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AUGUST 1978
VOLUME 54
NUMBER 4
ISSUE 858

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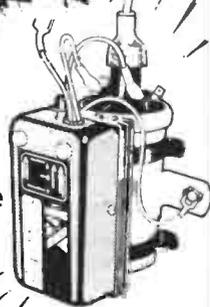
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(for details see page 39)

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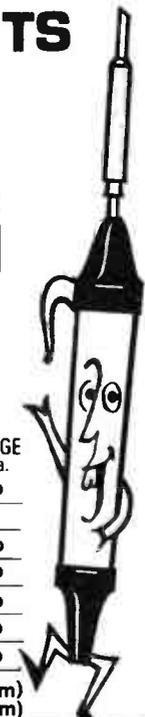
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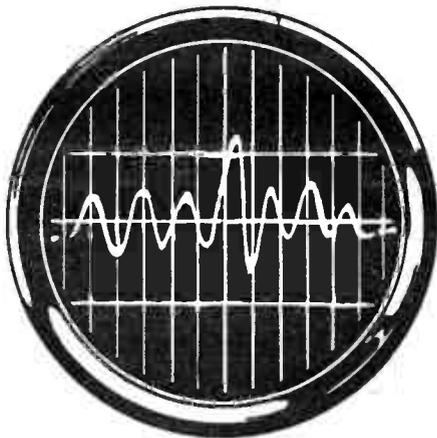
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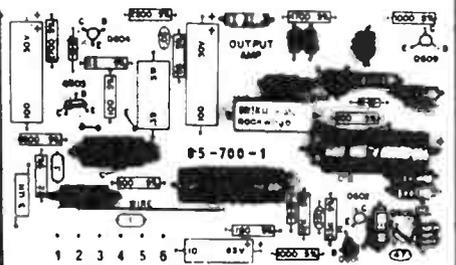
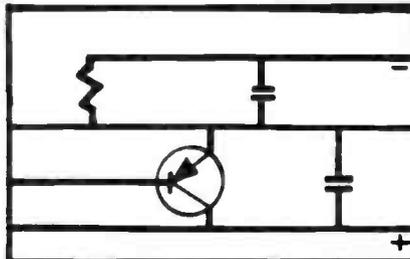
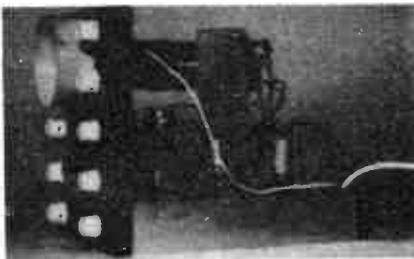
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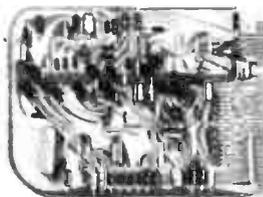
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A further drawback to cheap receivers is massive image interference on the higher frequencies due to the use of a low IF, typically 455 kHz. The cure for this problem is the use of a high IF and the SRX-30 employs a first IF of around 40 MHz—so goodbye to first IF images. You could of course find the same system as this in the Racal RA17 series receivers; after all, the SRX-30 has copied the basic idea from this very receiver. The big drawback to the RA17 (apart from the price !) is that unless you have the muscles of a prize fighter, lifting the RA17 may send you for a holiday at Hernia Bay (staying at the Truss House?).

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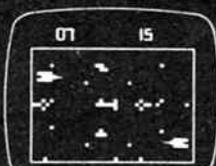
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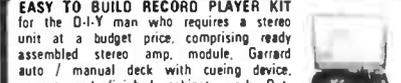
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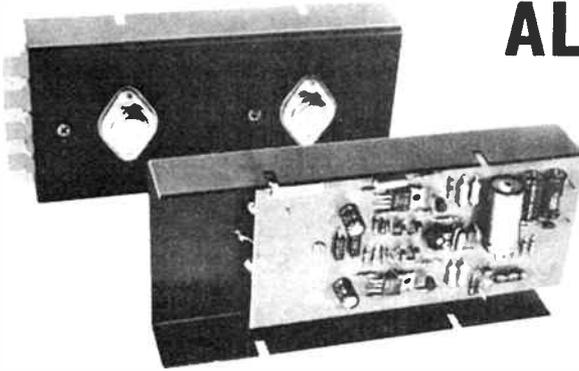
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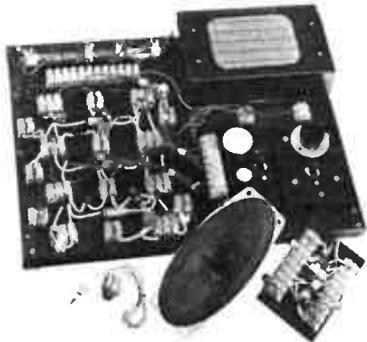
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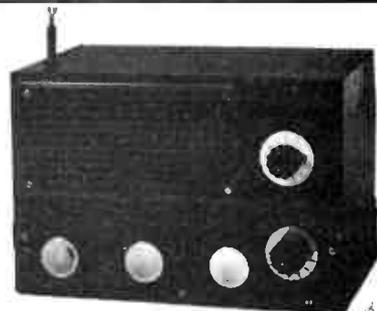
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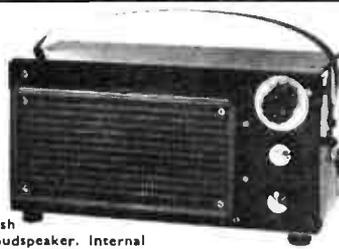
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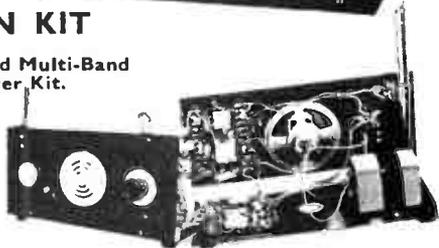


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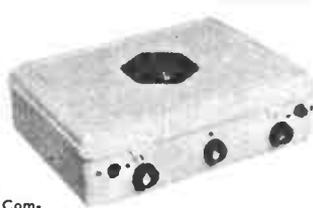
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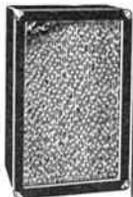
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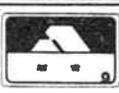
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TV games power unit stabilized 7.7V 100mA £3.10. 3-way models with switched output and 4-way multi-jack:- 3/4/8V 100mA £2.82. 6/7/12/30V 300mA £3.39. 100mA radio models same size as PP9 battery. With press stud connectors. 9V £2.85. 8V £2.85. 4 1/2V £2.85. 9V + 9V £4.50. 8V + 8V £4.50. 4 1/2V + 4 1/2V £4.50. Cassette recorder mains unit 7 1/2V 100mA with 5 pin din plug £2.85. Car converters 12V dc input. Output 9V 300mA £1.50. Output 7 1/2V 300mA £1.50. Output 6/7/12/30V 3-way switched 1A £3.95.

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COMPONENTS

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2N929	0.37	2N3417	0.25	2N4062	0.20	2N5245	0.37	AF106	0.60	BC182L	0.15
2N930	0.37	2N3439	0.85	2N4121	0.27	2N5248	0.44	AF109	0.82	BC183A	0.12
2N1131	0.32	2N3441	0.92	2N4122	0.27	2N5293	0.14	AF114	0.70	BC183LA	0.15
2N1303	0.80	2N3442	1.45	2N4123	0.19	2N5294	0.44	AF115	0.70	AC184	0.12
2N1305	0.80	2N3565	0.25	2N4124	0.19	2N5401	0.44	AF118	0.70	BC184L	0.15
2N1501	0.35	2N3566	0.25	2N4125	0.19	2N5416	0.85	AF124	0.70	BC205	0.17
2N1613	0.30	2N3567	0.25	2N4126	0.19	2N5447	0.18	AF139	0.75	BC212A	0.15
2N1837	0.72	2N3638	0.17	2N4235	1.35	2N5448	0.18	AF200	1.30	BC212LA	0.18
2N1890	0.30	2N3639	0.30	2N4236	1.65	2N5449	0.20	AF201	1.30	BC213B	0.15
2N1893	0.30	2N3644	0.48	2N4237	1.65	2N5457	0.35	AF239	0.70	BC213LA	0.17
2N1991	1.10	2N3662	0.25	2N4240	1.70	2N5401	0.44	AF240	1.25	BC214	0.17
2N2193	0.50	2N3663	0.29	2N4250	0.26	2N5555	0.85	AF279	0.88	BC214L	0.18
2N2194	0.42	2N3702	0.14	2N4266	0.32	2N6109	0.55	AF280	0.95	BC237B	0.15
2N2217	0.55	2N3703	0.14	2N4284	0.38	2N6122	0.44	ASY28	1.30	BC238B	0.17
2N2218	0.35	2N3704	0.14	2N4286	0.32	2N6123	0.48	ASY55	0.70	BC239C	0.13
2N2219	0.38	2N3705	0.14	2N4287	0.22	2N6124	0.45	BC107	0.16	BC256A	0.29
2N2221	0.25	2N3706	0.14	2N4288	0.22	2N6125	0.47	BC108	0.16	BC257A	0.18
2N2222	0.25	2N3707	0.14	2N4292	0.27	2N6288	0.50	BC109	0.16	BC258B	0.24
2N2270	0.40	2N3708	0.12	2N4302	0.31	2S702	0.38	BC112	0.22	BC259B	0.19
2N2368	0.27	2N3709	0.12	2N4303	0.33	2S702	0.38	BC112	0.22	BC261A	0.25
2N2369	0.27	2N3710	0.12	2N4303	0.33	2S702	0.38	BC115	0.22	BC262B	0.26
2N2483	0.30	2N3711	0.12	2N4401	0.20	40332	0.60	BC116	0.21	BC263B	0.28
2N2613	0.90	2N3712	1.39	2N4402	0.20	40331	0.55	BC118	0.22	BC264B	0.85
2N2646	0.80	2N3714	1.55	2N4403	0.20	40363	1.45	BC135	0.22	BC307B	0.16
2N2846	1.10	2N3715	1.70	2N4403	0.20	40389	0.70	BC137	0.22	BC308B	0.18
2N2904	0.31	2N3794	0.21	2N4822	0.83	40408	0.88	BC138	0.44	BC327	0.22
2N2905	0.31	2N3819	0.38	2N4870L	0.58	40440	0.40	BC138	0.44	BC327	0.22
2N2906	0.25	2N3820	0.38	2N4871L	0.51	40512	1.70	BC140	0.30	BC328	0.20
2N2907	0.25	2N3821	0.95	2N4898	1.55	40594	0.87	BC141	0.32	BC337	0.20
2N2923	0.17	2N3827	0.27	2N4902	0.20	40595	0.88	BC142	0.32	BC414	0.17
2N2924	0.17	2N3854A	0.30	2N4902	0.20	40673	0.80	BC147	0.13	BC415	0.17
2N2925	0.19	2N3855	0.30	2N4903	0.25	40673	0.80	BC148	0.16	BC416	0.17
2N3011	0.37	2N3856A	0.19	2N4904	1.85	AC127	0.48	BC149	0.15	BC547A	0.13
2N3020	0.75	2N3858A	0.20	2N4905	2.40	AC128	0.48	BC153	0.30	BC547B	0.13
2N3053	0.25	2N3859A	0.22	2N4920	0.83	AC151	0.43	BC154	0.30	BC548	0.13
2N3054	0.72	2N3860	0.18	2N5086	0.30	AC152	0.54	BC157A	0.15	BC549B	0.14
2N3055	0.75	2N3866	1.88	2N5087	0.30	AC153	0.59	BC158B	0.15	BC558	0.13
2N3108	0.17	2N3901	0.30	2N5088	0.30	AC153K	0.59	BC159B	0.17	BC559	0.15
2N3133	0.50	2N3904	0.18	2N5089	0.30	AC176	0.54	BC160	0.38	BCY54	2.40
2N3242	0.68	2N3905	0.18	2N5129	0.62	AC176K	0.90	BC167B	0.13	BCY58	0.27
2N3250	0.35	2N3906	0.18	2N5130	0.22	AC178	0.90	BC168B	0.13	BCY70	0.21
2N3301	0.45	2N3982	0.95	2N5131	0.22	AC187K	0.65	BC169B	0.13	BCY71	0.28
2N3302	0.39	2N4031	0.55	2N5137	0.22	AC188	0.54	BC170B	0.19	BCY72	0.18
2N3392	0.17	2N4032	0.85	2N5143	0.22	AC188K	0.65	BC171B	0.17	BCY78	0.43
2N3394	0.17	2N4033	0.65	2N5180	0.58	ACY17	1.00	BC172C	0.15	BO129	2.20
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CA3008	2.55	CA3078	2.12	LM374N	3.35	LM1458N	0.45	MC1352P	SN76227N1	0.88
CA3012	1.65	CA3080	1.85	LM377N	1.80	LM1496N	1.80	MC14335C	SN76228N1	0.55
CA3013	1.85	CA3089A	2.10	LM378N	2.40	LM1812N	6.20	MC1435C	SN76531N0	82
CA3014	2.20	CA3095	0.50	LM379S	4.25	LM1820N	1.16	MC1435C	SN76532N1	85
CA3018	0.75	CA3088F	1.87	LM380N	0.96	LM1828N	1.90	MC1439G	SN76533N1	85
CA3018A	1.10	CA3089E	2.90	LM380N14	1.98	LM1841N	1.99	MC1440G	SN76533N1	85
CA3020	2.20	CA3090Q	4.40	LM381A	2.70	LM1845N	1.90	MC1456G	SN76544N1	60
CA3020A	2.50	CA3130	1.06	LM381N	1.89	LM1848N	1.80	MC1463R	SN76545N1	80
CA3021	2.40	CA3140	1.84	LM382N	1.32	LM1889N	1.90	MC1489N	SN76550-2	0.38
CA3022	2.20	LOBST	2.25	LM384N	1.55	LM1890N	1.90	MC1495L	SN76552-2	0.57
CA3023	2.20	LM114H	2.75	LM388N	0.85	LM2907N-8	1.80	MC1529G	SN76570N1	0.80
CA3026	0.80	LM301AH	5.00	LM387N	1.10	LM2987N-8	1.80	MC1529G	SN76570N1	0.80
CA3028A	0.90	LM301	8.30	LM388N	1.00	LM555CH	3.38	MM5314	SN76620AN	1.20
CA3028B	1.25	LM304	2.60	LM389N	1.00	LM555CH	3.38	MM5316	SN76650N1	80
CA3029	0.75	LM307N	5.20	LM390N	0.70	LM555CH	3.38	MM5320	SN76650N0	88
CA3029A	0.90	LM308H	1.50	LM390N	0.70	LM555CH	3.38	NE555	SN76666N0	69
CA3030	1.50	LM308N	0.45	LM391N	1.10	LM555CH	3.38	NE556	SN76666N0	69
CA3032	2.20	LM309KC	1.95	LM391N	1.10	LM555CH	3.38	NE558	SN76666N0	69
CA3033	3.70	LM317K	3.35	LM392N	0.55	LM555CH	3.38	NE561	SN76666N0	69
CA3034	2.75	LM318N	2.15	LM702C	0.81	LM555CH	3.38	NE562	SN76666N0	69
CA3035	1.95	LM320T5	2.15	LM703L	1.15	LM555CH	3.38	NE565	SN76666N0	69
CA3036	1.21	LM320T122	1.15	LM709-8	0.50	LM555CH	3.38	NE568	SN76666N0	69
CA3038	2.90	LM320T152	1.15	LM709-14	0.49	LM555CH	3.38	NE569	SN76666N0	69
CA3038A	4.10	LM320T242	1.15	LM710	0.82	LM555CH	3.38	NE570	SN76666N0	69
CA3039	0.77	LM320MP5	1.15	LM710-14	0.84	LM555CH	3.38	NE571	SN76666N0	69
CA3040	3.75	LM320MP12	1.15	LM711CN	0.72	LM555CH	3.38	NE572	SN76666N0	69
CA3041	1.65	LM320MP15	1.15	LM723C	0.75	LM555CH	3.38	NE573	SN76666N0	69
CA3043	2.20	LM323MP15	1.15	LM723C-14	0.75	LM555CH	3.38	NE574	SN76666N0	69
CA3045	1.58	LM323MP24	1.15	LM728	0.45	LM555CH	3.38	NE575	SN76666N0	69
CA3046	0.77	LM323MP24	1.15	LM728	0.45	LM555CH	3.38	NE576	SN76666N0	69
CA3047	2.20	LM323MP24	1.15	LM741C	0.70	LM555CH	3.38	NE577	SN76666N0	69
CA3047A	3.70	LM323K	0.95	LM741C-80	3.00	LM555CH	3.38	NE578	SN76666N0	69
CA3048	2.45	LM339N	0.60	LM741C740	3.00	LM555CH	3.38	NE579	SN76666N0	69
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12v	5 amp	TM 9	£1.85
13v	1 amp	TM 7	£2.16
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15v-0-15v	31 amp	TM 35	£4.86
17v	1 amp	TM 12	£1.62
18v	1 amp	TM 13	£1.90
18v	1 amp	TM 14	£1.92
20v	5 amp	TM 20	£4.32
20v-0-20v	12 amp	TM 15	£4.86
20v	6 amp	TM 15	£4.86
13v	100mA	TM 21	£1.62
24v	11 amp	TM 16	£2.12
24v	2 amp	TM 17	£2.70
24v + 2v 7 amp	2 amp	TM 19	£2.87
24v	4 amp	TM 40	£3.78
25v	1 amp	TM 18	£2.43
26v	2 amp	TM 39	£2.98
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30v	8 amp	TM 15	£4.86
31v	3 amp	TM 23	£3.86
40v tapped at 30v, 20v & 10v	6 amp	TM 22	£4.86
50v-2 amp with 6.3v shrouded	8 amp	TM 29	£11.65
50v	5 amp	TM 24	£7.02
75v-3 amp with 6.3v shrouded	1 amp	TM 23	£3.86
75v	1 amp	TM 24	£7.02
80v tapped 60v & 75v	4 amp	TM 24	£7.02
100v	1 amp	TM 25	£7.02
100v-0-100v	1 amp	TM 25	£7.02
130v tapped 120v	1 amp	TM 28	£3.78
200v	1 amp	TM 25	£7.02
250v-0-250v with 6.3v 2A	1 amp	TM 36	£3.78
250v	100mA	TM 36	£3.78
500v	50mA	TM 36	£3.78
260v	60mA	TM 26	£3.24
1Kv	1 amp	TM 44	P.O.A.
2Kv	1 amp	TM 44	P.O.A.
5Kv	5mA	TM 30	£7.80
8.5Kv	10mA	TM 31	£10.26

Quantity prices available. Please, unless you are calling, add 25% to your order to cover the cost of carriage.

Quick Cuppa. Mini immersion heater, ideal for taking on holiday, for making a "quick cuppa" tea, or for heating by the bedside for baby's feed etc. 250w heater @ 230 volts or approximately 90 watts @ 110 volts. Price £2.95.

Neon Screwdrivers. Two useful models: - 7 1/2" price 70p and 5 1/2" price 55p.

240° 1mA Moving Coil Panel Meter. A large instrument, size approximately 4 1/2" square at the front and 4 1/2" deep. Intended for panel mounting, its scale is calibrated 0-7 and it was intended to be used as rev. counter. £14 each.

Pressure Switch. Adjustable through a range of pressures from where it can be operated by sucking or blowing to approx. 50 psi-10 amp changeover microswitch, metal body with threaded inlet. Price £2.99.

Push-Push Switch. Fixed through panel this is a ratchet action, double pole changeover switch, the contacts we understand are hard gold plated. Spindle is 3/8" diameter so that a standard radio knob can be fitted. Price 30p + 3p. Good quantity available at usual discounts.

C.R.T. Display Unit. We feel this would be easy to convert to an oscilloscope, it has all the necessary ingredients. It is in a case size 15" x 10" x 1 1/2". approx. with a carrying handle and a front protection flap. Plenty of controls and is mains operated through step down transformer. Size of the tube is 3". Price £16.75.

VU Meter. Edgewise mounting, through hole size 1 1/2" x 1 1/2" approx: these are 100 micro amp fsd and fitted with internal 6 volt bulb for scale illumination, also have zero reset. The scale is not calibrated but has very modern appearance. Price £1.85.

Cassette Mechanism. Jap. made to rigid specification. These will fit many music centres and cassette players. Chassis size approx. 4 1/2" wide by 5 1/2" deep, 6v motor and tape position counter at the rear. The six levers for "play", "fast forward", "rewind", "stop", record and eject are all at the front, as is the auto mechanism to stop the motor when tape end is reached. These are new and unused and have record playback and erase heads. Limited quantity. Price £15.50.

Shortened 3kw Tangential Heater. This is in fact near enough the same size as the normal 2kw tangential. Motor runs a bit faster to compensate for the increased heating and the fan impellers are metal to save any possibility of extra heat distorting them. The heater element is tapped so that 1, 2 or 3kw's of heating can be used or of course this will blow cold. Price £8.95, post £1.50p + 12p.

Omron 410 Relay. Built like a contactor, this has a clear plastic cover over the working parts but the terminals are all brought out of the front so that connection may be made without removing the cover also the relay may be fitted into position and the wires brought to it afterwards, generously rated at 10 amps the contacts are really more like 15 amps, they are changeover and there are 4 sets of them. A really robust relay which looks as though it will give a lifetime of service. Size 3 1/2" x 3" x 3 1/2" high. Price £4.50.

8 Track Cartridge Players. In car units with amplifiers but this amplifier may need attention, mechanism guaranteed O.K. £9.00 + 19p.

Low rpm Crouzet Motors. Two more types have just come in; these are 2 rpm and 15 rpm, both 115v motors but as these consume only two to three watts it is a simple matter to divide the mains voltage using a mains working condenser, resistor auto transformer or of course use them in pairs. Price £2.25, £2.00 + 16p each.

12 volt Miniature Relay. Gold plated contacts with plastic duct covers 4 sets of changeover contacts, 90p, bases 45p.

MULLARD UNILEX

A mains operated 4+4 stereo system. Rated one of the finest performers in the stereo field, this would make a wonderful gift for almost anyone in easy-to-assemble modular form and complete with a pair of Plessey speakers this should sell at about £30—but due to a special bulk buy and as an incentive for you to buy this month we offer the system complete at only £15 including VAT and postage.



SPIT MOTOR WITH CARTER G/BOX

Probably one of the best spit motors made. Originally intended to be used in very high priced cookers, however this can be put to plenty of other uses, for instance your garden barbeque or to drive a tumbler for stone polishing; in fact there are no ends to its uses. Normal mains operation. £4.32.

PP3/PP9 REPLACEMENT MAINS UNIT

Japanese made in plastic container with leads size 2" x 1 1/2" x 1 1/2", this is ideal to power a calculator or radio, it has a full wave rectified and smoothed output of 9 volts suitable for a loading of up to 100mA. £2.53.



SHORTWAVE CRYSTAL SET

Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 19, 25, 29, 31 metre bands. Kit contains chassis front panel and all the parts £1.84—crystal earphone 55p including VAT and postage.



RADIO STETHOSCOPE

Easiest way to fault find, traces signal from aerial to speaker when signal stops you've found the fault. Use it on Radio, TV, amplifier, anything. Kit comprises transistors and parts including probe tube, twin stetho-ster. £3.95.



BREAKDOWN PARCEL

Four unused, made for computer units containing most useful components, and these components unlike those from most computer panels, have wire ends of usable length. The transistors for instance have leads over 1" long—the diodes have approx. 1 1/2" leads.

List of the major components is as follows:—17 assorted transistors—38 assorted diodes—60 assorted resistors and condensers—4 gold plated plugs in units which can serve as multipin plugs or as hook up boards for experimental or quickly changed circuits (note we can supply the socket boards which were made to receive these units). The price of this four unit parcel is £1 including VAT and post (considerably less than value of the transistors or diodes alone). DON'T MISS THIS SPLENDID OFFER.

INFRA RED BINOCULARS

Made for military purposes during and immediately after the last war to enable snipers, vehicle drivers, etc. to see in the dark. The binoculars have to be fed from a high voltage source (5KV approx.) and providing the objects are in the rays of an infra red beam then the binoculars will enable these objects to be seen. Each binocular eye tube contains a complete optical lens system as well as the infra red cell, technical data on which is available. The binoculars are unused, believed to be in good order. Sold without guarantee. Price £17.50 per set. Post & VAT £2.50.



SOUND TO LIGHT UNIT

Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450W). Unit in box all ready to work. £9.95.



MINI-MULTI TESTER

Amazing, deluxe pocket size precision moving coil instrument—jewelled bearings—1000 opv—mirrored scale. 11 instant ranges measure:—DC volts 10, 50, 250, 1000 AC volts 10, 50, 250, 1000 DC amps 0-1 mA and 0-100 mA Continuity and resistance 0-150K ohms. Complete with insulated probes, leads, battery, circuit diagram and instructions.

Unbelievable value only £5.50p + 50p post and insurance. FREE Amps ranges kit enable you to read AC current from 0-10 amps, directly on the 0-10 scale. It's free if you purchase quickly, but if you already own a mini tester and would like one send £1.50p.

Terms: Prices include Post & VAT. But orders under £6.00 please add 50p to offset packing. Bulk enquiries—Please Phone for Generous Discounts 688 1833.

J. BULL (ELECTRICAL) LTD
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IT'S FREE!

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

Mains Transformer. Small 2 secondaries, 115 volts at 10 mA and 6.3 volt @ 1A, a useful transformer for many instruments. £2.70.

25 Watt Audio Systems in Cabinets. Comprising 8" woofer and 3" tweeter with crossover and terminal connection panel, mounted in simulated teak finish cabinet with fabric front. These are extremely good quality units comparable with those selling at twice the price. Cabinet size approx. 20" high 10 1/2" wide and 8 1/2" deep, heavy cabinet made of thick block-board. Price £25.00 the pair, well worth your coming in to collect them but if you cannot collect them, then still worth adding £5.00 the pair for carriage.

Another Special Item, for called this month is a pen recorder. Main indicator this is a bigish instrument which probably cost originally several hundreds of pounds. We are having a reverse auction on this. The starting price is £50 but the price will come down £5.00 per week until it is sold.

Opto Electronics. Two special bargains in this field, the ORP 70 price 75p and the ORP 71 price 85p.

Tilt Switch 15 amp. Meant to switch off heater should it be knocked over; this pendulum operated switch is on only when it is in the upright position. It could be incorporated in burglar alarm, car alarms etc. Contacts look quite able to cope with 15 amp loads at mains voltage. Price 50p + 4p.

Neon Indicator Lamp. Two features about this particular one are:—has screw down terminal connectors for wiring and is fixed by a single threaded screw. The lens is clear so you could colour to suit your needs. Price 35p.

Indicator Lamp Holders. For low voltage lamps (Liliput) type, we have these in five different colours—red, yellow, blue, green and white. Price 35p.

Twin Padded Wire. 5 amp lead for some electric irons and appliances which require very flexible lead, 10 metre lengths. Price £1.50.

Heating Pads. These measure 11" long x 8 1/2" wide and are flat. Look rather like pieces of thick blotting paper. Wire ended 250 watt or joined in series they would be approximately 60 watt each. Dozens of uses. Price 80p or two for £1.50.

Rod Thermostat. For high temperatures up to 550°F. This is adjustable either at the head or remotely by a length of flexible drive. Price £2.95.

Interval Timer. As used in schools and similar establishments to trigger off the bell which sounds the end of lessons, lunch breaks etc. This is another one off item we feel for callers only. It is in polish hardwood case, glass fronted, comprises a 24 hour switch, a large brass disc and other smaller discs on which the time is set out in relatively small intervals and a pair of contacts to switch a bell or something similar or operate a lamp. Price £1.25.

Two More Mullard Modules. Pre amp module ref. 1181/1183, stereo or mono. It is on a printed circuit board with wire connections. Supplied complete with connection diagram. Price 99p.

Mullard IF Module Type 1181. In a metal case 2 1/2" long x 1 1/2" wide x 1 1/2" thick. Can be mounted on a printed circuit board or connected to wire lead outs. Price £1.25.

Silicon Diode. Two special bargains this month. 400 volt 1 amp, 10 for £1.25. 50 volt 1 amp, 20 for £1.25. Large quantities available at very much discounted prices.

Flex Cable Bargains. Core size 5mm 2 white pvc outer, pvc covered cores. Coloured coded with the usual blue, brown and green/yellow. Price 100 metre coil for £18.25.

Electrical Installation Work. We have good stocks of all the mains items required for ring mains and light installations, for example we have 2.5mm twin and earth pvc covered at £12.50 + £1.00. Carriage £2.00 + 16p. We hope to make a complete list of the installation items we have in time for our next newsletter but if there is anything you are wanting by all means give us a ring.

Plastic Case Sections. Small very tough plastic cases at very reasonable prices, always repeats. The case is 2-11/16" long. Section A is 1 1/2" deep and section B 1" deep, use 2AA's 2BB's or an A and a B to get different depths, i.e. 1 1/2", 1" or 2"—note these are external dimensions, the wall thickness of the case is 15" thick. Price, section A 25p, B 30p.

Computer Capacitors. Made by famous American companies for working under very exacting conditions. Ideal for large condenser units in Alicans for upright monitoring. Ideal if you want to make a large storage bank 15,500 uf 10 volts working, 15 volts surge, 10 for £8.

Alarm Bells. Holiday time can often be a heyday for house breakers; why not fit a really loud alarm as good a method as any is to use trigger, mate and probe, at windows and doorways. Join them all in series through a latching circuit to sound off a really loud bell or hooter, prices of these various parts are as follows:

Loud Ringing Bell, industrial type with 6" gong, 24v, OC operated, price £7.50.

Switch Trigger Mat, size 24" x 18" for going under carpet etc. Price £2.50.

24v Relay with latching contacts. Price 95p.

Secret Switch with key. Price 85p.

24v 1 amp DC Power Supply Price £5.50.

Circuit Diagram. No charge, just request.

Mouth Operated Switch. Probably not made with this use in mind, more likely made for washing machines to control water level etc. this is a sensitive low pressure device which operates three pole changeover switches at different levels of pressure but all within a normal persons blowing capacity—blow gently into it and No. 1 switch operates, blow a little stronger and No. 2 operates, blow harder still and No. 3 fluid substance could operate it. Undoubtedly a switch with very many applications. Olsc type construction, this is approximately 3 1/8" dia. x 1 1/2" thick—the air entry is a pipe approximately 3/16" diameter—electrical contacts we estimate a 10 amp c/o a 230volt connection by push on tags. Order ref. P.S. Price £1.95. Large quantity available.

Powerful Induction Motor. 1 1/2" stack, double ended, would drive a small lathe, drill or grinder or would power a blowing or extracting fan. Fit suitable pulleys and it would drive a pebble polisher or similar, being double ended it will drive in either direction. Can also be fixed from either end, fixing bolts are fitted and these are 1 1/2" apart. Spindles 1 1/2" diameter, 1 1/2" between each end plate. A motor like this would cost at least £3 from makes but we have a large quantity to offer at £2.50, Order Ref. MM.10.

Can any reader help? We urgently need some reasonably priced decoders to go with the F.M. tuner we have. If you can help us to find a supply we will be very much obliged and will try to do you a good turn some day—thank you.

B. BAMBER ELECTRONICS

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OSMOR 10V REED RELAY COILS 1k ohm coil to fit 1" reeds (not supplied) 2 for 50p.
HF CHOKES wound on 1/2" x 1" long ferrites. 4 for 50p.
VHF CHOKES wound on 6-hole tubular ferrites. 5 for 40p.
DUAL TOB HEATSINKS 1" x 1/2" x 1/2" with screw-in clamps. 3 for 50p.

MAINS TESTER SCREWDRIVERS 100 to 500V. Standard size 50p. Large 70p.
RADIO PLIERS 5 1/2" £1.80. 6 1/2" £2.00.
DIAGONAL SIDE CUTTERS 6 1/2" £2.20.
SMALL SIDE CUTTERS LJ2. Standard £4.00. L7 (with wire holding device) £4.50.
MINIATURE FILE SETS. Set of 6 £2.20. Set of 10 £3.00 (Round, flat, etc.).

TAP AND DIE SETS (18 piece) contain 1 each of 2, 4, 6, 8, BA SIZES in Dies, Plug Taps, Taper Taps + American type tap wrench, 1 type tap wrench, Die Holder. £12.50.

LARGE ELECTROLYTIC PACKS. Contain range of large electrolytic capacitors, low and high voltage types, over 40 pieces. £3.00 per pack (+12 1/2% VAT).

Slider Switches. 2 pole make and break (or can be used as 1 pole change-over by linking the two centre pins), 4 for 50p.

A NEW RANGE OF QUALITY BOXES & INSTRUMENT CASES.

Aluminium Boxes with lids.		
AB10	5 1/2" x 4" x 1 1/2"	75p
AB13	6" x 4" x 2"	£1 00
AB14	7" x 5" x 2 1/2"	£1 25
AB15	5" x 6" x 3"	£1 50
AB16	10" x 7" x 3"	£1 75
AB17	10" x 4" x 3"	£1 50
AB25	6" x 4" x 3"	£1 25

Vinyl Coated Instrument Cases
Light Blue tops and plain lower sections.
Very smart finish

WB1	5" x 2 1/2" x 2 1/2"	75p
WB2	6" x 4" x 1 1/2"	£1 35
WB3	8" x 5" x 2"	£1 80
WB4	9" x 5 1/2" x 2 1/2"	£2 00
WB5	11" x 6 1/2" x 3"	£2 25
WB6	11" x 7 1/2" x 3 1/2"	£2 50
WB7	12" x 6 1/2" x 3 1/2"	£2 85
WB853	8" x 5 1/2" x 3"	£2 25

MAINS TRANSFORMERS. Type 15/300 240V input. 15V at 300mA output. £1.50 each.
MAINS TRANSFORMERS. Type 45/100, 240, 220, 110, 0V input. 45V at 100mA output. £1.50 each.

PLEASE ADD 8% VAT UNLESS OTHERWISE STATED

A NEW RANGE OF SPEAKERS & CABINETS. BRAND NEW & BOXED. AT BARGAIN PRICES.

CELESTION 8" x 5" ELLIPTICAL SPEAKERS. 20 ohm, 3 watts rated, £1.50 each + 12 1/2% VAT.

TYPE L2 TRIANGULAR CORNER CABINETS. Smart woodgrain Formica type finish with nylon grille. Overall height 23" x 12" wide. Contain three 15 ohm 6 1/2" x 4" Full range speakers in parallel + 100V line transformer (easily disconnected for 5 ohm operation). £7.50 each (or 2 for £14.00) + 12 1/2% VAT.

TYPE M7M4 CEILING SPEAKERS. White plastic fascia 10" square, for recess mounting into ceiling, with 8" dia. 15 ohm full range speaker. £4.00 each + 12 1/2% VAT.

TYPE L4 PORTABLE SPEAKER CABINET. Smart woodgrain Formica type finish with nylon grille. 15" high x 14" wide x 7" deep. (Including top). Containing 10" round, 15 ohm full range speaker + 100V line transformer. £7.00 each + 12 1/2% VAT.

TYPE HT4 HOTEL SPEAKER CABINET. Wood veneered, 12 1/2" wide x 5 1/2" high x 3 1/2" deep, with aluminium grille + volume control and 4 way + off switch panels on front. Very smart. Contains 3 ohm 5" x 3" elliptical speaker + 100V line transformer. £5.00 each + 12 1/2% VAT.

