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Practical Wireless

APRIL 1981

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Malaysia $4.00.

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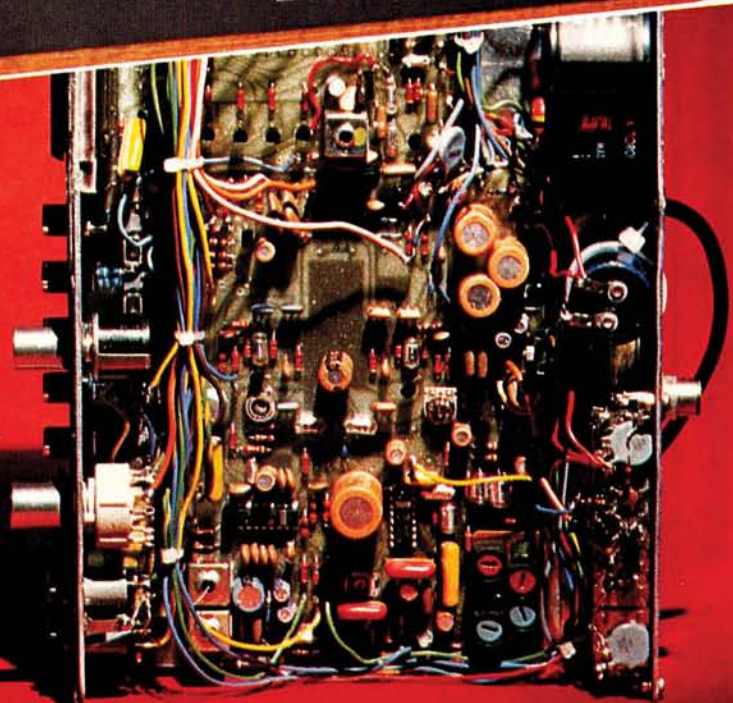
The PW 'WINTON' STEREO TUNER

LW·MW·SW·VHF plus TV SOUND

Part 1



also:

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FDK MULTI 700EX

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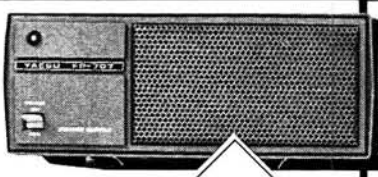
YAESU FT480R

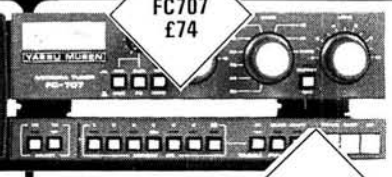
£359 inc. VAT free Delivery

TRANSCEIVERS



FP707 £109

FT707 £499



FC707 £74

FV707 DM £178

H.F. (All fitted new bands)

TRIO TS130V	£404.00
YAESU FT707S	£465.00
TRIO TS130S	£491.00
YAESU FT101Z	£488.00
YAESU FT707	£499.00
YAESU FT101ZD	£569.00
TRIO TS830S	£639.00
YAESU FT107M	£690.00

HANDHELDS

FDK PALM II	£99.00
ICOM IC2E	£159.00
FDK PALM IV	£159.00
TRIO TR2300	£166.00
AOR AR245A	£178.00
TRIO TR2400	£198.00
YAESU FT207R	£199.00

2M MOBILES

ICOM IC240 FM	£169.00
FDK Multi 700EX FM	£199.00
STANDARD C8800 FM	£250.00
ICOM IC255E FM	£255.00
TRIO TR7800 FM	£265.00
FDK Multi 750E Multimode	£299.00
ICOM IC260E Multimode	£339.00
TRIO TR9000 Multimode	£345.00
YAESU FT480R Multimode	£359.00

RECEIVERS

TRIO R1000 £285

H.F.

LOWE SRX30	£158.00
YAESU FRG7	£189.00
TRIO R1000	£285.00
YAESU FRG7700	£309.00

2.M. F.M.

SEARCH 9	£45.00
A.O.R. AR22	£83.00
FDK TM56B	£79.00
BEARCAT 220FB	£258.00

MARINE V.H.F.

SEARCH 9	£45.00
FDK TM56B	£79.00
BEARCAT 220FB	£258.00

YAESU FRG7700 £309

ACCESSORIES

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HK 707 Up/Down Key	£10.50 (£0.50)
MK704 Squueze paddle	£10.50 (£0.50)
EK121 Elbug	£29.95 (£0.50)
EKM12 Matching side tone oscillator	£10.95 (£0.50)
EK150 Electronic keyer	£74.00 (—)
SWR – POWER METERS	
YW-3 Twin Meter	£11.50 (£0.50)
TOYO T435 (144-435 MHz)	£34.45 (£0.75)
DAIWA SW110A (1.8-150 MHz)	£35.00 (£0.75)
WELZ SP200 (1.8-150 MHz)	£49.95 (£0.75)
WELZ SP400 (130-500 MHz)	£49.95 (£0.75)
DAIWA CN620A (1.8-150MHz)	£52.80 (—)
WELZ SP300 (1.8-500MHz)	£69.95 (—)
DAIWA CN630 (140-500MHz)	£71.00 (—)
SAFETY MICROPHONES	
ADONIS MM202S Clip on	£20.95 (£0.50)
ADONIS MM202H Head Band + Up/Down	£29.00 (£0.50)
ADONIS MM202FU Swan Neck + Up/Down	£30.00 (£0.50)
DAIWA RM940 infra red link	£45.00 (£0.50)
DESK MICROPHONES	
YAESU YD148 (Dual Imped)	£20.95 (£0.75)
TRIO MC50 (Dual Imped)	£24.15 (£0.75)
ADONIS AM502 Compressor Mic	£39.00 (£0.75)
ADONIS AM802 Compressor Mic 3 O/P	£59.00 (£0.75)
PROBLEMS WITH T.V.I.	
YAESU Low Pass Filter FF501DX (1KW)	£19.95 (£0.75)
TRIO Low Pass Filter LF30A (1KW)	£18.40 (£0.75)
HP3A High Pass Filter (TV down lead)	£3.50 (£0.25)
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Overvoltage Crowbar Protection
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AND IT'S MADE IN THE UK!

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6 amp	**£44.95** (£2.00)
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24 amp	**£92.00** (£3.00)

N.B. These are prices for Fully Protected British power supplies.

