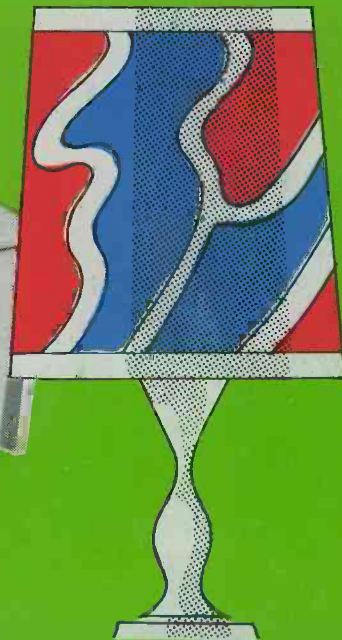
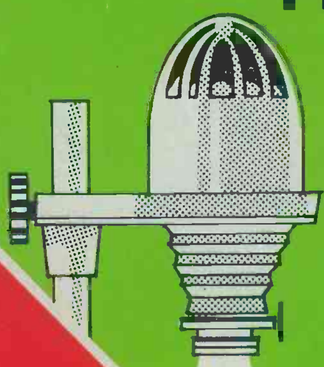
RADIO & ELECTRONICS CONSTRUCTOR

JUNE 1981 60p

FUMBLE-FREE ILLUMINATION

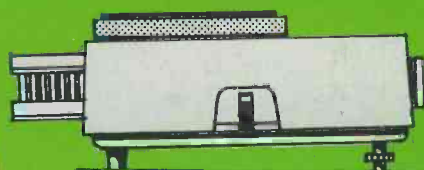


PROXIMITY ACTIVATED LIGHT SWITCH



ENLARGER PROCESS TIMER

BAMBOOZLE BUZBY WITH A TELEPHONE CHARGE REMINDER



SLIDE PROJECTOR PULSER

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RADIO & ELECTRONICS CONSTRUCTOR

JUNE 1981
Volume 34 No. 10

Published Monthly

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Technical Queries. We regret that we are unable to answer queries other than those arising from articles appearing in this magazine nor can we advise on modifications to equipment described. We regret that queries cannot be answered over the telephone, they must be submitted in writing and accompanied by a stamped addressed envelope for reply.

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OUR NEXT ISSUE WILL BE PUBLISHED 15th JUNE

C.B. P.A. MICROPHONES,
Hand held with thumb switch & Curly Lead, Type 1 600Ω dynamic at **£4.25.** Type 2 600Ω, noise cancelling type at **£7.25** Type 3 Power type, with volume control 1KΩ Imp, **£7.95**

SEMICONDUCTORS
LM340 **80p.** BY103 **10p.** 2N5062 100V 800mA SCR **18p.** BX504 Opto Isolator **25p.** CA3130 **95p.** MC4741CP **50p.** 741 **22p.** 741S **35p.** 723 **35p.** NE555 **24p.** 2N3773 **£1.70.** NE556 **50p.** ZN414 **75p.** BD238 **28p.** BD438 **28p.** CB4069 **15p.** 4" Red Led Displays, c.c. or c.a. **95p.** TIL209 Red Leds 10 for **75p.** Man3A 3mm Led Displays **40p.** BY223 **20p.**

PROJECT BOXES
Sturdy ABS black plastic boxes with brass inserts and lid. 75 x 56 x 35mm **65p.** 95 x 71 x 35mm **75p.** 115 x 95 x 37mm **85p.**

MOTOROLA PIEZO CERAMIC TWEETERS
No crossover required

2.5" Direct Radiating Tweeter, maximum rating 25 volts R.M.S. 100 watts across 8 ohms. Freq. range 3.8kHz-28kHz, **£3.65**

TOOL SALE
Small side cutters 5" insulated handles **£1.** Radio-pliers, snipe nosed insulated handles **£1.** Heavy duty pliers insulated handles **£1.10.** Draper side cutters spring loaded **£1**.

HANDY BENCH VICE
1" Jaw opening, **£2.95.**

Hand drill, double pinion with machine cut gears, 5/16", only **£2.75p** plus **50p** p&p.

MORSE KEYS
Beginners practice key **£1.05.** All metal full adjustable type. **£2.60**

F.M. MICROPHONE,
Electret condenser type, tuneable 85-95Mhz. Arrival distance 50 mtrs. (Approx outdoors) Size 163 x 35 mm **£10.25.** (Not licenseable in U.K.).

JVC NIVICO STEREO CASSETTE MECHANISM. Music centre type. Rev. counter, remote operation **£13.50** and **£1.00** p&p.

JUMPER TEST LEAD SETS
10 pairs of leads with various coloured croc clips each end (20 clips) **90p** per set.

TRANSFORMERS
All 240VAC Primary (postage per transformer is shown after price). MINIATURE RANGE: 6-0-6V 100mA, Volts 100mA, 12-0-12V 50mA **all 79p** each **(15p).** 0-6, 0-6V, 280mA **£1.20 (20p).** 6V 500mA **£1.20 (15p).** 12V 2 amp **£2.75 (45p).** 30-0-30V 1 amp **£2.85 (54p).** 20-0-20V 2 amp **£3.65 (54p).** 0-12-15-20-24-30V 2 amp **£4.75 (54p).** 24 volt 2 Amp **£2.45 (54p).**

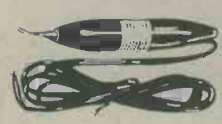
T.V. AERIAL AMPLIFIERS
Wide Band, 240 VAC operated, with two outlets, **£7.75**

MICROPHONES
Min. tie pin. Omni, uses deaf aid battery (supplied), **£4.95,** ECM105 low cost condenser, Omni, 600 ohms, on/off switch, standard jack plug, **£2.95.** EM507 Condenser, uni, 600 ohms, 30-18kHz., highly polished metal body **£7.92.** F.M. WIRELESS MICROPHONE, 88-108 MHz, Electret type **£10.25.** EM506 dual impedance condenser microphone 600 ohms or 50K, heavy chromed copper body, **£12.95.** CASSETTE replacement microphone with 2.5/3.5 plugs **£1.35.** GRUNDIG electric inserts with FET pre amp, 3-6VDC operation **£1.00.**

LIGHT DIMMER
240VAC 800 watts max. wall mounting, has built in photo cell for automatic swich on when dark **£4.50**

C.B. 40 CHANNEL RECEIVER
For car use, operates on 12v DC., **£7.95**

SPECIAL OFFER TAPE HEAD DEMAGNETIZER



240VAC with curved probe suitable for reel to reel or cassette machines, **£1.95.**

STEREO FM/GRAM TUNER AMPLIFIER CHASSIS, VHF and AM. Bass, treble and volume controls, Gram. 8-track inputs, headphone output jack, 3 watts per channel with power supply. **£14.95** and **£1.20** p&p

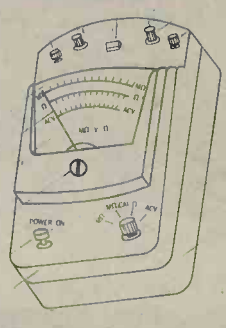
MULTIMETER BARGAINS

Pocket Multimeter, 1,000 opv sensitivity. Ranges 1KV AC/DC Volts, 150ma DC current, resistance 0-2.5K, 0-100K, **£4.50**

20,000 opv., 1,000 volts AC/DC, DC current to 500ma, 5 ranges, resistance 4 ranges to 6 meg. Mirror scale, carrying handle, **£975.**

40kHz Transducers. Rec/Sender **£3.50 pair.**

TELEPHONE PICK UP COIL
Sucker type with lead and 3.5mm plug **62p.**



500v electronic megger, push button operation. Ranges:– LO ohm Range 0 – 100Ω (MW scale 5Ω)0 – 100MΩ Mid scale 5MHΩ) **£46.75p**

Stabilized power supplies, 240V A.C. input output 13.8 volts at 3/5 amps D.C. **£14.75p**

TERMS:
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S.A.E. for illustrated lists

MULTI-TESTER

KRT5001 50k/v range doubler multimeter, 0-1kv (125mv LO range) 0 – 1kv AC. 0 – 10amp DC. 0 – 2OMΩ res. (LO ohm 0 – 2k range) 170 x 124 x 50mm **£15.50.**

YN360TR MULTIMETER

YN360 M/Meter. 20,000 ohms per volt. IKV AC/DC volts, 250ma dc current, 4 resistance ranges to 20meg, also has built in transistor tester with leakage and gain ranges. **£12.50**

CRIMPING TOOL
Combination type for crimping red blue and yellow terminations also incorporates a wire stripper (6 gauges) and wire cutter, with insultated handles only **£2.30.**

SWITCHED TYPE PLUGS into 13 amp socket, 3-6-9 volts DC out at 300mA, **£2.95.** STABLISED SUPPLY, 3-6-7.5-9 volts DC out at 400mA max., with on/off switch, polarity reversing switch and voltage selector switch, fully regulated to supply exact voltage from no load to max. current **£4.95.**

AMPHENOL CONNECTORS
(PL259) PLUGS **47p.** Chassis sockets **42p.** Elbows PL259/SO239 **90p.** Double in line male connector (2XPL259) **65p.** Plug reducers **13p.** PL259 Dummy load, 52 ohms 1 watt with Indicator bulb **95p.**

BUZZERS
MINIATURE SOLID STATE BUZZERS, 33 x 17 x 15mm white plastic case, output at three feet 70db (approx), low consumption only 15mA, voltage operating 4-15VDC, **75p** each. LOUD 12VDC BUZZER, with, metal case. 50mm diam. x 30mm high **63p.** Carters 12 volt Minimite Alarm sirens **£7.65p.** 12VDC siren, all metal rotary type, high pitched wall, **£6.25.**

TOOLS
SOLDER SUCKER, plunger type, high suction, teflon nozzle, **£4.99** (spare nozzles **69p** each).
All Antex irons still at pre increase prices, order now as new stock will be going up next month.
Antex Model C 15 watt soldering irons, 240VAC **£4.45**
Antex Model CX 17 watt soldering irons, 240VAC **£4.45**
Antex Model X25 25 watt soldering irons, 240VAC **£4.45**
ANTEX ST3 iron stands, suits all above models **£1.65**
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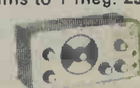
Servisol Solder Mop **50p** each.
Neon Tester Screwdrivers 8" long **59p** each.
Miyarna IC test clips 16 pin **£1.95**

SWITCHES
Sub. miniature toggles: SPST (8 x 5 x 7mm) **42p.** DPDT (8 x 7 x 7mm) **55p.** DPDT centre off 12 x 11 x 9mm **77p.** PUSH SWITCHES, 16mm x 6mm, red top, push to make **14p** each, push to break version (black top) **16p** each.

TEI Mobile SWR metre, with field strength, PL259 connection, **£8.35.**

RES. SUB BOX

Resistance Substitution Box. Swivelling disc provides close tolerance resistors of 36 values from 5 ohms to 1 meg. **£3.95.**



Signal Generator. Ranges 250Hz-100MHz in 6 Bands, 100MHz-300MHz (harmonics) internal modulator at 100Hz. R.F., output Max. 0.1vRMS. All transistorised unit with calibrating device. 220-240VAC operation, **£48.95.**

TAPE HEADS
Mono cassette **£1.75.** Stereo cassette **£3.90.** Standard 8 track stereo **£1.95** BSR MN1330 ½ track **50p.** BSR SRP90 ¼ track **£1.95.** TD10 tape head assembly — 2 heads both ¼ track R/P with built in erase, mounted on bracket **£1.20**

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Ideal for following a test match, or generally listening to the radio when those about you do not share your tastes !

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If you don't need the radio facility - then these phones provide an excellent basis for the development of a 'cordless' headphones set - complete with battery compartment and controls. R&EC will be exploiting this aspect in an early issue with a project based on the 'phones'.

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KB4424	1.65
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KB4432	1.95
KB4433	1.52
KB4436	2.53
KB4437	1.75
KB4438	2.22
KB4441	1.35
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4008AE	0.80	4073	0.24
4009	0.58	4075	0.25
4010	0.58	4076	0.90
4011AE	0.24	4077	0.35
4011B	0.24	4078	0.30
4012	0.55	4082	0.28
4013	0.55	4093	0.86
4015	0.95	4175	1.15
4016	0.52	4503	1.15
4017	0.80	4506	0.68
4019	0.60	4510	0.99
4020	0.98	4511	1.49
4021	0.82	4512	0.98
4022	0.96	4514	2.55
4023	0.25	4518	1.03
4024	0.76	4520	1.09
4025	0.25	4521	2.36
4026	1.80	4522	1.49
4028	0.79	4529	1.61
4029	1.04	4539	1.28
4030	0.59	4549	3.50
4035	1.20	4554	1.73
4040	0.98	4560	2.18
4042	0.85	4566	1.59
4043	0.85	4568	2.18
4043AE	0.93	4569	3.03
4044	0.94	4572	0.30
4046	1.30	4585	1.00
4047	0.99		
4049	0.52		
4050	0.55		
4051	0.78		
4052	0.79		
4053	0.78		
4060	1.54		
4063	1.18		
4066	0.57		

TTL

TTL	'N'	'LSN'
7400	0.13	0.20
7401	0.13	0.20
7402	0.14	0.20
7403	0.14	0.20
7404	0.14	0.24
7405	0.18	0.26
7406	0.36	
7407	0.38	
7408	0.19	0.24
7409	0.21	0.24
7410	0.18	0.24
7411	0.26	0.32
7412	0.27	
7413	0.32	
7414	0.51	
7415		0.40
7416	0.30	
7417	0.30	
7420	0.19	0.24
7421	0.38	0.24
7423	0.27	
7425	0.27	
7427	0.32	0.35
7428	0.35	0.35
7430	0.17	0.26
7432	0.32	0.28
7437	0.40	
7438	0.33	0.35
7440	0.20	0.28
7441	0.74	
7442	0.70	0.99
7443	1.15	
7444	1.12	
7445	1.05	
7446	1.32	
7447		0.89
7448	0.56	0.99
7449		0.99
7451	0.20	0.25
7453	0.20	

TTL	'N'	'LSN'
7454	0.20	0.30
7455		0.30
7460	0.20	
7463		1.24
7470	0.40	
7472	0.30	
7473	0.35	0.45
7474	0.35	0.35
7475	0.56	
7476	0.41	0.45
7478		0.50
7480	0.52	
7481	1.20	
7482	0.75	
7485	1.04	0.99
7486		0.40
7489	2.05	
7490	0.42	0.90
7491	0.85	1.25
7492	0.50	0.78
7493	0.57	0.99
7494	0.85	
7495	0.70	1.15
7496	0.58	1.20
7497	1.85	
74107		0.45
74109	0.63	
74110	0.54	
74111	0.68	
74112		0.41
74113		0.75
74114		0.40
74118	0.85	
74120	1.15	
74121	0.48	
74122	0.46	
74123	0.73	
74124		1.80
74125	0.55	0.46
74126	0.57	0.46

TTL	'N'	'LSN'
74128	0.74	
74132	0.73	0.78
74136		0.40
74138		0.72
74141	0.75	
74142	2.65	
74143	3.12	
74144	3.12	
74145		0.97
74147	1.75	
74148	1.09	1.19
74150	0.99	
74151	0.55	0.90
74153	0.70	0.85
74154	1.30	
74155	0.75	1.10
74156	0.80	
74157	0.78	0.70
74158		0.71
74159	2.10	
74160	0.99	1.30
74161	0.99	0.98
74162		1.30
74163	0.99	0.95
74164	1.20	1.30
74165	1.20	1.45
74167	2.50	
74169		2.10
74170	2.30	2.88
74174	1.05	1.20
74175	0.87	1.10
74176	0.80	
74177	0.84	
74181	2.80	3.50
74183		2.98
74184	1.35	
74185	1.34	
74190	0.92	
74192	1.20	1.80
74193	1.42	1.80

TTL	'N'	'LSN'
74194	1.05	
74196	1.34	1.20
74197	1.10	
74198	1.60	
74199	1.60	
74247		0.93
74257		1.08
74260		0.89
74279		0.88
74283		1.20
74293		1.32
74365		0.66
74366		0.65
74367		0.64
74368		0.92
74374		1.80
74377		1.99
74379		2.15
74393		1.40

VOLTAGE REGS.

78 series	0.95
79 series	1.00
78M series	0.65
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79L05	0.85
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79MGT2C	1.75
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L200	1.95
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LM317MP	1.48
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8216	1.95

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81LS97	1.25

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SQUARE 3x3mm
RECT. 2.5x5mm
TRIA. 2.5x5mm
TRIA. 3x3mm
TRIA. 5x5mm
ROUND 3mm
ROUND 5mm

PRICED BY COLOUR:

Red	17p
Green	20p
Yellow	20p
Orange	26p

TRANSISTORS

BC237	8p
BC238	8p
BC239	8p
BC307	8p
BC308	8p
BC309	8p
BC413	10p
BC414	11p
BC415	10p
BC416	11p
BC546	12p
BC556	12p
BC550	12p
BC560	12p
BC639	22p
BC640	22p
2SC1775	18p
2SA872A	14p
2SD666A	30p
2SB646A	30p
2SD668A	40p
2SB648A	40p
2SD760	45p
2SB720	45p
2SC2547	19p
2SA1085	20p

LEDS

STD DOMED TYPES

5mm RED	12p
3mm RED clr	15p
3mm RED	15p
2.5x5 RED	17p
5mm GRN	15p
3mm GRN clr	16p
3mm GRN	16p
2.5x5 GRN	20p
5mm YL	15p
3mm YL clr	16p
3mm YL	18p
2.5x5 YL	20p
5mm ORA	20p
5mm ORA clr	29p
3mm ORA	19p
2.5x5 ORA	24p
5mm Infra Rd	56p
BPW41 IF Det	1.51
IF Opto Cplr	1.44
5mm Clip	5p

TRANSISTORS

BF256	38p
2SK55	28p
2SK168	35p
J310	69p
J176	65p
40823	65p
40673	3SK51
3SK45	49p
3SK51	54p
3SK60	58p
3SK88	1.24
MEM680	75p
BF961	70p
BF194	18p
BF195	18p
BF224	22p
BF241	18p
BF274	18p
BF440	21p
BF441	21p
BF362	49p
BF395	18p
BF479	66p
BF679S	55p
BFR91	1.33
BFW92	60p
BFT95	99p
BFY90	90p
40238	85p
2SB753	2.34
2SB723	2.34
2SK134	3.10
2SJ49	3.10
2SK135	4.25
2SJ50	4.25
2SK227	3.55
2SJ83	3.55
VN66AF	95p
2N3866	85p

CRYSTALS

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455kHz	5.00	10.700	2.00
1.000MHz	2.95	10.7015	2.50
3.2768	2.70	11.00	2.00
4.000	2.00	11.115	2.00
4.1934	2.00	11.520	2.00
4.096	2.00	8.9985	2.00
4.032	2.00	9.0015	2.00
4.433619	2.00	21.000	2.00
4.800	2.00	24.000	2.00
5.000	2.00	25.000	2.00
6.5536	2.00	26.000	2.00
7.000	2.00	18.000	2.50
7.68	2.00		
8.000	2.00		
9.000	2.00		
10.000	2.00		
10.240	2.00		

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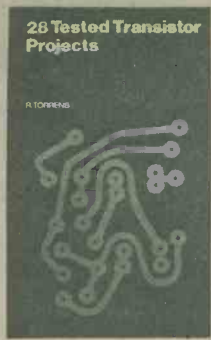

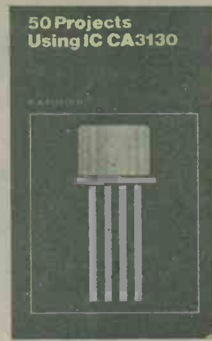

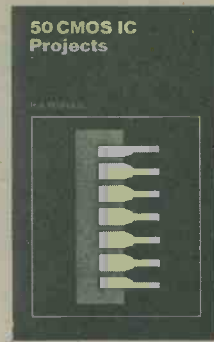

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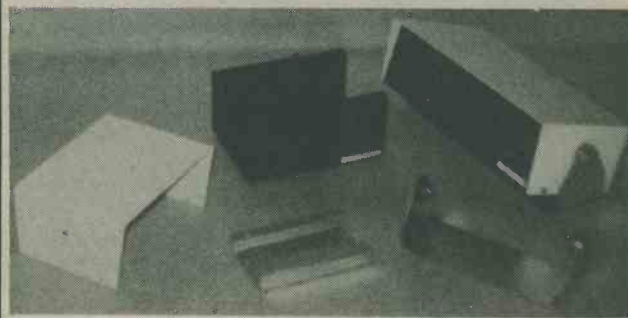

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OC84 32v .6w 30p
OC200 30v .25w 41p

OC201 25v .25w 66p
OC202 15v .25w 66p
OC603 22v .1w 50p
OC701 80v .35w 50p
ON222 23p
P77 Plastic 10wt 15p
P346A 30v .6w 24p
P7029 30p
PXB103 30v .15w 25p
RCP701A/B/D 10wt 30p
R1039 (2008B) 54p
R2008B 660v 85w £1.18
R2010B £1.18
R2306 100v 40w 26p
R2540 £1.70
S3017 25p
SB240 26p
SFT357 20v .12w 26p
SL102 40p
TE886 £1
TIP29 40v 30w 22p
TIP30 40v 30w 22p
TIP30C 100v 30w 26p
TIP31C 100v 40w 26p
TIP32A 60v 40w 22p
TIP32C 100v 40w 26p
TIP41 40v 65w 15p
TIP42C 100v 65w 33p
TIP48 300v 40w 33p
TIP 110 60v 50w Darl. 30p
TIP112 100v 50w 45p
TIP115 60v 50wt Darlington 30p
TIP2955 100v 90w 45p
TIP3055 100v 90w 34p
TIS44 25v .25w 9½p
TIS60GY 40v .3w 3p
TIS61 40v .3w 3p
TIS73L FET 7p
TIS90 40v .65w 4p
TIS91 40v .65w 6p
TIS92GY 40v .65w 14p
TIS98 30v .25w 3p
TK24 30v .2w 20p
V435 30v .6w 20p
U14710 20p
ZT403P 30v .3w 30p
ZT1486 110v 2.5w £1.10
ZTX341 100v .3w 9p
2G103 15v .3w 33p
2G302 20v .2w 12p
2G309 20v .3w 30p
2G339A 30v .15w 20p
2G371 20v .2w 18p
2N388 25v .15w 7½p
2N456A 40v 90w 71p
2N525 45v .3w 12p
2N527 45v .2w 12p
2N597 45v .25w 16p
2N598 35v .25w 16p
2N601 35v .75w £1.50
2N644 30v .15w 22p
2N698 120v .8w 12p
2N699 120v .6w 12p
2N706/A 25v .3w 10½p
2N708 40v .4w 9p
2N718 60v .4w 10p
2N720A 120v .5w 12p
2N720 120v .5w 12p
2N736 80v .5w 7½p
2N914 40v .4w 15p
2N918 15v .2w 12p
2N929 45v .3w 16p
2N930 45v .3w 7p
2N984 15v .1w 28p
2N987 40v .1w 45p
2N1091 25v .2w 16p
2N1132 50v .6w 14p
2N1302 25v .2w 16p
2N1303 30v .2w 16p
2N1395 40v .15w 25p
2N1484 100v .25w 36p
2N1485 60v 25w 36p
2N1487 60v 70w 90p
2N1490 100v 70w £3
2N1500 15v .1w 30p
2N1507 60v .6w 18p
2N1711 75v .8w 13p
2N1716 90v 15w 15p
2N1724A 118wt RF 180v £2.10
2N1748 30v .2w 28p
2N2192A 60v .8w 15p
2N2221A 40v .5w 9p
2N2222A 40v .5w 8p
2N2369 40v .4w 10p
2N2401 7½p
2N2412 25v .3w 27p
2N2483 60v .36w 28p
2N2484 60v .4w 10p
2N2586 60v .3w 15p
2N2614 32v .9w 4p
2N2887 £2

2N2894 12v .36w 11p
2N2904 60v .6w 9p
2N2905 60v .6w 15p
2N2906 60v .4w 9p
2N2907/A 60v .4w 9p
2N2926Y 25v .2w 4p
2N2926 Orange 25v .2w 4p
2N3020 140v .8w 25p
2N3054 90v 30w 35p
2N3055RCA 100v 115wt 68p
2N3133 50v .6w 24p
2N3283 25v .1w 25p
2N3418 85v 1wt 15p
2N3442 160v 117w 75p
2N3583 250v 38w 18p
2N3645 60v .3w 3p
2N3663 30v .2w 6p
2N3702 40v .4w 4p
2N3703 50v .3w 3p
2N3704 50v .4w 4p
2N3707 30v .3w 4p
2N3711 30v .3w 8p
2N3714 80v 150w 54p
2N3794 75v .5w 14p
2N3799 90v .36w 18p
2N3823 FET 30v 25p
2N3904 60v .3w 7½p
2N3905 40v .3w 7½p
2N3906 40v .3w 8p
2N4000 100v 15w 15p
2N4026 60v .5w 15p
2N4031 80v 1w 15p
2N4039 MOSFET 54p
2N4285 17p
2N4403 40v .3w 7½p
2N4891 FET 30p
2N4918 40v 30w 15p
2N5058 300v .5w 11p
2N5147 100v 7w 15p
2N5293 80v 36w 30p
2N5294 80v 36w 30p
2N5295 60v 36w 30p
2N5296 60v 36w 30p
2N5297 80v 36w 36p
2N5449 30v .3w 3p
2N5484 30v FET 37p
2N5492 75v 50w 36p
2N5915 (16068) 450Mhz 6WT R.F. 12v £2.50
2N6028 PUJT 6p
2N6106 80v 40w 44p
2N6109 60v 40w 44p
2N6111 40v 40w 36p
2N6124 45v 40w 24p

2N6178 100v 25w 30p
2N6180 100v 25wt 30p
2N6181 75v 25w 30p
2N6288 30v 40w 36p
2N6290 60v 40w 30p
2N6292 80v 40w 30p
2N6385 80v 100wt Darlington 55p
2N6486 40v 75w 36p
2N6488 90v 75w 36p
2S701 30v .5w 18p
2SA12 16v .1w 42p
2SA50 18v .1w 36p
2SA80 20v .1w 36p
2SA83 25v .1w 36p
2SA141 15v .1w 36p
2SA142 15v .1w 36p
2SA234 20v .1w 50p
2SA236 18v .1w 50p
2SA354 25v .1w 38p
2SA360 20v .1w 34p
2SA367 20v .1w 56p
2SA518 18v .1w 38p
2SA634 50v 10w 80p
2SB75 25v .15w 25p
2SB77 25v .15w 25p
2SB135 30v .1w 25p
2SB136 25v .15w 25p
2SB156 16v .15w 60p
2SB175 30v .15w 20p
2SB176 32v .15w 20p
2SB457 20v .15w 25p
2SC1061 50v 25w 50p
2SD234 60v 25w 50p
2SD315D 200v 40w 80p
353-3 40v 5wt 22p
362-4 300v 6wt A/F Video Amp (BF459) 30p
868-01 Plast. 10wt 15p
1034 Plast. 10wt 15p
16120 (MPSU55/ BD238) 19p
40235 45v .2w 50p
40250 50v 30w 36p
40250VI (2N3054 + Ht sink) 40p
40316 40v .50w 36p
40372 (2N3054 + Ht. sink) 40p
40349v2 160v 1w 30p
40394 60v 1w 30p
40633 NPN 40w 36p
40911 (2N6261 + Ht. sink) 40p

SLIDE SWITCHES
IP3w P.C.B. 12p
2P2w 3a 15p
2P2w 8p

DOORSWITCH
1P2w on bracket 40p

WALLSWITCH
Flush white S.P. Rocker 35p

INERTIA SWITCH
On when thrown 90p

ROTARY CLICK SWITCH
P.C.B. 1P4w 9p

MINIATURE
Push to make 16p

PUSH SWITCH
2P2w latching P.C.B. 20p

MULTI BANK PUSH SWITCHES
6 bank: 4 x 4P2w + 6P2w + 2P2w interlocking 63p
3 bank: interlock 2P2w + knobs 75p
3 bank: latching D.P. mains + 2 non latch 4P2w 50p
4 bank: independent 2P2w 40p
4 bank: 2P2w self cancelling 50p
5 bank: 2P2w independent + 2 x 2P2w + 4P2w + 6P2w interlocking 48p

TRIACS

Amp	Volt		
0.1	40	7W84	4p
2.5	600	2N5757	44p
3.5	400	T2710D	58p
4	400	T2716D/40730	74p
6	200	T2500B/41014	54p
8	400	T2850D	72p
8	500	BT137-500	72p
12	500	BT138-500	90p
25	100	BTX94-100	£2.25
25	200	TIC256	£1.05
25	1200	BTX94-1200	£5

HUGHES

MICRO ELECTRONICS 400MW ZENER DIODES 200 IN CLEAR PLASTIC HINGED LID COMPONENT BOX £2.40
3V, 3.6V, 3.9V, 4.3V, 4.7V, 11V, or 13V.

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3lb for £2.80 7lb for £5.00

MARKED FULL SPEC DIGITAL I.C.'s
Branded – New 25 for £1 Mixed

7 MILLION CARBON FILM RESISTORS PURCHASED

¼ – ⅓ – ½ – ¾ – 1 – 1½ watt Iskra and Piher, mainly 5%, few 2%. Lucky Dip as the packs come (will not duplicate under 20 packs) due to cartons packed tight and on top of each other to ceiling of warehouse.

PACK OF 100 FOR 28p

PAY A VISIT – THOUSANDS MORE ITEMS BELOW WHOLESALE PRICE. CALLERS PAY LESS ON MANY ITEMS AS PRICES INCLUDE POSTAGE. PRICES INCLUDE VAT AND ADDITIONAL DISCOUNT IN LIEU OF GUARANTEE. GOODS SENT AT CUSTOMERS' RISK UNLESS SUFFICIENT ADDED FOR REGISTRATION OR COMPENSATION FEE POST.

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OPTO ELECTRONICS

Photo Diodes: 30F2, 31F2, 32F2, 33F2, BPX40, BPY10, BPY68, BPY69, BPY77, CQY17, CQY77. All types 38p

Wire end neons 5p.

Photo transistor: BPX43, BP103, 2N5777, Darlington 36p; LED's (Mullard Siemens) Red 5mm 8p. 3mm 13p; Green 5mm 13p, 3mm 13p; Yellow 5mm 13p, 3mm 13p, micro LD481 8p

PHOTO SILICON CONTROLLED SWITCH BPX66 PNPN 10 amp 36p.

CA3062 Photo Detector and power amp. £1.05p

7 SEGMENT L.E.D. DISPLAYS

.3" Red com. anode 81p

.6" Green C.A. £1.77

5082-7650 Red com. anode.

5082-7653 Red com. cath

5082-7600 Yellow com. anode.

H.P. Highbrilliance .43" 72p

HEWLIT PACKARD MULTIPLEXED .11" 7 SEGMENT LED DISPLAYS

3 Digit HP5082 7413 45p

4 Digit HP 5082 7414 45p

5 Digit HP 5082 7415 45p

Infra red transmit diodes CQY11B or LD271 High power 1.6-2v or 3-3.5v Pulse 32p

LD242 36p

H15B Photon coupled isolator I.R. diode and NPN Photo-Darlington amp 26p

CNY17/1 opto coupler 70p

Cold cathode tubes I.T.T. G517A or 5870L 60p

SPECIAL OFFER

IN4004 or IN4006 Sealed manufacturers carton of 300.

£6.85

SLIDE POTENTIOMETERS ALL TYPES 30p

60mm	40mm
LOG	LOG
250Ω	10K
1K	22K
5K	50K
47K	100K
50K Neg	LIN
100K	470Ω
250K	1K
470K	1KB
1M	100K
2M	470K
LIN	
500Ω	
1K	30mm
2K2	LOG
10K	5K
22K	22K
47K	50K
50K	100K
100K	LIN
250K	1K
500K	5K

BOXES – Grey polystyrene 61 x 112 x 31mm, top secured by 4 self tapping screws 85p

Clear perspex with sliding lid. 46 x 39 x 24mm 18p

ABS, ribbed inside 5mm centres for P.C.B. brass corner inserts screw down lid. 50 x 100 x 25mm orange 85p; 80 x 150 x 50mm black £1.39, 110 x 190 x 60mm black £1.98.