TYPE 6079 FULL RANGE SPEAKER. 10" dia. 15 ohm, £5.00 each (or 2 for £9.00) + 12 1/2% VAT.

SEMICONDUCTORS

BSX20 (VHF Osc/Mult). 3 for 50p.
BC108 (metal can). 4 for 50p.
PBC108 (plastic BC108). 5 for 50p.

BFY51 Transistors. 4 for 50p.
BCY72 Transistors. 4 for 50p.

PNP audio type TO5 Transistors. 12 for 25p
BF152 (UHF amp/mixer). 3 for 50p.

2N3819 Fet. 3 for 60p.
SCC18 SILICON. 4 for 50p.

BC158 PNP SILICON. 4 for 50p.
BAY 31 Signal Diodes. 10 for 35p.

IN4148 (IN914) 10 for 25p.
BC107 (Metal can) 4 for 50p.

SCRs 400V at 3A, stud type. 2 for £1.00.
TIPO55 Silicon PNP power transistor. 60V at 1.5A, 90 Watts. Flat pack type. 2 for £1.50.

GERMANIUM DIODES. approx 30 for 30p.

741CG op amps by RCA. 4 for £1.
RED LEDs (Min type) 5 for 70p.

SPEAKER CABINET TYPE M321. White matt finish wood cabinet with white sprayed cloth grille. 9" x 9" x 4 1/2" deep, containing 6 1/2" dia. 15 ohm full range speaker, with 100V line transformer. £4.50 each or 2 for £8.00 + 12 1/2% VAT.

8-TRACK CARTRIDGE PLAYER UNITS. with internal mains psu and 25 watt mono amplifier (100V line). To play standard 8-track cartridges. All contained in a smart veneered wood cabinet, size approx. 14" wide x 5 1/2" high x 11" deep. Supplied with circuits. Brand new and boxed. **SPECIAL OFFER** £35.00 each + 12 1/2% VAT.

VIDICON SCAN COILS (Transistor type, but no data) complete with vidicon base £6.50 each. Brand New.

12V CONTINENTAL TYPE PLUG-IN RELAYS. 2 pole change-over, 60p each. Bases for above (only supplied with relays) 10p each.

GLASS BEAD FEEDTHROUGH INSULATORS. Solder-in type, overall dia. approx. 5mm. Pack of approx. 50 for 50p.

DIE-CAST ALUMINIUM BOXES Send for Latest Price List.

PLASTIC PROJECT BOXES with screw on lids (in black ABS) with brass inserts. Type NB1 approx 3 1/2" x 2 1/2" x 1 1/2" 45p each

Type NB2 approx 3 1/2" x 2 1/2" x 1 1/2" 55p each

Type NB3 approx 4 1/2" x 3 1/2" x 1 1/2" 65p each

TO3 transistor insulator sets, 10 for 50p

PLUGS AND SOCKETS

BNC Plugs, new 50p each.

N-Type Plugs 50 ohm, 60p each, 3 for £1.50.

PL259 Plugs (PTFE) brand new, packed with reducers, 75p each.

SO239 Sockets (PTFE), brand new (4-hole fixing type), 60p each.

SOLDER SUCKERS (Plunger type). Standard Model. £5.50. Skirted Model £6. Spare Nozzles 60p each.

NEW MARKSAM RANGE OF SOLDERING IRONS.

SI40D 40W 240V £4.50.

SI25DK 25W 240V + bite etc., KIT £5.30.

BENCH STAND with spring and sponge for Marksam Irons £2.70.

Spare bits MT9 (for 15W) 60p, MT5 (for 25W) 50p, MT10 (for 40W) 55p.

ALL PRICES + 8% VAT.

TCP2 TEMPERATURE CONTROLLED IRON

Temperature controlled Iron and PSU. £30 + VAT (£2.40).

SPARE TIPS

Type CC single flat. Type K double flat fine tip. Type P, very fine tip £1.50 each + VAT (8p). **MOST SPARES AVAILABLE.**

WELLER SOLDERING IRONS

EXPERT. Built-in spotlight illuminates work. Pistol grip with fingertip trigger. High efficiency copper soldering tip.

EXPERT SOLDER GUN #100 £12.00.

EXPERT SOLDER GUN KIT (spare bits, case, etc.) £15.00. Spare bits 40p pair.

MIXED COMPONENT PACKS. containing resistors, capacitors, pots, etc. All new. Hundreds of items. £2 per pack, while stocks last.

BSR AUTOCHANGE RECORD PLAYER DECKS with cue device, 33-45-78RPM, for 7", 10", 12" records. Fitted with SC12M Stereo Ceramic cartridge and styl. Brand new £14.00 + 12 1/2% VAT.

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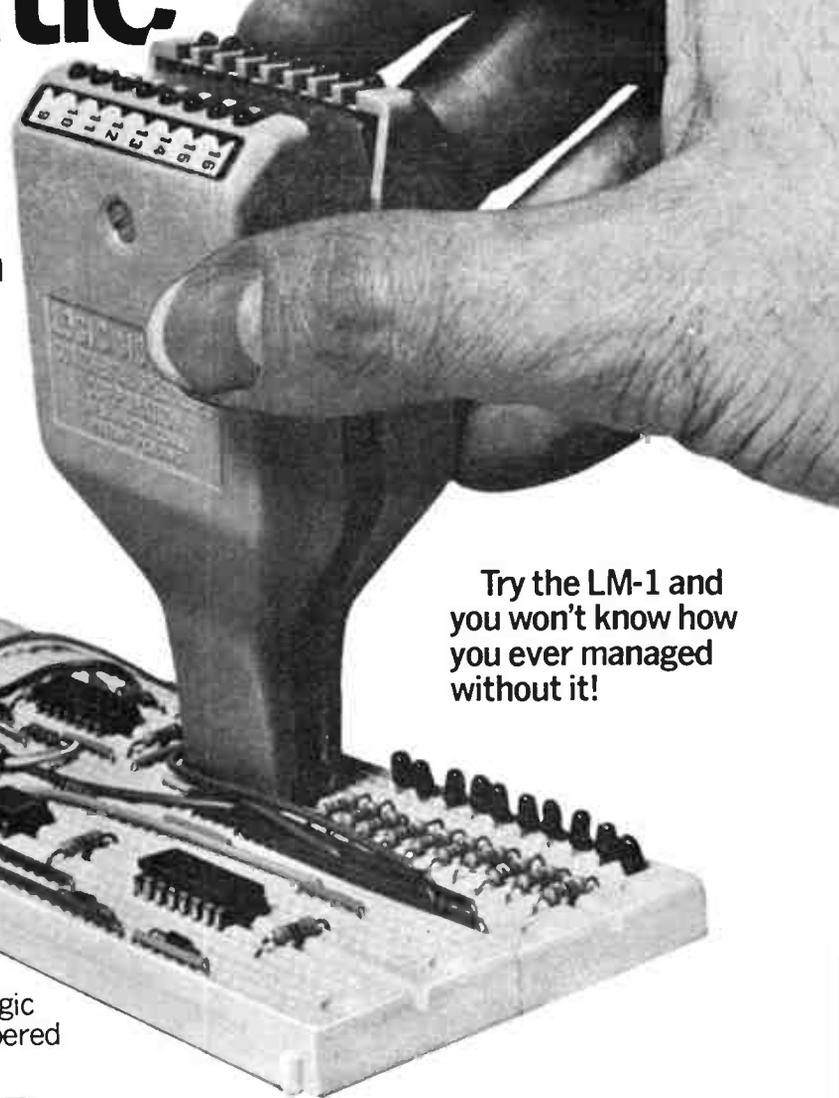
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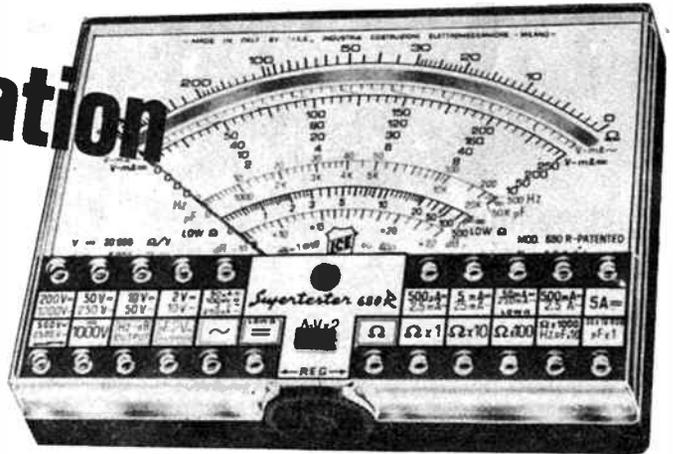
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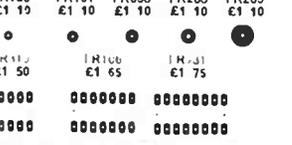
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Chicken & Egg

NEW developments in electronics tend to fall broadly into two categories. Some appear to be the result of someone saying "Here's an idea or an i.c. that will do something that's never been possible before—what can we use it for? The results are often rather gimmicky and pointless and remind me of a course in "Design" which I attended a few years back. There, each project team was given a portable videotape recorder and camera and told to go out and find something to record. A definite case of a means looking for an application.

Other new pieces of equipment seem to announce that their designers have done a tremendous amount of research into what people need, and then proceeded to pack the maximum facilities possible into the product.

Happily there were several examples of the latter type among new items on display at the recent round of London radio and TV trade shows. Perhaps it is a little unfair to mention some without mentioning all, but two particularly took my fancy. From Ferguson comes a clock radio which they have nicknamed (with some justification) "The Great Little Time Machine". This has two time zone settings (BST and GMT?), two alarm time settings (husband and wife?), day and month calendar, forward and reverse setting facility (no more advancing 23½ hours to achieve a half-hour earlier call) and Long, Medium and v.h.f. bands, (ready for the new frequency plan in November). Add to this all the usual facilities and the bonus of auto-dimming of the clock display and you have a very handy item for the bedside table.

Those of you who have ever caught the end of a radio announcement and thought "That sounded as if it could be of interest, I wonder what it was", may find their salvation in a fascinating new system by Intermetall Semiconductors of the ITT group. Based on "bucket-brigade" i.c.s., this continuously stores the last 15 seconds or so of a sound transmission, which may be repeated at the press of a button. So that subsequent announcements are not missed, the recorded speech is compressed in time by removing pauses between words. This process continues until the replayed speech catches up with real time and then normal speech is resumed. Altogether very cunning, and a delightful example of someone recognising that a new technique could be adopted to solve an age-old problem!

Geoffrey C. Arnold

PRINTED CIRCUIT BOARDS SERVICE FOR PW PROJECTS

It has now been decided, commencing with our issue dated September 1978, to enlarge the facilities for the supply of p.c.b.s to readers by authorising additional suppliers. It is hoped that readers may benefit from being able to purchase boards as part of component kits, thereby reducing the number of separate orders for a project.

For some time, most p.c.b.s published in *Practical Wireless* have been available exclusively from Reader's PCB Services Ltd., P.O. Box 11, Worksop, Notts, who will continue to be a supplier and to whom we would wish to say thank you for helping us to get the service started.

Applications for permission to reproduce boards for resale purposes must be made to the editor.

RAE

The Mid-Warwickshire College of Further Education notify us that they will be offering the City & Guilds, RAE Course No. 765 in September 1978.

Enrolment will be on September 7th and 8th. The course will be one evening each week for approximately 30 weeks and is intended to prepare students for examination No. 765-1-02. *Mid-Warwickshire College of Further Education, Department of Engineering, Warwick New Road, Leamington Spa CV32 5JE. Tel: (0926) 311711.*

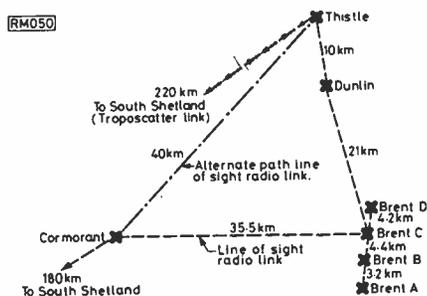
Hello Thistle

North Sea oilmen in the Brent oilfield will soon be able to telephone each other thanks to new equipment now being installed by Marconi engineers.

Shell (UK) Ltd placed a contract worth over £300,000 with Marconi Communications Ltd, a GEC-Marconi Electronics company, for the installation of radio equipment that will establish a communications link between offshore stations, and also back to the mainland.

Phase one of the contract will be to link Dunlin and Brent A, B and D by line-of-sight radio equipment and also to connect Dunlin to BNOC's Thistle platform, Thistle having a troposcatter terminal relaying back to the new Post Office terminal in South Shetland. Phase two will connect Brent C and Cormorant into the system and establish a line-of-sight microwave link between Cormorant and Thistle.

Finally, there will also be a troposcatter link from Cormorant to South Shetland and the line-of-sight microwave link between this platform and Thistle will complete the triangulation for alternate path operation.



Computer Clubs

I am informed of the existence of two northern sub-groups of the Amateur Computer Club, whose object is to help anyone who has an interest in computers, microprocessors etc.

For details of joining the groups those in the North East should contact: *Thomas Turnbull, 49 x 9th Row, Ashington, Northumberland NE63 8JY*, and those in the North West: *David Wade, 26 Wolsey Close, Radcliffe, Manchester M26 0AG*.

Special Event

Yeovil Amateur Radio Club will be running a special event station for Air Day at RNAS Yeovilton, Somerset on Saturday 5th August. Call-sign GB3FAA. For further information contact: *John Howard, 127 Goldcroft, Yeovil, Somerset BA21 4DD*.

Diary notes

The Telford Mobile Rally Group are organising a rally for radio amateurs at Town Centre Malls of Telford, New Town, Salop, on Sunday 10th September, 1978—starting at 11am. There will be many trade stands and exhibits. Details from: *Martyn Vincent G3UKV, 9 Sleaford, Long Lane, Telford, Salop*.

The British Amateur Electronics Club are holding their Amateur Electronics Exhibition this year at the Centre of the Esplanade, Penarth, S. Glamorgan, between 15th and 22nd July 1978. As before all proceeds will be given to the Cancer Research Campaign. Further information from: *Cyril Bogod, "Dickens", 26 Forrest Road, Penarth, Glam*.

The British Amateur Radio Teleprinter Group is holding its annual convention at Harpenden Public Hall, Harpenden, Herts. on Saturday 15th July, 1978—starting at 11am. There will be trade stalls, demonstrations and lectures, including one on Microprocessors by G3PLX, which is expected to attract particular attention. Details from: *J. P. G. Jones GW3IGG, Heywood, 40 Lower Quay Road, Hook, Haverfordwest, Dyfed SA62 4LR*.

The 1978 Harrogate International Festival of Sound is to be held at The Harrogate Exhibition Centre, Harrogate. The public are invited on Saturday 19th and Sunday 20th August from 11.00am until 9.00pm and admission will be free of charge. Trade days are Monday 21st and Tuesday 22nd August, when admission will be by ticket, available from the organisers in a special dealer invitation pack. Further information from *Stan Smith and Peter Hainsworth of: Exhibition and Conference Services Ltd., Claremont House, Victoria Avenue, Harrogate, North Yorkshire. Tel: (0423) 62677*.

Microprocessor terminal

Soon to be launched on the home market is the SR100 series Minitype computer terminal from Warren Logic Ltd.

Designed specifically as a low cost teletype or v.d.t. replacement, it is expected to cost less than £300.

A teletype compatible keyboard with full ASCII capabilities is used. The display section consists of fifteen alphanumeric sixteen segment i.e.d. elements which utilize a sixty-four character ASCII subset. The On-Line mode of operation is full duplex and a local facility is also provided. Both E.I.A. and 20mA current loop operation are standard and any baud rate between 50 and 240 baud may be selected by an eight pin d.i.l. module.

For further details contact: *Warren Logic Ltd., Hockley Road, Brosley, Salop, TF12 5HT. Tel: (0952) 883010*.

PW "Avon"

Those constructors of the "Avon" 2m Transmitter, who intend purchasing transistor types 2N4427 and BLY83 from Watford Electronics should note that the prices quoted in their advertisement are wrong. The correct prices for these transistors are: 2N4427 90p plus 8% VAT and BLY83 £8.50 plus 8% VAT.



Part 5

OSCILLOSCOPE

IAN HICKMAN

This month's instalment deals with the trigger circuits, timebase generator and X output amplifier, all contained on board 4. Figs. 2 and 4 show the component and wiring side of the board and Fig. 1 gives the complete circuit diagram.

The trigger input (either from front panel SKT5 or 6 or from the trigger pick-off stage of the Y amplifier board) is first buffered, amplified and squared up and then passed to a polarity selector gate IC403a which inverts it or not under control of front panel switch 85.

So now we have a squared-up waveform at standard TTL logic levels applied to trigger gate IC402d.

Let's assume the time base hasn't been triggered for some time, so that flyback is complete. Then the output of the control bistable will be a logic 0 (about +0.2V) and the emitter of Tr406 will be negative by a few hundred millivolts.

As the current through its emitter resistor always exceeds the current supplied by the constant current generator Tr404, diode D404 will hold C12 at about 0V and the inverting input of the end-of-flyback comparator IC406 will be slightly negative. IC406 will therefore apply a logic 1 (about +3.8V) to the trigger gate.

The control bistable IC404a is positive edge triggered. Therefore when the output from IC403a goes negative, causing the output of the 2 input nand gate IC402 to go positive, IC404a's Q output will go to a logic 1. D404 will therefore be cut off and the con-

stant current source will start to charge up C12 linearly.

Meanwhile, once triggered, further edges will have no effect on the control bistable and anyway, shortly after the start of the scan, the inverting input of IC406 will go positive, putting a logic 0 on IC402d. The latter's output will therefore sit at logic 1 until the end of retrace (flyback). When the scan reaches +3V, the output of IC405 will change from a logic 1 to logic 0, resetting IC404a. The Q output will therefore fall to 0V, cutting off Tr406, the whole of the current through R429 then being available to charge C12 back down negative.

As soon as the recharge commences, of course, the output of IC405 returns to a logic 1, removing the reset from IC404a.

However, not until the end of flyback will IC406 re-enable IC402d by applying a logic 1 to it, preventing early retriggering of the scan. It doesn't matter whether IC403a output is positive or negative when IC406 re-enables trigger gate IC402d, either way the first edge out of the latter will be negative going.

The control bistable will only be retriggered on a positive edge, i.e. on the first negative edge from IC403a following the appearance at IC402d of a logic 1 from end-of-flyback comparator IC406.

With a basic understanding of the circuit operation, we can now look in more detail at the complete circuit diagram. Emitter follower Tr401 drives the trigger amplifier IC401 via two 150Ω resistors in

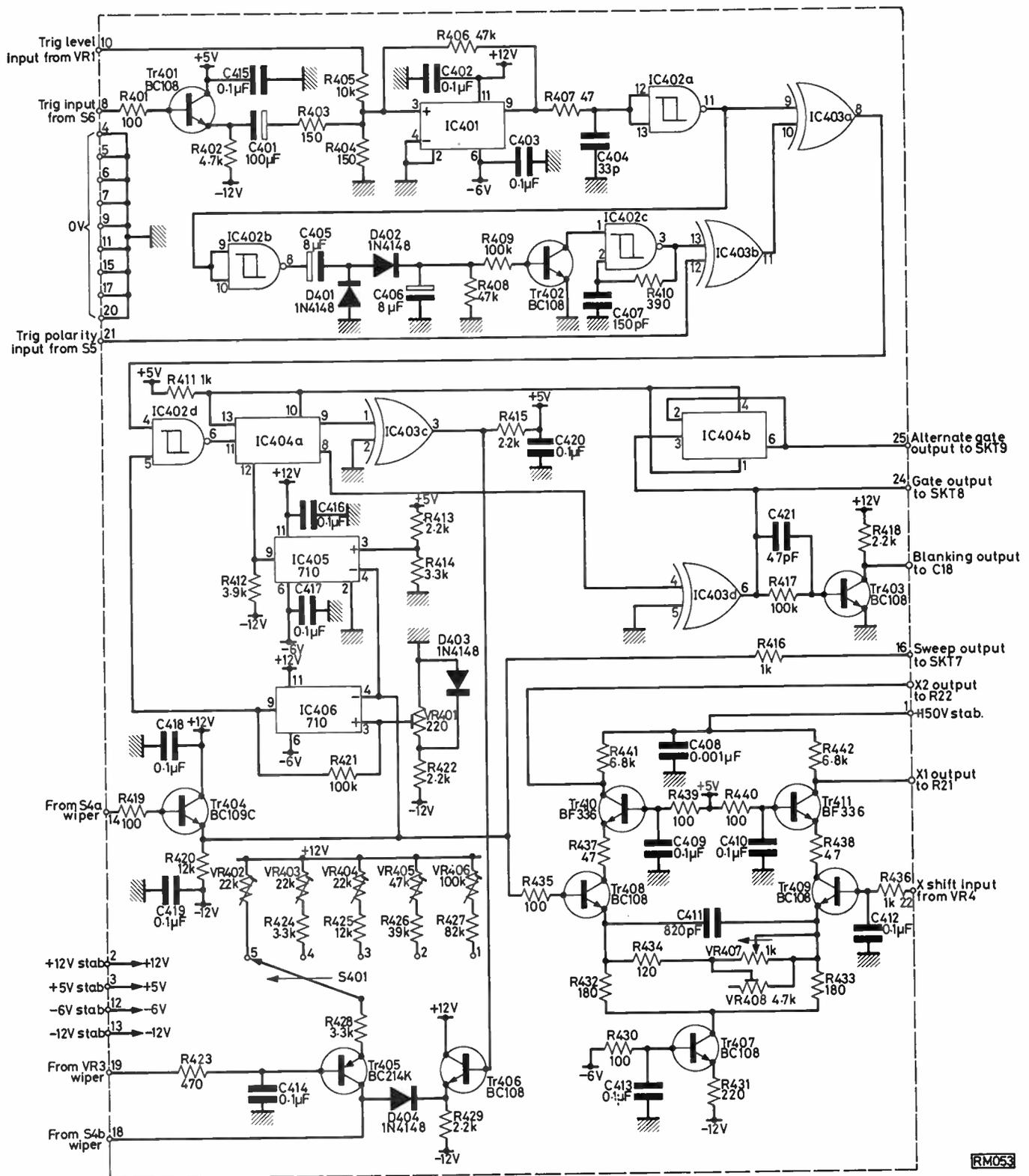


Fig. 1: The circuit diagram of the trigger circuits, timebase generator and X output amplifier, all on board 4

series, providing a low source impedance. At their junction a current injected via R405 provides a variable offset voltage at pin 3, giving control of the trigger level. The gain and bandwidth of the 710 are so great that despite the low source impedance there is a possibility of oscillation as a low

frequency input is passing through the triggering point. This would lead to false triggering and is prevented by applying a small amount of positive feedback via R406, thus introducing a small hysteresis. The output of IC401 drives IC402a, a two input nand Schmitt

trigger circuit used as a buffer. The 710 will only drive one standard TTL load and so cannot drive both IC402b and IC403a directly.

The sudden change in loading on the 710 when IC402a switches can cause the 710 to retrigger falsely. This is prevented by the retardation network R407, C404.

The brightline circuit IC402b to IC403b works as follows. If IC402a is producing a squared-up trigger waveform, the output of IC402b will be detected by D401 and 402, charging C406 up positive. Current through R409 will keep Tr402 bottomed and the output of IC402c must therefore remain permanently high (logic 1). If the other input of exclusive or gate C403b is low, its output will be high. Under these conditions the output of IC403a will be an inverted version of its input. Conversely, if pin 12 of IC403b is high, IC403a output will not be inverted. This provides trigger polarity selection.

If there is no trigger input to the board or RV1 is right at either end of its travel, IC402a output will sit permanently at either a logic 0 or a 1. With no a.c. output from IC402b for the diodes to detect, after about a second, C406 will be discharged and Tr402 will turn off.

With pin 1 now high, IC402c will oscillate, since if its output is high, C407 will charge up via R410 until pin 2 reaches the trigger point and the output drops to a 0 and conversely. As IC403a and b are exclusive-or gates, the output must change whenever one of the inputs changes.

The square wave generated by IC402c will thus be passed to the trigger gate IC402d, operating the

timebase and providing a trace when there is no trigger available.

If the square wave produced by Tr402c were of a very low frequency, on the fast time-base setting a very rapid scan would be followed by a much longer pause before retriggering.

This would result in a very dim trace. IC402c therefore oscillates at a very high frequency, giving a non-triggered trace brightness independent of time-base speed setting.

Note that IC402c output could have been taken straight to pin 10 of IC403a and IC403b inserted between the latter and IC402d.

However, mixing the polarity control in with IC402c "off line" minimises the number of gate delays in the main trigger path. This in turn enables more of the leading edge of a wave form to be seen.

The basic operation of the ramp generator section has already been described, but there are several points of detail worth noting. The D input, pin 13, of IC404a is tied to +5V, i.e. logical. Therefore the "Q" output, pin 9, will go high when a positive edge appears at pin 11. IC403c is a non-inverting buffer and the pull-up resistor R415 takes its output right up to +5V when high, taking the emitter of Tr406 to about +4.4V.

The end of trace comparator IC405 resets the control bistable when the ramp reaches +3V, so there is no danger of D404 tending to turn on before the end of the ramp. VR401 is set so the end-of-flyback comparator only re-enables the trigger gate when the ramp voltage is within a per cent or so of the value at which it would rest if IC404a was never triggered.

★ components

Resistors

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

47 Ω	2	R407, 437, 438
100 Ω	6	R401, 419, 430, 435, 439, 440
120 Ω	1	R434
150 Ω	2	R403, 404
180 Ω	2	R432, 433
220 Ω	1	R431
390 Ω	1	R410
470 Ω	1	R423
1k Ω	3	R411, 416, 436
2-2k Ω	5	R413, 415, 418, 422, 429
3-3k Ω	3	R414, 424, 428
3-9k Ω	1	R412
4-7k Ω	1	R402
10k Ω	1	R405
12k Ω	2	R420, 425
39k Ω	1	R426
47k Ω	2	R406, 408
82k Ω	1	R427
100k Ω	3	R409, 417, 421

5W Wire Wound

6-8k Ω	2	R441, 442
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Potentiometers

Miniature vertical skeleton preset

220 Ω	1	VR401
4-7k Ω	1	VR408
22k Ω	3	VR402, 403, 404
47k Ω	1	VR405
100k Ω	1	VR406

$\frac{1}{4}$ inch diameter spindle

1k Ω	1	VR407
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Capacitors

Ceramic

33pF	1	C404
47pF	1	C421
150pF	1	C407
820pF	1	C411
1nF (500V)	1	C408

30V disc ceramic

0-1 μ f	13	C402, 403, 409, 410, 412, 413, 414, 415, 416, 417, 418, 419, 420
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Electrolytic

8 μ F 16V	2	C405, 406
100 μ F 10V	1	C401

Semiconductors

Diodes

1N4148	4	D401, 402, 403, 404
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Transistors

BC108	7	Tr401, 402, 403, 406, 407, 408, 409
BC109C	1	Tr404
BC214K	1	Tr405
BF336	2	Tr410, 411

Integrated circuits

SN72710	3	IC401, 405, 406
SN7474	1	IC404
SN7486	1	IC403
SN74132	1	IC402

Switches

1p. 6w.	1	S401
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Miscellaneous

Printed circuit board (1)	(Watford Electronics)
Test pins and sockets (3)	

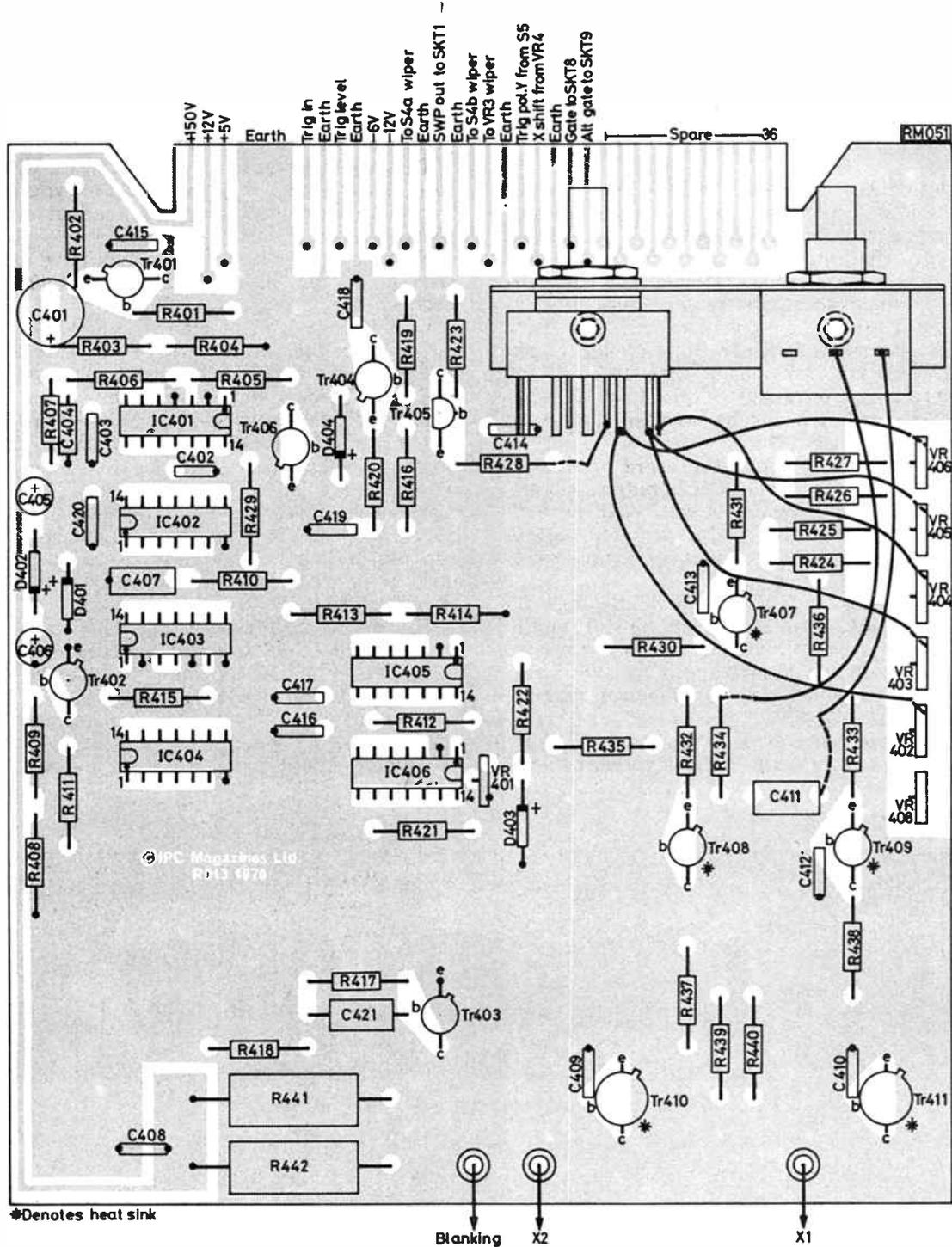


Fig. 2: Component layout of board 4. Note that the components are mounted on the copper ground plane side of the board

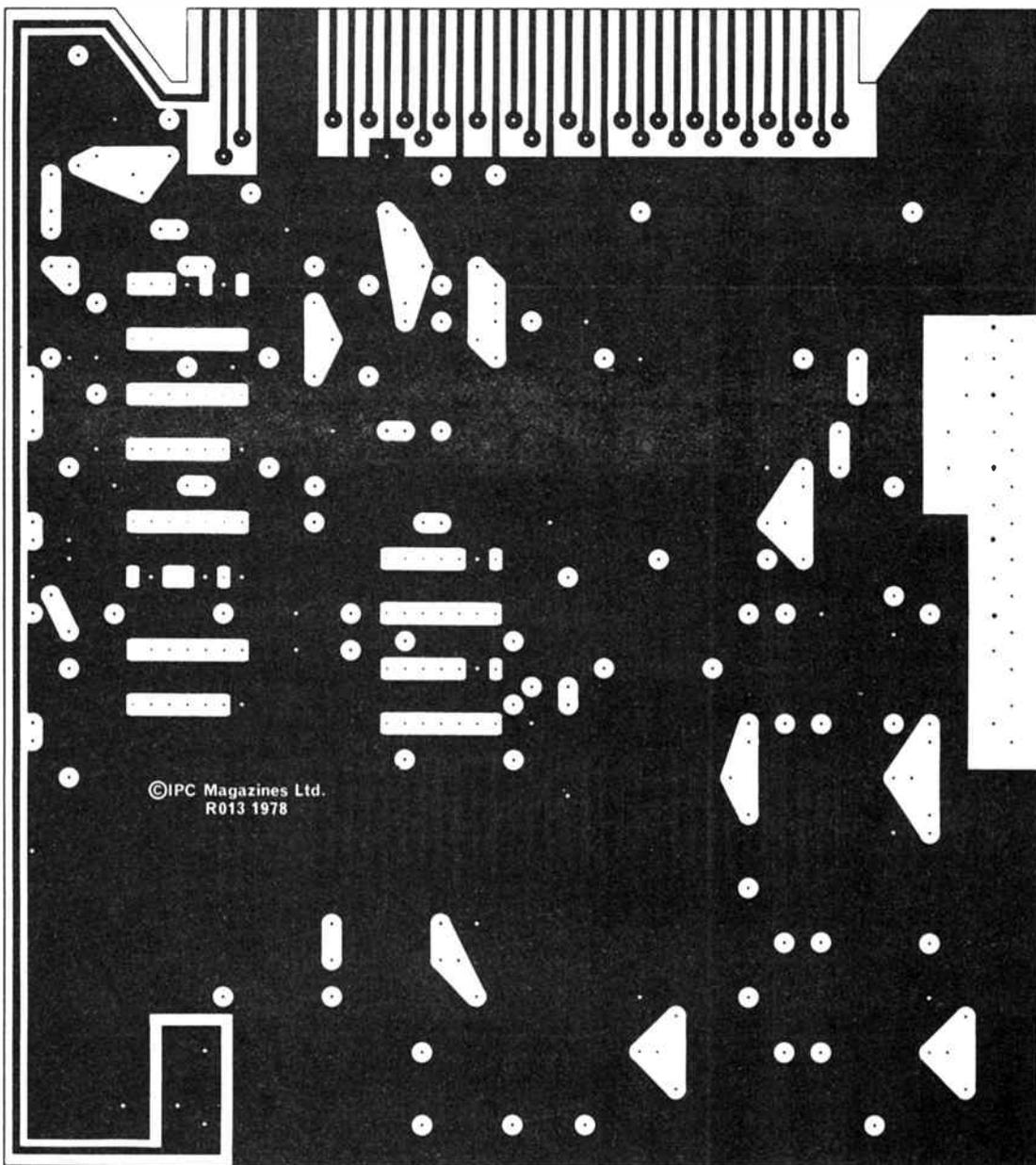
To ensure clean operation of IC406, a small amount of hysteresis is built in by applying positive feedback via R421.

Time base speed is selected by S4 (in 10 to 1 range steps), by S401 (providing multipliers of x 0.5, x 1, x 2, x 5 and x 10) and by RV3 (continuously variable x 1 to x 3 approx., fully clockwise—x 1—being the Calibrated position).

The Q output of IC404a is buffered by IC403d and made available at front panel socket SKT 8 as a negative going pulse which “frames” the scan period.