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28 MHz 1/4 (10SE)	£11.50 (£1.50)
144 MHz 1/4 (0dB)	£1.50 (£0.50)
144 MHz 5/8 (3dB)	£8.50 (£1.50)
144 MHz 7/8 (4·5dB)	£13.00 (£1.50)
432 MHz 2×5/8 (5·5dB)	£11.50 (£1.00)
CABLE MOUNT	£3.50 (£0.50)
GUTTER CLIP	£3.50 (£0.50)
MAGNETIC MOUNT	£6.95 (£0.50)
BOOT LIP MOUNT	£3.50 (£0.50)
MICROWAVE MODULES	
MMC 144/28 converter	£27.90 (£0.75)
MMC 432/28 converter	£34.90 (£0.75)
MMC 432/144S converter	£34.90 (£0.75)
MMC 1296/28 23cm converter	£32.20 (£0.75)
MMK 1296/144 23cm converter	£59.80 (£1.00)
MMT 144/28 transverter	£99.00 (£1.00)
MMT 432/285 transverter	£149.00 (£1.00)
MMT 432/144R transverter	£184.00 (£1.00)
MMT 1296/144 transverter	£184.00 (£1.00)
MML 144/25 linear	£59.00 (£0.75)
MML 144/40 linear	£77.00 (£0.75)
MML 144/100P linear	£142.60 (£1.00)
MML 432/20 linear	£77.00 (£1.00)
MML432/50 linear	£119.00 (£1.00)
MML 432/100 linear	£228.00 (£1.00)
MMD 50/500 500 MHz counter	£69.00 (£0.75)
MMA28 10M Preamp	£14.95 (£0.75)
MMA 144V Preamp RF switched	£34.90 (£0.75)

Buy it with Access

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Practical Wireless

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Practical Wireless
Westover House
West Quay Road
Poole, Dorset BH15 1JG
℡ Poole 71191

Geoff Arnold G3GSR
Editor

Dick Ganderton C.Eng., MIERE,G8VFH
Assistant Editor

Peter Metalli
Art Editor

John Fell G8MCP
Technical Editor

Alan Martin G8ZPW
News & Production Editor

Elaine Howard
Technical Sub-Editor

Rob Mackie
Technical Artist

Keith Woodruff
Assistant Art Editor

Sylvia Barrett, Sharron Breeze
Secretarial

ADVERTISEMENT OFFICES
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King's Reach Tower
Stamford Street
London SE1 9LS
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℡ 01-261 6636

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Ad. Sales Executive
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Classified Advertisements
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THE SHIMIZU SS105S *80-10 metres ssb/cw transceiver*

This super new transceiver covers 80-10 metres, gives 10W out and is smaller than anything else we have seen so far. Ideal for transverter driving, the SS105S has FM transmit and receive options as well as excellent performance on SSB/CW for HF band use. The SS105S is supplied in semi kit form so as to keep down the price, but all the RF and mixer boards are ready built and aligned so no test equipment is required. All the cabinet work has been carried out so all you have to do is assemble the IF strip, xtal oscillator, and fit them to the completed chassis. Great idea and it brings back the flavour of home brew with the added advantage that the rig will work when you've finished it. For more info, just ask us or come along and see it. It's a great little rig.

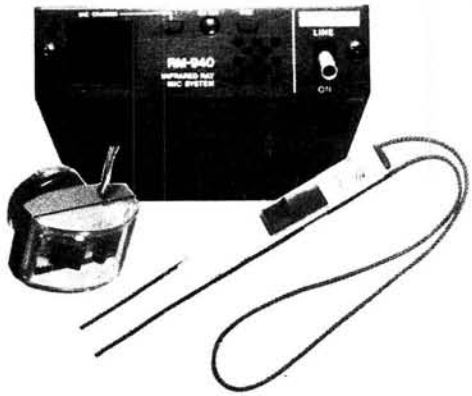
		NETT.	inc. VAT	CARR.
SS105S	80-10m solid state SSB/CW/FM transceiver. Semi kit form	**225.00**	**258.75**	4.50
SE-NB	Noise blanker kit	**6.75**	**7.76**	.50
SE-FMrx	RX FM discriminator kit	**15.00**	**17.25**	1.00
SE-FMtx	TX FM generator kit	**11.00**	**12.65**	1.00
SE-MK	RX marker kit	**9.60**	**11.04**	.50
0.5 CWF	500 Hz CW filter	**19.50**	**22.43**	.50
Optional band crystals		**3.00**	**3.45**	.25

AR 245 *2 metre hand held synthesized 144-146 5/1 watt.*

AR 240A *2 metre hand held synthesized 144-146 1½ watt.*

***AR 245 £178** inc. VAT.* ***AR 240A £158** inc. VAT.* *Carriage £1.50.*

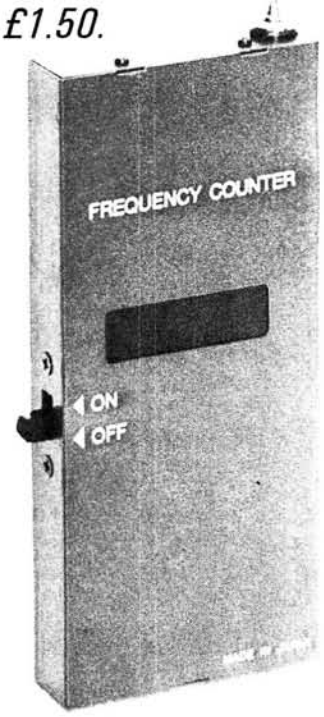
CORDLESS INFRARED MOBILE MIKE



The Daiwa infrared mike system, comprising of a control box, sensor and infrared mike enables you to dispense with the hand mike and cable when operating in your car or shack. By using an infrared beam audio is transmitted from the mike to the sensor and then to the control box which activates the transmitter. To transmit, press the locking switch on the mike and talk. To receive, release the switch and your rig immediately returns to receive. When you have finished your contact return the mike to its slot in the control box and the mike nicad battery is maintained at full charge. For those of you who like fresh air and drive with all windows open there is a matching wind shield available at an additional 75p. So there we are, the latest in technology to bring safety to your mobile operation, the Daiwa infrared mike.

DAIWA INFRARED MIKE SYSTEM

£45.00 inc. VAT.
Carriage £1.50.



FREQUENCY COUNTER *Model HFC 55.*

The HFC55 is a sensibly priced, easy to use digital frequency meter covering 10 kHz-55 MHz in a single range. The bright 5 digit display gives a direct reading of frequency when the built in telescopic aerial is placed near a source of RF. The HFC 55 operates from internal dry batteries and is housed in a strong metal case to withstand regular and continuous use.

