DEC 1977

practical WIRELESS

45p

BLYTH

LABORATORY POWER UNIT

also:
TRAFFIC LIGHT CONTROLLER
&
SOLID-STATE TUNING INDICATOR

A SPECIAL OFFER

Soldering Kit

T.T.L. 74 I.C's By TEXAS, NATIONAL, I.T.T., FAIRCHILD Etc

7400	14p	7413	30p	7432	25p	7454	15p	7490	35p	74121	25p	74139	100p	74156	70p	74174	100p	74189	350p
7401	14p	7414	60p	7437	25p	7460	15p	7491	75p	74122	40p	74141	60p	74157	70p	74175	75p	74190	140p
7402	14p	7416	30p	7438	25p	7470	30p	7492	45p	74123	60p	74142	270p	74160	90p	74176	100p	74191	140p
7403	14p	7417	30p	7440	15p	7472	25p	7493	40p	74125	50p	74143	270p	74161	90p	74177	100p	74192	120p
7404	14p	7420	15p	7441	65p	7473	30p	7495	60p	74126	50p	74144	270p	74162	90p	74178	140p	74193	120p
7405	14p	7422	20p	7442	65p	7474	30p	7496	70p	74130	130p	74145	75p	74163	90p	74179	140p	74194	100p
7406	40p	7423	25p	7445	80p	7475	30p	74100	95p	74131	100p	74147	230p	74164	125p	74180	100p	74195	100p
7407	40p	7425	25p	7446	85p	7476	30p	74104	40p	74132	65p	74148	160p	74165	125p	74181	200p	74196	100p
7408	20p	7426	25p	7447	75p	7483	85p	74105	40p	74135	100p	74150	120p	74166	125p	74182	75p	74197	100p
7409	20p	7427	25p	7448	70p	7485	100p	74107	30p	74136	80p	74151	65p	74167	325p	74184	150p	74198	185p
7410	15p	7428	40p	7450	15p	7486	30p	74109	50p	74137	100p	74153	65p	74170	200p	74185	150p	74199	185p
7411	20p	7430	15p	7451	15p	7489	250p	74118	90p	74138	125p	74154	120p	74173	150p	74188	350p		
7412	20p			7453	15p			74120	90p			74155	70p						

SEMICONDUCTORS
by MULLARD, TEXAS, MOTOROLA, SIEMENS, I.T.T., R.C.A.

AA113	10p	BA138	16p	BC168B	14p	BC548C	14p	BF123	45p	BF336	35p	BY164	50p	OC140	150p	TIP35A	230p	2N1305	30p
AA144	10p	BA148	16p	BC168C	15p	BC549B	13p	BF125	45p	BF337	35p	BYX94	8p	OC171	40p	TIP35C	280p	2N1306	38p
AAZ17	30p	BA154	12p	BC169C	15p	BC549C	14p	BF127	50p	BF363	60p	C1120	30p	OC200	80p	TIP36A	350p	2N1308	50p
AC121	30p	BA157	15p	BC171	12p	BC557	13p	BF166	30p	BFS94	30p	C1164	20p	ORP12	70p	TIP41A	70p	2N1711	22p
AC126	19p	BA173	15p	BC172C	12p	BCY34	80p	BF167	25p	BFW58	20p	E100	42p	R1039	150p	TIP41B	75p	2N2219A	25p
AC127	19p	BA216	16p	BC178A	16p	BCY70	15p	BF173	25p	BFX29	30p	E300	47p	TIP29	45p	TIP41C	80p	2N2483	30p
AC127/01	25p	BA316	16p	BC182	10p	BCY71	20p	BF179	35p	BFX81	130p	E430	125p	TIP29A	47p	TIP42A	80p	2N2906	18p
AC128	18p	BAX13	5p	BC182L	12p	BCY72	15p	BF179C	40p	BFX84	25p	MJE340	45p	TIP29C	75p	TIP42B	85p	2N2907	20p
AC151	25p	BAX16	5p	BC183	10p	BD121	85p	BF180	30p	BFX85	30p	MPSA06	25p	TIP30	55p	TIP2955	70p	2N3053	20p
AC153K	40p	BB105A	35p	BC183L	12p	BD123	100p	BF181	35p	BFX87	25p	OA10	40p	TIP30A	58p	TIP3055	55p	2N3054	50p
AC176	20p	BB110	45p	BC184	10p	BD124	85p	BF182	30p	BFX88	25p	OA47	15p	TIP30B	65p	TIS90	25p	2N3055	60p
ACY17	35p	BC107	10p	BC184L	12p	BD131	36p	BF183	30p	BFY50	20p	OA90	6p	TIP30C	80p	TIS91	25p	2N3439	50p
ACY21	30p	BC108	10p	BC186	24p	BD132	39p	BF186	25p	BFY51	20p	OA91	6p	TIP31	55p	IN914	5p	2N3702	11p
AD149	60p	BC108C	15p	BC205	14p	BD133	45p	BF194	10p	BFY52	20p	OA202	8p	TIP31A	58p	IN3754	10p	2N3703	12p
AD161	40p	BC109	10p	BC212	11p	BD135	40p	BF195	10p	BFY90	125p	OC23	200p	TIP31B	65p	IN4001	5p	2N3704	11p
AD162	40p	BC109C	14p	BC212L	12p	BD136	40p	BF196	10p	BR101	35p	OC25	100p	TIP31C	70p	IN4002	5p	2N3705	12p
AD161/2MP	90p	BC113	12p	BC213L	12p	BD137	40p	BF197	10p	BRY39	35p	OC28	75p	TIP32	60p	IN4003	5p	2N3706	11p
AF114	22p	BC117	19p	BC214	13p	BD139	38p	BF198	25p	BRY56	35p	OC35	75p	TIP32A	65p	IN4004	5p	2N3711	12p
AF115	22p	BC125	20p	BC214L	14p	BD140	40p	BF199	25p	BSX20	20p	OC42	35p	TIP32B	85p	IN4005	5p	2N3715	300p
AF116	22p	BC126	15p	BC258	13p	BD181	80p	BF200	30p	BSY40	25p	OC43	35p	TIP32C	90p	IN4006	6p	2N3772	175p
AF117	22p	BC146	12p	BC294	35p	BD182	80p	BF224	20p	BSY95	20p	OC45	35p	TIP33	100p	IN4007	7p	2N3819	25p
AF118	50p	BC147	10p	BC303	55p	BD207	70p	BF225	20p	BT100A	80p	OC71	25p	TIP33A	105p	IN4148	4p	2N3866	95p
AF125	25p	BC148	10p	BC317	15p	BD233	50p	BF241	16p	BU105	150p	OC72	30p	TIP33B	115p	IS44	4p	2N3904	15p
AF139	35p	BC148C	14p	BC323	60p	BD263	65p	BF244B	35p	BU133	75p	OC75	30p	TIP33C	130p	2N456A	90p	2N4062	14p
AF239	45p	BC149	10p	BC328	13p	BDY10	100p	BF257	26p	BU208	220p	OC81	30p	TIP34	115p	2N697	15p	2N4126	20p
ASY26	40p	BC157	10p	BC338	12p	BDY62/01	90p	BF258	26p	BY100	20p	OC81D	25p	TIP34A	118p	2N929	20p	2N5061	35p
BA114	9p	BC158	10p	BC547	12p	BF120	50p	BF259	30p	BY126	15p	OC83	50p	TIP34B	145p	2N930	20p	2N5163	35p
BA121	9p	BC159	10p	BC547B	13p	BF121	45p	BF274	15p	BY127	19p	OC84	50p	TIP35	225p	2N1302	25p	2N6027	50p
		BC167A	12p	BC548	12p			BF324	30p	BY133	22p							2SD234	50p

BZY88
400M.W.
Zeners

OV7	10p
2V4	10p
2V7	10p
3V0	10p
3V3	10p
3V6	10p
3V9	10p
4V7	10p
5V1	10p
5V6	10p
6V2	10p
6V8	10p
7V5	10p
8V2	10p
9V1	10p
10V	10p
11V	10p

BZY88

12V	10p
13V	10p
15V	10p
18V	10p
20V	10p
22V	10p
27V	10p
30V	10p
33V	10p

100 Mixed Zeners 850p
BZY88 Zeners 850p

SN76013ND	125p
SN76013N	180p
SN76023ND	125p
SN76023N	180p
SN76227N	160p
SN76228N	180p
SN76666N	100p
ZN414	120p

CA3090AQ	400p

TAA300	150p
TAA350	190p
TAA550	50p
TAA570	220p
TAA661B	140p
TAA700	390p
TAD100	250p
TAD110	200p
TBA120S	125p
TBA120T	125p
TBA540	300p
TBA540Q	400p
TBA550Q	400p
TBA560	400p
TBA641A12	250p
TBA720	230p
TBA800	100p
TBA820	100p
TBA990	250p
TCA270Q	250p
TCA270S	250p

LM301A	65p
LM307N	65p
LM308TO5	130p
LM308 8 DIL	130p
LM309K	180p
LM317K	325p
LM348N	200p
LM380N	110p
LM555	35p
LM710 TO5	60p
LM710 P	65p
LM723 TO5	60p
LM723 14 DIL	75p
LM741	25p
LM748	45p
LM1303N	155p
LM3900	90p

NE555	35p
NE556	100p
NE562B	400p

ELECTROLYTIC CAPACITORS

µF/V			
·47/25	5p	330/35	16p
1/16	5p	330/50	18p
1/25	5p	470/10	12p
1/50	5p	470/25	16p
2·2/25	5p	470/35	18p
2·2/35	5p	470/50	22p
3·3/25	5p	680/25	25p
4·7/10	5p	1000/16	25p
4·7/16	5p	1000/35	30p
4·7/25	5p	1000/63	50p
4·7/50	5p	2200/10	28p
6·8/25	5p	2000/35	50p
10/10	5p	2200/16	35p
10/16	5p	2200/63	75p
10/25	5p	2200/100	120p
10/35	5p	3300/16	40p
10/50	5p	3300/25	42p
22/6V3	5p	3300/63	80p
22/10	5p	4700/25	45p
22/16	5p	4700/40	50p
22/25	5p	4700/63	120p
22/35	5p		
22/50	6p		
33/6V3	5p		
33/16	6p		
33/25	6p		
33/40	6p		
33/50	7p		
47/10	6p		
47/16	6p		
47/25	6p		
47/35	6p		
47/50	7p		
100/10	6p		
100/16	6p		
100/25	6p		
100/50	8p		
100/63	10p		
125/15	6p		
220/16	10p		
220/25	12p		
220/50	20p		
330/25	15p		

POLY'TER CAP'ITORS
Mullard or Erie

µF	
·001	5p
·0022	5p
·0033	5p
·0047	5p
·0068	5p
·01	5p
·022	5p
·033	5p
·047	5p
·1	6p
·22	7p
·33	9p
·47	12p
1·00	20p
2·2	25p
4·7	35p
6·8	40p

SPECIAL OFFERS

BC147
BC148
BC149
BC157
BC158
BC159
BF194
BF195
BF196
BF197

100 ASSORTED FOR £7·50p

IN4148
100 for 150p

741 Op AMPS
100 for £20

555 TIMERS
100 for £30

RELAYS
24V 3 C.O. H.D. 11 Pin Plug 1N £1·00 Each

ASSORTED POLYESTER CAPACITORS
100 for £3·00

BYX94 DIODES
1250 PIV 1 Amp.
100 for £6·00

MULLARD
4500/64V C.432 Screw Terminal 75p

RESISTORS CARBON FILM 5%

·25 W
2·2 Ω–4·7M 2p

·5 W
2·2 Ω–4·7M 2·5p

1 W
2·2 Ω 10 MEG 3·5p

POTENTIO-METERS

1K Lin	30p
5K Lin	30p
10K Lin	30p
25K Lin	30p
50K Lin	30p
100K Lin	30p
250K Lin	30p
500K Lin	30p
1 Meg Lin	30p
2 Meg Lin	30p
5K Log	30p
10K Log	30p
25K Log	30p
50K Log	30p
100K Log	30p
250K Log	30p
500K Log	30p
1 Meg Log	30p
2 Meg Log	30p

ROTARY SWITCHES BY LORLIN

1P 12W	40p
2P 6W	40p
3P 4W	40p
4P 3W	40p

MULLARD POT CORES

LA3	100–500 KHz	75p
LA4	10–30 KHz	100p
LA5	30–100KHz	100p
LA7	< 10KHz	100p

LA13 FOR W.W. OSCILLOSCOPE 200p

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LEDS ·125
OR ·2 RED ONLY
100 for £9·00
1000 for £60·00
SPECIAL QUOTATION FOR LARGER QUANTITIES

WESTINGHOUSE THYRISTORS
300 Volts 16 Amp 250p

CMOS

4000	20p	4023	20p	4055	140p
4001	20p	4024	100p	4056	145p
4002	20p	4025	20p	4060	130p
4006	120p	4026	200p	4066	55p
4007	20p	4027	85p	4069	30p
4009	70p	4028	155p	4071	30p
4011	20p	4029	130p	4072	30p
4012	20p	4030	60p	4081	20p
4013	55p	4032	150p	4082	30p
4015	90p	4043	220p	4510	145p
4016	55p	4046	150p	4511	200p
4017	110p	4047	115p	4516	140p
4018	250p	4049	70p	4518	110p
4020	140p	4050	50p	4528	130p
4022	180p	4054	130p		

BRIDGE RECTIFIERS

		V/REG.	
1A 50V	25p	7805	140p
1A 100V	30p	7812	140p
1A 200V	30p	7815	140p
1A 400V	35p	7818	140p
1A 600V	40p	7824	150p
2A 50V	35p		
2A 100V	50p		
2A 200V	55p		

SKELETON PRE-SET POTEN-TIOMETERS
0·1W 50N–5M mini vert & horiz 7p
·25W 100N–3·3M horiz. 7p
·25W 200N–4·7M vert. 8p

TANTALUM BEAD CAPACITORS
35V: 0·1µF, 0·22, 0·33, 0·47, 0·68, 1·0, 2·2, 3·3, 4·7, 6·8, 25V 1·5, 10, 16V 4·7, 10, 22, 10V 4·7, 15, 25, 33
Price 14p each

LEDS

RED ·125	15p
GREEN ·125	25p
YELLOW ·125	25p
RED ·2	15p
GREEN ·2	25p
YELLOW ·2	25p
DL747 Display	200p

DIL SOCKETS

8 Pin	13p
14 Pin	14p
16 Pin	15p

BZX61
Zeners 1·3W

6V8	15p
9V1	15p
11V	15p
13V	15p
15V	15p
22V	15p
30V	15p
39V	15p
43V	15p
47V	15p
51V	15p
56V	15p
68V	15p
72V	15p
160V	15p

XEROZA RADIO

306 ST. PAUL'S ROAD, HIGHBURY CORNER, LONDON, N.1

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LARGE STOCKS OF NEONS, NUMICATOR TUBES, SINGLE AND MULTIPHASE HIGH CURRENT RECTIFIER STACKS, CAPACITORS OF ALL TYPES INCLUDING PHOTO-FLASH AND MOTOR START, TV TUNERS ALSO SOME HIGHLY TECHNICAL EQUIPMENT AND PARTS FOR INDUSTRIAL USERS AND SCHOOLS FOR PERSONAL CALLERS

Manufacturers (Large and Small) we welcome your enquiries. Overseas Buyers/Agents etc. let us know your requirements.

ISSUE 850

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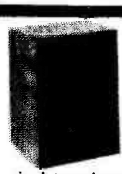
DIY SPEAKER KITS

15-WATT KIT IN CHASSIS FORM

When you are looking for a good speaker, why not build your own from this kit. It's the unit which we supply with the enclosures illustrated below Size 13" × 8" (approx.) woofer (EMI), tweeter, and matching crossover components. Power handling capacity 15 watts rms. 30 watts peak.

£17.00 PER STEREO PAIR + P & P £3.40



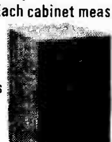
EASY-TO-BUILD WITH ENCLOSURE

Specially designed by RT-VC for cost-conscious hi-fi enthusiasts, these kits incorporate two teak-simulate enclosures, two EMI 13" × 8" (approx.) woofers, two tweeters and a pair of matching crossovers. Easily constructed, using a few basic tools. Supplied complete with an easy-to-follow circuit diagram, and crossover components. Input 15 watts rms. 30 watts peak, each unit. Cabinet size 20" × 11" × 9½" (approx.).

£28.00 PER STEREO PAIR + p & p £5.50

COMPACT' FOR TOP VALUE

How about this for incredible bookshelf value from RT-VC! A pair of high efficiency units for only £8.50 – just what you need for low-power amplifiers. These infinite baffle enclosures come to you ready mitred and professionally finished. Each cabinet measures 12" × 9" × 5" (approx.) deep, and is in wood simulate. Complete with two 8" (approx.) speakers for max. power handling of 7 watts.



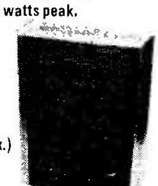
per stereo pair **£8.50** + p & p £2.20

SPEAKERS Two models – Duo IIb. teak veneer. 12 watts rms. 24 watts peak. 18½" × 13½" × 7¼" (approx.).

★ **£34** PER PAIR + p & p £6.50

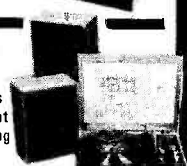
Duo III. 20 watts rms, 40 watts peak, 27" × 13" × 11½" (approx.)

★ **£52** PER PAIR + p & p £7.50



EASY TO BUILD RECORD PLAYER KIT

Ideally suited for the constructor who requires a complete stereo unit at a budget price, comprising ready assembled stereo amp. module. Garrard auto/manual deck with cueing device, pre-cut and finished cabinet work. Output 4 watts per channel, phones socket and record / replay socket

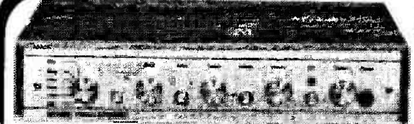


£26.95 + p & p £4.05

CAR RADIO KIT

Complete with speaker, baffle and fixing strip. The Tourist IV for the experienced constructor only. The Tourist IV has five push buttons, four medium band and one for long wave band. The tuning scale is illuminated and attractive small aluminium control knobs are used for manual tuning and volume control. The modern style fascia has been designed to blend with most car interiors and the finished radio will slot into a standard car radio aperture. Size approx. 7" × 2" × 4¼". 12 volts pos or neg earth (altered internally) p & p £1.50 **£12.50** Output 4 watts into 4 ohms.

● FREE TO PERSONAL SHOPPERS BUYING CAR RADIO KIT ELECTROMATE Rear window heater modern line element all wiring and switch worth **£3.00**



SPECIAL OFFER TO PERSONAL SHOPPERS See Below

20 x 20 WATT STEREO AMPLIFIER ★

Superb Viscount IV unit in teak-finished cabinet. Silver fascia with alimunium rotary controls and pushbuttons, red mains indicator and stereo jack socket. Function switch for mic. magnetic and crystal pick-ups, tape, tuner, and auxiliary Rear panel features two mains outlets. DIN speaker and input sockets, plus fuse. 20 + 20 watts rms. 40 + 40 watts peak.

£29.90 p & p £2.50

●**FREE** To cash or cheque personal shoppers

A 4 channel Stereo Adaptor to all buyers of the Visicount 20 x 20 Amplifier at **£29.90** limited offer. Available separately at **£3.95** + £1.00 p & p

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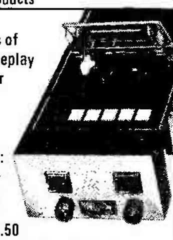
★ on complete stereo systems using ★ starred Products

ADD-ON STEREO CASSETTE TAPE DECK KIT

Designed for the experienced D.I.Y. man. This kit comprises of a tape transport mechanism, ready built and tested record/replay electronics with twin V.U. meters and level control ready for mating together with the mechanism.



Specifications: Sensitivity – Mic. 0.85mV @ 20K OHMS; Din. 40mV @ 400K OHMS: Output – 300mV RMS per channel @ 1KHz from 2K OHMS source: Cross Talk – -30db: Tape Counter – 3 Digit - Resettable: Frequency Response – 40Hz – 8KHz ± 6db: Deck Motor – 9 Volt DC with electronic speed regulations: Key Functions – Record, Rewind, Fast Forward, Play, Stop & Eject. **£19.95** p & p £2.50

Optional extras: Pair of Dynamic microphones **£3.95** + £1.00 p & p. Mains transformer **£2.50** + £1.00 p & p.

Personal Shoppers Only!

STEREO CASSETTE record/replay fully built P.C. board incorporating 4 I.C.s.	£2.75
GRUNDIG 5¾" tape 1800 ft.	£1.20 each. 5 for £5.00
PAIR STEREO 8 WATT SPEAKERS 8" bass units with 3½" approx. tweeters power handling 8 watts imp 8 ohms. Size 16½" × 11" × 8½" approx.	£12.95
SLIMLINE Record Player Plinth accepts BSR T/T	95p
GOODMAN 5" approx., 7 watt bass speaker	£2.70
AM. FM. TUNER P.C.B. with Mullard L.P. 1186, 1185, 1181 modules	£9.50
100K Multiturn Varicap tuning pots 6 for	£1.00
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DECCA DC1000 Stereo Cassette Record deck P.C.B. complete with switch oscillator coils and tape-heads and circuit diagrams.	£2.95
AM. FM. STEREO MULTIPLEX CAR RADIO/cassette player in dash fixing Negative earth 5 watts output	£36.00
I.C. Stereo 8 Track to Cassette adaptor converts, any 8 track player to cassette player.	£18.95

BSR TURNTABLES

BSR MP60 TYPE Single play record player (Chassis form) **£15.95** less cartridge. P & P £2.55

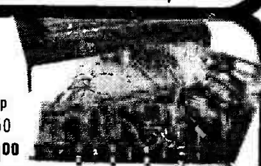
BSR automatic record player deck (Chassis form) with cueing device and stereo ceramic head. **£9.95** P & P £2.55

Cartridges to suit above ACOS MAGNETIC STEREO ...... £4.95 CERAMIC STEREO £1.95

TURNTABLE illus. Popular BSR MP 60 type, complete with magnetic cartridge, diamond stylus, and de luxe plinth and cover. Ready wired ★ **£29** + p & p £4.50

30 x 30 WATT AMPLIFIER KIT

Specially designed by R T-VC for the experienced constructor, this kit comes complete in every detail. Same facilities as Viscount IV amplifier. Chassis is ready punched, drilled and formed Cabinet is finished in teak veneer. Silver fascia and easy-to-handle aluminium knobs: Output 30 + 30 watts rms, 60 + 60 peak.



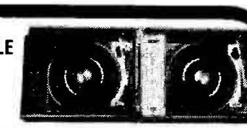
p & p £2.50 **£29.00**

NOW AVAILABLE fully built and tested. **£35.00** + p & p £2.50

DECCA 20 WATTS STEREO SPEAKER

This matching loudspeaker system is hand made, kit comprises of two 8" diameter approx. base drive unit, with heavy die cast chassis laminated cones with rolled P.V.C. surrounds, two 3½" diameter approx. domed tweeters comp with crossover networks £4.00 p & p stereo pair **£20.00**

PORTABLE MONO DISCO

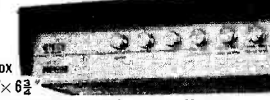


with built-in pre-amplifiers

Here's the big-value portable disco console from RT-VC! It features a pair of BSR MP 60 type auto-return, single play professional series record decks. Plus all the controls and features you need to give fabulous disco performances. Simply connects into your existing slave or external amplifier. p & p £6.50 **£64.00**

45 WATT MONO DISCO AMP

£35.00 + p & p £2.50



Size approx 13⅜" × 5¼" × 6¾".

Here's the mono unit you need to start off with. Gives you a good solid 45 watts rms. 90 watts peak output. Big features include two disc inputs, both for ceramic cartridges, tape input and microphone input. Level mixing controls fitted with integral push-pull switches. Independent bass and treble controls and master volume.

70 & 100 WATT MONO DISCO AMP

Size approx. 14" × 4" × 10¾".

Sloping facia, you can use the controls without fuss or bother. Brushed aluminium fascia and rotary controls. Five smooth acting, vertically mounted slide controls – master volume, tape level, mic level, deck level, PLUS INTER-DECK FADER for perfect graduated change from record deck No. 1 to No. 2, or vice versa. Pre-fade level control (PFL) lets YOU hear next disc before fading it in. VU meter monitors output level. Output 100 watts RMS 200 watts peak.

70 watt **£57** 100 watt **£65** p & p £4.00

BSR BDS95 TYPE

Belt drive turntable unit, 2 speed, semi automatic operation **£24.95** + p & p £2.55

PRACTICE GUITAR AMPLIFIER WITH BUILT-IN SPEAKER

This budget practice amplifier, has been specially designed for the amateur, who requires a quality self-contained unit with all facilities. 2 inputs – 1 for mic or guitar, the 2nd for record player or cassette deck, it also can be used for cine-sound amplification. 2 volume controls, 1 for each input, also base and treble controls. Power output with internal speaker, 10 watts RMS, with remote speaker (not supplied) 20 watts RMS. Size approx. 17" × 9" · 11". **£32.50** + p & p £3.00

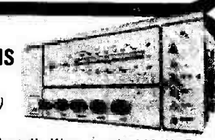
HOME 8 TRACK CARTRIDGE PLAYER

Output 125 Mv

Automatically switches programmes monitored by indicators, with manual override track selection. This unit will match with the Unisound modules and is compatable with the Viscount IV amplifier with Sim teak cabinet. approx. 9" · 8" · 3½". p & p £2.50 **£16.50**

PYE STEREO GRAM CHASSIS

(Complete with circuit-diagrams)



Complete ready to install – Wave bands LM, VHF STEREO, VHF MONO. Controls for tuning volume, balance, bass and treble. Power output 7 watts R.M.S per channel 14 watts peak 8 ohms. 2" · 8" approx chassis speakers and BSR auto record player deck.

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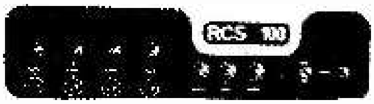
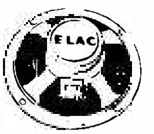


Four inputs. Four way mixing, master volume, treble and bass controls. Suits all speakers. This professional quality amplifier chassis is suitable for all groups, disco, P.A., where high quality power is required. 5 speaker outputs. A/C mains operated. Slave output. Produced by demand for a quality valve amplifier. Send for details.
Suitable carrying cabinet £16. Carr. £2. Price **£94** carr. £2·50

ANOTHER R.C.S. BARGAIN !

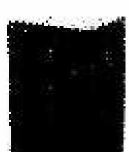
ELAC 9 + 5in. HI-FI SPEAKER TYPE 59RM
This famous unit now available, 10 watts, 8 ohm.
Price **£3·45** Post 40p

10" ELAC HI-FI SPEAKER



Large ceramic magnet.
Response: 50-18,000 cps.
Bass resonance 55 cps.
16 ohm impedance
10 watts. Post 40p **£4·50**

TEAK VENEER HI-FI SPEAKER CABINETS



MODEL "A". 20 × 13 × 12in. For 12in. dia. or 10in speaker. Illustrated. **14·50** Post £1·60

MODEL "B" BOOKSHELF For 13 × 8in. or 8in. speaker **£8·50** Post £1

R.C.S. BOOKSHELF CABINET Size 16in. × 6in. × 5in. approx. Response 50 to 14,000 cps. 6 watts rms. 8 ohms. **£16 pair** Post £1·30

LOUDSPEAKER CABINET WADDING 18in. wide, 20p ft.

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3½in. diam. 18,000 C.P.S. 25 WATTS 8 Ω **£3·25**
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BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER. Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9 volt battery operated. **£6·75**
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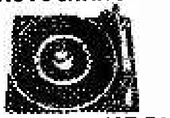

Plays 12in. 10in. or 7in. records Auto or Manual. A high quality unit backed by BSR reliability with 12 months guarantee. A.C. 200/250V. Size 13½ × 11¼in.
Above motor board 3¼in.
Below motor board 2½in.
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90-14,500 c/s, 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c/s rated 25 watts. NOTE: 4 or 8 or 16 ohms must be stated.

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30-17,000 c/s with tweeter, crossover, baffle 19 × 12½in. Please state 4 or 8 or 16 ohms. **£19·00**
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Bass resonance 55 cps.

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Professional amplifier using advanced circuit design. Ideal for disco, groups, P.A. or musical instruments. 4 inputs 4 way mixing. Master treble, bass and volume controls. 3 speaker output sockets to suit various combinations of speakers. 4-8-16 ohm. Slave output. A/C mains. Guaranteed. Details S.A.E. **£72** Carr. £1·00

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MADE BY JENNINGS MUSICAL INSTRUMENTS **£59**
4 Speaker outputs volume, treble, bass, controls
CAN BE USED AS 100 WATT SLAVE Carr. £1

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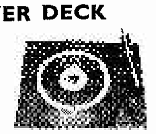

3 speed. Plays all size records, Stereo Cartridge. Cueing device, Ideal Disco Deck.
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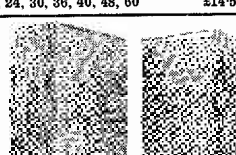
3A, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60	£11·00
5A, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60	£14·50

R.C.S. BOOKSHELF SPEAKERS



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for Disco or PA all fitted with carrying handles and corners. Black vynide covered. Other cabinets in stock. SAE for leaflet

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Ideal for Disco, Organ or PA work.
High quality. Full range.

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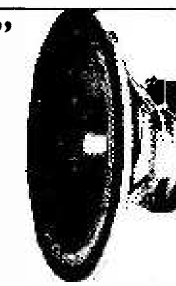
12in 25 watts



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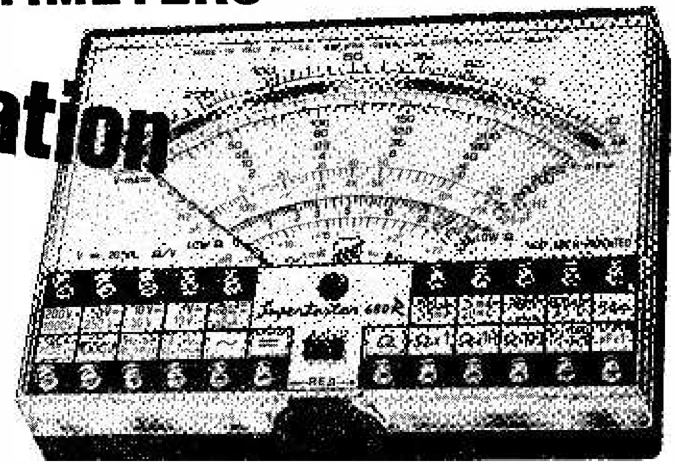

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24-0-24V	500mA	2·15*
0-19-25-33-40-50V+	½A	3·25*
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Please add an extra 50p to items marked +

HEATSINKS

TO 92	7p*	TO 5 (5F)	9p*
TV 2	25p*	TO 18 (18F)	11p*
TV 3	26p*	U1 (TBA800)	16p*
TV 4	24p*	U2 (TBA810AS)	21p*
TV 5	24p*	U3 (TDA2020)	52p*
TV 16	33p*	AY 14	51p*
CH 106	31p*	1·18 E-17 (For 1xTDA2020)	80p*
3·15 E-18 (For 1xTDA2020)	1·10*	3·15 E-19 (For 2xTDA2020)	1·57*

Transistor Covers
TO66 and TO3 12p*

PLUGS AND SOCKETS

DIN Connectors

Pins	Plugs	Sockets	Line Couplers
2	14p	10p	18p
3	14p	10p	18p
4	14p	10p	18p
5 (180)	14p	10p	18p
5 (240)	14p	10p	18p
6	14p	10p	18p
7	14p	10p	18p

JACK CONNECTORS

Type	Plugs Plastic	Plugs Chrome	Sockets
2·5mm	15p	25p	12p
3·5mm	15p	25p	12p
Mono	—	30p	20p
Stereo	—	37p	25p

PHONO Connectors

Plugs		Sockets			
Plastic Moulded	10p	1 way	8p	3 way	12p
Chrome Screened	15p	2 way	12p	4 way	14p

CO-AXIAL Connectors

Plug	Surface Socket	Coupler
16p	16p	43p

SWITCHES

D.P.D.T. toggle	·50p*
S.P.S.T. toggle	·30p*
D.P.D.T. Slide	·18p*
D.P.D.T. Slide Miniature	·15p*
Push to Make Miniature	·18p*

RESISTORS

Type	Range	
¼ watt 5% Carbon film	E12 Series 10R-1M	2p each
½ watt 5% Carbon film	E24 Series 3·3R-10M	2p ea.
1 watt 5% Carbon film	E12 Series 10R-1M	5p each

POTENTIOMETERS

5K 250K, 10K 500K, 25K 1M, 50K 2M, 100K:

Lin and Log less Switch (inc. in Lin)	·27p
Lin and Log Dual less Switch	·75p
Lin and Log with Switch	·60p
10K, 100K, 500K, 1M Dual log with Switch	·75p
10K Log + 10K Antilde less Switch	·75p

PRESETS

100R	5K	250K	·1 watt
250R	10K	500K	Horizontal
500R	25K	1M	and
1K	50K	2·5M	Vertical
2·5K	100K	5M	7p each

SPECIAL OFFER

THIS MONTH'S SPECIAL OFFER £1·00's WORTH OF PASSIVES (OUR CHOICE) WITH EVERY ORDER OVER £4·00.

SEE NEXT MONTH'S ADVERT FOR FREE SEMICONDUCTOR PACK.

CAR ALARM

Car Alarm and Immobiliser Unit. Easy to fit. Excellent Anti-Theft Device.
Send for Free Leaflet. Price £17·27.

DIODES

BA114	15p	BY105	25p	OA91	10p
BA115	25p	BY126	12p	OA200	10p
BA145	20p	BY127	12p	OA202	10p
BA148	20p	BY133	25p	IN914	5p
BA155	15p	BY182	1·65	IN4003	7p
BA156	15p	BY250	30p	IN4007	8p
BAX16	12p	OA47	12p	IN4148	5p
BB105B	50p	OA79	12p	IN5401	15p
BY103	25p	OA90	10p	IN5407	25p

BRIDGES

1A 50V	25p	1A 400V	30p	2A 50V	40p
1A 100V	25p	1A 600V	35p	2A 100V	45p
1A 200V	25p	1A 100V	40p	2A 200V	50p

ZENERS

BZY88	400mw 2·7v–33v	10p
1ZS	1w 3·6v–100v	20p

T.T.L.

Just a selection. Send for full list

7400	16p*	7430	16p*	7474	27p*	74121	27p*
7401	16p*	7441	56p*	7475	40p*	74123	49p*
7402	16p*	7442	52p*	7476	30p*	74141	41p*
7403	16p*	7445	70p*	7485	76p*	74145	65p*
7404	17p*	7447	59p*	7486	27p*	74151	49p*
7408	19p*	7448	65p*	7489	2·32*	74154	85p*
7410	16p*	7451	16p*	7490	38p*	74174	72p*
7413	27p*	7470	27p*	7492	41p*	74192	86p*
7420	16p*	7472	22p*	7493	41p*	74193	86p*
7427	28p*	7473	27p*	74107	27p*	74196	79p*

C.Mos

4000	18p*	4014	1·00*	4024	78p*	4051	86p*
4001	18p*	2015	97p*	4025	19p*	4052	86p*
4002	18p*	4016	53p*	4026	1·76*	4060	1·16*
4006	1·09*	4017	97p*	4027	58p*	4068	22p*
4007	19p*	4018	97p*	4028	87p*	4070	22p*
4009	62p*	4019	58p*	4029	1·18*	4071	22p*
4010	62p*	4020	1·08*	4040	1·08*	4081	22p*
4011	18p*	4021	97p*	4042	83p*	4082	22p*
4012	21p*	4022	88p*	4049	58p*	4510	1·24*
4013	58p*	4023	19p*	4050	58p*	4511	1·54*

LINEAR INTEGRATED CIRCUITS

uA703 (TO99)	£1·00	LM370N	£2·75	SL415A	£2·47
uA709 (8 pin DIL)	41p	LM371	£1·75	SL440A	£2·38*
uA709 (14 pin DIL)	41p	LM372N	£1·75	SN75491N	95p*
uA709 (TO99)	50p	LM373N	£2·99	SN75492N	£1·15*
uA709 (8 pin DIL)	50p	LM337N	£1·95	SN76001N	£1·40
uA710 (14 pin DIL)	55p	LM380N-8	£1·00	SN76003N	£2·45
uA710 (TO99)	60p	LM380N	99p	SN76013N	£1·60
uA711 (14 pin DIL)	90p	LM381N	£1·75	SN76023N	£1·60
uA711 (TO99)	98p	LM322N	£1·35	SN76033N	£2·45
uA741 (8 pin DIL)	25p	LM390N	65p	SN76544N	£1·55
uA741 (14 pin DIL)	42p	LM3905N	£1·50*	SN76532N	£1·55
uA741 (TO99)	45p	LM3909N	70p*	SN76552N	65p
uA847 (14 pin DIL)	90p	MC1303/LM1303N	£1·10	SN76666N	£1·00
uA748 (8 pin DIL)	42p	MC1310P	£1·80	SN76660N	65p
uA748 (14 pin DIL)	60p	MC1312P	£2·15	TAA263	£2·50
uA748 (TO99)	65p	MC1314P	£3·50	TAA320A	75p
uA753 (8 pin DIL)	£1·95	MC1315P	£6·10	TAA350A	£2·70
AY-1-0212	£6·50	MC1327P/TDA1327		TAA570	£2·50
AY-1-5051	£1·65		£1·50	TBA120S	£1·00
AY-5-1224A	£3·39*	MC1330P	£1·15	TBA231	£1·00
AY-5-3507	£5·99*	MC1350P	£1·00	TBA520Q	£2·00
AY-5-4007	£7·99*	MC1351P	£1·00	TBA530Q	£2·00
CA3045	£1·50	MC1352P/		TBA540Q	£2·00
CA3046	80p	TDA1352	£1·20	TBA550Q	£2·00
CA3053	85p	MC1357P/		TBA651	£2·25
CA3075	£2·00	LM2111N	£1·70	TBA750Q	£2·00
CA5080	80p	MC1375P	£1·50	TBA800	£1·00
CA3081	£1·50	MC1456CG	£2·50	TBA810S	£1·10
CA3082	£1·50	MC1495L	£4·90	TBA820	£1·10
CA3089/TDA1200	£2·30	MC3302P	£1·65	TBA990Q	£2·00
CA3090Q	£4·25	MFC6030A	£1·00	TCA730	£4·69
CA3123E/LM1820	£1·50	NE540L	£2·25	TCA740	£4·69
CA3097E	£1·75	NE546	£2·15	TCA940	£1·75
CA3130S	99p*	NE555	35p*	TDA2020	£3·50
CA3140S	99p	NE556	90p*	ZN414	£1·10
CA3160S	£1·60	NE560	£4·40*	ZN417E	£1·68
CA3600E	£1·75	NE561	£4·40*	ZN423T	£1·08*
LM301AN (8 pin)	40p	NE562	£4·40*	ZN424E	£1·35
LM301AT (TO99)	50p	NE565	£1·40*	ZN425E	£3·78*
LM308N (8 pin)	90p	NE566	£1·65*	ZN1034E	£2·03*
LM308T (8 pin)	£1·40	NE567	£1·85*	ZN1040E	£8·43*
LM339N	£1·00	SL414A	£1·90	ZNA116E	£6·75*

REGULATORS

723 Variable		45p*
7BL05AWC	5V	65p*
78L12AWC	12V	65p*
78L15AWC	15V	65p*
7805KC	5V	2·17*
7812KC	12V	2·17*
7815KC	15V	2·17*
7805UC	5V	1·25*
7812UC	12V	1·25*
7815UC	15V	1·25*
7818UC	18V	1·25*
7824UC	24V	1·25*
L005T1	5V	1·50*
L036T1	12V	1·50*
L037T1	15V	1·50*
L129	5V	85p*
L130	12V	85p*
L131	15V	85p*
TBAG25A	5V	1·25*
TBA625B	12V	1·25*
TBA625C	15V	1·25*
LM309K	5V	1·50*

Negative

7905UC	5V	1·25*
7912UC	10V	1·25*
7915UC	15V	1·25*
7918UC	18V	1·58*
7924UC	24V	1·25*

TRANSISTORS

AC126	20p*	BC558	15p	MPF104	40p	2N1302	45p*
AC127	20p*	BC559	15p	MPF105	40p	2N1304	45p*
AC128	20p*	BC547	15p	MPSA05	25p	2N1305	30p*
AC176	20p*	BC548	15p	MPSA06	25p	2N1306	45p*
AC187K	35p*	BC549	15p	MPSA55	30p	2N1307	30p*
AC188K	35p*	BCY70	18p*	MPSA56	30p	2N1309	45p*
AD161	45p*	BCY71	18p*	MPSU05	50p	2N1711	25p
AD162	45p*	BCY72	18p*	MPSU06	55p	2N1893	35p
BC107	10p*	BD131	50p*	MPSU55	55p	2N2646	50p*
BC108	10p*	BD132	50p*	MPSU56	60p	2N2925	10p
BC109	10p*	BD135	40p	TIP31A	55p*	2N2926G	10p
BC147	9p	BD136	40p	TIP32A	60p*	2N3053	22p*
BC148	9p	BD139	40p	TIP41A	65p*	2N3054	55p*
BC149	10p	BD140	40p	TIP42A	75p*	2N3055	60p*
BC157	11p	BD239C	35p*	TIS43	40p*	2N3442	1·50
BC158	11p	BF180	35p*	TIS91	25p	2N3702	11p
BC159	11p	BF181	35p*	ZTX107	12p	2N3703	11p
BC159C	12p	BF184	25p*	ZTX108	12p	2N3704	11p
BC177	18p*	BF185	25p*	ZTX109	12p	2N3705	11p
BC178	18p*	BF194	12p	ZTX300	15p	2N3706	11p
BC179	18p*	BF195	12p	ZTX301	15p	2N3708	12p
BC182L	11p	BF196	12p	ZTX302	17p	2N3709	12p
BC183L	11p	BF197	12p	ZTX303	20p	2N3710	12p
BC184L	11p	BF200	35p	ZTX311	15p	2N3711	12p
BC212L	11p	BF244B	35p	ZTX312	17p	2N3772	1·50*
BC213L	11p	BFY50	20p*	ZTX341	20p	2N3819	25p
BC214L	11p	BFY51	20p*	ZTX500	15p	2N3904	20p
BC141	35p	BRY39	50p*	ZTX501	17p	2N3906	20p
BC461	35p	MJ2955	1·20*	ZTX502	17p	2N5447	18p
BC477	25p	MJ3055	1·20*	ZTX503	20p	2N5449	19p
BC478	25p	MJE340	50p	ZTX504	25p	2N5777	50p*
BC479	25p	MPF102	40p	ZTX531	25p	3N141	1·00
BC557	15p	MPF103	40p	ZTX550	17p	40673	75p*

LIGHT EMITTING DIODES

0·125" (inc. clip)	1+	10+	100+
TIL209 Red	15p*	13p*	11p*
TIL212 Yellow(H.B.)	27p*	22p*	17p*
TIL216 Red (H.B.)	27p*	22p*	17p*
TIL232 Green(H.B.)	27p*	22p*	17p*
0·2" (inc. Clip)			
TIL220 Red	15p*	13p*	11p*
TIL224 Yellow(H.B.)	30p*	26p*	20p*
TIL228 Red (H.B.)	30p*	26p*	20p*
TIL234 Green (H.B.)	30p*	26p*	20p*

(H.B.)—High Brightness.