DIODES

*Germanium: rest silicon

*AA118 90v 50ma	4p
*AA119 30v 35ma	7p
*AA133 100v 50ma	9p
*AA144 100v 5ma	4p
*AAZ15 100v 250ma	15p
*AAZ17 50v 40ma	6p
B1	11p
BA101B varicap	10p
BA116 20v 100ma	30p
BA127 60v 100ma	3p
BA128 50v 100ma	2½p
BA145 350v 500ma	2½p
BA148 350v 500ma	12p
BA182 Varicap	6p
BAX 13 50v 150ma	3p
BAX14 40v 350ma	2½p
BAX20 25v 115ma	3p
BAX21 50v 120ma	3p
BAX22 100v 120ma	3p
BAX54	8p
BAY36P 30v 3ma	2½p
BAY44 50v 250ma	4p
BAY68 25v 115ma	3p
BAY72 100v 400ma	4p
BB103 Varicap	24p
BB104 Varicap	16p
BB109 Varicap	24p
BB110B Varicap	24p
BB113 3x Varicap	43p
BB139 varicap	£1
BR100 Diac.	15p.
BY206 350v 600ma	7½p
BY207 600v 600ma	23p
BY402 100v ½A	2½p
BY403 200v ½A	2½p
Centercell	3p
CG651	9p
CR HG/3	10p
CSD117YLZ	40p
CV7095	2½p
CV7098	2½p
D3202Y Diac.	11p
DC2845 Microwave	20p
DOG53	11p
FSY28A	40p
*HG1005 100v 45ma	3p
*HG1012 50v 50ma	10p
MPN3401 VHF switch	30p
*OA5 100v 115ma	25p
*OA7 25v 50ma	25p
*OA10 25v 110ma	25p
*OA40 40v 50ma	4p
*OA47 30v 150ma	7p
*OA51 50v 50ma	4p
*OA70 22v 50ma	10p
*OA75 40v 50ma	11p
*OA79 45v 35ma	11p
*OA81 115v 150ma	3½p
*OA90 30v 45ma	4p
*OA91 115v 150ma	6p
*OA95 115v 150ma	6p
OA200 50v 250ma	2½p
*IN63 100v 40ma	4p
IN337 200v 200ma	4p
*IN447 40v 25ma	3p
IN604 400v 300ma	4p
IN662 80v 40ma	2½p
IN916 100v 300ma	2½p
IN3062 75v 20ma	3p
IN3063 (BAV10)	6p
IN3064 75v 10ma	2½p
IN4009 25v 75ma	2½p
IN4148 100v 200ma	1½p
IN4149 100v 200ma	3p
IN4150 50v 200ma	2½p
IN4151 50v 200ma	2½p
IN4152 40v 200ma	3p
IN4446 100v 200ma	2½p
IN4449 100v 200ma	2½p
IN5154 25v 30ma	3p
IN5456 Varicap	15p
IS922 150v 200ma	4p
IS940 30v 50ma	3p
5082 2900 RF Schotky Barrier	50p

RECTIFIERS

Type	Volt	Amp	Price
BY126	650	1	5p
BY127	1250	1	5p
BY212	15kv	500ma	6p
BY235	600	1½	7½p
BY236	900	1½	7½p
BY264	300	3	9p
BY265	600	3	11½p
BY266	900	3	15p
BY275	600	5	19½p
BY277	1200	5	27p
BY1202	2kV	10mA	6p
BYW55	800	2 (Oxide bead)	15p
BYW56	1000	2 (Oxide bead)	18p
BYX20-200	200	25	72p
BYX22-200	300	1½	25p
BYX38 300R	300	6	48p
BYX38 600	600	6	52p
BYX38 900	900	6	60p
BYX38 1200	1200	6	65p
BYX42 300	300	12	36p
BYX42 600	600	12	46p
BYX42 900	900	12	92p
BYX42 1200	1200	12	£1.07
BYX46 300R	300	15 Avalanche	£1.19
BYX46 400R	400	15 Avalanche	£1.75
BYX46 500R	500	15 Avalanche	£2.00
BYX46 600	600	15 Avalanche	£2.30
BYX48 300R	300	6	47p
BYX48 600	600	6	60p
BYX48 900	900	6	70p
BYX48 1200R	1200	6	92p
BYX49 300R	300	6	35p
BYX49 600	600	6	42p
BYX49 900R	900	6	47p
BYX49 1200	1200	6	60p
BYX52 300	300	48	£2.05
BYX52 1200	1200	48	£2.90
BYX70	500	1	4p
BYX72 150R	150	10	42p
BYX72 300R	300	10	52p
BYX72 500R	500	10	65p
BYX94	1250	1	6p
E250C50	250	½	14p
KS11394	800	3	23p
LT102	30	2	15p
M1	68	1	5p
MR856	600	3	24p
MSR5	800	3	12p
OA210	400	5	33p
RAS3 1OAF	1250	1½ Avalanche	48p
RAS508AF	1250	1½ (Avalanche)	50p
REC53A	1250	1½ Pack of 4	66p
SKE4G	200	6	22p
SR100	100	1½	9p
SR400	400	1½	10p
SR1825	100	50	75p
IN3254	400	1	4p
IN4002	100	1	4p
IN4004	400	1	4½p
IN4005	600	1	6p
IN4006	800	1	6p
IN4007	1250	1	6p
IN5059	200	1½	10p
IN5401	100	3	12½p
IN5402	200	3	11p
IN5406	600	3	15p
IN5408	1000	3	19p
IS027	800	1½	11p
IS138	800	1	2½p
25G100	100	60	£4.35
3052	200	3	11p
16094P	900	2	15p
16492	700	1½	9½p

BRIDGE RECTIFIERS

½AMP	60VOLT	BC30 C350	23p
½	1,600	BYX10	34p
0.6	110	EC433	20p
1	100V	B40C800	12p
1	140	OSH01-200	25p
1	400V	MDA104	29p
1½	50V	WO05	27p
1½	75V	IBIBY234	11½p
1½	150V	IBIBY235	15p
1½	200V	WO2 Ex Equip	15p
1½	400V	WO4	28p
1½	400V	UE4R1	12p
1½	800V	WO8	27p
1½	1000	W10	36p
2½	100	I.R.	40p
2½	350V	9F2	53p
2½	500V	9E4	85p
3	50	KBS005	30p
3	100	KBS01	30p
3	200	KBS02	30p
3	400	KBS04	30p
3	600	KBS06	30p
3½	100	B40C 3200	39p
5	400	Texas	85p
Miniature	Meter	Type	34p

THYRISTORS

Amp	Volt		
0.8	200	2N5064	18p
1	240	BTX18-200	35p
1	240	BTX30-200	35p
1	400	BTX18-300	41p
1	700	BT 106	70p
2	400	S2710D with heatsink	40p
3	600	T3N06C00	53p
3	100	T3N1C00	36p
4	50	S107F Sensitive Gate	36p
4	50	S2060F Sensitive Gate	36p
4	400	S2061D Sensitive Gate	38p
4	500	40506 with heatsink	58p
4	500	17083	36p
4	600	C106M Sensitive Gate	37p
4	600	2N3228	36p
4	600	GAK	36p
5	400	S5800D/R	36p
5	500	17047A	40p
5	600	17058	44p
5	600	S5800M	44p
6.5	500	BT109/SCR957	71p
7	400	S2620D	45p
7	600	S2620M	45p
8	100	S2800A	36p
8	600	S122M	54p
12	1000	CR121103-RB	£8
15	800	BTX95-800 Pulse Modulated	£1
20	600	BTW92-600RM	£3.40
75	800	71CG80	£6
110	20	72RC2A	£3
150	1000	151RA100	£10
150	1200	151RA120	£11
BT 121		70p	
BT 107		£1	

ZENER DIODES

4/500MW. BZY88, BZX97, etc. 5½p
2v. 2v7. 3v. 3v3. 3v6. 3v9. 4v3. 4v7. 5v1. 5v6. 6v8. 7v5. 8v2. 9v1. 10v. 11v. 12v. 13v. 13v5. 15v. 18v. 20v. 22v. 24v. 27v. 30v. 33v. 43v.

BZY61 Laboratory Standard 400MW 7v5. Voltage Regulator Diode 12p

1.3/1.5WT BZX61, BZY97, etc. 11p
2v7. 3v. 3v6. 3v9. 4v3. 4v7. 5v6. 6v2. 6v8. 8v2. 10v. 11v. 12v. 15v. 18v. 20v. 27v. 33v.

2.5WT BZX70, etc. 13p
3v6. 3v9. 5v6. 6v2. 7v. 7v5. 8v. 9v. 10v. 11v. 14v. 15v. (8p) 20v. 22v. 26v.

5WT BZV40, etc. 15p
3v3. 3v6. 3v9. 4v3. 4v7. 5v1. 5v6. 6v2. 6v8. 7v5. 8v2. 8v7. 9v1. 10v. 11v. 12v. 15v. 20v. 33v. 68v. 120v.

10WT Z5D, ZX, IS50, etc. 23p
4v3. 4v7. 5v1. 5v6. 6v2. 6v8. 7v5. 8v2. 10v. 11v. 12v. 13v. 16v. 18v. 21v. 22v. 33v. 36v. 39v. 43v. 51v. 56v. 62v. 68v. 75v. 150v.

15WT BZV15C 12R 12volt 37p

20WT BZY93, etc. 44p
8v2. 39v.

TEMPERATURE COMPENSATED REFERENCE 8p
IN935B, IN936B, IN937B 9volt
IN941B, IN942B, IN943B 11.7volt

ROTARY WAFER SWITCHES

Pole	Way		
1	3		26p
1	5		40p
1	8		40p
1	11		26p
1	12		26p
2	3	plus Mains D.P.	30p
2	4		26p
2	5		48p
2	6		40p
3	7		26p
4	2		26p
4	3		48p
4	5		49p
6	3		26p
7	4	plus Mains D.P.	26p
12	3	plus Off	26p

BULBS

MES
2v5 .3A 12p. 3v5 .15A 11p. 3v5 .3A 6p. 6v .3A 12p. 12v 2.2W 18½p. 24v 2.8W 13½p. 14v .8W 13½p. 24v 3W 13½p.

WIRE END
12v 13p. 19v 60ma 13p.

Minature Flange
6v 12v 24v 28v 21½p

Submin. Flange
8v. 28v. 26p

L.E.S.
6v 11p. 12v 11p. 28v 19p.

BRIAN J. REED

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74H01 } Nand + O/C out 26p
7402 quad 2 in pos nor 12p
7403 Quad 2 in Nand O/C 12p
7404 Hex. Inverter 11p
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74L10 } Positive Nand 25p
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			10,000	£1.80		
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470	22p	40 VOLT	2,200	25p	4,000	£1
500	22p		2,500	55p	4,700	72p
800	50p		3,300	38p	6,800	£1.50p
1000	23p					
2,000	35p	50 VOLT				
500	30p	60/64 VOLT	1,500	45p	2,500	£1.10
1,000	52p				4,700	£1.07
		70 VOLT	1,000	30P	1,500	38p
		100 VOLT			500	55p
			250	£1	1,000	79p
					2,000	87p
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NEWS . . . AND

SOLDERING STATION FIRST

Adcola Products of Adcola House, Gauden Road, London, SW4 6LH believe that their new Unit 2001 is the first genuine complete soldering station. The Unit consists of an electronically controlled soldering tool, fume extractor, fluorescent lighting, and solder dispenser, which is suspended over the work piece by a pole system clamped to the rear or side of the bench. This system is fully adjustable in height and depth with the facility that the Unit can be swung away from the work when not required.

The electronically controlled soldering instrument is based on their already well accepted Unit 101, which is a 50 watt electronically controlled 3/16in./4.75mm dia. bit soldering instrument with a temperature range of 120 deg. C to 420 deg. C. This soldering tool is potential free and has a positive earthing system which, should the user wish, may be connected to a known earth source. Also, being electronically controlled, there is no mains spiking or magentic effect, thereby reducing any possibility of damage to voltage/temperature sensitive components.

The lighting system gives an excellent spread of light on the work piece from three diffused 6 watt fluorescent lamps.

The two 11 watt fans are dual speed which pass the flux fumes through a special filter to aid in obtaining a clean air situation. By

extracting and controlling the fumes from a soldering operation reduces operator fatigue and the hazards associated with soldering fumes in the hand soldering situations.

More than 1,000 Warden 4 receivers sold

The thousandth Warden 4 watchkeeping receiver ordered from The Marconi International Marine Company Limited, a GEC-Marconi Electronics company, is to be fitted aboard the 'Sea Conquest', an offshore drilling rig belonging to BP Petroleum Developments Limited. 'Sea Conquest' is currently operating in the North Sea and fitting will be carried out by Marconi Marine's office at Riverside, Aberdeen.

Warden 4, a watchkeeping receiver operating on the international radiotelephone distress frequency 2182kHz, was introduced in January 1980, by Marconi Marine in anticipation of the new requirements resulting from the recommendations of the International Safety of Life at Sea Convention 1974. One of these requirements, now embodied in the Merchant Shipping (Radio Installation) Regulations 1980, is for all sea-going vessels of over three hundred tons to carry such a watchkeeping receiver, and to have it switched on in a place that is permanently manned, at all times whilst the ship is at sea.

So far the orders received by Marconi Marine are averaging one hundred per month. They are being received from owners and shipyards throughout the world.

Ultra low power DPM with digital hold

A new LCD meter from Lascar Electronics Ltd., Unit 1, Thomasin Rd., Basildon, Essex, is claimed to be the first of a new generation of DPMs, giving at least ten times the battery life of any existing type. A PP3 battery will power the meter for typically two years, if operated for eight hours a day, seven days a week.

LCD Watch manufacturing techniques are used to reduce the depth to a minimum, the meter being fitted into a DIN bezel of 72mm x 36mm. The 0.6in. (15mm) digits can be read at distances up to ten metres, and the display contains many other useful annunciators. The totally flush face makes it easy to screen print any other logo or engineering unit onto the display.

Other standard features include a Digital Hold facility, Auto-zero, Auto-polarity, External bandgap reference for maximum stability, single-rail supply of 5 – 15V d.c. drawing 200μA, programmable decimal points and a 200mV full scale deflection. The DPM can be used in single ended, differential or ratiometric modes, and may also be used in applications such as temperature measurement or weighting systems, where a variable offset or tare is required. Display backlighting is a customer option. The meter is supplied with brackets for front or rear panel mounting.

. . . COMMENT

Here we go . . . .

The changes at R & E C are gathering pace, and we now offer you a chance to influence the change of format and content, simply by completing the inserted reader survey form.

Our intention is to be a **magazine** of ideas, new techniques and viable projects – rather than a series of abstracts from standard textbooks, and projects that bear precious little resemblance in both technology and presentation to their commercial counterparts. We do concede that some aspects of theory need to be examined from time-to-time, since certain interpetations of basic concepts tend to get overlooked, unless given an occasional airing. To cater for the need for theory and tutorial reference works, we will soon be offering a vastly expanded range of titles from our book pages.

Special Offers

You can't be in the business of publishing electronics mags these days without some sort of 'Reader Offer' page, but we hope to keep ours reasonably different and diverse, even at the possible expense of some of the universality of their appeal. The radio headphones we offer with this issue are certainly slightly different, since as well as offering an entertaining alternative to simple ear defenders in noisy environments, the brave are invited to get inside and use them for derivative projects – such as infra red headphones for HiFi, magnetic loop communications etc. Even if you could get them, a set of 'phones with a battery compartment, volume control and switch would probably cost more.

Loudspeaker flat-back cabinet kits

To make life really easy for the loudspeaker constructor, Wilmslow Audio now offer flat-pack cabinet kits for many popular designs including the new Wharfedale E50, E70 and E90 kits.

All panels are accurately cut to size and baffle boards have the necessary speaker apertures cut and rebated where required. The cabinets when assembled may be painted or stained, or finished with iron-on veneer.

Wilmslow Audio Ltd, are now in new premises at 35/39 Church St., Wilmslow, Cheshire, where touch-control customer operated demonstration facilities enable prospective kit buyers to listen before purchase.

The company claims to have the largest selection of speaker drive units and kits available anywhere.

Quotation

"In those days ITN wasn't in smart premises in Wells Street in the heart of the West End. It had some rooms in an office block in Kingsway, which were so dingy they say vandals once broke in and decorated the place."

Peter Sissons presenting the tenth and final Richard Spriggs Memorial Lecture.

Excellent housing for portable equipment

Electronic Products (Coventry) Ltd., of 20 Duke Street, Chapel fields, Coventry, are selling a moulded high impact styrene box no. 7544, which provides an excellent housing for electrical equipment such as, portable test instruments, alarms, etc. They are extremely robust and may be used in a variety of applications where a small enclosure or potting box is required.

The dimensions of the box are 75mm x 75mm x 44mm depth, and are in two colours, grey or black. (Other colours in large quantities are available on request).

They can be machined, engraved or silk screened and the maximum working temperature is 65 deg C. These extremely useful general purpose boxes come complete with lid and four self-tap fixing screws.

For original equipment manufacturers using quantities of 1,000 upwards a customised tooling service for the lids, grills, holes and logos, which can be foil blocked, can be provided.

The box singly is £0.49p. + V.A.T. postage and packing. For larger quantities a price list is available on request.

SUSSEX MOBILE RALLY

The second Sussex Mobile Rally to be held at Brighton Race Course will be on Sunday 19th July 1981, from 10.30 am to 6 pm. Last year nearly three thousand people attended the rally, with more than one hundred stands under cover. The rally is organised by six amateur radio clubs in the Sussex area.

This year's rally will be even larger (20,100 sq. ft of display area) with more trade stands dealing in all forms of electronics, including amateur radio, microprocessors, components and C.B. This is the rally which caters for the whole family, with free trips to the sea front by mini bus, super restaurant and bar facilities, side shows for the children, demonstrations by marching bands, majorettes etc.

Entrance charge will be 50p (with free lucky draw ticket). For disabled persons and children under 14 years there will be no charge. There are free parking facilities for more than four thousand cars. An area for caravan parking is available.

Further details can be obtained from: – A. K. Baker. (G4GNX). 38, Elphick Road, Newhaven, Sussex. Tel: (07912) 5327 Evenings.

* Ye Gods! Who is this pratt? These sentiments sounded the death knell for RC! RIP. Jim Jobe 1990.

FINAL

SUGGESTED CIRCUIT

SLEEPY TIME RADIO SWITCH

Many people like to have a bedside radio playing softly when, in bed, they settle down to sleep. Ideally, the radio should be switched off just before falling into final sleep but the necessity of reaching out and switching it off can, of itself, be a deterrent to sleep. Alternatively, it can happen that the radio does not get turned off at all, with the result that, on waking, the sleeper realises that the set has been switched on all night, shortening the life of its battery.

The circuit to be described this month is for a timing circuit which can switch off a radio about quarter of an hour after it has been activated. All that has to be done is press a button, snuggle down into the sheets and descend into the land of Nod, secure in the knowledge that the radio will switch itself off after the timing period has elapsed.

The switch-off circuit is primarily intended to be built as a separate unit with its own 9-volt battery. An important feature of the circuit is that an infinitesimal average current is drawn from this battery, so that its active life is virtually equal to its shelf life. In most instances, no measurable extra current is drawn also from the radio battery. The circuit is suitable for standard transistor superhets powered by 9 volt or 6 volt batteries, and the exceptionally low current requirements are due to the use of a VMOS power f.e.t. type VK1011.

PERFORMANCE CHECK

The VK1022 is a small device in a T092-style package, and has a maximum drain current rating of 0.5 amp. It is intended for operation with the source negative of the drain, and it is cut off when the gate is at the same potential as the source. Taking the gate positive causes the device to become conductive. An extremely high resistance is given between the gate and the remaining two electrodes. An input protection zener diode is provided inside the device and no special handling precautions are necessary.

It is often a good idea to check out new devices in simple characteristic testing circuits. The writer has not previously encountered the VK1011 and so he checked out several in the circuit of Fig.1. The gate voltage is adjustable by means of the 10kΩ potentiometer, the gate source voltage being monitored by a voltmeter. The drain couples to a 9 volt positive supply by a load, RL, and the drain-source voltage is measured by a second voltmeter.

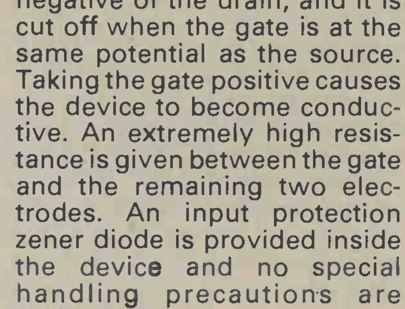

Fig.1. Simple test circuit to find the characteristics of the VK1011 VMOS power f.e.t.

Readings were taken with RL at 10kΩ, at 1kΩ and at 100Ω, and the results are shown in the curves given in Fig.2. When the gate voltage, Vgs, is at zero the f.e.t. is cut off, and its drain-source voltage, Vds, is equal to the full 9 volts of the supply. With the 10kΩ load the f.e.t. commences to pass drain current when the Vgs is about 1.4 volts, and the f.e.t. is fully turned on with the Vgs at about 1.6 volts. The drain current through the 10kΩ resistor is then 0.9mA. With a 1kΩ load the device starts to draw current with a Vgs of around 1.6 volts and is fully turned on with a Vgs of slightly more than 2 volts. In this state there is about 0.2 volt across the drain and source, which reduces to zero at a Vgs of approximately 4 volts. The on-current here is 9mA. With a 100Ω load, a significant drain current starts to flow at a gate voltage of around 1.8 volts, and there is 1 volt across the drain and source at 3 volts Vgs. Vds settles down to around 0.4 volt at a Vgs of 4 volts and higher. The current here is slightly less than 90mA.

The curves of Fig.2 are not taken from manufacturers' data, but are the result of measurements taken by the writer. In the application to be

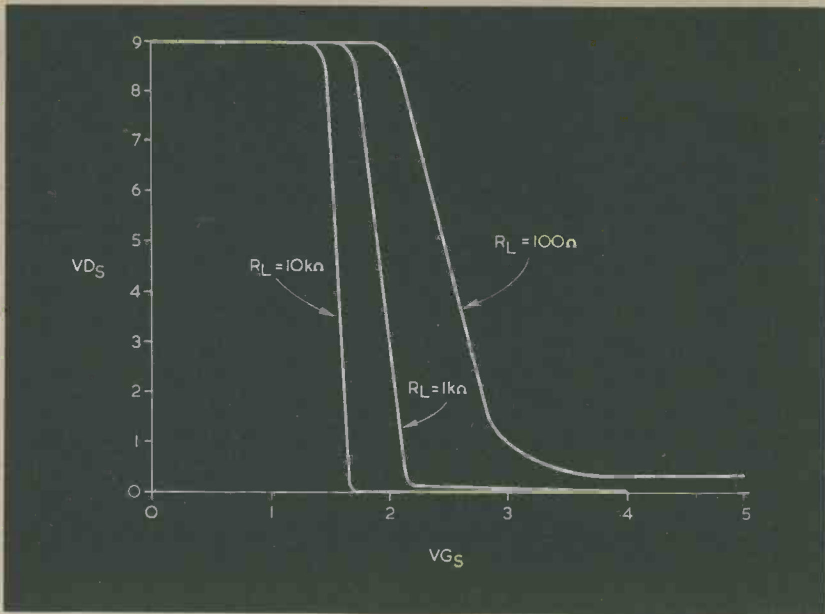

Fig.2. Curves obtained from the set-up of Fig.1. for load resistors of 10kΩ, 1kΩ, and 100Ω.

described, where precision in the timing is not necessary, they should be sufficiently close to central, typical, performance to enable a practicable circuit design to be realised. The average small transistor radio draws a quiescent current of about 10mA and, when it is used as a bedside radio late at night, will be turned low and draw few output current peaks. We can assume, therefore, that we will obtain about the same results if we use a VK1011 to turn a radio off as we get with the 1kΩ load resistor of Fig.2. (It should be noted, incidentally, that the timing circuit will still work with a radio having its volume turned high and drawing consequent current peaks at high a.f. output levels). Working from the 1kΩ load curve in Fig. 2, we can anticipate that, at gate voltages above around 2 volts, a VK1011 in series with a radio will be fully turned on, and that it will fully turn off when the Vgs is about 1.6 volts. The change from fully on to fully off with relation to Vgs is relatively fairly slow and so it is necessary to provide the timing circuit with a trigger action which will speed the turn-off operation.

COMPLETE CIRCUIT

The complete circuit of the bedside radio switch-off timer is given in Fig.3. TR2, a VK1011 is interposed in series with the negative terminal of the radio battery and the radio negative supply rail. TR2 is the switching f.e.t., and R3 is merely a current limiting resistor which ensures that the surge current in TR2 cannot exceed 0.5 amp if it is turned on when the supply bypass electrolytic capacitors are discharged. R3 should have no effect on the performance of a standard radio having the usual supply bypass capacitors, and the voltage dropped across it at 10mA is less than 0.2 volt. S2 short-circuits TR2 and allows the radio to be played in normal manner.

Capacitor C1 is normally discharged, causing the voltage on TR2 gate to be equal to that on its source. If, with the radio turned on at its own switch, S2 is opened TR2 will pass no current and the radio will then turn off. The full radio battery voltage appears across TR2, and the voltage on TR2 drain is passed to the gate of TR1, which is another VK1011. Push-button S1 is now pressed. A momentary pulse of 9mA is passed through R2 because, at the instant of closure of S1, TR1 has a high positive voltage on its gate. At the same time, 9 volts positive is applied to the gate of TR2, turning this f.e.t. on, and causing the radio to be turned on also. TR2 drain-source voltage, now very nearly zero volts, is applied to the gate of TR1, which turns off. C1 becomes charged to 9 volts.

When S1 is released, C1 commences to discharge into the 1MΩ resistor, R1. The discharge rate is slow, and is dependent upon the value of the capacitor. When the voltage on the positive terminal of C1 is greater than about 2 volts, TR2 is turned fully on and the radio continues to play. Near the end of the timing period the voltage on the gate of TR2 is at about 2 volts and TR2 starts to turn off. Its drain voltage begins to rise, taking the gate of TR1 positive. When TR1 gate voltage reaches the level at which this f.e.t. starts to conduct, it draws a discharge current from C1 and the voltage across the capacitor decreases more rapidly. So also does the gate voltage of TR2, whereupon its drain voltage rises further and TR1 is turned more fully on. There is a rapid cumulative changeover which results in TR1 being turned fully on, C1 fully discharged and TR2 (and the radio) fully

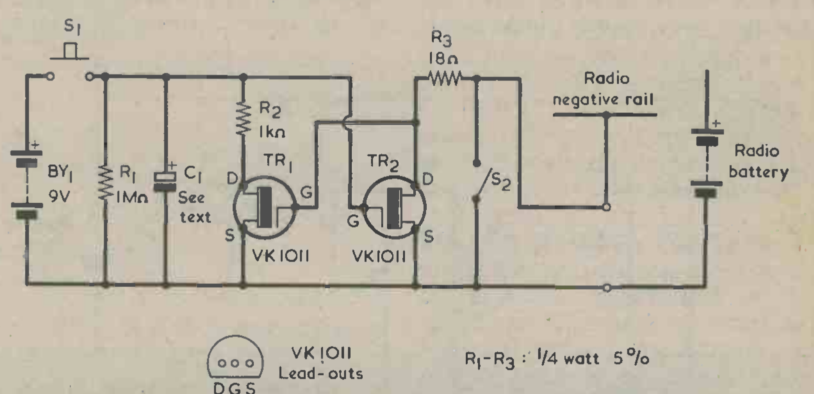

Fig.3. The circuit of the bedside radio switch-off timer. This can be built as a separate small unit coupled by two wires to the radio circuitry.

turned off. By this time the sleeper should be fully turned off too, and safely in the arms of Morpheus.

The quick changeover is due to the phase reversal between gate and drain in each f.e.t. When coupled together as here, the two f.e.t.'s give a high level of positive feedback during the brief period when they are both giving linear amplification. Working from the curves of Fig.2 it would be expected that TR1 starts to turn on when the voltage across TR2 reaches about 1.2 volts. In practice, the changeover occurs at a voltage lower than 1 volt across TR2. Doubtless, TR1 starts to draw a small drain current at gate voltages of this level, and such a current does not give significant indications in the analogue voltmeters which were used in the simple test set-up of Fig.1, and from which the curves of Fig.2 were drawn.

When the circuit has turned off the radio, the only current which flows from the radio battery is leakage current between the drain and source of TR2, and leakage current between the gate and source of TR1. This current was checked by inserting a meter in series with the radio negative rail. There was no perceptible current indication at all when the meter was switched to read 0-50μA.

TIMING VALUES

Working from the assumptions we have made, the circuit triggers to the off state when the voltage across C1 falls to about 2 volts. This is 22% of the initial voltage across C1 and the corresponding time of discharge is approximately 1.5CR. However, we can use this figure as a very rough guide only because it does not take into account spread in gate voltage in TR2. There is also the fact that we shall have to use an electrolytic capacitor for C1 and such a component has a notoriously wide tolerance on value. Another factor is that some very high electrolytic capacitors tend to give unpredictable discharge times when discharging into a 1MΩ resistor. Because of all these factors, the value finally fitted in the C1 position has to be found after some experiment.

When the circuit has been assembled and wired up to the radio, a 10μF capacitor is employed for C1. This allows the circuit to be given a quick check-over. The radio is switched on, S2 is opened and S1 is pressed. The radio will then turn on and the timing period proceed until the radio turns off again. The length of the period should be measured by means of a watch with a sweep second hand or a digital readout. From our assumptions, the period should be about 15 seconds, but in practice it will probably be somewhere between, say, 10 and 25 seconds. Let us say that it is 20 seconds. We then say that, if 10μF gives 20 seconds, 100μF should give 200 seconds, 300μF should give 600 seconds (10 minutes) and 500μF should give 1,000 seconds (17 minutes). A 10 minute delay before the radio turns off seems fairly reasonable for starting off and we could next try a 330μF capacitor for C1. It is quite possible that this will give a period significantly longer than 10 minutes, and this may then be considered satisfactory. Finding the final value for C1 is an experimental procedure which follows the reasoning process just described. It will be preferable to avoid using values greater than 500μF.

The length of the timing period is affected by the current drawn by the radio through TR2. If this current decreases due to aging of the radio battery, TR2 gate has to be taken to a lower voltage by the discharging C1 before the f.e.t. starts to turn off. The length of the timing period thus increases. Although the reduction in required gate voltage is small it occurs when the CR discharge curve is flattening out and the increase in timing period will be disproportionately long. This raises no problems in the present application, where accuracy of timing is relatively unimportant. Nevertheless, it may be to advantage to find the final value in C1 with the radio at a low volume setting and with a partly exhausted battery fitted (around 8 volts for a 9 volt radio and a little more than 5 volts for a 6 volt radio).

The only current drawn from BY1 is a momentary 9mA pulse when S1 is pressed and BY1 can, in consequence, be a small battery. A PP3 will be adequate.

The components in the circuit are quite small and some constructors may decide to assemble the timer as an integral part of the radio. In this instance, BY1 is not required and capacitor C1 can be charged from the radio battery as shown in Fig.4. The negative side of the radio battery is already connected to the negative terminal of C1, and it is merely necessary to connect the contact of S1 which is remote from C1 to the positive side of the radio battery. Using the radio battery in this way has the slight advantage that, as it ages, the voltage to which C1 is charged is reduced, and this will partly counteract the lengthening of the timing period caused by the reduced current in TR2. The charging voltage will, of course, be smaller if the radio uses a 6 volt battery, but it should still be possible to find a value for C1 which gives a satisfactory long period between the pressing of S1 and the turning off of the radio. ■

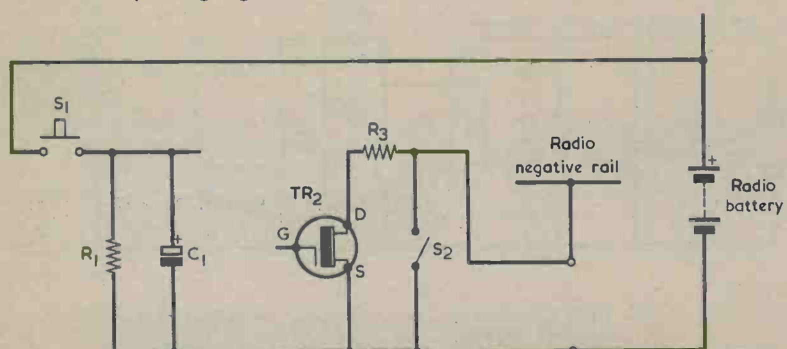

Fig.4. If desired, the timing circuit can be built into the radio. BY1 can then be dispensed with, and C1 can be charged from the radio battery itself.

in next month's

RADIO & ELECTRONICS CONSTRUCTOR

JULY 1981

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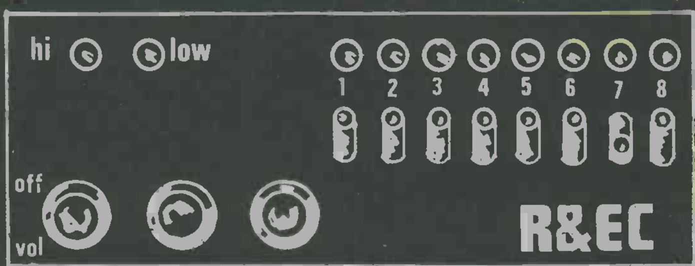

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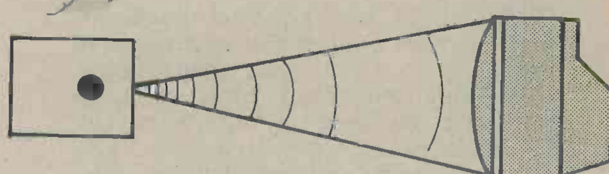

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SCHMITT OSCILLATOR

By R. J. Caborn

Oscillation with negative feedback.