***HFC55 Frequency Counter £36.50** inc. VAT. Carriage £1.50*

POWER SUPPLY UNITS

the PP1305 4 amp 13.8 volts d.c. ***£18.40** inc. VAT.*
the PP137 7 amp 13.8 volts d.c. ***£32.00** inc. VAT.*
the PP1310 10 amp 13.8 volts d.c. ***£49.50** inc. VAT.*
Carriage £2.00.

LOWE ELECTRONICS LTD
CHESTERFIELD ROAD, MATLOCK, DERBYSHIRE. Tel. 0629/2817.

TRIO *pacesetter in amateur radio*

TR-9000 *compact rig with FM/SSB/CW, scan and 5 memories.*

The TR-9000 combines the convenience of FM with long distance SSB and CW. It is extremely compact . . . perfect for mobile operation. Matching accessories are available for optimum fixed-station operation.

TR-9000 FEATURES:

* FM, USB, LSB, and CW.
* Only 6-11/16 inches wide, 2-21/32 inches high, 9-7/32 inches deep.
* Two digital VFOs.
* Digital frequency display.
* Covers 144-146 MHz.
* SSB/CW search of selectable 9.9-kHz bandwidth segments.
* Five memories.
* UP/DOWN microphone (standard) for manual band scan.
* Noise blanker for SSB and CW.

SP-120 TR-9000 BO-9 PS-20

* RIT (receiver incremental tuning) for SSB and CW.
* RF gain control.
* CW sidetone.
* Selectable RF power output . . . 10 W (HI)/1 W (LO).
* Mobile mounting bracket with quick-release levers.
* LED indicators . . . ON AIR, BUSY, and VFO.

OPTIONAL ACCESSORIES:

* PS-20 fixed-station power supply.
* SP-120 fixed-station external speaker.
* BO-9 System Base . . . with power switch, memory-backup power supply, and headphone jack.

TR-9000 £345 inc. VAT.
Securicor carriage £4.50.

R-1000

hear, there and everywhere
easy tuning, digital display.

The R-1000 is an amazingly easy-to-operate, high-performance, communications receiver, covering 200 kHz to 30 MHz in 30 bands. This PLL synthesized receiver features a digital frequency display and analog dial, plus a quartz digital clock and timer.

R-1000 FEATURES:

* Covers 200 kHz to 30 MHz continuously.
* 30 bands, each 1 MHz wide.
* Five-digit frequency display with 1-kHz resolution and analog dial with precise gear dial mechanism.
* Built-in 12-hour quartz digital clock with timer to turn on radio for scheduled listening or control a recorder through remote terminal.
* Step attenuator to prevent overload.
* Three IF filters for optimum AM, SSB, CW. 12-kHz and 6-kHz (adaptable to 6-kHz and 2.7-kHz) for AM wide and narrow, and 2.7-kHz filter for high-quality SSB (USB and LSB) and CW reception.
* Effective noise blanker.
* Terminal for external tape recorder.
* Tone control.
* Built-in 4-inch speaker.
* Dimmer switch to control intensity of S-meter and other panel lights and digital display.
* Wire antenna terminals for 200 kHz to 2 MHz and 2 MHz to 30 MHz. Coax terminal for 2 MHz to 30 MHz.

R-1000 receiver £285.20 inc. VAT. **Matching speaker £26.45** inc. VAT.
Securicor carriage £4.50.

TR-7800 *the only 2 metre FM mobile transceiver.*

Frequency selection with the TR-7800 2-metre FM mobile transceiver is easier than ever. The rig incorporates new memory developments for repeater shift, priority, and scan.

TR-7800 FEATURES:

* 15 multifunction memory channels, selected with a rotary switch. M0 to M12 . . . memorize frequency and offset (± 600 kHz or simplex). M13 and 14 . . . memorize transmit and receive frequencies independently for non-standard offset.
* Internal backup for all memories, by installing four AA NiCd batteries (not supplied) in battery holder.
* Priority channel (memory "14") and priority alert.
* Covers 144-146 MHz, in 25-kHz or 5-kHz steps.
* Front-panel keyboard for selecting frequency, transmit offset, programming memories, and controlling scan.

* Automatic scan of entire band (5-kHz or 25-kHz steps) and memories.
* Manual scan of band and memories, with UP/DOWN microphone (standard).
* Repeater REVERSE switch.
* Selectable power output. 25 W (HI)/5 W (LOW).
* LED S/RF bar meter.
* TONE switch to activate 1750 kHz repeater access tone.

TRIO TR-7800 £268 inc. VAT.
Securicor carriage £4.50.

HEAD OFFICE AND SERVICE CENTRE
Chesterfield Road, Matlock, Derbys. Tel. 0629 2817 or 2430.
Open Tuesday-Friday 9-5.30, Saturday 9-5.00. Closed for lunch 12.30-1.30.
For all that's best in ham radio, contact us at Matlock.
For full catalogues send 70p in stamps with your address. Mark enquiry PW.

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BI-PAK NEW EXTENDED 1981 RANGE