I.C. SOCKETS

8 pin	10p*	16 pin	14p*	28 pin	30p*
14 pin	12p*	24 pin	26p*	40 pin	44p*
I.C. pins		100	54p*	1,000	£3·78*

POLYESTER CAPACITORS

Mullard C280 Series 250vw

0·01µf	5p	0·068µf	6p	0·47µf	12p
0·015µf	5p	0·10µf	6p	0·68µf	17p
0·022µf	5p	0·15µf	6p	1·0µf	25p
0·033µf	5p	0·22µf	8p	1·5µf	34p
0·047µf	5p	0·33µf	9p	2·2µf	40p

Mullard C281 Series 400vw

0·01µf	10p	0·068µf	15p	0·47µf	33p
0·015µf	10p	0·17f	16p		
0·022µf	10p	0·15µf	18p		
0·033µf	12p	0·22µf	25p		
0·047µf	15p	0·33µf	30p		

CERAMIC CAPACITORS

Mullard 632 Series			Mullard 630 Series	
1·8pf	10pf	56pf	390pf	1500pf
2·2pf	12pf	68pf	470pf	1800pf
2·7pf	15pf	82pf	560pf	2200pf
3·3pf	18pf	100pf	680pf	2700pf
3·9pf	22pf	120pf	820pf	3300pf
4·7pf	27pf	150pf	1000pf	3900pf
5·6pf	33pf	180pf	1200pf	4700pf
6·8pf	39pf	220pf		
8·2pf	47pf	270pf		
		330pf		

6p each

Mullard 629 Series
0·01uf 0·022uf

POLYSTYRENE CAPACITORS

10pf	100pf	1000pf	10,000pf (0·01uf)
12pf	120pf	1200pf	
15pf	150pf	1500pf	
22pf	220pf	2200pf	
33pf	330pf	3300pf	
47pf	470pf	4700pf	6p each
56pf	560pf	5600pf	
48pf	680pf	6800pf	
82pf	820pf	8200pf	

SILVER MICA CAPACITORS

2·2pf	10p	68pf	10p	500pf	15p
3·3pf	10p	75pf	10p	560pf	15p
5pf	10p	82pf	10p	680pf	15p
10pf	10p	100pf	10p	820pf	15p
18pf	10p	120pf	10p	1000pf	20p
20pf	10p	150pf	10p	1500pf	20p
22pf	10p	180pf	10p	1800pf	20p
25pf	10p	200pf	10p	2200pf	20p
27pf	10p	220pf	10p	2700pf	30p
30pf	10p	250pf	10p	3600pf	30p
33pf	10p	270pf	15p	4700pf	30p
39pf	10p	300pf	15p	5000pf	30p
47pf	10p	330pf	15p	6800pf	40p
50pf	10p	390pf	15p	8200pf	40p
56pf	10p	470pf	15p	0·01µf	40p

MYLAR CAPACITORS

1000pf	5p	0·04µf	8p
2000pf	5p	0·047µf	8p
2200pf	5p	0·05µf	8p
4700pf	5p	0·068µf	9p
5000pf	5p	0·1µf	10p
0·01µf	6p	0·02µf	12p
0·02µf	7p	0·22µf	12p
0·022µf	7p		

TANTALUM BEAD CAPACITORS

0·1µf	35v	15p	10µf	16v	15p
0·22µf	35v	15p	10µf	25v	15p
0·47µf	35v	15p	10µf	35v	20p
1·0µf	35v	15p	22µf	16v	20p
2·2µf	35v	15p	47µf	16v	20p
4·7µf	35v	15p	100µf	3v	20p

LOW VOLTAGE DISC CERAMIC CAPACITORS

0·022µf 18V 0·047µf 12V 0·22µf 6V 5p each

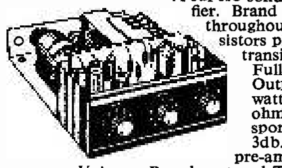
ELECTROLYTIC CAPACITORS

uf	V6·3	10	16	25	40	63
1	—	—	—	—	—	7p
1·5	—	—	—	—	—	7p
2·2	—	—	—	—	—	7p
3·3	—	—	—	—	—	7p
4·7	—	7p	—	7p	—	7p
6·8	—	—	—	—	7p	7p
10	—	—	—	7p	—	7p
15	—	—	—	—	7p	8p
22	7p	7p	7p	7p	7p	8p
33	—	—	7p	—	7p	—
47	7p	7p	—	7p	7p	12p
68	7p	—	7p	8p	—	—
100	—	—	7p	8p	12p	25p
150	—	—	7p	8p	12p	25p
220	—	8p	8p	12p	15p	25p
330	—	8p	8p	—	—	30p
470	—	15p	—	25p	30p	35p
680	—	15p	20p	25p	30p	—
1000	15p	15p	30p	25p	40p	65p
1500	—	—	25p	—	—	—
2200	—	30p	35p	45p	70p	90p
4700	—	35p	—	55p	80p	95p

VAT INCLUSIVE PRICES

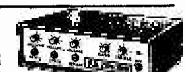
Postage and Packing 25p
Items followed by a * include V.A.T. @ 8% all others include 12·5% ALWAYS PLEASED TO SEE PERSONAL CALLERS
TRADE AND EXPORT CUSTOMERS MOST WELCOME Overseas Customers deduct 2/27 from items marked with a * 1/9 from others

SUPERSOUND 13 HI-FI MONO AMPLIFIER



A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 8 ohms. Frequency response 12Hz 30KHz ± 3db. Fully integrated pre-amplifier stage with separate Volume. Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3" high × 6" wide × 7½" deep. AC 200/250V. PRICE £15·00. P. & P. £1·20.

HAVERSONIC MODEL P.A. TWO ZERO

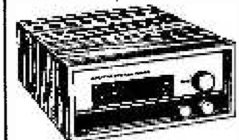


An advanced solid state general purpose mono amplifier suitable for Public Address system, Disco, Guitar, Gram., etc. Features 3 individually controlled inputs (each input has a separate 2 stage pre-amp). Input 1·5mv into 47k. Input 2·5mv into 47k. (suitable for use with mic. or guitar etc.). Input 3 100mv into 1 meg. suitable for gram. tuner, or tape etc. Full mixing facilities with full range bass & treble controls. All inputs plug into standard jack sockets on front panel. Output socket on rear of chassis for an 8 ohm or 16 ohm speaker. Output in excess of 20 watts R.M.S. Very attractively finished purpose built cabinet made from black vinyl covered steel, with a brushed anodised aluminium front escutcheon. For ac mains operation 200/240v. Size approx. 12½" w.×5" h.×7½" d. Special introductory Price £28·00+£2·50 carr. & pkg.

Mullard LP1159 RF-IF Module 470 kHz £2·25+ P.&P. 20p. Full spec. and connection details supplied. Pye VHF/FM Tuner Head covering 88-108 M/Hz. 10·7 M/Hz I.F. output. 7·8 Volt + earth. Supplied pre-aligned, with full circuit diagram with precision-geared FM gang and 323Pf + 323Pf A.M. Tuning gang only £3·15 + P. & P. 35p.

STEREO DECODER
SIZE 2" × 3" × ½" ready built. Pre-aligned and tested for 9-16V neg. earth operation. Can be fitted to almost any FM VHF radio or tuner. Stereo beacon light can be fitted if required. Full details and instructions (inclusive of hints and tips) supplied. £6·00 plus 20p. P. & P. Stereo beacon light if required 40p extra.

MAINS OPERATED SOLID STATE AM/FM STEREO TUNER



200/240V Mains operated Solid State FM AM Stereo Tuner. Covering M.W. A.M. 540-1605 KHz VHF/FM 88-108 MHz. Built-in Ferrite rod aerial for M.W. Full AFC and AGC on AM and FM. Stereo Beacon Lamp Indicator. Built in Pre-amps with variable output voltage adjustable by pre-set control. Max o/p Voltage 600m/v RMS into 20K. Simulated Teak finish cabinet. Will match almost any amplifier. Size 8½"w × 4"h × 9½"d approx.
LIMITED NUMBER ONLY at £28·00 + £1·50 P. & P.

Push Button Switch bank. 8 Buttons giving 16 S/P C/O interlocked switches plus 1 Cancel Button Plus 3 d/p c/o. Overall size 5" × 2½" × 1". Supplied complete with chrome finished switch buttons. 2 for £1·80+20pP.&P.

10/14 WATT HI-FI AMPLIFIER KIT
A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15 Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 25p + SAE (Free with parts). All parts sold separately. ONLY £13·50 P. & P. £1·40. Also available ready built and tested £18·00 P. & P. £1·40.

"POLY PLANAR" WAFER-TYPE, WIDE RANGE ELECTRO-DYNAMIC SPEAKER
Size 11¾" × 14$\frac{5}{16}$" × 1$\frac{3}{16}$" deep. Weight 19oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Response 40Hz-20kHz. Can be mounted on ceilings, walls, doors, under tables, etc., and used with or without baffle. Send S.A.E. for full details.
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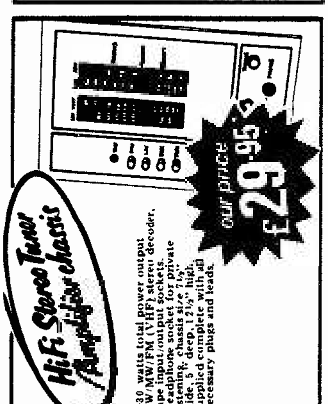

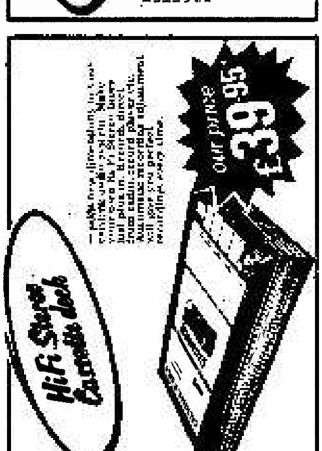

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200V	0·64	0·64	0·75	0·75	0·87	0·87	0·97	0·01	1·17	1·17
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7412	0·25
7413	0·40
7414	0·72
7417	0·43
7420	0·16
7425	0·30
7427	0·30
7430	0·16
7432	0·28
7437	0·80
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7442	0·65
7445	0·90
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7470	0·32
7472	0·26
7473	0·30
7474	0·32
7475	0·47
7476	0·36
7480	0·55
7482	0·75
7486	0·32
7489	2·42
7490AN	0·49
7491AN	0·85
7492	0·67
7493	0·45
7494	0·85
7495	0·67
7496	0·82
74100	1·07
74107	0·35
74121	0·34
74122	0·47
74123	0·65
74141	0·78
74145	0·68
74154	1·30
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74174	1·40
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AC128	0·16
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AC141K	0·34
AC142	0·18
AC142K	0·32
AC176	0·16
AC176K	0·32
AC187	0·18
AC187K	0·36
AC188	0·18
AC188K	0·32
AD149	0·80
AD161	0·35
AD162	0·35
AF114	0·20
AF115	0·20
AF116	0·20
AF117	0·20
AF118	0·50
AF124	0·25
AF125	0·25
AF126	0·25
AF139	0·35
AF239	0·37
AL102	1·45
AL103	1·30
AU107	3·30*
AU110	1·75*
AU113	1·60*
BC107	0·12
BC107B	0·12
BC108	0·12
BC108B	0·12
BC109	0·12
BC109B	0·12
BC109C	0·15
BC117	0·19*
BC119	0·25
BC125	0·18*
BC126	0·20*
BC140	0·32
BC141	0·28
BC142	0·23
BC143	0·23
BC147	0·09*
BC148	0·09*
BC149	0·09*
BC157	0·09*
BC158	0·09*
BC159	0·09*
BC160	0·32
BC161	0·38
BC168	0·09*
BC169	0·12*
BC169C	0·14*
BC182	0·11*
BC182L	0·12*
BC183	0·10*
BC183L	0·10*
BC184	0·11*
BC184L	0·12*
BC186	0·20*
BC187	0·24*
BC207B	0·12*
BC212	0·11*
BC212L	0·12*
BC213	0·12*
BC213L	0·14*
BC214	0·14*
BC214L	0·15*
BC237	0·16*
BC238	0·16*
BC300	0·34
BC301	0·32
BC302	0·40
BC303	0·46
BCY30	0·55
BCY31	0·55
BCY32	0·60
BCY33	0·55
BCY34	0·55
BCY38	0·50
BCY39	1·15
BCY40	0·75
BCY42	0·30
BCY54	1·60
BCY70	0·12
BCY71	0·18
BCY72	0·12
BD115	0·55
BD131	0·36
BD132	0·40
BD135	0·36*
BD136	0·39*
BD137	0·40*
BD138	0·48*
BD139	0·58*
BD144	2·20
BD157	0·60
BD181	0·86
BD182	0·92
BD183	0·97
BD184	1·20
BD232	0·60
BD233	0·48
BD237	0·55
BD238	0·60
BD410	0·60
BDX32	2·30
BDY10	1·50
BDY11	2·00
BDY20	0·80
BDY38	0·60
BDY60	1·70
BDY61	1·65
BDY62	1·15
BDY95	2·14
BDY96	4·96
BF179	0·30
BF180	0·30
BF181	0·30
BF182	0·30
BF183	0·30
BF184	0·20
BF185	0·20
BF194	0·10*
BF196	0·12*
BF197	0·12*
BF224J	0·18*
BF244	0·17*
BF257	0·30
BF336	0·35*
BF337	0·32*
BF338	0·45*
BFW30	1·25
BFW59	0·30
BFW60	0·36
BFX29	0·26
BFX30	0·30
BFX845	0·23
BFX8	0·25
BFX86	0·25
BFX87	0·20
BFX88	0·20
BFX89	0·90
BFY11	1·10
BFY18	0·50
BFY40	0·50
BFY41	0·60
BFY50	0·20
BFY51	0·18
BFY52	0·19
BFY53	0·25
BFY64	0·35
BFY90	0·90
BSX19	0·16
BSX20	0·18
BSX21	0·20
BSY52	0·28
BSY53	0·39
BSY54	0·33
BSY55	0·74
BSY65	0·30
BSY76	0·20
BSY78	0·75
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BU109	2·50*
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MJE340	0·40*
MJE520	0·45
MJE521	0·55
OC43	0·95
OC44	0·32
OC45	0·32
OC46	0·20
OC70	0·30
OC71	0·35
OC72	0·22
OC84	0·40
OC139	1·30
OC140	1·30
OC170	0·23
TIP29A	0·44*
TIP30A	0·52*
TIP41A	0·54
TIP32A	0·64
TIP41A	0·68
TIP42A	0·72
2N404	0·40
2N696	0·20
2N697	0·20
2N706	0·15
2N1131	0·15
2N1132	0·16
2N1302	0·40
2N1303	0·40
2N1304	0·45
2N1305	0·45
2N1306	0·50
2N1307	0·50
2N1308	0·60
2N1309	0·60
2N1711	0·24
2N2102	0·44
2N2217	0·30
2N2369	0·14
2N2369A	0·14
2N2483	0·20
2N2484	0·16
2N2646	0·50
2N2711	0·20
2N2712	0·15
2N2904A	0·20
2N2905	0·18
2N2905A	0·22
2N2906	0·18
2N2925	0·14*
2N2926O	0·09*
2N2926R	0·10*
2N2926Y	0·09*
2N2926G	0·10*
2N3053	0·20
2N3055	0·50
2N3137	1·10
2N3440	0·56
2N3442	1·20
2N3570	3·60
2N3702	0·10*
2N3703	0·10*
2N3704	0·10*
2N3705	0·10*
2N3706	0·10*
2N3707	0·10*
2N3708	0·09*
2N3709	0·09*
2N3710	0·10*
2N3711	0·10*
2N3715	1·70
2N3716	1·80
2N3771	1·60
2N3772	1·90
2N3773	2·10
2N3819	0·28*
2N4347	1·10
2N4348	1·20
2N4870	0·35*
2N4871	0·35*
2N4918	0·60*
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4010BE	0·52
4011BE	0·20
4012BE	0·20
4013BE	0·50
4014BE	1·00
4015BE	0·95
4016BE	0·54
4017BE	1·00
4018BE	1·10
4019BE	0·50
4020BE	1·12
4021BE	1·03
4022BE	0·95
4023BE	0·20
4024BE	0·86
4025BE	0·20
4026BE	1·55
4027BE	0·62
4028BE	0·91
4029BE	1·10
4030BE	0·55
4041BE	0·80
4042BE	0·83
4034BE	1·00
4044BE	0·94
4046BE	1·32
4049BE	0·54
4050BE	0·54
4069BE	0·30
4070BE	0·50
4071BE	0·26
4072BE	0·26
4081BE	0·20
4082BE	0·26
4510BE	1·42
4511BE	1·50
4516BE	1·35
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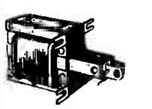
Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450W). Unit in box all ready to work. £8·95 plus £1·00 VAT & Postage.

MAINS OPERATED SOLENOIDS



Model TT2—small but powerful 1in. pull—approx. size 1½ × 1½ × 1¼in. £1·00.
Model 4001/—⅞in. pull. Size 2⅞ × 2 × 14in. £1·50.
Model TT10—1¼in. pull. Size 3 × 2½ × 2in. £4·50.
Prices include VAT & postage.

PP3/PP9 REPLACEMENT MAINS UNIT

Japanese made in plastic container with leads size 2" × 1½" × 1½, this is ideal to power a calculator or radio, it has a full wave rectified and smoothed output of 9 volts suitable for a loading of up to 100mA. £2·53.

3 NEW BOOKS BY G. C. DODDS

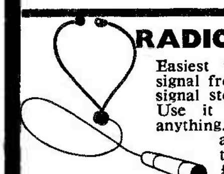
Practical Test Equipment describes the theory, the construction, and the operation of 7 instruments for beginners to make from readily obtainable components: Transistor Tester—Transistor checker—Square wave oscillator—AC Bridge—Signal injector and signal tracer combined in a Multi Checker—Dual range ohm meter, the final chapter deals with a range of test leads and give more detailed notes on signal injecting and signal tracing.
Published price 75p our price **50p**.

Practical Electronic Projects describes the construction and uses of 9 projects for beginners, all made from easily obtainable parts describes construction and operation of:—Windscreen wiper delay—Electronic Siren—Drum beat simulator—Lamp dimmer—Light/Dark operated switch—electronic bird, emotional state indicator—telephone amplifier—Solar powered radio.
Published price 75p our price **50p**.

Shortwave Receivers for Beginners after a few pages of general notes on wave bands, band spreading etc, the author gives constructional details of a one transistor radio then a two transistor and finally a multi stage receiver with band spreading and reaction.
Published price 60p our price **45p**.

FREE If you purchase the other two you get the shortwave one free.

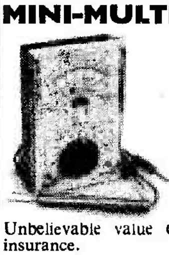
RADIO STETHOSCOPE



Easiest way to fault find, traces, signal from aerial to speaker, when signal stops you've found the fault. Use it on Radio, TV, amplifier, anything. Kit comprises transistors and parts including probe tube and twin stetho-set. £3·95 VAT and postage inc.

Breakdown Parcel—four unused, made for computer units containing most useful components, and these components unlike those from most computer panels, have wire ends of usable length. The transistors for instance have leads over 1" long—the diodes have approx. ½" leads.
List of the major components is as follows:—17 assorted transistors—38 assorted diodes—60 assorted resistors and condensers—4 gold plated plugs in units which can serve as multipin plugs or as hook up boards for experimental or quickly changed circuits (note we can supply the socket boards which were made to receive these units). The price of this four units parcel is £1 including VAT and post (considerably less than value of the transistor or diodes alone) DON'T MISS THIS SPLENDID OFFER.

MINI-MULTI TESTER



Amazing, deluxe pocket size precision moving coil instrument—jewelled bearings—1000 opv—mirrored scale.
11 Instant ranges measure:—
DC volts 10, 50, 250, 1000
AC volts 10, 50, 250, 1000
DC amps 0-1 mA and 0-100 mA
Continuity and resistance 0-150K ohms.
Complete with insulated probes, leads, battery, circuit diagram and instructions.
Unbelievable value only **£5·50p** + 50p post and insurance.

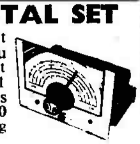
FREE

Amps ranges kit enable you to read AC and DC current from 0-10 amps, directly on the 0-10 scale. It's free if you purchase quickly but if you already own a mini tester and would like one send £1·50p.

MULLARD UNILEX

A mains operated 4 + 4 stereo system. Rated one of the finest performers in the stereo field this would make a wonderful gift for almost any one in easy-to-assemble modular form and complete with a pair of Plessey speakers this should sell at about £30—but due to a special bulk buy and as an incentive for you to buy this month we offer the system complete at only **£14·00** including VAT and postage.

SHORTWAVE CRYSTAL SET



Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 19, 25, 29, 31 metre bands. Kit contains chassis front panel and all the parts **£1·90** —crystal earphone **55p** including VAT and postage.

MEASURING A.C. AMPS with POPULAR MULTI-TESTERS

This is not usually possible because a current transformer is required—We can now offer a kit of parts to make a suitable transformer which will enable you to measure A.C. amps directly on your Multi-tester two ranges would be available—usually 0–1 amp and 0–10 amps. This current transformer is quite easy to construct with our kit and we provide full instructions—price **£2·55** post and V.A.T. paid.

ROOM THERMOSTAT

Famous Satchwell, elegant design, intended for wall mounting. Will switch up to 20 amps at mains voltage, covers the range 0·30°C. Special snip this month **£3·00**, post and VAT paid.

MAINS RELAYS

With triple 10 amp changeover contacts—operating coil wound for 230 volts AC, chassis mounting, one screw fixing, ex unused equipment **60p** each, 10 for **£5** post and VAT paid.

LEARNERS PLEASE NOTE

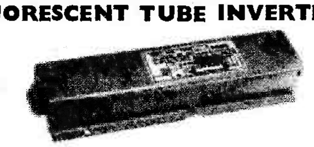
P.W. associated publication "Everyday Electronics" is just starting a series called Teach in 78. This is a practical course with simple theory explained. We are offering a kit of parts for the practical side for £3 deposit and 5 monthly payments of £2 or **£12** cash.

CENTRAL HEATING HEARTS

Randal (illustrated) replacement in 3060 etc. **£6·75.**
HORTSMAN **£6·30.**
SMITHS Controller 10/100 complete in wall mounting case **£7·50.**

THIS MONTH'S SNIP

FLUORESCENT TUBE INVERTER



For camping—car repairing—emergency lighting from a 12v battery you can't beat fluorescent lighting, it will offer plenty of well distributed light and is economical. We offer Philips invertor for 12" 8 watt miniature tube for only **£2·75** with tube and tube holders as well.

TANGENTIAL HEATER UNIT

A most efficient and quiet running blower-heater by Solatron—same type as is fitted to many famous name heaters —Comprises mains induction motor—long turbo fan—split 2 kw heating element and thermostatic safety trip—simply connect to the mains for immediate heat—mount in a simple wooden or metal case or mount direct onto base of say kitchen unit —price **£4·95** post **£1·50** **control switch** to give 2kw, 1kw, cold blow or off available 60p extra.

3kW MODEL
£5·95 +
£1·50 p & p

TERMS:

Cash with order—but orders under **£6** must add 50p to offset packing etc.
BULK ENQUIRIES INVITED. PHONE: 01-688 1833

IT'S FREE

Our monthly Advance Advertising Bargains List gives details of bargains arriving or just arrived—often bargains which sell out before our advertisement can appear—it's an interesting list and it's free—just send S.A.E. Below are a few of the Bargains still available from previous lines.

20 Amp Car Starter/Charger kit still available **£7·95p**, post and VAT paid.

Solo Mastermind. Practical Wireless, October issue, describes this novel device which we think will be very popular now with the dark evenings, we can offer all the electronic components as follows:

Transistor type BCY 71—8 required	**20p** each
Transistor type BC 109—8 required	**15p** each
General purpose silicon diodes	**10p** each
2 Pole 6 way midget wafer switch—8 required	**40p** each
Push to make switch	**25p** each
Pack of 12 Resistors (note 2·2K are selected 5% type)	**50p** pack
1mA Panel meters, oblong, full vision, Japanese make—2 required	**£2·70p** each
or Round ex equipment 1mA meters scaled 0-10	**£2** each
Plain knobs—4 required	**15p** each
Pointer knob—4 required	**15p** each
EP3 Battery clip	**15p** each
·1 Veroboard size 3¼" × 1¼"	**25p** each

Or all the above parts purchased as a parcel **£13·50p** with the Japanese meters **£12·50p** with round meters.

Humidity Stats. These are damp sensitive devices, in fact the membrane which is the vital part expands with increasing dampness, breathing on it for instance will switch on a micro switch which can control a water spraying arrangement to increase humidity or a fan heater to lower the humidity. We have two models, the Ranco J11 which is a preset model, reated 3 amps 250v, has a screwdriver control for setting up, once set it cannot easily be tampered with. Overall size of this 3¼" long and 1" wide and 1¾" deep. Price of this is **65p** + 5p. The other model is by Honeywell of America and is a little larger, overall size 3½" long 1" wide 2" deep is adjustable by spindle which comes out of the front end and to which can be fitted a normal control knob. This operates 5 amps at 240v AC, price **£1·00** + 8p.

Bridge Rectifiers suitable for instruments encapsulated and wire ended 100 volts 2 amp **50p** + 4p.

Ditto suitable for power circuits, "battery charging" etc. 200v, 10 amp. Price **£1·25p** + 6p each.

Time and Set Switch, with the cost of heating going up and up it is not good economics to leave the heating on when there is no-one at home. On the other hand it is not nice to come home to a cold house so the time and set switch made by Smiths could be the answer. This is mains driven device which has contacts capable of switching 25 amps. Delay of up to 18 hours is possible with this. Glass fronted and with control knob this is a nice looking instrument, easy to mount in a box or on a panel, made by Smiths price **£4·35p** + 35p. Post 50p + 4p.

100w 8 ohm Speaker Units. Just right for the Disco made by Kelly Acoustical, we can thoroughly recommend these are **£27·50p** + **£2·20p**, carriage **£3·00** + 24p. We feel certain that at this price these will be quickly snapped up so advise early action.

Water Pump ex Washing Machine. We believe that this comes from the Indesit Automatic Machine, these are really for callers as obviously you must have the right one. Price **£7·00** + 56p.

12 Hour Switch On made by Crouzet, this device consists of a 12 hour mains operated motor mounted on a chassis with two 5 amp trip switches. Through the front a chrome and red push switch which would protrude through the panel, in fact the main unit being held behind the panel with two screws depressing the switch, starts the motor and switches on controlled circuit and after 12 hours the motor will have rotated completely and will then switch off itself and the main circuit. There is obviously many uses for this device, one being to charge batteries for 12 hours or to switch on lighting or heating for 12 hours and no doubt many other uses will be found for it. **£3·95p** + 32p.

Bead Thermister, glass encapsulated. This is a very sensitive device, you can see it decreases its resistance as you hold it in a warm hand. Resistance at 60°f is approx. 18k, at 100°f (approx. blood heat) it drops to 2k so you can see it is quite a sensitive device. ex unused G.P.O. equipment, price **50p** + 4p.

Experimenters Resistor Assortment. Parcel comprising 500 ½ and ¼ watt carbon resistors 10 each of 50 different values covering 10 ohms to 20 megs. Supplied with a copy of the resistor colour code **£4·00** + 50p.

Resistors in Bulk, we have over 2 million resistors covering values from 1 ohm to 50 meg ohms ⅛, ¼, 1 and 2 watt types, price 75p per 100 for ¼ and ½'s, **£2** per 100 for 1 watt, **£4** per 100 for 2 watt. List your requirements and state if near value may be sent if any out of stock. V.A.T. is 12½%.

Electrical Tape made by Scotch, this is polyester film, thermosetting pressure sensitive, yellow, 1½" wide and is on a big reel 66m (70 yards approx.) Price **50p** + 4p.

McMurdo Plugs & Sockets. Some additional types have arrived so we now have in stock 8 way plug and socket, price **40p** + 4p per pair. 12 way **50p** + 4 p per pair, 25 way **60p** + 4p per pair.

Time Delay Module, mains working perspex type cover plugs into B7G base. Connect this through a mains relay and in 15 seconds approx the relay will close. If you want it to latch then use a relay with spare contacts to maintain the circuit to the coil. The delay as set is approx. 15 seconds, screwdriver control can alter this, still bigger alternatives to the 15 second time delay can be made by replacing the 1 pre set resistor with an external pot. The module contains a 4 amp 400v SCR, an FET transistor, all ancillary components also circuit is supplied. Priced at only £1.50p+12p. it is obviously quite a bargain.

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12 AND 24 VOLT OR 12-0-12V
PRIMARY 220-240 VOLTS

Ref	Amps 12V	Amps 24V	£	P & P
111	0·5	0·25	2·20	0·45
213	1·0	0·5	2·64	0·78
71	2	1	3·41	0·78
18	4	2	4·03	0·96
70	6	3	5·35	0·96
108	8	4	6·98	1·14
72	10	5	7·67	1·14
116	12	6	8·99	1·32
17	16	8	10·39	1·32
115	20	10	13·18	2·08
187	30	15	17·05	2·08
226	60	30	26·82	OA

50 VOLT RANGE
Prim 220/240V Sec 0-20-25-33-40-50V Voltages available 10, 13, 15, 17, 20, 33, 40, 25, 025, 020.

Ref	Amps	£	P & P
102	0·5	3·41	0·78
103	1·0	4·57	0·96
104	2·0	6·98	1·14
105	3·0	8·45	1·32
106	4·0	10·70	1·50
107	6·0	14·62	1·64
118	8·0	17·05	2·08
119	10·0	21·70	OA

MAINS ISOLATING (SCREENED)
PRIM 120/240 SEC 120/240 CT

Ref	VA (Watts)	£	P & P
07	20	4·40	0·79
149	60	6·20	0·96
150	100	7·13	1·14
151	200	11·16	1·50
152	250	12·79	1·84
153	350	16·28	1·84
154	500	19·15	2·15
155	750	29·06	OA
156	1000	37·20	OA
157	1500	45·00	OA
158	2000	54·80	OA
159	3000	79·05	OA

115 or 240 sec

HIGH VOLTAGE MAINS ISOLATING
Prim 200/220V or 400/440V
Sec 100/120V or 200/240V

Va	Ref	£	P & P
60	243	5·89	1·32
350	247	14·11	1·84
1000	250	35·65	OA
2000	252	54·25	OA

30 VOLT RANGE
Prim 220/240V Sec 0-12-15-20-24-30V Voltages available 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30V 15-0-15V, 12-0-12

Ref	Amps	£	P & P
112	0·5	2·64	0·78
79	1·0	3·57	0·96
3	2·0	5·27	0·96
20	3·0	6·20	1·14
21	4·0	7·44	1·14
51	5·0	8·37	1·32
117	6·0	9·92	1·45
88	8·0	11·73	1·64
89	10·0	13·33	1·84

60 VOLT RANGE
Prim 220/240V Sec 0-24-30-40-48-60V. Volts available 6,8,10,12,16,18,20,24,30, 36,40,48,60V or 24-0-24V or 30-0-30V.

Ref	Amps	£	P & P
124	0·5	3·88	0·96
126	1·0	5·58	0·96
127	2·0	7·60	1·14
125	3·0	10·54	1·32
123	4·0	12·23	1·84
40	5·0	13·95	1·64
120	6·0	15·66	1·84
121	8·0	20·15	OA
122	10·0	24·03	OA
189	12·0	27·13	OA

AUTO TRANSFORMERS

Ref	VA (Watts)	Volts	£	P & P
113	20	0-115-210-240	2·48	0·71
64	75	0-115-210-240	3·95	0·96
4	150	0-115-200-220-240	5·35	0·96
66	300	0-115-200-220-240	7·75	1·14
67	500	0-115-200-220-240	10·99	1·64
84	1000	0-115-200-220-240	18·76	2·08
93	1500	0-115-200-220-240	23·36	OA
95	2000	0-115-200-220-240	34·82	OA
73	3000	0-115-200-220-240	48·00	OA

CASED AUTO TRANSFORMERS
240V cable in & 115V USA 2 pin outlet

VA	£	P & P	Ref
20	4·96	0·96	113W
150	8·48	1·14	4W
200	9·92	1·45	65W
250	10·49	1·45	69W
350	12·53	1·64	53W
500	15·73	1·64	67W
750	18·55	1·76	83W
1000	22·68	OA	84W
1500	26·02	OA	93W
2000	37·65	OA	95W

SCREENED MINIATURES

Ref	mA	Volts	£	P&P
238	200	3-0-3	1·99	0·55
212	1A, 1A	0-6, 0-6	2·85	0·78
13	100	9-0-9	2·14	0·38
235	330, 330	0-9, 0-9	1·99	0·38
207	500, 500	0-8-9-, 0-8-9	2·59	0·71
208	1A, 1A	0-8-9, 0-8-9	3·53	0·78
236	200, 200	0-15, 0-15	1·99	0·38
214	300, 300	0-20, 0-20	2·56	0·78
221	700 (DC)	20-12-0-12-20	3·41	0·78
206	1A, 1A	0-15-20-0-15-20	4·63	0·96
203	500, 500	0-15-27-0-15-27	3·99	0·96
204	1A, 1A	0-15-27-0-15-27	5·39	0·96
239	50	12-0-12	1·99	0·38
S112	500	12-15-20-24-30	2·64	0·78

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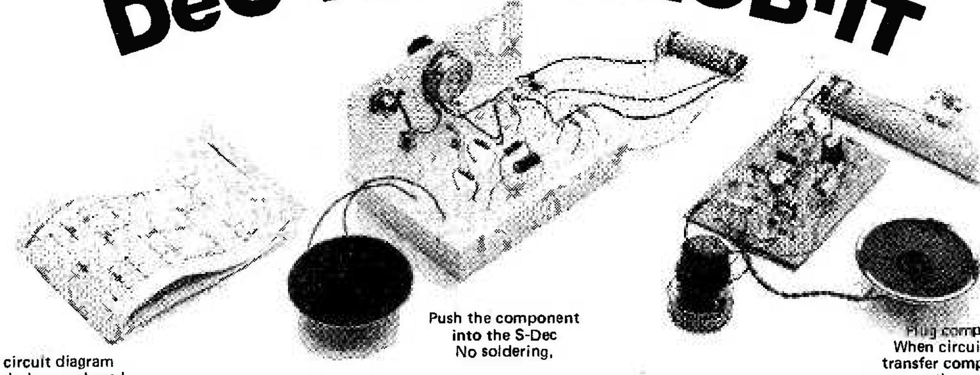
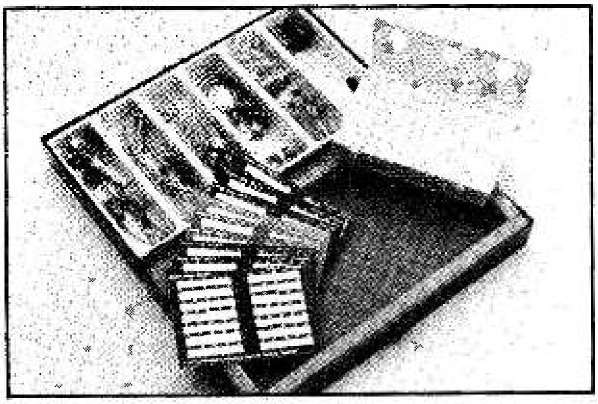
DeC·IT and BLOB·IT



Each circuit diagram has the holes numbered into which the components are inserted.

Push the component into the S-Dec No soldering.

Plug components in and out. When circuit is proved working, transfer component by component to exactly same numbered position in Blob-Board.



S-De-K-IT

The perfect kit for beginners, students, professionals and all users of discrete components. This S-De-K-IT contains 1 S-DeC + control panel, 9 Blob-Boards, 20 double ended Leads + Instruction book to build (no components) Electronic Flasher + Binary Counter + LC Oscillator + 3 Stage Amplifier, Morse Practice Oscillator, Radio Receiver, Radio-Microphone, Light Operated Switch, CR Oscillator, Wien Network Oscillator, S-De-K-IT complete in ABS box, with component tray.

Normally £6.38 only £4.95 + £1.00 Post and VAT

NB The discrete components to build the above S-De-K-IT are listed but not supplied. This is because using discrete or surplus components you can buy all the components very cheaply from your local component supplier.

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Telephone: Saffron Walden (0799) 22876 Telex: 817185.

Dawes Electronic

121 Dawes Road, London SW6

Tel 01 831 3975

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2518 Hex 32 & 40	£3·20
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5311 Clock	£2·99
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10	14p	123	55p
11	18p	125	62p
13	27p	132	85p
14	112p	141	85p
15	30p	145	71p
16	26p	150	82p
17	26p	151	65p
20	14p	153	76p
23	27p	154	114p
27	24p	155	86p
30	15p	156	75p
32	27p	157	75p
37	27p	158	86p
38	27p	160	97p
40	12p	161	106p
41	63p	162	97p
42	52p	163	97p
43	52p	164	114p
44	65p	165	115p
45	76p	166	115p
46	87p	170	179p
47	75p	173	119p
48	65p	174	108p
50	13p	175	108p
51	14p	176	112p
53	14p	177	99p
54	14p	180	87p
60	14p	181	312p
70	26p	182	85p
72	25p	190	102p
73	27p	191	102p
74	27p	192	102p
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561B	318p		
562B	318p		
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709A	30p		
710A	32p		
711A	37p		

(All prices include V.A.T. Min. order £3·00 + 20p p. & p.)

Mixed Nuts and Bolts, screws, eyelets, Grommets*, etc. @ 50p per lb + Postage and Packing @ 50p.

Mixed Resistors, mainly Erie make, mixed value, 500 @ £1, 250 @ 60p, 100 @ 30p.

Mixed Capacitors. 500 @ £1·25, 250 @ 70p, 100 @ 40p.

IS Coils AM & FM OSC, Disc made by Toko, Mixed 25 @ 50p or 3p each

Mixed Potentiometers 10 @ 75p

Knobs @ 2p each
Aerial Coils, MW & LW @ 3p each
With Ferrite Rod @ 12p each

Car Radio, Push Button Switches @ 25p each

Push Button Switches: Single @ 3p each

Triples @ 8p each: **Fours** @ 12p each

Sixes @ 18p each

RF & HT Choke @ 2p each

Car Radio Transformers @ 10p each

VHF Diode Tuner @ £1 each

Gang Condensers @ 25p each

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Electrolytic Capacitors: 400 uf 16v, 125 uf 16v, 400 uf 10v, 10 uf 16v All at 3p each

Polystyrene Caps. 10 - 68 - 100 - 130 - 1080 all 5% Tol 30 VDC Working. 100 - 200 - 320 - 390 - 1200 - 1300 - 1800 all 2½% Tol 30 VDC Working 200 - 300, both 10% Tol 30 VDC Working, 1300 2½%. Tol 125 VDC Working, all @ 1p each.

Potentiometers. Slide 100K Log Dual, 1MO Lin Single and Dual @ 5p each

Rotary Single, 100K Lin @ 10p each

Rotary Doubles, 100K Lin, 100K Log, 470K Log, 20K Lin, 1MO Log 20K + 80K @ 10p each

ABOVE, SINGLE and DOUBLE, SOME WITH SWITCHES.

Nylon Fuse Holder—Nylon Bulb Holder
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Very Limited First Come First Served

Speaker Sockets 2 Pin @ 3p each

Change Plugs @ 2p each

Terminal Pins—Electronic 100 @ 10p

Support Clips* @ 1p each

Slide Switch, Skeleton Type @ 5p each
Limited No. only

Sockets @ 3p each

PLEASE NOTE THAT ALL ITEMS ARE SUBJECT TO V.A.T. All items marked with star @ 8%, all others 12½%. PLUS POSTAGE and PACKING @ 35p per £1 order. EXCEPT NUTS and BOLTS @ 50p. Minimum Order £1. TERMS: CASH WITH ORDER REGRET MAIL ORDER ONLY.

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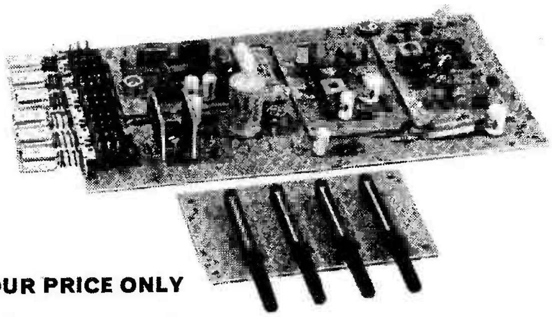
BI-PAK

High quality audio



STEREO FM TUNER

Fitted with Phase Lock-loop

- ★ FET Input Stage
- ★ VARI-CAP diode tuning
- ★ Switched AFC
- ★ Multi turn pre-sets
- ★ LED Stereo Indicator

Typical Specification:
Sensitivity 3μ volts
Stereo separation 30db
Supply required 20-30v at 90 Ma max.

OUR PRICE ONLY

£20.45

The 450 Tuner provides instant programme selection at the touch of a button ensuring accurate tuning of 4 pre-selected stations, any of which may be altered as often as you choose, by simply changing the settings of the pre-set controls.

Used with your existing audio equipment or with the BI-KITS **STEREO 30** or the **MK60** Kit etc. Alternatively the **PS12** can be used if no suitable supply is available, together with the Transformer **T461.**

The S450 is supplied fully built, tested and aligned. The unit is easily installed using the simple instructions supplied.

VAT ADD 12½%

STEREO PRE-AMPLIFIER PA 100

A top quality stereo pre-amplifier and tone control unit. The six push-button selector switch provides a choice of inputs together with two really effective filters for high and low frequencies, plus tape output.

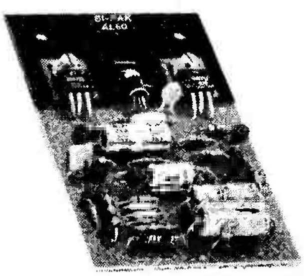
Frequency Response + 1dB 20Hz-20KHz.
Sensitivity of inputs:
1. **Tape Input 100mV into 100K ohms**
2. **Radio Tuner 100mV into 100K ohms**
3. **Magnetic P.U. 3mV into 50K ohms**

P.U. Input equalises to R1AA curve within 1dB from 20Hz to 20KHz. Supply 20-35V at 20mA. Dimensions—299mm × 89mm × 35mm.

£13.75 *p & p 45p*

MK60 AUDIO KIT:
Comprising: 2 x AL60's 1 x SPM80, 1 x BTM80, 1 x PA100, 1 front panel and knobs. 1 Kit of parts to include on/off switch, neon indicator, stereo headphone sockets plus instruction booklet. **COMPLETE PRICE £35·00** *plus 62p postage.*

TEAK 60 AUDIO KIT:
Comprising: Teak veneered cabinet size 16¾" x 11½" x 3¾", other parts include aluminium chassis, heatsink and front panel bracket plus back panel and appropriate sockets, etc. **KIT PRICE £13·25** *plus 62p postage.*



AL 60

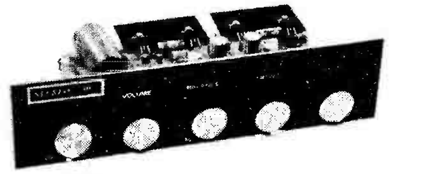
25 Watts (RMS)

- Max Heat Sink temp. 90C. ● Frequency response 20Hz. ● Distortion better than 0·1 at 1kHz. ● Supply voltage 15-50v. ● Thermal Feedback. ● Latest Design Improvements. ● Load—3, 4, 5, or 16ohms. ● Signal to noise ratio 80db. ● Overall size 63mm. 13mm.

Especially designed to a strict specification. Only the finest components have been used and the latest solid-state circuitry incorporated in this powerful little amplifier which should satisfy the most critical A.F. enthusiast.

ONLY £4.35

STEREO 30 COMPLETE AUDIO CHASSIS



7 + 7 WATTS R.M.S.

The Stereo 30 comprises a complete stereo pre-amplifier, power amplifiers and power supply. This, with only the addition of a transformer or overwind will produce a high quality audio unit suitable for use with a wide range of inputs i.e. high quality ceramic pick-up, stereo tuner, stereo tape deck etc. Simple to install, capable of producing really first class results, this unit is supplied with full instructions, black front panel, knobs, mains switch, fuse and fuse holder and universal mounting brackets enabling it to be installed in a record plinth, cabinets of your own construction or the cabinet available. Ideal for the beginner or the advanced constructor who requires Hi-Fi performance with a minimum of installation difficulty (can be installed in 30 mins.).

TRANSFORMER £3.25 plus 50p p & p.

TEAK CASE £5.45 plus 70p p & p.

£16.25 *P & P 45p.*

Stabilised Power Supply Type SPM80

SPM80 is especially designed to power 2 of the AL60 Amplifiers, up to 15 watts (r.m.s.) per channel simultaneously. With the addition of the Mains Transformer **BMT80**, the unit will provide outputs of up to 1·5A at 35V. Size: 63mm, 105mm, 30mm. Incorporating short circuit protection.

