4066	55p
4067	450p
4068	22p
4069	20p
4070	30p
4071	22p
4072	22p
4073	22p
4075	22p
4076	107p
4081	22p
4082	22p
4093	80p
4094	175p
4096	120p
4097	300p
4098	120p
4411	£11
4502	120p
4503	70p
4507	55p
4510	99p
4511	150p
4514	250p
4516	110p
4518	100p
4520	90p
4528	100p
4532	140p
4538	140p
4543	180p
4553	450p
4556	90p
4560	250p
4569	180p
4572	40p
4583	90p
4584	90p
14433	£11
14500	£7

INTERFACE ICs

MC1488	100p
MC1489	100p
75107	160p
75150	175p
75154	175p
75182	230p
75322	275p
75324	375p
75325	375p
75451	72p
75491/2	96p
8T26	250p
8T28	300p
8T95	160p
8T97	160p
81LS95	140p
81LS96	140p
81LS97	140p
81LS98	140p
9601	140p
9602	220p
9603	60p

'RESISTORS High Stab Carbon Film 5% Tol E12
'¼W 10R-10M **5p**/pack of 3 (one value)
'¼W 10R-1M **7p**/pack of 5 (one value)

'MINIATURE PRESETS Horz/Vert
'100R-1M **10p**

CARBON TRACK POTENTIOMETERS
1/4 LOG or LIN

Single	5K-1M	30p
Single with DP Switch	5K-1M	55p
Dual	5K-1M	70p

93 SERIES

9301	160p
9302	175p
9308	316p
9310	275p
9311	275p
9312	160p
9314	165p
9316	225p
9321	225p
9322	150p
9334	225p
9368	200p
9370	200p
9374	200p

VEROBOARD 0.1 (copper clad) 0.15

2½ x 3¼	41p	33p
2½ x 5	49p	45p
3¼ x 3¼	49p	45p
3¼ x 5	56p	60p
2½ x 17"	200p	180p
3¼ x 17"	260p	220p
4¼ x 17"	310p	—

Pkt of 35 pins 30p
Spot face cutter 85p
Pin insertion tool 99p

VERO WIRING PEN
Plus Spool 325p
Spare spool (wire) 80p
Combs 7p each

LINEAR ICs

AY1-0212	600p
AY1-1313	888p
AY1-1320	320p
AY1-5050	200p
AY5-1224A	240p
AY5-1315	600p
AY5-1317A	775p
CA3019	80p
CA3046	70p
CA3048	225p
CA3080E	22p
CA3086	48p
CA3089E	225p
CA3090AQ	375p
CA3130E	100p
CA3140E	70p
CA3160E	100p
CA3161E	150p
CA3162E	450p
FX209	750p
ICL7106	850p
ICL8038	340p
LF356P	95p
LF358P	75p
LM301A	30p
LM311	120p
LM318	200p
LM319	200p
LM324	70p
LM339	75p
LM348	95p
LM377	175p
LM380	75p
LM381AN	160p
LM389N	140p
LM709	36p
LM710	50p
LM725	350p
LM733	100p
LM741	20p
LM747	70p
LM748	35p
LM3302	80p
LM3900	70p
LM3911	130p
LM3914N	250p
LM4136	120p
MC1310P	150p
MC1458	55p
MC1495L	350p
MC1496	100p
MC3340P	120p
MC3360P	120p
MK50398	750p
MM57160	620p
NE531	110p
NE555	25p
NE556	70p
NE561B	425p
NE562B	425p
NE565	130p
NE566	155p
NE567	175p
NE571	425p
SAD1024A	1250p
SFF96364	1150p
SN76003N	175p
SN76013N	140p
SN76018	140p
SN76013ND	120p
SN76023N	140p
SN76023ND	120p
SN76131	110p
SN76477	250p
SP8515	750p
TAA621	275p
TBA641B11	225p
TBA651	200p
TBA800	90p
TBA810	100p
TBA82D	90p
TCA4500A	250p
TCA940	175p
TDA1004	300p
TDA1008	320p
TDA1022	600p
TDA1034B	250p
TDA2020	320p
TL071	70p
TL072	95p
TL074	150p
TL084	130p
TL170	50p
U0N6118	320p
U0N6184	320p
ULN2003	100p
XR2206	350p
XR2207	400p
XR2211	600p
XR2216	675p
XR2240	400p
ZN414	90p
ZN424E	135p
ZN425E	400p
ZN1034E	200p
95H90	800p
11C90	£14