TRANSISTORS

AC107	25	BC107B	11	BC173	09	BC549	11	BD200	99	BF163	30	BFR52	25	MPSA05	20
AC125	30	BC107C	12	BC174	15	BC550	14	BD201	80	BF164	50	BFR62	24	MPSA06	20
AC126	22	BC108	10	BC175	35	BC556	14	BD202	80	BF165	50	BFR79	28	MPSA55	20
AC127	22	BC108A	11	BC177	14	BC557	13	BD201/202		BF167	24	BFR80	28	MPSA56	20
AC128	20	BC108B	11	BC178	14	BC558	13	M/P	1.70	BF173	24	BFW10	55	ND120	18
AC128K	37	BC108C	12	BC179	14	BC559	14	BD203	80	BF176	36	BFX29	25	OC19	85
AC132	26	BC109	10	BC180	12	BCY30	80	BD204	80	BF177	24	BFX30	30	OC20	1.85
AC141	26	BC109A	11	BC181	10	BCY31	80	BD203/204		BF178	25	BFX84	24	OC22	1.50
AC141K	40	BC109B	11	BC182	10	BCY32	85	M/P	1.70	BF179	30	BFX85	26	OC23	1.50
AC142	26	BC109C	12	BC182L	10	BCY33	80	BD205	80	BF180	30	BFX86	26	OC24	1.35
AC142K	40	BC113	16	BC183	10	BCY34	80	BD206	80	BF181	30	BFX87	26	OC25	1.00
AC176	24	BC114	17	BC183L	10	BCY70	14	BD207	80	BF182	30	BFX88	26	OC26	1.00
AC176K	40	BC115	18	BC184	10	BCY71	15	BD208	80	BF183	30	BFX90	55	OC28	90
AC187	25	BC116	19	BC184L	10	BCY72	15	BD222	47	BF184	22	BFY50	20	OC29	95
AC187K	45	BC116A	20	BC186	15	BCZ10	70	BD225	47	BF185	22	BFY51	20	OC35	90
AC188	25	BC117	20	BC187	18	BCZ11	70	BD232	85	BF186	26	BFY52	20	OC36	90
AC188K	40	BC118	17	BC207	11	BCZ12	70	BD233	65	BF187	26	BFY53	20	OC41	20
ACY17	50	BC119	29	BC208	11	BD106	50	BD234	55	BF188	32	BFY90	80	OC42	22
ACY18	50	BC120	35	BC209	12	BD115	50	BD235	55	BF194	10	BIP19	38	OC44	24
ACY19	50	BC125	25	BC212	10	BD116	50	BD236	58	BF195	10	BIP20	38	OC45	20
ACY20	50	BC126	30	BC212L	10	BD121	65	BD237	65	BF196	12	BIP19/20		OC70	24
ACY21	50	BC132	18	BC213	10	BD123	65	BD238	65	BF197	12	M/P	80	OC71	15
ACY22	50	BC134	18	BC213L	10	BD124	75	BD239A	50	BF198	15	BRY39	39	OC72	24
AD130	75	BC135	18	BC214	10	BD131	35	BD240A	50	BF199	16	BSX19	20	OC74	26
AD140	70	BC136	20	BC214L	10	BD132	35	BD239A/		BF200	30	BSX20	20	OC75	30
AD142	85	BC137	20	BC225	26	BD131/132		240A	1.00	BF222	90	BSX21	21	OC76	35
AD143	85	BC138	28	BC226	36	M/P	80	BD240	45	BF224	20	BSY95	13	OC77	50
AD149	70	BC139	32	BC237	13	BD133	40	BD241	45	BF240	17	BSY95A	13	OC79	40
AD161	40	BC140	25	BC238	14	BD135	35	BD506	38	BF241	18	BU105	1.60	OC81	22
AD162	40	BC141	28	BC239	15	BD136	35	BD508	38	BF244	28	BU105/		OC81D	24
AD161/162		BC142	25	BC251	15	BD137	35	BDX32	2.20	BF257	30	02	1.95	OC82	24
M/P	80	BC143	25	BC251A	16	BD138	36	BDY11	1.30	BF258	30	BU204	1.40	OC82D	30
AF114	50	BC144	40	BC261	18	BD139	38	BDY17	1.80	BF259	35	BU205	1.40	OC83	26
AF115	50	BC145	46	BC300	30	BD140	38	BDY20	80	BF262	60	BU208	1.90	OC84	38
AF116	50	BC147	09	BC301	28	BD139/140		BDY55	1.40	BF263	60	BU208/		OC139	80
AF117	50	BC148	09	BC302	29	M/P	80	BDY56	1.60	BF270	36	02	2.25	OC140	80
AF118	65	BC149	09	BC303	28	BD155	50	BF115	25	BF271	31	GP300	40	OC169	80
AF124	50	BC150	20	BC304	28	BD175	60	BF117	50	BF273	36	MJ480	95	OC170	80
AF125	50	BC151	22	BC307	13	BD176	60	BF118	75	BF274	38	MJ481	1.05	OC171	80
AF126	50	BC152	20	BC327	12	BD177	68	BF119	75	BF324	35	MJ490	95	OC200	46
AF127	50	BC153	25	BC328	13	BD178	68	BF121	50	BF336	34	MJ491	1.15	OC201	95
AF139	38	BC154	19	BC337	13	BD179	75	BF123	60	BF337	34	MJ2955	90	OC202	1.20
AF239	42	BC157	10	BC338	13	BD180	75	BF125	50	BF338	38	MJE340	50	OC203	85
AL102	1.90	BC158	10	BC384	14	BD185	68	BF127	60	BF371	26	MJE370	55	OC204	90
AL103	1.80	BC159	10	BC440	30	BD186	68	BF152	25	BF457	37	MJE371	60	OC205	1.15
ASY26	50	BC160	26	BC441	30	BD187	75	BF153	25	BF458	37	MJE520	45	R2008B	2.50
ASY27	50	BC161	38	BC460	32	BD188	75	BF154	22	BF459	38	MJE521	65	R2010B	2.60
ASY28	50	BC167	11	BC461	32	BD189	78	BF155	35	BF594	30	MJE2955	90	TIC44	29
ASY29	50	BC168	10	BC477	20	BD190	78	BF156	28	BF595	28	MJE3055	65	TIC45	35
AU104	1.90	BC169	10	BC478	20	BD195	90	BF157	28	BF596	28	MJE3440	52	TIP29	30
AU110	1.90	BC169C	11	BC479	20	BD196	90	BF158	28	BFR39	24	MP8113	52	TIP29A	55
AU113	1.90	BC170	09	BC546	10	BD197	95	BF159	28	BFR40	25	MPF102	60	TIP29B	42
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BC107A	11	BC172	09	BC548	10	BD199	99	BF162	24	BFR50	25	MPF105	35	TIP30	38