INPUT VOLTAGE	33-40V. A.C.
OUTPUT VOLTAGE	33V. D.C. Nominal
OUTPUT CURRENT	10mA-1·5 amps
OVERLEAD CURRENT	1·7 amps approx.
DIMENSIONS	105mm × 63mm × 30mm
TRANSFORMER BMT80	£5·40 + 86p postage

£3.75

equipment mono and other modules for Stereo

THE MEDIUM POWERED AL 80

35 RMS W power Amp!

ONLY

£6.95 +8% VAT

A High Fidelity Power Amplifier with a maximum Power Output of 35 watt R.M.S., which has a maximum operating voltage of 60v. A MUST for all Hi-Fi users.

Maximum supply voltage	15-60v
Power output for 2% THD	35 watts R.M.S.
Harmonic distortion	0·1%
Load impedance	3e8e16 ohm
Input impedance	50K ohm
Frequency response +3dB	20Hz–40KHz
Sensitivity for 25 watts O/P	280mV R.M.S.
Max. Heat sink temperature	90°C
Dimensions	102mm × 64mm × 15mm
Mounting	2, 4BA fixing holes in heat sink
Fuse requirements	1·5A

MPA 30

Enjoy the quality of a magnetic cartridge with your existing ceramic equipment using the new Bi-Pak M.P.A. 30 which is a high quality pre-amplifier enabling magnetic cartridges to be used where facilities exist for the use of ceramic cartridges only. Used in conjunction are 4 low noise high gain silicon transistors. It is provided with a standard DIN input socket for ease of connection. Supplied with full, easy-to-follow instructions.

£2.85

VAT ADD 12½%

POSTAGE & PACKING

Postage & Packing add 25p unless otherwise shown. Add extra for airmail. Min. £1·00

AND for those who need more

P-O-W-E-R

AL250 125 RMS W

POWER AMP

Specially designed for use in—
Disco Units, P.A. Systems, high power Hi-Fi, Sound reinforcement systems

SPECIFICATION:

Output Power: 125 watt RMS Continuous
Operating voltage: 50-80
Loads: 4-16 ohms
Frequency response: 25Hz-20kHz *Measured at 100 watts*
Sensitivity for 100 watts output at 1kHz: 450mV
Input impedance: 33K ohms
Total harmonic distortion
50 watts into 4 ohms: 0·1%
50 watts into 8 ohms: 0·06%
S/N ratio: better than 80dBs
Damping factor, 8 ohms: 65
Semiconductor complement: 13 transistors 5 diodes
Overall size: Heatsink width 190mm, length 205mm, height 40mm

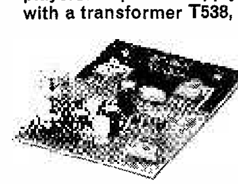
ONLY £15.95 + 8% VAT

NEW AL30A

10w R.M.S. AUDIO AMPLIFIER MODULE

The AL30A is a high quality audio amplifier module replacing our AL20 & 30. The versatility of its design makes it ideal for use in record players, tape recorders, stereo amps, cassette & cartridge players. A power supply is available comprising of PS12 together with a transformer T538, also for stereo, the pre amp PA12.

SPECIFICATION:



- Output Power 10w R.M.S.
- Load Impedance 8 to 16 ohms
- Sensitivity 90mV for full output
- Frequency Response 60Hz to 25KHz – 2db
- Supply 22 to 32 volts
- Input Impedance 50K
- Total Harmonic Distortion less than ·5% (Typical: ·3%)
- Max Heat Sink Temp 80°C
- Dimensions 90 × 64 × 27mm

ONLY £3.65

PS12 £6.70

NEW PA12 Stereo Pre-Amplifier completely redesigned for use with AL-30A Amplifier Modules. Features include on/off volume, Balance, Bass and Treble controls. Complete with tape output.
Frequency Response 20Hz-20KHz (–3dB)
Bass and Treble range ± 12dB
Input Impedance 1 meg ohm
Input Sensitivity 300mV
Supply requirements 24V. 5mA
Size 152mm × 33mm

PA12

Power supply for AL-30A, PA12, S450 etc. Input voltage 15-20v A.C. Output voltage 22-30v D.C. Output Current 800 mA Max. Size 60mmx 43mmx26mm. **£1.30**

Transformer T538 £3·20

BI-PAK

DEPT. P.W.12 P.O. BOX 6 WARE HERTS

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BACK NUMBERS

We are very glad to announce the re-establishment of a PW Back Numbers Service for our readers. In future back numbers dated from June 1977 only will be available from our Post Sales Department for 65p, which includes postage and packing. Cheques and Postal Orders should be made payable to IPC Magazines Ltd.

Send your orders to:- Post Sales Department, IPC Magazines Ltd., Lavington House, Lavington Street, London SE1 0PF.

Calling all Constructors

IF YOU'RE an electronics enthusiast, then whether you are lucky enough to have a room set aside for your hobby, or you just commandeer the kitchen table from time to time, you will need some sort of tool kit and at least one or two bits of test gear.

In this issue we have two items of particular interest, the first being a special offer of a soldering iron kit at some twenty per cent below the normal retail price. With four different-sized bits, this iron should be able to cope with all your PCB joints and plenty more besides. This offer is exclusive to *PW* readers.

Our cover subject this month is one of those pieces of equipment that, once you've got it, you wonder how you ever managed without. When working on experimental circuits, or just doing some servicing, a good stabilised power supply unit is so much easier to use than a lash-up of batteries and potential dividers. This particular design offers two independent outputs, one for driving TTL and the other for CMOS, operational amplifiers or discretes.

As many of you will know, almost all the constructional projects published in *PW* are written by outside contributors, and we are always on the look-out for interesting articles from our readers. Don't be put off by the fact that a few authors' names seem to crop up fairly regularly—it's an open stage. The only qualifications are that your project is likely to be of interest to a reasonable number of other readers, and that the components required must be currently available through retail sources. Articles should preferably be typewritten, double-spaced on one side of the paper only, with all drawings on separate sheets. Try to follow as far as possible the style used in the magazine. Next month, we hope to publish a more comprehensive guide for budding authors.

If you're not sure whether it's worth going to the extent of writing a complete article about your project, just drop us a line giving the basic details of what it does and how it does it. We'll tell you if it looks promising. Remember, you don't have to be an accomplished technical author. If your idea is worth publishing, *PW* staff can do whatever is required to put it into shape. We look forward to hearing from you!

Geoffrey Arnold.

PLEASE NOTE

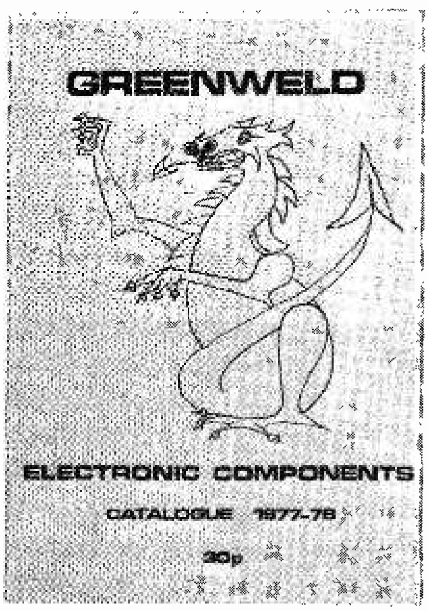
We do not operate a Technical Query Service except on matters concerning constructional articles published in PW. We do not supply service sheets or information on commercial radios, TV's or electronic equipment.

All queries must be accompanied by a stamped self-addressed envelope otherwise a reply cannot be guaranteed.

NEWS... NEWS... NEWS...

Component catalogue

In these penny-pinching days the electronic enthusiast needs every help if he is to continue building projects and eat as well! Sifting through PW will usually account for most of your much needed components but they're so spread out that postage robs you of any financial advantage you may have gained. The answer is to purchase most, if not all from a single supplier—and to do it from a comprehensive catalogue. Greenweld who regularly advertise in PW have just



launched their latest catalogue which contains over 4000 items, hundreds of which are illustrated, and range from multimeters to IC's to semiconductors and switches.

Included in the catalogue are five 10p vouchers which can be used against any component purchased. The price for the catalogue is 30p plus 15p postage and can be obtained from *Greenweld, 443 Millbrook Road, Southampton. Tel: 0703 772501.*

All change

Readers who were unfortunate enough to have had to take their Philips or Pye radio in for servicing will no doubt be familiar with the initials CES—for the uninitiated (Combined Electronic Services). Well now that you are all familiar with this name you can now forget it, because as from September 1st, Philips have been running these service departments up and down the country under the new name "Philips Service".

Philips Service will comprise 25 Service Centres for spares and repairs with the main centre still sited at Woddon, Croydon. In fact, Philips claim that this new system will enable them to introduce a new pricing policy, which could lead to price reductions on certain spare parts. For those customers unable to get to one of the Centres, the now all-too-familiar computer situated at Woddon should speed up and give a better service to those orders sent by post.

Philips Electrical, Century House, Shaftesbury Ave., London. Tel: 01-437 7777.

Exit the inch

Like it or not the days of Imperial measure are numbered (no pun intented) and that total metrication is creeping ever closer and closer with the almost inevitable conclusion that accompanied decimalisation of our money—someone somewhere will make a pretty 'fast buck'.

The reason that metrication has fuelled the inflation fires can almost be put down to one thing, and that is ignorance. If a manufacturer 'rounds' his product up to the nearest whole penny or to the nearest kilo, and in the latter case charges more than he should for the extra weight, the public should make it known to the authorities, and refuse to buy the commodity. But how can honest 'Joe Soap' do this if he doesn't know what a kilo is, what 500ml means, and how-on-earth, can he ask for a shirt with a size 39 collar?!

The people who teach the public, such as school teachers and examiners, and for people in trade, industry, publishing, journalism and printing the Metrication Board has produced a style guide for teaching and using SI Units. The Booklet, titled 'How To Write Metric' is roughly divided into two sections—'The Teaching of SI Usage' and 'Rules and Guidelines'. The guide ends with a wide selection of SI Units and symbols, derived units, prefixes, base units and supplementary units. Priced at 50p each or £20 for 50 copies they can be obtained from *HMSO 49 High Holborn, London WC1V 6HB. The reference number is ISBN 0 11 700867 2.*

RAE examples

A couple of months ago we published a list of Colleges who are running the Radio Amateurs Examination Course. A useful addition to any course is a book containing past question and answers, properly set out, with diagrams in a form that the examiners like to see. The RSGB now publishes a book titled 'Radio Amateurs Examination Questions and Answers', which has been compiled with the assistance of the City and Guilds of London Institute.

The book is arranged in the same format as the UK examination, with chapter titles as follows: Licensing conditions, Transmitter interference, Elementary electricity and magnetism, Elementary alternating current theory, Thermionic valves and semiconductors, Radio receivers, Low power transmitters, Propagation, Aerials, and Measurement.

Containing 118 pages and costing £1·70, copies can be obtained from *RSGB, 35 Doughty Street, London, WC1. Tel: 01-37 8688.*

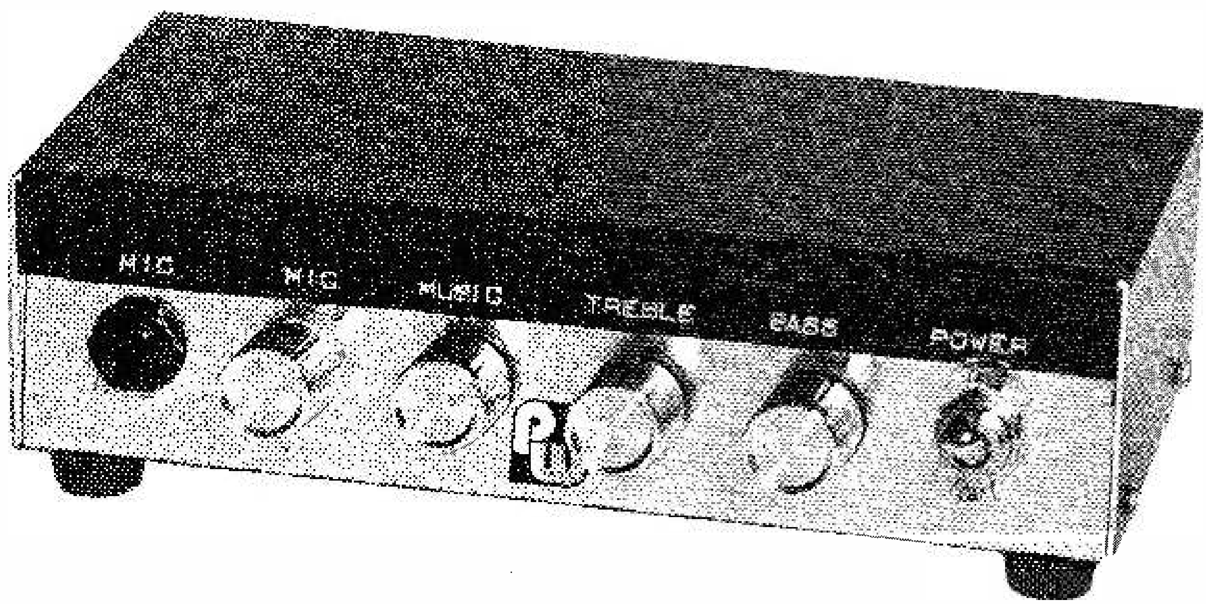
BSI to the rescue?

You remember that little story we published some months ago on this page, about the new International 16A plug that was being considered by the UK?—Well, they have considered it, that is the British Electrotechnical Committee have, and they've approved it. We must add though that this approval is for the first draft only, and does not commit this country to accept any further proposals or to final adoption of the system.

If The British Standards Institute were to publish a document on this system they would require that all socket-outlets should have shutters, and would require a minimum recess depth of 9mm in order to provide assurance that live parts cannot be touched. Also the Institute would require socket-outlets and adaptors to be fused. As yet, these features are not included in the IEC draft.

PORTABLE P.A. AMPLIFIER

S.H.DAVIES



A small amplifier which will operate from a 12V Battery is often useful. This particular example was intended for loud-hailing from a small motor boat, so the amplifier was designed with mobile PA applications, in mind. The prototype was used to drive an ordinary boxed speaker, but a small horn type would be far more suitable, and less bulky. Another likely application is for audio systems for cars and boats, fed by a cassette player and tuner or small radio. With alterations to the preamplifier circuitry, many variations on the basic circuit given are possible. Only two active devices are used—a quad operational amplifier and an IC power amplifier. This will drive any speaker from 4 ohms upwards, and has an output power of 2·5W into 4 ohms. To increase the amplifier's versatility a music input and comprehensive tone controls are included. The music input accepts signals from any cassette recorder or tuner having an output of 50mV or more.

Preamplifier

The circuit of the preamplifier is shown in **Fig. 1**. It uses the quad Norton amplifier which is an unconventional operational amplifier in that it amplifies the difference between two currents rather than two voltages.

The IC will work using any voltage between 4V and 18V. However a stable supply is needed, so the Zener stabilised circuit of **Fig. 2** is used to give a stable 10V. The small capacitor C13 across the electrolytic is essential to decouple the supply at high frequencies in order to prevent instability.

Microphone Mixer Stages

The microphone preamplifier (IC1a) is designed for a low-impedance microphone, and therefore has to give a considerable amount of voltage gain. With VR1 at maximum, the gain is about 115. The gain is reduced by decreasing VR1, increasing the amount of negative feedback. C2 prevents changes in VR1 from affecting the biasing of the amplifier by blocking d.c. The input circuitry is a little more complex than appears necessary. To obtain a 600 ohm input impedance, it would be usual to make R2 600Ω and omit R1. However to avoid loss of bass, C1 would then need to be about 250μF, which is bulky. Use of a higher value than this for R2 reduces C2 to a sensible size. The input impedance is then reduced to about 600 ohms by R1 (for use with a 2k microphone omit R1).

The music preamplifier (IC1b) is very similar in operation to the microphone stage. However to obtain a high input impedance R6 must be large, unless more complex circuitry is used. This restricts the stage gain to one-third, but this is offset by the small amount of gain in the mixer stage, giving an overall sensitivity of about 50mV music for full output.

Tone Control Circuit

This is the standard Baxandall circuit, and has unity gain. The amplifier is biased by R15 and R16. The non-inverting input is grounded, effectively disconnecting the current mirror. The voltage at the inverting input is a fairly constant 0·5V whatever the input current, and use is made of this to set the output voltage to the correct value. The quiescent voltage

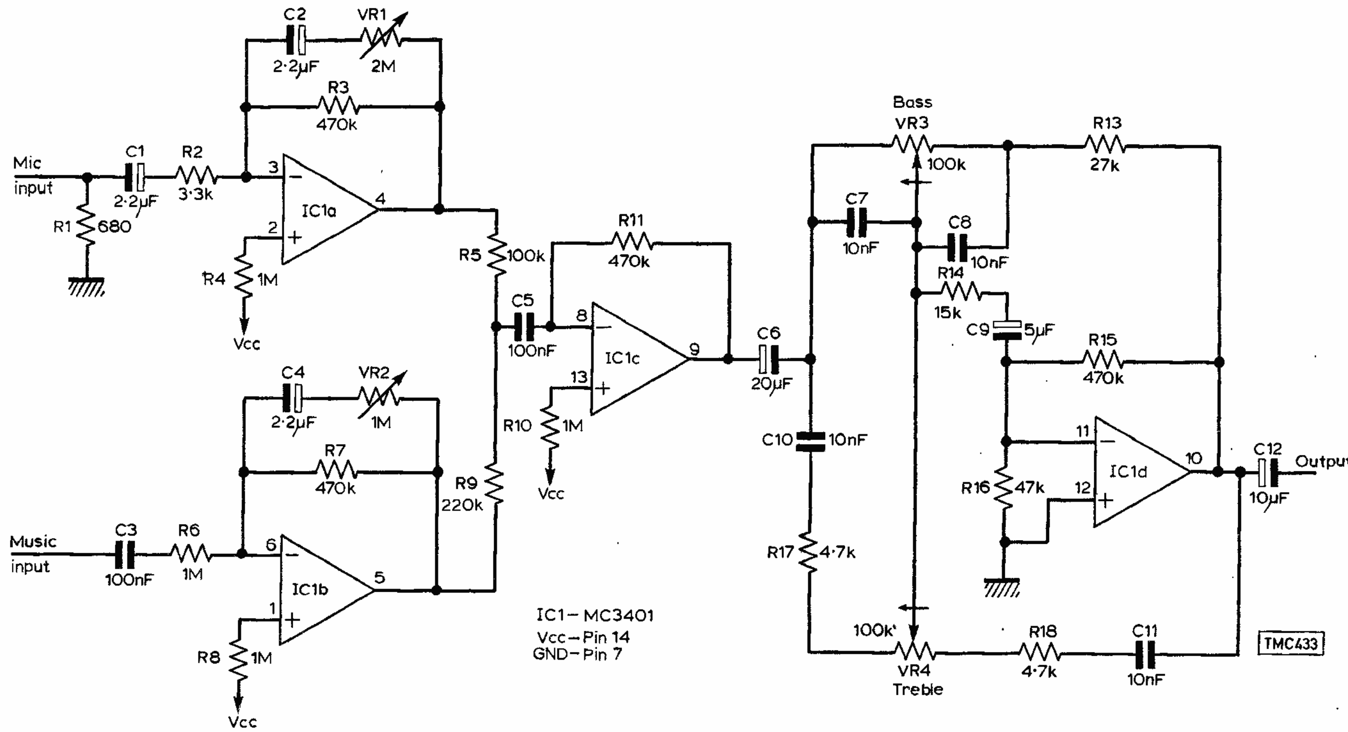


Fig. 1: The main (quad Norton) preamplifier circuit diagram.
Note: R12 (27kΩ) has by an oversight been omitted. The junction of C6 and C7 should be broken, and R12 interposed.

at the output will be that which gives 0·5V at the inverting input—about 5V here.

The other amplifiers are biased by the more usual method. A 1MΩ resistor from the supply rail (R4, R8, R10) to the non-inverting input gives about 10μA through the current mirror. This is balanced by an equal current through a 470k resistor connected between the inverting input and output, setting the quiescent output voltage to half supply voltage −5V here. It is worth remembering that in the first case the output voltage is a fixed multiple of the voltage at the inverting input terminal, and therefore is substantially independent of the supply voltage. In the second case, however, the output voltage is a fixed fraction of the supply voltage. Thus the second method of biasing should be used where large variations in supply voltage are envisaged, to give the maximum possible undistorted output voltage swing.

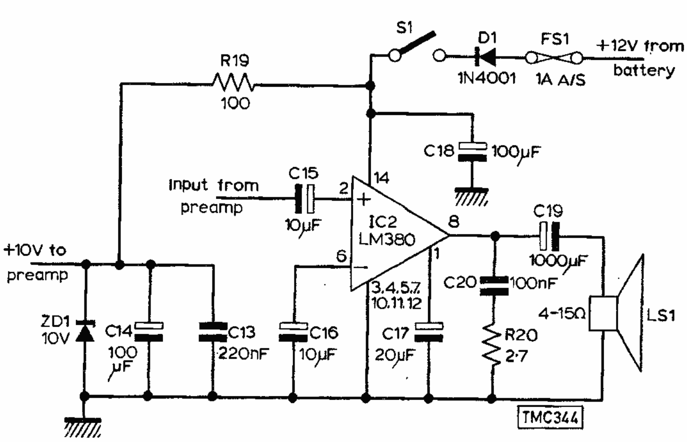


Fig. 2: Zener-stabilised supply and power amplifier circuitry. C19 is 100MFD and not 1000MFD as shown.

★ components

Resistors		Capacitors		
R1	680Ω	C1	2·2μF	15V
R2	3·3kΩ	C2	2·2μF	15V
R3	470kΩ	C3	100nF	
R4	1MΩ	C4	2·2μF	15V
R5	100kΩ	C5	100nF	
R6	1MΩ	C6	20μF	15V
R7	470kΩ	C7	10nF	
R8	1MΩ	C8	10nF	
R9	220kΩ	C9	5μF	15V
R10	1MΩ	C10	10nF	
R11	470kΩ	C11	10nF	
R12	27kΩ	C12	10μF	15V
R13	27kΩ	C13	220nF	
R14	15kΩ	C14	100μF	15V
R15	470kΩ	C15	10μF	15V
R16	47kΩ	C16	10μF	15V
R17	4·7kΩ	C17	20μF	15V
R18	4·7kΩ	C18	100μF	15V
R19	100Ω	C19	100μF	15V
R20	2·7Ω (see text)	C20	100nF	(see text)

VR1 2MΩ log
VR2 1MΩ log
VR3 100kΩ lin. preset
VR4 100kΩ lin. preset

Semiconductors
IC1 MC3401; IC2 LM380; D1 1N4001; ZD1 10V, 400mW Zener

Miscellaneous
S1 SPST Toggle; FS1 1A Fuse; Case 203mm × 95mm × 50mm; Veroboard (2 pieces); Line Fuseholder; 4 Knobs; 2 Jack Sockets; DIN Speaker socket; 14-pin IC Socket; 2 large crocodile clips; Power supply cable; Loudspeaker 4–15Ω.

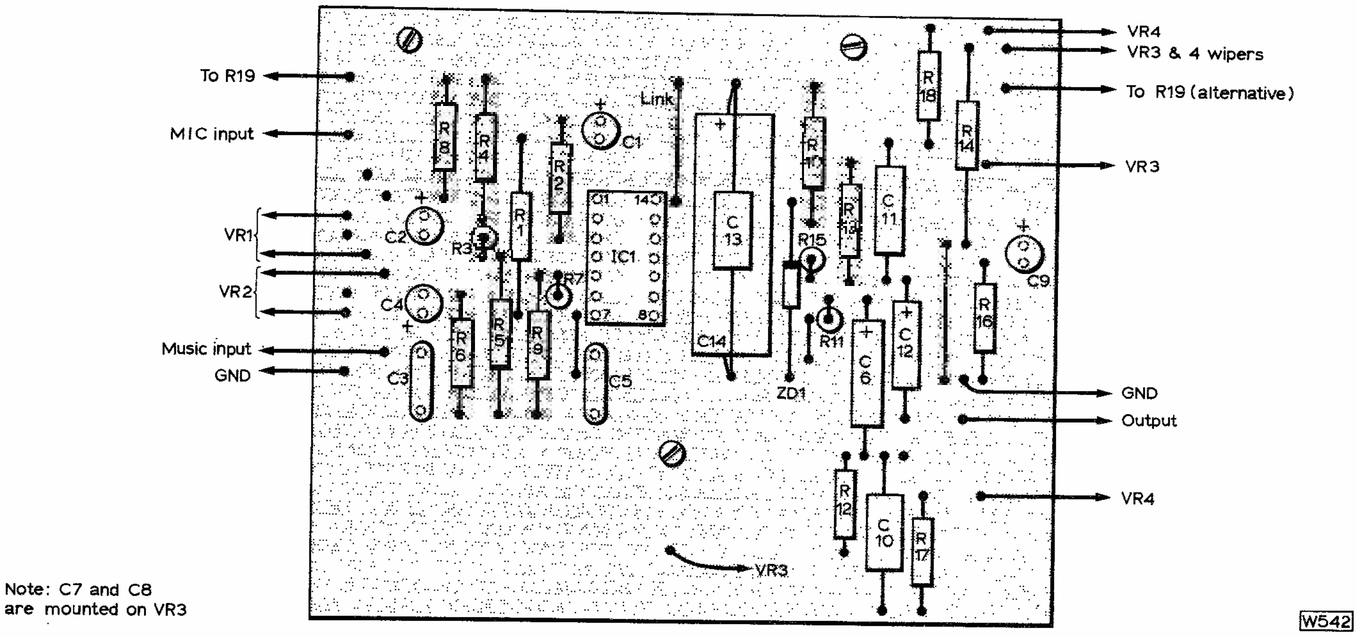
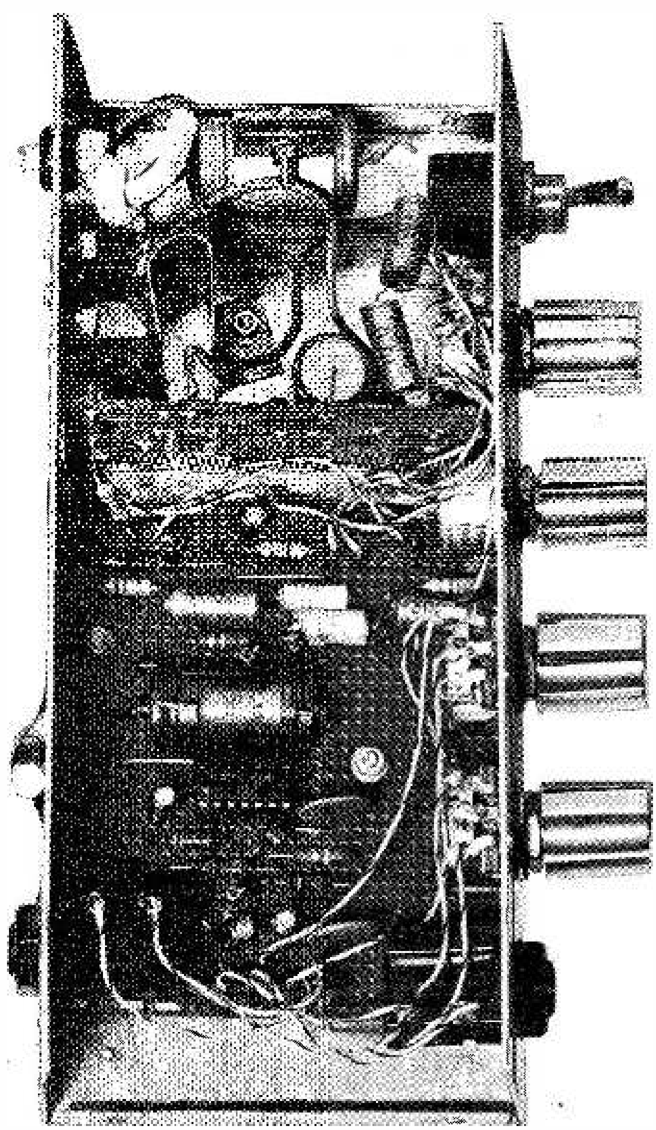


Fig. 5 (below):—a general view of the inside of the unit.

Fig. 3: Preamplifier board, with component layout.



Power Amplifier

The circuit is shown in Fig. 2, and uses an LM380 amplifier. Briefly, it is an audio amplifier with its gain internally fixed at 50, giving a sensitivity of about 50mV for full output. It will drive a 4 ohm load with a supply of up to 14V, producing an output of 2·5W.

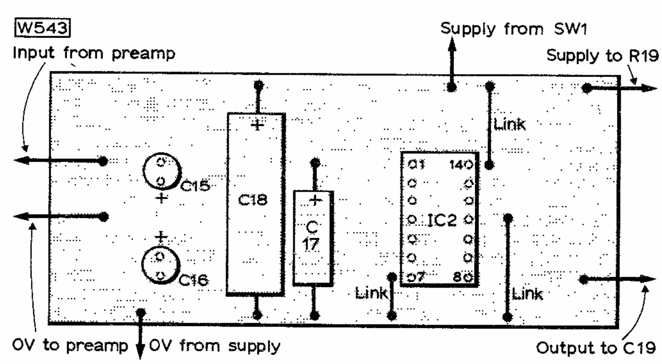


Fig. 4: The wiring of the output stage board.

Construction

The power and pre-amplifiers are built on separate pieces of 0·1 matrix Veroboard. Layouts for these are given in **Figs. 3 and 4.** The completed unit may be housed in a proprietary aluminium box, with a slightly sloping front. The internal layout can be seen from **Fig. 5**, and is not critical. An IC socket is recommended for IC1, but not for IC2, since this will reduce the heatsinking by the circuit board.

Some attention must be paid to the heatsinking of IC2. No heatsink is required with load impedances greater than 8 ohms, provided the case is well ventilated. With impedances down to 4 ohms a heatsink area of at least 4 square inches is required. ●

special offer!

SOLDERING IRON KIT

This month we offer to PW readers the chance to buy a miniature soldering iron kit at a substantial saving on normal prices. Why not treat yourself—or, with the festive season fast approaching, perhaps you could persuade your nearest and dearest to get one for your Christmas stocking.

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Also in each kit are four interchangeable bits—one each of No's 19 (1·5mm tip size), 20 (3·0mm), 21 (4·5mm) and 22 (6·0mm). An instruction leaflet will be included in each kit.

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PACK A: The iron and four bits as described above. The recommended retail price of such a pack would be £4·73 including VAT; the special "all-inclusive" price to readers is £3·75.

PACK B: The iron and four bits as PACK A, PLUS 6m of Multicore Savbit solder 22 SWG and one 1 amp fuse. The recommended retail price of this pack would be £5·29; the special "all-inclusive" price to readers is £4·15.

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No. of packs required		

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Address: ....
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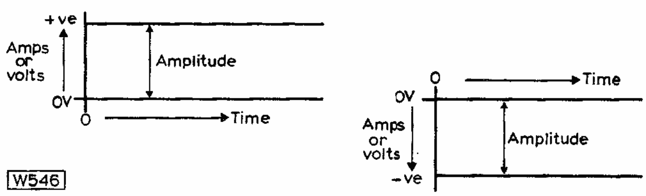
So you want to pass the R.A.E. (Radio Amateurs' Examination)? No. 4

John Thornton Lawrence GW3JGA & Ken Mc Coy GW8CMY

The passing of the Radio Amateurs' Examination, set by the City and Guilds, requires a certain level of theoretical technical knowledge. Whether one considers that this level is too high or too low is beside the point. The course that follows is intended, with the help of certain external aids, to prepare the reader to pass the examination. It will not teach him all about electronics!

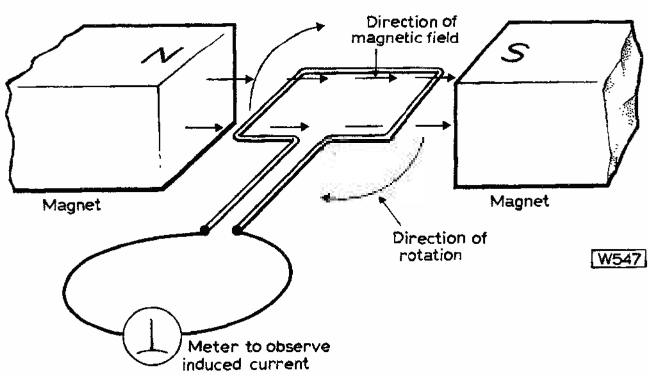
Alternating current

In the previous sections we have dealt with direct current and we know that D.C. maintains a steady value, either positive or negative in polarity, as shown graphically below. Alternating Current (A.C.) on



the other hand, varies in a special way and to understand this, we return to the magnetics section. You will remember that when a conductor is moving in a magnetic field, the direction of the induced voltage (and the resultant induced current) depends on the direction of movement and the direction of the magnetic field.

Let us imagine two bar magnets, a loop of wire and a current meter, arranged:



The loop is rotated and, using Flemings Left Hand Rule, we look in detail at the induced currents in the loop, as shown in **Fig. 14.** In (a) no current flows because the direction of movement of the conductors forming the loop is parallel to the direction of the magnetic field. In (b) current begins to flow in the direction shown, as the conductor cuts across the field. In (c) maximum current flows as the conductors now cut the field at right angles. In (d) the current is decreasing and at (e) again no current flows. Here the position is similar to (a) except that conductors A and B are transposed. This means that when moving to (f) and beyond, conductors A and B are then cutting the field in the opposite direction. This results in the flow of current being reversed every half revolution. This is shown graphically in **Fig. 15** and it can be seen that in one revolution, the current starts at zero, rises to a positive maximum and falls to zero again, then rises to a negative maximum and again falls to zero, thereafter the pattern is repeated for every revolution of the loop. If the rotation is continuous and at a constant speed then the **peak amplitude** of the voltage (and resultant current) waveform and the **period** are also constant.

The Sine Wave

The shape of the alternating waveform we have observed is called **sinusoidal** or a **sine wave** because the amplitude of the voltage or current at any point during the cycle is related to the trigonometrical function called the 'sine' of the angle of rotation. Fig. 16 will help you to remember some of the terms used when referring to sine waves. The amplitude at the peak of a sine wave is known as the **peak value.** Because the instantaneous value is continuously varying between the peak value and zero, the value which is equivalent in heating effect to D.C. lies between these values. It is known as the **root mean square** or rms value and it is this rms value which we use when stating the mains supply voltage, transformer ratings, etc. The rms value is 0·707 of the peak value and conversely, the peak value is 1·414 the rms value. For example, the peak value of the 240 volt mains supply is 240 x 1·414=339 volts. The peak value is of particular interest when specifying the maximum voltage rating of components in an A.C. circuit.

In Fig. 16, a 2Hz sine wave is shown, each period or cycle occupying 0·5 second.

As a further example, suppose that the time of one period was 1 ms (1/1,000 second) then there would be 1,000 cycles or periods in 1 second and the frequency would be written as 1,000 Hz or 1 kHz.

$$\text{f (frequency)} = \frac{1}{\text{t (time of one period)}}$$

$$\text{and} \qquad t = \frac{1}{f}$$

Now test yourself:

Q. If the time of one period of an alternating current supply is 0·02 second (or 0·0166666 second if you live in the U.S.A.) what is the frequency?

A. The answer to this one is engraved on the front of your electricity supply meter.

The alternating current supply to your home is generated at the power station in a similar manner to the mechanically rotating coil we have just described. The alternating current passing from an Amateur VHF transmitter to the aerial is generated

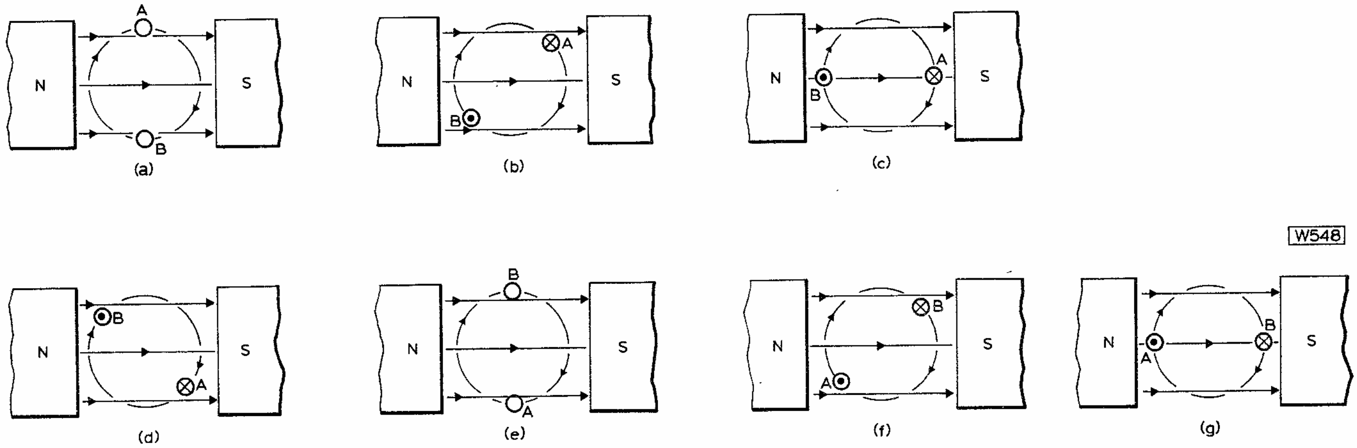
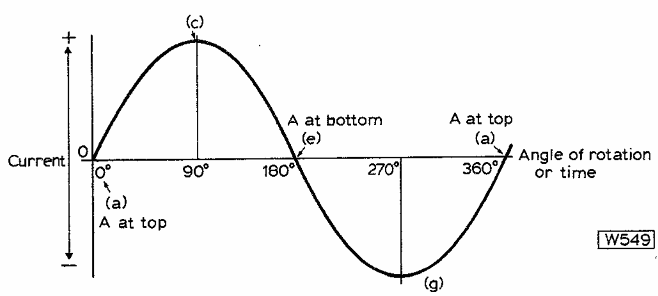


Fig. 14: (above) and Fig. 15 (below).



by a valve or transistor oscillator and amplifier. The frequency may be 145MHz (145,000,000 cycles-per-second) but the alternating current is still a sine wave and it has the same properties as its lower frequency compatriot.

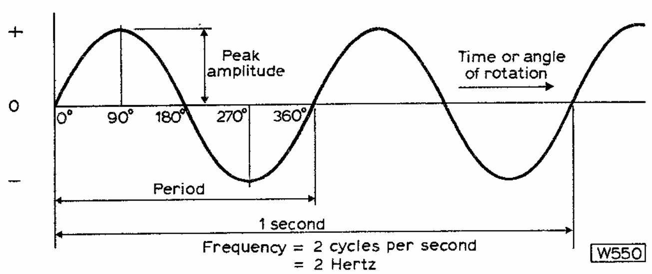


Fig. 16: 2Hz sine wave, showing peaks.

Self Inductance

When a conductor is carrying A.C., the magnetic field produced by the current varies in both amplitude and direction. This variation of the magnetic field around the conductor induces, by self inductance, a voltage (back e.m.f.) in the conductor and this produces a current which opposes the 'main' current producing it (Lenz's Law).

In a straight conductor, the self induced current is smaller than if the conductor is wound into a coil or solenoid. Here the magnetic field lines surrounding each conductor also pass through adjacent conductors and induce currents in these which also oppose the 'main' current. The effect is shown diagramatically in Fig. 17. The self inductance of a coil depends on a number of factors including the number of turns, the diameter of the conductor, the permeability of the material in the core, and the volume and general configuration of the coil. The unit of self inductance or inductance is the Henry (H) and practical coils or inductances may have values from a few microhenrys (μH) to several millihenrys (mH) for radio frequency use and up to many tens of Henrys for low frequency purposes.

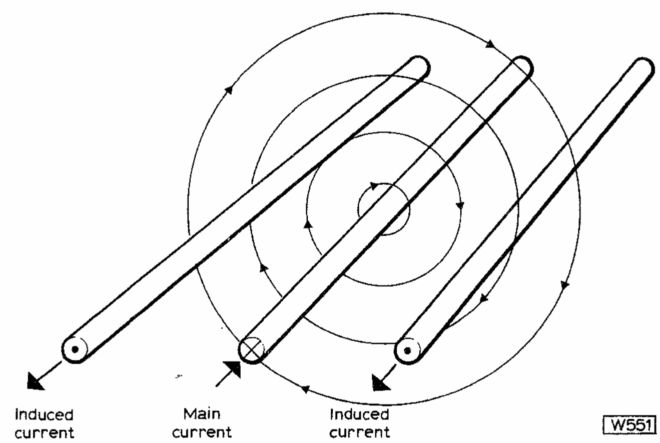
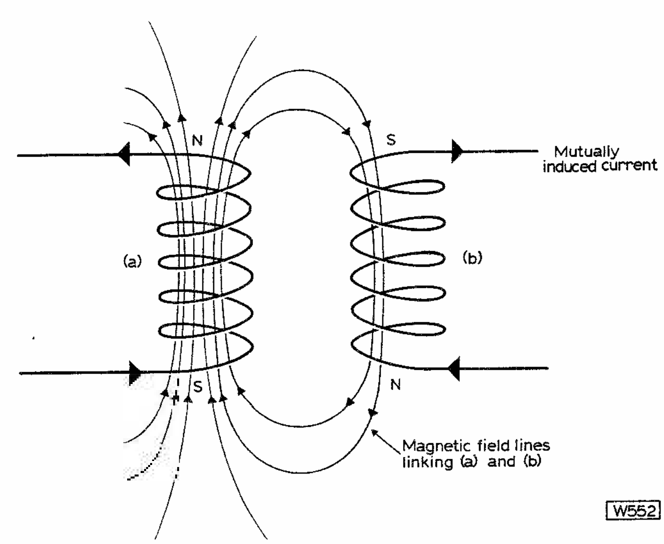


Fig. 17

Mutual Inductance

Mutual inductance is easier to visualise than self inductance and is shown in diagram form in Fig. 18:



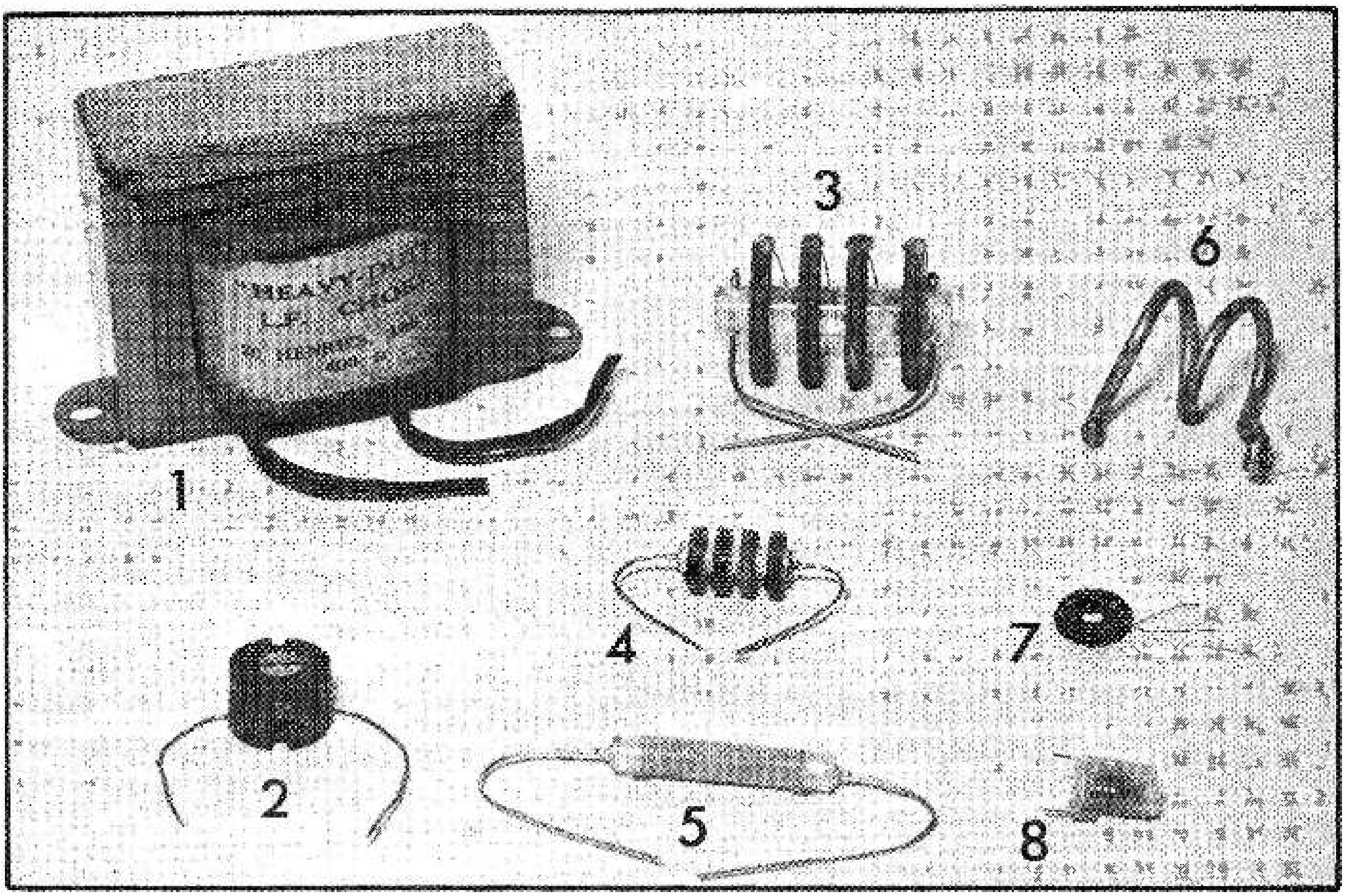
Suppose we pass a current through coil A in the direction shown. The resultant magnetic field lines link it with B and induce a voltage and resultant current in that coil. (Note that the current flowing in coil B is opposite to that in A. See Memory Aid Fig. 7.)