VOLTAGE REGULATORS
Fixed Plastic TO-220

	+ve		−ve	
1A				
5V	7805	75p	7905	90p
12V	7812	75p	7912	90p
15V	7815	75p	7915	90p
18V	7818	90p	7918	100p
24V	7824	90p	7924	100p
100mA	TO-92			
5V	78L05	30p	79L05	80p
12V	78L12	30p	79L12	80p
15V	78L15	35p	79L15	80p

OTHER REGULATORS

LM309K	135p	LM320T-12	90p
LM317T	200p	LM340T-12	75p
LM323K	625p	78H05KC	675p
LM723	32p	78MGT2C	135p

OPTO-ELECTRONICS

2N5777	45p	OCP71	130p
ORP12	90p	ORP60	90p
ORP61	90p	TIL78	70p

LEDS

0.125		0.2	
TIL321 R	75p	TIL220 Red	16p
TIL209 Red	13p	TIL222 Gr	18p
TIL211 Gr	20p	TIL228 Red	22p
TIL212 Ye	25p	MV5491 TS	120p
TIL216 Red	18p	Clips	3p

DISPLAYS

3015F	200p	FND500	120p
DL704	140p	FND507	120p
DL707 Red	140p	MAN3640	175p
707 Gr	140p	TIL311	600p
DL747 Red	225p	TIL312/3	110p
747 Gr	225p	TIL321/2	130p
FND357	120p	TIL330	140p
		7750/60	200p

DRIVERS 9368/9370 **200p**

TRANSFORMERS (Prim 220-240V)

6-0-6	100mA	88p	9-0-9	1A	270p+
9-0-9	75mA	92p	12V	2A	350p+
12-0-12	100mA	95p	0-12-15-		
0-12 0-12	500mA	280p+	20-24-30	1A	340p+
			15-0-15	1A	265p+

(Please add 50p p&p charge to all items marked + above our normal p&p charge)

TRANSISTORS

AC126	25p
AC127/8	20p
AC176	25p
AC287/8	25p
AF116/7	30p
AD149	70p
AD161/2	45p
AU107	200p
BC107/8	11p
BC109	11p
BC109C	13p
BC117	20p
BC147/8	9p
BC149	10p
BC157/8	10p
BC159	11p
BC169C	12p
BC172	12p
BC177/8	17p
BC179	18p
BC182L	10p
BC182/3	10p
BC183L	10p
BC184L	11p
BC187	30p
BC212L	11p
BC212/3	11p
BC213L	11p
BC214L	12p
BC327	16p
BC337	16p
BC338	16p
BC461	36p
BC477/8	30p
BC516/7	50p
BC547B	18p
BC548C	16p
BC549C	18p
BC557B	16p
BC558B	16p
BC559C	18p
BCY70	18p
BCY71/2	22p
BC131/2	50p
BD135/6	54p
BD139	56p
BD140	60p
BD241B	70p
BD242	70p
BDY56	200p
BF200	32p
BF244B	35p
BF256B	70p
BF257/8	32p
BF259	34p
BFR39	30p
BFR40	30p
BFR41	30p
BFR79	30p
BFR80	30p
BFR81	30p
BFX29	30p
BFX30	34p
BFXB4/5	30p
BFXB6/7	30p
BFXB8	30p
BFW10	90p
BFY50	22p
BFY51/2	22p
BFY56	33p
BFY90	90p
BRY39	45p
BSX19/20	20p
BU104	225p
BU105	190p
BU108	250p
BU109	225p
BU205	200p
BU208	200p
BU406	145p
E300	50p
E304	50p
E308	50p
E310	50p
MJ2501	225p
MJ2955	100p
MJ3001	225p
MJE340	65p
MJE2955	100p
MJE3055	70p
MPF102	45p
MPF103/4	40p
MPF105	40p
MPS6531	50p
MPS6534	50p
MPSA06	30p
MPSA12	50p
MPSA13	50p
MPSA20	60p
MPSA56	32p
MPSU06	63p
MPSU56	78p
OC28	130p
OC35	130p
R2008B	200p
R2010B	200p
TIP29A	40p
TIP29C	55p
TIP30A	48p
TIP30C	60p
TIP31A	58p
TIP31C	62p
TIP32A	68p
TIP32C	82p
TIP33A	90p
TIP33C	114p
TIP34A	115p
TIP34C	160p
TIP35A	225p
TIP35C	290p
TIP36A	270p
TIP36C	340p
TIP41A	65p
TIP41C	78p
TIP42A	70p
TIP42C	82p
TIP120	100p
TIP122	110p
TIP2955	78p
TIP3055	70p
TIS43	34p
TIS93	30p
ZTX108	12p
ZTX300	13p
ZTX500	15p
ZTX502	18p
ZTX504	30p
2N457A	250p
2N696	35p
2N697	25p
2N698	45p
2N706A	20p
2N708	20p
2N918	45p
2N930	18p
2N1131/2	20p
2N1613	25p
2N1711	25p
2N2102	60p
2N2160	300p
2N2219A	22p
2N2222A	20p
2N2369A	16p
2N2484	30p
2N2646	50p
2N2904/5A	25p
2N2906A	24p
2N2907A	30p
2N2926	8p
2N3053	22p
2N3054	65p
2N3055	48p
2N3442	140p
2N3553	240p
2N3565	30p
2N3643/4	48p
2N3702/3	12p
2N3704/5	12p
2N3706/7	14p
2N3708/9	12p
2N3773	300p
2N3819	25p
2N3820	50p
2N3823	70p
2N3866	90p
2N3903/4	18p
2N3905/6	20p
2N4036	65p
2N4058/9	12p
2N4060	12p
2N4061/2	18p
2N4123/4	27p
2N4125/6	27p
2N4289	20p
2N4401/3	27p
2N4427	90p
2N4871	60p
2N5087	27p
2N5089	27p
2N5172	27p
2N5179	90p
2N5191	83p
2N5194	90p
2N5245	40p
2N5296	55p
2N5401	50p
2N5457/8	40p
2N5459	40p
2N5460	40p
2N5485	44p
2N6027	48p
2N6247	190p
2N6254	130p
2N6290	65p
2N6292	65p
3N128	120p
3N140	100p
3N141	110p
3N201	110p
40290	250p
40360	40p
40361/2	45p
40364	120p
40408	70p
40409	65p
40410	65p
40411	300p
40594	87p
40595	105p
40673	75p
40841	90p
40871/2	90p