It is also divided by two by IC404b and made available at SKT9 as an “alternate sweep gate”—logic 0

Several readers have enquired about the possibilities of using alternative tubes for Purbeck. We cannot advise anyone as to the suitability of components other than those specified. Not only will the mechanical construction need alteration, but revised amplifiers and e.h.t. supplies will also be required.



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R013 1978

Fig. 3: The copper ground plane pattern of board 4

and 1 on alternate traces. IC403d also drives Tr403, which is cut off during the scan and bottomed during retrace. The collector wave-form is used to blank the c.r.t. during flyback.

Besides driving the comparators IC405 and 406, emitter follower Tr404 makes the ramp wave form available at SKT 7 (sweep output) via R416 and drives the X deflection amplifier.

This is basically similar to the Y deflection amplifier, but driven unbalanced at Tr408 with the X shift voltage fed in at Tr409.

In view of the more limited frequency response

WARNING

Extra care must be taken when working on any part of this instrument while power is switched on. 1100 volts can kill. When delving into the insides of the scope for any reason with power on keep one hand in your pocket.

which suffices for the X amplifier, a single frequency compensation capacitor C411 is used in the emitter circuit. The Calibrated position for VR407 is fully anticlockwise, corresponding to minimum gain. RV408 allows this value of gain to be set to the required value.

Owing to the larger deflection voltage required for the X plates, the collector resistors of TR410 and 411 are returned directly to +150V.

With a higher supply voltage than the Y amplifier, the current is reduced, about 10mA in each transistor, to keep the dissipation of the BF336s the same.

Having completed the construction of Board 4, check each power supply pin to 0V with an ohmmeter to make sure none is short circuit and centre all preset potentiometers except VR401, which should be set with the wiper at the earthy end. Set VR407 fully anticlockwise.

Plug the board into the mainframe, remove the temporary 47kΩ and 100kΩ resistor chain and con-

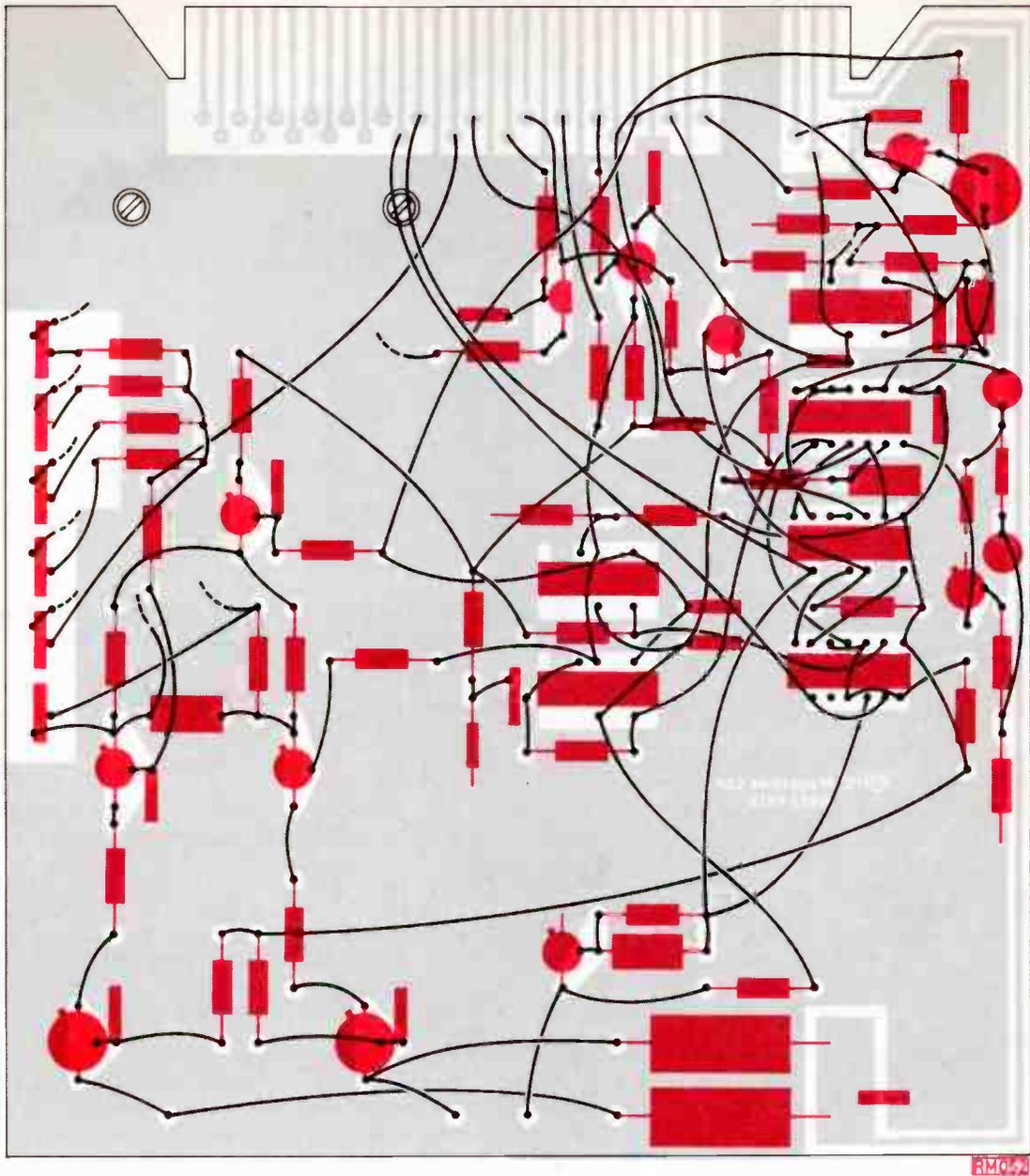


Fig. 4: Back wiring of board 4 in relation to the components. This layout of the wiring should be followed to avoid any possibility of instability occurring

nect the X plates via R21 and R22 and sockets to pins X1 and X2 of the board.

Connect one lead of C18 to c.r.t. pin 3 (one of the tube base mounting holes—which are not used—can be fitted with a solder tag to support the lead) and the other via a socket to the blanking output of the board.

Set RV3 fully clockwise, S4 to position 2 and S401 to position 5. Plug in briefly and check that all stabilised supply voltages are normal, indicating no shorts anywhere.

A trace should appear on the screen—the tube may need rotating a little if it is not horizontal, but the spigot should be somewhere near the top. It is safest to turn off first, remember there is -800V around! Next, set S401 to position 2 and connect SKT3 to SKT1. With S3 and S301 both in position 3, two or

three cycles of the 50Hz Cal. square wave should appear on the screen.

If the waveform is running through, adjusting RV1 should synchronise it, provided of course that S6 is in the Internal position.

The trace should start with a positive or with a negative edge according to the position of S5. Now set S401, Timebase Multiplier, to position 5 (X0.5). Rotate the wiper of RV401 away from the earthy end of its track until the trace stops running and then set it back just a few degrees beyond the point where the trace starts to run again.

These tests show that Board 4 is basically operational; setting up is covered in next month's instalment.

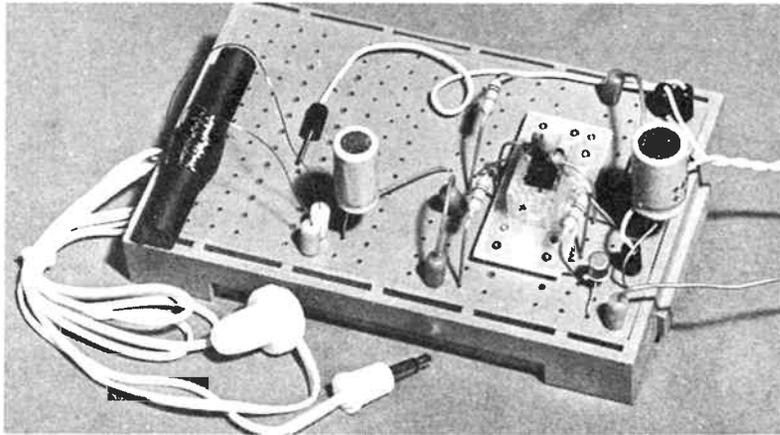
Next month we will deal with the case and other mechanical details.

DAVID GIBSON

5



THIS MONTH



'Mains Cable Detector'

This month's circuit uses the 741 op. amp. in a closed loop inverting mode to form a sensitive mains cable detector. A simple but very useful device it can save certain disaster when deciding where to bang nails, etc., into walls.

When a.c. mains current flows in a conductor there is a magnetic/electric field surrounding the conductor, albeit a very weak field. If this field comes within range of our search coil (L1) then the fluctuating 50Hz field from the conductor will induce tiny voltages and currents in the coil L1. These can be quite clearly heard in the earpiece.

On test, the circuit shown could easily and positively detect the presence of a mains cable to a small Ni Cad battery charger laid on a bench at a distance of 12 inches. A simple, small bar magnet could also be 'heard' when passed within some 3 to 4 inches of the search coil.

The complete circuit of the mains cable detector is shown in Fig. 1, it can be built on a μDeC in less than 15 minutes and takes only 20 minutes to transfer to a piece of matching Blob Board. The inverting closed loop amplifier IC1 has its output fed to C3. By connecting the earpiece recommended between the positive plate of C3 and the negative line the circuit will function well, although it would be wise to reverse the polarity of C3 if this circuit configuration is settled as permanent. In Fig. 1 an additional stage of amplification is afforded by the addition of only two components, R4 and Tr1.

The total measured current drawn by the circuit with 3V applied was only 0.6mA and battery life should be very long indeed if the device is used intermittently. A magnetic microphone was tried as a small loudspeaker in place of the earpiece. This worked well but increased the current drawn to 1.4mA. The microphone had an impedance of 300Ω. Note that a lower impedance should not be used and

that small 8Ω loudspeakers would be unsuitable in the circuit as shown.

The value of C2 should be found by experiment for optimum results. This is extremely simple with the μDeC because one simply 'plugs in' different values of capacitor in turn. The capacitance shown will work well but various values from 10pF to 0.1μF were tried. In general, the best value will lie between about 80pF and 350pF. The effect of adding this capacitor across the feedback resistor R3 is to make it frequency conscious and to attenuate the higher frequencies.

This is sensible for two reasons. Firstly we are only interested in 50Hz, which is a very low frequency. Secondly, without this capacitor the circuit becomes a h.n.c. circuit (Horrible Noise Oscillator!). The values of the input and output capacitors C1 and C3 are not all critical. Low values were selected because they would present less resistance/impedance to the lower frequency of interest. However, even using 0.1μF in each case still gave excellent results.

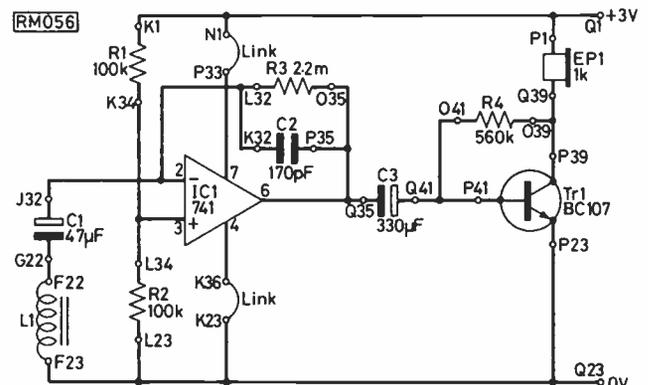


Fig. 1: Circuit diagram of the cable detector

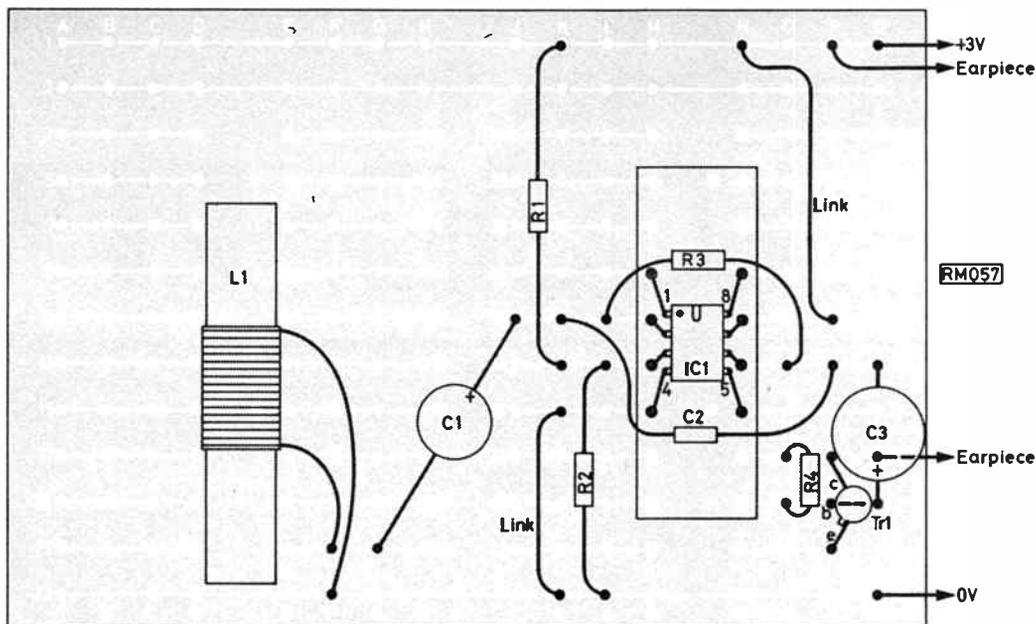


Fig. 2: Layout of the mains cable detector on a μ DeC. The same layout can be used to build the circuit permanently on a matching Blob Board

The search coil L1 was simply an old relay. The contacts connections were ignored. The one used was a midget 700 Ω type, but almost any kind should work well. For the constructionally-minded a few hundred turns of, say, 30 s.w.g. enamelled copper wire wound higgledy-piggledy on a 2 inch piece of ferrite rod (any diameter) should also work.

The circuit might also be used as a telephone amplifier. This can be useful where you might require another person to listen to a conversation. One of the small telephone pick-up devices with a little rubber sucker may be plugged in directly in place of L1. The

inner wall of the case using a generous blob of Bostick to its plain side. You will also need an on/off switch—not shown in Fig. 1, the search coil should be mounted inside the case for protection and two small (3mm) holes drilled just above the coil and in both sides of the box.

When using the device, the wall is swept for maximum pick up. A long knitting needle is then pushed gently through both holes and the container drawn away up the knitting needle to reveal a locating point. This can then be marked lightly with a pencil and a further sweep made to trace the cable. ●

★ components

R1	100k Ω	IC1	741 op amp (8-pin DIL)
R2	100k Ω	Tr1	BC107
R3	2.2M Ω	L1	relay coil 700 Ω
R4	560k Ω	EP1	earpiece Acos red spot 1k Ω
C1	47 μ F		μ DeC
C2	170pF		μ DeC jumper leads
C3	330 μ F		3V battery

telephone pick-up could also double as the search coil for the cable detector operation.

Sensitivity of the circuit can be damped by reducing the value of R3 to 820k Ω . Experimenters might like to insert a potentiometer in place of R3. Connect the outer tags on the potentiometer to μ DeC holes L32 and 035 (i.e. in place of R3), and connect the middle tag to either of the others. It is suggested that a 1M Ω potentiometer be used.

For best results, the earpiece should be an Acos red spot 1k Ω type. All others tried were found to be inferior in terms of sensitivity. A crystal microphone was also tried in place of the earpiece and this worked tolerably well provided that a 560k Ω resistor was wired in parallel with it to provide a d.c. path for the collector of Tr1.

If (like the writer) a permanent circuit is required, the device could be transferred to a matching piece of Blob Board and the components then soldered into position. The Blob Board is then stuck directly to the

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Introduction to

LOGIC ~ 2

S.A.MONEY

Last month we started our exploration of digital logic by examining the characteristics of digital signals and the AND gate circuit. In a real logic system the AND type gate alone will not allow us to perform all of the operations that we might need. Obviously we shall need some other types of logic gate if we are to produce a logic system.

The OR Gate

Let's go back to our simple electrical lamp and switch circuit. This time however, instead of having the two switches connected in series, we shall have them in parallel as shown in Fig. 9. Now we have produced a different type of logic gate function. Here the lamp will light if either of the switches is closed. In logical terms, the output is 1 when input A OR B is at 1. As one might expect, this type of gate is called an OR gate.

We can of course make up an OR gate by using discrete diodes, using the circuit shown in Fig. 10. If we compare this with a diode AND gate, we see that it is in effect an AND gate which has been turned upside down whilst the diodes have had their polarity reversed.

If input A goes to 1 diode D1 conducts and pulls the output up to 1 by driving current through resistor R. Input B will have the same effect upon the output. Only if both A and B inputs are at 0 will both diodes turn off to leave the output at the 0 level.

We can now draw up a truth table to show the various logic states that can exist in a 2-input OR gate (Table 3).

Table 3

Input		Output
A	B	Y
0	0	0
1	0	1
0	1	1
1	1	1

In fact the OR gate is effectively complementary to the AND gate. For an AND gate the output is 1 only when all of the inputs are at 1, whilst for the OR gate the output is at 0 only when all of the inputs are at 0. If we changed all of the 1s for 0s and vice versa in the OR-gate truth table, we should end up with the same set of logic conditions as we had in the AND-gate truth table. For an OR gate we can also say that if any one or more of the inputs is at 1 the output will be at 1.

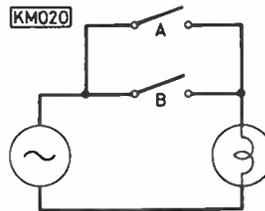


Fig. 9: Electrical OR gate

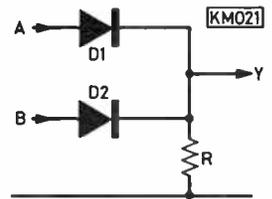


Fig. 10: Diode OR gate

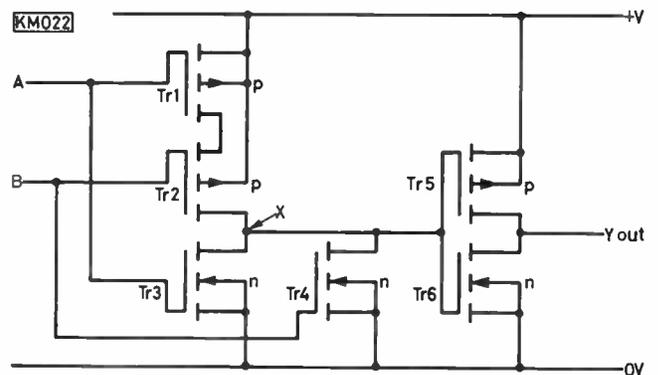


Fig. 11: A typical CMOS OR gate

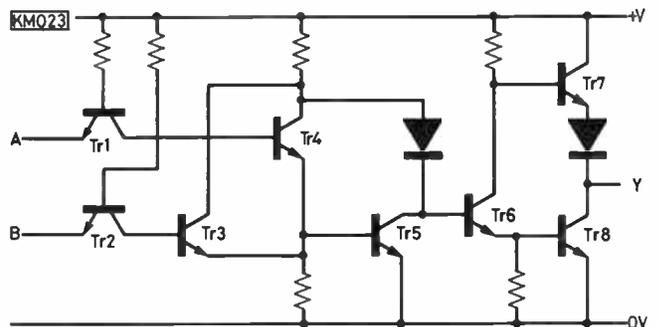


Fig. 12: A typical TTL OR gate

In CMOS logic devices, the OR gate arrangement looks similar to the CMOS AND gate except that it has effectively been turned upside down so that the p transistors are now in series and the n transistors are in parallel. A circuit for a typical CMOS 2-input OR gate is shown in Fig. 11. If either of the inputs is at 1, then either Tr3 or Tr4 will be turned on to bring point X down to the 0 level. This produces a 1 level at the output because of the inverting action of the output stage itself.

In the case of the TTL type devices, the circuit of an OR gate is rather different from that of an AND gate and is shown in Fig. 12.

OR Gate Symbol

Once again, because of the complex nature of the gate circuit, a special symbol is used to denote an OR gate. This one takes the shape of a shield, with the output line coming from the pointed end of the shield as shown in Fig. 13(a). For convenience in drawing an OR gate with a large number of inputs this symbol may be modified to that shown in Fig. 13(b). The symbols we shall use in this series are those of American MIL STD 806B. Alternative symbols are used in other standard systems.

Actual OR-gate integrated circuits come in a similar range of combinations to the AND-gate types. In the CMOS range we have the 4071 which is a quadruple 2-input OR gate arrangement. Then there are the 4075 (triple 3-input OR gate) and the 4072 which contains two separate 4-input OR gates. These are shown together with their connections in Fig. 14.

In the TTL series, the OR gate is not very popular and only one variety is available. This is the 7432 which contains four separate 2-input OR gates as shown in Fig. 14(d).

When designing actual logic systems we shall, from time to time, want to use OR gates which have more inputs than those available as standard circuits. These larger OR gates can be built up by cascading several smaller OR gates as shown in Fig. 15. Here an 8-input OR gate has been produced by using two 4-input gates feeding a 2-input gate. If any input of G1 goes to 1 then its output goes to 1 and hence the output of G3 will also go to 1. Similarly a 1 applied to any of the inputs of G2 will produce a 1 at the output. Thus the combination will behave as if it is an 8-input OR gate.

Using OR Gates

How might we use OR gates in practice? Let us once again consider our automatic hot drinks machine, and see how it might be organised using logic. For a start we'll assume that some mechanical valves are used to control the flow of coffee, tea, milk etc. into the cup and that these valves are operated by solenoids driven from the logic.

When a 1 signal is applied to a solenoid the associated valve will deliver a metered amount of coffee, tea, etc. into the cup. If a 0 signal is applied to the solenoid the valve will remain closed.

Suppose we allow for six basic drink combinations, each of which is selected by a push button on the front of the machine. In this case these will give black or white coffee, which may be sweet or not as desired. Other options will be tea (with milk) which may be either with or without sugar. There are six inputs to our logic system and four outputs to control the valves for tea, coffee, milk and sugar. A suitable arrangement for the logic is shown in Fig. 16.

Let us start by looking at the coffee output line. This must go to 1 whenever any of the buttons calling for a coffee drink is pressed. We can produce the output required by feeding the signals from the four buttons selecting coffee combinations to a 4-input OR gate (G1). The output from this gate drives the coffee control valve.

If we consider the milk output signal this must be set to 1 when white coffee or tea has been selected. Again we have four inputs which are fed to an OR gate G2 to provide the drive for the milk control solenoid.

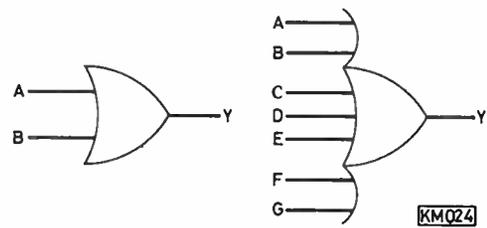


Fig. 13: OR gate symbols

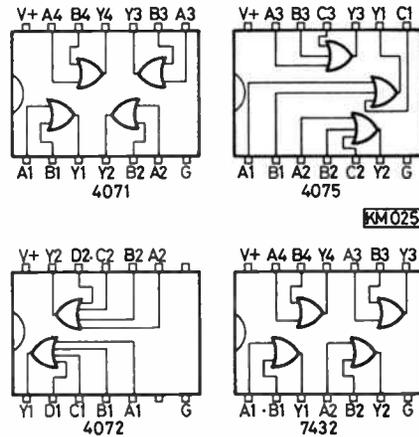


Fig. 14: Some actual OR gates

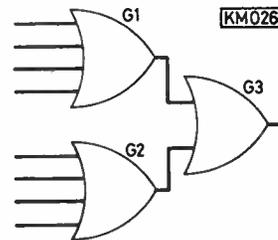


Fig. 15: Cascading OR gates to provide more inputs

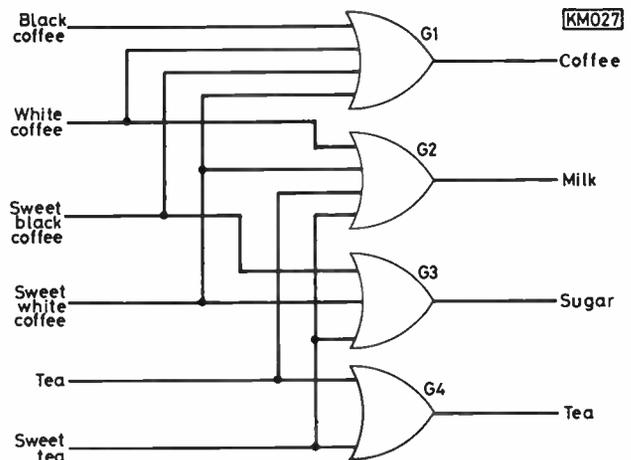


Fig. 16: Logic circuit for a hot drinks machine

For tea there are only two combinations which need a 1 output so here a 2-input OR gate G4 is used for the tea control signal. Finally for sugar control we can OR together all of the inputs that require sugar and here we need a 3-input OR gate G3 to produce the output.

This basic logic scheme could now be extended to allow for more combinations such as lemon tea, chocolate and maybe even cold drinks such as Coca Cola or lemonade by adding more inputs and more OR gates.

The Inverter

Apart from the AND and OR type gates, we need one more basic logic function which is called the inverter. This produces a 1 output for 0 input and vice versa.

Suppose we have a 2-input AND gate with signals A and B applied to its inputs. Now assume that we want to achieve a 1 output when A is at 1 but B is at 0. In a simple AND gate the output would be 0. Now suppose we invert the B input so that a 1 is applied to the input of the gate when the actual B input is 0, then we shall get a 1 out of the gate if A is 1 and B is 0.

A logic inverter might be a simple transistor stage as shown in Fig. 17. When 0 is applied at the input the transistor is cut off and the output line will go to the 1 level. If a 1 input is applied, the transistor will turn on and its collector voltage will fall to zero to give a 0 output. Such an inverter stage might have been used with discrete diode logic in the days before integrated logic circuits appeared.

In TTL and CMOS logic an inverter usually consists of simply the output stages of a gate circuit which with most logic types gives a logical inversion.

The symbol used for an inverter is shown in Fig. 18. Here the triangle indicates an amplifier whilst the small circle on the output line indicates that the logic signal has been inverted.

Actual inverter devices usually come in groups of six to a package. In the TTL range the standard version is the 7404 which is shown in Fig. 19(a) whilst the CMOS equivalent is the 4049 shown in Fig. 19(b).

Logic Equations

The theory of logic systems is by no means new. The ancient Greeks had already worked out many of the ideas but in the mid 19th century mathematicians, such as George Boole, developed logic as a branch of mathematics. Now a logic system could be reduced to mathematical equations and operated upon by special algebra called Boolean algebra. We shall not go into the theory of logic in a mathematical sense, but it is useful to understand the shorthand used to describe a logic system.

If we take a simple 2-input AND gate we can write down its operation as the equation

$$Y = A.B$$

Here the inputs have been named as A and B and the output is called Y. In a logic system the signals may be denoted by letters such as A, B, etc. or they may be given names such as DATA, CLOCK etc. In the equation for the AND gate the full stop between A and B signifies an AND function, so the equation can be translated as output Y equals input A AND input B.

For the OR function a + sign is used, so that for a 2-input OR gate the logic equation would become,

$$Y = A + B$$

If there were three inputs to the OR gate the equation would then become,

$$Y = A + B + C$$

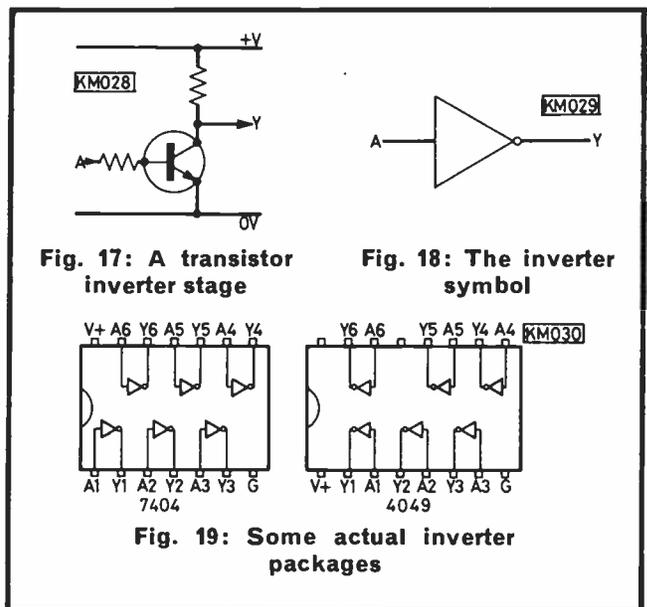


Fig. 17: A transistor inverter stage

Fig. 18: The inverter symbol

Fig. 19: Some actual inverter packages

We can make up much more complex logic equations by mixing both OR and AND functions so that we might have,

$$Y = (A.B) + (C.D)$$

Here brackets have been added to make it clear which of the logic operations go together. In this case if both A AND B go to 1, OR, if both C AND D go to 1, the output Y will go to 1. The logic arrangement which will produce this equation is shown in Fig. 20.

What happens if we put an inverter into the system? Any logic signal which has been inverted is denoted by a bar drawn over the name of the signal. So for a simple inverter the logic equation will be

$$Y = \bar{A}$$

Such an inverted signal might be referred to as BAR A or alternatively NOT A, where A is the name of the signal. Thus we might have,

$$Y = \bar{A}.B$$

This means that output Y will go to 1 when input A is 0 ($\bar{A} = 1$) AND B is at 1.

Now by using only these three types of logic unit, the AND gate, the OR gate and the INVERTER we can build up virtually any logic system.

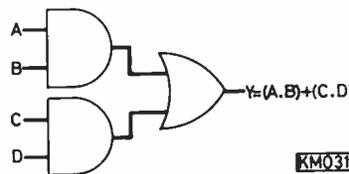


Fig. 20: Combining gates to produce a more complex function

The NAND Gate

If you look up a data book of TTL devices, the first one you are likely to meet is the 7400 which is described as a quadruple 2-input NAND gate. So what is a NAND gate and why should we need one anyway? Basically the NAND gate is simply an AND gate followed by an inverter, built up as a single device. One advantage of this type of gate is that we can produce all of our logic systems by using just one type of gate rather than three.

In the NAND gate the function is similar to that of an AND gate except that the output is inverted so that the truth table becomes as shown in Table 4.

Table 4

Input		Output
A	B	Y
0	0	1
1	0	1
0	1	1
1	1	0

The symbol used for a NAND gate is similar to that for the AND type except that it has a circle at its output to indicate logic inversion. This is shown in Fig. 21. The logic equation for a NAND gate will be,

$$Y = \overline{A \cdot B}$$

where the bar over the A.B indicates the inversion of the complete logic signal at the output of the gate.

If we take a NAND gate and join all of its inputs together in parallel it will become a simple inverter. If we feed the output of a NAND gate through an inverter it will perform the same function as an AND gate, since the extra inverter will cancel out the action of the one inside the NAND gate. By inverting each of the input signals to a NAND gate we can produce the OR function. Here if any of the inputs goes to 1 the actual signal applied to the NAND gate goes to 0 and hence the output of the NAND gate must go to 1, thus producing the same result as an OR gate. You can check all of these actions by looking at the truth tables and working out the various states of the inputs and outputs of these combinations of NAND gates.

In TTL the NAND gates come in the same combinations as the AND types, giving four 2-input gates (7400) three 3-input gates (7410) and two 4-input gates (7420). Each of these arrangements has the same pin layout as the AND counterpart. In NAND gates however we can also have an 8-input gate (the 7430). For CMOS the 2, 3 and 4-input gates are the 4011, 4023 and 4012 respectively, and they have the same pin configuration as the AND versions. There is an 8-input gate in CMOS which has the number 4068.

The NOR Gate

Having produced a NAND gate we might now consider the possibility of combining an OR gate with an inverter. This will in fact produce what is called a NOR gate. Like the NAND gate it has the advantage that you could build up any logic system by using just NOR gates instead of having AND, OR and INVERT functions.

In the NOR gate a 1 applied to any of its inputs will produce a 0 to the output. Conversely the output can only become 1 when both inputs are at 0. This produces the truth table shown in Table 5.

Table 5

Input		Output
A	B	Y
0	0	1
1	0	0
0	1	0
1	1	0

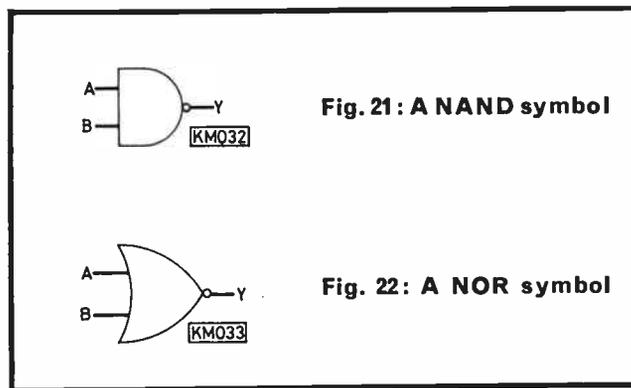


Fig. 21: A NAND symbol

Fig. 22: A NOR symbol

As we might expect, the symbol for a NOR gate is like that for OR but with a circle on the output line to show that the output is inverted. This is shown in Fig. 22. We can write down the action of a NOR gate as

$$Y = \overline{A + B}$$

Practical devices are the 4001, 4025 and 4002 in CMOS, which are the NOR equivalents of the 4071, 4075 and 4072 respectively and have the same pin connections. In addition to these there is the 4078 which is an 8-input NOR gate. In TTL there is also quite a range of NOR gates giving two inputs (7402), three inputs (7427) and four inputs (7425).

By inverting the output of a NOR gate we can get an OR gate and by inverting its inputs we can produce an AND gate, so the NOR gate alone can be used to build up almost any logic function.

Changeover Gate

Let's see how we might use some of the gates that have been described. One frequently used function is to simulate a changeover switch. Here we want to pass either input A or input B through to the output according to the state of a control line C. Such a circuit can be built up from NAND gates as shown in Fig. 23, which also shows the equivalent switch circuit.

When control input C is a 0, gate G3 is effectively closed and its output remains at 1 irrespective of the state of the B input. Gate G1 acts as an inverter and G2 is therefore held open and allows input A to pass through to the input of G4. Since the other input of G4 is at 1, signal A passes through to the output. The inversions in gates G2 and G4 cancel out to leave A uninverted at the output. When C goes to 1, G2 closes and G3 opens to let input B pass through to the output.

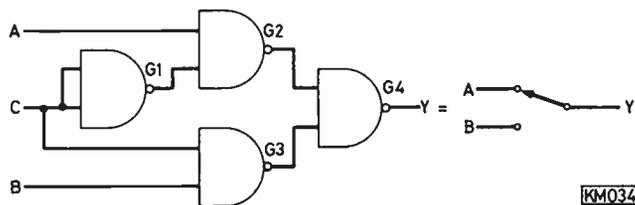


Fig. 23: Logic circuit of a changeover gate, and its electrical equivalent

This changeover gate function can of course be made up by using other combinations of gates and inverters and as an exercise you might like to work out some of these alternatives. Generally the circuit shown is convenient because it can be implemented by using a single 7400.

The EXCLUSIVE OR Gate

There is one further special gate function which it is worthwhile to investigate. When we looked at the OR gate you will remember that the output went to 1 when either input A or input B or both went to 1. There are occasions however when we would like the output to go to 1 if A or B was at 1 but to remain at 0 if both of the inputs went to 1. A gate that performs this action is called the EXCLUSIVE OR gate.