If an alternating current is made to flow in A, then for each change in current direction there will be a change in magnetic field direction and a resultant change in the induced voltage and current in B. In other words, an alternating current in A produces an alternating current in B. The circuits are electrically isolated but magnetically linked or coupled by the 'magnetic circuit'. You will no doubt recognise this as the action of a **transformer.**

all of the primary field lines pass through the secondary winding. The losses in the windings themselves result from power being dissipated as heat due to the ohmic resistance of the copper wire used. With careful design, transformers can be made where these losses are very small indeed, in fact a modern power transformer can have an efficiency as high as 98%.

Transformer types

Transformers come in many shapes and sizes. The construction may vary between two "hairpins" of heavy gauge wire making a transformer that will couple power out of a VHF or UHF transmitter, to



1: Heavy duty L.F. choke. 2: Ferrite pot-core inductance. 3: Transmitting H.F. choke. 4: H.F. choke. 5: VHF choke. 6: VHF transmitter tank coil. 7: Ferrite toroid inductance. 8: VHF tuning inductance.

the heavy, laminated iron cored, version found in the mains transformer. The primary and secondary windings need not be physically placed side by side. Often they are wound one on top of the other, or adjacent, end to end. The windings may also share a common core material, such as in the mains transformer. This serves to concentrate the linking magnetic field, improving the efficiency of the magnetic circuit. The windings may also form part of a tuned circuit, as in the case of the I.F. transformer, which we will be dealing with later.

The Transformer

A Transformer consists of two (or more) coils or 'windings' magnetically coupled, so that an alternating current in one coil, the **primary**, produces an alternating current in the other, the **secondary.** The method of magnetically coupling the coils depends largely on the frequency of the alternating current with which it will be used.

Providing that the primary and secondary windings have the same number of turns then the secondary current will be almost equal to the primary current and the secondary voltage almost equal to the primary voltage. It will not be exactly equal because of losses in the magnetic circuit and in the resistance of the windings. The losses in the magnetic circuit are mainly due to a loss of induced current because not

Basic rules

There are some basic rules that apply to transformers, particularly low frequency and power types, which define the relationships between **primary and secondary current, primary and secondary voltage** and the **numbers of turns** in the primary and secondary windings. These are best summarised in some simple equations, but let us first define the quantities involved.

Primary current = Ip
Secondary current = Is
Primary voltage = Vp
Secondary voltage = Vs
No. of primary turns = Np
No. of secondary turns = Ns

In these equations we will ignore the losses which occur since they are relatively small, so that:

$$\frac{\text{V secondary}}{\text{V primary}} = \frac{\text{No. of secondary turns}}{\text{No. of primary turns}}$$

$$\text{or } \frac{Vs}{Vp} = \frac{Ns}{Np}$$

also:

$$\frac{Ip}{Is} = \frac{Vs}{Vp}$$

We may combine these two equations, as follows:

$$\frac{Ip}{Is} = \frac{Ns}{Np} = \frac{Vs}{Vp}$$

Using these equations it is possible, if we know some of the quantities involved i.e. current, voltage, no. of turns, to calculate the others without too much trouble.

Example 1

A mains transformer has a 250 volt primary winding and a secondary winding that provides 15 volts for use in a low voltage supply unit. How much current can be drawn from the secondary if the primary current is 0·5 amps?

The part of the equation we require is:

$$\frac{Ip}{Is} = \frac{Vs}{Vp}$$

putting in the values that we know:

$$\frac{0{\cdot}5}{Is} = \frac{15}{250}$$

Rearranging we get:

$$Is = \frac{0{\cdot}5}{0{\cdot}06} = 8{\cdot}33 \text{ amps (say 8 amps)}$$

So we have found that we may draw 8 amps from the secondary winding, at 15 volts.

Example 2

A mains transformer has the following windings:

Primary 240 volts
Secondary (a) 1000 volts
Secondary (b) 12 volts

The primary winding consists of 1,440 turns of wire. Assuming there are no losses, calculate the turns required for the secondary windings (a) and (b).

$$\frac{Ns}{Np} = \frac{Vs}{Vp} \text{ therefore } Ns = Np \times \frac{Vs}{Vp}$$

$$Ns\,(a) = 1440 \times \frac{1000}{240} = 6000 \text{ turns}$$

$$Ns\,(b) = 1440 \times \frac{12}{240} = 72 \text{ turns}$$

CONSTRUCTION

Inductances and Chokes

In a practical circuit the actual value of the Inductance and its construction is governed largely by the frequency and the characteristics of the circuit in which it is to be used. A selection of inductors and chokes is shown in the photograph.

Low frequency laminated iron-cored chokes are used for filtering purposes in D.C. power supplies. The winding is carried on a bobbin, through which the core is asembled. In audio frequency circuits, chokes may also be wound and enclosed in a ferrous material 'pot-core'.

Intermediate and low radio frequency coils are usually layer wound on a former or tube, sometimes in several sections to reduce self capacitance. Tuning coils are wound on a former inside which is a threaded core of iron dust material which can be

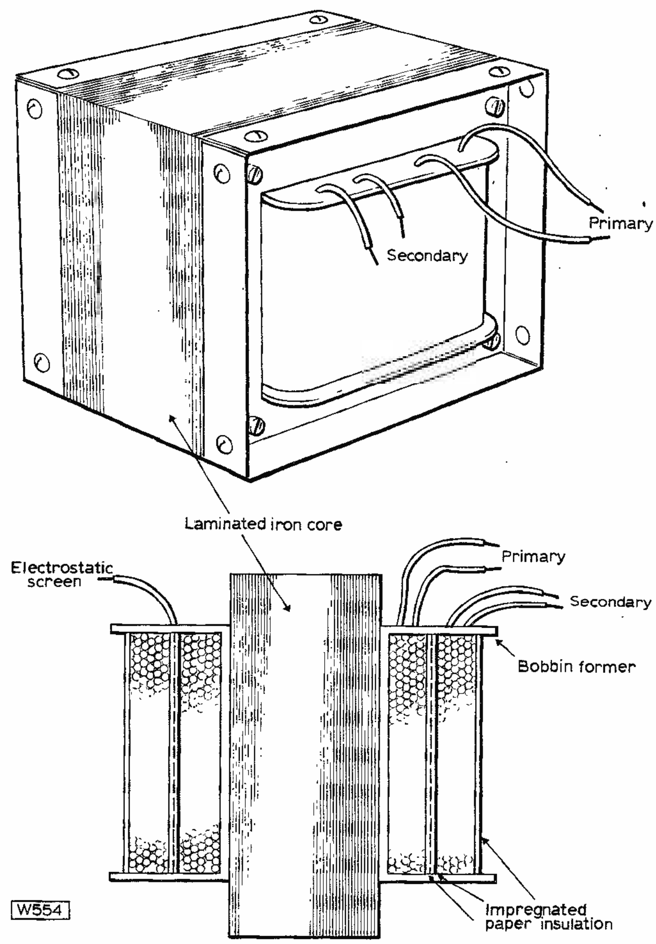


Fig. 20: Mains transformer-physical construction.

screwed in and out to adjust the inductance to the exact value required. Coils for HF and VHF are usually made of thicker wire wound on low-loss formers or self supporting with an air 'core'. At UHF inductors may be in the form of strips or lines of flat strip or rod and bear little physical resemblance to a conventional coil.

Fig. 21: Mains transformer (18V rectifier trans.). 2: Transistor driver transformer. 3: I.F. transformer. 4: Miniature I.F. transformer. 5: R.F. transformer coil. 6: Broadband R.F. transformer.

Transformers

The mains transformer has windings designed to suit the expected operating conditions. If the transformer has to provide a high value of current (as in our Example No. 1) then the windings are of heavy gauge (diameter) wire, appropriate to the current, so that the overall resistance of the winding is small and the power lost, also small. The mains transformer often has an electrostatic screen between the primary and secondary windings. This is connected to 'earth' and prevents any capacitive leakage or other effects from affecting the secondary windings. The windings themselves consist of enamel covered copper wire wound on a bobbin with layers of insulating material between each winding. The core is made up of thin laminations of special iron to reduce 'eddy current' losses. Eddy currents are produced in the core by induction (remember that iron is also a conductor) and the laminations provide many breaks in the electrical continuity of the core material thus preventing the flow of eddy currents while leaving its magnetic properties largely unaffected.

Transformers for audio frequencies are similar in construction to power transformers but the core material is specially made to operate over a wide frequency range and to cause negligible distortion.

I.F. (Intermediate Frequency) transformers usually consist of two windings which are each tuned to the operating frequency by associated capacitors and adjustable tuning iron dust cores. The magnetic coupling between the windings is critical and is set in manufacture to provide the desired selectivity characteristic.

R.F. (Radio Frequency) transformers vary widely in design and construction and may be wound on a former with or without an adjustable core. R.F. transformers for use over a wide range of frequencies are sometimes wound on a ferrite ring. The secondary winding may be separate from or interwound with the primary. ●

KINDLY NOTE!

IC of the month—Nov 1977

We apologise to our readers, and to Ferranti Ltd., for misquoting the type number of the timer IC on the cover and contents page of the magazine. The number should be ZN1034E, as given in the article.

Low Distortion Sine/Square Wave Generator, October 1977

In Fig. 1 the connection from the switch S2a 'Sine' position should go only to VR5, and not to S3 or VR2. The PCB is correct. If the circuit is constructed on other than our PCB, using Fig. 1, the effect of the error will be that the output attenuator will be inoperative on 'Sine'.

Resistors R4 ($3{\cdot}3k\Omega$) and R5 (680Ω) are shown transposed on the PCB. The circuit diagram is correct.

Solo Supermind, October 1977

The case details should be "R.S.Comps. code 509-276, with a front panel size of 250mm x 130mm. If inaccuracies are noted in meter deflection, resistors R1 to R8 (all $2{\cdot}2k\Omega$) should be changed to $2k\Omega$ high stability (metal oxide).

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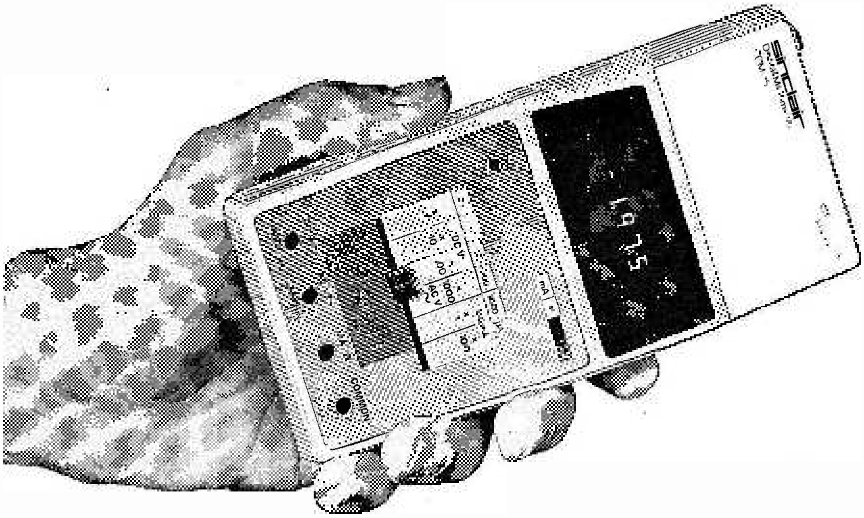

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The PDM 35's 1% of reading compares with 3% of full scale for a comparable analogue meter. That makes it around 5 times more accurate on average.

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Technical specification

DC Volts (4 ranges)
Range: 1 mV to 1000 V.
Accuracy of reading 1.0% ± 1 count.
Note: 10 MΩ input impedance.
AC Volts (40 Hz-5 kHz)
Range: 1 V to 500 V.
Accuracy of reading: 1.0% ± 2 counts.
DC Current (6 ranges)
Range: 1 nA to 200 mA.
Accuracy of reading: 1.0% ± 1 count.
Note: Max. resolution 0.1 nA.
Resistance (5 ranges)
Range: 1Ω to 20 MΩ.
Accuracy of reading: 1.5% ± 1 count.
Also provides 5 junction-test ranges.
Dimensions: 6 in x 3 in x 1½ in.
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74C85	200p
74C86	65p
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74C93	90p
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4019	52p
4020	120p
4021	115p
4022	100p
4023	22p
4024	80p
4025	22p
4026	170p
4027	65p
4028	98p
4029	120p
4030	55p
4033	250p
4034	240p
4035	130p
4040	120p
4042	90p
4043	100p
4044	100p
4046	140p
4047	100p
4049	55p
4050	57p
4051	110p
4054	120p
4055	140p
4056	135p
4060	130p
4066	65p
4067	425p
4068	24p
4069	27p
4070	65p
4071	27p
4072	27p
4073	30p
4076	170p
4081	21p
4082	24p
4093	94p
4098	120p
14502	180p
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LM339N	175p	SN76023N	175p
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LM380N	112p	SP8515	710p
LM381N	190p	TCA940	200p
LM389N	160p	TAA661A	150p
M252AA	850p	TBA120	97p
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5V	7805	115p	5V	7905	160p
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8V	7808	115p	15V	7915	160p
12V	7812	115p	24V	7924	160p
15V	7815	115p	Heat Sink 17°/W		25p
18V	7818	115p	suitable for T0220		
24V	7824	115p			

0·1A +ve T092			0·1A −ve T092		
5V	78L05	70p	5V	79L05	80p
6·25V	78L62	70p			
12V	78L12	70p	12V	79L12	80p
15V	78L15	70p	15V	79L15	80p

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AF114/5	22p	BF257	34p
AF116/7	22p	BF258	39p
AF127	40p	BF259	48p
AF139	40p	BF337	32p
AF239	48p	BFR39	34p
BC107/B	10p	BFR40/1	34p
BC108/B	10p	BFR79	34p
BC109	10p	BFR80/1	34p
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BC172	11p	BFY50	22p
BC177	20p	BFY51	22p
BC178	17p	BFY52	22p
BC179	20p	BFY90	90p
BC182/3	12p	BRY39	48p
BC184	14p	BSX19/20	20p
BC187	32p	MJE340	70p
BC212	14p	MJ481	175p
BC213	12p	MJ491	216p
BC214	16p	MJ2501	250p
BC461	40p	MJ2955	130p
BC478	32p	MJE2955	130p
BCY70	20p	MJ3001	250p
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BD124	140p	MPF102/3	45p
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BD139	56p	MPSA12	62p
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BF167	25p		
BF170	25p		
BF173	27p		
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TIP41C	84p	2N5179	75p
TIP42A	76p	2N5245	40p
TIP42C	96p	2N5296	58p
TIP2955	76p	2N5401	62p
TIP3055	60p	2N5457/8	40p
TIS43	40p	2N5459	40p
2N696/7	25p	2N5485	45p
2N698	43p	2N6107	70p
2N706/8	22p	2N6027	60p
2N918	43p	2N6247	200p
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2N1131/2	25p	2N6292	70p
2N1304/5	75p	3N128	85p
2N1306/7	75p	3N140	97p
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2N1711	22p	3N187	200p
2N1893	32p	40360	43p
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2N2160	120p	40409/10	75p
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2N2219	22p	40594	90p
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L.E.D. TUNING INDICATOR

J.P. MACAULAY

Most modern FM tuners either employ, or make provision for, a centre zero meter to indicate when accurate tuning has been achieved. However, a suitable meter can be expensive and requires hole-cutting and drilling of chassis to fit. These thoughts prompted the author to design and build a completely solid state equivalent which will cost the constructor less than £1, assuming that all the components are bought new.

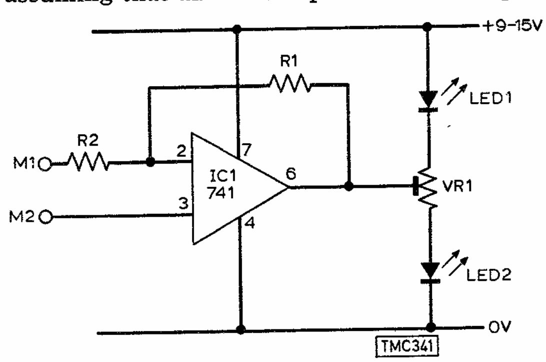


Fig. 1: Circuit of the tuning indicator.

Circuit Outline

By using a 741 op amp in the differential mode and driving a pair of LED from the output a very simple circuit can be realised employing only 6 basic components. The circuit diagram is shown in **Fig. 1.** Here the dc voltage across the meter output terminals is applied to the inverting and non-inverting inputs of the op-amp, pins 2 and 3 respectively.

Since very few components are employed the circuit can be constructed on a small piece of Veroboard and supported by the LED mounting clips. A suitable layout is shown in **Fig. 2.** The prototypes which have so far been constructed have been tried on a number of tuners which already possessed a tuning meter and the circuit described has been found to be virtually as accurate.

With the circuit wired into the tuner a check is made that both LED are illuminated. A point off-station is tuned so that only inter-station noise is being received, and VR1 adjusted until both LED are equally illuminated.

★ components

Resistors
R1 1MΩ, R2 2·2kΩ, both ¼ watt, 5% carbon, VR1 1kΩ horizontal preset.

Semiconductors
IC1 741, LED 1 and 2, 0·2" diam. 50mA max, colour to choice.

Miscellaneous
Veroboard 0·1" matrix, 47mm × 38mm, LED clips.

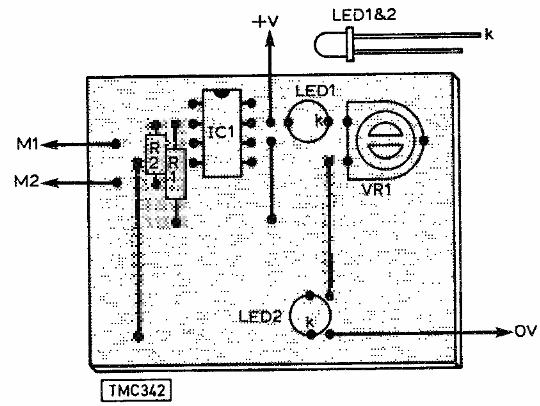
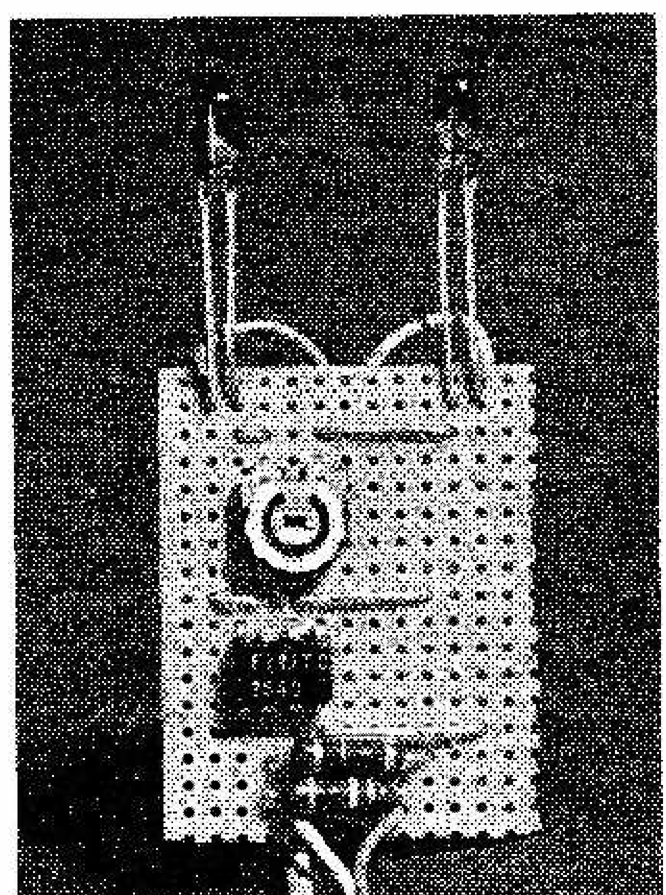


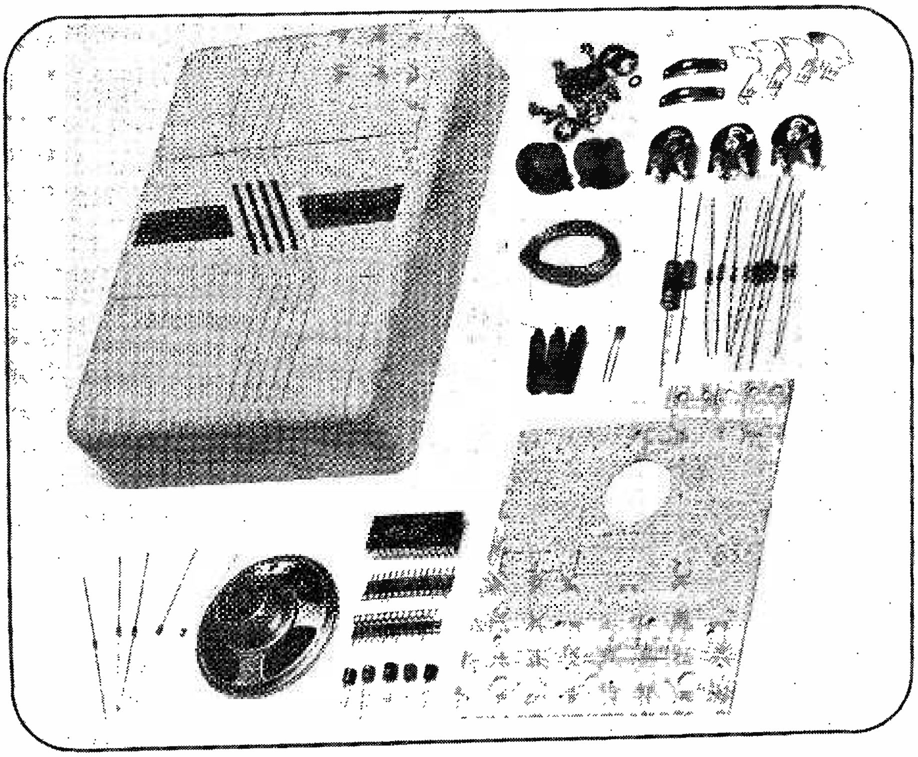
Fig. 2: Physical layout.



A station is tuned in, and as tuning proceeds the LED will vary in brightness, the correct tuning position being the point where they are both equally illuminated. ●

SPECIAL PRODUCT REPORT

CHROMATRONICS



the 'chroma-chime' kit

The Chroma-Chime is an electronic door chime which provides a selection of 24 different tunes. Readers may already have seen advertisements for the complete unit, which has also been featured on TV.

The heart of the design is a microprocessor chip, produced for Chromatronics by Texas Instruments, and containing all the necessary software (programs) to generate the various tunes. Now, the electronics enthusiast can buy a kit from which he can make up his own chime unit, and probably his first microprocessor-based project, to boot.

Besides the microprocessor itself, the circuit uses five transistors, four diodes and handful of resistors and capacitors, all mounted on a single printed circuit board. The loudspeaker and batteries (two PP3 etc.) are the only off-board components.

Provision is made for the connection of two circuits to external bell-pushes (Front and Back doors?). Closing one of the pushes will cause the unit to play whatever tune has been selected on the two internal switches. Closing the other push will play one tune which is pre-selected by the manufacturer.

Apart from the Tune Selector switches, the other controls are three preset potentiometers which are used to set the Volume, Speed (Tempo) and Tone (Sustain) of the tune.

Assembly

The kit is supplied complete down to the last screw—even a coil of p.c. solder is included. In the sample kit supplied for review, the loudspeaker had been slightly damaged in transit, but we are assured by Chromatronics that this item is normally packed in a protective bag, so the problem should not arise again.

Building up the kit is very straightforward, following the instructions given in the comprehensive assembly manual. The time required is quoted as about three hours, but the experienced constructor should be able to manage it in not much over half that time.

The microprocessor is an MOS device which is, of course, susceptible to damage from static electricity. For added safety in assembly, Soldercon sockets are provided for mounting this component. A variety of different transistor types may be included, according to availability. Included in the assembly manual is a table covering every possible type and its leadout configuration. Except, that is, the ones supplied with the review kit! The transistor manufacturer had supplied devices marked with a standard type number but having a non-standard pattern of leadouts. You will not be surprised to learn that the unit did not work when first switched on. Again, Chromatronics assure us they now have this problem under control.

Results

After sorting out the transistor problems, the unit worked well, providing its allotted selection of tunes. The volume is possibly a bit low for some houses, particularly when TV viewing or Hi Fi listening is in progress. However, terminals are provided for connecting an extension loudspeaker, and a purpose-designed unit will be available shortly.

The kit costs £18 including VAT and postage and packing. It is available from **Chromatronics, River Way, Harlow, Essex.**

WIRELESS TIME:

12:34.

approx. ¾ full size digits shown here

National's MA1012 LED digital clock module is a complete clock & alarm unit, operating from 50 or 60 Hz mains, and offering all the features you would expect: Hours-minutes display in bright 0.5" leds with optional seconds, sleep and snooze alarms, fast and slow setting, AM/PM indicator, switched alarm outputs - but best of all <u>no RFI.</u> Thus the MA1012 is suitable for use in any radio/tuner applications, and requires just 1.75 x 3.75 x 0.7" total. (Ex. transformer). £9.45 per module, isolating mains transformer £1.50 each. (*8% vat) Two modules, and two transformers for £20.00 (+8% vat)

<u>In the latest Ambit catalogue</u>: more TOKO coils, chokes, filters etc., data on the short wave coil sets, a revised price list, micro-microphone inserts, special offer lines etc.

DETECKNOWLEDGEY

Metal locator principles and practise, including some of the facts and information manufacturers of £100+ detectors would rather you <u>didn't know. £1.00 each.</u>

The Bionic Ferret 4000 - a VCO metal locator based on the PW seekit, including all parts, plasticwork, ready wound coil etc. Inc. free copy of deteckknowledgey. £34.26 in pp and VAT at 8%.

<u>Special announcement.</u> The Bionic Radiometer metal locator is at last to be released. A full VLF discriminator, with simultaneous display of ferrous, non-ferrous and foil objects. With a little practise, you can actually find objects obscured by junk. Outperforms units costing £150+. <u>Digital control.</u> Demo available at Brentwood, on sale soon for less than £75.SAE info:

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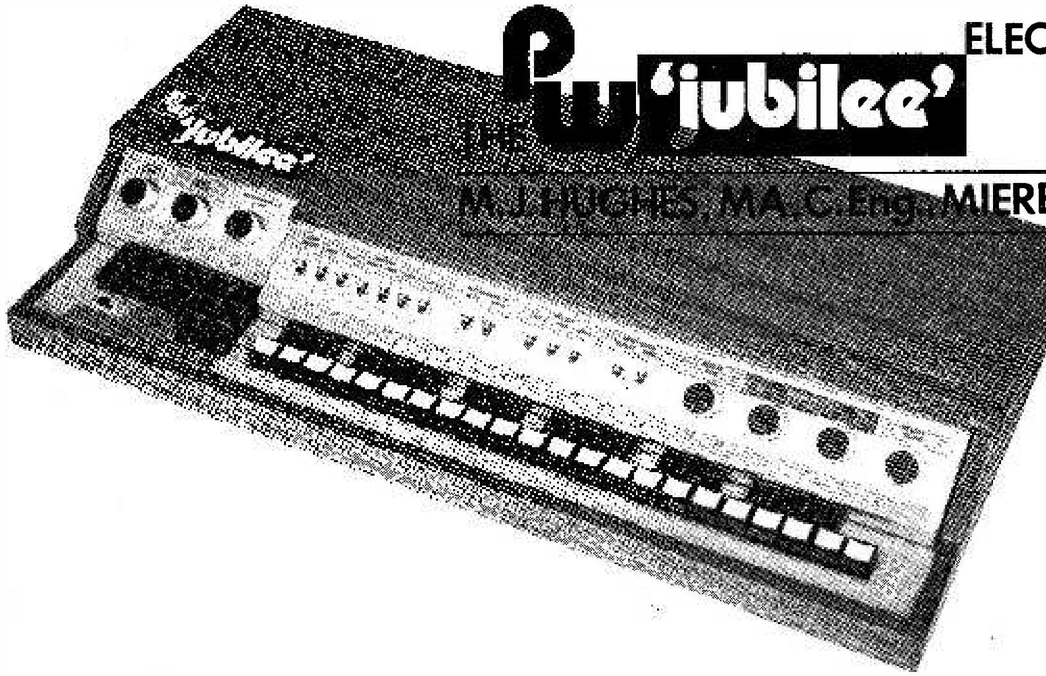


THE PW 'jubilee' ELECTRONIC ORGAN

Part 4

M.J. HUGHES, MA, C.Eng., MIERE

This part describes the assembly of the cabinet and off board interconnections for the calculator keyboard version of the instrument. The slight variations required for the conventional keyboard version will follow next month.

Back panel wiring

In the prototype, the front and back panels were cut and folded out of 14 swg aluminium sheet. The rear panel is shown in **Fig. 1.** The large bracket at one end carries the mains transformer while the narrower flange running the full length takes self tapping screws to fasten the chassis into its cabinet. Four small brackets fix the printed circuit board into place on the back panel. Their height is critical to the final assembly of the chassis into its cabinet; read on before starting any mechanical work! These brackets should be fixed to the back panel so as to register exactly with the centres of the fixing holes on the PCB. Drill these for self tapping screws. At the same time mark and drill clearance holes at the front of the transformer platform for the mains transformer mounting bolts, which also secure the PCB at the front of the cut out.

When fitting the voltage regulators, make allowance for any variation from the specified devices. The prototype used a TO-3 encapsulation for IC21. No insulating kit is needed for this as its can should be in electrical contact with the panel. Bolt a solder tag under one of its fixing screws.

When using a plastic version, the same comments apply. The same cannot be said for IC22 (the −12V regulator). It is *most important* that a mica washer and insulating bush are used when fixing this.

The mains input cable should be clamped to the back panel and the earth wire connected to a solder tag mounted under the clamp. The neutral connection should go straight to the transformer and the live should, at this stage, be left long enough to reach the front left hand corner of the PCB—where the mains switch will be mounted. Connect the side terminal of the fuse holder to the other input of the mains transformer and then link the two secondary pairs to their respective pins of the PCB. Refer to Fig. 1.

Solder up all the chassis tag connections. All must go to the same solder tag under IC21. This cannot be stressed too highly otherwise nasty earth loop problems and instability are likely! Connections to this solder tag come from the PCB pins located as follows:

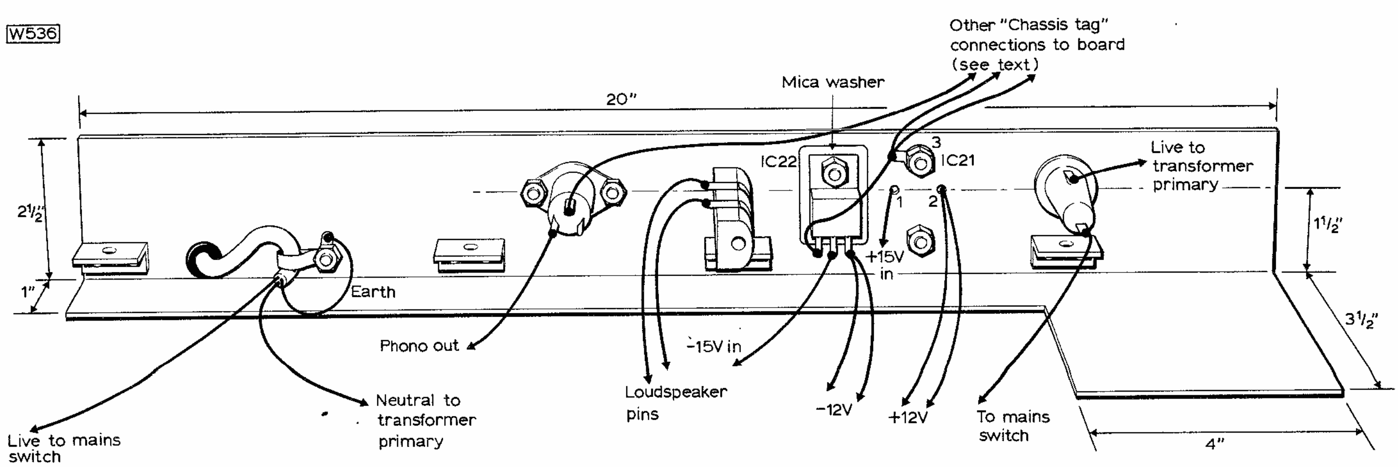


Fig. 1: Back panel assembly. The dimensions are for guidance only.

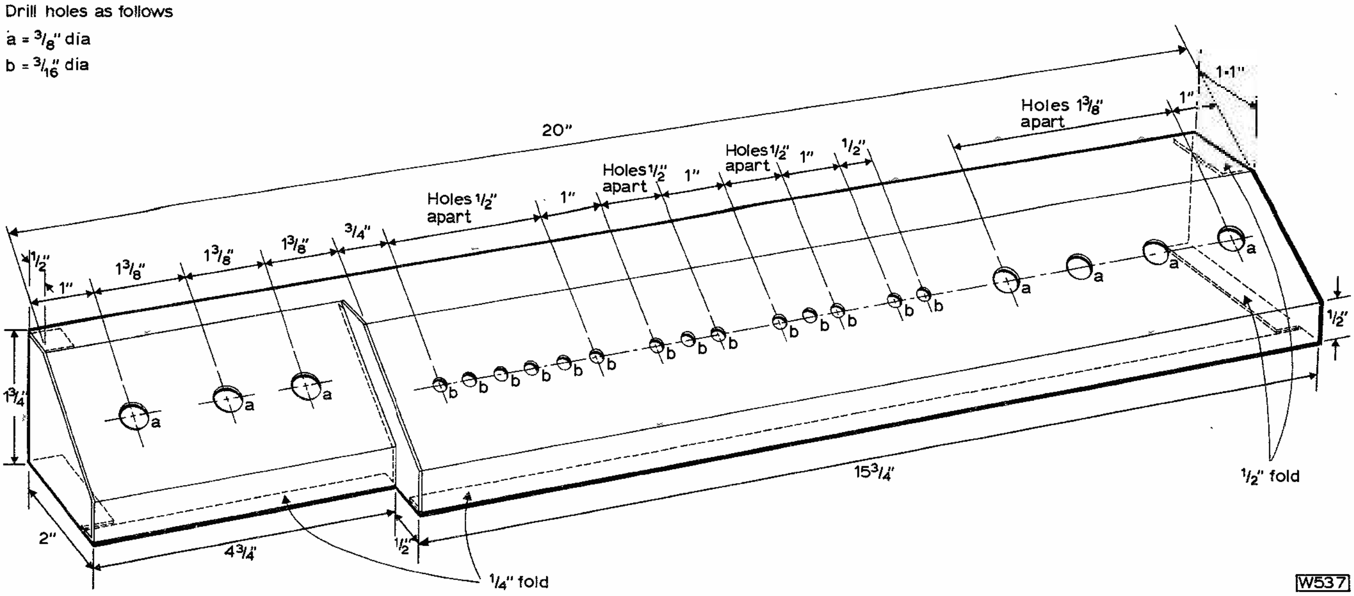
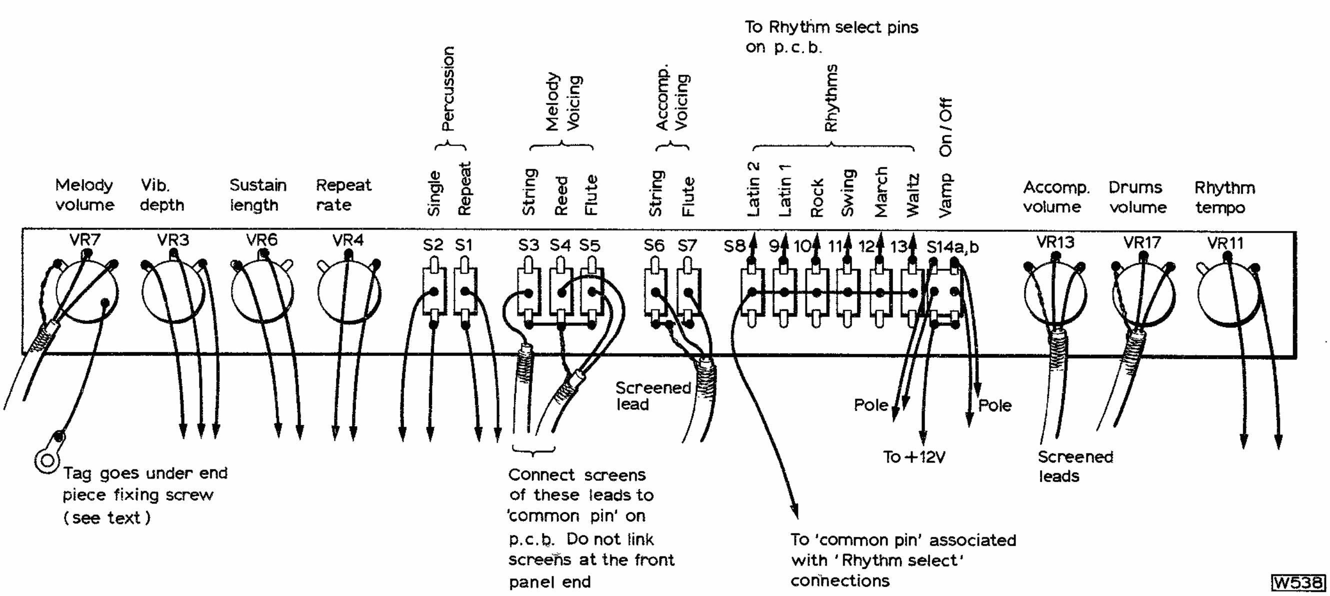


Fig. 2 (above): Front panel metalwork. The prototype front panel was constructed from three pieces of 14 gauge aluminium, two end pieces (each of different dimensions to allow for the step in the keyboard) and one main section. These are suitably folded and then stuck together with Araldite. Special attention should be paid to earthing the separate metal sections; epoxy adhesive is a very good insulator!

Fig. 3 (below): Front panel wiring. Note that earth connections to VR7, 13 and 17 are made through the screens of the stereo twin pairs; the cores connect to the wiper and to solder lug of each respective potentiometer. Screened leads are required to connect with switch groups S3, 4, 5, 6 and 7. To avoid instability problems caused by unwanted earth loops, connect the screens of the stereo pairs exactly as per this drawing.

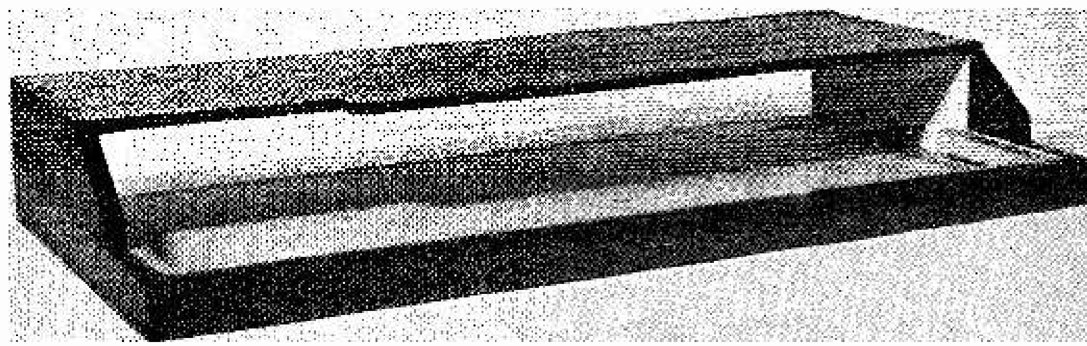


(a) Immediately to the left of B1, (b) Immediately in front of C44, (c) From pin 3 of IC22, (d) Immediately behind the positive end of C44, (e) Immediately behind IC19, (f) The earth connection of the DIN (Phono) output socket.

Having done this, connect leads between the output sockets and their respective board pins as shown on Fig. 1. Finally connect the input and output pins of the voltage regulators to their respective PCB pins—note that there are two output wires coming from each to feed different parts of the board, one pair goes to the pins above C49 and C50 while the other pair goes to the right of IC2.

Front panel

A degree of skill is needed to make the front panel as it has a 'dog's leg' in it to help differentiate between the accompaniment and melody keys. The critical dimensions are the overall height of the front panel to allow the chassis to slip into the cabinet and the depth of the step in the 'dog's leg' which is the equivalent of one row of calculator keys (0·6in). The latter is important for cosmetic reasons and to ensure that the flange running along its underside tallies with the positions of fixing holes in the PCB.



The photograph shows the plywood sleeve cabinet as used for the prototype calculator keyboard version. Note that the front of the cabinet has a pair of runners to give extra support to the keyboard section of the printed circuit board.

Start by cutting out the two end plates—these set the overall height and the depth of the step together with the angle of the bends. **See Fig. 2 for details.**

The main panel is cut and folded out of one piece. Use a fine saw and cut a slot to allow for the different positions of the bend at the 'dog's leg'. Using the smaller end plate as a template, fold the front panel for the accompaniment end of the keyboard. Start with the bottom flange then draw the material from the vice or clamp to put in the small angle bends at the top of the vertical and sloping sections. If you need to extend the slot this can be done quite easily. When folded, the end plate should fit *under* the top flange of the panel and the bottom flange of the end plate should be flush with that of the main panel.

Move to the other end of the work piece and put in the bends for the melody section of the keyboard; this time use the larger end plate as a template. Try to ensure that the sloping panel is parallel over both sections and then use a liberal quantity of Araldite to glue the end plates into position. Run a fillet of the glue under the inside edges where the sloping and vertical parts of the panel butt on to the end plates. Cut a filling piece and glue into the gap left between the two parts of the front panel. Use plenty of glue to fill any gaps or irregularities in the fit.

When the glue is rock hard—leave for at least 24 hours—mark and drill the front panel for the potentiometers and switches. Marry the panel to the PCB so that the vertical edges are just clear of the push button keys and mark positions for fixing holes along the underside flange by spotting through the PCB in the six marked locations. Self tapping screws should be used; drill the holes undersize.

At the left hand end of the panel (accompaniment end) drill a hole for a nut and bolt through the PCB and into the flange under the end piece. This hole should go through the copper area which is at earth (chassis) potential. A solder tag should eventually be fixed on this screw and a bonding connection made to the front panel with a wire soldered to the body of one of the potentiometers. **Note**—it is no good relying on connection through the end piece because the Araldite will have acted as an insulator! Drill a similar hole through the PCB and end piece at the melody end but keep the position clear of any of the PCB wiring. Fix the completed front panel to the PCB—forming threads for the self tapping screws, etc—before progressing further. Make sure that all the push buttons will operate without fouling anything.

