

RADIO... ELECTRONICS... INSTRUMENTS... AUDIO...

practical WIRELESS

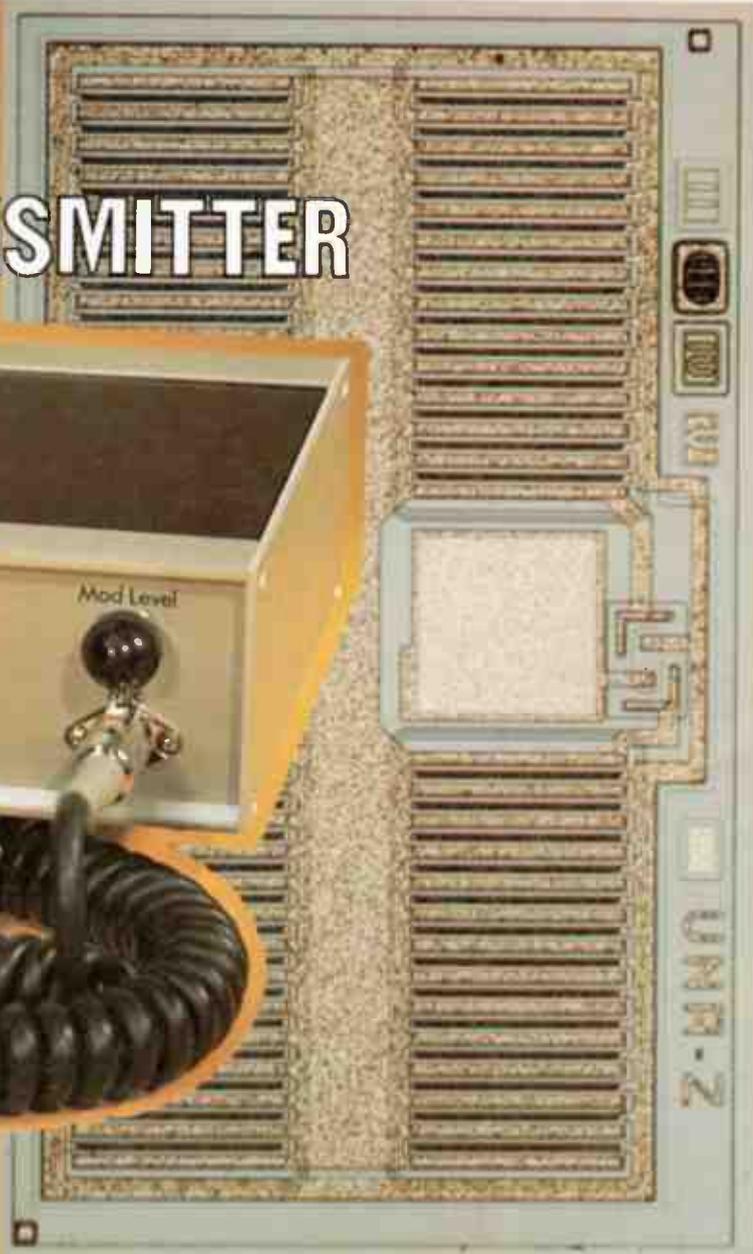
50p

Australia 95c
New Zealand 95c
South Africa 90c
Malaysia \$2.75

JULY 1979

VMOS

TOP BAND TRANSMITTER



also:



AM/FM FREQUENCY READOUT

&

THE YAESU FRG-7 RECEIVER REVIEWED

TTL			
7400	10p	74109	25p
7401	10p	74118	75p
7402	10p	74120	20p
7403	10p	74121	20p
7404	12p	74122	35p
7405	12p	74123	40p
7406	25p	74125	35p
7407	25p	74126	35p
7408	12p	74128	60p
7409	12p	74130	120p
7410	12p	74131	90p
7411	15p	74132	45p
7412	15p	74135	90p
7413	25p	74136	80p
7414	25p	74137	90p
7416	25p	74138	100p
7417	25p	74141	50p
7420	12p	74143	20p
7421	20p	74144	270p
7422	15p	74145	55p
7423	20p	74148	65p
7425	20p	74147	100p
7426	22p	74148	90p
7427	22p	74151	45p
7428	25p	74153	45p
7430	12p	74154	70p
7432	20p	74155	45p
7433	20p	74156	45p
7437	20p	74159	45p
7438	20p	74160	55p
7440	12p	74161	55p
7441	45p	74162	55p
7442	40p	74163	55p
7443	60p	74164	60p
7444	60p	74165	60p
7445	65p	74166	75p
7446	50p	74167	160p
7447	50p	74170	100p
7448	50p	74173	80p
7450	12p	74174	60p
7451	12p	74175	60p
7452	12p	74176	50p
7454	12p	74177	50p
7460	12p	74178	75p
7470	25p	74179	120p
7472	20p	74180	90p
7473	25p	74181	130p
7474	25p	74182	50p
7475	25p	74184	120p
7476	25p	74188	320p
7481	85p	74190	70p
7482	75p	74192	60p
7483	75p	74193	60p
7484	70p	74194	55p
7485	60p	74195	50p
7486	60p	74196	50p
7489	130p	74197	50p
7490	25p	74198	100p
7491	40p	74199	100p
7492	35p	74293	90p
7493	30p	7L500	18p
7494	40p	74S112	80p
7495	45p		
7496	45p		
7497	120p	7805	100p
74100	80p	7812	100p
74104	40p	7812	100p
74105	40p	7815	100p
74107	25p	7818	100p
74108	100p	7824	100p

POWER SUPPLY CAPACITORS			
2200/16	35p	4700/63	120p
2200/16	80p	4700/70	135p
2200/100	150p	10000/10	100p
3300/30	50p	10000/25	150p
3300/63	90p	15000/15	150p
4700/25	50p	22000/25	200p
4700/40	65p		

ENQUIRIES FOR ANY OTHER TYPES

CMOS			
4000	12p	4047	80p
4001	12p	4048	50p
4002	12p	4049	25p
4006	80p	4050	25p
4007	14p	4054	100p
4009	30p	4055	130p
4011	12p	4056	120p
4012	12p	4060	100p
4013	30p	4066	35p
4015	50p	4069	12p
4016	30p	4070	12p
4017	50p	4071	12p
4018	55p	4072	12p
4019	40p	4081	12p
4020	50p	4082	12p
4022	50p	4093	70p
4023	12p	4510	60p
4024	40p	4511	70p
4025	12p	4516	65p
4026	80p	4518	65p
4027	30p	4520	65p
4028	45p	4528	80p
4029	50p	4583	70p
4030	30p		
4032	80p		
4033	100p		
4040	60p		
4043	60p		
4046	90p		

FX1592
FERRITE RINGS
O/D 12mm, I/D 6mm
10 for 70p

TOGGLE SWITCHES
SUB MIN
Single Pole C.O. 85p
Single Pole C.O. Biased 85p

RESISTORS 1/3RDW
100 of 1 type £1.00p E12 only

LINEAR			
AY38500	450p	NE556	90p
CA3039	70p	NE562B	400p
CA3066	60p	SAD1024	1500p
CA3080	225p	SL917B	65p
CA3085	200p	SN76033N	150p
CA3076	250p	SN76013N	110p
CA3080	75p	SN76013ND	125p
CA3084	250p	SN76023N	110p
CA3085	85p	SN76023ND	125p
CA3086	60p	SN76033N	150p
CA3088	190p	SN76227N	160p
CA3088	160p	SN766228N	180p
CA3090A	360p	SN76662DN	75p
CA3123E	130p	TAA300	100p
CA3130	100p	TAA350	190p
CA3140	60p	TAA550	35p
LF357	80p	TAA570	220p
LM211H	250p	TAA700	350p
LM300T/RS	170p	TAA790	350p
LM301AN	30p	TAD100	150p
LM304	200p	TAD110	130p
LM307N	65p	TBA120S	60p
LM308T/OS	100p	TBA480Q	200p
LM309K	100p	TBA520Q	200p
LM310T/OS	150p	TBA530Q	200p
LM311T/OS	150p	TBA540	200p
LM317K	325p	TBA550Q	250p
LM324	70p	TBA560Q	250p
LM339	60p	TBA641A12	
LM348N	90p	TBA700	250p
LM380	60p	TBA720Q	225p
LM381N	90p	TBA750Q	200p
LM382	90p	TBA800	80p
LM391	180p	TBA810	100p
LM355	60p	TBA820	100p
LM709C	40p	TBA920Q	280p
LM710T/OS	65p	TCA270Q	220p
LM710DIL	60p	TCA270S	220p
LM723T/OS	40p	TCA760S	300p
LM723DIL	40p	TCA4500A	40p
LM733	120p	TDA1008	300p
LM741	20p	TDA1034	45p
LM748	40p	TDA2002	300p
LM1303N	100p	TDA2003	300p
LM1458	100p	TL084	120p
LM3080	75p	XR200	250p
LM3900	55p	XR2206	450p
LM3909N	65p	XR2207	450p
MC1310P	140p	XR2208	600p
MC1312P	150p	XR2216	650p
MC1314P	190p	XR2567	250p
MC1315P	230p	XR4136	150p
MK50398	650p	XR4202	150p
MM5314	380p	XR4212	150p
MM5316	480p	XR4739	150p
NE529K	15p	YN414	100p
NE555	25p	95H90	700p

ELEC CAPACITORS			
0.47/25	7p	47/10	8p
1/16	7p	47/16	8p
1/25	7p	47/25	8p
1/50	7p	47/35	8p
2/25	7p	47/50	8p
2/35	7p	100/10	8p
3/25	7p	100/16	8p
4/7/10	7p	100/25	8p
4/7/16	7p	100/50	8p
4/7/25	7p	100/63	8p
4/7/50	7p	220/16	12p
6/8/25	7p	220/25	14p
10/10	7p	220/50	22p
10/16	7p	330/25	17p
10/25	7p	330/35	18p
10/50	7p	330/50	20p
22/6V3	7p	470/10	14p
22/10	7p	470/25	19p
22/16	7p	470/35	22p
22/25	7p	470/50	24p
22/35	7p	1000/16	27p
22/50	7p	1000/25	30p
33/6V3	7p	1000/35	35p
33/16	7p	1000/40	40p
33/25	7p	1000/63	50p
33/40	7p	1200/63	60p
33/50	7p	2200/10	30p

POLY CAPS			
1000 PF	5p	0.1 uF	6p
2200	5p	0.22 uF	7p
3300	5p	0.33 uF	7p
4700	5p	0.47 uF	12p
6800	5p	1.0 uF	20p
0.01 uF	5p	2.2 uF	25p
0.022 uF	5p	4.7 uF	35p
0.033 uF	5p	6.8 uF	40p
0.047 uF	5p	10 uF	60p

TANT. BEADS			
0.1/35V	14p	3/16V	14p
0.15/35V	14p	4/7/16V	14p
0.22/35V	14p	4/7/25V	14p
0.33/35V	14p	4/7/35V	14p
0.47/10V	14p	6/8/5V3	14p
0.47/35V	14p	6/8/35V	14p
0.68/35V	14p	1.0/35V	14p
1.0/10V	14p	22/15V	21p
1.0/35V	14p	33/16	25p
1.5/35V	14p	47/3V	28p
2.2/25V	14p	47/16V	28p
2.2/35V	14p	100/3V	25p

SPECIAL OFFER
2000uF 35v 40p 100/£30

REED INSERTS One Price
26MM Long 10 for £1.00p
50MM Long 10 for £1.00p

TRANSISTORS			
AA113	10p	BC171	12p
AA217	30p	BC172	12p
AC121	30p	BC177	15p
AC126	20p	BC178	15p
AC127	20p	BC182	10p
AC127/01	25p	BC182L	12p
AC128	20p	BC183	10p
AC151	25p	BC183L	12p
AC153	30p	BC184	10p
AC153K	40p	BC185	10p
AC154	30p	BC204	12p
AC187	20p	BC205	12p
AC188	20p	BC207	12p
AC191	35p	BC212	11p
AC192	35p	BC212L	12p
AC193	35p	BC213	15p
AC194	50p	BC213L	15p
AC195	50p	BC214	15p
AC196	50p	BC214L	18p
AD130	150p	BC237	10p
AD143	150p	BC237B	15p
AD149	80p	BC294	30p
AD161	30p	BC300	25p
AD162	30p	BC301	25p
AD161/2MP	70p	BC303	30p
AF114	25p	BC307	15p
AF115	25p	BC317	15p
AF116	25p	BC318	12p
AF118	80p	BC323	30p
AF178	95p	BC328	18p
AF139	35p	BC337	20p
AF239	45p	BC338	18p
AF239	50p	BC348	20p
AU110	180p	BC461	35p
BA114	12p	BC516	35p
BA121	12p	BC517	35p
BA154	12p	BC547	12p
BA157	15p	BC548	12p
BA173	15p	BC548	12p
BAX13	5p	BC548C	14p
BAX16	5p	BC549B	13p
BAW21	20p	BC549C	14p
BB105	35p	BC557	15p
BB110	35p	BC557B	15p
BC107	10p	BC574	10p
BC108	10p	BCY38	10p
BC108C	15p	BCY42	25p
BC109	10p	BCY43	25p
BC109C	15p	BCY58	18p
BC113	12p	BCY59	25p
BC114	15p	BCY60	25p
BC115	15p	BCY71	20p
BC116	15p	BCY72	15p
BC117	18p	BD115	45p
BC118	12p	BD121	85p
BC119	25p	BD131	35p
BC125	16p	BD32	16p
BC125B	20p	BD133	45p
BC126	20p	BD135	45p
BC134	15p	BD136	35p
BC136	16p	BD137	40p
BC137	16p	BD139	40p
BC140	30p	BD140	40p
BC140	30p	BD144	160p
BC141	30p	BD181	100p
BC142	30p	BD182	100p
BC143	30p	BD188	130p
BC147	10p	BD207	70p
BC148	10p	BD220	65p
BC148C	14p	BD222	65p
BC149	10p	BD233	50p</

practical WIRELESS

JULY 1979
VOLUME 55
NUMBER 7
ISSUE 869

BRITAIN'S LEADING JOURNAL FOR THE RADIO & ELECTRONIC CONSTRUCTOR

Published by IPC Magazines Ltd., Westover House, West Quay Rd., POOLE, Dorset BH15 1JG

QUERIES

While we will always try to assist readers in difficulties with a *Practical Wireless* project, we cannot offer advice on modifications to our designs, nor on commercial radio, TV or electronic equipment. Please address your letters to the Editor, *Practical Wireless*, at the above address, giving a clear description of the problem and enclosing a stamped self-addressed envelope. Only one project per letter please.

Components are usually available from advertisers. A source will be suggested for difficult items.

SUBSCRIPTIONS

Subscriptions are available to both home and overseas addresses at £10.60 per annum, from "Practical Wireless" Subscription Department, Oakfield House, Perrymount Road, Haywards Heath, West Sussex RH16 3DH.

BACK NUMBERS AND BINDERS

Limited stocks of some recent issues of *PW* are available at 75p each, including post and packing to addresses at home and overseas.

Binders are available (Price £2.85 to UK addresses or £3.45 overseas, including post and packing) each accommodating one volume of *PW*. Please state year and volume number for which the binder is required.

Send your orders to Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF.

All prices include VAT where appropriate. Please make cheques, postal orders, etc., payable to IPC Magazines Limited.

COPYRIGHT

© IPC Magazines Limited 1979. Copyright in all drawings, photographs and articles published in *Practical Wireless* is fully protected and reproduction or imitation in whole or in part is expressly forbidden.

All reasonable precautions are taken by *Practical Wireless* to ensure that the advice and data given to readers are reliable. We cannot however guarantee it and we cannot accept legal responsibility for it. Prices are those current as we go to press.

NEWS & VIEWS

- 20 **Editorial**
Opinion
- 20 **PW Personality**
Charles Molloy
- 21, 31 **News . . . News . . . News . . .**
- 27 **Special Product Report**
Logic Probe kit, Continental Specialties Corporation
- 30 **RAE Reprint Announcement**
- 32 **Production Lines** Alan Martin
Information on the latest products
- 52 **Kindly Note**
PW "Imp" Beginners Receiver, May 1979
- 55 **Radio Special Product Report**
FRG-7 Communications Receiver, Yaesu Musen
- 61 **Hotlines** Ginsberg
Recent developments in electronics

FOR OUR CONSTRUCTORS

- 22 **AM/FM Frequency Readout** William Poel
Do away with mechanical tuning-scale drives
- 28 **Ideas Department**
Workbench Amplifier. Tachometer/Dwell Meter. TTL Snap Indicator
- 38 **Selective Sound Operated Switch** C. R. Harris
Control equipment with a hand-clap
- 44 **VMOS Top Band Transmitter** J. R. Green
A design for the 160m band, using power f.e.t.s
- 62 **Inexpensive AF Electronic Voltmeter** M. Tooley
A high-impedance, wide-band instrument

GENERAL INTEREST

- 34 **Numbers Without Tears** Dr G. Brown
An educational toy for children of 2½ years and upwards
- 50 **Changes in Broadcast-Band Listening on Short Waves**
A look at the international broadcasting scene Jonathan Marks
- 66 **On the Air**
Amateur Bands Eric Dowdeswell
MW Broadcast Bands Charles Molloy
SW Broadcast Bands Charles Molloy
VHF Bands Ron Ham
VHF Personality — John Tye Ron Ham

We regret that Part 2 of the PW "Trent" has had to be held over, due to production difficulties

OUR COVER
The object looking rather like a ventilation grille is in fact a much-enlarged view of the "works" of a power f.e.t. Photograph courtesy Siliconix Ltd.

Our August issue will be published on 6 July
(for details see page 43)

The latest kit innovation!

from Sparkrite

Sparkrite - was featured by Shaw Taylor in "DRIVE IN"



the quickest fitting
CLIP ON
capacitive discharge
electronic ignition
in KIT FORM

- Smoother running
- Instant all-weather starting
- Continual peak performance
- Longer coil/battery/plug life
- Improved acceleration/top speeds
- Optimum fuel consumption

Sparkrite X4 is a high performance, high quality capacitive discharge, electronic ignition system in kit form. Tried, tested, proven, reliable and complete. It can be assembled in two or three hours and fitted in 1-3 mins. Because of the superb design of the Sparkrite circuit it completely eliminates problems of the contact breaker. There is no misfire due to contact breaker bounce which is eliminated electronically by a pulse suppression circuit which prevents the unit firing if the points bounce open at high R.P.M. Contact breaker burn is eliminated by reducing the current to about 1/50th of the norm. It will perform equally well with new, old, or even badly pitted points and is not dependent upon the dwell time of the contact breakers for recharging the system. Sparkrite incorporates a short circuit protected inverter which eliminates the problems of SCR lock on and, therefore, eliminates the possibility of blowing the transistors or the SCR. (Most capacitive discharge ignitions are not completely foolproof in this respect.) The circuit incorporates a voltage regulated output for greatly improved cold starting. The circuit includes built in static timing light systems function light, and security changeover switch. All kits fit vehicles with coil distributor ignition up to 8 cylinders.

THE KIT COMPRISES EVERYTHING NEEDED

Die pressed epoxy coated case. Ready drilled, aluminium extruded base and heat sink, coil mounting clips, and accessories. Top quality 5 year guaranteed transformer and components, cables, connectors, P.C.B., nuts, bolts and silicon grease. Full instructions to assemble kit neg. or pos. earth and fully illustrated installation instructions.

NOTE: Vehicles with current impulse tachometers (Smiths code on dial RV1) will require a tachometer pulse slave unit. Price £3.85 inc. VAT post & packing.

Electronic Design Associates, 82 Bath Street, Walsall, WS1 30E U.K. only

Electronics Design Associates, Dept. PW7
82 Bath Street, Walsall, WS1 3DE. Phone: (9) 614791

Name

Address

Phone your order with Access or Barclaycard

Inc. VAT and P.P.

QUANTITY REQ'D

Send SAE if brochure only required

I enclose cheque PO's for

X4 KIT £16.65

TACHOPULSE SLAVE UNIT £3.85

£

Cheque No

Please state polarity pos. or neg. earth
Access or Barclaycard No

VALVES

A1065	1.40	EF80	0.45	PC900	1.40	U25	1.15	SB/255M	0.45	6J7	0.80	1963	0.75
AR8	0.70	EF83	1.70	PC984	0.75	U26	0.95	SB/258M	0.45	6J7G	0.80	1966	18.15
ARP3	0.70	EF84	2.25	PC989	0.85	U27	1.15	SR4GY	1.25	6K7	0.45	19H5	0.70
ATP4	0.60	EF86	0.85	PCF80	0.80	U281	0.80	5U4G	1.05	6K7G	0.85	20J1	0.70
812H	3.35	EF91	0.70	PCF82	0.45	U301	0.60	5Y4GT	0.75	6K8GT	0.75	21F2	1.15
CV31	0.60	EF92	1.00	PCF84	0.75	U801	0.90	5Y3GT	0.75	6L6M	1.05	20P1	0.45
DAF98	0.70	EF95	2.95	PCF86	0.75	UABC80	0.70	5Z4G	0.80	6L7G	0.75	20P3	1.25
DET22	21.95	EF98	1.40	PCF200	1.05	UAF42	0.85	5Z4GT	0.85	6L18	0.70	20P4	1.15
DF90	0.70	EF184		PCF201	1.05	UBF87	0.85	6D020	0.70	6D020	0.85	20P5	0.80
DK96	1.05	EF804		PCF801	1.05	UBF89	0.80	6A7	0.70	607G	0.85	25L6GT	0.70
DH76	0.90	EFL200		PCF802	0.75	UBL1	1.15	6AH6	0.80	6SA7	0.85	25Z4G	1.15
DL92	0.60	EH90		PCF805	2.05	UBL21	0.85	6AX5	0.85	6SG7	0.80	30C15	1.25
DY88/87	0.85	EL32		PCF806	0.85	UCC84	0.70	6AX8	0.45	6SJ7	0.80	30C17	1.15
DF02	0.65	EF34		PCF808	2.05	UCG35	0.80	6A5	0.45	6SJ7GT	0.70	30C18 see	
ES1	0.45	EL37		PCF200	0.90	UCF80	0.80	6ALSW	0.75	6SK7	0.85	30F805	1.15
E88 CC01	1.50	EL38	4.50	PCL81	0.70	UCH81	0.70	6AM5	1.80	6SL7GT	0.85	30F5	1.35
		EL41	0.90	PCL82	0.75	UCL82	0.85	6AM6	0.75	6SN7GT	0.85	30F12	1.35
		EL41	0.90	PCL84	0.80	UF41	1.00	6AN8	0.95	6S07	0.90	30F12	2.05
E180CC	1.50	EL81	1.20	PCL86	0.80	UF80	0.55	6AQ5	1.45	6V6GT	0.70	30FL14	1.15
E180E	0.75	EL82	0.70	PCL805/85	0.85	UL41	0.85	6AQ5W	0.95	6A4	0.85	30L15	1.15
E182CC	0.95	EL84	0.80			0.85	0.85	6AS6	0.90	6X5GT	1.10	30L17	1.15
EA76	2.25	EL86	1.05	PD500	3.85	UL84	0.85	6AT6	0.85	6Y6G	0.75	30P12	1.15
EABC80	0.60	EL90	1.45	PFL200	2.80	UM80	0.70	6AU6	0.45	6Z4	1.95	30P1L	1.25
EB91	0.45	EL91	1.80	PL36	0.90	UM84	0.45	6AV6	0.60	6-30L2	0.90	30P1L3	1.25
EB93	1.15	EL95	0.80	PL81	0.85	UY82	0.85	6AX40	0.90	787	0.90	30P1L4	1.15
EBF80	0.60	EL504	0.90	PL82	0.80	UY85	0.80	6B7	1.15	714	0.75	35L6GT	0.80
EBF83	0.80	EL802	0.80	PL83	0.80	VR105/30	2.05	6B6	0.60	10C2	0.70	50C5G	0.90
EBF89	0.60	EL822	5.05	PL84	0.75	VR150/30	1.40	6B7A	0.70	11E2	0.70	75C1	0.85
EC52	0.45	EM31	0.85	PL504	1.80	Z66	1.05	6B7B	2.70	12A6	0.55	76	0.85
ECC81	0.85	EM80	0.70	PL508	1.50	X61M	1.70	6BW6	3.10	12AT6	0.65	78	2.50
ECC82	0.80	EM81	0.70	PL509	3.65	Z800U	3.40	6BW7	1.15	12AT7	0.60	80	12.40
ECC83	0.85	EM84	0.45	PL802	3.15	Z801U	3.00	6C4	0.45	12AU7	0.80	65A2	0.75
ECC85	0.50	EM87	1.15	PLL80	3.40	Z900T	1.70	6C6	0.65	12AV6	0.80	73A2A	20.25
ECC86	1.60	EY51	0.55	PL33	0.70	1A3	0.70	6C8G	5.05	12AV6	0.80	80F5	0.80
ECC88	0.70	EY86/87	0.85	PY80	0.70	1L4	0.40	6CL6	1.70	12BA6	0.70	805	11.80
ECC189	0.80	EY88	0.85	PY81/800	0.85	1R5	0.65	6C5Y5	1.00	12BE6	0.70	807	12.40
ECF80	0.60	EZ80	0.55	PY82	0.55	1S4	0.45	6D6	0.85	12BM7	0.65	813	5.05
ECF81	0.90	GYS01	1.05	PY83	0.60	1S5	0.45	6E8A	0.90	12C8	0.80	829B	3.15
ECH34	1.15	G232	0.75	PY88	0.75	1T4	0.45	6F6G8	0.85	12E1	0.85	832A	0.75
ECH35	1.70	G233	3.95	PY80	0.70	1A3	0.70	6F86	0.75	12J5GT	0.70	866A	0.60
ECH42	0.95	G234	2.25	PY85	1.50	1U4	0.70	6F12	1.25	6F12	0.90	12K7GT	0.80
ECH43	0.55	G237	2.80	PY859	6.45	1X2B	1.25	6F14	0.70	12K8GT	0.80	931A	0.55
ECH84	1.15	KT66	5.85	PY801	0.70	2021	0.65	6F14	0.70	12K8GT	0.80	954	0.80
ECL80	0.70	KT88	6.45	QDV03-10	2.80	2K25	12.40	6F15	1.15	12Q7GT	0.85	955	1.00
ECL82	0.65	MH4	1.15	QDV03-12	2.80	2X2	0.90	6F17	1.00	12SC7	0.80	956	1.15
ECL83	1.40	ML6	1.15	WV0V6-40A	3.84	0.70	6F24	4.75	12SH7	0.65	957	0.80	
ECL85	0.75	D4	0.85	PS500	1.50	1U4	0.70	6F86	0.75	12SJ6T	0.70	866A	0.60
ECL86	0.85	D82	0.70	QV03-12	2.80	3021	22.50	6H6	1.95	12S07	0.45	1629	2.80
EF37A	1.70	PABC80	0.60	SC1400	4.50	3E29	6.20	6J4WA	0.85	12Y4	0.70	2051	3.35
EF39	3.30	PC85	0.80	SC1600	4.50	3S4	0.60	6J5	0.85	12D6	1.15	5763	3.40
EF40	0.80	PC86	0.95	SP61	0.95	3V4	0.95	6J5GT	0.80	14S7	0.85	5842	0.95
EF41	0.85	PC88	0.85	TT21	11.80	5B/254M	0.45	6J6	0.85	19A05	11.25	5933	0.95

VAT. INCLUDED

POSTAGE: £1-£2 20p; £2-£3 30p; £3-£5 40p; £5-£10 60p; over £10 free. minimum order £1.
A lot of these valves are imported and prices vary for each delivery, so we reserve the right to change prices for new stock when available.

VALVES AND TRANSISTORS

Telephone enquiries for valves, transistors, etc.; retail 749 3934, trade and export 743 0899.

COLOMOR 907353/
(ELECTRONICS) LTD. London
170 Goldhawk Rd., London W.12
Tel. 01-743 0899
Open Monday to Friday
9-12.30, 1.30-5.30 p.m.

Now, complete your system!



Citronic MM313 Mixer

Ideal for the DIY enthusiast looking up a complete disco system 4 in 6 ch mono inc. LED indicators, connections via phono sockets at rear. Bargain price, including PSU EB4 24

The ultimate range of speakers

We carry a good selection of high quality chassis for the DIY speaker constructor 12" or 15" Bass speakers and Dual Concentrics Exponential horns from £13.77, or our fabulous Piezo Horns which handle a 5K-20K frequency range in any PA system up to 100W (No X over required) and cost only £6.18 each



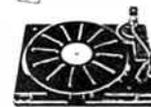
Projectors

Come and see our specially selected projectors from £22.12 (Square Multi-flet 150) to £94.50 (Tutor 11E) plus the widest array of projector attachment and effects that you'll ever see on continuous demonstration



Ropelights

Great effect at discos. 7 metres long. Multiway connectors 4 channel £43.20 (inc. pack of spare bulbs)

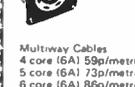


Turntables

Our unsurpassed Disco experience has enabled us to select the best turntables for your requirements. For example the new BSR P200 belt drive ONLY £28.12

Bulgin Octal plugs and sockets

There's always hundreds of Bulgin Octal multiway plugs and sockets in stock at Roger Squire's. Each pin rated 6A. Perfect for your Sound to Light System. P552 SOCKET £0.65 P551 PLUG £1.94



Many disco accessories

All Roger Squire's shops have a service department which carries large stocks of DISCO SPARES & ACCESSORIES

PERSONAL CALLERS ONLY

Roger Squire's
DISCO CENTRES
Tel: 01-272 7474

LONDON 176 Juno Iron Road, N19 5QW's Telford Park Tube Station. 1 mile from end of M32
BRISTOL 125 Church Road, Redditch (Near St. George's 1 mile from City Centre) Tel: 061 831 7676
MANCHESTER 251 Deansgate 3, 15 mins from City Centre Tel: 061 272 55050
GLASGOW 1 Queen Margaret Road (off Great Margaret Drive) Kelvinside 20, just behind the BBC. Tel: 041 846 3303

RADIO EXCHANGE LIMITED

NEW ELECTRONIC MASTER KIT



With special V.H.F. Tuner Module to construct. A completely Solderless Electronic Construction Kit, with ready drilled Bakelite Panels, Nuts, Bolts, Wood Screws, etc. Also in the kit: Transistors, Capacitors, Resistors, Pots, Switches, Wire, Sleeving, Knobs, Dials, 5" x 3" Loudspeaker and Speaker Case, Crystal Earpiece, etc. Also ready wound Coils and Ferrite Rod Aerial. These are the Projects you can build with the components supplied with the kit, together with comprehensive Instruction Manual Pictorial and Circuit Diagrams.

Projects:
 V.H.F. Tuner Module ★ A.M. Tuner Module ★ M.W. L.W. Diode Radio ★ Six Transistor V.H.F. Earpiece Radio ★ One Transistor M.W. L.W. Radio ★ Two Transistor Metronome with variable beat control ★ Three Transistor and Diode Radio M.W. L.W. ★ Four Transistor Push Pull Amplifier ★ Eight Transistor V.H.F. Loudspeaker Receiver ★ Variable A.F. Oscillator ★ Jiffy MultiTester ★ Four Transistor and Diode M.W. L.W. Radio ★ A.F. R.F. Signal Injector ★ Five Transistor Push Pull Amplifier ★ Sensitive Hearing Aid Amplifier ★ Three Transistor and Diode Short Wave Radio ★ Signal Tracer ★ Three Transistor Push Pull Amplifier ★ One Transistor Class A Output Stage to drive Loudspeaker ★ Sensitive Transistor Pre-Amp ★ Transistor Tester ★ Sensitive Three Transistor Regenerative Radio ★ Four Transistor M.W. L.W. and Diode Tuner ★ Five Transistor M.W. L.W. Trawler Band Regenerative Radio ★ Five Transistor V.H.F. Tuner ★ Three Transistor Code Practice Oscillator ★ Five Transistor Regenerative Short Wave Radio ★ Four Transistor and two Diodes M.W. L.W. Loudspeaker Radio ★ Seven Transistor M.W. L.W. Radio with Loudspeaker Push Pull output ★ One Transistor Home Broadcaster.

£14.99 + P & P £1.10

V.H.F. AIR CONVERTER KIT

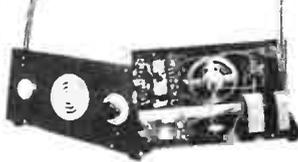


Build this converter kit and receive the aircraft band by placing it by the side of a radio tuned to medium wave or the VHF band and operating as shown in the instructions supplied free with all parts.

Uses a retractable chrome-plated telescopic aerial, gain control, V.H.F. tuning capacitor, transistor, etc. Size 5½" x 1½" x 3¼". All parts including case and plans.

£4.95 + P & P and Ins. 60p

ELECTRONIC CONSTRUCTION KIT E.C.K. 2



Self Contained Multi-Band V.H.F. Receiver Kit.

8 transistors and 3 diodes. Push pull output. 2½ in. loudspeaker, gain control, 7 section chrome-plated telescopic aerial, V.H.F. tuning capacitor, resistors, capacitors, transistors, etc. Will receive T.V. sound, public service band, aircraft, V.H.F. local stations, etc. Operates from a 9 volt P.P.7 battery (not supplied with kit).

Complete kit of parts

£7.95 + P & P and Ins. 90p

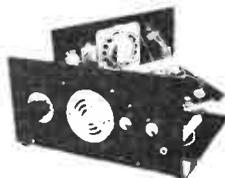
NEW MODEL R.K.1.



MultiBand A.M. Receiver. M.W.L.W. Trawler Band and Three Short Wave Bands. Seven Transistors and Four Diodes. Push Pull Output stage. 5" x 3" Loudspeaker. Internal Ferrite Rod Aerial. Kit includes all parts to build it up including Carrying Strap, Rubber Feet and ready-drilled Panels. Comprehensive Instruction Manual for stage by stage construction. Uses P.P.9 Nine Volt Battery.

£8.99 + P & P 90p

EDU-KIT JUNIOR



Completely Solderless Electronic Construction Kit. Build these projects without Soldering Iron or Solder

- ★ Crystal Radio Medium Wave Coverage—No Battery necessary
- ★ One Transistor Radio
- ★ 2 Transistor Regenerative Radio
- ★ 3 Transistor Earpiece Radio Medium Wave Coverage
- ★ 4 Transistor Medium Wave Loudspeaker Radio
- ★ Electronic Noise Generator
- ★ Electronic Metronome
- ★ 4 Transistor Push/Pull Amplifier

All parts including Loudspeaker, Earpiece, M.W. Ferrite Rod Aerial, Capacitors, Resistors, Transistors, etc. Complete kit of parts including construction plans.

£6.95 + P & P and Ins. 90p

NEW ROAMER TEN MODEL R.K.3.



Multiband V.H.F. and A.M. Receiver. 13 Transistors and Six Diodes. Quality Loudspeaker

With Multiband V.H.F. section covering Mobiles, Aircraft, T.V. Sound, Public Service Band, Local V.H.F. Stations, etc. and Multiband A.M. section with separate Tuning Capacitor for easier and accurate tuning, covering M.W.1, M.W.2, L.W. Three Short Wave Bands S.W.1, S.W.2, S.W.3 and Trawler Band. Built-in Ferrite Rod Aerial for Medium Wave, Long Wave and Trawler Band, etc., Chrome-plated 7 section Telescopic Aerial, angled and rotatable for peak Short Wave and V.H.F. reception. Push-Pull output using 600mW Transistors. Gain, Wave-Change and Tone Controls. Plus two Slider Switches. Powered by P.P.9-9 volt Battery.

Complete kit of parts including carrying strap. Building Instructions and operating Manuals.

£14.79 + P & P £1.10

E.V.6 PLUS ONE

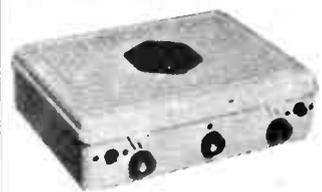


Build this exciting new design. Now with 7 Transistors and 4 diodes. MW/LW. Powered by 9V battery. Ferrite rod aerial, tuning condenser, volume control, and 2½ in. loudspeaker. Attractive case with speaker grille. Size 9 in. x 5½ in. x 2½ in. approx. All parts including Case and Plans.

Total Building Costs:

£6.95 + P & P and Ins. 90p

EDU-KIT MAJOR



Completely solderless Electronic Construction Kit. Build fifteen projects including:—
 ● Signal Injector ● Transistor Tester NPN-PNP ● 7 Transistor Loudspeaker Radio MW/LW ● 5 Transistor Short Wave Radio.

Components include:

- 24 Resistors ● 21 Capacitors
 - 10 Transistors ● 5" x 3" Loudspeaker ● Earpiece ● Mica Base-board ● 3 12-way Connectors
 - 2 Volume Controls ● 2 Slider Switches ● 1 Tuning Condenser
 - 3 Knobs ● Ready Wound MW/LW/SW Coils ● Ferrite Rod ● 6½ yards of wire ● 1 yard of sleeving, etc.
- Complete kit of parts including construction plans.

Total building costs:

£9.99 + P & P and Ins. £1.10

RADIO CONSTRUCTION KIT Q7



A compact small radio kit covering Medium Wave and Long Wave bands. Rugged Micanite construction and simple square design allows for easy carrying and positioning. Ideal for the Garage, Workroom, Kitchen, etc., has seven Transistors and four Diodes, quality Loudspeaker, ready wound Ferrite Rod Aerial and Carrying Strap. Size 4½" x 4½" x 4½". All parts and plans excluding 9v PP7 Battery.

£6.25 + P & P and Ins. 75p

POCKET FIVE



NOW WITH 2½" LOUDSPEAKER 3 Tuneable wavebands. M.W., L.W., and Trawler Band, 7 stages, 5 transistors and 2 diodes, supersensitive ferrite rod aerial, attractive black and gold case. Size 5½" x 1½" x 3½" approx. All Parts including Case and Plans.

Total Building Costs

£4.95 + P & P and Ins. 80p

To: RADIO EXCHANGE LTD

61A High Street, Bedford MK40 ISA

Tel.: 0234 52367

- Callers side entrance "Lavelis" Shop.
- Open 10-1, 2.30-4.30 Mon.-Fri. 9-12 Sat.

Reg. No. 788372

I enclose £..... for.....

Name

Address

PW779

U.K. RETURN OF POST MAIL-ORDER SERVICE ALSO WORLD WIDE EXPORT SERVICE

R.C.S. LOUDSPEAKER BARGAINS

3 ohm. 6 x 4in. £1-50. 7 x 4in. £1-50. 8 x 5in. £2-50. 5in. £1-50.
6 1/2in. £1-80. 8in. £2-60. 10in. £3. 12in. £4.
8 ohm. 2 1/2in. £1-50. 3in. £1-50. 5in. £1-50. 10in. £3. 12in. £4.
16 ohm. 6 x 4in. £1-50. 7 x 4in. £1-50. 5in. £1-50. 8in. £2-60.
10in. £3. 12in. £4. 10 x 6in. £3-50.

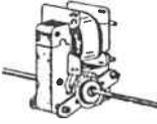
THE "INSTANT" BULK TAPE ERASER
Suitable for cassettes, and all sizes of tape reels.
A.C. mains 200/249V.
Leaflet S.A.E. **£5-50** Post 50p



HEAD DEMAGNETISER PROBE £4-75

A.C. ELECTRIC MOTORS

2 Pole, 240V, .2 Amp. Spindle — 1.43 x 0.212in. £1-75. 2 pole, 240V, .15 Amp. Double spindle — 1.75 x 0.16in. Each £1-50. 2 Pole, 120V, .5 Amp. Spindle — 0.75 x 0.2in. Two in series = 240V. 75p each. Brush Motor. From a Food Mixer 240V, .3 Amp. High Speed and Powerful. Spindle — 0.5 x 0.25in. £2-95 Post 50p each.



BLANK ALUMINIUM CHASSIS, 18 s.w.g. 2 1/2in. sides, 6 x 4in. 95p; 8 x 6in. £1-40; 10 x 7in. £1-55; 14 x 9in. £1-90; 16 x 6in. £1-85; 12 x 3in. £1-20; 16 x 10in. £2-20; 12 x 8in. £1-70.

ALUMINIUM PANELS, 18 s.w.g. 6 x 4in. 24p; 8 x 6in. 38p; 10 x 7in. 54p; 12 x 5in. 44p; 12 x 8in. 70p; 16 x 6in. 70p; 14 x 9in. 94p; 12 x 12in. £1; 16 x 10in. £1-16.

ALUMINIUM ANGLE BRACKET 6 x 1/2 x 1/2in. 20p.

ALUMINIUM BOXES, MANY SIZES IN STOCK
4 x 2 x 2in. 80p; 3 x 2 x 1in. 60p; 6 x 4 x 2in. £1; 8 x 6 x 3in. £1-90; 12 x 5 x 3in. £2; 6 x 4 x 4in. £1-30. 10 x 7 x 3in. £2-20.

DE LUXE BSR HI-FI AUTOCHANGER

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 13 1/2 x 11 1/2in. Above motor board 3 1/2in. Below motor board 2 1/2in.



£18 Post on All Decks £1.

With **CERAMIC STEREO CARTRIDGE**

Garrard 2025 Autochanger with ceramic cartridge. **£14-95**

Garrard Minichanger. Plays all size records. Ceramic cartridge. Stereo. **£8-95**

BSR. P182. Snake arm, flared Aluminium Turntable Stereo ceramic cartridge. Latest model. **£22-50**

BSR. Disco Single Player Cueing Device 1 in. Turntable. Budget price **£19-50**

RSC Disco Deck 3 speed Stereo **£8 or £15 pair**

BAKER 50 WATT AMPLIFIER £59



Post £1

Superior quality ideal for Halls/PA systems, Disco's and Groups. Two inputs with Mixer Volume Controls. Master Bass, Treble and Gain Controls. 150 watts RMS. Three loudspeaker outlets 4, 8, 16 ohm. AC 240V (120V available). Blue wording on black cabinet.

BAKER 150 Watt AMPLIFIER 4 inputs £79.

DRILL SPEED CONTROLLER/LIGHT DIMMER KIT. Easy to build kit. Controls up to 480 watts AC mains. Post 35p **£3-25**

STEREO PRE-AMP KIT. All parts to build this pre-amp. 3 inputs for high medium or low gain per channel, with volume control and P.C. Board. Can be ganged to make multi-way stereo mixers. Post 35p **£2-95**

R.C.S. SOUND TO LIGHT DISPLAY MK 2

Complete kit of parts with R.C.S. printed circuit. Three channels. Upto 1,000 watts each. Will operate from 200MV to 100 watts signal source. Suitable for home Hi-Fi and all Disco Amplifiers. Cabinet extra £4. **£17**

200 Watt Rear Reflecting White Light Bulbs. Ideal for Disco Lights. Edison Screw 75p each or 6 for £4, or 12 for £7-50.

MAINS TRANSFORMERS

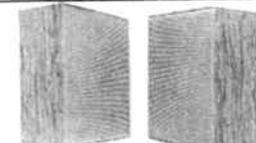
6 VOLT 1/2 AMP. £1-00 3 AMP. £1-95 9 VOLT 3 AMP. £2-75
12 VOLT 300 MA. £1-00 750 MA. £1-30 20 VOLT 2 AMP. £2-50
30 VOLT 5 AMP. AND 34 VOLT 2 AMP. C.T. £3-45
20 VOLT 1 AMP. £2-00 20-0-20 VOLT 1 AMP. £2-95
30 VOLT 1 1/2 AMP. £2-75 40 VOLT 2 AMP. £2-95 30V 2 AMP. £3
0-20-40-60 VOLT 1 AMP. £3-50 2 x 18 VOLT 6 AMP. £9.
Low Voltage 0-8-12V. 2 AMP. £3.
Low Voltage 12-0-12V. 2 AMP. £3.

GENERAL PURPOSE LOW VOLTAGE Voltages available at
2A, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30V **£5-80**
1A, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 **£5-80**
2A, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 **£8-50**
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. TEAK COMPACT SPEAKERS

13 x 10 x 6in.
50 to 14,000 cps.
10 watts. 4 or 8 ohms.

£16 pair Post £1-50



BAKER SPEAKERS "BIG SOUND"

Robustly constructed to stand up to long periods of electronic power. Useful response 30-13,000 cps. Bass resonance 55 cps.

GROUP "35" **£14-00**
12in. 40 watt
4, 8 or 16 ohms.

GROUP "50/12" **£21-00**
12in. 60 watt professional model. 4, 8 or 16 ohms.
Response 30 — 16,000 cps.
With aluminium presence dome.

GROUP "50/15" **£33-00**
15in. 75 watt
8 or 16 ohms.

Send for leaflets on Disco, P.A. and Group Gear.



E.M.J. 13 1/2 x 8in SPEAKER SALE!

With tweeter. And crossover.

10W. State 3 or 8 ohm.

Illustrated

15W model

8 ohms Bass unit only.

GOODMANS 20 Watt Woofer

Size 12 x 10in. 4 ohms.

Rubber cone surround.

Hi-Fi Bass unit.

GOODMANS TWIN AXIOM 8

8in. 8 ohm Hi-Fi Twin Cone

Special unit

£8-95 Post 45p

£10-50 Post 65p

£9-95 Post 65p

£9-95 Post 50p



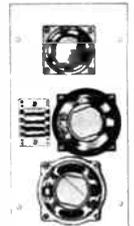
R.C.S. MINI MODULE HI-FI KIT 15 x 8 1/2in 3-way Loudspeaker System, EMI 5in, Bass 5in, Middle 3in. Tweeter with 3-way Crossover and Ready Cut Baffle. Full assembly instructions supplied.

Response = 60 to 20,000cps

12 watt RMS. 8 ohm.

£10.95 per kit. Two kits £20.

Postage 75p. One or two kits.



RADIO COMPONENT SPECIALISTS 337 WHITEHORSE ROAD, CROYDON

Minimum post 30p. Components List 20p. Phone orders. Access & Barclay VISA only. Open 9—6 Sat. 9—5 (Closed all day Wednesday) Tel. 01-684 1665

MAIL ORDER DEPT.

CRESCENT RADIO LTD

1 ST. MICHAELS TERRACE, WOOD GREEN,
LONDON N22 4SJ. 01-888 3206



"FLIP" PUSH BUTTON HEADS OR TAILS

Complete kit and full instructions supplied. A pocket game, easy to build and great to play. **KIT PRICE = £5-25 + 8% VAT. Post free.**

75 OHM

2 1/2" (57mm) LOUDSPEAKER BARGAIN
This ever popular many project loudspeaker. Only while stocks last 90p + 12 1/2% each.

REAR SHELF CAR SPEAKERS

5W 8 ohm good quality car stereo loudspeakers. Still only **£3-75 + 12 1/2% per pair.**

HEAVY DUTY XOVER 2 WAY 8 OHM

A 2 way 8 ohm H/D Xover suitable for US systems up to 100 watt. Fitted with screw terminals for input and a three position 'HF LEVEL' switch which selects either Flat, -3dB or -6dB. **ONLY £3-00 + 8% VAT**

A CRESCENT 'SUPERBU' Goodmans 5" 8 ohm long throw H/D loudspeaker.

Mounting plate is integral with US chassis and has fixing holes with centres spaced at 5 1/2" (diagonally). **ONLY £5-00 + 12 1/2% VAT**

CR. 3000. SCREWDRIVER SET

£1-75p. + 8% VAT
In neat plastic case. Consists of: awl, jewellers screwdriver, watchmaker's screwdriver, radio screwdriver, phillips screwdriver. All fit into master swivelling handle.

CR. 4110. DESOLDERING PUMP

ONLY £6 + 8% VAT
High suction pump with automatic ejection. Knurled, anti corrosive casing. Teflon nozzle.

CR. LV1. 12v DRILL

£12-00p. + 8% VAT
BRITISH MADE "Versadrill". 12 volts DC. Compact battery operated power tool, sufficiently powerful to perform all the operations associated with 240V drills. Dimensions:- 150 x 50mm (dia.)

C.180-'KEYNECTOR' MAINS CONNECTOR

Essential equipment for the showroom, workshop, factory, laboratory, home and hobby bench, the 'Keynector' provides quick, efficient and safe temporary mains connection. **£6-25 + 8% VAT**

FOOTSWITCH C.338

250v, 5 amp. Non-slip base. Lead with 2.5mm plug. Body dims:- 88 x 66 x 25mm. **£3-75 + 8% VAT**



P & P. Orders up to £5, add 30p. Orders £5-£10, add 50p. All orders over £10 post free! Please add V.A.T. as shown. S.A.E. with all enquiries please.



Personal callers welcome at: 21 Green Lanes, Palmers Green N13. Also 13 South Mall, Edmonton Green, Edmonton.

PRACTICAL WIRELESS T.V. SOUND TUNER

(Nov. 75 article by A. C. Alnalle)

Copy of original article supplied on request

IF Sub-Assembly (G8) **£7-65**. P&P 75p.

Mullard ELC1043 V'cap UHF Tuner **£6-19**. P&P 35p.

3-way Station Control Unit **£1-35**. P&P 25p.

6-way Station Control Unit (Special Offer) **£1-12**.

Power Supply Prtd Circuit Board **£1-12**. P&P 30p.

Res, Caps, Semiconds, etc. for above **£6-53**.

Mains Transformer for above **£2-81**. P&P 30p.

(Price of goods includes 12 1/2% VAT) P&P all items 85p.

Callers welcome at shop premises.

MANOR SUPPLIES

172 WEST END LANE, LONDON NW6

(Near W. Hampstead Tube Stn.) Tel. 01-794 8751



Model 146
VERY LOW DISTORTION (.0015%) AUDIO SIG. GENERATOR

Based on J. Linsley Hood design (W.W.) **£36-00**

(Kit. £31-00) + tax 8%

Low cost version, AO113 (.02% dist.) £27-50 (Kit. £23). Other instruments include Millivoltmeter, Tachometer, Noise level meter, Distortion Analyser, F.M. Sig. Gen. Crystal Frequency Standard, KEF Speaker Units. Send S.A.E. for lists. VAT extra 8%. Post/Pkg. £1-50.

TELERADIO ELECTRONICS

325 Fore Street, Edmonton N.9. 01-807 3719

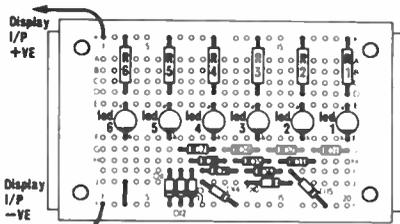
Closed all day Thursday

THREE FOR FREE FROM CSC

ELECTRONICS BY NUMBERS
FREE PROJECTS
 No 1, No 2,
 & No 3.

ELECTRONICS BY NUMBERS LED BAR GRAPH UNIVERSAL INDICATOR

Now using **EXPERIMENTOR BREADBOARDS** and following the instructions in "Electronics by numbers" **ANYBODY** can build electronic projects. Look at the diagram and select R1, this is a resistor with a value between 120 to 270 ohm. Plug it into holes X20 and D20, now take LED 1 and plug it into holes E20 and F20. Do the same with the Diodes e.g. plug D7 into holes G7 and G10.



YOU WILL NEED

EXP. ANY EXPERIMENTOR BREADBOARD
 D1 to D15 – Silicon Diodes (such as 1N914)
 R1 to R6 – From 120-270 ohm resistors ¼ watt.
 LED1 to LED6 – Light emitting diodes.

LED BAR GRAPHS are replacing analogue meters as voltage-level indicators in many instances.

This circuit uses the forward voltage drop of diodes to determine how many LEDs light up. Any type of diode can be used but you must use all the same type. For full working details of this circuit fill in the coupon. If you have already built the Two-transistor Radio and the Fish'n'cliks projects you will find that you can reuse the components from these projects to build other projects in the series.

FILL IN THE COUPON AND WE WILL SEND YOU FREE OF CHARGE FULL COPIES OF "ELECTRONICS BY NUMBERS" PROJECTS No 1, No 2 and No 3.

PROTO-CLIP TEST CLIPS.

Brings IC leads up from crowded PC boards. Available plain or with cable with clips at one or both ends.

- PC – 16 pin. £2.75.
- PC – 16 pin with cable. £6.00.
- PC – 16 with cable and 16 pin clips at both ends. £10.25.



Europe, Africa, Mid-East: CSC UK LTD.
 Unit 1, Shire Hill Industrial Estate,
 Saffron Walden, Essex CB11 3AQ.
 Telephone: SAFFRON WALDEN 21682.
 Telex: 817477.

EXPERIMENTOR BREADBOARDS.

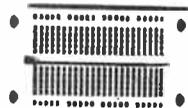
No soldering modular breadboards, simply plug components in and out of letter number identified nickel-silver contact holes. Start small and simply snap-lock boards together to build breadboard of any size.

All EXP Breadboards have two bus-bars as an integral part of the board, if you need more than 2 buses simply snap on 4 more bus-bars with the aid of an EXP.4B.

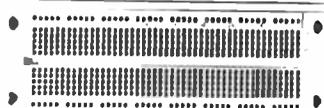
EXP.325. The ideal breadboard for 1 chip circuits. Accepts 8,14,16 and up to 22 pin IC's. **ONLY £1.60.**



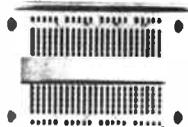
EXP.350. £3.15. 270 contact points with two 20-point bus-bars.



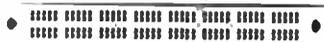
EXP. 300. 550 contacts with two 40-point bus-bars. **£5.75.**



EXP. 650 for Micro-processors. **£3.60.**



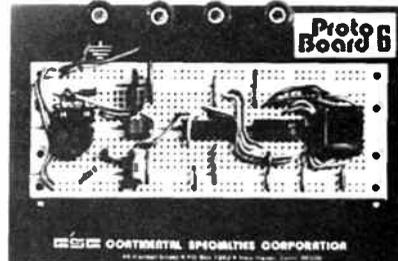
EXP 4B. More bus-bars. **£2.30.**



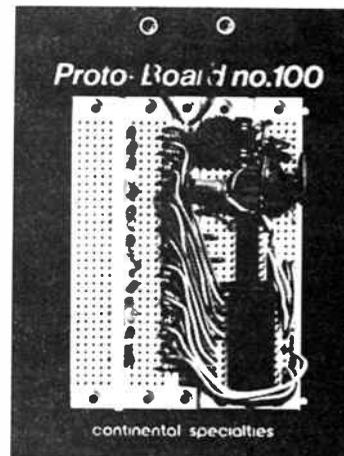
ALL EXP.300 Breadboards mix and match with 600 series.

PROTO-BOARDS.

THE ULTIMATE IN BREADBOARDS FOR THE MINIMUM COST. TWO EASILY ASSEMBLED KITS.



PB.6 Kit, 630 contacts, four 5-way binding posts accepts up to six 14-pin Dips. **PROTO-BOARD 6 KIT. £9.20.**



PB.100 Kit complete with 760 contacts accepts up to ten 14-pin Dips, with two binding posts and sturdy base. Large capacity with Kit economy. **PROTO-BOARD 100 KIT £11.80.**

HOW TO ORDER AND RECEIVE FREE COPY OF TWO-TRANSISTOR RADIO PROJECT, FISH'N'CLIKS AND LED BAR GRAPH.

CSC UK LTD. Unit 1, Shire Hill Industrial Estate, Saffron Walden, Essex CB11 3AQ.

It's easy. Give us your name and full postal address, in block capitals. Enclose cheque, postal order or credit card number and expiry date. OR telephone 0799 21682 and give us your Access, American Express or Barclaycard number and your order will be in the post that night.

EXPERIMENTOR BREADBOARDS.	CONTACT HOLES.	IC CAPACITY 14 PIN.DIP.	UNIT PRICE INCLUDING POSTAGE AND V.A.T.
EXP. 325	130	1	£ 2.53
EXP. 350	270	3	£ 4.21
EXP. 300	550	6	£ 7.29
EXP. 650	270	use with 0.6 pitch Dip's Bus-Bar Strip	£ 4.69
EXP. 4B.	Four 40 Point Bus-Bars		£ 3.29
TEST CLIPS			
PC. 16.			£ 3.78
PC.16-1B.			£ 7.56
PC. 16-1B Dual Clip			£12.15
PROTO-BOARDS.			
PB. 6.	630	6	£11.01
PB. 100.	760	10	£13.82

NAME

ADDRESS

DEPT. 6T

FILL IN COUPON & RECEIVE FREE COPY OF ELECTRONICS BY NUMBERS PROJECTS Nos 1, 2 AND 3

CHROMASONIC electronics

your soundest connection in the world of components

Dept PW1, 56 FORTIS GREEN ROAD, MUSWELL HILL, LONDON, N10 3HN

TELEPHONE: 01-883 3705

The items shown in this advert are just a small selection taken from our new 78/79 Catalogue which is now available. It contains everything from Resistors to the latest in Micro-processors. Don't delay order your copy today. The price is only 40p (inc. 45p vouchers).