Such a gate arrangement can be built up as shown in Fig. 25. Here the two AND gates are detecting the input conditions $A = 1, B = 0$ and $A = 0, B = 1$ and these are the only states where there will be a 1 at the output.

The EXCLUSIVE OR gate has its own special symbol as shown in Fig. 26. In logic equations too it uses a special symbol which is a + enclosed in a circle so that for a 2-input gate we get the equation,

$$Y = A \oplus B$$

The truth table for this type of gate is shown in Table 6.

Table 6

Input		Output Y
A	B	
0	0	0
1	0	1
0	1	1
1	1	0

Normally, EXCLUSIVE OR gates are produced with only two inputs and the standard package is to have four separate 2-input gates in one device. In TTL this is the 7486, and in CMOS it is the 4070.

We shall see later that the EXCLUSIVE OR gate is useful when comparing patterns of bits, and can also be used as a switched inverter device which will allow us to invert a signal on command from another signal.

At this point we have looked at most of the useful types of gate, although there are of course many other combinations in both TTL and CMOS which can sometimes be useful, but whose functions can be reproduced by a mixture of the gates we have looked at already.

Next month we shall go on to look at the other major group of logic devices, namely the flip-flops.

The Multiplexer

We can expand the idea of a changeover switch to produce a multiway switch similar to our old friend the rotary switch. Such an arrangement of logic is normally called a multiplexer.

In Fig. 24 we show the logic for a 4-way multiplex switch. The control signals C1 to C4 are arranged so that only one of them can be at 1 at any time. If C1 were at 1 then signal A would pass through G1 and since G5 is an OR gate it will also pass through G5 to the output. Gates G2, G3 and G4 will be off because one of their inputs is at 0 and hence they will have no effect on the state of G5. The number of inputs can be expanded by adding more AND gates and having more inputs to the final OR gate. If desired, multi-bank switches can be produced by having a series of parallel multiplexer circuits with the control inputs connected in parallel across the banks.

Because multiplexers are often used, special logic devices are available such as the 74151 which is an 8-input single-bank multiplexer in one package.

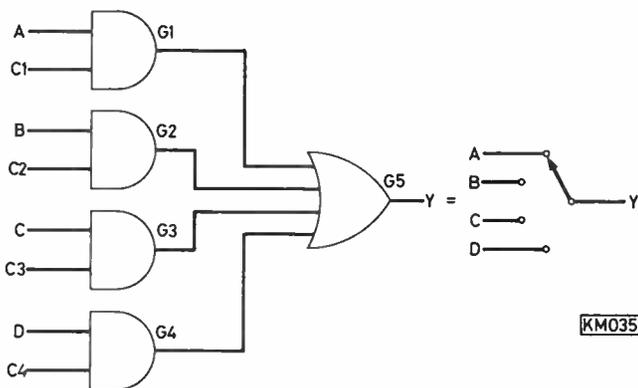


Fig. 24: Logic circuit of a multiplexer, and its electrical equivalent

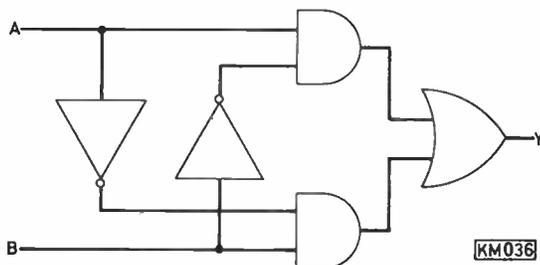


Fig. 25: A logic circuit for an EXCLUSIVE OR gate

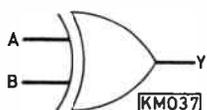


Fig. 26: EXCLUSIVE OR gate symbol

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M. J. DARBY

The construction of an amplitude modulation (a.m.) receiver can be considerably simplified by the use of one of the semiconductor devices which have been especially developed for this particular application. This and future articles will review the various types of device available and include a selection of typical circuits which the reader can construct and with which he can experiment.

Practical constructional details will not be included, since a variety of circuits are covered and constructional details for specific receivers are regularly included in our pages. Audio amplifier sections will not be included since the audio output from any of the receiver circuits can be fed into a standard audio amplifier. Integrated circuits will be used throughout, since this reduces the number of components used compared with discrete (separate) transistor designs.

Amplitude Modulation

The amplitude of an a.m. signal varies at the frequency of the audio signal concerned. For example, one may consider a 1MHz radio frequency carrier wave (which is far above the level of human hearing) and which varies in amplitude at an audio frequency of 1kHz. When a receiver is tuned to this signal, the 1kHz frequency will be heard from the loudspeaker.

Amplitude modulation is used on long, medium and short wave transmissions. Frequency modulation can be used at much higher frequencies (e.g. f.m. sound at about 90MHz) for high quality reception, but cannot be used with advantage at relatively low frequencies.

A.M. receivers are usually simpler than f.m. receivers and it is therefore sensible for a beginner to commence with a.m. circuits. Signals at the high f.m. frequencies cannot be received from distant transmitters, so if you wish to receive a signal from a station more than about 50 to 100 miles away, it will be an a.m. signal you will select. However, the fact that distant a.m. signals can reach your aerial inevitably means that one is much more likely to experience interference from unwanted signals than with f.m. reception.

T.R.F. or Superhet?

There are two main types of a.m. receiver, the so-called "t.r.f." (tuned radio frequency) and the superheterodyne or "superhet". The t.r.f. type is far simpler than the superhet, so the beginner who wishes to experiment is strongly advised to commence with a t.r.f. circuit.

In a t.r.f. receiver the incoming signal is amplified, detected or demodulated in a stage which converts

the radio frequency wave into an audio signal and the audio signal is then amplified so that it can feed a loudspeaker or an earphone.

In a superhet the incoming signal is changed in frequency to another radio frequency signal known as the intermediate frequency. It is convenient to obtain most of the selectivity (or ability to reject interference from adjacent signals) at this intermediate frequency before the signal is demodulated and fed to an audio amplifier and hence to a loudspeaker.

A t.r.f. receiver can give good audio quality provided there are no interfering signals, thus if you require a simple bed-side or kitchen receiver for local programmes, a t.r.f. circuit will be satisfactory.

If, however, you wish to receive stations from Europe on medium waves or even from other continents on short waves, one will normally obtain much better results using a superheterodyne receiver.

T.R.F. Circuits

The remainder of this article will be devoted to t.r.f. circuits mainly for the purpose of helping the beginner. Numerous t.r.f. circuits have been published using discrete transistors, but a unique integrated circuit was released some years ago which has been designed especially for use in t.r.f. receivers.

This device is the Ferranti ZN414 which is ideal for use by the home constructor and is readily available. It requires only a low voltage power supply and provides a very high gain when used in a simple circuit.

The ZN414 is encapsulated in a simple transistor metal envelope, and the pin connections are shown in Fig. 1. There are only three leads, these being input, earth, and a common lead for output and the positive voltage supply.

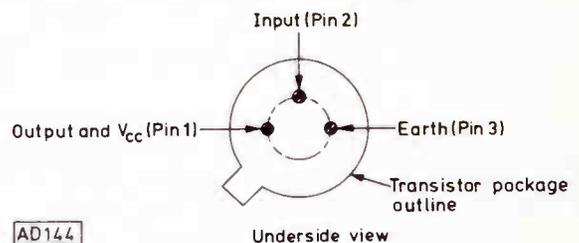
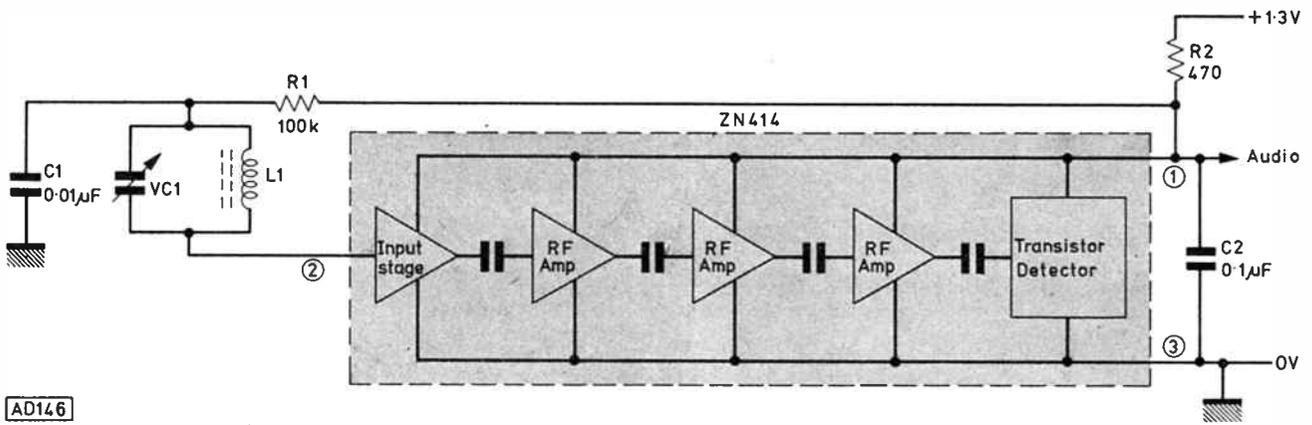


Fig. 1: Pin connections of the ZN414

ZN414 basic circuit

A basic t.r.f. receiver circuit using the ZN414 device is shown in Fig. 2. The inductance L1 is a winding on a ferrite rod or slab aerial which will be described in detail later. This inductance must



AD146
Fig. 2: A basic t.r.f. receiver circuit using the ZN414

resonate with the variable capacitor VC1 at the frequency of the desired station; in other words, VC1 is the receiver tuning capacitor.

The upper end of resistor R2 is fed from a positive supply of about 1.3V, normally a single cell or a potential divider circuit. A small bias current passes through R1 and the winding of L1 to the input (pin 2) of the ZN414. This input stage has a very high input impedance so that a negligible load is imposed on the tuned circuit; the selectivity of this tuned circuit is therefore almost unaffected by the connection of the ZN414.

The input stage is capacitively coupled to three internal cascaded r.f. amplifiers which in turn feed a transistor detector stage. The output capacitor in conjunction with the load resistor R2 filters radio frequencies from the output, but leaves the audio signal almost unaffected. There are ten transistors fabricated on the ZN414 chip.

The audio output from the Fig. 2 circuit is relatively small. It can be used to operate a sensitive earpiece, but generally it is better to feed it into an audio amplifier circuit. It is important that the output capacitor C2 should be soldered as close as possible to pins 1 and 3 of the ZN414 and that the device leads should be kept fairly short, or the high gain of the device may result in instability. This is of the order of 4,000 times voltage gain or some 72dB.

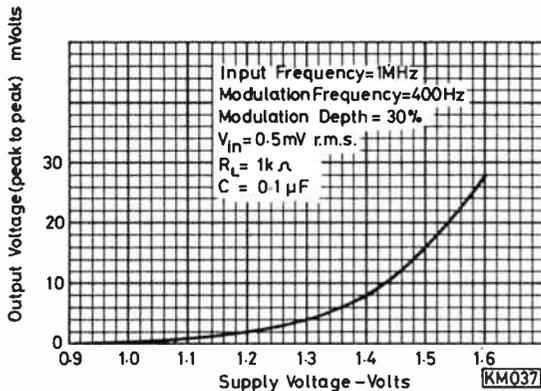
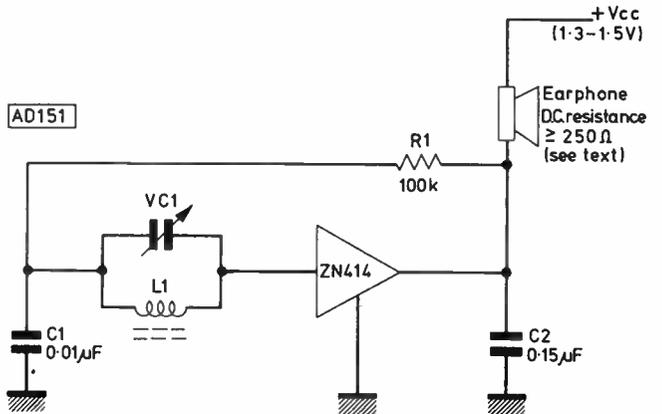


Fig. 3: Gain characteristics of the ZN414

As shown in Fig. 3, the gain of the ZN414 is dependent on the voltage applied to the upper end of R2 in Fig. 2. It is therefore necessary to stabilise this voltage if one does not wish the gain to vary with the state of discharge of the battery used.

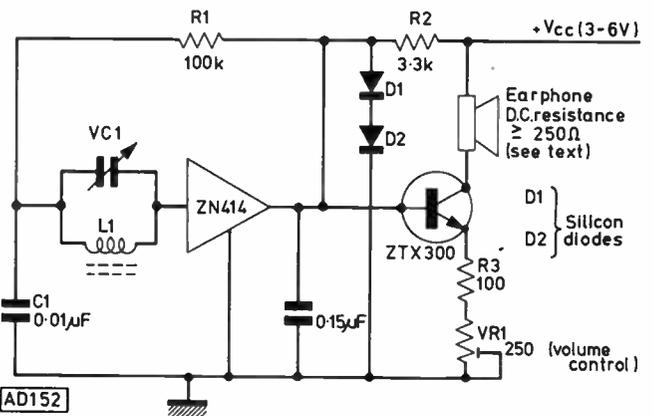
The current taken by the ZN414 circuit itself is only about 0.3mA, but when a strong signal is being received this can rise to about 0.5mA. The additional current taken in the presence of a strong signal results in a greater voltage drop across R2 of Fig. 2 so that the ZN414 operates at a slightly lower voltage; thus the gain is reduced in the presence of a strong signal and one has automatic gain control built into the circuit.



AD151
Fig. 4: A simple radio receiver circuit using a ferrite rod aerial

Earpiece Radio Receivers

The circuit of Fig. 4 shows one of the simplest possible radio receiver circuits for use with a ferrite rod aerial, L1. The load resistor R2 of Fig. 2 has been replaced with a sensitive earpiece which should have an impedance of not less than 250Ω.



AD152
Fig. 5: Adding a single transistor amplifier stage

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AC128 28p	BC134 19p	BC208 16p	BD163 85p	BF597 22p	R2010B £1.95	7475 38p			0-1 27 12-7 £1.34	
AC128K 32p	BC135 19p	BC212 13p	BD182 98p	BF839 27p	TIP29 54p	7480 38p			0-15 27 12-7 £1.52	
AC141 22p	BC136 19p	BC212L 14p	BD183 £1.03	BF841 27p	TIP31A 55p	7478 38p			0-22 33 16 £1.68	
AC141K 44p	BC137 19p	BC212LA 15p	BD184 £1.25	BF842 45p	TIP32A 57p	7482 38p			0-25 33 16 £1.78	
AC142 29p	BC138 23p	BC213 13p	BD187 59p	BF843 40p	TIP33 96p	7490 38p			0-33 33 16 £1.82	
AC142K 44p	BC148 34p	BC213L 14p	BD232 85p	BFY10 75p	TIP41A 79p	7493 38p			0-47 33 19 £2.08	
AC153K 38p	BC140 35p	BC214 13p	BD233 £2.35	BFY84 28p	TIP42A 79p	7496 38p			0-5 33 19 £2.24	
AC176 35p	BC143 34p	BC214L 15p	BDX18 £2.35	BFX85 29p	TIP3055 £1.15	7491 38p			0-68 50-8 22 £2.49	
AC178 44p	BC147 10p	BC237B 16p	BDX32 £2.35	BFX86 31p	TIS43 39p	7492 38p			1-0 50-8 22 £2.64	
AC179 44p	BC147A 11p	BC238 17p	BDY11 85p	BFX87 31p	TIS90 25p	74141 38p			1-5 50-8 25-4 £3.14	
AC187 42p	BC147B 12p	BC239 18p	BDY20 £1.05	BFX88 29p	TIS91 26p	74154 38p			2-0 50-8 25-4 £3.74	
AC187K 42p	BC148 11p	BC240 21p	BF115 42p	BFY51 52p	2N705 46p	74175 38p				
AC188 37p	BC148B 11p	BC242 34p	BF117 75p	BFY52 22p	2N2946 75p	74190 38p				
AC188K 42p	BC149 10p	BC258A 22p	BF120 38p	BFY53 34p	2N2904A 38p	74192 38p				
AC193K 41p	BC149B 11p	BC261A 25p	BF121 38p	BFY53 34p	2N2905A 38p	74199 38p				
AC194K 41p	BC149C 12p	BC261B 25p	BF123 38p	BFY72 51p	2N2906 22p	74199 38p				
AC197 54p	BC153 22p	BC262A 28p	BF125 38p	BFY77 22p	2N2906 22p	74199 38p				
AD140 84p	BC153 22p	BC262B 28p	BF127 38p	BFY90 £1.10	2N2907A 59p	74199 38p				
AD142 81p	BC154 15p	BC263 23p	BF127 38p	BR101 41p	2N2926G 17p	74199 38p				
AD143 83p	BC157 12p	BC267C 23p	BF133 25p	BR101 41p	2N2926Y 17p	74199 38p				
AD149 68p	BC157A 13p	BC268A 12p	BF158 17p	BR101 41p	2N2926Y 17p	74199 38p				
AD181 58p	BC158 12p	BC268C 14p	BF159 25p	BR101 41p	2N3053 42p	74199 38p				
AD182 58p	BC158B 13p	BC303 33p	BF160 25p	BR101 41p	2N3054 97p	74199 38p				
AF114 32p	BC159 12p	BC304 46p	BF168 35p	BR101 41p	2N3055 85p	74199 38p				
AF115 32p	BC159B 13p	BC309 30p	BF161 25p	BR101 41p	2N3070 17p	74199 38p				
AF116 32p	BC159C 14p	BC304 46p	BF168 35p	BR101 41p	2N3703 17p	74199 38p				
AF117 32p	BC161 50p	BC307A 15p	BF167 27p	BR101 41p	2N3704 17p	74199 38p				
AF118 60p	BC167B 14p	BC307B 15p	BF173 27p	BR101 41p	2N3705 17p	74199 38p				
AF121 53p	BC182A 14p	BC308A 16p	BF177 38p	BT106 £1.50	2N3706 17p	74199 38p				
AF124 38p	BC182B 14p	BC309 30p	BF178 42p	BU105 £1.80	2N3707 17p	74199 38p				
AF125 38p	BC182C 14p	BC323 62p	BF179 33p	BU108 £2.20	2N3709 17p	74199 38p				
AF126 38p	BC182D 14p	BC328 17p	BF181 33p	BU126 £1.94	2N3819 42p	74199 38p				
AF127 38p	BC170 14p	BC328 17p	BF181 33p	BU204 £2.30	Z5321 17p	74199 38p				
AF139 45p	BC170B 15p	BC337 15p	BF182 38p	BU205 £2.10	RCA40530 85p	74199 38p				
AF178 84p	BC170C 14p	BC338 15p	BF183 40p	BU206 £2.30	RCA40654 79p	74199 38p				
AF179 74p	BC171 14p	BC347A 18p	BF184 28p	BU208 £2.85		74199 38p				
AF180 75p	BC171A 15p	BC377 21p	BF185 29p			74199 38p				
AF181 75p	BC171B 15p	BC384 18p	BF186 42p			74199 38p				
AF186 38p	BC172 12p	BC440 29p	BF184 33p			74199 38p				
AF239 45p	BC172B 14p	BC460 38p	BF194A 13p			74199 38p				
AF278 80p	BC172C 18p	BC547 12p	BF195 12p			74199 38p				
ASV67 £1.30	BC173 18p	BC548 12p	BF195C 14p			74199 38p				
AU110 £1.75	BC173B 18p	BC558A 13p	BF196 15p			74199 38p				
AU113 £1.45	BC176 18p	BCY31 85p	BF197 15p			74199 38p				
BC107 12p	BC177 18p	BCY31 85p	BF198 15p			74199 38p				
BC107A 14p	BC177A 19p	BCY42 29p	BF199 29p			74199 38p				
BC107B 14p	BC178 20p	BCY70 21p	BF200 38p			74199 38p				
BC108 12p	BC178A 21p	BCY71 23p	BF224J 25p			74199 38p				
BC108A 14p	BC178B 21p	BCY72 18p	BF224 25p			74199 38p				
BC108B 14p	BC179 23p	BCZ11 £1.11	BF240 20p			74199 38p				
BC108C 14p	BC179A 24p	BD115 61p	BF241 18p			74199 38p				
BC109 12p	BC179B 24p	BD116 67p	BF254 38p			74199 38p				
BC109A 14p	BC182 12p	BD123 87p	BF255 29p			74199 38p				
BC109B 14p	BC182B 13p	BD123 87p	BF255 29p			74199 38p				
BC109C 15p	BC182L 14p	BD124P 67p	BF257 48p			74199 38p				
BC113 15p	BC183 12p	BD131 41p	BF258 34p			74199 38p				
BC114 15p	BC183B 13p	BD132 41p	BF259 44p			74199 38p				
BC115 18p	BC183L 13p	BD133 54p	BF282 40p			74199 38p				
BC116 19p	BC183LB 14p	BD135 34p	BF283 40p			74199 38p				

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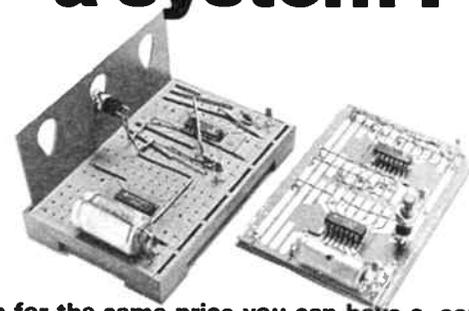
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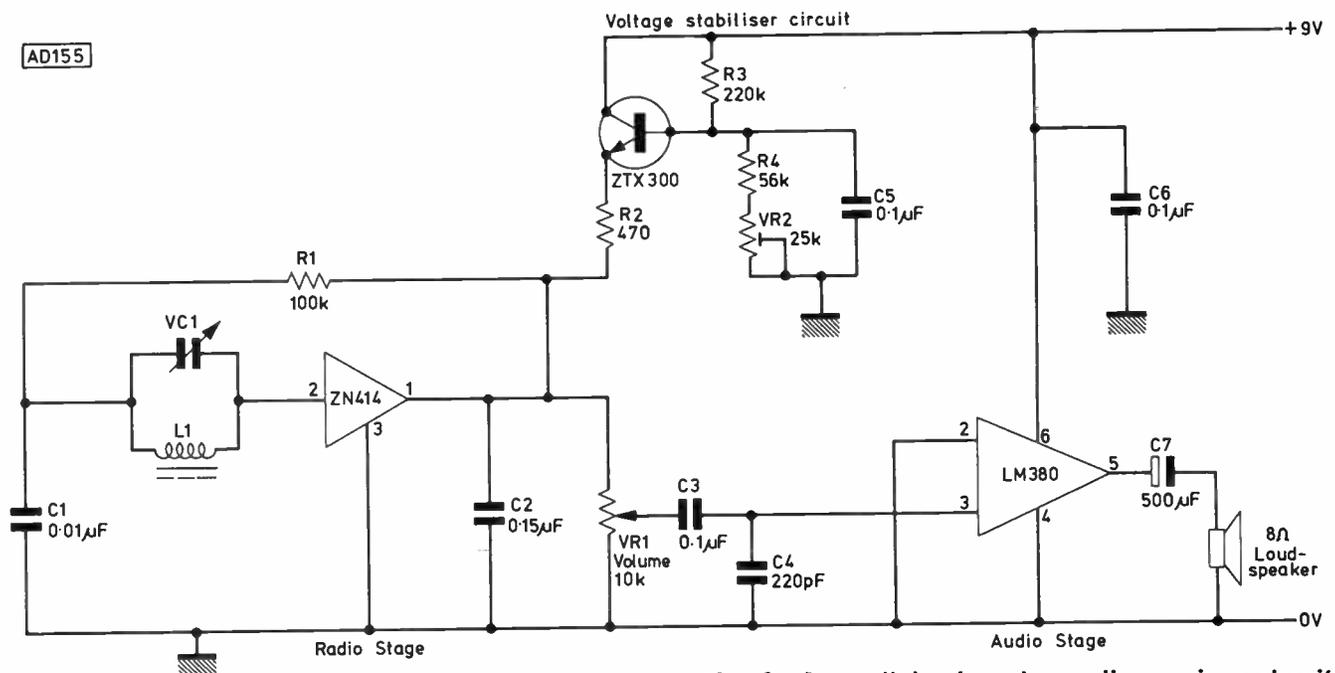


Fig. 6: A small loudspeaker radio receiver circuit, using a single transistor voltage stabiliser circuit

It is normally preferable to employ at least a single transistor amplifier stage (such as that shown in Fig. 5) so that the requirements of the earpiece are far less critical and a cheaper earpiece is satisfactory. A volume control is also incorporated in the Fig. 5 circuit, whilst the two forward biased diodes limit the voltage across the ZN414; the Ferranti BAW 37A double diode may be used here.

Loudspeaker circuits

The audio output from a ZN414 circuit can be fed to almost any audio amplifier which can drive a loudspeaker. Audio amplifiers using discrete transistors have been published for use with the ZN414, but simpler circuits can be made using an integrated circuit audio amplifier.

A small loudspeaker radio receiver circuit is shown in Fig. 6. In this circuit the ZN414 device is fed from a simple single transistor voltage stabiliser circuit so that the gain is almost independent of the power supply voltage used. If no stabiliser circuit is used, the gain will fall considerably as the battery ages. The supply voltage to the ZN414, and therefore the gain, can be set by means of VR2. The audio signal passes through the d.c. blocking capacitor C3 to the input of an integrated circuit audio amplifier. C4 helps to remove any radio frequencies from the audio signal and prevents spurious noise.

The LM380 was selected for this circuit partly because an extremely simple circuit can be employed, but also because it contains protection circuits. If the output of this device is shorted to ground accidentally, the output current will be limited to a safe value so that the device is not destroyed. In addition, if the device becomes so hot that it is in danger of failing, the output current is automatically reduced until it cools to a safer temperature.

Diode stabilisers

An alternative to the transistor voltage stabiliser of Fig. 6 involves the use of two series connected forward biased silicon diodes in the circuit of Fig. 6(a). The larger the value of R, the greater the gain

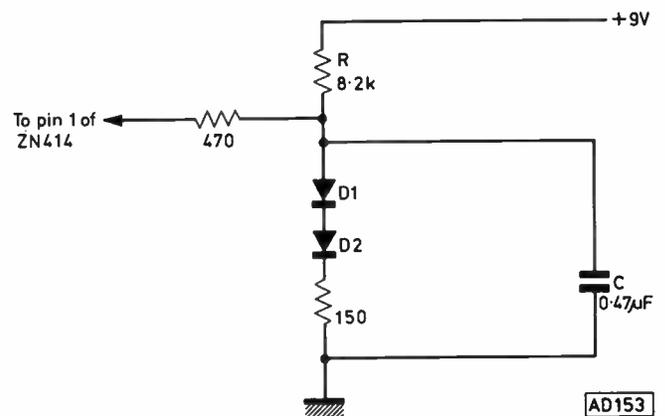


Fig. 6(a): An alternative voltage stabiliser using two silicon diodes

of the ZN414. The voltage drop across this resistor is added to the voltage drop of about 1.3V across the two forward biased diodes.

It is also possible to employ a small light emitting diode instead of the two silicon diodes of Fig. 6(a), but the current required to enable the light emitting diode to provide a reasonable light output will be greater than that required by the Fig. 6(a) circuit. In other words, the value of R must be reduced.

Frequencies

The variation of the ZN414 gain with frequency is typically similar to that shown in Fig. 7. The peak gain is at about 1MHz, but the device can be used with a reasonable gain from about 100kHz up to about 3MHz. However, one should remember that the gain is much reduced near these limiting frequencies. The lowest frequency for reasonable gain is set by the values of the internal coupling capacitors shown in Fig. 2, whilst the maximum practicable frequency is determined by the properties of the internal transistors in the device.

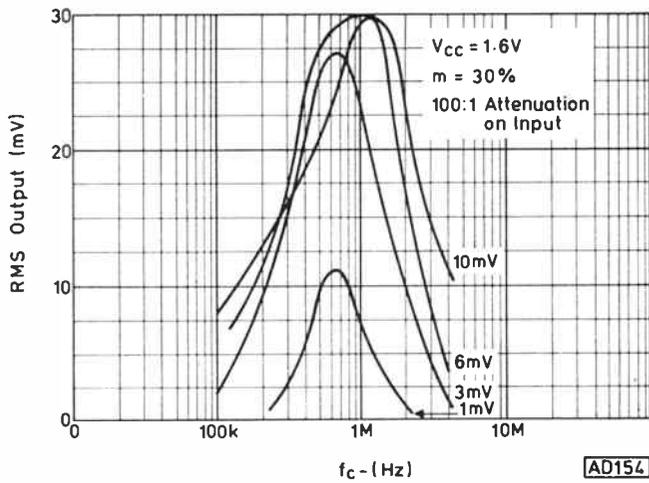


Fig. 7: Frequency response of the ZN414

It can be seen from Fig. 7 that there is a considerable difference in the output voltage as the input rises from 1mV up to 3mV, but any further increase in the input voltage produces a relatively small change in the audio output level owing to the a.g.c. action.

Aerial

The aerial may consist of a ferrite rod about 12cm in length with 55 to 65 turns of 28 gauge wire wound as a single layer for medium wave. The long wave coil may consist of some 250 turns of 38 gauge single silk covered wire wound in a random way with turns on top of one another, as indicated in Fig. 8. The exact number of turns will depend on the value of the tuning capacitor placed in parallel with the coil (typically 200pF).

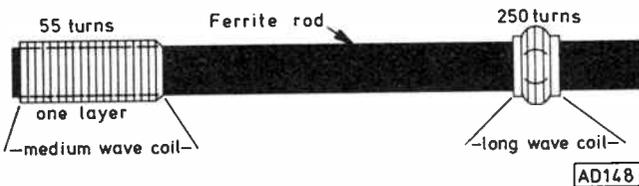
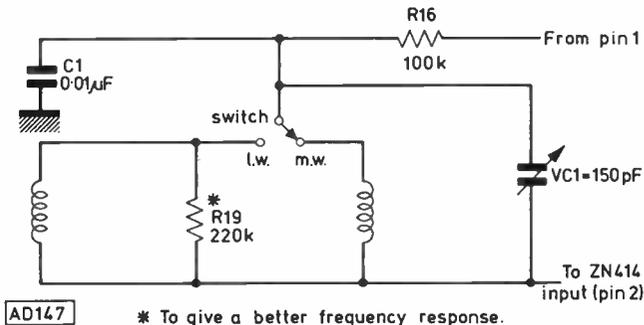


Fig. 8: The ferrite rod aerial with l.w. and m.w. coils

Only one aerial coil has been shown in the circuits of Figs. 2, 4, 5 and 6. If both medium and long wave coils are required, the switched circuit of Fig. 9 may be used with any of these circuits. It is important that the aerial coil should have a high Q (magnification) so that reasonable selectivity is obtained.

If one requires an extremely small receiver (possibly using the circuit of Fig. 4), there will not be



* To give a better frequency response.

Fig. 9: Switching circuit for l.w. and m.w. coils

enough space for a reasonably long ferrite rod aerial in the case. One can employ a ferrite slab with only a medium wave coil wound on it in such receivers; the slab should not be less than about 3cm in length unless one intends to use the receiver only fairly close to a transmitter. A longer ferrite slab will produce a greater signal voltage.

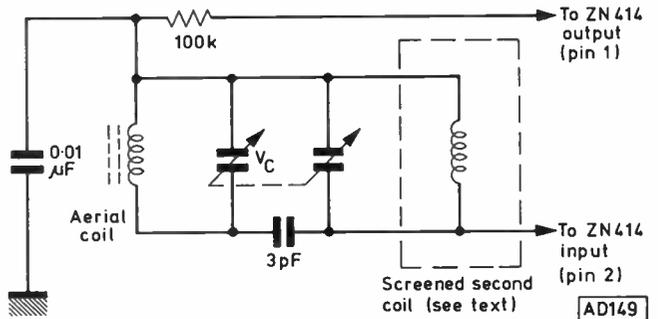


Fig. 10: A double tuned circuit for greater selectivity

If greater selectivity is required, a double tuned circuit can be used before the ZN414 as shown in Fig. 10, but this requires careful alignment for optimum performance. The Q factors of the two tuned circuits should be similar. If the two tuned circuits are not correctly matched, each station may be received at two points in the band. This type of double tuned circuit is especially useful when one has a larger external aerial coupled to the ferrite rod. The lead from the external aerial should be connected to a few turns of wire around the ferrite rod, the other end of the winding preferably being connected to earth.

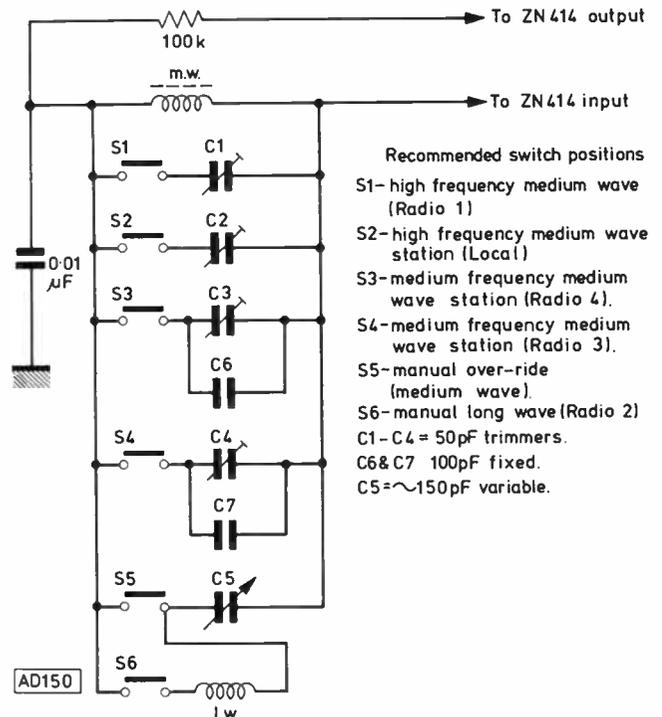


Fig. 11: A six position switching circuit

The circuit of Fig. 11 shows how four pre-selected stations may be selected by the push buttons S1 to S4. The buttons S5 and S6 enable the normal medium and long wave bands respectively to be tuned by means of the variable capacitor C5.

Next month we will consider superheterodyne receivers for a.m. reception.

NEXT MONTH IN...

practical

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Abbreviation	Question	Answer or Advice
QSK	Can you hear me between your signals and if so can I break in on your transmission?	I can hear you between my signals; break in on my transmission.
QSL	Can you acknowledge receipt?	I am acknowledging receipt.
QSM	Shall I repeat the last telegram which I sent you (or some previous telegram)?	Repeat the last telegram which you sent me (or telegram(s) number(s) . . .).

CHARLES MOLLOY

In official lists of the "Q" codes—the comprehensive system of abbreviations used by professional telegraphy operators to speed the exchange of traffic—the meaning of each code is clearly defined.

Many of these codes have been adopted by other services, such as broadcasting, and by the amateur radio fraternity. For each class of user, the same abbreviation can have a quite significantly different shade of meaning.



To the transmitting amateur, a QSL is an acknowledgment of a successful two-way radio contact established with another amateur, and normally takes the form of a specially printed card. To this are added a note of the date, time and frequency of the contact, and brief technical details of the equipment used.