Front panel wiring

Remove the front panel and finish it off with a rub down and give it several coats of hard polyurethane based silver lacquer. Fix all the controls in place and connect them with flying leads to their respective board pins (see **Fig. 3** for details). This operation is best done with the front panel tilted forward over the push buttons. Use screened leads for connections to VR7 (Melody Volume), VR13 (Accompaniment Volume), VR17 (Drums Volume) S3, 4 and 5 (Melody Voicing) and S6 and 7 (Accompaniment Voicing). Lightweight stereo screened pairs help cut down the number of separate leads required. Always use the earthing pin on the PCB associated with the respective 'live' terminals for each potentiometer or group of switches. **Do not** link all the earth connections on the front panel controls together or you will get major earth loop problems!

Note that the switches should be orientated as follows: S1, 2, 3, 4, 5, 6 and 7 should normally be closed in the 'Up' condition; S8 to S13 inclusive should normally be open in the 'Up' condition. When S14 a and b is 'Up'—in the Vamp OFF condition—the poles should be connected to +12V at the positive end of C17.

Screw the front panel into place—not forgetting the solder tag and bonding link going from the left hand end plate to the body of one of the potentiometers. Finally, mount the mains slide switch in front of the accompaniment keys. A small LED may be fitted next to the switch connected via a 470 ohm resistor across the −12V supply and ground. The cathode should go to the more negative voltage. Connect the live mains input lead to the main switch and run another wire from the latter to the central terminal of the fuse holder. The organ is now complete.

Next month—the variations required for conventional keyboard instruments, setting up the preset controls and fault tracing.

TRAFFIC LIGHT CONTROLLER

P. CHAMBERS

Outline

This design uses TTL ICs to simulate the appearance of traffic lights. The "lights" consist of three LEDs which go on and off in the sequence followed by actual traffic lights. Applications of this circuit might be found in model town and railway layouts, or (with a little modification) as a yes/no decision maker.

The sequence displayed must be: red, red/yellow, green, yellow, and back to red again. In addition the red or green periods (which are equal) must be longer than the yellow or red/yellow periods (which are also equal). The circuit follows this succession in a continuous cycle.

Circuit Description

The circuit consists of four distinct sections; these are the oscillator, the counter, the decoder and the display.

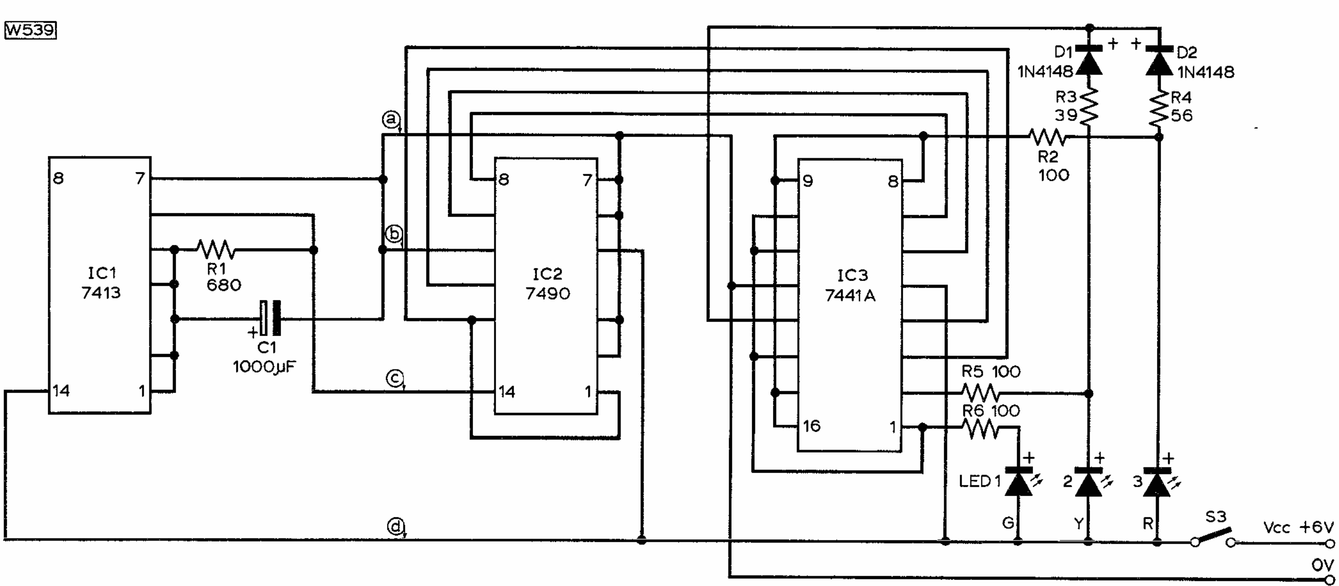
The oscillator is a SN7413, dual four input nand Schmitt which, together with R1 and C1, generates a series of pulses. The frequency is set by C1 (1000μF) which gives reasonable timing for a model layout. These pulses are fed to a SN7490 decade counter, which advances by one whenever an input pulse is detected. When it reaches nine, it resets to

zero; in this way the continuous cycle is produced. The count appears in binary at pins 12, 9, 8, 11 (1, 2, 4, 8 respectively). This count is taken to IC3, which is a SN7441A binary to decimal decoder. It has ten output pins which are normally high, but which go low in conjunction with the binary input. For example, when binary 0101 appears at the input pins, output pin 14 (associated with decimal 5) goes low. Since the decoder input cycles from zero to nine, the decoder outputs will do the same. These outputs are in four groups, each controlling a particular display function.

The display

This consists of three LEDs, arranged one above the other as in conventional traffic lights. The red LED is driven from counts zero, one, two and three; the

Fig. 1: The main circuit diagram.



green LED from counts five, six, seven and eight; and the yellow LED from count nine. Count four drives both the red and yellow LEDs, via diodes D1 and D2. These prevent the yellow LED lighting during counts zero, one, two and three, and the red LED lighting during count nine.

★ components

Resistors
R1 680Ω
R2 100Ω
R3 39Ω
R4 56Ω
R5 100Ω
R6 100Ω
R7 10kΩ

Capacitors
C1 1000µF, 25V
C2 10µF, 6V
C3 100µF, 6V

Semiconductors
IC1 SN7413
IC2 SN7490
IC3 SN7411A
Tr1 BC109C
D1 and D2 general purpose silicon
LED 1 Green, LED 2 Yellow, LED 3 Red

Miscellaneous
Relay 14 pin DIL reed type (Doram), Veroboard 0·1" matrix 50mm × 45mm, S1 2 pole, 2 way. S2 push-to-make switch. S3 Single pole, one-way. 6V batteries, Case.

Construction

The unit is constructed on a piece of 0·1in Veroboard which measures 50 x 45mm. Layout details, including modifications for the decision maker, are shown in **Fig. 3**

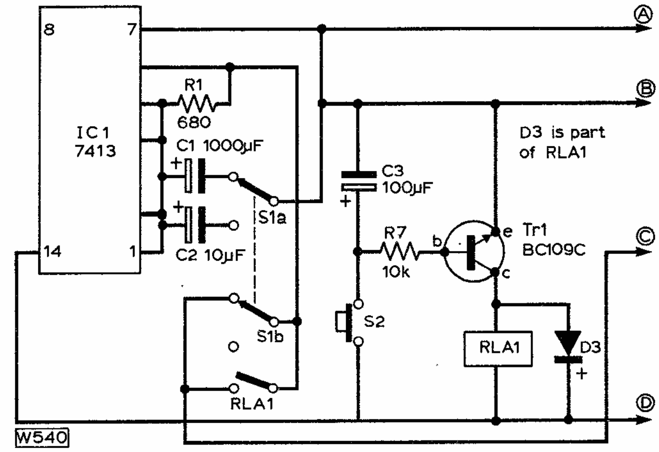


Fig. 2: Modifications around IC1 for use in "random" mode.

Modifications for Decision Maker

These modifications detailed in **Fig. 2**, allow the circuit to be turned into a form of "coin tosser". When switched in C2 determines the oscillator frequency, and sets it much faster than C1. The input to the 7490 is also disconnected from the oscillator, but is reconnected when the relay (a 14-pin DIL reed type) is energised. The relay is operated by TR1, which has a delay circuit C3/R7. When S2 is pushed, C3 charges to the supply potential and holds TR1 on. As C3 slowly discharges through R7 and TR1 base, it provides a delay of a few seconds, holding the relay on after S2 has been released. When RLA1 de-energises, the counter is again disconnected from the oscillator, and the display freezes in one state. When the switching speed of the display and the time delay on RLA1 are combined, it becomes impossible to predict just how the display will stop—in other words, the outcome is random. Should the display halt at a state which includes a yellow light, S2 may be pushed again. ●

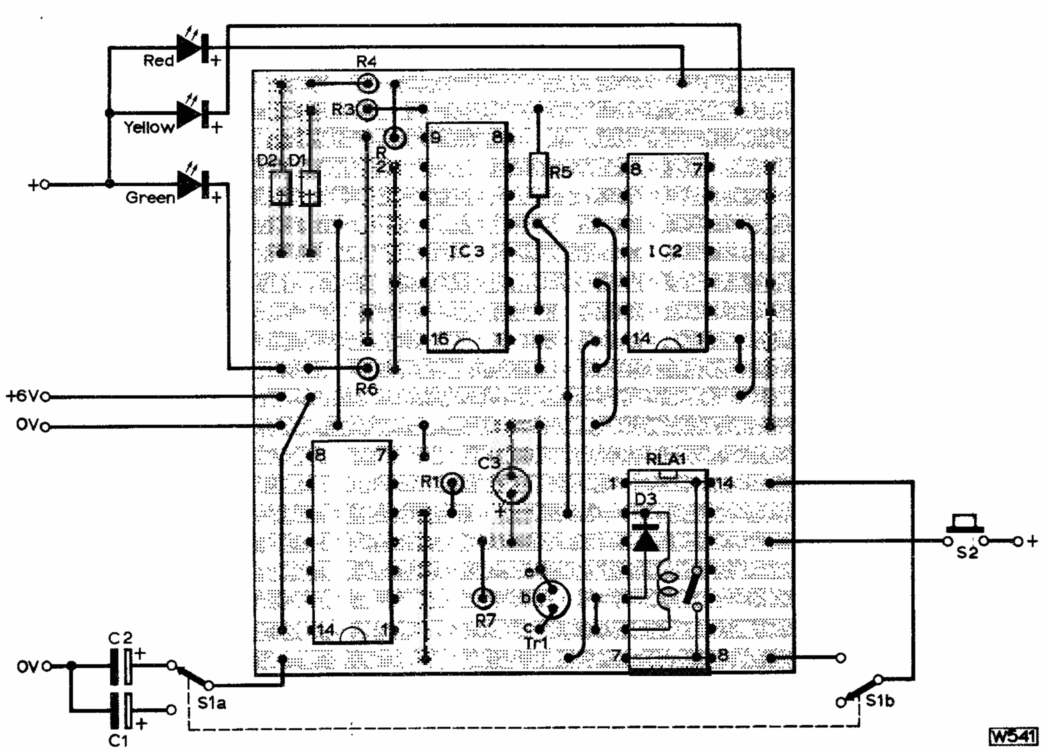


Fig. 3: General Veroboard layout of composite unit.

HOTLINES

A REVIEW OF RECENT DEVELOPMENTS
In general, the author does not have any more information on products than appears in the article.

Loud mouthed chips

If noise annoys your neighbours, they will not be very pleased to hear about one of the latest IC chips to arrive on the US market. It is a 28-pin device which has the sole purpose in life of generating noises! But it isn't quite so strange as might first appear. The manufacturers are aiming the new chip mainly at the toy and games market and they've taken the job very seriously.

The chip is a mixture of bipolar logic circuitry and injection logic (I^2L). Crammed into its tiny area, the device has noise oscillator, noise generator, noise filter, SLF (super low frequency) oscillator, VCO (voltage controlled oscillator), mixer, system-enable logic section, one-shot circuitry, envelope and generair modulator, attack/delay logic, and an amplifier. In very large quantities the device will sell for just one dollar.

The beauty of the device is that it only requires external resistors and capacitors to programme virtually any desired sound. For example it would be possible to have a sound like a submarine engine, then the throbbing of a heavy bomber aircraft, the screech of bombs falling followed by the sound of an explosion. The latter sound is aided by the one-shot oscillator in the device. This caters for sounds which last for less than two seconds, whereas other sections of the chip concentrate on allowing continuous sounds like sirens etc. The user may provide switching logic to switch in different sets of components. However, the chip manufacturers are rumoured to be currently working on a complementary chip which is designed to programme this device giving a series of several "standard" sounds.

The chip is not available in the UK, but readers might care to toy with some ideas for sounds they'd like to produce as and when it does become available. Do I detect someone saying "Hear hear"?

Where there's smoke

Some time back a sensor was launched onto the market which detected smoke and chemical fumes. Various electronics journals subsequently published circuitry using these sensors. For those interested in this area of electronics—great news brothers.

A British company has manufactured a chip for use with ionization smoke alarms. The device replaces some 30 discrete components. The magic number you're looking for is MEM4962; a single chip LSI (large scale integration) package which harbours an FET input, detector, voltage comparator, oscillator, trigger, horn driver, and CMOS output stage; in fact, just about all the circuitry you need to make a sensitive electronic nose to detect combustion—just add the sensor and alarm device. Please note; manufacturers very seldom if ever supply direct to the public.

Under water warmth

Microwave ovens are gaining popularity. Their ability to cook food in very short times and using minimal power are plus factors. The latest application of microwave heating is that of "cooking" divers while they plod happily round the sea bed. This work is currently going on at the University of Newcastle upon Tyne.

The Newcastle "chefs" viewed current methods of keeping divers warm at great depths with no real enthusiasm. One method relies on heating gas near the diver's suit. Another approach uses energy transmission which involves very heavy electrical currents and much copper connecting material.

Workers at Newcastle use a horn antenna fed at 8GHz with some 3kW of power. This power is transmitted down the diver's air hose which has a high dielectric material lining. The air is heated safely and transferred to the diver.

Ingenious though this may be, I don't think there's any real substitute for a good coal fire!

PW on a disc

When the laser was first publicised it was hailed as a solution in search of a problem. But with the passing of time, this has changed. A new video disc storage system has appeared which employs a laser beam. A disc of thin, transparent plastic, about the size of an LP record, has one side coated with a very fine layer of metal.

The recording tracks are made by burning minute holes in this metallized surface with a laser beam. The holes are typically a bare one micrometre in diameter.

In this way, the manufacturers are able to store some 18,000 separate pictures. Any individual picture may be called up in just one second. The system has various applications varying from storage of video signals, to the compact storing and playback of things like photographs for police work.

Just think, you might one day buy a whole year's *Practical Wireless* on a single LP.

Out for the count

Frequency counters have come a long way over the years. Many Hams will smile wistfully at the mention of a BC221 with its little dial and a set of interpolation figures to enable the user to work out what the frequency was.

A newcomer to the frequency measurement range is the FC600A. This beautiful little beasty can be held on the palm of your hand. It gives an eight digit digital readout of frequency from 6Hz to 600MHz. The weight is only $1\frac{1}{2}$lbs.

The counter oscillator has an ageing rate of just 3ppm (three parts per million) per year and is guaranteed accurate to within 5ppm over its operating temperature range of 0°C to +55°C. And it's economical to run, drawing only 300mA from a 12V supply.

Just in case you want one the cost is around 595 dollars (about £350) and the size is $5\frac{1}{2} \times 3\frac{3}{4} \times 1\frac{3}{4}$in.; about the size of a well stocked wallet.

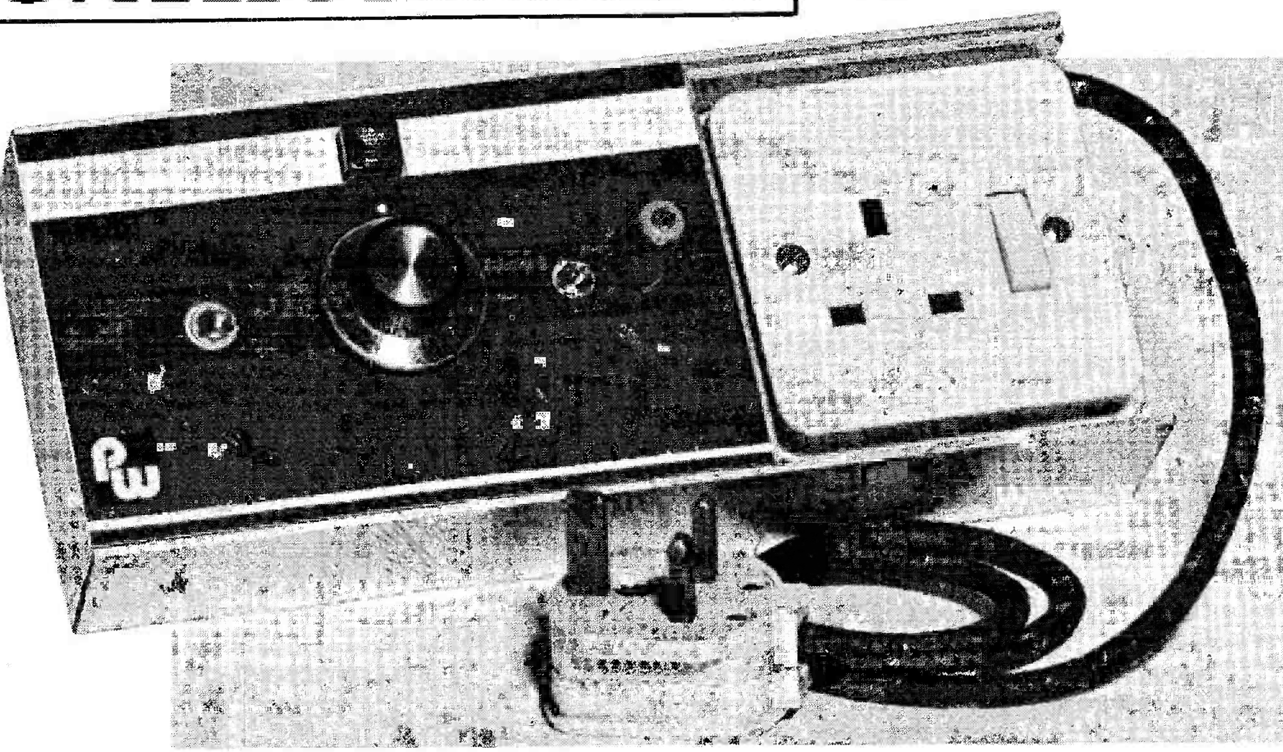
Ginsberg

ON SALE DEC. 2ND.

NEXT MONTH IN... practical WIRELESS

a PROPORTIONAL POWER CONTROLLER

Earlier methods of room temperature control fade into technical obscurity as our Proportional Power Controller leaps into the future! Using zero voltage switching technique, the unit provides interference-free temperature control of resistive loads (such as bar type electric fires) in the convenient range 40° F to 80° F.



plus Aerial Performance Test Set

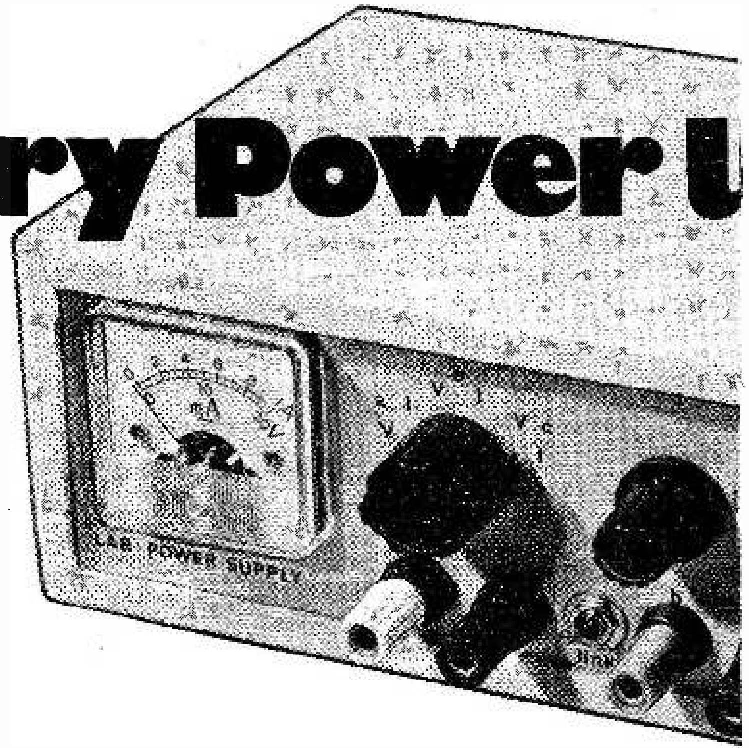
Constructing aerials from a book and taking their radiation patterns for granted is one thing. Testing model aerials, or even fullsized ones, and plotting their characteristics is something else. Fred Judd G2BCX, inventor of the very popular 'ZL Special' aerial, shows how to tackle the problem scientifically.

&

HF Direct Conversion Receiver

This ultra simple direct conversion short wave receiver offers a performance comparable to a £200 double conversion superhet. Intended for SSB and CW, the selectivity is controlled entirely by the AF passband—this makes alignment and operation easy. It uses a dual gate FET for optimum noise performance and a balanced mixer for good AM and spike noise rejection.

Laboratory Power U



When building any electronic equipment, some form of power supply is required for testing and experimental purposes, even though the equipment power supply, in its final form, may be batteries or even a purpose-built mains powered unit.

The ability to vary the supply voltage, to simulate the effect of a failing battery for example, is a desirable feature when testing certain equipment. Many circuits require bipolar supplies (dual rail) while a fixed +5V for TTL is a definite asset. To anyone who has struggled to test a new circuit with partly discharged batteries or some hairy hook-up to give 5 volts for the logic, this Lab Power Supply will certainly take some of the exasperation out of experimentation.

J. THORNTON-LAWRENCE GW3JGA

Description

The Lab Power Supply provides three individual power supplies: +5V 0-400mA for TTL, 0 to +15V 0-100mA, 0 to −15V 0-100mA for op. amps and general transistor circuitry.

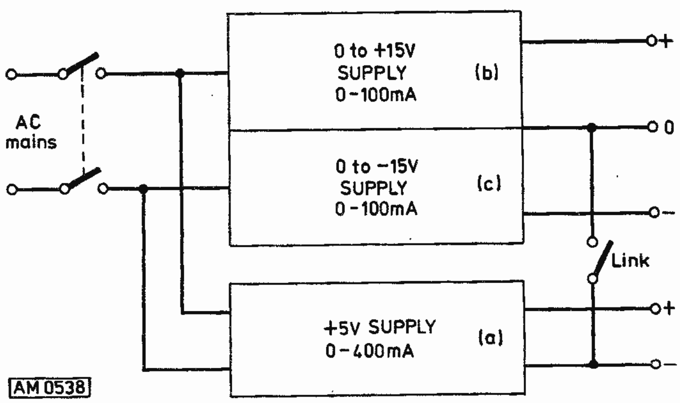


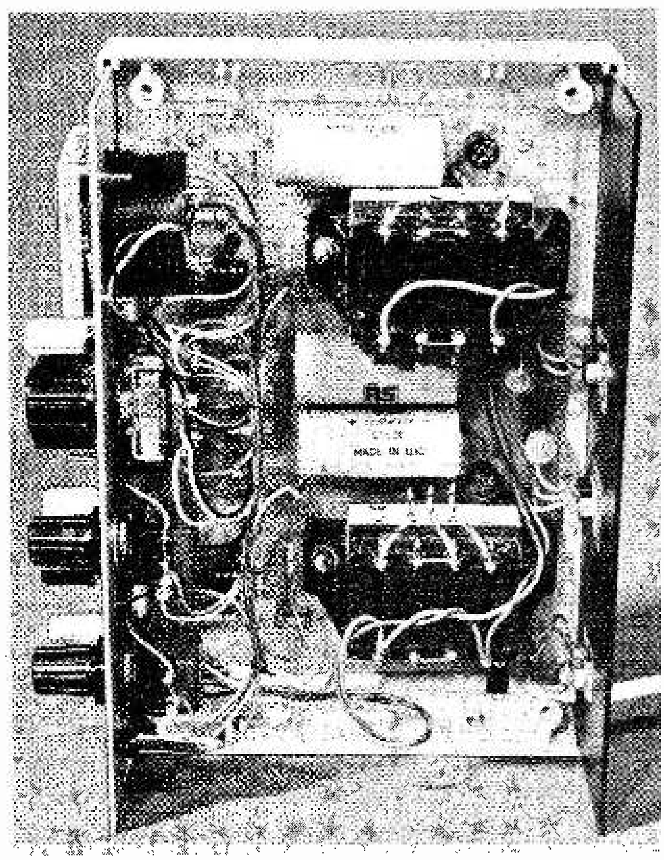
Fig. 1: Block diagram.

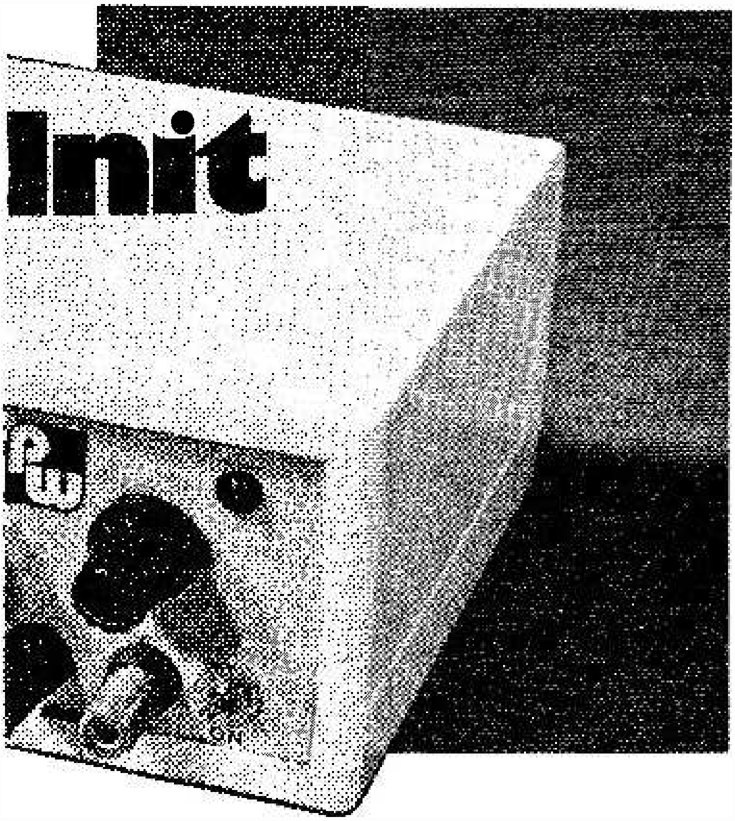
The +5V is fully floating while the bipolar supply has a common zero volt connection as shown in **Fig. 1**. This arrangement provides a fixed supply for TTL and a fully variable supply which may provide up to 30V at 100mA, with the supplies in series, or 0 to +15V and 0 to −15V with a common 0V connection.

In conventional usage, the 0V output of the 5V TTL supply and the centre 0V of the dual supply would be joined together. To do this, a link switch is provided to join or 'common' the 0V connections. This switch may be set to the un-linked position when full isolation of the supplies is required.

Circuit

The full circuit diagram is shown in **Fig. 2**. The 5V supply is shown in the lower part of Fig. 2 and comprises a mains transformer T2, full-wave bridge rectifier BR2, smoothing capacitor C5 and integrated circuit regulator IC3. Current and voltage metering is provided by R19-22 and R23 respectively. These are connected to the meter by S3. The rather unusual resistor arrangement for monitoring current avoids the difficulty of making up a low resistance shunt for the meter. The recommended resistors for R19-21 are 2% thick film types and for R22, 2% metal oxide, giving a worst case error of about 7%.





For voltage monitoring, the meter is switched in series with R23, giving 20V full scale deflection.

In the variable supplies, the mains transformer T1, bridge rectifier BR1, and smoothing capacitors C1 and C2 generate a dual 20V supply line. From these rails, regulated lines of +10V, +5V, −5V and −10V are provided by corresponding Zener diodes D1, D2, D3 and D4. These voltages are fed to various parts of the circuit.

Variable regulator circuit

The basic regulator circuit is shown in **Fig. 3**. It consists of a 741 operational amplifier used as a summing amplifier and a power transistor, Tr1, connected as an emitter follower. The output from the emitter follower is fed back to the inverting input of the 741 and so provides negative feedback. This causes the output of the emitter follower to maintain the voltage at the inverting input equal to the non-inverting input, i.e. at zero volts.

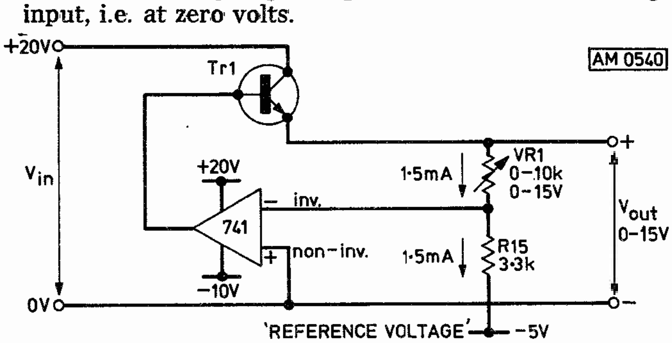


Fig. 3: The basic schematic of the variable voltage section. Fig. 2, the complete circuit diagram, is shown on page 589.

A negative current of 1·5mA is set up through R15 by connecting the bottom end to −5V. An equal but opposite polarity current comes from TR1 emitter (the output terminal) through VR1 to cancel out this

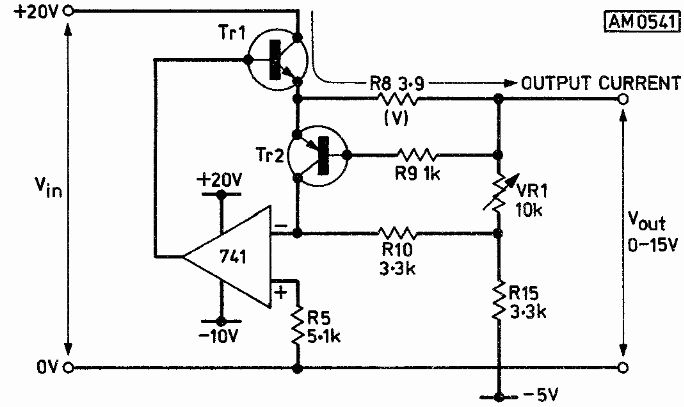


Fig. 4: The current limiting circuitry.

negative current thus maintaining the 'summing junction' at 0V. With VR1 set at zero resistance, +1·5mA will be provided with the output terminal virtually at 0V; with VR1 set to maximum (10kΩ), Tr1 emitter and the output will now move to +15V to maintain +1·5mA through VR1. Therefore, at any setting of VR1 the output voltage will be equal to the voltage drop across VR1 produced by 1·5mA through it.

★ components

Resistors

R1 680Ω ½W	R13 330Ω 2%
R2 680Ω ½W	R14 3·9Ω 2% ½W thick film
R3 330Ω	R15 3·3kΩ
R4 680Ω	R16 3·3kΩ
R5 5·1kΩ	R17 20kΩ 2%
R6 5·1kΩ	R18 20kΩ 2%
R7 330Ω 2%	R19 3·9Ω 2% ½W thick film
R8 3·9Ω 2% ½W thick film	R20 3·9Ω 2% ½W thick film
R9 1kΩ	R21 3·9Ω 2% ½W thick film
R10 3·3kΩ	R22 1·2kΩ 2%
R11 3·3kΩ	R23 20kΩ 2%
R12 1kΩ	

All ¼W 5% carbon film, except where stated.
VR1 10kΩ 1W wire wound VR2 10kΩ 1W wire wound

Capacitors
C1 2200µF 25V
C2 2200µF 25V
C3 10µF 25V
C4 10µF 25V
C5 2200µF 25V
C6 220nF
C7 470nF

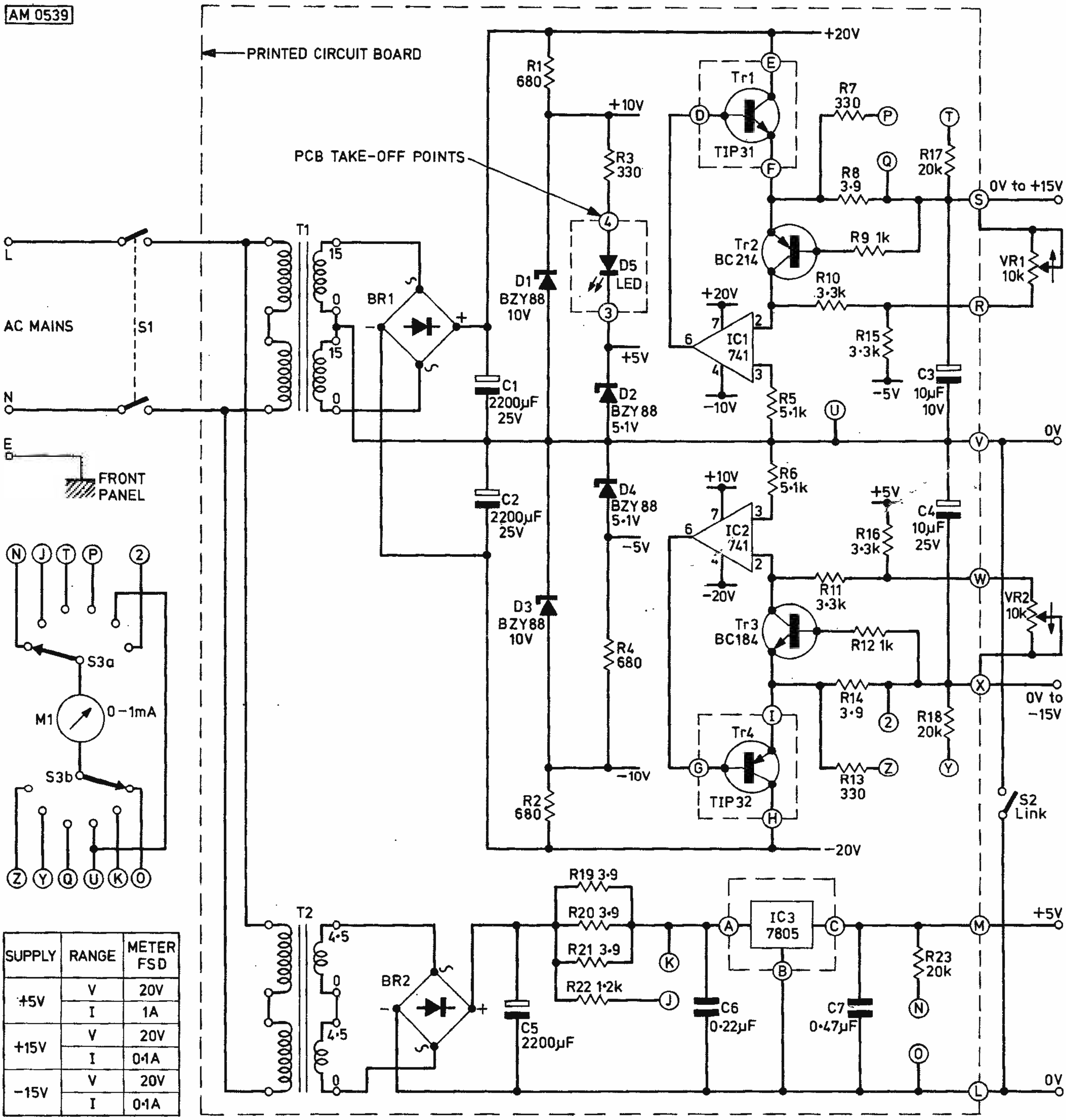
Semiconductors

Tr1 TIP31	IC1 741
Tr2 BC214	IC2 741
Tr3 BC184	IC3 7805
Tr4 TIP32	BR1 1A type
	BR2 1A type

Switches
S1 DPDT
S2 SPST
S3 2 pole 6 way

Transformers
T1 Primary 240V, secondary two windings each of 15V 0·2A
T2 Primary 240V, secondary two windings each of 4·5V 0·6A

Miscellaneous
PC (from Readers PCB service, if required), Meter 0-1 mA, terminals, knobs, mains lead, hardware, cabinet (21 × 8 × 14cms).



SUPPLY	RANGE	METER FSD
+5V	V	20V
	I	1A
+15V	V	20V
	I	0·1A
-15V	V	20V
	I	0·1A

Fig. 2: The complete schematic. The mains transformer primaries are not connected to the printed circuit board. As such, they are not indicated by reference letters which correspond with Fig. 6, the PCB overlay.

Rotation of VR1 produces a linearly variable output voltage of 0-15V.

When a current is drawn from the output terminal, this tends to reduce the output voltage slightly and this negative change is at once apparent at the 'summing junction' and so produces a positive change at the output and restores the output voltage to the correct value again, or almost so. This amplified correction gives the characteristically low output impedance that can be obtained from electronic voltage regulator circuits.

Regulator with current limiting

The circuit with the additional components is shown in **Fig. 4**. A current sampling resistor, R8, monitors the load current. This resistor is between the emitter and base of Tr2 and when the load current produces a sufficient voltage drop across R8, Tr2 turns on causing positive current to flow from the collector of Tr2 to the 'summing junction'. This results in a negative polarity change in the output, ensuring that the output current does not rise to a dangerously high value. Tr2 will turn on when the emitter-base voltage (V) reaches about 0·55V:

$$I_{max} = \frac{0{\cdot}55\text{V}}{3{\cdot}9\Omega} = 140\text{mA approx.}$$

The resistor R8 performs a dual purpose in that with R7 (see Fig. 2) it provides a meter shunt for monitoring output current, giving a full scale deflection of the panel meter for 100mA. The shunting arrangement is similar to the +5V supply circuit previously described.

R9 is included in the base circuit of Tr2 to limit the base current to a safe value and R5 is included in the non-inverting input of the 741 to balance the small voltage off-sets produced by the input currents of the device. C3 is fitted across the output terminals to provide a low output impedance at medium and high frequencies. The negative supply is a mirror image of the positive supply.

The panel meter has a basic sensitivity of 1mA full scale deflection and is switched to various parts of the circuit for output voltage and current measurements.

Construction

The prototype was housed in a Verobox. The printed circuit board carrying all the components was fixed to tapped pillars provided in the base of the Verobox. The front and rear panels fit into slots in the base and cover.

The printed circuit board layout is given in **Fig. 5**. The overlay, **Fig. 6**, shows numbered interconnection points where the wiring from the front and rear panels is connected. These points are also identified on the circuit diagram shown in Fig. 2. The only connections not identified in this way, are those to the mains transformer primaries, as they do not connect with the PCB. The primaries of the transformers are fed from S1, the double-pole on/off switch.

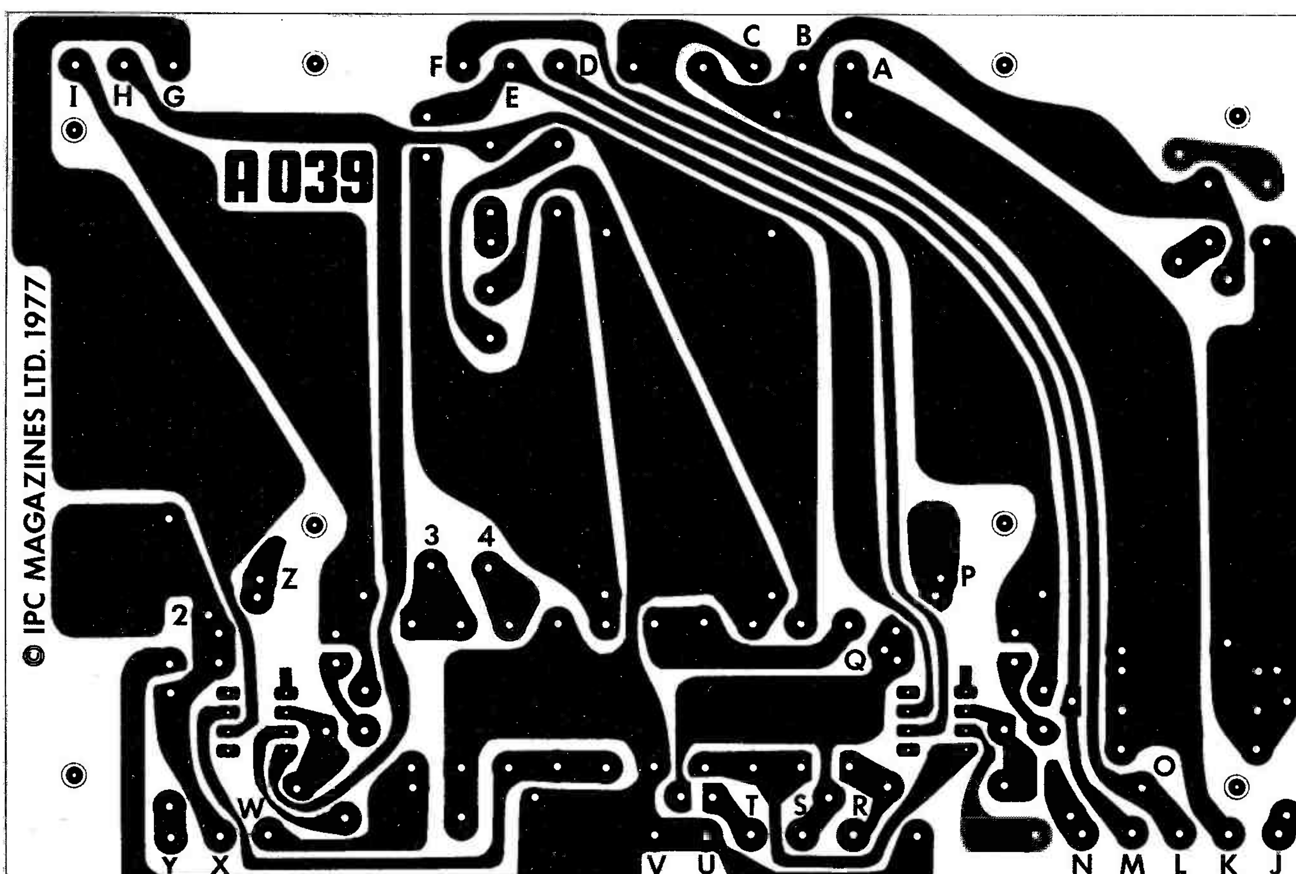
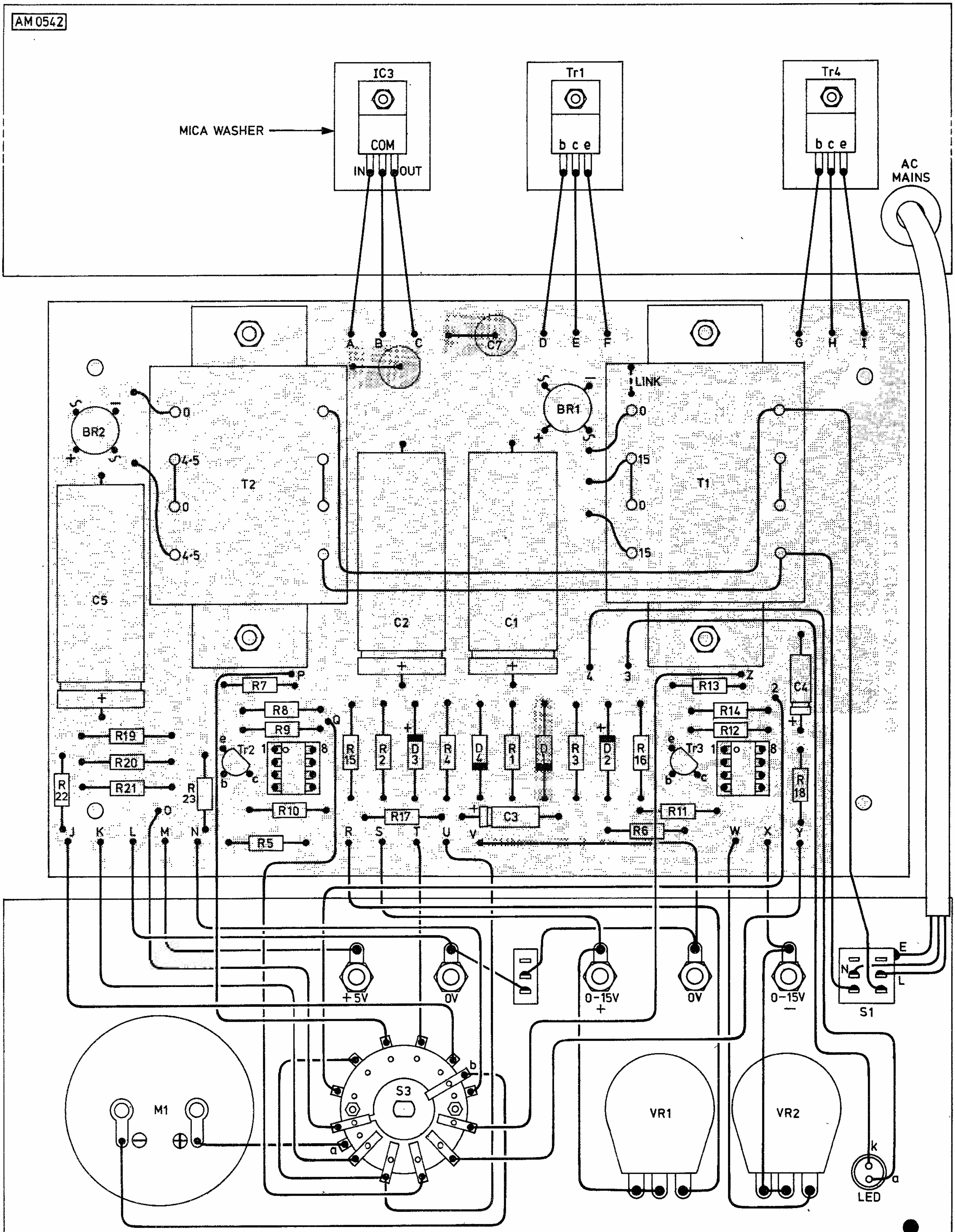


Fig. 5: The PCB shown copper side. The scale factor is one; ready made boards may be obtained from the PW Readers' PCB service. Details page 593.
Fig. 6: Component overlay. This drawing is shown on page 591 (overleaf). The reference letters refer to the circuit diagram.