To make up an oscillator you normally need an amplifier with positive feedback from its output to its input. Some form of frequency-conscious filter is inserted in the feedback path and this controls the frequency at which oscillation takes place. A typical example is shown in Fig. 1(a), in which a parallel tuned circuit is connected between earth and the non-inverting input of the amplifier. A low value feedback capacitor, CF, couples the output of the amplifier to the non-inverting input and, if the amplifier voltage gain and the feedback capacitance have reasonably practical values, the whole arrangement will oscillate sweetly at the resonant frequency of the tuned circuit.

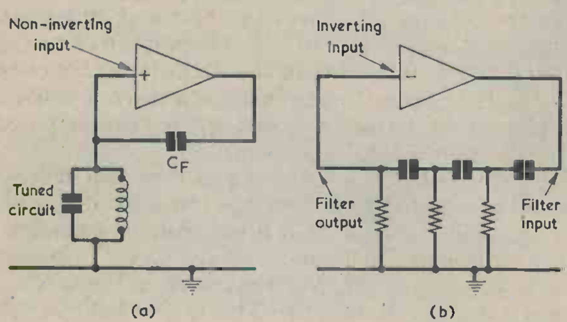


Fig. 1(a). A conventional oscillator incorporates an amplifier with positive feedback from its output to its input. A frequency-conscious filter is connected in the feedback loop. Here, the feedback is to a non-inverting input and the frequency is controlled by a parallel tuned circuit.

(b). In this phase shift oscillator circuit the feedback is to an inverting input. The feedback is still positive, neverthe-less, because the three capacitors and resistors in the filter produce a phase shift of 180 degrees at the oscillator frequency.

POSITIVE FEEDBACK

Oscillation occurs because of the positive feedback given by CF. When the non-inverting input of the amplifier goes positive so also, by a greater amount, does the amplifier output. So, any losses in the tuned circuit are overcome by the voltage gain of the amplifier and the circuit goes into oscillation.

There is positive feedback in the phase shift oscillator of Fig. 1(b), even though the amplifier output is this time coupled back to an inverting input. When that inverting input goes positive the amplifier output goes **negative**, by a larger amount. How does the circuit oscillate? It does so because there is a frequency at which, due to phase shifts in the feedback filter, the output of the filter is 180 degrees out of phase with the filter input. In other words, the filter output is exactly out of phase with its input. Thus, at the oscillation frequency there is a phase reversal in the amplifier and another compensatory phase reversal in the filter.

What about an oscillator using the circuit of Fig. 2?

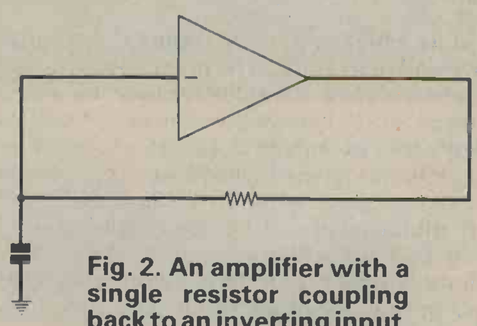


Fig. 2. An amplifier with a single resistor coupling back to an inverting input. A linear amplifier will not oscillate in this circuit, but an amplifier with a Schmitt characteristic will.

Here we have an amplifier output connecting back to an inverting input via a **single** resistor, with a **single** capacitor coupling that input to earth. Such an oscillator could not possibly work if the amplifier were an ordinary type because the feedback cannot help but be negative. On the other hand, the oscillator will work very well if the amplifier has a Schmitt input characteristic.

Fig. 3 shows a t.t.l. device type 74132, which has four Schmitt NAND gates. If we take one of the Schmitt

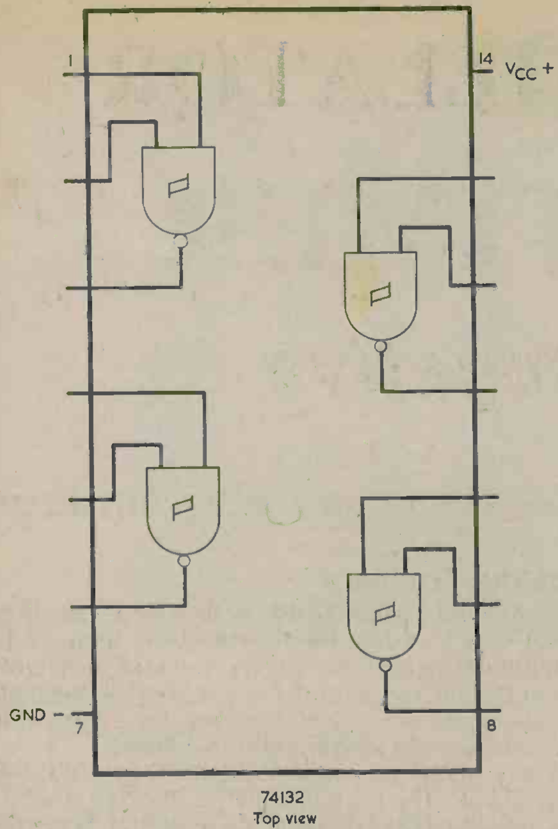


Fig. 3. The four Schmitt NAND gates in a 74132 t.t.l. chip.

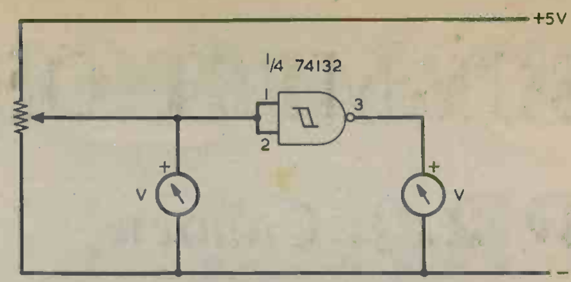


Fig. 4. Checking the input-output characteristic of a 74132 gate connected as an inverter. The two voltmeters monitor input and output voltage.

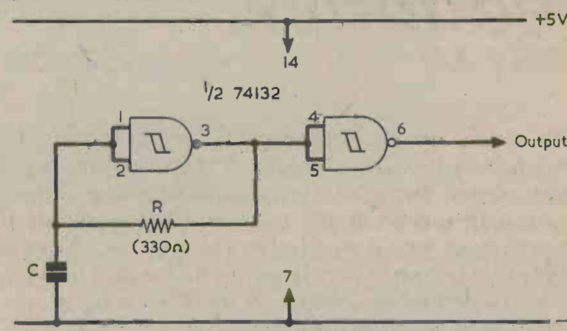


Fig. 5. A practical Schmitt oscillator. The second gate functions as a buffer amplifier. The units in the equation are Hertz and microfarads.

NAND gates, strap its two inputs together to make it an inverter and connect these two inputs to the slider of a potentiometer connected across the supply rails we can examine its characteristic. The circuit is shown in Fig. 4 and, to be theoretically correct, the standing current in the potentiometer track must be significantly greater than the input current requirements of the gate.

We start with the potentiometer slider fully at the negative end of its track. The inverter output will then be high, i.e. positive. If we slowly move the slider up the potentiometer track we will arrive at an input voltage, with respect to the negative rail, at which the inverter output suddenly goes negative, or low. This voltage will be typically 1.7 volts. If we now slowly take the potentiometer slider back down the track to its negative end we will find that we have to take it considerably lower than the 1.7 volt level before the inverter output goes high again. This second voltage will be typically 0.9 volt.

PRACTICAL SCHMITT OSCILLATOR

A practical Schmitt oscillator using the 74132 NAND gate associated with pins 1, 2 and 3 is shown in Fig. 5. At switch-on C is discharged, whereupon the inverter input is low and the inverter output is high. The capacitor commences to charge via R until the voltage at the inverter input is sufficiently positive for the inverter output to go low. C next commences to discharge via R and the voltage across it falls. Because of the Schmitt action the voltage across C has to be considerably lower than the previous positive-going trigger voltage for the inverter output to go high again. And so the oscillation continues, with C alternately charging to the positive-going trigger voltage and discharging to the negative-going trigger voltage. The output of the inverter goes to a second Schmitt NAND gate which acts as a buffer amplifier. The output of the second gate can be loaded with all manner of t.t.l. circuitry without any effect on the oscillating gate.

The oscillator circuit of Fig. 5 is perfectly practical and has the full blessing of the manufacturers of the 74132. They specify that R should have a value of 330Ω, as is shown in Fig. 5, and say that the frequency range is from 0.1Hz to 10MHz.

The value of C? That's a bit experimental because, due to the wide tolerances on input characteristics with any t.t.l. NAND gate, it is impossible to calculate a precise value of capacitance for any given frequency. You'll find in practice that frequency, in Hertz is very approximately equal to 2,000 divided by the capacitance in microfarads. So if C is an electrolytic with a value of 2,000 μF (and there's no reason whatsoever why an electrolytic cannot be used in the circuit) you can expect the frequency of oscillation to be in the region of 1Hz. A 200μF capacitor will correspond to 10Hz, a 20μF capacitor to 100Hz, a 2μF capacitor to 1kHz and a 0.2μF capacitor (non-electrolytic now) to 10kHz. To get the oscillator to work at a specific frequency you start off with a capacitance approximately equal to the calculated figure. This will bring oscillator frequency close to the desired value. If the frequency is too high the value of C is experimentally increased, and if it is too low the capacitance is experimentally decreased.

An unusual feature of the oscillator is that if the capacitor is connected into circuit after switch-on of power the oscillator may not start. Similarly if, when the oscillator is running, the capacitor is temporarily disconnected and then reconnected the oscillator may stop and refuse to start until the power has been switched off and switched on again. ■

ENLARGER/ PROCESS TIMER

By Peter Roberts

Easy to use. Gives accurate repeatable timings.

Long bright summer days – an ideal season for photography. Now you can ease the coming winter problems of the darkrrom with the enlarger and process timer described here. The unit was designed for a photographer by the writer (who also has some interest in photography) and the following requirements have been incorporated.

1. To switch 'off' apparatus after required time lapse.
2. To switch 'on' apparatus after required time lapse.
3. Push-button start for easy darkroom operation and easy repeats without resetting dials.
4. Minutes/seconds selector with hours as optional extra.
5. Audible alarm to indicate end of process, with a 'disable' if not required.
6. Visible and Audible/'second' pulses allows full concentration on the enlarger whilst working.
7. Dial-up selection of process time or time-lapse easily visible in subdued light.
8. Manual override for focusing etc.
9. Can be positioned remote from enlarger to prevent vibration.
10. Can be used for other applications – 150 watts max. load.

Digital timers are not common, probably because of the extra cost involved, however such timers do have advantages. Pulses can be counted precisely, although the accuracy depends on the oscillator. Reading the setting on a thumbwheel switch is easier than finding a pointer on a dial, especially in the dark.

It was decided to use a relay to switch the load since this gives the option of switching the controlled apparatus 'on' or 'off' at the end of the selected interval. This option would not be so easy with thyristors or triacs. The relay contacts and mains switches are then the only limiting factors on the load which can be controlled.

Being a digital device, the circuit design is particularly easy and to simplify the drawings and the recognition of elements in the block diagram, the circuit has been drawn in sections. It should not be difficult to see how they fit together.

A printed circuit board has been designed for which copies of the track pattern and ready etched and drilled boards are available. The total parts cost is about £35.00. including the case and p.c.b. A cheaper version could be made by omitting those parts which provide facilities which are not required.

Fig. 1 shows the straight forward operation of the instrument. A 1 Hz oscillator applies pulses to two identical cascaded divide-by-sixty circuits thus producing 'seconds', 'minutes' and 'hours' pulses. These pulses are taken via a selector to the counter/detector circuit which operates the relay through the relay driver when the selected time has elapsed. The relay latches itself, resets the dividers and counter, stops the oscillator and controls the enlarger. When the 'start' button is pressed the relay releases, the oscillator starts and the sequence is repeated.

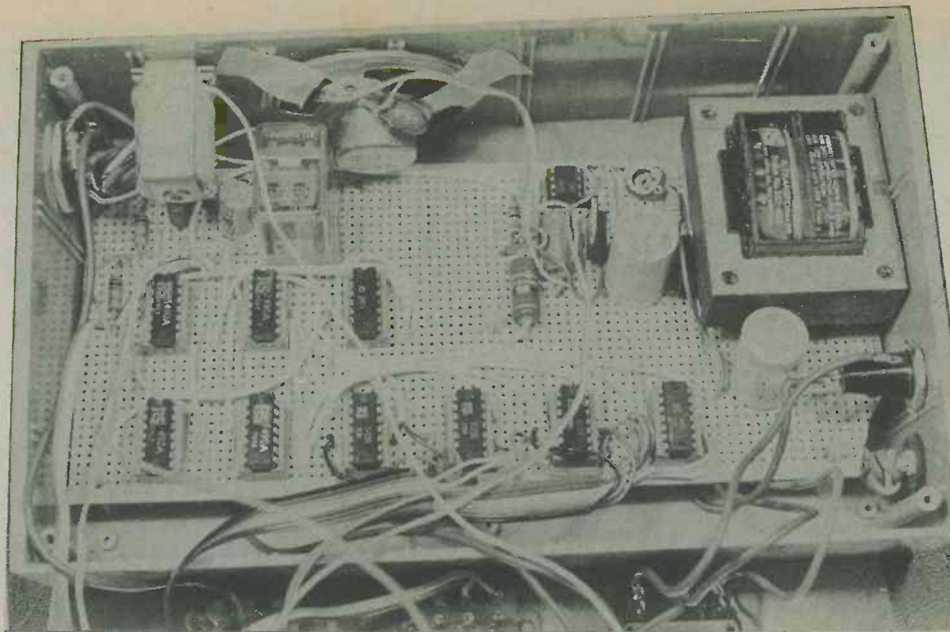
The 1 Hz oscillator (Fig. 2) uses a 555 timer ic. Both VR2 and VR3 are included so that a high degree of accuracy can be achieved for the long timing intervals. The writer has achieved an accuracy of 99.93% over 8 hours (for those interested the alarm sounded after 7 hrs. 59 mins. 40 seconds).

Both divide-by-sixty circuits are identical to that shown in Fig. 3. Each divider uses two 7490 counters, the first as a decade counter, the second resetting on the sixth pulse, to give a divide-by-sixty function overall.

The relay driver is a BC 107 or similar device (see Fig. 4). The diode across the relay coil absorbs any back-emf. The 10μF capacitor reduces the possibility of false relay operation due to 'sneak' pulses, noise or circuit transients. A positive – going voltage at the circuit input (on R4) causes the relay to operate and to latch over its own 'make' contact.

The 100μF capacitor causes the relay to operate immediately on first switch-on regardless of the setting of the selectors. The enlarger can be set up and the required time interval set on the selectors, then when the start button is pressed the relay releases and the selected time-lapse commences.

The reset circuit is also derived from the relay contacts, but two gates from a 7400 are included in a bistable configuration to eliminate contact bounce which can give rise to inconsistent timings. The 1μF capacitor ensures that the bistable is correctly set on switch-on.



Internal view of the prototype unit.

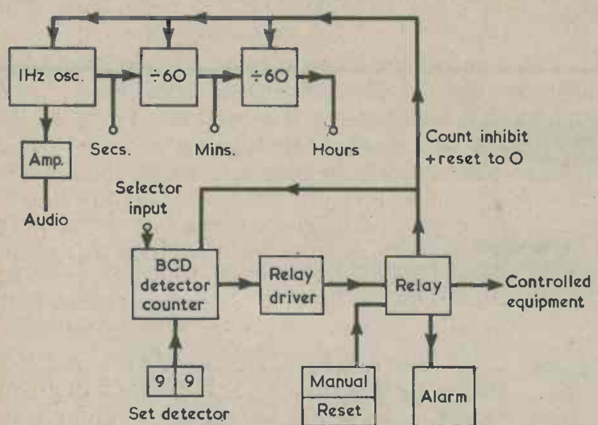


Fig. 1. Block diagram of enlarger/ process timer.

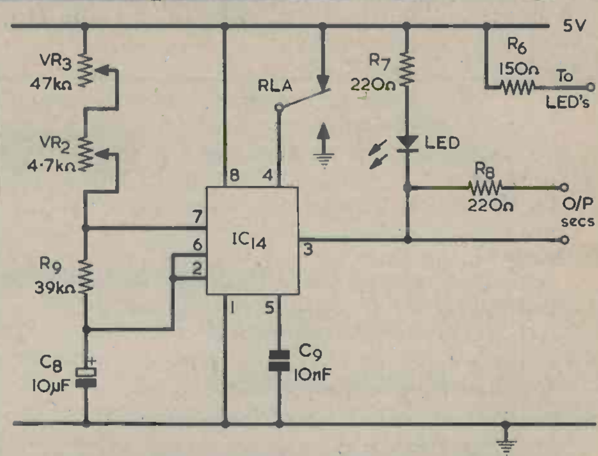


Fig. 2. 1 Hz oscillator. The Change-over contact is part of the output relay. VR3 and VR2 provide coarse and fine frequency adjustment.

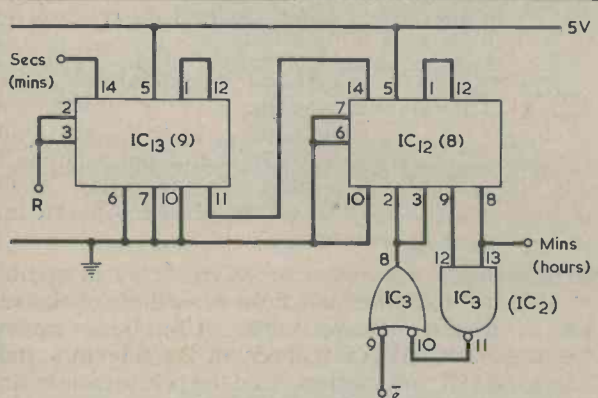


Fig. 3. Divide-by-60 circuit. This counter circuit is used twice. Once to derive a minutes count from a seconds input and also to derive an hours count from a minutes input.

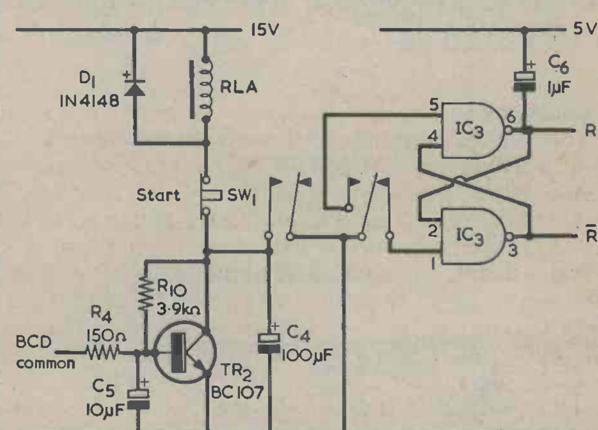
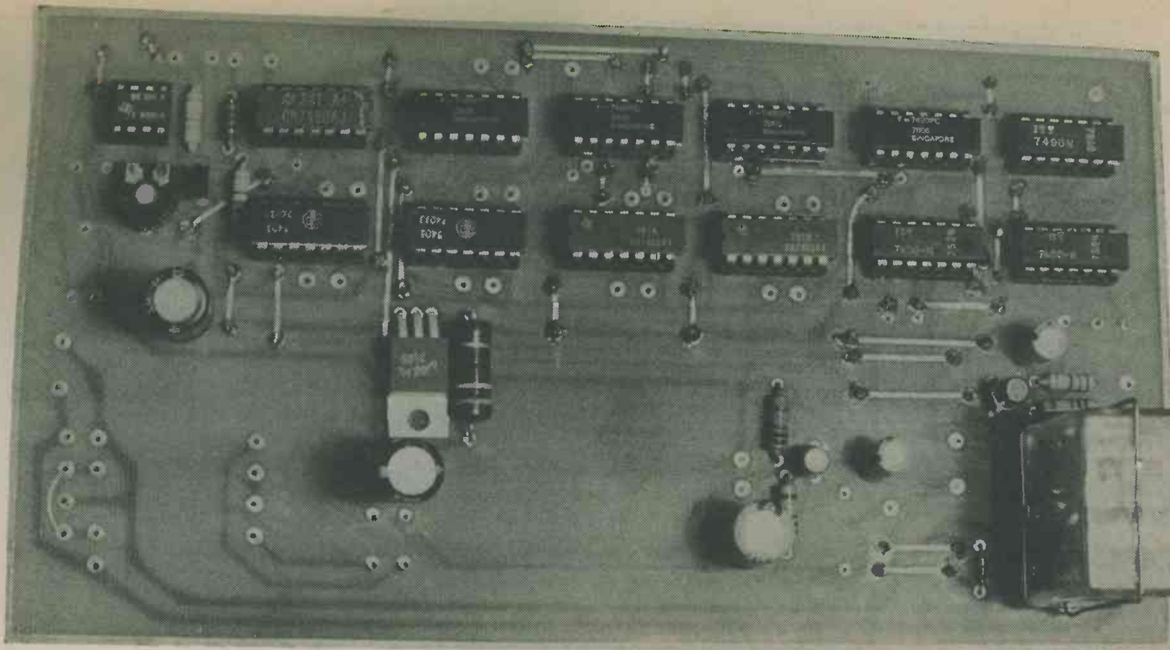


Fig. 4. Circuit of relay driver, latch and reset bistable. The two NAND gates in the bistable circuit are half of a 7400.



Photograph showing component layout using a pre-etched and drilled board.

COMPONENTS

Resistors

(All fixed values ¼ watt 10% except where shown otherwise).

R1 1.5KΩ or 1KΩ (not critical)
R2 1KΩ
R3 1KΩ or 500Ω (not critical)
R4 150Ω
R5 27Ω 2 watt
R6 150Ω
R7 220Ω
R8 220Ω
R9 39KΩ
R10 3.9KΩ
VR1 1KΩ preset
VR2 4.7KΩ preset
VR3 47KΩ preset

Capacitors

(All electrolytics are 15V working minimum)

C1 100μF	C6 1μF
C2 10μF	C7 470μF
C3 470μF	
C4 100μF	C8 10μF
C5 10μF	C9 0.01μF (10nF)

Integrated circuits

IC1 +5V Regulator	
IC2 7400	
IC3 7400	IC9 7490
IC4 7403	IC10 7490
IC5 7403	IC11 7490
IC6 7403	IC12 7490
IC7 7403	IC13 7490
IC8 7490	IC14 NE 555 or similar

Transistors

TR1 BC107 or similar
TR2 BC107 or similar

Diodes

D1 IN914 or IN4148
BD1 50V 1 Amp bridge rectifier.
l.e.d. 3 high brightness 0.2" or suitable

Switches

SW1 Push to break
SW2 Single pole change-over slide
SW3 Single pole miniature toggle
SW4 Single pole miniature slide
SW5 Mains neon rocker switch, single pole
BCD Thumbwheel switches (2 off) R.S. Components type 338-399 or similar.

Selector switches: Single pole change-over slide switch. Double pole change-over slide switch or, one only, 2-pole 3-position rotary switch.

Miscellaneous

Relay, 'Continental' style 4 pole changeover, 12V nominal. Transformer, R.S. Components type 207-740 6VA 0-6, 0-6V. PCB ready prepared from WGR Enterprises Ltd., 64 Purford Green, Harlow, Essex, CM18 6HN.
Loudspeaker 8Ω miniature.
Fuse holder to suit 20 mm mains fuse.
Buzzer 240V a.c. type
Case to suit location and application.
Nuts, bolts, wire etc.

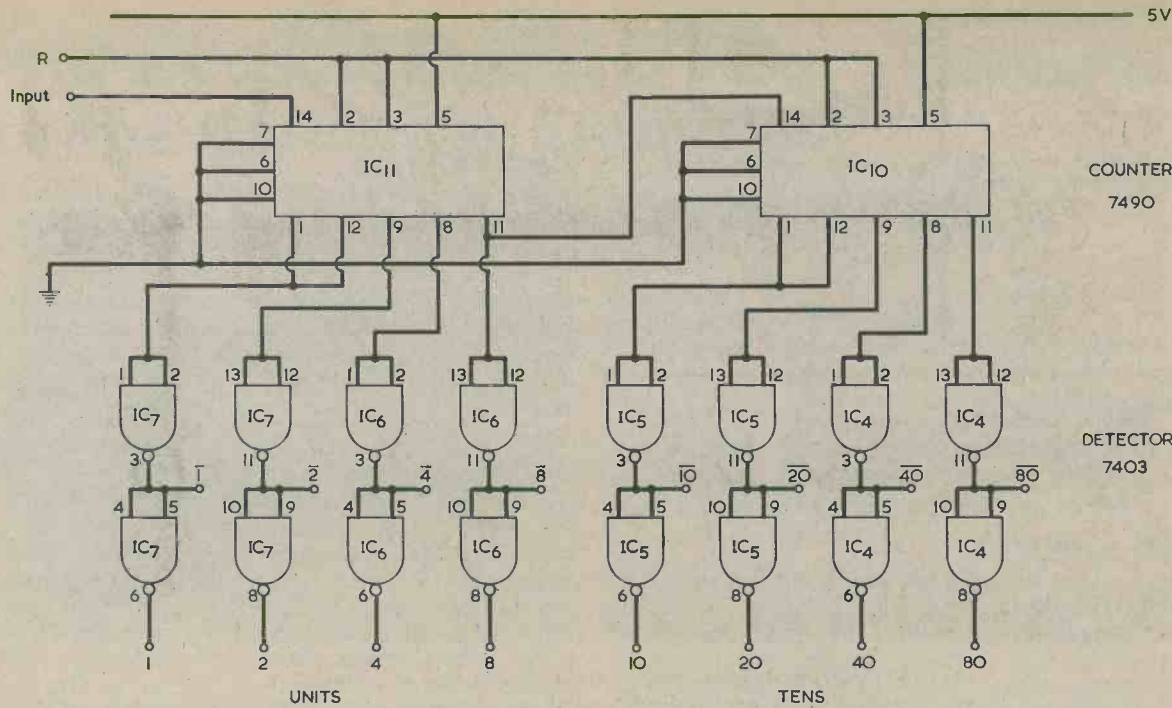


Fig. 5. Tens and Units counter and NAND gate detector circuits. This section is driven from the 'seconds' output, 'minutes' output or 'hours' output of Fig. 1 via a seconds, minutes or hours selector switch. The outputs of the NAND gates connect directly to the appropriate inputs on the BCD switch.

The hard work is done by the detector counter shown in Fig. 5. The counter consists of two 7490 decade counters with binary outputs of weightings 1, 2, 4 and 8. The inverse functions 1, 2, 4 and 8 are also generated by the detector section. The eight outputs from each of these two detector circuits are then taken to the appropriate eight inputs on the two thumbwheel switches. Thus we have two thumbwheel switches, one for units count and one for tens count.

By suitable switching we can choose to drive the counter input (see Fig. 5) from the seconds, minutes or hours pulse sources shown in Fig. 1, ellowing tim ngs of 0 to 99 seconds, 0 to 99 minutes or 0 to 99 hours using just these two thumbwheel switches and a selector switch.

The outputs from the thumbwheel switches are called 'common' and both these outputs are connected to the 'BCD common' input at R4 in the relay driver circuit (see Fig. 4.). When the correct number of tens and units of pulses from the selected seconds, minutes or hours source have been counted then the relay is energised to mark the end of the elapsed time.

The more technically minded reader may care to note that 7403 type open-collector NAND gates are used in the detector circuits rather than the more usual 7400 type totem-pole output NAND gates since the action of the BCD switch is such that these outputs can be commoned together in a wired – OR fashion. In this application the totem-pole outputs could self-destruct!

POWER SUPPLY

The power supply (Fig. 6) is a standard full wave bridge rectifier/smoothed circuit supplying +15V for the relay and audio amplifier and +5V for the logic circuits. The 27Ω 2 watt resistor takes most of the power which would otherwise be dissipated in the 5V regulator.

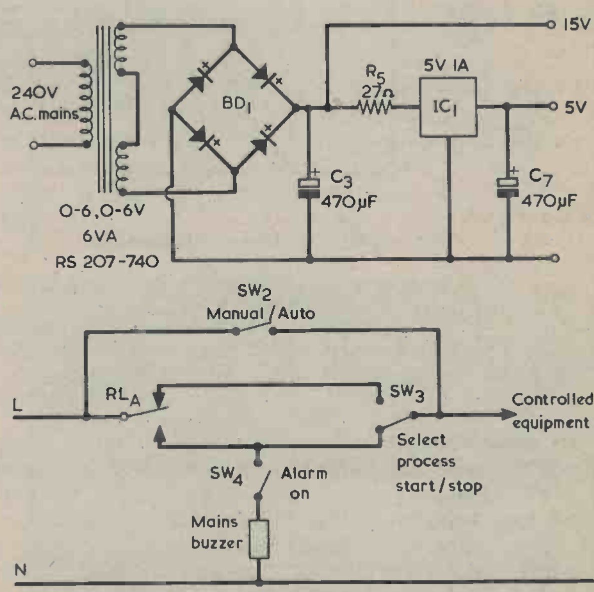


Fig. 6. Circuit of power supply and load switching arrangement.

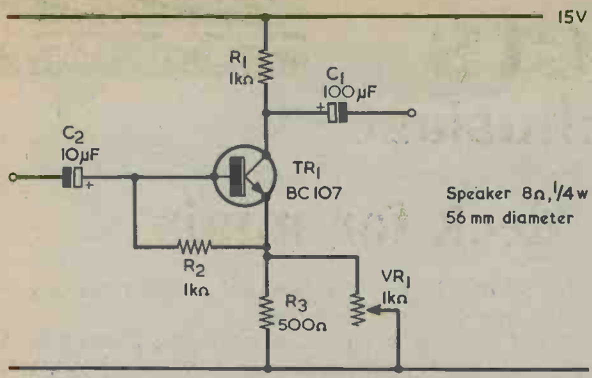


Fig. 7. Circuit of audio amplifier. Any low impedance small loudspeaker is suitable to reproduce the 1 second 'blips'.

TIMER OUTPUT

Fig. 6 also shows the switching arrangement between the Live and Neutral mains input and the supply to the photographic apparatus. The connection of the relay change-over contacts and the 'select process' changeover switch (SW3) is such that power can be applied to the controlled equipment either during the selected time interval, or only after that interval has elapsed.

Since it is only intended to reproduce the marker blips, the miniature 8Ω loudspeaker can be mounted inside the case without outlet holes.

CONSTRUCTION

The unit can be constructed inside any suitable enclosure. For use in a dark-room a robust waterproof case would seem to be the best idea. Fig. 8 shows the rear view of the front panel layout used by the author. The positions of the various controls can be seen. All the switching, selecting and indicating components are shown and the purpose of the two slide switches below the BCD switches is explained below.

These two slide switches are used to select which of the timing pulses, 'seconds', 'minutes' or 'hours' (shown in Fig. 1) are connected to the single input to the counter circuit formed by IC10 and IC11. This could be achieved using a 3-position single pole slide switch, but the author has found that in the peculiar circumstances of the darkroom it is best if the user has only two positive switch positions to locate. Thus the lower switch selects minutes and the upper switch selects seconds or hours. As shown in Fig. 8. the upper switch can conveniently be a double pole type with the second pole selecting a led indicator showing whether seconds or hours have been selected. Constructors may of course prefer to use a rotary switch or some other arrangement to suit their preference.

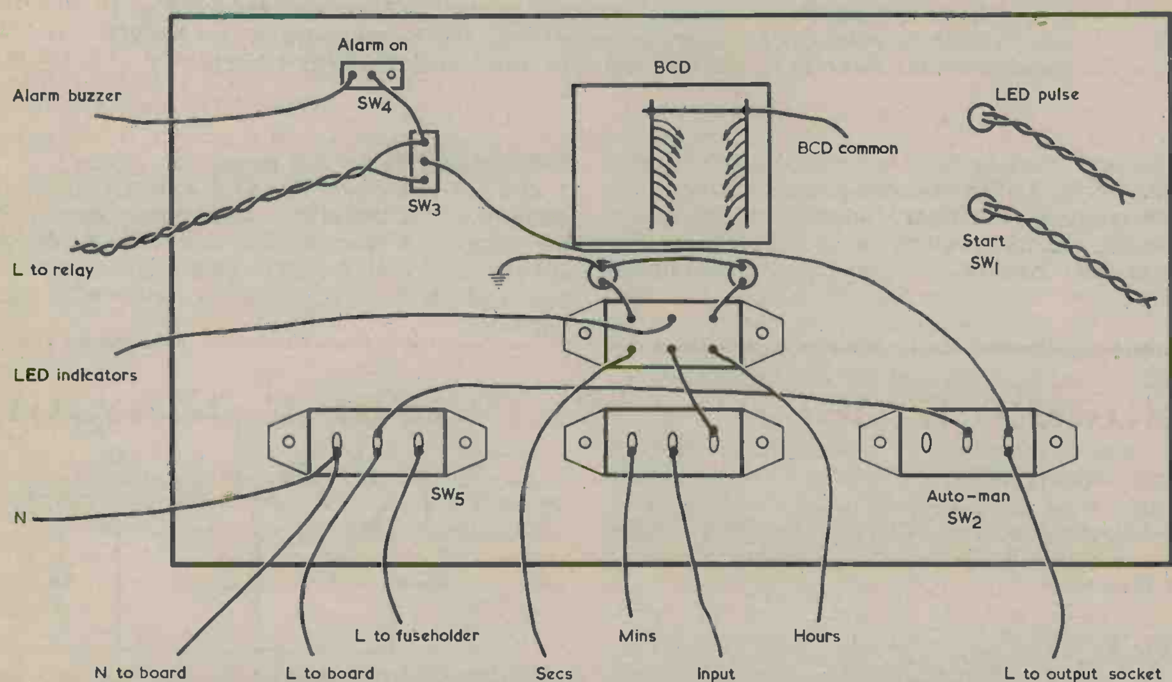


Fig. 8. Rear view of suggested front panel layout. For ease of operation in a dark-room only two position slide switches are used to select seconds, minutes or hours.