Low Power Schottky and TTL

CMOS

I.C. cookbooks

BITS and PIECES

Regulators

Linear I.C.'s

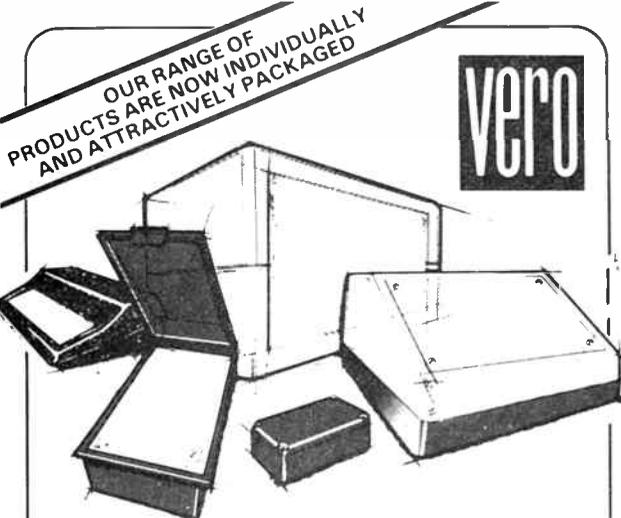
<table border="1"> <tr><th>N</th><th>LS</th><th>N</th><th>LS</th></tr> <tr><td>7400.13*</td><td>19*</td><td>7449</td><td>87*</td></tr> <tr><td>7401.13*</td><td>19*</td><td>7450</td><td>16*</td></tr> <tr><td>7402.15*</td><td>19*</td><td>7451</td><td>16*</td></tr> <tr><td>7403.15*</td><td>19*</td><td>7452</td><td>16*</td></tr> <tr><td>7404.16*</td><td>21*</td><td>7454</td><td>16*</td></tr> <tr><td>7405.16*</td><td>21*</td><td>7455</td><td>16*</td></tr> <tr><td>7406.28*</td><td>—</td><td>7460</td><td>16*</td></tr> <tr><td>7407.26*</td><td>—</td><td>7470</td><td>23*</td></tr> <tr><td>7408.17*</td><td>19*</td><td>7472</td><td>23*</td></tr> <tr><td>7409.17*</td><td>19*</td><td>7473</td><td>28*</td></tr> <tr><td>7410.15*</td><td>19*</td><td>7474</td><td>28*</td></tr> <tr><td>7411.25*</td><td>19*</td><td>7475</td><td>44*</td></tr> <tr><td>7412.18*</td><td>19*</td><td>7476</td><td>30*</td></tr> <tr><td>7413.21*</td><td>40*</td><td>7478</td><td>—</td></tr> <tr><td>7414.71*</td><td>79*</td><td>7482</td><td>73*</td></tr> <tr><td>7415</td><td>—</td><td>7483</td><td>—</td></tr> <tr><td>7416.25*</td><td>—</td><td>7485</td><td>118*</td></tr> <tr><td>7417.34*</td><td>—</td><td>7486</td><td>25*</td></tr> <tr><td>7420.16*</td><td>19*</td><td>7489</td><td>2.80*</td></tr> <tr><td>7421</td><td>—</td><td>7490</td><td>34*</td></tr> <tr><td>7422</td><td>—</td><td>7491</td><td>73*</td></tr> <tr><td>7423.25*</td><td>—</td><td>7492</td><td>46*</td></tr> <tr><td>7425.25*</td><td>—</td><td>7493</td><td>34*</td></tr> <tr><td>7426.25*</td><td>19*</td><td>7495</td><td>54*</td></tr> <tr><td>7427.39*</td><td>19*</td><td>7496</td><td>67*</td></tr> <tr><td>7428.38*</td><td>19*</td><td>74107</td><td>21*</td></tr> <tr><td>7430.16*</td><td>19*</td><td>74108</td><td>44*</td></tr> <tr><td>7432.25*</td><td>25*</td><td>74112</td><td>—</td></tr> <tr><td>7433</td><td>—</td><td>74113</td><td>—</td></tr> <tr><td>7437.25*</td><td>25*</td><td>74114</td><td>—</td></tr> <tr><td>7438.25*</td><td>25*</td><td>74121</td><td>27*</td></tr> <tr><td>7440.17*</td><td>19*</td><td>74122</td><td>50*</td></tr> <tr><td>7441.70*</td><td>—</td><td>74123</td><td>60*</td></tr> <tr><td>7442.50*</td><td>55*</td><td>74124</td><td>—</td></tr> <tr><td>7445.60*</td><td>—</td><td>74125</td><td>51*</td></tr> <tr><td>7446.60*</td><td>—</td><td>74126</td><td>51*</td></tr> <tr><td>7447.60*</td><td>87*</td><td>74132</td><td>72*</td></tr> <tr><td>7448.60*</td><td>87*</td><td>74133</td><td>—</td></tr> </table>				N	LS	N	LS	7400.13*	19*	7449	87*	7401.13*	19*	7450	16*	7402.15*	19*	7451	16*	7403.15*	19*	7452	16*	7404.16*	21*	7454	16*	7405.16*	21*	7455	16*	7406.28*	—	7460	16*	7407.26*	—	7470	23*	7408.17*	19*	7472	23*	7409.17*	19*	7473	28*	7410.15*	19*	7474	28*	7411.25*	19*	7475	44*	7412.18*	19*	7476	30*	7413.21*	40*	7478	—	7414.71*	79*	7482	73*	7415	—	7483	—	7416.25*	—	7485	118*	7417.34*	—	7486	25*	7420.16*	19*	7489	2.80*	7421	—	7490	34*	7422	—	7491	73*	7423.25*	—	7492	46*	7425.25*	—	7493	34*	7426.25*	19*	7495	54*	7427.39*	19*	7496	67*	7428.38*	19*	74107	21*	7430.16*	19*	74108	44*	7432.25*	25*	74112	—	7433	—	74113	—	7437.25*	25*	74114	—	7438.25*	25*	74121	27*	7440.17*	19*	74122	50*	7441.70*	—	74123	60*	7442.50*	55*	74124	—	7445.60*	—	74125	51*	7446.60*	—	74126	51*	7447.60*	87*	74132	72*	7448.60*	87*	74133	—	<table border="1"> <tr><th>N</th><th>LS</th><th>N</th><th>LS</th></tr> <tr><td>74136</td><td>—</td><td>74138</td><td>—</td></tr> <tr><td>74139</td><td>—</td><td>74139</td><td>—</td></tr> <tr><td>74141</td><td>76*</td><td>74141</td><td>76*</td></tr> <tr><td>74145</td><td>75*</td><td>74145</td><td>75*</td></tr> <tr><td>74147</td><td>159*</td><td>74147</td><td>159*</td></tr> <tr><td>74148</td><td>132*</td><td>74148</td><td>132*</td></tr> <tr><td>74150</td><td>102*</td><td>74150</td><td>102*</td></tr> <tr><td>74151</td><td>67*</td><td>74151</td><td>67*</td></tr> <tr><td>74153</td><td>67*</td><td>74153</td><td>67*</td></tr> <tr><td>74154</td><td>121*</td><td>74154</td><td>121*</td></tr> <tr><td>74155</td><td>67*</td><td>74155</td><td>67*</td></tr> <tr><td>74156</td><td>67*</td><td>74156</td><td>67*</td></tr> <tr><td>74157</td><td>67*</td><td>74157</td><td>67*</td></tr> <tr><td>74158</td><td>—</td><td>74158</td><td>—</td></tr> <tr><td>74160</td><td>121*</td><td>74160</td><td>121*</td></tr> <tr><td>74161</td><td>121*</td><td>74161</td><td>121*</td></tr> <tr><td>74162</td><td>121*</td><td>74162</td><td>121*</td></tr> <tr><td>74163</td><td>121*</td><td>74163</td><td>121*</td></tr> <tr><td>74164</td><td>102*</td><td>74164</td><td>102*</td></tr> <tr><td>74165</td><td>—</td><td>74165</td><td>—</td></tr> <tr><td>74166</td><td>102*</td><td>74166</td><td>102*</td></tr> <tr><td>74168</td><td>—</td><td>74168</td><td>—</td></tr> <tr><td>74169</td><td>—</td><td>74169</td><td>—</td></tr> <tr><td>74170</td><td>185*</td><td>74170</td><td>185*</td></tr> <tr><td>74171</td><td>41*</td><td>74171</td><td>41*</td></tr> <tr><td>74174</td><td>101*</td><td>74174</td><td>101*</td></tr> <tr><td>74175</td><td>81*</td><td>74175</td><td>81*</td></tr> <tr><td>74176</td><td>101*</td><td>74176</td><td>101*</td></tr> <tr><td>74177</td><td>101*</td><td>74177</td><td>101*</td></tr> <tr><td>74178</td><td>101*</td><td>74178</td><td>101*</td></tr> <tr><td>74179</td><td>21*</td><td>74179</td><td>21*</td></tr> <tr><td>74180</td><td>101*</td><td>74180</td><td>101*</td></tr> <tr><td>74181</td><td>21*</td><td>74181</td><td>21*</td></tr> <tr><td>74182</td><td>81*</td><td>74182</td><td>81*</td></tr> <tr><td>74183</td><td>101*</td><td>74183</td><td>101*</td></tr> <tr><td>74184</td><td>101*</td><td>74184</td><td>101*</td></tr> <tr><td>74185</td><td>162*</td><td>74185</td><td>162*</td></tr> <tr><td>74186</td><td>297*</td><td>74186</td><td>297*</td></tr> <tr><td>74189</td><td>317*</td><td>74189</td><td>317*</td></tr> <tr><td>74190</td><td>121*</td><td>74190</td><td>121*</td></tr> </table>				N	LS	N	LS	74136	—	74138	—	74139	—	74139	—	74141	76*	74141	76*	74145	75*	74145	75*	74147	159*	74147	159*	74148	132*	74148	132*	74150	102*	74150	102*	74151	67*	74151	67*	74153	67*	74153	67*	74154	121*	74154	121*	74155	67*	74155	67*	74156	67*	74156	67*	74157	67*	74157	67*	74158	—	74158	—	74160	121*	74160	121*	74161	121*	74161	121*	74162	121*	74162	121*	74163	121*	74163	121*	74164	102*	74164	102*	74165	—	74165	—	74166	102*	74166	102*	74168	—	74168	—	74169	—	74169	—	74170	185*	74170	185*	74171	41*	74171	41*	74174	101*	74174	101*	74175	81*	74175	81*	74176	101*	74176	101*	74177	101*	74177	101*	74178	101*	74178	101*	74179	21*	74179	21*	74180	101*	74180	101*	74181	21*	74181	21*	74182	81*	74182	81*	74183	101*	74183	101*	74184	101*	74184	101*	74185	162*	74185	162*	74186	297*	74186	297*	74189	317*	74189	317*	74190	121*	74190	121*	<table border="1"> <tr><th>N</th><th>LS</th><th>N</th><th>LS</th></tr> <tr><td>74191</td><td>121*</td><td>74191</td><td>121*</td></tr> <tr><td>74192</td><td>121*</td><td>74192</td><td>121*</td></tr> <tr><td>74193</td><td>121*</td><td>74193</td><td>121*</td></tr> <tr><td>74194</td><td>121*</td><td>74194</td><td>121*</td></tr> <tr><td>74195</td><td>101*</td><td>74195</td><td>101*</td></tr> <tr><td>74196</td><td>118*</td><td>74196</td><td>118*</td></tr> <tr><td>74197</td><td>118*</td><td>74197</td><td>118*</td></tr> <tr><td>74198</td><td>181*</td><td>74198</td><td>181*</td></tr> <tr><td>74199</td><td>181*</td><td>74199</td><td>181*</td></tr> <tr><td>74201</td><td>—</td><td>74201</td><td>—</td></tr> <tr><td>74202</td><td>—</td><td>74202</td><td>—</td></tr> <tr><td>74203</td><td>—</td><td>74203</td><td>—</td></tr> <tr><td>74204</td><td>—</td><td>74204</td><td>—</td></tr> <tr><td>74205</td><td>—</td><td>74205</td><td>—</td></tr> <tr><td>74206</td><td>—</td><td>74206</td><td>—</td></tr> <tr><td>74207</td><td>—</td><td>74207</td><td>—</td></tr> <tr><td>74208</td><td>—</td><td>74208</td><td>—</td></tr> <tr><td>74209</td><td>—</td><td>74209</td><td>—</td></tr> <tr><td>74210</td><td>—</td><td>74210</td><td>—</td></tr> <tr><td>74211</td><td>—</td><td>74211</td><td>—</td></tr> <tr><td>74212</td><td>—</td><td>74212</td><td>—</td></tr> <tr><td>74213</td><td>—</td><td>74213</td><td>—</td></tr> <tr><td>74214</td><td>—</td><td>74214</td><td>—</td></tr> <tr><td>74215</td><td>—</td><td>74215</td><td>—</td></tr> <tr><td>74216</td><td>—</td><td>74216</td><td>—</td></tr> <tr><td>74217</td><td>—</td><td>74217</td><td>—</td></tr> <tr><td>74218</td><td>—</td><td>74218</td><td>—</td></tr> <tr><td>74219</td><td>—</td><td>74219</td><td>—</td></tr> <tr><td>74220</td><td>—</td><td>74220</td><td>—</td></tr> <tr><td>74221</td><td>—</td><td>74221</td><td>—</td></tr> <tr><td>74222</td><td>—</td><td>74222</td><td>—</td></tr> <tr><td>74223</td><td>—</td><td>74223</td><td>—</td></tr> <tr><td>74224</td><td>—</td><td>74224</td><td>—</td></tr> <tr><td>74225</td><td>—</td><td>74225</td><td>—</td></tr> <tr><td>74226</td><td>—</td><td>74226</td><td>—</td></tr> <tr><td>74227</td><td>—</td><td>74227</td><td>—</td></tr> <tr><td>74228</td><td>—</td><td>74228</td><td>—</td></tr> <tr><td>74229</td><td>—</td><td>74229</td><td>—</td></tr> <tr><td>74230</td><td>—</td><td>74230</td><td>—</td></tr> <tr><td>74231</td><td>—</td><td>74231</td><td>—</td></tr> <tr><td>74232</td><td>—</td><td>74232</td><td>—</td></tr> <tr><td>74233</td><td>—</td><td>74233</td><td>—</td></tr> <tr><td>74234</td><td>—</td><td>74234</td><td>—</td></tr> <tr><td>74235</td><td>—</td><td>74235</td><td>—</td></tr> <tr><td>74236</td><td>—</td><td>74236</td><td>—</td></tr> <tr><td>74237</td><td>—</td><td>74237</td><td>—</td></tr> <tr><td>74238</td><td>—</td><td>74238</td><td>—</td></tr> <tr><td>74239</td><td>—</td><td>74239</td><td>—</td></tr> <tr><td>74240</td><td>—</td><td>74240</td><td>—</td></tr> <tr><td>74241</td><td>—</td><td>74241</td><td>—</td></tr> <tr><td>74242</td><td>—</td><td>74242</td><td>—</td></tr> <tr><td>74243</td><td>—</td><td>74243</td><td>—</td></tr> <tr><td>74244</td><td>—</td><td>74244</td><td>—</td></tr> <tr><td>74245</td><td>—</td><td>74245</td><td>—</td></tr> <tr><td>74246</td><td>—</td><td>74246</td><td>—</td></tr> <tr><td>74247</td><td>—</td><td>74247</td><td>—</td></tr> <tr><td>74248</td><td>—</td><td>74248</td><td>—</td></tr> <tr><td>74249</td><td>—</td><td>74249</td><td>—</td></tr> <tr><td>74250</td><td>—</td><td>74250</td><td>—</td></tr> <tr><td>74251</td><td>—</td><td>74251</td><td>—</td></tr> <tr><td>74252</td><td>—</td><td>74252</td><td>—</td></tr> <tr><td>74253</td><td>—</td><td>74253</td><td>—</td></tr> <tr><td>74254</td><td>—</td><td>74254</td><td>—</td></tr> <tr><td>74255</td><td>—</td><td>74255</td><td>—</td></tr> <tr><td>74256</td><td>—</td><td>74256</td><td>—</td></tr> <tr><td>74257</td><td>—</td><td>74257</td><td>—</td></tr> <tr><td>74258</td><td>—</td><td>74258</td><td>—</td></tr> <tr><td>74259</td><td>—</td><td>74259</td><td>—</td></tr> <tr><td>74260</td><td>—</td><td>74260</td><td>—</td></tr> <tr><td>74261</td><td>—</td><td>74261</td><td>—</td></tr> <tr><td>74262</td><td>—</td><td>74262</td><td>—</td></tr> <tr><td>74263</td><td>—</td><td>74263</td><td>—</td></tr> <tr><td>74264</td><td>—</td><td>74264</td><td>—</td></tr> <tr><td>74265</td><td>—</td><td>74265</td><td>—</td></tr> <tr><td>74266</td><td>—</td><td>74266</td><td>—</td></tr> <tr><td>74267</td><td>—</td><td>74267</td><td>—</td></tr> <tr><td>74268</td><td>—</td><td>74268</td><td>—</td></tr> <tr><td>74269</td><td>—</td><td>74269</td><td>—</td></tr> <tr><td>74270</td><td>—</td><td>74270</td><td>—</td></tr> <tr><td>74271</td><td>—</td><td>74271</td><td>—</td></tr> <tr><td>74272</td><td>—</td><td>74272</td><td>—</td></tr> <tr><td>74273</td><td>—</td><td>74273</td><td>—</td></tr> <tr><td>74274</td><td>—</td><td>74274</td><td>—</td></tr> <tr><td>74275</td><td>—</td><td>74275</td><td>—</td></tr> <tr><td>74276</td><td>—</td><td>74276</td><td>—</td></tr> <tr><td>74277</td><td>—</td><td>74277</td><td>—</td></tr> <tr><td>74278</td><td>—</td><td>74278</td><td>—</td></tr> <tr><td>74279</td><td>—</td><td>74279</td><td>—</td></tr> <tr><td>74280</td><td>—</td><td>74280</td><td>—</td></tr> <tr><td>74281</td><td>—</td><td>74281</td><td>—</td></tr> <tr><td>74282</td><td>—</td><td>74282</td><td>—</td></tr> <tr><td>74283</td><td>—</td><td>74283</td><td>—</td></tr> <tr><td>74284</td><td>—</td><td>74284</td><td>—</td></tr> <tr><td>74285</td><td>—</td><td>74285</td><td>—</td></tr> <tr><td>74286</td><td>—</td><td>74286</td><td>—</td></tr> <tr><td>74287</td><td>—</td><td>74287</td><td>—</td></tr> <tr><td>74288</td><td>—</td><td>74288</td><td>—</td></tr> <tr><td>74289</td><td>—</td><td>74289</td><td>—</td></tr> <tr><td>74290</td><td>—</td><td>74290</td><td>—</td></tr> <tr><td>74291</td><td>—</td><td>74291</td><td>—</td></tr> <tr><td>74292</td><td>—</td><td>74292</td><td>—</td></tr> <tr><td>74293</td><td>—</td><td>74293</td><td>—</td></tr> <tr><td>74294</td><td>—</td><td>74294</td><td>—</td></tr> <tr><td>74295</td><td>—</td><td>74295</td><td>—</td></tr> <tr><td>74296</td><td>—</td><td>74296</td><td>—</td></tr> <tr><td>74297</td><td>—</td><td>74297</td><td>—</td></tr> <tr><td>74298</td><td>—</td><td>74298</td><td>—</td></tr> <tr><td>74299</td><td>—</td><td>74299</td><td>—</td></tr> <tr><td>74300</td><td>—</td><td>74300</td><td>—</td></tr> <tr><td>74301</td><td>—</td><td>74301</td><td>—</td></tr> <tr><td>74302</td><td>—</td><td>74302</td><td>—</td></tr> <tr><td>74303</td><td>—</td><td>74303</td><td>—</td></tr> <tr><td>74304</td><td>—</td><td>74304</td><td>—</td></tr> <tr><td>74305</td><td>—</td><td>74305</td><td>—</td></tr> <tr><td>74306</td><td>—</td><td>74306</td><td>—</td></tr> <tr><td>74307</td><td>—</td><td>74307</td><td>—</td></tr> <tr><td>74308</td><td>—</td><td>74308</td><td>—</td></tr> <tr><td>74309</td><td>—</td><td>74309</td><td>—</td></tr> <tr><td>74310</td><td>—</td><td>74310</td><td>—</td></tr> <tr><td>74311</td><td>—</td><td>74311</td><td>—</td></tr> <tr><td>74312</td><td>—</td><td>74312</td><td>—</td></tr> <tr><td>74313</td><td>—</td><td>74313</td><td>—</td></tr> <tr><td>74314</td><td>—</td><td>74314</td><td>—</td></tr> <tr><td>74315</td><td>—</td><td>74315</td><td>—</td></tr> <tr><td>74316</td><td>—</td><td>74316</td><td>—</td></tr> <tr><td>74317</td><td>—</td><td>74317</td><td>—</td></tr> <tr><td>74318</td><td>—</td><td>74318</td><td>—</td></tr> <tr><td>74319</td><td>—</td><td>74319</td><td>—</td></tr> <tr><td>74320</td><td>—</td><td>74320</td><td>—</td></tr> </table>				N	LS	N	LS	74191	121*	74191	121*	74192	121*	74192	121*	74193	121*	74193	121*	74194	121*	74194	121*	74195	101*	74195	101*	74196	118*	74196	118*	74197	118*	74197	118*	74198	181*	74198	181*	74199	181*	74199	181*	74201	—	74201	—	74202	—	74202	—	74203	—	74203	—	74204	—	74204	—	74205	—	74205	—	74206	—	74206	—	74207	—	74207	—	74208	—	74208	—	74209	—	74209	—	74210	—	74210	—	74211	—	74211	—	74212	—	74212	—	74213	—	74213	—	74214	—	74214	—	74215	—	74215	—	74216	—	74216	—	74217	—	74217	—	74218	—	74218	—	74219	—	74219	—	74220	—	74220	—	74221	—	74221	—	74222	—	74222	—	74223	—	74223	—	74224	—	74224	—	74225	—	74225	—	74226	—	74226	—	74227	—	74227	—	74228	—	74228	—	74229	—	74229	—	74230	—	74230	—	74231	—	74231	—	74232	—	74232	—	74233	—	74233	—	74234	—	74234	—	74235	—	74235	—	74236	—	74236	—	74237	—	74237	—	74238	—	74238	—	74239	—	74239	—	74240	—	74240	—	74241	—	74241	—	74242	—	74242	—	74243	—	74243	—	74244	—	74244	—	74245	—	74245	—	74246	—	74246	—	74247	—	74247	—	74248	—	74248	—	74249	—	74249	—	74250	—	74250	—	74251	—	74251	—	74252	—	74252	—	74253	—	74253	—	74254	—	74254	—	74255	—	74255	—	74256	—	74256	—	74257	—	74257	—	74258	—	74258	—	74259	—	74259	—	74260	—	74260	—	74261	—	74261	—	74262	—	74262	—	74263	—	74263	—	74264	—	74264	—	74265	—	74265	—	74266	—	74266	—	74267	—	74267	—	74268	—	74268	—	74269	—	74269	—	74270	—	74270	—	74271	—	74271	—	74272	—	74272	—	74273	—	74273	—	74274	—	74274	—	74275	—	74275	—	74276	—	74276	—	74277	—	74277	—	74278	—	74278	—	74279	—	74279	—	74280	—	74280	—	74281	—	74281	—	74282	—	74282	—	74283	—	74283	—	74284	—	74284	—	74285	—	74285	—	74286	—	74286	—	74287	—	74287	—	74288	—	74288	—	74289	—	74289	—	74290	—	74290	—	74291	—	74291	—	74292	—	74292	—	74293	—	74293	—	74294	—	74294	—	74295	—	74295	—	74296	—	74296	—	74297	—	74297	—	74298	—	74298	—	74299	—	74299	—	74300	—	74300	—	74301	—	74301	—	74302	—	74302	—	74303	—	74303	—	74304	—	74304	—	74305	—	74305	—	74306	—	74306	—	74307	—	74307	—	74308	—	74308	—	74309	—	74309	—	74310	—	74310	—	74311	—	74311	—	74312	—	74312	—	74313	—	74313	—	74314	—	74314	—	74315	—	74315	—	74316	—	74316	—	74317	—	74317	—	74318	—	74318	—	74319	—	74319	—	74320	—	74320	—	<table border="1"> <tr><th>N</th><th>LS</th><th>N</th><th>LS</th></tr> <tr><td>4000</td><td>15*</td><td>4053</td><td>81*</td></tr> <tr><td>4001</td><td>16*</td><td>4054</td><td>129*</td></tr> <tr><td>4002</td><td>16*</td><td>4056</td><td>148*</td></tr> <tr><td>4006</td><td>92*</td><td>4059</td><td>518*</td></tr> <tr><td>4007</td><td>18*</td><td>4060</td><td>124*</td></tr> <tr><td>4008</td><td>92*</td><td>4066</td><td>48*</td></tr> <tr><td>4009</td><td>54</td><td>4068</td><td>21*</td></tr> <tr><td>4010</td><td>54*</td><td>4069</td><td>21*</td></tr> <tr><td>4011</td><td>18*</td><td>4070</td><td>21*</td></tr> <tr><td>4012</td><td>18*</td><td>4071</td><td>21*</td></tr> <tr><td>4013</td><td>48*</td><td>4072</td><td>21*</td></tr> <tr><td>4014</td><td>92*</td><td>4077</td><td>21*</td></tr> <tr><td>4015</td><td>92*</td><td>4081</td><td>21*</td></tr> <tr><td>4016</td><td>43*</td><td>4082</td><td>21*</td></tr> <tr><td>4017</td><td>81*</td><td>4085</td><td>92*</td></tr> <tr><td>4018</td><td>92*</td><td>4086</td><td>92*</td></tr> <tr><td>4019</td><td>56*</td><td>4093</td><td>81*</td></tr> <tr><td>4020</td><td>92*</td><td>4099</td><td>181*</td></tr> <tr><td>4021</td><td>92*</td><td>4502</td><td>92*</td></tr> <tr><td>4022</td><td>92*</td><td>4508</td><td>145*</td></tr> <tr><td>4023</td><td>18*</td><td>4510</td><td>107*</td></tr> <tr><td>4024</td><td>65*</td><td>4511</td><td>95*</td></tr> <tr><td>4025</td><td>18*</td><td>4514</td><td>270*</td></tr> <tr><td>4026</td><td>184*</td><td>4515</td><td>270*</td></tr> <tr><td>4027</td><td>51*</td><td>4516</td><td>107*</td></tr> <tr><td>4028</td><td>92*</td><td>4517</td><td>410*</td></tr> <tr><td>4029</td><td>118*</td><td>4518</td><td>95*</td></tr> <tr><td>4030</td><td>56*</td><td>4521</td><td>254*</td></tr> <tr><td>4032</td><td>108*</td><td>4522</td><td>189*</td></tr> <tr><td>4034</td><td>189*</td><td>4526</td><td>189*</td></tr> <tr><td>4035</td><td>106*</td><td>4528</td><td>92*</td></tr> <tr><td>4040</td><td>92*</td><td>4534</td><td>712*</td></tr> <tr><td>4042</td><td>70*</td><td>4536</td><td>374*</td></tr> <tr><td>4043</td><td>81*</td><td>4543</td><td>162*</td></tr> <tr><td>4046</td><td>106*</td><td>4553</td><td>453*</td></tr> <tr><td>4049</td><td>43*</td><td>4566</td><td>151*</td></tr> <tr><td>4050</td><td>43*</td><td>4583</td><td>102*</td></tr> <tr><td>4051</td><td>81*</td><td>4585</td><td>107*</td></tr> <tr><td>4052</td><td>81*</td><td>4585</td><td>107*</td></tr> </table>				N	LS	N	LS	4000	15*	4053	81*	4001	16*	4054	129*	4002	16*	4056	148*	4006	92*	4059	518*	4007	18*	4060	124*	4008	92*	4066	48*	4009	54	4068	21*	4010	54*	4069	21*	4011	18*	4070	21*	4012	18*	4071	21*	4013	48*	4072	21*	4014	92*	4077	21*	4015	92*	4081	21*	4016	43*	4082	21*	4017	81*	4085	92*	4018	92*	4086	92*	4019	56*	4093	81*	4020	92*	4099	181*	4021	92*	4502	92*	4022	92*	4508	145*	4023	18*	4510	107*	4024	65*	4511	95*	4025	18*	4514	270*	4026	184*	4515	270*	4027	51*	4516	107*	4028	92*	4517	410*	4029	118*	4518	95*	4030	56*	4521	254*	4032	108*	4522	189*	4034	189*	4526	189*	4035	106*	4528	92*	4040	92*	4534	712*	4042	70*	4536	374*	4043	81*	4543	162*	4046	106*	4553	453*	4049	43*	4566	151*	4050	43*	4583	102*	4051	81*	4585	107*	4052	81*	4585	107*	<table border="1"> <tr><th>N</th><th>LS</th><th>N</th><th>LS</th></tr> <tr><td>8 pin</td><td>18*</td><td>2102A</td><td>2 (350ns)</td></tr> <tr><td>14 pin</td><td>12*</td><td>2102A 2</td><td>2 (650ns)</td></tr> <tr><td>16 pin</td><td>13*</td><td>2111A 1</td><td>1 (500ns)</td></tr> <tr><td>18 pin</td><td>18*</td><td>2112A 2</td><td>2 (350ns)</td></tr> <tr><td>20 pin</td><td>20*</td><td>21102</td><td>2 (350ns)</td></tr> <tr><td>22 pin</td><td>24*</td><td>MM5257</td><td>(1MS4044)</td></tr> <tr><td>25 pin</td><td>26*</td><td>2114</td><td>(450ns)</td></tr> <tr><td>40 pin</td><td>44*</td><td>6810</td><td>—</td></tr> <tr><td>8 pin</td><td>23</td><td>8900</td><td>—</td></tr> <tr><td>15 pin</td><td>34*</td><td>E-Prim's UV</td><td>—</td></tr> <tr><td>15 pin</td><td>37*</td><td>1702AO</td><td>—</td></tr> <tr><td>18 pin</td><td>43*</td><td>27080</td><td>—</td></tr> <tr><td>20 pin</td><td>55*</td><td>TriState Buffers</td><td>—</td></tr> <tr><td>24 pin</td><td>60*</td><td>81LS95</td><td>75*</td></tr> <tr><td>28 pin</td><td>65*</td><td>81LS96</td><td>75*</td></tr> <tr><td>36 pin</td><td>95*</td><td>81LS97</td><td>75*</td></tr> <tr><td>40 pin</td><td>105*</td><td>81LS98</td><td>75*</td></tr> <tr><td>74365</td><td>75*</td><td>74366</td><td>75*</td></tr> <tr><td>74367</td><td>75*</td><td>74368</td><td>75*</td></tr> </table>				N	LS	N	LS	8 pin	18*	2102A	2 (350ns)	14 pin	12*	2102A 2	2 (650ns)	16 pin	13*	2111A 1	1 (500ns)	18 pin	18*	2112A 2	2 (350ns)	20 pin	20*	21102	2 (350ns)	22 pin	24*	MM5257	(1MS4044)	25 pin	26*	2114	(450ns)	40 pin	44*	6810	—	8 pin	23	8900	—	15 pin	34*	E-Prim's UV	—	15 pin	37*	1702AO	—	18 pin	43*	27080	—	20 pin	55*	TriState Buffers	—	24 pin	60*	81LS95	75*	28 pin	65*	81LS96	75*	36 pin	95*	81LS97	75*	40 pin	105*	81LS98	75*	74365	75*	74366	75*	74367	75*	74368	75*	<table border="1"> <tr><th>N</th><th>LS</th><th>N</th><th>LS</th></tr> <tr><td>1+</td><td>17-63</td><td>64+</td><td>—</td></tr> <tr><td>1.05*</td><td>95*</td><td>88*</td><td>—</td></tr> <tr><td>1.29*</td><td>1.15*</td><td>1.08*</td><td>—</td></tr> <tr><td>2.46*</td><td>2.19*</td><td>2.05*</td><td>—</td></tr> <tr><td>2.14*</td><td>1.90*</td><td>1.78*</td><td>—</td></tr> <tr><td>1.07*</td><td>95*</td><td>86*</td><td>—</td></tr> <tr><td>8.10*</td><td>7.19*</td><td>6.75*</td><td>—</td></tr> <tr><td>3.50*</td><td>2.97*</td><td>2.52*</td><td>—</td></tr> </table>				N	LS	N	LS	1+	17-63	64+	—	1.05*	95*	88*	—	1.29*	1.15*	1.08*	—	2.46*	2.19*	2.05*	—	2.14*	1.90*	1.78*	—	1.07*	95*	86*	—	8.10*	7.19*	6.75*	—	3.50*	2.97*	2.52*	—	<table border="1"> <tr><th>N</th><th>LS</th><th>N</th><th>LS</th></tr> <tr><td>78M Series</td><td>—</td><td>78 Series</td><td>—</td></tr> <tr><td>+(POS) 500mA</td><td>—</td><td>+(POS) 1A</td><td>—</td></tr> <tr><td>5v 6v 8v 12v 15v</td><td>—</td><td>5v 8v 12v 15v</td><td>—</td></tr> <tr><td>All 85p* each</td><td>—</td><td>All 85p* each</td><td>—</td></tr> <tr><td>79M Series</td><td>—</td><td>79 Series</td><td>—</td></tr> <tr><td>-(NEG) 500mA</td><td>—</td><td>-(NEG) 1A</td><td>—</td></tr> <tr><td>5v 6v 8v 12v 15v</td><td>—</td><td>5v 8v 12v 15v</td><td>—</td></tr> <tr><td>20v 24v</td><td>—</td><td>18v 24v</td><td>—</td></tr> <tr><td>All 85p* each</td><td>—</td><td>All 85p* each</td><td>—</td></tr> <tr><td>CD4011</td><td>7 for £1.00*</td><td>LM380</td><td>3 for £2.50</td></tr> </table>				N	LS	N	LS	78M Series	—	78 Series	—	+(POS) 500mA	—	+(POS) 1A	—	5v 6v 8v 12v 15v	—	5v 8v 12v 15v	—	All 85p* each	—	All 85p* each	—	79M Series	—	79 Series	—	-(NEG) 500mA	—	-(NEG) 1A	—	5v 6v 8v 12v 15v	—	5v 8v 12v 15v	—	20v 24v	—	18v 24v	—	All 85p* each	—	All 85p* each	—	CD4011	7 for £1.00*	LM380	3 for £2.50
N	LS	N	LS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7400.13*	19*	7449	87*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7401.13*	19*	7450	16*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7402.15*	19*	7451	16*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7403.15*	19*	7452	16*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7404.16*	21*	7454	16*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7405.16*	21*	7455	16*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7406.28*	—	7460	16*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7407.26*	—	7470	23*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7408.17*	19*	7472	23*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7409.17*	19*	7473	28*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7410.15*	19*	7474	28*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7411.25*	19*	7475	44*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7412.18*	19*	7476	30*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7413.21*	40*	7478	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7414.71*	79*	7482	73*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7415	—	7483	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7416.25*	—	7485	118*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7417.34*	—	7486	25*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7420.16*	19*	7489	2.80*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7421	—	7490	34*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7422	—	7491	73*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7423.25*	—	7492	46*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7425.25*	—	7493	34*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7426.25*	19*	7495	54*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7427.39*	19*	7496	67*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7428.38*	19*	74107	21*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7430.16*	19*	74108	44*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7432.25*	25*	74112	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7433	—	74113	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7437.25*	25*	74114	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7438.25*	25*	74121	27*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7440.17*	19*	74122	50*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7441.70*	—	74123	60*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7442.50*	55*	74124	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7445.60*	—	74125	51*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7446.60*	—	74126	51*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7447.60*	87*	74132	72*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7448.60*	87*	74133	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
N	LS	N	LS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74136	—	74138	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74139	—	74139	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74141	76*	74141	76*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74145	75*	74145	75*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74147	159*	74147	159*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74148	132*	74148	132*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74150	102*	74150	102*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74151	67*	74151	67*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74153	67*	74153	67*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74154	121*	74154	121*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74155	67*	74155	67*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74156	67*	74156	67*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74157	67*	74157	67*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74158	—	74158	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74160	121*	74160	121*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74161	121*	74161	121*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74162	121*	74162	121*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74163	121*	74163	121*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74164	102*	74164	102*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74165	—	74165	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74166	102*	74166	102*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74168	—	74168	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74169	—	74169	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74170	185*	74170	185*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74171	41*	74171	41*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74174	101*	74174	101*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74175	81*	74175	81*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74176	101*	74176	101*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74177	101*	74177	101*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74178	101*	74178	101*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74179	21*	74179	21*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74180	101*	74180	101*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74181	21*	74181	21*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74182	81*	74182	81*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74183	101*	74183	101*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74184	101*	74184	101*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74185	162*	74185	162*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74186	297*	74186	297*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74189	317*	74189	317*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74190	121*	74190	121*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
N	LS	N	LS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74191	121*	74191	121*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74192	121*	74192	121*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74193	121*	74193	121*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74194	121*	74194	121*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74195	101*	74195	101*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74196	118*	74196	118*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74197	118*	74197	118*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74198	181*	74198	181*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74199	181*	74199	181*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74201	—	74201	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74202	—	74202	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74203	—	74203	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74204	—	74204	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74205	—	74205	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74206	—	74206	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74207	—	74207	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74208	—	74208	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74209	—	74209	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74210	—	74210	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74211	—	74211	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74212	—	74212	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74213	—	74213	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74214	—	74214	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74215	—	74215	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74216	—	74216	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74217	—	74217	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74218	—	74218	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74219	—	74219	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74220	—	74220	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74221	—	74221	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74222	—	74222	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74223	—	74223	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74224	—	74224	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74225	—	74225	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74226	—	74226	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74227	—	74227	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74228	—	74228	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74229	—	74229	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74230	—	74230	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74231	—	74231	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74232	—	74232	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74233	—	74233	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74234	—	74234	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74235	—	74235	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74236	—	74236	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74237	—	74237	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74238	—	74238	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74239	—	74239	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74240	—	74240	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74241	—	74241	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74242	—	74242	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74243	—	74243	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74244	—	74244	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74245	—	74245	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74246	—	74246	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74247	—	74247	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74248	—	74248	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74249	—	74249	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74250	—	74250	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74251	—	74251	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74252	—	74252	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74253	—	74253	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74254	—	74254	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74255	—	74255	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74256	—	74256	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74257	—	74257	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74258	—	74258	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74259	—	74259	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74260	—	74260	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74261	—	74261	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74262	—	74262	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74263	—	74263	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74264	—	74264	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74265	—	74265	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74266	—	74266	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74267	—	74267	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74268	—	74268	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74269	—	74269	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74270	—	74270	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74271	—	74271	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74272	—	74272	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74273	—	74273	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74274	—	74274	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74275	—	74275	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74276	—	74276	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74277	—	74277	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74278	—	74278	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74279	—	74279	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74280	—	74280	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74281	—	74281	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74282	—	74282	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74283	—	74283	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74284	—	74284	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74285	—	74285	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74286	—	74286	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74287	—	74287	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74288	—	74288	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74289	—	74289	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74290	—	74290	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74291	—	74291	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74292	—	74292	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74293	—	74293	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74294	—	74294	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74295	—	74295	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74296	—	74296	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74297	—	74297	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74298	—	74298	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74299	—	74299	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74300	—	74300	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74301	—	74301	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74302	—	74302	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74303	—	74303	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74304	—	74304	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74305	—	74305	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74306	—	74306	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74307	—	74307	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74308	—	74308	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74309	—	74309	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74310	—	74310	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74311	—	74311	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74312	—	74312	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74313	—	74313	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74314	—	74314	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74315	—	74315	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74316	—	74316	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74317	—	74317	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74318	—	74318	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74319	—	74319	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74320	—	74320	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
N	LS	N	LS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4000	15*	4053	81*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4001	16*	4054	129*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4002	16*	4056	148*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4006	92*	4059	518*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4007	18*	4060	124*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4008	92*	4066	48*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4009	54	4068	21*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4010	54*	4069	21*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4011	18*	4070	21*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4012	18*	4071	21*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4013	48*	4072	21*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4014	92*	4077	21*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4015	92*	4081	21*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4016	43*	4082	21*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4017	81*	4085	92*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4018	92*	4086	92*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4019	56*	4093	81*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4020	92*	4099	181*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4021	92*	4502	92*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4022	92*	4508	145*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4023	18*	4510	107*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4024	65*	4511	95*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4025	18*	4514	270*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4026	184*	4515	270*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4027	51*	4516	107*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4028	92*	4517	410*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4029	118*	4518	95*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4030	56*	4521	254*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4032	108*	4522	189*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4034	189*	4526	189*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4035	106*	4528	92*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4040	92*	4534	712*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4042	70*	4536	374*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4043	81*	4543	162*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4046	106*	4553	453*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4049	43*	4566	151*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4050	43*	4583	102*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4051	81*	4585	107*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
4052	81*	4585	107*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
N	LS	N	LS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
8 pin	18*	2102A	2 (350ns)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
14 pin	12*	2102A 2	2 (650ns)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
16 pin	13*	2111A 1	1 (500ns)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
18 pin	18*	2112A 2	2 (350ns)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
20 pin	20*	21102	2 (350ns)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
22 pin	24*	MM5257	(1MS4044)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
25 pin	26*	2114	(450ns)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
40 pin	44*	6810	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
8 pin	23	8900	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
15 pin	34*	E-Prim's UV	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
15 pin	37*	1702AO	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
18 pin	43*	27080	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
20 pin	55*	TriState Buffers	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
24 pin	60*	81LS95	75*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
28 pin	65*	81LS96	75*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
36 pin	95*	81LS97	75*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
40 pin	105*	81LS98	75*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74365	75*	74366	75*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
74367	75*	74368	75*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
N	LS	N	LS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
1+	17-63	64+	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
1.05*	95*	88*	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
1.29*	1.15*	1.08*	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
2.46*	2.19*	2.05*	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
2.14*	1.90*	1.78*	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
1.07*	95*	86*	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
8.10*	7.19*	6.75*	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
3.50*	2.97*	2.52*	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
N	LS	N	LS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
78M Series	—	78 Series	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
+(POS) 500mA	—	+(POS) 1A	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
5v 6v 8v 12v 15v	—	5v 8v 12v 15v	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
All 85p* each	—	All 85p* each	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
79M Series	—	79 Series	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
-(NEG) 500mA	—	-(NEG) 1A	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
5v 6v 8v 12v 15v	—	5v 8v 12v 15v	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
20v 24v	—	18v 24v	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
All 85p* each	—	All 85p* each	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
CD4011	7 for £1.00*	LM380	3 for £2.50																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																



VAT Inclusive prices *8% others 12.5% Export Customers deduct VAT 2/27 from *1/9 from others

Postage and Packing 25p Trade and Export Inquiries most Welcome. Hours 9.00am - 5.00pm

Now available our ORDER-RING line, just phone your order through with your Access or Barclaycard number and providing the order is received by 3.00pm the components will be despatched the same day (min tel order £5.00)



OUR RANGE OF PRODUCTS ARE NOW INDIVIDUALLY AND ATTRACTIVELY PACKAGED



Our new catalogue lists a whole range of plastic boxes to house all your projects. And we've got circuit boards, accessories, module systems, and metal cases - everything you need to give your equipment the quality you demand. Send 25p to cover post and packing and the catalogue's yours.

VERO ELECTRONICS LTD. RETAIL DEPT.
Industrial Estate, Chandlers Ford, Hants. SO5

Technical Training in Radio, Television and Electronics

ICS have helped thousands of ambitious people to move up into higher paid, more secure jobs in the field of electronics—now it can be your turn. Whether you are a newcomer to the field or are already working in the industry, ICS can provide you with the specialised training so essential to success.

Personal Tuition and Guaranteed Success

The expert and personal guidance by fully qualified tutors, backed by the ICS guarantee of tuition until successful is the key to our outstanding record in the technical training field. You study at the time and pace that suits you best and in your own home. In the words of one of our many successful students: "Since starting my course, my salary has trebled and I am expecting a further increase when my course is completed."

City and Guilds Certificates

Excellent job prospects await those who hold one of these recognised certificates. ICS can coach you for:

- Telecommunications Technicians
- Radio, TV Electronics Technicians
- Technical Communications
- Radio Servicing Theory
- Radio Amateurs
- Electrical Installation Work
- Also MPT Radio Communications Certificate

Diploma Courses

- Colour TV Servicing
- Electronic Engineering and Maintenance
- Computer Engineering and Programming
- Radio, TV and Audio, Engineering and Servicing
- Electrical Engineering, Installations and Contracting

Qualify for a New Career

Home study courses for leading professional examinations and diploma courses for business and technical subjects:—

G.C.E.	Engineering	Purchasing
60 subjects	Farming	Sales
at "O" & "A" levels	Heating	Storekeeping
Accountancy	Industrial	Work Study
Air	Management	
Conditioning	Mechanical	
Building		

POST OR PHONE TODAY FOR FREE BOOKLET.

ICS To: International Correspondence Schools

SINCE 1890
Dept H277 Intertext House, London
SW8 4UJ or telephone 622 9911

Subject of Interest

Name

Address

Telephone Number

J. BIRKETT

Radio Component Suppliers

25 The Strait, Lincoln LN2 1JF. Tel: 20767

8F 679 STRIPLINE 1000 MHz PNP TRANSISTORS e 25p.
8F 362 STRIPLINE 800 MHz NPN TRANSISTORS e 25p.
MINIATURE VARIABLE CAPACITORS S.M. Drive 250 + 250 + 20 + 20 + 20pf e 75p, Direct Drive 25 + 25 + 25pf e 75p.
X BAND GUNN DIODES CYX 11A e £3 each.
X BAND DETECTOR DIODES LIKE SIM 2 e 15p or 1N 23 e 25p.
STRIPLINE FET with data 2N 4417 e £2.20 each.
100 C280 CAPACITORS assorted for 57p.
200 1/2, 1/4 watt RESISTORS assorted values e 75p.
50 2 watt ZENER assorted untested e 57p.
TOKO 10-7 MHz FILTER CFS 10.7M e 27p, MURATA 10-7MHz FILTER SFW 10.7mA e 27p, 5.5MHz SFC 5.5mA e 27p.
VERNITRON FM4 10-7MHz FILTER e 50p or 3 for £1.
STC CRYSTAL FILTER 8.W. ± 7.5KHz e £5.
455KHz CRYSTAL FILTER 8.W. 7 KHz e 50p.
RADIO TELEPHONE MIKE INSERTS YA 8548 e 50p.
UA 742 ZERO CROSSING AC TRIGGER TRIGAC with data e 25p.
FX 1115 FERRITE BEADS at 15p doz.
3/16" COIL FORMERS with core at 6 for 25p.
BA 156 SILICON DIODES at 50 for 57p.
20 PHOTO TRANSISTORS AND DARLINGTONS assorted untested e £1.
6000 VOLT PIV 1 AMP DIODE ASSEMBLY e £1 each.
DAU TRIMMERS 2 to 9pf e 15p, 7 to 35pf e 15p, 6 to 45pf e 15p, 8 to 125pf e 15p, 8 to 140pf e 15p.
MULLARD CAPACITORS C281 Type 1uf 250v.w. at 20p doz.
CRYSTAL PACKS 30 10XAJ e £1.10, 20. FT 241A e £1.10, 20. FT 243 e £1.50, 25. 10X Types e £1.25.
50. AC 12B TRANSISTORS Branded but untested for 57p.
50. VARI-CAP DIODES LIKE BA 102 untested e 57p.
50. 1 AMP THYRISTORS T05 Case untested for £1.
25. 5 AMP STUD MOUNTING THYRISTORS untested e £1.
20. PHOTO TRANSISTORS AND DARLINGTONS assorted untested e £1.
50. BC 107-8-9 TRANSISTORS assorted untested for 57p.
10. MULTI-TURN PRE-SET POTENTIOMETERS assorted e 60p.
UNIUNION TRANSISTORS 2N 4871 e 22p, 2N 602B e 25p, 2N 6029 e 25p, MEU 21 e 22p, MU 4894 e 22p, 4J05E29 e 22p, Similar to TIS 43 e 20p.
FET'S J310 e 20p, E304 e 20p, E111 e 12p, E113 e 12p, 2N 3819T e 20p, 8F 256 e 25p, 8F 244 e 25p, DUAL GATE MOS FET'S 40873T e 33p, MFE 131 e 50p.
STUD MOUNTING DIODES 100 PIV 10 amp e 15p, 100 PIV 20 amp e 25p.
1 amp TRIACS T05 Case 400 PIV e 35p each.
R.F.-I.F. I.C. RCA CA 3011 with data e 60p.
MULLARD TRANSISTORS 8C 548 e 10p, 6 for 50p, 8C 549 e 10p, 6 for 50p.
TRANSFORMERS 240 volt AC Input Type 1. 24 volt Tapped at 14 volt 1 amp e £1.30 (P&P 25p).
Please add 20p for post and packing on U.K. orders under £2. Overseas postage at cost.

PHILIP H. BEARMAN

6 POTTERS RD, NEW BARNET HERTS.

Tel: 01-449-1934/5.

LARGE RANGE OF BVA & QUALITY VALVES. SAE LISTS.

NEW MONO TUBES, USUALLY 2 YEAR GUARANTEE.

A31/120; A31/300; A31/410W.	£18.50 incl VAT
A34/100; CME 1420, M6529 FZP.	£19.50 incl VAT
A38/160; CME1520, Thorn.	£19.50 incl VAT
A44/120; CME1713, Thorn.	£19.50 incl VAT
AW47/91; CME1903, A47.14W	£10.00 incl VAT
A47/11W; A47.26WR, Mullard.	£15.00 incl VAT
A47/13W; CME1906, Thorn.	£15.00 incl VAT
A50/120W; CME2013, Vega.	£18.00 incl VAT
A59/15W (AW59.91), Mullard.	£11.00 incl VAT
A59/23WR (A59.11W), Mullard.	£16.00 incl VAT
A61/120WR (CME2413) Vega	£21.00 incl VAT

VARIOUS OTHERS — NO 90° PORTABLE TYPES.

CARRIAGE MAINLAND £2 EACH, ENQUIRIES SAE. (310, 340 SERIES).

SPECIAL OFFER SEMICONDUCTORS

T8A800 50p. LM3900 40p. 741 8 pin 6 for £1.00. NE555 22p. ZN414 75p. IN4005 10 for 35p. 723 REGS 35p. OC140 TRANS. 40p. 8X504 opto isolators 25p. 2N5062 (100V 800MA SCR) 18p.

MINIATURE TOGGLE SWITCHES. SPST 8x5x7mm 49p. DPDT 8x7x7mm 53p. DPDT centre off 12x11x9mm 78p. HEAVY DUTY TOGGLE DPDT 240V AC 10 amps 35p.

MINIATURE SOLID STATE BUZZERS. 33x17x15mm white plastic rectangular case. output at 3 feet 70dB. Low consumption only 15mA. 4 voltage types available. 6-9-12 or 24V DC 75p each. LOUD BUZZER. 50mm diameter 6 or 12 volts 60p. GPO ADJUSTABLE BUZZER, 6-12V DC 25p.

DE-SOLDERING TOOL. Good suction. Teflon nozzle. £4.75p.

MOTORS. Miniature model motors 1.5-6V DC 20p. 12V DC 5 pole motors 35p. 8 track replacement motors 12V DC 55p. 'Big inch' tiny precision motor 115V AC 3 rpm 30p. Smiths Clock Motor Synch., 240V AC 1 rev. per hour £1.75p.

SURPLUS BOARDS. No. 1 has 14 encapsulated reed relays, 12V £1.95p.

No. 2 has 11 50V 2.5 amp scrs., one relay and various transistors including UJT £1.95p.

No. 3 car radio RF/IF boards 2 transistors. LM382 IC trimmers IF's etc. 65p.

No. 4 car radio boards with 6 transistors including power output types IF's choke etc. 75p.

TELEPHONE PICK UP COIL. Suction type with lead and plug 55p.

Terms — Cash with order (or official orders from schools etc.) Postage 30p. (Overseas at cost) VAT inclusive.

SAE for illustrated lists.

PROGRESSIVE RADIO

93 Dale Street,
Liverpool L2 2DY.



TUAC

TRANSISTOR UNIVERSAL AMPLIFICATION CO. LTD.
 PHONE 01-672 3137/672 9080
 MANUFACTURERS OF QUALITY AMPLIFICATION AND LIGHTING
 CONTROL SYSTEMS

PRICES INCLUDE VAT. P & P FREE

correct at 1.5.79

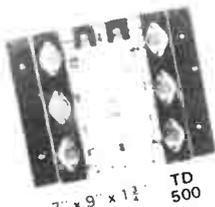
TO ORDER BY POST

Make cheques/P.O.s payable to TUAC LTD. or quote
 Access/Barclaycard No. and post to TUAC LTD. 121
 Charlmont Road, London SW17 9AB. We accept phone numbers
 from Access/Barclaycard Holders. Phone 01-672 9080.

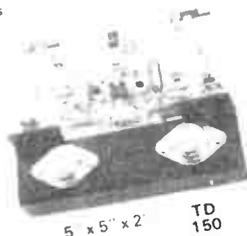
NEW FROM TUAC ULTRA QUALITY HIGH POWER New D.C. Coupled Design AMPLIFIERS

Featuring
 Electronic Short Open & Thermal Overload Protection

Brief Spec
 Input Sensitivity 0.775 v R.M.S. (0 dB) at 25 K Ohms
 Frequency Response 20 Hz-20 KHz
 Hum & Noise 100 dB Relative full output

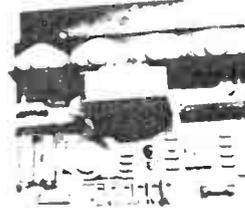


- THD at full power 0.1%
 - T D 500 300W into 2 Ohms
 - 220W into 4 Ohms
 - 140W into 8 Ohms
 - Power supply P.S. 300 **£45.00**
 - T D 150 150W into 4 Ohms
 - 100W into 8 Ohms
 - Power supply P.S. 150 **£30.00**
 - T D 150 60 Version 60W into 8 Ohms
 - 40W into 15 Ohms
 - Power supply P.S. 60 **£26.25**
 - Power supply P.S. 60 **£19.75**
 - Power supply P.S. 60 **£15.50**
- Note P.S. 300 will drive 2 T D 150 amplifiers



All output ratings are R.M.S. continuous sine wave output

AMPLIFIER MODULES



SPEC INPUT
 SENSITIVITY 60 mV
 for full output
 Frequency response
 20 Hz-20 KHz
 HUM & NOISE 70dB

- TL30 5" x 5" x 2"
 * 35 watt 10 amp output transistors **£13.25**
- TL60 5" x 5" x 3"
 * 60 watt R.M.S. continuous sine wave output
 * 2 R.C.A. 110 watt 15 amp output transistors **£18.50**
- TL100 5" x 5" x 3"
 * 100 watt R.M.S. continuous sine wave output
 * 2 R.C.A. 150 watt 15 amp output transistors **£21.50**
- TP125 7" x 6" x 5"
 * 125 watt R.M.S. continuous sine wave output
 * 4 R.C.A. 150 watt 15 amp output transistors **£27.50**

4 CHANNEL SOUND TO LIGHT SEQUENCE CHASER - 4LSMI

- Full wave control
- RCA BA Tracs
- 1000W per channel
- Fully suppressed and fused
- Switched master control for sound operation from 1W to 125W
- Speed control for fixed rate sequence from 8 per minute to 50 per second
- Full logic integrated circuitry with optical isolation for amplifier protection

£21.50

Model 501 500W per channel as above without sound triggering

£14.00



STEREO DISCO MIXER

With touch sensitive switching and auto fade

INPUTS Four identical stereo inputs available with any equalisation. Two magnetic and two flat supplied as standard. High quality slider control on each channel. Volume, Treble and bass controls for each pair of stereo. Sensitivity mag. 3mV (R.I.A. comp.) Flat 50mV at 1kHz. Bass controls +18dB at 60Hz. Treble controls +18dB at 15kHz.

OUTPUT Up to 3 volts (-12dB), available. Attenuated output for TUAC Power Modules. Rotary master and balance controls. Band width 15Hz - 25kHz - dB.

P.F.L. Output 250mV into 8 ohms. Rotary volume control. Monitoring facility for all 4 channels. Selection via touch sensitive illuminated switches. Switched visual cue indicator.

Miscellaneous Facilities Two illuminated deck on/off switches. Mains illumination on/off switches. Auto last illuminated on/off switch. Mains powered with integral screen and back cover. Complies with full British Bore.

Size 25in long x 6in high x 3in deep

Mono Disco Mixer with autofade **£52.00**

£189.00

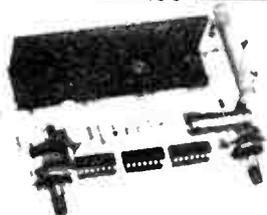
3 CHANNEL LIGHT MODULATOR SILMB

- RCA BA Tracs
- 1000W per channel
- Each channel fully suppressed and fused
- Master control to operate from 1W to 125W
- Full wave control

£20.75

Single Channel Version 1500 Watts

£9.75



FRONT PANEL FOR LIGHTING EFFECT MODULES

(complete with switches, neons and knobs)
 as illustrated



For S1LMB **£7.25**
 Size 8" x 4 1/2"



4LSM1 **£6.00**
 Size 6 1/2" x 4 1/2"

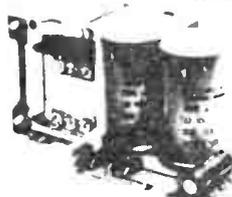


FUZE LIGHTS
 Red, Green, Blue,
 Amber **£24.50**



S1LMB **£8.25**
 Combined with 3SDM1
 Size 9" x 4 1/2"

POWER SUPPLIES



Vacuum varnish impregnated Transformers
 with supply board incorporating pre-amp supply

- PS250 for supplying 2 TP125s **£30.00**
- PS200 for supplying to TL100s **£30.00**
- PS60/60 for supplying 2 TL60s **£30.00**
- PS125 ± 45 volts for TP125 **£18.50**
- PS100 ± 43 volts for TL100 **£17.00**
- PS60 ± 38 volts for TL60 **£15.50**
- PS30 ± 25 volts for TL30 **£11.75**
- PSU 2 for supplying disco mixer **£7.50**

STOCKISTS - CALLERS ONLY

A1 Music, 88 Oxford Street, Manchester (Tel 061-238 0340)
 Geo. Mathews, 85/87, Hurst St., Birmingham (Tel 021-622 1941)
 Soccold, 9, The Friars (Tel. Canterbury 60948)
 Cookies Disco Centre, 126/128, West Street (Tel Crewe 4739)
 Garland Bros. Ltd., Deptford Broadway, London 01-692 4412
 Luton Disco Centre, 88, Wellington Street, Luton (Tel Luton 411733)
 Session Music, 163, Mitcham Road, Tooting (Tel 01-672 3413).
 Mon-Sat 10am to 6pm. Closed Wed.
 Electrosonic Ltd., Four St., Exeter. Tel. 50487.
 Salscogan Ltd., 43 Borough Rd., Cleveland, Middlesbrough.
 (Tel. 242851).
 Menhouse Ltd., 82, St. Mary St., Southampton. (Tel 236220)
 Electra Centre, 58 Lancaster Road, Preston (Tel. Preston 58482)
 TRADE & EXPORT ENQUIRIES 01-672 3137

ADD SEQUENCE CHASING + DIMMING EFFECTS FOR TUAC 3 CHANNEL LIGHT MODULATOR



- Speed Control 3 per min to 10 per sec
- Full logic integrated circuitry
- Dimmer control to each channel

3SDM1 **£15.25**

SUPPLIERS TO H.M. GOVT. DEPTS. MANUFACTURED AND ASSEMBLED IN GT. BRITAIN FULLY TESTED AND GUARANTEED
 SEND NOW FOR OUR FREE 28 PAGE ILLUSTRATED CATALOGUE. SEND STAMP PLEASE

Electronics. Make a job of it....

Enrol in the BNR & E School and you'll have an entertaining and fascinating hobby. Stick with it and the opportunities and the big money await you, if qualified, in every field of Electronics today. We offer the finest home study training for all subjects in radio, television, etc., especially for the CITY AND GUILDS EXAMS (Technicians' Certificates); the Grad. Brit. I.E.R. Exam; the RADIO AMATEUR'S LICENCE; P.M.G. Certificates; the R.T.E.B Servicing Certificates; etc. Also courses in Television; Transistors; Radar; Computers; Servo-mechanisms; Mathematics and Practical Transistor Radio course with equipment. We have OVER 20 YEARS' experience in teaching radio subjects and an unbroken record of exam successes. We are the only privately run British home study College specialising in electronics subjects only. Full details will be gladly sent without any obligation.



Become a Radio Amateur.

Learn how to become a radio-amateur in contact with the whole world. We give skilled preparation for the G.P.O. licence.

WL779

Free!

Brochure without obligation to:

British National Radio & Electronic School

P O Box 156, Jersey, Channel Islands

NAME _____

ADDRESS _____

Block caps please

Catronics
SPECIAL DISCOUNT PRICES!

Exceptional Value in the complete Range of VERO CABINETS

a few examples:

ALL PLASTIC RANGE		
Code No.	Size (mm)	Price
65-2514F	100x50x25	£1.70
65-2516G	100x50x40	£1.91
65-2518H	120x65x40	£2.15
65-2520J	150x80x50	£2.45
65-2522K	188x110x60	£3.25

METAL FRONTED RANGE		
Code No.	Size (mm)	Price
75-1237J	85x40x154	£2.80
75-1238D	85x60x154	£3.06
75-1239K	85x80x154	£3.65
75-1411D	205x140x75	£4.26
75-1412K	205x140x110	£5.53
75-1410J	205x140x40	£3.80

Aluminium top panel	65-3851A (120x65x40)	£3.31
Sloping front panel	75-1798K (171x121x75/37.5)	£4.82
Sloping front panel	65-2523E (220x174x100/52)	£6.90

19" CARD FRAME/CASE SYSTEM

Card Frame/Case	71-3841-L	£24.60 -£1 25 p.p.s
Pair end plates	71-3842-F	£1.01
8" Module	71-3843-A	£5.00
4" Module	71-3844-G	£3.80
Veroboard	09-3979-K	£1.35
2" Front panel	71-3845-B	£2.37
1" Front panel	71-3846-H	£2.06
Veroboards (less connector)	09-1034-F	£1.42
Plain board (less connector)	09-1040-J	94p
DIP board (less connector)	10-1041-J	£2.66
Connector, plug, 31 way	17-0267-H	£1.09
Connector, socket, 31 way	17-0268-C	£1.20
VQ DIP board	01-0044-C	£1.17

All prices INCLUDE VAT, at current rates. Please note our minimum U.K. post & packing charge, except where indicated, is 30p.

**CATRONICS LTD., COMMUNICATIONS HOUSE,
(Dept. 987) 20 WALLINGTON SQUARE,
WALLINGTON, SURREY SM6 8RG.**

Tel. 01-669 6700 (9 a.m. to 5.30 p.m. Sat. 1 p.m.)



Wilmslow Audio

THE firm for speakers!

SEND 15P STAMP FOR THE WORLD'S BEST CATALOGUE OF SPEAKERS, DRIVE UNITS, KITS, CROSSOVERS ETC. AND DISCOUNT PRICE LIST.

AUDAX ● AUDIOMASTER ● BAKER ● BOWERS & WILKINS ● CASTLE ● CELESTION ● CHARTWELL ● COLES ● DALESFORD ● DECCA ● EMI ● EAGLE ● ELAC ● FANE ● GAUSS ● GOODMAN'S ● I.M.F. ● ISOPHON ● JR ● JORDAN WATTS ● KEF ● LEAK ● LOWTHER MCKENZIE ● MONITOR AUDIO ● PEERLESS ● RADFORD ● RAM ● RICHARD ALLAN ● SEAS ● SHACKMAN ● STAG ● TANGENT ● TANNON ● VIDEOTONE ● WHARFEDALE ● YAMAHA

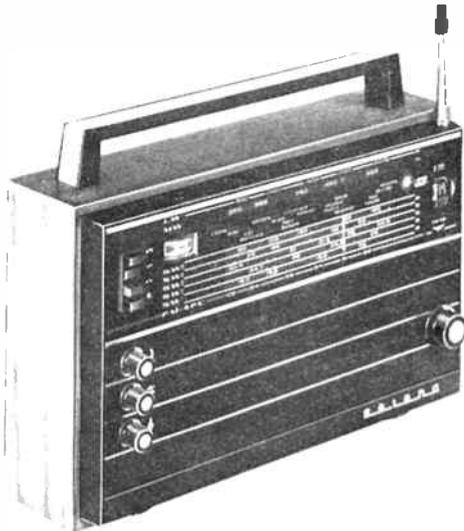
WILMSLOW AUDIO (Dept. P.W.)

SWAN WORKS, BANK SQUARE, WILMSLOW,
CHESHIRE SK9 1HF

Discount Hi-Fi Etc. at 5 Swan Street and 10 Swan Street

Speakers, Mail Order & Export 0625 529599 Hi-Fi 0625 526213

Vega are long on Short Wave Value



Vega 206 Superhet portable receiving long and medium waves plus 6 short-wave bands: 150-60m (2-5mHz), 60-40m (5-7.5mHz), 32.35-24.8m (9.3-12.1mHz), 19.85-19.4m (15.1-15.45mHz), 16.95-16.75m (17.7-17.9mHz), 14-13.8m (21.45-21.75mHz). Intermediate frequency 465kHz. Rated Output 150mW. Circuitry comprises 12 semi-conductors including voltage stabilising diode, plus turret waveband selector, treble control, inbuilt ferrite rod aerial for med and long waves, 7-section telescopic antenna for short waves. Sockets for line aerial, 9v DC external power source, tape-recorder, earphone or extension loudspeaker. Dimensions: 229x297x105mm. Weight: 2.7kg (6lb) without batteries. **Price: £24.15 inc VAT.**



Vega Spidola 250 Superhet portable receiving VHF/FM, long, medium and 6 short-wave bands: 150-60m (2.0-5.0mHz), 60-40.5m (5.0-7.4mHz), 31.6-30.7m (9.5-9.77mHz), 25.7-24.8m (11.7-12.1mHz), 19.85-16.75m (15.1-17.9mHz), 14-13.8m (21.45-21.75mHz).

Intermediate frequency 465kHz. Rated Output 800mW. Circuitry includes 23 semi-conductors, independent bass and treble tone controls, automatic frequency control, battery condition/tuning meter, inbuilt ferrite rod aerial for long and medium waves, 8-section telescopic swivelling antenna for VHF/FM and short waves. Sockets for: line aerial, 9v DC external power source, tape recorder, earphone or extension speaker. Dimensions: 250x365x105mm. Weight: 3.4kg (7.5lb) without batteries. **Price: £34.79 inc VAT.**

Note: prices shown are rec retail. You may find lower prices locally.

See these and the other fine Vega radios right away. Ask us to send you the Vega Radios colour brochure.



VEGA

programmed for value

Vega value is convincingly demonstrated in the superb short-wave coverage of the 206, Spidola and Selena models: no less than six short-wave bands on the 206 and Spidola, five (including "trawler" bands) on the Selena. Engineered in the USSR to the highest electronic standards, these powerful portables – and the other models in the range – give you top performance (for complete "home" listening too) and reliable service at competitive prices.

Vega Selena 210/2 MB

Superhet portable receiving VHF/FM, long, medium and 5 short-wave bands: 19.85-19.4m (15.1-15.45mHz), 25.8-24.8m (11.7-12.1mHz), 31.6-30.7m (9.5-9.77mHz), 50.4-41.0m (5.95-7.3mHz), (marine) 186.9-76.0m (1.605-3.95mHz). Intermediate frequency 465kHz. Rated Output 500mW (max 750mW). 31 semi-conductor circuitry. Independent bass and treble tone controls. Automatic frequency control. Built-in mains convertor. Sockets for line aerial, earth, tape-recorder, earphone or extension speaker. Inbuilt ferrite rod aerial for long and med waves, 8-section telescopic swivelling antenna for VHF/FM and short waves. Battery condition/tuning meter. Weight 4.08kg (9lb) without batteries. **Price: £39.34 inc VAT.**

Dimensions: 370x250x115mm.



Imported, Distributed and Guaranteed by Technical & Optical Equipment (London) Ltd., Zenith House, The Hyde, Edgware Road, London, NW9 6EE. Tel: 01-200 6505

Sonic

HI-FI DISCOUNT CENTRES



DISCOUNT SPEAKERS

Imp 8 or 15 as app.
Guarantees:
TITAN 5 years
FANE LIFETIME
OTHERS 1 year
ALL PRICES INC. VAT

Prices correct at 23.1.79

HI-FI TYPES

	List/Value	Sonic Price
5" FANE 501 Mid or Full range		£4.95
8" A.F. Model 80 Dual Cone		£4.95
8" A.F. Model 83 Dual Cone		£6.95
FANE 8" 80BT Dual Cone		£3.95
WH'FEDEALE L'TON 3xP kit Pt.	£60.70	£35.95
... DENTON 2xP KIT pair	£39.15	£21.95
... GLENDALE 3xP KIT	£82.44	£58.95
A.F. FRI 8" SPKR KIT	Sp. Price Pair	£14.95
8" FANE MODE ONE KIT	Sp. Price Pair	£19.99
10" ELAC Model 10RM 10-15w	Sp. Price	£2.50

CABINETS (TEAK VENEERED)

20" x 11 1/2" x 9 1/2" Suitable for Mode 1 or FRI Kits and Models 80, 83 or 80BT Spkrs.

Limited Number £6.95 ea.

GROUP/DISCO TYPES

12" TITAN T12/45R	£15.00	£12.95
12" TITAN T12/60R	£22.50	£14.95
12" TITAN T12/100A 100w	£36.00	£22.95
12" CELESTION G12M	£16.50	£11.95
12" CELESTION G12H 30w	£22.00	£14.95
12" CELESTION G12/50 50w	£25.75	£18.95
12" GOODMANS 12 PD	Sp. Price	£21.95
12" GOODMANS 12 PG	Sp. Price	£18.95
12" FANE 'SPECIALIST' P.A. 80	£29.95	£18.95
12" " " DISCO 80	£39.95	£19.95
12" " " DISCO 100	£39.95	£21.95
12" " " GUITAR 80L	£28.95	£18.95
12" " " GUITAR 100L	£31.95	£19.95
12" " " GUITAR 80B	£29.95	£19.95
12" FANE CRESCENDO 80	£44.95	£29.99
12" " " 80LT	£49.95	£34.95
12" " " 12A	£64.45	£41.95
12" " " 12L	£67.67	£39.95
12" " " 12 BASS	£63.95	£39.95
15" TITAN T15/70 70w	£28.00	£19.95
15" TITAN T15/100 100w	£41.00	£29.95
15" FANE 'SPECIALIST' BASS 85	£41.95	£29.95
15" " " BASS 100	£41.00	£31.95
15" GOODMANS 15P	Sp. Price	£23.95
15" FANE CRESCENDO/15	£82.66	£51.95
15" " " BASS	£85.95	£51.95
15" " " 15/100LT	£74.69	£51.95
15" " " 15/160 160w	£107.23	£72.95
15" " " COLOSSUS 200w	£121.91	£72.95
18" TITAN T18/100 100w	£51.00	£39.95
18" GOODMANS 18P	Sp. Price	£39.95
18" CELESTION G18C	£53.00	£41.95
18" FANE CRESCENDO 18A	£114.97	£72.95
18" " " BASS	£101.86	£69.95
18" " " COLOSSUS 200w	£129.81	£75.00

PLEASE STATE IMPEDANCE.

HORN UNITS (Carr. 85p)

CELESTION MH1000 25w	£17.00	£13.75
FANE 910 MK II 50w	£17.75	£10.99
.. 920 100w	£62.95	£44.50
.. J44 30-50w	£7.95	£4.95
J73 50w	£11.75	£7.95
J104 50-70w	£16.95	£10.95

HIGH POWER 'CROSS-OVERS'

FANE HPx1R or HPx2R Carr. 35p	£3.65	£2.25
-------------------------------	-------	-------

ADD-ON HIGH FREQUENCY UNITS

F.A.L. 'Add-on' Carr. £1	£41.95	£35.95
TITAN T1H 70w Carr. £1	£33.00	£23.95
TITAN TS2H 100w Carr. £1	£33.00	£23.95
TITAN T2H Carr. £1	£39.00	£26.95

BIG DISCOUNTS ON WHARFEDALE SPEAKER KITS

LINTON 3XP	List/Value	Sonic Price
Power handling 30 watts DIN	£60.70	£35.95
DENTON 2XP		
Power handling 25 watts DIN	£39.15	£21.95

Also for personal shoppers only

AMPS, TTABLES, JINGLE MACHINES, DISCO CONSOLES, LIGHTING, CABINETS, CREDIT TERMS AVAILABLE orders £20 over

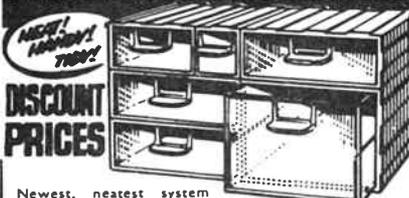
Phone orders accepted from Access & Barclay card holders.

403 SAUCHIEHALL STREET

GLASGOW

Mail Orders/Export enquiries only to 24 Newgate Shopping Centre, NEWCASTLE. Add £1 carr. on HI-FI spkrs. or kits. Otherwise add £1.25 (12" Spkr). £1.50 (15") £2.50 (18")

INTER-LOCKING PLASTIC STORAGE DRAWERS



NEW! HIGHER! TOWER!
DISCOUNT PRICES
Newest, neatest system ever devised for storing small parts and components: resistors, capacitors, diodes, transistors, etc. Rigid plastic units interlock together in vertical and horizontal combinations. Transparent plastic drawers have label slots. 1D and 2D have space dividers. Build up any size cabinet for wall, bench or table top.

As supplied to Post Office, Industry and Government Depts.

SINGLE UNITS (1D) (5in x 2 1/2in x 2 1/2in). £3.50 DOZEN.
DOUBLE UNITS (2D) (5in x 4 1/2in x 2 1/2in). £3.50 DOZEN.
TREBLE (3D) £3.50 for 8.
DOUBLE TREBLE 2 drawers, in one outer case (6D2) £7.90 for 8.
EXTRA LARGE SIZE (6D1) £6.90 for 8.

PLUS QUANTITY DISCOUNTS
Orders over £20. less 5%. Orders over £60. less 7 1/2%. PACKING POSTAGE CARRIAGE: Add £1.00 to all orders over £10. Orders £10 and over, please add 10% carriage. Quotations for larger quantities. Please add 8% V.A.T. to total remittance. All prices correct at time of going to press.

4-WAY IN-LINE POWER PANEL 13 AMP
EASY ACCESSIBLE FUSE
MOUNT IT OR TRIAL IT!
Modern, slim-line power panel, countless uses in home, office, factory, showrooms. Perfectly safe, unbeatable. Can be mounted on wall or trailed anywhere in room. Nicot Ober base. Smart PVC outer cover. White £3.30 P&P 60p. (V.A.T. Incl.)
FLAIRLINE SUPPLIES (Dept. PW2)
124 Cricklewood Broadway, London NW2
Tel. 01-450 4844

OSMABET LTD

We make transformers amongst other things
LOW VOLTAGE TRANSFORMERS: Prim 240V ac.
6 3V 1 5A £2.95; 3A £3.80; 6A CT £6.85; 12V 1 5A £3.95; 3A CT £6.85; 6A CT £8.50; 15V 1 5A £2.75; 18V 1 5A CT £6.85; 24V 1 5A 6.85; 3A CT £8.50; 5A CT £15.50; 8A CT £26.75; 12A CT £35.00; 40V 3A CT £12.25.
TWIN SEC TRANSFORMERS: Prim 240V ac.
6V 0.6A - 6V 0.6A; 9V 0.4A - 9V 0.4A; 12V 0.3A - 12V 0.3A; 20V 0.15A - 20V 0.15A; all £3.65 each; 15V 0.75A - 15V 0.75A £5.65; 15V 1.5A - 15V 1.5A £7.75; 18V 1A - 18V 1A 6.85; 18V 1.5A - 18V 1.5A £8.50; 20V 1.5A - 20V 1.5A £8.50; 12V 4A - 12V 4A £10.50; 25V 2A - 25V 2A £10.50.
MIDGET RECTIFIER TRANSFORMERS: Prim 240V ac.
6-0-6V 1.5A or 9-0-9V 1A £3.00 each; 12V-0-12V 1A or 20V-0-20V 0.75A £3.75 each; 9-0-9V 0.3A or 12V-0-12V 0.25A or 20V-0-20V 0.15A £2.85 each
LT TRANSFORMERS TAPPED SEC. prim 240V ac.
0-10-12-14-16-18V 2A £8.50; 4A £8.25; 0-12-15-20-24-30V 2A £7.35; 4A £10.50; 0-20-30-60V 1A £8.25; 2A £10.50; 0-40-50-60-80-100-110V 1A £10.50.
MAINS TRANSFORMERS SPECIAL OFFER: prim 240V ac.
250-0-250V 60Ma 6 3V 1A £2.00; 250V 100Ma 6 3V 2A £3.00; 9V 3A £2.50; 25V 0.3A £1.00.
LOUDSPEAKERS
2 1/2in 8Ω, 2 1/4in 8Ω or 25Ω, 2 1/2in 8Ω, 3in 35Ω, 3 1/2in 3.8, 8, 16 or 80Ω, all at 1.25 each; 5 - 3in 4, 8, 15 or 25Ω, £1.50; 7 - 4in 4, 8, 16, 25 or 80Ω, £1.75; 8 - 5in 4, 8 or 25Ω, £3.00; Bin 8Q, £2.50.
"INSTANT" BULK CASSETTE TAPE ERASER
Instant erasure of cassettes, and any diameter of tape spools, demagnetises tape heads, 200/240V ac. £6.00.
POWER SUPPLY, TWIN OUTPUT: Prim 240V ac.
New, British manufacture smoothed d.c. output 20V 1.5A, plus stabilised output of 15V 100 Ma, plus 12V ac 0.5A output, complete with diagram. £3.50.
EDGEWISE LEVEL METER FSD 200/μA
Size 19 x 18 x 20mm 8000Ω £1.10.
CHARGING METERS 1 1/2 ins diameter
2A or 3A £1.25 each; 5A or 10A £1.50 each.
SYNCHRONOUS GEARED MOTORS 240V ac.
Brand new, built in gear box. 1 or 20 RPH. £1.25 each.
O/P TRANSFORMERS FOR VALVE AMPLIFIERS
P.P. sec tapped 3.8-15Ω, A-A 6K, 30V £15.25; A-A 3K, 50V £22.75; 100V IEL31, KT88, etc. £31.25.
G.E.C. MANUAL OF POWER AMPLIFIERS
Covers valve amplifiers 30V to 240V £1.00.
MULTIWAY SCREENED CABLE, PVC COVERED
36 way £1.00; 25 way 75p; 14 way 50p; 6 way 25p; 4 way 20p; 2 way 10p; 1 way 8p; 4 way individually screened 25p per metre fig 8 twin stereo do screened 15p, metre.
MAINS CABLE
4 way, 3A 30p metre; fig 8 for loudspeakers etc. £5.00 100 metres.
CONDENSERS
Electrolytic, 400/400V 75p; 2000/30V 30p; 1200/75 50p; 2200/40V 40p; 8-8/450V 40p; Paper tubular, W/E 4/160V, 8/160V, 2/150V, 0.1/2000V 25p each.
CARRIAGE EXTRA ON ALL ORDERS
ALL PRICES INCLUDE V.A.T.
Callers by appointment only. S.A.E. Enquiries, Lists.
46, Kenilworth Road, Edgware, Middx.
HA8 8YG. Tel: 01-958 9314

ELECTRONICS SUPPLIERS
SHOPS, IMPORTERS,
MANUFACTURERS

HONG KONG IS CHEAPER

Owing to the rising value of the Japanese Yen, products from Japan are becoming very expensive.