TIP30A	40	2N707	48	2N2714	22	2N3823	
TIP30B	42	2N708	14	2N2904	24	(FET)	60
TIP30C	44	2N711	30	2N2904A	26	2N3903	12
TIP31	38	2N717	30	2N2905	24	2N3904	12
TIP31A	40	2N718	25	2N2905A	26	2N3905	12
TIP31B	42	2N718A	50	2N2906	18	2N3906	12
TIP31C	44	2N726	29	2N2906A	20	2N4058	12
TIP32	38	2N727	29	2N2907	20	2N4059	14
TIP32A	40	2N743	20	2N2907A	22	2N4060	14
TIP32B	42	2N744	20	2N2923	15	2N4061	12
TIP32C	44	2N914	20	2N2924	15	2N4062	12
TIP41A	44	2N918	30	2N2925	15	2N4220	
TIP41B	46	2N919	20	2N2926G	10	(FET)	35
TIP41C	48	2N930	18	2N2926Y	09	2N4284	28
TIP42A	44	2N946	40	2N29260	09	2N4285	28
TIP42B	46	2N1131	24	2N2926R	09	2N4286	28
TIP42C	48	2N1132	24	2N2926B	09	2N4287	28
TIP2955	60	2N1302	25	2N3010	20	2N4288	28
TIP3055	50	2N1303	28	2N3011	20	2N4289	28
TIS43	22	2N1304	28	2N3053	22	2N4290	28
TIS90	20	2N1305	28	2N3054	45	2N4291	28
TIS91	22	2N1306	35	2N3055	42	2N4292	28
TIS92	22	2N1307	35	2N3402	21	2N4293	28
UT46	20	2N1308	40	2N3403	21	2N4860	
ZTX107	10	2N1309	40	2N3404	29	(FET)	60
ZTX108	10	2N1599	35	2N3405	42	2N4923	65
ZTX109	10	2N1613	28	2N3414	16	2N5135	10
ZTX300	12	2N1711	30	2N3415	16	2N5138	10
ZTX301	12	2N1889	45	2N3416	29	2N5172	14
ZTX302	16	2N1890	45	2N3417	29	2N5194	56
ZTX303	16	2N1893	40	2N3614	1.00	2N5245	40
ZTX304	20	2N2147	75	2N3615	1.05	2N5294	50
ZTX330	15	2N2148	70	2N3616	1.05	2N5296	50
ZTX500	13	2N2192	38	2N3646	09	2N5448	12
ZTX501	12	2N2193	38	2N3702	09	2N5457	
ZTX502	16	2N2194	38	2N3703	09	(FET)	32
ZTX503	12	2N2217	25	2N3704	09	2N5458	
ZTX504	25	2N2218	25	2N3705	09	(FET)	32
ZTX531	25	2N2218A	28	2N3706	10	2N5459	
ZTX550	25	2N2219	28	2N3707	10	(FET)	35
2N388	36	2N2219A	30	2N3708	09	2N5551	36
2N388A	56	2N2220	30	2N3708A	09	2N6027	
2N404	20	2N2221	20	2N3709	09	(P.U.T.)	34
2N404A	24	2N221A	22	2N3710	10	2N6121	70
2N524	40	2N2222	20	2N3711	10	2N6122	70
2N527	50	2N2222A	20	2N3771	1.40	2N6289	70
2N598	40	2N2368	18	2N3772	1.60	2S301	50
2N599	46	2N2369	14	2N3773	2.20	2S302	43
2N696	24	2N2369A	14	2N3819		2S302A	43
2N697	24	2N2411	25	(FET)	18	2S303	56
2N698	30	2N2412	25	2N3820		2S304	71
2N699	32	2N2646	47	(FET)	35	2S305	80
2N706	10	2N2711	22	2N3821		2S306	80
2N706A	12	2N2712	22	(FET)	60	2S307	80

DIODES

AA119	08	BB104	30	BY176	75	OA79	10
AA120	08	BAX13	07	BY206	30	OA81	10
AA129	09	BAX16	08	BYZ10/600	05	OA85	10
AAY30	09	BY100	22	BYZ10	45	OA90	07
AAZ13	15	BY103	22	BYZ11	45	OA91	07
AAZ17	15	BY105	22	BYZ12	40	OA95	07
BA100	10	BY114	22	BYZ13	40	OA182	13
BA102	20	BY124	22	BYZ16	41	OA200	08
BA144	09	BY126	11	BYZ17	36	OA202	08
BA148	15	BY127	12	BYZ18	36	IN34A	07
BA154	12	BY128	16	BYZ19	36	IN60	06
BA155	14	BY130	17	OA5	60	IN914	04
BA156	14	BY133	21	OA10	35	IN916	05
BA173	15	BY156	08	OA47	08	IN4148	04
BA248	16	BY164	51	OA70	08	IS44	05

74 SERIES TTL

7400	14	7437	30	7485	95	74153	65
7401	12	7438	30	7486	28	74154	1.00
7402	12	7440	15	7489	1.95	74155	70
7403	12	7441	60	7490	36	74156	70
7404	13	7442	60	7491	75	74157	70
7405	13	7443	1.00	7492	50	74160	90
7406	28	7444	1.00	7493	36	74161	90
7407	28	7445	90	7494	75	74162	90
7408	20	7446	90	7495	65	74163	90
7409	20	7447	65	7496	65	74164	1.00
7410	13	7448	65	74100	1.10	74165	1.00
7411	20	7450	15	74104	50	74166	1.00
7412	22	7451	15	74105	50	74167	2.30
7413	30	7452	15	74107	32	74174	90
7414	50	7453	15	74110	46	74175	80
7416	28	7454	15	74111	60	74176	85
7417	28	7460	15	74118	95	74177	85
7420	14	7470	32	74119	1.20	74180	90
7421	32	7472	28	74121	36	74181	2.30
7422	24	7473	32	74122	46	74182	85
7423	28	7474	30	74123	60	74184	1.35
7425	28	7475	44	74124	60	74190	1.00
7426	30	7476	35	74136	65	74191	1.00
7427	28	7480	48	74141	60	74192	95
7428	34	7481	95	74144	2.50	74193	1.00
7430	14	7482	70	74145	80	74194	90
7432	28	7483	68	74150	1.00	74195	90
7433	36	7484	95	74151	65	74196	95

CMOS

CD4000	18	CD4021	1.05	CD4042	78	CD4081	26
CD4001	19	CD4022	95	CD4043	88	CD4082	26
CD4002	20	CD4023	23	CD4044	88	CD4085	90
CD4006	92	CD4024	70	CD4045	1.50	CD4093	70
CD4007	22	CD4025	20	CD4046	1.10	CD4501	28
CD4008	80	CD4026	1.50	CD4047	95	CD4502	1.20
CD4009	40	CD4027	48	CD4048	65	CD4503	70
CD4010	48	CD4028	80	CD4049	45	CD4506	70
CD4011	22	CD4029	1.00	CD4050	45	CD4507	60
CD4012	22	CD4030	55	CD4052	80	CD4508	2.95
CD4013	45	CD4031	2.00	CD4054	1.25	CD4510	99
CD4014	84	CD4034	1.95	CD4055	1.25	CD4511	1.15
CD4015	84	CD4035	1.20	CD4056	1.35	CD4516	1.10
CD4016	42	CD4036	3.30	CD4068	25	CD4518	1.00
CD4017	80	CD4037	95	CD4069	25	CD4520	1.00
CD4018	85	CD4038	1.15	CD4070	29	CD4528	1.10
CD4019	45	CD4040	95	CD4071	25	CD4531	1.50
CD4020	99	CD4041	78	CD4072	25	CD4561	1.00

VOLTAGE REGULATORS

MVR7805-NVR7824	all 58p Ea.
MVR7905-NVR7924	all 63p Ea.
78L05-78L24	all 28p Ea.
79L05-79L24	all 55p Ea.