For setting up purposes such as focusing and masking, a manual/auto bypass switch (SW2) is included. The mains buzzer will sound when the relay is operated unless the muting switch (SW4) is operated.

AUDIO AMPLIFIER

The audio amplifier (Fig. 7) is arranged to produce a 'blip' on the 'seconds' count. It is capacitively coupled via C2 to R8 on the 1Hz oscillator (Fig. 2) VR1 adjusts the output level which can be quite powerful!

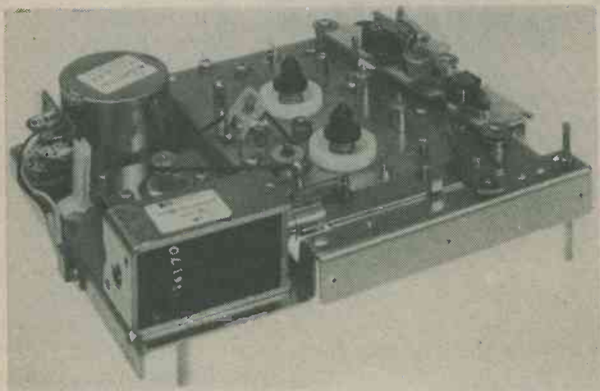
CALIBRATION

Calibrating the device is a matter of patience and a stopwatch. The author suggests timing over 30 seconds in the first instance and then fine adjusting as necessary. Timing over a period of 15 minutes is time-consuming but gives good results, and timing to within 1 second should be possible. ■

New Products

For the Computer Enthusiast

High quality cassette deck for minis



The C1000 from Monolith Electronics, a new low cost, high quality cassette tape deck for minis.

A new, low cost, high quality cassette tape deck, the C1000, has been introduced by Monolith Electronics, 5/7 Church Street, Crewkerne, Somerset. Aimed at the home mini-computer enthusiast, the C1000 is a development of Monolith's proven C2000 series tape transports which are widely used in industrial process control, data logging and computer applications. It can be operated either remotely or locally via the control circuitry.

The C1000 is designed around the international compact cassette and consists of two motors (capstan and spooling), head plate and solenoid. It operates from a nominal 12V d.c. supply.

The basic control circuitry allows remote or local selection of fast forward, fast rewind, record and play. A Hall effect sensor and an opto end of tape sensor are optional extras to the control circuit and are supplied separately.

The Hall effect sensor can serve two functions viz. detection of tape motion and breakage of tape and also as a tape spool rotation counter. The device senses motion of the supply tape spool and delivers four pulses for each revolution of the spool.

The opto device is designed primarily for use with high speed tapes fitted with coded windows (available from Monolith).

The main motor, which is electronically speed controlled, drives the capstan. As supplied, the deck operates at the standard tape speed of 1 7/8 in/sec (4.76 cm/sec) but with a slight modification to the circuit this can be made variable over the range 2.4 cm/sec to 9.5 cm/sec – approximately 15/16 in/sec to 3 3/4 in/sec. Wow and flutter are typically 1.15% r.m.s. (DIN 45507). The C1000 is 180mm long x 145mm wide x 60mm tall, and weighs 1.4kg (3.1 lbs). Prices (inc. VAT) are: C1000 main unit £42.49, Opto sensor £13.80, Hall effect unit £5.75.

Valuable accessory for personal computers

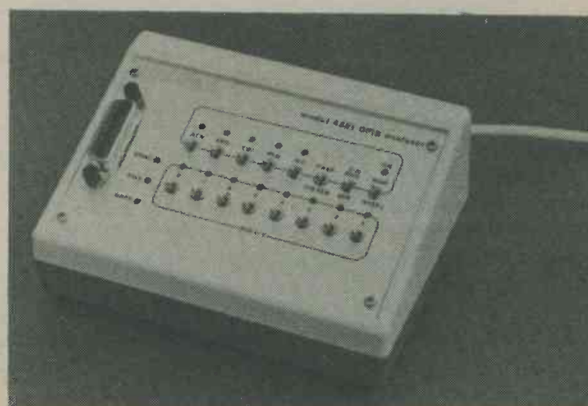
Model 4881 GPIB Analyser announced by WASEC is an invaluable accessory for all personal computers which use the IEEE 488 bus for peripheral interconnection. With Talker, Listener and Controller capabilities the model 4881 facilitates development, investigation and troubleshooting of systems incorporating GPIB compatible processors such as the ABC80, Apple, Commodore PET, Hewlett Packard HP85 and Research Machines 380Z.

16 LED's monitor the GPIB signals with individual switch control over each line. Using the Single Step Listener facility the model 4881 can display system activity allowing the user to check through each Bus transaction one at a time. Alternatively, as a Talker, the Analyser can output switch selected data bytes to a Listener either in a continous or a Single Step mode.

As a Controller model 4881 can send Bus Commands and control the Bus management signals ATN, EOI, SRQ, REN and IFC. This permits complete tests to be made on Bus Systems at a simple level prior to attempting to run complex Bus programmes.

Model 4881 is fully portable, self contained and is powered from any 240v. 50Hz. supply. A top-of-panel GPIB connector facilitates easy CRO monotoring of Bus signals and a simple adaptor affords connection to the IEC 625.1 Instrumentation Bus.

For further information write to:- Sales Department, WASEC, 45 Hurstcourt Road, Sutton, Surrey SM1 3JF.



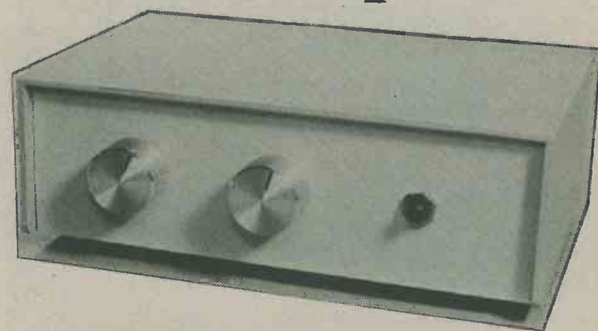
Proximity Lamp Switch

By R.A. Penfold

No fumbling in the dark for manual switches.

Proximity of hand turns lamp on.

This project is a proximity switch which can be used to turn on a bedside lamp by placing a hand on the insulated case of the unit. Switches of this type are often incorporated in clock-radios intended for bedside use, and it was the convenience of using one of these which led to the present design.



The proximity lamp switch circuitry is housed in an all-plastic case. Placing a hand on the insulated lid of the case switches on the lamp.

OPERATING PRINCIPLE

The block diagram of Fig. 1 shows the various stages of the circuit and the way they interconnect. A metal sensor plate is positioned near a strong source of mains hum (a mains transformer) and the 50Hz hum signal picked up in the plate is fed via a buffer stage to a high gain amplifier. The output from this is rectified and passed to a latching relay driver stage.

If the input signal level to the latching stage is high enough it triggers and energises the relay, which in turn switches on the lamp. The circuit is adjusted so that under normal conditions the input signal to the latching stage is just too small to produce triggering.

If a person's hand is held near without actually touching the sensor plate, hum picked up in the person's body is capacitively coupled to the plate. Although the coupling capacitance will be extremely low and the frequency involved, at 50Hz, is also low, the high input impedance of the buffer amplifier ensures that a significant amount of additional hum signal is coupled to the plate. This increases the input signal to the latching stage, causing the latter to be triggered and the lamp to be turned on. The unit can be returned to the off state by briefly pressing the reset button.

THE CIRCUIT

The complete circuit of the proximity switch appears in Fig. 2.

Power for the electronics is given by mains transformer T1 and the full wave rectifier circuit incorporating D1, D2 and C1. It is essential that the buffer and voltage amplifier stages have a supply with a low ripple content, as the input signal could otherwise be swamped by hum on the supply rails. Additional smoothing for these two stages is given by R6 and C7. S2(a)(b) is the main on-off switch. Fuse FS1 in the rectifier circuit gives protection against damage due to circuit faults. Its rating is somewhat higher than the secondary current rating of T1 but it is a quick-blow type which will blow rapidly in the event of excessive current.

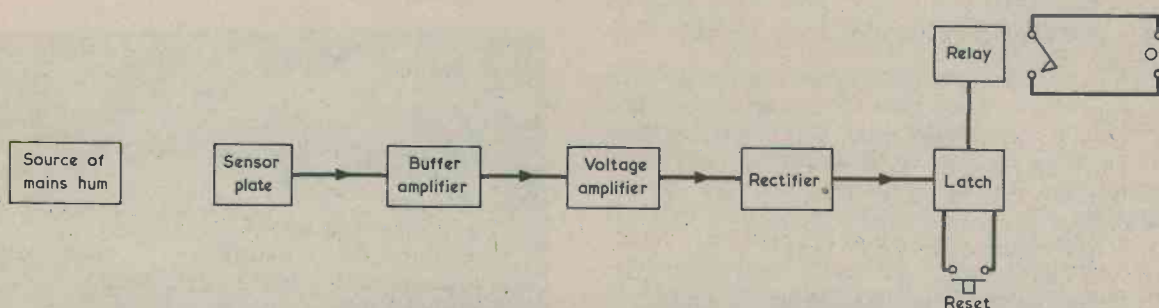


Fig. 1. Stage line-up of the proximity switch. The mains hum picked up by the sensor plate is amplified, rectified and fed to the latch. Placing a hand near the sensor plate increases the hum level, triggers the latch to its alternate state and causes the relay to energise.

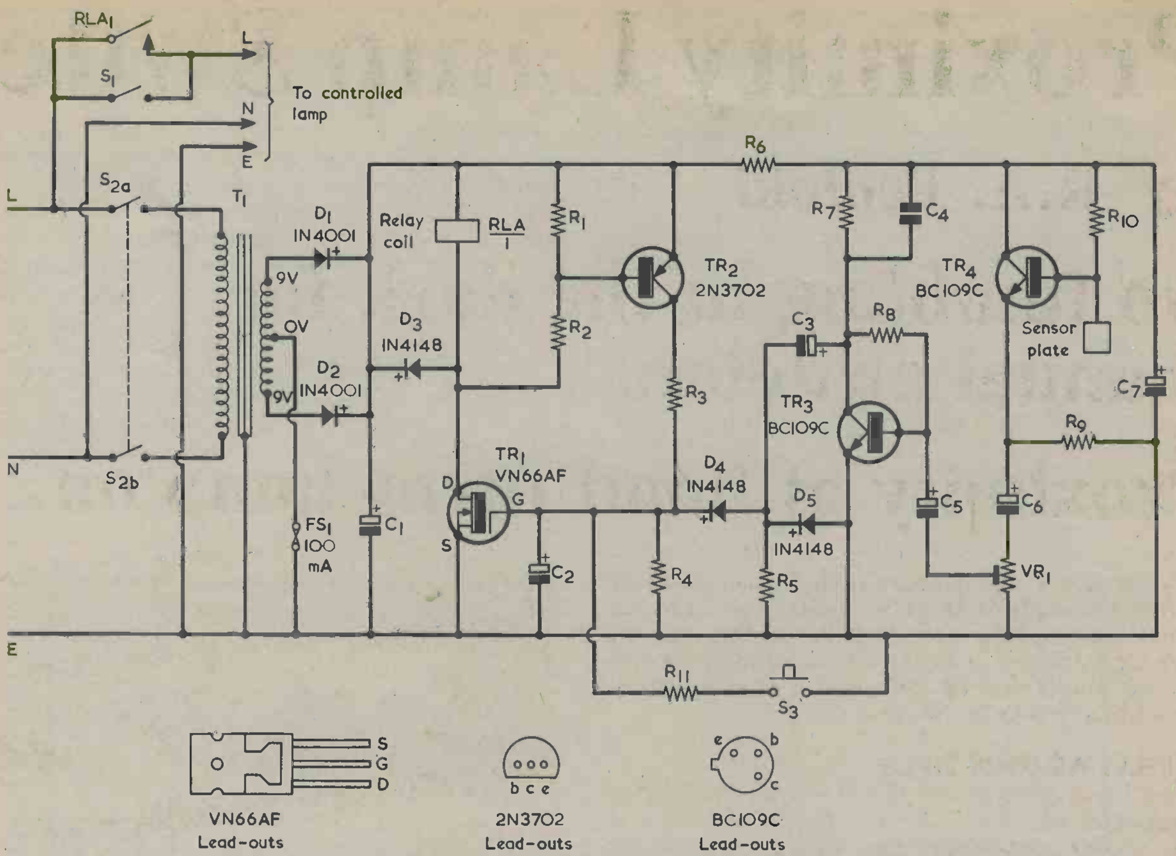


Fig. 2. The circuit of the switch. TR4 is the input buffer amplifier and TR3 the voltage amplifier. TR1 and TR2 are in the latching circuit and TR1 controls the relay.

COMPONENTS

Resistors
(All fixed values $\frac{1}{4}$ watt 5% unless otherwise stated).
R1 4.7kΩ
R2 22kΩ
R3 22kΩ
R4 39kΩ
R5 56kΩ
R6 560Ω
R7 4.7kΩ
R8 2.7MΩ 10%
R9 4.7kΩ
R10 1.8MΩ 10%
R11 12Ω
VR1 10kΩ pre-set potentiometer, 0.1 watt, horizontal

Capacitors
C1 100μF electrolytic, 16V. Wkg.
C2 15μF electrolytic, 16V. Wkg.
C3 1μF electrolytic, 16V. Wkg.
C4 0.22μF polyester, type C280
C5 2.2μF electrolytic, 16V. Wkg.
C6 1μF electrolytic, 16V. Wkg.
C7 100μF electrolytic, 16V. Wkg.

Transformer
T1 sub-miniature mains transformer, secondary 9-0-9V at 67mA.

Semiconductors
TR1 VN66AF
TR2 2N3702
TR3 BC109C
TR4 BC109C
D1 1N4001
D2 1N4001
D3 1N4148
D4 1N4148
D5 1N4148

Switches
S1 s.p.s.t. rotary mains toggle
S2(a)(b) d.p.s.t. rotary mains toggle
S3 press-button, push to make

Relay
RLA see text

Fuse
FS1 100mA quick-blow cartridge fuse 20mm.

Miscellaneous
Plastic case (see text)
Veroboard, 0.1in. matrix
Chassis-mounting fuseholder, 20mm.
2 control knobs
Aluminium sheet (for sensor)
3-core mains wire
Nuts, bolts, wire, etc.

TR4 is in the buffer stage, and is connected as a simple emitter follower. There is a high input impedance at its base, to which the sensor plate connects directly. TR1 output is coupled by C6 to VR1, a variable attenuator, the slider of which connects to the base of voltage amplifier TR3 through C5. This is a conventional common emitter amplifier, and its output couples via C3 to the rectifier comprising D4 and D5. The amplified and rectified hum signal takes the gate of TR1 positive, and the hum pulses are smoothed by C2.

C2 is not essential for triggering of the latching circuit and is included to improve reliability. It was omitted from the circuit during initial design work, and it was found that the lamp tended to frequently switch itself on! The problem was found to be due to large noise spikes on the mains supply (of which there are a great many in most areas these days). C2 helps to prevent these transients giving false triggering, since the brief spikes have little charging effect and are absorbed by the capacitor. The much longer 50Hz hum pulses charge C2 up to virtually their peak amplitude.

Due to their short duration, the mains noise spikes consist largely of high frequencies. C4 gives further protection against false triggering by reducing amplifier gain at frequencies higher than 50Hz. When C2 and C4 had been added to the circuit there were no further problems with spurious triggering, and all attempts to purposely cause such triggering failed.

TR1 and TR2 form the latching circuit. In the standby condition there is insufficient gate bias to cause TR1 to pass a sufficient drain current. With the resultant low voltage across the relay coil, TR2 is cut off. When the rectified hum voltage at TR1 gate increases, due to a hand being placed near the sensor, TR1 drain current increases and TR2 starts to turn on. Its collector current, through current limiting

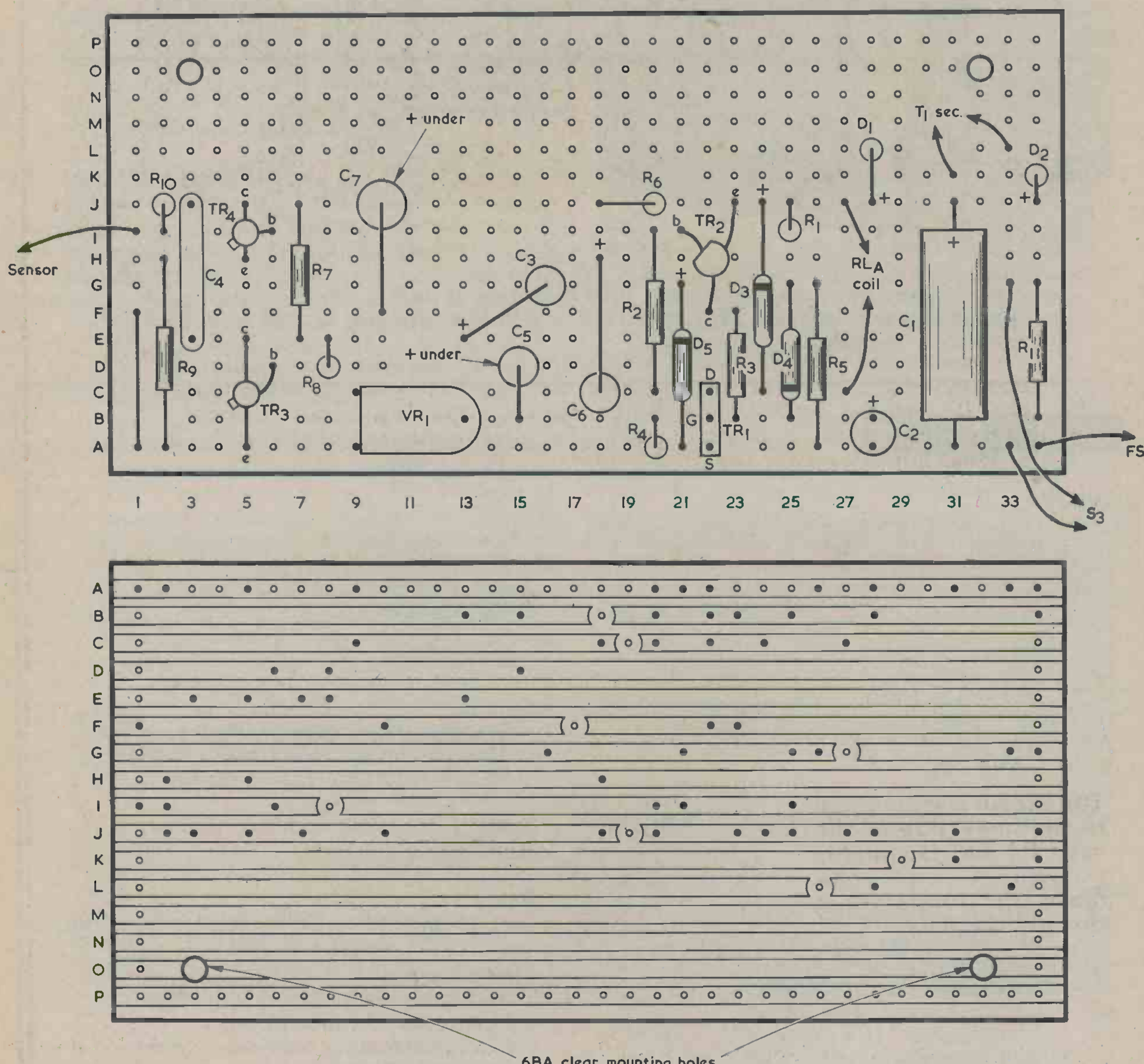
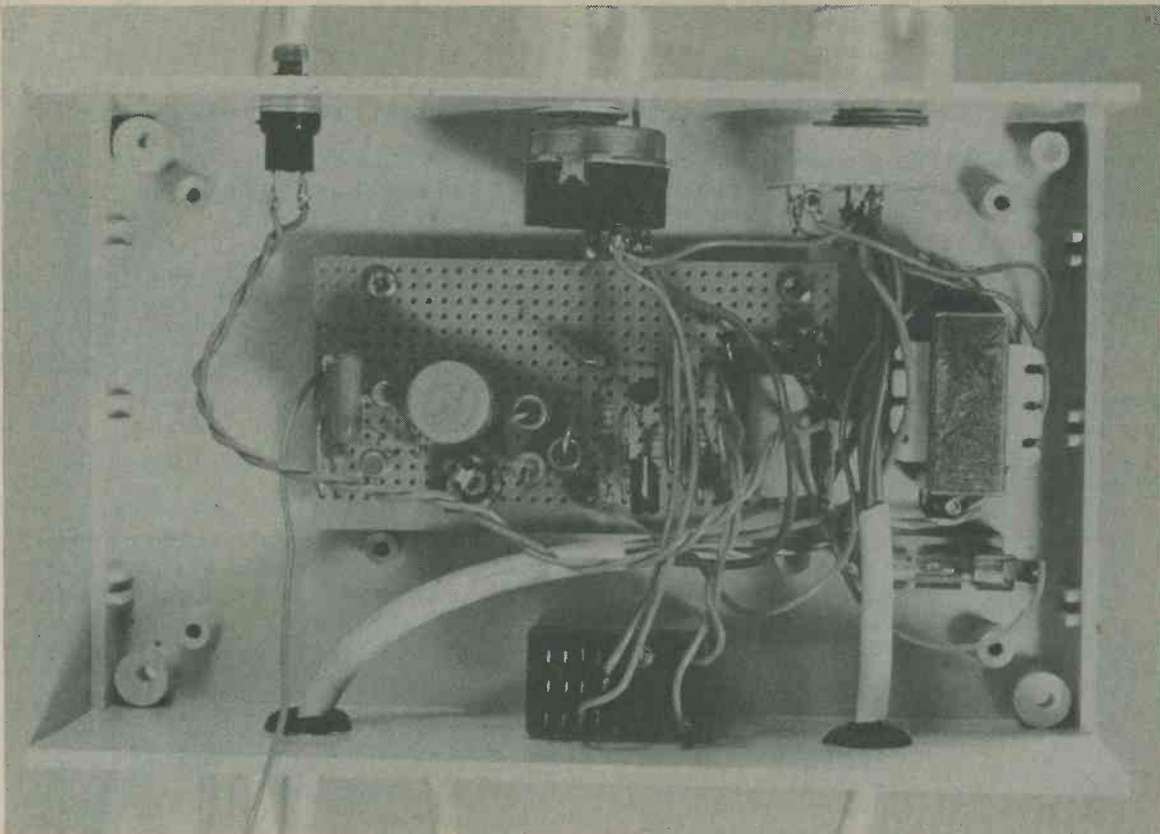
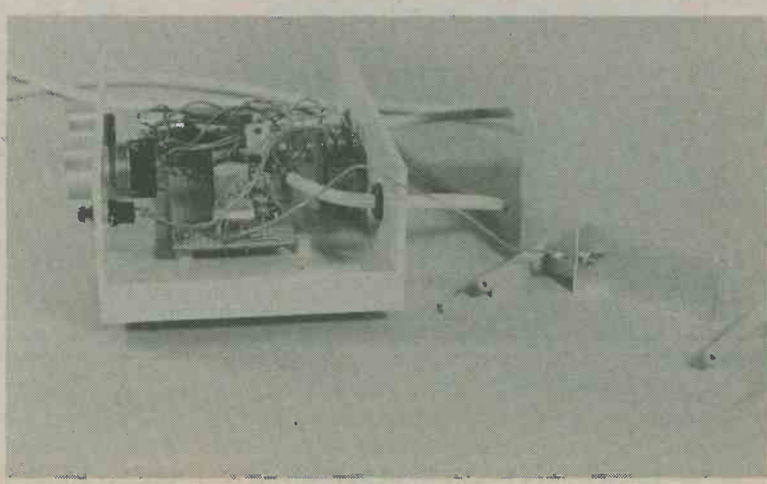


Fig. 3. The Veroboard assembly. After the board has been cut out the two mounting holes are drilled. Next, the breaks in the strips are made and then the components are soldered in position.



Internal layout inside the case. The mains transformer and fuseholder are positioned at one end of the case. The Veroboard assembly is positioned so that D1 and D2, mounted on the board, are close to the transformer. (NB constructors should use 'strain relief' grommets for mains wiring – or at least knot the cable inside the box).

The sensor plate is glued to the underside of the case lid and is roughly positioned over the mains transformer when the lid is in place.



resistor R3, causes the gate of TR1 to go more positive and the relay energises. Virtually the full supply potential appears across the relay coil and both TR1 and TR2 are turned hard on. The circuit now remains latched in this state. It can be returned to its previous state by pressing the reset switch S3. This reduces TR1 gate voltage to almost zero, whereupon both transistors turn off and the relay de-energises. D3 is the usual protective diode which prevents the formation of high back-e.m.f. voltages across the relay coil when it releases.

Two make contacts of the relay switch on the bedside lamp when the relay energises. S1 can be used to bypass these contacts so that the lamp can be switched on and off in the normal manner, if desired.

COMPONENTS

The relay should have a coil resistance of 185Ω or more with at least one make contact set of adequate rating for mains voltages. It should energise reliably at around 9 volts. The prototype employed a miniature plastic cased type having four changeover contact sets. As with many relays this had no provision for chassis mounting and it was glued to the rear panel of the case with an epoxy adhesive. Other means of mounting the particular relay to be employed can also be devised.

The low value electrolytic capacitors, C3, C5 and C6, are specified in the Components List as having working voltages of 16 volts. In practice it will be found difficult to obtain those components with this low working voltage and it will be quite in order to use capacitors having a much higher working voltage, such as 63 volts. The transistor specified for TR1 and the mains transformer are both available from Maplin Electronic Supplies. Any all-plastic case that will comfortably accommodate all the components can be used, the smallest suitable size being about 150 by 100 by 50mm.

CONSTRUCTION

Two holes are required in the rear panel of the case. Through one of these passes a 3-core mains input lead and through the other passes a 3-core output lead connecting to the bedside lamp. Each lead should be secured inside the case with a plastic or a plastic-faced clamp. The three switches are mounted on the front panel, S2 being to the left, S1 central, and S3 to the right. The mains transformer and the fuseholder are positioned to the left of the case, making sure that sufficient space is left for the component panel and the relay.

Details of the component panel are given in Fig.3. This is a piece of Veroboard of 0.1in. matrix having 16 copper strips by 34 holes. TR1 has a built-in zener protection diode and does not need any special handling precautions. The wiring external to the board is illustrated in Fig. 4.

The sensor plate merely consists of a piece of aluminium sheet of around 16 to 22 s.w.g., measuring about 60 by 25mm. A small flange about 8 to 10mm deep is bent at right angles at one end. A solder tag is bolted to this flange and this provides the connection for the input lead from the component panel. The plate is glued to the underside of the case lid so that it will be positioned roughly above T1 when the lid is fitted in place. The exact positioning of the plate is not critical, but it should not be too far away from T1 as there might then be insufficient pick-up of the mains hum signal.

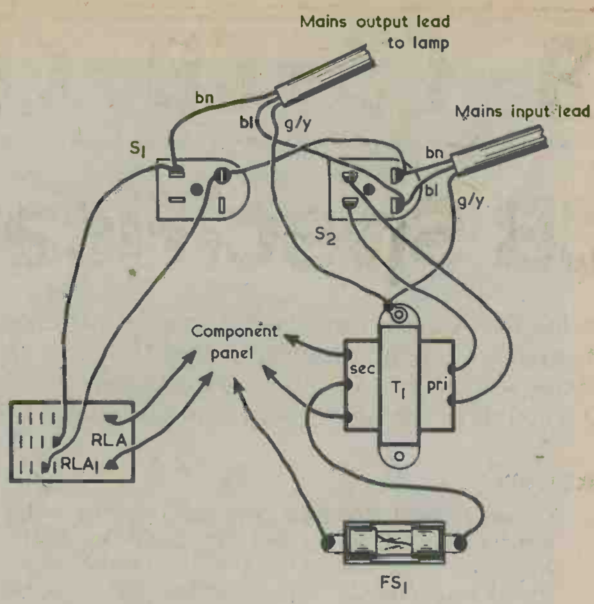


Fig.4. Wiring to the component panel. Two wires from S1 connect to a make contact set on the relay. Confirm the tags of S1 and S2 with a continuity tester before wiring to these switches. Not shown is S3, which simply connects to the two appropriate wires from the component panel.

ADJUSTMENT

One method of giving VR1 the correct setting is to stand with it fully backed-off (slider fully clockwise) and then advance it slowly until the relay energises. The potentiometer is then backed-off slightly to a setting which gives reliable operation. With this method the sensor plate has to be in its normal position, since the correct setting for VR1 varies according to the position of the plate. Access to VR1 can be obtained by drilling a small hole in the case lid directly above VR1.

Alternatively, since the adjustment of VR1 is a once-and-for-all operation, it can simply be adjusted by trial and error with the case lid being removed for the adjustment and then replaced. Whatever method is chosen, do not be tempted to adjust VR1 for the highest possible sensitivity. Instead, adjust the potentiometer down to the lowest setting which gives good results. There should then be no problems whatsoever with noise spikes on the mains causing spurious triggering. When adjusting VR1 by the second method, always remember that the mains supply is present at the rotary switches and the relay contacts, and take all precautions against accidental shock. The unit should not then be subsequently used without the case lid firmly secured in place.

Although the design is presented here as a light switch, it can of course be used to control other items of equipment provided that the relay contact ratings are not exceeded. It can also be used to switch a circuit off instead of on, and this is achieved by using a relay break contact set instead of a make contact set. ■

CB Specification at last...

Herewith an edited abstract from the official word LMSC/CB1 24th April. R&EC brings you this information on the understanding that this is the full and final specification, and that the frequencies, power and mode is not subject to any further discussion. But we cannot accept any responsibility for any errors and omissions that may have slipped through.

Foreward

1. Citizen's Band Radio, a personal two-way radio system, is available for use throughout the United Kingdom. It operates in the 27 MHz waveband and the 930 waveband.
2. The Wireless Telegraphy Act 1949 provides that no radio equipment may be installed or used except under the authority of the Secretary of State. All citizens band radio equipment whether hand held, mobile or base station, must be covered by a licence; it is a condtion of this that the apparatus fulfils, and is maintained to, certain minimum technical standards. This specification sets out these standards for 27MHz FM equipment; 934MHz FM equipment is subject to a separate specification.
3. The manufacturer, assembler or importer of citizens band equipment is responsible for ensuring that the apparatus conforms with the specification; and any additional requirements imposed by regulations under the Wireless Telegraphy Act 1949. Conformity with the required standards may be established by tests carried out by the manufacturer, assembler or importer, or by a reputable test establishment acting on his behalf, but in either case conformity with the specification will remain the responsibility of the manufacturer, assembler or importer.

27MHz band equipment.

1. GENERAL

1.1 Scope of Specification

This specification covers the minimum performance requirements for frequency modulated radio equipments, comprising base station, mobile and hand held transmitters and receivers or receivers only and additionally any accessories e.g. attenuators, power amplifiers, vehicle adaptors for optional use with the above for use in the Citisens Band Radio service.

For all equipments covered by this specification, the nominal separation between adjacent channel carrier frequencies is 10kHz.

1.2. Permitted Effective Radiated Power

The output radio frequency power of the equipment is limited to 4W. With attenna permitted for use with the equipment this gives an effective radiated power of 2W.

If an antenna is mounted at a height exceeding 7m the licence will require a reduction in transmitter power of 10dB.

To enable the use to accomplish this easily the equipment manufacturer should provide as a standard accessory an attenuator or low power switch having a nominal attenuation of 10dB, which may be purchased by the licencee.

1.3. Operating Frequencies

The equipment shall provide for transmission and reception only of the frequency modulated emissions on one or more of the following radio frequency channels.