For the broadcast band listener, the radio contact is, of course, strictly one way, and the situation therefore differs again.

Broadcast Band QSLs

What is a QSL? is a question sometimes asked by newcomers to the hobby. According to the March 1978 bulletin of the International Short Wave Club, "a QSL is an acknowledgement". International broadcasters like to hear from their listeners, many of whom are not DXers and in reply these stations issue QSL cards which are really mementos of the occasion. The cards themselves are often colourful. On one side there may be a photograph, a design of some sort or even the station's callsign, while on the other side there will be the acknowledgement and perhaps some information that would confirm that the listener did in fact hear the broadcast.

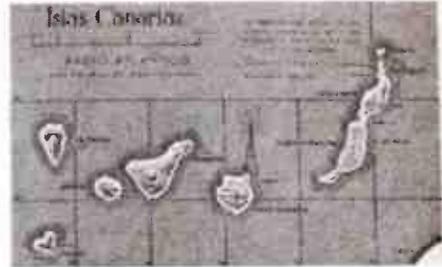


It is the last factor that causes difficulty for some DXers. Though many will be content to have a card that can be shown to others and perhaps kept in a photograph album, the serious DXer who is interested in obtaining a diploma from a DX club, or who simply wants to be able to prove his reception, will be disappointed. As the ISWC puts it, "To prove reception the document that one receives from the station should be plainly endorsed with the date, time and frequency". Such a reply is called a verification (verie for short) and this is what the majority of DXers hope to receive in return for a reception report.



A final word on QSLs comes from Peter Gatehouse of Buckingham, who refers to a recent communication from Radio Canada International which says that to receive a QSL card from Radio Canada International one has to be on the mailing list! Programme schedules will be sent free but QSLs will not be sent to people not on the mailing list. Write to RCI Publicity and Audience Relations, PO Box 6000, Montreal, Canada H3C 3A8. Clearly, this type of QSL is intended for listeners rather than DXers.

The current QSL card from Radio Australia is an example of a pleasant QSL that is also a verie. It is a card with a colour photo on one side and the sort of details that the serious DXer would want, on the other side. Even here, the purist might complain that it should have stated my address. The card came inside an envelope!

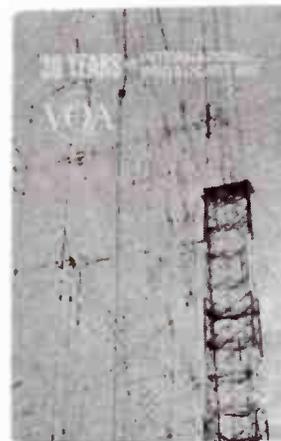


Medium Wave

The medium wave DXer invariably resides outside the service area of his DX and this should be kept in mind when writing to a station. The reception report is unlikely to be of any value to the station and one is depending on goodwill for a reply. So, always include return postage, either an International Reply Coupon, currently 25p at main Post Offices, or as unused postage stamps of the country concerned. These are obtainable from stamp dealers (philatelist shops).



DX clubs consider QSLs and Veries to be a major part of their activities. The Twickenham DX Club for example, recently produced a 16-page QSL Survey which summarises verification details submitted to their "QSL Report". Broadcasting stations are listed by country. The frequency band verified, number of verifications received from 1974-76 and 1976 to March 1978, the type of verification (card, letter, folder), whether return postage is recommended and the time taken to receive a reply, are all listed in this comprehensive survey. Copies can be obtained from the TDXC, 13 Tennyson Avenue, Twickenham, TW1 4QX for four 7p stamps in the UK or for 3IRCs surface mail or 5IRCs airmail to any other part of the world.



Send the reception report to the Chief Engineer, if possible in the language of the country, as there will not be an international department to deal with listeners' letters. Many radio clubs supply report forms in a number of languages, Spanish and Portuguese being the most useful. Try to convince the station that you really did hear them as they may be surprised to hear from you. Station announcements, slogans, weather report details, time checks, news items are the sort of material to mention and these can be heard at programme changes which usually occur on the hour or half hour.

model railway

POINT MOTOR SUPPLY

R.A.GANDERTON

EM Gauge Society

Introduction to the Problem

Many model railways use the solenoid type of point motor to operate the point blades from a central control panel. Although the manufacturers claim that these units will operate at a supply of 12 to 20 volts they rarely do so reliably and it is generally better to operate them at around 30 volts. This ensures that they throw properly and overcomes any resistance due to mechanical deficiencies inherent in the design. A typical point motor is shown in the photograph, along with the unit which forms the subject of this article.

The coils forming the solenoids have a d.c. resistance of around 2Ω each and it does not take much imagination to see what happens when 30 volts is applied to the motor. If the armature sticks or the operator leaves the switch on for any length of time then some 15 amps will flow (assuming that the power supply is capable of delivering this current) and 450W will be generated as heat. The end result is that the solenoid coil burns out.

Solution and Circuit Description

The situation can be avoided by using a capacitor discharge system to provide enough energy to ensure that the armature is thrown over but not enough to burn out the coils if the operating switch is left on.

The circuit shown in Fig. 1 uses a transistor to switch off the charging current to the operating capacitor C2 whenever the output is connected to the 0V line by a low resistance such as a motor coil.

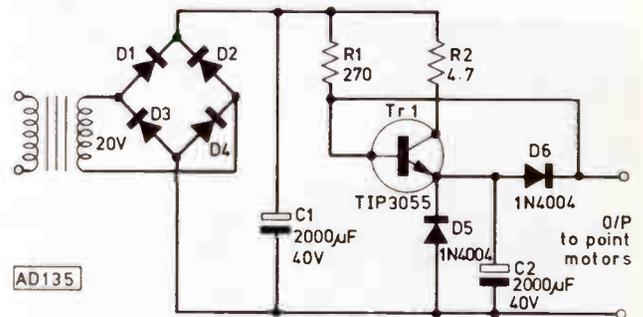


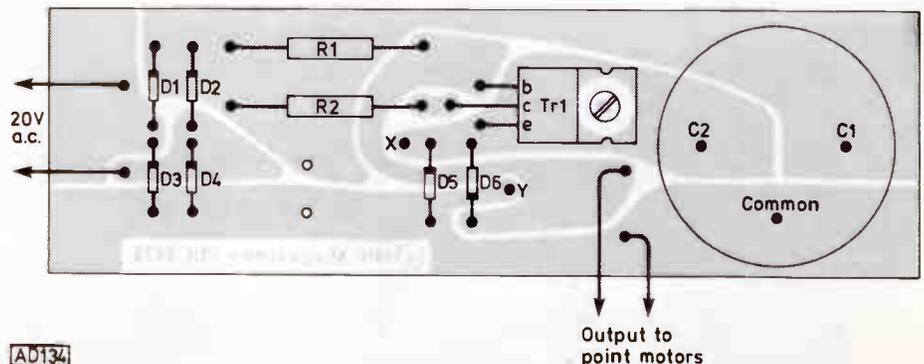
Fig. 1 The complete circuit diagram

When the load is removed from the output the base of Tr1 is unclamped and Tr1 is turned on allowing current to flow through R2 to charge C2. The low value resistor R2 is used to limit the maximum charging current and its value is not critical. R1 limits the current which flows when the load is left applied and C2 has fully discharged. When C2 is fully charged and there is no load on the output, Tr1 is turned off via D6. Any small loss of charge due to leakage is made up automatically. Diode D5 provides reverse voltage protection for C2, preventing back e.m.f. damage due to the transients produced when the current in the solenoid coil changes rapidly.

Power Supply and Switching

The power supply is a conventional bridge rectifier circuit with a large reservoir capacitor C1. The input

Fig. 2: The component layout. (Note; The two unmarked holes are for alternatively mounting C1 remote from the p.c.b.)



The prototype of the Model Railway Point Motor Supply Unit, shown with a typical point motor

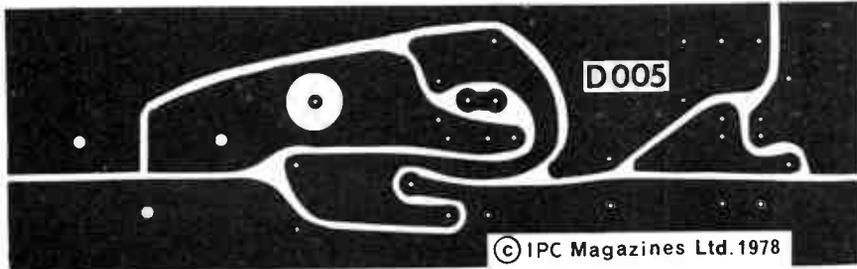
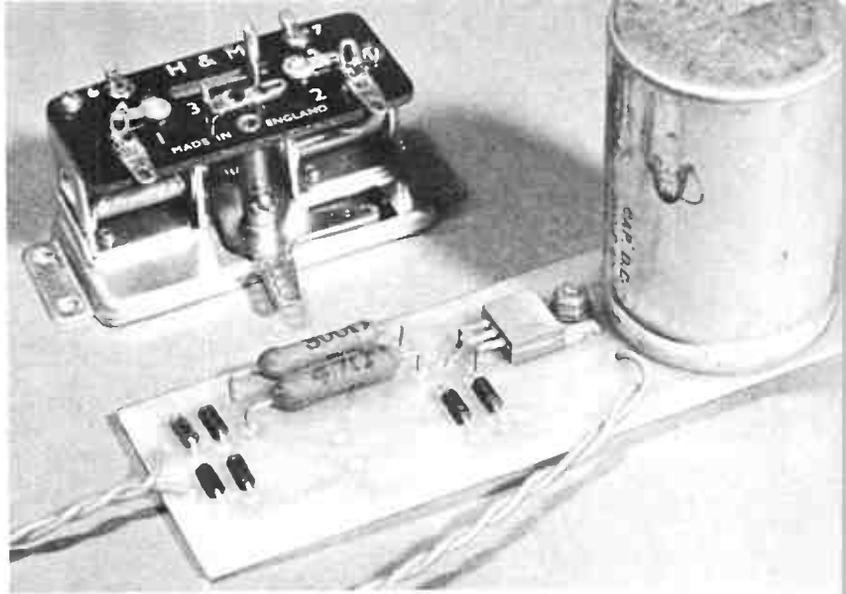


Fig. 3: PCB viewed from the copper side. This board is available from the PW Readers PCB Service

voltage to the bridge rectifier can be between 20V and 25V a.c. giving a d.c. level on C2 of between 28V and 35V.

This circuit will switch one point motor at a time without any problems. However, it is often necessary to switch more than one motor when, for instance, interlocking or route selection systems are being used and in this case it may be necessary to increase the value of C2. Provision has been made on the printed circuit board to allow additional capacitors to be wired into the circuit across C2 using pads marked X and Y. The extra capacitance required is found by trial and error but as a suggestion it could be based on a figure of 1,500 μ F per extra point motor to be switched.

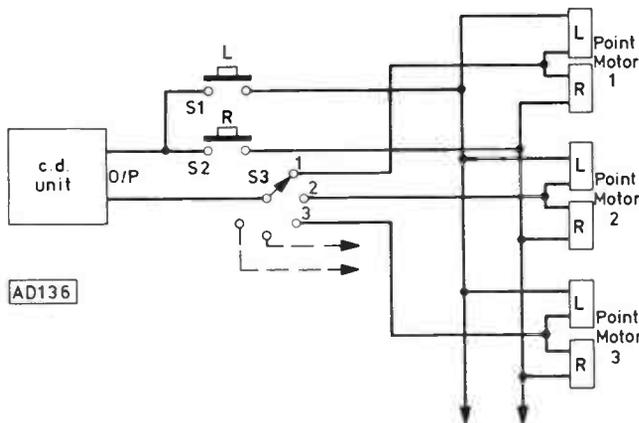


Fig. 4 Circuit diagram showing switching arrangement for operating more than one point motor

Practical Wireless, August 1978

★ components

Resistors

3W 10% wire-wound

R1 270 Ω

R2 4.7 Ω

Capacitors

C1, C2 each 2000 μ F 40V electrolytics in common can (e.g. Erie type KB 3104)

Semiconductors

Tr1 TIP3055

D1-6 1N4004 or similar

Miscellaneous

PCB, 6BA bolt, nut and washer, connecting wire, mains transformer 20V at 1.5A (see text)

Construction

Construction is simple, the component layout being shown in Fig. 2 and the printed circuit board pattern in Fig. 3. C1 and C2 are both in the same can. No case has been detailed since most modellers will mount the unit inside the control panel. The a.c. supply can be from a small transformer capable of supplying between 1A and 2A.

Using this c.d. unit it is possible to use push button switches instead of passing contact types and point selection can be easily carried out using a standard wafer rotary switch as shown in Fig. 4. If you prefer the "wandering pencil" type of selection system, then the use of this unit will prevent point motor burn-outs which often happen when the operator lets the pencil drop on to the control panel. ●



PARIS Components SHOW

DAVID GIBSON

With a record attendance by nearly 82,000 visitors, the Salon International des Composants Electroniques 1978 chalked up yet another international success. This giant electronics exhibition, held each year in Paris, attracted over 1345 registered exhibitors from 30 countries and spread itself over an area of 60,900m².

Exhibits ranged from Ham radio equipment and accessories to laser trimming equipment, from single components to highly complex instrumentation and, of course, microprocessors.

In this latter area it was interesting to see a microprocessor timer kit. This offered a choice of 21 programmes plus a digital readout of time. The unit has many applications but suggested text included ideas like, automatically waking you up in the morning (you can programme in different times for different mornings), switching on your egg and boiling it to perfection, switching the heating on and off plus putting lights on an off during the evenings to deter burglars. The input keyboard (supplied with the kit) has buttons for each day of the week, a one to nine set of tabs, plus an am/pm button although the digital clock can be switched to read either 12 hours or 24 hours.

Readers wanting to conduct underwater experiments in the bath (?) or elsewhere will be pleased to hear of a special transducer shown by a French company. An electret (an electrostatic transducer) for underwater applications has been developed. The air gap which is commonly present in such transducers has been replaced by a compressible, very high resistivity

material which is held in intimate contact (lovely wording those French use!) with the electret. This design suppresses the drawbacks which result from the presence of air in such transducers—variation of sensitivity as a function of immersion depth for example. The advantages claimed for the new device are a sensitivity higher than 30 μ V/ μ Bar (-90 dB relative to 1V/ μ Bar), broad bandwidth, and an acoustic impedance close to that of water. The company is understood to be making some experiments with an array/antenna of electrets which could prove interesting for listening underwater.

One device causing raised eyebrows was the "Snapistor". This is a thick



Signs of things to come. A complete data terminal in an attache case. It comprises a full keyboard, all necessary electronics, and a small collapsible television screen which folds down. The station may be used over a standard telephone via a modem, and can chat to computers and data terminals anywhere in the world

film resistor network on a ceramic substrate. Pre-scribed lines on the back of the substrate divide it into ten parts. Each part can be snapped off, one by one, and each snap increases the remaining resistance by 20%. This gives a five-fold increase in resistance when all nine parts have been broken off. Applications suggested are; to set the gain of a transistor stage, or to set up the voltage of a voltage regulator. Here, one could use one Snapistor for coarse adjustment, and another for fine setting. Various ranges of resistance values were offered. These included; 100 Ω to 520 Ω , 10k Ω to 52k Ω , 33k Ω to 520k Ω , and 100k Ω to 520k Ω . The resistance values are $\pm 20\%$, TCR ± 100 p.p.m./ $^{\circ}$ C and operating temperature range -40° C to $+125^{\circ}$ C. Power handling capability depends on how much snapping you've done. If they are unsnapped (i.e. all sections are in circuit) then the power capability is 250mW; with just a lonely one segment, power is 50mW. Maximum voltage is 100V.

Trends were not hard to spot. Many people offered microprocessors—either a single chip, or with a complementary keyboard, or as a complete kit of parts with a manual.

Motorised rotation of f.m. antennas featured strongly. These came complete with a nicely styled box. The box shows you which way your aerial is pointing and the whole array is controllable from your living room. Many companies showed results, including a BBC2 test card which had superb definition.

One dealer displayed an impressive array of Yaesu Ham equipment. Inter-

Practical Wireless, August 1978

esting to see the FT-301D solid state transceiver. It has a digital readout and uses no valves at all, not even those ubiquitous 6146's in the final. The unit runs from 12V direct—ideal for mobile work, although a separate mains p.s.u. is available which includes a digital clock and an automatic call sign sender for the c.w. enthusiast. Price was horrendous and interest high!

French giant Thomson-CSF took a huge number of stands, indeed their particular alleyway was signposted "Avenue de Thomson-CSF". Along this Avenue was found an "Easy-to-use Super-Noticon". This turned out to be Thomson's latest addition to its range of low-level TV camera tubes. The Super-Noticon really is super, too. It can view a scene without trouble even on a cloudy and moonless night. The French boffins mumbled something about sensitivity down to 10^{-5} lux.

Also on the Thomson stand were a number of quartz resonators which achieve 300MHz in fundamental mode. Close by were a number of devices described as piezoelectric but using Lithium Tantalate and not quartz. These synthetic single crystal devices have inherent properties suited to the production of wideband filters in the 0.08 to 35MHz band. A stand spokesman hinted at possibilities that this frequency could be raised to 400MHz in the not-too-distant future.

Surface wave filters were a feature on the Siemens stand. The company has succeeded in laying these down on a lithium nobate substrate. The technique is to lay down tiny fingers of conducting pattern which intermesh (but do not touch) rather like the teeth of a comb. The result is that the signal can be made to pass along these closely coupled subminiature antennas which are frequency sensitive and thus have a filtering action. Although other materials made the surface wave filter a reality, high cost and low consistency were deterrents. Lithium Nobate is claimed to overcome these problems. The filter has the great advantage that it has no coils or capacitors. First applications are in the i.f. strips of TV sets. Siemens has already manufactured filters to suit British standards and markets. The standard package size on the stand was $19 \times 16 \times 5$ mm with five terminals brought out at one side.

The French Amateur Radio Association—Réseau des Emetteurs Français—had a real live repeater satellite on show. Unlike other repeater stations which are fired aloft from places like Cape Canaveral, the French decided to try a much cheaper method. They attached their 144MHz repeater station to a balloon and let it loose. The



The French Ham v.h.f. radio repeater Anjou 009, which was sent up by balloon on September 25th 1977 and returned to earth via parachute. It is one of a series which have been launched by French Amateur Radio enthusiasts.

highest one of these repeaters (there have been about nine) has reached is 31,400 metres. The "flight" can be up to 24 hours long, then the balloon bursts and the repeater parachutes back to earth. The REF has around 12,000 members in France in some 250 Ham radio clubs. Annual subscription is 120 French Francs.

One normally associates Sprague with capacitors, but visitors to the stand in Paris found quite a number of useful i.c.s on display. A good one to watch for is the ULN-2283B. This is a little audio chip which offers 1W output with 12V applied. It will function from -40°C right up to a very hot $+85^{\circ}\text{C}$. Gain is claimed to be 43dB and the i.c. will function at voltages down to only 3V. The circuit shown on the Sprague stand gave an idea of the simplicity when using the ULN-2283B. Apart from the chip and loudspeaker, only two capacitors plus a volume control are required.

The new Philips personal bleeper system looked a good idea. The tiny pocket receiver, besides having a bleep "you're wanted" facility, also boasts an alphanumeric readout. Speech facilities can be added, too, if required. By using a standard code, say from

one to nine, a message can be sent very easily. Thus a number 3 displayed would mean outside telephone call; number 6 might mean return to the office etc.

At more official levels, the exhibition literature had some intriguing headings. How about "Universal elastic banana plug"? Upon my breathless arrival I was shown a banana plug whose spring arrangement assures good electrical contact with any diameter socket from 3.9mm to 4.5mm in diameter. After 100,000 pluggings in and out (no, I didn't) the plug still has a contact resistance between it and its socket of only 0.8 milliohms. Maximum current is 15A.

A fascinating device was one which varied the inductance of a coil—useful in tuning up aerials no doubt. The main coil has its windings composed of silver-plated tape-like metal. One end of this is fixed, but the other goes across to another former, which is motor driven. When power is applied to the motor, it simply unwinds turns off the coil onto the secondary former and thus the original coil has its inductance decreased. By deriving the motor power drive command from a signal fed back from an s.w.r. bridge, aerials may be loaded automatically from transmitters even when the frequency is changed by quite a large amount.

Solar cell enthusiasts will be pleased to hear that production of professional industrial components is driving the prices down and they could well make an appearance on the Amateur market before very long. One French company is talking of 500,000 cells of 57mm diameter for 1978, and the production has already dropped the price by 30% at the beginning of this year.

Still in terms of economical power, Lithium batteries were commonly offered. One of these would give $300\mu\text{A}$ for 100,000 hours. Couple this with a CMOS circuit and your battery replacement problems could be over. Carrying this capacity to the 30mA mark would give 1,000 hours of operation. The operating temperature range of these batteries is impressive; from -65°C up to $+160^{\circ}\text{C}$.

Smallest radar I've seen was on the Jay Electronic stand. It measures $126\text{mm} \times 60\text{mm} \times 70\text{mm}$. It's called a guarding radar because its power dissipation is 22mA at 12V, and it is undisturbed by small things, such as passing birds, insects etc. Its range is fully adjustable from 0 to 15 metres.

In the heavier machinery part of the exhibition was a machine for winding wire onto toroids. It does this at the rate of 2,000 turns/minute. Have you ever thought—how do you automatically wind onto a ring or toroid?

Experimental Broadcasting Satellite for Japan

A new high-power experimental broadcast satellite was launched from Cape Canaveral in April for the National Space Development Agency (NASDA) of Japan. It will doubtless be the forerunner of many new satellites designed to provide high-quality experimental colour television reception in regions of the world where the terrain makes it difficult or impossible to receive high-quality signals from normal earthbound television transmitters. The spacecraft was constructed for NASDA by the Space Division of the US General Electric Company of Valley Forge, Pennsylvania under contract to the Tokyo Shibaura Electric Company (Toshiba).

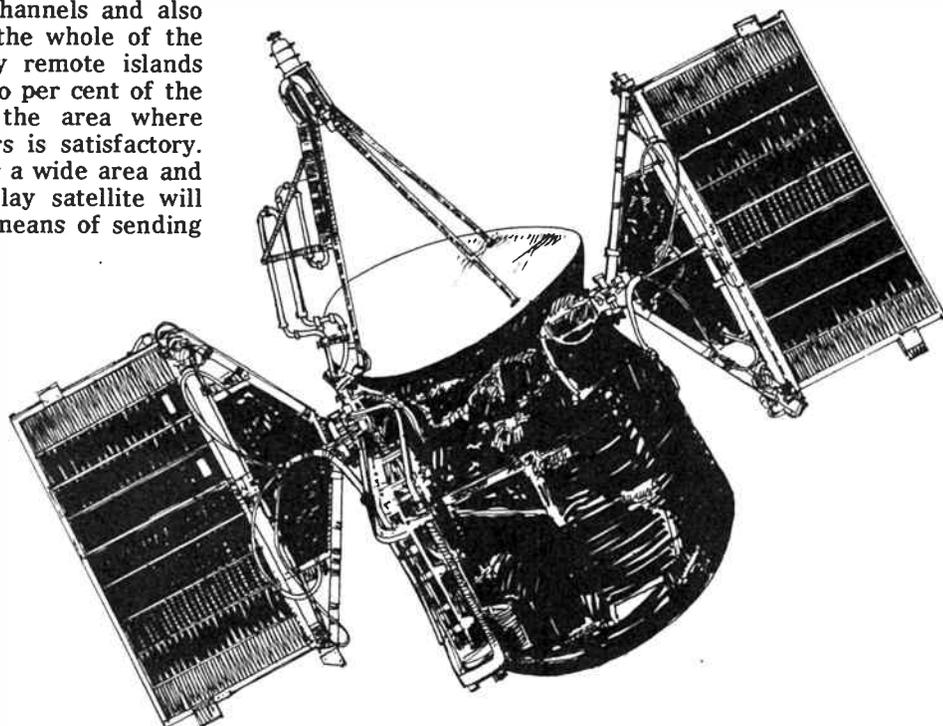
This BSE (Broadcast Satellite Experimental) craft weighs 678kg and was sent into orbit by a Delta 2194 rocket. Onboard propulsion jets propelled the satellite into a geosynchronous orbital position at longitude 110°E, and the control system will be able to maintain its position to $\pm 0.1^\circ$ in latitude and longitude.

Television and voice signals will be sent from the Japanese mainland to the satellite using frequencies in the 14.0 to 14.5GHz band, and the satellite will then relay these signals back to ground using frequencies in the 11.7 to 12.2GHz band. It will provide two high-quality colour television channels and also voice communication circuits over the whole of the Japanese mainland and over many remote islands and mountainous regions. About two per cent of the Japanese population are outside the area where reception from existing transmitters is satisfactory. Japan has many islands spread over a wide area and it is thought that a high-power relay satellite will provide an economic and effective means of sending television signals to such regions.

Receiving stations

If a satellite relay system is to be an economical proposition, it is essential that the cost of each of the numerous small receiving stations shall be minimised. This implies that the power transmitted by the satellite must be quite high—especially if the power is beamed to cover a relatively wide area of a country.

The experimental broadcast satellite has been designed with this particular objective in mind. Many satellites use a cylindrical array of solar cells which are spinning in space so that the spacecraft is stabilised. However, such spin-stabilised craft have the disadvantage that only a small proportion of the solar cells are receiving the maximum amount of energy from the sun at any one time. The experimental broadcast satellite therefore employs three-axis stabilisation with its solar cells on arrays of extended arms; all of the solar cells in such a satellite can be directed towards the sun at all times (except during eclipses of the satellite by the earth) and therefore maximum power is available. The solar cells of the satellite provide a minimum power of at least 780W.



The Japanese BSE satellite. The aerial reflector can be seen in the centre and the solar cells on each side.

The receiving stations will employ parabolic antennae, but owing to the high power level transmitted by the satellite and the fact that only Japan will be included in the transmitted beam, the parabolic reflectors of the receiving aerials can be as small as 1m in diameter. (This may be contrasted with the huge 30m diameter aerials used for international satellite communications which provide about 900 times the gain of a 1m aerial). In many cases, a single receiving station will be able to feed the received signals to a whole district, but cheap receivers will be able to be used in individual homes in remote districts. The satellite has an expected life of three years and many signal strength measurements will be made at various points in the reception area so that this experimental satellite can be used as a model for future craft.

Command and control signals will be transmitted to the satellite from ground stations in Japan in the S and Ku microwave bands. It is interesting to note the tendency to use higher and higher frequencies for satellite communications with earth stations in order to obtain more bandwidth and hence a greater information carrying capacity.

Future developments

The basic design of this satellite can be readily adapted to provide both expanded telephone, data and television services and in addition to incorporate educational and health care transmissions to the developing countries in future satellites. Some satellites of the future will be operated by one nation, whereas others will be jointly operated by a group of small nations. All are situated in a geostationary orbit some 36,000km above the equator where they remain at the same position above the earth's surface. They are expected to have a very great impact on health and medical care in many of the developing countries.

SPECIAL ANNOUNCEMENT

PRINTED CIRCUIT BOARDS SERVICE FOR PW PROJECTS

It has now been decided, commencing with our issue dated September 1978, to enlarge the facilities for the supply of p.c.b.s to readers by authorising additional suppliers. It is hoped that readers may benefit from being able to purchase boards as part of component kits, thereby reducing the number of separate orders for a project.

For some time, most p.c.b.s published in *Practical Wireless* have been available exclusively from Reader's PCB Services Ltd., P.O. Box 11, Worksop, Notts, who will continue to be a supplier and to whom we would wish to say thank you for helping us to get the service started.

Applications for permission to reproduce boards for resale purposes must be made to the editor.

READERS PCB SERVICE

To:- READERS PCB SERVICES LTD,
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Please supply PCB/s as indicated by tick/s in box/es.....

Issue	Project	Ref	Price P/P	
Dec 75	Sound-To-Light Display	DN0798	1.15+12	<input type="checkbox"/>
Dec 75	Disco System, Amp. (2 req'd) each	AM0421	4.40+22	<input type="checkbox"/>
Dec 75	Disco System, Light Modulator	AM0423	3.50+22	<input type="checkbox"/>
Mar 76	CMOS Crystal Calibrator	AM0438	1.19+12	<input type="checkbox"/>
July 76	Disco Preamplifier	A003	0.65+12	<input type="checkbox"/>
Oct 76	Digital Car Clock (set)	A011/012/013	2.58+12	<input type="checkbox"/>
Oct 76	Interwipe	DN8JM	0.80+12	<input type="checkbox"/>
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Nov 76	Cirtest Probe	A018	0.48+12	<input type="checkbox"/>
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May 77	Seekit Metal Locator	A031	3.38+12	<input type="checkbox"/>
June 77	Versatile AF Generator	A033	2.38+12	<input type="checkbox"/>
June 77	Tele-Games	D029	3.22+18	<input type="checkbox"/>
July 77	20W IC Amplifier	A034	1.38+12	<input type="checkbox"/>
July 77	Radio 2 Tuner	A035	1.68+12	<input type="checkbox"/>
July 77	Digital Clock Timer	A036	3.28+12	<input type="checkbox"/>
Aug 77	Shoot (Telegames)	D035	1.55+15	<input type="checkbox"/>
Aug 77	Atomic Time Receiver	D036	2.65+15	<input type="checkbox"/>
Aug 77	Morse Code Tutor Cards (SRBP)	A037	4.75+15	<input type="checkbox"/>
Sept 77	Jubilee Electronic Organ	A038	19.00+75	<input type="checkbox"/>
Sept 77	Electronic Car Voltage Regulator	D037	1.25+12	<input type="checkbox"/>
Oct 77	Audio Level Indicator	D039	0.98+12	<input type="checkbox"/>
Oct 77	Sine-Square Wave Generator	D040	2.35+15	<input type="checkbox"/>
Nov 77	Laboratory Power Supply	A039	3.50+12	<input type="checkbox"/>
Jan 78	Direct Conversion Receiver	D043	1.85+15	<input type="checkbox"/>
Jan 78	Proportional Power Controller	DN9JM	0.78+12	<input type="checkbox"/>
Mar 78	Audio/Visual Logic Probe	R001	1.40+15	<input type="checkbox"/>
Apr 78	Europa Stereo Amplifier	R002	9.55+45	<input type="checkbox"/>
May 78	DX'ers Audio Filter	D001	2.35+15	<input type="checkbox"/>
June 78	Bovington Tank Game	R006	3.80+20	<input type="checkbox"/>
June 78	Audio Distortion Meter (set)	R007/8/9/10	6.75+25	<input type="checkbox"/>
June 78	Darkroom Timer	R011	1.55+15	<input type="checkbox"/>
July 78	Avon Transmitter	R015/16/19/20	5.10+40	<input type="checkbox"/>
July 78	Digital Lock	D002	1.25+15	<input type="checkbox"/>
July 78	Morse Tutor	R014	2.35+15	<input type="checkbox"/>
Aug 78	Point Motor C.D. Supply	D005	1.25+15	<input type="checkbox"/>

Post and packing is for one board or set of boards. Prices include VAT. Remittances with overseas orders must be sufficient to cover despatch by sea or air mail as required.

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HOTLINES

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

Go West

If inflation is hitting you and/or you are intending to take a job in electronics, think about the USA. The IEEE (Institution of Electronic and Electrical Engineers) out there reckons that its members' salaries have kept well ahead of inflation over the past two difficult years—and they're still well ahead. Average annual salary is put at around 27,500 dollars, and some members have confessed to raking in 70,000 dollars.

No, I don't have any membership forms!

Watch what you say

Microprocessors seem to be creeping into practically everything these days. There's even one lurking in a new system under development which will recognise continuous speech. The basic unit has a 16 word vocabulary. Each word is converted/translated into a pattern generated by a spectrum analyser. This pattern, representing the word, is then stored in a memory bank.

When the system hears words, it nips along to its memory bank and rummages around comparing the words it's hearing with the words it's "learned". If it finds a match you get a response.

One particular version of the system was hooked up for a demonstration and arranged to respond to single word commands. The whole affair was coupled to the telephone network via a suitable interface. When the system was instructed to hunt through the files of the New York Times Information Bank (which was hundreds of miles away) it did just that. It took less than a minute to display, on a video terminal, abstracts of the particular topic selected.

Intelligent to credit cards

And that's not the end of the microprocessor—yet. They're doing things with them in France, too. Like one company that is actually putting one (albeit a mighty thin one) into a bank credit card. When you think that the familiar 14 or 16-pin in-line package contains only a very tiny, thin chip, then if one can do away with all that bulky

packaging a very thin circuit indeed can be had. The exact method of fabrication is still under wraps but the future looks extremely promising. Unlike many credit type cards which can only "store" a very limited amount of information on magnetic stripe, these microprocessor beasts will be able to store lots of things, like the balance in the account which would be easily updated at every transaction. Perhaps they might even put a radio receiver chip in there somewhere: do I recognise someone saying "Hear hear"?

High Power

Hams (radio Amateurs) will remember their first experiments with transistors, particularly using them to generate r.f. Some of the early Ginsberg experiments on 1.8MHz with these three-wire fuses were, to put it kindly, expensively disastrous! One watt was, in the early days, quite something. This contrasts with the new power field effect transistors just out which will happily give 100W of c.w. at 175MHz. Certain advantages are claimed by the manufacturers. For example they tell that the devices draw very little input current and things like biasing and modulating are simpler than with bipolar devices. They also tolerate load mismatches and in terms of distortion they are ahead of bipolars. Third order distortion is reckoned to be about the same as a similar size bipolar component, but because the f.e.t. devices have a square law characteristic the higher order distortion is between 5 and 10dB less.

Spot your Tank

So there you are, peering at your video screen, looking for the enemy. But it's difficult. Tanks, for example, can be camouflaged quite cunningly. One answer is to employ a computer with built-in edge detection routines. These things take the data from the sensor and tell the computer to enhance all the straight lines. This crafty dodge has the effect of outlining man-made objects quite dramatically. But we have a problem—the process involves using things called algorithms and these can take some 10 seconds. By that time, our unfriendly

tank crew could have done some very nasty things to both you and your algorithm.

However, tank spotters among you can now rest easy because a solution is at hand. The answer has been to use a charge-coupled device which acts extremely fast—almost in real time to all intents and purposes. If you want to be more precise, the manufacturers say it works up to 1,000 times faster than a general purpose computer. The technique employed is subject to a patent and is quite ingenious.

The chip receives the image signal from the electronic camera (another c.c.d. used for the sensor) and gives it to three separate parallel shift registers. Each register takes just one line at a time and so at any instant these registers hold three contiguous lines of the image. Backing these are 20 edge-detection algorithms which are so arranged that they are able to treat the three lines held by the registers as a 3×3 array of nine separate little picture elements.

The straight edge components of the signal are located simultaneously in 2D i.e. in both vertical and horizontal planes. This is achieved by part of the chip continuously calculating the difference in picture signal between the separate picture elements in the little 3×3 array.

And to think I was impressed by the first op amp.

Micropot

If I mention the word "potentiometer" you will probably have a mental picture of a pot about 25mm diameter with a spindle which is always too long and has to be hacked off! But what about the latest potentiometers which are so small you can get a dozen or so on your fingernail? These truly minute pots are only 0.172in. in diameter and 0.1in. high. Presumably a magnifying glass and micro-screwdriver come with each.

'AVON'

2 metre f.m. transmitter

PART 2 BRIAN L. PHILLIPS G8FWM



Board 3—Power Amplifier (Fig. 7)

If a greater power output is required, then Board 3 may be fully constructed as shown and will be found to deliver around 10 watts r.f. output with a 25 volt supply to the final two stages. It is also quite feasible to construct just one amplifier, or two, or three, etc., depending on requirements.