LM309K 1.25
UA79MGHC 2.50
LM320 15v, 12v, 15v, 24v 95p Ea.

74 LS SERIES TTL

74LS00	13	74LS78	46	74LS165	1.20	74LS279	85
74LS01	13	74LS83	68	74LS166	1.70	74LS280	2.40
74LS02	15	74LS85	75	74LS168	1.80	74LS283	85
74LS03	15	74LS86	38	74LS169	1.80	74LS290	90
74LS04	15	74LS90	38	74LS170	2.50	74LS293	1.00
74LS05	22	74LS91	1.10	74LS173	95	74LS295	1.90
74LS08	21	74LS92	68	74LS174	95	74LS298	1.50
74LS09	21	74LS93	58	74LS175	95	74LS299	3.50
74LS10	20	74LS95	95	74LS181	2.70	74LS323	3.50
74LS11	22	74LS96	1.10	74LS183	2.80	74LS324	1.90
74LS12	26	74LS107	40	74LS190	95	74LS325	3.00
74LS13	34	74LS109	70	74LS191	95	74LS326	3.20
74LS14	50	74LS112	38	74LS192	95	74LS327	3.10
74LS15	34	74LS113	68	74LS193	95	74LS348	1.80
74LS20	18	74LS114	38	74LS194	95	74LS352	1.50
74LS21	26	74LS122	68	74LS195	85	74LS353	1.50
74LS22	32	74LS123	60	74LS196	1.00	74LS365	45
74LS26	38	74LS124	1.60	74LS197	85	74LS366	55
74LS27	35	74LS125	45	74LS221	1.00	74LS367	62
74LS28	35	74LS126	45	74LS240	1.60	74LS368	80
74LS30	18	74LS132	60	74LS241	1.60	74LS373	1.45
74LS32	22	74LS136	50	74LS242	1.60	74LS374	1.45
74LS33	34	74LS138	60	74LS243	1.60	74LS375	1.10
74LS37	28	74LS139	68	74LS244	1.50	74LS378	1.20
74LS38	28	74LS145	1.15	74LS245	2.20	74LS386	75
74LS40	25	74LS147	2.00	74LS247	1.20	74LS393	1.10
74LS42	55	74LS148	1.60	74LS248	1.20	74LS395	2.00
74LS47	72	74LS151	70	74LS249	1.20	74LS398	2.70
74LS48	80	74LS153	68	74LS251	1.20	74LS399	2.00
74LS49	90	74LS155	65	74LS253	90	74LS490	1.40
74LS51	24	74LS156	80	74LS257	90	74LS670	2.50
74LS54	28	74LS157	60	74LS258	1.10
74LS55	28	74LS158	60	74LS260	85
74LS63	1.40	74LS160	85	74LS259	1.50
74LS73	30	74LS161	75	74LS261	4.00
74LS74	30	74LS162	1.00	74LS266	72
74LS75	38	74LS163	90	74LS273	1.65
74LS76	42	74LS164	90	74LS275	3.50

COMPUTER I.C.s

2114 L-3	2.40
2708	3.50
2516/ 2716-5v	4.90
4116	2.25

LINEAR I.C.'s

CA270BE	95	LM320/12v	95	72709	46
CA280Q	95	LM320/15v	95	709P	35
CA3011	98	LM320/24v	95	UA710C	40
CA3014	1.75	LM324N	48	72710	30
CA3018	65	LM337T	1.35	UA711C	32
CA3020	1.75	LM339N	65	72711	32
CA3028	80	LM348N	90	UA723C	45
CA3035	2.30	LM380	85	72723	45
CA3036	1.00	LM381	1.45	UA741C	24
CA3042	1.60	LM382N	1.20	72741	24
CA3043	1.85	LM384	1.45	74I1P	17
CA3046	70	LM1458	42	UA747C	60
CA3052	1.60	LM3900	58	72747	60
CA3054	1.10	LM3909N	70	UA748	35
CA3075	1.50	LM3911N	1.20	748P	35
CA3080	65	LM3914N	2.20	SN76013N	1.60
CA3081	1.50	LM3915N	2.20	SN76023N	1.65
CA3085	95	MC1304	1.90	SN76110	1.50
CA3089	2.00	MC1310P	1.45	SN76115AN	1.90
CA3090	3.60	MC1312	1.70	SN76660N	90
CA3123E	1.50	MC1350	1.20	TAA550B	35
CA3130E	90	MC1352	1.40	TAA621	2.00
CA3140E	48	MC1469	2.70	TAA661B	1.50
LF351N	55	MC1496	90	TAD100	1.30
LF353N	88	NE555	20	TBA120B	70
LF356N	90	NE556	55	TBA540	1.40
LH0042CH	2.25	NE561	3.80	TBA641A	2.20
LM301A	25	NE562	4.00	TBA800	85
LM334	1.60	NE565	1.20	TBA810S	95
LM308	75	NE566	1.50	TBA820	70
LM309K	1.25	NE567	1.70	TBA920Q	2.50
LM317H	2.50	72702	46	TCA270S	1.40
LM318H	1.95	UA703C	25	ZN414	90
LM320/5v	95	UA709C	25	ZTK33B	15

SILICON RECTIFIERS

200mA		IS020 100v	10	IN5408 1000v	25
IS920 50v	06	IS021 200v	11	6 Amp	
IS921 100v	07	IS023 400v	13	BYX38-300	45
IS922 150v	08	IS025 600v	14	BYX38-600	60
IS923 200v	09	IS027 800v	16	BYX38-300R	45
IS924 300v	10	IS029 1000v	20	BYX38-600R	60
1 Amp		IS031 1200v	25	10 Amp	
IN4001 50v	04½	3 Amp		IS10/50 50v	30
IN4002 100v	05	IN5400 50v	11	IS10/100 100v	35
IN4003 200v	06	IN5401 100v	12	IS10/200 200v	40
IN4004 400v	06	IN5402 200v	14	IS10/400 400v	50
IN4005 600v	07	IN5403 300v	15	IS10/600 600v	60
IN4006 800v	07	IN5404 400v	16	IS10/800 800v	70
IN4007 1000v	08	IN5405 500v	17	IS10/1000 1000v	85
1.5 Amp		IN5406 600v	18	IS10/1200 1200v	95
IS015 50v	09	IN5407 800v	22		

BRIDGE RECTIFIERS

1 Amp RMS		2 Amp RMS		6 Amp RMS	
BR1/50v	20	BR2/50v	35	BR6/50v	75
BR1/100v	22	BR2/100v	40	BR6/100v	80
BR1/200v	25	BR2/200v	44	BR6/200v	88
BR1/400v	29	BR2/400v	50	BR6/400v	95
		BR2/1000v	65		