Channel 1	27.60125 MHz	Channel 21	27.80125 MHz
Channel 2	27.61125 MHz	Channel 22	27.81125 MHz
Channel 3	27.62125 MHz	Channel 23	27.82125 MHz
Channel 4	27.63125 MHz	Channel 24	27.83125 MHz
Channel 5	27.64125 MHz	Channel 25	27.84125 MHz
Channel 6	27.65125 MHz	Channel 26	27.85125 MHz
Channel 7	27.66125 MHz	Channel 27	27.86125 MHz
Channel 8	27.67125 MHz	Channel 28	27.87125 MHz
Channel 9	27.68125 MHz	Channel 29	27.88125 MHz
Channel 10	27.69125 MHz	Channel 30	27.89125 MHz
Channel 11	27.70125 MHz	Channel 31	27.90125 MHz
Channel 12	27.71125 MHz	Channel 32	27.91125 MHz
Channel 13	27.72125 MHz	Channel 33	27.92125 MHz
Channel 14	27.73125 MHz	Channel 34	27.93125 MHz
Channel 15	27.74125 MHz	Channel 35	27.94125 MHz
Channel 16	27.75125 MHz	Channel 36	27.95125 MHz
Channel 17	27.76125 MHz	Channel 37	27.96125 MHz
Channel 18	27.77125 MHz	Channel 38	27.97125 MHz
Channel 19	27.78125 MHz	Channel 39	27.98125 MHz
Channel 20	27.79125 MHz	Channel 40	27.99125 MHz

Citizens Band Radio equipment shall not contain facilities for transmission of radio frequencies other than those listed above, and those contained in the specification for 934MHz band equipment. Single channel equipment may be tested on any one of the approved channels. Multi-channel equipment shall be equipped to operate at the centre, and the upper and lower limits of the frequency range over which channel switching is possible.

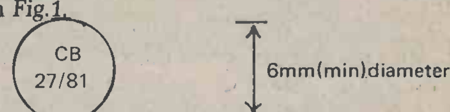
1.4. Permitted Modulation

Only equipment which employs frequency or phase modulation and has no facilities for any other form of modulation will meet the requirements of this specification.

1.6. Certificate of Compliance

Compliance with this specification shall be indicated by an authorised mark stamped or engraved on the front panel of the equipment.

The mark used to indicate compliance shall be as shown in Fig.1.



Letter & Figure Height NOT less than 1mm

Figure 1

3. ELECTRICAL TEST CONDITIONS

3.1. Transmitter Artificial Load

Tests on the transmitter shall be carried out using a 50 ohm non-reactuve, non-radiating load connected to the antenna terminals. If necessary an impedance matching device may be used for testing.

3.3. Test Site

The test site shall be located on a surface or ground which is reasonably level. At one point of the site, a ground plane of at least 5 metres diameter shall be provided. In the middle of this ground plane, a non-conducting support, capable of rotation through 360 degrees in the horizontal plane shall be used to support the test sample 1.5 metres above the ground plane.

The test site shall be large enough to allow the erection of a measuring or transmitting antenna at a distance from the test sample of not less than half the wavelength corresponding to the lowest frequency to be considered.

The distance actually used shall be recorded with the results of the tests carried out on the site. Sufficient precautions shall be taken to ensure that reflections from extraneous objects to adjacent to the site and ground reflections do not degrade the measurements.

3.3.3 Substitution Antenna

The substitution antenna shall be a half wave dipole resonant at the frequency under consideration, or a shortened dipole, calibrated against the half wave dipole. The centre of this antenna shall coincide with the reference point of the test sample it has replaced. This reference point shall be the point at which the external antenna is connected.

The distance between the lower extremity of the dipole and the ground shall be at least 0.3m.

The substitution antenna shall be connected to a calibrated signal generator when the site is used for radiation measurements.

The signal generator and the receiver shall be operating at the frequencies under investigation and shall be connected through suitable matching and balancing networks.

3.4. Normal Test Modulation

Where stated, the transmitter shall have normal test modulation as follows:

The modulation frequency shall be 1 kHz and the resulting frequency deviation shall be 60% of the maximum permissible frequency deviation (Clause 4.3.1.).

4. TRANSMITTER

4.1. Frequency Error

4.1.3. Limits

The frequency error, under both normal and extreme test conditions, or at any intermediate condition, shall not exceed +/-1.5kHz. If — for determining the transmitter frequency — use is made of a synthesizer and/or a phase-locked loop system. the transmitter shall be inhibited when synchronisation is absent.

4.2. Carrier Power

The equipment manufacturer should provide as a standard accessory an attenuator having a nominal attenuation of 10dB, which may by purchased by the licensee. This attenuator is for insertion, where necessary, between the transmitter output and the antenna terminals of the equipment, a removable link may be necessary.

4.2.1. Definition

For the purpose of this specification: the carrier power shall be the value of the power of an unmodulated carrier at the output terminals of a transmitter. For equipment with an integral antenna, it is the maximum value of effective radiated power of an unmodulated carrier. The rated output power is the maximum value of the transmitter output declared by the manufacturer, at which all the requirements of this specification are met.

4.2.2. Method of Measurement (Terminal Power)

a) The transmitter shall be connected to a test load equal to the impedance for which it was designed.

b) With the transmitter operating without modulation in accordance with the manufactuers' instructions, the power delivered to the test load shall be measured.

c) The measurement shall be made under normal test conditions (Clause 2.3.) and repeated under extreme test conditions Clauses 2.4.1. and 2.4.2. applied simultaneously.

4.2.3. Radiated Power

4.2.3.1. Method of Measurement under Normal Test Conditions

a) On a test site fulfilling the requirements of Clause 3.3., the equipment shall be placed on the support in the following position
(i) equipment with internal antennae shall be arranged with that axis vertical which is closest to vertical in normal use:
(ii) for equipment with rigid external anennae, the antenna shall be vertical:
(iii) for equipment with non-rigid external antennae, with the antenna extended vertically upwards by a non-conducting support.

b) The transmitter shall be switched on, without modulation, and the test receiver shall be tuned to the frequency of the signal being measured.

c) The test antenna shall be orientated for vertical polarization and shall be raised or lowered through specified height range until a maximum signal level is detected on the test receiver*.

d) The transmitter shall then be rotated through 360 degrees until the maximum signal is received.

e) The transmitter shall be replaced by the substitution antenna, as definted in Clause 3.3. and the test antenna raised or lowered as necessary to ensure that the maximum signal is still received.

f) The input signal to the substitution antenna shall be adjusted in level until an equal or a known related level to that detected from the transmitter is obtained in the test receiver.

g) The carrier power is equal to the power supplied to the substitution antenna, increased by the known relationship if necessary.

h) Steps a) to g) shall be repeated for any alternative integral antenna supplied by the manufacturer.

j) A check shall bew made at other planes of polarisation to ensure that the value obtained above is the maximum. If larger values are obtained, this fact shall be recorded in the test report.

*Note: The masimum may be a lower value than that obtainable heights outside the specified range.

4.2.4. Limits

The carrier power measured under normal test conditions in accordance with Clause 4.2.2. shall not exceed 4 watts. The effective radiated power measured under normal test conditions in accordance with Clause 4.2.3. shall not exceed 2 watts.

The carrier power under extreme condtions shall not exceed by more than 2dB, that measured under normal conditions in accordance with Clause 4.2.2. in case of the fixed station equipment and Clause 4.2.3. in the case of portable equipment.

4.3. Frequency Deviation

The frequency deviation is the difference between the instantaneous frequency of the modulated radio-frequency signal and the carrier frequency in the absence of modulation. For test purposes, only the maximum value of the frequency deviation available in the transmitter will be measured.

Electronics Magazines: Are you getting what you want ?

Radio & Electronics Constructor is presently undergoing a metamorphosis to adapt its format and style to suit the interests and needs of the electronics *user* and enthusiast of the 1980's.

We are endeavouring to aim the content of *R&EC* very much at the 'sharp end' of the hobby and industry, where people are actively engaged in the design and use of electronics in situations that range from a simple hobby - through to the design and manufacture of commercial electronic systems. Particular prominence will be given to the endeavours of smaller scale enterprises in the field of electronics and communications - since so much of the hard work and basic innovation takes place outside the rigid structures of the giant multi-national electronics organizations.

During the past 20 years, electronics has evolved into three main streams:

1. Communications: now encompassing everything from broadcast radio, to satellite data transmissions into the consumers' back yards.
2. Computing: a subject that was virtually unknown 20 years ago - and now as commonplace as a TV
3. Electronics: the basic bread and butter aspects of design with modern components - everything from simple power supplies to 'state of the art' instrumentation and the building blocks of computing.

We would very much like our magazine to try and bring together as many of these disciplines as possible, and try to illustrate some of the many ways in which different aspects of electronics can be mutually beneficial. Design ideas will feature prominently, alongside practical projects that are designed to both provide an end 'article' and illustrate the thinking and techniques that have been employed from inception through to practical results.

This Survey will help us to identify both the nature of our readers - and the nature of their interests, so we ask for your assistance during this process of change. We anticipate that the 'new look' will be complete with our September issue (published August) - and we are using the intervening months to phase in some of the new ideas and style suggested by this survey, and our own reactions as active participants in both the design and use of modern electronics.

R&EC '81: Aims and objects

The Editorial will be guided by the most knowledgable and best informed team of 'active' electronics users in the business of publishing. Our resources include the best equipped lab in either hobby or professional publishing - and some of the best informed exponents of the practical art of radio and electronics. We are always pleased to welcome new contributors - and can offer excellent support for those of you who would like to have a go, but feel slightly uncertain of their resources.

Radio and communications

With the advent of CB, it is anticipated that interest in this aspect of the hobby is set for a rapid increase. *R&EC* will be providing an informed and objective viewpoint of the situation as it unfolds in the UK, with coverage of all aspects from TVI to building your own gear - and also reviewing ready made units. CB will lead many followers onto the world of amateur radio - and it seems that the past few years has seen the demise of the practical side of the hobby, with the temptations of the ready made transceiver getting just too irresistable for most radio amateurs. This dearth of construction had led to a breed of radio amateur that is perilously unfamiliar with the more practical considerations of communications. We hope to strike a balance between equipment reviews, mods to commercial gear and constructional features. We certainly have a few eye-openers on the stocks.

Electronics

The nuts and bolts of the subject. *R&EC* will be publishing tutorials and updates - although we feel the basics of the subject are perhaps best learnt from one of the many books on the subject. (We will be expanding the *R&EC* book service, and providing regular reviews). New ideas and techniques will be explored with new features on design ideas and innovation, but we may have stop short of trying to include everything from basic resistor colour codes to communications satellites - most people have interests that lie somewhere in between.

Computing

The hobby of computing has suffered from the uncoordinated nature of the nascent market for the micro computer. Consequently, there are few 'standard' approaches - although one or two packages have emerged through weight of numbers to dominate the market. Our approach will be on three levels:

1) Practical applications of the MPU - eg controlling electronic systems, rather than playing Space Invaders.
2) Software and the complete microcomputer - here we intend to adopt one of the standard small scale systems as the basis for the features,
3) Peripheral, interface and support considerations - connecting (2) to the outside world.

A specific section on the back of this form covers some very detailed aspects of computing interest, since we are very keen to establish the levels of interest and experience we should aim for.

To summarize - *we want R&EC to be intelligible to the beginner, but not insulting to the experienced - and we would like to cover as many topics as possible inside two covers - not necessarily splitting the format whenever a new publishing opportunity arises. With your help and support, we look forward to our first 400 page issue !!*

R&EC

As a reward for your efforts in completing this comprehensive reader survey - subscriptions for R&EC received with this form will be charged at £8.50 - a saving of £1 from the *current* rate. So take this opportunity to subscribe now, and follow the metamorphosis of R&EC into the leading Radio and Electronics monthly...............

Reader Survey: 1981

Q1 : How do you rate the electronics press ??

Please check through the following lists of the electronics press, and indicate how you react to each under the headings provided. The scale of appreciation goes from 0 (worst) to 10 (best). Please make any specific comments you have about any of the magazines in the space left at the end.

If you have never heard of a magazine listed here, please put an 'X' in the first column - if you have heard of it, but do not frequently find it on offer on the bookstall, then please place a 'Y' in the first column.

Section one: 'Enthusiast Press'

Column 1 = Project content and quality
2 = News and features
3 = Layout and presentation
4 = Advertisement content
5 = How often do you buy it

TITLE	1	2	3	4	5
a Practical Electronics					
b Practical Wireless					
c Everyday Electronics					
d Wireless World					
e Electronics Today Int					
f Hobby Electronics					
g R&EC					
h Elektor					
i RadCom					
j Short Wave Magazine					
k QST (USA)					
l 73 (USA)					
m Ham Radio (USA)					
n Radio-Electronics (USA)					
o Popular Electronics (USA)					
p Computing Today					
q Practical Computing					
r Personal Computer World					
s Byte (USA)					
t Liverpool software Gazette					
u Others					
.					
.					
.					

■ If you have any favourite features, please state the magazine, and the title of the feature:

____

____

____

____

Section two : 'Professional Press'

Much the same as above, but this time we would like you to consider carefully just how much effort you put into reading the magazine

Column 1 = Newsworthyness
2 = Feature articles
3 = Product reviews
4 = Advertisement value
5 = How thoroughly do you read it

TITLE	1	2	3	4	5
a New Electronics					
b Electronic Engineering					
c Electronic Times					
d Electronics Weekly					
e Electronics & Power (IEEE)					
f Electronic Product Design					
g Electronic Equipment News					
h Electronic Product News					
i What's New in Electronics					
j Electronics Industry					
k Communications International					
l Communications Engineering					
m Electronics (USA)					
n Electronic Design (USA)					
o Microwave System News					
p RF Design (USA)					
q Microwaves (USA)					
r Others					
.					
.					
.					
.					

Q2 How much time do you spend each month on reading magazines? (Please tick the appropriate box):

0-2 hours □ 2-4 hours □
4-6 hours □ 6-10 hours □
over 10 hours (please indicate) □

■ How closely do you read the adverts?

a) when looking for something specific □
b) general scan to see what's new □
c) avidly □
d) try and avoid □

Q3 How long do you keep your copies for?

a) 0-2 months □ b) 2-6 months □
c) 6-12 months □ c) longer □

If this time varies widely for different magazines, please insert the appropriate letter from the above after column 5 back in Q1.

Q4 How do you usually discover a magazine ?

a) Advertisement □ b) Impulse buy □
c) Friends copy □ d) Seen at work □
e) Seen at college □ e) Mystery □

Q5 Please list the 5 most recent constructional projects you have undertaken, indicating both the source of inspiration, and your overall estimate of the success achieved: (using a scale of 0-10)

1
Source ____________________
Success

2
Source ____________________
Success

3
Source ____________________
Success

4
Source ____________________
Success

5
Source ____________________
Success

■ Does the availability of a complete kit to support a project influence your decision ? YES / NO
Would an easily accessible technical support service offered by a magazine influence your decision to build ? YES / NO....and your choice of magazine ? YES / NO
(Please delete as apprpriate)

■ What 5 projects would you most like to see in a magazine ?

1 ____________________
2 ____________________
3 ____________________
4 ____________________
5 ____________________

Q6 Do you buy from mail order advertizing:

a) Exclusively ☐ b) Frequently ☐
c) Occasionally ☐ d) Last resort ☐
e) Never ☐ f) No longer ☐

■ How do you prefer to pay ?
a) Access ☐ b) Barclaycard ☐ c) Cheque ☐
d) PO ☐ e) Other ☐

Broadly speaking, is the service:
a) Good ☐ b) Bad ☐ c) Indifferent ☐

■ Where do you buy the majority of your electronic parts from ?

____
____
____

■ Are you satisfied with the service ?

____
____
____

■ What improvements could be made to the service you get from Mail Order suppliers?

____
____
____
____

Q7 Please rate your own interests on the 0-10 scale, using the following headings:

a) Radio Communications
b) CB
c) HiFi
d) Broadcast radio
e) TV
f) General electronics
g) Computing hardware
h) Software
i) Computing *applications*
j) Others

____
____
____

Q8 Test equipment: please tick the appropriate box

Column 1 : Currently owned
Column 2 : Have ready access to (work/college)
Column 3 : Hope to get soon
Column 4 : Made/make yourself

Item	1	2	3	4
a) Multimeter	☐	☐	☐	☐
b) DVM	☐	☐	☐	☐
c) Frequency counter	☐	☐	☐	☐
d) GDO	☐	☐	☐	☐
e) RF sig gen	☐	☐	☐	☐
f) AF sig gen	☐	☐	☐	☐
g) AF powermeter	☐	☐	☐	☐
h) RF powermeter /SWR meter	☐	☐	☐	☐
i) Spectrum analyzer AF	☐	☐	☐	☐
j) Spectrum analyzer RF	☐	☐	☐	☐
k) Logic analyser	☐	☐	☐	☐
l) Others:	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐
	☐	☐	☐	☐

Q9 About you, please. We promise names and addresses will not be supplied to any external mailing list agencies, and that you will not be pestered to subscribe to the Reader's Digest or Which......

Your Name ____________________
Your age and gender ____________________
Your address

____
____
____
____
____

■ Your level of education, please:
a) CSE ☐ b) O-Level ☐ c) A-Level ☐
d) ONC ☐ e) HNC ☐ f) Degree ☐
g) PhD ☐ h) other ☐

■ If you are currently a student, please state the name of the establishment and the course:

____
____
____

Q10 Computing Survey:

A Survey within a Survey - we are trying to establish the present 'standards' - and exactly what approach our readers need:

1 ■ Do you own a 'personal' computer ?
YES / NO

2 ■ If 'YES', what make or configuration of hardware:

3 ■ Do you have access to a computer:
a) At school
b) At college
c) At university
d) At work
e) Other (please specify):

■ What type of computer ?

4 ■ What programming languages do you know ? Please rate your competence level from 1-10.....
a) Machine code(s) (please specify):

b) High Level languages (please specify and indicate any machine variant or dialect):

5 ■ How did you learn programming ?
a) School ☐
b) College ☐
c) University ☐
d) Commercial course ☐
e) Self taught ☐
f) Other (please specify)

6 ■ Will you be following the BBC's course on computing
a) Occasionally ☐
b) Whenever possible ☐
c) Thoroughly ☐
d) Not at all ☐

7 ■ How would you like to see *R&EC* approach the subject of computing and microprocessors ?

Thankyou very much for your time and patience - anything you have said will be taken down and used as evidence that *R&EC* is responding to the needs and wishes of its readers. If you are school/college or you have friends who want more copies of this form to submit their own ideas - then please write and ask with an SAE that's big enough for the number you want.

For the future student of Sociology: This is a typical example of the onset of Thatcherism & all its works which brought

RADIO & ELECTRONICS
CONSTRUCTOR

about the downfall, in this ?small way of RC. RC's successor failed miserably. Sic transit gloria mundi. Jim Jobe 8 Feb. 2007.

Please send completed forms to:

RADIO & ELECTRONICS CONSTRUCTOR
1981 READER SURVEY
57 MAIDA VALE
LONDON W9 1SN

Subscriptions may be paid by PO, cheque, Access or Barclaycard. Please make the cheques out to "Radio and Electronics Constructor"

4.3.1.3. **Limit**

At any modulating frequency, the frequency deviation shall not exceed +/-2.5 kHz.

4.4. **Adjacent Channel Power**

4.4.1. **Definition**

The adjacent channel power is that part of the total power output of a transmitter under defined conditions of modulation, which falls within the bandwidth of a receiver of the type normally used in the system and operating on a channel either 10 kHz above or below the nominal frequency of the transmitter.

4.4.3. **Limits**

The adjacent channel power shall not exceed a value of 60dB below the carrier power of the transmitter, without the need to be below 2uW.

4.5. **Spurious Emissions**

4.5.1. **Definition**

Spurious emissions are emissions at frequencies other than those of the carrier and sidebands associated with normal modulation. The level of spurious emissions shall be measured as:

a) Their power level in a specified load, where the equipment is fitted with output terminals and

b) Their effective radiated power when radiated by an integral antenna or from the cabinet and chassis of the equipment.

4.5.2. **Method of Measurement — Power Level**

a) The transmitter output shall be connected to either a spectrum analyser via an attenuator, or an artificial load, with means of monitoring the emission with a spectrum analyser or selective voltmeter.

b) The transmitter shall be unmodulated and at each spurious emission in the frequency range 100 kHz to 1000 MHz, or four times the working frequency whichever is the greater, the level of the emission shall be measured relative to the carrier emission.

c) The power level of each emission shall be determined by applying the ratio measured to the carrier power level determined in Clause 4.2.3.

4.5.3. **Method of Measurement — Effective Radiated Power**

a) On a test site fulfilling the requirements of Clause 3.2. the transmitter shall be placed at the specified height on the support.

b) The transmitter shall be unmodulated and its output connected to an artificial load, where the equipment is fitted with output terminals (Clause 3.1.)

c) Radiation of any spurious emissions shall be detected by the test antenna and receiver, over the frequency range 30 to 1000 MHz or four times the working frequency whichever is the greater.

d) At each frequency at which an emission is detected, the transmitter shall be rotated to obtain maximum response.

e) The transmitter shall be replaced by a signal generator and dipole antenna and the effective radiated power of the emission determined by a substitution measurement.

f) The measurements shall be repeated with the test antenna in the orthogonal polarisation plane.

g) The measurements shall be repeated with the transmitter modulated with normal test modulation (Clause 3.4.)

h) The measurements shall be repeated for any alternative integral antenna which can be supplied with the equipment.

4.5.4. **Limits**

Any spurious emission from the transmitter with and without any ancillary equipment, expressed as a power into as test load or as a radiated power, in either plane of polarisation, shall not exceed 50nW within the following frequency bands:

80 MHz — 85 MHz	135 MHz — 136 MHz
87.5 MHz — 104 MHz	174 MHz — 230 MHz
108 MHz — 118 MHz	470 MHz — 862 MHz

The power of spurious emissions at any other frequency outside the above bands shall not exceed 0.25uW.

5. **RECEIVER**

5.1. **Receiver Spurious Emissions**

5.1.1. **Defnition**

Spurious emissions from receivers are any emissions present at the input terminals or radiated from an integral antenna or the chassis and case of the receiver.

5.1.2. **Method of Measurement for Equipment Fitted with Antenna Terminals**

a) The methods shall be as described in Clauses 4.5.2. and 4.5.3. except that the test sample shall be the receiver.

5.1.3. **Method of Measurement for Equipment Incorporating Integral Antenna**

a) The method of measurement shall be as described in Clause 4.5.3. except that the test sample shall be the receiver.

5.1.4. **Limits**

Any spurious emission from a receiver expressed either as a power into a test load or as a radiated power, shall not exceed 20nW on any frequency.

Comment

The obviously noteworthy part of the specification is the choice of 40 channels (as opposed the Euro standard of 23 channels), and the starting point of the band — which bears no relation to any other CB service anywhere in the world. Whilst this may have the CB fraternity beating its breast and wailing, it is basically good news for newcomers, since the band is a great deal less cluttered (at present it seems it is used for weather balloons and other non-civil purposes).

The use of straight 10kHz increments makes the use of existing CB synthesiser systemss difficult — since the US 40 channel plan jumps from 10kHz to 30 kHz between 22 and 23, and channels 25/26 jump 20 kHz. The same sort of trouble occurs at channels 3/4. 11/12, 19/20.

The start point at 27.60125MHz also means that the simple 'decade' approach to synthesis would require a division of 2.760125 to arrive at the reference of 10kHz spacing.

The US plan starting at 26,965MHz is divided by 2,6965 to get 10kHz in a direct synthesis system. Obviously, a mixing synthesiser (*Figure 2*) where the synthesiser is responsible for controlling an scillator that does not directly correspond to the output frequency can simply produce any 40 channels in 10kHz increments — given that the channel spacing and numbering remains consistent. The start point is simply determined by the frequency of a crystal oscillator used to mix with the VCO — first get your synthesiser VCO to tune.—

10.000 to 10.400 MHz (simple stuff for the cognescenti)

...then mix with 6.90125MHz from a crystal oscillator for 'receive' with a 10.7MHz IF offset (oscillator low), and 17.60125 for the direct transmit frequency.

This approach would call for a few extra coils to trap the mixing products, but it can readily be handled by a competent designer.

Power Politics

The power has been carefully considered to provide a realistic and workable range — and when you take into account the simple fact that the UK band is relatively uncluttered by continental users (in fact, it is unique as a

CB frequency), then you won't need extra urge to blast through the interference. In fact, the conditions may approach the relative calm of a VHF allocation.

The use of an 'Effective Radiated Power' of 2W means that the range will be about 3-5 miles in indifferent conditions mobile, peaking at 10-15 miles with a bit of luck and a good installation.

The base station power can still be 2W ERP — but if the base of the antenna is more than 7m above ground level, then a 10dB attenuation of the transmitter signal is required. The original draft suggested a fixed attenuator to actually plug into the set — but since this would lead to confusion and the unacceptable attenuation of the receiver sensitivity, this has been relaxed to include a simple high/low power switch on the front of the set.

Whether or not anyone will be good enough to observe this rule remains to be seen. Most realists agree that since no one has managed to stamp out CB in its currently totally illegal form, then it is doubtful if this rule will be closely observed.

The HO's main reason being that unless some steps are seen to be taken to prevent excessive range being achieved by base stations, then the band will get unduly clogged (witness the present naughty-forty channels), and the prime intention of the CB service will become submerged in a morass of pseudo radio amateur stations trying to work the DX by the sheer brute force and ignorance that this would require.

Another reason is that most domestic electronic and TV equipment is fairly impervious to 400mW (4W RF attenuated by 10dB) of 27MHz closeby, and thus the authorities have covered any potential uproar when the TV viewing public finds the breakers breaking up Coronation Street by showing that if their rules are followed, then this is not a problem.

That it *will* be a problem is tacitly acknowledged, since quite apart from failing to observe the power switch for a base station, there is little doubt that RF amplifiers will be hung on the output socket, and so 10dB of boost will be applied by those CBers who don't know any better,

It might have been better to suggest that the manufacturer provides a set of five 27MHz traps with Belling-Lee coax terminations (universal for UK TVs) rather than this nebulous low power attenuator. It seems that we may all find out the hard way.

A la Mode....

FM with 2.5kHz peak deviation roughly equates to the range achieved by AM. Last months' supplements speculated on this point, so we won't repeat it here. The UK's deviation 'allowance' is more generous than most, and hopefully this will provide further persuasion for the AM brigade to give it a try.

We'll say this again though — an FM only set will be cheaper and far more reliable than an AM or AM/FM set — see the announcement elsewhere in this issue.

Come back....

There will doubtless be a tirade from some existing CB user groups. There always is, and isn't it getting boring? What we have here is the most workable solution yet offered in Europe, that avoids total destruction of the existing users service in 27MHz (like the paging services opt cited). The HO has pulled a hitherto unimagined 40 channels out of the bag, and could scarcely now be expected to retrace. They have possibly let themselves in for the first official 80 channel CB service anywhere, since unless human nature can be changed — or hanging reintroduced for sets using the illegal 27MHz allocations, then sooner or later some concession to the US standard may have to be made.

It would be nice to think that we British have a shade more sense than those others who have all but destroyed the CB service in other countries. If you want to talk across the Atalantic and have enormous DX potential, then for heaven's sake get an amateur radio operator's licence. Children of 13 manage to do it with surprising ease — and so can you, if you have shown enough enthusiasm to buy this magazine.

Putting away the toys....

Under any circumstances, CB is a toy compared to the capability of 'amateur radio'. The 144-146MHz band offers a plethora of ready made gear, a range that is 2 to 3 times that available from 27 MHz on a car-to-car basis, and over 60 miles if your use the repeaters available. The antenna is unobtrusive and efficient, and the people you meet mostly speak English, and are not engaged in overly illegal behaviour.

You will learn facts and information in the course of getting the radio amateur qualification that will provide you with a great deal of assistance in operating — and you will quickly appreciate that CB has too many limitations. CB will be fine for 'around the town' and other family members who simply want to keep in touch — but do not expect more than that.

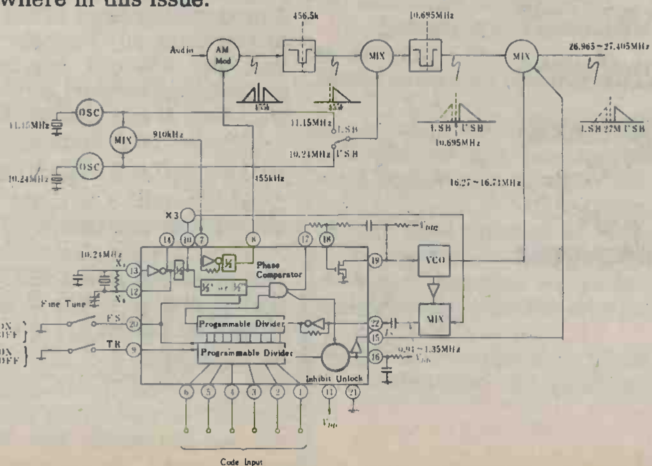
The HF band allocations available to the radio amateur permit global coverage 24 hours a day if you have the time and patience to set up the right sort of station. By all means cut your teeth on CB to see if it seems like a hobby you would like to pursue, but please view it as a stepping stone to better things, and don't go out and try to blast your way through by using illegal power and spoiling CB for others.

CB is simply not suitable for 'DXing',

Next time....

This month's big news has once again reshuffled the schedule. We will give a run down on 934MHz (as it now is) next month, and give more details on the equipment for legal CB.

Figure 2



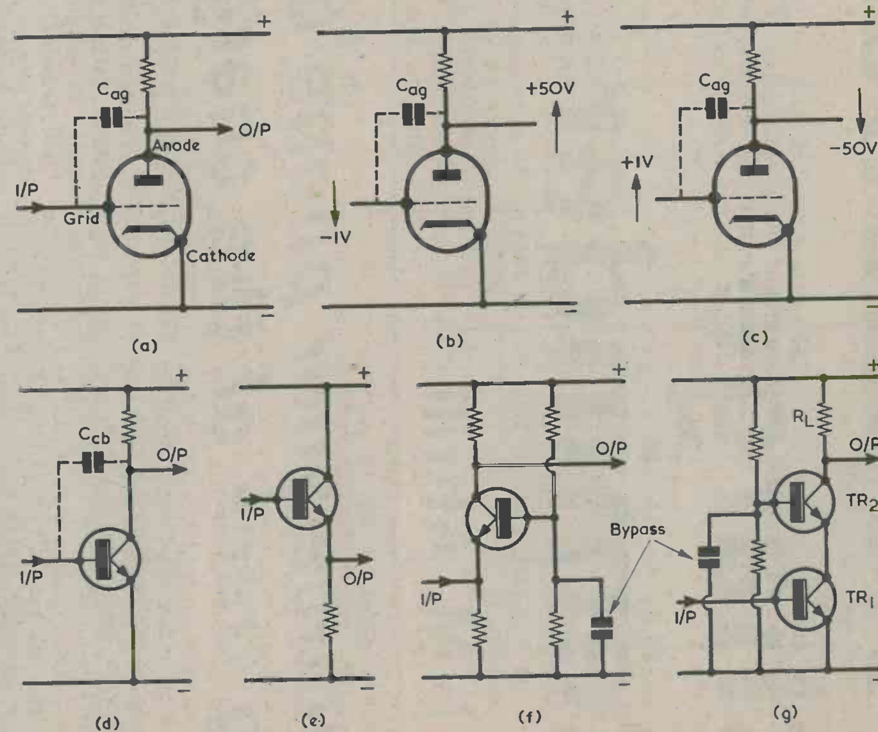
MILLER EFFECT

Miller Effect can be most readily explained with the old-fashioned triode valve. This is shown in (a) and there is a stray capacitance, Cag, between anode and grid. Let us say the valve has a voltage gain of 50 times.

In (b) we take the grid negative by 1 volt, whereupon the anode goes positive by 50 volts. The voltage across Cag increases by 51 volts and so the charging current flowing into it is 51 times that which would have been given if the anode voltage had been fixed. In (c) the grid goes positive by 1 volt and the anode goes negative by 50 volts, causing the voltage across Cag to fall by 51 volts. There is a 51-fold increase in discharge current.

Charge and discharge currents are proportional to capacitance and so the effective grid input capacitance of the triode is 51 times Cag. Generally, the effective input capacitance is equal to (G + 1) Cag, where G is the voltage gain of the triode. This increase in input capacitance is known as Miller Effect.

Miller Effect is given in the common emitter transistor of (d) and is equal to (G + 1) Ccb, where G is the voltage gain from base to collector. Quite high effective input capacitance results and this can limit high frequency amplification. Miller Effect is absent in the emitter follower of (e) and the common base amplifier of (f). It is also absent in the cascode amplifier of (g). Here, TR2 acts as a common base amplifier, holds the collector of TR1 at a fixed voltage and allows the collector current of TR1 to flow through RL. Since there is no voltage change at TR1 collector, Miller Effect is overcome.