Merely using the single Tr1 on this board will produce about ¼-watt, whereas including Tr2 will increase this to about 1 watt. In each case, the aerial filter will connect adjacent to the appropriate tuning capacitors and the remainder of the circuit is omitted.

Do not apply more than 15 volts to Tr1 and Tr2 as in this configuration Tr2 especially is running near to its maximum rating.

In the completed power amplifier, the two BLY83 transistors are bolted direct to the metal case and holes are drilled in the board for the transistor body to sit in ensuring good heat transfer. Push-on heat sinks are fitted to Tr1 and Tr2, which are wired to the board conventionally.

Readers who intend to operate the Avon Transmitter should be in possession of the appropriate licence issued by the Home Office to those who have passed the City and Guilds Radio Amateurs' Examination. Details may be obtained from: The Home Office, Radio Regulatory Department, Amateur Licensing Section, Waterloo Bridge House, Waterloo Road, London SE1 8UA.

The board layout for etching is shown in Fig. 8 and Fig. 9 illustrates the component positions.

The aerial filter consists of a parallel-tuned circuit offering low attenuation to the 2m signal, but is effective in reducing harmonic and spurious emissions to an acceptable level.

★ components

BOARD 3

Resistors

½ Watt 20%		
47Ω	2	R2, 3
2 watt 10%		
82Ω	1	R1

Capacitors

Ceramic 50V		
2200pF	4	C2, 4, 6, 8
0.01μF	2	C5, 10

Polycarbonate

0.1μF	2	C3, 7
0.47μF	2	C1, 9

Trimmers

3-30pF	Ceramic	8	TC1-8
3-25pF	Airspaced	1	TC9

Semiconductors

2N3866*	2	Tr1, 2
BLY83*	2	Tr3, 4
2N5642		

Inductors

RFC1, RFC2	10 turns 24 s.w.g. enamelled copper, close-wound on 1MΩ carbon resistor
RFC3, RFC4	7 turns 24 s.w.g. enamelled copper 6.3mm dia. self-supporting and spaced 1 turn apart
RFC	All other chokes 3 turns 24 s.w.g. enamelled copper on ferrite bead
L1, 3, 5, 7, 11	1 turn 18 s.w.g. enamelled copper 6.3mm dia.
L2, 4, 6, 8, 10	3½ turns 18 s.w.g. enamelled copper close-wound on 1MΩ carbon resistor
L9	2 turns 18 s.w.g. enamelled copper 6.3mm dia.

Miscellaneous

- Heatsinks. Push-on types 85° c/w for Tr1, 2. RS type 401.409
- SKR 50Ω BNC socket (Aerial to receiver)
- SKA 50Ω F & E type SO239 socket (Aerial input)
- *If difficulty is experienced in obtaining the transistors for this project, they are stocked by Technomatic Ltd., 54 Sandhurst Road, London NW9.
- Case Foxall T4108 (Watford Electronics)
- Chassis Foxall T2004 (Watford Electronics)

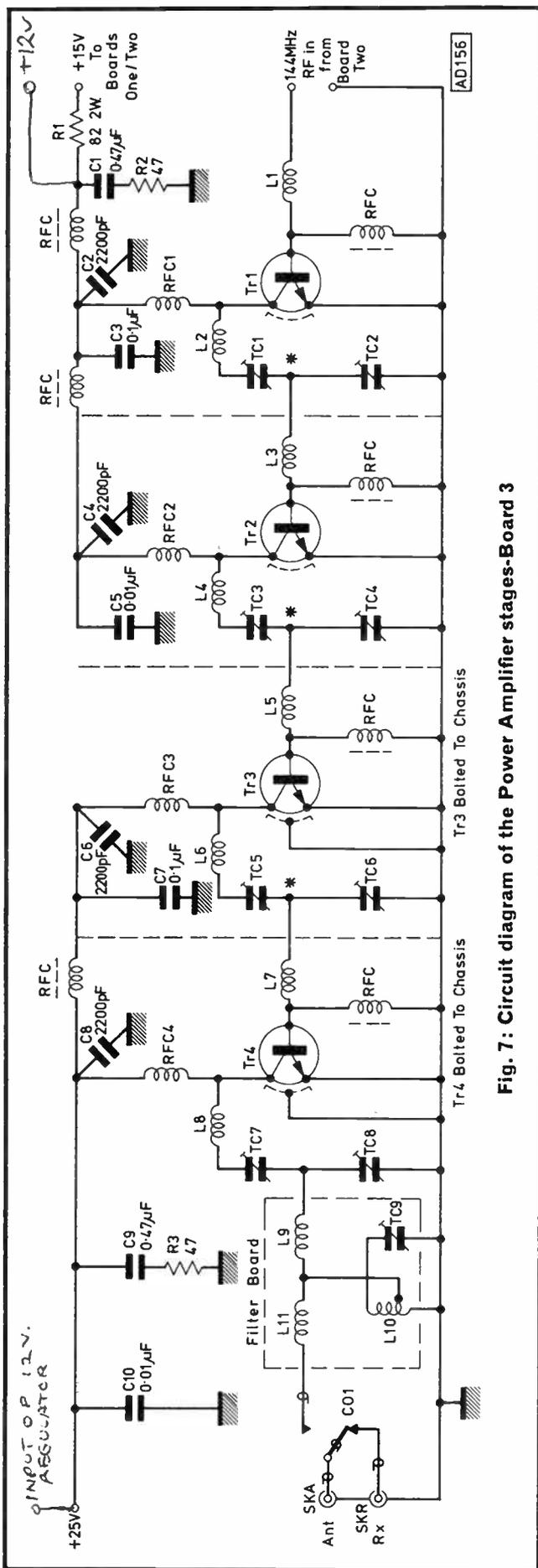


Fig. 7: Circuit diagram of the Power Amplifier stages-Board 3

Two small inductors either side of the tuned element resonate at the second and third harmonics respectively and further reduce the possibility of radiation at these frequencies.

A small, separate board supports the filter and is mounted close to the chosen output stage.

The low level r.f. input from Board 2 is coupled to Tr1 base via a short length of miniature 50Ω co-axial cable. Inductor L1 provides a match into the base/emitter junction of the transistor with L3, L5 and L7 of the following stages.

Each stage is in class C and there is therefore no d.c. bias required. Each positive half-cycle of the r.f. sinewave input turns the transistors on and the flywheel effect of the collector tuned circuits modifies this pulsed signal to a sinewave again.

To allow a d.c. path from base to emitter, small ferrite-cored r.f. chokes are used from base to ground. These are marked "r.f.c." on the diagrams and they are all wound in a similar manner, including the three used in the supply line decoupling.

The inductors RFC1 and RFC2 are wound on 1/2 watt 1MΩ resistors, their leads being used to anchor the windings.

All remaining r.f. chokes are air-spaced types and pictorial details are given in Fig. 12.

Note that the high-power output and driver are fed directly from the 25 volt d.c. supply whilst the remainder of the transmitter, with the exception of the display, is fed from an integrated circuit regulator type 7815. This device has short-circuit and over-temperature protection, and delivers a constant 15 volts at up to 1 amp.

Its inclusion is not necessary if a reasonably stable d.c. supply is available, and of course the entire transmitter can be operated from 12 volts at reduced output.

Relay Switching (Fig. 10)

The incoming 25 volt supply has a diode D1 (BY127) inserted in series with its positive line as protection against polarity reversals. Relay RLA is the keying relay, and is operated by the microphone pressel switch or by the "send" toggle on the fascia of the transmitter. The co-axial relay CO is the aerial changeover, and operates through contact RLA3 of the keying relay.

On operating the microphone pressel switch, RLA operates, RLA1 completes the circuit to the 15 volt regulator, RLA2 illuminates the status l.e.d. "send", RLA3 energises the co-axial changeover relay CO and RLA4 applies the 25V to the BLY83 final amplifiers.

The "send" switch S3, located on the front of the transmitter merely overrides the microphone switch and provides a latching facility, enabling the transmitter to be permanently keyed.

Switch S1 "cal" enables the transmitter to be keyed at very low power by removing the 25 volts to the power amplifiers. Contacts S1a close, completing the RLA coil circuit; RLA1 closes, RLA2 changes over but the "send" l.e.d. is prevented from operating by S1c. The CO relay circuit is completed by RLA3, RLA4 closes but the 25 volts is prevented from reaching the power amplifiers by S1b, which is open.

The "tune" facility S2a again energises RLA; S2b disables the 25 volt supply to the power amplifiers and operates the "net" l.e.d., whilst S2c prevents the aerial changeover relay CO from operating.

An additional contact set on RLA can be used to provide a loop make or break facility for receiver muting and sufficient contacts on the d.c. input plug have been provided for this option.

Tuning

Each transistor collector is series-tuned to give a low impedance feed to the following stage and ultimately to the aerial. The trimmer furthest from

the board edge in each section—i.e. TC1—tunes the coil, and the other—TC2—is adjusted for maximum drive into the next stage.

This arrangement has proved to be both reliable and stable in operation. Tests with the prototype indicated that however badly out of alignment the board was, negligible stray oscillations or spurious signals were produced. Should the board be well off tune, there will be no output.

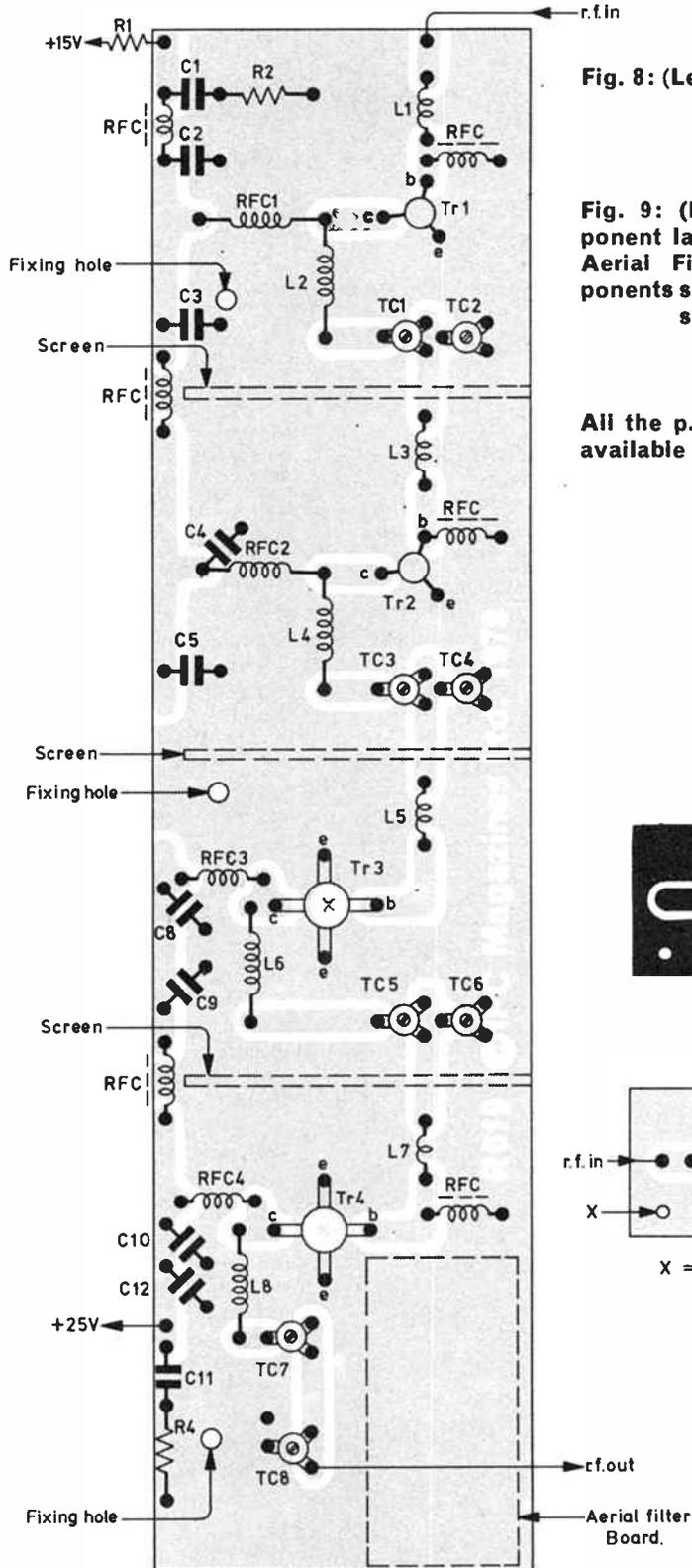
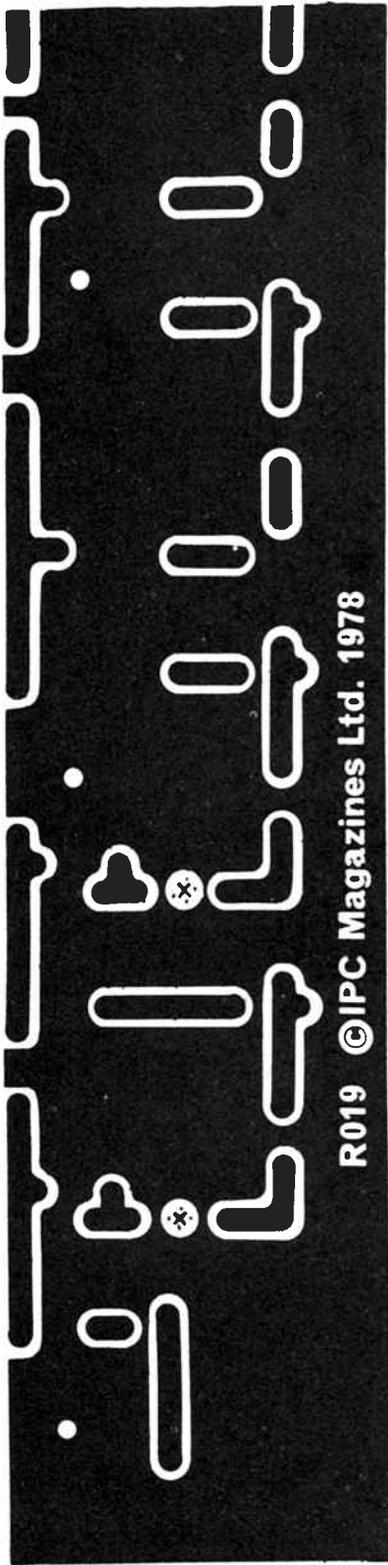
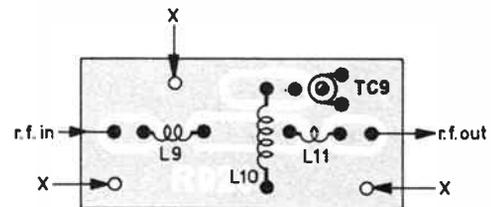


Fig. 8: (Left) Copper side layout of Board 3

Fig. 9: (Right and below) Component layout of Board 3 and the Aerial Filter Board. Note components soldered directly to copper side of the p.c.b.s

All the p.c.b.s for this project are available from: PW Reader's PCB Service



X = 1/16" holes for ground leads to main board.

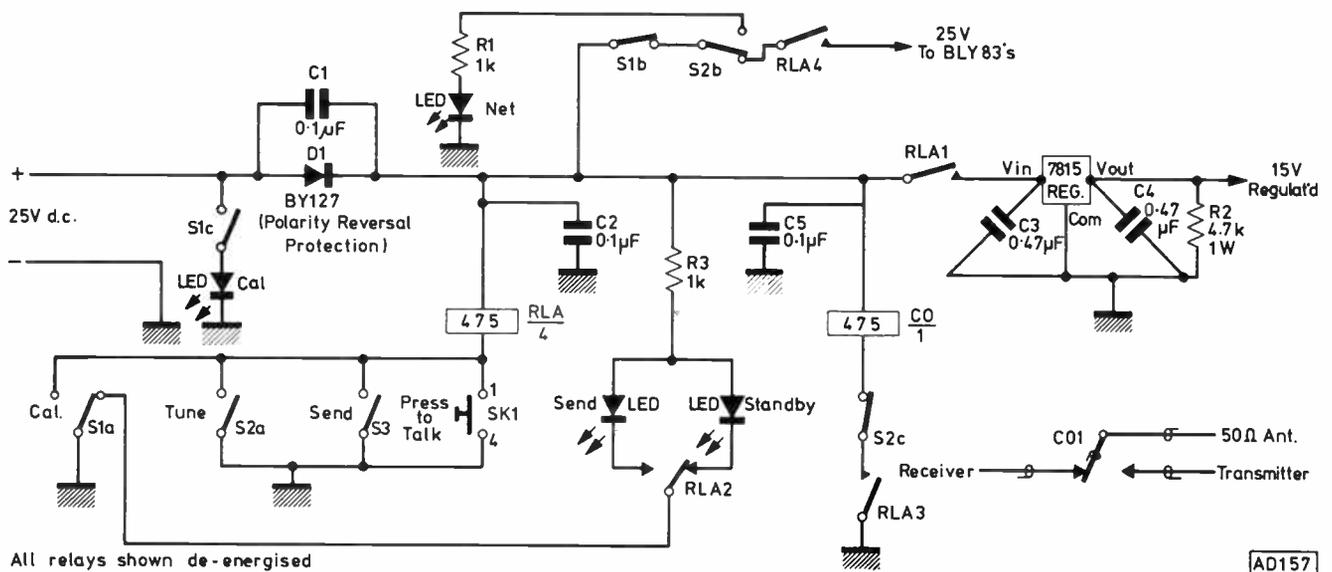


Fig. 10: Circuit diagram of the switch and relay wiring

Decoupling

Notice on the circuit diagram the extensive use of capacitive decoupling on the power supply lines. Various values are used to give broadened effectiveness and the specified types are particularly important here.

A characteristic of the r.f. power transistor is that generally speaking it will not withstand high switching transients, such as those produced by relays. Filters are therefore included from the supply rail to ground thus reducing the charging effects on the line as the voltage is applied and removed.

★ components

POWER SUPPLIES AND SWITCHING ARRANGEMENTS

Resistors

$\frac{1}{2}$ watt 20%	
1k Ω	2 R1, 3
2 watt 20%	
4.7k Ω	1 R2

Capacitors

Ceramic 50V	
0.01 μ F	3 C1, 2, 5
0.047 μ F	2 C3, 4

Semiconductors

Diodes	
BY127	1 D1
Regulators	
7815	1 +15 Volts

Relays

RLA	6 c.o. Siemens plug-in type 475 Ω or RS 349.169, with base
CO	12-24 Volt co-axial relay. Magnetic Devices or RS type 349.686

Switches

S1, 2, 3	4-pole double-throw miniature toggle RS type 316.816
----------	--

Miscellaneous

	4 l.e.d. indicators
--	---------------------

Hardware Notes

The prototype was constructed in a Foxall T4108 instrument case on a Foxall T2004 chassis specifically made for this enclosure (see Fig. 11).

The boards are bolted directly to the chassis, with the exception of the oscillator (Board 1), which is supported by small insulated pillars and secured by 6BA PK screws. Construction is not too critical, provided clearance for the switches etc on the front panel is allowed and sufficient room is made available for the relays, co-axial sockets and power jack.

Three different types of 50 Ω co-axial connector were used to avoid confusion or the accidental insertion of wrong cables. The aerial input is an SO239, the aerial output (to receiver) a BNC and the v.f.o. input a miniature BNC: power is applied via a 4-way McMurdo connector.

Tuning (Boards 1 and 2)

After checking for correct values and component positioning, power can be applied to Boards 1 and 2 having first made the necessary r.f. connections with miniature 50 Ω co-axial cable. Temporarily solder a 60-80 Ω $\frac{1}{2}$ watt resistor across the output and ground, i.e. across TC7. Set all trimmers mid-way and the slugs in L1 (Board 1) and L1 (Board 2) to the centres of their respective coils. Do not connect Board 3 at this stage.

With a diode probe connected to a suitable meter (f.s.d. 50-150mA) and with power applied to both boards, check the oscillator output and tune TC1 on board 2 for maximum signal at the base of Tr2. Loosely couple L1 to a receiver tuned to 24MHz and a strong signal should be detected. Establish that TC1 tunes this frequency by turning it through 360 $^\circ$, when a rise and fall in output should be produced.

Place the probe on the base of Tr3 and adjust TC2 or maximum. Now transfer it across TC7, adjust TC4 and TC5 for maximum level, peaking TC6 and TC7. Repeat all tuning until no further improvement can be obtained.

Signs of erratic tuning indicates either an incorrect crystal harmonic from L1 or some other source of instability.

Re-check the 8MHz and 24MHz signals on the receiver and also the decoupling capacitors before attempting further tuning. If a 2-metre receiver or converter is available it will be a simple matter to prove and in-band signal at Tr6 and also monitor the modulation. As Board 3 is purely an amplifier, the audio quality and deviation must be correct before proceeding from here.

Next remove the dummy load resistor across TC7 and connect Board 3 into circuit. Make certain that the 25 volt and 15 volt supplies are routed to the correct positions.

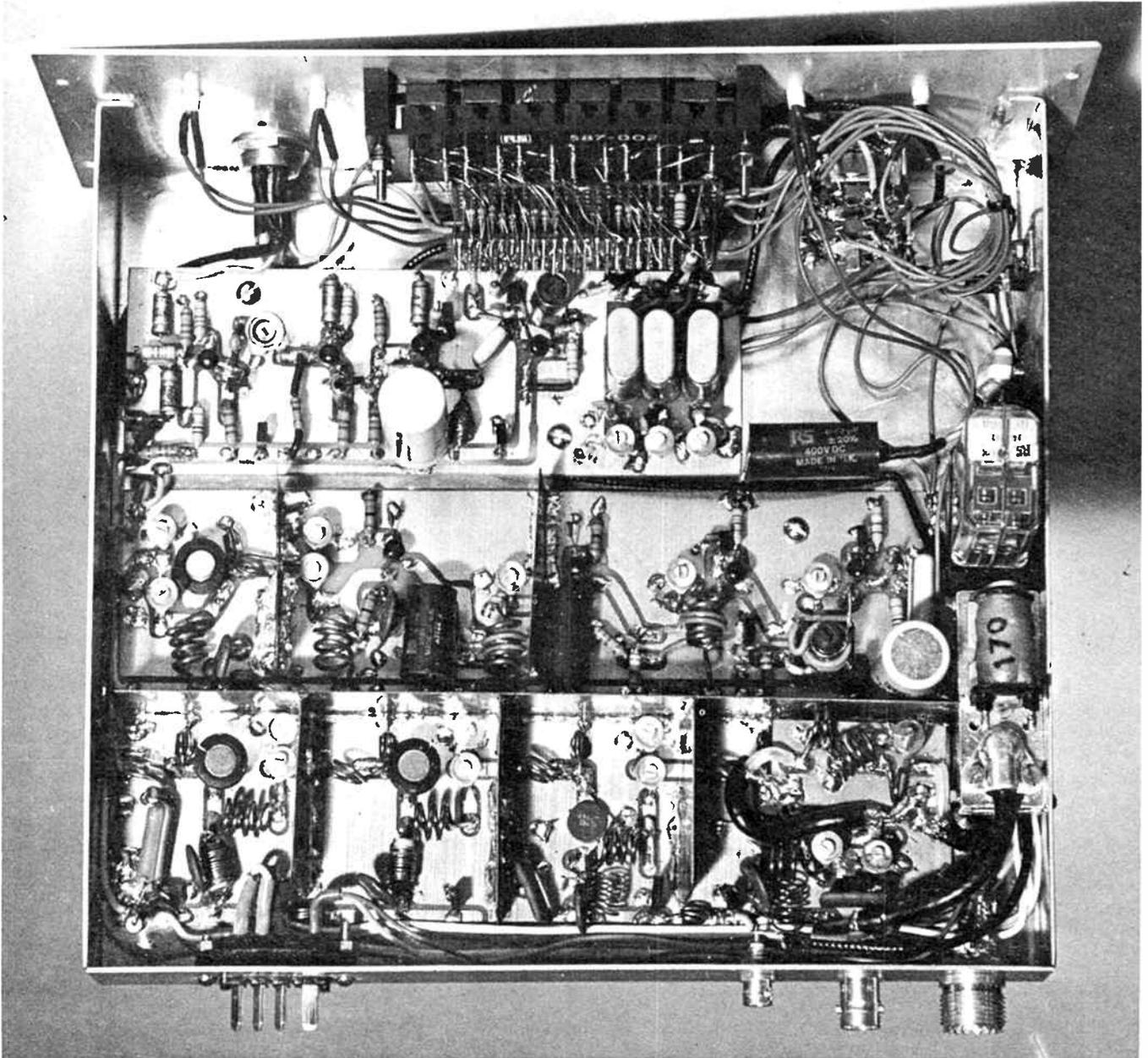
Provide a suitable 10 watt load—a 10 watt low voltage lamp will suffice—across the aerial output socket. Check all trimmers are in the central position then solder a temporary link across the filter board and disconnect one end of TC9.

Tuning (Board 3)

Apply power (25V and 15V) to the transmitter again and, should there be no indication of output, couple the diode probe to the base of Tr2 and tune TC1, TC2 for maximum. Repeat the procedure with Tr3, tuning TC3, TC4 for maximum.

At this point there should be a pronounced indication of r.f. at the output: i.e. if a lamp has been used as a load, it should start to glow. Each trimmer is now adjusted for maximum output, finally peaking TC6, TC7 on Board 2.

If a v.h.f. power meter is used, the r.f. output of the transmitter should lie in the region of 8 to 12 watts. Key the transmitter and after a few minutes check the temperature of each transistor; there is no cause for concern if the heat sinks are found to be



An inside view of the 'Avon Transmitter'. Note, that while six are specified, the prototype used only 3 channels in the crystal oscillator on Board 1

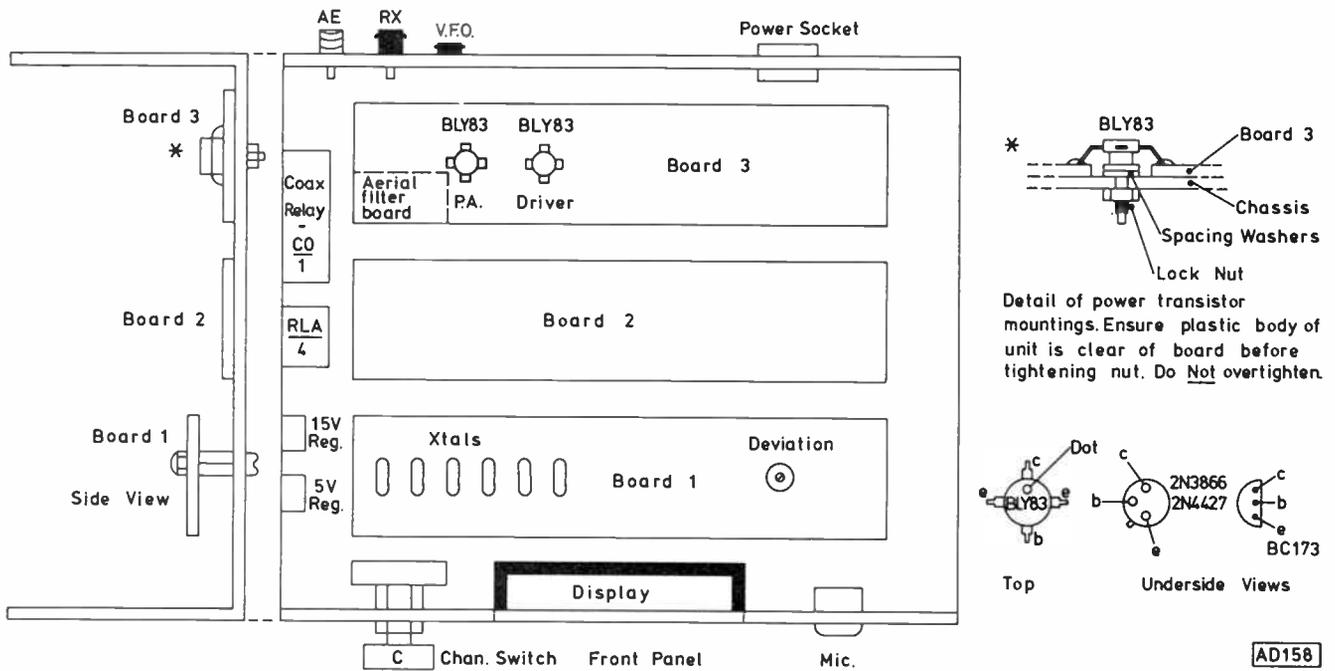


Fig. 11: Suggested chassis layout and details of transistor connections

quite hot, as they are designed for temperatures of 150°C. The section of chassis around the power output transistors will become warm after a few minutes operation.

Remove the power from the transmitter and the link across the aerial filter. Re-apply voltage and adjust TC9 for maximum output: a sharp point should occur where maximum power is reached.

Remove the dummy load and couple an aerial via an s.w.r. bridge to the transmitter. Key the unit and re-adjust TC7, TC8, TC9 for maximum forward reading. The setting will most likely differ from that used when tuning into the dummy load, due to a variation of impedances.

Channel Frequencies

As previously discussed, a number of crystals covering several frequencies within the 2-metre band can be utilised. Each crystal will have an associated trimmer and capacitor, the precise frequency being set by means of a counter or calibrated receiver.

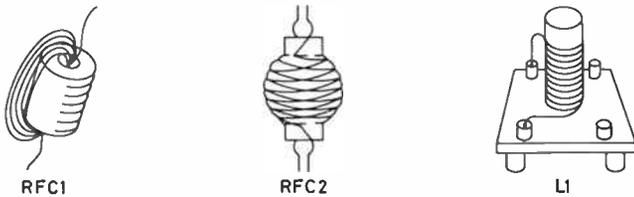
NOTE: In compiling the components lists for part 1, a few inconsistencies occurred. The following values are correct:

Board 1. R5—15kΩ, R6—8·2kΩ, R11—68kΩ, R15—10kΩ

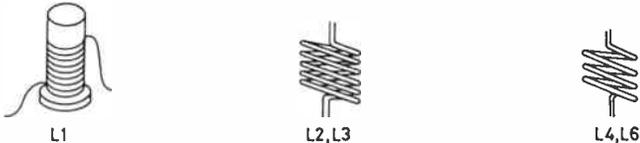
Board 2. R4—10kΩ, R13—56Ω, C3—0·1μF

Also on Fig. 3 page 46; C18 should be shown in parallel with R15.

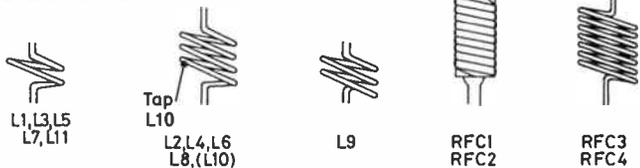
Board 1: Inductors



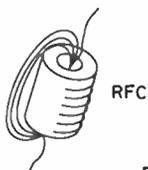
Board 2: Inductors



Board 3: Inductors

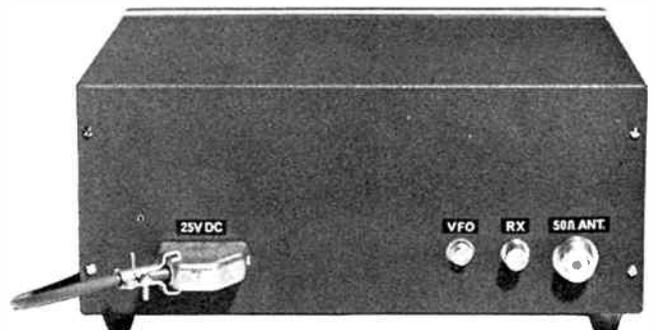


All boards



AD159RM

Fig. 12: Pictorial details of inductors



Next month we will consider the digital display and power supplies for the Avon.

Practical Wireless, August 1978

Battery Power Supply for

The PW

ECONOMY TIMING STROBE

G.GOULD

If, like myself, you live on the top floor of a high-rise block of flats then you will appreciate the problems involved in using the PW Economy Timing Strobe featured last February.

The need to use the mains supply to power the strobe tube seriously limits its use to those who have easy access to a suitable mains socket.

If the strobe could be made to operate from the car battery then its usefulness would be improved immensely.

The power supply described here is both simple to build, cheap and can be fitted into the case used for the original version.

The inverter shown in the circuit diagram produces around 400V and is a conventional inverter circuit using one transistor to convert the d.c. supply to a.c. ready for transforming up to 400V at the secondary of the transformer.

As the circuit is so simple and uses few components the construction can take any convenient form such as Veroboard or a small tag strip.

The transformer bobbin is wound with about 150 turns of 29 s.w.g. enamelled copper wire which is covered with a layer of insulating tape. This winding, which is the secondary, should almost fill the bobbin leaving just enough room for the primary and feedback windings (8 turns and 4 turns respectively).

★ components

Resistors

1W 5%		
820Ω	1	R1
220Ω	1	R2

Capacitors

Polyester 250V		
10μF	1	C1

Semiconductors

Diodes		
BY127	1	D1

Transistors		
2N3055	1	Tr1 (TIP3055 or other similar power type)

Miscellaneous

- Transformer, Ferroxcube FX2242 potcores with bobbin
- Twin core cable
- H.T. cable
- 29s.w.g. enamelled copper wire
- Automobile line fuse assembly
- Croc. clips for connecting to battery. (2)

Take care to note the start and finish of the primary and feedback windings as this is important to ensure that the inverter oscillates.

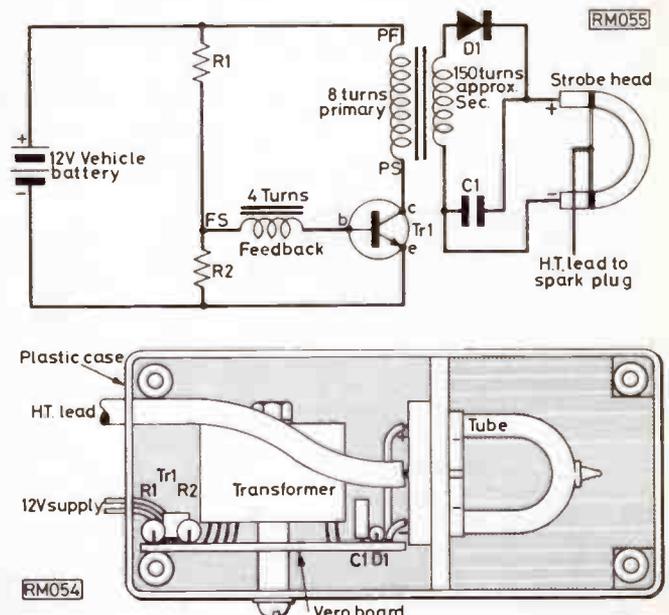
The two ferrite pot cores can then be bolted together with the bobbin inside and the finished transformer secured by the central bolt to a convenient place in the box.

The small piece of Veroboard or tag strip can be bolted using the same bolt as shown in the drawing.

A standard line fuse should be inserted in the cable which is to be attached to the live terminal of the car battery to give protection against short circuits and other disasters which might possibly occur during use.

The basic circuit of the inverter can be used to power a standard 2 foot long fluorescent tube as an emergency lighting unit. In this case D1 and C1 should be omitted and R1 changed to 220Ω. The unit can then be run from a 6V lantern battery.