We have equivalent quality products at far better prices from Hong Kong, Taiwan and Korea.

We can supply in both large and small quantities with proven quality.

Even if you have never imported goods before, we can show you how!

86 pages, comprehensive, fully priced catalogue available: specialising in products for the electronics hobbyist.



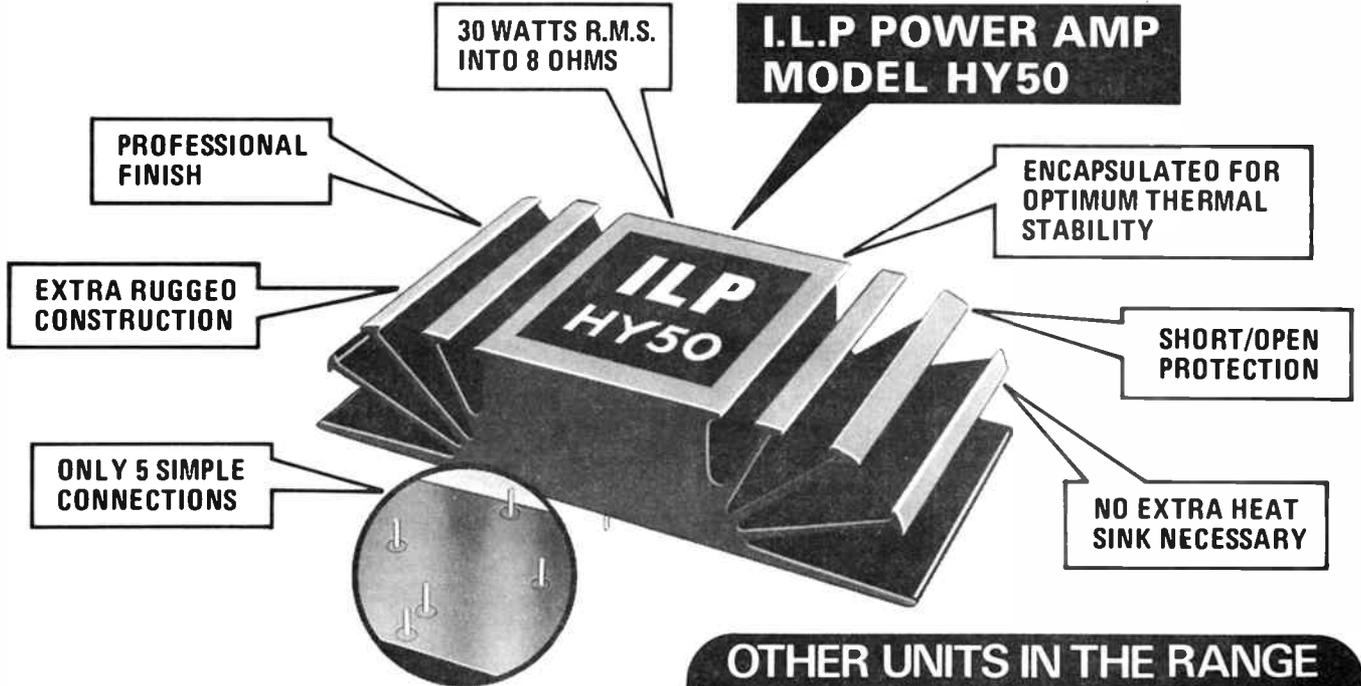
OVER 3000 ITEMS

Catalogue \$US4.00 to cover airmail postage.

DICK SMITH ELECTRONICS (HK) LTD.
Retail Showroom & Buying Office
29-39 Ashley Rd, Kowloon, H.K.
Tel. 3-669 352 Tlx. 64398
Call in when you're next in Hong Kong!

Simply ahead!

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



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

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

Encapsulated power amp with integral full-rated heatsink.
Input – 500mV
Output 30 watts RMS/8Ω
Load Impedance – 4 to 16Ω
Distortion – 0.04% from 100mW to 25 watts at 1KHz/8Ω
Supply Voltage – ±25V, Size 105 x 50 x 25mm
Inc. V.A.T. and postage in U.K.

£8.15

Nothing has been overlooked in the design and manufacture of I.L.P. Modular Units. Heavy duty heatsinks, encapsulated circuitry, no-compromise production standards and true professional finish ensure world leadership for I.L.P. Now we have up-graded output ratings and down-graded prices to bring I.L.P. within easier reach of all who want the best.

New production techniques enable us to reduce prices by an average of 20%, making I.L.P. a better buy than ever.

(Guaranteed 7 days despatch)

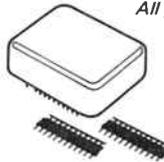
USE OUR FREE POST SERVICE for sending your orders, requests for information sheets etc. Simply address envelope.
NO STAMPS REQUIRED.



FREEPOST 1
Graham Bell House, Roper Close, Canterbury, Kent CT2 7EP
Phone (0227) 54778 Telex 965780

OTHER UNITS IN THE RANGE

All prices inc. V.A.T. & Postage in the U.K.



HY5 PRE-AMPLIFIER

Compatible with all I.L.P. power amps. and P.S.U.'s. In a single pack, needs external pots and switches. Multi-function equalization. 5 inputs. High overload margin. Active tone controls, 500 mV out. Distortion at 1 KHz – 0.01%.

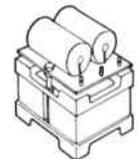
Two connect easily for stereo. **£5.22**



THE POWER AMPS

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

HY120 60 Watts RMS/8Ω 114 x 50 x 85mm **£16.42**
HY200 120 Watts RMS/8Ω 114 x 50 x 85mm **£19.92**
HY400 240 Watts RMS/4Ω 114 x 100 x 85mm **£29.89**



THE POWER SUPPLY UNITS

(Split line outputs to suit I.L.P. power amps and HY5)

PSU50 for 1 or 2 x HY50 **£9.11**
PSU70 for 1 or 2 x HY120 **£14.70**
PSU90 for one HY200 **£14.70**
PSU180 for one HY400 or 2 x HY200 **£24.80**

Information sheets on application – Use our FREEPOST Service.

★ NOW-PRICES DOWN BY 20%

Please supply
Total Purchase Price
I Enclose Cheque Postal Orders
Please debit my Access/Barclaycard Account number
Name
Address
Signature
Reg. Bus. No. 1032630 Eng. FP1/7

The measure of our success.

**METRAVO
1H** £24.50



No screws, just clips together only 4 basic parts. Do it yourself replacement. 36 ranges to 1000V-AC/DC 5A AC/DC 20 Kohm/V

**Transistor
Tester** £29.50



In Circuit Tester. NPN & PNP Signal & Power Devices. Clear Colour Zone Scale.

OX712 Scope
£340.25



Dual trace 15MHz Oscilloscope Sensitivity 1mV(max) Full 8cm x 10cm display. Finger tip SYNC, TV, YA, YB mains external.

Signal Injector £9.25



Useful for both valve and transistorised equipment. Frequencies up to 500MHz VHF & UHF. Pen type style.

Illustrated above are just 4 of the 350 instruments offered by PIL covering practically every measuring capability for Industry Education Science or Hobby.

Our new 1500 sq ft showroom displays a wide range of the products we distribute for some 60 manufacturers both British and international.

All visitors whether company engineers buyers or hobbyist are welcome and may purchase direct from the showroom in preference to mail order.

For further information on the showroom or on our product range please write to or call at **Precision Instrument Laboratories, 727 Old Kent Road, London SE15 Tel 01-639 4461** Products may be purchased by sending cheque with order to our showroom or by personal visit.

Prices including carriage and 8% VAT

PIL IEC
IEC GROUP COMPANIES

Showroom/Sales/Export 01-639 4461
Open Mon. to Fri. (ring for Sat. opening times)
North London Showroom 01-965-2352
Factory / Repair 01-639-0155

BUILD YOUR OWN METAL DETECTOR TR/IB TR/VCO BFO ...



Test equipment not required. Manuals for kits available at 25p each (refundable). UK prices post & VAT paid except where mentioned. Overseas: write for quote. Literature available: SAE please.

Shadow TR/IB (Illustrated)

A true transmit receive/ induction balance metal detector - uses the latest circuitry for maximum range and sensitivity. Speaker or phones. Pre-assembled search head with lightweight closed cell foam encapsulated coils for thermal insulation and water resistance. A very powerful machine!

Shadow TR/VCO

An advanced version of the above detector, use it as a sensitive TR/IB machine or switch to VCO mode when the depths achieved approach the maximum "in air" range. Low power requirement: runs on standard 9 volt batteries. The most sophisticated detector available as a kit.

Shadow TR/IB kit £22.50 (£29.95 assembled)
Shadow TR/VCO kit £27.50 (£36.95 assembled)
Padded stereo headphones suitable for 'Shadow' detectors £5.50

Designing your own detector? Then we can supply the (hard to obtain) hardware "shell" including fully adjustable shaft with handle, search head moulding with hinge assembly, special clips to mount your own control housing (any box is suitable) completely non-metallic; suitable for any type of detector (TR-PI-VLF-8FO etc). Supplied undrilled as a kit with full instructions (as used on our Shadow range). Detector Shell kit £8.50

Low cost BFO detector 200mm (8") annular search head gives wide scan with easy pinpointing. Simple high efficiency circuit draws <3mA. Extra lightweight 300gms (10.5ozs) with battery. Very detailed construction manual: ideal as a first project. Absolutely everything supplied including pre-assembled search head, tuning coil and earpiece.

ALT3 detector (kit) - £13.95.
Padded high Z headphones for ALT3: £4.90.

Order by post or phone (24 hours) - for quickest delivery quote credit card number. Callers by appointment only please!

ALTEK Dept. (P.W.) 1 Green Lane,
Walton-on-Thames, Surrey.
Phone (093 22) 44110

★ BARGAIN BUYS ★

All prices include VAT—Just add 25p post

from **GREENWELD**
443B Millbrook Road Southampton SO1 0HX
Tel: (0703) 772501/783740

SN76110 Stereo decoder 75p; 25/£15
100/£45.
8C184 Prepared for T05 spacing 100/£4.50 1000/£30.
8C213L straight leads 100/£5 1000/£33.
2N5060 0.8A SCR 30V. Ig 200uA 10/£2 100/£15 1000/£120.
1N4148, bandoliered 1000/£15 2500/£32 10,000/£90. Loose, boxes of 10k/£75.
741 8DIL 10/£1.80 100/£14.50.
555 8DIL 10/£2.40 100/£19.50.
1N4003 100/£2.90 1000/£24.
1N4007 100/£4.90 1000/£44.
Electrolytics: 10u40V PC mntg 25/£1.25 100/£3; 4.7u63V V.PC mntg. 1u/63V H.PC mntg same price.
1250u/25V can 10/£1.60 100/£10.
1500u/40V can 10/£2.20 100/£15.
800u/250V can 10/£5.50 100/£44.
400u/400V can 10/£8 100/£56.
200u/350V, 100 - 100 - 50/300V (all in one can) 10/£5 100/£36.
Pots - 10k lin std bush & spindle 1" long 10/£1 100/£7.50 1000/£50.
Slider 1 8k lin 60mm long prices as above. Dual 100k lin PC or chassis mntg. min type 18 x 13 x 17mm 0.125" spindle supplied with smart knob 40p 10/£3.50 100/£30.
Compression trimmer, 10-100pF 10 for £1.20 100/£8.50.
Resistors - 1/2W 5% carbon film, these values only: 220R 1k 3k9 4k7 33k 47k 220k 18R 330k 39k. All @ 1000/£4 (min qty of one value) or £35 per 10,000 any mix.
80 ohm 2 1/2 inch speaker 55p. 100/£38.
T03 sockets 10p. 100/£7.
Ferrite rod aerial 140mm x 10mm with LW & MW windings—40p. 100/£30.
Powerful 6V buzzer 50mm x 20mm. 70p. 100/£48.
8C2398, 100/£4. 1,000/£27.
1% half watt resistors 111k, 333k, 500k, 900k 100/£2.50.
Other valves on bargain list, send S.A.E.

Audible Warning device - solid state circuit drives high efficiency transducer to give high output. Voltage req'd 6-18V. Can also be driven direct from TTL or CMOS. Module size 45 x 21 x 12mm. Comprehensive data supplied £1.20.
VU meters - 2 meters 40 x 40mm x driver board supplied with full data and circuit £3.50.

OSCILLOSCOPES

We have available from stock the following SCOPEX models 4D10A DC-10MHz. 10mV sensitivity; Stab Power supplies. Dual beam; 3% accuracy. Excellent value at £214 inc VAT and Carr 456 - DC-6MHz. 10mV sensitivity Ideal portable scope. Solid state circuitry. All for £150 inc VAT and Carr

NIXIE TUBES

ITT type GNP7AH. Supplied with data 60p each.
Slider 1 8k lin 60mm long prices as above. Dual 100k lin PC or chassis mntg. min type 18 x 13 x 17mm 0.125" spindle supplied with smart knob 40p 10/£3.50 100/£30.
Compression trimmer, 10-100pF 10 for £1.20 100/£8.50.
Resistors - 1/2W 5% carbon film, these values only: 220R 1k 3k9 4k7 33k 47k 220k 18R 330k 39k. All @ 1000/£4 (min qty of one value) or £35 per 10,000 any mix.
80 ohm 2 1/2 inch speaker 55p. 100/£38.
T03 sockets 10p. 100/£7.
Ferrite rod aerial 140mm x 10mm with LW & MW windings—40p. 100/£30.
Powerful 6V buzzer 50mm x 20mm. 70p. 100/£48.
8C2398, 100/£4. 1,000/£27.
1% half watt resistors 111k, 333k, 500k, 900k 100/£2.50.
Other valves on bargain list, send S.A.E.

1979 CATALOGUE

64 big pages with 50p discount vouchers + qty prices for bulk buyers + reply paid envelope—All this for just 45p inc. post

Relays, push button banks and variable caps; Switches, component packs etc. etc. all in our latest Bargain List — send SAE for your free copy.

Prices in this ad include VAT and are valid until 30.7.79. Add 25p UK/8FPO postage. We buy surplus electronic components for cash.

FF1 WALL MOUNTING KIT FOR HI-FI SPEAKERS

Fidelity Fastenings FF1 is a precision made, vibration damped wall fastening for Hi-Fi and Stereo Speakers of up to 50lbs weight each. Almost undetectable when fitted, the FF1 allows easy adjustment of speaker angle, and the rubber mounting ensures that they do not move accidentally. Speakers can also be quickly and easily lifted off for dusting, cleaning and redecorating.

£6.49

in case of difficulty, direct from the manufacturer at £6.89 inc P & P

- ★ Holds up to 50lbs weight per speaker.
- ★ Precision cast mounting brackets.
- ★ Rubber friction mounting for complete stability.
- ★ Easy adjustment of angle for precise stereo image.



THE NUMBER BEHIND MOST LEADING MAKES OF HI-FI SPEAKER SYSTEMS.

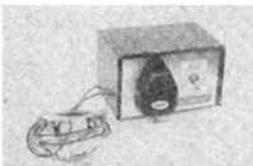
PRECISION AUDIO PRODUCTS FROM



The Ridgeway, Iver, Buckinghamshire
Tel: (0753) 654222

TRANSISTORISED INVERTERS

12v or 24v DC INPUTS
200/240v AC OFF LOAD OUT
SQUARE WAVE



FREQUENCY 48/52Hz DEPENDING ON LOAD
SILICON POWER TRANSISTORS
DC INPUT FUSED

ECONOMY MODELS

12v DC inputs:

EC1 - 6" x 4" x 4" approx. 20 watts	£9.50
EC2 - 6" x 4" x 4" approx. 40 watts	£12.80
EC3 - 11" x 7 1/2" x 4 1/2" approx. 150 watts	£25.48
EC4 - 11" x 7 1/2" x 4 1/2" approx. 200 watts	£32.20
EC5 - 11" x 7 1/2" x 5" approx. 300 watts	£39.00

ED1 - 11" x 7 1/2" x 4 1/2" approx. 100 watts	£22.10
ED2 - 11" x 7 1/2" x 4 1/2" approx. 150 watts	£26.80
ED3 - 11" x 7 1/2" x 5" approx. 200 watts	£33.50
ED4 - 11" x 7 1/2" x 5" approx. 300 watts	£42.00

Please add £2.00 per unit carriage.
All units assembled to order approx. 28 days.
Caged sizes are subject to variations.

TEL: **ELECTROVANCE**
01-736 0685 P.O. Box 191, London SW6 2LS

MICRO CHIMES

FROM THE INVENTORS OF MICROPROCESSOR MUSICAL CHIMES

New price for the original

CHROMA-CHIME KIT

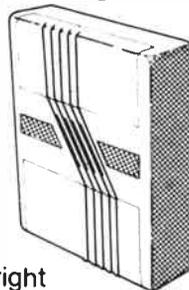
24 tune model!

Due to the fantastic success of this product right across the World we are able to offer it at

only **£9.95 + 75p p&p**

Comes complete with:

- * TMS1000 Micro
- * Superb cabinet
- * All R's & C's
- * Switches & pots
- * Fully prepared PCB
- * All semiconductors
- * Loudspeaker
- * Socket & Hardware
- * Fully detailed kit manual



TMS 1000N - MP0027A Micro-computer chip available separately if required. Full 24 tune spec device supplied with data sheet and fully guaranteed.

New low price only **£4.95** inc. p&p
(Only present 24 tune repertoire currently available.)

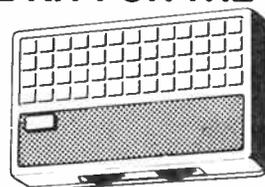
A COMPLETE KIT FOR THE NEW MICRO CHIME

This easy to build kit includes:

- * TMS1000 Custom MPU Chip
- * Special purpose designed case
- * Fully drilled and legended PCB
- * All transistors, Resistors and Capacitors
- * Full set of mechanical parts
- * Smart fascia labels
- * IC Socket and Loudspeaker
- * Really Low Price!

only **£8.95 + 55p p&p**

Chromatronics, Riverway, Harlow Essex, U.K.
ALL CHROMATRONICS PRODUCTS SUPPLIED WITH MONEY BACK REFUND PLEASE ALLOW 7-21 DAYS FOR DELIVERY



Please send me: TO: CHROMATRONICS, RIVER WAY, HARLOW, ESSEX, U.K.

NAME _____

ADDRESS _____

I enclose cheque/PO value £ _____
or debit my ACCESS/BARCLAYCARD account no. _____

Signature _____

CHROMATRONICS

Largest range of quality components in the U.K. - over 8,000 types stocked

Marshall's

Head Office and Mail Order to Dept. E.E.,
A. Marshall (London) Ltd.,
Kingsgate House, Kingsgate Place,
London NW6 4TA. Tel: 01-624 0805.
Telex: 21492.

Retail Sales: London: 40 Cricklewood Broadway, NW2 3ET. Tel: 01-452 0161/2 ALSO 325 Edgware Road, W2. Tel: 01-723 4242.
Glasgow: 85 West Regent Street, G2 2QD. Tel: 041-332 4133 AND Bristol: 108A Stokes's Croft, Bristol. Tel: 0272 426801/2.

TRANSISTORS (full range in catalogue)

2N698	N70	30	2N1507	N70	35	AF178	P64	1.30
2N697	N70	31	2N1524	P54	36	AF186	P65	1.30
2N698	N70	31	2N1553	P66	1.60	AF200	P20	1.30
2N699	N70	30	2N1613	N70	30	AF201	P20	1.30
2N706	N70	30	2N1637	P70	72	AF239	P65	70
2N704	N70	30	2N1638	P54	70	AF240	P65	1.26
2N708	N70	30	2N1711	N70	30	AF279	P59	80
2N718	N70	30	2N1895	N70	30	AF280	P59	80
2N718A	N70	34	AC1276	P54	48	AF442	P65	1.65
2N720A	N70	30	AC1276	N54	48	AU110	P66	1.70
2N721	P70	1.85	AC1278	P54	48	AU113	P66	1.70
2N722	P70	46	AC1281	P54	43	BC107A/B	N70	1.80
2N727	P70	1.85	AC1282	P54	43	BC108A/B/C/D	N70	1.80
2N744	N70	36	AC1283	P54	58	BC109A/B	N70	1.80
2N753	N70	36	AC153K	P54	58	BC113	N54	22
2N760	N70	36	AC178K	N54	70	BC114	N54	22
2N869	P70	36	AC178	N54	84	BCY70	P70	21
2N914	N70	38	AC187	N54	88	BCY71	P70	24
2N918	N70	33	AC187K	P54	86	BCY72	P70	18
2N917	N65	38	AC187	P54	84	BCY77	P70	70
2N918	N65	41	AC188K	P54	85	BCY78	P70	43
2N929	N70	37	AD138	P59	276	BCY79	P70	41
2N929A	N70	37	AD142	P66	145	BCY87	N101	6.35
2N930	N70	37	AD143	P66	145	BCY88	N101	3.90
2N930A	N70	38	AD149	P66	286	BCY89	N101	3.90
2N1131	P70	32	AD150	P66	118	BD115	N70	88
2N1132	P70	36	AD181	N66	100	BD116	N66	1.10
2N1204	P70	1.65	AD182	P66	100	BD121	N66	2.20
2N1302	N70	30	AF108	P65	80	BD124	N66	2.20
2N1303	P70	30	AF109	P65	82	BD131	N67	86
2N1304	N70	30	AF114	P64	78	BD132	P67	76
2N1305	P70	30	AF115	P64	78	BD135	N67	40
2N1306	N70	1.00	AF116	P64	78	BD138	P67	40
2N1307	P70	1.00	AF117	P64	78	BD137	N67	41
2N1308	N70	1.18	AF118	P64	78	BD136	P67	41
2N1309	P70	1.18	AF119	P64	78	BD139	N67	43
2N1370	P70	56	AF125	P70	70	BF115	N20	39
2N1420	N70	56	AF128	P70	70	BF119	N70	1.18
2N1483	N70	1.06	AF139	P65	76	BF121	N19	60
2N1485	N70	2.28	AF172	P68	70	BF123	N19	60

LINEAR (see catalogue for full range)

CA3013	£1.25	SL610C	£2.75	SN76001M	£1.30	TAA283	£1.38	TAA700	£3.90
CA3014	£2.20	SL611C	£2.75	SN76003M	£3.08	TAA300	£2.70	TAA930A	£1.45
CA3018	£0.76	SL812C	£2.75	SN76003K	£1.25	TAA321	£1.18	TAA930B	£1.45
CA3018A	£1.10	SL820C	£3.65	SN76013M	£2.04	TAA522	£1.85	TBA120	£0.20
CA3020	£2.20	SL921C	£2.75	SN76021M	£1.72	TAA550	£0.48	TBA331	£0.90
CA3020A	£2.50	SL923C	£2.25	SN76021K	£1.90	TAA611B	£2.30	TBA341	£0.95
CA3021	£2.40	SL930C	£2.25	SN76023M	£2.05	TAA622	£2.50	TBA355	£1.80
CA3022	£2.20	SL940C	£4.40	SN76023K	£1.72	TAA651A	£1.65	TBA368	£1.20
CA3023	£2.20	SL411A	£4.40	SN76033M	£1.72	TAA661B	£1.45	TBA400	£2.20
CA3026	£0.70	SL701C	£2.50	SN76111M	£1.30	TAA730	£1.55	TBA440	£1.80
CA3028A	£0.80	CA3085F	£1.07	SN76115M	£1.05				
CA3028B	£1.25	CA3085E	£2.90	SN76116M	£1.80				

NEW 1979 CATALOGUE
48 pages containing largest range of quality components in the UK - over 8,000 line items - 50p post paid or 40p to callers at any of our 4 branches. MAIL ORDER All prices are VAT incl. Telephone Credit Card Orders - minimum £10. ACCESS AND BARCLAYCARD.

VALVES - MULLARD

09B7/802	£1.17	EL86	£2.43	PCF200	£2.77	PL63	£2.87
0C62	£1.38	EL95	£1.71	PCF201	£2.77	PL64	£1.78
0C63	£1.31	EY88/802	£1.17	PCF801	£1.77	PL95	£1.48
0C64	£1.51	EY501	£2.87	PCF802	£1.77	PL504	£2.90
0C68	£2.16	G234	£2.14	PCF806	£1.77	PL508	£2.87
0C69	£1.51	PC86	£2.31	PCJ200	£2.60	PL509	£2.76
0C84	£2.76	PC89	£2.31	PCJ82	£1.51	PL519	£6.83
0C85	£1.71	PC97	£1.31	PCJ83	£1.60	PL602	£3.89
0C82	£1.71	PC900	£2.43	PCJ84	£1.67	PY800	£1.78
0C86	£1.71	PC98	£1.51	PCJ86	£1.78	PY88	£1.58
EF85	£1.17	PC285	£1.71	PCJ85/85	£1.18	PY500A	£2.48
EF183	£1.61	PC289	£1.76	PS10	£4.40	UC82	£1.88
EF184	£1.82	PC289	£1.82	PH200	£2.26	UC83	£1.88
EL38	£2.60	PCF80	£1.81	PL36	£2.31	UL84	£1.88
EL84	£1.30	PCF86	£1.77				

TTL (see catalogue for full range)

74LS242N	£1.25	74LS273N	£1.30	74LS326N	£2.70	74LS379N	£1.25
74LS243N	£1.25	74LS275N	£3.20	74LS327N	£2.65	74LS380N	£0.44
74LS244N	£1.90	74LS279N	£0.58	74LS328N	£1.18	74LS381N	£0.90
74LS245N	£1.85	74LS280N	£1.65	74LS329N	£1.07	74LS382N	£0.90
74LS247N	£1.00	74LS283N	£1.70	74LS330N	£1.50	SN74S40N	£0.77
74LS248N	£1.00	74LS289N	£3.24	74LS353M	£0.85	SN74S48A	£0.77
74LS249N	£1.00	74LS290N	£1.00	74LS358M	£0.56	SN74S58M	£0.77
74LS251N	£1.00	74LS293N	£1.90	74LS367M	£0.95	SN74S112N	£1.70
74LS253M	£1.00	74LS298M	£1.38	74LS368M	£0.85	SN74S114N	£1.70
74LS257M	£1.00	74LS299M	£2.95	74LS373M	£0.85	SN74S140N	£0.77
74LS258M	£1.00	74LS299M	£1.35	74LS374M	£0.85	SN74S157N	£2.85
74LS259M	£1.35	74LS233N	£3.50	74LS375M	£0.86	SN74S188A	£2.70
74LS261N	£1.25	74LS244N	£1.85	74LS377M	£1.30	SN74S189N	£1.81
74LS268M	£0.44	74LS225N	£2.40	74LS378M	£1.07	SN74S200N	£3.60

POTENTIOMETERS - VOLUME CONTROLS
ROTARY POTENTIOMETERS. All standard 1/4" spindles
35p 1) SINGLE LESS SWITCH Long spindle double wiper, available in following values
75p 2) SINGLE SWITCH As above but with 2 Pole Switch 2 Amp 250V AC
95p 3) DUAL GANGED STEREO As above but dual No Switch All Log or Lin available in the following values
5k, 10k, 25k, 50k, 100k, 250k, 500k, 1Meg, 2Meg, except type 1 not available in 1Meg value

TEST LEADS KIT PN90 Complete luxury kit - curly leads, long reach prods - banana plug, pin plug Spade terminal and croc clip. PRICE £3.50/SET.

SIGNAL INJECTOR Model SE250N. Unusually stable trouble-shooter - for checking TV, Radio, amp, etc. £5.30.

TINNED COPPER WIRE Available on 2 oz. reels in the following gauges:

SWG	Price	SWG	Price	SWG	Price
18	£0.55	26	£0.60	32	£0.73
22	£0.55	30	£0.65	36	£0.80

MULTICORE SOLDER - SAVBIT 1.2mm
Approx. 13.7 metres of size 12 SAVBIT solder. Ideal for Radio, TV and similar work - £2.28.

CMOS (see catalogue for full range)

CD4000	£0.20	CD4012	£0.20	CD4021	£1.06	CD4031B	£2.25
CD4001B	£0.20	CD4018	£0.82	CD4022B	£1.00	CD4034B	£2.44
CD4002	£0.18	CD4034	£1.00	CD4028	£0.20	CD4035B	£1.30
CD4005	£1.25	CD4015	£0.78	SN74S24B	£0.78	CD4037	£1.20
CD4007	£0.18	CD4018	£0.82	CD4026	£0.20	CD4040	£1.12
CD4008B	£0.99	CD4017B	£1.06	CD4027B	£0.55	CD4041B	£0.88
CD4010	£0.80	CD4018B	£1.06	CD4028B	£0.80	CD4042B	£0.86
CD4019	£0.80	CD4019B	£0.82	CD4029B	£1.10	CD4043	£1.05
CD4011B	£0.20	CD4020B	£1.15	CD4030	£0.84	CD4044	£1.00

TRANSFORMERS

EX-STOCK - SAME DAY DESPATCH VAT 8%

TRANSFORMERS END OF LINE OFFERS

30 VOLT RANGE
Pri 220/240 sec 0-12-15-20-24-30V Voltages available 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30V or 12V-0-12V and 15V-0-15V.

Ref	Amps	Price	P & P
112	0.5	2.64	0.78
79	1.0	3.57	0.96
3	2.0	5.77	0.96
20	3.0	6.20	1.14
21	7.0	9.99	1.14
51	5.0	9.87	1.32
117	6.0	11.17	1.45
88	8.0	14.95	1.64
89	10.0	17.25	1.64
90	9.0	19.17	2.08
91	15.0	21.96	2.08
92	2.0	20.45	O.A.

50 VOLT RANGE
Pri 220/240V Sec 0-20-25-33-40 Voltages available 1.2, 7, 8, 10, 13, 15, 17, 20, 33, 40 or 20V 0-20V and 25V 0-25V.

Ref	Amps	Price	P & P
102	0.5	3.41	0.78
103	1.0	4.57	0.96
104	2.0	7.16	1.14
105	3.0	8.56	1.32
106	4.0	11.41	1.50
107	6.0	16.06	1.64
118	8.0	20.26	2.08
119	10.0	24.98	O.A.
109	12.0	28.90	O.A.

MAINS ISOLATORS (SCREENED)
PM 120/240V CT Sec 120/240V CT

Ref	VA	Price	P & P
*07	20	4.40	0.79
149	60	6.70	0.96
150	100	7.62	1.14
151	200	11.16	1.14
152	250	13.28	1.50
153	350	16.43	1.84
154	500	20.47	2.15
155	750	29.08	O.A.
156	1000	37.20	O.A.
157	1500	51.38	O.A.
158	2000	61.91	O.A.
159	3000	86.86	O.A.

*Pri 0-220 240V Sec 115 or 240V. State sec volts required.

CASED AUTO TRANSFORMERS
240V cable in 115V USA flat pin outlet

VA	Price	P & P	Ref
20	5.95	0.90	56W
75	7.73	1.14	64W
150	10.01	1.14	4W
200	14.82	1.45	65W
250	11.59	1.45	69W
500	19.17	1.64	67W
1K	27.88	2.30	84W
1.5K	26.02	O.A.	93W
2K	49.97	O.A.	95W

12 OR 24V OR 12-0-12V
Pri 220-240 volts

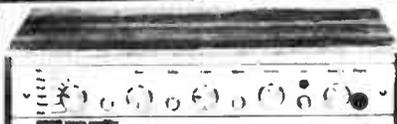
Ref	12V	24V	Price	P & P
111	0.5	0.25	2.20	0.45
213	1.0	0.5	2.64	0.78
71	2	1	3.51	0.78
18	4	2	4.03	0.96
85	0.5	2.5	5.00	0.96
70	6	3	6.35	0.96
108	8	4	7.42	1.14
72	10	5	8.12	1.14
116	12	6	9.39	1.32
17	16	8	10.72	1.32
115	20	10	13.98	2.08
187	30	15	17.93	2.08
226	60	30	36.74	U.C.

COMPONENT PACKS
65 1W Metal Oxide Resistors
65 1W Metal Oxide Resistors
150 Mixed Value Capacitors
10 Reed Switches
50 Wire Wound Resistors
10 3000mf 30V Capacitors
25 Assorted presets
50 3 tag terminal strips
Hardware BA nuts bolts
200 Mixed Resistors
10 mixed value electrolytic caps
32 mf to 2000 mf.

70p + 12 1/2% VAT
P & P 40p + 8% VAT

BRIDGE RECTIFIERS

100V	25A*	£2.36
200V	2A	£0.51
400V	4A	£0.96
400V	6A	£1.41
500V PM7A6 12A*		£



20 x 20 WATT STEREO AMPLIFIER

Viscount IV unit in teak simulate cabinet. Silver finish rotary controls and pushbuttons with matching fascia. red rms indicator and stereo jack socket. Functions switch for mic, magnetic and crystal pickups, tape tuner and auxiliary. Rear panel features two mains outlets DIN speaker and input sockets plus fuse 20x20 watts RMS 40x40 watts peak for use with 8 to 15 ohm speakers

£29.90
£2 50 p&p

30x30 WATT AMPLIFIER IN KIT FORM

For the experienced constructor complete in every detail same facilities as Viscount IV but with 30x30 output 60x60 watts peak. For use with 4 15 ohms speakers

£29.00 £2 50

SPECIAL OFFER

30 x 30 WATT AMPLIFIER KIT with BSR P200 belt drive deck and Shure M75 cartridge. **£55.00** + p&p £5.00

EMI SPEAKER BARGAIN

Stereo pair 350 kit. System consists of 13" x 8" approx woofer with rolled surround 2 1/2" approx. Audax tweeter crossover components and circuit diagram. Frequency response 20 Hz to 20 KHz. Power handling 15 watts RMS 20 watts max 8 ohm impedance

£14.95
Per stereo pair
£3.40 p&p

BSR P200

Belt drive chassis turntable unit semi-automatic, cueing device **£24.95** p&p £2 55

A O C OLM 30 Mk III Magnetic Cartridge to suit **£7.75**



BSR manual single play record deck with auto return and cueing lever. Fitted with stereo ceramic cartridge 2 speeds with 45 rpm spindle adaptor ideally suited from home or disco use. **OUR PRICE £10.95** p&p £2 55

GARRARD DECK MODEL CC 10A

Record changer with cueing device fitted with stereo ceramic cartridge ready to fit into your own plinth **£7.95** p&p £2 00 Size 12" x 8"

SANYO Nic/cad battery, with mains charger equivalent in size and replaces 4 SP11 type cells. Size 3 1/4" x 1 1/4" x 2" approx **£7.50** p&p £1 50p



BARGAIN FOR PERSONAL SHOPPERS ONLY
Altone UA4 Stereo System
Features 8 watt total output. Full size BSR manual turntable with cueing and auto return. Socket for tape in and out and stereo headphones complete with speakers **£34.95**

Micro Cassette Recorder
Pocket size—home or office use or when travelling **£13.95**

Battery operated fluorescent camping lamp.
Runs off 8 U2 batteries **£4.50**

Mullard

AUDIO MODULES IN BARGAIN PACKS

CURRENT CATALOGUE
PRICE **£25** AT OVER **PER PACK**
SEE OUR PRICES

- 1** PACK 1 2 x LP1173 10w RMS output power audio amp modules, + 1 LP1182/2 Stereo pre amp for ceramic and auxiliary input **OUR PRICE £4.95** p&p £1 00
- 2** PACK 2 2 x LP1173 10w RMS output power audio amp modules + 1 LP1184/2 Stereo pre amp for magnetic, ceramic and auxiliary inputs **OUR PRICE £7.45** p&p £1 00

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

10 + 10 AMPLIFIER KIT

An opportunity to buy a 10 watts per channel stereo amplifier kit which is suitable for use with a ceramic cartridge. The amplifier utilises proven Mullard modules and is available at a very competitive price. The amplifier kit comes complete with instructions and includes a Mullard LP1183 stereo preamplifier module, two LP1173 power amplifiers with integral heatsinks, a power supply, Zobel networks, front and back mounting panels, a finished fascia panel, all control potentiometers (bass, treble, volume and balance), switches, input, output and headphone sockets, wire, and an easily assembled wrap around cabinet to house the finished unit. Size approximately 9 1/2" x 8 1/2" x 4" **p&p £2 05 £11.95**



BARGAINS FOR PERSONAL SHOPPERS

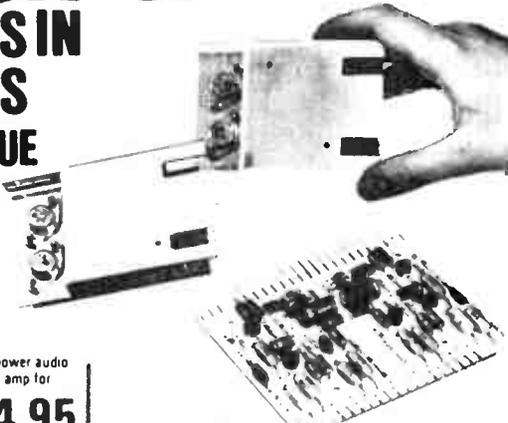
- LED 5 function men's digital watch stainless steel finish **£5.95**
- LCD 5 function men's digital watch stainless steel finish **£6.95**
- LCD 8 Function CHRONOGRAPH men's digital watch stainless steel finish **£12.95**
- POCKET CALCULATOR With LED display memory and percentage key **£2.95**
- AM/FM DIGITAL CLOCK RADIO Accurate 4 Digit Electronic Clock with 7" LED display Buzzer and snooze timer **£11.95**
- 125 Watt Power Amp Module **£13.95**
- Mains power supply for above unit **£3.50**
- MULLARD Built power supply **£1.50**
- DECCA 20w Stereo speaker kit comprising 2 8" approx bass units + 2 3 1/2" approx tweeter inc crossovers **£20.00**
- VIDEOMASTER Super Score TV Game with pistol mains operation **£14.95**
- PORTABLE RADIO/CASSETTE RECORDER, AM-FM with clock LW MW SW VHF mains/battery operation **£41.95**
- VIDEOMASTER COLOUR SHOT TV GAME Choice of three games—Football, Tennis and Squash. Ready to play—one or two players. MAINS OPERATED OPPORTUNITY AT **£9.95 ONLY**



323 EDGWARE ROAD, LONDON W2
21B HIGH STREET, ACTON W3 6NG

ACTON: Mail Order only. No callers
ALL PRICES INCLUDE VAT AT 12 1/2%
All items subject to availability. Price correct at 1/5/79 and subject to change without notice

ACCESSORIES ARE ONLY AVAILABLE TO THOSE CUSTOMERS WHEN BUYING OUR BARGAIN PACKS



ACCESSORIES

Suitable mains power supply parts consisting of mains transformer, bridge rectifier, smoothing capacitor and set of rotary stereo controls for treble, bass, volume and balance **£2.90** plus £1 50 p&p

Two Way Speaker Kit

Comprising of two 8" x 5" approx 4 ohm bass and two 3 1/2" 15 ohm mid range tweeter with two cross over capacitors **£3.95** per stereo pair plus £1 50 p&p

50 WATT MONO DISCO AMP

£29.95 P&P £2 50
Size approx. 13 1/4" x 5 1/4" x 6 1/4"

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

70 & 100 WATT MONO DISCO AMP

Size approx. 14" x 4" x 10 1/4"
Brushed aluminium fascia and rotary controls

Five vertical 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**
140 watt peak p&p £4 00
100 watt £65

DUO II SPEAKERS

Attractive teak finish, modern design, incorporating 2 separate speaker units—8" approx woofer and 2 1/2" approx tweeter 45 to 1800 Hz Impedance 8 ohms Power 15 watts RMS 20 watts max Per stereo pair **£17.00**
For personal callers only.

FOR PERSONAL SHOPPERS ONLY

STEREO RADIOGRAM CABINET
Finished in a natural teak veneer with opening top. Easily modified to accommodate stereo equipment of your choice. Price **£10.95**
Size approximately 47" x 15 1/2" x 15"

Personal Shoppers EDGWARE ROAD LONDON W2 Tel: 01-723 8432. 9.30am-5.30pm. Closed all day Thursday ACTON: Mail Order only. No callers GOODS NOT DESPATCHED OUTSIDE UK

Quality audio modules and accessories for

S450

STEREO FM TUNER
Fitted with phase lock-loop
£26.14
+ 40p p&p



The S450 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, simply by changing the settings of the pre-set controls. Features include FET input stage, Vari-Cap diode tuning, Switched AFC LED Stereo Indicator.

FREQUENCY RANGE	88-108 Mhz
SENSITIVITY	3 0 μV
BANDWIDTH	250 kHz
SPURIOUS REJECTION	50 dB
SELECTIVITY ± 400 kHz	55 dB
AUDIO OUTPUT (22.5 kHz deviation)	100 mV
STEREO SEPARATION	30 dB
SUPPLY REQUIREMENTS	20 to 30V (90mA max)
AERIAL IMPEDANCE	75 ohms
DIMENSIONS	240mm x 110mm x 32mm

Stereo 30

COMPLETE AUDIO CHASSIS
£21.57
+ 66p p&p



7 + 7w 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, main switch, fuse and fuse holder and universal mounting brackets.

OUTPUT POWER	7 Watts RMS
LOAD IMPEDANCE	8 ohms
TOTAL HARMONIC DISTORTION	Less than 5% (Typically 3%)
FREQUENCY RESPONSE	50 Hz to 20 kHz ± 3dBs
TONE CONTROL RANGE	± 12 dBs at 100Hz and 10kHz
SENSITIVITY	190 mV for full output
INPUT IMPEDANCE	1 M ohms
TRANSFORMER REQUIREMENTS	22 V. A.C. rated at 1A
DIMENSIONS (less controls and panel)	200mm x 130mm x 33mm

AL60

AUDIO AMPLIFIER MODULE
25 Watts RMS
£5.27 + 35p p&p



25w R.M.S.

This high quality audio amplifier module is for use in audio equipment and stereo amplifiers and provides output powers up to 25 RMS with distortion levels below 0.1%

OUTPUT POWER	25 Watts RMS
SUPPLY	30-50 V
LOAD IMPEDANCE	8-16 ohms
TOTAL HARMONIC DISTORTION	Less than 1% (Typically 0.6%)
FREQUENCY RESPONSE	20 Hz to 30 kHz ± 2 dBs
SENSITIVITY	280 mV for full output
MAX. HEAT SINK TEMPERATURE	90°C
DIMENSIONS	103mm x 64mm x 15mm

AL80

AUDIO AMPLIFIER MODULE
35 Watts RMS
£7.92 + 35p p&p



35w R.M.S.

The AL80 is similar in design to the AL60 above and is of the same high quality but provides output powers up to 35W with distortion levels below 0.1%

OUTPUT POWER	35 Watts RMS
SUPPLY	40-60 V
LOAD IMPEDANCE	8-16 ohms
TOTAL HARMONIC DISTORTION	Less than 1% (Typically 0.6%)
FREQUENCY RESPONSE	20 Hz to 30 kHz ± 2 dBs
SENSITIVITY	280 mV for full output
MAX. HEAT SINK TEMPERATURE	90°C
DIMENSIONS	103mm x 64mm x 15mm

AL250

POWER AMPLIFIER
£19.24 + 66p p&p



125w R.M.S.

This unit, designated AL250, is a power amplifier providing an output of up to 125W RMS, into a 4 ohm load.

OUTPUT POWER	125 Watts RMS continuous
OPERATING VOLTAGE	50-80 V
LOADS	4-16 ohms
FREQUENCY RESPONSE	25 Hz to 20 kHz measured at 100 Watts
SENSITIVITY FOR 100 WATTS O/P AT 1 kHz	450 mV
INPUT IMPEDANCE	33 K ohms
TOTAL HARMONIC DISTORTION	
50 WATTS into 4 ohms	0.1%
50 WATTS into 8 ohms	0.06%

AL30A

AUDIO AMPLIFIER MODULES
£4.26 + 35p p&p



10w R.M.S.

These low cost 10 watt modules offer the utmost in reliability and performance, whilst being compact in size.

MAXIMUM SUPPLY VOLTAGE	30 V
POWER OUTPUT for 2% THD	10 Watts RMS
TOTAL HARMONIC DISTORTION	Less than 25%
LOAD IMPEDANCE	8-16 ohms
INPUT IMPEDANCE	100 K ohms
FREQUENCY RESPONSE	50 Hz-25 kHz ± 3 dBs
SENSITIVITY	75 mV for full output
DIMENSIONS	74mm x 63mm x 28mm

SPM80

STABILISED POWER SUPPLY
£4.95 + 35p p&p



Designed to power two AL60s at 15 Watts per channel simultaneously. Circuit Techniques include full short circuit protection.

INPUT A.C. VOLTAGE	33-40V
OUTPUT D.C. VOLTAGE	33 V nominal
OUTPUT CURRENT	10 mA-1.5 amps
OVERLOAD CURRENT	1.7 amps approx.
DIMENSIONS	105mm x 63mm x 30mm

PA100

STEREO PRE-AMPLIFIER
£18.05
+ 40p p&p



A top quality stereo pre-amplifier and tone control unit, the PA100 provides a comprehensive solution to the front end requirements of stereo amplifiers or audio units. The six push button selector switch gives a choice of inputs together with two filters for high and low frequencies.

FREQUENCY RESPONSE	20 Hz to 20 kHz x 1 dB
TOTAL HARMONIC DISTORTION	Less than 1% (Typically 0.7%)
SENSITIVITY	1 TAPE 100 mV/100 K ohms } For an
INPUTS	2 RADIO TUNER 100 mV/100 K ohms } output
	3 MAGNETIC P.U. 3.5 mV/50 K ohms } 250 mV
EQUALISATION	Within ± 1 dB from 20 Hz to 20 kHz
BASS CONTROL RANGE	± 15 dBs at 75 Hz
TREBLE CONTROL RANGE	+ 10-20 dBs at 15 kHz
SIGNAL/NOISE RATIO	Better than 65 dBs (All inputs)
INPUT OVERLOAD	Better than 26 dBs (All inputs)
SUPPLY	20 to 40 V
DIMENSIONS	300 x 90 x 33mm (less controls)

MPA30

MAGNETIC CARTRIDGE PRE-AMPLIFIER
£3.35
+ 35p p&p



Enjoy the quality of a magnetic cartridge with your existing ceramic equipment using the MPA 30 which is a high quality pre-amplifier enabling magnetic cartridges to be used where facilities exist for the use of ceramic cartridges only.

SENSITIVITY	3.5 mV for 100 mV output
EQUALISATION	Within ± 1 dB from 20 Hz to 20 kHz
INPUT IMPEDANCE	50 K ohms
SUPPLY	18 to 30 V—re earth
DIMENSIONS	110 x 50 x 25mm (inc DIN socket)

PA12

STEREO PRE-AMPLIFIER
£8.75
+ 35p p&p



The PA12 Stereo Pre-Amplifier chassis is designed and recommended for use with the AL20/30 Audio Amplifier Modules, the PS12 power supply and the T538 Transformer. Features include on/off volume, Balance, Bass and Treble controls. Complete with tape output.

FREQUENCY RESPONSE	20 Hz-20 kHz (-3dB)
BASS CONTROL	± 12 dB at 60 Hz
TREBLE CONTROL	± 14 dB at 10 kHz
INPUT IMPEDANCE	1 Meg. ohm
INPUT SENSITIVITY	300 mV
CROSSTALK	-60 dB
SIGNAL/NOISE RATIO	-65 dB
OVERLOAD FACTOR	± 20 dB
TAPE OUTPUT IMPEDANCE	25 K ohms
DIMENSIONS	152mm x 84mm x 25mm

PS12 POWER SUPPLY MODULE

Power supply for AL20A-30A, PA12, S450 etc. Transformer T538.

Input A.C. Voltage 15-20V. Output D.C. Voltage 22-30V approx. (Dependent upon input.) Output Current 800mA maximum. Dimensions 60 x 43 x 26mm.



£2.13
+ 35p p&p.

BP124 SIREN ALARM MODULE

American Police siren powered from any 12 volt supply into 4 or 8 ohm speaker. Ideal for car burglar alarm, freezer break-down, and other security purposes.



ONLY £3.78
+ 35p p&p.

5 WATTS —

MA60 HI-FI AMPLIFIER KIT

Build your own top quality amplifier, save yourself pounds. The MA60 kit comprises the following B1-kits modules, 2 x AL60 amps, 1 x PA100 pre-amp, 1 x SPM80 stab. power supply, 1 x BMT80 trans. giving 15 watts RMS per channel STEREO. All modules covered by the B1PAK satisfaction or money back guarantee. Details of the above modules are in this ad. Price £36.00 + 62p p&p.

TC60 KIT

A beautifully designed genuine TEAK WOOD veneered cabinet to put the professional touches to your home built amplifier. Full set of parts incl. Front & Back Panels, Knobs, Chassis, Fuses, Sockets, Noen, etc. Ideal for the MA60. Size: 425mm x 290mm x 95mm. Price £22.44 + 86p p&p.

TRANSFORMERS

T538 For use with S.450 AL30A MPA30 Order No. 2036 Price: £3.60 + 55p p&p.
T2050 For use with Stereo 30 Order No. 2050 Price: £3.66 + 55p p&p.
BMT80 For use with AL60 SPM80 Order No. 2034 Price: £6.08 + 86p p&p.
BMT250 For use with AL250 Order No. 2035 Price: £7.14 + £1.10 p&p.
2040. For use with AL60 Order No. 2040 Price: £5.85 + 80p p&p.
2041. For use with AL80, AL120 and AL250 Order No. 2041. Price: £7.65 + 86p p&p.

CASES

TEAK 30, 32 x 23 x 8cm, designed mainly for use with our stereo 30 Audio System but has proved very helpful to home constructors. Fitted with solid uncut front and back. o/n 139. £6.69. p&p 70p.

TEAK 60, 42 x 29 x 9cm, for use with AL60/MK60 Audio Kit. Useful for the home constructor requiring an amplifier sleeve — has no front or back panel. o/n 140. £7.87. p&p 85p.

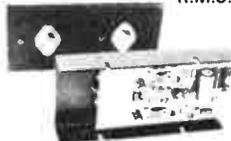
Professionals and Enthusiasts from BI-PAK

AL120

AUDIO AMPLIFIER
(With integral heat sink and short-circuit protection).

£12.91
+ P. & P. 35p

Introduced to fulfill the demand for a fully protected power amp. capable of driving high quality speaker systems at up to 50W. with distortion levels below 05%. Ideal for domestic use. Discos, P.A. systems, electronic organs etc. The generously rated components ensure continuous operation at high output levels.



50W R.M.S.

OUTPUT POWER SUPPLY	50 Watts R.M.S.
LOAD IMPEDANCE	8-16 ohms
TOTAL HARMONIC DISTORTION	05% Max. (Typically 02%)
FREQUENCY RESPONSE	25Hz-20kHz
SENSITIVITY	500mV
MAX HEAT SINK TEMP.	45 deg C
DIMENSIONS	192 x 89 x 49 mm

SPM120

STABILISED POWER SUPPLIES

SPM120/45
SMP120/55
SMP120/65
£6.52
+ P. & P. 35p



SPM120 is a fixed voltage stabiliser available with an output of either 45v, 55v, or 65v. Designed primarily for use in audio applications, the stabiliser which provides output currents up to 2.5A., operates direct from a mains transformer requiring only the addition of 2 Electrolytic capacitors to complete the s/c protection.

AC INPUTS	
SPM120/45	40-48v
SPM120/55	50-55v
SPM120/65	60-65v
OUTPUT CURRENT	2.5A
RIPPLE	1A 100mV 2A 150mV

GE100 Mk2.

10 CHANNEL MONOGRAPHIC EQUALISER

£22.50
+ P. & P. 35p



Only 155mm x 65mm x 50mm including the 10 x 10K 1in slider potentiometers and knobs which are mounted on a board positioned above the circuitry. In the frequency range of 31Hz to 20KHz you can cut and boost ± 12 dB with the 10 sliders, each of which has its frequency marked on the circuit board. The GE100 has numerous uses including mixers, P.A. systems and discos. It will also greatly improve the sound reproduction of your existing audio equipment. Power Supply for GE100 o/d SG30 £3.80

Control Range	± 12 dB
Dynamic Range	110dB
Maximum Output	± 15 dB
Frequency Response	30Hz-20KHz (± 1 dB)
Power Supply	15-0-15v
Voltage Handling Input	3v R.M.S
T.H.O.	005%

VPS30

REGULATED VARIABLE STABILISED POWER SUPPLY

£8.20 + P. & P. 35p



This NEW versatile Regulated Variable Stabilised Power Supply with short circuit protection and current limiting is a must for all electronics enthusiasts. It incorporates adjustable voltage from 2v-30v. with a current limiting range of 0-2A. With this module there is no need to build a separate power supply for each of your projects, with the simple addition of a transformer (o/d 2033), 0-1ma (o/d 1310 or 1305), plus a suitable shunt, a voltmeter (o/d 1311 or 1306), a 470ohm pot (o/d 1896) a 4K7 pot (o/d 1899). It can be used again and again as a self-contained bench, power supply, eliminating the use of batteries and thus saving ££'s!

AC Input Maximum	25v
Voltage Regulation	2-30v
Regulated Current	0-2A
Incorporating short circuit protection	

PA200

STEREO PRE-AMPLIFIER

£16.55
+12 1/2% V.A.T.
P. & P. 40p



The PA200 is basically our popular PA100. Modifications have been made to make it compatible with the higher output AL120 and AL250 amplifiers.

FREQUENCY RESPONSE	20Hz to 20kHz x 1dB	
TOTAL HARMONIC DISTORTION	Less than 1% (Typically 70%)	
SENSITIVITY	1 TAPE	100mV/100 K ohms
INPUTS	2 RADIO TUNER	100mV/100 K ohms
	3 MAGNETIC P U	3-5mV/50 K ohms
		output 500mV
EQUALISATION	Within ± 1 dB from 20Hz to 20kHz	
BASS CONTROL RANGE	± 15 dBs at 75Hz	
TREBLE CONTROL RANGE	± 10 20dBs at 15kHz	
SIGNAL NOISE RATIO	Better than 65dBs (All inputs)	
INPUT OVERLOAD	Better than 2dBs (All inputs)	
SUPPLY	35 to 70v	
DIMENSIONS	300 x 90 x 33mm (less controls)	

ADAPTORS

AC DC enables a large range of battery powered radios, recorders, calculators to be run off the mains (220-240V AC). Switchable for 3-6-9-12 volts. Current rating 300mA. Polarity reversing switch. Universal plug incorporated. o/n 137. £4.06. p&p 35p.
DC-DC for use in all cars, boats etc., with pos. or neg. earth for a regulated output of 6, 7.5 or 9 volts DC at 300mA. For radios, recorders etc. o/n 138. £3.15. p&p 35p.

CROSSOVER NETWORKS

2-WAY channels for high and low frequencies to correct speakers - high to tweeters, low to woofers. Complete with instructions. Frequency: 3,000Hz. o/n 1904. £1.24. p&p 35p.
2-WAY for 8 ohm speakers up to 30 watts. Frequency: .3KHz. o/n 1905. £1.81. p&p 35p.
3-WAY for 8 ohms speakers up to 30 watts. Frequency: 800Hz and 4.5KHz. o/n 1906. £3.32. p&p 35p.

MICROPHONES

DYNAMIC CASSETTE
For equipment requiring a high quality microphone. Sturdy, solid moulded body in black with neat chrome surround. Pick-up pattern is omnidirectional. On/Off switch. 1 metre of tough lead with floating 2.5 and 3.5mm plugs. Matching moulded strut. Impedance: 200 ohms. Sensitivity: 30dB. Frequency: 90-10,000Hz. Size: 20mm dia x 120mm. o/n 1326. £1.80. p&p 35p.
DYNAMIC MICROPHONE
Superior quality portable cassette recorder mike with built-in remote control switch and lead fitted with 5-pin 240° DIN plug (remote switch) and 3-pin DIN plug (microphone). Provides a direct replacement for those supplied with recorders. With detachable stand. Omnidirectional. Impedance: 200 ohms. Freq. response: 100 to 10,000Hz. Sensitivity: 79dB at 1,000Hz. o/n 1327. £2.98. p&p 35p.

RE-317 DYNAMIC MICROPHONE
Highly sensitive, high-grade desk or hand mike suitable for use with many popular cassette decks. Incorporates On/Off switch and 1 metre lead with moulded standard jack plug. Complete with desk stand. Omnidirectional. Impedance: 5,000 ohms. Freq. response: 100 to 12,000Hz. Sensitivity: -7 dB at 1,000Hz. o/n 1338. £4.48. p&p 35p.

OMNIDIRECTIONAL CARDIOID
Powered by a 1 1/2 battery located within the aluminium body. Satin silver finish with front disk protection to the diaphragm housing. On/Off switch. Also with 'Busby' type windshield. "U" bracket and stem and extremely flexible cable. Consumption 0.2mA from 1 1/2 battery providing approx. 8-10,000 hours continuous life. Impedance: 600 ohms. Sensitivity: 70dB. Frequency: 30-16,000Hz. Size: 23mm dia x 267mm. o/n 1329. £14.40. p&p 35p.
UNIDIRECTIONAL CARDIOID
Dual imp. 600 and 50,000 ohms. Response 50 to 14,000Hz. Sensitivity 54dB at 50K ohms. Size 1 1/2" dia x 6 1/2" long. Weight approx. 190gm. o/n 1328. £12.32. p&p 35p.

STANDS

GOOSENECK CHROME FLEXIBLE HOLDERS
Length 320mm. o/n 1333. £2.70. p&p 35p.
Length 515mm. o/n 1334. £3.83. p&p 35p.
FLOOR STAND Heavy chrome. Slow-away feet with rubber ends for maximum stability. Draws to a height of 5' maximum. o/n 1335. + £10.69. p&p 85p.
BOOM ARM for use with the above stand. Heavy chromed metal. It gives 30" reach from the stand. o/n 1337. £10.36. p&p 70p.

WINDSHIELD COVERS

o/n 1331 Medium per pair £1.35. p&p 35p. o/n 1332 Large per pair £2.03. p&p 35p.

AUDIO LEADS

107	FM Indoor Ribbon Aerial	£0.68
113	3.5mm Jack plug to 3.5mm jack plug Length 1.5m	£0.84
114	5 pin DIN plug to 3.5mm Jack connected to pins 3&5 Length 1.5m	£0.95
115	5 pin DIN plug to 3.5mm Jack connected to pins 1&4 Length 1.5m	£0.96
116	Car aerial extension. Screened insulated lead. Fitted plug & ski	£1.24
117	AC mains connecting lead for cassette recorders & radios. 2 metres	£0.76
118	5 pin DIN phono plug to stereo headphone jack socket	£1.18
119	2 - 2 pin DIN plugs to stereo jack socket with attenuation network for stereo headphones. Length 0.2m	£1.01
120	Car stereo connector. Variable geometry plug to fit most car cassette, 8 track cartridge & combination units. Supplied with inline fused power lead and instructions.	£0.68
123	6.6m Coiled Guitar Lead Mono Jack Plug to Mono Jack Plug BLACK	£1.82
124	3 pin DIN plug to 3 pin DIN plug. Length 1.5m	£0.84
125	5 pin DIN plug to 5 pin DIN plug. Length 1.5m	£0.84
126	5 pin DIN plug to Tinned open end. Length 1.5m	£0.84
127	5 pin DIN plug to 4 Phono Plugs. All colour coded. Length 1.5m	£1.46
128	5 pin DIN plug to 5 pin DIN socket. Length 1.5m	£0.90
129	5 pin DIN plug to 5 pin DIN plug mirror image. Length 1.5m	£1.18
130	2 pin DIN plug to 2 pin DIN inline socket. Length 5m	£0.76
131	5 pin DIN plug to 3 pin DIN plug 1&4 and 3&5. Length 1.5m	£0.93
132	2 pin DIN plug to 2 pin DIN socket. Length 10m	£1.10
133	5 pin DIN plug to 2 phono plugs. Connected pins 3&5. Length 1.5m	£0.84
134	5 pin DIN plug to 2 phono sockets. Connected pins 3&5. Length 23cm	£0.76
135	5 pin DIN socket to 2 phono plugs. Connected pins 3&5. Length 23cm	£0.76
136	Coiled stereo headphone extension lead. Black. Length 6m	£1.97
178	AC mains lead for calculators etc	£0.54

ALL PRICES INCLUDE V.A.T.

BI-PAK
DEPT. PW7, P.O. Box 6,
18 Baldock Street, Ware, Herts.

HEADPHONES

A top quality headphone with cushioned earpads and headband. Separate balance/volume controls. Stereo or Mono switch. Impedance 8 ohms. Frequency 30-18,000Hz. o/n 884. £9.78. p&p 50p.

A brilliant compromise between price and performance. Superb stereo reproduction for the newcomer to Hi-Fi. Impedance 8 ohms. Frequency 30-15,000Hz. o/n 885. £4.96. p&p 50p.

BIB HI-FI ACCESSORIES

Parallel Tracking GROOV KLEEN
The very latest in automatic record cleaning. Designed to suit all modern single play decks. Simple to fit, it is extremely efficient. Complete with two types of base and three height extensions. o/n 8101. £3.97. p&p 35p.

Cassette Tape Editing Kit
Enables cassette tapes to be edited and joined easily, quickly and accurately. Kit comprises: Tape Splicer (3.2mm) 2 Precision Tape Cutters. Tape Piercer. 9 Self-adhesive Labels. Reel of Splicing Tape. 3 Winders and removers and instructions, all in a handy wallet. o/n 811. £2.69. p&p 35p.

GROOV-STAT
The BIB Groov Stat static reducer neutralises the static charge on records and other plastic surfaces. o/n 8103. £5.89. p&p 35p.

Cassette Head Cleaner
Essential for cleaning of tape heads, capstans and rollers. Pack contains Tape Head Applicator and tape head polisher tools. Plus bottle of special formula cleaning fluid and full instructions. o/n 832. £0.72. p&p 35p.

METERS

Miniature Balance & Tuning Meter
Miniature moving-coil meter for stereo balance indicator. tuning indicator for FM or similar application. Pointer at centre indicates zero or null position. Robust construction. Sensitivity 100 0.100MA. Dimensions 23 x 22 x 26mm. o/n 1318. £2.11. p&p 35p.



Balance and Tuning Meter
Clear view edge-wise meter. Centre zero application. Sensitivity 100 0.100UA. Dimensions 45 x 22 x 34mm. o/n 1319. £2.16. p&p 35p.



Miniature Level Meter
Moving coil, for accurate level indication for tape recorders, amplifiers etc. Neat design rugged construction. Will withstand five times rated value. Sensitivity FSD 200UA. Odb 130UA. Dimensions: 23 x 22 x 26mm. o/n 1320. £3.02. p&p 35p.



Vu Meter
Calibrated 20 to +3 and 0 100%, making it suitable for use as a recording level meter or as a power output indicator. Sensitivity 130UA. Dimensions: 40 x 29mm. o/n 1321. £2.16. p&p 35p.





EDITOR
Geoffrey C. Arnold

ASSISTANT EDITOR
Dick Ganderton C. Eng., MIERE

ART EDITOR
Peter Metalli

TECHNICAL EDITOR
Peter Preston

NEWS & PRODUCTION EDITOR
Alan Martin

TECHNICAL SUB-EDITOR
Joe Bishop

TECHNICAL ARTIST
Rob Mackie

ASSISTANT ART EDITOR
Keith Woodruff

SECRETARIAL
Sylvia Barrett
Debbie Chapman

EDITORIAL OFFICES

Westover House,
West Quay Road,
POOLE, Dorset BH15 1JG
Telephone: Poole 71191

ADVERTISEMENT MANAGER

Telephone: 01-261 6636
Dennis Brough

CLASSIFIED ADVERTISEMENTS

Telephone: 01-261 5762
Colin R. Brown

MAKE UP & COPY DEPARTMENT

Telephone: 01-261 6570
Dave Kerindi

ADVERTISEMENT OFFICES

King's Reach Tower, Stamford St.,
London, SE1 9LS
TELEX: 915748 MAGDIV-G

Opinion

ALTHOUGH we have, over the years, reviewed quite a number of kits, for items ranging from intruder alarms to ignition systems, it has long been editorial policy that reviews of ready-built equipment were confined to pieces of test equipment which were likely to appeal to the electronics or radio enthusiast. This was considered to be the right approach for a magazine which was aimed principally at constructors.

We have recently been receiving a growing stream of letters from readers, asking for advice and comment on currently-available communications receivers and other radio equipment for the short-wave listener and amateur, and it is to meet this demand that we are now embarking on a series of reviews. You may rest assured, however, that this change in policy does not mean that we shall be devoting less attention to designs for home-constructed equipment.

It is not our intention to carry out any *Which*-style comparative tests, nor to suggest a "Best Buy". Neither shall we be carrying out full-scale specification testing, in the way that the hi-fi magazines do on tuners, amplifiers and the like. We shall simply try to convey the feel of the equipment as gained from user tests, to give an idea of how good the instruction manual, etc. is, and to say what accessories or options may be available.

In choosing items for review, we have selected what seem to be the most popular, plus any others available within roughly the same price bracket. This month it is the turn of the Yaesu FRG-7 receiver—future plans include several more receivers, transmitters, transceivers, aerials and various pieces of ancillary equipment. We also hope to comment on some professional receivers now available on the second-hand market. We hope that you will find the reviews interesting and useful, and would be glad to receive suggestions for items to include in the future.

Charles Molloy G8BUS—"On the Air" Contributor

Trained as a telecommunications engineer, Charles worked abroad for several years and became an associate member of the IEE. He is now a technical author in electronics.

Interest in the medium waves began when a schoolboy in the mid-1930s, after constructing a receiver for domestic use. He later turned to the short waves after building a one-valve receiver from a design by F. J. Camm in *Practical Wireless*, and became a regular SWL while living in the Middle East.

Although a holder of a class B amateur licence, appearances on 70cm and 2m are infrequent as the main interest in radio these days is in broadcast band DXing.

Charles collects books on the early days of radio, and enjoys messing about in boats. Other interests include classical music, opera and attending ballet with wife Mary, who is a devotee. He is looking forward to retirement and the opportunity to catch up with a number of outstanding radio projects.



Marshall's Bristol move

Subsequent to the recent publishing of Marshall's 1979 product range catalogue their Bristol retail shop has moved.

From 24 April 1979, the new shop will be in larger premises at 108A Stoke's Croft, Bristol. This new location is approximately 5 minutes walk from the main shopping centre of Bristol.

At the same time they announce that they have been appointed sole specialist distributors to the constructor market for the new Mullard 'Teletext' chips—SAA 5000, 5010, 5012, 5020, 5030, 5040 and 5050. These will be available shortly.

Further information from: *Mardata, Kingsgate House, Kingsgate Place, London NW6 4TA. Tel: 01-624 0805.*

Conferences

An IERE/RSGB colloquium is to be held on Tuesday, 5 June 1979 starting at 2 pm at The Royal Institution, Albemarle Street, London W1.

The subject for discussion will be amateur work on microwave propagation and techniques over the last five years, which have made the professionals look hard.

There has been some fascinating work, particularly in the UK, e.g. "s.s.b. at 10GHz" and the colloquium will describe these great developments which are currently going on.

Further details from: *The Conference Secretariat, IERE, 99 Gower Street, London WC1. Tel: 01-388 3071.*

The programme for the Consumer Electronics Symposium, announced by the Society of Electronic and Radio Technicians (SERT) last autumn, has now been finalised, and is to be held at the University of Essex between 8 and 10 July 1979.

Copies of the programme/registration form are being widely distributed and applications from nearly 100 potential delegates have already been received.

As can be seen from the programme, there is a wide representation of authors from industry, broadcasting authorities and servicing organisations who are providing an extremely varied programme of lectures and discussion covering all aspects of electronics in the consumer field.

Further details from: *SERT, Faraday House, 8-10 Charing Cross Road, London WC2H 0HP. Tel: 01-240 1152.*

Club News

The North England Radio Club has a national and European membership, with the heart of the club on Merseyside.

They publish a monthly magazine called 'Spectrum' and meet monthly, usually at The Sports Centre, Grange Road West, Birkenhead.

New members from anywhere in the world would be very welcome. A copy of 'Spectrum' and club information may be obtained for two 9½p stamps, in the UK, or two IRC's from abroad.

The man to contact is: *Norman Monti, 66 Chesnut Grove, Birkenhead, Merseyside L42 0MZ.*

TI 9900 data book

A self-teaching microprocessor design manual—written for beginners and experts alike—is now available from Texas Instruments.