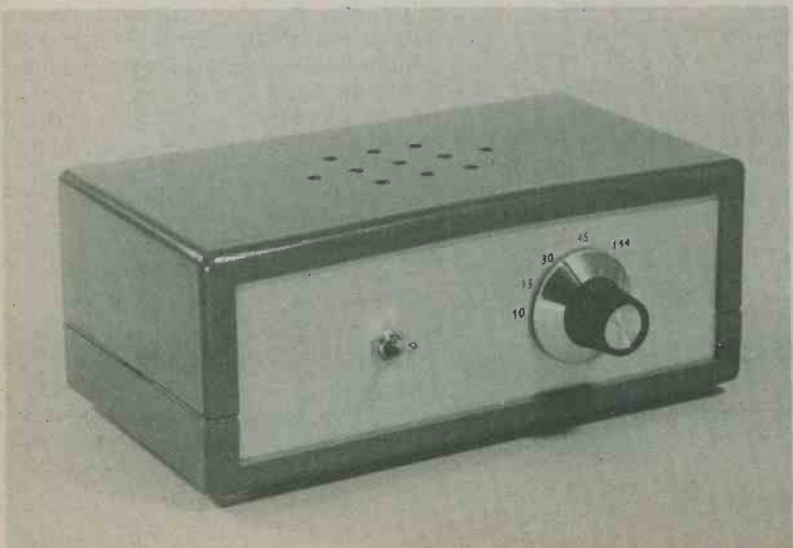
Telephone Charge Reminder

By I. M. Attrill

Reduce your phone bill by keeping track of the charges.

When making telephone calls it is very easy to lose track of the passage of time, with consequent high phone bills arriving on the doormat in due course! One way of overcoming this problem is to have a device which gives an indication of the number of time units which are being accumulated while the call is in progress. This can either be in the form of a unit which gives an actual read-out of the number of units, or it can simply be an instrument which gives an indication of the passage of each unit. In most instances the second is probably the most practical approach since it is relatively cheap and simple, but is still, nevertheless, effective at preventing the telephone user from losing track of time (and money spent).

The unit to be described provides a brief audible tone each time a unit elapses. The units are for inland calls, as detailed in the British Telecom leaflet "Telephone Charges", and the amount of time corresponding to one unit depends on the distance involved and the time when the call is made, as shown in the Table. There are actually nine different time units in use at the present time. However, the accuracy of the unit does not really merit the inclusion of both the 45 second and 48 second times, as these are so close together, and they are therefore covered by an intermediate time of 46.5 seconds. Also, it was not considered to be worthwhile including a 9 minute interval since, at this rate, even long calls cost very little. The timing intervals which the unit provides can be seen in the range switching circuit of Fig. 2.



The finished unit is robust, compact, and simple to operate and free from trailing wires.

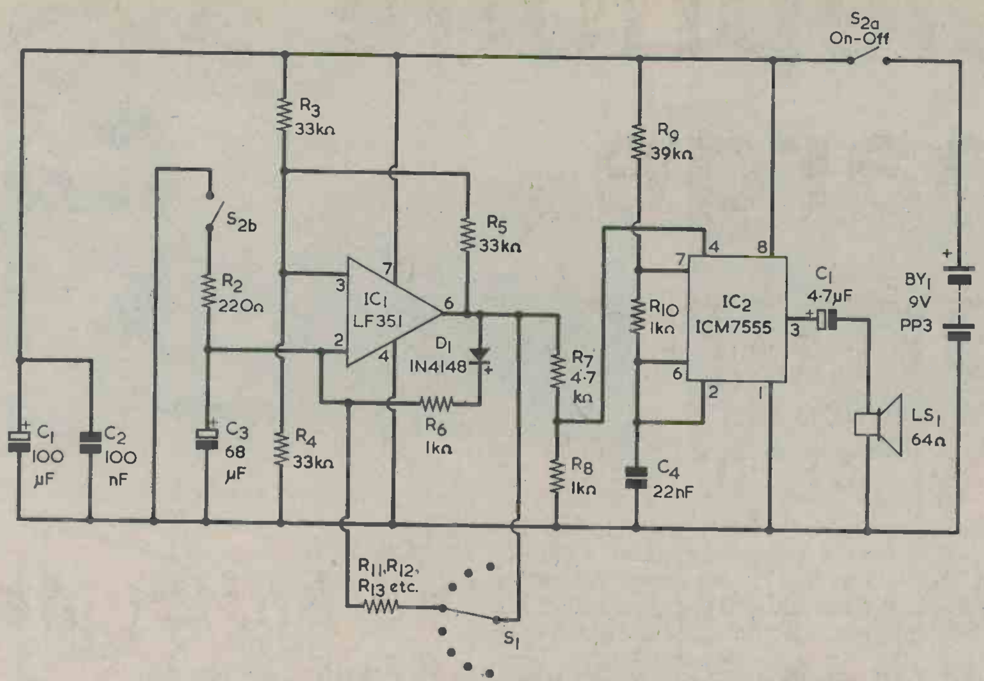


Fig. 1. The circuit diagram of the Telephone Charge Reminder

THE CIRCUIT

There are two main sections in the unit, these being a timer which gives brief pulses at the ends of the appropriate intervals and a tone generator which produces an audible tone when these pulses are present. In the circuit given in Fig. 1, IC1 is in the timer section and IC2 is in the tone generator section.

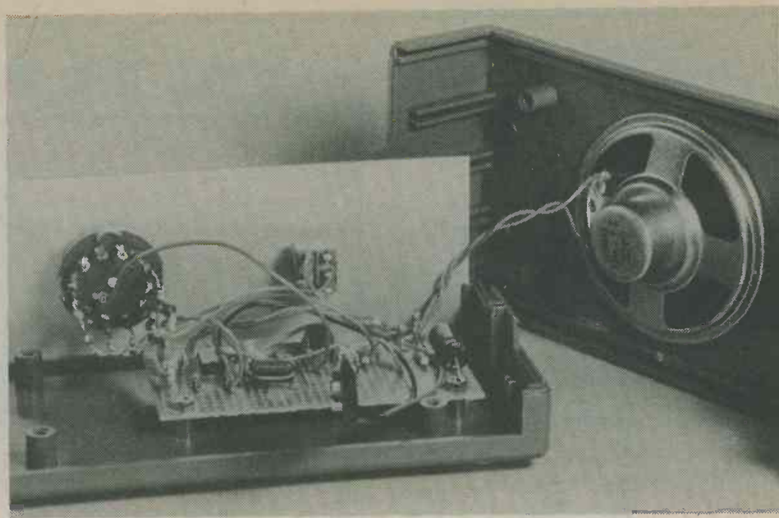
IC2 is an ICM7555 employed in a standard astable circuit which oscillates at around 1.6hHz. It drives the loudspeaker via d.c. blocking capacitor C5. The ICM7555 has its pin 4 returned to the timer section, and it will only oscillate when this pin is taken more than about 0.5 volt positive of the negative coil. An ICM7555 is used instead of the standard 555 because it draws a much lower quiescent current. The ordinary 555 draws a current of about 6mA at 9 volts, and would cause the total current consumption of the circuit to be approxiamately 8mA. The quiescent current requirement of the ICM7555 is only about 60μA, and causes the total average current drawn to be of the order of 2mA. This is low enough to permit economic operation with a small PP3 battery, and such would not be the case if a standard 555 was used.

TABLE Telephone Time Units			
	Local	**Up to 56km**	**Over 56km**
Peak	**2 minutes**	**30 seconds**	**10 seconds**
Standard	**3 minutes**	**45 seconds**	**15 seconds**
Cheap	**9 minutes**	**144 seconds**	**48 seconds**

The timing circuit around IC1 is rather similar to a 555 circuit in that the timing capacitor, C3, charges to around two-thirds of supply voltage and discharges to one-third of supply voltage. At switch-on C3 is discharged, whereupon the output of IC1 is high and the non-inverting input of the i.c. at pin 3 is at two-thirds of supply potential since R5 is effectively in parallel with R3. The capacitor charges rapidly through D1 and R6 until the voltage at the inverting input very closely approaches that at the non-inverting input, whereupon the output swings low and effectively connects R5 in parallel with R4. The capacitor now discharges slowly, through whatever resistance is selected by S1, until the voltage across it falls to one-third of supply potential. The i.c. output then goes high again and the next half-cycle commences. The ICM7555 is enabled when the i.c. output is high and produces a tone burst for a fraction of a second. The potential divider given by R7 and R8 is needed because the output of IC1 does not, in practice, go to a sufficiently low voltage when it is low.

Thus, the overall circuit produces short tone bursts at intervals which are governed by C3 and the timing resistance selected by S1. As with all circuits of this nature the initial cycle is longer than the subsequent ones because the timing capacitor has to charge from zero volts instead of from one-third of the supply voltage. This causes no problems in the present application because the initial charge period is the very high brief time given as C3 charges through D1 and R6. The subsequent discharge period in the first cycle is the same as the discharge period in the following cycles. The unit produces a short tone burst at switch-on, and this is correct since the subscriber is charged one unit as soon as the phone call is answered, which is when the circuit is switched on.

The internal view shows the straight forward method of construction with the loudspeaker mounted underneath the lid.



The full timing resistance circuit is given in Fig. 2. The discharge time for C3 is approximately 0.685CR seconds and, with C3 at 68μF, this means a timing resistance of approximately 21.5kΩ per second. If, in the future, the telephone time units are changed, the timing resistors can be altered accordingly. The required value is equal to 21.5kΩ multiplied by the required interval in seconds. Either the nearest preferred value can be used, or two resistors in series can be employed if the calculated value is too far from a preferred value. It is for this reason that two resistors are used at the 144 second position of S1. The switch is a 12-way type with adjustable end stop set for 7-way operation. If future charges in time units are introduced by British Telecom it is an easy matter to increase or decrease the number of ways provided, should this be necessary.

It is not necessary for the unit to have an extremely high degree of accuracy, but to keep errors reasonably small the timing resistors in Fig. 2 should have a tolerance of 5%. This may necessitate the use of ½ watt instead of ¼ watt resistors for values above 1MΩ. Also, C3 should be a tantalum bead capacitor, which will have a much closer tolerance on value than an ordinary electrolytic capcitor. Tantalum bead capacitors with the value specified for C3 are available from several retail outlets, including Watford Electronics, 33/35 Cardiff Road, Watford, Herts.

S2(a) (b) is the on-off switch, with S2(a) being in the positive supply rail circuit. S2(b) discharges C3 through current limiting resistor R2 when the unit is switched off. This is necessary because the capacitor can otherwise retain a charge if the unit is switched off for a brief time and is then switched on again, resulting in an incorrect initial timing period.

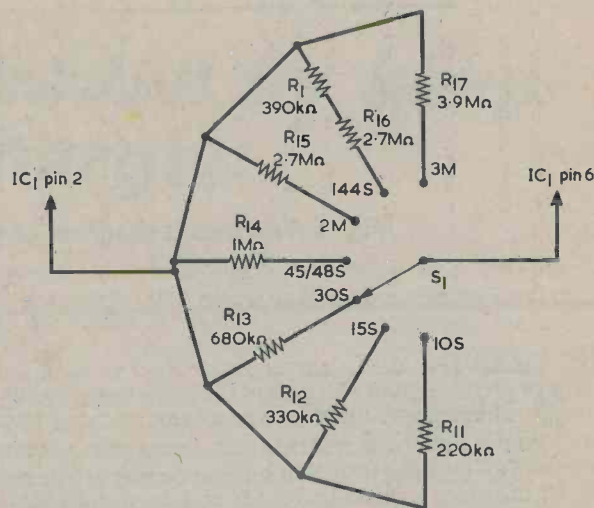
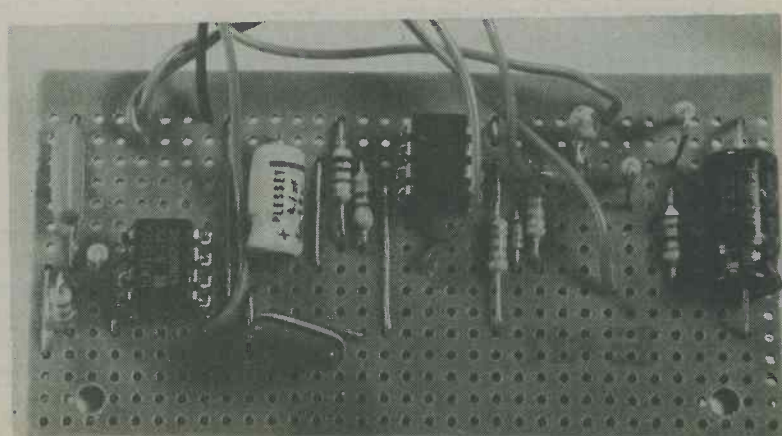


Fig. 2. Details of the range switching.

Close up view of the Veroboard showing the component mounting details.



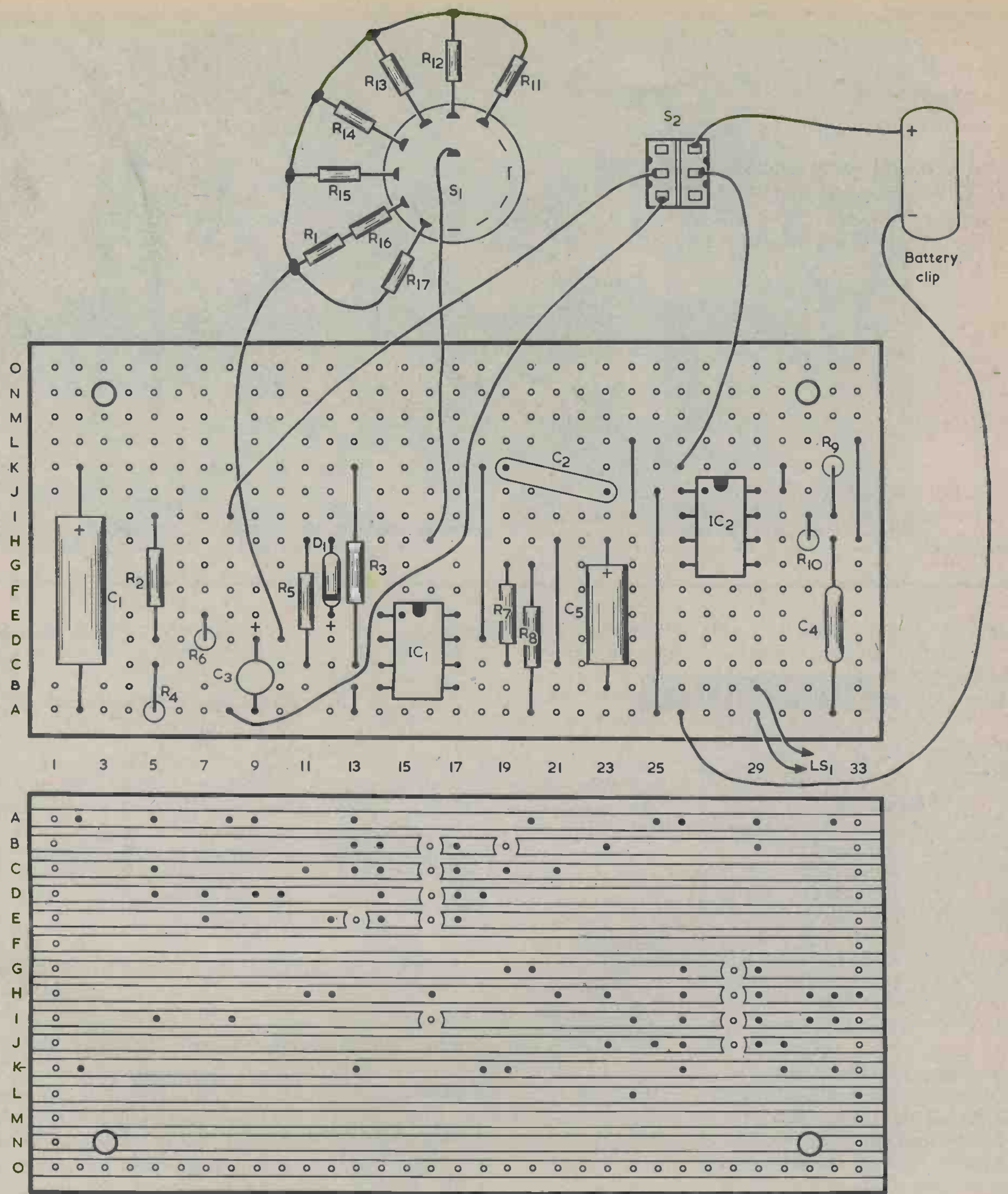
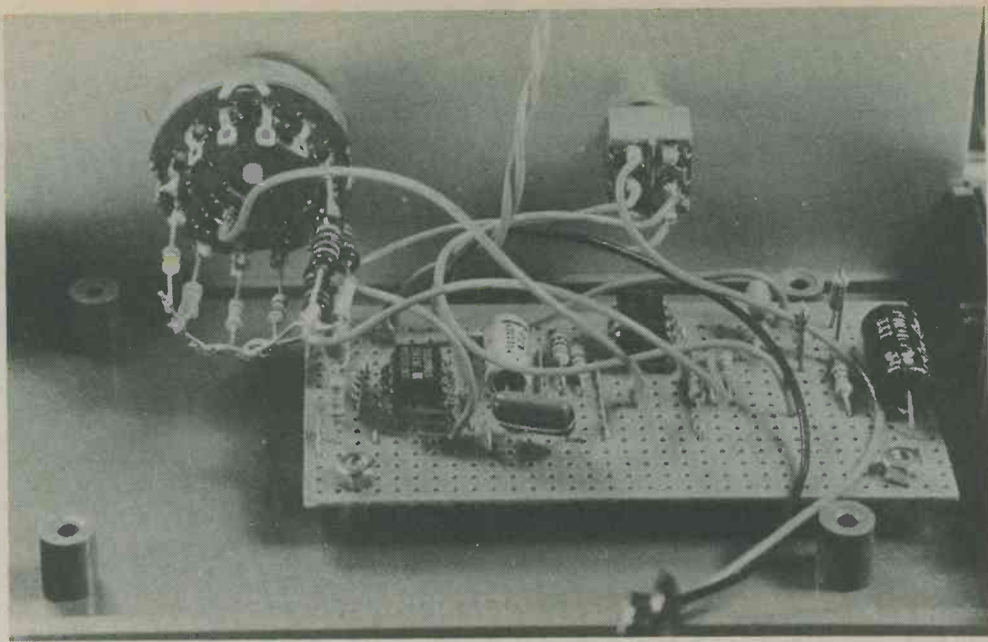


Fig. 3 Details of the component panel and the wiring of the unit.

CONSTRUCTION

A Verocase type 202 21041C (old part number 75-1238-D) measuring 153 by 84 by 59 mm. provides a suitable housing for the project. As is shown in the photographs, the two switches are mounted on the front panel. The speaker is mounted on the underside of the top panel of the case, and it is necessary to make a speaker grille here by drilling a matrix of small holes. The speaker is glued in place by means of a modest amount of good quality adhesive taking care to ensure that none of the adhesive gets on to its diaphragm, where it could upset its operation.

Most of the other components are assembled on a piece of 0.1 in. Veroboard having 15 copper strips by 33 holes. The timing resistors are soldered direct to the tags of S1. Details of the Veroboard and all the wiring of the unit are given in Fig. 3. The board is secured to the bottom panel of the case by two M3 bolts and nuts, with spacing washers on the bolts to



COMPONENTS

Resistors
(All ¼ watt 5% – see text)
R1 390kΩ
R2 220Ω
R3 33kΩ
R4 33kΩ
R5 33kΩ
R6 1kΩ
R7 4.7kΩ
R8 1kΩ
R9 39kΩ
R10 1kΩ
R11 220kΩ
R12 330kΩ
R13 680kΩ
R14 1MΩ
R15 2.7MΩ
R16 2.7MΩ
R17 3.9MΩ

Capacitors
C1 100μF electrolytic, 10V. Wkg.
C2 0.1μF polyester, type C280
C3 68μF tantalum bead, 6V. Wkg.
C4 0.022μF polyester, type C280
C5 4.7μF electrolytic, 10V. Wkg.

Semiconductors
IC1 LF351
IC2 ICM7555
D1 1N4148

Switches
S1 1-pole 12-way rotary with adjustable end stop
S2 d.p.d.t. miniature toggle

Speaker
LS1 miniature speaker, 64Ω

Battery

BY1 9 volt battery type PP3

Miscellaneous
Plastic case (see text)
Veroboard, 0.1 in. matrix
Battery connector
Control knob
Nuts, bolts, wire, etc.

keep the board underside clear of the inside surface of the case. The board is mounted towards the left hand side of the case, as seen from the front, with the mounting holes to the rear. This will leave ample space for the PP3 battery on the right hand side of the case.

Although IC2 is a CMOS device it requires no special handling precautions because of its internal protection circuitry.

USING THE UNIT

In use, S1 is set to the appropriate timing interval with S2(a) (b) switched off. The call is dialled and S2(a) is turned on when the call is answered. The unit will give a brief tone burst at switch-on to indicate that the first time unit has been charged and will then produce further tone bursts at the timed intervals.

■

In your work-shop

Problems with T.V. gain control:

Too much contrast?

Dick picked up the neat little Japanese monochrome television receiver and carried it over to his bench. A circular loop aerial was connected to two terminals at the upper rear of the cabinet and Dick decided initially to check the performance of the set with this aerial. He plugged the receiver into one of the mains sockets at the rear of his bench and then looked for the on-off switch for the set. On the front panel was the channel selector tuning control and, below the tube, two slide controls and a knob. The slide controls were patently for contrast and brightness, whereupon the knob had to be the volume control. Dick experimentally turned it clockwise. It moved freely without any switch operation, so he pulled it out.

The Workshop was at once filled with a babble of barking puppies. The tube soon came to life, to reveal an advertisement extolling the virtues of Woof-Woof, the Wonder Dog Food.

SOOT AND WHITEWASH

"For goodness'sake," roared Smithy from his side of the Workshop, "turn that down!"

"Sorry, Smithy," said Dick, as he hastily turned back the volume control. "I accidentally turned it up high before I switched the set on."

He looked back at the screen. The commercial had frozen in its final frame. It then faded, to be replaced by the title "Police Chopper Emergency Down Under". The picture reproduced on the tube screen was a little noisy and grainy but otherwise seemed satisfactory. Sound was obviously adequate. Dick tuned next to BBC1, to find a similar picture with a slight background of snow. He had to reduce the contrast slightly to obtain a good picture but no other adjustment was necessary.

He turned the volume control fully back, sat down and glared at the receiver.

Smithy, curious at the unwonted silence from Dick's bench, glanced round at his assistant.

"Dear. oh dear," he complained. "One minute you're raising Bedlam in here, and the next minute you're sitting there all useless just gazing into space."

"It's this set," stated Dick morosely.

"What's wrong with it?"

"Nothing for the moment!"

"Nothing?"

"Nothing at all," repeated Dick. "It's just my luck to have picked a set which has got an intermittent on it."

Smithy put down his soldering iron and walked over to Dick's bench. He looked critically at the picture on the television screen.

"Take off that loop aerial," he ordered, "and try it with the outside aerial."

Obediently, Dick unscrewed the two terminals, removed the loop and then plugged in the lead from the outside aerial. As soon as the aerial plug made contact the receiver produced a grossly over-contrasted picture having almost all its detail in black and white, and with hardly a trace of grey between the two extremes. Dick put the contrast control to minimum, but the excessive contrast was still present.

"That's what we used to call a 'soot and whitewash' picture in the old days," pronounced Smithy in a tone of satisfaction. "You haven't got an intermittent fault here, Dick, you've got a straight-forward automatic gain control snag. The a.g.c. circuitry should have reduced the gain of the set when you applied the much stronger signal which is available from the outside aerial. It didn't, and so that's your fault."

"An a.g.c. fault?" queried Dick as he switched off the set. "I think I'd rather have an intermittent!"

"Nonsense," snorted Smithy, "curing an a.g.c. fault in these monochrome receivers is a piece of cake. See if you can find the service sheet for this set, and I'll show you where the a.g.c. bit is."

Dick walked over to the filing cabinet and, after some searching, located a service sheet for the receiver. He returned and handed it to Smithy, who opened out the circuit diagram on Dick's bench.

"Here we are," said Smithy. "The a.g.c. section in this receiver is very simple, and it uses a single gated a.g.c. amplifier transistor."

Smithy pointed to the a.g.c. section of the receiver circuit. (Fig. 1.).

"You call that simple?" gasped Dick. "To my eyes it looks horrible. For a start, that gated a.g.c. amplifier transistor has got connections going to the first video amplifier, to the line output transformer and to the first vision i.f. stage!"

"Take it easy," said Smithy soothingly. "Let's look at this a.g.c business working from basic. The 625 line u.h.f. transmitted signal has negative modulation, which means that sync pulse tips correspond to maximum signal strength and peak brightness corresponds to minimum signal strength." (Fig.2(a).).

"Well, that's fair enough."

"Right," said Smithy. "Now, to get an a.g.c. voltage we have to get a measure of signal strength after the vision detector, and what could be better than sampling the amplitude of the sync pulse tips? To ensure that the a.g.c. voltage we get isn't influenced by interference, we sample the amplitude of the sync pulses only when they are present." (Fig. 2(b).).

"That's fair enough, too," conceded Dick.

"Good," said Smithy. "First of all we have to get the sync pulse tips from somewhere, and in this set they're obtained from the emitter of the first video amplifier, which happens to be an emitter follower. The vision detector is connected so that the sync pulses in the detected signal are negative-going. So also are the sync pulses at the emitter of the first video amplifier, and these are applied to the base of the gated a.g.c. transistor through a 330Ω resistor. We want to sample the sync pulse amplitude only when the pulses are present, and so we supply the a.g.c. transistor from a floating winding on the line output transformer. The waveforms accompanying the circuit diagram in this service sheet tell us that the line flyback section of the line output waveform, as applied to the transistor collector via a 1N60 diode, are negative-going." (Fig. 3.).

"I'm beginning to make sense of this now," said Dick keenly, as he gazed at the circuit. "The a.g.c. transistor is a p.n.p. type, and so it will only

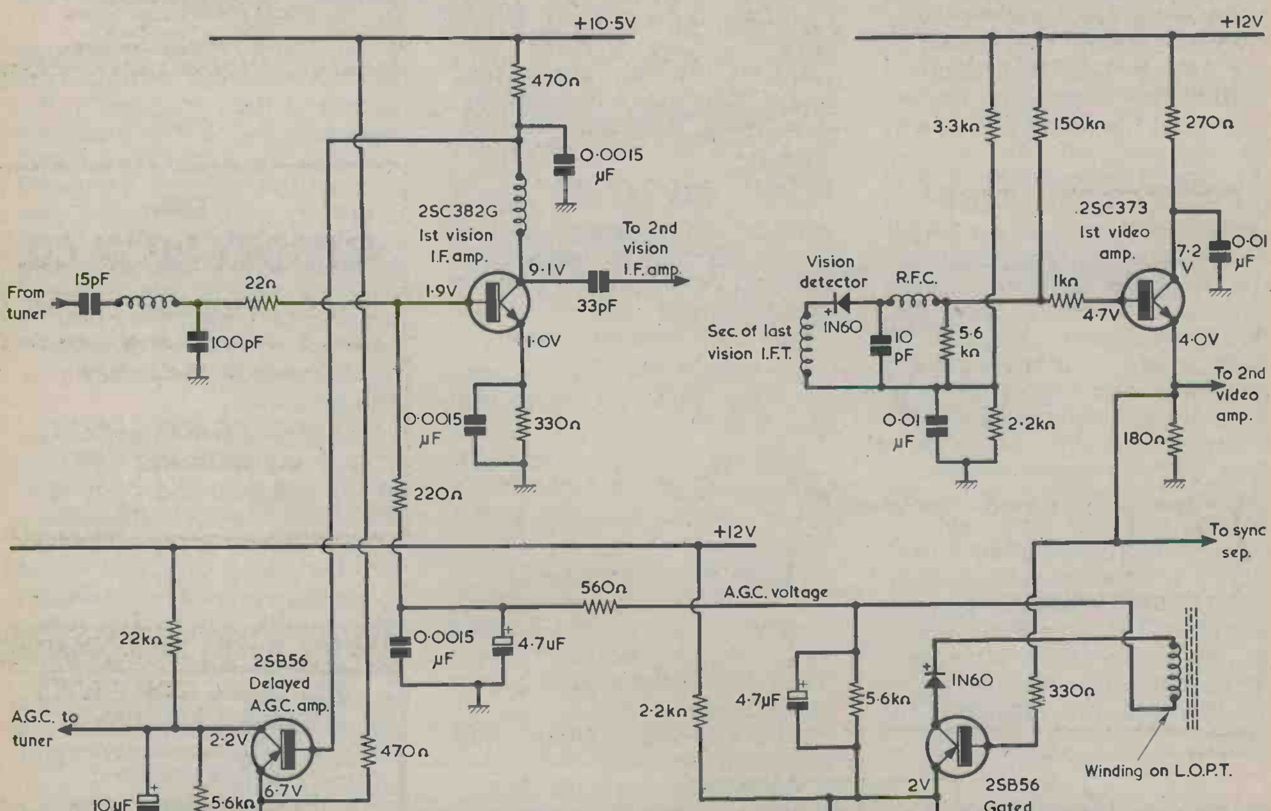


Fig. 1. The gated a.g.c. amplifier and associated circuits in the monochrome television receiver selected by Dick. This circuit is employed in the Teleton receiver model TW-12BS Mk II. The voltages shown are with respect to chassis under no-signal conditions.

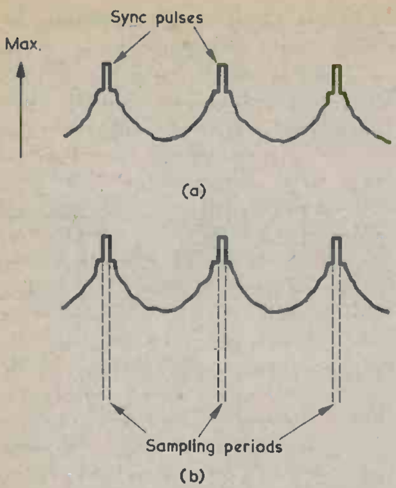


Fig. 2(a). In the 625 line waveform, sync pulse tips correspond to maximum transmitted signal strength.

(b). A gated a.g.c. voltage may be obtained by sampling sync pulse tip level in the detected vision signal at periods which coincide with the sync pulses. The sampling pulses can be obtained from the line output transformer.

be turned on when its collector is negative, which means it will only be turned on during the flyback part of the line output waveform."

"You've got it," stated Smithy, pleased. "During the scan part of the waveform the voltage applied to the collector will be positive and the transistor won't conduct. The 1N60 dode in series with the collector will also make it quite certain that no collector current flows during the scan period."

UPSIDE-DOWN VOLTAGE

"This is all starting to make sense," said Dick happily. "Let's see what we've got up to now. We've got a p.n.p. transistor which is only turned on when sync pulse tips are present. These pulse tips are applied to the p.n.p. transistor base through a 330Ω resistor. Also, the sync pulses are negative-going."

Dick stopped for a moment.

"So?"

"So," continued Dick excitedly, "if the signal amplitude increases, the sync pulse tips go more negative whereupon the p.n.p. transistor must pass a higher collector current."

"That's exactly right."

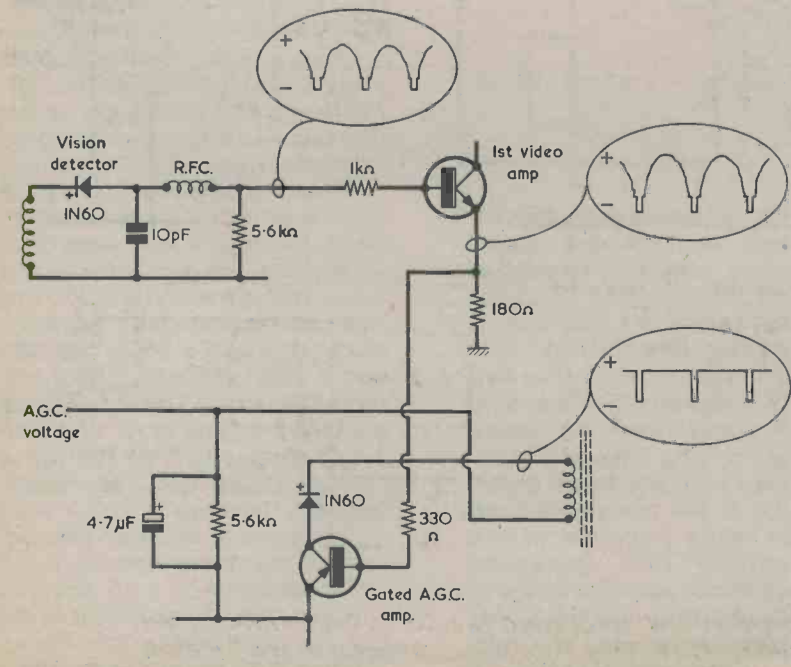


Fig. 3. Waveform polarities in the circuit of Fig. 1.

"And now," said Dick, suddenly crestfallen, "I'm stuck! How does the increased collector current get translated into an a.g.c. voltage?"

"Do you see that 5.6kΩ resistor with the 4.7μF electrolytic across it?"