The method of connecting the strobe unit to the Number 1 plug lead suggested in the original article and the subsequent Extra Data published in the April issue may prove difficult to use on some engines and a modification is to use a length of Bowden cable outer sleeving to provide a flexible take-off point instead of the rigid 4BA stud. The 4BA stud should of course be fitted to the end of the flexible cable. ●



Circuit diagram and layout for battery-powered strobe

PRODUCTION LINES

alan martin

resist coated epoxy glass laminate sheets, developing and etching trays, label and panel materials, high-speed drill, and all the requisite developers.

The Photolab Kit has been designed for use by both the amateur constructor and the professional engineer. It has been introduced to fill the gap between commonly used '1-off' prototype p.c.b. production methods and the facilities offered by the existing, larger kits currently available. However, with its pricing at only £49.50,

Telephone Charge Clock

Trying to calculate the cost of a telephone call while you are actually making it is an almost impossible mental exercise. An attractive new unit by Monitel now makes the process simplicity itself. All that is required of the caller is to select the appropriate charge band, as listed in the Post Office dialling code book, and start the clock at the appropriate moment. The microprocessor-based circuitry does the rest, displayed the accumulating charge continuously on an l.e.d. display, and taking account of the time of day, and the day of the week. The unit is programmed by means of a punched card, and in the event of a change in charge rates, can be reprogrammed by inserting a new card supplied by the makers.

When not in use, the display functions as a conventional digital clock. Produced in similar style and colours to Post Office telephones, the Monitel Telephone Charge Clock is available in a UK version, retailing at about £29, and an International version at about £39. The latter also copes with a selection of the charge bands for overseas calls.

Further details are available from *Monitel Limited, Berechurch Road, Colchester CO2 7QH.*



Light work

Mega Electronics Ltd. have introduced a comprehensive kit which enables the preparation of artwork for, and the production of, both printed circuit boards and front panels or labels.

Known as the Photolab Kit, it consists of an ultraviolet exposure unit, draughting aids and film, positive

complete, and its ability to handle p.c. boards and labels of up to 228 x 152mm, it is anticipated that the kit will have wide ranging appeal in both sectors of the market.

Available from: *Mega Electronics, Ltd., 9 Radwinter Road, Saffron Walden, Essex CB11 3HU. Tel: (7099) 21918.*

Tele-View Module

Texas Instruments have recently announced the production in quantity of their VDP11 combined Viewdata/Teletext decoder module. It uses a microprocessor system based on the familiar TMS 9980, which performs Viewdata decoding, and if used with a remote control system, a code-converting PROM on the input lines enables the codes to be chosen by each customer. An internal TV sync. generator is included, and this is automatically switched in when Viewdata is selected. Auto-dialler telephone numbers are controlled by a four-pole DIL switch, and the unit also features terminal identification.

The complete p.c.b. module (300 x 165mm) is available from *Texas Instruments Ltd., Manton Lane, Bedford,* priced at approximately £250, depend-

ing upon options selected; a version of the VDP11 with expanded memory in the microprocessor system, suitable for editing terminals, is expected to be available shortly.

PCB aids

A comparatively new product is available which will be of great benefit to engineers and amateurs who need to make their own printed circuit boards.

The Alfac Electro range of dry transfers contains almost 100 different patterns for making printed circuit layouts, quickly and accurately. As the symbols are etch resistant, they can be used for making 'one-off' printed circuits by direct application on to copper clad boards.

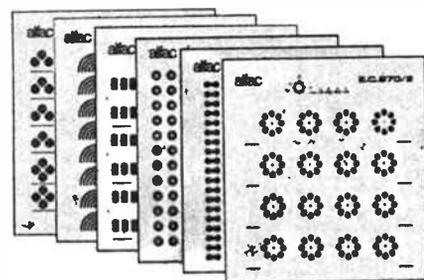
They are simple to use, and need no

special 'fixing' since the double action adhesive used, prevents the patterns from moving once they are laid down. The quality of the ink used avoids any cracking enabling users to obtain a very fine detailed finish.

They are available in a range of patterns and sizes and give correct spacing for integrated circuits and transistors. Also available are a range of lines and rounded corners etc., thus enabling a highly professional standard of finish to be achieved.

Alfac Electro transfers are economical in price and are available in handy blister packs which are ideal for storage. They do not deteriorate with age and if left on their backing sheets can be used after months of storage. Each blister pack contains 5 sheets of patterns and costs £1.30.

Further details and catalogue can be obtained by writing to the sole UK agents for Alfac; *Pelltech Ltd., Alfac Electro Division, 6 Church Green, Witney, Nr. Oxford.*



A selection of some of the patterns available

LETTERS

Pen-Pal

Sir: I am a Ghanaian boy of seventeen years old. I am a first year apprentice in radio and TV servicing. I plan to start a course in radio and TV servicing, and I would be happy if you can help me to correspond with any beginner or experienced radio and TV technician from anywhere and of any age.

*Francis K. Acquaye
c/o Mr. K. Agyei
Box 756
Takoradi
GHANA*

CQ-CQ

Sir: It seems a long time since I saw a "CQ" column in *PW*, and I wondered whether any reader could loan me for no more than just a few hours, the assembly instructions, or even just the circuit-diagram only, of the Tandy's "ArcharKit" Timing-light Kit, Cat. No. 28-4061.

This kit is discontinued, and the instructions were missing. In spite of exhaustive enquiries, Tandy have been unable to turn a replacement set up.

*Jim Robson
47 Rosewood Crescent
Newcastle upon Tyne
NE6 4PR*

Band II FM

Sir: I would like to hear from any of your readers who are interested in long-distance Band II v.h.f. (f.m.) reception. I have made contact with several people in the immediate locality, and feel sure that there are others who find the possibility of alternative good-quality programmes (both mono and stereo) interesting.

Some years ago a series of articles on Band II topics, written by Mr. Austin H. Uden, appeared in *Hi-Fi News*. If any reader knows of an address where Mr. Uden can be contacted, I would be grateful if they could send me details.

*G. P. Stanbury
275 Meadgate Avenue
Great Baddow
Chelmsford
Essex CM2 7NJ*

Mains Plugs

Sir: I read with interest your editorial about plugs and fuses (*PW*, May, p 18).

It may be of interest to compare the situation here with that in America. Over there, there is only one kind of plug configuration, so all appliances come with the plug already fitted. However, there are no fuses in plugs, nor switches on outlets. Most appliances have two-pin plugs, with no earth pin, though all outlets accept three-pin plugs.

Perhaps this country could combine the advantages of the two systems by standardising on a single type of plug. Then manufacturers could supply equipment with plugs and fuses already in place.

*M. A. Covington
Cambridge*

The proposed 16A "International" plug and socket has most of the features of the American plug described in this letter. Ed.

Sir: The recent comments in *PW* about 13A plugs have been most interesting.

May I point out that it is good practice to wire such a plug so that there is more slack in the earth lead than in the other two. Then, if the cable is wrenched from the plug, the earth lead is the last to part company, maintaining the safety of the equipment.

Plugs like those mentioned in May's *PW*, which accommodate equal length leads, do not encourage this practice. They should have the earth connection point even nearer the cable grip.

*E. F. Chase
Titchfield, Hants*

KINDLY NOTE!

Portable P.A. Amplifier, December 1977

In Fig. 3, three additional breaks are required in the Veroboard tracks, as follows:—

1. Between +ve end of C4 and bottom end of R1.
2. Between top end of C3 and top end of C5.
3. Between bottom end of C5 and bottom end (—ve) of C12.

IMAGE REJECTION FILTER

R.A.PENFOLD

Image Rejection Filter

Use of the superheterodyne principle enables highly efficient communications receivers to be produced, but these sets are not totally free from flaws. The main drawback experienced with most s.w. superhet receivers is what is termed the "image response." This is a secondary response of the set which at high frequencies is often nearly equal to the main response, or "primary" signal.

The image response is produced because there are actually two possible difference frequencies for each oscillator frequency. One is equal to the oscillator frequency minus the i.f., and this is conventionally the main response. The other is equal to the oscillator frequency plus the i.f. Thus in order to convert a 1MHz signal to an i.f. of 455kHz, the oscillator would operate at 1.455MHz, and the image response would be at 1.91MHz ($1.455\text{MHz} + 0.455\text{MHz}$).

Reducing the Image Response

Usually the image response is attenuated by using one or more parallel tuned circuits ahead of the mixer in the basic manner shown in Fig. 1(a). Theoretically, a parallel tuned circuit has a very high impedance

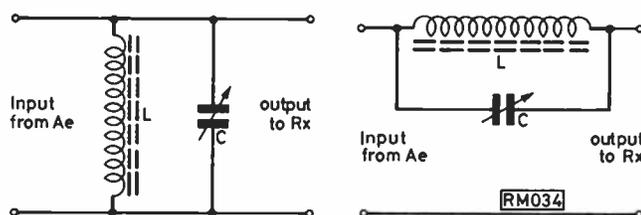


Fig. 1(a) Parallel-tuned, parallel-connected tuned circuit, and Fig.1(b) parallel-tuned, series-connected tuned circuit

at its resonant frequency and a low impedance at other frequencies. By tuning the circuit to the desired input frequency the input signal should pass unhindered and the image signal should be largely shunted to earth.

A practical tuned circuit does not achieve anything like perfection, and there will be some attenuation of the desired signal and perhaps only modest attenuation of the image signal. Several factors determine just how much attenuation of the image signal can be obtained, and one of the most important is the ratio of the input signal frequency to i.f.

In our example of an image response at 1.91MHz, produced by a 455kHz i.f. this response is at virtually double the original. Even a single tuned circuit would be sufficient to greatly attenuate the image response. If the same receiver were to be tuned to a frequency of 10MHz the image response would be at 10.91MHz, which is less than 10% higher than the primary signal. Therefore, the image rejection of a receiver falls away with increasing frequency, and on many sets it falls to a surprisingly low level. For example, a typical s.w. receiver might have two tuned circuits ahead of the mixer, an i.f. of 455kHz, and an image rejection of about 20dB at 14MHz, which means that the set is only ten times more sensitive on the primary frequency than it is on the image frequency. At higher frequencies the image rejection would be further reduced.

Problem Area

In practice it tends to be on the 20 metre amateur band that a lack of image rejection becomes most troublesome. This is because the image response overlaps the 19 metre broadcast band, and strong signals from that band can often largely obliterate the h.f. end of the 20 metre band. This only occurs with receivers having an i.f. in the 455 to 470kHz range, but unfortunately this probably includes the majority of communications receivers in amateur hands. The author experienced this difficulty with his Trio QR666 receiver, and it was this that prompted the construction of the simple filter which forms the subject of this article.

Rejection Filter

Probably the most obvious way of increasing the image rejection of a set is to insert an extra parallel tuned circuit in the r.f. signal path, as in Fig. 2.

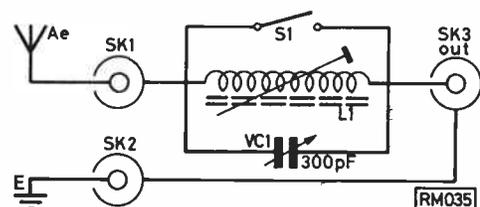


Fig. 2: The circuit of the rejection filter—a parallel-tuned, series-connected tuned circuit, modified to make its response variable

Here the tuned circuit responds to the image frequency rather than the primary signal. As mentioned earlier, a parallel tuned circuit has a very high impedance at resonance, and so this should result in almost total suppression of the image signal and the wanted signal can pass with virtually zero losses.

The practical circuit of Fig. 3 clearly does not achieve perfection, but can provide a high degree of image rejection. A signal breaking through at about S9 or so can be reduced to less than S1, and the wanted signal is only very slightly attenuated.

The circuit is very straightforward with VC1 and L1 forming a variable tuned circuit which can be adjusted over the range 12MHz to 30MHz approximately. S1 enables the tuned circuit to be shorted out when the filter is not required.

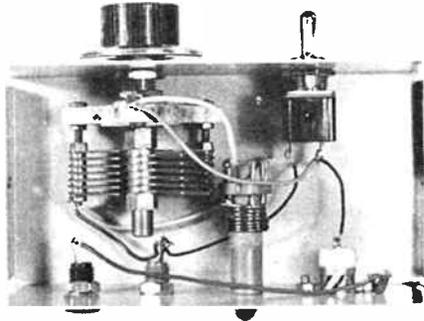


Fig. 3: A photograph of the practical layout, which is simple enough to construct from the theoretical circuit details

★ components

VC1	Approx. 300pF to 400pF air spaced variable.
L1	See text.
S1	S.P.S.T. toggle type.
SK1	Red wander socket.
SK2	Black wander socket.
SK3	Flush mounting coax socket.

Miscellaneous
Metal case.
Control knob.

Construction

L1 consists of 6½ turns of 0.9mm diameter enamelled copper wire wound around the bottom part of a Denco ¾in (9.5mm) coil former. This is fitted with an iron dust core which is adjusted so that the threaded part of the core is flush with the top of the coil. If preferred, a ready made coil can be used. Suitable types are Denco Range 5 blue aerial or yellow r.f. coils. Use the winding between pins 1 and 6, and ignore any others. The tuning capacitor can be any good quality air spaced type having a maximum value in the range 300 to 400pF.

Using the Filter

The filter is coupled to the receiver via a short length of coaxial cable. When an interfering signal is noted, it is merely necessary to switch the filter in and adjust VC1 to null this signal. ●

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AMATEUR BANDS

by Eric Dowdeswell G4AR

As promised last month I should like to discuss the question of what makes a callsign or prefix "rare". It arises with those listeners who start to keep a log of stations heard in the amateur bands.

The newcomer who has just heard his first American amateur, probably on 20m s.s.b., is a little put out when more experienced listeners do not share his initial excitement. In fact, thousands of such stations can be heard, as our beginner will soon appreciate!

He'll go on to log calls from around the world and tick them off against a prefix list. He'll notice that some countries, like the US, are divided into call areas comprising groups of states. On the other hand G2, G3, G4, G5, G6, G8 and several other derivatives could all be in the same block of flats, in England!

Some of the prefixes are hard to find but periods spent listening during the wee small hours will always produce a few more. Certain countries do not appear to have any amateurs at all, frequently due to political reasons. Some "countries" are no more than reefs or small islands that are uninhabited until a group of amateurs form themselves into a DXpedition in order to put a new country in the log of thousands of amateurs.

It is very important to note that **distance** does not come into the question as to whether a call is rare or not. Due to skip it might be next to impossible to log a station in GU (Guernsey) on 20m, while capturing all the VK areas without difficulty. The purpose of the log extracts each month is to alert readers to the comparatively few rare calls that have appeared recently.

Details of time and precise frequency are not required because of the time that the information takes to get into print. The date and band and mode is sufficient. An excellent prefix list with much other useful information costs just 40p from Geoff Watts, 62 Belmore Road, Norwich NR7 0PU. No amateur can afford to be without it.

Talking about sunspot curves, a plot of rainfall against letters received here would be very interesting! Lousy weather so plenty of mail this month!

Newcomers

Having read this column for the last three years Paul Bown at 2 Sunnyside, Theale, Reading, Berks has at last acquired a receiver. Unfortunately it seems to need a bit of attention, not doing much above 20MHz, and Paul is very keen to get on 10 and 15m. So, can anyone help with a manual for the Skywood CX203? Replies direct to Paul, please.

Four months on the bands with an FRG7, and a good log, hardly qualifies J. S. Goodier of Marple, Cheshire as a newcomer. He is now keen enough to start studying for the RAE! He thinks he may have to go it alone but I hope my advice to contact his local radio club and technical college may avoid that.

Round the Shacks

Dave Greenhalgh BRS39965 in Poynton, Cheshire found two goodies in VK9NGE on Norfolk Is. and VRIAR in the Gilbert Is. on 10m. I hope Bill Rendell down in Truro, Cornwall won't mind if I mention him in this section. He has been lapsed for seven years but is hard at it again with a 1961 Heathkit AR3 four-valve set plus preselector and a very short wire in the attic. Naturally, selectivity is a problem and I fear that something a bit better may be the only answer. Bill reckons the lads and lasses would do a better job communicating if they stuck to the proper phonetic alphabet instead of the "homebrew" variety.

An AR88 and 120ft of wire brought in strings of Japs on 10m for Brian Harrison in Hastings, Sussex while in Tetbury, Glos. Jim Rowland is putting the finishing touches to a Heathkit HR1680. He finds the components a bit "fiddly" compared to those of the '20s! Dick Smith reckons he is the only SWL in Porthcawl, Mid-Glamorgan but I doubt it very much! He has a Codar MC3 t.r.f. set with pre-selector, a.t.u., 100ft of wire and an "artificial earth" whatever that is! Could be a collection of quarter wave wires all joined to the set's chassis. A CR100 will, hopefully, be added to the strength in the holidays.

Army type Sgt. Anderson, Dennis, also BRS36591, reports back to the column after wandering around Jamaica and the Sudan. Wonder if he saw my old tri-bander still up there in Khartoum? Dennis now has a Venus SS2 for SSTV and getting good results, with RAE studies going on apace aided by G8LVB. John Whiting, Fareham, Hants, has done well in the Pacific area with a sort of vee beam with 90ft legs, with the feed from one end.

G. M. Davies of Rhyl, N. Wales has been SWLing for 25 years and has reached the FRG7 stage, but wishes the Fine Tune were a lot finer and doesn't

like a common i.f. filter for three different modes. Compromise, I suppose, against cost. **E. Vaughan** of 108 Mickfield Road, High Wycombe, Bucks reckons he's a bit cheeky in asking if anyone has a circuit of the Electronics QP166 valved front-end tuner.

Another FRG7-ite is **Ian Marquis** in Leigh-on-Sea, Essex with a 66ft end-fed and 10m ground plane. Fifteen-year-old Ian recommends a net on 3780kHz run by GW4GMA at around 1630 for "school kids like myself". **Brian Smith** (Barry, Glam) has the same set and would like to be able to turn down the r.f. gain sometimes but finds he only has the equivalent of a DX-Distant switch. Naughty!

Viv Thursfield has got going with the PW Direct Conversion set (Jan 78) and a "modest long wire" on 20m. He has already taken the code test, before the RAE, so let's hope his go at the latter has been successful.

A lovely letter from **Pat Painting** G3OUC concerning **Ted Burr** of Newbury, Berks who is 80+ and has been listening for the last two years, mainly on 160 and 80m with an indifferent receiver. He's hoping to get something like a CR100 before long, and to study for the RAE! Good luck OM!

Clubs Calling

Lincoln SW Club has been re-formed and possibly reformed and meets second and fourth Wednesdays but fuller info from **Bob Shaw** G3VRD, 60 Wragby Road, Lincoln. Slight boo-boo in June column re **Stevenage and District ARS** as code classes are held on club nights, first and third Thursdays. "Contest Planning" is subject for July 20. Info from **Trevor Tugwell** G8KMV, 11 The Dell, Stevenage, Herts.

Reports on the **Bury RS** have resulted in several new members, I'm glad to say. Club has initiated RAE course at Bury Tech starting September. July 11 is annual Fox Hunt time so contact **Eric Thirkell** G4FQE, 59 Oulder Hill Drive, Rochdale, Lancs. Almost last gathering of **Blackwood and District ARS** before summer break is on July 7 with two ARRL films on "A visit to MARS" (Military Affiliate Radio System) and "WAIIOX-Oscars and moon bounce". It's 1900 at Oakdale Community College near Blackwood, Gwent, or write to **S. Cole** GW4BLE, 10 Llanthewy Road, Newport, Gwent.

"Spurious", newsletter of **Silverthorn Radio Club** regretfully reports death of founder member **Eric Johnson** G2HR, first licensed 1929. Club camp at end of August, or any Friday night at Friday Hill House, Simmons Lane, Chingford, London E4, at 1930, or write to **C. J. Hoare** there.

Lastly, an airing for the **Newbury and District ARS** who meet second Tuesday of the month at Newbury College of Further Education at 1900. Details of forthcoming meetings from **Alan Wood** G4EEE, 9 Hillcrest, Tadley, Basingstoke.

SPECIAL ANNOUNCEMENT

Bringing our popular series right up to date, "So You Want to Pass the RAE (New Scheme)" giving details of the new examination format for 1979, will appear in our September issue.

Log Extracts (All SSB)

I. Marquis— 80m CO2JA HC1SC OA4RT ZL3GS ZL4AP 40m CO2DC CP5UW FM7WS VK7GK ZL3BBP 20m HP1XYA VR3AK ZL4LR/A (Campbell Is) 15m HK0QA HS1WR 10m KG6DX VP8PM ZD8RG.

S. Turner— 20m C5AL (The Gambia) VP8MZ 15m WD5AJE/SU 6W8MW.

J. Whiting— 20m J3AH (Grenada) VR3AK YB1BF/7 15m 5X1AA EP2II.

D. Anderson— 20m HK5ARB VS6CZ VK7AE ZL4MG 15m JH7TEG ZL2AUW 10m P29KW VK4NSD ZS6BP.

B. Harrison— 20m VK9XW ZL4LR/A (Campbell Is) 15m YS1SRD 10m JA1MCU A6XB VK5NAP YN1H 5H3BP.

J. Goodier— 20m C5ABK EA9FF FK8CR HM1DW VP2KT VP8PU ZL4LR/A 8R1Q 15m HI8BMC XE2HL 8P6AH 10m C5AAL VU2KT ZS1PF.

D. Greenhalgh— 20m FY7BC YS1RVE ZD9GG 15m 5W1BK 10m HH2MC TU2GL VK9NGE (Norfolk Is) VR1AR.

C. Rendell— 20m J3AH (Grenada) JY9VK VP8PM VK7EB 15m VK7RX 6W8MW.

BROADCAST BANDS

MEDIUM WAVE DX

by **Charles Molloy G8BUS**

What is a medium wave loop, and what does it do, are two questions often asked by newcomers to medium wave DXing. A loop is a modern development of the frame aerial used in the 1920s when broadcasting first began and domestic receivers were rather primitive. The frame aerial was part of the receiver, performing the dual function of tuning coil and aerial in much the same way that the internal ferrite rod aerial does in the modern transistor portable. The m.w. loop is not part of the receiver. It is a separate aerial that has its own tuning control which is used to peak up the incoming signal. The loop is also directional. There are two directions where pick-up is a maximum, these lie along the plane of the windings in opposite directions to one another. There are also two directions where minimum pick-up occurs. These are at right angles to the windings and again are in opposite directions to one another. An illustration of a medium wave loop is shown on page 8 of the Guide to Aerials, March 1978 edition of PW.

For the mathematically minded, the loop response follows a cosine law, the angle being that between the windings and the direction of the incoming signal. When this angle is zero then the cosine is 1 and signal pick-up will be at its greatest. When the angle is 90 degrees the cosine is zero and the pick-up too will be zero. When the angle is 60 degrees the cosine will be 0.5 which means that the signal will only be half its maximum value. By plotting cosine against direction it can be seen that the loop has two very broad peaks

and two rather sharp nulls. It is the nulls that are of use to the DXer. A loop is used to null out QRM. It is not used to peak up DX.

How to use the Loop

A loop is very easy to use. For example, with the loop pointing in any direction, tune the receiver to 782kHz and peak up the mixture of stations heard, using the loop's tuning control. East Germany and Portugal are on 782. Now rotate the loop slowly around its vertical axis. In one position East Germany should be heard reasonably clear of QRM while in another position Portugal will appear. Similarly on 989kHz where from this QTH Madrid can be heard clear of the jamming that is normally on this channel. Similar results can be obtained with a transistor portable that has an internal aerial. The whole receiver must be rotated and the two nulls on most models will be along the length of the receiver parallel to the tuning scale.

When DXing with a loop, rotate it for optimum results. North American DX often suffers from QRM from Latin America and the two are easily separated. The loop may not always null out QRM. North American DX sometimes has European QRM coming from the opposite direction from the DXer and the loop cannot help on this occasion. On the other hand European QRM can nearly always be nulled out when listening to South America.

Advantages and Disadvantages of Loops

The only disadvantage the loop has is its low pick-up compared with a long wire. My 40 inch loop has a pick-up somewhere between that of my 90ft longwire and a ferrite rod aerial. It is claimed that the standard 40 inch loop has a pick-up equivalent to a 30ft long-wire 10ft above the ground and although I have not done comparative tests I think this value is about right.

The loop has a number of advantages in addition to its ability to reduce QRM. It is an indoor aerial and can be used in locations where a long wire could not be erected. Some excellent DX comes from readers who live in multi-storey flats. A loop will nearly always improve the signal-to-noise ratio and if static is coming from one direction, perhaps from tropical thunderstorms in the south in summer, then the static can be eliminated when listening to North America to the west. DXers claim that a "cleaner" signal is sometimes obtained when using a loop and surprisingly, this is true. Overloading, sideband splatter, cross-modulation, when reduced can leave a much cleaner DX signal on some receivers. Loops are not made commercially in the UK so you will have to make your own. This is not a disadvantage. A lot of satisfaction is to be had from quite a simple device that you can easily make yourself and that will on occasion produce quite startling results.

Problems with Loops

Reader John Cook of Southend-on-Sea has constructed the loop described in the 1976 edition of the *World Radio and TV Handbook*. The tuning capacitor is a 365pF variable and the loop works well between 525kHz and 1250kHz, but on higher frequencies John

has to switch out the tuning capacitor. Try reducing the number of turns. You should then be able to tune to 1605kHz but you may then not be able to tune as low as 525kHz. If so, switch in additional capacitance (220pF should do) whenever you want to reach the l.f. end of the band. The general rule is; if you cannot tune to the h.f. end, remove turns and if you cannot reach the l.f. end, increase the tuning capacitance.

As a rough guide, 100ft of wire will be found to be the correct length to wind most loops irrespective of size. On this basis a loop of 4ft size would have six turns, though it might be possible to squeeze in another turn or two if the self capacitance of the winding and the minimum value of the tuning capacitor are low.

A number of readers, including John, ask for details of a suitable pre-amplifier for use with a loop. My advice is, do not use a pre-amp, at least until you have some experience handling a loop. Even then a pre-amp is of limited value. The same applies to the use of a preselector on the medium waves. DX on this band is often quite strong and it is interference, some 80 megawatts in Europe, that is the problem. High selectivity, not high gain, is what is required and a loop pre-amp or preselector may easily overload the receiver.



SHORT WAVE BROADCASTS

by Charles Molloy G8BUS

During the early days of wireless, Saturday was aerial cleaning day when enthusiasts used to scrub their aerials with steel wool to remove corrosion and hopefully, bring about improved reception. While it is not suggested that this practice should be resurrected it is a fact that outdoor aerials do require maintenance now and again and summertime, when the days are long and the weather is kind, is the time to do it. Several years ago I discovered with horror that my long wire was no more than a 10ft lead-in, as the joint between lead and aerial had corroded away!

It can be rather annoying if an aerial comes down during the winter when the weather makes repair work difficult and even hazardous. I take down my long wire every summer to examine it for mechanical weakness or breakage. It is only the active part of the aerial between the insulators, that needs to be copper wire. The parts between insulators and supports can be of stronger material such as steel wire or nylon rope. Leakage is not a great problem when an aerial is used with a modern receiver but if the aerial is down then it only takes a moment or two to clean the insulators and it might just make a difference when you are chasing weak DX. Dirty insulators and bad connections can also cause crackles.

Summer is also the time to experiment with aerials. If you have a long wire then why not try a vertical or a whip? An ounce of practice is worth a ton of theory. If you have the space, try making your aerial longer to see if it makes any difference. Height is usually

more important than length and with an inverted "L" or a "T" aerial it may well be the vertically hanging downlead that is the effective part.

"Could you suggest an aerial which would be good on the tropical bands as well as the h.f. bands" asks **Martin Liezers** of Newport in Gwent who uses a 230ft long wire, homebrew a.t.u. and Realistic DX160 receiver. Well, the 230 footer should be more than adequate on the tropical bands. It should also perform well on the main short wave bands when they are quiet; on 19m late at night for example, but problems with overloading may occur on the h.f. bands when they are crowded with strong signals. Cross-modulation, splash and spurious can then occur. The answer, is to fit an attenuator between the a.t.u. and the receiver.

Is Your Aerial Too Long?

There was a pre-war book on DXing which had a chapter entitled "Is your aerial too long" and it was suggested there that shorter aerials would give better results with the sensitive receivers that were then coming into use. While this is correct when dealing with strong signals it is not necessarily true for weak signals. Put up the best aerial that you can. Fit an a.t.u. between the aerial and receiver so that a good match is obtained for each band. If the receiver r.f. gain control is unable to cope with strong signals or if your receiver does not have an r.f. gain, then fit a variable attenuator between the a.t.u. and the receiver.

Details on how to make an a.t.u. appeared on page 12 of the Aerial Supplement in the March 1978 issue of *PW*. A simple attenuator can be made using a 1000 ohm potentiometer as outlined in the MW DX section of last month's *PW* or, alternatively by inserting a variable capacitor in series with the aerial. A value in the region of 200pF will do. The latter was once the subject of a patent held I believe by John Scott Taggart who developed the famous ST range of receivers. As well as acting as an attenuator the variable capacitor will also improve selectivity.

Logs and News

News of more late evening DX on the higher frequencies come from **Goff Curtis** (South Harrow) who pulled in Radio Grenada on 15105kHz, Radio Nacional Chile in 15150, Radio Jornal do Comercio Brasil on 15145, Radio TV Congolaise 15190, Taipeh Taiwan 15225, Radio Habana Cuba 15230, Radio Mexico 15385, all in the 19m band around 2330 (details of receiver and aerial not given). Also heard and taped was a station with the call Radio Guyana with YL announcer on approx 15130kHz at 1330. Has anyone any information about this station? According to the *World Radio and TV Handbook* Guyana is only on the tropical and medium wave bands. On the 25m band this time, **N. C. Dove** (Thornhill, Dumfries and Galloway) reports hearing Radio Clarin, Dominican Republic on several occasions in English on 11700 around 2200 at SIO 444 using his homebrew receiver, preselector and 15ft indoor aerial.

On 60m at the other end of the s.w. spectrum **James Edwards** (Bryn near Wigan) used his FRG7 and 60ft loft aerial to log R. Nacional Espejo in Ecuador on 4680kHz at 0645, ELWA Liberia on 4770 at 2230, Radio Lara Venezuela on 4800 at 0430, Radio Reloj Costa Rica on 4832 at 0650, Ecos del Combeima Colombia

4875 at 0700, Accra Ghana 4915 at 2350, Radio Brasil Central 4985 at 0630, Radio Reloj Continente Venezuela on 5030 at 0430. "Could you tell me anything about Radio Lebanon which I have heard on the edges of the 49m and 19m bands around 2030?" asks James. Radio Lebanon is on 5980 with its Arabic service and according to Sweden Calling DXers it is on 15440 to Africa from 1830 to 2030. **Roy Patrick** has also been on 60m with his Trio 9R59D and Joystick antenna and he reports hearing YVLK Radio Rumbos on 4970kHz at 0600. Roy mentions that Radio Finland is on a new channel, 15265kHz at 1300 on Sundays which replaces 15330. **Gary Ross Perry** (Cardiff) DXes with a 5-valve Philco receiver of uncertain age along with a 60ft long wire. His log includes Radio Japan on 17825 at 0815, Radio Kuwait in English on 12085 at 1950 and the Voice of Nigeria on 15120 at 1830. An FRG7 receiver and 65ft long wire brought in some interesting DX for **Bill Iball** (Billinge near Wigan). He logged Radio Australia on 6035 at 2135, R. Nac. Chile 15150 at 2205, Radio el Mundo Argentina on 15290 at 2120, Radio Japan 17795 at 1018, and R. Nac. Chile on 17715 at 2024.

Radio New Zealand

A letter from the well-known New Zealand DXer **Arthur Cushen** to *PW* reader **George E. Lee** of Ossett in Yorkshire gives the latest schedule of Radio New Zealand effective from 6th May 1978. The Pacific Service is on 6105kHz from 0500 to 1030 GMT, 9770 from 1800 to 2015, 11800 from 1800 to 2215, 15130 from 0400 to 0730, 15380 from 2030 to 0345, 17710 from 2230 to 0445. The Australian Service is on 9620kHz from 0745 to 1030. Arthur recommends listening in the UK on 6105 at 0600 GMT and a little later on 9620. He says that NZ transmissions are also heard in the UK around 2000 on 11800kHz and a little later when frequencies in the 19m band are in use. *PW* reader **Martin Liezers** heard RNZ on 15130 at 0700 and he was surprised at the strength of the signal. The RNZ transmissions are all with a power of 7.5kW.



by **Ron Ham BRS15744**

The solar activity recorded by **Cmdr Henry Hatfield**, Sevenoaks, Kent, **John Smith**, Rudgwick, Sussex, and myself from April 23rd to May 8th was dominated by some huge individual bursts of radio noise, covering a wide range of frequencies. The largest of these, 1320, April 28th, lasted 34 minutes at 136MHz and 82 minutes at 95MHz. Almost instantaneously, **Alan Baker**, G4GNX, Newhaven, **Barry Ainsworth**, G4GPW, Sompting, Sussex, **Roy Bannister**, G4GPX, Lancing, Sussex, and **Neil Clarke**, BRS34306, Knottingley, Yorkshire, all noted a Sudden Ionospheric Disturbance (SID), which blacked out much of the h.f. bands until about 1500. Neil was listening to a QSO between ZC4AJ and GW4GSS on 10m when it started and the ZC4 just faded into the noise.

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7411	20p	29p	7484	97p		74151	64p
7412	17p		7485	104p	141p	74153	64p
7413	30p		7486	31p	59p	74154	96p
7414	51p		7489	205p		74155	54p
7416	30p		7490	33p	99p	74156	80p
7417	30p		7491	76p		74157	67p
7421	16p	26p	7492	38p	99p	74158	120p
7421	29p	26p	7493	32p	99p	74159	210p
7422	24p	26p	7494	78p		74160	82p
7423	27p		7495	65p	119p	74161	92p
7425	27p		7496	58p		74162	92p
7426	36p		7497	185p		74162	92p
7427	27p	29p	74100	119p		74163	92p
7428	35p		74104	63p		74164	104p
7430	17p	26p	74105	62p		74165	105p
7432	25p	26p	74107	32p		74167	20p
7433	40p		74109	63p	56p	74170	230p
7437	40p	42p	74110	54p		74172	625p
7438	33p	42p	74111	68p		74173	170p
7440	17p	29p	74112	88p	56p	74174	87p
7441	74p		74116	198p		74175	87p
7442	70p	114p	74118	83p		74176	75p
7443	115p		74119	119p		74177	78p
7444	112p		74120	115p		74180	85p
7445	94p		74121	25p		74181	165p
7446	94p		74122	46p		74184	135p
7447	82p		74123	48p	64p	74185	134p
7448	56p		74125	38p	64p	74188	275p
7450	17p		74126	57p	64p	74190	115p
7451	17p	26p	74128	74p		74192	105p
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- EC3302 TOKO's budget 3 cct FM varicap tunerhead. JFET RF. £8.25
- 7252 Larsholt's MOS frontend/CA3089E IF system HiFi complete varicap tuner for 88-108. Mute, AFC, AGC etc. £26.50
- 7253 Larsholt's FET frontend/CA3089E/MC1310 stereo tunerhead with varicap tuning. Like 7252, signal level/tuning meter drives. £26.50

Linear ICs for audio and radio applications - Old ones, new ones etc.