The soft-cover "9900 Family Systems Design and Data Book", will offer in more than 1000 pages a comprehensive selection of educational and applications information that can help users develop a deeper understanding of the complex technology and tremendous potential available in microprocessors.

Combining hardware and software information, the data book should assist both the engineer doing advanced m.p.u. design work and "interested" people who simply want to know more about the subject. It is a complete reference book containing the basic knowledge and data a novice might need to become better acquainted with m.p.u.s—and it carries that knowledge through into complete technical and systems design data needed to use TI's 9900 family of 16-bit microprocessor and microcomputer circuit boards.

The "9900 Family Systems Design and Data Book" costs £8.00 plus P&P, and is available from: *The Modern Book Co., 19-21 Praed Street, London.*

SERT

The Society of Electronics and Radio Technicians is pleased to announce that Mr T. Bryce McCrerrick has become a Vice-President of the Society.

Mr McCrerrick has recently been appointed Director of Engineering to the British Broadcasting Corporation in

succession to Sir James Redmond.

The current President of SERT is Air Vice Marshal Alec Morris and the other Vice-Presidents are Mr Michael Clark (Deputy Group Chairman of the Plessey Company) and Sir Edward Fennessey.

Rally Dates

The Royal Naval Amateur Radio Society's Mobile Rally, will take place at HMS Mercury, Petersfield, Hampshire, on Sunday, 17 June 1979. It will be open to the general public between 1000 and 1700 hours.

The rally is intended as an outing for the whole family, with stands, arena events and displays of interest to all ages. There will also be the usual trade stands.

Further details from: *Wally Walker G4DIU, 9 Woodstock Road, Bedhampton, Havant, Hants PO9 3HX.*

The "East Suffolk Wireless Revival" Amateur Radio Mobile Rally will take place on Sunday, 3 June, 1979, at the I.A.C.S.S.A. Sports ground, Bucklesham, near Ipswich. Commencing at 1100hrs and admission will be 40p, which includes a free raffle ticket.

In addition to talk-in stations on 2m, 70cm f.m. and 80m s.s.b., there will be trade stands, technical displays (featuring Prestel, RTTY and m.p.u.s), refreshments and a licensed bar.

Further details from: *C. P. Ranson G8LBS, 67 Tranmere Grove, Ipswich, Suffolk IP1 6DU.*

"Nunsfield House Community Association Amateur Radio Group" of Derby, hold their 10th Rally, at Elvaston Castle Country Park, on Sunday, 10 June 1979.

It is expected to be their largest rally yet, with over 50 trade stands, along with many other attractions of interest to all the family.

Talk-in stations will be available on callsign GB2ECR, on 2m f.m. Ch. 22, and 70cm f.m. Ch.s SU8, SU20.

Further details from: *Chris Wallace G8PTW, QTHR. Tel: Derby 752358.*

"Bangor & District Amateur Radio Society" hold their mobile rally on 24 June 1979, at the Castlewella Forest Park. There will be all the usual events including trade stands and a "bring and buy" stall.

Further details from: *W. H. Langtry G14AMM, QTHR. Tel: Bangor 65394.*

a.m./f.m. Frequency Readout

William POEL

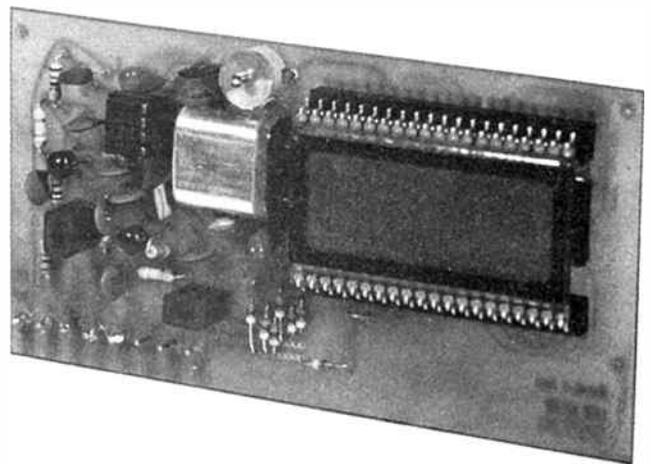
If you can think of an application for an arrangement of c.m.o.s. logic with a potential sale of a million plus, then the chances are that some enterprising manufacturer of l.s.i. has got a dedicated chip either on the drawing board, or in the market place. The application described here is an ideal candidate, since it is yet another instance of age-old analogue technology being swept aside with digital technology. For a long time past, an accurate readout of a radio receiver's tuned frequency has only been available with large amounts of logic, and large amounts of patience to work out the various i.f. offset programming steps. Such systems have also cost considerably more than the best analogue arrangements, and have consequently been restricted to the very expensive exotica in both consumer and communications applications.

Just as Intersil have revolutionised the concept of the instrument type counter with their ICM7216, OKI Electric of Japan have introduced a family of c.m.o.s. for consumer and communications digital frequency readouts which render all other approaches now quite simply obsolete. For in a 40-pin l.s.i. the counter gives both a.m. and f.m. frequency readout, plus straight kHz frequency count (no offset); drives an l.c.d. directly with no r.f.i. to the radio in question and all this with a current consumption of 4mA with the prescaler off, or 15mA with it on. The unit described here is conceived and designed as a universal readout for long wave through medium wave to a maximum a.m. count of 2.999MHz, including the popular marine DF band where digital readout is almost essential for reasonable operation in congested waters. The f.m. range operates from about 20MHz to 200MHz (with SP8629 prescaler) with a resolution of 100kHz—e.g. a typical readout is 88.1MHz. In the direct mode, the display shows kHz from the a.m. input, and 100s of kHz from the prescaled input.

Purists will complain that 100kHz is insufficient for f.m. resolution—but the display flicker brought about by further resolution is very tedious, and the small number of stations not on 100kHz channels makes the exercise rather pointless for the nuisance involved. And not many f.m. receivers would show up too well from the point of view of oscillator drift.

The Circuit

The full circuit (Fig. 1) reveals a remarkably simple overall approach compared to previous endeavours to produce this type of unit. Nearly all functions are carried



on within the MSM5526 i.c.—and the few remaining peripheral components are included as an extra for maximum flexibility. On f.m. the divide-by-100 prescaler is an obvious essential, but the input sensitivity of both the SP8629 and the MSM5526 is such that, if the unit is wired into many receivers directly, the pre-amps are not required. However, with these pre-amps using the high f_t BF274 type of transistor, typical sensitivities of 800 μ V on a.m. and 10–15mV on f.m. can be achieved—thus permitting connection of the digital display with the barest minimum of coupling. In the case of one portable radio tried by the author, it is sufficient simply to couple in via a single-ended wire loosely draped around the relevant oscillator section for either a.m. or f.m. So, even if your set doesn't possess specific local oscillator drive, a small piece of wire poked into the oscillator section will work in almost all applications.

The SP8629 has a very useful 6.3V Zener on-chip, permitting a simple but adequate 5.5V stabiliser stage to be built with an external pass transistor. The National Semiconductor equivalent DS8629 does not incorporate this facility, and a separate external Zener must be used. The stabiliser stage has an 82 Ω resistor in the output—and this is the result of a mistake when assembling the prototype, since 8.2 Ω should have been used. However, the whole circuit worked perfectly when switched on—and it was only when a check was made on the current drain, that this error was discovered, since the unit took a sur-

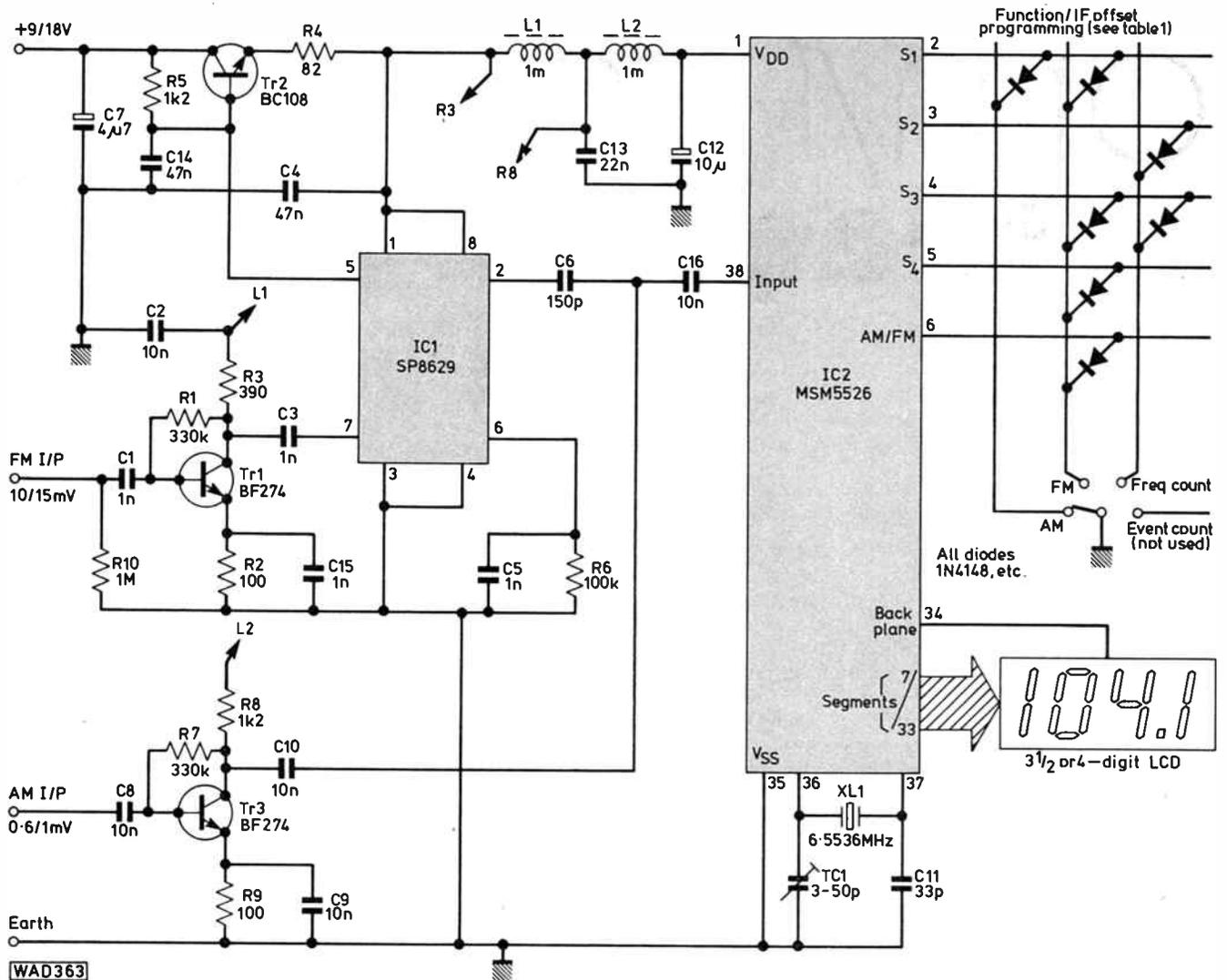


Fig. 1: Complete circuit diagram of the a.m./f.m. frequency readout based on the OKI MSM5526 i.c.

LCD 3 1/2 Digit		LCD 4 Digit	
PIN		PIN	
1	Back Plane	40	Back Plane
2	- Bar	39	Bar
3	b ₄ , c ₄	38	Over Range
4	nc	37	nc
5	nc	36	nc
6	nc	35	nc
7	nc	34	nc
8	DP3	33	nc
9	e ₃	32	g ₃
10	d ₃	31	f ₃
11	c ₃	30	a ₃
12	DP2	29	b ₃
13	e ₂	28	DP4 (colon)
14	d ₂	27	g ₂
15	c ₂	26	f ₂
16	DP1	25	a ₂
17	e ₁	24	b ₂
18	d ₁	23	g ₁
19	c ₁	22	f ₁
20	b ₁	21	a ₁

Table 1

Display Select	Input conditions AM/FM S1S2S3S4	IF offset value
AM	H H H H X	-452.5kHz
	H L H H X	-454.5
	H H L H X	-456.5
	H L L H X	-465.5
	H H H L X	-467.5
	H L H L X	-469.5
FM	L H H H H	+10.68
	L L H H H	+10.71
	L H L H H	+10.75
	L L L H H	+10.79
	L H H L H	+10.82
	L L H L H	-10.58
	L H L L H	-10.60
	L L L L H	-10.61
	L H H H L	-10.62
	L L H H L	-10.63
	L H L H L	-10.65
	L L L H L	-10.66
	L H H L L	-10.69
	L L H L L	-10.70
L H L L L	-10.72	
L L L L L	-10.73	
direct	H H L L X	none
event counter	H L L L X	impulses
"H" = open (or Vdd) "L" = ground (Vss) "X" = either		

prisingly low 15mA from a 9V source. The SP8629 is rated at a typical 30mA—so investigation with a voltmeter revealed that both prescaler and display i.c. were happily clocking away with only a 3.8V rail—as a result of the 82Ω mistake. A second unit was built with the same values, and worked just as well—and so it is assumed that most others will too—but if faulty counting is experienced, this 82Ω should be gradually reduced until the circuit settles.

The input to the counter i.c. is common for both a.m. and f.m. count, and the drives from the f.m. prescaler and a.m. pre-amp may be simply paralleled. The output of the SP8629 settles either high or low, depending where the last count cycle left it—and so whilst the outputs were originally paralleled via 10nF capacitors, the f.m. coupling capacitor has to be reduced to 150pF—otherwise the a.m. signal can easily be shunted through the prescaler output stage when it has settled to the low state. A value of 150pF

is still quite enough to pass the very fast edges of the logic output of the prescaler, since counting of the l.s.i. occurs on edges, the actual waveform (which looks quite distorted) is immaterial.

The input to the 8629 must be disabled when reading a.m., and it is important to follow Plessey's application advice, and tie the unused differential input down via a 100kΩ resistor to ground, to prevent spurious oscillation occurring under no-input conditions.

The i.f. offsets are all pre-programmed via a diode matrix, set according to Table 1. Just about every standard offset is available, although occasional 500Hz compromises are called for, e.g. 454.5kHz not 455kHz. With an a.m. resolution of 1kHz, and an average i.f. filter tolerance of 1kHz, this sort of error is unlikely to be at all significant.

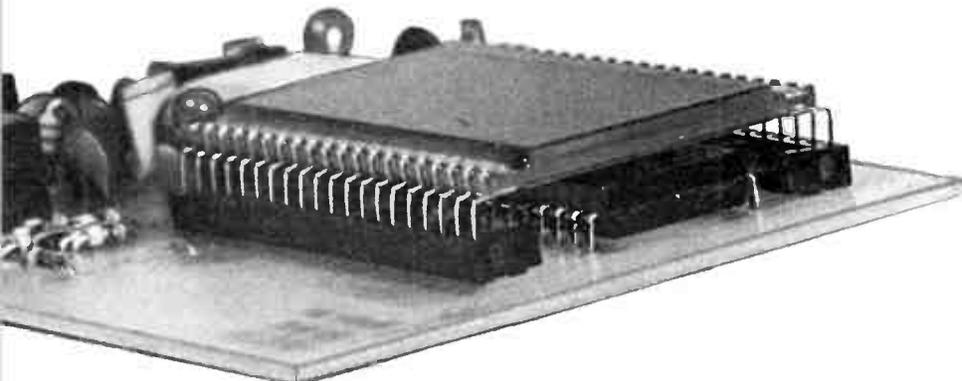
The functional setting is likewise matrix controlled, enabling selection via the simplest of all devices, a ground-to-operate switch. As well as the three modes available on this board, a straightforward event counter is also available for batch counting to a maximum of 2999 units, but this feature is not used in this instance.

Had this been a description of a "discrete" approach c.m.o.s. unit, the circuit description would have just about reached the oscillator stage, but instead, there is nothing more to say!

Construction method

The printed circuit board layout, Figs. 2 and 3, employs a useful technique when using direct drive to l.c.d.s from l.s.i., namely placing the i.c. under the display. This technique saves space—and cuts the only marginal area of possible interference (from the l.c.d. backplane strobe) to a bare minimum. Construction on anything but the properly made p.c.b. is not really feasible. Fixing holes for mounting are provided so that the unit may be fitted directly behind the receiver front panel. The c.m.o.s. MSM5526 is not a particularly fragile device, but the usual care should be taken when soldering, to avoid static damage, caused by poorly earthed soldering implements, or earth leakage currents. The p.c.b. is laid out for either HC13 or HC18 style crystals, and since 6.5536MHz is a standard binary frequency, the supply is not generally a problem.

Great care must be taken when mounting liquid crystal displays, since these are not only costly, but very fragile if pressure is applied unevenly. A socket must be used to raise the l.c.d. above the rest of the components, and either socket strip or a 40-pin d.i.l. socket cut in half is suitable for the purpose. Molex i.c. pins are not a good idea since in strips of 20, it is very difficult to accurately locate the pins of the display. The electrical contact is also somewhat more chancy at this sort of length, since a small displacement of one pin can cause a lot of trouble.



The MSM5526 is mounted directly on the board and the liquid crystal display is mounted over it, using i.c. sockets to space it from the p.c.b. (see text)

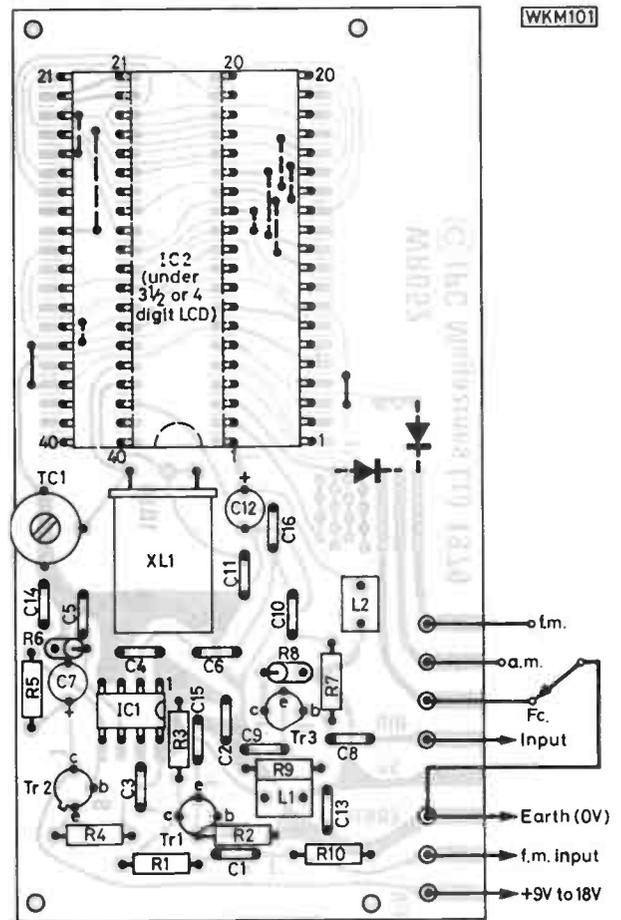
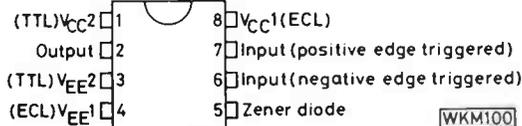


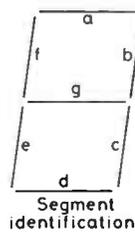
Fig. 2 (above): Full-size track layout of the p.c.b.

Fig. 3 (above right): Component layout and details of external connections to the p.c.b. The switch will normally be part of the wave-change switch of the associated receiver. When using a $3\frac{1}{2}$ -digit I.c.d., two "U"-links of insulated wire should be soldered to the track side of the p.c.b., linking pins 2 and 5/6, and pins 3 and 7 of the display

Fig. 4: Pin-outs of the SP8629 (below) and the MSM5526 (right)

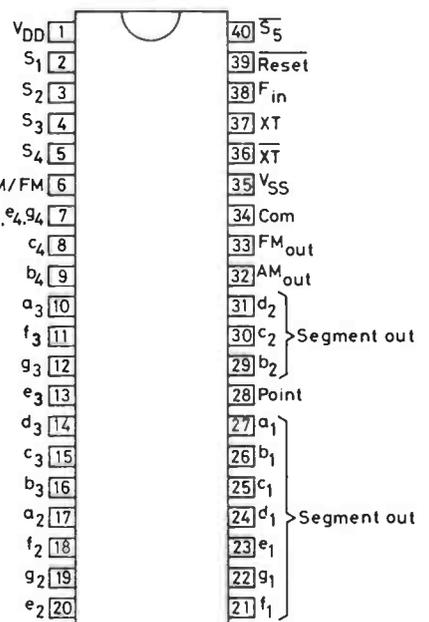


WKM100



Segment identification

Segment out



WKM102

★ components

Resistors

0.25W 5%

82Ω	1	R4
100Ω	2	R2, 9
390Ω	1	R3
1.2kΩ	2	R5, 8
100kΩ	1	R6
330kΩ	2	R1, 7
1MΩ	1	R10

Capacitors

Ceramic disc or plate (lead spacing 5mm max.)

33pF	1	C11
150pF	1	C6
1nF	4	C1, 3, 5, 15
10nF	4	C2, 8, 9, 10, 16
22nF	1	C13
47nF	2	C4, 14

Tantalum bead

4.7μF	1	C7
10μF	1	C12

Sub-min trimmer

3-50pF	1	TC1
--------	---	-----

Semiconductors

Transistors

BF274	2	Tr1, 3
BC108	1	Tr2

Diodes

1N4148	as required for programming (see Table 1)	
--------	---	--

Integrated circuits

MSM5526	1	IC2 (OKI Electric)*
SP8629	1	IC1

Inductors

1mH	2	L1, 2 (Toko 7BA 144LY-102)*
-----	---	-----------------------------

Miscellaneous

XL1 6.5536MHz Crystal, Style HC13 or HC18 wire-ended*
 4-digit (or 3½-digit) liquid crystal display
 Socket for l.c.d. (see text)
 Printed circuit board Ref. WR052
 Terminal pins (8 off)

*Available from Ambit International and Watford Electronics

Switch-on and test

Provided the components are located correctly, then there is nothing to go wrong apart from your soldering. Check the very fine tracks for splashes, and clean the board with flux remover if available. Using a current-limited power supply (for extra security), apply 5 volts at first, gradually turning up to 12V if the current drain is not excessive—indicating a short circuit somewhere. Switch to the desired input, and place a finger on the relevant pre-amp input, when some stray counting should occur from the pickup thus provided. Remember, this is very sensitive.

With a suitable radio to hand, place a pickup coil near the oscillator, and feed this to the counter input via r.f. coaxial cable. Something is almost certain to happen, and usually no more trouble than this is necessary. In fact, a single-ended pickup is frequently enough, though not suitable if more than 150mm long. If you don't know the exact i.f. offset, assume 10.7MHz high for f.m., and in the f.m. mode, tune to a station of known frequency. If the display reads incorrectly—say 89.2 instead of 89.1 with the tuning indicator zeroed—then the i.f. offset should be adjusted to 10.79MHz (the closest to 10.8MHz available) by diode programming. Many of the finer variations of offset will not be apparent unless you have a very accurately calibrated signal source handy.

To set the internal clock accurately, switch to Direct Count and with a signal generator and reference counter, tune to 999kHz so that the generator output reads 999.4999kHz. Tuning to 999.501 should cause the counter to change over to 1000kHz, and the trimmer capacitor on the crystal input to the MSM5526 may then be adjusted to provide this threshold point. With the trimmer approx 30 per cent enmeshed, the whole unit is sufficiently accurate to be self calibrating anyway, so do not worry too much about these very fine adjustments if you cannot

get access to appropriate equipment. Another way is simply to count the crystal oscillator frequency on a separate counter so that it is trimmed for exactly 6.5536MHz (take care not to load the crystal—try to use inductive coupling if possible).

To set the a.m. offset, tune to a known frequency with the offset pre-programmed for 469.5kHz (nearest available to 470kHz) for most UK- and European-made sets, and 455kHz for most Japanese sets, and check the error. Simple maths will tell you what to do—e.g. if the station is known to be on 910kHz, and the counter says 905 when the i.f. is set for 470kHz, then reprogramme the offset for 465.5 and all will be well.

Applications

Apart from new equipment, there is obviously a large retrofit application for improving existing equipment—since the accuracy of frequency display has let down many otherwise good designs. Varicap diode designs can occasionally put strains on analogue scale design, since the end-point capacitance can vary widely, although the diodes themselves remain well matched. This display takes away those problems, and does away with the last remaining mechanical headaches of the set designer.

One point which is very important about the MSM5526 is the fact the display is totally static. This means that there is no multiplexing interference—and the only potential source is in the shape of the backplane strobe, which is very, very low power for an l.c.d. Thus without screening, this device can readily be used without problems in any radio environment, from supplies ranging from 8V to 20V d.c. (thanks to the regulator on board). So next time the drive cord snaps, forget about a replacement and fit a digitally accurate alternative. ●

SPECIAL PRODUCT REPORT

CONTINENTAL SPECIALTIES CORPORATION



LOGIC PROBE KIT

If you are involved in digital electronics it is essential that you have some means of detecting pulses and logic states. Without this necessary equipment you will be totally in the dark when trying to find out why your latest creation does not work.

There are many logic probes on the market but for the amateur they tend to come a touch on the pricey side. Continental Specialties Corporation, who also make a range of logic probes, have recently introduced a kit for a probe which will detect and display logic levels, pulses and voltage transients.

The kit is complete down to the last piece of wire and even includes a length of solder. All the components appeared to be of good quality and fitted the holes drilled in the glass fibre printed circuit board without any problems.

The instruction manual is very comprehensive and covers not only the building of the probe but also notes on how to use it.

★ specifications

Input impedance: 300k Ω

Threshold: Logic 1 (Hi-l.e.d.) 70% Vcc
Logic 0 (Lo-l.e.d.) 30% Vcc

Detectable pulse width: 300 nanoseconds min.

Input signal frequency: 1.5MHz max.

Pulse detector: High-speed pulse train or single events (positive or negative transitions), active 0.1 second pulse stretcher

Input voltage: \pm 50V continuous, 120V a.c. for less than 15 seconds

Power requirements: 5 volt Vcc at 30mA
15 volt Vcc at 40mA
25 volts max., with power lead reversal protection

Physical size: 147 x 25.4 x 17.8mm

Weight: 85 grams



Construction proved to be very simple and straightforward, the step-by-step assembly instructions proving easy to follow. Unlike traditional British component placement drawings however this one did not show the copper track pattern of the p.c.b. and no holes are shown so that it is very important to check twice that the components are correctly placed.

No problems were encountered and the probe worked first time, but if you are unfortunate a page is devoted to trouble-shooting and two pages to testing the probe following construction.

The plastics case, which is available separately and has been used for the *PW* Car Test Probe, is very neat and the two labels supplied with the kit are self-adhesive giving the finished probe a professional look.

The probe is simple to use, requiring the power leads to be clipped to suitable voltage rails on the circuit under test and the probe tip to be held against the test point.

Indication of the status of the point is by a combination of three l.e.d.s which light, or pulse, depending upon the logic state being investigated.

As a simple means of determining logic states this kit is very good value for money.

Dick Ganderton

SEE NEXT MONTH'S ISSUE OF
PRACTICAL WIRELESS FOR DETAILS
OF A SPECIAL INTRODUCTORY OFFER
FEATURING THIS KIT

Ideas DEPARTMENT

Some original circuit ideas provided by our readers. These designs have not been proved by us, and we cannot therefore guarantee their effectiveness. They should at least provide a basis for experimentation.

Why not send us your idea? If it is published, you will receive payment according to its merits. Articles submitted should follow the usual style of PW in circuit diagrams and the use of abbreviations. Diagrams should be clearly drawn on separate sheets, not included in the text.

Each idea should be accompanied by a declaration that it is the original work of the person submitting it, and that it has not been accepted for publication elsewhere.

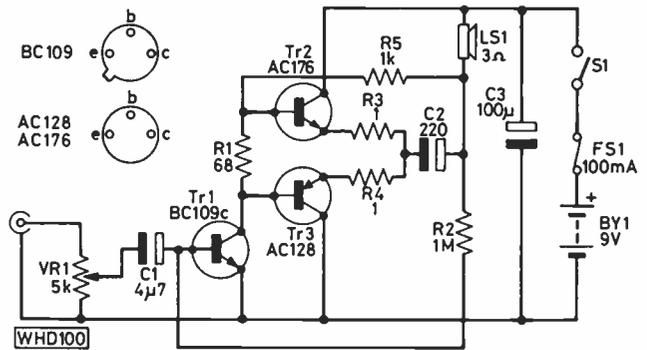
WORKBENCH AMPLIFIER

Although there are plenty of amplifier i.c.s and modules available, there are many applications where discrete circuitry can hold its own on cost and simplicity. One of these is a battery-powered audio amplifier for workbench use.

The input signal goes via the volume control VR1 to Tr1, which is a high-gain voltage amplifier. Its output is applied to the bases of Tr2/Tr3, the complementary output pair, with R1 providing the necessary standing bias. For reasons of simplicity and cost, no form of temperature compensation has been included.

Two negative feedback paths are included. Resistor R5, which is basically the collector load for Tr1, also provides bootstrapping for the output stage. Resistor R2 provides base bias for Tr1 and also overall negative feedback. Audio quality may be improved at the expense of reduced output by lowering the value of R2. Capacitor C3 decouples the supply, and helps to maintain audio quality when the battery approaches the end of its life.

Transistors Tr2 and Tr3 should be purchased as a



matched pair, and must be fitted with heat-sinks—the push-on, finned type should suffice. With no signal applied, the total consumption of the amplifier should be less than 35mA.

D. L. Jones,
Denbigh,
Clwyd.

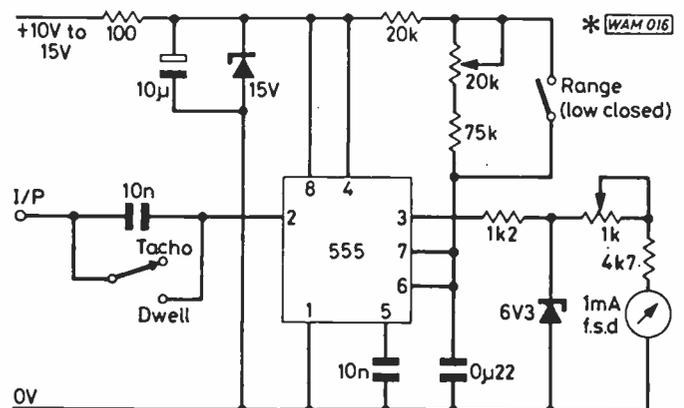
TACHOMETER/DWELL METER

This circuit utilises a 555 timer chip in a dual function as a tachometer or dwell meter. In the tachometer mode, the input signal is taken from the car's contact breaker as a square-wave and fed via a capacitor to pin 2 of the timer, realising a high mark/space ratio. The two switched ranges, 0 to 1000 r.p.m. and 0 to 5000 r.p.m., are calibrated by a 20kΩ and a 1kΩ potentiometer.

In the "dwell" mode, the input capacitor is by-passed, maintaining a square-wave at the input of the device, which means that the output at pin 3 is an inverted version of the input waveform. In the "dwell" mode, only the lower of the two tacho ranges should be switched in.

The circuit requires a minimum supply of 12V for consistent operation.

R. J. Jenkins & M. E. Taylor,
Knebworth,
Herts.



Hey, Good Looking!



P.W.
'WINTON'

Beautiful innit?, but a swish exterior can often be an eye catching cover for some very ordinary "guts", so what's so different about the WINTON?

Well, for a start we have discarded Bi-Polar output devices in favour of the far superior performance of the Hitachi Power MOS-FETS, which until now have only been available in some of the most expensive Hi-Fi Amplifiers around, (and we consider £700 to be expensive with a capital E!). Secondly, our extremely low distortion figures are obtained at FULL RATED OUTPUT with both channels driven, across the entire audio spectrum.

Further, at these power levels 2nd and 3rd order inter-modulation components are typically less than 0.005% (See the March issue of P.W. for the full spec' and a few shots from the Spectrum Analyser.) Whilst we freely admit that ownership of a Winton will not prevent your hair from falling out, nor warts from growing on your nose, you will feel a nice sense of achievement when the job is complete, and you will own an Amplifier that will make your mates positively green with envy, until that is they see the light and obtain one of their own.

The WINTON Kit is available in the following form:-

- | | |
|---|---|
| Pack (A) Capacitors & Fixed Value Resistors | Price Inc. V.A.T. & carriage. £21.45 |
| Pack (B) Switches, Potentiometers, Pre-Sets & Knobs | £13.26 |
| Pack (C) Printed Circuit Board, and Terminal Pins | £8.10 |
| Pack (D) Hardware Pack, consisting of Chassis, Heat Sinks, Cabinet, Screws, Wire, Fuseholders etc., and a Brushed Aluminium Fascia Front Panel. | £32.99 |
| Pack (E) Semiconductors (including HITACHI MOS Power Fets) | £30.53 |
| Pack (F) Toroidal Mains Transformer | £17.22 |
| Complete Kit of all parts necessary to build the WINTON | £120.00 |

ORDER WITH COMPLETE CONFIDENCE (Cash with order please) FROM:-

T. & T. ELECTRONICS. GREEN HAYES, SURLINGHAM LANE, ROCKLAND ST. MARY, NORWICH, NORFOLK. NR14 7HH. PLEASE ALLOW 28 DAYS FOR DELIVERY.

New Heathkit electronic test equipment course.

- Section 1. Analogue and digital meters.
- Section 2. Oscilloscopes.
- Section 3. Frequency generation and measurement.
- Section 4. Special measuring instruments.

New Heathkit car electrical systems course.

- Section 1. Electrical principles of the car.
- Section 2. Starting system fundamentals.
- Section 3. Car charging systems.
- Section 4. Accessories and body electrical.

Two new self-instruction courses from Heathkit. Based on step-by-step programmed instructions, they let you learn at your own pace in your own home.

Each course is complete and contains audio/visual material, text, and parts for 'hands on' experiments with the optional Heathkit experimenter trainer. So all you need is a cassette player and the will to learn.

Full details of Heathkit courses are available in the Heathkit catalogue, together with hundreds of kits you can build for yourself - computers, oscilloscopes, transceivers etc. . . . Send for your copy now.

There are Heathkit Electronics Centres at 233 Tottenham Court Road, London (01-636 7349) and at Bristol Road, Gloucester (0452 29451). Registered in England, No. 606177.



New Heathkit CI 1265 Digital Tach/Speedometer.

Push-button digital readout. Displays engine speed/rpm. Accurate to 1 mph or rpm variations of 100.

To: Heath (Gloucester) Limited, Dept. PW779 Bristol Road, Gloucester, GL2 6EE. Please send a copy of the Heathkit catalogue. I enclose 20p in stamps. Please send a copy of the Computer Brochure. I enclose 20p in stamps.

Name _____
Address _____

Soldering Iron offer FREE

N.B. If you are already on the Heathkit mailing list you will automatically receive a copy of the latest Heathkit catalogue without having to use this coupon.

When you receive your catalogue you will get details of this free offer.



HEATHKIT
HEATH
Schlumberger

UNICOM 21

To celebrate the 21st anniversary of the birth of their company, South Midlands Communications Ltd. are holding an Exposition and Symposium on Communications, called Unicom 21, on 22/23 June at Kempton Manor, Sunbury-on-Thames. Opening hours for the general public are 6pm–10pm on the Friday and 10am–8pm on the Saturday. Kempton Manor is adjacent to the M3 and A305, alongside Kempton Park Race Course.

There will be demonstrations of equipment by SMC, Strumech, Ascot Antennas and Microwave Modules, with experts on hand to answer all your questions. *Practical Wireless* will be there too, showing a selection of recent projects for the radio enthusiast.

The programme of lectures includes such subjects as: "A Single-chip Frequency Synthesiser", "FM vs SSB Bandwidths", "WARC 79", "Direct Conversion Receivers" and "Working more DX".

There will be a talk-in station operating on channel S22 with the special call-sign GB3SMC. Full bar and buffet facilities will be available.

Exhibitions

"The Great British Electronics Bazaar" is to be held at Alexandra Palace between 28 and 30 June 1979. The Bazaar is aimed at attracting the amateur, hobbyist and small professional buyer.

Among the stands booked by both large and small companies and organisations, will be demonstrations of building electronic circuits and home computer systems, to suit virtually everyone.

It is hoped that the event may be televised and application has been made for an amateur radio station with its own call sign.

Free tickets (send s.a.e.) from: *The Great British Electronics Bazaar, 34–36 High Street, Saffron Walden, Essex CB10 1EP.*

Computer shop

Since Friday, 16 March 1979, London's West End shoppers have been able to walk up to a counter and say "Can I have a computer, please?" And

that's precisely what they can do at The Byte Shop, located in the capital's home electronics heartland, Tottenham Court Road.

At The Byte Shop, the fascinating world of computers is only a counter's width from the man in the street. For the first time, businessmen in Central London will be able to nip out at lunchtime for an impromptu demonstration. Everything needed to computerise a small to medium sized business is now on show—from the smaller self-contained systems costing a few hundred pounds to the most professionally-configured systems incorporating external printers and visual display units priced up to around £15 000.

The Byte Shop also offers a broad selection of advanced computer games, with shoppers being invited to pit their skills against chess, poker and backgammon programs compiled by experts. Further information from: *The Byte Shop, 48 Tottenham Court Road, London WC1.*

Cartoon computer

A unique computerised system to expedite the production and lower the costs of making animated films is now being used by the Swedish Broadcasting Corporation (SBC) for its television services.

Conventional methods of preparing animated films are enormously time-consuming. Most of the work is very repetitive since each second of finished film requires from 20 to 25 almost similar drawings.

Under the new system, utilising a Sperry Univac 1100/11 computer, SBC uses a technique developed by Alan Kitching, an animation and data processing specialist, who manages Grove Park Studios in Camberwell.

The technique, known as ANTICS, begins with a basic drawing being prepared and entered into the computer using a special light pen. By means of special command words and codes, direction, speed and position specifications are also fed into the computer. The basic drawing can then be modified in different ways, for example, it can be shrunk, enlarged, panned, skewed, shaken or reversed. It can also be induced to rotate, jump, rock, etc. The system now contains some 40 commands, but Alan Kitching is working on further expansion.

One of the latest concepts within ANTICS is the Skeleton command. In response to a Skeleton command, a part of the basic drawing—such as a human character—will move in a natural manner. Using single skeletal figures the operator can specify a pattern of movements based on key positions. The computer then automatically creates all the intervening pictures needed to complete the overall sequence of movements and the final result appears as a smooth natural motion which matches the position of the skeletal figures entered into the computer.

With the new ANTICS system, sophisticated films that would have taken more than six months to produce by conventional means can be made in a few man-weeks. *Sperry Univac, 65 Holborn Viaduct, London EC1.*



PRODUCTION LINES

alan martin

Mighty Midget

Toolrange, distributors of the Panavise range, announce availability of the Model 502 Precision Panapress. This small but tough arbor press, less than



178mm high, is ideal for pressing bearings, forming and assembling small parts, staking rivetting and broaching. Built to stand the rigours of daily production line usage, the press has a rated capacity of 500psi.

The arbor and table plate are pressure die cast in high strength Zamak III alloy. The operating mechanism and operating lever are hardened ground steel, leverage ratio 13:25:1. Throat depth is 64mm and vertical capacity is 89mm. Ram ends are supplied unfinished for custom tooling by the user and the operating ram is fully reversible. A unique feature of the Panapress 502 is the four self lubricating adjustment gibs which give fine directional control of the ram/plate alignment.

The Panapress 502 is available at £36 plus VAT, from Toolrange Ltd., Upton Road, Reading RG3 4JA. Tel: (0734) 29446 or 22245.

Test prod connector

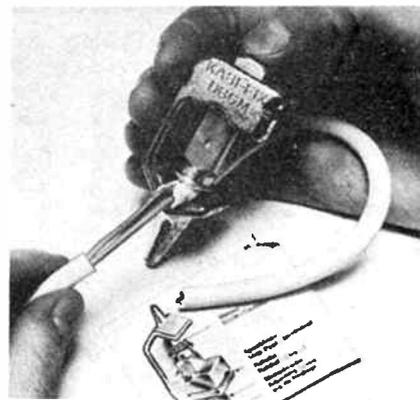
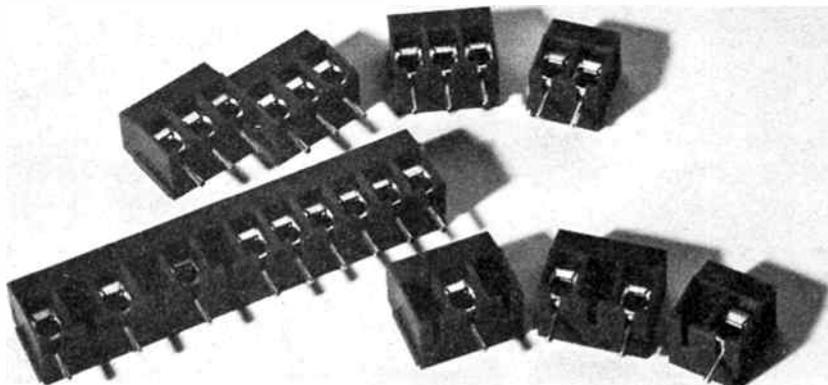
The new Kaffka range of connectors being imported from Germany by West Hyde consists of six types, made in 5mm or 10mm spacing. They dovetail together to form a connector of any desired configuration.

They are of high-quality precision manufacture in red Nylon 66. The connector bodies are of zinc-plated brass with leaf springs to avoid conductor damage from the chromed nickel

plated clamping screws.

Behind each screw there is a hole for a 2mm test prod. Current rating is 13 amps and accept cables of 2.5mm², with temperature range of from -30°C to +120°C.

Prices range from 7p to 23p each and are available from: West Hyde Developments, Unit 9, Park Street Industrial Estate, Aylesbury, Bucks HP20 1ET. Tel: (0296) 20441.



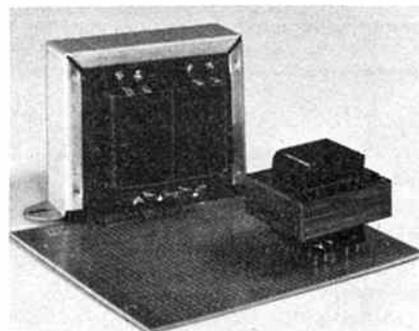
Handy Stripper

Recently introduced into the Carel Components catalogue, is the "Kabifix" DBP cable stripper which can effectively and accurately end or centre strip cables up to 25mm diameter.

Complete with a blade which easily adjusts to the insulation thickness and swivels automatically, the tool can be snapped closed over the cable, rotated round the insulation or pulled longitudinally to expose the cable.

Durable and easy to operate, this handy stripping tool supplied with an instruction leaflet and plastic pouch, costs £8.25 plus VAT.

Carel Components, 40-44 The Broadway, Wimbledon, London SW19. Tel: 01-540 7186.



Transformers

A new range of high quality competitively priced transformers, designed to conform generally to BS2214, is now being stocked by Verospeed.

All the transformers are fitted with full shrouds and are varnish protected. Two 120V windings are provided for the primary and they may be connected in series or parallel for operation at 50 and 60Hz. Two secondary windings are provided for series or parallel connection. Various output voltages from 0-3V to 0-20V are available within a range from 1.2VA to 50VA.

Further details are contained in the new Verospeed catalogue, available direct from: Verospeed, Barton Park Industrial Estate, Eastleigh, Hampshire SO5 5RR. Tel: (0703) 618525.

Learning to spell

The latest learning aid from Texas Instruments, known as "Spelling B", uses proven word/picture association techniques to help children progress in spelling regardless of their basic writing skills. Using an alphabetical calculator-type keyboard and display, combined with a picture book containing 264 carefully selected, colourful pictures of familiar objects, "Spelling B" is designed to provide an early introduction to word recognition, and also incorporates a series of simple and entertaining word games to improve basic reading skills.

In operation, the "Spelling B" selects and displays a picture number, the child finds the numbered picture in the book, and then spells the name of the picture by pressing the letter keys. As the letters are keyed they appear in the display, and at the end of each word the display signals "right or wrong". If the word is misspelled, the

child is given a second attempt, and if this is wrong the correct answer is displayed. The number of correct answers is displayed as a "score" at the end of each set of five words.

"Spelling B" is programmed so that one of three different levels of difficulty can be selected. In addition, a variety of pre-spelling activities for younger children plus word games for all ages are available.

Among the games which add fun and variety to "Spelling B" are: "Starts with", a pre-spelling exercise in which the child only has to enter the first letter of the displayed word; "Missing letter", in which a word is selected at random and displayed with letters missing; "Mystery word", a variation of "Hangman" in which players have to guess words one letter at a time; and "Scramble", in which up to five words can be put into a memory in anagram form and recalled for "unscrambling" at a later stage.



The "Spelling B" costs £19.95 (r.r.p. including VAT), and is available through the usual distributors.

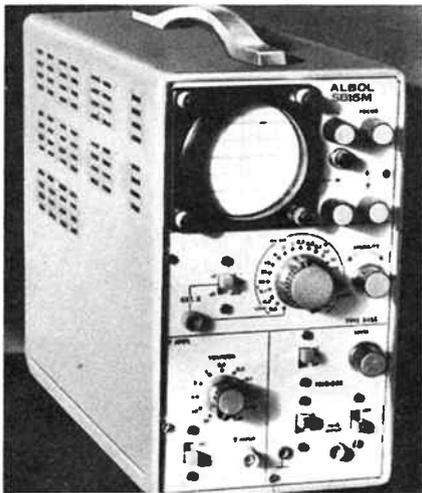
Texas Instruments Ltd., European Consumer Division, Manton Lane, Bedford MK41 7PA.

Portable 'scope

The new Model SB15M lightweight portable oscilloscope from Albol Electronic is claimed by the makers to break all records for cost-effectiveness for a professional/amateur instrument.

Albol say that the bandwidth goes up to 15MHz within 3dB limits and nine ranges cover, with an accuracy of 5% 10mV to 20V/cm on the 45 by 60mm measuring area of the c.r.t. Input impedance is $1M\Omega \pm 3\%$ in parallel with 30pF, and the maximum input voltage is 400V.

The timebase can be freely running or triggered, and is displayed on 19 calibrated ranges from 0.5s/cm to 0.5 μ s/cm. Synchronisation can be either internal or external, with the a.c. mode giving 20Hz to 1MHz, and the h.f. mode 1 to 15MHz. Trigger sensitivity is said to be 0.5cm of the display on "internal", or 0.5V p-p on "external".



Bandwidth of the X amplifier, within 3dB, goes from d.c. to 3MHz, with an input impedance of $1M\Omega$ in parallel with 45pF. The X deflection coefficient varies from 0.3 to 1.5V/cm. An attractive feature of this truly portable scope is that it can operate from 220 to 240V mains (using the optional adaptor) at 50 to 400Hz, with a power consumption of 40VA, or else from internal 1.5V cells giving 12V d.c. (rated then at 27W).

The width of the SB15M is 150mm, depth 340mm, and height 280mm, and it weighs only 7.6kg. Price is £150 plus VAT.

Available from: Albol Electronic & Mechanical Products Ltd., 3 Crown Buildings, Crown Street, London SE5 0JR. Tel: 01-703 2311.

New Sinclair DFM

Latest from Sinclair's new instrument product range, is a high specification, low cost, digital frequency meter, called the PFM200.

Designed to provide the performance of high quality bench-style instruments with the portability of a 158 x 76 x 45mm unit in a light (6oz) but rugged case, the PFM200 is priced at only £49.80 plus VAT, which should permit most laboratory engineers, service technicians, students and hobbyists to possess their own personal digital frequency meter.

Its bright, sharp 8-digit display with variable accumulation period gives high resolution coverage from low audio frequencies right up to v.h.f.

without the need for complex range changing and with exceptional sensitivity of 10mV. Guaranteed range is 20Hz to 200MHz, typically higher, with a frequency resolution down to 0.1Hz. Power is from a 9V battery or approved a.c. adaptor.

Supplied complete with test leads and probes, protective wallet and operator's manual, optional extras are a.c. adaptors for 117V, 220V or 240V; de-luxe padded carrying case with lead storage compartment; and a connector pack comprising BNC, coaxial, DIN and phono adaptors plus telescopic aerial for direct signal pick-up from nearby transmitter.

A technical information leaflet on the PFM200 is also available from: Instrument Sales, Sinclair Radionics Ltd., London Road, St Ives, Huntingdon, Cambs PE17 4HJ. Tel: (0480) 64646.



numbers without tears

Dr G. BROWN

The aim of this design was to produce an educational toy capable of teaching rapid number recognition to children of 2½ years and upwards. The absolute minimum of instruction should be necessary, the idea being that the child learns as he plays, without external influence. The toy should thus be interesting to play with.

To a young child this means: (a) visual stimulation—things should be seen to happen; (b) tactile stimulation—the instrument should respond to touch, to pressure—there should be something to turn, something to switch.

This simple unit has all these facilities and can hold a child's attention for remarkably long periods. It can also double as a single die for use with other games.

General Features

Fig. 1 shows the basic design blocks. A swept-frequency clock generator feeds the first decade counter, the digit outputs of which are used to drive ten light-emitting diodes (l.e.d.s) arranged in a circle. A second decade counter, fed from the same clock source, drives a single 7-segment l.e.d. numeric display. As the clock frequency rises from zero, the circular l.e.d. display assumes a rotating motion with a visible acceleration. As the clock frequency then falls to zero, the "flywheel" effects slows and stops at a random position.

The l.e.d.s are labelled 0 to 9, as are the positions on the manual number selector, which is a rotary switch. Provided that both decade counters are reset to zero initially, they will always remain synchronised, i.e., if the flywheel stops at position "4", then the 7-segment outputs will correspond to the figure 4 also.

The number selector is wired such that the 7-segment display is only illuminated when this switch is turned to the same number at which the flywheel has stopped. The normal fixed-frequency clock is used when the device is employed as a die.

Some simple logic is included to make the toy more interactive with the child, and will be described in the appropriate sections.

The Swept-frequency Clock Generator

For this particular application, a manually-initiated frequency sweep was required from zero up to about 100Hz and back again to zero. The circuit is shown in Fig. 2.

The clock is designed around the ubiquitous NE555V integrated circuit connected in the astable mode.

If the circuit to the left of the dashed line is studied, the timing components R1 and C1 are easily recognised. C1 is

charged up through R1, and IC1 will discharge C1 when the voltage at point A reaches 0.67V_{DD}. The negative-going edge corresponding to the discharge of C1 re-triggers the cycle and the system becomes astable, the frequency of oscillation being given by:

$$f = \frac{1.44}{R1 \times C1} \text{ Hz}$$

In the circuit to the right of the dashed line Tr1 and Tr2 are connected as a Darlington pair controlled by the touch plate connected to the base of Tr2. The quiescent-state voltage at point A is controlled by resistors R1, R2, and R3, the two transistors being effectively open-circuit. A simple Ohm's Law calculation shows that point A is held at 0.65V_{DD} and, because IC1 will not discharge C1 until point A reaches 0.67V_{DD}, the clock oscillator is biased off, its output being a logic "1" in this condition.

When a finger is applied to the touch plate, charge flows into the electrolytic capacitor, C2. As this charges up, the potential at point B rises. With C2 fully charged (after about one second), both transistors are turned fully on and point B is taken almost to V_{DD}. Thus the Darlington pair may be regarded as a variable resistance, R_t, between point B and V_{DD}, this resistance varying from infinity to near zero. As soon as R_t becomes finite, point A is lifted above the threshold value of 0.67V_{DD} and oscillation begins.

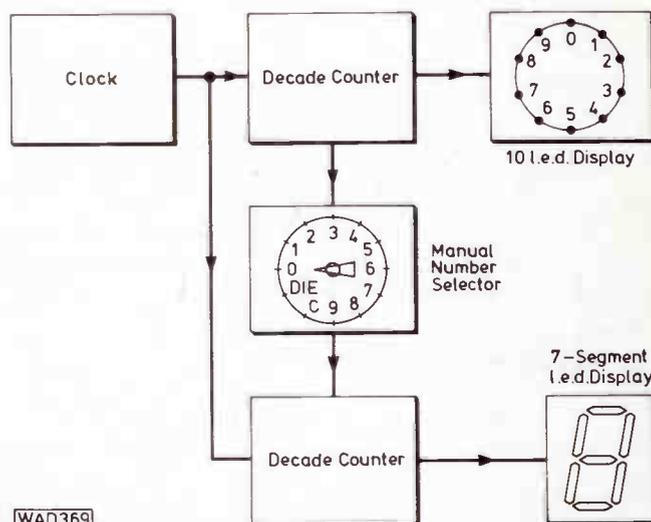


Fig. 1: The basic block diagram of the numbers toy

The frequency of oscillation is still given by the above equation, except that R1 must be replaced by the effective instantaneous value of R1, R2 and Rt. In the limit, with Tr1 and Tr2 turned fully on, R1 and R2 are virtually in parallel between Vdd and point A, and have an effective resistance of 24.8kΩ. This gives a theoretical upper frequency limit of:

$$f = \frac{1.44}{2.48 \times 10^4 \times 3.3 \times 10^{-7}} = 176\text{Hz}$$

This figure is not attained in practice because Rt never falls completely to zero.

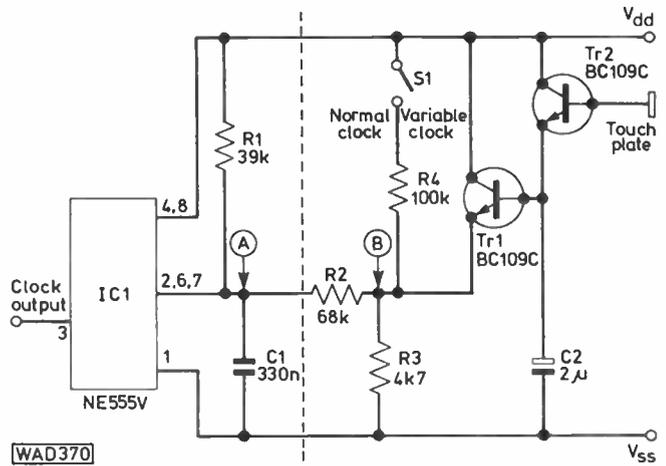
When the finger is removed from the touch plate, C2 discharges slowly through Tr1 and R3, and Rt increases correspondingly. The frequency of oscillation falls and finally reaches zero when point A falls again below its threshold value. This decay time is of the order of 10 to 15 seconds.

Switching R4 into the biasing network by closing S1 holds point A just above threshold and a constant-frequency output of about 15Hz is produced. The use of this clock frequency is described in a later section.

The touch plate is very sensitive in its action, and this encourages the child to experiment as he watches the effects of his finger's pressure illustrated on the flywheel display.

The Decade Counters

Apart from the NE555V oscillator, this instrument employs c.m.o.s. devices which are relatively cheap and are ideal for this purpose. Fig. 3 shows the circuit diagram of



WAD370

Fig. 2: Circuit diagram of the swept-frequency clock generator

the first decade counter and the transistor drivers for the 10-l.e.d. flywheel display. The 4017 decade counter is fed from the clock generator described above. In order to drive the flywheel l.e.d.s at 20mA, ten transistors operating as emitter followers are used. As only one l.e.d. is illuminated at any instant, only one current limiting resistor, R10, is necessary. It will be noted from Fig. 3 and Fig. 4 that the "reset" and "clock inhibit" functions are made common to both decade counters. This is to ensure complete synchronism of the two counters at all times. The combination of C3 and R5 resets both counters to zero when power is first applied.

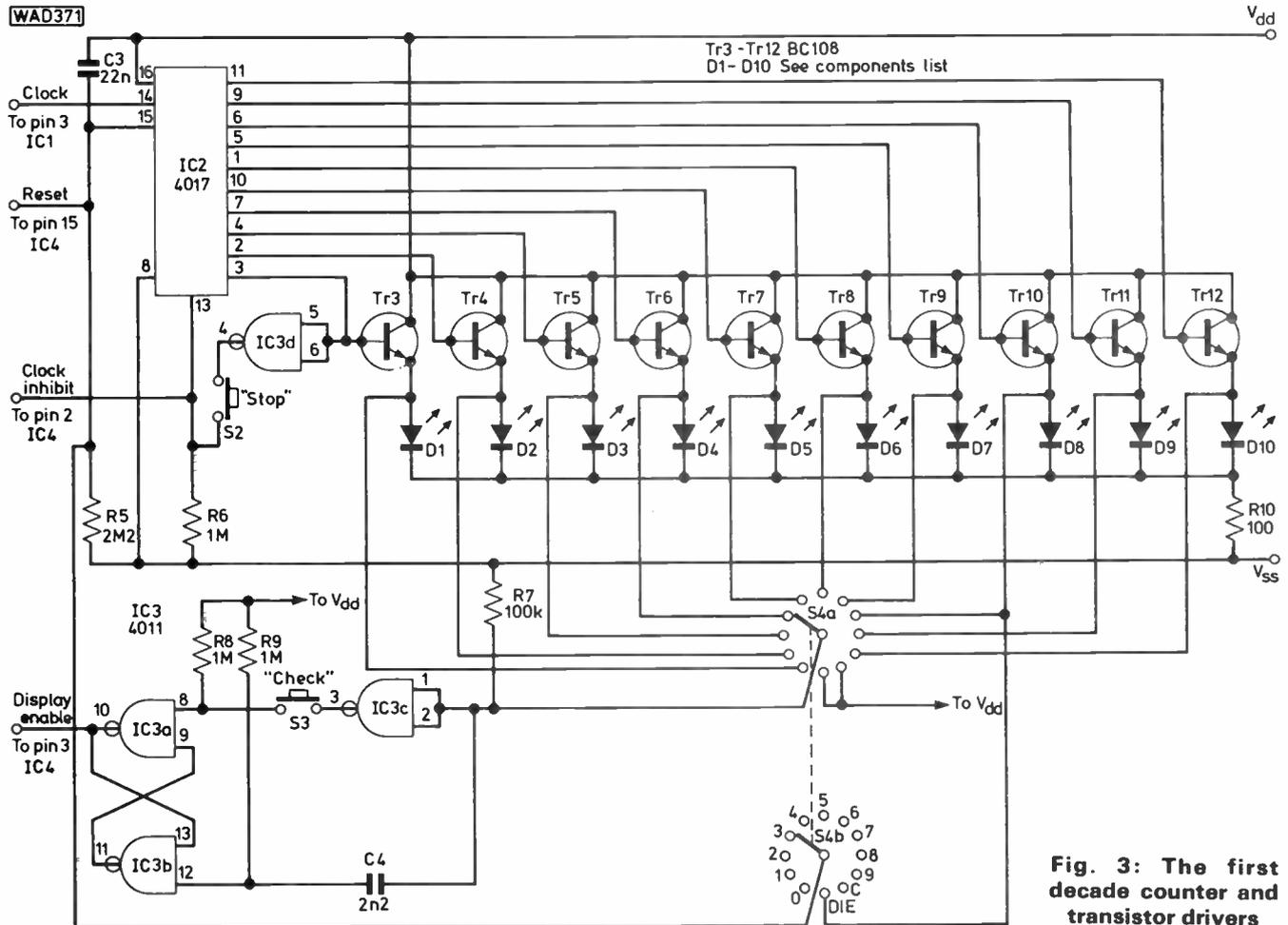


Fig. 3: The first decade counter and transistor drivers

constantly illuminated. S4b comes into operation at this point and connects the "7" digit of the l.e.d. flywheel to the "reset" pins of both counters. Thus both of the displays count repetitively from "0" to "6" when the clock runs. The swept-frequency clock can be used for this, but it has been found that the use of a constant 15Hz clock (selected by S1) is more satisfactory, in that the procedure is less involved for the child.

To "throw" the die, all that the child does is press S2: both displays stop immediately, showing a number between "1" and "6". On releasing S2, counting begins again. This function utilises the "clock inhibit" pins of both counters. When these pins are taken to logic "1", counting will cease, even though the clock is still running. The last NAND gate of IC3 is used for a rather devious purpose in this mode. Both IC2 and IC4 are counting from "0" to "6" yet it would clearly be incorrect to allow the die to stop at "0".

Instead, the die is slightly "weighted" such that it can never be stopped at "0"! The probability of throwing a given number on a die is 1:6. On this die, the probability of throwing a number between 2 and 6 is 1:7 and the probability of throwing a 1 is 2:7.

In use by young children, or even unsuspecting adults, this would never be noticed. To prevent a "0" being thrown, the signal to inhibit the clock is taken from the "0" digit output (pin 3) of the 4017 counter. If, at the moment S2 is pressed, a number from "1" to "6" is being displayed, pin 3 will be at logic "0". IC3d inverts this to logic "1" and inhibits the clock. However, if "0" is being displayed when S2 is pressed, pin 3 is at logic "1" and the logic "0" produced by IC3d will *not* inhibit the clock. Instead, it waits for the next clock pulse which increments both counters to the digit "1", at which instant pin 3 of the 4017 goes to logic "0" and IC3d then inhibits the clock with logic "1" at its output.

Power Supply

A single-polarity, stabilised 5 volt supply is used, employing an integrated circuit regulator. Stabilisation is to be preferred here, because the current taken from the supply varies between about 23mA with only the flywheel display on, to about 160mA with the 7-segment display showing an "8". Fig. 6 shows the circuit used. The regulator is mounted on the metal box to dissipate the small amount of heat generated. The use of 15V d.c. supply for the regulator may seem excessive. In fact, this supply rail will drop to 12 volts on full load and, as the regulator needs a supply of at least 8.5 volts, the supply is not too conservatively rated. A transformer with a 9-0-9 volt secondary could be used, provided that the supply rail for the regulator did not fall below 9 volts on full load.

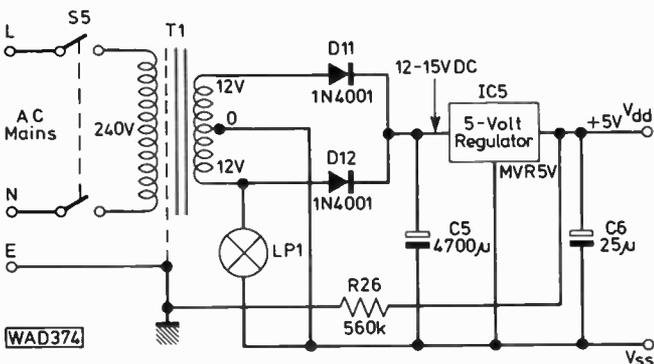


Fig. 6: Power Supply

★ components

Resistors

$\frac{1}{4}$ W 5% carbon film

82Ω	7	R19, 20, 21, 22, 23, 24, 25
100Ω	1	R10
4.7kΩ	1	R3
1.5kΩ	7	R12, 13, 14, 15, 16, 17, 18
33kΩ	1	R11
39kΩ	1	R1
68kΩ	1	R2
100kΩ	2	R4, 7
560kΩ	1	R26
1MΩ	3	R6, 8, 9
2.2MΩ	1	R5

Capacitors

Electrolytic

2µF 6V	1	C2
25µF 6V	1	C6
4700µF 25V	1	C5

Polycarbonate or polyester

2.2nF	1	C4
22nF	1	C3
0.33µF	1	C1

Semiconductors

Diodes

1N4001	2	D11, 12
LED	10	D1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Transistors

BC108C	17	Tr3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19
BC109C	3	Tr1, 2, 20
BFY52	1	Tr21

Integrated circuits

MVR5 regulator	1	IC5
NE555V	1	IC1
4011	1	IC3
4017	1	IC2
4026	1	IC4

Switches

s.p.s.t.	1	S1
Push to make	2	S2, 3
2p 12w rotary	1	S4
s.p.d.t. slide	1	S5

Miscellaneous

12-0-12V 200mA transformer T1 (1); 12V panel lamp (1); 7-segment red l.e.d. display, common cathode MAN74 (1); Veroboard (see text), case.

Constructional Notes

Apart from the power supply, displays and switches, the entire circuit was constructed on a single piece of Veroboard measuring 95 × 63mm. The layout is not important, so no details are given, but it is advisable to take all Vss leads to a common point.

In general, this precaution is unnecessary, but in this circuit the emitter connection of the digit driver Tr21

Continued on page 60

Selective Sound



OPERATED

Switch

C.R.HARRIS

This unit was developed after I was asked by a friend to build a device with which he could turn a light on by clapping his hands.

Obviously this could be done by using a simple sound operated switch comprising a microphone, audio amplifier and trigger circuit, but such a simple circuit would respond to any sound of sufficient volume. Clearly something more sophisticated was required.

After a number of tests had been made, it was found that satisfactory operation could be obtained by making the circuit respond only after receiving two sounds with a fixed time interval between them of around one second. This achieves a good compromise between simplicity, spurious operation from background noise and ease of use. The human brain is very bad at estimating short time intervals and a sequence of more than two sounds becomes impossible to generate with any accuracy. The circuit also incorporates a filter and a level trigger so only sounds of the correct pitch and sufficient volume will be detected.

Circuit Operation

IC1 and associated components amplify the sound picked up from the microphone and include rough frequency filtering. VR1 is a gain control and VR2 adjusts the d.c. level of the output from this stage. This is fed to a Schmitt trigger comprising Tr1 and Tr2 and also has a time delay (C4, R2) to prevent multiple triggering. The components following (Tr3-Tr5) form a driver stage for the logic circuit, and the l.e.d. D2 indicates when a sound has been detected. The circuit gives a logical '0' on receiving an input above a preset threshold set by VR2.

The output from this stage is first fed to a monostable comprising G1 and associated components which in turn triggers two more monostables G3, G4 and associated components. Monostable G1 has a period of about 5 seconds and is included to prevent the other two monostables re-triggering before the circuit has finished its cycle. G3 has a period of about 1 second and G4 about 3 seconds.

The circuit comprising G6-G11 and FF1 looks for the state in which, after a pulse has triggered the monostables, a second pulse arrives during the period when G3 has turned off again and G4 is still on, i.e. 1-3 seconds after the first pulse. When this happens a logical '1' is sent to FF2 which then changes state and opens or closes the relay via Tr9 and Tr10. If the second pulse arrives before or after

the allowed period it is ignored and will also work the latch G9, G11 to make the circuit ignore all further inputs until G1 has reset. Thus on receiving two sounds with a time interval of about 1 second between them the circuit will operate the relay, turning the load circuit on or off.

Construction

Construction is simplified by the use of printed circuit boards. Start by soldering in the smallest components, i.e., resistors and diodes and add the tallest components (capacitors and transistors) last. The c.m.o.s. integrated circuits (IC2-IC5) should be connected using i.c. sockets, installing them in after all the other components have been soldered. Standard c.m.o.s. handling precautions should be used. Sockets should also be used for the other integrated circuits. Take great care to connect all components such as diodes, transistors, i.c.s and electrolytics the correct way round as incorrect connection can cause a large range of puzzling faults.

At this point, something should be said about the microphone and the mains transformer. The microphone used is a high impedance balanced armature earpiece which is better than a crystal microphone in this application. There is also space on the circuit board for putting a resistor in series with C2 to adjust the low frequency characteristics (10-100Ω).