THYRISTORS

1 Amp – TO39 CASE		THY5A/100v	45	THY5A/400vP	50
THY1A/50v	34	THY5A/200v	50	THY5A/600vP	60
THY1A/100v	38	THY5A/400v	57	THY5A/800vP	70
THY1A/200v	42	THY5A/600v	60	10 Amp – TO48	
THY1A/400v	50	THY5A/800v	75	THY10A/50v	45
THY1A/600v	65	5 Amp – TO66		THY10A/100v	50
THY1A/800v	78	THY5A/50v	36	THY10A/200v	55
BT101/500R	80	THY5A/100v	45	THY10A/400v	60
BT102/500R	80	THY5A/200v	50	THY10A/600v	80
BT106	1.25	THY5A/400v	57	THY10A/800v	1.10
BT107	93	THY5A/600v	60	16 Amp – TO48	
BT108	98	THY5A/800v	75	THY16A/50v	65
2N3228	70	2N3525	77	THY16A/100v	80
3 Amp – TO66		BTX30/50L	40	THY16A/200v	90
THY3A/50v	35	BTX30/400L	70	THY16A/400v	1.20
THY3A/100v	37	BT116	1.50	THY16A/600v	1.50
THY3A/200v	40	C106D	38	THY16A/800v	2.00
THY3A/400v	50	BTY79/400R	95	30 Amp – TO49	
THY3A/600v	60	5 Amp – TO220 PLASTIC		THY30A/50v	1.30
THY3A/800v	75	THY5A/50vP	35	THY30A/100v	1.50
5 Amp – TO64		THY5A/100vP	45	THY30A/200v	2.95
THY5A/50v	36	THY5A/200vP	47	THY30A/400v	4.00
				THY30A/600v	4.20

TRIACS & DIACS

2 Amp – TO39		4 Amp – TO202		6 Amp – TO220	
TRI2A/100v	30	TRI4A/400v	55	TRI6A/100v	45
TRI2A/200v	42			TRI6A/200v	52
TRI2A/400v	50	8 Amp – TO220		TRI6A/400v	60
		TRI8A/400v	64	12 Amp – TO220	
10 Amp – TO48				TRI12A/400v	70
TRI10A/100v	55	10 Amp – TO220 – PLASTIC			
TRI10A/200v	80	TRI10A/400P	68	DIACS	
TRI10A/400v	90			BR100	20
				D32	20

ZENER DIODES

400W 1.3V-39V	all at 8p
1.3W 1.3V-100V	all at 15p
10W 1.3V-100V	all at 35p

LARGEST SELECTION – LOWEST PRICES

AERIALS

105	Adjustable Aerial Gutter Mount	3.00
106	C.B. Mobile Antenna	9.50
107	FM Indoor Ribbon Aerial	0.50
108	4 Section Car Aerial (Stainless)	2.16
109	4 Section Car Aerial (Chrome)	1.80
110	8 Section 1200mm Telescopic Aerial	2.00
111	8 Section 750mm Telescopic Aerial	2.60
112	5 Section 570mm Telescopic Aerial	2.64
113	Roof Mounting Aerial (Car)	3.80

AUDIO LEADS

114	5 pin – 3.5mm 3 & 5 connected	0.65
115	5 pin – 3.5mm 1 & 4 connected	0.65
116	Car Aerial Ext Lead	1.00
117	Mains Cassette Lead	0.48
119	2 - 2 pin Plug in In Line Stereo Jack Socket	0.74
120	Universal Car Adaptor Plug	0.52
123	20ft. Coiled Guitar Lead	1.50
125	5 pin to 5 pin DIN	0.65
126	5 pin to DIN to open ends	0.65
127	5 pin to DIN to 4 Phono Plugs	1.00
128	5 pin Plug to 5 pin socket	0.75
129	5 pin to 5 pin Plug (Mirror image)	0.72
130	2 pin Plug to 2 pin Line Socket 5 mtrs	0.55
132	2 pin Plug to 2 pin Line Socket 10 mtrs	0.85
133	5 pin Plug to 2 Phono Plug	0.65
136	Headphone ext lead 7 mtrs	1.50

A.B.S. PLASTIC BOXES

141	4" · 1" · 2"	1.08
142	4.4" · 1.22" · 2.44"	1.24
143	4.75" · 1.56" · 2.56"	1.30
144	6.00" · 2.00" · 3.15"	1.50
145	7.5" · 2.38" · 4.33"	2.64
146	2.8" · 4.37" · 1.63"	1.40
147	3.78" · 6.33" · 2.06"	1.92
148	5.63" · 4.14" · 2.19"	2.14
149	5.63" · 6.7" · 2.19"	2.62
150	6.65" · 4.98" · 2.76"	3.84
151	9.57" · 7.36" · 4.06"	5.82

VERO CASES

152	23/16" · 2" · 1" Black	0.47
153	23/16" · 2" · 1" White	0.47
154	Vero plastic case box	4.82

INSTRUMENT CASES

155	8" · 5¼" · 2"	1.70
156	11" · 6" · 3"	2.63
157	6" · 4⅜" · 1¾"	1.64
158	9" · 5¼" · 2½"	2.20

ALUM BOXES

159	5⅛" · 2¼" · 1½"	0.83
160	4" · 4" · 1½"	0.83
161	4" · 2⅛" · 1⅛"	0.83
162	5⅛" · 4" · 1⅛"	0.93
163	4" · 2⅛" · 2"	0.83
164	3" · 2" · 1"	0.57
165	7" · 5" · 2¼"	1.30
166	8" · 6" · 3"	1.68
167	6" · 4" · 2"	1.12
168	Sloping Box – Large	6.97
169	Sloping Box – Small	4.63

CASSETTES

301	Low Cost C60	0.36
302	Low Cost C90	0.45
303	Low Cost C120	0.65
304	30 Min Letter Tape	0.38
305	Empty Library Case	0.12