- CA3089E / KB4402 classic FM IF system. Includes mute, afc, agc, metering. £1.94
- HA1137W/KB4420A as CA3089E, with improved deviation muting and S/N. £2.20
- CA3189E Update, though not replacement for 3089. inc af gain. £2.75
- TBA120A/SN76660N Limiting DC coupled IF amp plus balanced detector. £0.75
- TBA120S Hi gain version of TBA120A. £1.00
- uA720DC/CA3123E AM radio IC, useful gain controlled RF/IF gain block. £1.40
- TBA651 low voltage, hi gain AM radio cum linear RF/IF gain. £1.81
- HA1197 Complete HiFi AM radio inc detector wide agc range. £1.40
- MC1350 AGC wideband IF amplifier block for AM/FM/SSB. £1.20
- MC1330 Synchronous AM/video detector. £1.35
- LM1496/SG1496 Classic double balanced mixer for DC to 300MHz. £1.25
- LM374N National's multimode communications IF/detector. £3.45*
- MC1495 Precision four quadrant multiplier system. £6.86*
- TDA1062NEW Complete DC to 200MHz front end system. £1.95
- TDA1083NEW Complete DC to 30MHz AM/FM +800mW AF radio ic. £1.95
- TDA1090NEW Complete AM radio to 30MHz, with built in 3089 type FM IF and function system for HiFi. £3.35
- KB4406 NEW Differential AM/FM IF gain. £0.50
- KB4412 NEW 2 balanced mixers, agc 55dB gain IF amp cooms device. £2.55
- KB4413 NEW Comp to KB4412, AM, FM, SSB detector, ANL, mute AGC driver, meter driver. Complex function comms ic. £2.75
- KB4417 NEW 3mV mike preamp, limiter, vogad for comms. £2.55
- SD6000 Dual DMOS RF/Mixer mosfet pair. £3.75

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4008	80p	4068	25p	4508	248p
4009	58p	4069	20p	4510	99p
4010	58p	4070	20p	4511	149p
4011	17p	4071	20p	4512	98p
4012	17p	4072	20p	4513	206p
4013	55p	4073	20p	4514	260p
4016	52p	4075	20p	4515	300p
4017	80p	4076	90p	4516	125p
4018	80p	4077	20p	4517	382p
4019	60p	4078	20p	4518	103p
4020	93p	4081	20p	4519	57p
4021	82p	4082	20p	4520	109p
4022	90p	4085	82p	4521	236p
4023	17p	4086	82p	4522	149p
4024	76p	4089	150p	4527	157p
4025	17p	4093	50p	4528	102p
4026	180p	4094	190p	4529	141p
4027	55p	4096	105p	4530	90p
4028	72p	4097	372p	4531	141p
4029	100p	4098	110p	4532	125p
4030	58p	4099	122p	4534	614p
4031	250p	4160	90p	4536	380p
4032	100p	4161	90p	4538	150p
4033	145p	4162	90p	4539	110p
4034	200p	4163	90p	4541	141p
4035	120p	4174	104p	4543	174p
4036	250p	4175	95p	4549	399p
4037	100p	4194	95p	4553	440p
4038	105p	4501	23p	4554	153p
4039	250p	4502	91p	4556	77p
4040	83p	4503	76p	4557	386p
4041	90p	4507	60p	4558	117p
4042	85p	4510	128p	4559	388p
4043	85p	4511	163p	4560	218p
4044	80p	4512	116p	4561	65p
4045	150p	4514	325p	4562	530p
4046	130p	4515	325p	4566	159p
4047	99p	4516	128p	4568	281p
4048	60p	4517	403p	4569	303p
4049	55p	4518	119p	4572	25p
4050	55p	4519	58p	4580	600p
4051	65p	4520	120p	4581	319p
4052	65p	4528	122p	4582	164p
4053	65p	4553	440p	4583	84p
4054	120p			4584	63p
4055	135p			4585	100p

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- BIMOS
- CA3130E 84p
- CA3130T 90p
- CA3140E 35p
- CA3140T 72p
- CA3160E 90p
- CA3160T 99p
- Op amps
- LM301AH 67p
- LM301AN 30p
- LM308H 121p
- LM308N 97p
- LM318H 279p
- LM318N 224p
- LM324N 71p
- LM339N 66p
- LM348N 186p
- LM3900N 60p
- 709HC to5 64p
- 709PC dil 36p
- 710HC to5 65p
- 710PC dil 59p
- 723CN 65p
- 741CH to5 66p
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- 747CN 70p
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2 Gresham Road, Brentwood, Essex. & finishes here.

Solar noise was frequently heard at 28 and 50MHz with normal communications receivers and dipole aerials on May 3rd, 5th, and 7th and large bursts were recorded at 136MHz at 1201 (8 mins) on the 6th and 1213 (37 mins) on the 8th. Noise storms were recorded on May 1st, 4th, and 18th. On April 30th, Henry, using his spectrohelioscope, counted 5 large sunspots, 6 small ones, 3 bright plages and on May 3rd he saw a baby flare. Another look on the 17th revealed 10 spots in 5 separate groups.

Aurora

After that April 28th burst, and with more solar activity on May 1st and 3rd, it was not surprising that auroral events began during the afternoon of April 30th and rolled around, with varying intensity until the small hours of May 4th. Between 1555 and 1720 on April 30th, **John Branegan**, GM8OXQ, Saline, Fife, heard tone-A, c.w., signals from G, GI, GM, PA0, SM and beacon signals from GB3ANG, GI, LER, and VHF on 2m. John found it impossible to access OSCAR-8 during the aurora while the satellite was to the north of his QTH. Alan Baker heard GMs on the 30th and around midnight on May 1st/2nd, Barry Ainsworth had s.s.b. contacts with GM4COX and GM8ODN and a c.w. contact with GM4CXM. At 2354 on May 2nd, Alan worked GI5SJ, at 0013 on the 3rd he worked GM4BYF and heard GI4GVS and GM8FFX.

Around 2215 on May 1st, Neil Clarke heard tone-A beacon signals from GB3CTC, GB3GI, DL0PR and SK7VHF and auroral s.s.b. from 7 Gs, 5 GMs, 1 GI, 1 GW, 1 ON, 1 PA0 and 3 DCs. At the same time John Branegan heard several of his GM colleagues "piling up the Continentals on both c.w. and s.s.b., with Gs in the London area very prominent". Between 1645 and 1850 on May 3rd John heard tone-A c.w. from Russian and Swedish amateurs, meanwhile I heard auroral signals from G8LIC, Middlesbrough, G8AZA, Scarborough, 11 east-European f.m. broadcast stations (67-73MHz), Meldrum TV sound (58.25MHz), GI4GVK and **Mike Rowe**, G8JVE, some 10 miles south of me at East Preston, Sussex. Mike also heard GI4GVK and GI4GVS, while at nearby Lancing, Roy Bannister worked GW2HIY and GM4EYF on c.w., and further east in Newhaven, Alan Baker heard 4 Gs, 1 GI, 1 GM and a GW.

Around 0249 on the 4th Alan had auroral QSOs with a couple of GMs and a GW, and agreed with Barry, Roy and myself that GM4COK was the most consistent auroral signal in southern England. Having weighed all this up, **Charlie Newton**, G2FKZ, London, RSGB auroral co-ordinator, is studying the relationship between large individual solar bursts and aurora and would appreciate any information you can give him. Between 1534 and 1738 on May 9th John Branegan worked G8LIC and G8MJG via aurora and heard strong c.w. signals from G, GI, GW, LA, and beacons DL0PR, GB3GI, LER, and VHF.

10m Band

Harold Brodribb, St. Leonards-On-Sea, Sussex and Alan Baker reported that the 10m band was dead on April 20th and, periodically, on other days ionospheric disturbances menaced the BBC's World Service transmissions on the h.f. bands. On most days between April 20th and May 18th, John Branegan, **Gordon Goodyer**, BRS37345, Petworth, Sussex, Neil Clarke, and myself received strong signals from the Cyprus

beacon, 5B4CY, project TESSA beacon ZE2JV, and occasionally A9XC, Bahrain, and DL0IGI when sporadic-E was present. Neil reports that on April 29th and May 3rd, 10m was open from 0800 until 2000 with signals from South Africa, South America, Israel and Russia. Gordon logged a host of Ws around 1840 on May 6th and Middle East stations during the afternoon of the 7th, while on the 14th he received s.s.b. signals from 30 countries from Japan to South America and Russia to South Africa.

Sporadic-E

The 1978 Sporadic-E season (northern-Hemisphere) began at 0800 on April 26th when I received both sound (56.25MHz) and picture (49.75MHz) on the R1 television channel with only dipole aerials feeding my R216 v.h.f. receiver and JVC 3060 television receiver. At the same time I heard strong f.m. signals from seven east-European broadcast stations (66-72MHz) and during the morning of May 1st, I watched part of Russia's May Day parade on R1. A most intense Es disturbance occurred between 0900-1100 on May 13th when I received very strong signals from 33 broadcast stations (65-73MHz), European radiotelephone signals in Band I and on Ch.R1 I watched an ice hockey match. There are many transmitters on the R1 system and periodically (typically sporadic-E) one picture would fade out and another take its place. At 1241 on the 15th, a test card appeared on R1, and reference to Roger Bunney's book, *Long Distance Television*, revealed that the station was Televidnie Sovietskogo Soiuza (USSR) using test card pattern 0249.

Tropospheric

Conditions on v.h.f. improved greatly between May 6th and 18th, during which time the atmospheric pressure fluctuated from 30.0in to 30.5in and down again. On the 6th, Mike Rowe worked 3 Ds, 8 Fs, 5 ONs, and 6 PA0s on 2m s.s.b. and during the afternoon of the 7th he had a 59 QSO with DK8VRA. Mike runs a TS700G, with a home-brew 50 watt linear to an 8-element crossed Yagi. At 2240 on the 9th, Neil Clarke heard a PA0 calling through his local 2m repeater, GB3NA, R3, and on s.s.b. he heard 17 PA0s and 7 DCs working UK stations from Kent to Wales and north to Scotland.

During the afternoon of the 7th G4GNX had 2m s.s.b. QSOs with PA0WRL/P, F1ENH/P and DC9DZA, and on the 10th both **Andrew "Jim" Lyon**, G8LPY, Worthing, and G4GNX heard signals through the French repeater, FZ3THF, R4. On the 11th, Jim worked Roy Bannister, holidaying in Yorkshire, via GB3PI, R6. Like Mike Rowe, Jim uses a TS700G to an 8-element crossed Yagi and they are both now equipped for 70cm operation. In a c.w. contact on the 10th PA0DOG told G4GNX that PA0MI had worked into Russia via the aurora on May 1st, and at 2028 on the 15th G4GNX had a 2m c.w. QSO with F6BCK.

Band II FM DX

Guy Stanbury, Chelmsford and **Bob Dewick**, Southminster, Essex, are keenly interested in Band II DX. Guy uses a home-brew receiver built from Ambit International modules and Bob has a Trio KT7001. Both stations use two Fuba Uka Stereo '8's aerials stacked vertically and rotatable. Guy sent a detailed

15-240 Watts!

HY5 Preamplifier

The HY5 is a mono hybrid amplifier ideally suited for all applications. All common input functions (mag Cartridge, tuner, etc) are catered for internally. The desired function is achieved either by a multi-way switch or direct connection to the appropriate pins. The internal volume and tone circuits merely require connecting to external potentiometers (not included). The HY5 is compatible with all I.L.P. power amplifiers and power supplies. To ease construction and mounting a P.C. connector is supplied with each pre-amplifier.

FEATURES: Complete pre-amplifier in single pack—Multi-function equalization—Low noise—Low distortion—High overload—Two simply combined for stereo.

APPLICATIONS: Hi-Fi—Mixers—Disco—Guitar and Organ—Public address

SPECIFICATIONS:

INPUTS: Magnetic Pick-up 3mV; Ceramic Pick-up 30mV; Tuner 100mV; Microphone 10mV; Auxiliary 3-100mV; Input Impedance 4-7kΩ at 1kHz.

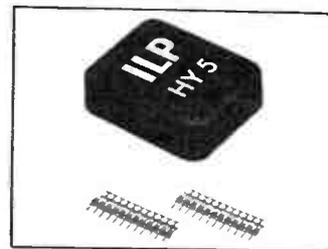
OUTPUTS: Tape 100mV; Main output 500mV R.M.S.

ACTIVE TONE CONTROLS: Treble ± 12dB at 10kHz; Bass ± at 100Hz.

DISTORTION: 0.1% at 1kHz. Signal/Noise Ratio 65dB.

OVERLOAD: 38dB on Magnetic Pick-up. **SUPPLY VOLTAGE** ± 16-50V.

Price £5.22 + 65p VAT P&P free.



HY30 15 Watts into 8Ω

The HY30 is an exciting New kit from I.L.P. It features a virtually indestructible I.C. with short circuit and thermal protection. The kit consists of I.C., heatsink, P.C. board, 4 resistors, 6 capacitors, mounting kit, together with easy to follow construction and operating instructions. This amplifier is ideally suited to the beginner in audio who wishes to use the most up-to-date technology available.

FEATURES: Complete Kit—Low Distortion—Short, Open and Thermal Protection—Easy to Build.

APPLICATIONS: Updating audio equipment—Guitar practice amplifier—Test amplifier—audio oscillator.

SPECIFICATIONS:

OUTPUT POWER 15W R.M.S. into 8Ω. **DISTORTION** 0.1% at 1-5W.

INPUT SENSITIVITY 500mV. **FREQUENCY RESPONSE** 10Hz-16kHz—3dB.

SUPPLY VOLTAGE ± 18V.

Price £5.22 + 65p VAT P&P free.



HY50 25 Watts into 8Ω

The HY50 leads I.L.P.'s total integration approach to power amplifier design. The amplifier features an integral heatsink together with the simplicity of no external components. During the past three years the amplifier has been refined to the extent that it must be one of the most reliable and robust High Fidelity modules in the World.

FEATURES: Low Distortion—Integral Heatsink—Only five connections—7 amp output transistors—No external components

APPLICATIONS: Medium Power Hi-Fi systems—Low power disco—Guitar amplifier

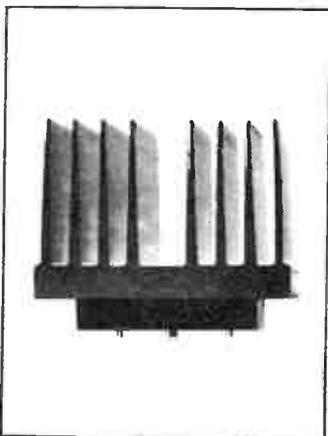
SPECIFICATIONS: **INPUT SENSITIVITY** 500mV

OUTPUT POWER 25W RMS into 8Ω **LOAD IMPEDANCE** 4-16Ω **DISTORTION** 0.04% at 25W

SIGNAL/NOISE RATIO 75dB **FREQUENCY RESPONSE** 10Hz-45kHz—3dB.

SUPPLY VOLTAGE ± 25V **SIZE** 105 50 25mm

Price £6.82 + 85p VAT P&P free.



HY120 60 Watts into 8Ω

The HY120 is the baby of I.L.P.'s new high power range. Designed to meet the most exacting requirements including load line and thermal protection this amplifier sets a new standard in modular design.

FEATURES: Very low distortion—Integral heatsink—Load line protection—Thermal protection—Five connections—No external components

APPLICATIONS: Hi-Fi—High quality disco—Public address—Monitor amplifier—Guitar and organ

SPECIFICATIONS:

INPUT SENSITIVITY 500mV.

OUTPUT POWER 60W RMS into 8Ω **LOAD IMPEDANCE** 4-16Ω **DISTORTION** 0.04% at 60W

SIGNAL/NOISE RATIO 90dB **FREQUENCY RESPONSE** 10Hz-45kHz—3dB **SUPPLY VOLTAGE**

± 25V

SIZE 114 50 85mm

Price £15.84 + £1.27 VAT P&P free.

HY200 120 Watts into 8Ω

The HY200 now improved to give an output of 120 Watts has been designed to stand the most rugged conditions such as disco or group while still retaining true Hi-Fi performance.

FEATURES: Thermal shutdown—Very low distortion—Load line protection—Integral heatsink—No external components

APPLICATIONS: Hi-Fi—Disco—Monitor—Power slave—Industrial—Public Address

SPECIFICATIONS:

INPUT SENSITIVITY 500mV

OUTPUT POWER 120W RMS into 8Ω **LOAD IMPEDANCE** 4-16Ω **DISTORTION** 0.05% at 100W

SIGNAL/NOISE RATIO 96dB **FREQUENCY RESPONSE** 10Hz-45kHz—3dB **SUPPLY VOLTAGE**

± 45V

SIZE 114 50 85mm

Price £23.32 + £1.87 VAT P&P free.

HY400 240 Watts into 4Ω

The HY400 is I.L.P.'s "Big Daddy" of the range producing 240W into 4Ω! It has been designed for high power disco address applications. If the amplifier is to be used at continuous high power levels a cooling fan is recommended. The amplifier includes all the qualities of the rest of the family to lead the market as a true high power hi-fidelity power module.

FEATURES: Thermal shutdown—Very low distortion—Load line protection—No external components.

APPLICATIONS: Public address—Disco—Power slave—Industrial

SPECIFICATIONS:

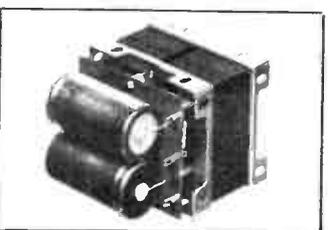
OUTPUT POWER 240W RMS into 4Ω **LOAD IMPEDANCE** 4-16Ω **DISTORTION** 0.1% at 240W

SIGNAL/NOISE RATIO 94dB **FREQUENCY RESPONSE** 10Hz-45kHz—3dB **SUPPLY VOLTAGE**

± 45V

INPUT SENSITIVITY 500mV **SIZE** 114 100 85mm

Price £32.17 + £2.57 VAT P&P free.



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PSU36 suitable for two HY30's £5.22 plus 65p VAT. P/P free.

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PSU90 suitable for one HY200 £12.65 plus £1.01 VAT. P/P free.

PSU180 £23.10 + £1.85 VAT.

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log containing some 49 stations heard, both mono and stereo, between 87-104MHz on May 9th, and 68 stations on the 10th. His logs are impressive and give comparable signal strength for the British and Continental stations. The strongest signal on these two days was Lopik 3s, 96.80MHz. Guy, Bob and myself would like to hear more from readers on this subject.

Microwaves

On April 2nd, Peter Kerry, G8ARO and Don Hayter, G3JHM, established their portable 3cm equipment, with an 18in dish, on the Hogs Back, Surrey, and worked G8BDJ and G8GKV, situated 40km away on Chanctonbury Ring, Sussex, at good strength. On May 1st, Peter set up the same gear on top of an 80ft high residential tower block, 320ft a.s.l., at Highgate and received the London 3cm beacon, GB3LBH, at 25km, 48dB above the noise. Peter points out that only 30dB of this was produced by the 18in dish. At 0950 on May 3rd he recorded a 2dB increase in noise when he pointed the dish towards the sun compared with cold sky.

OSCAR

John Branegan told me on May 6th "As of today, I have worked 20 countries by satellite" and at 1310 on May 9th he made his first transatlantic QSO with W2BAX, New Jersey, through OSCAR-8. John is now operational on OSCAR-7, Mode A and OSCAR-8, Modes A and J and has had over 70 QSOs via satellite in his first 10 weeks on the air.

Down under

Anthony Mann, Applecross, Western Australia, says "If sunspot activity keeps on increasing, the start of the next sporadic-E season (southern hemisphere) in October or November ought to see some really high MUFs to the north". Between 1325-1545 on April 16th he received for the first time, via F2, signals on Ch.R1 (Russian) sound, Ch.E3 video and Japanese amateurs on 50.1 and 52.0MHz.

April 13th was another memorable day for Anthony with E2 and R1 in around 1100 and out at 1810, and late night transequatorial skip producing Korean Broadcast Service, 44.3MHz, and Ch.E2 West Malaysia from 2220 to 2255. The only other evening T.E. skip observed by Anthony this autumn was on March 12th from 1915-2015, with KBS 44.3MHz and 44.9MHz and Radio Peking, 45.3MHz. Around 35MHz on April 3rd, 8th, and 9th he heard "This is Radio Call Paging Service of Oklahoma City".

From your letters

"I have just come back to radio as a hobby" writes R. Horsfield, Sandbach, Cheshire, "having started in the early 50s with an R1155, and after using a R210 have ordered an FRG7 digital", he is also looking for a v.h.f. receiver.

Eleven members of the Brighton and District Radio Society visited the *Practical Wireless* stand at the RSGB show at Alexandra Palace on May 6th. The mini-bus used for the journey was equipped with an IC240 and an Antec window-mount, ground plane aerial for contacting the exhibition talk-in station, GB2VHF, organised by the Grafton Radio Society.

Many reports exist that static-like radio interference is heard prior to an earthquake, any readers

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.

who have experienced this, please let us know because Richard Hill of Tunbridge Wells is making a special study of this.

Geoff Drewe, G4CAO, Weybridge, Surrey, is operational on c.w., 625-line TV, Slow Scan TV, and Facsimile. Geoff had a 2m FAX contact with G8ONE on April 17th using sync for the first time. The frequency is 144.700MHz and Geoff says "We can now transmit two-way FAX in fine detail in sync without too much stress". He also hopes that more amateurs will become active in this field.

Many thanks for all your interesting reports on such a wide range of subjects.

PW PERSONALITY VISITS WEST KENT ARS

Richard Leman, G8CDD, challenged fellow members of the West Kent Amateur Radio Society to make a crystal set, to look again at the first principles and provide a competitive activity for the Society.

The completed set had to receive the 200kHz BBC transmitter and any medium wave station, excluding the BBC World Service transmitter at Crowborough which pounds a signal into Tunbridge Wells. Bonus marks (10%) were awarded for not using new components, and (15%) for using wireless parts of the pre-1940 era.

Judging by G8CDD, for loudness, clarity, construction and originality (one competitor used a 30 amp antenna fuse), was carried out on top of a local multi-storey car park using a long wire aerial and a connection to the fire hose rising main for earth.

The prizes were presented on May 12th, at the fortnightly meeting of WKARS, by Ron Ham, our VHF Columnist, who was the visiting speaker seen here fourth from left.



Practical Wireless, August 1978

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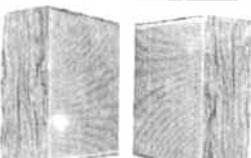
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for Disco or PA all fitted with carrying handles and corners. Black vinyls covered. Other cabinets in stock. 6AE for leaflet

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Bass Resonance 25cps

Flux Density 16,500 gauss

Useful response 20-17,000cps

8 or 16 ohms models.

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A full range reproducer for high power. Ideal for Hi-Fi and Discotheques. Electric Guitars public address, multi-speaker systems, electric organs.

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Flux Density 15,000 gauss

Useful response 25-16,000cps

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7401	14p	74100	140p	74LS04	30p	4008	115p	CA3140	75p	709	40p	2102-2	RAM	160p	2N2928RB	9p	BY127	12p	IN914	7p	
7402	16p	74104	75p	74LS08	30p	4009	50p	CA3160	120p	7107	150p	2107	R.A.M	700p	2N2928OG	11p	OA47	9p	IN916	7p	
7403	16p	74105	75p	74LS10	32p	4010	60p	LM301A	40p	741	25p	2112-2	RAM	300p	2N3054	65p	OA81	15p	IN4001/2	7p	
7404	20p	74106	30p	74LS12	32p	4011	20p	LM318N	175p	747	75p	8080A	C.P.U.	750p	2N3055	48p	OA80	9p	IN4003/4	7p	
7405	25p	74109	60p	74LS13	55p	4012	20p	LM324N	85p	748	40p	AY-1013	UART	600p	2N3442	151p	OA91	9p	IN4148	4p	
7406	40p	74110	60p	74LS16	32p	4013	20p	LM348N	140p	776	216p	RO3-253	ROM	650p	2N3644	54p	OA90	9p	IN5401/3	15p	
7407	40p	74111	75p	74LS27	45p	4014	115p	MC1458P	60p	3900	70p				2N4172/3	14p	OA95	9p	IN5407/7	20p	
7408	22p	74116	216p	74LS30	30p	4015	90p	LINEAR I.C.s							2N4270/5	14p					
7409	22p	74118	100p	74LS47	150p	4016	50p	AY-1-0212	650p	NE543K	225p				2N4306/7	14p					
7410	11p	74120	120p	74LS55	45p	4017	100p	AY-1-1313	775p	NE555	30p				2N4308/9	14p					
7411	20p	74121	32p	74LS57	60p	4018	110p	AY-1-5050	250p	NE560	85p				2N4310	14p					
7412	25p	74121	32p	74LS57	60p	4019	52p	AY-1-8500	775p	NE581B	450p				2N4311	14p					
7413	40p	74122	52p	74LS75	75p	4020	120p	AY-5-1315	750p	NE582B	450p				2N4312	14p					
7414	85p	74123	75p	74LS83	120p	4021	115p	AY-5-1317A		NE585	140p				2N4313	14p					
7416	40p	74125	70p	74LS84	140p	4022	100p			NE586	180p				2N4314	14p					
7417	40p	74126	85p	74LS86	65p	4023	22p	CA3028A	112p	NE567	180p				2N4315	14p					
7420	18p	74128	82p	74LS90	80p	4024	60p	CA3048	85p	RC4151	432p				2N4316	14p					
7421	43p	74132	81p	74LS93	80p	4025	22p	CA3048	250p	SG3402N	275p				2N4317	14p					
7422	28p	74136	81p	74LS107	55p	4026	140p	CA3053	75p	SN72710N	54p				2N4318	14p					
7423	36p	74141	65p	74LS112	120p	4027	85p	CA3065	200p	SN76003N	275p				AD149	60p	BF244B	40p			
7425	33p	74142	300p	74LS123	110p	4028	85p	CA3080E	97p	SN28008	200p				AD181	45p	BF256B	60p			
7426	43p	74145	95p	74LS138	140p	4029	120p	CA3089E	250p	SN76013N	175p				AD182	45p	BF257	34p			
7427	40p	74147	100p	74LS139	150p	4030	55p	CA3090A	425p	SN76013N	100p				AF114/5	22p	BF258	39p			
7428	40p	74148	160p	74LS139	150p	4031	240p	CA3090A	425p	SN76013N	100p				AF116/7	22p	BF259	48p			
7430	18p	74150	130p	74LS153	200p	4034	240p	ICL8038CC	400p	SN76023N	175p				AF120	40p	BF339	32p			
7432	37p	74151	81p	74LS157	130p	4035	130p	LM339N	175p	SN76023N	160p				AF130	40p	BF339	32p			
7433	43p	74153	81p	74LS158	150p	4036	120p	LM337N	200p	SP8515	800p				AF139	40p	BF339	32p			
7437	37p	74154	140p	74LS160	180p	4042	90p	LM381N	140p	TCA940	200p				AF139	40p	BF339	32p			
7438	37p	74155	97p	74LS162	180p	4044	100p	LM381AN	160p	TAA861A	150p				BC107/B	10p	BFR80/1	34p			
7440	18p	74156	97p	74LS162	180p	4044	100p	LM389N	160p	TBA120	97p				BC109	18p	BFR88	37p			
7441	85p	74157	180p	74LS163	180p	4048	140p	LM3911N	120p	TBA451	225p				BC109C	11p	BFW10	90p			
7442	75p	74159	250p	74LS164	120p	4047	100p	MC1310P	190p	TBA800	112p				BC147	9p	BFX29	40p			
7443	120p	74160	100p	74LS165	225p	4049	55p	MC1351P	110p	TBA810	125p				BC158/9	13p	BFY50	22p			
7444	120p	74161	100p	74LS174	160p	4051	110p	MC1488L	90p	TBA820	100p				BC169C	15p	BFY50	22p			
7445	97p	74162	100p	74LS175	160p	4054	120p	MC1498L	112p	TAA821A	310p				BC172	12p	BFY52	22p			
7446	100p	74163	100p	74LS175	160p	4054	120p	MC3340P	180p	TD A2020	300p				BC173C	11p	BFY52	22p			
7447	75p	74164	120p	74LS190	250p	4056	135p	MC3360P	130p	ZN414	140p				BC177	20p	BFY50	22p			
7448	85p	74165	150p	74LS191	200p	4058	130p	MC3401	70p	ZN424E	140p				BC178	17p	BLY83	750p			
7450	18p	74166	160p	74C00	25p	4067	425p	VOLTAGE REGULATORS - Fixed							BC179	20p	BR339	48p			
7451	18p	74167	320p	74C02	25p	4068	24p	1A +ve T6229	1A -ve T6229						BC182	12p	BSX19/20	20p			
7454	18p	74172	50p	74C03	25p	4070	65p	5V 7805 100p	5V 7905 130p						BC187	32p	MJ340	70p			
7450	18p	74173	100p	74C08	27p	4071	27p	6V 7806 100p	12V 7912 130p						BC212	14p	MJ481	175p			
7470	38p	74174	120p	74C08	27p	4070	65p	8V 7808 100p	15V 7915 130p						BC213	12p	MJ491	210p			
7472	32p	74175	97p	74C10	27p	4071	27p	12V 7812 100p	24V 7924 130p						BC214	16p	MJ2501	250p			
7473	36p	74176	130p	74C14	90p	4072	27p	15V 7815 100p	Heat Sink						BC241	40p	MJ2955	100p			
7474	37p	74177	120p	74C42	110p	4073	170p	18V 7818 100p	17" W	25p					BC478	32p	MJ3001	250p			
7475	43p	74180	320p	74C48	230p	4076	21p	24V 7824 100p	suitable for T6229						BCV71	24p	MJ3055	90p			
7476	37p	74181	320p	74C85	200p	4093	94p	0-1A +ve T602	0-1A -ve T602						BD131/2	65p	MPF102/3	45p			
7480	54p	74182	150p	74C86	65p	4098	120p	5V 7805 100p	5V 7905 130p						BD135/6	54p	2N2905/5	48p			
7482	90p	74185	100p	74C90	90p	14502	180p	6-25V 78L62	48p						BD139	56p	2N2906/A	22p			
7483	90p	74186	100p	74C93	90p	14503	90p	12V 78L12	48p						BD140	56p					
7484	100p	74187	120p	74C107	125p	14507	300p	15V 78L15	48p						BDY58	225p					
7485	120p	74191	120p	74C157	250p	14510	130p								BF115	24p					
7486	36p	74192	100p	74C160	155p	14511	160p	LM309K	150p	LM320-12	160p				BF167	25p					
7489	340p	74193	100p	74C161	155p	14516	120p	LM323K	700p	TBA825B	120p				BF178	30p					
7491	90p	74195	110p	74C162	155p	14515	160p	LM340T-5	115p	7805K	150p				BF179	35p					
7492	50p	74196	100p	74C163	155p	14518	110p	VARIABLE		LM317	T0220				BF180/1	35p					
7493	36p	74197	130p	74C164	140p	14520	130p	723 DIL	45p	78MG2C	145p				BF184/5	24p					
7494	90p	74198	250p	74C165	140p	14520	130p														
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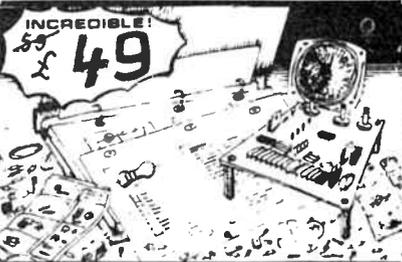
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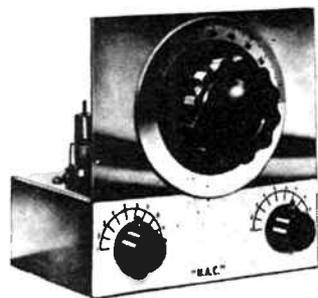
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Practical Wireless, August 1978

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116	12	6	8.99	1.32
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115	20	10	13.18	2.08
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79	1-0	3.57	0.96
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20	3-0	6.20	1.14
21	4-0	7.44	1.14
51	5-0	8.37	1.32
117	6-0	9.92	1.45
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89	10-0	13.33	1.84

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105	3-0	8.45	1.32
106	4-0	11.50	1.50
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152	250	12.79	1.50
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157	1500	45.69	0A
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SCREENED MINIATURES

Ref	mA	Volts	£	P&P
238	200	3-0-3	1.99	0.55
212	1A, 1A	0-6, 0-6	2.85	0.78
13	100	9-0-9	2.14	0.38
235	300, 330	0-9, 0-9	1.99	0.38
207	500, 500	0-8-9, 0-8-9	2.59	0.71
208	1A, 1A	0-8-9, 0-8-9	3.53	0.76
236	200, 200	0-15, 0-15	1.99	0.38
214	300, 300	0-20, 0-20	2.56	0.78
221	700 (DC)	20-12-0-12-20	3.41	0.78
206	1A, 1A	0-15-20-0-15-20	4.63	0.96
203	500, 500	0-15-27-0-15-27	3.99	0.96
204	1A, 1A	0-15-27-0-15-27	5.39	0.96
239	50	12-0-12	1.99	0.38
S112500		12-15-20-24-30	2.64	0.78

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AVO MM5	£26.10		£42.50
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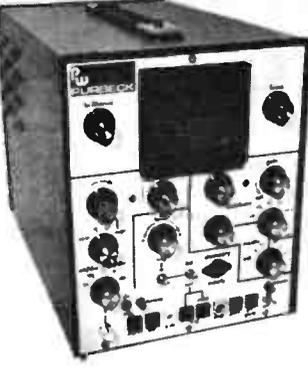
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145p each	
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LM323K	625
MVR5 or 12	180
1A -ve: 5V, 12V	220
Plastic Case: +ve	
0-1A (TO92) 5V, 30,	8-2V, 12V, 15V, 30
1A (TO220) 5V, 12V,	15V, 18V, 24V
Plastic (TO220) case	
-ve 0-5A: 5V, 6-2V,	8-2, 12, 15V
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LM341-15 +ve	180
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LM304H010 +40V	240
LM317H +1-2 -37V	160
LM317K +1-2 to 37V	350
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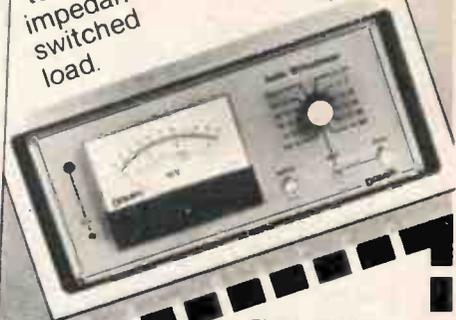
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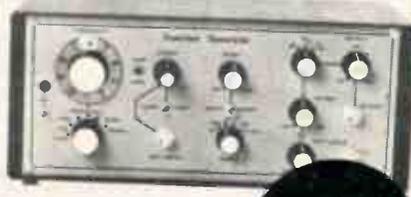
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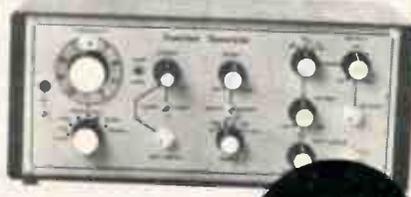
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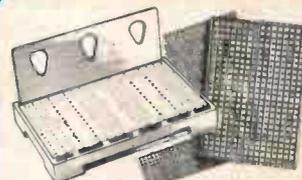
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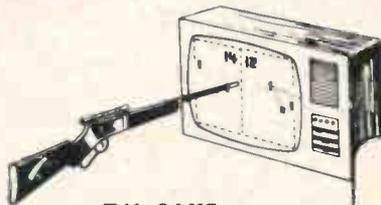
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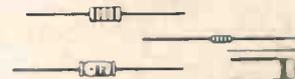
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