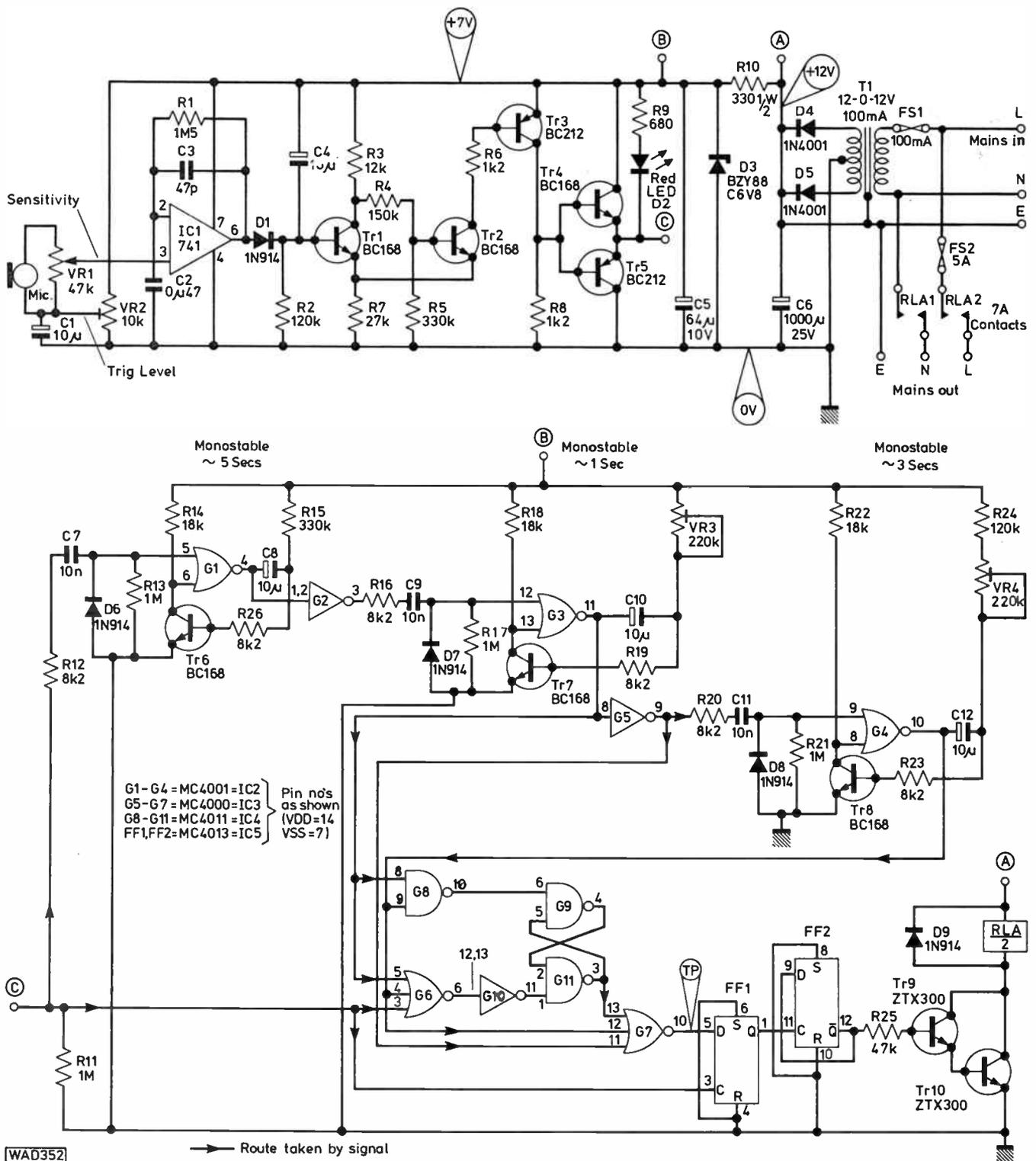


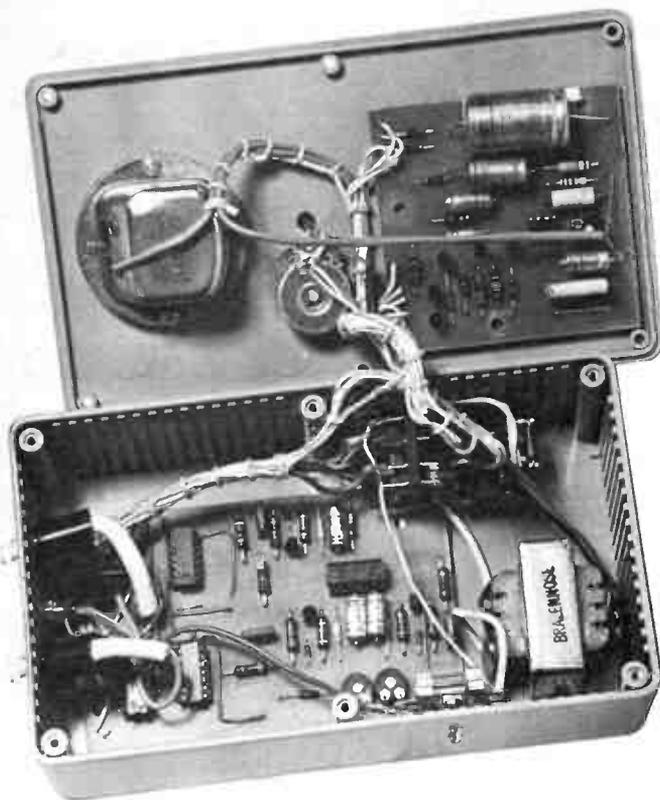
Fig. 1: Circuit diagram of the selective sound operated switch

The mains transformer is a 12-0-12V type designed to supply up to 100mA d.c. from a full-wave rectifier. Most of the current is drawn by the relay (60-80mA) with the rest taking less than 20mA. Thus if a relay is used which draws more than 80mA a larger transformer will be needed. A 100mA fuse is shown connected to the primary of the transformer and this is necessary for safety. If it is found that the fuse blows on switch-on an anti-surge fuse can be fitted. The other fuse supplying the appliance being controlled should be rated according to the relay contacts and mains cable used.

A suitable case for the unit can be made from a plastics Bimbox. When fitting components into the case, it is important to keep all the high voltage components (relay, transformer and fuse holders) well away from the other components so that there is no chance of any live connections touching any other part of the circuit. Holes are drilled in the case for the microphone, the l.e.d. and the gain control VR1. The circuit boards should be positioned within the case such that the presets VR2-VR4 can easily be reached to be adjusted. The boards are held in place using self-adhesive pads. When wiring up between the

circuit boards, it is very important that all the supply rails are connected up correctly because the c.m.o.s. chips can be damaged if an input is fed to them before the power rails are connected.

★ components



The components and p.c.b.s are fitted into a plastics Bimbox. The two p.c.b.s are attached to the box base and lid using self-adhesive foam pads

Setting Up

First set VR3 and VR4 midway along their tracks. Set the gain control VR1 to minimum. It should be found that as VR2 is moved the l.e.d. will light at one end of the track and be extinguished at the other. Adjust VR2 until it is just extinguished. Then turn the gain control VR1 up a little. It should now be found that any loud sound near the microphone will cause the l.e.d. to flash on for just under a second. If it stays on or does not come on at all then adjust VR2 until the response is satisfactory. Next, connect a voltmeter between the 0V rail and pin 10 of IC3 (marked TP in the diagram) or, if no meter is available, disconnect R25 from IC5 and make a temporary connection from that end of the resistor to pin 10 of IC3.

It should now be found that if, after at least 5 seconds of silence, a sound is made near the unit loud enough to make the l.e.d. flash, then a short pulse of approximately +7V will be indicated on the meter, or the relay will close momentarily about one second after the sound. If this does not happen adjust VR3 and VR4 until it does. This is the period during which the device is sensitive and it will switch the load if a second sound is made during this period. Adjust VR3 and VR4 until the time period is satisfactory. Note, however, that if the values of the presets are made too low then the monostables will stop working, so that if a satisfactory time period cannot be achieved then it may be necessary to change C8 or C12. Do not make the "sensitive" period too short or it will be found very difficult to estimate the required time interval.

After R25 has been replaced in its correct position and the lid has been attached, then the unit is ready for use.

Resistors

$\frac{1}{4}$ W 5%		
680 Ω	1	R9
1.2k Ω	2	R6, R8
8.2k Ω	6	R12, 16, 19, 20, 23, 26
12k Ω	1	R3
18k Ω	3	R14, 18, 22
27k Ω	1	R7
47k Ω	1	R25
120k Ω	2	R2, 24
150k Ω	1	R4
330k Ω	2	R5, 15
1M Ω	4	R11, 13, 17, 21
1.5M Ω	1	R1
$\frac{1}{2}$ W 5%		
330 Ω	1	R10

Potentiometers

Horiz. miniature preset

10k Ω Lin.	1	VR2
220k Ω Lin.	2	VR3, 4

$\frac{1}{4}$ inch shaft

47k Ω	1	VR1
--------------	---	-----

Capacitors

Disc ceramic

47pF	1	C3
10nF	3	C7, 9, 11

Polyester

0.47 μ F	1	C2
--------------	---	----

Electrolytic

10 μ F 25V	5	C1, 4, 8, 10, 12
64 μ F 16V	1	C5
1000 μ F 16V	1	C6

Semiconductors

Diodes

1N4001	2	D4, 5
1N914	5	D1, 6, 7, 8, 9
Red l.e.d.	1	D2
BZY88 C6V8	1	D3

Transistors

BC168	6	Tr1, 2, 4, 6, 7, 8
BC212	2	Tr3, 5
ZTX300	2	Tr9, 10

Integrated circuits

741	1	IC1
4000	1	IC3
4001	1	IC2
4011	1	IC4
4013	1	IC5

Miscellaneous

Bimbox (190 x 110 x 60mm BIM 2006/16); Mains transformer 12-0-12V 100mA (1); Relay 12V 80mA max. 7A 240V d.p.c.o. (1); Fuse holder (2); Fuses 100mA and 5A; Balanced armature earpiece (see text) (1); Printed circuit board (2 in set); Sockets, 14 pin d.i.l. (4); 8 pin d.i.l. (1); Knob (1); Mains cable, socket and cable clamps.

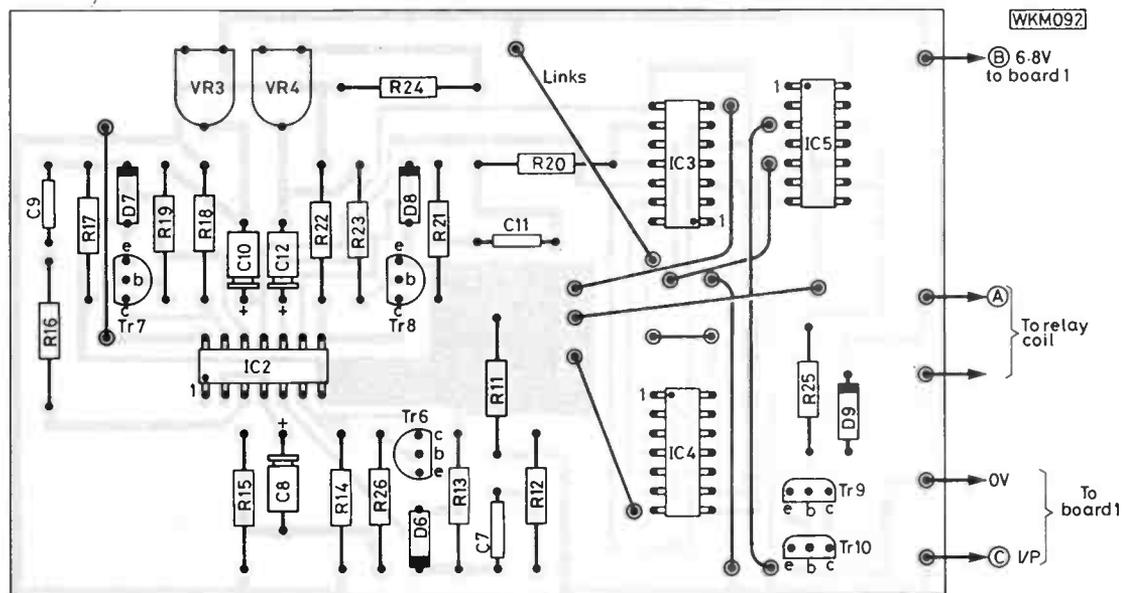
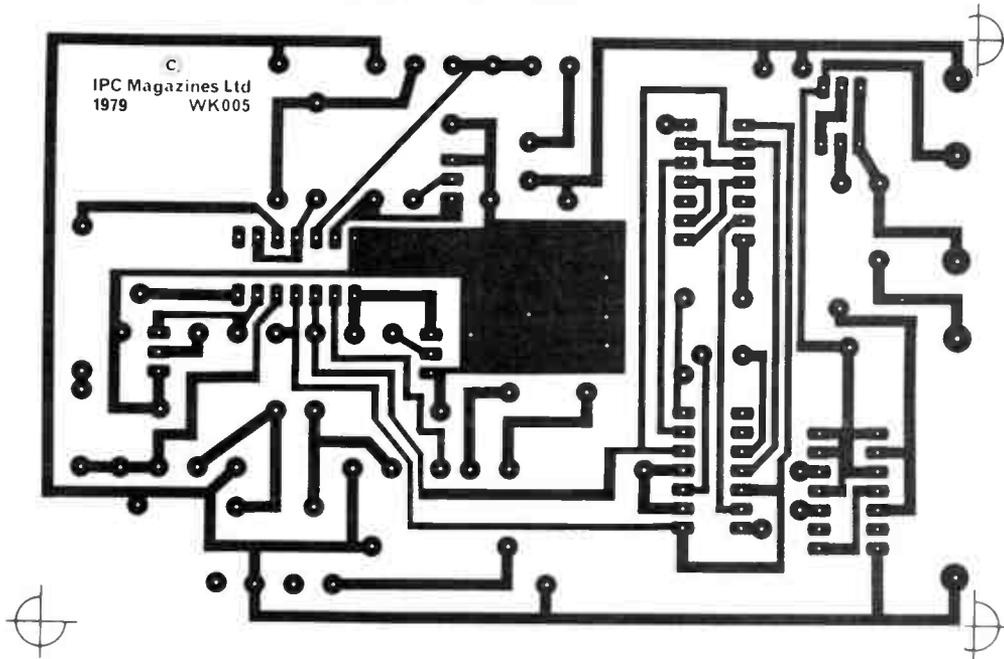


Fig. 2: The copper track pattern and component placement drawing for Board 2 shown full size.

Using the Switch

Adjust VR1 so that the l.e.d. will not flash from background noise in the room, but will reliably respond to a hand clap. The l.e.d. will be found very useful for indicating whether the unit has "heard" a sound or not, when setting the sensitivity.

Although originally intended purely as a gimmick, the device has been found to be extremely reliable and may well have more practical uses. The prototype was left in an average sitting room for a week without triggering spuriously, but would immediately respond on hearing the correct sound sequence.

There could be practical uses where it is necessary to operate equipment remotely, possibly by a disabled

person, or in other cases where it is not possible to operate a switch directly.

Fault-finding

Once the design had been finalised, it was found that the units could be relied upon to work correctly immediately they had been assembled and adjusted. Most faults are likely to be caused by wire links in the wrong places and diodes or transistors the wrong way round. Remember that the circuit uses both *nnp* and *pnp* transistors. A puzzling intermittent fault in one unit was traced to C6 being open-circuit. This resulted in the supply rails

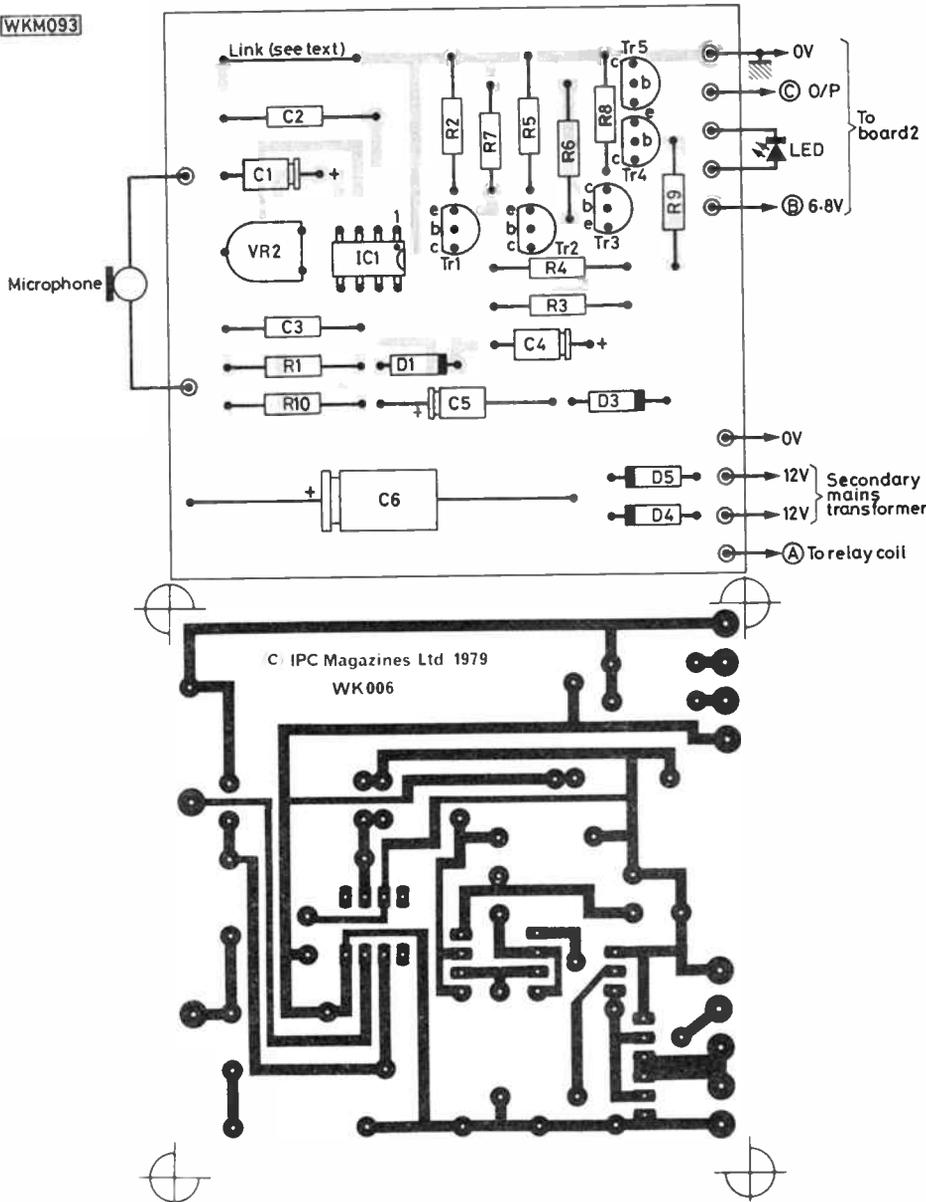


Fig. 3: The copper track pattern and component placement drawing for Board 1 shown full size

So You Want to Pass the RAE?

carrying unsmoothed a.c. and played havoc with the logic functions.

Provided that the l.e.d. flashes in response to sounds then faults are best traced by first checking the outputs of the monostables (pins 4, 10, 11 of IC2) and then following the voltage levels through the rest of the circuit. Remember that the monostables give an inverse output, i.e. "1" in the quiescent state and "0" when active, and remember also that the circuit takes 5 seconds to complete its cycle and if it receives an input before G1 has reset it will ignore it.

If the l.e.d. does not light up then first check IC1. The voltage on pin 6 (output) should equal that on the wiper of VR2, except at extreme settings of VR2. The Schmitt trigger, Tr1, Tr2 should turn on when the voltage on Tr1 base exceeds about 5V, turning on the l.e.d. via Tr3-Tr5, and should turn off sharply as the voltage is lowered. These functions can easily be checked with a multimeter and should show up the location of any fault. However, provided the unit is constructed carefully, there is no reason why it should not work first time. ●

For details and coupon see page 30

NEXT MONTH IN...

practical

WIRELESS

ON SALE 6TH. JULY



Automatic Intercom

Unwanted salesman? Tired after a hard day? PW's Automatic Intercom allows you to answer callers from your armchair without even pressing a button, while the front door remains securely bolted. Digital and analogue techniques are combined in this comprehensive, yet easy-to-install aid to basic security for the old, infirm or just plain lazy.



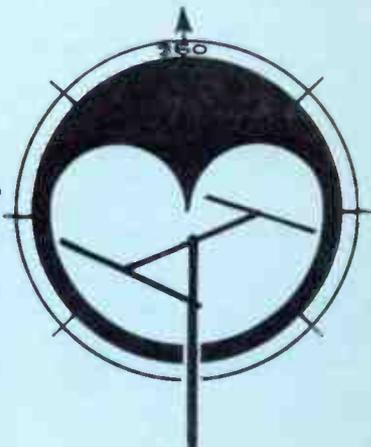
Ultrasonic Remote Control

A short introduction to the use of ultrasonics for cordless on/off control of domestic appliances etc. The article suggests some suitable circuits based on i.c.s intended for use in other fields, allowing the construction of very small transmitters and receivers.



Aerial Design with Scale Models

Aerial designs can be tested and developed easily by building scale models of the proposed systems and making measurements at u.h.f. This article describes how a surplus marine radar display can be adapted to plot the resulting polar diagrams automatically.



Plus SPECIAL PRODUCT REPORT on the LOWE SRX-30 Receiver

W m e

top band tran

J. R. Green BSc, G3WVR*

This low-power a.m. transmitter design illustrates the use of power f.e.t. devices—in particular, the VN66AF recently introduced by Siliconix Ltd.—and takes full advantage of modern semiconductor technology. The unit is particularly suitable for use within the 160-metre band, although operation at higher frequencies is quite possible.

Design Considerations

The Author has carried out a great number of experiments with low-power transmitter circuitry using bipolar (i.e. “conventional”) devices over the last few years. Some degree of success was achieved in later designs, using the now-defunct BD123, but en route many pitfalls for the unwary were uncovered.

Technically, however, the bipolar device fell down on several counts, notably:

1. High drive power was required: typically 10%, even at low frequencies.
2. Difficulty was experienced in achieving really linear amplitude modulation, even when modulating both the driver and p.a. stages. Modulation of the p.a. only, by swinging the supply rail, was unsuccessful. Modulation of the driver as well was essential and far more modulator power was required.
3. Problems were encountered in achieving stability in the transmitter r.f. strip. Often appreciable “slugging” was called for to prevent h.f. or v.h.f. parasitics.
4. Modulation excursions also tended to introduce instability, often producing undesirable steps of modulation non-linearity in the modulated r.f. carrier envelope.
5. It proved remarkably easy to destroy the p.a. transistor(s) if instability occurred or the transmitter was mis-tuned.

These difficulties led the Author to the conclusion that solid-state transmitter design could be much simplified if a

* Senior Development Engineer—Gould Instruments Division

device existed which exhibited the characteristics of a thermionic valve. In particular, low drive power, modulation linearity and stability were desirable in addition to the ability to operate from low voltages. In other words, a high-power f.e.t. was needed.

During 1978, Siliconix Ltd. produced the VN66AF and samples were supplied to further the Author's experiments. The ultimate results are incorporated into the transmitter featured in this article. Whilst the published form is for 160-metres, the basic circuit could be used to produce a transmitter capable of at least 10MHz and possibly more.

Circuit Description

The transmitter employs a crystal oscillator which incorporates a twice-frequency, parallel-resonant crystal, with a TIS88A f.e.t. as the oscillator transistor (Care with substitutes! The circuit may fail to oscillate with devices requiring different d.c. conditions.). This stage provides sufficient drive to switch Tr2, a 2N2369A switching transistor which provides a twice-frequency 5 volt peak-to-peak square-wave to drive IC1. This i.c. is a 7473 flip-flop wired to divide-by-two, thus producing the output frequency “ f ”.

The 7473 limits the “ $2f$ ” crystal to around 6MHz (therefore the output frequency “ f ” to 3MHz) but this may be extended by substituting a Schottky 7473 (i.e. a 74S73).

From IC1 the signal is passed to Tr3, another 2N2369A switching transistor, to present 12 volts peak-to-peak square-wave drive to the output devices. With Tr3 looking into 100 Ω the two VN66AF p.a. devices are easily driven. Their input capacity of 50pF each is the prime limiting factor with untuned drive, although a BFY50 could be substituted for Tr3 and R11 reduced in value to increase the operating frequency or drive more than two p.a. devices. A power output of 6 watts is typical for a 10 watt d.c. input.

A simple “constant K” type low-pass filter is provided, together with transformer matching to transfer the output power effectively into a 50 Ω load and remove harmonics.



Transmitter



Note that since a 1:1 mark-space square-wave drive is derived for the p.a., optimum efficiency with minimal second-harmonic radiation in the unfiltered output is assured, with the filter biting hard at the third and subsequent harmonics.

Filter values shown are for a cut-off frequency of 2500kHz, but others may be calculated from the expressions:

$$C = \frac{1}{f_c \pi z} \quad \text{and} \quad L = z^2 C$$

where $z = 50\Omega$ and $L = L1 = L2 = L3$

$$C = C_{10} = C_{11} \quad \text{and} \quad C_9 = C_{12} = \frac{C}{2}$$

f_c is the cut-off frequency.

The modulator circuit is merely a modified version of the Author's hi-fi amplifier design and should not present any problems. A speaker matching transformer rated at 10 watts (T2) is used to transfer the modulator power to the p.a. This should have a core area of around 25mm square and a winding resistance between the 0 and 16 Ω taps of not more than 1 Ω . The modulator input sensitivity is in the order of 100mV, so a pre-amplifier will be necessary for microphone level signals.

The r.f. matching transformer T1 was wound on a Mullard binocular "balun" ferrite block, measuring approximately 25 x 20 x 8mm and consists of three turns on the primary (transistor) side and nine on the secondary (filter) side. Experiments using these baluns showed a power-handling capability of 100 watts peak! Substitutes should have the following characteristics:

1. Suitable for the intended operating frequency.
2. 1:3 turns ratio for 6 watts, 50 Ω output with wire gauge as large as possible.
3. 50 Ω secondary reactance to be $\geq 50\Omega$ at operating frequency.
4. Peak power rating of at least 20 watts.

If a suitable ferrite block cannot be found, three Mullard FX2249 blocks can be used.

No Adjustments Needed!

It will be apparent from the r.f. circuitry that no tuning is required on the r.f. strip, which should work from switch-on. Trimmer VC1 is used for very fine frequency adjustment and could well be omitted, replacing it with a fixed capacitor of 18pF if the facility is not required. The pre-set potentiometer VR2 should be rotated until Tr11 and Tr12 just start to conduct—say 50mA of standing current.

The VMOS VN66AF devices performed very impressively throughout the development of the prototype transmitters. Only very low drive was necessary and very linear upward and downward modulation was produced. In every respect, the devices performed entirely to specification and simply shut down if an unacceptably-low load was connected.

Possibly it will be found that the modulator output is not quite sufficient to achieve 100% upward modulation but with a suitable transformer the quality is very good indeed and certainly far superior to so-called "communications quality", which covers a multitude of sins!

Construction

The construction techniques are clearly seen in the photograph, most of the components being soldered and mounted on one side of a double-sided "earth-plane" printed-circuit board, measuring 160 x 100mm. The top of the board, the component side that is, forms an earth-plane and the copper should be cleared (using a drill and an oversized bit) around the larger holes indicated in Fig. 2. The remainder form earth-plane connections. Details of the p.c.b. are given in Fig. 2 and the component locations are shown in Fig. 3.

The modulation transformer T2 is mounted on the bottom panel of the West Hyde Developments instrument case, as are Tr4 and 5 (on insulated washers). Transistors Tr11 and 12 are mounted on the extrusion as shown in the photograph. (In fact, the VMOS devices could also be fixed in the same manner, if preferred).

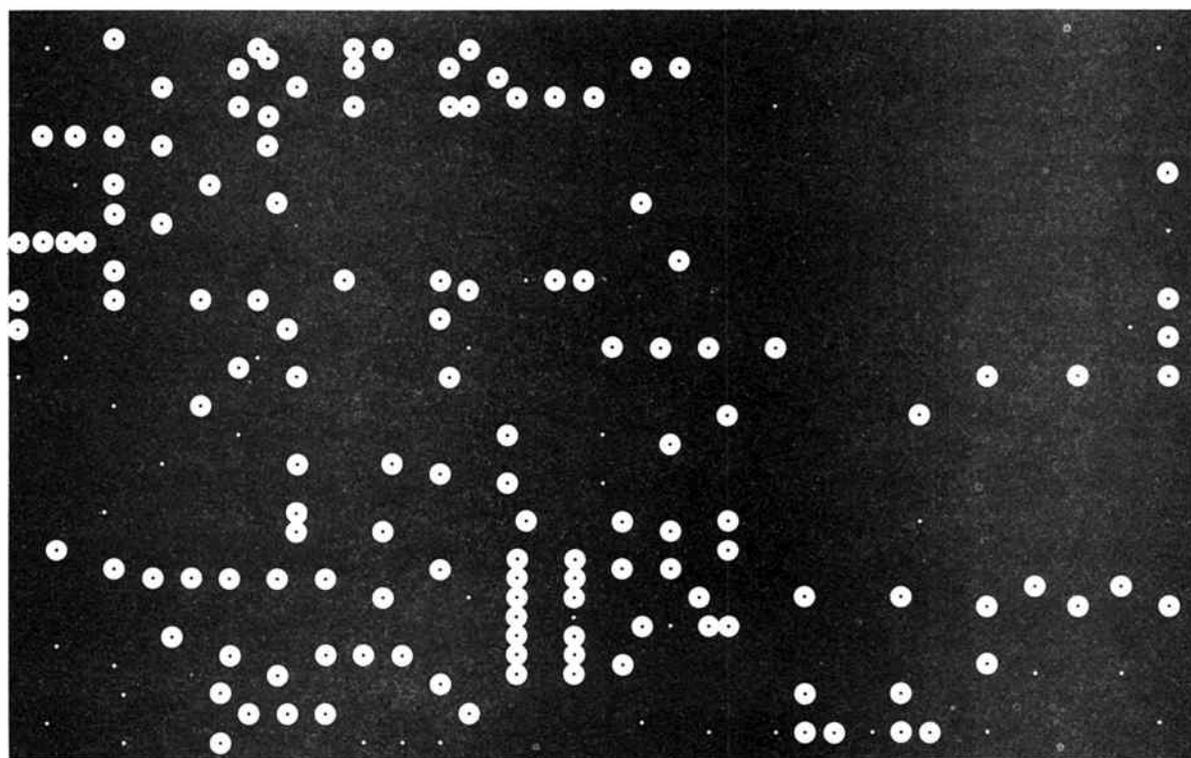
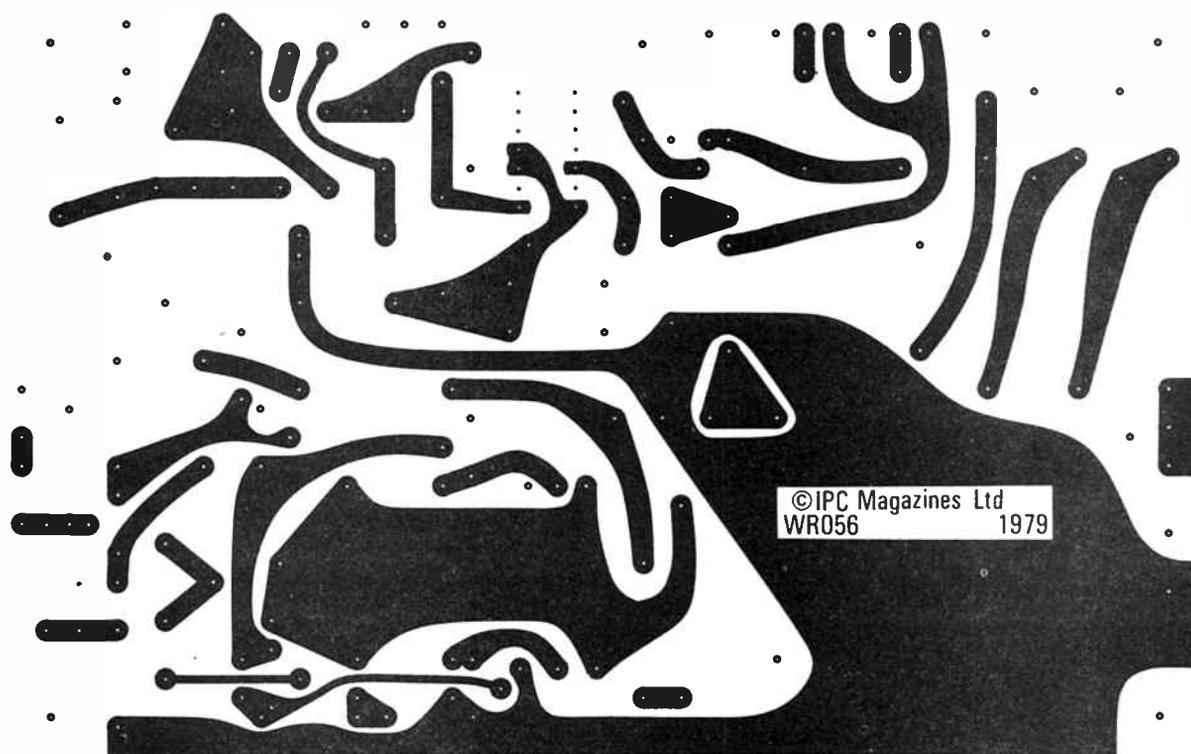


Fig. 2: The copper track side of the p.c.b. is shown full size at the top with the copper ground plane on the component side below it.

★ components

Resistors

$\frac{1}{4}$ watt 5% Metal Oxide

39 Ω	3	R2, 13, 14
47 Ω	1	R19
82 Ω	1	R22
100 Ω	2	R3, 11—see text
150 Ω	1	R6
330 Ω	3	R23, 24, 25
470 Ω	3	R7, 8, 9
2.2k Ω	1	R4
3.3k Ω	1	R5
4.7k Ω	3	R12, 20, 21
5.6k Ω	1	R10
10k Ω	2	R15, 18
22k Ω	1	R16
33k Ω	1	R17
100k Ω	1	R1

Potentiometers

5k Ω	1	VR2 Skeleton pre-set
10k Ω	1	VR1 Log. Panel mtg. pre-set with locking nut and cap

Capacitors

Silver Mica

22pF	1	C1
170pF	1	C2 180pF may be necessary

Ceramic disc

22nF	2	C5, 7
0.1 μ F	2	C3, 16 see text
0.33 μ F	2	C4, 8

Polystyrene 350 volt

1.25nF	2	C9, 12 (Use 1.2nF)
2.5nF	2	C10, 11 (Use 2.2nF)

Tantalum bead, 16 volt

25 μ F	1	C13
47 μ F	1	C14 100 μ F may be used

Electrolytic, axial leads

25 μ F 25V	1	C19
50 μ F 6.4V	1	C6
100 μ F 16V	1	C17
220 μ F 16V	1	C15 470 μ F may be used
1000 μ F 16V	1	C18

Trimmers

Dau type ceramic

3–30pF	1	VC1 see text (from J. Birkett)
--------	---	--------------------------------

Semiconductors

Diodes

1N914	1	D1 1N916 may be used
1N5339B	1	D2 5.6 volt Zener

Transistors

TIS88A	1	Tr1
2N2369A	2	Tr2, 3
VN66AF	2	Tr4, 5 (from C. Bowes & Co.)
2N3250	1	Tr6
BC108	1	Tr7
BFY50	2	Tr8, 9
BFX88	1	Tr10
MJE3055	1	Tr11
MJE2955	1	Tr12

Integrated circuit

SN7473N	1	IC1 SN74S73N for higher frequency operation
---------	---	---

Crystal

XL1 Twice-frequency HC6U type, parallel-resonant

Inductors

Calculated filter values for 160 metres:

6.25 μ H, $f_c = 2.5$ MHz.

L1, 2, 3 38 turns of 26 s.w.g. enamelled copper wire on 25mm long 8mm diameter former, air cored.

Transformers

T1 20 watt rating r.f. transformer (peak). Turns ratio 1:3, secondary reactance $\geq 50\Omega$, wound on suitable binocular balun-block ferrite (or 3 type FX2249, see text).

T2 10 watt rating speaker matching transformer with 0–3–8–16 Ω taps. The step-up ratio using 0 Ω as common 3 Ω as input and 16 Ω (or 15 Ω) as output is a fraction in excess of 1:2.

Hardware

Insulating kits for VN66AF transistors (2), MJE3055 and MJE2955. Socket for crystal. 50 Ω BNC connector (or SO239). West Hyde Developments instrument case type "Classic" CL2ADK (See advertisers' index). Printed-circuit board.

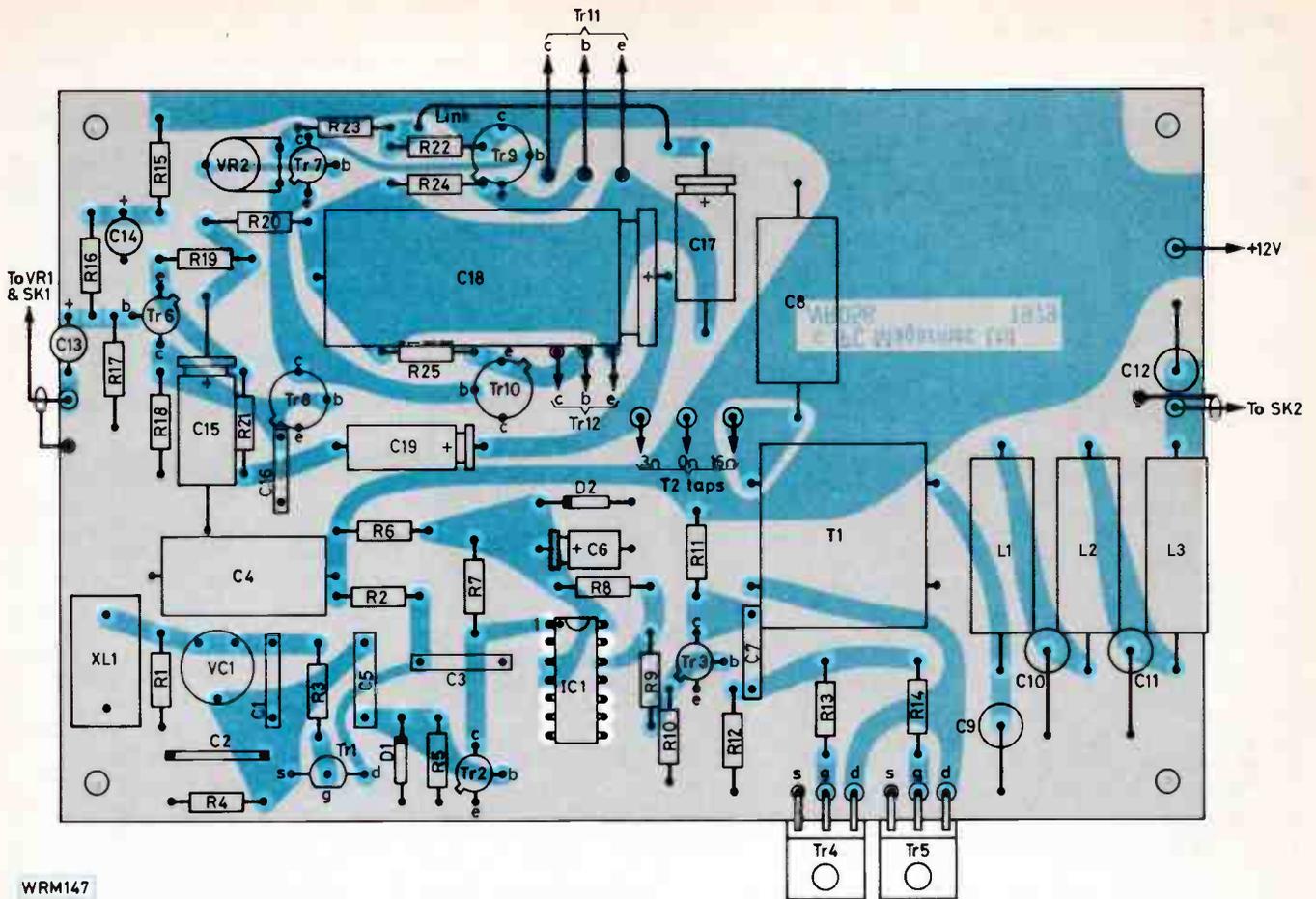
Setting Up

A very short section this! No tuning is required and the r.f. strip should work straight away. The d.c. input current to the final stage can be monitored and should be about 800mA when looking into 50 Ω . Other loads will affect the p.a. current and in extreme cases may require some sort of matching transformer.

Poor quality "inactive" crystals will reduce the oscil-

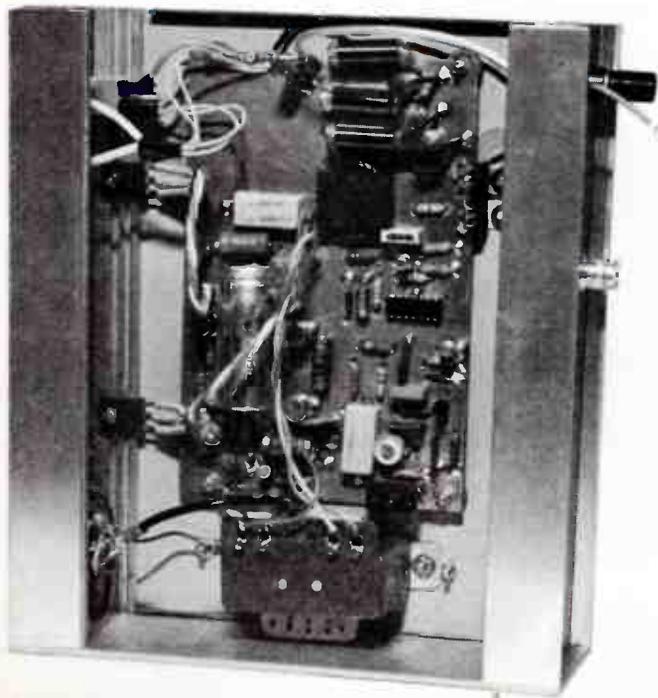
lator drive level and this may reach proportions where Tr2 will not switch and consequently there will be no output.

The quiescent current of the modulator should be set at around 50mA by means of VR2. If this adjustment is a smooth one all is well, but if the current flicks up to a high value check for amplifier instability. This can be cured by fitting C16, which also helps to keep r.f. from reaching the modulator.



WRM147

Fig. 3: The component placement drawing of the p.c.b. showing the ground plane (component) side of the board.



Aerial Matching

Most low-frequency aerials in amateur use are unlikely to present a good 50Ω match due to their small electrical size. The following techniques, based on a little theory and a lot of experimentation, are suggested.

The transmitter filter is quite tolerant of a mis-match—say $30\text{--}80\Omega$ —but placing a low impedance load on the output may violate the d.c. input power requirements. A really low load will cause the VN66AFs to overheat, but do not worry if this should occur; adequate protection is afforded within the devices, and they will merely shut down.

VFO Operation

Those who develop the transmitter may well wish to add the facility of v.f.o. operation. This is easily achieved by feeding the twice-frequency v.f.o. signal, at 2 volts peak-to-peak, into C5, in place of the injection from the crystal oscillator.

No problems with f.m. pulling should be encountered, as the v.f.o. and output frequencies are not the same.

Well, now you know how to build and operate your VMOS transmitter. Incidentally, the VN66AFs should only cost around £1 each. We hope it brings you enjoyment. ●

Changes in

BROADCAST-BAND LISTENING on Short Waves

PART 1

Jonathan MARKS

If you follow *Practical Wireless* regularly, then by now you may have put together or bought a short-wave general coverage receiver. Tuning around between 3 and 30MHz it soon becomes apparent that the spectrum is divided into blocks which are used for various purposes. If you listen between the frequencies 5950–6200, 7100–7300, 9500–9775, 11700–11975, 15100–15450, 17700–17900, 21450–21750 and 25600–26100kHz you'll hear radio programmes originating from broadcasting organisations all over the world. These radio stations are obviously different from the BBC or IBA domestic broadcast channels that the general public are used to, since their target audience is often a whole continent if not the world, rather than a single country or indeed a particular town.

A first flick through any short-wave (usually abbreviated to s.w.) broadcast band may prove disappointing. Many stations seem to be talking in foreign languages and are all crowded together. The secret with this hobby though is slow, careful tuning and frequent checks on "who's around". Most stations put out a magazine-style programme of about half-an-hour's duration in a number of languages, and with English the most common international language there are few stations without an English section. Indeed many s.w. stations broadcast specifically to Great Britain and Ireland every evening with programmes in English.

Station Types

Short-wave broadcasting stations fall into two main categories. The first group of stations aim to provide their listeners with news which is unlikely to hit world headlines (and therefore overseas newspapers and radio bulletins), yet never-the-less would be interesting to people with a

desire for information on world events and culture. Such stations are usually given a grant by their government, but the journalists and broadcasters are given a free hand to make programmes without government censorship. Hence the programmes give an objective, often critical insight into current affairs in the 'country, the reaction of its people to world events and a sample of the culture, music and perhaps even language. Stations in this category include Radio Finland, the Swiss Broadcasting Corporation, Radio Canada International, Austrian Radio, Radio Sweden and the BBC World Service.

In the second category are the government-run stations, whose main aim is to put over the political views of the government in power. As a result programming is rather one-sided, promoting only national achievements and churning out masses of statistics. That aside, such stations can be a source of quite fascinating information, and it is often interesting to compare their version of a news story with others, either in your national newspaper or on TV. Such government-run stations include Radio Moscow, Radio Peking, Radio Berlin International, Radio Tirana and the Voice of Vietnam.

ABOUT THE AUTHOR

Jonathan Marks is a broadcaster/journalist who formerly worked in Vienna for the Austrian Radio Short Wave Service, becoming involved with the weekly SWL news programme "Austrian SW Panorama", broadcast world-wide every Sunday. Since returning to the UK, he has continued to make regular contributions to the programme, and is an active DX enthusiast



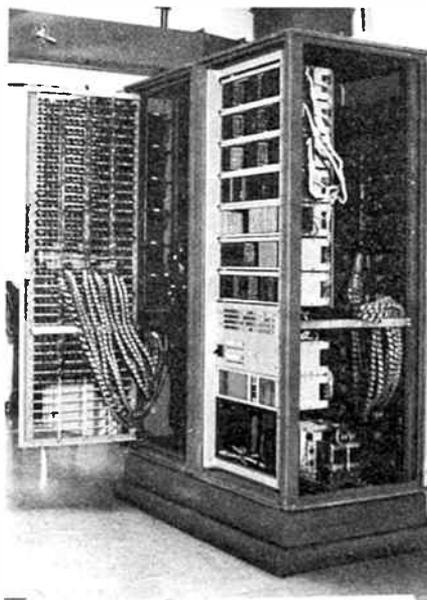
A view of the BBC Monitoring Service listening room, as seen from the console

Photo courtesy BBC



Austrian Radio studio centre in Vienna, with s.w. section in foreground

Photo courtesy ORF, Vienna



Computer-controlled switching gear selects appropriate transmitters and aerials to suit propagation conditions

Photo courtesy ORF, Vienna



Continuity suite for Radio Sweden. The cartridge machine on the left provides multi-lingual station identifications

Photo courtesy Arne Skoog, R. Sweden

Reception Reports

While reading *PW*'s "On the Air" feature you may have heard of QSLs and reception reports. These are really terms adopted by the broadcasting stations from the amateur radio world, and go back to the early thirties when many s.w. stations started up. In those days, stations didn't know if they were being heard in the target areas at all, and so in return for a listener sending in a report of reception (containing details of time, date, frequency and quality of reception, plus notes on the programme heard and receiving equipment used), stations would issue a confirmation card or QSL. This consisted of a picture postcard with the time, frequency and date of the transmission heard confirmed in writing on the back.

Many stations still send out QSLs, but since the thirties there have been a lot of changes on the technical side. Stations now use very much higher power (many in the order of 500kW), and because of the existence of professional monitoring stations, the larger broadcast stations know exactly how they are being received in target zones. Thus, as far as these stations are concerned, listeners' reception reports are now of marginal interest and the QSL card is more of a public relations venture since the reports are not checked. However, the smaller stations operating in only a few languages (especially religious stations), still need reception reports from listeners. They have only a limited budget and very much lower powered equipment, so regular reports on more than one frequency remain very important.

How can you judge if the station wants your report? The answer is to look in an excellent annual publication called the *World Radio and Television Handbook* which is available through most bookshops. It lists all known radio organisations in the world and where and when to listen out for them. It will give you a clear idea as to the size of the station, its QSL policy and the exact address to send your report to. In general, the smaller the station the more welcome your reception report, with the exception of small stations in West and Central Africa and South America. Stations in these areas use s.w. for domestic broadcasting

in much the same way as v.h.f. is used in Europe, and distant reception reports are usually QSLd only out of courtesy.

Programmes

All international broadcast stations, large or small, welcome your comments on the programmes heard. Over the last 10 years, programming standards have improved enormously compared with the sixties when most stations were of the "cold war" variety, deadly dull and boring. Then, the hobbyist could do little but send a technical reception report. In 1979, though you'll still find some pure propaganda stations, most stations in the Western world (and even a few in the Eastern Bloc) have woken up to the fact that sheer political fact switches Mr Average SWL off. Instead you can now find interesting, well-presented cultural material, whether it be tips on hitch-hiking across Sweden, eating out in Brussels, getting around in Tokyo or exploring caves in the Alps of Austria. Younger listeners too are catered for, with music programmes which broaden one's outlook on the pop music scene and enable one to get world-wide contacts. It is also important to point out that listeners who provide stations with critical constructive comments are well respected by the editorial staff.

Who listens to these international s.w. programmes? In the UK, s.w. broadcast listening is not widely known. Radios sold today in the average British hi-fi shop have no facilities for s.w. listening, but this is not the case in other parts of Europe. In West Germany or Finland for example, thanks to publicity of SWL clubs and the availability of suitable sets, SWL means more to the man in the street. There are signs though that the UK may be catching up on its European neighbours, as good s.w. receivers become cheaper thanks to integrated circuits, and digital readout eases the tuning problem. Also with more holidays being taken abroad, people like to keep in touch with countries they've seen. In the USA and Canada, s.w. is catching on simply because listeners are fed up with their local station full of commercials, time and weather men and rip-and-read news.

The more factual style of s.w. is also important in the developing countries, where radio is very different to Europe. There is usually no v.h.f. or m.w. service, and s.w. radio is the only means for the government to reach listeners in its own country. Thanks to ionospheric propagation though, signals from other countries (e.g. in Europe) can also reach developing countries. The BBC's African Service for example, thanks to a network of on-the-spot correspondents, provides a very fast, accurate picture of what is going on in Africa for African listeners, often before the national radio station reports it. Of course politics comes into play here. Many stations in the Western world beam vernacular programmes towards a developing country which disagree with what the national government station in that country is saying; something which often worries the latter if it is trying to influence its population.

Local Stations

Most stations in Latin America broadcast on the 60 metre tropical s.w. band (4750-5060kHz) instead of medium waves, which are full of static due to tropical thunderstorms. Propagation is such that from about midnight until dawn in the UK you can hear these stations broadcasting to their local population: an excellent insight into Latin America with wide opportunities to study the language or simply enjoy the music. Such small stations in the jungle run on a shoe-string and provide amusing stories for those who've visited them.

The official time signal on one station in Peru for example, turned out to be made by a simple audio oscillator triggered by the DJ watching the second hand on an ancient clock. A station in Bolivia came up on the wrong frequency for over a month because the station engineer had plugged in the wrong crystal. Similar stories come from Asia where the national station in Nepal sometimes comes on the air late when they forget to switch on the carrier of the transmitter. All this added together makes for a fascinating hobby.

The secret is to know when and where to look. One of the best ways is to contact one of the UK Broadcast DX Clubs as well as reading "On the Air". In addition stations themselves put out SWL programmes to assist listeners, for example: *Sweden Calling DXers* (Radio Sweden), *World Radio Club* (BBC World Service), *Austrian SW Panorama* (Austrian Radio), *World DX News* (AWR, Portugal) and *DX Juke Box* (Radio Nederland) to name just a few. In addition, an organisation exists in the UK, called the Handicapped Aid Programme, to help introduce this hobby to the disabled. Undoubtedly, broadcast listening can open up new horizons for a person who is house-bound, and no licence is needed.

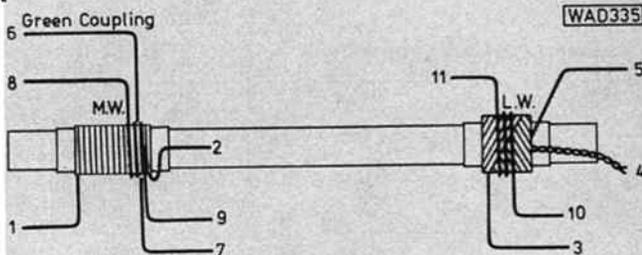
Finally, if you would like to combine your hobby with a holiday, then you might consider joining a DX camp for a few days. These take place during the summer months in Austria, West Germany, Sweden, Finland and, starting in 1979, in the UK. These meetings offer an excellent chance to try out new equipment and antennas as well as meeting fellow DXers and SWLs. Such camps are often coordinated under the European DX Council which acts as an umbrella organisation for European clubs and has a number of useful publications for broadcast band listeners. Meetings on a local basis also explode the myth that a typical SWL is someone who hibernates in his shack, to find friends all over the world but none in his own country!

CONTINUED NEXT MONTH

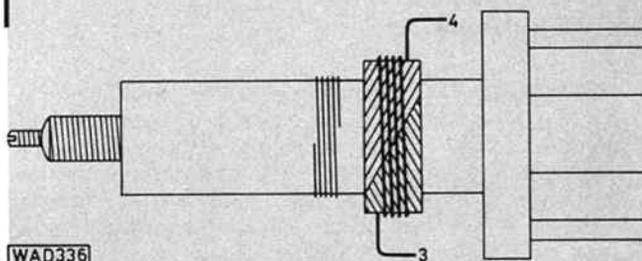
KINDLY NOTE!

PW Imp 3-Waveband Receiver May 1979

The details of the extra windings to be added to the coils were unfortunately omitted from Figs. 5 and 6. They are given below.



Additional reaction windings. 38s.w.g. enamelled copper wire. 8-9, 2 full turns in sense shown above; 11-10, 2 full turns in sense shown above. Note that the coils should be on the rod as shown so that the windings are in the same direction from the 'live' ends (1 and 3).



Reduce winding 5-7 to 2 turns. Add 12 turns of 38s.w.g. enamelled copper wire on top (3-4) in direction shown above.

VISIT THE PW STAND AT

UNICOM 21

22-23 JUNE

SEE OUR NEWS PAGES
FOR FULL DETAILS



SERVICES

194A Northolt Road
South Harrow, Middx
London. Tel: 01-864 1166



RF POWER METERS

JD 110 10 & 100w	£11.88
Reace UH74 432/144	£15.26
Hanson 20/200w-150Mhz	£26.50
Leader LPM 885 20/200/1Kw	£55.08
SWR 25 Twin 3.5/150Mhz	£11.90
Leader LPM 880 absorption watt-meter 5/20/120w 1.8-500	£85.00
Inc. VAT & Delivery	

YAESU PRICE LIST (inclusive VAT & Carriage)

HF Equipment		FL 110	£144.00
FT901DM	£995.00	FR 101S	£444.00
FT 901D	£825.00	FR 101D	£585.00
FV 901DM	£240.00	FR 101DD	£685.00
SP 901	£27.00	FRG 7	£210.00
FTV 901	£245.00	FRG 7000	£365.00
FC 901	£129.00	FT 7	£297.00
YO 901	£260.00	FT 7B	£421.00
FT 101Z	£562.00	VHF Equipment	
FT 101ZD	£646.00	FT 225RD	£600.00
FT 101E	£569.00	FT 225R	£545.00
FV 101B	£95.00	Memory	£104.00
SP 101B	£21.00	FT 227R	£227.00
FL 2100	£345.00	FT 227RA	£225.00
YO 101	£190.00	CPU 2500R	£325.00
FT 301	£575.00	CPU 2500RK	£345.00
FT 301D	£656.00	CPU 2500RS	£295.00
FT 301SD	£590.00	CPU 2500RKS	£330.00
FC 301	£120.00	FT 202	£99.00
FY 301	£105.00		

ROTATORS

STOLLE 2010	£48.50
AR 30 VHF/UHF	£47.50
AR 22 VHF Light HF	£49.50
AR 40 VHF Light HF	£54.50
AR 33 AR40 De Luxe	£67.00
CD 44 Heavy duty	£108.00
Ham III Heavy duty	£156.00
KR 400 HF	£96.50
DR 7500 HF	£106.00
KR 9502A VHF	£46.00
Bearing CD 562	£7.80
Bearing RZ100 Stolle	£12.00
Incl. VAT & Delivery	

JUST TELEPHONE YOUR CARD NUMBER OR
SEND YOUR CHEQUE WITH ORDER



01-864 1166 01-422 9585

Full range of Accessories Available
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

ICOM

Full range in Stock	
IC 701	£810.00
IC 701PS	£136.00
IC 211E	£530.00
IC 245E	£393.00
IC280E	£265.00
IC 240	£185.00
IC 202S	£205.00
IC 215	£169.00
ICV 402 UHF	£270.00
IC RM3	£94.00
IC SM2	£24.50
Incl. VAT & Delivery	

MICROWAVE MODULES

MMT 144/Any IF	£88.00
MMT 432/Any IF	£109.00
MMT 432/28S	£133.80
MMT 432/144	£149.60
MMT 432/144R	£169.80
MMV 1152/Tripler Var.	£34.80
MMV 1296/23cm Tripler	£33.70
MMD 050/500 DFM to 500Mhz	£69.00
MMC 144/Any	£20.25
MMC 144/28 LO	£20.25
MMC 70/Any	£20.25
MMA 144 Preamp	£14.60
MML 144/100 Linamp	£139.50
MMC 28/144	£20.25
MMA 28 Preamp	£14.63
Inc. VAT & Post	

General Coverage Communications Receiver FRG-7



● 0.5-29.9MHz Coverage with 10kHz Readout

The FRG-7 is a precision-built all-purpose communications receiver featuring all solid state construction for long life and high performance. Utilizing the Wadley Loop drift cancellation system, in conjunction with a triple conversion super-heterodyne circuit, the FRG-7 boasts high sensitivity along with excellent stability. It provides broadcast listeners with such features as a 3-position tone selector, an RF attenuator, and an automatic noise suppression circuit. For many years of satisfying reception, the FRG-7 is the receiver for you.

Supplied with SM module and free Securicor delivery £210.

JAYBEAM

2M Antennas	
5Y/2M 5 el yagi	£9.66
8Y/2M 8 el yagi	£12.25
10Y/2M 10 el yagi	£26.13
P8M 10/2M parabeam	£30.75
P8M 14/2M parabeam	£37.55
5XY/2M 5 el x'd yagi	£19.60
8XY/2M 8 el x'd yagi	£24.10
10XY/2M 10 el x'd yagi	£31.76
PMH/2C circular harness	£8.15
Q4/2M 4 el quad	£20.17
Q6/2M 6 el quad	£28.70
D5/2M el slot	£17.00
D8/2M el slot	£22.20
UGP/2M ground plane	£8.58
SVMK/2M vertical slot	£5.30
HO/2M halo head	£4.20
HM/2M halo mast	£4.98
PMH2/2M 2-way harness	£8.10
PMH4/2M 4-way harness	£16.94
70cm Antennas	
P8M18/70cm Parabeam	£22.53
MBM4B/70cm Multibeam	£26.45
MBM8B/70cm Multibeam	£34.82
12XY/70cm 12 el x'd yagi	£35.52
PMH2/70cm harness	£8.93
PMH4/70cm harness	£14.35
CB/70cm 8db colinear	£46.03

QM 70

70/28RC 4m-10m conv.	£18.46
144/28RC 2m-10m conv.	£18.46
432/28RC 70cm-10m conv.	£26.99
432/144RC 70cm-2m conv.	£26.99
434/28RC 70cm-10m conv.	£26.99
434/144RC 70cm-2m conv.	£26.99
432 - 434/28 two band 70cm-10m conv.	£32.33
432 - 434/144 two band 70cm-2m conv.	£59.00
144PA 10/40P10W in 40W out linear amp with preamp	£59.00
144PA2/45 2W in 45W out FM Amp with preamp	£70.25

Post & tax paid everywhere



Multi 700E	£229.00
Multi U11	£299.00
Multi 2700	£499.00
TM 56B Rcvr 2m	
amateur	£104.00
TM 56B Marine band	£113.00
Inc. VAT & Delivery	

SMC MONITOR - SCOPE £79 inc. VAT DELIVERY FREE

ANTENNA TUNING UNITS

Amtch 300 1.5/30 Mhz	£37.50
SST 1 Random Wire	
1.5-30Mhz	£24.40
SST 2 Ultra Tuner	
3.5-30Mhz	£33.50
SST 3 Mobile Match	£14.90
SST 4 ATU/SWR/PWR	
1.8-30Mhz 30w	£49.50
Dentron MT3000	
10-160Mhz 3kw	£365.00
Leader LAC B95 500w	
SWR/PWR/ATU	£103.00
Incl. VAT & Delivery	
XTAL FILTERS	
YF 90H12	£13.50
YF 30H350	£13.50
YF 90H2.4	£13.50

SECURICOR - HIRE PURCHASE - ALL EQUIPMENTS SERVICED

THE CHOICE IS YOURS!



YAESU MUSEN General Coverage Communications Receiver FRG-7



£182.75 PLUS VAT

● **0.5-29.9MHz Coverage with 10kHz Readout**
The FRG-7 is a precision-built all-purpose communications receiver, featuring all solid state construction for long life and high performance. Utilizing the Wadley Loop drift cancellation system, in conjunction with a triple conversion superheterodyne circuit, the FRG-7 boasts high sensitivity along with excellent stability. It provides broadcast listeners with such features as a 3-position tone selector, an RF attenuator, and an automatic noise suppression circuit. For many years of satisfying reception, the FRG-7 is the receiver for you.

YAESU MUSEN Digital Display Communications Receiver with CPU Digital Clock & Timer FRG-7000



£327 PLUS VAT

● **0.25 Thru 29.9MHz Coverage with 1kHz Readout**
Computer technology and convenience features are brought together in the FRG-7000, a digital-display general coverage receiver for the discriminating SWL. The digital clock and timer, controlled by a CPU (Central Processing Unit) chip, will read out both local and GMT time, and will control peripheral station equipment such as a tape recorder. Improved SSB selectivity, ease of operation, and rugged construction are yours with the new FRG-7000 from YAESU.

FULL DETAILS OF THESE EXCITING RECEIVERS FROM THE NUMBER ONE IMPORTER - PLUS EX-STOCK FREE SECURICOR DELIVERY!

(36 pence in stamps brings Illustrated Brochure and our Credit Voucher value £3.60) - A 10 to 1 Winning Offer!

AMATEUR ELECTRONICS UK

508-514 ALUM ROCK ROAD
BIRMINGHAM 8

Tel: 021-327-1497/6313
Telex: 337045



Meet 'Uncle Tom'. He's on your wavelength.



Tom Beaumont - a radio enthusiast for 25 years - sells radio equipment for love! And he particularly loves Lowe - Trio for quality, value and reliability.

Tom is the sole authorised Lowe - Trio distributor for Yorkshire and North East England, and he offers the best before-and-after-sales service around on units like the top-value SRX-30 receiver illustrated.

THE LOWE SRX-30

All the facilities of a top-class communications receiver in one top-quality, economically priced unit. Covers 500 KHz to 30 MHz with excellent dial readout and re-set accuracy. AM, CW, SSB reception. The SRX-30 is equally at home in broadcast or amateur bands.

Other features include RF gain, fine tuning selectable sidebands, built-in loudspeaker, AC mains or 12V DC operation and rugged construction at an attractive price - Just £175.00 inc. VAT.

Buy by post or call in - or phone your Barclay Card or Access number. For speedy delivery on your SRX-30, please send cheque/P.O. made out to Leeds Amateur Radio for £178.00 which includes £3.00 carriage and packing. We will deal with your order by return.

Alternatively, call in for a chat at 'Uncle Tom's Cabin'. The shop is just 10 minutes from Leeds City Station, and there's easy parking if you travel by car.

● Instant H.P. for Licenced Amateurs. ● Extended Credit Terms Available. ● Send 50p for Catalogue and Price List.

LOWE TRIO DISTRIBUTOR



Leeds Amateur Radio are area distributors for Jay Beams, Antenna specialists and Hilomast products.



LEEDS AMATEUR RADIO
Reliability in Radio

Leeds Amateur Radio, 27 Cookridge Street, Leeds 2, West Yorkshire. Tel. Leeds 452657.

FIT A DIGITAL DISPLAY TO YOUR FRG7 OR SRX30.

These units come complete, with only three wires to connect. The FDU7 for the Yeasu FRG7 can be fitted in place of the KHz dial, or can be supplied for external use. (Please state when ordering) The FDU3 for the SRX30 is supplied for top of the set use only. (Full Fitting Instructions are supplied.)

(FDU7) for FRG7
(FDU3) for SRX30

@ £44.77
@ £44.77

We also manufacture an R.T.T.Y. Converter. The MB6R (Receive only) and the MB6R/T (Receive/Transmit). We supply these units with single or double current loops for connection to teleprinter. To Order. T.T.L./C-MOS Logic Levels and Oscilloscope Outputs are provided. Dimensions (84X304X210).

(MB6R Double or single current) @ 77.96
(MB6R/T Double or single current) @ £83.25

(All Units are fully Guaranteed, and come complete)

(No extras needed)
(All prices inclusive of postage and V.A.T.)
(Payment by P.O., Cheque or Access)

**B. BROOKES ELECTRONICS, 69 Leicester Street,
NORWICH NR2 2DZ, ENGLAND.
Tel: 0603-24573.**

STEPHENS-JAMES LIMITED

COMMUNICATION ENGINEERS

47 WARRINGTON ROAD, LEIGH WN7 3EA
ENGLAND
Telephone (0942) 676790

Everything for the Short Wave Listener.

We stock receivers and listening aids by most of the world's leading manufacturers. Full range of VHF receivers - transceivers. Mobile equipment pre-selectors - filters - antennas. Stabilised power supplies from 2 to 20 Amp. Antenna switches - converters. Aluminium masts - clamps. Antenna rotators.

Yaesu
FRG7-FRG7000

Drake
SSR-1 * SPR4 * R4C *

Secondhand Equipment

Our secondhand equipment stock changes daily. Send S.A.E. for latest price list. Part exchanges welcome. Access-Barclaycard and H.P. facilities.

TRIO
R-300-R820S

Lowe SRX30 Receiver

Antenna Multituners
Designed and manufactured by ourselves. Over 1000 sold in over 50 countries.

Mk2 covers 550 KHz 30MHz
Prices include VAT and postage.

£25.00



FRG-7



GENERAL COVERAGE RECEIVER



There are many types of communications receivers currently available, the choice of which is initially determined by where the user's interests lie. General-coverage receivers, as the name implies, cover a range of frequencies which include broadcast bands, amateur bands and other communications channels, and the Yaesu FRG-7 falls into this category.

On the other hand, if only the amateur bands are required, then receivers for this purpose, offering a greater bandwidth over these frequencies, are available.

In both instances, the tuned frequency may be displayed by "conventional" analogue means, or a digital readout, which gives the tuned frequency in illuminated digits.

The FRG-7 tested by *PW* was already fitted with a digital readout when supplied by SMC Ltd. This is an option which can be retro-fitted to existing FRG-7s and replaces the original dial unit with a $4\frac{1}{2}$ -digit red l.e.d. display. The digital display indicates the kilohertz part of the frequency to which the receiver is tuned, while the megahertz part is set using the original MHz knob in conjunction with the "Lock" indicator lamp and the "Band" switch.

A Preselector control is provided which enables the r.f. circuits to be tuned for optimum signal. This control operates a vertically mounted drum which has four bands marked on it. The Band switch selects the basic range over which the Preselector and MHz controls operate, at the same time illuminating the appropriate preselector band.

The "Lock" indicator lamp is extinguished when the MHz tuning control is correctly set to mid-band.

The main tuning control is fitted with a large diameter handwheel knob which has a large felt washer fitted behind it to provide a measure of friction although by no stretch of the imagination could the control be described as flywheel. The fine tune control is fitted just to the right of the main tuning knob and was positioned too close to the main knob for comfort. It proved to be annoying when, after getting the main control set, operating the fine tune meant that one's thumb or index finger caught the large knob putting the set off tune. The fine control also seemed to be much too coarse in operation making precise adjustment of setting, so

essential for successful s.s.b. listening, very difficult. In fact with an adjustment of $\pm 6\text{kHz}$ over 180° swing it was only four times better than the main control and it was almost as easy to set the tuning using only the main control and ignoring the fine one. As supplied the fine control operated in reverse to the main control but this was easily altered by slackening the grub screw of the knob and turning the knob through 180° .

An input attenuator is fitted with a three position switch labelled DX, NOR, Local. The handbook indicates that in the DX position a station which is swamping the set can be attenuated to enable a weaker distant station to be received. We were not able to verify this as in the Bournemouth area no signals seemed strong enough to overload the front-end. All the attenuator seemed to do was cut down the signal strength, so the set was operated with the attenuator in the normal position.

The Tone switch changes the audio response of the receiver and has three positions, 250Hz to 3kHz, 400Hz to 2.5kHz and 250Hz to 1.5kHz.