DIODES

*BY127	12p
*OA47	9p
*OA81	15p
*OA85	15p
*OA90	9p
*OA91	9p
*OA95	9p
*OA200	9p
*OA202	10p
*1N914	4p
*1N916	7p
*1N4148	4p
1N4001/2	5p
1N4003/4	6p
1N4005	6p
1N4006/7	7p
1N5401/3	14p
1N5404/7	19p
*1S920	9p

HEAT SINKS
For TO220 Voltage Regs. and Transistors 22p
For TO5 12p

BRIDGE RECTIFIERS

*1A 50V	21p
*1A 100V	22p
*1A 400V	30p
*1A 600V	36p
*2A 50V	30p
*2A 100V	35p
*2A 400V	45p
*3A 200V	60p
*3A 600V	72p
*4A 100V	95p
*4A 400V	100p
6A 50V	90p
6A 100V	100p
6A 400V	120p
10A 400V	200p
25A 400V	400p

'ZENERS
2.7V-33V
400mW 9p
1W 15p

TRIACS PLASTIC

3A 400V	60p
3A 500V	65p
6A 400V	70p
6A 500V	88p
8A 400V	75p
8A 500V	85p
12A 400V	85p
12A 500V	105p
16A 400V	110p
16A 500V	130p
T2800D	130p

THYRISTORS

1A 50V	40p
1A 400V	65p
1A 600V	70p
3A 400V	90p
8A 600V	140p
12A 400V	160p
16A 100V	160p
16A 400V	180p
16A 600V	220p
BT106	110p
C106D	45p
*MCR101	36p
2N3525	130p
2N4444	140p
*2N5060	34p
*2N5064	40p

'LOUDSPEAKERS

2½"	64R	70p
2½"	8R	70p
2"	8R	75p
1½"	8R	75p

MEMORIES

2102-2L	120p
2107B	500p
2111-2	225p
2112-2	300p
2114	525p
4027	370p
4044	900p
4116	900p
5101	510p
6810	350p

ROM/PROMs

74S188	225p
74S287	350p
74S387	350p
74S471	600p
74S571	650p
93427	400p
93436	650p
93446	650p
93448	£10