"Yes."

"Well, when the a.g.c. transistor passes a higher collector current, the upper end of that 5.6kΩ resistor goes positive!"

A look of utter bewilderment spread over Dick's face.

"Goes ***positive?***" he repeated incredulously. "How the flaming heck can the upper end of that resistor go positive?"

"To explain that," said Smithy in reply, "we can start off by assuming that the emitter of the gated a.g.c. transistor is held at a fixed voltage by the 2.2kΩ and 470Ω resistors which connect across the 12 volt supply rails. If we then freeze the action of the gated a.g.c. transistor circuit to an instant during the line flyback, we can pretend that it is fed by a floating battery instead of by a winding on the line output transformer." (Fig. 4.).

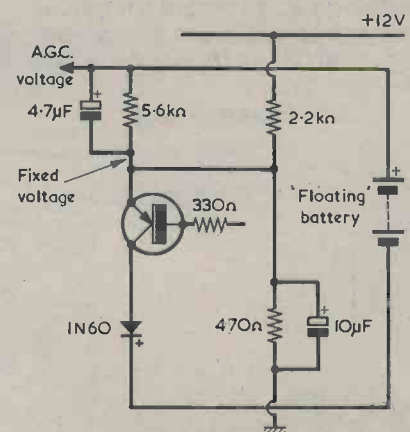


Fig. 4. Redrawing the circuit around the gated a.g.c. amplifier transistor with the action "frozen" to represent conditions during line flyback. The voltage from the line output transformer winding is presented as being given by a "floating" battery with the same polarity. If the transistor base is taken negative of the emitter, the increased collector current flows in the battery and the 5.6kΩ resistor, causing the voltage across the resistor to increase.

"Yes," said Dick slowly, "I think I can visualise that."

"Good," said Smithy. "Now the collector current of the transistor flows only in the circuit loop consisting of the battery and the 5.6kΩ resistor which takes the positive side of the battery back to the emitter. When increasing signal sync pulse amplitude takes the transistor base negative the collector current, as you so rightly said, has to increase. That increased collector current flows through the 5.6kΩ resistor and so the voltage across the resistor must also increase. Since the emitter end of the 5.6kΩ resistor is held at a fixed voltage relative to chassis the other end has to go positive. Got it?"

Dick looked at the circuit in the service manual in a bemused manner.

"Of course the voltage must go positive," he stated slowly. "But it's a bit of a shaker to find that increased collector current in a p.n.p. transistor causes an increased ***positive*** voltage. It seems all upside-down to me!"

"It does need a little imagination to see the effect," agreed Smithy. "Don't forget that our imaginary battery is floating and isn't connected to any part of the remaining television circuitry. When the transistor draws increased collector current it actually causes the whole battery to go positive with reference to the fixed voltage on the transistor emitter."

"Yes," said Dick, "I can understand it now. So, the voltage goes positive with increased signal strength. What happens next?"

"The voltage, which is of course smoothed to a steady level by the 4.7μF capacitor across the 5.6kΩ resistor, is the a.g.c. voltage and it's fed to the base of the first vision i.f. transistor through a 560Ω resistor and a 220Ω resistor. There are two filter capacitors, a 0.0015μF one and another 4.7μF electrolytic, at the junction of these two resistors." (Fig. 5.).

"Hang on a minute. There's something queer here!"

"What's that?"

"Well, the i.f. transistor is an n.p.n. one," stated Dick. "Won't increasing the positive bias voltage increase its gain

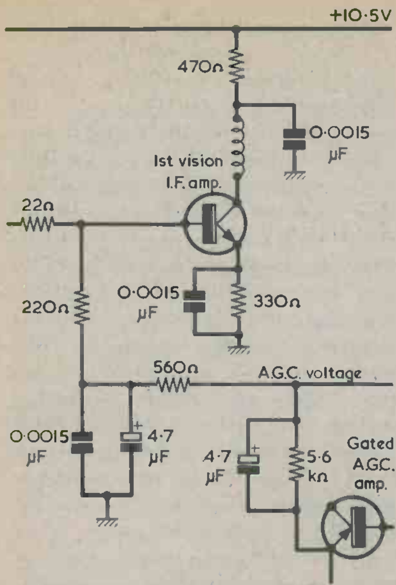


Fig. 5. The a.g.c. voltage at the upper end of the 5.6kΩ resistor is applied via a filter to the base of the first vision i.f. amplifier transistor. The circuit gives forward a.g.c..

rather than decrease it?"

"You're thinking of the a.g.c. systems you find in transistor radios," said Smithy. "With these, the base bias current of an i.f. transistor is reduced when a strong signal is received. But the circuit we've got here uses what is called forward a.g.c. When the a.g.c. voltage from the 5.6kΩ resistor goes positive the increased base bias current in the i.f. transistor causes the internal base-emitter impedance to reduce. This means that there is less signal voltage between the base and emitter and the signal amplitude at the collector goes down. The advantage of forward bias in a television receiver is that the transistor is always giving reasonably linear amplification and there's little risk of cross-modulation effects."

TUNER A.G.C.

"Well, that seems to have wrapped up the a.g.c. business," said Dick with satisfaction. "Just a minute, though, there's another transistor in the a.g.c. circuit. It's called a delayed a.g.c. transistor." (Fig. 6.).

"Ah yes," said Smithy. "That transistor provides delayed a.g.c. for the tuner. As you can see, it's another p.n.p. transistor, and it's wired up so that under no-signal conditions, the emitter is about 6.7 volts positive of chassis and the collector is about 2.2 volts positive of chassis. Which means that the emitter is positive of the collector, which is just what is required for a p.n.p. transistor."

"The base of that transistor," put in Dick, scowling down at the circuit diagram, "goes to a 470Ω resistor in the collector circuit of the first vision i.f. transistor."

"It does," agreed Smithy. "Now, we already know that the base current of that transistor increases with increased signal strength because of the gated a.g.c. action. For low level signals, the voltage dropped across the 470Ω collector resistor will be such that the base of the delay transistor will be positive of its emitter, and the delay transistor won't pass collector current. If a high level signal comes along, the first vision i.f. transistor will pass increased collector current because of the forward a.g.c., whereupon the voltage across the 470Ω resistor will go up. This means that the base of the delay transistor will be taken negative. If it goes sufficiently negative to overcome the base-emitter voltage drop, the delay transistor will start to pass collector current, whereupon its collector goes positive. That collector voltage is fed, as an a.g.c. voltage, to the tuner."

"Why," asked Dick, "do you only pass an a.g.c. voltage to the tuner when there are high level signals?"

"The tuner will have a signal frequency r.f. amplifier before the oscillator and mixer stage," replied Smithy, "and the a.g.c. voltage is applied to the r.f. amplifier. Now, it's very desirable to have the r.f. amplifier running at full gain for all but quite strong signals in order that its output over-rides the relatively high degree of noise which is generated in the following mixer circuit. When the input signal strength reaches a level at which a high degree of automatic gain control is being exerted in the i.f. amplifier the voltage delay is overcome, and a.g.c. is then also fed to the tuner. Signal strengths as high

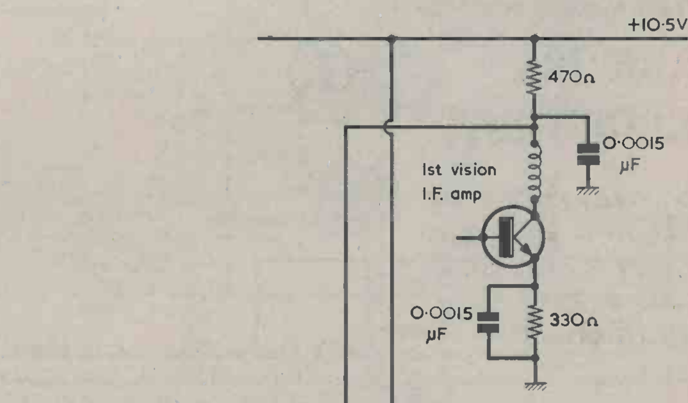


Fig. 6. Details of the delayed a.g.c. amplifier section. This provides a.g.c. for the tuner unit with signal strengths above a pre-determined level.

as this will be capable of overriding the noise which is given in the tuner mixer-oscillator stage. And that's all there is to the delayed a.g.c. section of the circuit."

Smithy glanced at his watch.

"I see that I've done it again," he continued.

"Done what?"

"Spent my time nattering to you instead of getting on with my own work!"

Dick grinned.

"You know you enjoy doing it. Besides, it's necessary, isn't it?"

"In what way?"

"To keep this show of ours on the road!"

FAULT FINDING

Smithy chuckled.

"Perhaps you're right," he said. "Anyway, I might as well see this thing through to the bitter end now that I've started getting myself involved in it. The fact that the picture was so strongly over-contrasted when you plugged the outside aerial in makes it fairly probable, but by no means certain, that the fault is in the gated a.g.c. stage rather than in the delayed a.g.c. stage which controls the tuner. So we'll start an investigation in the gated a.g.c. stage first."

"What sort of checks will you carry out?"

"Ohmmeter checks, I think. Seeing that there seems to be a complete lack of a.g.c. there may be just a simple open-circuit or short-circuit somewhere. Could you get the back off, Dick?"

Obligingly, Dick removed the mains plug from its socket, disconnected the input lead from the outside aerial and took off the back of the receiver. He was soon able to make the printed board available for testmeter checks. Smithy switched Dick's battered testmeter to a low resistance range, short-circuited the test prods and adjusted the set zero control. He next consulted the service sheet and then studied the printed circuit board.

"I'll begin," he announced, "by checking the winding on the line output transformer. Here goes!"

Smithy applied the test prods to the line output transformer winding. (Fig. 7(a).).

"There's very nearly zero resistance there," said Dick, as he observed the meter needle. "Just the odd ohm or so."

"Thank goodness for that," said Smithy in a relieved tone. "I'd had a horrible feeling that the winding might have been open-circuit. If it had been we'd have had to change the whole line output transformer. Well now, there was enough base bias current getting through to the first vision i.f. amplifier transistor for it to work, so I'll assume for the moment that there are no open-circuits in the 2.2kΩ and 470Ω resistors which supply the emitter of the gated a.g.c. transistor, or in the resistors between that emitter and the base of the i.f. transistor. Sync pulses must be getting to the sync separator so let's check that 330Ω resistor in series with the transistor base."

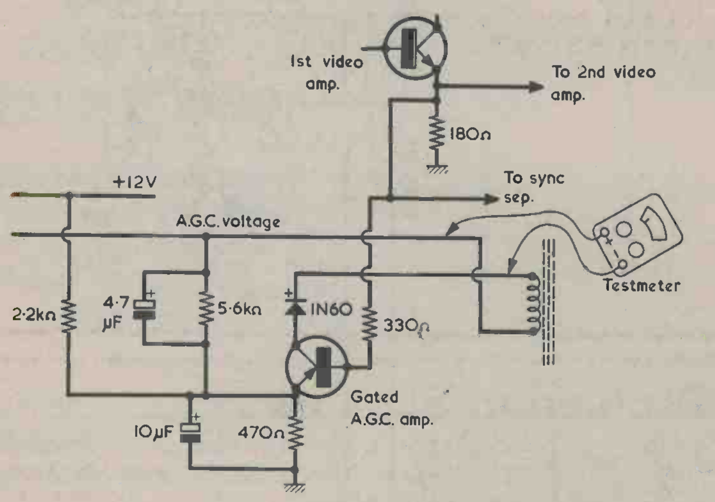
Smithy applied the test prods once more to the printed board. (Fig. 7(b).).

"Did you," asked Dick, "say that the resistance was 330Ω?"

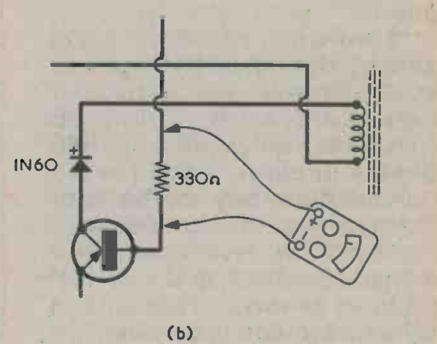
"I did."

"The meter's reading a bit under 280Ω."

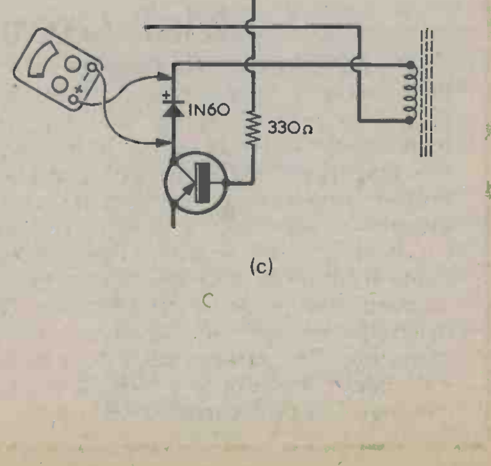
"Not to worry," replied Smithy cheerfully. "The lower reading will be due to other resistances in the circuit which



(a)



(b)



(c)

Fig. 7(a). Smithy first checked the line output transformer winding for continuity.

(b). Next to be checked was the 330Ω resistor in the base circuit of the gated a.g.c. amplifier.

(c). Checking the 1N60 diode. A standard analogue testmeter, switched to an ohms range, will pass forward current through a diode when connected with the polarity shown here.

happen to be connected across the one I'm checking. The next things to check are the 1N60 diode and the gated a.g.c. transistor itself. The diode will be the easier, so I'll do that first."

"Is it silicon or germanium?"

"If my memory serves me properly," said Smithy, "the 1N60 is a germanium diode." He glanced at the receiver circuit diagram, "Ah yes, it must be. There's another 1N60 which is used as the vision detector. Now, if I put the negative meter lead to the diode anode and the positive lead to its cathode, the diode should pass forward current and the meter should give a low resistance reading.

Smithy looked carefully at the printed board, then placed the test prods across the diode. (Fig 7(c).).

There was silence for a moment.

"Well," said Smithy, "what does the meter say?"

"It doesn't say anything," replied Dick. "Have you got the test prods in position?"

"Of course I have."

"Well, the needle hasn't even moved."

"Why that's great!" exclaimed Smithy triumphantly. "We've found the fault!"

"You mean the diode's gone open?"

"I mean just that," said Smithy gleefully. "I'll leave it to you to fit in a new diode."

"I don't think," objected Dick, "that we've got any 1N60 diodes in stock. I don't recall our handling any diodes with that type number before."

"Don't worry about it," advised Smithy happily. "Fit an 0A90 in its place. That should be an adequate substitute."

BACK IN SERVICE

Dick soon located an 0A90 in the spares cupboard and soldered it to the printed board in place of the unserviceable 1N60. He then re-connected the television receiver to the mains and once more plugged in the outside aerial.

The pair waited expectantly for the screen to come alive. The tube cathode soon commenced emission and a picture from BBC1 with weak contrast appeared. Smithy adjusted the contrast control and was pleased to find that correct contrast was given when the control was almost at the centre of its travel. He tuned to the local I.T.A. channel to find that the closing scenes of "Police Chopper Emergency Down Under" were being screened, and were being reproduced by the set with exactly correct contrast. He next removed the outside aerial and connected the loop aerial, to find that both channels produced a slightly noisy picture which still, nevertheless, had correct contrast.

"Another job done," he announced with satisfaction, tuning back to the I.T.A. signal and advancing the volume control.

The Workshop was suddenly filled with the sound of twittering birds. "And here," said a resonant voice from the speaker, "is the news that all British pet-lovers have been waiting for. The makers of Woof-Woof, the Wonder Dog Food, now proudly introduce their new product: Splat-Splat, the Wonder Bird Seed." ■

"If that's stolen property, you'll be charged with being a RX and probably servo six months."

SLIDE PROJECTOR PULSER

By C. J. Bowes

Controls an automatic slide projector to give programmable intervals between slides

There are many occasions, such as at Exhibitions and lectures, when it is desirable to show a series of slides in sequence. The unit described in this article is designed to assist in such presentations by automatically changing the slides with an interval set by means of the speed control. This avoids the necessity of stationing someone alongside the projector to operate the slide change control.

It is suitable for use on any remote control slide projector but operates more easily on those models designed to take circular magazines since these can be started and then left unattended. The pulser can be used on projectors with different magazine mechanisms but it may be necessary to replace the magazine after it has run through the machine.

The device is designed to run off the power supply contained in the projector (usually used for operating the remote slide change and focusing mechanism) but if desired a separate power source, such as that shown in Fig. 4 can be used instead.

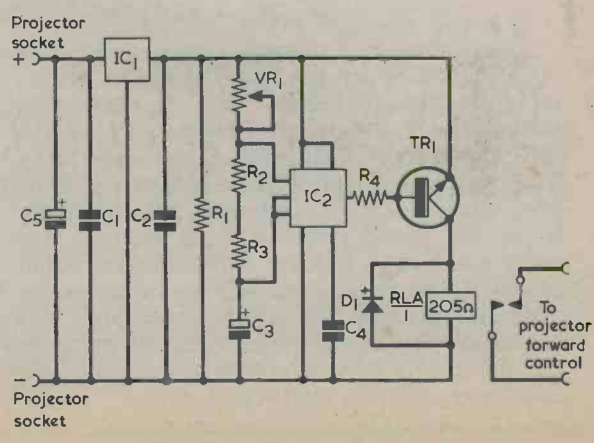
CIRCUIT DESCRIPTION

The pulser circuit diagram is shown in Fig. 1. and it can be considered in two parts. The part of the circuit to the left of and including R1, forms a power supply providing 12 V d.c., which is used to operate the timing and operating circuit.

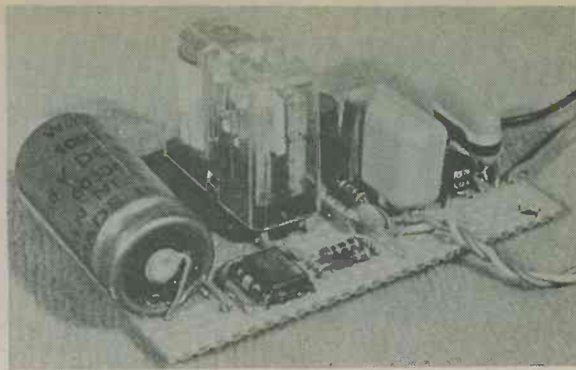
The power supply consists of a smoothing capacitor C5, which removes any a.c. ripple from the voltage supplied by the projector and C1, C2 IC 1 & R1 which form a voltage stabilizer network which reduces the voltage supplied by the projector (of the order of 20 V) to a steady 12V suitable for operating the timer. Strictly speaking it is not necessary to fully stabilize the supply but this circuit provides a relatively cheap method of reducing the voltage from the projector and makes the circuit suitable for all voltages of operating mechanism.

The only important points concerning this section of the circuit are to make certain that the projector uses a d.c. voltage in excess of 15 V at the control

Fig.1. Circuit diagram of projector pulser. To the left of R1 the circuit is a conventional +12 V power supply



Completed Veroboard with components ready for installation



socket (a look at the circuit diagram or interior of the projector will soon show this) and to ensure that both C1 & C5 are rated for working at the voltage supplied by the projector power supply.

PROJECTOR PULSER

The timing circuit is operated by a 555 timer, IC2. This useful device is programmed to produce an output from pin 3 which switches from +12 V to 0 V in a cycle controlled by VR1, R2, R3 & C3. The period for which this voltage remains positive is the interval between slide changes. In the circuit shown this period is adjusted by altering the setting of VR1 and with these component values the interval can be adjusted between 5 seconds and 2 minutes.

The time for which the output is at 0 V, which operates the slide change mechanism, is set by C3 and R3. The values given for Fig.1. set this time to approximately 0.5s, which is generally long enough to operate the slide change mechanism of most projectors without giving a double change effect. If this time is too short it can be lengthened by increasing the value of R3, similarly the time can be shortened by decreasing the value of R3. The timer drives a relay through a simple transistor current amplifier circuit comprising Tr 1 and R4. D1 is a protection diode which limits the collector voltage when the relay is turned off.

The relay contacts operate the slide change mechanism and the unit is therefore universal in its application since it is capable of switching any polarity of current or voltage used on projector slide change mechanisms.

The alternative power supply, shown in Fig.4. is conventional and replaces part of the power supply section of Fig.1. This type of supply should be used if the projector remote controls are operated by an a.c. supply.

CONSTRUCTION

A straightforward method of construction is to mount all the components except for C5 (which is likely to be fairly bulky) on a piece of Veroboard. The board should be cut to size and the tracks cut to the pattern shown in Fig.2. The three mounting holes should be drilled using a 3mm bit.

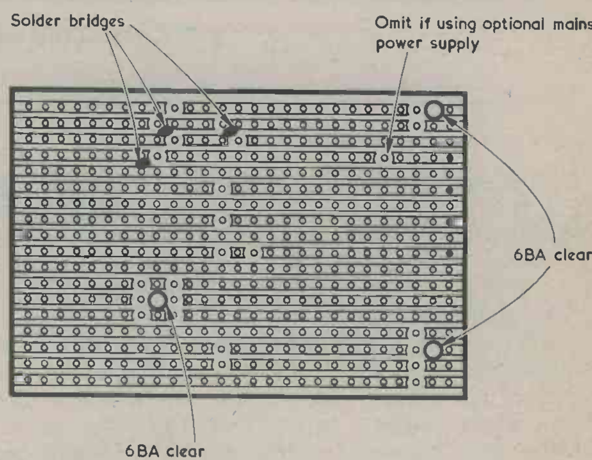
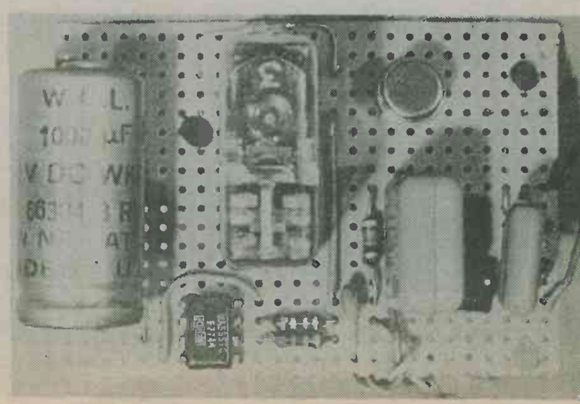
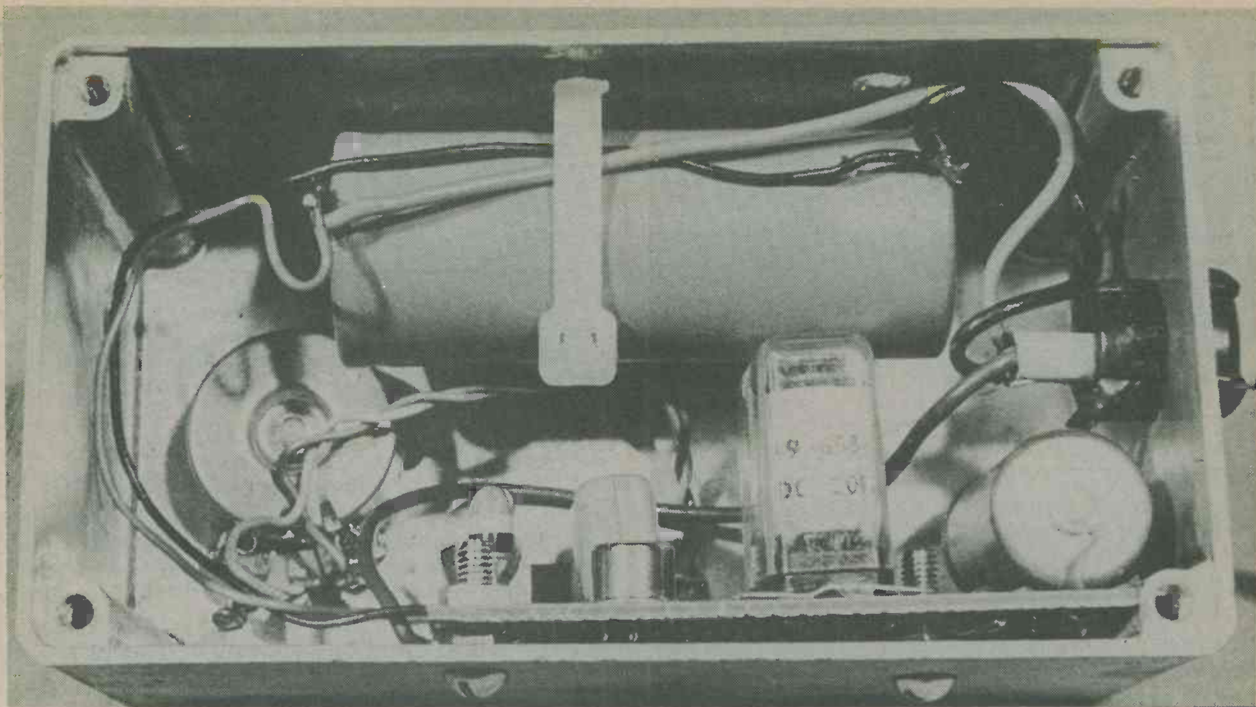


Fig.2. Veroboard cutting details. The tracks can be cut using a 4mm twist drill. All components except C5 and the alternative power supply are mounted directly on the Veroboard. Veropins may be used to make the external connections

Veroboard layout





Completed unit, interior view

The components should be mounted as shown in Fig.2. It will be found easier to do this if the smallest components are mounted first. Once the components have been mounted the board should be carefully inspected for errors, broken tracks and solder bridges before testing.

If a d.c. power supply of between 15 and 50 volts is available the circuit can be tested using this, but it is important to ensure that C5 is incorporated in the circuit when testing is carried out. The relay should click in and release at a rate dependent upon the setting of VR1.

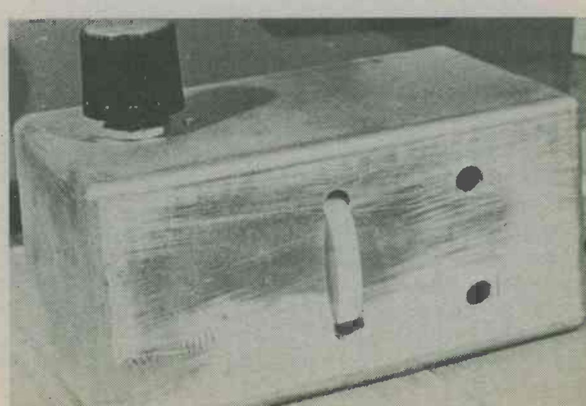
If this is satisfactory the device can be mounted inside a suitable box once the correct connections to the projector have been worked out. C5 should be connected to the positive and negative power supply leads from the projector and secured in the box. The appropriate connections from the Veroboard to the projector remote control plug and to C5 should then be made and the Veroboard and VR1 mounted inside the box.

CONNECTING TO THE PROJECTOR

The correct plug connections to the projector should be worked out, preferably from the projector manufacturers circuit diagram and the connections made by a suitable cable. The positive and negative power supplies are usually connected to the focusing switch and the forward slide change contacts to the forward button of the remote control unit.

On some projectors the forward control operates by making a connection between one of the power supply contacts and the forward control pin on the

Completed unit, exterior view



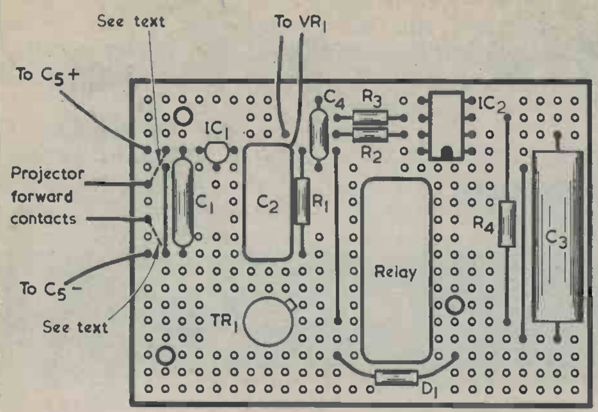


Fig.3. Component layout on Veroboard

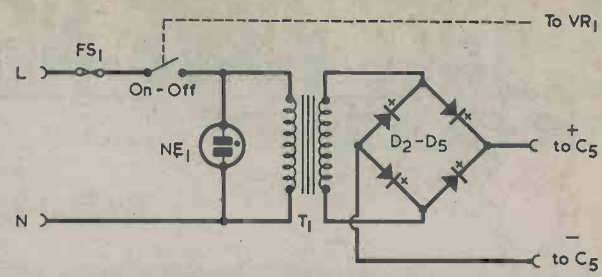


Fig.4. Mains power supply for use when the projector supply is not suitable.

When using this supply IC1, R1, C1 and C2 (see Fig 1) can be omitted

The mains indicator Ne 1 must include a suitable limiting resistor

CAUTION: This circuit is mains powered and must be properly built into a protective box.

COMPONENTS

Resistors
(All fixed values ¼ watt 5%)
R1 4.7KΩ
R2 2.2KΩ
R3 560Ω
R4 6.8KΩ
VR1 100KΩ potentiometer, linear (with mains switch if a separate mains power supply is to be used).

Capacitors
C1 0.22μF
C2 0.47μF
C3 100μF 16V electrolytic
C4 0.1μF
C5 2200μF 40V electrolytic

Semiconductors
IC1 78L12 (12V 100mA regulator)
IC2 555 timer
TR1 BC461 or equivalent.
D1 IN914, IN4148, IN4001

Miscellaneous
Relay 12V 205Ω printed circuit relay (RS type 349-658
Veroboard 0.1 in. pitch 18 lines x 26 holes.
Plug to suit projector remote control outlet.
Knob for VR1.
Case to hold complete unit
Connecting cable.
Mains cable if required.
Nuts, bolts, plastic straps etc.

remote control socket. In this case a suitable wire link can be made on the Veroboard between the appropriate power supply line and the relay. This is shown by the two dotted lines marked on Fig.3. Of course **only one** connection should be made and **not both of the connections shown.** The remaining relay contact should be connected to the "forward" pin on the remote control plug.

If the alternative power supply is used then the only connections to the projector are from the two relay contacts to the forward contacts on the remote control plug, the power supply leads to the Veroboard layout being connected to C5 on the power supply.

USING THE UNIT

The projector should be set up and focussed in the normal way. The pulser unit is then plugged into the projector and VR1 is set to give the required time between slide changes. The projection programme is most effective if a full magazine is used as the projection sequence is then uninterrupted.

■

SHORT WAVE NEWS
FOR DX LISTENERS

By Frank A. Baldwin

Times = GMT *Frequencies = kHz*

In these columns last month we dealt with the rather meagre results achieved in the quest for reception of transmissions from Laos and expressed the hope that greater success would be apparent after the next season. This month we very briefly review some of the log entries made with respect to other far-eastern based transmitters.

Information from China about some of the local stations is not all that plentiful, much of it provided by fellow enthusiasts listening sessions and the publication of such details in the SWL press. For those who would like to swell the ranks of the 'China-watchers' why not add the following to your list of targets?

● CHINA

PBS Hangzhou, Zhejiang, on **4785** at 2304, female announcer with a talk in Chinese. This rarely heard station was very soon blotted out by commercial QRM, in fact it is the first time I have logged this one owing to the unremitting interference usually on this channel but absent just long enough to make a log entry. Sheer good luck in fact! This is Zhejiang 1 which has a schedule from 2100 to 0500 and from 0850 to 1415 with local programmes and relays of Beijing (Peking) 1.

Xining, Quinghai, on **4940** at 1513, OM and YL alternate in Chinese. This one was audible under QRM from the more powerful Kiev transmitter in the Ukrainian SSR. Xining features both local and Home Service 1 programmes and operates from 2150 to 0100 and from 0930 to 1525.

Guizhou, Guiyang, on **7275** at 1435, OM with a talk in Chinese. The schedule is from 2130 to 0020, 0150 to 0620 and from 0850 to 1600.

Neimenggu, Hohhot, on **7300** at 1120, OM with the usual talk in Chinese. The schedule on this particular channel is unknown.

This review will be continued in the next issue.

AROUND THE DIAL

In which we feature some items of possible interest to readers of these columns. All details are correct at the time of writing although some may be subject to change during the intervening period. Most however will remain constant.

● SPAIN

Madrid on **9765** at 1910 when radiating a programme about Latin American folk music and its origins followed by station identification and "Press Review" – all about local affairs – in the English programme for Europe, scheduled from 1900 to 2100 hours. It is however a one hour programme repeated.

● U.S.S.R.

Radio Moscow on **9585** at 0140, OM with a programme in Standard Chinese to China, scheduled from 0000 to 0300 on this channel.

● AUSTRALIA

Melbourne on **9570** at 0750, YL with pop song, OM announcer in the English programme for Europe scheduled from 0700 to 0900 on this frequency. Local temperatures announced at 0753.

Melbourne on **17725** at 0758, 'Waltzing Matilda', OM with station identification, frequency details and programme review, time-check for 0800 then a review of world news in the English programme for Europe (schedule as above). Also logged in parallel on **17725** and **21680.**

Melbourne on **21570** at 1018, pops on records, OM announcements in the English Service to the Pacific, Papua and New Guinea, scheduled from 0800 to 1100 on this channel.