The other front panel controls fitted are a volume control and the Mode switch. A horizontal scale S-meter is fitted above the tuning dial. The dial lamps can be switched off independently of the main power, which cuts down on current drain from the battery pack when running from batteries.

The audio output, rated at 2 watts, is not hi-fi but is presentable and enables the receiver to be used on the broadcast bands.

A pair of phones can be used instead of the speaker fitted, the phone jack being on the front panel together with the jack for the record output.

The performance of the FRG-7 on a.m. was excellent with a very good single-signal response. However, on s.s.b. and c.w. the set lacked selectivity with the standard filters. Alternative filters are available as optional extras but were not tried in this test.

Three sockets are provided on the rear of the case for aerials. Two of these are push-type terminals for long-wires while the third is a SO239 socket for use with a coaxial type

THE WADLEY LOOP

The FRG-7, in common with many other contemporary communications receivers, employs the Wadley Loop, triple-conversion superheterodyne system. This offers a number of advantages in terms of performance.

A high first intermediate frequency can be used, in this case around 55MHz, giving good image (second-channel) rejection. The problems inherent in achieving satisfactory frequency stability in the first oscillator ("MHz Set"), which must operate in the v.h.f. band and tune over a range of some 30MHz (55.5-84.5MHz), are overcome by mixing its output in twice, so that any errors due to drift are self-cancelling.

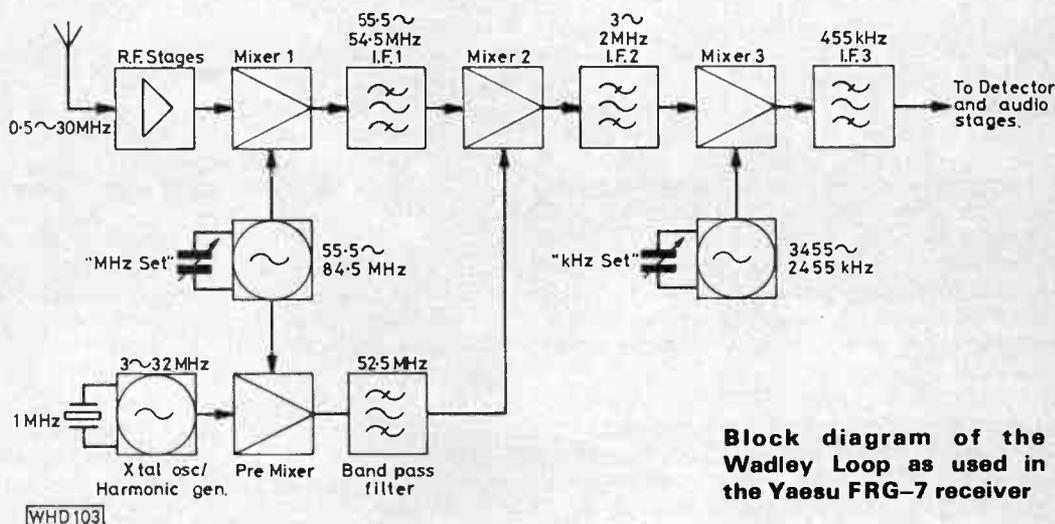
As shown below, this is done by mixing the first oscillator output with a spectrum of harmonics from a stable 1MHz crystal oscillator. The product at 52.5MHz is selected by the Band-pass Filter and mixed with the 1MHz-wide band of signals coming from IF1 to translate them to the band 3-2MHz for IF2.

The output of IF2 is mixed with the output of the "kHz Set" oscillator in Mixer 3. Because this oscillator operates at a reasonably low frequency, and over a band just one megahertz wide, it is not too difficult to make it adequately stable. The output of Mixer 3 is at 455kHz, and is passed to a conventional i.f. filter/amplifier chain, detectors and a.f. stages.

Because there are no conventional band switches other than in the r.f. preselector stage, problems due to varying contact resistance in the oscillator circuits (a common cause of instability) are eliminated. Because the whole range of 0.5-30MHz is tuned in bands 1MHz wide, the tuning resolution of the receiver is the same at 1MHz as at 30MHz.

Disadvantages of the system are the large number of mixing stages employed, calling for careful screening and filtering if spurious products are to be kept low, and the need to design efficient filters operating in the v.h.f. band, for IF1 and the Band-pass Filter.

The actual frequencies adopted in the early stages of receivers using the Wadley Loop principle vary between different models; those shown here are as used in the FRG-7. Anyone checking the sums for themselves may wonder about the fact that the "MHz Set" oscillator tunes down to 55.5MHz, which is within the passband range of IF1, inferring that the receiver will tune down to zero frequency! In fact the lowest band is cut off at just below 0.5MHz by the response of the r.f. stages, and on that band, the signals passed to IF1 are limited to 55-54.5MHz and those in IF2 to 2.5-2MHz. The "kHz Set" oscillator only tunes over 2955-2455kHz on this band. In many Wadley Loop receivers, IF2 is fixed-tuned with a 1MHz passband, but in the FRG-7 it is tuned in step with the "kHz Set" oscillator.



Block diagram of the Wadley Loop as used in the Yaesu FRG-7 receiver

feeder and this is electrically common with the push terminal labelled SW1. This can cause confusion since the coaxial socket is labelled SW1 on the circuit diagram, SW2 on the receiver back panel and to add to the confusion a label immediately above the aerial sockets gives the ranges as SW1, SW2, SW3 and SW4.

The handbook provided with the set was generally good, with an adequate circuit description, a full circuit diagram drawn reasonably well and very legible, a block diagram of the set and a comprehensive components listing.

The operating instructions were generally good but there

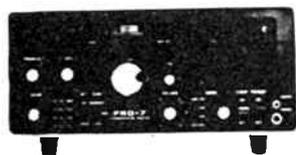
were some omissions. The English was very good for a Japanese model with none of the usual funny sentences which seem to occur during translation from the original.

Maintenance and alignment information together with a voltage chart and p.c.b. component layout drawings should help if it is ever necessary to overhaul or repair the set.

As well as the operating manual, the FRG-7 is supplied with two lengths of copper flex for use as aerials, all the necessary plugs and two spare fuses.

The maker's guarantee is for twelve months but does not include the semiconductors.

THE COMMUNICATIONS RECEIVER THAT HAS IT ALL . . .



FRG-7

The finest general-coverage synthesised communications receiver on the market

£210.00 inc. VAT

Also available from us with special 2m converter, all for just an extra **£17.00**



Phone for details of current stocks, both new and secondhand



AMATEUR RADIO EXCHANGE
2 Northfield Road, Ealing, London, W.13.
Tel: 01-579 5311

Easy terms up to 2 years

Credit Card Sales by Telephone

Closed all day Wednesday

DATONG ELECTRONICS LIMITED

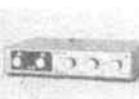
MODEL D70



INSTANT MORSE PRACTICE
Imagine the convenience of having your own source of accurate Morse for instant receiving practice anywhere at any time!
The Datong MORSE TUTOR produces digitally a random stream of five character groups at variable speed and with variable extra spacing between letters. You can select letters or numbers or a mixture and unlike records or tapes, the sequence never repeats.
Advanced CMOS circuitry gives long life from internal 9 volt battery (PP3). Supplied ready to use, only £37.00 plus VAT (£41.62 total)

MODEL UC/1 UPCONVERTER

"GOOD GENERAL COVERAGE RECEIVERS COST A FORTUNE!"



True . . . but if you already own a good quality ten-metre or two-metre receiver or transceiver you are only £118 away from a really high performance general coverage receiver. Just add the magic ingredient, MODELUC/1 from DATONG!
You get full coverage in thirty synthesised 1 MHz segments from 80kHz (Rugby MSF) to 30MHz, at high sensitivity and with all the facilities and high performance of your existing rig!
For good measure UC/1 also adds two-metre coverage to ten-metre receivers.
Power requirements: 12v, 120 M.A.
Price: £105.00 plus VAT (£118.13 total)

MODEL AD 170 ACTIVE ANTENNA



"A GOOD RECEIVER DESERVES A GOOD AERIAL"
For sensitive reception right through from MSF at 80kHz to Band 1 TV DX around 50MHz, without the need for an antenna farm, MODEL AD170 has no adjustments and needs no external tuning units. Although only three metres long, MODEL AD170 has the same directional properties as a full size dipole.



even at 80kHz
Price: £29.50 plus VAT (£33.19 total); Special price complete with mains power unit: £33.00 plus VAT (£37.13 total)

Full data sheets available on request.

Contact: DEPT: P.W.7, DATONG ELECTRONICS LTD.,
Spence Mills, Mill Lane, Bramley, Leeds LS 13-3HE.
Tel: (0532)-552461

FRG7 Communications Receivers Ours are Better . . .



... Why?

£210 inc vat*
and Securicor delivery

PLUS
FREE: HEADPHONES
SHORT WAVE AERIAL

SAE FOR COLOUR BROCHURE

*Price correct at 8th May.

We've been selling this receiver now for more than two years and, as value for money, its pretty difficult to beat. It's been our pleasure to introduce many hundreds of customers to the fascinating hobby of short wave listening and as the first step to obtaining their amateur radio transmitting licence. So why are our FRG7's better?

Well, as enthusiasts as well as retailers, we're pretty fussy on the receiver performance and with mass production, limited factory alignment time and a journey of 6,000 or so miles, the untested, boxed item may not be giving its best performance.

That's why every unit we sell is first checked in our well equipped service department for sensitivity, stability and mechanical soundness. In fact, the test equipment we employ for this task alone costs over £5,000! Once we are satisfied that the receiver performs to specification, we despatch to you via Securicor for safety and speed. Maybe we are a little more particular than most retailers, but that way we tend to get more satisfied customers.

For those of you with Barclay or Access cards you need simply telephone us, quoting us your number and address, and your receiver will be despatched by return.

The Complete Ham Radio Centre:—

WATERS & STANTON
ELECTRONICS

31, SPA ROAD, HOCKLEY, ESSEX. TEL. 03-704 6835

Opening hours Mon-Sat. 9 a.m.-5.30 p.m. Exc. Wed. 1 p.m.

**S.E.M. BOX 6, CASTLETOWN,
ISLE OF MAN.**
TEL. MAROWN (0624) 851277



JOIN THE THOUSANDS OF OTHERS WHO HAVE IMPROVED RECEPTION SENTINEL STANDARD FET 2 METRE PRE-AMPLIFIER
Ultimate performance pre-amp with a 1dB N.F. selected FET and 18dB gain. 12V nominal (9-15V) at 5mA.
£10.85. 70cms, Satellite and Marine Band also in stock.

SENTINEL AUTO 2 METRE PRE-AMPLIFIER

Same performance as above with an r.f. switch so that the unit can be left in the tranceiver aerial lead and transmitted through.
£17.35.

SENTINEL H.F. WIDEBAND PRE-AMPLIFIER

Covers 2-40MHz. 15dB gain. Ideal for receivers where gain falls off above 20 metres. Weak signals e.g. OSCAR. When used with a short aerial acts as an ACTIVE aerial.
£9.00.

SENTINEL AUTO H.F. PRE-AMPLIFIER

Same as above but with a relay for transmitting through, or to give straight through operation when switched OFF.
£12.94.

For further details on our S.E.M. Z Match A.T.U., Power Amplifier/Pre-Amplifier, Converters and Transverters do ring or write.

ACCESS/BARCLAYCARD/VISA or C.W.O. All units in stock. 12 months guarantee. Prices include VAT and delivery.

★ specifications

Mode: AM; SSB: (USB, LSB); CW

Frequency range: 0.5MHz–29.9MHz

Sensitivity: SSB/CW better than 0.7 μ V for 10dB S/N at 30% modulation

Selectivity: 3kHz – 5dB
7kHz – 50dB

Frequency stability: Within 500Hz during any 30 minute period after warm-up

Input Impedance: 0.5MHz – 1.6MHz High Impedance
1.6MHz – 29.9MHz 50–75 Ω unbalanced

Output Impedance: 4 Ω

Audio Output: More than 2 watts

Power requirements: 100/110/117/200/220/234V a.c. 50/60Hz or 13.5 d.c.
Negative ground

Batteries: Type UM–1 \times 8

Dimensions: 340 \times 153 \times 285mm

Weight: 7kg without batteries



Internal view of the Yaesu FRG-7

Used in conjunction with a 400 watt p.e.p. transmitter, the receiver performed well. Many contacts were made with W, VK, ZL, ZS and so on, some of these on a simple end-fed long-wire antenna. Copy on the h.f. bands was good, but on the more congested frequencies—such as 40m—it was often felt that a little more selectivity would have been nice. Still, "You pays your money . . ." as the old adage goes, and the FRG-7 represents particularly good value.

A 2.4kHz mechanical filter to improve the s.s.b. performance is available from Ambit International, 2 Gresham Road, Brentwood, Essex, priced at £15.30 (inc VAT). We understand that a Yaesu approved s.s.b. filter may be available from SMC in the very near future.

Prices

Basic FRG-7 receiver £210.37

FRG-7 receiver with digital readout £270.00

Yaesu approved digital readout (SMC) £56.25

(All prices quoted include VAT and carriage)

The FRG-7 receiver reviewed was kindly loaned by South Midlands Communication Company Ltd., Osborne Road, Totton, Southampton SO4 4DN. Tel: 04216 7333, and we would like to thank them for their invaluable assistance in this respect.

The standard of engineering is excellent as can be seen from the photograph of the inside of the set we tested.

The receiver was subjected to several air-tests, using a variety of antennas, ranging from a 132ft long wire to a multi-element rotary beam. On the broadcast bands the receiver performed very well indeed and the s.s.b. capability for amateur reception was also quite good. (The latter mode can be quite dramatically improved, incidentally, by the inclusion of the mechanical filter, produced for the FRG-7 by Ambit International.)

The Wadley Loop provides a good degree of stability in the receiver. This is especially necessary for acceptable sideband resolution—at 29MHz, for the receiver to remain within about 25Hz of the tuned frequency, a stability factor of about one part per million is called for. Long-term stability is perhaps less important to the amateur than stability in the short-term, and the FRG-7 performs quite well in this respect. However, since the Wadley Loop system involves multiple conversion, it is difficult to achieve a wide dynamic range, a problem which is overcome to some extent in this receiver by the use of a balanced mixer.

**NEXT MONTH WE REVIEW THE
LOWE SRX-30
RECEIVER**

C.B. ELECTRONICS

UNIT 3, 771 ORMSKIRK ROAD, PEMBERTON, WIGAN, WN5 8AT
Telephone: Wigan (0942) 216567

THE BEST IN THE NORTH-WEST

The Communications Receiver that has it all

FRG-7

£210.00 incl. VAT + £2.00 p&p./ins.

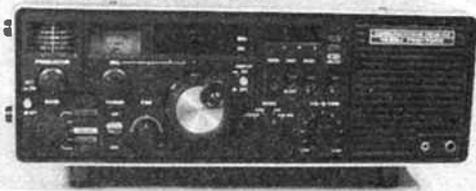
Also available from us with Microwave Modules converter all for just an extra
£20.25

All orders dealt with promptly by Mr. Jack Stephens

G3LRB

Western

THE COMMUNICATIONS SPECIALISTS
EVERYTHING FOR THE RADIO AMATEUR



YAESU FRG-7000

£329

The New Performance Standard in Communications receivers!
A high quality general coverage receiver for the discerning SWL and a worthwhile addition as a second receiver for the transmitting amateur.
How often have you wanted a true general coverage receiver of this calibre but been put off by the price.

The FRG-7000 is a cost-effective answer to your prayers.
* Full and continuous coverage 250kHz to 29.999MHz * Operation on SSB/AM/CW * Switched selectivity and fine tune control for maximum efficiency on SSB * Accurate digital frequency readout to 1kHz, using advanced CPU techniques * Built-in digital clock with facilities for setting two time zones (GMT and local), selected at the flick of a switch * CPU controlled timing clock switches receiver on or off at preselected times; also enables control of external unit such as tape recorder * Wadley loop circuitry for minimum drift and maximum stability * Simple and accurate frequency selection; easy-to-use colour coded bandswitch and preselector.

Send large SAE for further details of this and other equipment - or use our Answerphone after hours.

Western Electronics (UK) Ltd

HEAD OFFICE (All Mail/Enquiries)

FAIRFIELD ESTATE

LOUTH, LINCS, LN11 0JH

Tel: Louth (0507) 4955/6

ACCESS
VISA
DINERS CLUB
H.P.

SOUTHERN VALVE CO.

Telephone 01-440/8641

SECOND FLOOR, 8 POTTERS ROAD,
NEW BARNET, HERTS.
CALLERS BY APPOINTMENT MINIMUM ORDER 80p

Some leading makes available. VAT invoices issued on request.
8VA valves do NOT carry any guarantee, Enquire prices.

Some Mullard Mazda available at extra cost.

NOTE: PLEASE VERIFY CURRENT PRICES. Correl. 82p at time of going to press.

DY86/7	55p	EF86	55p	GY501	£1.40	PCF802*	85p	PL36	£1.00	PY500A	£1.80
DY802	55p	EF89	75p	PC86	80p	PCF805	£1.75	PL31A	70p	UBF89	80p
ECC81	60p	EF183	55p	PC88	80p	PCF806	75p	PL83	48p	UCC85	85p
ECC82	63p	EF184	55p	PC97	75p	PCF808	£1.75	PL84	50p	UCH81	80p
ECC83	63p	EH90	80p	PC900	85p	PCL82	85p	PL500	£1.20	UCL82	75p
ECC85	63p	EL34	£2.00	PCC84	35p	PCL83	£1.00	PL504	£1.20	UCL83	95p
ECH81	55p	EL84	52p	PCC85	55p	PCL84	70p	PL508	£1.75	UF89	55p
ECH84	65p	EL509	£3.00	PCC89	50p	PCL805	85p	PL509	£3.05	UL41	95p
ECL80	52p	EM84	90p	PCC189	55p	PCL85	85p	PL519	£3.30	UL84	90p
ECL82	65p	EY86-7	48p	PCF80	80p	PCL86	85p	PL802*	£2.90	UY85	80p
ECL86	72p	EY500A	£1.80	PCF86	80p	PCL200	£1.45	PY88	90p	U25	60p
EF80*	42p	EZ80	43p	PCF200	£1.80	PD500	£3.70	PY800	70p	U26	80p
EF85	45p	EZ81	45p	PCF801	80p	PFL200	£1.35	PY801	70p		

We offer return of post service. CWO ONLY. No C.O.D.

Post free over £25. £6 to £25—80p (max).

Items in stock at time of going to press but subject to possible market fluctuations if unavoidable.

STOP PRESS! One valve post 15p, each extra valve 6p. Large valves 2p each extra.

STOCKISTS UHF WIDE BAND MAX 75p. LISTS AND ENQUIRIES. S.A.E. PLEASE!

"MICRO" AERIAL! ALL PRICES INCLUDE VAT @ 12½%. E240/41. 70p each

SIZE 1½" x 3" only £3 70p incl. ENQUIRIES WELCOMED FROM TRADE and RETAIL (same prices)

Can YOUR Antenna do all this?

A SMALL SELECTION FROM OUR HUGE FILE OF TESTIMONIAL LETTERS ON THE JOYSTICK VARIABLE FREQUENCY ANTENNA (1.5—30MHz).

G4DJY's COPY LOG shows 68 North Americans worked in the ARRL W/Ve contest.

W6TYP worked WA6JPR over hundreds of miles on 40m. using the JOYSTICK VFA and MICROWATTS "equivalent to 1,000,000 MILES PER WATT"—A WORLD RECORD—we can supply conclusive evidence!

"I have used Rhombics, 4 x ½ waves in phase, centre fed dipoles, etc., but the success I have had with the V.F.A. has been AMAZING... only 20ft. high... in front of my mobile home. I NEVER RECEIVE LESS THAN R7 AND MOSTLY R9 ON CWDX WORKING—Bob Green, SUIKG/G3APH, W.V.B.E., W.A.C. Phone and CW.

W7OE, U.S.A. Government Electronics Engr. (reted.), claims "VFA 5ft. below ground, same as dipole, elevated 15ft., one "S" point UP on dipole."

IN USE BY AMATEUR TRANSMITTING AND SWL STATIONS WORLD-WIDE AND IN GOVERNMENT COMMUNICATION

JOYSTICK ANTENNAS

SYSTEM "A"

£41.00

200 w. p.e.p.
OR for the SWL

SYSTEM "J"

£47.95

500 w. p.e.p.
(Improved "Q" on receive)

"PACKAGE DEALS"

COMPLETE RADIO STATIONS FOR ANY LOCATION

All packages include the JOYSTICK VFA (System "A") 8ft feeder, all necessary cables, matching communication headphones. Delivery Securicor our risk. ASSEMBLED IN SECONDS. You SAVE £14-15 on each PACKAGE DEAL!

PACKAGE No. 1. Features R.300 Rx.

£222.00

PACKAGE No. 2. Features FRG7 Rx.

£237.45

PACKAGE No. 3. Features SRX30 Rx.

£212.45

PACKAGE No. 4. Our "Rolls"—Rx. FRG7000.

£402.00

RECEIVERS ONLY

R.300

£184.50

FRG7

£199.95

SRX 30

£174.95

FRG 7000

£364.50

All prices are correct at time of going to press and include VAT at 12½% and carriage.



Just telephone
your card number
Phone 0843 62535 (ext.5)
(or 62839 after
office hours)



or write for details, send 9p stamp

G3CED



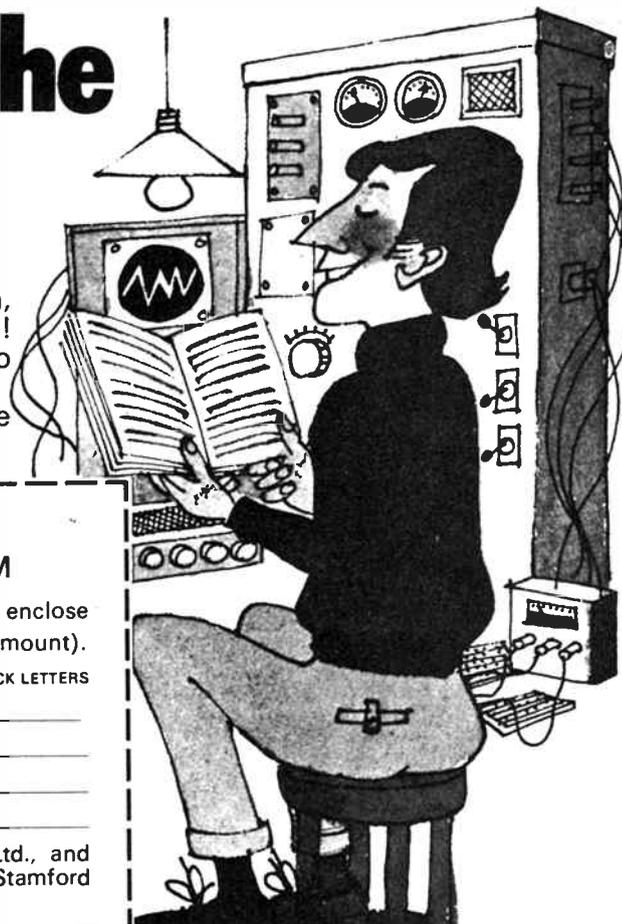
G3VFA

5, Partridge House, Prospect Road, Broadstairs, CT10-1LD. (Callers by appointment).

Every month is the right frequency

When you're building a major project from a PW design, you want to be sure of getting every issue in sequence! Use this order form for a year's supply to be posted to you.

ANNUAL SUBSCRIPTION RATES (including postage and packing) U.K. £10.60. Overseas £10.60.



practical WIRELESS SUBSCRIPTION ORDER FORM

Please send me Practical Wireless each month for one year. I enclose a Sterling cheque/international money order for..... (amount).

PLEASE USE BLOCK LETTERS

NAME Mr/Mrs/Miss _____

ADDRESS _____

POSTCODE _____

Make your crossed cheque/MO payable to IPC Magazines Ltd., and post to: Practical Wireless, Room 2613, King's Reach Tower, Stamford Street, London SE1 9LS.

NUMBERS WITHOUT TEARS

Continued from page 37

should not be taken to V_{SS} via any wire connecting the c.m.o.s. to V_{SS} . When Tr21 is switching a full 140mA, some very strange arithmetic may be evident from the counters if some of the wiring to V_{SS} is common! Anyone contemplating a p.c.b. design is especially warned of this point.

In order to make the touch plate as mechanically simple as possible, a 6BA cheeseheaded bolt was mounted on (but insulated from) the metal front panel and recessed so that the head was flush with the panel. The entire box was earthed and connected to the mains transformer screen, and connected to V_{DD} via R26 (see Fig. 6).

In this way, a finger placed on the head of the bolt must also touch some of the surrounding painted panel, and this provides sufficient base current to operate the Darlington pair, Tr1 and Tr2. The instrument is thus electrically safe while providing 100 per cent reliable touch operation of the swept-frequency clock.

Fault-finding

It may be found that, on closing S1, the clock does not run. Decreasing R4 to 82k Ω will solve the problem. Similarly, in the swept-frequency mode, it may be found that the clock is still "ticking over" even when C2 is discharged. Increasing R1 to 47k Ω should stop the clock.

These problems arise because of the 5% tolerance resistors used to derive quite a precise voltage at point A (Fig. 2). The author has not found this to be a problem, but theory shows that it is quite possible.

The mains switch, S5, is a d.p.d.t. slider switch mounted on the side of the box adjacent to the top of the front panel. It is thus normally out of sight, reducing the temptation to tamper with it.

Summary

This instrument is designed to appeal to children of 2½ years upwards. The visual effects produced by it are pleasant and interesting. There are switches to use, buttons to press, a knob to turn, and a touch-controlled flywheel display. It aids in the teaching of rapid number recognition and matching, without obviously being a "teaching" toy.

It can also be used as a die for other board games when the numbers themselves have become of secondary importance.

With a little judicious help, the child will soon grasp the cyclic nature of counting in the decimal system—the progression from single-digit numbers to dual-digit numbers, the second (tens) digit being the number of complete revolutions of the flywheel, the first (units) digit being the number at which the flywheel stops. ●

Microprocessor Miscellany

People have long been chanting that microprocessors are going to end up in "everything". One of the latest applications to reach my ageing eyeballs is in typewriters. The new ET 221 for example is not the established "golfball" but a "daisywheel". Built-in is a Z80-based system that uses a number (note: not just one) of 8-bit, single-chip microcomputers. To be sold in the US for under \$2000, this new wonder-writer has a 20-character display for showing what you've been typing in line at a time. It can also store lines and page formats too, so it appears to be bordering on a form of word processor.

Another microprocessor application to loom is in controlling motors. When one considers that there are virtually millions and millions of motors in so many different applications, the enormous market becomes apparent.

There are some very good reasons, too, for using microprocessors in this application. The first is that old chestnut—money. For example, many motors rely on costly feedback loop circuitry required for close speed control. It has been claimed that just over £1 worth of digital chip can replace £5 worth of analogue circuitry to do the same job. The microcomputer can also do far more than adjust speed. For example, it can check the motor current against a table of maximum values which it holds safely stored in its ROM. This very same ROM can contain a program that limits both the instantaneous and surge currents drawn by the motor at any given time. This, besides offering a safety factor, also allows the manufacturer to use smaller, and probably cheaper motors to do exactly the same job.

Big Bang Theory

A few Ginsbergs ago I mentioned Lithium batteries. They appeared to offer advantages, but I now hear of disadvantages—like they explode. Perhaps not all Lithium batteries do this, but it is reported from America

that the powerful Federal Aviation Administration has ordered that Lithium-Sulphur-dioxide batteries must be removed from emergency aircraft locator transmitters within 30 days. Apparently half a dozen or so reports were received of LiSO_2 batteries exploding. Some 6000 aircraft in the US carry equipment that uses LiSO_2 batteries.

Mon Dieu

I note with great interest that a British company has come up with an i.c. certain to cause a linguistic stir. By adding it to your teletext/viewdata decoder set, you can have the potential to display the whole lot in one of 28 different languages—Ha so! Perhaps you don't get the whole 28 in one go, but an order has already been received for the chip from across the pond in Canada, where the new i.c. is to enable delighted viewers to see viewdata information in a 20-row format (32 characters/row) in English and French. Had this happened when de Gaulle was in office, the designers would have been given the Legion of Honour and free wine for life. How about it, Giscard?

Stable Arrays

And pleased I am, too, to tell of another British achievement. A well-known establishment has come up with a new way of addressing twisted nematic liquid crystals. The liquid crystal display matrix can be driven continuously over the whole of its area and thus the annoying flicker associated with multiplexed arrays is eliminated.

Complementary m.o.s. (CMOS) powered by only 15V is used to drive a 100×100 matrix at around 5kHz. Researchers believe that 1000×1000 element arrays are possible. This, coupled with the low voltages and flicker-free display, could have great impact on the small screen TV and scope development. A pocket oscilloscope with a power consumption of, say, 500mW becomes a reality.

Bye-Bye Noise

The Dolby system of noise suppression in audio and hi-fi equipment is now very well entrenched. But a German company has arrived with an alternative—and the claims are that it's better, too. The new system is called High Com and it claims to be an improvement over the Dolby system in two areas. The first is that it removes an extra 10dB of noise. It is also said to perform this kind act over the audio spectrum—that's 30Hz to 20kHz, not just over a narrow band.

The immediate area of obvious improvement is at the l.f. end. The Dolby system starts to be effective at around 300Hz, so it isn't so effective against our old audio enemy "mains hum" at around 50Hz. The name High Com derives from "high fidelity compander" and during compression the lowest level signals are amplified. Thus any noise that is picked up or contributed by either the storage medium employed or the actual transmission path finds the amplified signal that much stronger and therefore that much higher above the noise level.

The immediate application for such a device is in consumer audio goods and it is rumoured that some 20 European electronics manufacturers are very interested indeed, as are four of the big Japanese producers. One claim is that when the High Com was used on an audio cassette tape recorder, the measured noise was found to be no less than 20dB down. The magic i.c. that helps achieve all these wonderful things is designated U401B and it comes disguised in a 24 pin d.i.l. plastic package. It has been suggested that the new device could be very usefully employed in radio and television. Although it will cost a little more than the Dolby counterpart at present, volume production will doubtless bring the prices tumbling down. Please note: you cannot buy one yet.



INEXPENSIVE AF electronic voltmeter

M. TOOLEY BA G8CKT

Most multi-range meters offer a rather mediocre performance on the a.c. voltage ranges. The Avo 8 MkIV, which has long been one of the writer's favourite test instruments, exhibits an internal resistance of only 250 ohms on the most sensitive (2.5V) a.c. range. This is clearly very unsatisfactory regarding sensitivity and circuit loading when measurements are to be made on today's electronic circuits. The instrument described was therefore developed as a replacement for the Avo on the a.c. voltage ranges and it offers the advantages of a $1M\Omega$ constant input impedance on all ranges and a frequency response which is substantially flat from 10Hz to well over 100kHz. Six voltage ranges are provided, with a maximum sensitivity of 100mV r.m.s.

The unit uses low cost readily available components and can be built for an outlay of around £10. Battery consumption is minimal and a small 9V battery will provide for many hours of operation.

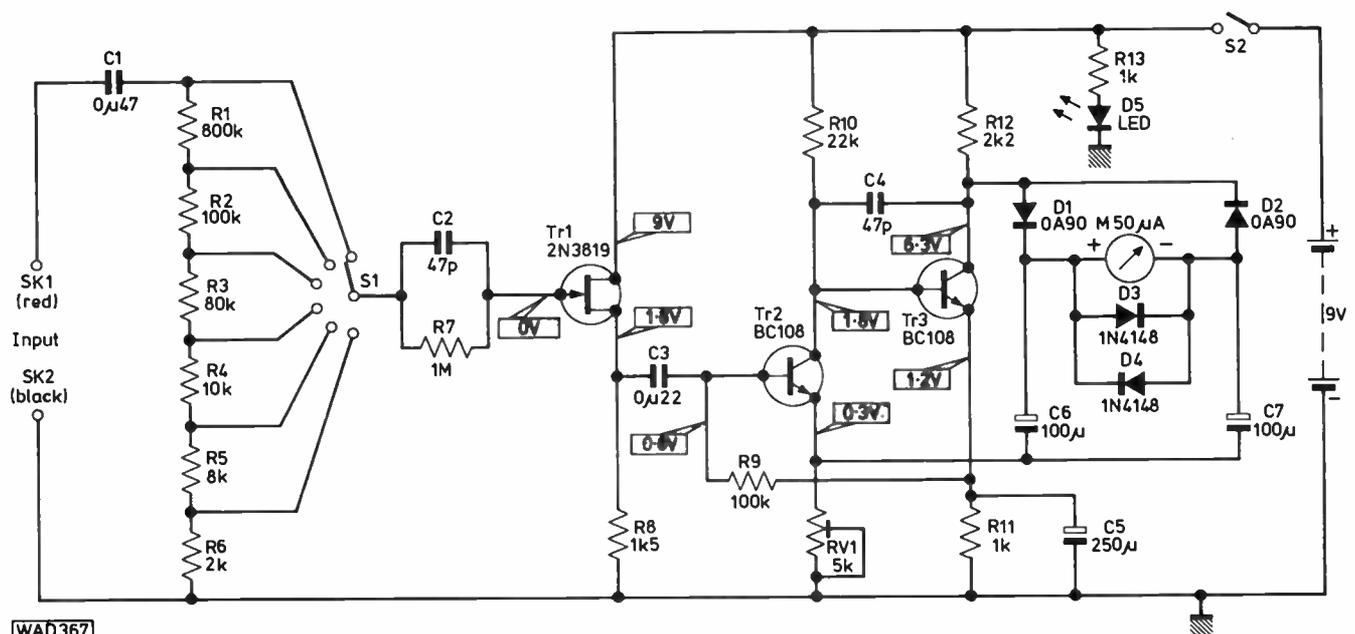
Circuit Operation

The a.c. voltage to be measured is applied to a switched potential divider, R1 to R6. The range is selected by S1 and capacitor C1 is used to remove any d.c. level present on the input voltage. R7 provides a measure of protection for the field effect transistor, Tr1, and C2 provides a degree of high frequency compensation. Tr1 operates as a

source follower and exhibits an extremely high input impedance (greater than $100M\Omega$) thus minimising the loading effect on the potential divider. Tr1 provides a voltage gain of slightly less than unity, the output voltage being developed across R8.

Silicon transistors, Tr2 and Tr3, form a two-stage high-gain amplifier. Both transistors are operated in the common emitter mode. The amplifier incorporates three feedback loops which help to ensure unconditional stability, a wide operating bandwidth and a high degree of linearity. Stabilisation of the transistor bias is provided by means of direct current feedback from the emitter of Tr3 to the base of Tr2 using R9. C4 provides negative feedback in the second stage of the amplifier. This helps reduce any tendency to oscillation at high frequencies and also ensures that the frequency response "rolls-off" beyond a few hundred kilohertz. VR1, the emitter resistor of Tr2, is used to set the overall voltage gain by controlling the amount of negative feedback present.

Germanium diodes, D1 and D2, from a voltage doubler rectifier arrangement. The arrangement of C6 and C7 provides a means of reducing the surge current through the meter movement during switch-on. Silicon diodes, D3 and D4, provide a "last ditch" protection for the meter movement by offering a shunt path to current when a 600mV voltage drop of either polarity appears at the meter terminals; this corresponds to an eight times overload.



WAD367

Fig. 1: Circuit diagram of the a.f. electronic voltmeter



★ specifications

Voltage ranges: 100mV, 500mV, 1V, 5V, 10V, 50V

Input resistance: 1M Ω on all ranges

Frequency response: Typically 5Hz to 250kHz at 3dB down

Accuracy: $\pm 5\%$

Supply: 9V d.c. at 10mA

Construction

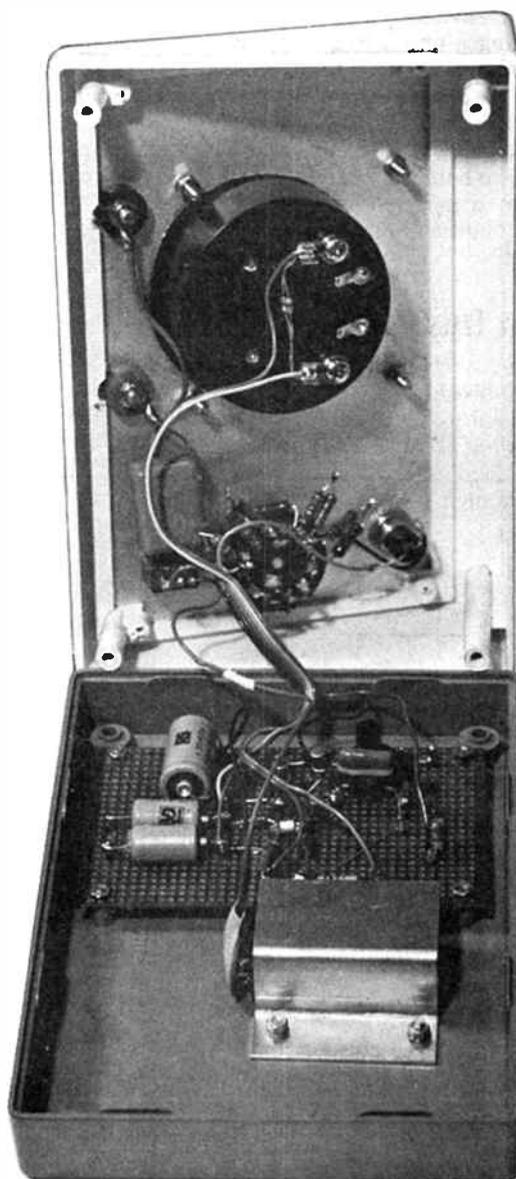
The impedance converter and the amplifier circuit are constructed on a p.c.b. The circuit board layout is shown in Fig. 3. The range selector switch, S1, is mounted on the front panel of the instrument together with the meter movement, power on/off switch, l.e.d. indicator and input sockets. The potential divider resistors, R1 to R6, are most conveniently wired directly to the tags of S1. C1 is wired directly between the input terminal and top end of R1, which is located on S1. Note that the high frequency response of the instrument will depend very much on the stray reactance associated with the input and potential divider wiring. It is essential that all connecting leads be kept as short and direct as possible. The front panel wiring layout is shown in Fig. 4.

Earthing of the metal front panel is achieved by means of the body of S1, which may be soldered to directly in order to provide a common earth point. If an alternative switch is substituted for the recommended type, it may be necessary to locate a separate earth tag on the front panel. This may be most conveniently accomplished by using one of the meter securing nuts. The front panel is labelled by means of dry transfers, and then sprayed with clear lacquer to protect the transfers. During this operation the meter should either be removed from the front panel or be protected using several layers of masking tape.

The instrument is housed in a standard Vero case. Any other suitable case may of course be substituted provided that any metal parts are connected to the earth or common rail. It was not found necessary to use a totally screened enclosure for the instrument, as with careful wiring there should be no pick-up of hum or stray signals within the unit. The unit will not, however, give accurate indications in the presence of very strong r.f. fields such as may be experienced when measurements are made on medium or high power transmitters.

Testing and Calibration

After completing the assembly of the instrument it is advisable to carry out a thorough visual check of the wiring. Connect a 9V battery to the instrument and measure the d.c. current supplied. If the circuit is functioning correctly this should be approximately 10mA and will vary slightly according to the setting of RV1. Due to a slight difference in the charging currents of C6 and C7, the meter pointer



Internal view of the complete instrument. This is the prototype which used a matrix board instead of a p.c.b.

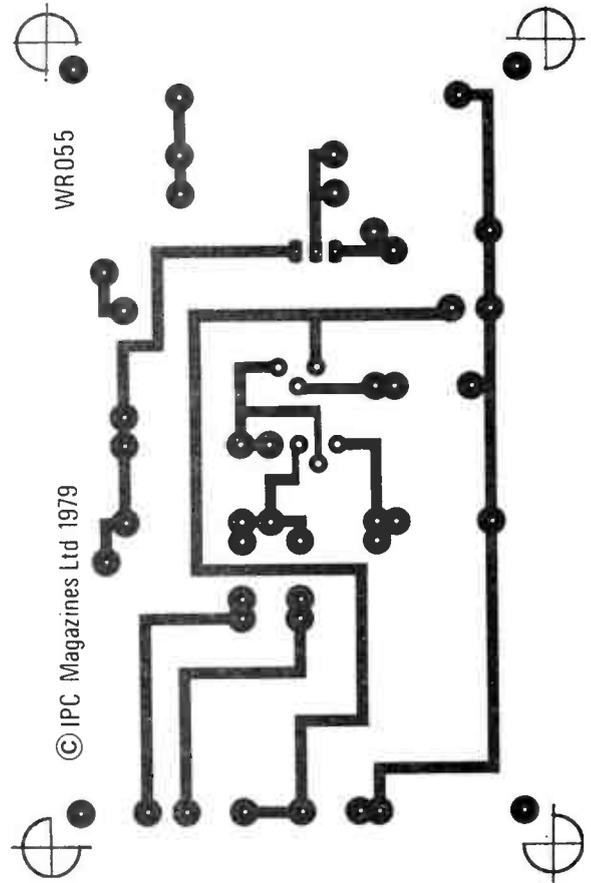
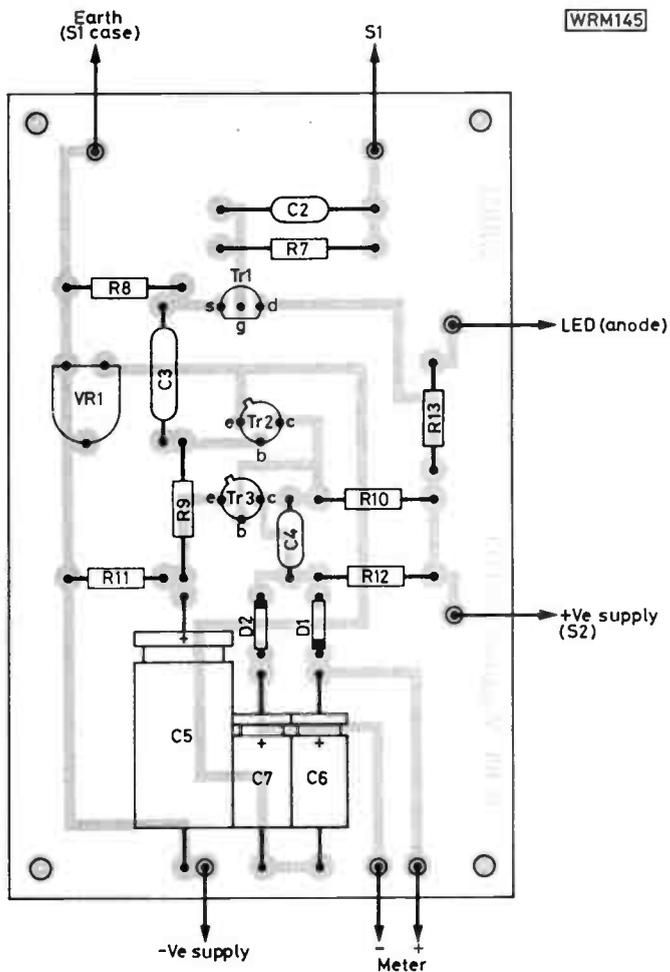
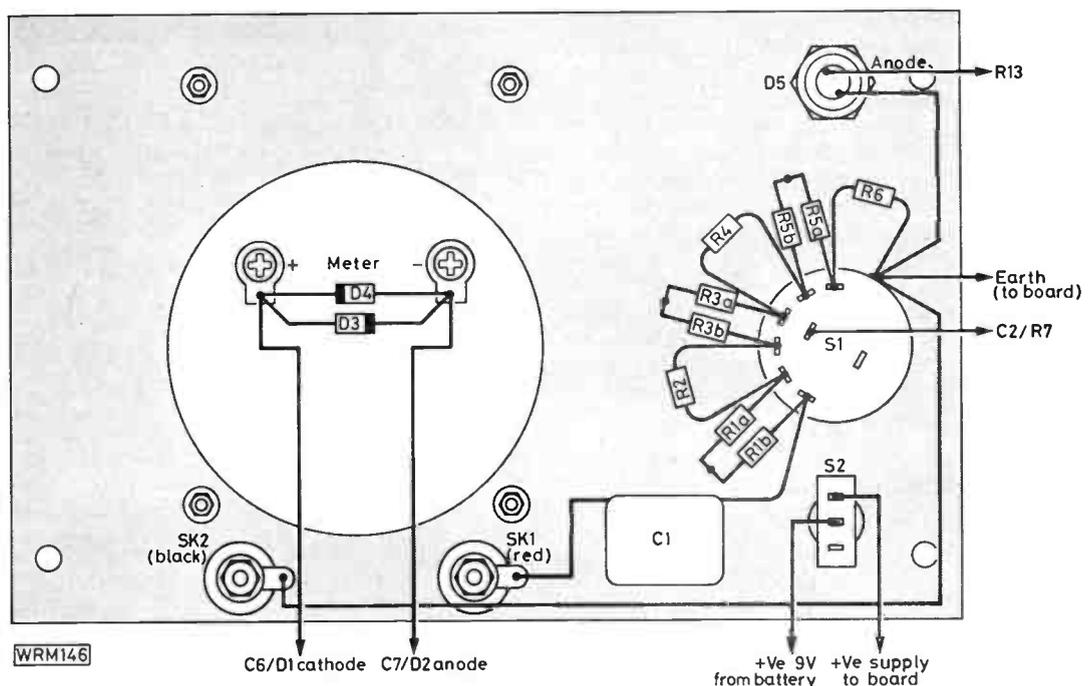


Fig. 2: (above left) The component overlay for the p.c.b. version of the a.f. voltmeter

Fig. 3: (above right) The copper track layout of the p.c.b. shown here full size

Fig. 4: (below) The wiring and layout of the front panel. The resistors on S1 are soldered directly to S1 tags and the end of R6 is soldered directly to the body of the switch



★ components

Resistors

$\frac{1}{2}$ W 2% metal oxide

1.2k Ω	1	R5a
2k Ω	1	R6
6.8k Ω	1	R5b
10k Ω	1	R4
12k Ω	1	R3a
68k Ω	1	R3b
100k Ω	1	R2
120k Ω	1	R1a
680k Ω	1	R1b

$\frac{1}{2}$ W 5% carbon film

1k Ω	2	R11, 13
1.5k Ω	1	R8
2.2k Ω	1	R12
22k Ω	1	R10
100k Ω	1	R9
1M Ω	1	R7

Capacitors

Electrolytic axial leads

100 μ F 25V	2	C6, 7
250 μ F 25V	1	C5

Polystyrene

47pF	2	C2, 4
------	---	-------

Polyester

0.22 μ F	1	C3
0.47 μ F	1	C1

Potentiometers

Miniature horizontal preset

5k Ω lin.	1	VR1
------------------	---	-----

Semiconductors

Diodes

OA90	2	D1, 2
1N4148	2	D3, 4
LED	1	D5

Transistors

BC108	2	Tr2, 3
2N3819	1	Tr1

Switches

1p6w rotary	1	S1
s.p.d.t. min. toggle	1	S2

Miscellaneous

Case Vero 75-1798-k 171 x 121 x 75mm (1); 4mm terminals 1 red, 1 black; Meter, 50 μ A 4 inch scale 110 x 82mm; Printed circuit board; battery connector, knob SW150 with cap and skirt (Sifam).

may give a momentary indication when switching on. The pointer should however return to zero fairly quickly, and if this is not the case the wiring should be re-checked for faults.

To calibrate the instrument a known source of a.c. voltage is required. A signal generator with a calibrated output level may be used, alternatively a comparison may be made with an existing a.c. voltmeter. If neither is available,

a rough calibration can be carried out using a low voltage transformer of known output. A 6.3V filament transformer or the 9V transformer of a power supply is ideal for this purpose. The instrument should be switched to the 10V range and RVI adjusted for the correct reading. The calibration on the other ranges should follow automatically provided that the potential divider has been wired correctly. If a signal generator is available a check can be carried out on each range. The calibration should be consistent to within $\pm 5\%$ on all ranges. If a signal generator is used, it is suggested that calibration be carried out at a frequency of 1kHz. Where a mains transformer is used the calibration will, of course, be at 50Hz. The frequency response of the instrument should be "good" over a wide frequency range, at least 10Hz to 100kHz at the 3dB points, and the frequency response of the prototype instrument on the 1V range is shown in Fig. 5.

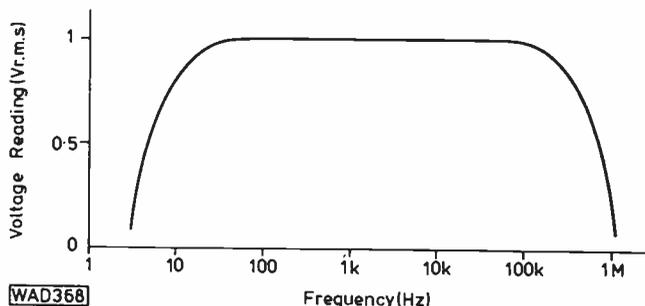


Fig. 5: The frequency response of the instrument

Note that, due to the high input impedance of the instrument, false readings can sometimes be produced on the more sensitive ranges. This is due to pick-up of hum and stray signals on the input leads. The input leads can be screened if desired; the inner lead of the coaxial cable is connected to SK1 (red) and the outer screen to SK2 (black). It is important to note that coaxial cable possesses an appreciable shunt capacitance between the inner conductor and screen (often as much as 100pF per metre). Long screened cables should therefore be avoided since they will impair the high frequency response of the instrument.

VISIT THE *PW* STAND AT
THE GREAT BRITISH
ELECTRONICS BAZAAR,
ALEXANDRA PALACE.
JUNE 28 to 30.

JOHN THORNTON-
LAWRENCE WILL PRE-
SENT THE *PW* LECTURE
"GETTING STARTED IN
AMATEUR RADIO", ON
SATURDAY AT 1200hrs.



AMATEUR BANDS

by Eric Dowdeswell G4AR

The problem of identifying correctly an amateur callsign can present a problem to anyone unaccustomed to listening on the amateur bands. It often seems to be a jargon incapable of being decoded! The answer is not always obvious even if the station is in the clear, but if it is being clobbered with QRM then there really is a problem.

Although there is an ITU phonetic alphabet, given below, it is seldom adhered to by amateur operators who seem to use part of this alphabet and part of their own invention. In a perfect phonetic code the word used to represent a letter, such as "alfa" for A and "bravo" for B, must be neutral, one without any particular connotation and generally understood world-wide.

The approved code starts off all right but then uses "Charlie" for C, although personal and place names ought to be avoided since these can be misleading, especially in amateur use, where station locations and operator's names are constantly being exchanged.

A Alfa	J Juliett	S Sierra
B Bravo	K Kilo	T Tango
C Charlie	L Lima	U Uniform
D Delta	M Mike	V Victor
E Echo	N November	W Whiskey
F Foxtrot	O Oscar	X X-Ray
G Golf	P Papa	Y Yankee
H Hotel	Q Quebec	Z Zulu
I India	R Romeo	

There are several words in the phonetics list which I do not agree with personally, but the problem is to find suitable alternatives.

What causes most confusion however is the amateur's own version of the phonetic code, especially the use of "George" for the G in UK callsigns, particularly where the operator is called "Fred"! Might not matter too much among lads and nets on 2m or u.h.f., but used on the DX bands can only make identification of a callsign all that more difficult.

On numbers, the recommended procedure is to use the word "figure" before any number, to indicate that a figure is to follow, thus "Golf, figure four, alfa romeo". This can only help but it is seldom employed by amateurs unless

they have been trained on a military or commercial network of some kind. The use of phrases like "Red Hot Momma" for RHM in the suffix of a call may be amusing to some but meaningless to the amateur with little or no knowledge of the English language.

I appreciate that this little homily will have no effect whatsoever, but I hope it will serve to demonstrate to the innocent listener to the amateur bands that there is little or no "system" with amateur phonetics. Initially, it is better to write down in full what is heard and then the callsign ought to become apparent, aided by a good list of prefixes, but, as ever, experience will prove the best teacher.

Here and There

Well known to this column for his SSTV reports in the past, **Paul Barker** of Sunderland is now busy on c.w. and s.s.b. with his new callsign G4HPS, having started off with G8OVD. Paul's first s.s.b. QSO was with FG7AS/FS7 on 10m, which is enough to make anyone's mouth water! He uses a TS520S transceiver to an 18AVT multiband vertical, plus an FT221R on 2m to an indoor 4-element quad. Paul managed to get QSLs from all six continents for SSTV reports before getting his ticket.

In Southport, **Peter Hawks** has got going with a DX160 but, like others, found the manual's calibration chart did not match up to reality. He's talking about a digital readout unit but I think he would be better off initially with a crystal calibrator. **Philip Charlesworth** (Southport) has got going with an outside aerial which he finds "staggering" after his indoor one. As he lives on the only hill in Southport he will find the advantage of much greater importance when he gets his ticket in due course. Philip mentions the PA0AA transmissions on 3750kHz for amateurs, followed by slow Morse transmissions. Details of the latest schedules would be appreciated.

Peter Lucas of Newport, Salop, has dumped his R207 and settled for an AR88 but needs to rewire a lot of it. A circuit or manual would be appreciated at 3 Queen's Drive if anyone can help. Pete's been hearing plenty on 10m of late with only a 16ft vertical. In Chiswick, London, **George Gizebieniak** BRS 41733 has bought an old SX24 receiver for £20 and found it worked fine on the 10m band, with converters for 2m and 70cm.

An appeal from **Jim Timoney** ZS1TK for a spare for his KW2000 transceiver, not having had any success with the descendants of KW in this country. He wants the 3-gang tuning capacitor on the pre-selector, part number C40 on the circuit diagram. Any offers of help to me direct please. Another reader in need of help is **M. David** of 46 Pentathlon Way, Cheltenham, Glos, who has got hold of a Star SR550 for just a £1! It works fine but he'd like a manual for copying and return. He's heard an HK on the 10m band and threatens to send in some logs in future.



SOUTH MIDLANDS COMMUNICATIONS LTD.

OSBORNE ROAD, TOTTON
SOUTHAMPTON SO4 4DN

Cables: Aerial Southampton
Telex: 477351 SMMCOMM G
Tel: Totton (04216) 7333



21 YEARS OF PROFESSIONAL EXPERIENCE

Main importers of Yaesu Musen Communications Products
"2 Year Guarantee – Free Securicor Delivery"

THE FRG7 Synthesised General Coverage Communications Receiver.



The FRG7 is solid state mains and 12v. receiver offering continuous coverage 0.5-30 MHz with specifications unparalleled in its price range.

Its advanced circuitry provides superb performance either as a standby receiver or for SWL's (Broadcast and Amateur Bands alike)

PRICE: FRG7 £210.37 (Carr. Foc.)
FRG7D £270.00 (Carr. Foc.)
(DIGITAL VERSION)
AS REVIEWED IN THIS ISSUE

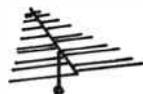
SMC YOUR SINGLE STOP SOURCE FOR: TRANSCEIVERS, RECEIVERS – HF, VHF AND UHF. ANTENNAS AND ROTATORS CABLE – CONNECTORS – TOWERS – MASTS AND FITTINGS



VHF BEAMS



VHF DISCONES



VHF LOG PERIODICS



HF QUADS



HF BEAMS

For fixed station antennas, (from top band to twenty three, from a dipole to a box of 352 elements) for Rotators (a choice of 15 models from Stolle and C.D.E.) and all accessories and fittings – coax, baluns, lightning arrestors, wall brackets, etc, SMC must be the natural choice.

Antenna Tuners
Baluns
Coax Switches and relays
Crystals
Convertors

Dummy Loads
Filters
Frequency Counters
Grid Dip Oscillators
Microphones

Morse keys
Multi-meters
Power meters
Power Units
Rotators

Speakers
Speech Processors
Transvertors
2mtr. Linear Amplifiers
Valves

Available from the following manufacturers:

'Alimasts'
Ampere
Ascot
Bantex
Barlow-Wadley
Belcom
Burns
CDE
CIR
Center Rise
Cushcraft

Dentron
Diawa
Electronic Devlps.
F.D.K.
Fulton
G-Whip
Gem Quads
H.S.
HYP
Hansen
Henry Radio

Hi Mound
Hills
Honda
Hy Gain
I.C.E
Icom
J.D.
J.R.C.
Jaybeam
Junker
KDC

KE
KLM
K.W. (Decca)
Katsumi
Ken
Kenpro
Kuranishi
Kyokuto
Leader
Leson
M.F.J.

Maiden-Sound
Metron
Mickey Mouse
Mini Beams
Mosley
N.E.C.
Nagasawa
Naigai
Omega
R.S.G.B.
Reace

S.M.C.
S.M.L
Sanyo
Seiwa
Shure
Soar
Speciality Coms.
Stolle
T.T.E.
Tavsau
Technical Assc.

Telco
Telomasts'
Telotowers'
Tempo
Toshiba
Unadilla
Varian
'Versatower'
Wightraps

A chance to see our complete range: Visit 'Unicom 21', Kempton Manor, Sunbury-on-Thames, June 22nd and 23rd. Further details from SMC HQ at Totton, call our Agents or Branches in your area.

G3ZUL Brian Stourbridge (03843) 5917
GM3ZBE Alex Aberdeen (065183) 328

GM8GEC Jack Edinburgh (031665) 2420
GI3WVY Mervyn Tandragee (0762) 84056

GW3TMP Howarth Pontybodkin (035287) 846/324
GW4GSWAlan Swansea (0792) 24140



S.M.C (Jack Tweedy) LTD
Roger Baines, G3YBO
79 Chatsworth Road,
Chesterfield, Derbyshire
Chesterfield (0246) 34982
9-5: Tuesday-Saturday

NORTHERN (Leeds) BRANCH
Colin Thomas G3PSM
257 Otley Road,
Leeds 16, Yorkshire.
Leeds (0532) 782328
9-5: Mon-Wed & Fri-Sat.

S.M.C. (Jack Tweedy) LTD
Jack Tweedy, G3ZY
Ham Shack, Roughton Lane,
Woodhall Spa, Lincolnshire
Woodhall Spa (0628) 52793
9-5: Tuesday-Sat (+ appointments)



Come to the Great British Electronics Bazaar

**"ALLY PALLY"
Thursday-Saturday
28th-30th June.**

FREE!

(AND WAIT TILL YOU SEE OUR SEMINAR PROGRAMME)

The Great Big 'Bazaar' for the hobbyist, amateur, and small buyer.

There's never been an event like this before.

First, the very scale of the exhibition is huge. Virtually all the companies you're used to hearing about (and buying from) will be there. Companies like Fluke and Gould showing off their low cost multimeters; smaller but important manufacturers like Lektrokit and Chromasonics; and even the R.S.G.B. who will have a station 'on the air' throughout the 'Bazaar.'

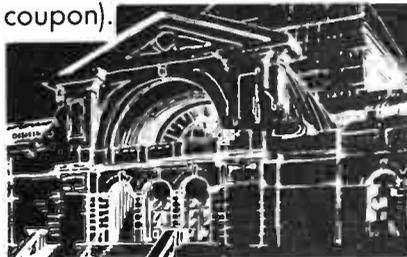
Then there are the suppliers of low-cost components and equipment. Plus almost all the journals in the business. Plus, oh, so many more interesting people catering for your needs (including computer kits!).

And you get in FREE if you send an s.a.e. (see alongside).

The Seminars.

If you would like to hear just what the experts have to tell you, a season ticket for three whole days can be yours for only £1.50.

Send an s.a.e. and we'll give you all the information (just use the coupon).



Our home for three days - Alexandra Palace, where it all began. (Our seminars are sited alongside the organ - for those who know this unique hall.)

SEMINAR TICKETS

£1.50.

I'd like to sit in at your seminars. (And like a free ticket to the exhibition.) Send me full details, please, and I enclose a large-ish s.a.e.

Name:

Address:

Post to: 'The Bazaar,' 34/36 High Street, Saffron Walden, Essex.

When?

Between Thursday to Saturday 28th-30th June.

You'll be in very good company; some ten thousand enthusiasts - and over a hundred stands displaying all that you want to see.

You'll come?

Eyes down for the appropriate coupon.

ADMISSION FREE

(or 50p on the door).

I'd like to see 'The Bazaar' FREE. I enclose a large-ish s.a.e. and will receive by return a ticket and full information.

Name:

Address:

Post to: 'The Bazaar,' 34-36 High Street, Saffron Walden, Essex. If you'd rather just pay 50p, go to Wood Green Tube Station and take a bus (every 3 minutes) to Alexandra Palace. We're open 10 am-6 pm daily, Thursday to Saturday, 28th-30th June.

Our Symbol. We think it tells you just what the Bazaar is all about.



Mike Stollov of Blackley, Manchester, has not deserted the column although active as G4HWP. Flu laid him low but he was able to drag his FRG-7 to the bedside and keep in touch with the bands on c.w. and s.s.b. Good finds on 15m c.w. were HH2T, HK0BKX, HM1DM and H44LW while on 10m s.s.b. FM7AY, HC1FM, KZ5AS and 6W8AAD were fairly rare ones. After some blush-making comments **R. Beswick** of "Hillhouse", Yatton-Keynell, Chippenham, Wilts, mentions that he has run through quite a few receivers and now has a Trio 9R59D and a Minimitter MR44, but is sadly in need of a circuit or manual for the latter. Any help direct please to him, all expenses paid of course.

We don't often get any RTTY news but here is **Dennis Sheppard** of Sheppey, Kent, with a long log of stations copied in this mode with Creed page printer, tape printer, tape reader and home-made terminal unit driven from a JR310 receiver. Any other RTTY enthusiasts are invited to write in with logs, etc.

Australian **J. Clark** arrived here with his equivalent to the "B" licence and wrote to the RSGB for info on clubs in the Reading area and on the licensing regulations in order to get a full licence while over here. He says: "The RSGB HQ was not particularly forthcoming about licensing exam procedures, nor even too certain about the active status of clubs in this area". Needless to say, he got a full reply from me in a couple of days!

DX Notes

Bill Rendell (Truro) has the solution to the S79MC mystery, straight from the horse's mouth! It is the Seychelles after all. Although Bill heard him some time ago, it was only in the middle of March that the QTH was given, seemingly. Bill has been up at sunrise to find the DX still rolling in on 80m such as C6AFR, CT2SH, HC1NJW, VP1KG plus three ZLs one of whom was mobile "out salmon fishing"! 40m revealed Bill's first GD logging, GD3KGC but little else. On 20m CT2YB on St Michael popped up, with D4CBS, J3ABN, M1D, VP2VBK and VP8SO on Signy Island, not to mention VK3MO reputed to have eight quads in a 4-over-4 arrangement!

The 10m band has been very good at times but several readers comment on weird and variable skip at times, which makes it all the more interesting! **P. Lucas** of Newport, Salop mentioned HH2LD, H44CF and S79MC on the band, all good catches in the early evening, on his AR88 and vertical. Looking at the c.w. end of bands can produce some unusual prefixes if one is interested in that direction. **Mike Stollov** found a CP5, EA8, HC2, HP1, OY9 on 20m and HH2, VS6 on 15m, plus KZ5, SV1, 6W8 and 8P6 on 10m. More c.w. logs would be very welcome.

As usual **Ian Marquis** sorted out the better ones at Leigh-on-Sea, Essex, on his FRG-7, 100ft wire and 28MHz dipole, such as M1C and ZB2CJ on 80m, VP2KF, XE1FU and YN1S on 40m, C6ANX and TR8AC on 15m with HC1FM and HL9KE on 10m, all s.s.b.

Club Activity

Let's start with the **Bury RS** which meets every Tuesday evening at Mosses Centre, Cecil Street, where visitors are more than welcome. June 12 sees G8SCA talking on the joys of medium-wave DXing (how did that get in?) and on July 10 there is a foxhunt for those keen on DFing. QRP-lovers may like to know that **Yeovil ARC's** transmitter G3CMH is reputed to have made the first

solid-state s.w. DX QSO in the UK in 1954, working 90 miles on 80m with 30mW input to a single transistor. The station is still active with QRP so pop along any Thursday evening to Building 101, Houndstone Camp, Yeovil and meet the gang, or write: **D. McLean G3NOF**, 9 Cedar Grove, Yeovil.

The second and fourth Thursdays of the month, see the **Edgware and District RS** (Middx), at the Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware. On June 14 a "Bring & Show" your favourite test gear, tools, etc., is a pleasant twist while on June 28 there is a junk sale. Contact: **D. Lisney G3MNO**, 119 Draycott Avenue, Kenton, Middx. Fridays is the day to find the **West Kent ARS** at the Adult Education Centre, Monson Road, Tunbridge Wells. On June 22 a Mr Constable will talk on the British Vintage Wireless Society and its work.

Trevor Tugwell G8KMV reports his retirement as Sec of the **Stevenage & District ARS** and I hope his replacement **Ted Godfrey** of 94 Common View, Letchworth, will be equally forthcoming with the club's news. June 14 is devoted to a DF hunt, with G4DDX talking about his Top Band DF receiver on June 21.

Don't forget the deadline for copy, the 15th of the month without fail.

Log Extracts

Ian Marquis:—80m M1C ZB2CJ 40m HC4JQ VP2KF, XE1FU YN1S 20m VP8ML VR3AH VS5XU 8Q7AH 15m C6ANX TR8AC VP9JA 10m HC1FM HL9KE

R. Bell:—20m OA8ODE 15m JY5ZM P29MF 10m CT2CP KZ5FF YB0ADW

P. Hawks:—20m VK7OH A9XBS CT4UU M1D VP9CP XT2AV

P. Charlesworth:—20m JY8AQ JY0OZ VP9BB 7X2LS 9V1TX

M. Stollov:—20m CP5NK EA8FO FY7BF HC2FN HP1XGL OY9J 15m HH2T H18MOG HM1DM H44LW KL7PJ VS6EN 10m FM7AY HC1FM KZ5AS VS6DT 8P6JQ (Bold are c.w.)

P. Lucas:—10m HH2LD HI8XEA H44CF S79MC VQ9JJ ZF2CL 9J2LL 9L1KB

W. Rendell:—80m C6AFR CT2SH EA8PP HC1NJW PJ2AAX VP1KG YS9RVE ZF1CL ZL3GS ZL4AP 40m EA8QY 20m D4CBS HP6JB J3ABN J6LFZ M1D VK7AE VP2VBK VP8ML VQ9JJ ZD7PL 15m CT2CP HC6FC J6LDE (St Lucia) S79MC VP5JFH VP8SB (Adelaide Is.) VQ9RL YB0WR ZB2DV

D. Sheppard:—All RTTY 20m A4XFW FP8DF 9G1JX 9J2KD 15m JA1ACB KC6CB LU1NH VE7DIA W7WHY YU3KAA 10m AG2M C5AAN FG7XT JA2JHR KZ5JA VK3KF ZS6AKO 3D6AD 5Z4PD

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, Ashted, 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.

BROADCAST BANDS

MEDIUM WAVE DX

by Charles Molloy G8BUS

Are you going abroad for your holidays this year? Then why not take along a portable receiver? As well as providing entertainment, it will give you the opportunity to listen to the medium waves from a new location. I had this experience while on holiday in Bulgaria a few years ago where the medium-wave scene was totally unrecognisable. I could have been on another planet! I even tried to do some DXing but could not pick up either the BBC or Luxembourg on the medium waves, though a weak unidentified on 200kHz might have been Droitwich. It would have been very interesting with a decent receiver and a loop.

Holidays abroad these days generally mean Spain, a country which is very interesting from the radio standpoint. As well as having an official government network, there are several chains of privately-owned local radio stations spread across the country. In most locations there are at least three to be heard during the day-time, while after dark many more are just waiting to be picked up. The holidaymaker also has the opportunity to hear "difficult" outlets such as Radio Gibraltar on 1458kHz.

DXing Spain

No need to visit Spain to listen to Spanish radio. A lot of it can be heard from the UK, and it is quite an interesting area to explore at this time of the year. A loop should sort out much of the co-channel QRM, since the DX is coming from the south while much of the QRM is from the east. The easiest stations to pick up are the high-powered RNE outlets at the l.f. end of the band. Listen to 585, 639, 684, 729, 738, 774 and 885kHz for the call Radio Nacional España.

The real interest for the DXer is with the local radio stations which operate on a number of channels between 792kHz and 1602kHz. The best time to listen for them is between 2300 and 0100 GMT when European QRM slackens off and many Spanish locals themselves close down leaving the frequencies clear for other weaker stations to appear in their place. Try on 1026kHz, 1107, 1134, 1224, 1260, 1314, 1395, 1521, 1539, 1584 and 1602kHz.