CPUs

1610	930p
6502	1200p
6800	900p
6802	£12
8080A	550p
Z80	1250p

EPROMs

1702A	600p
2708	900p
2716	£29

UART

AY-3-1015P	500p
AY-5-1013P	400p
IM6402	600p
TMS6011NC	400p

CHARACTER GENERATOR

3257ADC	995p
MCM6576	£10
RO-3-2513U.C	600p
RO-3-2513L.C	650p
SN74S262AN	1380p

OTHER

3245	400p
6820	500p
6850	500p
8205	320p
8212	225p
8216	225p
8224	400p
8228	525p
8251	700p
8253	£12
8255	550p
8257	£11
8259	£14
MC14411	£11
MC14412V	£11
Z80P10	£8
Z80CTC	£8

SUBMINIATURE SWITCHES

Toggle	
SPST	55p
SPDT	58p
DPDT	60p
DPDT (centre off)	80p
Push to make (Red, Green, Yel., Blue)	15p
Push to break (Black only)	25p

CRYSTALS

100KHz	300p
1MHz	370p
1.008MHz	370p
3.2768MHz	350p
3.579MHz	200p
4MHz	350p
5.185MHz	400p
8.867MHz	350p
10.7MHz	350p
18MHz	300p
27.135MHz	300p

EDGEBOARD CONNECTORS
0.156" Solder Tail

2 x 10 way	85p
2 x 15 way	100p
2 x 18 way	120p
2 x 22 way	135p
2 x 25 way	160p

KEYBOARD ENCODERS
AY-5-2376 £10

LOW PROFILE DIL SOCKETS BY TEXAS

8 pin	10p	18 pin	24p	24 pin	30p
14 pin	12p	20 pin	26p	28 pin	40p
16 pin	13p	22 pin	28p	40 pin	48p

WIRE WRAP SOCKETS

8 pin	30p	18 pin	65p	24 pin	90p
14 pin	40p	20 pin	70p	28 pin	110p
16 pin	55p	22 pin	80p	40 pin	140p

COUNTERS

74C925N	475p
ICM7217A	850p
ZN1040E	700p
4 DIGIT DISPLAY	
NSB5881 C.C.	570p

All items are normally stocked in depth and stock items are despatched by return.

Data Books on TTLs, CMOS, LINEARS, MEMORIES, TRANSISTORS ETC. AVAILABLE.

LOW VOLTAGE CAPACITORS
ELECTROLYTIC
TANTALUM
POLYESTER MICA
AVAILABLE

VDU SYSTEM PARTS

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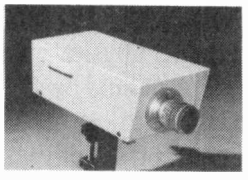

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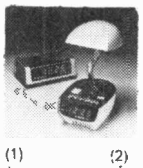
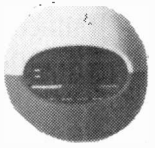

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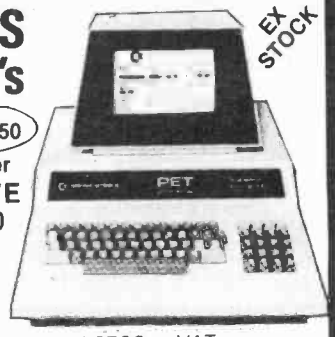

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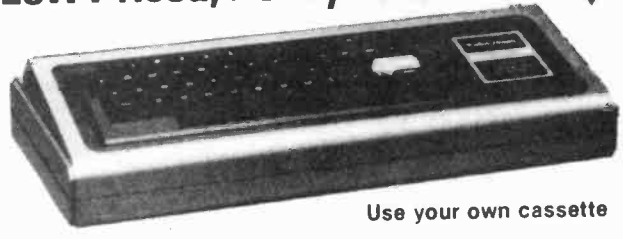

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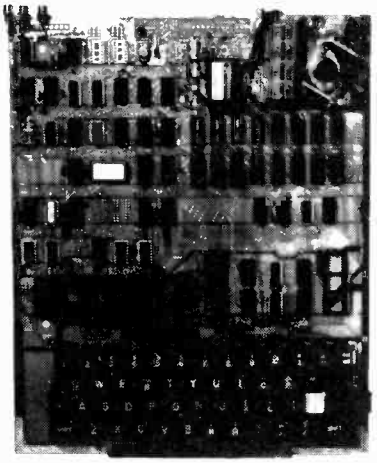

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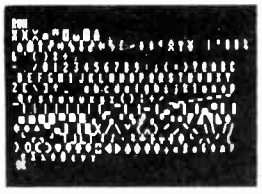