AM 0542
IC3
MICA WASHER
COM
IN
OUT
Tr1
b c e
Tr4
b c e
AC MAINS
A B C D E F G H I
C7
LINK
BR1
BR2
T2
T1
0
4·5
0
4·5
0
15
0
15
C5
C2
C1
C4
P
Q
Z
R7
R8
R9
R13
R14
R12
R19
R20
R21
R22
R23
Tr2
Tr3
R15
R2
D3
R4
D4
R1
D1
R3
D2
R16
R18
R10
R17
C3
R11
R6
R5
J K L M N O R S T U V W X Y
+5V
0V
0-15V +
0V
0-15V −
E
N
L
S1
M1
S3
a
b
VR1
VR2
k
a
LED

NEW BOOKS

ELECTRONICS FAULT DIAGNOSIS
by Ian R. Sinclair

Published by Fountain Press, Argus Books Ltd., 14 St. James Road, Watford, Herts.
108 pages £2·75

This book is unusual in several respects: it maintains a 100% educational aspect in the classic questions and answers textbook style while being *informative* at the same time. The author has managed to define closely the ability and technical understanding of his readership thus obviating the boring preliminaries of very basic theory; this book is not for beginners.

The content comprises about 50 or 60 circuits, each complete and functional, with accompanying descriptions of normal circuit operation. For each, the author provides tables of voltage readings, as well as 'scope diagrams where necessary, taken from critical points in the circuit. While one set of readings will correspond to normal circuit operation, others have been taken with various hypothetical fault conditions. The reader is left to work out which is the correct set of figures, given several fixed points to work from, and which sets correspond to various component failures. The format is certainly educational and occasionally mind bending—even for the more gifted amongst us. Answers of course are at the back.

What the book amounts to is a collection of technical puzzles capable of stretching professionals and amateurs alike. More surprising, it works at several levels of understanding; this mostly results from the author's policy of including the easy circuit examples first with more difficult ones further on. Interest is maintained by the nature of the circuits given. He has carefully avoided the textbook trap of including oft-quoted, boring circuits such as astables and the like. They are there but in heavily disguised form within larger circuit building blocks. One gets the feeling that the author is as happy with a soldering iron as he is with a typewriter. Indeed, most seem very efficient and would find ready application in many areas of amateur electronics—which is far more than can be said about most circuits published in text books.

Frank Ogden

A PRACTICAL INTRODUCTION TO DIGITAL ICs
By D.W. Easterling

Published by Bernards Ltd., The Grampians, Shepherds Bush Road, London, W6 7NF.
76 pages 95p

The title 'A Practical Introduction to Digital ICs' over-describes the content of this 76 page volume. More precisely, the latter deals with practical applications (sic) of six members of the 74 series. These applications are mostly adjuncts to a digital timer described in the penultimate chapter. It has to be said that the overall impression is one of confusion, inaccuracy and lack of aspect.

Throughout the book, the author seems unable to decide

continued on page 606

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Dec 75	Sound-To-Light Display	DN0798	1·15+12
Dec 75	Disco System, Amp. (2 req'd) each	AM0421	4·40+22
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Mar 76	CMOS Crystal Calibrator	AM0438	1·19+12
Apr 76	Wobbulator	AM0443	1·08+12
Apr 76	Auto. Slide Synchroniser	AM0441	2·33+15
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July 76	Transistor Tester	A002	3·08+18
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Aug 76	Cassette Player Power Supply	A001	0·65+12
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Apr 77	Gas/Smoke Sensor Alarm	A028	0·65+12
May 77	2-Way Intercom	D019	1·28+12
May 77	Protected Battery Charger	A027	2·38+12
May 77	Seekit Metal Locator	A031	3·38+12
June 77	Reverberation Amplifier	A032	2·38+12
June 77	Versatile AF Generator	A033	2·38+12
June 77	Tele-Games	D029	3·22+18
July 77	20W IC Amplifier	A034	1·38+12
July 77	Radio 2 Tuner	A035	1·68+12
July 77	Digital Clock Timer	A036	3·28+12
Aug 77	Shoot (Telegames)	D035	1·55+15
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Aug 77	Morse Code Tutor Cards (SRBP)	A037	4·75+15
Sept 77	Jubilee Electronic Organ	A038	19·00+75
Sept 77	Electronic Car Voltage Regulator	D037	1·25+12
Oct 77	Audio Level Indicator	D039	0·98+12
Oct 77	Sine-Square Wave Generator	D040	2·35+15
Nov 77	Laboratory Power Supply	A039	3·50+12

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A MERE 20 YEARS

R.HAM BRS15744

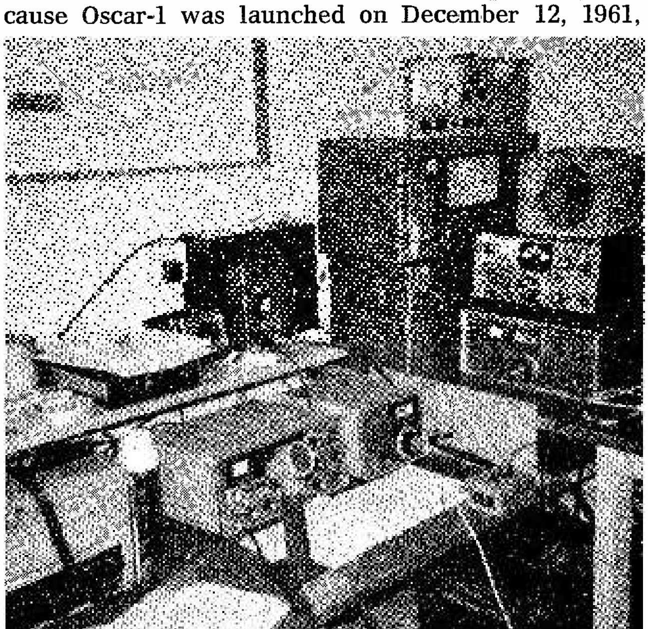
Within the past 20 years, man has achieved his dream of centuries and become clever enough to leave his own world and visit another. In fact, it was barely 12 years from October 1957, when the Russians launched the first artificial earth satellite, to July 1969 when the Americans placed two men on the moon.

It all began on October 4, 1957, when a 23in polished sphere, called Sputnik-1, and weighing 184lb, began orbiting the earth every 96·2 minutes, sending the first radio signals back to earth from a man-made space-craft. Very soon, radio enthusiasts throughout the world were working out orbit times and tuning their communications receivers around 20MHz to hear the bleeping signals as Sputnik-1 passed over. A month later, Soviet scientists put the dog Laika into earth orbit aboard their 1120lb Sputnik-2 and in February 1958 the Americans launched their first satellite, Explorer 1.

As the years passed by, hundreds of satellites were successfully launched by both the Americans and Russians and through their combined efforts a great deal of scientific knowledge has been gained.

Marconi's Day

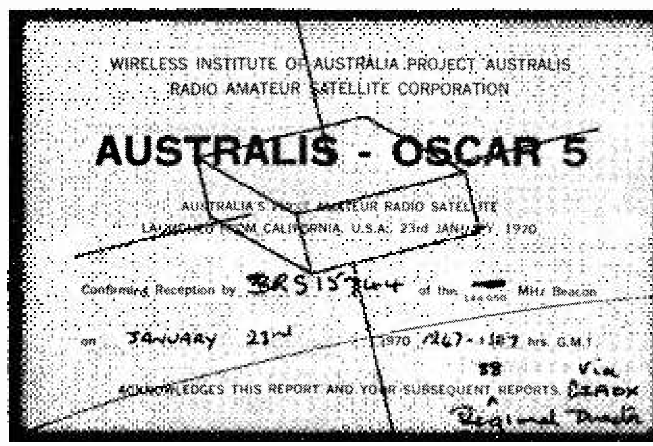
Just four years and two months after the conquest of space began, the first amateur radio satellite, Oscar-1 (Orbiting Satellite Carrying Amateur Radio) was sending signals back to earth on 145·008 MHz. Thanks to the United States Government Oscar-1 was placed in orbit, as a "piggy-back" passenger, by a USAF Thor-Agena rocket while on another mission from the Vandenberg base in California. At that time, amateur radio had much worth-while publicity because Oscar-1 was launched on December 12, 1961,



The equipment installed at the clubroom of the Mid-Sussex Amateur Radio Society for co-ordinating the launch of Oscar 7.

the 60th anniversary of the day that Marconi and his colleague Kemp, situated on Signal Hill, Newfoundland, heard for the first time in our history, a wireless signal which had originated from the other side of the Atlantic.

Technically minded people throughout the world praised the Project Oscar Association (formed by a group of American radio amateurs) for making it reality, that a 101lb capsule, carrying a tiny VHF transmitter was orbiting the earth and sending the letters 'hi'-'hi'-'hi' in morse code from space. Further satellites in this series were launched by American rockets in 1962, 65, 70, 72 and 74 of which the last two, Oscars 6/7, are both communications satellites and still operational. (Details in *Practical Wireless*, December 1976.)



The QSL card received by the author confirming his reception of signals from Australis Oscar 5.

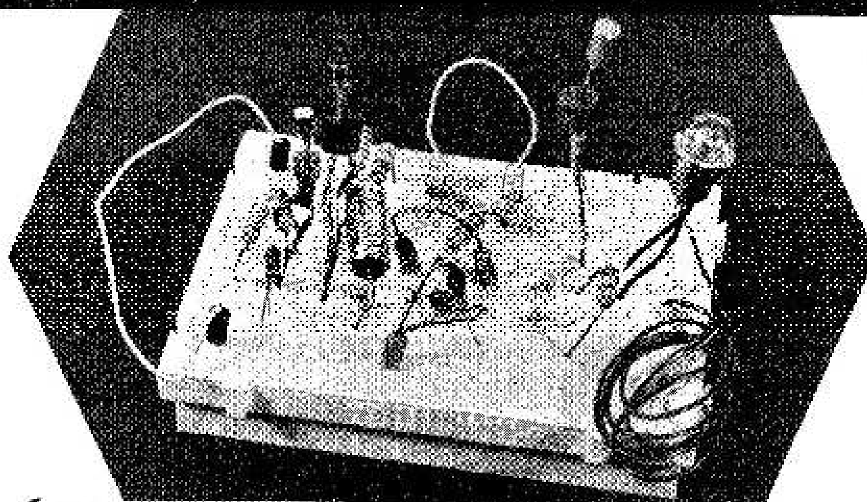
In January 1970 Australis-Oscar 5, constructed by amateurs in Melbourne, Australia, was launched and its signals, a series of variable tones, gave information about the satellite's attitude, battery condition and temperature. This data was received on 144·05MHz and, by ground command, on 29·45MHz was recorded by a team of regular observers on special log sheets distributed by Bill Browning, G2AOX, for the occasion.

Communications Satellites

Satellites provided the answer for faster communications around the world and, although the first "active" communications satellite Courier-1b, only operated for 17 days, by July 1962 the first television pictures had bridged the Atlantic via Telstar-1, followed in December 62 by Relay-1.

In July 1963 Syncom-2 was placed in synchronous orbit some 22,000 miles over the Indian Ocean, followed in 1964 by Syncom-3, in 1965 by Early Bird-1. In January 1967 Intelsat-2b was stationed, also in synchronous orbit, above the Pacific Ocean and was used to link Apollo programme stations together in addition to its commercial duties. The first "passive"

S-DeCnology



DAVID GIBSON

11

THIS MONTH

'Automatic Courtesy Light'

Throughout this series, electronics has been employed to amuse, assist or entertain. The circuit shown in **Fig. 1** must surely come under the heading of 'useful'.

The basic idea is that a momentary contact is made which causes a light to switch itself on. After a predetermined period, the light automatically switches itself off. It remains off until there is another contact (this need only be for a fraction of a second) when it will again illuminate and, after a set period, switch off again automatically.

It is envisaged that numerous uses could be found for an automatic courtesy light. For example, the bell push on a front door could form the contacts. When pushed, the light would come on just long enough for the keyhole to be found.

Circuitry

At first sight, the circuit of Fig. 1 may look unfamiliar and yet careful examination will show that it is merely a multivibrator connected for monostable operation. Transistors Tr2 and Tr3 form the mono-stable. Note the absence of a capacitor which (in an astable) would be inserted in place of R6.

The result is that the mono-stable normally remains in one state: with one transistor on and the other off. By making a momentary contact across S-DeC holes 65 and 70, it causes Tr2 to switch on and Tr3 to switch off. The result is that Tr1 now conducts and lights the lamp LP1 in its collector lead.

This new stable state is not permanent however. It only lasts for a finite time which is dependent upon the value of the resistor pushed into S-DeC holes 4 and 14; and on the value of the capacitor C1. After a time (which depends on these C1/R5 values) the circuit will automatically revert to its original state. It will remain in this state until the contacts are again shorted. See **Fig. 2** for component layout.

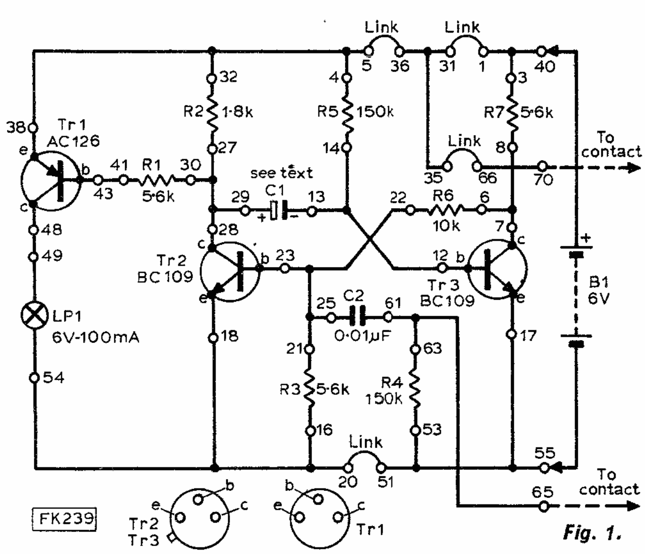


Fig. 1.

Components

Variation of R5/C1 gives a measure of control over the timing period during which lamp LP1 is on. Using the values shown, the lamp remains on for a period of 15 seconds. Changing the value of C1 to 330µF increased the 'on' period of LP1 to approximately one minute. Varition of R5 might be useful in some applications but it suggested that the minimum value of resistance should be 47kΩ. It is possible to use a potentiometer for R5 but in this event a 47kΩ resis-

you will need . . .

R1 5·6kΩ	C1 100µF (see text)
R2 1·8kΩ	C2 0·01µF
R3 5·6kΩ	Tr1 AC126
R4 150kΩ	Tr2 BC109
R5 150kΩ	Tr3 BC109
R6 10kΩ	LP1 6V 100mA bulb
R7 5·6kΩ	B1 6V battery
One S-DeC	Three transistor holders

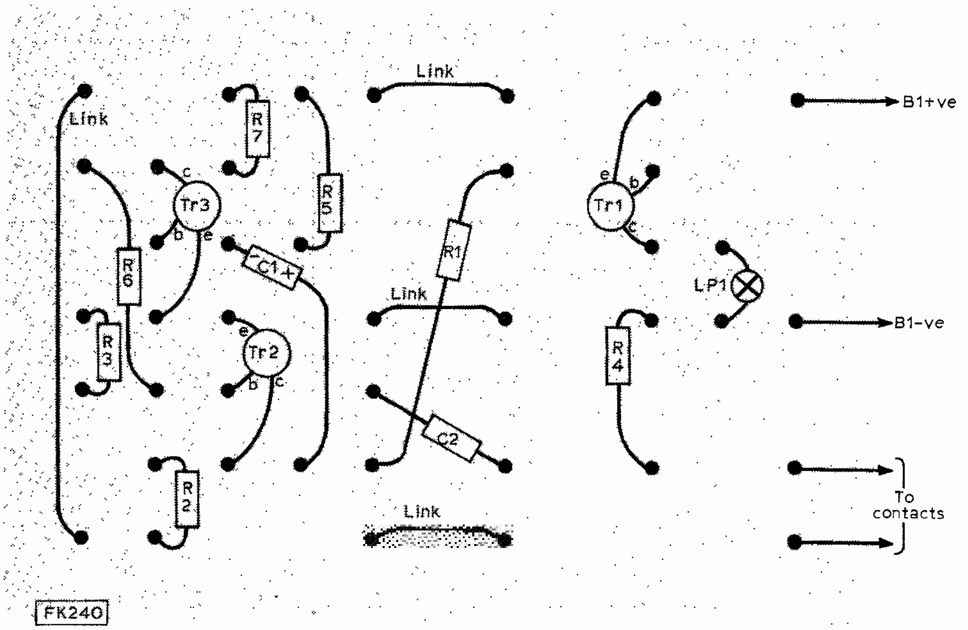


Fig. 2: The S-DeC layout for this month's project shown actual size. Alternative transistor types may be used to those shown in the circuit. However, make sure that their leadout configurations are in accordance with the layout. Also note that Tr1 is a PNP type while the others are NPN.

tor should be wired in series with the pot, thus ensuring a minimum value at all times.

Lamp LP1 should not be rated at greater than 100mA, and 6V should be considered the ideal voltage for general use with the circuit. If the light is to be on for only short cycle times, say not longer than 15 seconds, then up to 12V may be used. With 6V applied and a 330μF capacitor for C1, the quiescent current drawn by the total circuit was barely 1·25mA. Using a 4·5V battery, this dropped to approximately 0·9mA.

Contacts

The contacts which short together momentarily can be the bared ends of the wires from S-DeC holes 70 and 65. These might be fixed to a door (or whatever) in such a way that when the door opened the two bared ends brushed against each other. For other applications any type of switch or bell-push would be suitable, and a reed switch with magnet should be an elegant and reliable method. ●

communications satellite, Echo-1, launched August 1960, was a 100ft diameter balloon with a metallised surface for reflecting radio signals. Later, in January 1964, came the 135ft diameter Echo-2 which was used in a co-operative programme with the USSR. Many radio amateurs took part in the Echo experiments.

The Permit

Around April '62 the question arose as to whether amateurs would be contravening the terms of their licence if they listened to satellite signals outside the recognised amateur bands. However, as a result of discussions between the Radio Services Department and the RSGB the Post Office decided that if an amateur wishes to receive signals emitted by artificial earth satellites engaged in scientific space research, for the purpose of making observations on the technical characteristics of such signals, or otherwise carrying on technical investigations in radio technique, they will authorise him to do so.

Conquest of the Moon

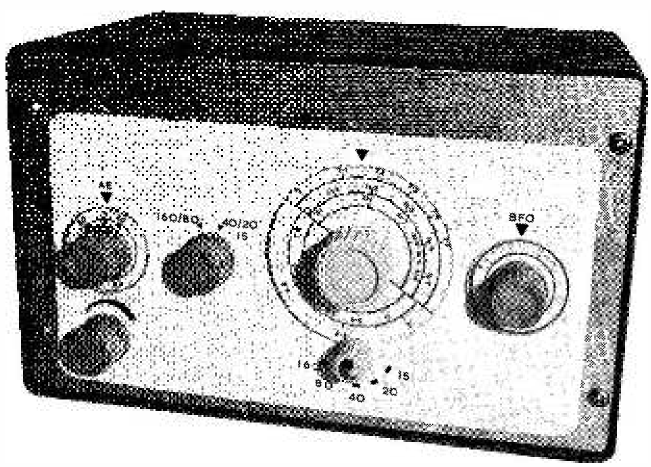
It was only 11 years and 7 months from the flight of Sputnik-1 to the day when Neil Armstrong and Edwin "Buzz" Aldrin landed on the moon, after a journey which had been pioneered by a series of earth satellites. Between July 1964 and March 1965 Rangers 7, 8 and 9 sent back a total of 17,000 TV pictures from their three journeys to the moon. In May 1966 Surveyor-1 made a successful soft landing and in 13 days it sent more than 11,000 pictures of the lunar terrain back to earth. In August 1966 Luna-Orbiter-1 photographed some two million square miles of the moon's surface while on earth, men were being trained in the Gemini, Mercury and Apollo capsules ready for that great moment in July 1969 when a radio signal from the moon, 240,000 miles away, carried the message: "this is Tranquility Base, the Eagle has landed."

When Neil Armstrong left the Eagle and set foot on the moon he said "one small step for Man . . . one giant leap for Mankind" and I think that sums up the whole of the space programme over the past 20 years.

all band short wave converter

Part 2

F. RAYER G3OGR



IF Unit

The IF stage is assembled on a metal chassis about 75 x 50 x 40mm (3 x 2 x 1½in) high, as in **Fig. 7**, made from scrap metal. Coil L5 is wound on a 7mm diameter former. Begin at point 1 and wind on thirty-three turns to 32SWG enamelled wire, finishing at point 2. C18 is across this winding, its leads projecting under the chassis. Winding 3-4 is ten turns, close to the main winding.

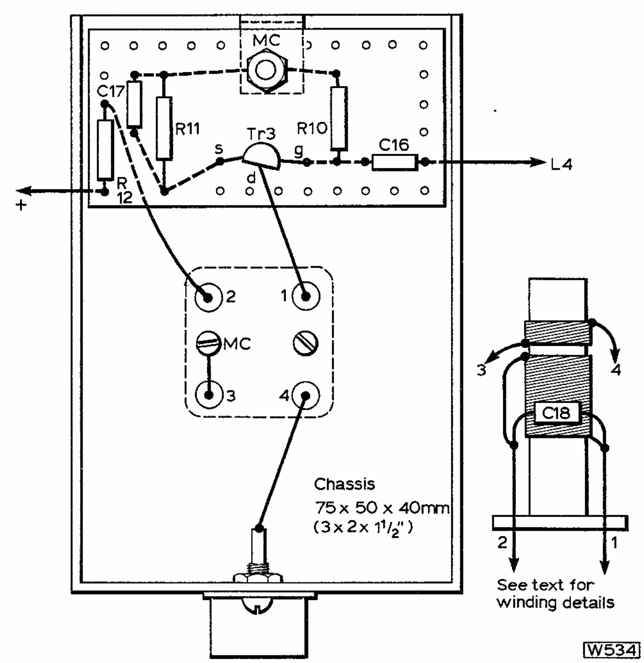


Fig. 7: Layout and wiring for the optional IF amplifier stage.

The small board in Fig. 7 is mounted by a bracket, which is the chassis and negative return. Output from 4 goes to a co-axial socket on the unit. The coil core is set to peak signals, as for L4.

Tuning Adjustments

L1, L2 and L3 and the trimmers can be set before adding the BFO and 5·5MHz FET stage. L3 and the trimmers determine the bands covered, so they must be adjusted correctly. Either of the following methods can be used:

1. If the associated receiver covers at least some of the correct oscillator frequencies, and if its calibration is reasonably accurate, the oscillator frequency can be checked by placing its aerial lead (preferably screened except near the end) near L3. It will then be possible to pick up the oscillator carrier. As the converter output is to be 5·5MHz, there will be 5·5MHz difference between the required band frequencies and the oscillator. For example, for 1·8 to 2·0MHz the oscillator will tune to 7·3 to 7·5MHz. TC1 and L3 are adjusted until this is achieved. All the required oscillator frequencies were listed earlier. If a required band cannot be reached with some of the trimmers, the core of L3 is slightly moved to correct this, until adjustment of the five trimmers alone allows all five bands to be covered.

2. An alternative method is to use a signal generator, or to find amateur band signals, working the converter into the receiver in the usual way. The core of L3 is sealed after adjustment.

Subsequently adjust the core of L1 so that 7MHz signals are peaked with VC1 fully closed, and 21MHz is reached with VC1 nearly completely open. L2 has more than adequate coverage for 160 and 80m and the core is set so that VC1 gives resonance with both bands. VC1 will allow tuning of signals 11MHz away from the required bands, in the way explained, so the five resonant points for the wanted bands should be marked on the dial of this control. The core of L4 is simply adjusted for best volume or sensitivity.

BFO Unit

Fig. 3 is the circuit, and **Fig. 8** the layout of this stage. L6 is wound on a 7mm diameter former, with core, and has thirty turns of 32SWG wire, close wound, centre-tapped for the chassis connection. R14 and R15 allow the shorting of VC3, to put the stage out of use, thus avoiding a separate switch. The extreme corner of one moving plate is bent outwards, so that it firmly contacts a fixed plate when the capacitor is closed.

A satisfactory level of BFO coupling was obtained by running an insulated lead from VC3 (marked IF) and looping this round the centre pin of the output socket in Fig. 7. When this stage is fitted, set VC3 half open, tune in an AM or CW signal and adjust the core of L6 for the usual zero beat position. Rotating VC3 either way should then cause a heterodyne, rising in pitch.

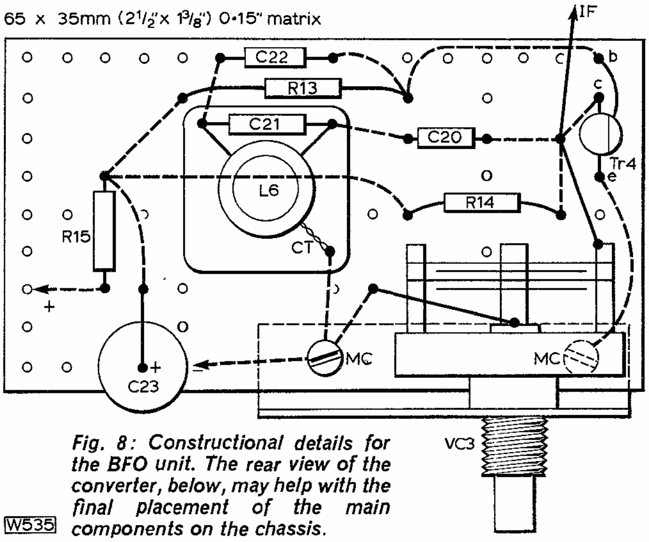
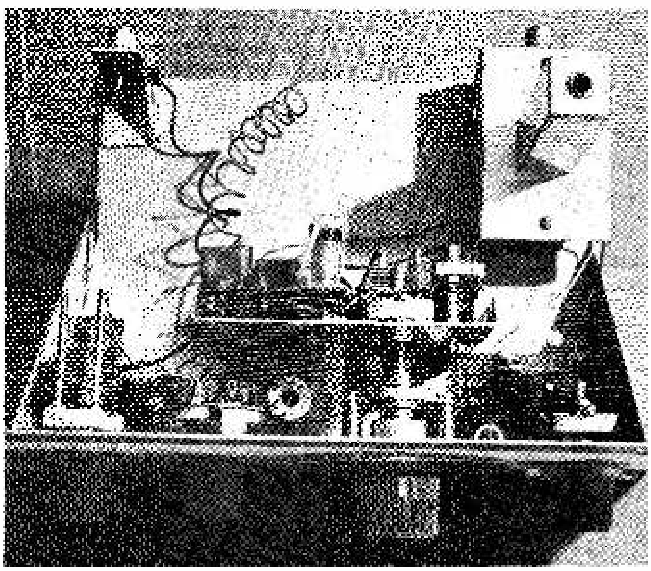


Fig. 8: Constructional details for the BFO unit. The rear view of the converter, below, may help with the final placement of the main components on the chassis.



The converter is ideal for use with the general coverage type of communications receiver, but can of course be used with other receivers. A screened aerial lead from receiver to converter is necessary, and should not be longer than necessary. This can provide an earth connection from converter to receiver, which is essential.

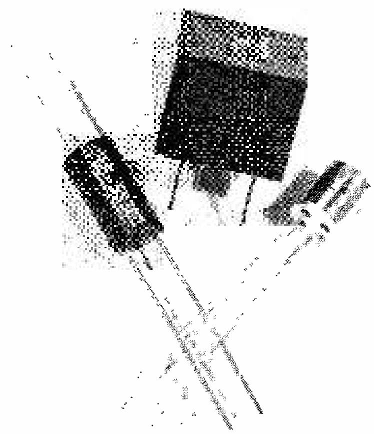
The likelihood of 5·5MHz breakthrough depends on the screening and other factors. A very small adjustment of receiver tuning above or below 5·5MHz will have little important effect on calibration, but if the shift away from 5·5MHz is substantial the converter ought to be re-aligned to suit the actual IF output to be used. Chances of 5·5MHz breakthrough will be very much reduced by using an aerial tuner, which will also allow best results with very weak signals. It is also possible to fit a 5·5MHz trap in the aerial lead at the converter. It is essential to turn back VR1 with strong signals to avoid overloading the receiver. ●

PRODUCTION LINES

bill tull

Coupled and amplified

A 50W audio power amplifier and a new family of LED/Photocell opto-couplers are two new products to come out of NSL. The amplifier, which is mounted on its own heatsink is claimed to have a frequency response from 15Hz up to 25kHz with the addition



of only one external capacitor and power supply. Notated the Epitek 5070A, distortion is put at less than 0·15% at full power, with the additional advantages of S/C protection and automatic thermal shut-down over 70°C.

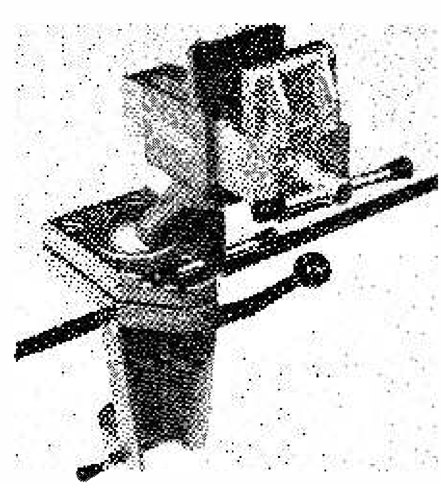
The opto-couplers which have been given the title '5S family' are encapsulated in a clear epoxy, with the detectors rated at 320V/250mW, with an LED current of 25mA, giving maximum on, and minimum dark resistances of 2k ohms and 100M ohms respectively. These coupled pairs are available in either 4pin TO5 size can, a cylindrical shaped package in which the detector and LED leads emerge at opposite ends, and a $\frac{3}{4}$in square module. The latter has the added advantage of housing either one or two cells. Prices range from £2·90 to £5·00 plus VAT each, and for the Epitek 5070A power amplifier the price is £16·50 plus VAT for 1off but including P&P.

National Semiconductors Ltd., Stamford House, Stamford New Road, Altrincham, Cheshire. Tel: 061-928 3417.

Get a grip on it!

Ideally suited to the electronic constructor is a new vice from Greenwood Electronics. If you've ever tried drilling a chassis or soldering components to a tag strip or PCB you know that a third hand is a necessity. This new vice, labelled the Oryx Model 1B is equipped with 3·5in jaws and is fully adjustable to rotate through 360° and can be locked in any position. Replaceable nylon jaw linings are included which protect delicate surfaces, while the finish is in stove enamelled green. The Oryx bench vice sells for £19·95 plus VAT.

Greenwood Electronics, Portman Road, Berkshire. Tel: Reading 595844.



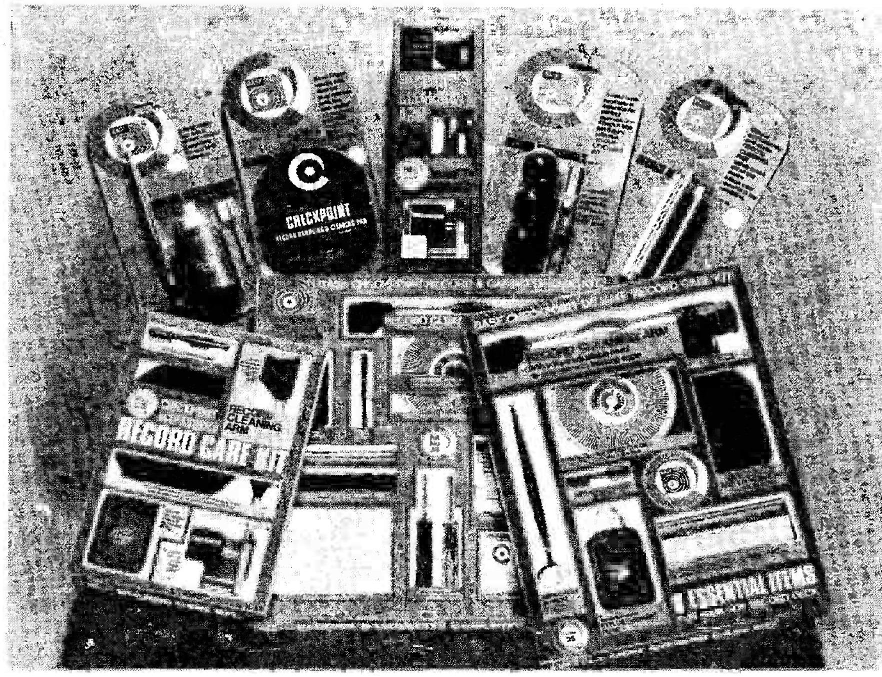
Philip's kits

Complete Kits manufactured by a reputable company usually have one big advantage over a project whose components have been bought 'piece-meal'—and that is the finished object looks professional. Of course by buying a complete kit, you have everything you need at once, together with instructions and probably useful hints and tips about the pitfalls a builder is likely to come across. A range of electronic kits have now been made available by Philips, and com-

prise a wide variety from a small multi-purpose amplifier to a studio-quality mixer unit. An illustrated catalogue giving full details of the complete range of kits is available from the distributors, and with every kit there is a money-back guarantee.

SST Distributors (Electronic Components) Ltd., West Road, Tottenham, London N17. Tel: 01-808 4884.

Packed-up



The latest products to join the bubble-pack band wagon are a range of record and cassette care accessories from BASF. Called Checkpoint products, BASF state that 'they are the result of careful research into what the market really needs, and that the series is therefore limited to useful, non-gimmicky products'. The items which make up the Checkpoint range are too numerous to list, but for the record enthusiast there are nine packs available, for the cassette and reel-to-reel enthusiast, 25 packs, and for the lucky person who has both record and cassette player, one pack.

As can be seen from the photograph, some of the packs are really comprehensive, with, for example, the Record and Cassette Care Kit containing such goodies as a record cleaning arm, cleaning pad, stylus cleaning fluid and brush, inspection mirror, two screwdrivers, index cards, self-adhesive cassette labels, stroboscope speed check discs and a cleaning cloth. Packs start at around 30p for the Record Cleaning Cloth and extend up to £7·94 for the Record and Cassette Care kit.

BASF (UK) Ltd., Haddon House, 2-4 Fitzroy Street, London W1. Tel: 01-637 8971.

Now you see it . . .

When you connected-up the PW 'Interwipe', or tried to repair that faulty TV, probably the most difficult problem that presented itself to you was in actually seeing what you were doing. There are many instances when the DIY enthusiast, electrician, technician or ordinary hobbyist needs a source of light that he can shine round corners.

Now, throwing a little light on this subject is GSPK (Sales) Ltd, who are marketing a torch that is designed to illuminate all those inaccessible spots. Called the 'Search Lite' it comprises a slim 140mm pen light and a 165mm detachable clear acrylic extension piece. It requires either HP7 or SP7 batteries.

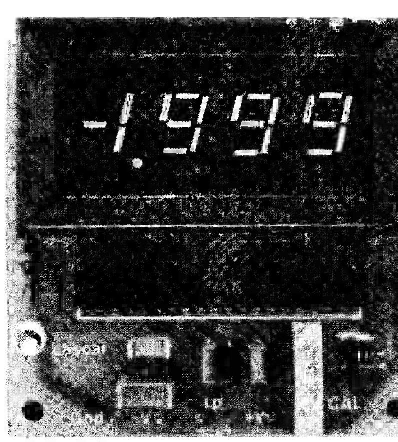
Priced at £1·99 incl. VAT it should be available just about everywhere.

GSPK (Sales) Ltd., Hookstone Park, Harrogate, Yorks. Tel: 0423 886641.

Display digits

A $3\frac{1}{2}$ digit panel meter, featuring auto-polarity, auto-zero, and an accuracy of 0·1% has recently been announced by Lascar electronics. Available with sensitivities of either 199·9mV or 1.999mV FSD, the purchaser can also choose between a 0·3in or a 0·43in red LED display. Over-range input is indicated by suppression of the last three digits, and the left-hand decimal point is programmable. Measuring 76 × 70 × 10mm, both versions can be obtained for the 'not unoriginal sum' of £19·99.

Lascar Electronics, PO Box 12, Module House, Billericay, Essex, Tel: 02774 3394.



DESIGN YOUR OWN PROJECTS

No.4

IMPEDANCE MATCHING AMPLIFIER

TOBY BAILEY & BOB WHITAKER

This month we are going to take a look at the solution to a simple problem which covers some very important points, many of which we have not really considered in previous projects in this series. The background to this project is that a little while ago we went to visit a friend who, seeing us arrive, gestured wildly from his window for us to be quiet and then came out to meet us. The reason for this charade turned out to be that he was trying to copy a tape from a reel-to-reel machine to a cassette recorder. The problem was that the output socket of the first machine was inadequate to drive the input of the second. He was solving this problem by recording from loudspeaker to microphone!

Now one doesn't need to be a dedicated Hi-Fi fanatic to realise that this is a horribly unsatisfactory way of recording, for more reasons than the inhospitality it creates so we resolved to settle the problem electronically.

Specification

A little delving around in the typically inadequate booklets supplied by the manufacturers of the machines revealed that we needed an amplifier with a voltage gain of about ten, an input impedance of at least 20kΩ and an output impedance of less than 5kΩ. Choosing a supply voltage of 9 volts which should prove to be a simple and practical value, completes the basic specification.

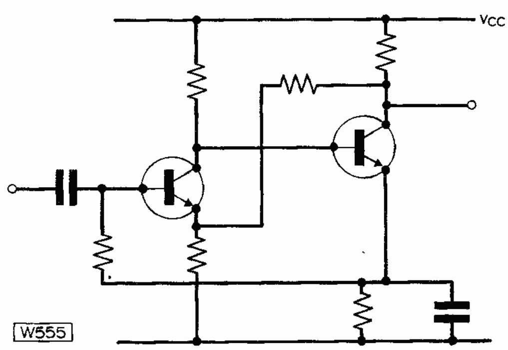


Fig. 1: A typical "feed-back pair".

With regard to the type of circuit that we are going to base the rest of our design on, the next thing to consider is whether a two-stage transistor amplifier is necessary or whether one stage is sufficient. The great advantage of "feedback pair" arrangements such as the one shown in **Fig. 1** is that you effectively "design out" the transistor characteristics by using masses of feedback. The reason for doing this is that the essential characteristics of the circuit are then almost independent of the parameters of the individual transistors used, which may vary quite a bit between individual specimens. These characteristics are then dependent on the passive components present.

Is it possible to achieve this desirable state of affairs using only one transistor? Well, the real reason that the circuit shown in **Fig. 1** works is that the two transistors used have a much higher gain than that of the overall circuit, this gain being settled by the feedback network. As the gain of a single transistor common emitter stage is in principle a couple of hundred and since we only want a gain of ten there seems to be plenty of scope for producing a stable circuit using negative feedback. The reader may well be acquainted with the technique that we are going to employ, but possibly does not recognise it as feedback.

Feedback

There are essentially two ways to apply negative feedback to a one transistor stage; these are shown in **Fig. 2**. Although both of these circuits stabilise the gain they differ in many respects—it is useful to have some idea of why this is so. First let us look at the series version shown in **Fig. 2(a)**. The operation is fairly simple: when the base voltage rises a little the collector current increases, however this means that the emitter current increases as well which causes the emitter voltage to rise. The total effect is that the emitter voltage tends to "follow" the base voltage and hence the voltage difference between the base and the emitter doesn't change nearly as much as the base voltage itself does. The result of all this is that the voltage gain is reduced and the input impedance is increased. Putting these facts in terms of formulae: the voltage gain becomes RL/Re and the input impedance is hFE x Re in parallel with the bias resistors. We should point out in passing that these formulae are at best only approximate and cease to be valid if you are overly ambitious and try to produce more gain than the transistor can provide. In particular a resistance of 25/Ie (where Ie is the emitter current in mA) should be put in series with Re for the purpose of both the above calculations. The circuit should be fed from a source with a low output impedance compared with the input-impedance, otherwise the feedback will not work as intended. The operation of the shunt feedback arrangement shown in **Fig. 2(b)** is entirely different. Here we require a high impedance source and the idea is to make the signal current taken by the base of the transistor negligible compared with that flowing in RF and the signal source. Under these conditions the current gain becomes Rf/RL and the voltage gain from the unloaded source to output is then Rf/Rs where Rs is the source resistance, This is essentially a current amplifier and the feedback will not be realised unless the source is a current source i.e. has a high internal impedance.

It is fairly clear that our application is one that requires a voltage amplifier and so we will base our design on the circuit of **Fig. 2(a)**. Given the basic framework of the circuit, let us now proceed with the detailed design.

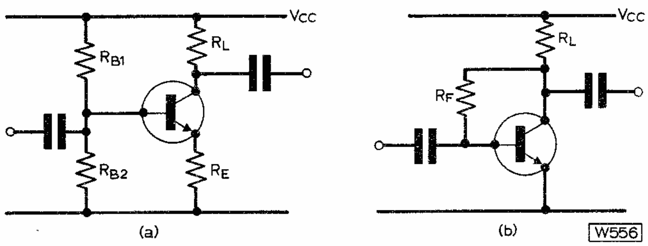


Fig. 2: Series and shunt feed-back circuits.

Design

The first thing to do is to decide on the static (i.e. DC) voltages and currents and select a suitable transistor. In the higher echelon of the designing business it is normal to design the circuit, find out what specifications are needed for the transistor and then select the transistor type from the multitudes available. It is a lot easier here to say that we will use a BC109 because it has high gain, low noise, and is readily available. Readers who have ever looked up data on the BC109 will have found that most of it is given for a collector current of 2mA, but 1mA seems quite adequate for this job. Our supply voltage is 9V and it is sensible to space out our collector and emitter voltages as much as possible so as to have a large margin for possible error. Lets settle for an emitter voltage of $2\cdot7$V and a collector voltage of $9-2\cdot7=6\cdot3$V. This means that we will require a base voltage of about $2\cdot7+0\cdot6=3\cdot3$V. This stage of the design is shown in **Fig. 3**: all that we have used here is Ohm's Law and the well known facts that the forward bias on the base-emitter junction of a silicon transistor is about $0\cdot6$V and that the emitter and collector currents will have about the same value.