Identification

Station identification includes the name of the town or city preceded by one of four titles depending on the particular network such as Radio Barcelona, Radio Popular Malaga, Radio Juventud Murcia, La Voz (pronounced Voth) de Granada. A callsign is allotted to each station which is generally used in the sign-off announcement but it can present a problem to the DXer unless he is familiar with the alphabet and numerals in Spanish. Four sets of three letters plus figures are in use depending on the network. For example, EFE14 is in Madrid, ECS5 in Granada, EFJ56 in Malaga and EAJ1 in Barcelona.

A list of Spanish frequency allocations extracted from the Boletín Oficial del Estado of the 13 November 1978 is available from Keith Hatcher, Duquesa de la Victoria 50bis, Logroño, Spain in return for 2 IRCs or 25 Pesetas in unused Spanish stamps. At the time of writing this is the most up-to-date list available, though it does include some stations not yet on the air.

Reception Reports to Spain

Spanish locals are usually good verifiers even to a report written in English, though a Spanish Report Form (obtainable from DX clubs) is better. A full list of callsigns and addresses is to be found in the *World Radio and TV Handbook* though the frequency information in the 1979 edition is quite out of date. No need to worry too much about the full address. A report sent to El Gerente, Radio Popular Malaga, Malaga, Spain will certainly find the station, El Gerente being the station manager. Always include return postage, either unused Spanish postage stamps which are obtainable from stamp shops or an International Reply Coupon (IRC). These are on sale in main post offices.

Region 2 Station Separation

According to a report in *DX Monitor*, the Daylight Broadcasters Association (USA) is asking the US government to press for 9kHz station separation plus a slight extension of the m.w. band, as an alternative to the current proposal to the WARC-1979, to extend the band to 1850kHz. The suggestion is that the band should start at 530kHz with stations spaced at 9kHz intervals up to 1610kHz, which would provide an additional 14 channels.

The DBA just cannot be serious! It would mean that the majority of stations in Region 2—North, Central and South America—would be on the old pre-Geneva channels, which incidentally are at the moment occupied by many broadcasters in the Middle East who have not (yet?) changed over. 1kHz heterodynes would be commonplace and a 1kHz audio notch filter would be an essential item in the m.w. DXer's shack. A more reasonable proposal would be to start at 540kHz and follow the Geneva frequencies right up to 1602kHz. This would give 12 additional channels and would not require approval by the WARC as the m.w. band would not have to be extended. It would only require approval by the countries in Region 2.

It is to be hoped that the DBA will not be successful. At present Region 2 is on 10kHz separation starting at 540kHz which is also a Geneva frequency. Coincidence between the two systems occurs at 90kHz intervals across the band but there are other parts where the separation between the two systems is as much as 4kHz and these are the "DX slots" that would disappear if the Geneva Plan becomes world-wide. Fortunately there is likely to be opposition within the USA to the DBA's proposals, as many stations would be put to considerable expense, not just in changing frequency but with modifications to directional aerials which are in widespread use in that country. None-the-less, m.w. DXers will await further developments with apprehension.

Loops in New Zealand

The Loop becomes Respectable is the title of a short, amusing article sent to me by its author **Tony King**, who is the *Mailbag* editor of Radio New Zealand. It seems that RNZ decided to restrict its racing coverage, which led to the experimental use of a DXer's loop to get better reception. Soon, a commercially produced "punter's loop"

appeared which was investigated by the NZ Consumers Council, who had to acknowledge its effectiveness. A competitor, the Space Raker soon turned up. This was a loop built into a briefcase for convenience of use and acceptability in domestic surroundings. Finally "the national TV network screened a programme on the loop, the a.t.u. and on erecting an outside aerial, all in the quest for better reception".

DXing does have a large following in New Zealand but I once knew a Kiwi who was a great leg puller, so you can take your choice. Either way, it is an interesting story.

Readers' Letters

Stephen Donnelly wonders how DXers identify foreign language broadcasts. His method is to look for key words (Voici=French). This is alright if you have a list of key words but an easier way is to listen for place names. Most countries carry local items in their news bulletins and if, for example, you hear Ankara mentioned several times then you may be listening to Turkey. Stephen has recently acquired a Trio 9R59D and he would like to hear from other users of this receiver. Replies direct to Stephen Donnelly, 25 Church St, Addlington, Lancs PR7 4EX.

From Pensilva in Cornwall comes another letter from reader **K. Lewis** who has modified the r.f. pre-amplifier intended for use with the *PW* "Dorchester" Tuner. He used it along with a long wire, a.t.u. and Realistic DX160 to pull in WINS on 1010kHz, Radio Margarita, Venezuela 1020, Radio Coro, Venezuela 1210 and Radio Paradise, St Kitts on 1265kHz, all heard between 0250 and 0330 during March. Listen in mid-summer during the hour before sunrise for this type of DX; results are sometimes very good.

DX Circle is the name of the weekly DX programme in English carried by Deutschlandfunk on 1269kHz each Tuesday at 1900 GMT. It is compiled and presented by DXer **Alan Thompson** and it has been running now for over 10 years, the session on the last Tuesday of the month being designed especially for newer members of the hobby.

It is nearly 10 years since I met Alan at the DX Convention he organised in his home town, Neath. It was attended by **Arthur Cushen** who was on a tour from New Zealand at the time, and this was the first gathering of Broadcast Band DXers to take place in this country so far as I know. Alan is the UK/Europe representative for the NASWA/FRENDX, Indian DX Clubs International and the Union of Asian DXers, which means that subscriptions to those bodies can be made through him. Alan can be contacted via the DX Circle, Deutschlandfunk, 5 Koln 51, Raderberggürtel 40, West Germany.

BROADCAST BANDS

SHORT-WAVE BROADCASTS

by **Charles Molloy G8BUS**

Questions asked by a number of readers recently have prompted me to produce the following few notes written in non-technical language which will, I hope, show how a receiver converts the incoming radio signals into the sounds heard from the loudspeaker or headphones. An understanding of what is happening should help the DXer to get the most out of the quite sophisticated gear that is under his control.

The Superhet Receiver

A block diagram of a superhet receiver suitable for broadcast reception is shown in Fig. 1. Facilities for s.s.b. and c.w. are not included, as these are not generally used for broadcast band DXing. Each square represents a particular job the receiver has to do. Starting at the left-hand side, radio signals are picked up by the aerial and applied to the aerial socket where they pass into the r.f. stage and out again to earth. The r.f. stage selects the wanted signal, amplifies it and applies it to the mixer where a further stage of frequency selection is encountered. The local oscillator is maintained at a frequency 465kHz higher than the incoming signal by the tuning control. The mixer, which is aptly named, mixes the two together and supplies a 465kHz difference frequency complete with modulation (programme) to the intermediate frequency (i.f.) stages. Here the signal is amplified and further selectivity is encountered.

The output from the i.f. stages is applied to the detector where the audio is extracted and applied to the audio amplifier. The output goes either to headphones or to a further amplifier which drives a loudspeaker. The output from the i.f. stages is also fed to the automatic gain control (a.g.c.) circuit, which adjusts the gain of the amplifiers in the r.f. and i.f. stages in sympathy with the strength of the signal.

That, very briefly, is the make-up of the superheterodyne receiver, to give it its full name. In this case the

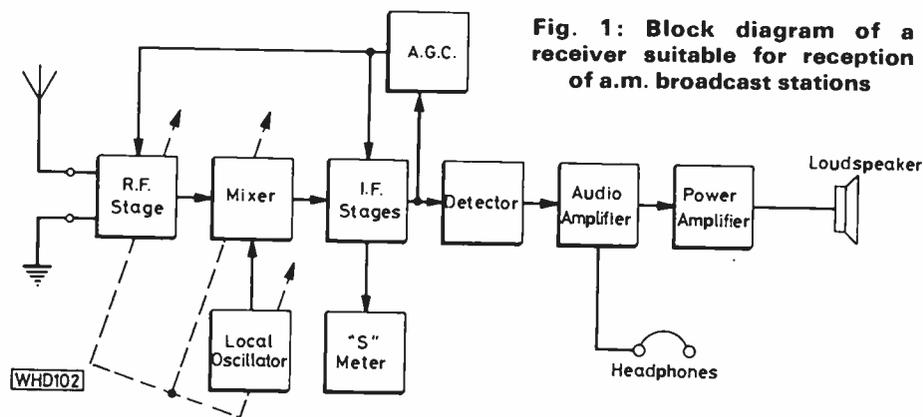


Fig. 1: Block diagram of a receiver suitable for reception of a.m. broadcast stations

heterodyne is 465kHz which is the standard value used in the UK. Anyone interested in the history and development of the superhet should try to get hold of a copy of *The Superhet Receiver* by Witts, first published in 1935. There are a number of later editions and although long out of print, copies can be found in secondhand bookshops. This book contains a fascinating account of the efforts of the early radio experimenters to produce a design that is now regarded as standard throughout the world.

Images

To get back to the block diagram. It is important that a receiver intended for DXing should have an r.f. stage. The majority of domestic receivers do not have one, the aerial going straight to the mixer. As well as increasing sensitivity, the r.f. stage helps to reduce what is known as second-channel or image interference. The mixer can produce the 465kHz heterodyne in two ways—by beating with a station 465kHz lower than itself, and also by beating with one 465kHz higher. The second is the image. For example, if the receiver is tuned to 6180kHz (49m band), the local oscillator will be generating 6645kHz and the image will be 7110kHz (41m band). The selectivity in the r.f. stage reduces the strength of the image compared with the wanted signal.

It is easy to tell if a receiver has an r.f. stage. Have a look inside at the tuning capacitor. It should be a three-gang, one section for the r.f., one for the mixer and one for the oscillator, all under the control of the main tuning knob. The dotted lines in Fig. 1 represent the 3-gang tuner. If it is only a twin-gang then there is no r.f. stage. Paradoxically, a receiver without an r.f. stage will sound a lot more lively than one with an r.f. stage. It picks up many more stations, in the example quoted, in the 49m band plus the stronger images in the 41m band. A receiver with poor image rejection will pick up the stronger stations at two points on the dial and this effect becomes worse the higher in frequency you go.

Automatic Gain Control

The a.g.c. does electrically what you can do for yourself manually—turn down the volume when listening to a strong station; turn it up to hear a weak one. The a.g.c. does it much faster and is therefore useful for dealing with fading. There are occasions, though, when you are better off without a.g.c. When two stations are operating on the same frequency, there will probably be a beat of a few hertz, equal to the slight difference between them. This can occur even if one station is a lot weaker than the other. The a.g.c. will follow the beat and may produce an unpleasant blasting effect at the loudspeaker. If you are searching for a weak station close to a strong one then the a.g.c. may respond to the strong station, reducing the receiver gain, so that the weak one is missed.

A.G.C. ON/OFF Switch

An a.g.c. on/off switch is fitted to communications receivers but seldom to other types. If you switch off the a.g.c. then you must be able to adjust the r.f. and i.f. gains, otherwise strong stations will cause overloading, therefore a separate r.f. gain control will have to be provided. In spite of the name, the r.f. gain control usually controls the gain of both r.f. and i.f. stages. To operate a receiver with the a.g.c. switched off; adjust the volume (a.f. gain) to a comfortable level and follow the strength of the incoming signal with the r.f. gain control, which replaces the a.g.c.

To sum up, a receiver for DXing should have an r.f. stage to provide adequate sensitivity and freedom from images. You can check by examining the tuning capacitor. It is also desirable to be able to switch off the a.g.c. but if you do this then you must have a manually operated r.f. gain control as a replacement.

Radio Finland QSLs

From Tullebody in Scotland comes a note from **James Thompson** who is a civilian instructor on radio with the ATC and a keen DXer. He sent a reception report to Radio Finland expecting to get a listener card in return, but much to his surprise he received a proper QSL giving the date, time, frequency and verifying that the report was correct. Whether this is the result of a genuine change of policy or the result of an error is not clear but let's hope it is the former.

Readers' Letters

The National Panasonic RF1105 is in the news again with a report from **E. Roper** who obtained his first experience of s.w. listening with this receiver and is more than satisfied with its performance. He finds that by increasing the diameter of the tuning control to 75mm, a more sensitive touch was obtained when tuning. Fitting a large knob to the tuning control is an old dodge, but it can spoil the appearance of the receiver. DX picked up with the RF1105 included Pakistan on the 16m band at 1100, Afghanistan on 19m at 1600 and Radio Australia on 25m at 1900.

"I am at present compiling a survey of the FRG-7 as there seem to be so many conflicting reports about these receivers," writes **George Tyler** from 41 Park Crescent, St George, Bristol BS5 7AY. George has already contacted about 20 FRG-7 owners and he would like to hear from more as he thinks some hints and guidelines could emerge from his survey. In particular he would like to know the good points, the faults and how the FRG-7 performs with an a.t.u., audio filter, etc. George has promised me a copy of the survey when complete and a summary of it will appear in this column. See also *Special Product Report this month. Ed.*

Arthur T. Cushen, MBE, writes from New Zealand to say that his book *The World in my Ears* will be published in August or September 1979. It is the story of a blind radio listener who has become a world authority in his hobby and who is a regular broadcaster on RNZ and Radio Nederland. The book, which is partly autobiographical and partly a guide to short-wave listening, can be obtained direct from Arthur Cushen, 212 Earn St, Enwood, Invercargill, New Zealand, at a pre-publication price of £7 until June 30.

DX Heard

Japan has been heard on 9585kHz at 2000, SIO 433 by **Chris Howles** (Lichfield) using his Vega 206 and 40ft loft aerial. **David Stevenson** (Thurso) has a National Panasonic receiver and a 100ft length of wire wound round his bedroom and he picked up Afghanistan on 11 805 at 1900 and Taiwan on 15 425 and 15 345 at 0100. **Bob Bell** (Blyth) reports hearing Radio RSA on 25 790kHz in the 11m band at 1520. According to a recent report in *Sweden Calling DXers*, IBA Jerusalem is now on 25 640kHz as well as on 25 645, Radio Nederland is on 25 650 at 0800 and the VOA is also on 25 880kHz.

A newly-acquired Sanyo RP 8880 is in use by newcomer to the s.w.s **Alan Curry** (Stockton-on-Tees) who

pulled in Japan on 15 195 in English at 2300 using the telescopic aerial. All India Radio was logged on 11 620 at 2225, SIO 444 with a programme in English about the Indian fishing industry. **Mark Hattam** (Hereford) is amazed at propagation on the 13m and 16m bands (the higher frequencies are really opening up now). His Realistic DX160 and 45ft long wire pulled in VOA Philippines on 17 780 at 1500, Chile on 17 715 at 2330 and Peking 17 680kHz all in the 16m band. **P. R. Sixe** (Cambourne) is puzzled by Radio Nacional de Colombia which was noted on 13 848kHz and he wonders if this could be the first station to appear on the new 22m band. This band has not (yet) been authorised and you may have heard a harmonic. **Craig Kelly** (Walsall) has been unable to identify a station on approx 31.2m with the call Hebra Radio (anyone any ideas?). **David Grimshaw** (Bury) has an FRG-7, long wire and a.t.u., and he reports that Radio Japan comes in well on 17 795 and 17 825kHz, in English, at 0800.

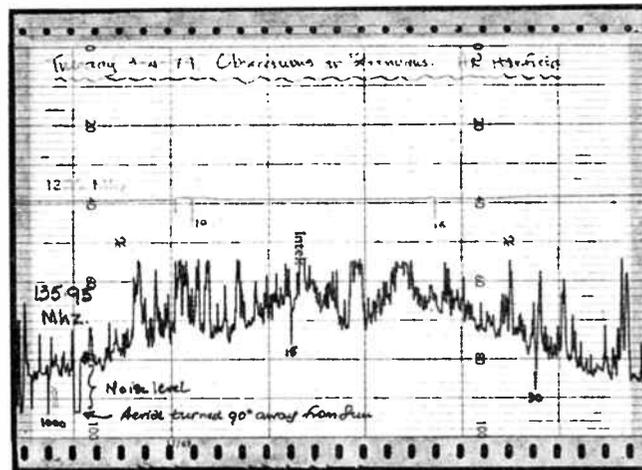


Fig. 2: Chart recording of solar noise received on 135.95MHz on 3 April 1979 by Henry Hatfield

VHF BANDS

by **Ron Ham BRS15744**

The propagation of radio waves between two points is a complex subject, because, whatever the wavelength of the transmitted signal it must travel somewhere through the earth's gaseous atmosphere, which, in a variety of ways can be upset by the sun. Every month, with the help of my readers, I endeavour to show what natural events have taken place and how our terrestrial radio communications are affected. New readers to my column often ask about basic reading matter so they can better understand such words as aurora, meteor scatter, sporadic-E, sunspots and solar radio noise, so, my first suggestion is, Chapter 11, in Volume 2 of the RSGB's *Radio Communication Handbook* (Fifth edition), and secondly, J. A. Ratcliffe's *Sun Earth Radio*, World University Library.

Solar Activity

On March 21, **Cmdr Henry Hatfield**, Sevenoaks, recorded bursts of solar radio noise at both 136 and 1296MHz, on the 22nd he saw an active plage through his spectroheliograph and on the 23rd he counted between 30 and 40 sunspots, in 8 groups, in addition to a long ribbon flare. **Nigel Fisher**, South-East Essex Astronomical Society, recorded a solar burst at 60MHz during the morning of the 27th and I heard strong solar noise in the 10m band at midday on the 30th. During the BBC's *World Radio Club* programme on April 8, **Lucian Prehner** said that ionospheric conditions were disturbed between April 2 and 6, mainly on the western paths, which was no doubt caused by the very large sunspot group, about 35 spots, and a long arched filament which occupied almost a quarter of the sun's diameter. This was a massive affair, bearing in mind that the sun's diameter is about 865 000 miles.

It was not surprising that Henry Hatfield, **John Smith**, Rudgwick, Sussex, and myself, were recording a solar noise storm, Fig. 2, at 136, 142 and 146MHz during the

morning and early afternoon of the 3rd. On the 5th, Henry noted that the large sunspot group was declining and the filament was much less active, explaining why we recorded only a few small bursts on the 4th and a slight noise storm on the 5th. Bursts of about 5 minutes duration were recorded around midday on the 8th and 11th, one 1.5 minute burst at 1310 on the 14th, and a 4 minute burst during the midday observation on the 16th.

The 10 Metre Band

Apart from the relatively few disturbed periods, 10m conditions were generally good between March 19 and April 16. On March 22, **Harold Goble G4FDQ**, Lancing, worked all Continents, UA6, VE, ZL3, 4S7, 5N2, and 8P6, on 10m using his KW 2000A into a 66ft end-fed long-wire aerial. The band was so good on the 22nd, a VK station told Harold, that they were burning the midnight (local time) oil working DX. "The band was running wild," said Harold; too true it was, around 1900, I was at a meeting of the Mid-Sussex ARS and listened to **Alan Baker G4GNX**, have a 59 contact with WB4HHY, Utah, using the club station G3ZMS. At 0843 on the 22nd, **Ern Hoare G3RZD**, Hove, and Harold had a joint QSO with 9H1CD who has established a beacon, using his own callsign on 432.25MHz, for use during the sporadic-E season, reports, of course, are welcome. Back in July 1976, Ern worked 9H1CD on 2m phone, during a sporadic-E disturbance.

From my own observations the 10m band was blacked out during the early mornings of March 23, 28, 30, and April 4, 6, 7, 15 and 16. The event on March 30 was reported by the BBC World Service and on April 4 the disturbance persisted for most of the day. On the majority of days throughout the period I received signals, averaging 549, from the International Beacon Project stations in Bahrain A9XC, and Cyprus 5B4CY, but, unlike previous months, the signals from the German beacon, DL0IGI, were much less frequent. During the afternoon, on the good days, signals, about 559, were heard from the Bermuda beacon VP9BA. The RSGB are responsible for the IBP service and in the April issue of *Radio Communication* they say: "The establishment of the beacon stations has stimulated scientific interest in the propagation paths revealed by reception of the beacons. In addition, they fulfil a practical role by providing signals on what may otherwise be a dead band."

Aurora

The aurora borealis which followed the big solar storm on April 3 began around 2300 and ended during the early hours of the 4th. Alan Baker noticed that the 20m band was almost dead towards the late evening of the 3rd, and what weak stations there were had an auroral tone. He soon checked the 2m band, turned his beam just east of north and had an auroral contact with G8BHH, Wolverhampton, and heard GM4COK, GM4DSZ and GI4GID. John Cooper G8NGO, Cowfold, Sussex, using his 14-element beam, had 59A contacts with G4HSS, GM4DSZ, GM8EYB, and weaker contacts with G8LHT, Doncaster, and G8RHI. John also heard GM8NET and tried to contact GI4GID who was very strong in southern England, but the pile up to work him was too great.

During the event I heard G8ODN, GI4GID, GM4COK and GM8NET. Up in Scotland the aurora affected v.h.f. signals earlier in the evening and between 1700 and 2000 GMT John Branegan GM8OXQ, Saline, Fife, heard 5 Gs, 4 GIs, 7 GMs, 2 LAs, 1 PA0 and the 2m beacons in Germany DL0PR, Northern Ireland GB3GI, and Cornwall GB3CTC. Dermot Cronin EI9DC/G4GRO, who normally reports from the Royal Sovereign Light, heard, at his home in Killiney, tone-A signals from G, GI, GM and LA during the evening of March 29. John Branegan said it was "A very odd aurora", and between 1700 and 1830 he heard signals from EI, DL, LA, G, GI, GM, OZ, SM and the beacons from Cornwall and Germany. At 1746, John heard EI3S, OZ1OF, GM3UU and GI5AJ all calling at once and writes: "they all appeared at or near the same tuning point but they were clearly not hearing one another. However, the OZ called the EI and was answered by the GI so at

least he got a QSO eventually". Auroral signals, mainly confined to GM, were heard by John during the early evenings of March 22, 26 and 27 and, around 1115 on April 13, Alan Baker noticed that some 10m signals had an auroral tone.

European DX

While at the BBC on April 6, I met Rudolf Heim, Secretary General of the European DX Council, who was visiting Bush House to see a recording of *World Radio Club*. The EDXC has some 35 member organisations throughout the world, among whom are several international broadcasters acting as observers. Rudolf told me that only about 10 per cent of broadcast DXers are interested in v.h.f. and TV DX, but the number is growing. The Dutch are well ahead in this field however, and have some remarkable aerial systems. Some German clubs are moving in this direction and the German DX Federation, AGDX, frequently publish their own v.h.f and TV DX Bulletin. The use of Citizens' Band in Germany is popular among people of all age groups.

Radio Astronomy

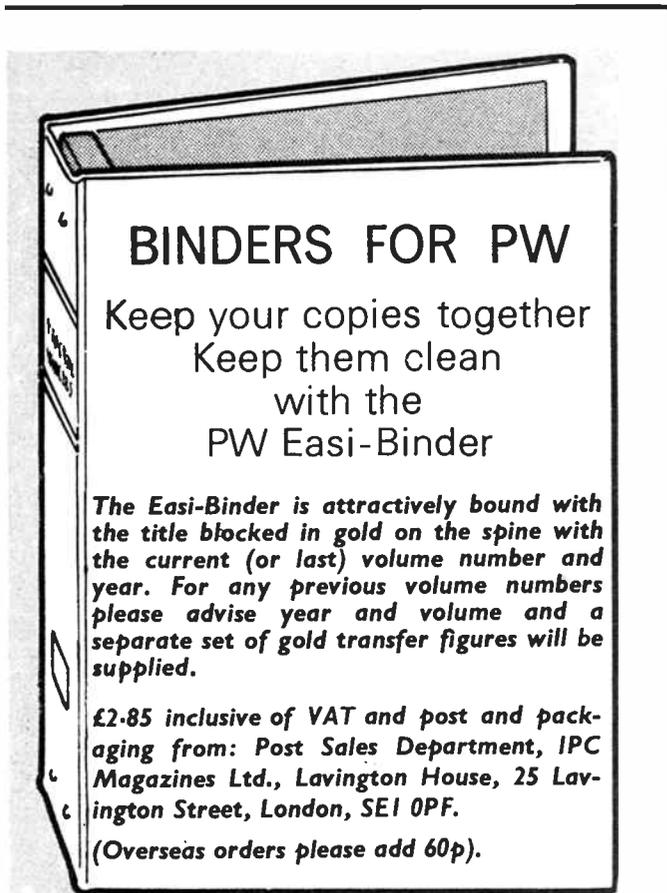
John Smith is experimenting with a receiver to record the bursts of radio noise which come from Jupiter between 20 and 30MHz. So far he has built a pair of 4 half-wave dipoles on a 300 metre baseline, the signals being fed to an FRG-7 followed by a d.c. amplifier to drive a pen recorder. John is also working on a microprocessor, based on the SC/MP chip, to drive his 30ft dish which he intends to use for astronomical observations at 1420MHz.

Satellites

As a result of John Branegan's article about 70cm propagation from satellites, published in the quarterly journal of AMSAT-USA, he has been busy answering letters, one of which came from JR1SWB, editor of the Japanese *OSCAR NEWS*. John is pleased to do this and play his part in the international co-operation of the OSCAR project. His talk on satellites to the Mid-Lankark ARS was well received. Recently, John's first QSL card arrived from OK3CDI for a contact through the Russian satellite, RS-1 and another card from W4AXR, Florida, confirming his best DX to date, 4300 miles, via OSCAR 7B. So far, John has had nearly 50 satellite QSOs with W2BXA who was the first amateur to work 100 countries via satellite and the one who helped John through his first transatlantic QSO via OSCAR.

Tropospheric

The predominantly poor weather conditions and the low atmospheric pressure between March 19 and April 12 gave little help to the v.h.f. enthusiast, in fact at midnight on March 27 it was 29.1in and only just reached 30.1in for a few hours on the 23rd, when a brief improvement in conditions took place. Suddenly, on Good Friday, April 13, the weather turned warmer, the pressure began to rise and by midday on Easter Sunday it was 30.2in and rising. At 2200 on March 23, Alan Baker heard DB5KGI and PA3ALK on 2m s.s.b. and at 2320, ON6CP on c.w. At 1931 on April 13, Alan had a difficult QSO with F3CF, Lille, and heard G3BDQ in nearby Hastings working a German station on 2m s.s.b. Later, Alan, from his home in east-Sussex, worked stations in Bedfordshire, Hampshire and Kent, via the London repeater GB3LO, R7. At 0853 on the 15th, I heard a QSO between GB2RN, HMS Belfast, London and G4EVI, Yeovil, Somerset, via the



BINDERS FOR PW
Keep your copies together
Keep them clean
with the
PW Easi-Binder

The Easi-Binder is attractively bound with the title blocked in gold on the spine with the current (or last) volume number and year. For any previous volume numbers please advise year and volume and a separate set of gold transfer figures will be supplied.

£2.85 inclusive of VAT and post and packaging from: Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London, SE1 0PF.
(Overseas orders please add 60p).

Hampshire repeater GB3SN, R5 and both stations were saying that they had not heard SN so strong for a long time.

Around 0730 on the 16th, I heard signals through GB3BC on R6, received a picture from Lichfield on Ch. 8, (189MHz) and noted some continental interference to the BBC stations in Band II. During the day **Barry Ainsworth G4GPW**, Sompting, Sussex and **Roy Bannister G4GPX**, in nearby Lancing, had a QSO via the French repeater FZ2THF on R9 and around 1530, G4GNX worked DJ0JW/A and DL0GO, who were both at their club station, DD8EE and using 4 × 21-element beams on 2m s.s.b.

DX Television

On April 1, **Andrew Coetzee**, one of my readers in Transvaal, SA received Ch.1 BBC TV, 45MHz on his KB receiver with a dipole aerial. Although the vision was only good enough to make out the figures, the sound was very strong. Congratulations are also due to Andrew, who has passed his amateur exams, and now has a restricted licence, callsign ZR6QP.

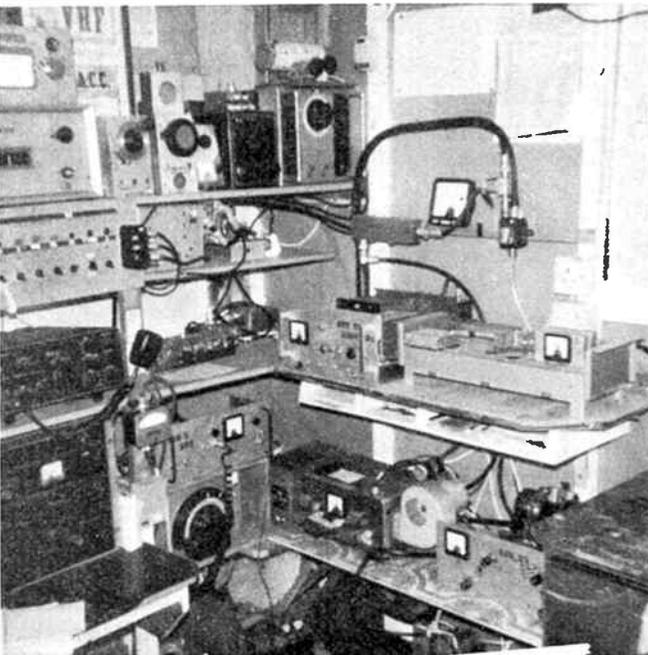
**PLEASE MENTION
PRACTICAL WIRELESS
WHEN REPLYING
TO ADVERTISEMENTS**

VHF PERSONALITY



JOHN TYE

by RON HAM



Part of John Tye's shack, on the right is home constructed equipment for 13 and 23cm

John Tye's interest in radio began around 1940 when, at the age of 14, he assisted with the servicing of broadcast receivers. His fascination for communications was fostered through listening to the short-wave bands on the government surplus receivers, R107 and R1155, which became available soon after the war. Later he joined the RSGB and, as BRS 27622, expanded his listening activities, with home-brew equipment, into the v.h.f. bands. John passed the RAE in May 1968 and, although he was soon active on 2m as G8BYV, his mind was set on building gear and experimenting on the centimetric bands. He passed the Morse test in 1973, and was then granted the callsign G4BYV.

John's signals have been heard in many European Countries on 70, 23 and 13cm from his home in Dereham, Norfolk and in September 1976 he earned the No. 1, Four Metres and Down, Microwave award from the RSGB for a contact of 883km on 1.3GHz with SK6AB. By the end of that year, he had achieved enough confirmed QSOs to qualify for the Society's 23cm award and the 70cm Senior award. One of John's overseas honours came in October 1973 when he received the Mirabel II certificate for sending a tape recording of Mirabel's 1296MHz beacon to F2LM. Mirabel II was a transponder with an up and down link on 144-432MHz, and a beacon on 23cm. It was launched from Nancy, France, by balloon and descended by parachute.

John's present aerial array, consisting of a 13-element Yagi for 70cm, an 8-element Yagi for 2m and separate 4ft dishes for 23cm and 9/13cm, is mounted on a tower which can be raised if required. For almost 30 years, John, a carpenter by trade, has been a reader of *Practical Wireless* and is supported in his amateur radio activities by his wife, Joan, who enjoys listening to the h.f. bands when driving their car. For the future, John plans to stay on the centimetric bands, use s.s.b. on 9cm and develop gear for 6cm.

RSC 100 WATT DISCO SYSTEM



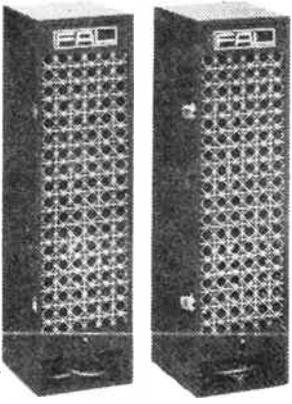
Consisting of
 (1) TWIN T/TABLE CONSOLE with PRE-AMP. and POWER OUTPUT STAGES (2) & (3) PAIR 50 WATT LOUOSPEAKERS including 12" UNITS and H.F. HORNS Model T50H £49.99 ea.

SAVE £40
£199.95

- * DISCOMAJOR POWER DISCO CONSOLE Mk.II with integral Power Amplifier £149.98.
- * TWIN FULL SIZE turntables with cueing device.
- * CARTRIDGES with Diamond Styl.
- * SEPARATE VOLUME CONTROLS for each turntable and Mic.
- * CONSOLE COMPLETE WITH L.I.D. FULL HEADPHONE MONITORING FACILITIES.

TERMS FOR SYSTEM
 Dep. £29.95 and 38 weekly payments £5.33 (Total £232.49)

DECOR LIGHT BOXES
 Standard Pair. List Price £58.32
 Total 6 lamps. Size 31" x 8 3/8" x 9" each half.



LIGHTING SYSTEM 'A'
 3 units complete with connecting leads
£89.95

or Deposit £9.95 and 38 weekly payments £2.48 Total £104.19 Carr. £3



List Price **£39.95**

AUTOMATIC RHYTHMLIGHT
 3-channel sound-to-light converter. Features separate channels for multicolour sequence light actuated from the bass, middle and treble frequencies of your sound system. Operates from L.S. outlet of amplifier. 750 watts capacity per channel. Total cost of above units normally **£98.27**

DISCO MODULES Make your own console
CONTROL UNIT (mains powered)



Vol. (left) Vol. (Right) Tape input and volume control. Bass, Treble, ON/OFF switch for each Table. **£25.00** Carr. £1

MONITOR UNIT With H/Phone Socket and Vol. Control Carr. Free. **£7.95**

FADER UNIT Carr. Free **£7.95**

100w OUTPUT UNIT Mains powered Carr. £1.50 **£29.95**

TITAN GROUP/DISCO SPKRS

	Value	RSC Price
T12/45R 12" 45w	£18.00	£13.95
T12/60R 12" 60w	£22.50	£16.95
T12/100 12" 100w	£36.00	£25.95
T15/70 15" 70w	£28.00	£19.95
T15/100 15" 100w	£41.00	£29.95
T18/100 18" 100w	£51.00	£39.95

Carr. £1-20, under £18, over this add 6p per £1.

ALL RSC PRICES INCLUDE VAT



Barclaycard & Access
 PHONE ORDERS quoting CARD NUMBER accepted

OPEN ALL DAY SATS (5 Day Week)
BRADFORD 10 North Parade (Closed Wed.) Tel. 25349
BIRMINGHAM 30/31 Great Western Arcade (Closed Wed.) Tel. 021-236 1279
CARLISLE 8 English Street (Closed Thurs.) Tel. 38744
COVENTRY 17 Shelton Sq. The Precinct (Closed Thurs.) Tel. 25983
DERBY 97 St. Peter's Street (Closed Wed.) Tel. 41361
DEWSBURY 9/11 Kingsway (Closed Tues.) Tel. 468058
DONCASTER 3 Queensgate, Waterdale Centre (Closed Thurs.) Tel. 63069
EDINBURGH 101 Lothian Rd. (Closed Wed.) Tel. 229 9501
GLASGOW 403 Sauchiehall Street Tel. 041-332 0700
HULL 7 Whitefriargate (Closed Thurs.) Tel. 20505
LEICESTER 32 High Street (Closed Thurs.) Tel. 56420
LONDON 238 Edgware Road, W/2 (Closed Thurs.) Tel. 723 1629

- MAIL ORDERS & EXPORT ENQUIRIES TO—**
 AUDIO HOME, HENCONNER LANE, LEEOS. 13. Tel. 0532 577631.
 MAIL ORDERS MUST NOT BE SENT TO SHOPS
- ★ LEEOS** 16-18 County (Mecca) Arcade, Briggate (Closed Wed.) Tel. 449609
 - ★ LIVERPOOL** 35 Dawson Way, St. John's Precinct (Closed Wed.) Tel. 708 9380
 - MIDDLESBROUGH** 103 Linthorpe Rd. (Cl. Wed.) Tel. 247096
 - ★ NEWCASTLE UPON TYNE** 59 Grainger St. (Closed Wed.) Tel. 21469
 - NOTTINGHAM** 19/19A Market Street (Closed Thurs.) Tel. 48068
 - SHEFFIELD** 13 Exchange Street (Castle Mkt. Blds.) (Closed Thurs.) Tel. 20716
 - ★ WOLVERHAMPTON** 6 Wulfrun Way (Closed Thurs.) Tel. 26612
 - ★ MUSICAL INSTRUMENTS & ACCESSORIES** in stock at these branches

TTLS BY TEXAS				LINEAR I.C.s				TRANSISTORS				DIODES			
7400 13p	7401 14p	7402 14p	7403 14p	74C157 250p	74C160 155p	74C161 155p	74C162 155p	AC127/8 20p	BFY51/2 22p	BFY56 33p	BFY80 90p	2N3866 90p	2N3903/4 18p	2N3905/6 20p	2N4039 65p
7404 14p	7405 14p	7406 14p	7407 14p	74C163 155p	74C164 155p	74C165 155p	74C166 155p	AD101/2 45p	BFY83 70p	BFY93 70p	BFY99 70p	2N4048 12p	2N4058/9 12p	2N4060 12p	2N4061/2 12p
7408 14p	7409 14p	7410 14p	7411 14p	74C167 155p	74C168 155p	74C169 155p	74C170 155p	AD107/8 11p	BFY99 70p	BFY99 70p	BFY99 70p	2N4062 12p	2N4063 12p	2N4064 12p	2N4065 12p
7412 14p	7413 14p	7414 14p	7415 14p	74C171 155p	74C172 155p	74C173 155p	74C174 155p	BC147/8 11p	BU109 11p	BU109 11p	BU109 11p	2N4066 12p	2N4067 12p	2N4068 12p	2N4069 12p
7416 14p	7417 14p	7418 14p	7419 14p	74C175 210p	74C176 210p	74C177 210p	74C178 210p	BC149 11p	BU109 11p	BU109 11p	BU109 11p	2N4070 12p	2N4071 12p	2N4072 12p	2N4073 12p
7420 14p	7421 14p	7422 14p	7423 14p	74C179 210p	74C180 210p	74C181 210p	74C182 210p	BC151 11p	BU109 11p	BU109 11p	BU109 11p	2N4074 12p	2N4075 12p	2N4076 12p	2N4077 12p
7424 14p	7425 14p	7426 14p	7427 14p	74C183 210p	74C184 210p	74C185 210p	74C186 210p	BC157/8 10p	BU109 11p	BU109 11p	BU109 11p	2N4078 12p	2N4079 12p	2N4080 12p	2N4081 12p
7428 14p	7429 14p	7430 14p	7431 14p	74C187 210p	74C188 210p	74C189 210p	74C190 210p	BC159 11p	BU109 11p	BU109 11p	BU109 11p	2N4082 12p	2N4083 12p	2N4084 12p	2N4085 12p
7432 14p	7433 14p	7434 14p	7435 14p	74C191 210p	74C192 210p	74C193 210p	74C194 210p	BC169C 12p	BU109 11p	BU109 11p	BU109 11p	2N4086 12p	2N4087 12p	2N4088 12p	2N4089 12p
7436 14p	7437 14p	7438 14p	7439 14p	74C195 110p	74C196 110p	74C197 110p	74C198 110p	BC171 12p	BU109 11p	BU109 11p	BU109 11p	2N4090 12p	2N4091 12p	2N4092 12p	2N4093 12p
7440 14p	7441 14p	7442 14p	7443 14p	74C199 110p	74C200 110p	74C201 110p	74C202 110p	BC172 12p	BU109 11p	BU109 11p	BU109 11p	2N4094 12p	2N4095 12p	2N4096 12p	2N4097 12p
7444 14p	7445 14p	7446 14p	7447 14p	74C203 110p	74C204 110p	74C205 110p	74C206 110p	BC177/8 17p	BU109 11p	BU109 11p	BU109 11p	2N4098 12p	2N4099 12p	2N4100 12p	2N4101 12p
7448 14p	7449 14p	7450 14p	7451 14p	74C207 110p	74C208 110p	74C209 110p	74C210 110p	BC179 10p	BU109 11p	BU109 11p	BU109 11p	2N4102 12p	2N4103 12p	2N4104 12p	2N4105 12p
7452 14p	7453 14p	7454 14p	7455 14p	74C211 110p	74C212 110p	74C213 110p	74C214 110p	BC181 11p	BU109 11p	BU109 11p	BU109 11p	2N4106 12p	2N4107 12p	2N4108 12p	2N4109 12p
7456 14p	7457 14p	7458 14p	7459 14p	74C215 110p	74C216 110p	74C217 110p	74C218 110p	BC182/3 10p	BU109 11p	BU109 11p	BU109 11p	2N4110 12p	2N4111 12p	2N4112 12p	2N4113 12p
7460 14p	7461 14p	7462 14p	7463 14p	74C219 110p	74C220 110p	74C221 110p	74C222 110p	BC184 11p	BU109 11p	BU109 11p	BU109 11p	2N4114 12p	2N4115 12p	2N4116 12p	2N4117 12p
7464 14p	7465 14p	7466 14p	7467 14p	74C223 110p	74C224 110p	74C225 110p	74C226 110p	BC187 10p	BU109 11p	BU109 11p	BU109 11p	2N4118 12p	2N4119 12p	2N4120 12p	2N4121 12p
7468 14p	7469 14p	7470 14p	7471 14p	74C227 110p	74C228 110p	74C229 110p	74C230 110p	BC212/3 11p	BU109 11p	BU109 11p	BU109 11p	2N4122 12p	2N4123 12p	2N4124 12p	2N4125 12p
7472 14p	7473 14p	7474 14p	7475 14p	74C231 110p	74C232 110p	74C233 110p	74C234 110p	BC214 12p	BU109 11p	BU109 11p	BU109 11p	2N4126 12p	2N4127 12p	2N4128 12p	2N4129 12p
7476 14p	7477 14p	7478 14p	7479 14p	74C235 110p	74C236 110p	74C237 110p	74C238 110p	BC215 11p	BU109 11p	BU109 11p	BU109 11p	2N4130 12p	2N4131 12p	2N4132 12p	2N4133 12p
7480 14p	7481 14p	7482 14p	7483 14p	74C239 110p	74C240 110p	74C241 110p	74C242 110p	BC217 11p	BU109 11p	BU109 11p	BU109 11p	2N4134 12p	2N4135 12p	2N4136 12p	2N4137 12p
7484 14p	7485 14p	7486 14p	7487 14p	74C243 110p	74C244 110p	74C245 110p	74C246 110p	BC218 11p	BU109 11p	BU109 11p	BU109 11p	2N4138 12p	2N4139 12p	2N4140 12p	2N4141 12p
7488 14p	7489 14p	7490 14p	7491 14p	74C247 110p	74C248 110p	74C249 110p	74C250 110p	BC219 10p	BU109 11p	BU109 11p	BU109 11p	2N4142 12p	2N4143 12p	2N4144 12p	2N4145 12p
7492 14p	7493 14p	7494 14p	7495 14p	74C251 110p	74C252 110p	74C253 110p	74C254 110p	BC221 11p	BU109 11p	BU109 11p	BU109 11p	2N4146 12p	2N4147 12p	2N4148 12p	2N4149 12p
7496 14p	7497 14p	7498 14p	7499 14p	74C255 110p	74C256 110p	74C257 110p	74C258 110p	BC223 11p	BU109 11p	BU109 11p	BU109 11p	2N4150 12p	2N4151 12p	2N4152 12p	2N4153 12p
7500 14p	7501 14p	7502 14p	7503 14p	75C01 110p	75C02 110p	75C03 110p	75C04 110p	BC224 11p	BU109 11p	BU109 11p	BU109 11p	2N4154 12p	2N4155 12p	2N4156 12p	2N4157 12p
7504 14p	7505 14p	7506 14p	7507 14p	75C05 110p	75C06 110p	75C07 110p	75C08 110p	BC225 11p	BU109 11p	BU109 11p	BU109 11p	2N4158 12p	2N4159 12p	2N4160 12p	2N4161 12p
7508 14p	7509 14p	7510 14p	7511 14p	75C09 110p	75C10 110p	75C11 110p	75C12 110p	BC226 11p	BU109 11p	BU109 11p	BU109 11p	2N4162 12p	2N4163 12p	2N4164 12p	2N4165 12p
7512 14p	7513 14p	7514 14p	7515 14p	75C13 110p	75C14 110p	75C15 110p	75C16 110p	BC227 11p	BU109 11p	BU109 11p	BU109 11p	2N4166 12p	2N4167 12p	2N4168 12p	2N4169 12p
7516 14p	7517 14p	7518 14p	7519 14p	75C17 110p	75C18 110p	75C19 110p	75C20 110p	BC228 11p	BU109 11p	BU109 11p	BU109 11p	2N4170 12p	2N4171 12p	2N4172 12p	2N4173 12p
7520 14p	7521 14p	7522 14p	7523 14p	75C21 110p	75C22 110p	75C23 110p	75C24 110p	BC229 11p	BU109 11p	BU109 11p	BU109 11p	2N4174 12p	2N4175 12p	2N4176 12p	2N4177 12p
7524 14p	7525 14p	7526 14p	7527 14p	75C25 110p	75C26 110p	75C27 110p	75C28 110p	BC230 11p	BU109 11p	BU109 11p	BU109 11p	2N4178 12p	2N4179 12p	2N4180 12p	2N4181 12p
7528 14p	7529 14p	7530 14p	7531 14p	75C29 110p	75C30 110p	75C31 110p	75C32 110p	BC231 11p	BU109 11p	BU109 11p	BU109 11p	2N4182 12p	2N4183 12p	2N4184 12p	2N4185 12p
7532 14p	7533 14p	7534 14p	7535 14p	75C33 110p	75C34 110p	75C35 110p	75C36 110p	BC232 11p	BU109 11p	BU109 11p	BU109 11p	2N4186 12p	2N4187 12p	2N4188 12p	2N4189 12p
7536 14p	7537 14p	7538 14p	7539 14p	75C37 110p	75C38 110p	75C39 110p	75C40 110p	BC233 11p	BU109 11p	BU109 11p	BU109 11p	2N4190 12p	2N4191 12p	2N4192 12p	2N4193 12p
7540 14p	7541 14p	7542 14p	7543 14p	75C41 110p	75C42 110p	75C43 110p	75C44 110p	BC234 11p	BU109 11p	BU109 11p	BU109 11p	2N4194 12p	2N4195 12p	2N4196 12p	2N4197 12p
7544 14p	7545 14p	7546 14p	7547 14p	75C45 110p	75C46 110p	75C47 110p	75C48 110p	BC235 11p	BU109 11p	BU109 11p	BU109 11p	2N4198 12p	2N4199 12p	2N4200 12p	2N4201 12p
7548 14p	7549 14p	7550 14p	7551 14p	75C49 110p	75C50 110p	75C51 110p	75C52 110p	BC236 11p	BU109 11p	BU109 11p	BU109 11p	2N4202 12p	2N4203 12p	2N4204 12p	2N4205 12p
7552 14p	7553 14p	7554 14p	7555 14p	75C53 110p	75C54 110p	75C55 110p	75C56 110p	BC237 11p	BU109 11p	BU109 11p	BU109 11p	2N4206 12p	2N4207 12p	2N4208 12p	2N4209 12p
7556 14p	7557 14p	7558 14p	7559 14p	75C57 110p	75C58 110p	75C59 110p	75C60 110p	BC238 11p	BU109						

TRANSMITTER RECEIVER MK. 123 very compact Army unit for use in range 2.5 to 20 Mc/s receiver section 7 valves inc RF stage & BFO provides O/P for 4 K phones 3 bands with direct cal 2.5 to 5, 5 to 10 & 10 to 20Mc/s. Tx section 2.5 to 20Mc/s in 3 ranges O/P 15/25 watts over range C.W. only as crystal osc & 5B254 P.A. will match into the following loads 25, 100, 500 & 1500 ohm as int tune up meter, reqs crystals type FT2543 in range 2.5 to 10 as int morser key with plug for ext key as int mains P.U. for 110/200/250v overhaul size 30x9x14cm weight 4kg also supplied with ext inverter unit for use on 12v DC. Supplied in clean condition with 80 page handbook inc circs etc. Price £54.

CABLE FAULT LOCATORS standard mains operated unit contains CRT type DG7-5 2½" 16 valves plus 2 Rect, slow motion dial, large number of misc parts in transit container £25.

CONTROL BOX aircraft radio sel box contains 4 min 1p c/o & 3 2p c/o miniature toggle swts, 2 small amp units etc £2.30 ea or 2 for £4.

AERIALS special purpose blade aerials precision made with BNC skat base, length 6½ or 10" from top of base £1.75 either type.

AERIAL dipole overhaul length 50½" with centre moulded fairing 2½" dia with BNC sk conn these contain int loading transformer were used on 20/50Mc/s or if this is removed can be used on nom 125Mc/s £2 ea or 2 for £3.50.

BLOWERS heavy duty single ended for use on 230/250v AC outlet 2½x3½" fix flange 5" sq req ext cond 2uf new boxed £10.80.

VARIAC UNITS for use on 180 v 500c/s dual gang rated 15 amps per section these can be used on 50c/s if the I/P voltage is limited to 50, these can be used to provide var O/P from L.V. trans or across 200/250v taps of H.D. trans to provide var O/P good cond with knob £13.

HELIPOT DIALS standard 10tr type to fit 3/8th bush approx 1½" dia £1.50 ea or 10 for £12.50 with 100K kelpot £2.

SLOW MOTION DRIVES 9:1 with ¼" shaft with knob & skirt also 2.5 or 25K 360' pot ex new equip £2.30.

PANEL METER edgewise type FSD 100-0-100 Ua scale 100-0-100 size front 2½x5/8th 3½" deep new £2.75.

U.H.F. T.V. tuners manual tuned type transis with circ new £2.50.

PHOTO TRANSIS type FPT120 end viewing high sensitivity with data new 60 p ea 2 for £1.

PANEL METERS assorted types mostly ¾" dia types all moving coil new 4 different for £4.

TEST SET DEVIATION freq 65 to 75Mc/s with int crystal check at 70Mc/s, as 1 Ma meter, slow motion dial ass, atten etc no details thought to be part of Microwave Link test equip 200/250v I/P good cond £17.

DYNAMOTORS small American pattern I/P 24v DC o/p 250v at 60Ma suit command sets good cond £3.50.

RECTIFIER UNITS ex Army unit 200/250v I/P as dual DC O/Ps of 12v at 3 amps can be connected for 12v 6a or 24v 3a will do 4 amps okay for battery chargers in steel case good cond with circ £10.80.

AUDIBLE WARNING DEVICE 1½" dia will work on 6/12v DC solid state gives tone about 800c/s takes 100Ma at 12v new £1 ea 2 for £1.70 or 10 for £7.50.

FILM RECORDERS special aircraft 16mm film recorders for use on 24v DC with cassette good cond in transit container £16.

FANS extractor type fans for 230v 50c/s Adm Patt cont rated mounting flange 7x8" with front guard 7" deep. new boxed £7.50.

TEST SET contains meter 5-0-5 Ua scale linear 5-0-5 3" dia complete in neat carrying case size 10x8x7½" good cond meter tested £8.50.

DOME BELLS 11½" dia 6" deep chrome with red base American made these are spring powered with solenoid control were used for supply failure warning, will adapt to most control voltages will ring when supply removed, new some blemishes due to storage £25.

METER UNIT 0 to 40 amps DC with shunt 2" dia m.c. flush mt new £3.

MANUALS & CIRCUIT DIAGRAMS we can supply these for ex M.O.D. equipments, test gear etc.

Above prices include Carriage & VAT.
Goods ex equipment unless stated new.
S.A.E. for List 22 or enquiry.

A. H. SUPPLIES

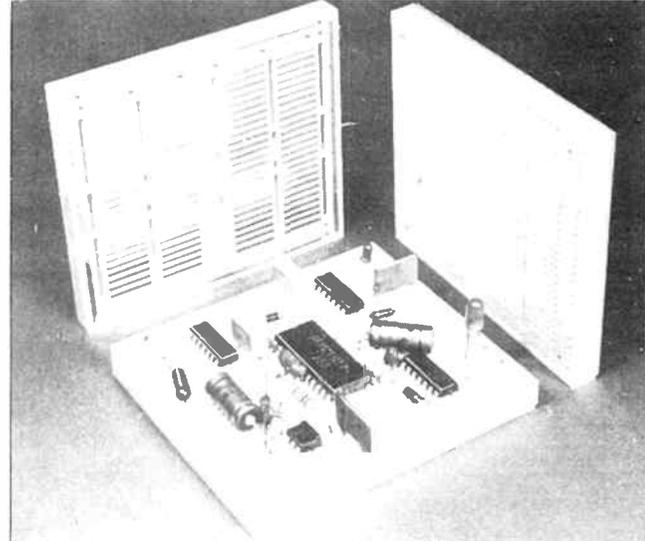
122, HANDSWORTH RD. SHEFFIELD S9 4AE

Phone: 444278 (0742)

THE NEW EUROSOLDERSUCKER

This 195mm long, all metal, high suction, desoldering tool with replaceable Teflon tip enables removal of molten solder from all sizes of pcb pads. Primed and released by thumb, it incorporates an anti-recoil system and built in safety guard. Only £6.80 inc. VAT & P.P.

THE UNIQUE EUROBREADBOARD



Logically laid out to accept both 0.3" and 0.6" pitch DIL packages as well as Capacitors, Resistors, LED's, Transistors and components with leads up to .85mm dia.

500 individual connections in the central breadboarding area, spaced to accept all sizes of DIL package without running out of connection points, plus 4 Integral Power Bus Strips around all edges for minimum inter-connection lengths.

All connection rows and columns are now numbered or lettered enabling exact location indexing.

Double-sided nickel silver contacts for long life (10K insertions) and low contact resistance (< 10m. ohms).

Easily removable, non-slip rubber backing allows damaged contacts to be rapidly replaced.

No other breadboard has as many individual contacts, offers all these features and costs only £5.80 each or £11.00 for 2 - inclusive of VAT and P P

Snip out and Post

David George Sales, r/o 74 Crayford High St., Crayford, Kent DA1 4EF

David George Sales
r/o 74 Crayford High Street,
Crayford, Kent, DA1 4EF.

PW779

Please send me 1 EuroSolderSucker @ £6.80 Please
 or 1 EuroBreadBoard @ £5.80 Tick
 or 2 EuroBreadBoards @ £11.00

(All prices include VAT and P.P., but add 15% for overseas orders).

Name

Company

Address

.....

.....

Tel. No

Please make cheque/P.O.'s payable to David George Sales

TOTAL AMPLIFICATION FROM CRIMSON ELEKTRIK

— WE NOW OFFER THE WIDEST RANGE OF SOUND PRODUCTS —

STEREO PRE-AMPLIFIERS



MC 1

CPR 1

CPR 1—THE ADVANCED PRE-AMPLIFIER

The best pre-amplifier in the U.K. The superiority of the CPR 1 is probably in the disc stage. The overload margin is a superb 40dB, this together with the high slew rate ensures clean top, even with high output cartridges tracking heavily modulated records. Common-mode distortion is eliminated by an unusual design. R.I.A.A. is accurate to 1dB; signal to noise ratio is 70dB relative to 3.5mV; distortion < .005% at 30dB overload 20kHz. Following this stage is the flat gain/balance stage to bring tape, tuner, etc. up to power amp. signal levels. Signal to noise ratio 85dB; slew-rate 3V/μS; T.H.D. 20Hz—20kHz < .008% at any level. F.E.T. muting. No controls are fitted. There is no provision for tone controls. CPR 1 size is 136 × 80 × 20mm. Supply to be ± 15 volts.

MC 1—PRE-PRE-AMPLIFIER

Suitable for nearly all moving-coil cartridges. Send for details.

X02 : X03 — ACTIVE CROSSOVERS

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

REG 1—POWER SUPPLY

The regulator module, REG 1 provides 15.0-15v to power the CPR 1 and MC 1. It can be used with any of our power amp supplies or our small transformer TR 6. The power amp kit will accommodate it.

POWER AMPLIFIERS

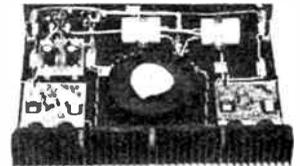
It would be pointless to list in so small a space the number of recording studios, educational and government establishments, etc. who have been using CRIMSON amps satisfactorily for quite some time. We have a reputation for the highest quality at the lowest prices. The power amp is available in five types, they all have the same specification: T.H.D. typically .01% any power 1kHz 8 ohms; T.I.D. insignificant; slew rate limit 25V/μS; signal to noise ratio 110dB; frequency response 10Hz-35kHz. —3dB; stability unconditional; protection—drives any load safely; sensitivity 775mV (250mV or 100mV on request); size 120 × 80 × 25mm.

POWER SUPPLIES

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

POWER AMPLIFIER KIT

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



ACTIVE CROSSOVERS

X02 £14-83 X03 £23-06

POWER AMPLIFIER MODULES

CE 608 50W/8 ohms 35-0-35v £18 30

CE 1004 100W/4 ohms 35-0-35v £10 22

CE 1008 100W/8 ohms 45-0-45v £23 22

CE 1704 170W/4 ohms 45-0-45v £29 12

CE 1708 170W/8 ohms 60-0-60v £31 90

TOROIDAL POWER SUPPLIES

CPS1 for 2 CE 608 or 1 X CE 1004 £14 47

CPS2 for 2 CE 1004 or 214 £16 82

CPS3 for 2 CE 1008 or 1704 £17 66

CPS4 for 1 CE 1008 £15 31

CPS5 for 1 CE 1708 £22 88

CPS6 for 2 CE 1704 or 2 CE 1708 £23 88

HEATSINKS

Light duty, 50mm, 2°C/W £1 30

Medium power, 100mm, 1 4°C/W £2 20

Disco/group, 150mm, 1 1°C/W £2 85

Fan, 80mm, static 120 or 240v £18 50

Fan mounted on two drilled 100mm heatsinks, 2 - 4°C/W, 65°C max. with two 170W modules. £29 16

THERMAL CUT-OUT, 70°C £1 38

POWER AMP KIT

£32 46

PRE-AMPS:

These are available in two versions—one uses standard components, and the other (the S) uses MO resistors where necessary and tantalum capacitors.

CPRI £29 49

CPRIIS £39 98

MC1 £18 59

MCIS £29 49

POWER SUPPLY

REG1 £8 75

TR8 £1 75

BRIDGE DRIVER, BDI

Obtain up to 340W using 2 × 170W amps and this module BDI £5 48

CRIMSON ELEKTRIK

1A STAMFORD STREET,

LEICESTER, LE1 6NL

Tel: (0533) 537722

U.K.—please allow up to 21 days for delivery.

All prices shown are UK only and include VAT and post. COD 90p extra, £100 limit. Export is no problem, please write for specific quote. Send large SAE or 3 International Reply Coupons for detailed information.

Distributor:—

"MINIC TELEPRODUKTER
BOX 12035 S-750 12
UPPSALA 12, SWEDEN"

ELECTROVALUE

Your leading direct suppliers for



**NASCOM MICROCOMPUTERS
AND FULL SUPPORTING RANGE
OF ITEMS TO ENABLE YOU TO
WORK AT PROPER
PROFESSIONAL LEVELS**

- ★ At newest reduced prices.
- ★ Widest possible range stocked
- ★ Information on request
- ★ Enquiries from trade, industrial and educational users invited

Appointed distributors for the fine products of:

**SIEMENS, ISKRA, RADIOHM,
VERO AND MANY OTHER
FAMOUS MANUFACTURERS**

It's a good deal better from

ELECTROVALUE LTD

Dept. PW7, 28 St. Judes Road, Englefield Green, Egham, Surrey TW20 0HB.

Phone: Egham 3603. Telex 264475.

Northern Branch (Personal shoppers only), 680 Burnage Lane,

Burnage, Manchester M19 1NA. Phone (061) 432 4945.

- We pay postage

in U.K. on orders list value £5 or over. If under add 27p handling charge

- We give discounts

on C.W.O. orders except items marked Net or N in our catalogues

5% on orders, list value £10 or more

10% on orders list value £25 or more.

Not on Access or Barclay orders

- We stabilise prices.

by keeping to our printed price lists which appear but three or four times a year.

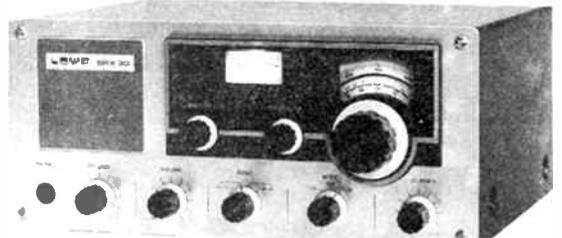
- We guarantee

all products brand new clean and to maker's spec. No seconds, no surplus.

- WE WILL SEND YOU OUR 120-PAGE CATALOGUE No. 9 FREE ON REQUEST.

Comprehensive informative very well produced. Write phone or call for your free copy together with latest price list.

OPEN UP THE EXCITING WORLD OF SHORT WAVE LISTENING



SRX-30

For the advanced, keen short wave listener, the choice of receiver has usually been between cheap and nasty or very good but very expensive equipment. We think that the SRX-30 will provide that listener with excellent performance at a reasonable cost and is the answer to this eternal problem. The SRX-30 is based on an advanced drift cancelling loop system which gives spot on dial accuracy at any frequency between 500 KHz and 30 MHz together with easy to understand frequency readout. Suitable for all users from raw beginners, thanks to its simplicity of operation; to experienced listeners and amateur operators thanks to its advanced technology, the SRX-30 is the best communications receiver available in its price range today. Completely self contained, including operation from mains or 12 volts dc, the SRX-30 is at home on broadcast or amateur bands. All mode reception of AM, CW, USB, and LSB is provided and receiver selectivity is automatically switched to give optimum performance on any mode. Send for full details today or give us a ring and we'll tell you all about the SRX-30. Price £175 inc. vat. Carnage by Securicor £3.

NEW CL22.

NEW CL22 aerial tuner which will match almost any receiver to almost any aerial at any frequency between 1.5 and 30 MHz. Six switched ranges with fully tunable receiver and aerial matching capacitors. A worthwhile addition to any SWL station and an instant improvement in aerial matching problems. Price £16.41 inc. V.A.T., post and packing.

CHASSIS PUNCHES

A set of first class chassis punches in a fitted plastic case which also includes a most useful tapered reamer—and believe me, if you've never used a reamer, you are in for a pleasant surprise when you find how easy it is to make beautifully round holes of almost any size. There are five punches having diameters of 1.6, 1.8, 2.0, 2.8 and 3.0mm. Price £8.77 including V.A.T., post and packing.

Honest Counter:

FC-5M. I don't know where the name came from, since you can hardly have a dishonest frequency counter, but this really is an outstanding Amateur accessory.

It is a five digit frequency counter requiring 12V or 5V DC for power and reading up to 50 MHz. Additionally, the FC-5M has a minus 455 kHz offset which allows you to hang it on to the oscillator of your 9R59 (or whatever) receiver, and to have digital readout. (N.B. full details supplied free with each counter). Price £39.16, including V.A.T., post and packing.

For all that's good in Amateur Radio, contact: LOWE ELECTRONICS LTD., 119 Cavendish Road, Matlock, Derbyshire. Tel: 0629 2430 or 2817. For full catalogue, simply send 45p in stamps and request catalogue CPW.

P.W. JUMBO CLOCK

Kits of parts by the designers of the clock.

Kit A.

Comprising of printed circuit board. **Price £8.96.** V.A.T. and postage included.

Kit B.

Comprising of printed circuit board, case, perspex panel, pillars, transformer and i.e.d.s. **Price £22.72.** V.A.T. and postage included.

Kit C.

Comprising of full kit, excluding mains cable and wire. **Price £29.00.** V.A.T. and postage included.

Two colours of cases are available:- Gloss White & Simulated Black Leather Grain.

Please state colour with order e.g. Kit C/Black.

Full range of R.S. components available (48 hours service)

If you are experiencing difficulty in obtaining certain components for projects please do not hesitate to telephone us.

I.C.'s LM3900 & MC3302

£1.13 per pair Postage and package 20 pence.

V mos transistors. VN66AF

£1.30 each Postage and package 20 pence.

P.C.B'S FOR

PRACTICAL WIRELESS PROJECTS

Nov. 78.	Sarum Q Meter	R030	Price £3.30 & 20 pence p & p.
Nov. 78.	S.T.D. Charge Timer	AD212	Price £2.80 & 20 pence p & p.
Nov. 78.	Porch Light Timer	AD222	Price £0.60 & 12 pence p & p.
Nov. 78.	Battery Indicator	AD225	Price £0.60 & 12 pence p & p.
Dec. 78.	Car Radio L.W. Converter	R034	Price £2.35 & 15 pence p & p.
Dec. 78.	Digital Door Chimes	R017	Price £3.78 & 25 pence p & p.
Dec. 78.	Car Radio L.W. Converter	R032	Price £2.62 & 20 pence p & p.
Jan. 79.	Acoustic Delay Line	R018	Price £3.53 & 20 pence p & p.
Jan. 79.	Dorchester	R033	Price £10.80 & 30 pence p & p.
Jan. 79.	Sandbank Met. Det.	R035	Price £3.19 & 20 pence p & p.
Feb. 79.	Hythe Receiver	WR037	Price £5.94 & 20 pence p & p.
March 79.	Hythe Receiver	WR038	Price £2.70 & 20 pence p & p.
March 79.	Soudlite Converter	WK001	Price £5.98 & 20 pence p & p.
March 79.	Tone Burst Generator	R023	Price £1.60 & 15 pence p & p.
March 79.	Wide Band Noise Source	WR036	Price £0.70 & 12 pence p & p.
April 79.	PW 'Winton'	WR039	Price £15.42 & 30 pence p & p.
April 79.	FM Multitester	WR040	Price £2.70 & 15 pence p & p.
May 79.	Car Test Probe	WR042	Price £0.90 & 15 pence p & p.
May 79.	Follow up to PW Gillingham	WR044	Price £1.36 & 15 pence p & p.
May 79.	PW Imp	WR043	Price £1.42 & 15 pence p & p.
May 79.	Inline Crystal Calibrator	WR041	Price £1.58 & 15 pence p & p.
June 79.	Jumbo Clock		Price £8.66 & 30 pence p & p.
June 79.	Logical D's+X's	WR046/ 7/8/9	Price £12.00 & 30 pence p & p.
June 79.	Trent	WR050	Price £3.80 & 20 pence p & p.

All prices include V.A.T.

Send orders to:

C. BOWES & CO. LTD.,

4, WOOD STREET,

CHEADLE,

CHESHIRE SK8 1AQ.

Tel. 061-428-4497.

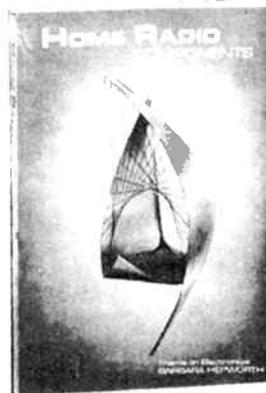
Please state type number and enclose cheque or postal order.

ASTRA-PAK

92 GODSTONE ROAD
WHYTELEAF SURREY CR3 0EB

All prices include V.A.T. Add 25p for P&P (Extra for overseas). Discounts over £10 less 5%, over £20 less 10%, over £50 less 15%, over £100 less 20%. Send SAE for complete list of components.