The Compukit UK101 Character Set

COMMANDS
CONT LIST NEW NULL RUN

STATEMENTS
CLEAR DATA DEF DIM END FOR
GOTO GOSUB IF GOTO IF THEN INPUT LET
NEXT ON GOTO ON GOSUB POKE PRINT READ
REM RESTORE RETURN STOP

EXPRESSIONS

OPERATORS
+ - / ↑ NOT AND OR > < <> > = < = RANGE 10^{-32} to 10^{+32}

VARIABLES
A B C ... Z and two letter variables
The above can all be subscripted when used in an array. String variables use above names plus $ e.g. A$

FUNCTIONS

ABS(X)	ATN(X)	COS(X)	EXP(X)	FRE(X)	INT(X)
LOG(X)	PEEK(I)	POS(I)	RND(X)	SGN(X)	SIN(X)
SPC(I)	SQR(X)	TAB(I)	TAN(X)	USR(I)	

STRING FUNCTIONS

ASC(X$	CHR$(I)	FRE(X$)	LEFT$(X$,I)	LEN(X$)	MID$(X$,I,J)
RIGHT$(X$,I)		STR$(X)		VAL(X$)	

SPECIAL CHARACTERS
↑ Erases line being typed. Then provides carriage return, line feed
◀ Erases last character typed
CR Carriage Return — must be at the end of each line
: Separates statements on a line
CONTROL/C Execution or printing of a list is interrupted at the end of a line. "BREAK IN LINE XXXX" is printed, indicating line number of next statement to be executed or printed
CONTROL/O No outputs occur until return made to command mode. If an input statement is encountered, either another CONTROL/O is typed or an error occurs
? Equivalent to PRINT

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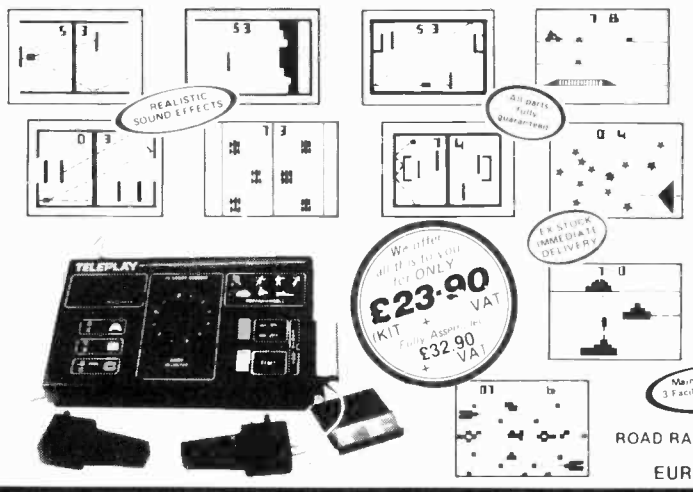

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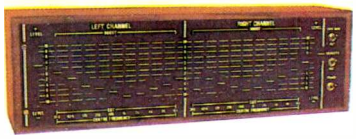

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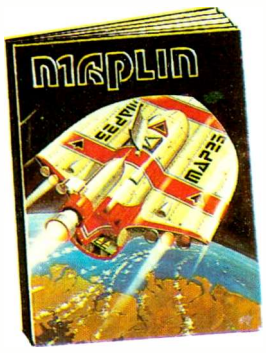

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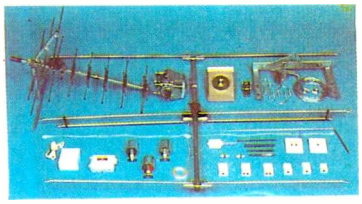

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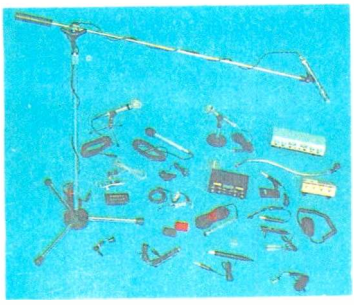

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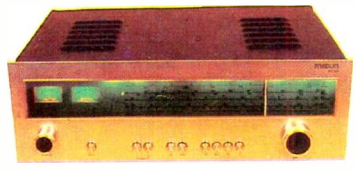

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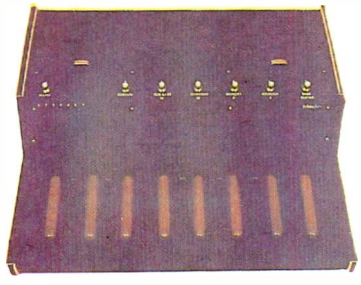

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