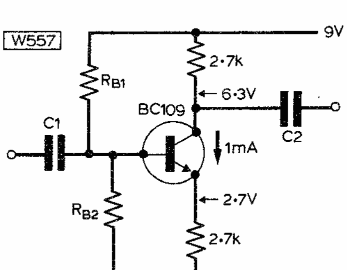


Fig. 3: Initial voltage requirements.

Bias Network

The time has now come to assign values to RB1 and RB2. There is a rule of thumb which states that the current flowing down the resistor chain should

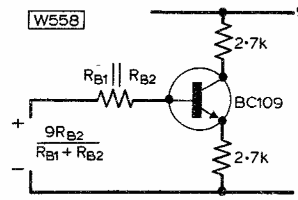


Fig. 4: Bias network equivalent circuit.

be at least five times, and preferably ten times, the maximum base current. There is, however, a much better way of calculating the resistor values: this involves regarding the bias network as a simple voltage source with an internal resistance. In our case the voltage is given by $\frac{9RB2}{RB1 + RB2}$ and its internal impedance is RB1 in parallel with RB2 (written RB1 ‖ RB2). An equivalent circuit of the bias network is shown in **Fig. 4**. We must now decide how great we can allow this source impedance to be. Now the static DC gain (hFE) of a BC109 at Ic=2mA is quoted as 200-800, so let us play safe and assume a value of 150. In this case the maximum base current

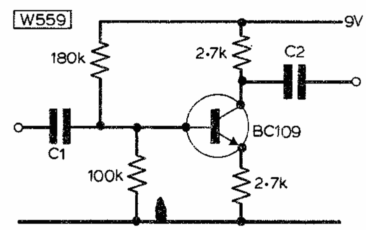


Fig. 5: The potential divider values.

is going to be 1/150 mA. It is probably quite safe to let this have the effect of dropping the bias voltage by half a volt, so we set a maximum on RB1 ‖ RB2 of

$$\frac{1}{2} \div \frac{1}{150}\,\text{k}\Omega = 75\text{k}\Omega.$$ So we want a potential divider which produces a voltage of about $3\cdot3$V off load and which has an impedance of about 75kΩ. A calculation reveals that RB1=180kΩ and RB2=100kΩ satisfy these conditions and have a source impedance of about 64kΩ. If you calculate it yourself you will find that these values give almost exactly five times the current in the divider as is expected in the base, confirming the value of the rule of thumb approach. The method that we have used is, however, more instructive and is applicable to cases when there are several different supply rails. Anyway, back to business: we have now reached the stage shown in **Fig. 5**.

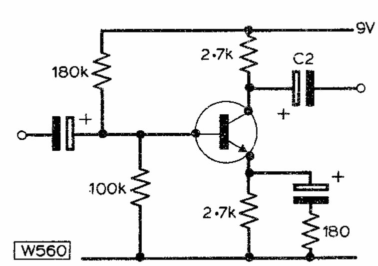


Fig. 6: Decoupling added to modify impedance.

Gain and Impedance

It is now time to look at the voltage gain of our circuit. At the moment it is just less than one, so to realise our aim of a gain of ten at audio frequencies we will need to reduce the impedance to AC signals at the collector. This is done with a decoupling capacitor. We have already mentioned that the gain

continued on page 606

OF THE MONTH 65

Brian DANCE M.Sc

THOMSON-CSF SPEED REGULATORS

It is very important that the speed of small motors used in tape recorders and record players shall remain constant or the frequencies of the audio notes reproduced in the loudspeaker will vary. The speed of mains driven synchronous motors is locked to the frequency of the mains supply but the speed of battery-driven motors used in portable equipment can vary with the ambient temperature and with the supply voltage, whilst variations in the mechanical resistance opposing the movement of the motor spindle can also result in speed variations.

Regulator Devices

A series of monolithic motor speed regulator devices manufactured by Thomson-CSF Ltd. can be used in extremely simple circuits to stabilise the motor speed. It is important to note that these devices can be employed only for the speed regulation of small permanent magnet DC motors; an entirely different type of motor speed regulator is required for use with AC motors.

Although the devices to be discussed have been developed especially for use with portable tape recorder or record player motors and for similar equipment used in road vehicles, they can also be used to regulate the speed of any small DC motor. Indeed, they can be used in applications not involving motors where one requires a voltage source which increases in value with the current taken from the output. However, care must be taken to ensure that the maximum permissible output current is not exceeded.

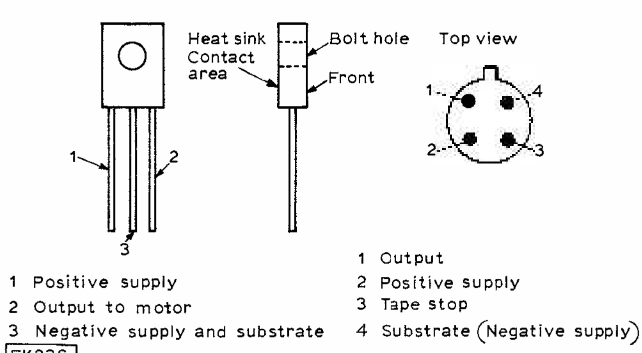


Fig. 1: Packaging and pin connections.

Types

The TCA900 and TCA910 devices are encapsulated in a plastic package of the type shown in **Fig. 1**; this is known as the TO-126, SOT-32 or CB-16 package. The rear metal face of this package is designed so that it can be clamped to a heat sink if necessary.

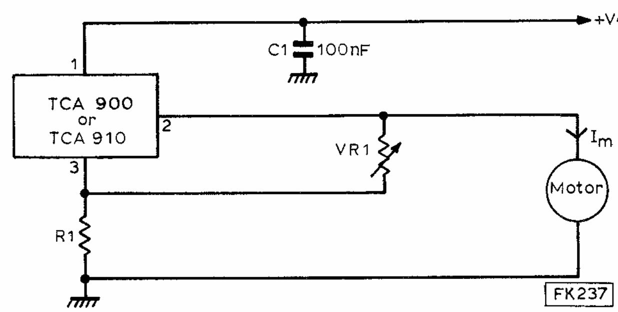


Fig. 2: The basic control circuitry.

The TCA900 and the TCA910 have different operating voltages. The TCA900 must not be used with a supply voltage above the absolute maximum limit of 14V or it may be damaged; this device is especially suitable for controlling the speed of motors in portable cassette players operating from power supplies in the range 5·5V to 12V. (The operating voltage should always be somewhat less than the maximum permissible value). The TCA910 has the higher absolute maximum voltage rating of 20V and is suitable for use with motors operating from supplies of up to 18V. For example, equipment in a vehicle operating from the nominal 12V (which can rise during charging) should use the TCA910.

The ESM900 and EM910 devices are rather similar electrically to the other two types, but incorporate a circuit for automatically stopping the motor at the end of a tape when the conducting aluminium foil at the end shorts a pair of stop contacts in the tape transport mechanism. The ESM900 has an operating voltage range similar to the TCA900, whilst the ESM910 has the same operating voltage ratings as the TCA910.

The ESM900 and the ESM910 are encapsulated in the TO-12 type of package shown in **Fig. 1**; it is a circular metal transistor-like package with four leads, the additional lead being used for the tape stop contacts. If no heat sink is used, the package of **Fig. 2** can dissipate a maximum of only 0·5W at ambient temperatures up to 60°C, whilst the plastic package of **Fig. 1** can dissipate up to 0·8W at ambient temperatures up to 70°C without any heat sink. The plastic package can dissipate up to 3·3W with a heat sink of thermal resistance 15°C/W at ambient temperatures up to 70°C.

Circuit

The circuit for use with the TCA900 and the TCA910 is shown in **Fig. 2** and is striking for its simplicity. The speed of the motor can be adjusted by means of VR1 which should normally have a value of between 2kΩ and 5kΩ. The maximum output cur-

Continued on Page 606

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IC OF THE MONTH—*continued from page 604*

rent from any of the devices under discussion is 0·5A. The voltage between pins 1 and 2 should not be less than about 1·5V, as the drop-out voltage between these terminals at which correct operation ceases is typically 1·2V. The capacitor C1 provides the normal power supply decoupling at high frequencies which should be used with all types of linear integrated circuits.

The value of R1 should be about 8·5 times the resistance of the motor, but a higher value of R1 may result in oscillation. A lower value of R1 will result in the speed regulation being impaired when variations in the mechanical load imposed on the motor occur. Typical values for R1 are in the region of 100 to 400Ω.

Tape Stop

The circuit for the use of the ESM900 and the ESM910 is shown in **Fig. 3.** The pin connections differ from those of **Fig. 2** and a stop switch is shown. The typical current which must pass between the contacts in the tape transport mechanism to stop the motor is 2mA; the motor starts again when the

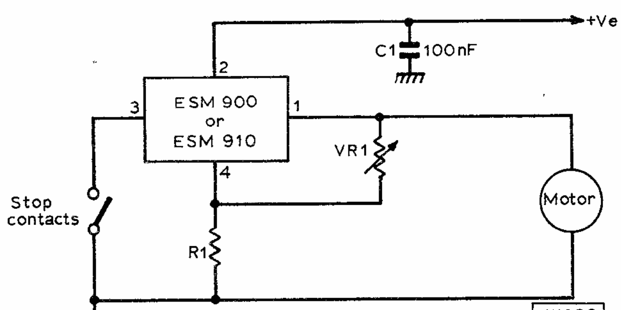

Fig. 3: External switching.

aluminium foil at the end of the tape is removed from the contacts. This stop mechanism may be used for other purposes when a motor must be stopped.

The value of R1 in **Fig. 3** should be about 10 times the resistance of the motor, but otherwise the performance is almost identical with that of the other two devices of **Fig. 2.**

Conclusion

One may regard these devices as over-compensated voltage regulators. The voltage supplied to the motor is not merely kept constant as the load current increases, but actually increases with the load current.

The devices are available from Phoenix Electronics Ltd., 46 Osborne Road, Southsea, Hants., PO5 3LT, and other advertisers in PW. ●

DESIGN YOUR OWN PROJECTS—*continued from page 603*

is the ratio of the load resistance to the impedance in the emitter so for a gain of ten we want, to be on the safe side, the AC impedance at the collector to be about 200Ω. We already have 25/Ie=25Ω internally which we mentioned earlier, so 180Ω in series with a capacitor should be fine (see **Fig. 6**). As for the value of the capacitor, we want its impedance to be small compared with the 180Ω for the lowest frequency at which we want the circuit to operate. If we take this frequency to be 30Hz, and say that the impedance should be about 20Ω at 30Hz then we have, using the expression for the impedance of a capacitor,

$$X=\frac{1}{2\pi fC}$$

$$20=\frac{1}{2\pi 30C} \quad \text{so} \quad C=\frac{1}{1200\pi}$$

so a value of 250μF should be adequate.

Now for a check of the input impedance of the circuit. This is given by the input impedance of the transistor in parallel with the bias network. We said before that the transistor's input impedance is hFE x Re. hFE for the BC109 should be at least 200, so this becomes 40kΩ. Now 40kΩ in parallel with 64kΩ (the bias network) will give a value well over the 20kΩ required by the specification, so we're OK here. We can easily allow C1 to have a value of 2kΩ at our

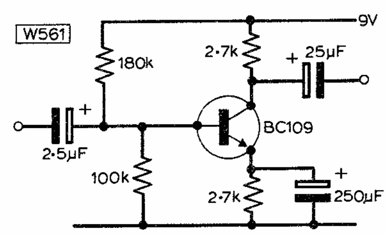

Fig. 7: The completed circuit of the matching amplifier.

low frequency limit, so anything over about 2·5μF should be adequate. At the output it seems reasonable to let C2 have an impedance of about 20Ω at 30Hz so this gives C2=25μF. The final design is shown in **Fig. 7.**

BOOK REVIEW—*continued from page 593*

the degree of detail to present to the reader. Or even who his readers are. In one glib breath he talks about "four dual-rank master/slave flip-flops internally connected to provide separate divide-by-two and divide-by-five counters." In another he describes a bottle of nail varnish for marking unknown ICs: "Partly serviceable devices are always handy for experimental work, and it is a good plan to mark them so that the good sections are easily identified. Coloured nail varnish is ideal for this purpose. It comes in bottles complete with a little brush for immediate use, and quickly dries." It could have been safely assumed that even the most butch amongst the potential readership would know all about the properties and packaging of nail polish.

The author is pedantic in detail yet leaves yawning gaps in useful information. Accepting that the book is intended to deal more with devices than Boolean algebra and system organisation, it gives virtually no mention of logic families other than the 74 series. Of these it deals only with simple gates, flip-flops (JK type), a counter, Schmitt trigger and a line decoder (for driving Nixie gas tubes). It mostly fails to do justice to this limited repertoire; from simply reading the book, one would never learn about shift registers, adders, latches and the exclusive OR. Never mind compounded functions within LSI packages (remember that the book is supposed to be about hardware). As for C-MOS, who ever heard of it anyway?

As reviewer, I could take issue with the few design circuits that the author has provided. I could get bitchy about unnecessary chapters such as the one concerning the salvaging of unidentified ICs from gash equipment. I could make unpleasant noises about the lack of useful chapters, or even useless ones (76 pages for 95p). However, I won't. I will simply say that it's a tough job writing about logic devices—or anything—for beginners and that the author simply isn't up to it. **Frank Ogden**

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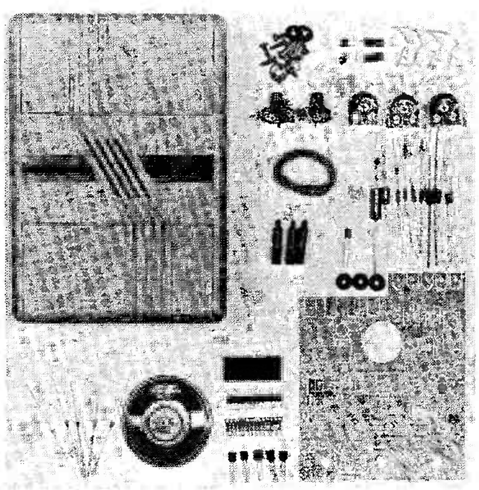

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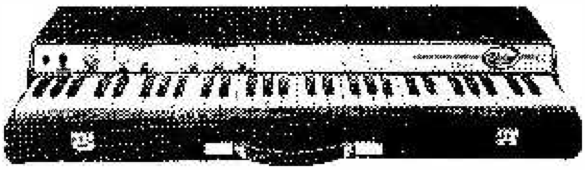

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ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

It will come as a surprise to readers to learn that *PW*, with certain other magazines of the Practicals Group, is moving to Poole, Dorset, in the very near future, together with a new Editor. Yours truly will not be going with them but I hope to continue the column as an outside contributor. So do keep writing to me, at my home QTH.

Reports are rather scarce again this month, so far. I am off to Greece for a couple of weeks and I hope to be able to squeeze in some more news at the end, from the letters that will have arrived in the meantime. We start off with **Nick Smith** (Leamington Spa), who first wrote in 1975 but who has obviously learned a lot since then! His trusty Bush valved radio has finally given up the ghost so he is looking for something a little more sophisticated. What better source of ads than Short Wave Mag or Radcom OM? The price bracket is £20-£30, so if you can help Nick drop him a line at 59 Wellington Road, Lillington, Leamington Spa.

Michael Walker, aged 15, is full of praise for the White Rose Radio Club up in Leeds and enjoyed getting his hands on some exotic gear at one of the Field Days. He will have started on his RAE course by now, so good luck, Michael. One year older **Tom Higgins** of Letterkenny, Co. Donegal, says he found the column "inspiring" and has been listening now for about a year and he too hopes to take the RAE when he can find time away from his regular studies. At the moment he has a home-brew TRF set but his problem is getting a decent aerial up, plus TV QRM. A shorter aerial, well away from the TV set, might be an answer OM.

Yet another young man who should now be in the throes of swotting for the RAE is **Robin Bayley,** in Kemberton, Salop. He has just passed an electronics exam at the local college which ought to be a good start towards getting a ticket. He still finds time to look around the HF bands. FP8 and HK0 can't be bad on 80m in the summer! Regular log-sender **Brian Harrison** tells me of a new club just formed in Hastings, using the call G6HH, the first club there, apparently, since the '30s. If you want any more info then you'd better write to Brian at 99 Farley Bank, Hastings, Sussex. Brian stuck to SSB on 10, 15 and 20m. He found a new prefix on 15m in the form of P29JS, better known as New Guinea. A51RG in Bhutan is a very rare one indeed so let's hope it turns up trumps with a QSL!

CLUB NEWS The first issue of the *Edinburgh and District ARC*'s newsletter "Ham News" looks good and the club has many interesting events coming up. Meetings Tuesday nights at the high spot of Edinburgh, the clubroom of the Edinburgh Astronomical Society, at 1930 hrs. President **Norman King** has just passed his RAE so hopes to be active soon while the call GM4HAM has been reserved for the club and should be issued before very much longer. Secretary is Jim Martin, 22 Ross Gardens, Edinburgh EH9 3BR, telephone 667 8707. Another newly-formed group is the *Brighton and District RS* and their newsletter is also very well produced and printed. Hon. Secretary is **Nigel Hewitt,** G8JFT, of 74 Carlyle Street, Brighton, Sussex. However, I must castigate both Hon. Secretaries for not putting their addresses, or anyone else's for that matter, on their broadsheets! Callsigns are just not enough! The same as the use of "QTHR" in ads always annoys me! It takes a while for newly-licensed people to get into the call books and anyway a callbook is not always to hand. Why not put the town, at least?

Yet another new club is the *Ormskirk ARC*. For the moment meetings are held at members' homes, on Wednesday evenings. They make a point of being on VHF on those evenings from 1930 to 2030 hrs on 145MHz so try to QSO for details or contact **Peter Kay,** G4GCB, at 24 Laurel Avenue, Burscough, Ormskirk, Lancs.

Paul Farnsworth of Adlington, Lancs, writes again to say he now has his home-brew set going. It is the design in the May 77 issue of Radio Constructor. One problem that comes up time and time again, in correspondence from newcomers to the amateur bands, is whether to buy or build a receiver. Unless the writer is experienced in the construction of electronic gear my answer always is "buy one"! Then a start can be made on listening while the enthusiasm is running hot and there is a fair chance that the newcomer can find the bands quite easily. There is nothing so depressing as spending weeks or even months on making a set and then running into alignment and calibration problems. Another bit of advice is never to rely upon the dial calibration of any set, particularly if it is secondhand. If an internal calibrator is fitted all well and good but otherwise an external crystal-controlled calibrator is, to my mind, just as important at the outset as the receiver itself.

Plenty of logs sent to me contain the calls of stations which are obviously outside the ends of an amateur band, because the user has relied upon the dial calibration. In some cases, of course, the stations concerned are rightfully using a shared band and only experience aided by a prefix list can sort this matter out. A suitable calibrator starts with a 1MHz crystal with dividers down to 100kHz, and 25kHz, or preferably, 10kHz.

Log extracts

B. Harrison:— 20m A51RG DX1PH HZ1BS OF1AJ/OJ0 (Faroes) **15m** KG6JEH P29BB TA1MB **10m** EA9FJ HI8MRF LU2MHG PJ2FR 8R1J (Guyana) 9Y4NP

R. Bayley:— 80m A2GCO AP2AD FP8DH HK0COP **40m** DU1DBT FP8DX HK0CAT KH6PP **20m** VK9XY ZL3AK **15m** EA9CR VK6WH

T. Higgins:— 80m ZS5LB **40m** VP1EDE

All stations were received on SSB.

SHORT WAVE BROADCASTS

by Charles Molloy G8BUS

The recent tests on 5925kHz by Austrian Radio (ORF) which have now been completed, have brought some comment from DXers about out-of-band transmissions. It is not illegal, as has been suggested, to operate outside the international shortwave bands. The ITU (International Telecommunications Union) regulations allow out-of-band broadcasting provided no interference is caused and many authorities, including the BBC, make use of this facility. There is incidentally, an interesting in-band programme from ORF on 6155kHz at 1805GMT when Austrian Shortwave Panorama can be heard in English.

The areas beyond the band edges are used, not only by well-established broadcasters but also by countries coming onto the short waves for the first time and looking for space. These areas are interesting places for the DXer to explore. Egypt and Israel seem to concentrate around the band edge as do China and some Eastern European outlets. Stations heard recently by the writer include:

5935kHz	Riga, Latvia with programmes in Latvian and Swedish at 2020
6205	Mebo 2 in Libya, testing with pops in the evening
6225	Peking with Chinese music at 2100
6230	Cairo at 2045
9915	Delhi in English at 2210
11620	Delhi in English at 1925
11655	Tel Aviv in English at 2000
12085	Kuwait in English until sign-off at 2000

Kuwait is also reported at 1930 by **Robin Beyley** from Kemberton, Salop, who uses a Marconi R1475 and longwire.

Following up last month's request for information on Radiostantsia Rodina, **Charles Hardie,** St Andrews reports hearing this programme on 14200kHz at 2000 using his JVC portable radio/TV which has a telescopic aerial. Charles asks about a peculiar sound, almost like a machine gun, on and around 7MHz and 9MHz. This noise is over-the-horizon shortwave radar coming from somewhere in Eastern Europe. It jumps about in an unpredictable way and is believed to be linked to ionospheric sounding equipment in such a way that the radar automatically operates near to the critical (penetration) frequency so that optimum propagation is obtained. This type of transmission is contrary to the ITU regulations and it has led to a number of international protests. If it continues and is copied by other countries then it will eventually put an end to all international broadcasting on the short waves.

Tony Cook writes from Gibraltar to say that he keeps his HAC radio permanently tuned to Radio Nederland because their programmes are so good. DX reported by Tony covers Peking on 9100kHz at 2030, Johannesburg (Radio RSA) on 9585 at 2030 and Jerusalem on 9425 at 2030. **Roy Patrick** (Mackworth, near Derby) has a Trio 9R59D communications receiver and a Joystick antenna with which he pulled in the Voice of Kenya on 4915kHz in the 60m band, Budapest in English on 5955, Malta Calling on 5990 on Saturdays at 2045, Ankara on 9515 in English at 2200, Lisbon 9740 in English at 2030, Israel on 11655 in English at 2200. Roy mentions that he does quite a lot with Latin Americans on 60m during the winter and reports of this would be of interest to readers.

Simon Hicks writes from Swindon to say that Radio Nederland will be altering their format from 90 to 50 minutes on November 7. Full details of the times and the frequencies in use are obtainable from Radio Nederland, PO Box 222, Hilversum, Holland. Simon gives news of a new 90 minute programme from Radio Finland which is on the air on Sundays at 1325 GMT on 11755kHz for Europe and 15105 for North America. A DX programme is included in this transmission.

November is the first month of the winter season on the short waves as many international broadcasts will be on new schedules and there will be changes of frequencies. The four seasonal schedules issued by the International Frequency Registration Board (IFRB) of the ITU are:

November schedule, for the period November to February.
March schedule, March and April.
May schedule, May to August.
September schedule, for September and October.

Thus there are two periods of four months and another two periods of two months when changes may occur. Although some countries do not change at every period the majority do change. Up-to-date information is to be had for the asking from most stations and DXers need not be put off if the station's address is not announced over the air. Radio Finland, Helsinki, Finland will certainly find this station even although the full address is PO Box 528, Helsinki 10.

News of activity on the 11m band (25605kHz to 26095kHz) comes from St Leonards-on-Sea where **Harold Brodribb** picked up Tel Aviv in Hebrew on 25065 between 1430 and 1540GMT using his CR100 receiver and an outdoor aerial. A number of Italian speaking stations, probably Citizens Band, were heard around 27MHz indicating that the higher frequencies are gradually picking up again. This is the first report of a logging on 11m for some time.

A letter from **R. J. Irvine,** Birmingham, asks if a varicap is the same as a variable capacitor. No it is not the same, but it does the same job by providing a capacitance that is easily adjustable and therefore can be used for tuning. The traditional variable capacitor is a mechanical device that has a spindle attached to a set of moving vanes. When the spindle is rotated one way, the moving vanes mesh with a set of fixed vanes to increase the capacitance between them. Turning the spindle the other way will decrease the capacitance.

A varicap is a semiconductor variable capacitor. It is really a reverse-biased diode whose capacitance depends on the value of the bias voltage. The latter is applied to the varicap by means of a potentiometer, and the combination of the two provide a convenient means of tuning a receiver when space is limited.

In the July issue of PW, **John McFadden** asked if it is possible to hear Latin American stations working with less than 1kW. **Harold Buggins** (Cowley) has a verification letter from HHCN Port au Prince, Haiti at the time when they were using 150W on 5660kHz and also a QSL card from PZH5 Paramaribo, Surinam, when it was on 5945kHz with 300W. Are these really LATIN Americans? One is French speaking and the other Dutch!

Harold has been DXing on and off since 1939 and he recalls how he won a prize of two pounds of coffee beans from TGWA Guatemala in 1940 for being the most distant listener to one of their programmes. Every Latin American country has been verified except Bolivia which is still on the wanted list.

MEDIUM WAVE DX

by Charles Molloy G8BUS

A new station in Newfoundland is reported by **Alf Cosham** who lives in Steyning in Sussex. Listening on approximately 620kHz with his Trio 9R59D receiver and 75ft longwire at 0520 on September 8 he heard the call CJYQ

and a reference to Newfoundland. Alf was probably listening to CJOX Grand Bank Newfoundland on 610kHz which is part of the CJON network. The 'CJON Radio Service' is a network of stations in Newfoundland centred on the 50kW CJON 930kHz in St John's. Others, in addition to CJOX are CJNW Musgravetown on 670, CJCN Grand Falls on 680 and CJCR Gander on 1350kHz. A station at St Anthony is under construction according to the World Radio Handbook but no frequency is given. Unfortunately, this mini-network often carries a single programme and the announcement will either be 'CJON Radio Service' or a list of the calls of the members of the network. All this is very confusing to the DXer. Probably CJYQ is the new station at St Anthony but it might be a change in callsign of one of the members of the network.

Another chain of privately owned stations with VOCM in St John's on 590kHz as the key station, includes CHCM in Marystown on 560, CKCM Grand Falls on 620, CKVO Clarenville on 710 and CKGA Gander on 730 and this network, too, sometimes carries a common announcement. The CBC is represented by CBT in Grand Falls on 540kHz right at the bottom of the band, CBN in St John's on 640, CBY in Corner Brook on 990 and a real challenge to the DXer, CBG in Gander on 1450 with only 250W.

Newfoundland is a fascinating place for the medium wave DXer. The majority of the stations mentioned here, including CBG, have been logged in the UK. There are others as well including two religious outlets with the old V prefix, VOWR on 800 and VOAR on 1230kHz, both in St John's. Finally, there is an AFRTS outlet at the US base in Argentia Bay which transmits with 50W on 1480 and it too has been heard in the UK.

I have always been interested in the medium waveband writes **Malcolm Laugharne** from Oxford who DXes with a Philips portable receiver. "Interference is bad when I use the mains earth and using the ATU I get a lot of whistling." A transistor portable is designed for use with its internal aerial and many of these receivers especially the more sophisticated ones, perform very well on the medium waves as they are. Trouble is inevitable though if an attempt is made to hot-up performance with a longwire aerial, with or without an ATU. Even where an external aerial socket is provided this is usually for use with a car aerial. Overloading and the generation of whistles will occur unless the longwire is very loosely coupled to the receiver via a capacitor of about 5pF. A mains earth may be unsuitable for use with any sort of receiver if the earth wire is long or it is a third conductor as part of the house wiring. Malcolm is thinking of changing to a communications receiver and this is probably the best thing to do if the portable is not living up to expectations.

Is it possible to hear Torshavn, Faroe Island, in the UK and does this station have English programming, asks Malcolm. Torshavn is on 584kHz with a power of 5kW but it shares this channel with high power outlets in Austria, Spain, USSR and Tunisia and also with a 10kW local station in Paris. Torshavn has been logged by the writer at 0715 when it signs on for the day but there is so much QRM that reception is very difficult. The language used is Faroese. A high power station at Torshavn is planned for the new channel on 531kHz which is allocated to the Faroe Island under the new Geneva Plan which comes into operation in the autumn of 1978 and when this comes on the air it will provide an interesting new country for medium wave DXers.

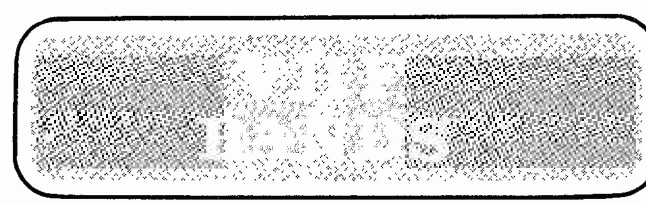
Derek Taylor (Preston Lancs) has swapped his DX160 for a Yaesu Musen FRG7. When used along with a 48in loop the new rig pulled in three Latin Americans, Radio Oriental Montevideo in Uruguay on 770kHz at 0144, Radio Margarita, Venezuela on 1020 at 0035 and Radio Litoral also in Venezuela on 1130 plus the VOA relay in Kavalla in Greece on 791kHz at 2000. Two recent QSLs from North America are from WWWE 1100kHz in Cleveland, Ohio, and Radio 1470 (kHz) WLAM which is owned and operated by 'The Great Down East Wireless Talking Machine Company Incorporated'.

Libreville, Gabon, on 1554kHz has been logged and identified at 2310GMT by **Harold Emblem** who DXes in **Mirfield, Yorkshire**, with an Eddystone 730 and a medium wave loop. This channel is occupied during the evening by Nice which transmits with a power of 300kW. Once Nice is off the air for the night then the only QRM is from Kaunas in Lithuania which occasionally has an English programme at this time. Libreville signs-off at midnight GMT. Another African reported by Harold is Ougadougou in Upper Volta on 746kHz which sent a QSL in six weeks.

An Eddystone 680 communications receiver and an 80ft longwire with ATU are used for MW DXing by newcomer to the band **S. E. Webb** of Reading. He reports that some of the North Americans heard were so clear at the time that he felt sure they must have been relayed by AFN. Highlights from the log are CHCM Marystown in Newfoundland on 560kHz, WOR New York City on 710, CBM in Montreal on 940, CFRB in Toronto on 1010kHz, WHN New York on 1050, WCAU Philadelphia on 1210 and WMEX in Boston on 1510. From midnight onwards is the time to look for these stations.

A new reporter to this column is **J. Edwards** who lives at Bryn near Wigan in Lancashire. With a Realistic DX160 receiver and a 100ft longwire with ATU, CBNM in Marystown, Newfoundland, was heard on 740kHz, WINS in New York on 1020 and WHAM in Rochester N.Y. on 1180, all between 0130 and 0300. A loop is now under construction. **David Harley** of Chesterfield has not been so lucky. Two attempts to locate CJON on 930 and WINS on 1010 with a homebrew receiver were unsuccessful. "All I got for an early setting of my alarm was an unidentified Spaniard" (or Latin American?). Propagation on the medium waves over the North American path is uncertain. Sometimes reception is good and at other times it is bad with stations inaudible. Try around midnight during the winter and if unsuccessful try again a few nights later. Poor conditions seldom last for long on the medium waves.

The Voice of Peace is back on the air again with tests on 1540kHz and it should be audible in the UK after dark. When it was last operational it could be found with English announcements sandwiched between Mainflingen, West Germany, on 1538kHz and the UK local radio channel 1546kHz. The Voice of Peace will QSL if an International Reply Coupon is enclosed with the reception report which should be sent to PO Box 4399, Tel Aviv, Israel.



by Ron Ham BRS15744

The tropospheric opening on Sunday, September 11, will be remembered for a long time and thanks to the vigilance of our readers, much of the event is herewith recorded for posterity.

It all began around midday on August 27, when, after a period of unsettled weather, the atmospheric pressure went above 30·0in and was still there on September 21 when this report was prepared. By midnight on the 28th the AP was 30·3in and gradually fell back to 30·0in by noon on the 30th. True to form, the VHFs opened up with the higher AP and at 2124 on the 27th, **Alan Baker,** G8LGQ, Newhaven, heard PA0CIS and at 2258 on the 28th he had a half-hour, solid copy, QSO with GW8EQH on 2m SSB.

Just before midnight on the 28th, I received 539 signals from both the Emley Moor and Sutton Coldfield beacons on 70cms and at 0015 on the 29th I heard signals via the 2m repeaters in Buxton and the Bristol Channel area. It is worth remembering that the aerial polarity of the repeaters is vertical, therefore I was getting better results on my vertically polarised dipole than I did with my horizontal beam.

During the evening of the 29th, **Ken Smith,** BRS 20001, Horsham, heard several French stations on 2m and G8LGQ worked a couple, heard a GD, and had a contact with GU3JHM/P on Alderney. Around this time both Ken and myself noted the predominant number of French broadcast stations in Band II.

By midnight on Friday, September 2, the AP was rising again just right for the weekend 2m contest, at midday on the 4th it was 30·3in and throughout the day continental broadcast stations were audible in Band II and GB3SUT on 70cms was 539.

The Martlet Contest Group, G4DZO/P, situated on Firle Beacon, near Eastbourne, some 700ft ASL on the South Downs Way, worked 346 contest stations during the 24 hour event and heard well over 400. It is not surprising that the group, comprising of G3XUS, G8LGQ, and recent members of the Cambridge University Wireless Society, were delighted with their efforts when they had EA1CR (923km), northern Spain, several French stations near Andorra, DB5FG/LX/P, HB9AYX and HB9AMH/P among their DX in addition to stations from Germany through to the Channel Islands, southern France to Yorkshire and very strong signals from Cornwall and GW.

These competitors used 150 watts of SSB from an IC201 transceiver plus G8LGQ's home-brew 4CX250B linear, into a 10-element Yagi approximately 45ft AGL.

Before the contest began, **John Branegan,** Fife, heard GM3PLR/P testing on top of Cairngorn mountain and during the event he heard GM4BWT/P, G3FPJ/P Yorkshire, G14COJ/P, and three GWs all with a loft mounted 7-element Yagi. Although John normally gets strong signals from the Angus beacon, GB3ANG, and varying strengths from the Northern Ireland beacon, GB3GI, he uses them, along with his barometer and the Central Scotland repeater, to indicate the prevailing 2m conditions. On August 28, John, using his newly acquired Microwave Modules 2m converter into his FRG-7, heard a contact between G3GZX, Merseyside, and GM3OGJ on SSB as well as G stations working through the CS repeater.

By the end of the contest the AP was down to 30·2in where it remained until 0200 on the 9th when it rose sharply to 30·4in by 1400 and set the stage for the big tropospheric disturbance which accompanied the falling AP on the 10th and 11th.

At 1430 on the 10th, **Pete Simmons,** G3XUS, Newhaven, called **Alan Baker,** saying "There is a lift on, I have worked HB9, do you want one?". As a result, Alan worked HB9MHN/P, Lucerne, and F1KBF in Paris. Pete, only 300 metres from Alan said "Mind your front end I am going after him". Alan heard other HB9s and then joined the queue and eventually worked F1CYO/P near Bordeaux. The signal paths were good down to central France, at 2320, Alan, using 10W, contacted F1ELY, Montrevil, via the FZ2THF repeater (RO 145·600MHz) and at 2334 he worked F9PH, the repeater controller, who was particularly interested in the QSO Alan had a few minutes previously with G2BHW in Cornwall, a distance of 2000km from Newhaven to Falmouth via this Vichy repeater.

The tropospheric influence over VHF/UHF signals expanded rapidly and at 0820 on the 11th, I counted 17 very strong signals from continental broadcast stations between 87-100MHz and by evening Band II, like the 2m band and the TV bands were in total disorder.

Like many others, **Gordon Goodyer,** BRS 37345, Petworth, often lost colour on his UHF TV as the signals fluctuated, and it was this interference that sent Gordon, Cyril Fairchild and several others hurrying to their shacks to look around 2m. Gordon heard amateur stations from the extremes of G, GW, EI, and GM, while Cyril, mainly an HF man, with only a loft ground-plane aerial, heard GM, GU, DJ, F, ON, PA0, and OH, and has never received such strong signals from the Wrotham and French 2m beacons.

The direct paths between PA0 and GW seemed very easy and both ends were also getting into the London repeater with little difficulty. I heard a rock-crushing signal from PE1ABX/M working through GB3LO and PE1AJE via GB3SN, with a vertical dipole feeding my receiver. I also heard signals through the Ipswich and Bristol Channel repeaters while G8LGQ worked G and F stations via the Belgian repeater, ON0HT (R2), and at 0123 on the 12th, he had QSOs with Dutch stations via the Antwerp repeater, ON0AN (R8). How many more, like Alan, stayed on the air until past 0400 on the 12th working the strong continental signals which presented themselves on FM, SSB, or via the repeaters? A delighted G8LGQ said afterwards that at 0125 on the 11th he contacted EA1CR, Gijon, and heard the Cornish beacon, GB3CTC, from his home QTH for the first time.

Joost Berden, G3RND, Isle of Wight, sent a copy of his barograph chart for the period September 5-11 which compares favourably to mine, he also sent a map of Europe with the area EI to ON and F to GW and north of London ringed, Joost is of the opinion that a great deal of ducting took place within this region. Around 2000 on the 11th, he had solid-copy QSOs on both 2m and 70cms with stations in Antwerp after which he had contacts on 2m with stations in Liverpool, Norfolk, and the Midlands, and points out that his signal was reaching them at 9 plus, but their signals were much weaker with him, while EI9Q was very strong on the back of Joost's 2m beam.

It is not uncommon for beam headings to become less critical during a tropospheric opening as Joost pointed out in his letter; "G3AUS (Exeter) maximum signal on 70cm, changing direction of beam had no influence on his signal". Both the Cornish and Wrotham beacons were 9 plus 20dB (usually S2) with Joost.

During the evening of the 12th the AP rose again sharply and by noon on the 13th it reached 30·5in setting the scene for another VHF opening. As the AP fell on the 14th, I counted 11 continental broadcast stations in Band II and received signals from both GB3SUT and GB3EM on 70cms. At 2200 on the 14th, **Alan Baker** was driving along Brighton sea front and heard GU5MEM/A working a GW via FZ8THF and at 2346 he contacted DD2EK and OE9NHI, from home, via an unidentifiable German repeater.

While our VHF addicts reaped their DX harvest, our solar observers also found life interesting. Both **Cmdr Henry Hatfield,** Sevenoaks, and **John Smith,** Cranleigh, have been watching the progress of several sunspots, optically, since late August. Henry, using his spectrohelioscope, located a small flare on September 9, and a filament on the 15th, and on the 12th he observed the largest sunspot group for three years. Henry, John and myself recorded radio noise, associated with these sunspots, around 136MHz, on August 28, 31, and September 7, 8, 11, 14, 15, 16, 17, 19 and 20. The most intense solar activity was on the 19th which was no doubt responsible for the Delinger type fade out, affecting some HF bands on the same day.

John Branegan has now built his own orbital plotter for OSCAR and has found that the down link, with 9 or 10 orbital passes each day, is an excellent reference for comparing home made VHF aerials. At 1148 on August 30 John heard KV4, in Virgin Islands via OSCAR-7 and says that there was a QSL rush after him, I'm not surprised.

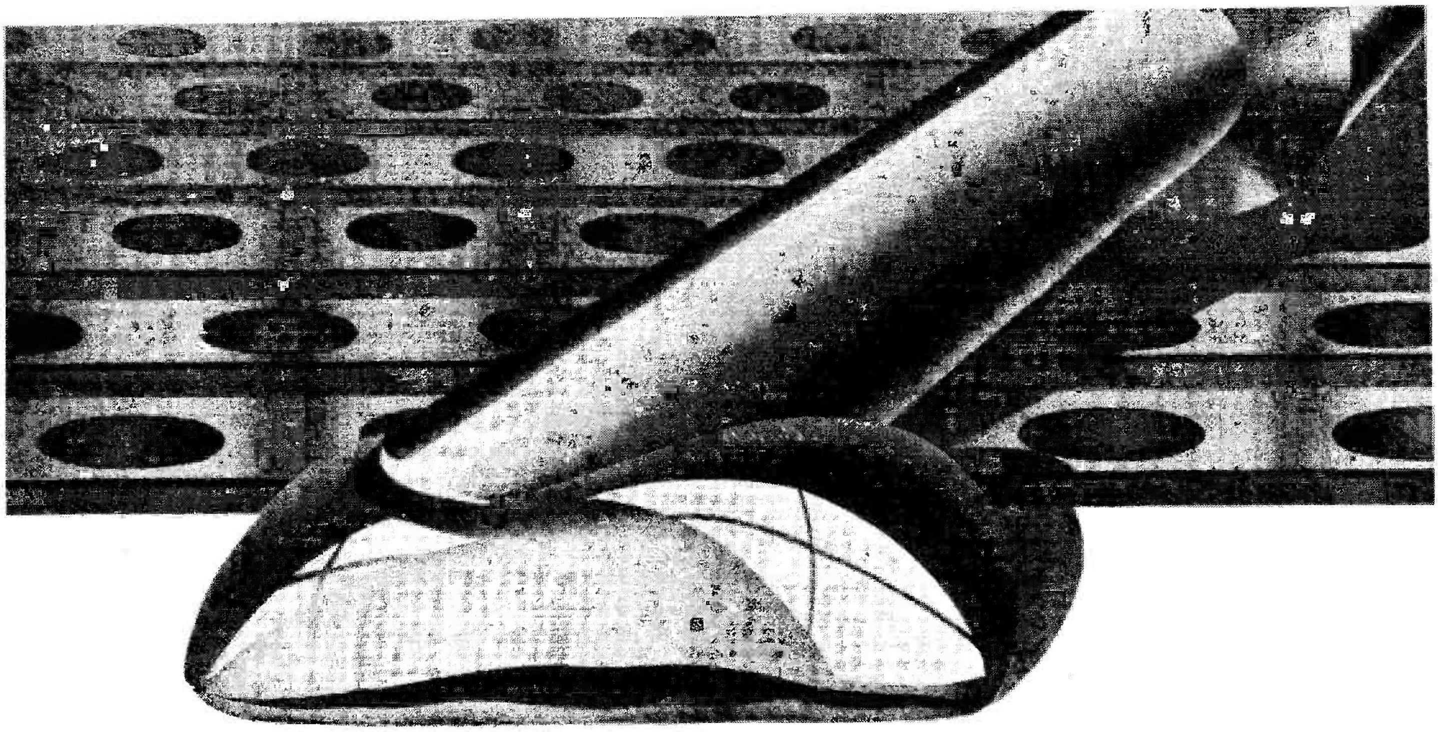
Thanks again for your most interesting and detailed reports and I look forward to hearing from you all again in the future.

Reports on the various bands are welcome and should be sent direct, by the 15th of the month, to

AMATEUR BANDS Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashtead, Surrey KT21 2TW. Logs by bands, each in alphabetical order.

MEDIUM and SW BANDS Charles Molloy G8BUS, 132 Segars Lane, Southport, PR8 3JG. Reports for both bands must be kept separate.

VHF BANDS Ron Ham BRS15744, Faraday, Greyfriars, Storrington, Sussex RH20 4HE.



The Blob Story.

Yes, they have got a funny name: Blob Boards.

And if you've never heard of them, you might wonder what on earth they're for.

After all they sound more like sci fi than practical electronics.

But in fact there is a good reason for the name.

It actually describes the way these printed circuit boards work. You just put a tiny blob of solder onto circuit board and component and you've made a perfect contact.

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And unlike those alternatives, on most Bandridge Blob Boards you won't have to break the contact rails to make your circuit. So you'll be able to use them again and again.

The roller tinned copper on Blob Board makes soldering easy, and it won't corrode, so they'll work for as long as you want them to.

You'll find a Bandridge Blob Board for every circuit you'll ever want to make, from the simplest to the most complex.

And if you're using Bandridge solderless DEC's for your prototypes you'll be pleased to learn that there's a Blob Board that exactly matches every DEC.

So when you're looking for a circuit board it'll be worth your while remembering Blob Boards.

As if you'd ever forget a name like that.

"V" Range – Easy to use, ·1" or ·15" matrix board.

"IC" Range – For integrated circuit work.