● AFGHANISTAN

Kabul on **4740** at 0152, OM with songs and local-style music in the Home Service 1, schedule from 0125 to 1930.

● YEMEN ARAB REPUBLIC

Sana'a on **9780** at 1850, YL with Arabic songs, local-style music in the Home Service, scheduled here from 0300 to 0700 and from 1000 to 2100 (Fridays from 0300 through to 2100). Also logged in parallel on **4853.**

● CANADA

RCI (Radio Canada International) Montreal on **9555** at 1550, OM with station identification followed by a light musical interlude in the English programme for the U.S.S.R., scheduled from 1545 to 1600. This is a BBC Daventry relay of RCI.

● NETHERLANDS ANTILLES

Radio Nederlands, Bonaire, on **9715** at 0630, OM with station identification after the National Anthem. The Dutch programme for New Zealand followed, being timed from 0630 to 0725. Also logged in parallel on **9630.**

● ISRAEL
Jerusalem on **15585** at 1054, YL with a ballad in the Hebrew languaged Domestic Service Network B programme scheduled on this channel from 0610 to 1400 and from 1800 to 2000.

● CAMEROON
Radio Bertoua on **4750** at 2018, OM with announcements in French, local-style songs and chants. The schedule is from 0430 to 0800 and from 1600 to 2208, the power is 20kW.

● NIGERIA
Lagos on **4990** at 0506, OM with details of forthcoming programmes and station announcements in English. This is the National Programme which is in English and vernaculars and operates from 0430 to 1000 and from 1700 to 2310. The power is 20kW.

● HONDURAS
Radio Lux, Olanchito, on **4890** at 0227, local pops on records, OM announcer, commercials, two chimes and gabbled identification at 0232. Sign-off at 0300 after station identification over some soft and sweet music (not the National Anthem).

● BRAZIL
Radio Difusora Taubate, on **4925** at 0233, OM song in Portuguese, local-style dance music. This one operates from 0830 to 0300 and the power is 1kW.
Radio Cultural do Para, Belem, on **5045** at 0149, OM with pops in typical local manner. Station identification at 0200. The schedule is from 0900 to 0300 although it has been reported closing as late as 0700. The power is 10kW.

● VENEZUELA
Radio Sucre, Cumana, on **4960** at 0315, OM station identification in Spanish, local songs and folk music. The schedule is from 1000 to 0400 and the power is 1kW.
Radio Reloj Continente, Caracas, on **5030** at 0323, OM with local and world news in Spanish, frequent chimes between news items and several station identifications. This one is times from 0900 to 0500 and the power is 10kW.

● COSTA RICA
Faro del Caribe, San Jose, on **5055** at 0342, OM with a recorded religious programme in English followed by announcements of times of transmission, frequencies and address. National Anthem and off at 0353. The schedule is from 1030 to 0400 but has been reported closing at 0430 on occasions. The English programme is timed from 0300 to 0400 and consists mainly of American religious organisations taped programmes. The power is 5kW.

● GREECE
VOA (Voice of America), Kavalla, on **9770** at 0435, OM with a newscast of world events followed by the "Breakfast Show".

● CLANDESTINE
Bizim Radyo (Our Radio) on **9585** at 1507, OM with a news commentary in Turkish. This transmitter, located in East Germany, also identifies as "Voice of the Communist Party of Turkey" prior to some transmissions. ("Turkiye Komunist Partisinin Sesi").

● CHINA
Radio Peking on **9860** at 1512, YL with a news review in the English programme directed to South Asia and scheduled from 1500 to 1600.
Radio Peking on **9880** at 1446, YL with the programme in Sinhalese for Sri Lanka, scheduled from 1400 to 1500.
PBS (People's Broadcasting Station) Nei Menggol on **7300** at 1453, YL with songs in Chinese, local-style music.

● TAIWAN
VOFC (Voice of Free China) Taipeh on **9630** at 1240, YL with songs in Chinese, YL announcements and identification in Chinese at 1245.

VOFC Taipeh on **9610** at 2115, OM and YL with an English/Chinese language lesson. Signal wiped out by Cologne signing on with interval signal and announcements at 2126.

● VIETNAM
Ho Chi Minh City on a measured **9623** at 1302, military music, YL in Vietnamese in the Domestic Service. The schedule of this one is from 2157 to 0030 (to 1540 on Saturdays), from 0200 to 0600 (not Sundays) and from 0930 to 1540 (not Sundays). All programmes are in Vietnamese.

Hanoi on **10040** at 1342, YL with station identification during the French programme intended for South East Asia and scheduled from 1300 to 1400 on this frequency.

● SOUTH KOREA
KBS (Korea Broadcasting System) Seoul on **15575** at 1049, YL with announcements and station identification, OM with a newscast mainly composed of local affairs. All in the English programme intended for Latin America, South East Asia, Africa, the Middle East and North Africa, scheduled from 1000 to 1100.
Seoul on **9870** at 1430, OM and YL announcers at the commencement of the Standard Chinese programme beamed to China, Korea and South Asia and scheduled from 1430 to 1520 on this channel.

● PHILIPPINES
FEBC (Far East Broadcasting Company) Manila on **9715** at 1440, OM and YL with an English/Chinese language lesson. This Standard Chinese programme is radiated to the Far East and South East Asia and is scheduled on this particular frequency from 1400 to 1615.

VOA (Voice of America) Tinang on **9555** at 1404, OM with announcements in an Asian dialect after 'Yankee Doodle' interval signal. The morning/afternoon schedule is from 0800 to 1700.

● INDIA
AIR (All India Radio) Delhi on **7280** at 1500, YL with station identification and programme review then OM with news of purely local affairs, all in the Domestic Service English programme.

● PAKISTAN
Karachi on **17665** at 1008, OM with a newscast of world affairs in the English section of the World Service transmission to the U.K., scheduled from 0715 to 1100 on this channel. The English newscast is timed from 1005 to 1010, most of the remainder of the transmission being in Urdu.

AMATEUR SATELLITE NEWS REPORT

By Arthur C. Gee

First Bulgarian Satellite: On the occasion of the 1300 years jubilee of the creation of the Bulgarian State, later this year, the first Bulgarian satellite is to be launched. Designated B – 1300, it will have a near circular orbit at 900 Km in an inclination of 85 degrees. The satellite will be equipped with laser reflectors, for laser tracking, thereby giving an improvement in detailing the satellite's position. Amongst the experiments to be carried out will be an investigation into the influence of the atmosphere on orbital parameters. The coordinator and manager of the "B – 1300" tracking program is the Central Laboratory for Geodesy of the Bulgarian Academy of Sciences, Sofia 7, Noemvri – Str. No. 1. Bulgaria.

University of Surrey's UOSAT Scientific Satellite Progress: Britain's first amateur satellite–UOSAT–which is under construction at the University of Surrey, is now entering its final stages before launch into a polar earth orbit on the 15th September next. It is scheduled for launch on a NASA Delta 2310 rocket, along with a Solar Mesosphere Explorer Spacecraft, from the Western Test Range at Vandenberg, California, U.S.A. The programmed orbital elements are: – Altitude 530 Km; inclination 97.5 degrees; period 98 minutes. Assuming all goes to plan, launch time is to be 11.19 GMT and the separation from the launch vehicle should be at 12:30 GMT over the Sudan.

International Solar Polar Mission in Jeopardy: Severe budgetary cuts imposed on NASA by the Office of Management and Budget in preparation of the Reagan Administration's federal budget, resulted in NASA's decision to cancel the American spacecraft forming part of the two-spacecraft International Solar Polar Mission.

The European Space Agency, the other partner in the project, has however, rejected this decision. At a high level meeting between the two agencies in February last, ESA officials pointed out that this decision had been arrived at without consultation with the ESA, which was a breach of the Memorandum of Understanding between the two agencies.

As a result of this decision, European scientists from 17 scientific institutes who were supplying experiments for the NASA spacecraft, would no longer be able to fly them. These experiments were in many cases, in an advanced state of development. More than 50% of the total costs had been committed and would consequently be lost without corresponding scientific return. Furthermore, ESA pointed out, that when the ISPM project was decided upon, by the ESA Science Programme Committee in 1979, it was chosen in preference to a number of other, purely European missions, because of the value ESA attached to transatlantic cooperation. ESA stressed that unilateral actions of this kind would be detrimental to future space cooperation between Europe and the U.S.A. The ESA Management Board resolved that immediate and strong action should be taken to obtain the full restoration of the ISPM programme.

European Scientific Spacecraft to Explore Halley's Comet: A major space "first" is going to be undertaken as part of the ESA's scientific activities. The Agency's Science Programme Committee have approved a European project under which a spacecraft will be sent to Halley's Comet. This exploratory mission involves flying a spacecraft through the comet in 1986 at a speed of 70 Km/sec. The scientific objective of the mission is to make measurements of the constituents of the comet's tail, or "coma"; ionised particles, dust, atmospheric constituents, etc, which boil off from the nucleus under the effect of the solar heating. Such measurements, as well as the taking of pictures of the nucleus by means of an onboard camera, are of fundamental importance in understanding the birth of comets, which are believed to consist of matter stemming from the formation of the planets in the solar system.

The spacecraft, derived from the GEOS satellite, will have a payload consisting principally of a camera and mass spectrometers for measuring the atomic composition of the comet. Of a total mass of approximately 750 Kg, it will be launched in July 1985 by an Ariane rocket.

The project has been given the name GIOTTO, which it takes from the "Adoration of the Magi" scene in the famous fresco cycle executed by the Florentine painter, Giotto di Bondone, that decorates the interior of the Arena Chapel, in Padua. Halley's comet, which can be seen in the sky background of the Adoration scene, enters the inner part of the solar system about every 76 years, and one of its appearances was made in 1301. Giotto was consequently able to use it as a model for the star of Bethlehem when he painted the Adoration scene, which he completed in 1304. In a way, Giotto's painting of this star can be considered as the first scientific description of Halley's comet.

The Arsene Project: In the January/February 1981, (No. 5) issue of "ORBIT", – the "Journal of the Radio Amateur Space Program", published by AMSAT; a very interesting account appears of the Radio Amateur Satellite organisation in France, under the heading "The Arsene Project". (ORBIT Vol. 2 No. 1 p.13.)

A group of amateurs in CNES (National Centre for the Study of Space in France) realising that France, the third power in space, is creating its own capability to orbit satellites thanks to the Ariane rocket, felt that France should at the same time, support amateur radio scope activity, particularly as it is such an advanced technical non-profit cause.

This idea was submitted to the Directors of CNES, towards the end of 1978. They were extremely favourable to supporting a program provided no financial commitment would be required. CNES's active support would consist of providing left-over parts and equipment from prior programs, which were not required for future projects, permitting its employees to take part in the project and helping to make appropriate tests preceding flights. They would also provide space on vehicles for missions not requiring the entire capacity of the Ariane.

The Directors of CNES suggested this idea should be submitted to the French Technical Schools which are training the future leaders in the French Space Program. These schools showed immediate and enthusiastic support for the scheme, many students offering specific participation in their third year thesis, by devoting them to concrete, highly technical projects relating to the program.

Next, most of the French companies, who are involved in the Space program were approached and they agreed to participate. As a first step (for two or three years) these companies will participate by employing and paying trainees from these technical schools and permitting them to work on matters arising in connection with the development project under the supervision of each company's own technical employees. Several have offered to help complete various parts of the satellite as part of the practical training in their own educational program.

In order to formalise the scheme, the Amateur Radio participants who have been most involved, have grouped together under an association called "RACE" – Radio Amateur Club de l'Espace. Since all Amateur Radio operators are more or less involved, the French national amateur radio association, the "Reseau des Emmitteurs Francais" (REF) with its 12000 members has also joined RACE.

The entire effort will be coordinated by a joint committee of the Directors of the Technical Schools involved; the Director of the Space Centre in Toulouse and the President of RACE.

The first project is to build a satellite to be designated ARSENE. It will be about 100 Kgms weight, have two transponders using amateur radio space allocated frequencies, a very high frequency beacon which will be used for a small scientific experiment which is yet to be defined. Stabilization of the satellite will be maintained by coupling with the earth's magnetic field. Energy to be provided by solar panels and rechargeable batteries. Ground communication and control station functions could be maintained by three ground stations, one being located on the French mainland; with the other two located in French Guiana and Renunion Island. All amateur radio stations throughout the world would be able to use the transponders. Technical schools could equip themselves with simple earth stations to make demonstrations and engage in practical experiments. The life expectancy for a satellite as the one envisaged should be several years.

"I see he's launched his Airborne early warning system."

Thatcherism again!!!

BACK NUMBERS

For the benefit of new readers we would draw attention to our back number service.

We retain past issues for a period of two years and we can, occasionally, supply copies more than two years old. The cost is 80p, inclusive of postage and packing.

Before undertaking any constructional project described in a back issue, it must be borne in mind that components readily available at the time of publication may no longer be so.

TRADE NEWS

INTEGRATED HI-FI SYSTEMS

The latest design in audio equipment, the integrated hi-fi system, has until recently remained a costly purchase. The introduction of the IS 100 and the IS 200 to the range of audio equipment from Fidelity Radio Limited of Victoria Road, London NW10, sees two products more attractively priced for the middle market.

With the living area in flats and houses becoming more limited many householders are finding free space for their audio equipment an increasing problem. The integrated system has grown in popularity over the last few years as its compactness deals ideally with this situation.

However, the price of these systems has been comparatively high when compared with the selection of music centres that are available. Fidelity Radio is one of the few companies to produce a product which is competitively priced, the IS 100 and the IS 200 are expected to retail at approximately £170 and £200.

The IS 100 is a compact shelf top unit finished in silver with matching open fronted speakers; whereas, the IS 200 has a glass fronted storage cabinet, dark fabric fronted speakers and is finished in a wood effect. The technical specifications for both units are the same.

The record player, with its hinged removable lid, has a semi-automatic two speed belt drive turntable; with stereo ceramic cartridge and cue.

The three waveband radio, LW, MW and FM has LED signal strength and FM stereo indicators; FM mono and mute selection; AFC on FM and frequency shift on long wave.

The new IS 100 integrated hi-fi system from Fidelity Radio seen in its compact shelf top version.

The cassette section has ferrous and chrome dioxide tape selection and noise reduction system. There are also two LED record/power bargraphs and indicators to show which mode is in operation. A tape counter and reset button are also incorporated.

The total output music power is 35 watts into 4 ohms.

Other facilities include: two way speaker system; stereo headphone socket; public address facility; push button controls; rotary volume, bass, balance and treble controls and the unit is fitted with a 13 amp moulded fused safety plug.

Stylish storage for video cassettes

With the proliferation of home video equipment on the market, it is good to know that the important question of video cassette storage has not been overlooked. Elegance combined with utility are two features of the new Lawco Video 90 cassette storage Cabinet.

Suitable for both VHS and Betamax systems, the Lawco Cabinet can house 36 video cassettes, yet is compact in size measuring 673 mm x 394mm x 165mm.

The Cabinet has a highly polished wood finish and is an attractive piece of furniture in its own right. In addition it can easily accommodate a video recorder placed directly on top if space is at a premium. The flat top design also allows for the storage system to grow vertically or horizontally to keep pace with increased demand.

The Cabinet's three drawers are made from tough polypropylene which can be easily wiped clean if dust or dirt accumulates inside. Each drawer contains dividers to ensure the cassettes remain in an upright position. The front opening action allows for easy access and instant visual recognition of the cassettes inside.

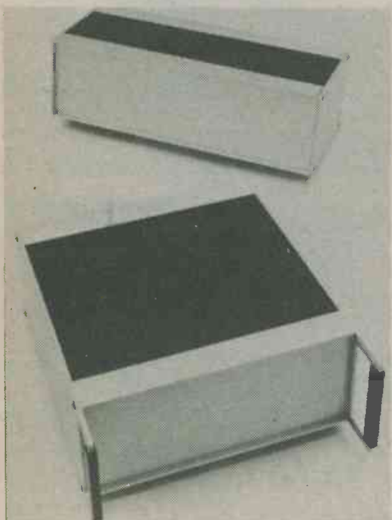
The Lawco Video 90 Cabinet has a recommended retail selling price of £36.00 exclusive of VAT.

Further details are available from Lawtons Limited, Stationery & Filing Division, 60 Vauxhall Road, Liverpool L69 3AU.

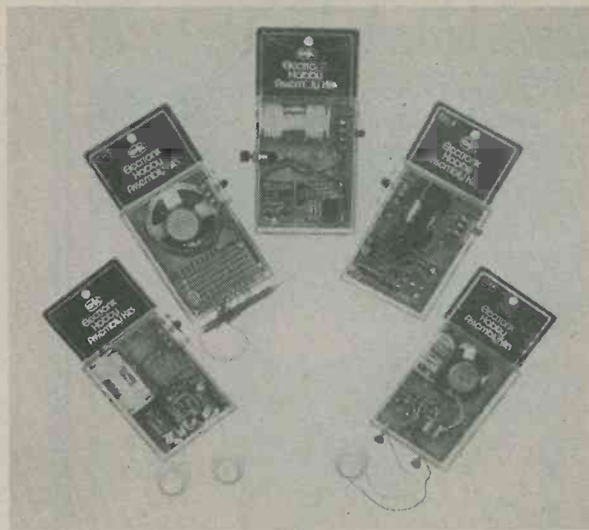
Octobox cases

Recently introduced by ZAERIX Electronics Ltd, their new OCTOBOX Series of easily assembled, professional quality, Instrument Cases are available in 72 sizes with heights ranging from 80 to 130mm, widths from 150 to 400mm, and depths from 150 to 300mm.

A very rigid and aesthetically pleasing design is achieved by utilising 3mm thick extruded aluminium front and rear panels, firmly attached by countersunk headed screws to 4mm thick side panels, these being manufactured with either plain or 'protruding handle' front edges. Having natural anodised finish, all four sides of these cases are substantial enough to also double as power semiconductor heatsinks.



DIY SILICON CHIP KITS



You don't have to be an electronics expert to assemble OK's new range of micro electronic hobby kits. Silicon chip based, these kits have very comprehensive step-by-step instructions which also describe the various terms and components used in electronics. Priced substantially less expensive than many electronic toys from only £3.99 to £8.60, they contain carefully selected components and when made fit into their original plastic packaging containers. OK say that these are suitable for 12 year olds upwards.

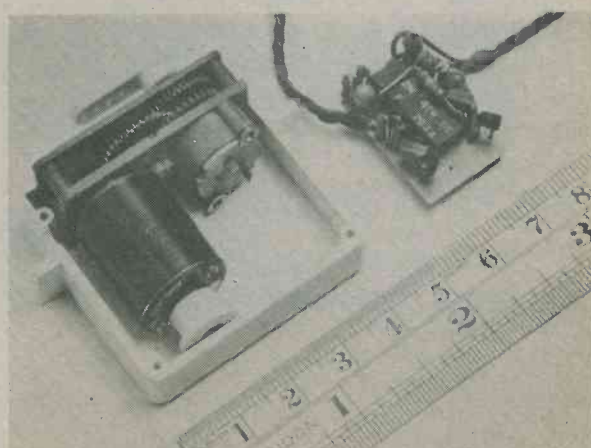
Five kits are available, Quick Reaction (£5.80), Electronic Dice (£7.98), Digital Roulette (£8.60), Morse Code (£3.99) and Electronic Organ (£6.70). All prices include VAT and p & p and items are available by mail order or by telephoning OK on 0703 610946 (24 Hour) or 0703 610944 9-5pm and placing a credit card order. OK Hobby Products are at Dutton Lane, Eastleigh, Hants SO5 4AA. Batteries, soldering irons and other tools are not provided but are available from OK. Soldering iron and solder £4.99, pliers, £2.50, cutters £2.99.

Servo amplifier IC for industrial use

To meet the strong market demand for a low cost servo-amplifier suitable for use in general industrial applications, Ferranti Electronics Ltd., Fields New Road, Chadderton, Oldham, has developed and is now offering the ZN409CE, a servo-amplifier device in a 19.3mm (standard length) dual in-line package.

This use of standard packaging has enabled the Company to market the new product at a pricing level which is some twenty five per cent below that of the popular and well established ZN419CE servo amplifier, which in its shorter length package (17.78mm) was specifically designed for use in areas where available space was limited.

Both the ZN409CE and ZN419CE have the same specifications, either being ideal for inclusion in a variety of pulse-width position control applications ranging from model control to industrial equipment control. The two devices are also well suited for use in motor speed control circuits.



A precision servo-amplifier integrated circuit manufactured by Ferranti Electronics Limited.

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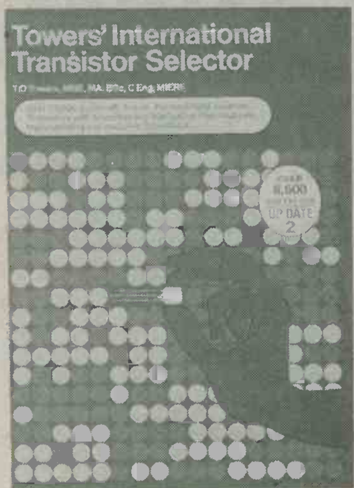

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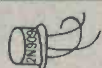

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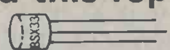

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(Continued on page 637)

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MC3357P	2.85
LM3900N	0.60
LM3909N	0.68
LM3914N	2.80
LM3915N	2.80
KB4400	0.80
KB4406	0.60
KB4412	1.95
KB4413	1.95
KB4417	1.80
KB4420B	1.09
TDA4420	2.65
KB4423	2.30
KB4424	1.65
KB4431	1.95
KB4432	1.95
KB4433	1.52
KB4436	2.53
KB4437	1.75
KB4438	2.22
KB4441	1.35
KB4445	1.29
KB4446	2.75
KB4448	1.65
NE5044N	2.26
NE5532N	1.85
SD6000	3.75
SL6270	2.03
SL6310	2.03
SL6600	3.75
SL6640	2.75
SL6440	POA
SL6690	3.20
SL6700	2.35
ICL8038CC	4.50
MSL9362	1.75
MSL9363	1.75
HA11211	1.95

HA11223	2.15
HA11225	1.45
HA12002	1.45
HA12017	0.80
HA12402	1.95
HA12411	1.20
HA12412	1.55
LF13741	0.33
SN76660N	0.80

FREQ. DISPLAY AND SYNTH. DEVICES

SAA1056	3.75
SAA1058	3.35
SAA1059	3.35
11C90DC	14.00
LN1232	19.00
LN1242	19.00
MSL2318	3.84
MSM5523	11.30
MSM5524	11.30
MSM5525	7.85
MSM5526	7.85
MSM5527	9.75
MSM55271	9.75
MSL2312	3.94
SP8629	3.85
SP8647	6.00
95H90PC	7.80
HD10551	2.45
HD44015	4.45
HD12009	6.00
HD44752	8.00
MC145151	12.45
MC145156	8.75

MISC

ICM7106CP	9.55
ICM7107CP	9.55
ICM7216BP	19.50
ICM7555	0.94

CRYSTALS

32.768kHz	2.70
100kHz	3.85
455kHz	5.00
1.000MHz	2.95
3.2768	2.70
4.000	2.00
4.1934	2.00
4.096	2.00
4.032	2.00
4.433619	2.00
4.800	2.00
5.000	2.00
6.5536	2.00
7.000	2.00
7.68	2.00
8.000	2.00
9.000	2.00
10.000	2.00
10.240	2.00

4000 series

4000	0.13
4001	0.13
4002	0.14
4007	0.19
4008	0.70
4009	0.30
4010	0.30
4011	0.24
4011	0.15
4012	0.20
4013	0.35
4015	0.70
4016	0.30
4017	0.65
4019	0.38
4020	0.68
4021	0.75
4022	0.68
4023	0.19
4024	0.45
4025	0.18
4026	1.05
4028	0.60
4029	0.75
4030	0.35
4035	0.75
4040	0.68
4042	0.65
4043	0.68
4043	0.93
4044	0.68
4946	0.69
4047	0.69
4049	0.30
4050	0.30
4051	0.65
4052	0.69
4053	0.69
4054	1.30
4055	1.30
4056	1.35

4060	0.95
4063	1.15
4066	0.38
4067	4.30
4068	0.18
4069	0.18
4070	0.25
4071	0.22
4072	0.22
4073	0.22
4075	0.18
4076	0.60
4077	0.23
4078	0.25
4082	0.25
4093	0.45
4099	0.99
4175	1.15
4502	0.90
4503	0.55
4506	0.75
4507	0.45
4508	1.99
4510	0.70
4511	0.85
4512	0.70
4514	2.20
4515	2.50
4516	0.75
4518	0.75
4520	0.80
4521	2.36
4522	1.49
4527	0.95
4528	0.95
4529	1.40
4539	1.10
4549	3.50
4554	1.73
4555	0.72
4556	0.58
4560	2.18

CRYSTALS

10.245	2.00
10.6985	2.50
10.700	2.00
10.7015	2.50
11.00	2.00
11.115	2.00
11.520	2.00
8.9985	2.00
9.0015	2.00
21.000	2.00
24.000	2.00
25.000	2.00
26.000	2.00
18.000	2.50

XTAL FILTERS

10M4B1; 10.7Mhz, 15Khz BW, 8 pole.	14.50
10M22D; 10.7Mhz, 2.4Khz BW, SSB, 8 pole.	17.20

4566	1.59
4568	2.18
4569	1.95
4572	0.30
4582	0.99
4584	0.49
4585	1.00
4702	4.50
4703	4.48
4704	4.24
4705	4.24
4706	4.50
4720	4.00
4723	0.95
4724	0.95
4725	2.24
40014	0.54
40085	0.99
40098	0.54
40106	0.54
40160	0.69
40161	0.69
40162	0.69
40163	0.69
40174	0.69
40175	0.69
40192	0.75
40193	0.75
40194	0.69
40195	0.69

TTL 'N'

7400	0.10
7401	0.10
7402	0.10
7403	0.11
7404	0.12
7405	0.12
7406	0.22
7407	0.22
7408	0.15

7448	0.56
7450	0.14
7451	0.14
7453	0.14
7454	0.14
7460	0.14
7470	0.28
7472	0.27
7473	0.28
7474	0.28
7475	0.35
7476	0.30
7480	0.26
7481	0.20
7482	0.75
7483	0.60
7485	0.75
7486	0.24
7489	1.05
7490	0.30
7491	0.55
7492	0.35
7493	0.35
7494	0.70
7495	0.60
7496	0.45
7497	1.40
74100	1.10
74104	0.62
74105	0.62
74107	0.26
74109	0.35
74110	0.54
74111	0.68
74112	1.70
74166	1.98
74118	0.85
74119	1.20
74120	0.95
74121	0.35
74122	0.34
74123	0.40

74125	0.40
74126	0.40
74128	0.65
74132	0.50
74136	0.65
74141	0.45
74142	1.85
74143	2.50
74144	2.50
74145	0.75
74147	1.50
74148	1.09
74150	0.79
74151	0.55
74153	0.55
74154	0.55
74155	0.55
74156	0.55
74157	0.55
74159	1.90
74160	0.55
74161	0.55
74162	0.55
74163	0.55
74164	0.55
74165	0.55
74166	0.70
74167	1.25
74170	1.25
74173	1.10
74174	0.75
74175	0.75
74176	0.75
74177	0.75
74178	0.90
74179	1.35
74180	0.75
74181	1.22
74182	0.70
74184	1.20
74185	1.20
74188	3.00

74190	0.55
74191	0.55
74192	0.55
74193	0.55
74194	0.55
74195	0.55
74196	0.55
74197	0.55
74198	0.85
74199	1.00
74221	1.00
74246	1.50
74247	1.51
74248	1.89
74249	1.89
74251	1.05
74265	0.66
74273	2.67
74278	2.49
74279	0.89
74283	1.30
74284	3.50
47285	3.50
74290	1.00
74293	1.05
74297	2.36
74298	1.85
74365	0.85
74366	0.85
74367	0.85
74368	0.85
74390	1.85
74393	1.85
74490	1.85

'LPSN'

7400	0.11
7401	0.11
7402	0.12
7403	0.12
7404	0.13

7405	0.14
7408	0.14
7409	0.14
7410	0.13
7411	0.14
7412	0.15
7413	0.28
7414	0.49
7415	0.14
7420	0.13
7421	0.15
7422	0.15
7426	0.18
7427	0.14
7428	0.35
7430	0.13
7432	0.14
7433	0.16
7437	0.17
7438	0.16
7440	0.13
7442	0.40
7447	0.42
7448	0.65
7449	0.61
7451	0.14
7454	0.15
7455	0.15
7463	1.50
7473	0.21
7474	0.18
7475	0.28
7476	0.22
7478	0.24
7483	0.50
7485	0.70
7486	0.18
7490	0.32
7491	1.25
7492	0.39
7493	0.38
7495	0.48

7496	1.20
74107	0.25
74109	0.25
74112	0.25
74113	0.25
74114	0.25
74122	0.40
74123	0.55
74124	1.80
74125	0.29
74126	0.29
74132	0.45
74133	0.30
74136	0.25
74138	0.40
74139	0.40
74145	1.20
74147	2.10
74148	1.60
74151	0.35
74153	0.35
74154	0.99
74155	0.50
74156	0.50
74157	0.36
74158	0.40
74160	0.40
74161	0.40
74162	0.40
74163	0.40
74164	0.50
74165	1.20
74166	1.75
74168	0.85
74169	0.85
74170	1.85
74173	0.75
74174	0.55
74175	0.55
74181	1.35
74183	2.96
74189	1.28

74190	0.60
74191	0.60
74192	0.68
74193	0.68
74194	0.42
74195	0.42
74196	0.65
74197	0.65
74200	3.45
74202	3.45
74221	0.60
74240	0.99
74241	0.99
74242	1.65
74243	1.65
74244	0.83
74245	1.50
74247	1.35
74248	1.35
74249	1.35
74251	0.46
74253	0.46
74257	0.55
74258	0.39
74259	0.39
74260	0.70
74266	0.24
74273	0.90
74275	3.20
74279	0.35
74280	2.50
74283	0.44
74290	0.58
74293	1.30
74295	1.50
74298	1.50
74365	0.35
74366	0.35
74367	0.35
74368	0.35
74373	0.78
74374	0.78
74375	1.15
74377	1.99
74378	1.40
74379	2.15
74384	2.50
74385	4.20
74386	0.29
74390	0.68
74393	0.61
74395	2.10
74396	1.99
74398	2.75
74399	2.30
74445	1.40
74447	1.95
74490	1.10
74668	1.05
74669	1.05
74670	1.70

74C CMOS

7400	0.20
7402	0.20
7404	0.20
7408	0.20
7410	0.20
7414	0.55
7420	0.20
7430	0.20
7432	0.20
7442	0.80
7448	1.03
7473	0.50
7474	0.50
7476	0.48
7483	0.98
7485	0.98
7486	0.26
7489	2.68
7490	0.80
7493	0.80
7495	0.94
74107	0.48
74151	1.52
74154	2.26
74157	1.52
74160	0.80
74161	0.80
74162	0.80
74163	0.80
74164	0.80
74165	0.84
74173	0.72
74174	0.72
74175	0.72
74192	0.80
74193	0.80
74195	0.80
74200	4.52
74221	1.06
74901	0.38
74902	0.38
74903	0.38
74904	0.38
74905	5.64
74906	0.38
74907	0.38
74908	0.84
74909	1.52
74910	3.62
74914	0.86
74918	0.98
74925	4.32
74926	4.32
74927	4.32

E&OE

Subject to availability

TRANSISTORS

BF194	18p
BF195	18p
BF224	22p
BF241	18p
BF274	18p
BF440	21p
BF441	21p
BF362	49p
BF395	18p
BF479	66p
BF679S	55p
BFR91	1.33
BFW92	60p
BFT95	99p
BFY90	90p
40238	85p
BF256	38p
2SK55	28p
2SK168	35p
J310	69p
J176	65p
40823	65p
40673	3SK51
3SK45	49p
3SK51	54p
3SK60	58p
3SK88	1.24
MEM680	75p
BF961	70p
BC237	8p
BC238	8p
BC239	8p
BC307	8p
BC308	8p
BC309	8p
BC413	10p
BC414	11p
BC415	10p
BC416	11p
BC546	12p
BC556	12p
BC550	12p
BC560	12p
BC639	22p
BC640	22p
2SC1775	18p
2SA872A	14p
2SD666A	30p
2SB646A	30p
2SD668A	40p
2SB648A	40p
2SD760	45p
2SB720	45p
2SC2547	19p
2SA1085	20p
2SB753	2.34
2SB723	2.34
2SK134	3.10
2SJ49	3.10
2SK135	4.25
2SJ50	4.25
2SK227	3.55
2SJ83	3.55

RADIO CONTROL

RC XTALS
AM TX/RX
FM RX:
3rd ot/30pF
HC25U 1.65
FMTX: Fund
20pF HC25U
½ freq 1.85
PAIRS...AM 3.10
PAIRS...FM 3.25
CHANNELLING:
27MHz. 50kHz
35MHz: 20kHz

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