7400	74N74LSN	7484	0.80	74183	0.80	0.82	74368	0.52	20 pin	0.27
7401	0.12	7485	0.80	74184	0.80	1.20	74388	0.58	22 pin	0.28
7402	0.12	74N74LSN		74185	0.80		74390	1.92	24 pin	0.30
7403	0.12	7486	0.28	74186	0.80		74393	2.00	28 pin	0.44
7404	0.12	7488	1.50	74187	0.80		73670	2.30	40 pin	0.55
7405	0.13	7489	2.00	74167	2.70		LINEARS			
7406	0.28	7490	0.35	74169	2.10		CA3045	-14	0.46	
7407	0.28	7491	0.85	74170	1.80	1.94	CA3046	-14	0.70	
7408	0.14	7492	0.44	74172	4.00		LM3800	-14	0.82	
7408	0.14	7493	0.40	74173	1.18	1.12	LM3811	-14	1.20	
7408	0.14	7494	0.80	74174	0.89	1.12	LM7101	-14	0.32	
7409	0.14	7495	0.54	74175	0.88	1.12	LM7111	-14	0.32	
7410	0.13	7496	0.80	74S175	3.25		MC1310P	-14	1.50	
7411	0.18	7497	2.00	74176	0.80		NE555N	-8	0.30	
7412	0.21	74100	0.94	74177	0.82		NE556N	-14	0.65	
7413	0.25	74104	0.40	74178	1.20		NE501B	-14	2.00	
7414	0.54	74105	0.40	74179	1.10		SN72702N	0.50		
7415	0.21	74107	0.28	74180	0.80		SN75110N	0.50		
7416	0.27	74109	0.45	74181	1.75	3.38	SN76033N	1.85		
7417	0.27	74110	0.48	74182	0.75		SN76013N	1.35		
7420	0.13	74111	0.70	74S182	2.30		SN76023N	1.35		
7421	0.28	74112	0.40	74H183	0.89		SN76033N	1.85		
7422	0.17	74113	0.30	74184	1.20		TA45508	0.35		
7423	0.25	74114	0.40	74185A	1.20		TA8681B	1.40		
7425	0.20	74116	1.80	74186	2.20	0.43	TBA120S	0.84		
7426	0.25	74118	0.82	74188	2.70		TBA541A	1.88		
7427	0.26	74119	1.25	74189		3.80	TBA800	0.75		
7428	0.34	74120	0.82	74190	1.05	0.98	TBA810S	1.04		
7430	0.13	74121	0.25	74191	0.89	0.98	TCA270SD	2.00		
7430	0.30	74122	0.40	74192	0.89	1.50	TDA2020	3.20		
7432	0.24	74123	0.50	74193	1.05	1.50	ZN414	1.06		
7437	0.24	74124	1.25	74194	0.80	2.00	OP AMPS			
7438	0.24	74125	0.40	74195	0.84	1.40	CA3130	-T099	1.00	
7440	0.13	74126	0.45	74196	0.80	1.15	LM301A	-8	0.30	
7441	0.52	74128	0.82	74197	0.80	1.15	LM301A	-T099	0.48	
7442	0.55	74132	0.82	74198	1.48		LM348N	-14	1.00	
7443	0.90	74134	0.36	74199	1.48		LM709	-8	0.40	
7444	0.80	74135	0.88	74221	1.50	1.05	LM709	-14	0.42	
7445	0.70	74136	0.55	74247	0.80		LM709	-T099	0.50	
7446	0.70	74137	0.94	74248	0.85		LM741	-8	0.22	
7447A	0.80	74138	0.82	74249	0.85		LM741	-14	0.20	
7448	0.80	74139	0.82	74251	1.00	0.85	LM741	-T099	0.45	
7449	0.94	74141	0.58	74252	0.80		LM747	-14	0.70	
7450	0.13	74142	2.00	74257	1.12		LM3900N	0.50		
7451	0.13	74143	2.00	74258	1.15		MC1458P	-8	0.42	
7453	0.13	74144	2.00	74260	0.28		VOLTAIRE REG			
7454	0.13	74145	0.84	74261	3.25		LM300	-T099	1.00	
7455	0.28	74147	0.98	74268	0.43		LM309K	-T03	1.30	
7460	0.13	74148	1.15	74273	2.15	1.80	ua723	-14	0.40	
7470	0.28	74150	0.88	74279	1.25	0.56	7805	T0220	0.85	
7472	0.22	74151	0.80	74283	1.70	1.05	7812	T0220	0.85	
7473	0.28	74153	0.80	74284	0.85		7815	T0220	0.85	
7474	0.28	74154	1.00	74289	3.92		7816	T0220	0.85	
73574	0.50	74155	0.83	74290	0.85		7905	T0220	1.10	
7475	0.30	74156	0.82	74293	1.35	1.00	7912	T0220	1.10	
7476	0.28	74157	0.83	74298	1.82	1.40	7915	T0220	1.10	
7478	0.39	74158	0.82	74352	1.00		OIL SOCKETS			
7480	0.45	74159	1.70	74353	1.05	8 pin	0.11	4054	1.10	0.58
7481	0.80	74160	1.30	74355	0.82	14 pin	0.12	4055	2.30	0.58
7482	0.75	74161	0.80	74356	0.82	16 pin	0.13	4060	0.98	0.83
7483	0.72	74162	0.80	74367	0.48	18 pin	0.23	4066	0.48	0.53



EVERYBODY'S DOING IT!

Doing what? Sending for the latest Home Radio Catalogue. It's the most comprehensive components catalogue you can get. 128 pages, about 2,500 items listed, and profusely illustrated. Now only £1.25 with a free bargain list. Send your cheque or postal order now.

HOME RADIO COMPONENTS LTD.
Dept. PW, 234 London Road
Mitcham, Surrey CR4 3HD



ACE MAILTRONIX LTD
Dept. Pwv Tootal Street
Waterfield, W. Yorkshire WF1 5JR

TOPS THE PACK!

- COMPONENTS** — Now over 1,000 types in stock!
- KITS** — See the new range of low-cost 'ELEKITS'.
- SERVICE QUALITY** — 1st Class same day despatch.
- PRICES** — All guaranteed products.
- MAGAZINE PROJECTS** — Many reductions!
- S.A.E. for list of PW projects** — Trouble-free!

I enclose 30p*, please send catalogue.

Name _____
Address _____

* Refundable with future orders over £5.00.

LOOK!

Here's how you master electronics.

.... the practical way.

This new style course will enable anyone to have a real understanding by a modern, practical and visual method. No previous knowledge is required, no maths, and an absolute minimum of theory.

You learn the practical way in easy steps mastering all the essentials of your hobby or to further your career in electronics or as a self-employed electronics engineer.

All the training can be carried out in the comfort of your own home and at your own pace. A tutor is available to whom you can write, at any time, for advice or help during your work. A Certificate is given at the end of every course.

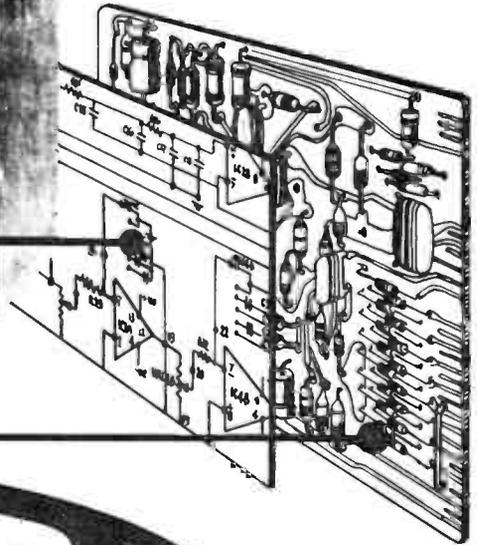
1. Build an oscilloscope.

As the first stage of your training, you actually build your own Cathode ray oscilloscope! This is no toy, but a test instrument that you will need not only for the course's practical experiments, but also for later if you decide to develop your knowledge and enter the profession. It remains your property and represents a very large saving over buying a similar piece of essential equipment.



2. Read, draw and understand circuit diagrams.

In a short time you will be able to read and draw circuit diagrams, understand the very fundamentals of television, radio, computers and countless other electronic devices and their servicing procedures.



3. Carry out over 40 experiments on basic circuits.

We show you how to conduct experiments on a wide variety of different circuits and turn the information gained into a working knowledge of testing, servicing and maintaining all types of electronic equipment, radio, t.v. etc.

4. Free Gift.

All students enrolling in our courses receive a free circuit board originating from a computer and containing many different components that can be used in experiments and provide an excellent example of current electronic practice.

FREE

Post now, without obligation, to:-

BRITISH NATIONAL RADIO & ELECTRONICS SCHOOL

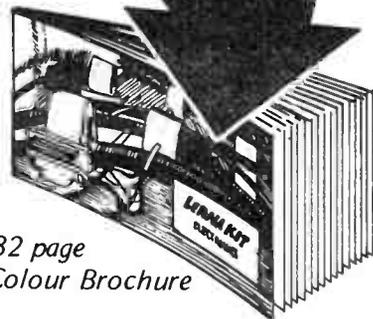
P.O. Box 156, Jersey, Channel Islands.

NAME _____

ADDRESS _____

Block caps please

WB7/79



32 page
Colour Brochure



NOTICE TO READERS

When replying to Classified Advertisements please ensure:

- That you have clearly stated your requirements.
- That you have enclosed the right remittance.
- That your name and address is written in block capitals, and
- That your letter is correctly addressed to the advertiser.

This will assist advertisers in processing and despatching orders with the minimum of delay.

Receivers and Components

AM/CW/SSB COMMUNICATION RECEIVER and preselector modules. 453 5 kHz Mech. Filter Modules 2 1 kHz BW, with diode-switching.

CRYSTALS Brand new high precision HC33/U: 1.0, 2.0, 3.0, 1.008, 2.5625 MHz £3-35, 1.28 MHz £4-15, HC13 100 kHz £3-25, HC18/U: 4.0, 5.0, 6.0, 7.0, 8.0, 10.0, 10.7 MHz £3-00, 18.0, 20.0, 38.6667, 48.0, 100.0, 116.0 MHz £3-50, HC25/U 8.08333 MHz (S20) £3-00. Large stocks of standard freqs for MPU etc. Any freq made to order 6 weeks from £3-75.

WINKLE PICKERS. Winkle out DX from the ORM with pin-sharp 250 Hz 8-pole crystal CW filters specially manufactured to fit TRIO and YAESU: FT/FR-101, FT-301, TS-520, TS-820. £28-90 each

All prices inc. VAT and UK post. SAE lists.

P. R. GOLLEDGE ELECTRONICS
G3EDW, Merritt, Somerset, TA16 5NS
Tel: 0480 73718

BRAND NEW COMPONENTS BY RETURN

Electrolytic Capacitors 16V, 25V, 50V. 0.47, 1.0, 2.2, 4.7, & 10 mfd. 5p. 22, 47, 51p. (50V-6p.), 100-7p. (50V-8p.) 220-8p. (50V-10p.), 470-11p. (50V-16p.) 1000/15V-18p. 1000/25V-18p. 1000/40V-35p.

Subminiature bead tantalum electrolytics. 0.1, 0.22, 0.47, 1.0, 35V, 4.7, 6.3V-5p. 2.2/35V & 4.7/25V-10p. 10/25V, 15/16V-14p. 22/16V, 33/10V, 47/6V, 68 & 100 & 3V-16p.

Mullard Miniature Ceramic E12 Series 63V 2%. 10 pf. to 47 pf.-3p. 56 pf. to 330 pf.-4p. **Vertical Mounting Ceramic Plate Caps 50V.** E12 22 pf.-1000 pf. E6 1500 pf.-47000 pf.-2p.

Polystyrene E12 Series 63V. Hor. Mounting. 10 pf. to 1000 pf.-3p. 1200 pf. to 10000 pf.-4p.

Mullard Polyester 250V Vert. Mtg. E6 Series. 0.1 to 1 4p. 15, 22-5p. 33, 47-8p. 68-11p. 1.0-14p. 1.5-20p. 2.2-24p.

Mylar (Polyester) Film 100V. Vertical Mtg. 0.01, 0.02, 0.05-3 1/2 p. 0.1, 0.2, 0.4, 0.5-5 1/2 p.

Miniature Film Resistors Highstab. E12 5%. 0.125 watt 10 0 to 2MΩ. 1p. 0.250 watt 10 0 to 10MΩ. (10% over 1M). 1p. 0.500 watt 10 0 to 2MΩ. 2p. 1.000 watt 10 0 to 10MΩ. 2p.

1N4148-2p, 1N4002 4p, 1N4006-6p, 1N4007-7p. 8C107/8/9, BC147/8/9, BC157/8/9, 8F194 & 7-9p. 8 Pin DiI ic's 741's-18p. 555's-24p.

20mm. fuses 15, 25, 5, 1.0, 2.0, 3.0 & 5A-3p. 20mm. fuseholders P.C. or Chassis Mtg.-5p. Post 10p (Free over £4). Prices VAT inclusive.

THE C. R. SUPPLY CO.

127, Chesterfield Road, Sheffield S8 0RN

THE VINTAGE WIRELESS COMPANY

1920 to 1950

Receivers, valves, components, service data, historical research books, magazines, repairs and restorations. A complete service for the collector and enthusiast of vintage radio.

S.a.e. with enquiries and for monthly newsheet.

THE VINTAGE WIRELESS COMPANY, 64, Broad Street, Staple Hill, Bristol BS16 5NL. Tel. Bristol 655472.

SMALL ADS

The prepaid rate for classified advertisements is 22 pence per word (minimum 12 words), box number 60p extra. Semi-display setting £7.50 per single column centimetre (minimum 2.5 cms). All cheques, postal orders etc., to be made payable to Practical Wireless and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, Practical Wireless, Room 2337, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846)

CONDITIONS OF ACCEPTANCE OF CLASSIFIED ADVERTISEMENTS

1. Advertisements are accepted subject to the conditions appearing on our current advertisement rate card and on the express understanding that the Advertiser warrants that the advertisement does not contravene any Act of Parliament nor is it an infringement of the British Code of Advertising Practice.

2. The publishers reserve the right to refuse or withdraw any advertisement.

3. Although every care is taken, the Publishers shall not be liable for clerical or printers' errors or their consequences.

VALVES

Radio - T.V. - Industrial - Transmitting
Projector Lamps and Semiconductors

We Dispatch Valves to all parts of the world by return of post. Air or Sea mail, 4000 Types in stock, 1930 to 1976. Obsolete types a speciality. List 30p. Quotations S.A.E. Open to callers Monday to Saturday 9.30 to 5.00 closed Wednesday 1.00. We wish to purchase all types of new and boxed Valves, Projector Lamps and Semiconductors.

COX RADIO (SUSSEX) LTD.

Dept. P.W. The Parade, East Wittering, Sussex PO19 1JH
West Wittering 2023 (STD Code 024366)

D.V.M. THERMOMETER KIT



Based on the ICL7106 single chip DVM the kit contains a 3 digit LCD, a PCB, ICL7106, and all components and instructions to make a 0-200mV FSD DVM. Components also supplied to enable this to be converted to a digital thermometer. Requires a 2mA 9V supply (PP3 battery). ONLY £21-99

TOUCH CONTROLLED LIGHTING KITS

Directly replace conventional light switches and control up to 300W of lighting. No mains rewiring. Insulated touch plates. Easy to follow instructions. **NEW! TD300K-TOUCHDIMMER!** Single touchplate with alternate action. Brief touch switches lamp on and off, longer touch dims or brightens lamp. Neon lamp helps find the switch in the dark. £8-99

—Extension kit for TD300K permits operation from another location, two-way switching, etc. £1-50
TS300K-TOUCHSWITCH-DIMMER—One alternate ON/OFF action. TOUCHPLATE. Small knob for presetting lamp brightness. £5-50

TS300K-ON/OFF TOUCHSWITCH. Two touchplates. £4-30

TSA300K-AUTOMATIC TOUCHSWITCH. Time delay variable 2 secs to 3 1/2 mins. £4-30

LD300K-300W LIGHTDIMMER KIT £2-90

* SPECIAL OFFER *

10% discount on any 4 lighting control kits.

24 HR. CLOCK/APPLIANCE TIMER KIT



Switches any appliance of up to 1KW on and off at preset times once a day. KIT contains: AY-5-1230 Clock/Appliance Timer IC, 0.5" LED display, mains supply, display drivers, switches, LEDs, triac, PCBs and full instructions. £14-90

White box 56 x 131 x 71 mm with red Acrylic window. £2-20

White box as above ready drilled for kit Ready-built in box, incl. mains cable £22-50

400V PLASTIC TRIACS OPTO COMPONENTS

3A	49p	0.2" dia LEDs	555	24p (4 for 90p)
8A	62p	Red 12p (1/10)	741	22p (5 for 90p)
12A	70p	Green	17p	LM3911
16A	90p	Yellow	17p	Temperature
20A	165p	DL727	£1-50	control IC
25A	190p	LCD 0.5"	£8-10	ZN1034E
30A	215p	LDR sim	ICL7106	£7-50
35A	240p	ORP12	50p	TIC106D SCR
40A	265p	Neon	8p	2N6027
45A	290p			AY-5-1230
50A	315p			£4-50
DIAC	18p			

QUANTITY DISCOUNTS ON REQUEST

ADD 8% VAT + 25p P&P. Callers by appointment only.

Tel: 01-579 9794

T. K. ELECTRONICS

108 STUDLEY GRANGE ROAD, LONDON W7 2LX

TUNBRIDGE WELLS COMPONENTS, BALLARD'S, 108 Camden Road, Tunbridge Wells, Tel: 31803. No Lists. Enquiries S.A.E.

Record Accessories

STYLI, Cartridges FOR MUSIC CENTRES, etc. FREE List No. 29 For S.A.E. includes Leads, Mikes, Phones etc. **FELSTEAD ELECTRONICS, (PW), Longley Lane, Gatley, Cheadle, Ches. SK8 4EE.**

Books and Publications

Build your own

P.A., GROUP & DISCO SPEAKERS

by R. F. C. Stephens

Save money with this practical guide. Plans for 17 different designs, line source, l.b., Horn and Reflex types, for 8"-18" drive units. £3-95 post free (\$8 overseas).

THE INFRA-BASS LOUDSPEAKER

by G. Holliman

(full constructional details for versions using 15", 12" and 10" drive units.) £2-95 post free (\$6 overseas)

THE DALESFORD SPEAKER BOOK

by R. F. C. Stephens

This book is a must for the keen home constructor. Latest technology DIY designs. Plans for l.b., and Reflex designs for 10-100 watts. Also unusual centre-bass system. £2-20 post free (\$5 overseas).

VAN KAREN PUBLISHING

5 SWAN STREET, WILMSLOW, CHESHIRE

WHY NOT START YOUR OWN BUSINESS REWINDING ELECTRIC MOTORS. A genuine opportunity to success. **LARGE PROFITS.** You can't help but make money if you follow the easy, step by step, instructions in our fully illustrated manual showing how to rewind Electric Motors, Armatures and Field coils as used in Vacuum Cleaners, Electric Drills and Power Tools. **NO PREVIOUS KNOWLEDGE IS REQUIRED,** as the manual covers in 13 chapters, where to obtain all the work you need, materials required, all instructions, rewind charts and how to take data etc. A gold mine of information. How to set up your home workshop and how to cost each job to your customer. £4-00 plus 30p P&P. CWO, to **INDUSTRIAL SUPPLIES, 102, Parrswood Rd., Withington, Manchester 20, Dept. PW.**

RADIO BOOK SERVICE

WORLD RADIO TV HANDBOOK 1979 Edition £9-25

Radio Stations Guide £1-55

Long distance Television Reception for the Enthusiast £1-55

Popular Electronic Projects £1-55

Electronic Projects for Beginners £1-45

Mobile Discotheque Handbook £1-45

Radio Circuits using ICs £1-45

Projects in Opro-Electronics £1-35

How to make Walkie-Talkies £1-35

Radio Antenna 'n' book for Long Distance Reception £0-95

How to build your own Metal & Treasure Locators £1-10

How to build Advanced Short Wave Receivers £1-30

Solid State Short Wave Receivers for Beginners £1-05

PRICES INCLUDE POSTAGE & PACKING

4 CHILCHESTER COURT, WICKHAM RD, BECKENHAM KENT BR3 2JW

Aerials

AERIAL BOOSTERS

Improves weak VHF Radio and Television reception. **B45-UHF TV, B11-VHF Radio.** For next to the set fitting.

Price £5. S.A.E. for Leaflets.

ELECTRONIC MAILORDER LTD,

Ramsbottom, Bury, Lancs, BL0 9AG.

SHORT WAVE LISTENERS. Use the best aerial for the best results, the G2DMY Anti-T.V.I. Trap-Dipole, send 10" x 8" 16p S.A.E. & 3 x 9p stamps for lists, Aerials Guide, testimonials. G2DMY, Uplowman, Tiverton, Devon.

Ladders

LADDERS varnished 22" extd. £30. Carriage £2-80. Leaflet. Also Alloy ext. up to 62ft. **LADDER CENTRE (WLS3), Halesfield (1), Telford, Tel: 586644.**

Service Sheets

HUGE G.T. TV/RADIO/ETC. CATALOGUE (with £4 worth of useful vouchers)

Lists thousands of service sheets, manuals, etc. Many unobtainable elsewhere. Plus up dated Chassis Guide, newsletter, etc. Essential for every firm/engineer - Save ££s - only £1 plus large S.A.E. S.A.E. for details of our Giant Service Sheet Collections - not available elsewhere.

G.T. TECHNICAL INFORMATION SERVICES

76 Church St, Larkhall, Lanarkshire ML9 1HE

Largest stocks of manuals, etc. anywhere. £1 + large S.A.E. brings any requested full size single service sheet. Service sheets from 50p; S.A.E. for full details of this plus unique T.V. Publications. The new 1979 British Colour T.V. Repair Manual and the new First Foreign Colour T.V. Repair Manual for £4.90 each - both for £9.50.

S.A.E. brings full details of these and other unique publications.

BELL'S TELEVISION SERVICES for Service Sheets on Radio, TV etc., £1.00 plus SAE Colour TV Service Manuals on request. SAE with enquiries to B.T.S., 190 King's Road, Harrogate, N. Yorkshire. Tel: (0423) 55885.

SERVICE SHEETS, Radio, TV etc., 10,000 models. Catalogue 24p, plus S.A.E. with orders, enquiries. TELRAY, 154 Brook Street, Preston PR1 7HP.

Educational

COLOUR TV SERVICING

Learn the techniques of servicing Colour TV sets through new homestudy course approved by leading manufacturers. Covers principles, practice and alignment with numerous illustrations and diagrams. Other courses for radio and audio servicing. Full details from:

ICS SCHOOL OF ELECTRONICS
Dept. 1227 Intertext House, London SW8 4UJ
Tel. 01-622 9911 (all hours)
State if under 18

TECHNICAL TRAINING

Get the training you need to move up into a higher paid job. Take the first step now—write or phone ICS for details of ICS specialist homestudy courses on Radio, TV, Audio Eng. and Servicing, Electronics, Computers, also self-build radio kits. Full details from:

ICS SCHOOL OF ELECTRONICS
Dept. 1227 Intertext House, London SW8 4UJ
Tel. 01-622 9911 (all hours)
State if under 18

CITY & GUILDS EXAMS

Study for success with ICS. An ICS homestudy course will ensure that you pass your C. & G. exams. Special courses for: Telecoms, Technicians, Electrical Installations, Radio, TV & Electronics Technicians, Radio Amateurs. Full details from:

ICS SCHOOL OF ELECTRONICS
Dept. 1227 Intertext House, London SW8 4UJ
Tel. 01-622 911 (all hours)
State if under 18

WHETHER SEA-GOING OR SHORE-BASED, an exciting life awaits you as a Marine Radio Officer. Full details from the Principal, Barking College of Technology, Dagenham Road, Romford RM7 0XU. (Tel: Romford 66841).

GO TO SEA as a Radio Officer. Write: Principal, Nautical College, Broadwater, Fleetwood, FY7 8JZ.

For Sale

NEW 10-18U Single Beam Oscilloscope. Price £60 o.n.o. with full instructions. Girish Patel, 77 Baggrave Street, Leicester.

NEW BACK ISSUES of "PRACTICAL WIRELESS" available 70p each, post free. Open P.O. Cheque returned if not in stock—BELL'S TELEVISION SERVICE, 190 Kings Road, Harrogate, N. Yorks. Tel: (0423) 55885.

AS NEW K.W.202 Receiver, was £236. Going for £70. Enquiries after 6 p.m. Swanley 63605.

SEEN WHISTONS CAT? 5000 odds and ends. Mechanical/Electrical Cat Free. WHISTON, (Dept. PW), New Mills, Stockport.

LARGE SUPPLIER OF SERVICE SHEETS

and Colour Manuals, TV Mono Radios, Tuners, Tape Recorders, Record Players, Transistors, Stereograms, all at 75p each + S.A.E. except colour TV and Car Radios. State if Circuit will do, if sheets are not in stock. All TV Sheets are full lengths 24 x 12, not in Bits & Pieces. Free Fault Finding Chart or TV Catalogue with order. All crossed PO's returned if service sheets not in stock.

C. CARANNA (Mail Order)
71, Beaufort Park, London, NW11 6BX
01-458 4882

SERVICE SHEETS for Radio, Television, Tape Recorders, Stereo, etc., with free fault-finding guide, from 50p and S.A.E. Catalogue 25p, and S.A.E. HAMILTON RADIO, 47 Bohemia Road, St. Leonards, Sussex.

Overseas Appointments

PRODUCTION TECHNICIAN

required in South Africa.

Excellent opportunity for skilled wireman with test experience.

The position is permanent and offers good salary, good working conditions, warm climate, subsidised house mortgage.

Write giving details of age, experience etc. to:

Klerkscale (Pty) Ltd,
P.O. Box 944 Klerksdorp 2570,
South Africa.

Wanted

WANTED PRACTICAL WIRELESS February 1976, March 1976, April 1976, May 1976. Evenings Tel: 061-620-0145.

CIRCUIT DIAGRAM and detailed parts list to build a radio permanently tuned to 194 metres or 1546 kHz with pre-set volume and nine volt battery supply or have such a radio constructed in a wooden or sturdy plastic box to be inserted into a padded bag or details of how to replace a variable tuning capacitor with a pre-set one. **THE JOB IS FOR AN IN-PATIENT OF WARLINGHAM PARK HOSPITAL WHO IS SUFFERING FROM A TERMINAL DISEASE WHICH SEEMS LIKE A TWENTY-FOUR HOUR EPILEPTIC FIT AND MAY SUBJECT THE RADIO TO ROUGH TREATMENT INCLUDING DROPPING IT!** Offers please to:- **BM BEDSITTER, LONDON, WC1V 6XX.**

ELECTRONIC COMPONENTS PURCHASED. All Types Considered - Must be new. Send detailed list - Offer by return - **WALTONS, 55A Worcester Street, Wolverhampton.**

Miscellaneous

COMPLETE CAR ALARM KIT, 12 Volt positive or negative earth, only 4 leads to car. I.C. design incorporating C.M.O.S.; Battery sensing with Keyswitch and internal buzzer. Ready made £24.95, kit £21.95 (repair service available) Buzzer as used in car alarm, 85dBA α 3 metres, 10-15 Volts £4.95, also available large range of audible devices, cases, switches and p.c.b. manufacturing service. Send S.A.E. for details. All prices include V.A.T. and p&p in U.K. Make cheques/P.O.s payable to:- **C.D.S. ELECTRONICS, Dept. P.W., 2-4 Chichester Rents, Chancery Lane, London WC2 2EJ.**

EX MINISTRY AND SURPLUS EQUIPMENT

A neat 2 1/2" dia DC Moving coil indicator, F.S.D. 1mA resistance 60 ohms, scaled 0-500 and 0-125 no caption (ideal for transistor tester) supplied unused £3.30.
24V DC Motor 1 1/2" dia x 2" long x 1/2" long removable worm on a 1/2" dia shaft, a quality made motor supplied unused £2.80.
50K ohms Ten Turn potentiometer 1/2" dia, servo mounting with a 1/2" dia shaft, supplied unused £1.25.
Seven segment nine digit Gas Discharge Display 180 V/W, character height 27", supplied unused £1.20.
Elliott Transistor Curve Tracer type 8079, requires an oscilloscope with D/C X and Y Amps to operate £30.00.
All prices include postage. Lots of other items in stock S.A.E. for lists. Shop hours 9.30am to 2pm weekdays, closed Thursdays. Saturday 9.30am to 5.30pm.
A.E. SUPPLIES,
1 Arnolds Yard, Old Market Place, Altrincham, Cheshire.

SUPERB INSTRUMENT CASES by Bazelli, manufactured from P.V.C. Faced steel. Hundreds of people and industrial users are choosing the cases they require from our vast range. Competitive prices start at a low 90p. Chassis punching facilities at very competitive prices, 400 models to choose from, free literature (stamp would be appreciated). **BAZELLI, Dept. No. 25, St. Wilfreds, Foundry Lane, Halton, Lancaster LA 6LT.**

RECHARGEABLE BATTERIES

TRADE ENQUIRIES WELCOME

FULL RANGE AVAILABLE SAE FOR LISTS. £1.25 for Booklet "Nickel Cadmium Power" plus Catalogue. Write or call, Sandwell Plant Ltd, 2 Union Drive, BOLDMERE, SUTTON COLDFIELD, WEST MIDLANDS. 021 354 9764 or see them at TLC, 32 Craven Street, Charing Cross, London WC2

THE SCIENTIFIC WIRE COMPANY

PO Box 30, London E 4
Reg. Office 22 Coningsby Gdns

ENAMELLED COPPER WIRE

SWG	1 lb	8 oz	4 oz	2 oz
10 to 19	2.65	1.45	.75	.60
20 to 29	2.85	1.65	.90	.70
30 to 34	3.05	1.75	1.00	.75
35 to 40	3.40	1.95	1.15	.84
41 to 43	4.55	2.55	1.95	1.30
44 to 46	5.05	3.05	2.15	1.70
47	8.00	5.00	3.00	1.80
48	15.00	9.00	6.00	3.30

SILVER PLATED COPPER WIRE

14, 16, 18	4.50	2.25	1.44	.90
20 & 22	5.00	2.85	1.74	1.06
24 & 26	5.70	3.31	2.00	1.22
28 & 30	6.67	3.86	2.35	1.44

Prices include P & P and VAT
SAE brings list of copper & resistance Wires
Dealer Enquiries Invited

ALFAC etch resist transfers and other p.c. board drawing materials available from stock. SAE details. Ramar Constructor Services, Masons Road, Stratford-upon-Avon, CV37 9NF.

GUITAR/PA MUSIC AMPLIFIER

100 watt with superb treble/bass overdrive, 12 months guarantee Unbeatable at £42; 60 watt £37; 200 watt £58; 100 Watt twin channel sep. treble/bass per channel £55; 60 watt £48; 200 watt £72; 100 watt four channel sep. treble/bass per channel £75; 200 watt £92; slaves 100 watt treble/bass per channel £49; fuzz boxes, great sound, £8-50; bass £9-50; overdriver, fuzz with treble and bass boosters £14; 100 watt combo superb sound overdrive, sturdy construction, castors, unbeatable. £89; twin channel £99; bass combo £99; speakers 15in 100 watt £35; 12in 100 watt £22-50; 60 watt £14-50, 10 watt 10in. £3.50, 8in £3.00.

Send Cheque or P.O. to

WILLIAMSON AMPLIFICATION

62 Thorncliffe Ave., Dukinfield, Cheshire.
Tel 061-344 5007 or 061-308 2064

TIRRO's new mail order price list of electronic components now available on receipt of SAE. **TIRRO ELECTRONICS, Grenfell Place, Maidenhead, Berks.**

NICKEL CADMIUM BATTERIES

Rechargeable and suitable for 'fast charge' HP7 (AA) £1-13, SUB C £1-47, HP 11 (C) £2-15, HP 2 (D) £3-27, PP3 £4-09, PP3 not suitable for fast charge, PP3 charger £5-81. All above Nickel Cadmium batteries are guaranteed 'EVER READY' full spec. and are supplied complete with solder tags (except PP3). Just in stock—New rechargeable sealed lead acid maintenance free batteries suitable for burglar alarms etc. 1.2 amp hr 6v £4-40 2.6 amp hr. 6v £5-85.

Quantity prices available on request. Date and charging circuits free on request with orders over £10 otherwise 30p post and handling (specify battery type). all prices include VAT Please add 10% P & P on orders under £10. 5% over £10.

Cheques, postal orders, mail order to: **SOLID STATE SECURITY DEPT PW 10, Bradshaw Lane, Parbold, Wigan, Lancs. 02575-4726.**

BELLS AND SIRENS
 CARTERS SIREN £5.95
 INDUSTRIAL SIX INCH BELL £8.95
 PRICES INCLUSIVE.
 SEND CHEQUE, P.O. to:
CWAS ALARM
 11 Danbrook Walk,
 Bradford BD4 0QS
 6 to 12v D.C. 12v D.C.
 SAE for full price list of Professional Burglar Alarm Equipment.




RARE DX UNDER QRM?
 DIG IT OUT from tiring whistles and cw interference with a Tunable Audio Notch Filter, 350-5000Hz, 40dB notch, speaker amplifier, £8.90, MORE DX.
 MISSING RARE DX? Get SPOT-ON with a Crystal Calibrator, 1MHz, 100, 25KHz markers, £13.80.
 SIG. GEN., 10Hz-200KHz, logic and variable sine or square wave outputs, £10.80, linear frequency scale.
 PROGRAMME YOUR OWN tunes on a MUSICAL OOBELL, new tune each day, just needs bell transformer and speaker, £19.50, great fun.
Giro 21-923-4000. Each easy-assembly kit includes all parts, printed circuit, case, postage etc. money back assurance so SEND off NOW.
CAMBRIDGE KITS
 45 (PU) Old School Lane, Milton, Cambridge.

BULK PURCHASE. Battery intercoms to clear. 50ft. lead & volume control £6.95 pair. J. HARMSWORTH (PW2) 34 Victoria Street, Eccles, Maudstone, Kent.

KEEP ONE HANDY IN THE WORKSHOP



The unique aerosol treatment for minor burns and scalds. From Boots and other Chemists.

BUILD you own 771B type Metal Detector, details SAE 117 Horton Road, Brighton, BN1 7EG.

Mail Order Protection Scheme

The Publishers of *Practical Wireless* are members of the Periodical Publishers Association which has given an undertaking to the Director General of Fair Trading to refund monies sent by readers in response to mail order advertisements placed by mail order traders, who fail to supply goods or refund monies owing to liquidation or bankruptcy. This arrangement does not apply to any failure to supply goods advertised in a catalogue or in a direct mail solicitation.

In the unhappy event of the failure of a mail order trader readers are advised to lodge a claim with *Practical Wireless* within three months of the date of the appearance of the advertisement, providing proof of payment. Claims lodged after this period will be considered at the Publisher's discretion. Since all refunds are made by the magazine voluntarily and at its own expense, this undertaking enables you to respond to our mail order advertisers with the fullest confidence.

For the purpose of this scheme, mail order advertising is defined as:—

'Direct response advertisements, display or postal bargains where cash had to be sent in advance of goods being delivered'. Classified and catalogue mail order advertising are excluded.

ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

Please insert the advertisement below in the next available issue of *Practical Wireless* for insertions

I enclose Cheque/P.O. for £.....

(Cheques and Postal Orders should be crossed Lloyds Bank Ltd. and made payable to Practical Wireless).

NAME.....

ADDRESS.....

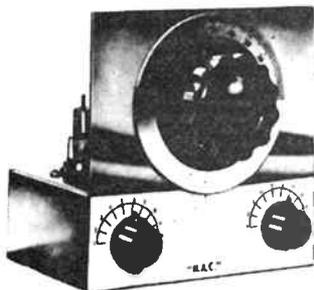
Send to: Classified Advertisement Manager
PRACTICAL WIRELESS,
 GMG, Classified Advertisement Dept., Rm. 2337,
 King's Reach Tower, Stamford Street,
 London SE1 9LS Telephone 01-261 5846

Rate
 22p per word, minimum 12 words. Box No. 60p extra.

Company registered in England Registered No. 53626. Registered office: King's Reach Tower, Stamford Street, London SE1 9LS

H.A.C. SHORT-WAVE KITS

WORLD-WIDE RECEPTION



'H.A.C.' well known by amateur constructors for its Short Wave receivers, now offers a complete range of kits and accessories to suit the novice and the expert.

£10.50 INCLUSIVE—the ever popular and easy to construct DX receiver Mark III; containing all genuine short wave components, drilled chassis, valve, accessories and full instructions.

NEW TWIN TRANSISTOR RECEIVER, selective, sensitive and with fantastic reception, yet needing only a single PP3 battery, at £12.50 this receiver is outstanding value, and will give you hours of interest and entertainment.

Lastly the K and K plus (illustrated above) this receiver has recently been re-designed for even better reception. All orders despatched within 7 days. Send stamped and addressed envelope now for free descriptive catalog of kits and accessories.

SORRY, NO CATALOGUES WITHOUT S.A.E.

"H.A.C." SHORT-WAVE PRODUCTS
P.O. Box No. 16, 10 Windmill Lane
Lewes Road, East Grinstead, West
Sussex RH19 3SZ

MORE SCOPE FOR YOUR MONEY



Model 3106C
5" CRT

£147.95

+11.84 VAT
+£2 carr. C.W.O.

SAE for further details

- DC to 10 MHz bandwidth.
- 10mV to 50V/cm in 12 calibrated steps.
- 0.5µS to 0.1 Sec/cm sweep range in 6 calibrated steps plus 12 1 Vernier.
- Magnifier x5.
- Fully automatic trigger.
- 2 MHz horizontal bandwidth.
- Fastest sweep 10 ins/cm with Magnifier.

Sensitivity < 1 cm deflection 10 Hz to > 15 MHz L.F. trigger extends below 5 Hz with 2 cm deflection. Trigger circuit locks to the mean value of the displayed waveform. It will lock to almost any wave shape including sine, square, triangle, pulse and TV video signals. When no signal is present to repetition rate is below 5 Hz the trace free runs producing a bright base line. Company orders welcome by phone and Telex. Function Generator also available.

5 MHz 4 inch CRT Scope available £111. SAE for details.

TECHNICAL SPECIFICATIONS

Frequency range: 20 Hz to 200 MHz
Display resolution: up to 8 digits
Lowest frequency resolution: 0.1 Hz
Gate time: decade adjustable from 0.01 secs to 10 secs
Sampling rate: varies with gate time up to 5 per second
Display format: 8 LEDs, direct reading in kHz
Attenuator: 20 db
Input impedance: 1 M in parallel with 50 pF
Timebase accuracy: 0.3 ppm/°C, 10 ppm/year
Dimensions: 6.2 in x 3 in x 1.25 in
Weight: 6 oz
Power requirement: 9V DC or AC adaptor
Sockets: standard 4 mm for resilient plugs
Standard accessories: test leads and prods, carrying wallet, owner's instruction manual
Optional equipment: AC adaptor for 240 V 50 Hz power: deluxe padded carrying case; connector kit comprising BNC, co-ax, DIN and phono adaptors, plus telescopic aerial for off-air transmitter measurements

METER £49. ADAPTOR £3.20
CASE £3.20. CONNECTOR KITS £10.58

KRAMER & CO.

9 October Place, Holders Hill Road, London NW4 1EJ.
Telex: 888941 attn. Kramer K7. Tel: 01-203 2437

Mail order only. Callers by appointment. Cash with order.

The world's smallest
LCD programmables can
be music to your ears

CASIO FX-501P and FX-502P

POCKET SIZED NON-VOLATILE PROGRAMMABLE CALCULATORS WITH MAGNETIC TAPE CASSETTE RECORDING ABILITY that convert to musical synthesizers!



- 1300 hours continuous use battery life
- Non-volatile memories and stores
- Conditional and unconditional jumps
- Up to 9 subroutines, up to 4 levels
- User defined keys
- Indirect on registers
- PAUSE key - Random Number key
- 51 scientific functions

World's first LCD pocket sized complete scientific programmables. Both use ALGEBRAIC operating system. The FX-501P offers up to 10 programmes and up to 128 non-volatile steps, with 11 non-volatile memories. The FX-502P has up to 10 programmes, up to 256 non-volatile steps and 22 non-volatile memories. Both have Automatic Power Off after approximately 14 minutes non-use. Dimensions of both are:—
9.6mm H x 71mm W x 141.2mm D (3/8" H x 2 3/4" W x 5 1/2" D)

Optional FA-1 Programme Adaptor available for either model - permits programmes to be recorded on standard tape cassette recorder and stored for re-entry later. Also contains a music switch which converts both calculators into musical synthesizers - keys 1 through 8 contain pre-programming for a full musical octave.

Model	RRP	Our Price
FX-501P	£59.95	£49.95
FX-502P	£79.95	£69.95
FA-1	£24.95	£19.95

★ THIS YEAR'S STAR BUY

CASIO 46CS-27B 46CS-29B

(As available - slight case difference only)
Almost certainly the slimmest and most sophisticated ALARM CHRONOGRAPHS available today.

- LC Display of hours, minutes, seconds, day; And with day, date, month and year.
 - 12 hour, with am/pm, or 24 hr clock display. 24 hr alarm setting. Optional hourly chimes. Chrono measures from 1/100 second to 6 hours. Laps, 1st & 2nd place. Stainless steel case only 7.8 mm thick. Water resistant 100'. Mineral glass face.
- Backlight for night time + 10 seconds/month. Removable links in bracket.
Was £74.95



NOW ONLY £39.95

Other CASIO multi-function watches from £19.95

UNBEATABLE QUALITY AND VALUE FOR MONEY FROM JAPAN - WHY SETTLE FOR LESS?

Most CASIO products available from stock. Send 25p for illustrated brochures of this superb range of high quality watches or calculators. (Both on request.)

Prices include VAT, P & P. Send cheque, P.O. or phone your ACCESS or BARCLAYCARD number to:—

TIMETRON
Callers welcome by appointment

Dept. P.W., Beaumont
Suite, 164 167 East Road
Cambridge CB1 1DB
Telephone 0223 67503

PLEASE MENTION

PRACTICAL WIRELESS

WHEN

REPLYING TO ADVERTISEMENTS

BURGLAR ALARMS

WE HAVE STOCKS OF EVERYTHING YOU NEED.
CALLERS WELCOME. OPEN 6 DAYS
EXPRESS POSTAL SERVICE FREE CATALOGUE SEND S.A.E.

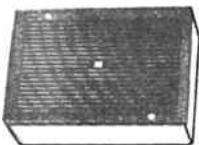
MAXIGUARD MK 4
ULTRASONIC DETECTOR

12V D.C. c/o relay output
Covers approx. 24 ft. Adjustable sensitivity

SPECIAL OFFER ONLY

£38.00

including VAT & Postage



A. D. E. (SECURITY) CO.,

217 WARBRECK MOOR
AINTREE, LIVERPOOL
TEL: 051-525-3440

STOP PRESS! Trade Price List Available
Applications on Official Stationery only

WATFORD ELECTRONICS

(Continued from opposite side)

DIODES		*BRIDGE RECTIFIERS		SPEAKERS	
AA119	15	1A/50V	20	80Ω 3W	66
AA129	25	1A/100V	22	40Ω 2.5"	69
AA130	15	1A/200V	25	60Ω 2.5"	66
AA135	20	1A/400V	29	80Ω 5W	190
8A100	24	2A/50V	35	8Ω 3W	85
8Y100	12	2A/100V	44	6" x 4"	160
8Y126	12	2A/200V	44		
8Y127	12	2A/400V	53		
CRO33	148*	2A/600V	65		
DA9	75	4A/100V	72		
DA47	12	4A/200V	75		
DA70	12	4A/400V	79		
DA79	12	4A/600V	105		
DA81	15	4A/800V	120		
DA85	12	6A/100V	73		
DA90	6	A2/200V	75		
DA91	6	6A/400V	75		
DA95	8	8Y164	56		
DA200	9	8Y18DIL	40		
DA202	8				
IN914	4	ZENERS			
IN916	5	Rng. 2V7-39V			
IN918	4	400mW 9p			
IN400/2*	5	Rng. 3V3-33V			
IN400/3*	6	1.3W 15p			
IN400/4/5*	6				
IN400/6/7*	7	VARICAPS			
IN4148	4	MVAM115140	35		
IS44	20	BA102	25		
3A/100V*	18	8B104	40		
3A/400V*	20	8B105B	40		
3A/600V*	27	8B106	40		
3A/1000V*	30	Noise Diode			
6A/600V	65	25J	160		
SCR's		ALUM. BOXES			
0.8A30V	28	with lid*			
0.8A100V	30	3x2x1"	48		
0.8A200V	35	2 1/2 x 1 1/2"	68		
1A600V	70	4x2 1/2 x 1 1/2"	64		
5A300V	35	4x5 1/2 x 1 1/2"	78		
5A600V	43	4x2 1/2 x 2"	64		
8A300V	48	5x4 1/2 x 2"	92		
8A600V	85	6x4 1/2 x 2"	96		
12A300V	59	7x5 1/2 x 2"	132		
12A800V	150	10x7 1/2 x 3"	192		
15A100V	195	10x4 1/2 x 3"	162		
15A700V	150	12x8 1/2 x 3"	190		
CT106D	38	12x8 1/2 x 3"	250		
TIC44	22	DIAC*			
2N4444	140	ST2	26		

OPTO ELECTRONICS*		SWITCHES*	
LEDs Plus Clip		TOGGLE 2A	250V
TIL209 Red 125	13	SPST	28
TIL211 Grn 125	18	DPDT	34
TIL212 Yellow	22	DPDT	38
TIL32 Infra Red	58	4 pole on/off	54
0.2" Red	16		
0.2" Yellow	19		
Grn, Amber			
Square LEDs	48		
OCPT7	120		
ORP12	63		
2N5777	45		
OPTO Isolators			
TIL111/2	85		
IL74	48		
TIL117	110		

"PURBECK OSCILLOSCOPE"

Author Approved Parts including PCBs available. Send SAE for Leaflet.

Cathode Ray Tube 3PB1 £7.75* (p&p insured add 95p)

VEROBOARD*		Pitch	
0-1"	0-15"	0-1"	0-15"
(copper clad)	(plain)		
2 1/2 x 3 1/2"	46p	39p	31p
2 1/2 x 5"	56p	50p	31p
3 1/2 x 3 1/2"	55p	50p	31p
3 1/2 x 5"	62p	57p	50p
4 1/2 x 17"	218p	180p	141p
4 1/2 x 17"	280p		183p
			30p
			85p
			120p

ROCKER: (white) 5A 250V SP change-over centre off	
ROCKER: Lights red when on. Chrome Bezel. 3A 250V. SPST	52
ROTCY: "Make-A-Switch" Make your own multiway Switch. Adjustable Stop Shafting Assembly. Accommodates up to 6 Wafers	75
Mains Switch DPST to fit	34
Break Before Make Wafers, 1 pole/12 way, 2p/6 way, 3p/4 way, 4p/3 way, 6p/2 way	47
Spacer and Screen	5
ROTCY: (Adjustable Stop) 1 pole/2 to 12 way, 2p/2 to 6 way, 3 pole/2 to 4 way, 4 pole/2 to 3 way	41
ROTCY: Mains 250V AC, 4 Amp	45

PW PROJECTS	
General Coverage Receiver, Chromachase	
JURBILEE Electronic Organ, General Purpose SW Receiver, Gas & Smoke Sensor Alarm, "PURBECK" Oscilloscope, Audio Distortion Meter, "AVON" 2m FM Transmitter, Acoustic Delay Line, "HYTTE" Jambo Wall Clock, "IMP" 3-Waveband Receiver, AM-FM Frequency Readout.	
Send SAE plus 5p per list.	

ROCKER: 5A 250V. SPST 23	
ROCKER: 5A 250V. SPST 23	35
ROCKER: 5A 250V. SPST 23	36
ROCKER: 5A 250V. SPST 23	36
ROCKER: 5A 250V. SPST 23	36

WIRE WRAP SOCKETS*	
8 pin 25p; 14 pin 35p; 16 pin 48p; 18 pin 52p; 20 pin 65p; 22 pin 70p; 24 pin 73p; 28 pin 85p; 36 pin 105p; 40 pin 109p.	

74LS* (Manufactured by Texas)	
74LS00 11	74LS123 70
74LS01 11	74LS124 180
74LS02 12	74LS125 60
74LS03 12	74LS126 60
74LS04 14	74LS127 95
74LS05 23	74LS128 173
74LS06 22	74LS129 85
74LS07 22	74LS130 95
74LS10 20	74LS131 95
74LS11 22	74LS132 95
74LS12 23	74LS133 95
74LS13 38	74LS134 95
74LS14 75	74LS135 115
74LS15 30	74LS136 95
74LS20 20	74LS137 95
74LS21 22	74LS138 95
74LS22 22	74LS139 95
74LS26 48	74LS140 128
74LS27 28	74LS141 98
74LS28 48	74LS142 138
74LS30 22	74LS143 116
74LS32 27	74LS144 114
74LS33 39	74LS145 115
74LS37 39	74LS146 115
74LS40 28	74LS147 115
74LS42 98	74LS148 115
	74LS149 115
	74LS150 115
	74LS151 96
	74LS152 96
	74LS153 96
	74LS154 96
	74LS155 96
	74LS156 96
	74LS157 96
	74LS158 96
	74LS159 96
	74LS160 128
	74LS161 98
	74LS162 138
	74LS163 110
	74LS164 114
	74LS165 75
	74LS166 228
	74LS167 158
	74LS168 158
	74LS169 150
	74LS170 286
	74LS171 100
	74LS172 100
	74LS173 105
	74LS174 108
	74LS175 110
	74LS181 398
	74LS182 398
	74LS183 298
	74LS184 298
	74LS185 298
	74LS186 298
	74LS187 298
	74LS188 298
	74LS189 298
	74LS190 140
	74LS191 140
	74LS192 132
	74LS193 130
	74LS194 166
	74LS195 136
	74LS196 100
	74LS197 140
	74LS198 128
	74LS199 128
	74LS200 348
	74LS201 348
	74LS202 345
	74LS203 175
	74LS204 175
	74LS205 175
	74LS206 175
	74LS207 175
	74LS208 175
	74LS209 175
	74LS210 175
	74LS211 175
	74LS212 175
	74LS213 175
	74LS214 175
	74LS215 175
	74LS216 175
	74LS217 175
	74LS218 175
	74LS219 175
	74LS220 175
	74LS221 98
	74LS222 98
	74LS223 98
	74LS224 231
	74LS225 231
	74LS226 231
	74LS227 231
	74LS228 231
	74LS229 231
	74LS230 231
	74LS231 231
	74LS232 468
	74LS233 468
	74LS234 468
	74LS235 468
	74LS236 468
	74LS237 468
	74LS238 468
	74LS239 468
	74LS240 236
	74LS241 231
	74LS242 232
	74LS243 232
	74LS244 155
	74LS245 270
	74LS246 190
	74LS247 190
	74LS248 190
	74LS249 190
	74LS250 190
	74LS251 134
	74LS252 142
	74LS253 142
	74LS254 142
	74LS255 110
	74LS256 110
	74LS257 110
	74LS258 110
	74LS259 160
	74LS260 160
	74LS261 450
	74LS262 52
	74LS263 52
	74LS264 52
	74LS265 52
	74LS266 52
	74LS267 52
	74LS268 52
	74LS269 52
	74LS270 52
	74LS271 52
	74LS272 52
	74LS273 244
	74LS274 244
	74LS275 250
	74LS276 250
	74LS277 212
	74LS278 212
	74LS279 66
	74LS280 250
	74LS281 192
	74LS282 192
	74LS283 192
	74LS284 192
	74LS285 192
	74LS286 86
	74LS287 86
	74LS288 86
	74LS289 86
	74LS290 128
	74LS291 128
	74LS292 128
	74LS293 128
	74LS294 128
	74LS295 185
	74LS296 185
	74LS297 185
	74LS298 68
	74LS299 218
	74LS300 175
	74LS301 175
	74LS302 175
	74LS303 175
	74LS304 175
	74LS305 175
	74LS306 175
	74LS307 175
	74LS308 175
	74LS309 175
	74LS310 175
	74LS311 175
	74LS312 175
	74LS313 175
	74LS314 175
	74LS315 175
	74LS316 175
	74LS317 175
	74LS318 175
	74LS319 175
	74LS320 175
	74LS321 175
	74LS322 175
	74LS323 468
	74LS324 468
	74LS325 468
	74LS326 468
	74LS327 468
	74LS328 468
	74LS329 468
	74LS330 468
	74LS331 468
	74LS332 468
	74LS333 468
	74LS334 468
	74LS335 468
	74LS336 468
	74LS337 468
	74LS338 468
	74LS339 468
	74LS340 468
	74LS341 468
	74LS342 468
	74LS343 468
	74LS344 468
	74LS345 468
	74LS346 185
	74LS347 48
	74LS348 186
	74LS349 186
	74LS350 186
	74LS351 186
	74LS352 186
	74LS353 186
	74LS354 186
	74LS355 186
	74LS356 65
	74LS357 65
	74LS358 65
	74LS359 65
	74LS360 65
	74LS361 65
	74LS362 65
	74LS363 65
	74LS364 65
	74LS365 65
	74LS366 65
	74LS367 65
	74LS368 65
	74LS369 65
	74LS370 65

Head Office and Warehouse
44A WESTBOURNE GROVE
LONDON W2 5SF
Tel: 727 5841/2/3

Z & I AERO SERVICES LTD.

Reg No. 242 1255 03

Please send all correspondence and Mail-Orders to Head Office

Retail Shop
85 TOTTENHAM COURT ROAD
LONDON W1
Tel: 580 8403
Open all day Saturday

A SELECTION FROM OUR STOCKS OF FULLY GUARANTEED FIRST QUALITY VALVES

1B3GT	0-84	8AX4GTB	1-13	8CY5	1-13	12AT6	0-68	ECF200	1-01	EM84	0-88	PCL81	0-73	PY82	0-82	UCC84	0-84
IR5	0-58	8AX5GT	1-48	6CY7	1-13	12AT7	0-56	ECF201	1-01	EM87	1-13	PCL82	0-80	PY83	0-79	UCC85	0-88
IX28	1-35	8BA6	0-51	8008B	1-63	12AU6	0-73	ECF801	1-07	EY81	0-82	PCL84	0-84	PY88	0-84	UCF80	0-84
5AT8	0-90	8BE6	0-54	8DT6	0-90	12AU7	0-53	ECF802	1-07	EY87	0-56	PCL86	0-86	PY500A	1-89	UCH42	1-13
5T4	0-84	8BF5	0-88	8DT8	0-90	12AV6	0-96	ECH42	1-24	EY88	0-82	PCL805	0-80	TT21	10-89	UCH81	0-73
5U4G	0-88	8BF6	0-84	8DW4	1-01	12AV7	1-13	ECH81	0-82	EY500A	1-89	PD510	3-78	TT22	10-89	UCL81	0-79
5U8	0-84	8BG6G	0-34	8ES5	1-13	12AX7	0-62	ECH200	0-90	EZ80	0-58	PL36	1-24	U25	1-13	UCL82	0-84
5V4G	0-88	8BH6	0-88	8EV5	1-69	12AY7	0-96	ECL80	0-68	EZ81	0-58	PL81	0-90	U28	1-13	UCL83	0-90
5X4G	0-90	8BJ6	1-35	6EW8	0-90	12BA6	0-90	ECL81	0-84	GY501	1-01	PL82	0-82	UAC80	0-85	UF41	1-13
5X8	1-01	8BJ7	0-73	8GH8A	0-90	12BF6	0-75	ECL82	0-68	GZ30	0-73	PL83	0-58	UAF41	0-90	UF80	0-58
5Y3GT	0-73	8BK4B	1-58	8GK5	0-79	12BH7A	0-84	ECL83	1-30	GZ32	0-73	PL84	0-84	UBC41	0-79	UF85	0-58
5Z4GT	0-73	8N4A	1-01	8GK6	1-61	12BL6	0-79	ECL84	0-79	GZ33	4-28	PL504	1-35	UBC81	0-85	UL84	0-88
8AB7	0-68	8N6	0-90	6J4	1-35	12B08	1-01	ECL85	0-73	DA2	0-70	PL508	1-58	UBF80	0-88	UM80	0-88
8AC7	0-90	8Q07A	0-79	8J5GT	0-80	12B7A	0-80	ECL86	0-96	DA3	0-81	PL802	3-15	UBF89	0-88	UM81	0-84
8AD8	0-88	8R8A	1-35	8J6	0-62	12CJ6	1-01	EF80	0-45	DB2	0-78	PY81	0-78	UBL21	1-01	UM84	0-51
8AF4A	0-90	8S7	2-59	8J7	0-90	19A05	0-84	EF85	0-54	DB3	0-81						
8AG5	0-73	8U8	0-88	8K5GT	0-84	19B68G	0-56	EF86	0-68	DB2	1-51						
8AG7	0-88	8W7	1-13	8K6GT	0-86	35A3	0-79	EF92	1-13	DC3	0-82						
8AH6	1-07	8Z6	0-73	8L6GT	1-24	35B3	0-73	EF97	0-79	DD3	0-81						
8AJ5	0-73	8Z7	0-79	8N7GT	0-86	35C5	0-96	EF98	1-01	PABC80	0-51						
8AK5	0-62	8C4	0-82	807	1-01	50C5	1-13	EF183	0-79	PC88	1-01						
8AK6	0-84	8C5GT	0-88	8SA7	0-90	50E85	0-96	EF184	0-79	PC88	1-01						
8AK7	0-88	8C8	0-58	8S67	0-90	DAF86	0-68	EFL200	1-80	PC96	0-58						
8AL5	0-45	8C8G	0-88	8SK7	0-90	0F96	0-68	EH90	0-88	PC97	1-07						
8AM6	0-79	8C8B	0-82	8SL7GT	0-79	OK92	1-13	EL33	2-81	PC900	1-13						
8AM8	0-79	8C67	0-79	6SN7GT	0-79	0L96	0-68	EL36	1-88	PCC84	0-58						
8AN5	2-81	8C68A	0-84	8S07	0-90	ECC84	0-68	EL81	0-90	PCC85	0-88						
8AN6	0-88	8CM7	0-80	6SR7	0-90	ECC85	0-54	EL82	0-88	PCC88	0-73						
8A05	0-88	8CM7	1-35	8V6GT	0-90	ECC86	1-41	EL83	0-88	PCC89	0-84						
8AS6	1-13	8C08	0-84	8X4	0-79	ECC86	0-84	EL84	0-73	PCC189	1-13						
8AS7G	1-35	8C57	0-98	8X5GT	0-68	ECC89	0-90	EL86	0-84	PCF80	0-86						
8AT6	0-84	8C05	1-13	8X8	0-90	ECC189	0-90	EL95	0-79	PCF82	0-51						
8AU6	0-58	8C08	1-13	12A8	0-68	ECF80	0-68	EL504	1-07	PCF84	0-73						
8AV6	0-84	8CW4	3-75	12A15	0-73	ECF82	0-62	EM80	0-73	PCF88	0-84						
8AW8A	0-84	8CX8	1-13	12A05	0-68	ECF86	0-90	EM81	0-68	PCF806	1-13						

OSCILLOSCOPE TUBES

current production. Made in USSR

One inch Tube Type 3L0 11. This tube is a good replacement for 1CP31. Tube characteristics are identical with those of 1CP31. As the connections are different the tube is supplied complete with base, connection diagram and technical data **£12.00** plus £0.96 VAT. **Three-inch tube Type 3BP1.** This well known tube used in "PURBECK" Oscilloscope can be supplied for **£7.50** plus £0.65 VAT. 14-pin base for the above **£0.80** plus £0.06 VAT.

Prices are inclusive of VAT (at current rates) except where shown separately. Postage and packing charges are **£0.10** per £ subject to a minimum of **£0.30**. Minimum order charge for Approved Credit customers **£20.00**. Minimum Transaction Charge for mail orders **£1.00**.

OUR NEW 1978/1979 CATALOGUE IS NOW READY AND WILL BE SENT ON RECEIPT OF REMITTANCE FOR £0.30

PRE-AMPLIFIER CP-P1

Shown here mounted with its associated components (and the CP-TM1 Peak Programme Monitor) on the CP-MPC1 interconnection board; the CP-P1 is a complete stereo pre-amplifier and tone control module. Performance features >70 db S/N ratio and >30 db overload margin (both ref. 3 mV) and distortion of 0.02%. The internal R.I.A.A. feedback compensation around the low-level pre-amp may be replaced with external networks and the tone control circuits can be programmed to give different turnover frequencies if required (including separate bass and treble 'defeat' facilities).

CP-P1 £14.95 incl. (U.K.) **£16.95** incl. (Export)

Also Available: Power Amplifiers, Filters, Stereo Image Width Control, Compressor/Expander, Active Crossovers, Power Supplies plus all pots, switches, etc.

MAGNUM AUDIO Ltd.

DEPT PW7, 13 HAZELBURY CRESCENT
LUTON, BEDS. LU1 1DF
TEL: 0582 28887

SEND LARGE S.A.E. FOR DETAILS

IT'S EASY WHEN YOU KNOW!

To avoid missing your copy of **PRACTICAL WIRELESS** – simply complete this order form and hand it to your newsagent.

ORDER FORM

To:
(name of newsagent)

Address

Please reserve/deliver every month one copy of **PRACTICAL WIRELESS** until further notice.

My Name

Address

**QUARTZ LCD
5 Function**

Hours, mins., secs., month, date, auto calendar, back-light, quality metal bracelet.

£6.65

Guaranteed same day despatch.
Very slim, only 6mm thick.



M1

**QUARTZ LCD
7 Function**

Hours, mins., secs., month, date, auto calendar, back-light, seconds STOP WATCH.

£9.65

Guaranteed same day despatch.
Very slim, only 6mm thick.



M2

**QUARTZ LCD
11 Function SLIM CHRONO**

6 digit, 11 functions. Hours, mins., secs., day, date, day of week, 1/100th, 1/10th, secs., 10X secs., mins. Split and lap modes. Back-light, auto calendar. Only 6mm thick. Stainless steel bracelet and back. Adjustable bracelet. Metac Price

£12.65 Thousands sold!

Guaranteed same day despatch.



M3

**QUARTZ LCD
ALARM 6 Function**

Hours, mins., secs., month, date, back-light, 24 hour ALARM. Adjustable stainless steel bracelet. Only 9mm thick.

£12.65

Guaranteed same day despatch.



M4

**QUARTZ LCD
ALARM 7 Function**

Hours, mins., secs., day, date, alpha day, back-light, auto calendar. Adjustable stainless steel bracelet. Only 9mm thick.

£15.95

Guaranteed same day despatch.



M5

**QUARTZ LCD Alarm
Chronograph with Dual
Time Zone Facility**

Constant LCD display of hours and minutes, plus optional seconds or date display, plus day of the week and am/pm indication. Perpetual calendar, day, date, month and year 24 hour alarm with on off indication. 1/10 second chrono graph measuring net, lap and first and second place times. Dual time zone facility night light. Only 9mm thick

£22.65



M6

**SOLAR QUARTZ LCD
Chronograph with Alarm
Time Zone Facility**

Constant LCD display of hours and minutes, plus optional seconds or date display, plus day of the week and am/pm indication. Perpetual calendar, day date, month and year 24 hour alarm with on off indication. 1/10 second chrono graph measuring net, lap and first and second place times. Dual time zone facility night light. Only 9mm thick

£25.65



SOL M7

**QUARTZ LCD
Alarm Chrono**

22 function, 6 digit. Hours, mins., secs., date, day of week, stopwatch, split time, alarm, second watch (dual time), back-light. FRONT BUTTON OPERATION.

£22.65

Guaranteed same day despatch

METAC **★** PRICE



M8

**SOLAR QUARTZ LCD
Chronograph**

6 digit, 11 function. Hours, mins., secs. 1/100, 1/10 secs., mins. Split and lap modules. Auto calendar and back light. Powered from solar panel with battery back-up.

£13.95



M9

SEIKO Alarm Chrono

LCD, hours, mins., secs., day of week, month, day and date, 24 hour Alarm, 12 hour chronograph, 1/10th secs., and lap time. Back light, stainless steel, HARDLEX glass.

List Price £130.00

METAC PRICE

£105.00



M10

SEIKO Chronograph

LCD, hours, mins., secs., day of week, month, day, date, 12 hour chronograph, 1/10th secs. and lap-time. Back light, stainless steel water resistant, HARDLEX glass.

List Price £85.00

METAC PRICE

£68.00



M11

**SOLAR QUARTZ LCD
5 Function**

Genuine Solar. Solar panel with battery back-up. Back light and auto calendar. Hours, mins., secs., day, date. Quality metal bracelet.

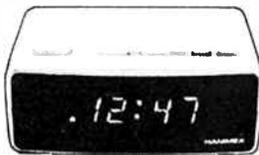
£ 8.95

Guaranteed same day despatch.



M12

**HANIMEX
Electronic
LED Alarm Clock**



Features and Specification: Hour/minute display. Large LED display with p.m. and alarm on indicator. 24 Hours alarm with on/off control. Display flashing for power loss indication. Repeatable 9-minute snooze. Display bright/dim modes control. Size: 5 15" x 3.93" x 2.36" (131mm x 11mm x 60mm). Weight: 1.43 lbs (0.65 kg). AC power 220V.

£9.65 Thousands sold!

Guaranteed same day despatch.

M13

**QUARTZ LCD
Ladies Slim Bracelet**

5 function. Hours, mins., secs., day, date and back light and auto calendar. Elegant metal bracelet in silver or gold. State preference.

£15.95

Guaranteed same day despatch.



M14

**QUARTZ LCD
Ladies 5 Function**

Only 25 x 20mm and 6mm thick. 5 function. Hours, mins., secs., day, date and back light and auto calendar. Elegant metal bracelet in silver or gold. State preference.

£9.95

Guaranteed same day despatch.



M15

**DIGITAL
LED CLOCK**



Automatic brightness control. Weekend alarm cancel.

Features and Specification: Hour/minute display. Large LED display with p.m. and alarm on indicator. 24 Hours alarm with on-off control. Display flashing for power loss indicator. Repeatable 9-minute snooze. Automatic brightness control. Weekend alarm cancel.

£10.95

Guaranteed same day despatch.

M16

HOW TO ORDER

Payment can be made by sending cheque, postal order, Barclay, Access or American Express card numbers. Write your name, address and the order details clearly, enclose 30p for post and packing or the amount stated. We do not wait to clear your cheque before sending the goods so this will not delay delivery. All products carry 1 year guarantee and full money back 10 day reassurance. Battery fitting service is available at our shops. All prices include VAT.

Trade enquiries: Send for a complete list of trade prices - minimum order value £100. Telephone Orders: Credit card customers can telephone orders direct to Daventry or Edgware Rd., 24 hour phone service at both shops: 01-723 4753 03272-76545.



CALLERS WELCOME
Shops open 9.30 - 6.00.

Metac ELECTRONICS & TIME CENTRES

North & Midlands
67 High Street, DAVENTRY
Northamptonshire
Telephone: 03272 76545

South of England
327 Edgware Road
LONDON W.2
Telephone: (01) 723 4753



A quality range of British made electronic components that's there for you... look. Do your own home electrical work with complete confidence. See our pages 124 to 128.



This superb organ - build the first working section in just over 1000. Full specifications in our catalogue.



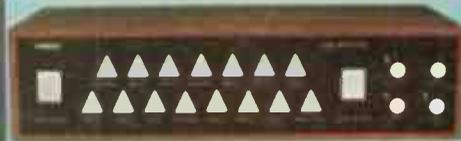
A range of highly attractive tools to be described in our catalogue. Our prices are very attractive too!



Audio base power unit for organs. Has excellent bass guitar input for guitarists' accompaniment. Specifications in our catalogue.



A guitar with an electronic amplifier. Shows tuning plus built-in looking and acceleration. Full construction details in our catalogue.



Touch operated stereo processor, the Domestic Companion. Details 75p. Dealer M2540. Specifications in our catalogue.



Mobile, amateur, radio, TV, and HF, aerials plus lots of accessories are described in our catalogue.



The 3800 synthesizer build it yourself at a fraction of the cost of one ready-made with the specification. Full details in our catalogue.



A wide range of clock accessories at handover prices. Our catalogue has all the details.

MARPLIN

ELECTRONIC SUPPLIES LTD

All mail to:-
 P.O. Box 3, Rayleigh, Essex SS6 8LR.
 Telephone: Southend (0702) 554155.
 Shop: 284 London Road,
 Westcliff-on-Sea, Essex.
 (Closed on Monday).
 Telephone: Southend (0702) 554155.



A superb technical bookshop in your home! All you need is our catalogue. Post the coupon now!



An attractive digital alarm clock with fully automatic sunrise and battery back up! Complete kit with case only £12.99 inc. VAT 8 p. or M254022 inc. case only £8.42 inc. VAT.



A massive new catalogue from Marplin that's over 280 pages and better than before if you want the electronic components, this is the one catalogue you must not be without. Over 280 pages - some of the best - it's a comprehensive guide to electronic components with hundreds of photographs and diagrams and page after page of readable data.

Our bi-monthly newsletter contains guaranteed prices, special offers and all the latest news from Marplin.



A 83-key A300 keyboard with 625 line TV monitor. A deep memory and microprocessor interface. Details in our catalogue.

Post this coupon now for your copy of our 1979-80 catalogue price 75p.

Please send me a copy of your 280 page catalogue as soon as it is published (8th Jan 1979). I enclose 75p but understand that if I am not completely satisfied I may return the catalogue to you within 14 days and have my 75p refunded immediately. If you live outside U.K. send £1 or ten International Reply Coupons.

NAME _____

ADDRESS _____