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354

For your nearest stockist contact Bandridge Ltd., 80a Battersea Rise, London SW11 1EH. Tel: 01-228 9227.

SAXON ENTERTAINMENTS LTD

SYSTEM 7000—GUARANTEED MODULES FOR ALL DISCO/PA APPLICATIONS

POWER AMPLIFIER MODULES 30—240 WATTS

- Fully tested & guaranteed.
- Full RMS Sine Wave output.
- Distortion typically 0·2%
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30 Watts rms	60 Watts rms		120 Watts rms		240W rms
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POWER SUPPLIES FOR THE ABOVE MODULES—READY WIRED & FUSED ON GLASS FIBRE PCB

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SYSTEM 7000 COMPLETE DISCO MIXERS (With Autofade)

Mono or Stereo

- Ready to plug in & use
- Automatic Mic override
- Two tone panel
- Twin deck & mic & tape inputs
- Left/Right deck fader
- 20Mz-20kHz Noise—77 dB

The choice of the professional D.J.

Controls: Mic volume, Bass, Treble, A/Fade Depth, Tape, L/Deck, R/Deck volumes, Bass, Treble, Master, Headphone volume, Selector & On/Off.

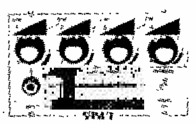
Mono 18v £39·50 Mains £45·75 Stereo 18v £57·50 Mains £63·75

IN MODULAR FORM—All you require is front panel (see below) knobs & sockets etc. All electronics are assembled & tested.

- Specification as for complete mixer
- All Potentiometers supplied & fitted
- Low cost do it yourself with step by step easy to follow instructions.

Mono £22·50 Stereo £33·50 Panel £3·95 Supply unit £9·50

SYSTEM 7000 LIGHTING CONTROL UNIT MK II (Four channel)



Has your light unit got?

- 4,000 W handling
- Sequence facility
- Smart 2 tone panel
- Advanced IC circuitry
- Top grade components
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- Automatic audio level

OURS HAS!

All your needs in one superbly designed unit

ONLY **£44·50**

IN MODULAR FORM—THE QUADRAFECT

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As with the mixers the Mk II L.C. unit may be purchased in module form with all controls, requiring only a panel, case & knobs etc. There are 13 simple connections

- 1-240w Audio
- 8A RCA triacs
- 0·5-20Hz Sequence
- Fully suppressed

CUSTOM MIXER MODULES (Complete or in printed circuit form only)

Make your own mixer, mono or stereo, up to 2 channels, with full monitoring facilities, and provision for echosend/return etc.

- Inputs for low and high 2 mic, ceramic & magnetic cartridge etc.
- Up to 20 input modules per single mixing module
- Feed most types of amplifier—accepts all inputs
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- Infinitely adaptable—Extremely economical

COMPLETE MODULES With facia panel, Knobs & sockets, Monitor buttons, Ready wired & tested

- 0·5W headphone circuit
- Full range bass/ treble controls
- Noise—80dB

Mono input **£8·95** Mono mixing stage **£8·95**
Stereo input **£12·50** Stereo mixing stage **£12·50**

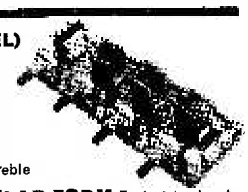
PRINTED CIRCUIT MODULES With controls fitted, requires only sockets, facia & knobs

Mono input **£5·95** Mono mixing stage **£5·95**
Stereo input **£9·50** Stereo mixing stage **£9·50**

Power supply for up to 20 channels—PPM18—£8·50.

SYSTEM 7000 SOUND—LITE (3-CHANNEL)

IN COMPLETE OR MODULAR FORM
(Modular form illustrated)



- Complete unit similar to Mk II unit above
- Long established & proven design
- 3 Channels—100W per channel
- RCA 8A Triacs—Individual channel fuses
- 1-240 W Input—master audio level plus Bass/Middle/Treble

COMPLETE UNIT—Fully cased with rear terminations—just plug in & go! £26·75

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COMPLETE DISCO SYSTEMS

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WITH TWO YEAR GUARANTEE—LOW INTEREST CREDIT

CENTAUR 100W STEREO

with TWIN LOUDSPEAKERS, SOUND to LIGHT SEQUENCER PLUS DISPLAY.
£225 + £10 carr. (Dep. £28·80, 12 months at £21·38 or 24 months at £12·01)

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As above but with 200 WATTS OUTPUT & larger TWIN CABINETS.
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As the SUPER CENTAUR but with extra large twin 200 WATT CABINETS, DECK LIGHTS, DECK STARTS & SUPERIOR DECKS.
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- Logic Circuitry Lightshow
- Complete and ready to use
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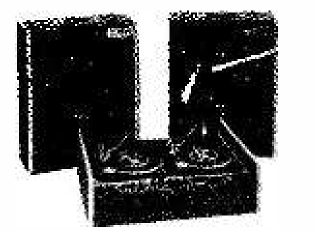

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Two extremely compact mono systems complete with loudspeakers and leads.

- TWIN BSR DECKS
- HEADPHONE MONITORING
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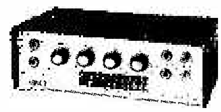
SYSTEM 7000 MINOTAUR 100—All Purpose Wide Range Amplifier



- 100W rms ± 1dB
- Standard 8 ohm output
- Twin mixed Inputs accept a wide range of signals
- 30HZ-30KHZ ± 2dB
- 23dB bass/treble

A four input, high power amplifier which will deliver up to 150 watts output. An absolute must where multiple mixing & power are required

- Four individually mixed Inputs
- Wide range bass/treble + master

An extremely compact and versatile amplifier with full protection and a clean, attractive appearance. Ideal for all groups, disco's & clubs

£49·50

- Vynide covered case
- Fully short proof
- Superb value for money

SAXON 150 HEAVY DUTY AMPLIFIER **£59·00**

STROBES & PROJECTORS (We stock the full Pluto range) Send for details

SUPERSTROBE £22·50

- 2-3 Joules
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- 6-8 Joules
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150 WATT LIQUID WHEEL PROJECTOR

- Accepts all accessories
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Remarkable value—Sold elsewhere at £39·50 Our price is only: **£37·50**

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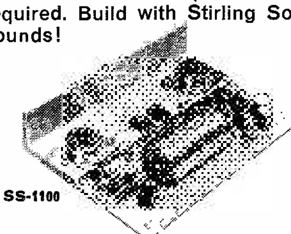
CHOOSE THE ITEMS *YOU* WANT AND BUY THEM THE STIRLING SOUND BARGAIN WAY whether for a new system, to up-grade what you use now, to build a disco or P.A. outfit, perhaps even a domestic intercom or any other device where an amplifier could be used. Whatever it be, there's a Stirling Sound power amp for it up to 100 watts R.M.S. (+1dB into 4Ω) together with stereo tone control/pre-amps if required. Build with Stirling Sound now! See what you save and hear how good it sounds!



SS-1100

Made in our own U.K. factory and sold direct to you

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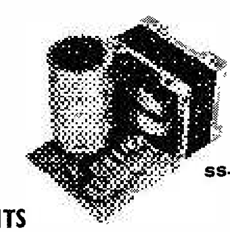
SATISFACTION GUARANTEED



SS-370

UNIT ONE

Combined stereo pre-amp and active tone control unit. Input sensitivity 50mV for 200mV out. 10-16V operation. Bass ±15dB at 30Hz; Treble ±15dB at 10KHz; Balance control; Volume control. For ceramic p.U., radio or tape inputs. WITH FREE CONTROL PANEL FASCIA. **£9·00**

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With control facilities similar to UNIT ONE but for magnetic cartridge input. Input sensitivity—5mV for 200mV out (can be varied) WITH FREE CONTROL PANEL FASCIA **£12·43**

CONTROL PANEL FASCIA FOR UNITS ONE OR TWO **0·50p**

SS.100

Basic active stereo tone control module to provide ±15db on bass at 30Hz and on treble at 10KHz. **£3·00**

SS.101

Stereo pre-amp suitable for ceramics, tape, radio, etc. **£2·75**

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AMPLIFIERS 3 to 100 WATTS R.M.S.

Ready assembled on P.C.Bs., tested and guaranteed. Easy to connect. With instructions. Output ratings +1dB.

SS.103 Typically 3 watts R.M.S. using 14V/4Ω I.C. amp. Input 100mV **£2·85**

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SS.105 5 watts R.M.S. into 3Ω using 13·5V. Sensitivity—30mV. THD—0·3% 3¼" × 2" × 1" **£3·95**

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Every unit is tested under working conditions before despatch, and guaranteed. All units except SS.312 include a stabilised low voltage take off point (13-15V) for pre-amp, tone control units etc. Outputs quoted are minimal unloaded ratings.

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SS.310/60 Stabilised power supply; variable in output from 10V to 50V/2A and short-circuit protected **£17·75**

SS.300 Power stabilising unit variable from 10 to 50V/8A max. for adding to existing unstabilised supply units. **£5·50**

Improved circuitry and performance standards. More to choose from. Pay by Access or Barclaycard if desired.

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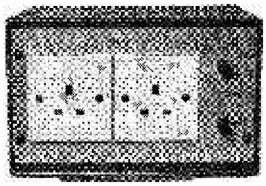
INVERTORS

KIT FORM or BUILT UP.



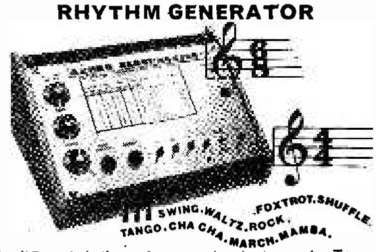
240v-50Hz from your 12v car battery.

O/P Powers available. 25W-40W-75W-150W-300W-400W-500W-1kW-1·5kW. Various battery I/P voltages available.

AUTOMATIC INVERTORS

These units have built-in battery charger which functions whilst mains are healthy. Upon mains failure unit automatically switches to invertor operation ensuring no interuption of supply. Send S.A.E. for price lists.

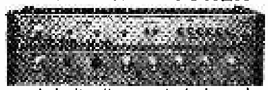
RHYTHM GENERATOR



15 different rhythms, 9 percussion instruments. Tempo range 15 to 100 bars/min. Full kit of parts available at £39·50 + £1·20 P. & P. + VAT at 8%. Price assembled and tested add **£12.** Parts available separately, send S.A.E.

We reserve the right to alter published prices in the event of component or postal increases.

P.E. ORION STEREO AMPLIFIER & TUNER



May be mounted slim line or stacked as above. Parts available separately for both units.

20 + 20 Watts r.m.s. into 8 ohm load. Distortion less than 0·1% 100Hz–10kHz. Frequency response ± 1dB 20 Hz to 20kHz. Hum level virtually nil with volume full on. This is a power amplifier of superb quality incorporating the very latest design features. Professional hi-fi enthusiasts have classed it as fantastic and real value for money. The CCT incorporates a low flux transformer and inputs for disc, tape, tuner, etc.

TUNER UNIT

May be purchased separately in matching slim line case. As full kit or individual parts.

Send S.A.E. for price list and specification sheets.

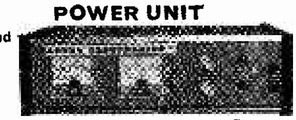
LOUDSPEAKERS

8 inch system

This system is designed for use with above amplifiers rated up to 25W r.m.s. per channel at 8Ω. May be incorporated in an enclosure 295 x 490 x 295mm (11·5 x 19·3 x 11·5in) approx. external, constructional details of which are given with each bass unit, to provide an overall frequency response of **50Hz to 22kHz.** Four-element cross-over, ready constructed on p.c.b. Output leads have push-on receptacles to suit speaker tags. Cross-over frequency is 2·8kHz approx.

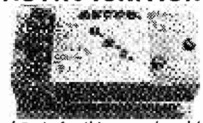
POWER UNIT

Regulated



Voltage adjustable from 1–35v at 2 amps. Short circuit protected. Voltage and current meters incorporated. Full Kit of parts £48 + 8% VAT or assembled and tested £58 + 8% VAT.

ASTRO IGNITION



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(£14·90 + 60p P. & P.) + 8% VAT.

Consider the advantages:

Fuel economy. Faster acceleration. More power. Excellent cold starting. Smoother running. No contact breaker burning. Less exhaust gases.

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6–0–6v–6VA.
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Transformer and coils manufactured to customer specifications both in High Volume and Small Order capacity.

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Complete digital Clock Kits

TEAK OR PERSPEX CASE

All prices include post, pack. & VAT

NON ALARM £12·50

ALARM £15·50

"DELTA"
6" × 2½" × 3"

FEATURES

- 4 LED digits ½" high. Red.
- 12 hour display with AM/PM indication
- Mains frequency accuracy
- Easy to build: all components included
- Beautiful real wood case or Perspex: White, Black, Red, Blue, Green
- Flashes to indicate power cuts

NON-ALARM

Complete kit	including case	..	£12·50
	Ready Built	..	£14·50
Module kit	excluding case	..	£9·50
	Ready Built	..	£10·00

ALARM

Pulsed Alarm Tone. Automatic Brightness control.
9 minute Snooze. Simple Setting.

Complete kit	including case	..	£15·50
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Module kit	excluding case	..	£13·00
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TIMER FACILITY: Stopwatch use up to 9min 59secs .. extra 50p.

EXCELLENT VALUE **GUARANTEED**

- LCD gents watch. 5-function, Backlight. Chrome case. Black strap £17·28
- 4 Function Calculator .. .. £4·00

DISPLAYS: FND 500 ½" LED £1·19 each: 6 for £6·48
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Includes: 4 AA (1·2v) Nickel Cadmium batteries (separately £1·08 each)
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ELECTRONIC DOORBELL. Warbling tone. Runs off PP3 £5·40

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Huge quantities of electronic components must be cleared as space required. 1000's of capacitors, resistors, transistors. Ex equipment panels, etc. covered in valuable components. No time to sort. Must sell by weight. 7 lbs **£4·95**, 14 lbs **£7·95**, 28 lbs **£12·00**, 56 lbs **£20·00**, 112 lbs **£30·00**.

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Handy Packs

4 aluminium boxes 128 × 44 × 38mm ideal for signal injectors, etc. £1·00
Self fluxing enamelled copper wire 18 & 22 swg on 2 oz reels 2 for £1·10
100 miniature reed switches ideal for burglar alarms, model railways, etc. £2·20
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20mm anti-surge fuses your selection 500mA to 3·15A 12 for £1·00
Hardware packs each containing 100's of items including BA nuts & bolts, nylon, self-tapping, Posidrive, "P" clips, cable-clamps, fusholders, spire nuts etc, etc. £1 per pound
100 assorted "P" clips. £1
Belling Lee outdoor triplexers, UHF, Band 1, Band 2. 50p each 3 for £1

Component Bargains

300 mixed resistors ¼ and ½ watt £1·00
200 modern mixed caps most types £3·30

100 mixed polyester caps £1·40
100 mixed modern miniature ceramic plate caps most values to 1000 PF £2·20
100 mixed polystyrene caps to 5000 PF £2·20
100 mixed electrolytics £2·20
100 mixed wirewounds £1·00
200 printed circuit resistors £1·00
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100 new and marked silicon and germanium transistors including BC148, BF194, BC183, etc. £3·95
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DE LUXE FIBRE GLASS PRINTED CIRCUIT ETCHING KITS

Includes 150 sq. ins. copper clad f/g board, 1 lb ferric chloride, 1 dalo etch resist pen, abrasive cleaner, 2 mini drill bits, etch tray and instructions—only **£5·30.**

REFILL PACKS FOR ABOVE

150 sq. ins. fibre glass board £1·50
Dalo pen 90p
1 lb ferric chloride to mil spec. £1·00
5 lbs ferric chloride to mil spec. £4·000
Instruction sheet 20p

T/V SURPLUS

Brand new ITT C.T.V. triplers, fit Decca "Bradford" chassis—**£2·50 each, 5 for £10.**
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AAZ17 0·25
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AC125 0·30
AC126 0·25
AC127 0·25
AC128 0·25
AC141 0·20
AC141K 0·30
AC142 0·20
AC142K 0·25
AC176 0·25
AC187 0·25
AC188 0·25
ACY17 0·65
ACY18 0·65
ACY19 0·65
ACY20 0·65
ACY21 0·65
ACY39 1·00
AD149 0·70
AD161 0·75
AD162 0·75
AF106 0·45
AF114 0·25
AF115 0·25
AF116 0·25
AF117 0·25
AF139 0·40
AF186 1·50
AF239 0·45
AFZ11 2·75
AFZ12 2·75

ASY26 0·45
ASY27 0·50
ASZ15 1·25
ASZ16 1·25
ASZ17 1·25
ASZ20 0·75
ASZ21 1·50
AU110 1·70*
AU113 1·70*
AUY10 1·70*
BA145 0·15*
BA148 0·15*
BA154 0·10
BA155 0·12
BA156 0·13
BAW62 0·05
BAX13 0·07
BAX16 0·07
BC107 0·12
BC108 0·12
BC109 0·13
BC113 0·15*
BC114 0·18*
BC115 0·19*
BC116 0·19*
BC117 0·22*
BC118 0·16*
BC125 0·18*
BC126 0·25*
BC135 0·15*
BC136 0·19*
BC137 0·16*
BC147 0·10*
BC148 0·10*
BC149 0·13*
BC157 0·12*
BC158 0·11*

BC159 0·13*
BC167 0·13*
BC170 0·16*
BC171 0·14*
BC172 0·13*
BC173 0·15*
BC177 0·19
BC178 0·18
BC179 0·20
BC182 0·11*
BC183 0·11*
BC184 0·12*
BC212 0·14*
BC213 0·14*
BC214 0·17*
BC237 0·17*
BC238 0·12*
BC301 0·45
BC303 0·60
BC307 0·20*
BC308 0·18*
BC327 0·22*
BC328 0·18*
BC337 0·19*
BC338 0·18*
BCY30 1·00
BCY31 1·00
BCY32 1·00
BCY33 0·90
BCY34 0·90
BCY39 3·00
BCY40 1·25
BCY42 0·30
BCY43 0·32
BCY58 0·23
BCY70 0·18
BCY71 0·22

BCY72 0·17
BCZ11 1·50
BD115 0·60
BD121 1·50
BD123 1·50
BD124 1·00
BD131 0·51
BD132 0·54
BD135 0·35*
BD136 0·36*
BD137 0·37*
BD138 0·40*
BD139 0·43*
BD140 0·47*
BD144 2·00
BD181 1·38
BD182 1·48
BD237 0·80
BD238 0·85
BDX10 0·75
BDX32 2·25
BDY20 1·42
BDY60 0·75
BF115 0·39
BF152 0·25
BF153 0·25
BF154 0·25
BF159 0·35
BF160 0·30
BF167 [illegible]
BF173 [illegible]
BF177 0·38
BF178 0·45
BF179 0·48
BF180 0·45
BF181 0·45
BF182 0·45
BF183 0·45
BF184 0·39
BF185 0·37

BF194 0·12*
BF195 0·11*
BF196 0·13*
BF197 0·14*
BF200 0·32
BF224 0·20*
BF244 0·35*
BF257 0·37
BF258 0·42
BF259 0·45
BF336 0·50*
BF337 0·53*
BF338 0·55*
BFS21 2·27
BFS28 1·38
BFS61 0·25*
BFS98 0·25*
BFW10 0·90
BFW11 0·90
BFX84 0·38
BFX85 0·41
BFX87 0·35
BFX88 0·32
BFY50 0·28
BFY51 0·26
BFY52 0·26
BFY64 0·30
BFY90 1·32
BSX19 0·34
BSX20 0·34
BSX21 0·32
BT106 1·25
BTY79/400R 3·19
BU205 2·25*
BU206 2·25*
BU208 2·50*
BY100 0·45
BY126 0·14
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BZX61 Series 0·20
BZY88 Series 0·13
CRS/105 0·45
CRS/140 0·60
CRS/305 0·45
CRS/340 0·75
CRS/360 0·90
GEX66 1·50
GEX541 1·75
GJ3M 0·75
GJ5M 0·75
GJ7M 0·75
GM0378A 1·50
KS100A 0·40*
MJE340 0·58
MJE370 0·65
MJE371 0·81
MJE520 0·65
MJE521 0·75
MJE2955 1·25
MJE3055 0·75
MPF102 0·30*
MPF103 0·30*
MPF104 0·30*
MPF105 0·30*
MPSA06 0·25*
MPSA56 0·25*
MPSU01 0·32*
MPSU06 0·40*
MPSU56 0·45*
NKT401 2·00
NKT403 1·73
NKT404 1·73
NE555 0·45
OA5 0·75
OA7 0·55
OA10 0·55
OA47 0·14

OA70 0·30
OA79 0·30
OA81 0·30
OA85 0·30
OA90 0·08
OA91 0·08
OA95 0·08
OA200 0·10
OA202 0·11
OA210 0·75
OA211 0·75
OAZ200 0·65
OAZ201 0·65
OAZ206 0·65
OAZ207 0·65
OC16 1·25
OC20 2·00
OC22 2·50
OC23 2·75
OC24 3·50
OC25 0·90
OC26 0·90
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OC44 0·50
OC45 0·50
OC71 0·45
OC72 0·45
OC73 1·00
OC75 0·50
OC74 0·75
OC76 0·50
OC77 1·20
OC81 0·75
OC81Z 1·00

OC82 0·75
OC83 0·55
OC84 0·60
OC122 1·50
OC123 1·55
OC139 2·25
OC140 1·95
OC141 2·25
OC170 0·60
OC171 0·60
OC200 1·00
OC201 1·50
OC202 1·25
OC203 1·25
OC204 1·25
OC205 1·75
OC206 1·75
OC207 1·25
OCP71 1·25
ORP12 0·70
R200SB 2·25*
R2009 2·25*
R2010B 2·25*
T1C44 0·36
T1C226D 1·30
T1L209 0·25
T1P29A 0·50*
T1P30A 0·60*
T1P31A 0·62
T1P32A 0·75
T1P33A 1·00
T1P34A 1·20
T1P41A 0·70
T1P42A 0·90
T1P2955 1·00
T1P3055 0·50
T1S43 0·35*
ZS140 0·25*
ZS170 0·12*
ZS178 0·54*

ZS271 0·22*
ZS278 0·56*
ZTX107 0·11*
ZTX108 0·10*
ZTX109 0·12*
ZTX300 0·12*
ZTX301 0·13*
ZTX302 0·17*
ZTX303 0·17*
ZTX304 0·19*
ZTX311 0·12*
ZTX314 0·20*
ZTX500 0·13*
ZTX501 0·14*
ZTX502 0·16*
ZTX503 0·17*
ZTX504 0·20*
ZTX531 0·20*
ZTX550 0·16*
1N914 0·07
1N916 0·07
1N4001 0·06
1N4002 0·07
1N4003 0·08
1N4004 0·09
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1N4006 0·15
1N4007 0·15
1N4009 0·15
1N4148 0·07
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1N5401 0·16
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1S920 0·08
1S921 0·08
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2G302 1·00
2G306 1·10
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2N696 0·25

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2N698 0·30
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2N708 0·21
2N930 0·26
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2N1132 0·26
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2N1671 1·50
2N1893 0·33
2N2147 1·40
2N2148 1·65
2N2218 0·33
2N2219 0·42
2N2220 0·35
2N2221 0·22
2N2222 0·25
2N2223 2·75
2N2368 0·17
2N2369A 0·21
2N2484 0·21
2N2646 0·50
2N2904 0·35
2N2905 0·35
2N2906 0·25
2N2907 0·21
2N2924 0·15*
2N2925 0·17*
2N2926 0·13*
2N3053 0·25
2N3054 0·50

2N3055 0·85
2N3440 0·60
2N3441 0·80
2N3442 1·20
2N3525 0·90
2N3614 1·20
2N3702 0·15*
2N3703 0·15*
2N3704 0·15*
2N3705 0·15*
2N3706 0·14*
2N3707 0·18*
2N3708 0·14*
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2N3711 0·15*
2N3771 1·60
2N3772 1·70
2N3773 2·65
2N3819 0·36*
2N3820 0·46*
2N3823 0·60*
2N3866 1·00
2N3904 0·21*
2N3905 0·22*
2N3906 0·22*
2N4058 0·20*
2N4059 0·15*
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2N4061 0·17*
2N4062 0·18*
2N4124 0·17*
2N4126 0·17*
2N4286 0·20*
2N4288 0·25*
2N4289 0·25*
2N5457 0·35*
2N5458 0·35*
2N5459 0·35*
3N125 1·75
3N141 0·85

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DK91† 0·55*
DK92 1·25*
DK96 1·10*
DL92 0·75*
DL94 1·20*
DL96 1·10*
DY86/7† 0·45*
DY802 0·68*
E88CC† 1·00
EABC80 0·40*
EAC91 0·50
EAF42 1·25*
EAF801 1·75*
EB41 1·75*
EB91† 0·30*
EBC33 1·75*
EBC41 1·25*
EBC81 1·10*
EBC90 0·65
EBF80 0·45*
EBF83 1·25*
EBF89† 0·40*
EBL31 2·50*
ECC40 1·25*
ECC81† 0·45*
ECC82† 0·45*

ECC83† 0·45*
ECC84† 0·50*
ECC85† 0·55*
ECC88† 0·60*
ECC91† 0·35*
ECC189 1·00*
ECF80† 0·60*
ECF82† 0·60*
ECH35 2·00*
ECH42 1·15*
ECH81† 0·50*
ECH83 0·85*
ECH84† 0·85*
ECL80† 0·60*
ECL82† 0·55*
ECL83 1·50*
ECL86† 0·65*
ECLL800 7·00*
EF37A† 1·60*
EF39† 1·60*
EF40 1·15*
EF41 1·20*
EF42 2·00*
EF50† 0·60*
EF80† 0·45*
EF83 1·75*
EF85† 0·50*
EF86† 0·45*
EF89 0·60*
EF91† 0·65*
EF92† 0·75*
EF98 1·25*
EF183† 0·50*
EF184† 0·50*

EH90 0·75*
EL32 1·50*
EL33 3·50*
EL34† 0·85*
EL41 1·25*
EL42 1·75*
EL81 1·10*
EL84† 0·35*
EL86† 0·50*
EL91 3·85*
EL95† 0·80*
EL360 2·75*
EM80 1·10*
EM81 1·00*
EM84 1·00*
EM85 1·25*
EM87 1·50*
EN91† 0·55
EY51† 0·75*
EY86† 0·50*
EZ40 1·25*
EZ41 1·25*
EZ80† 0·30*
EZ81† 0·35*
EZ90† 0·45*
GZ32 0·75*
GZ33 4·00*
GZ34† 1·24*
KT61 3·50*
KT66 4·00*
KT88 4·75*
KTW61 1·75*
KTW62 1·75*
KTW63 1·75*
MU14 1·00*
N78 7·50*
OA2† 0·45

OB2† 0·45
OC3† 0·45
OD3† 0·45
OZ4 0·75*
PC86† 0·85*
PC88† 0·85*
PC97 0·88*
PC900† 0·75*
PCC84† 0·45*
PCC88 0·65*
PCC89† 1·05*
PCC189† 0·65*
PCF80 0·72*
PCF82† 0·50*
PCF86† 0·65*
PCF87† 1·00*
PCF200† 1·05*
PCF201† 1·05*
PCF801† 0·55*
PCF802† 0·72*
PCF805 1·28*
PCF806 0·80*
PCF808 1·28*
PCL82† 0·50*
PCL83† 0·92*
PCL84† 0·50*
PCL85† 0·80*
PCL86† 0·65*
PCL8058/5† 0·80*
PD500 3·00*
PFL200 0·88*
PL36† 0·92*
PL81 0·55*
PL81A† 1·00*
PL82 0·60*

PL83† 0·55*
PL84† 0 60*
PL504/500† 0·96*
PL508† 1·32*
PL509† 2·16*
PL519† 2·96*
PL801 1·10*
PL802† 1·80*
PY33 0·68*
PY81† 0·72*
PY82 0·45*
PY83 0·60*
PY88† 0·68*
PY500A† 1·36*
PY800/81† 0·72*
PY801 0·72*
QQV02-6 9·60
QQV03-10† 1·60
QQV03-20A† 8·50*
QQV06-40A† 8·50*
R17 1·65*
R19 1·00*
R20 1·00*
U18-20 2·50*
U25 1·16*
U26 1·16*
UABC80† 0·50*
UAF42 0·75*
UB41 1·25*
UBC41† 0·75*
UCC84 0·75*

UCC85† 0·50*
UCF80 0·75*
UCH42 1·20*
UCH81† 0·50*
UCL82† 0·50*
UCL83 1·44*
UF41 0·75*
UF80† 0·50*
UF85† 0·50*
UF89† 0·50*
UL41 1·00*
UL84† 0·60*
UM80 1·00*
UY41† 0·75*
UY85† 0·65*
1B3GT† 0·55*
1R5† 0·55*
1S5† 0·40*
1T4† 0·40*
2AS15 10·00
2D21† 0·55
3A5 1·35
3CX100A5 20·00
3S4† 0·75*
3V4† 1·00*
4CX250B 17·50
5R4GY† 1·00*
5U4G 1·00*
5U4GB 1·00*
5V4G† 0·65*
5Y3GT 0·85*
5Z3 1·50*
5Z4G 1·00*
5Z4GT 1·00*
6-30L2 1·00*
6AB7 0·75*

6AC7 0·75*
6AF4A† 0·70*
6AG7 0·75*
6AH6† 0·70*
6AK5† 0·30
6AK6 0·95*
6AL5† 0·30*
6AM4 2·30*
6AM5 3·85*
6AM6† 0·65*
6AN5 2·50*
6AN8A† 0·70*
6AQ5† 0·75*
6AR5 0·70*
6AS6† 0·80*
6AS7G† 1·50*
6AT6† 0·65*
6AU6GT 4·26*
6AU6† 0·55*
6AV5GT 3·74*
6AV6† 0·50*
6AW8A† 1·00
6AX5GT 3·10*
6B7 0·75
6B8 0·75
6BA6† 0·50*
6BA7 5·12*
6BA8A 3·75
6BC4 3·71
6BE6† 0·45*
6BH6† 1·20*
6BJ6† 0·80*
GBK4 4·21*
6BL6 85·00
6BL7GT 3·86*
6BN6 0·80*
6BQ7A 1·55*

6BR7 4·00*
6BR8† 1·20*
6BS7 4·00*
6BW6 3·75*
6BW7 1·12*
6BX7GT 4·96*
6BZ6 1·78*
6C4† 0·40*
6CB6A† 0·50*
6CD6GA 4·00*
6CG7 1·72*
6CH6 4·42*
6CL6† 0·75*
6CW4 4·72*
6D2† 0·30*
6DK6 2·49*
6DQ6B 3·04*
6EA8 2·21*
6EB8 2·12*
6EW6 0·80*
6F6 0·75
6F23 1·32*
6F28 0·96*
6H2N 0·75*
6H3N 0·75*
6H6 0·75*
6J4† 0·75*
6J6† 0·35*
6J7 0·75*
6K4N 0·75*
6K6GT 0·75*
6K7 0·75*
6K8 0·75*
6KD6 4·79*
6L6G 2·50*
6L6GA 1·50*
6L6GT 0·75*

6L6GC 1·75*
6L7 0·75
6N2P 0·75
6N3P 0·75
6N7 0·75*
6P25 3·60*
6Q7 0·75*
6R7 0·75*
6SA7 0·75*
6SC7 0·75*
6SF7 0·75*
6SH7 0·75*
6SJ7 0·75*
6SK7 0·75*
6SL7GT† 0·55*
6SN7GT† 0·55*
6SQ7 0·75*
6SR7 0·75*
6SS7 0·75*
6U5G 2·00*
6U8† 0·40*
6U8A† 0·55*
6V6GT† 0·60*
6X4† 0·45*
6X5GT† 0·55*
7B7 1·00*
7C5 1·75*
7C6 1·25*
7H7 1·00*
7R7 1·50*
7S7 2·25*
7Y4 0·75*
7Z4 0·75*
12AT6 0·45*
12AT7† 0·45*

12AU6 0·50*
12AU7† 0·45*
12AV6 0·60*
12AV7 2·84*
12AX7† 0·45*
12AY7† 0·82*
12B4A† 1·00*
12BA6 0·50*
12BE6 0·60*
12BH7† 0·60*
12BY7† 0·80*
12E1 4·00
30C15 1·20*
30C17 1·20*
30C18 1·28*
30F5 1·00*
30FL1/2 1·00*
30FL12 1·44*
30FL14 1·28*
30L1 0·68*
30L15 1·32*
30L17 1·32*
30P4 0·92*
30P19 0·92*
30PL1 1·32*
30PL13 1·44*
30PL14 1·68*
30PL15 1·44*
35W4 0·60*
50C5 0·70*
85A2 1·50
90AG 7·26
90AV 7·16
90C1 1·50
90CG 5·74
90CV 5·99
92AG 7·26

92AV 7·16
150B2 1·80
150C2 1·50
150C4 2·30
211 5·00
723AB† 8·00
807† 0·65
811A† 3·00
812A 7·25
813† 6·00
833A 30·00
866A 8·85
872A 11·40
931A 12·24
2050 2·50
5642 3·16*
5654 3·53*
5651 1·80*
5670 2·86*
5814A 2·60*
6080† 3·40*
6146A 4·27
6146B 4·65
6159B 6·00
6442 15·00
6973 2·61
7586 6·79
7587 12·54
7868 2·93*
8068 5·50
8136 1·54

INTEGRATED CIRCUITS

7400 0·20
7401 0·20
7402 0·20
7403 0·20
7404 0·26
7405 0·23
7406 0·55
7407 0·55
7408 0·28
7409 0·28
7410 0·20

7412 0·26
7413 0·45
7416 0·40
7417 0·40
7420 0·20
7422 0·25
7423 0·35
7425 0·35
7427 0·35
7428 0·50
7430 0·20

7432 0·36
7433 0·37
7437 0·42
7438 0·37
7440 0·22
7441AN 0·92
7442 0·78
7447AN 1·20
7450 0·20
7451 0·20
7453 0·20

7454 0·20
7460 0·20
7470 0·35
7472 0·36
7473 0·36
7474 0·49
7475 0·59
7476 0·42
7480 0·60
7482 0·85
7483 1·00
7484 1·00
7486 0·40
7490 0·52

7491AN 0·85
7492 0·60
7493 0·70
7494 0·80
7495 0·80
7496 0·90
7497 3·67
74100 1·75
74107 0·45
74109 0·86
74110 0·57
74111 0·86
74116 1·89
74118 0·95

74119 2·00
74120 1·10
74121 0·45
74122 0·60
74123 1·00
74125 0·80
74126 0·80
74128 0·80
74132 0·80
74136 0·68
74141 0·85
74142 3·00
74143 3·00
74144 3·00

74145 1·00
74147 2·45
74148 2·00
74150 1·75
74151 0·90
74154 2·00
74155 0·90
74156 0·90
74157 0·90
74159 2·50
74170 2·60
74172 5·00
74173 1·75
74174 1·57

74175 1·00
74176 1·10
74178 1·65
74179 1·65
74180 1·65
74190 1·48
74191 1·48
74192 1·25
74193 1·25
74194 1·25
74195 1·10
74196 1·20
74197 1·00
74198 2·25

74199 2·25
76013N 1·75*
LM309K 1·50
TAA570 2·30*
TAA630S 3·50*
TBA480Q 1·84*
TBA520Q 2·30*
TBA530 1·98*
TBA540Q 2·30*

TBA550Q 3·22*
TBA560CQ 3·22*
TBA673 2·19*
TBA700 1·52*
TBA720Q 2·30*
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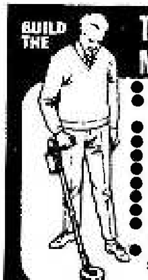

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DENCO COILS
Dual Purpose 'DP' VALVE TYPE
Range 1-5 B, Y, R, W **80p**
6-7 B, Y, R **70p**
1-5 Green **85p**
'T' Type (Trns. tuning)
Rng. 1-5 B, Y, R, W **88p**
B9A Valve Base **23p**
RDT2 **85p**
RFC 5 chokes **84p**
RFC 7(19mH) **90p**
IFT 13/14/15/16/17 **79p**
1FT 18/1·6 or 465 **95p**
TOC1 **80p**
MW 5FR **76p**
MW/LW 5FR **98p**

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3·3, 4·7, 6·8, 10, 12, 18, 22, 27, 33, 47, 50, 68, 75, 82, 85, 100, 120, 150, 200, 250 **9p** each. 300, 330, 360, 390, 600 & 820pF **16p** each. 1000, 2200pF **20p** each.

CRYSTALS
100KHz **365p**
1MHz **323p**
1·6MHz **395p**
3·2768MHz **380p**
4·433619MHz **165p**
Holder HC6U **18p**

CERAMIC TRIMMER CAPACITORS
2–7pF; 4–15pF; 6–25pF; 8–30pF **20p**

MINIATURE TYPE:
2·5–6pF; 3–10pF; 3–30pF; 10–40pF **22p**
5–25pF; 65pF; 88pF **30p**

COMPRESSION
3–40pF; 10–80pF **22p**
25–200pF **33p**
100–500pF 1250pF **38p**

AUDIBLE Warning Devices 12V **179p***

REVERB AMP
Short spring-line Unit **448p**

S-DEC **185p***
T-DEC **340p***
U-DEC 'A' **375p***
U-DEC 'B' **655p***
16 DIL Adaptor **170p***
TO5 Adaptor **160p***
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3·5mm **18p**
Crystal **33p**

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Sockets **20p**

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0-12 0-12 0·5A **240p+**
15-0-15V 0·5A **220p+**
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0-18 0-18V 1·5A **379p+**
9-0-9V 2A **270p+**
12-0-12V 2A **320p+**
30-25-20-0-20-25-30 2A **497p+**
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0-12 0-12A 6VA **240p**
0-15 0-15V 6VA **240p**
0-20 0-20V 6VA **240p**
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0–500µA 0–1 Amp
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0–100µA
0–500µA
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AC188*	20
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7404	20	7483	83	74165	120
7405	22	7484	95	74166	161
7406	38	7485	110	74167	198
7407	38	7486	38	74172	625
7408	20	7489	320	74173	175
7409	20	7490	36	74174	113
7410	15	7491	80	74175	90
7411	24	7492	53	74176	120
7412	23	7493	40	74177	118
7413	37	7494	85	74180	142
7414	74	7495	70	74181	299
7416	35	7496	82	74182	127
7417	39	7497	262	74184	228
7420	16	74100	125	74185	148
7421	33	74104	62	74188	850
7422	32	74105	62	74190	140
7423	30	74107	33	74191	140
7425	30	74109	84	74192	140
7426	30	74110	54	74193	140
7427	36	74111	74	74194	140
7428	38	74116	198	74195	95
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7438	33	74123	73		
7440	17	74125	65		
7441	74	74126	60		
7442	68	74128	77		
7443	115	74132	77		
7444	112	74141	72		
7445	94	74142	280		
7446	94	74143	314		
7447	82	74144	314		
7448	78	74145	85		
7450	17	74147	175		
7451	17	74148	143		
7453	17	74150	118		
7454	17	74151	70		
7460	17	74153	75		
7470	32	74154	140		
7472	28	74155	82		
7473	32	74156	80		
7474	32	74157	80		
7475	42	74159	225		
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4007	18	4028	90	4098	110
4008	92	4029	109	4099	190
4009	58	4030	58	4502	120
4010	58	4031	230	4507	55
4011	19	4032	100	4510	135
4012	18	4033	145	4511	168
4013	55	4034	196	4512	98
4014	99	4035	120	4516	128
4015	93	4036	325	4518	102
4016	52	4037	100	4519	55
4017	99	4038	108	4520	108
4018	99	4039	320	4528	99
4019	60	4040	105	4532	127
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		4045	145		
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		4048	58		
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		4053	89		
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		4078	21		
		4081	22		
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709C 14 pin	45	CA3035	140	NE555*	36
709C TO5	35	CA3036	180	NE556DB*	90
710*	48	CA3043	190	NE560*	325
723* 14 pin	45	CA3045	140	NE561*	410
741* 8 pin	22	CA3046	80	NE562B*	410
741* 14 pin	32	CA3048	200	NE565A*	185
741* TO5	32	CA3075	175	NE566*	180
747C 14 pin	70	CA3080E*	80	NE567V*	187
748C 8 pin	36	CA3081	190	NE571	450
753 8 pin	150	CA3089E	210	RAM2102-2*	210
AY-1-0212	580	CA3090AQ	390	ROM2513*	700
AY-1-1313A	660	CA3123	200	SAS560	225
AY-1-5050	241	CA3130*	94	SAS570	225
AY-1-5051	125	CA3140	95	SG3402*	255
AY-1-6721/6	195	ICL8038CC*	350	SL403D	250
AY-3-8500*	450	ICM7205*	1150	SL437A	560
AY-3-8550*	750	LM300H	170	SN72733	125
AY-5-1224A*	349	LM301AT	39	SN76003N	240
AY-5-1230*	490	LM308T	140	SN76013N	240
AY-5-1315	560	LM318H	205	SN76023N	140
AY-5-1317A	630	LM318S	195	SN76033N	230
AY-5-3500*	510	LM320-12*	150	SN76115N	215
AY-5-3507*	610	LM339	55	SN76227N	175
AY-5-4007	650	LM348	120	TAA550	50
CA3011*	82	LM379	398	TAA621AX1	228
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		M252AA*	850	TBA540	215
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		MC724*	175	TBA641-A12	250
		MC845		TBA641 BX1	250
		MC1303	145	TBA641 B11	250
		MC1304P	260	TBA651	180
		MC1310P	185	TBA800	90
		MC1312PQ	195	TBA810S	105
		MC1458P*	90	TBA820	80
		MC1496L	101	TBA920Q	350
		MC1710CG	79	TCA270Q	220
		MC3360P	89	TCA270SQ	220
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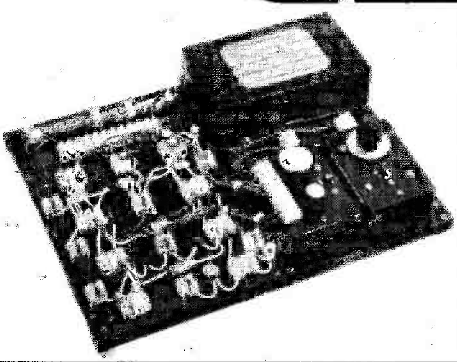

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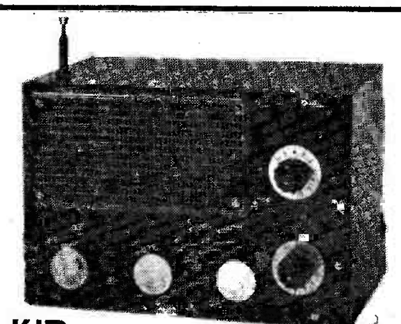

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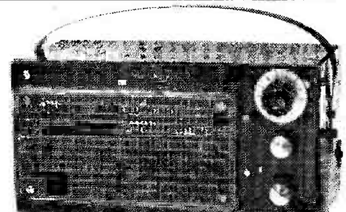

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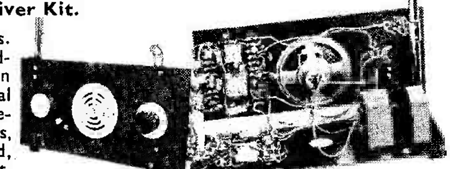

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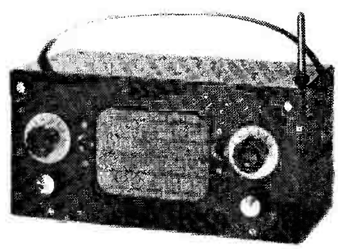

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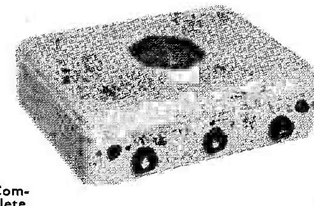

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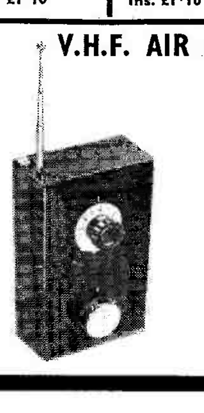

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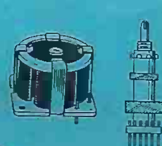

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