CAPS, CHOKES, TRIMMERS

327	Jackson Coupling	0.74
328	Jackson Slow Motion Drive	1.38
329	Jackson 300PF Dilecon	2.64
330	Jackson 500PF Dilecon	3.10
331	Jackson 01-365PF	2.86
332	Jackson 02-365PF Dual	4.34
333	Jackson 804 10PF	2.62
334	Jackson 804 25PF	2.88
335	Jackson 804 50PF	2.88
336	Jackson 804 100PF	3.42
337	Trimmer Cap 40PF	0.20
338	Trimmer Cap 250PF	0.25
339	Trimmer Cap 450PF	0.30
340	Trimmer Cap 750PF	0.34
357	Repanco CH1 2.5MH	0.44
358	Repanco CH2 5.0MH	0.50
359	Repanco CH3 7.5MH	0.56
360	Repanco CH4 10.0MH	0.56
361	Repanco CH5 1.5MH	0.44
362	Repanco CH6 5UH	0.38
363	Repanco DRX1 Coil	0.60
364	Repanco DRR2 Coil	1.00

CABLE

		per metre
390	Light Mic Cable	0.10
391	Twin Mic Cable	0.15
392	Fig. 8 Stereo Cable	0.12
393	4 Way SCR Cable	0.35
394	4 Way Ind. Screened Cable	0.18
395	Heavy Mic Cable	0.25
396	3 Amp 3 Core Mains Cable	0.16
397	Twin Oval Mains	0.10
398	Fig. 8 Speaker Cable	0.07
399	Low Loss Coax. 750ohms	0.20
400	Uniradio 76-50ohms coax.	0.30

ELECTROLYTIC CAPACITORS

430	470uF 50v	0.30
431	1000uF 25v	0.40
432	1000uF 63v	1.00
433	1000uF 100v	1.25
435	2200uF 25v	0.70
436	2200uF 40v	1.20
437	2200uF 100v	2.00
438	3300uF 100v	2.40
439	4700uF 25v	0.90
440	4700uF 63v	2.30

ENAM. COPPER WIRE 2oz

365	40 swg	1.00
366	38 swg	0.88
367	36 swg	0.90
368	34 swg	0.82
369	32 swg	0.80
370	30 swg	0.80
371	28 swg	0.76
372	26 swg	0.74
373	24 swg	0.66
374	22 swg	0.62
375	20 swg	0.60
376	18 swg	0.60
377	16 swg	0.52
378	14 swg	0.52

TINNED COP. WIRE 4oz

379	24 swg	0.94
380	22 swg	0.83
381	20 swg	0.86
382	18 swg	0.90
383	16 swg	0.78

HARDWARE IN PACKS OF 25

839	0BA 1" Bolt	0.70
840	0BA ½" Bolt	0.40
842	2BA 1" Bolt	0.35
843	2BA ½" Bolt	0.30
844	2BA ¾" Bolt	0.32
845	4BA 1" Bolt	0.28
846	4BA ½" Bolt	0.20
847	4BA ¾" Bolt	0.18
848	6BA 1" Bolt	0.24
849	6BA ½" Bolt	0.18
850	6BA ¾" Bolt	0.20
851	0BA Solder Tags	0.20
852	2BA Solder Tags	0.16
853	4BA Solder Tags	0.14
854	6BA Solder Tags	0.12
855	0BA Full Nut	0.42
856	2BA Full Nut	0.26
857	4BA Full Nut	0.18
858	6BA Full Nut	0.18
859	0BA Washer	0.12
860	2BA Washer	0.09
861	4BA Washer	0.09
862	6BA Washer	0.09

FUSE HOLDERS

506	20mm Chassis Fuse Holder	0.14
507	1¼" Chassis Fuse Holder	0.14
508	1¼" Car in line Fuse Holder	0.12
509	20mm Panel Fuse Holder	0.26
510	1¼" Panel Fuse Holder	0.32

FUSES:

Quick Blow 20mm:

611	150mA	0.06
612	250MA	0.06
613	500MA	0.06
614	800MA	0.07
615	1 Amp	0.06
616	1.5 Amp	0.07
617	2.0 Amp	0.06
618	2.5 Amp	0.06
619	3.0 Amp	0.06
620	3.15 Amp	0.07
621	5.0 Amp	0.06

Semi Delay: 20mm

622	100MA	0.07
623	250MA	0.07
624	500MA	0.07
625	1 Amp	0.07
626	1.6 Amp	0.07
627	2 Amp	0.07
628	2.5 Amp	0.07
629	3.15 Amp	0.07
630	5.0 Amp	0.07

Quick Blow: 1¼":

631	250MA	0.06
632	500MA	0.06
634	800MA	0.06
635	1 Amp	0.06
636	1.5 Amp	0.06
637	2.0 Amp	0.06
638	2.5 Amp	0.06
369	3 Amp	0.06
641	4 Amp	0.06
642	5 Amp	0.06

KNOBS

1101	Black/Silver Knob	0.28
1102	Large Calibrated Knob	0.30
1103	Alli PA100 Knob	0.46
1104	Heavy Brushed Alli Knob 15mm	0.32
1105	Heavy Brushed Alli Knob 22mm	0.40
1106	Heavy Brushed Alli Knob 28mm	0.52
1107	Matt Black Knob 17mm	0.40
1108	Matt Black Knob 24mm	0.46
1109	Matt Black Knob 28mm	0.56
1110	All Metal Serated Edge Knob 15mm	0.34
1111	All Metal Serated Edge Knob 24mm	0.48
1112	All Metal Serated Edge Knob 30mm	0.60
1113	Black Plastic Metal Skirt	0.24
1114	Black Pointer Knob	0.22
1115	Black/Chrome Instrument Knob 22mm	0.32
1116	Alli Push Button Knob 11mm	0.14
1117	Black Plastic Slider Knob	0.12
1118	Chrome Slider Knob	0.14
1119	Chrome/Black Slider Knob	0.22

MICROPHONES etc.

1325	Crystal Desk Mike	3.30
1326	Cassette Mike 2.4mm - 3.5mm Plugs	1.46
1327	Dynamic Cassette Mike	1.86
1328	Dual Imp Dynamic Mike	10.50
1329	Dual Imp Condenser Mike	13.20
1330	Plastic Mike Holder	0.66
1331	Windshield Medium (Pair)	1.38
1332	Windshield Large (Pair)	1.92
1333	Gooseneck 320mm (Chrome)	2.60
1334	Gooseneck 515mm (Chrome)	3.50
1335	Mike Floor Stand	10.70
1336	Cassette Deck Mike 5K ohm	5.30
1337	Mike Boom Arm	8.80
1338	Crystal Mike Insert	0.52
1339	Two-Station Intercom	6.60
1340	Mobile or CB Mike 600 ohms	5.98
1341	Mobile or CB Mike 250 ohms	6.00

SEMICONDUCTOR HARDWARE

867	T0220		0.20
868	T03		0.20
869	S055	Insulating kits	0.20
870	T066	in packs of 5	0.20
871	T064		0.20
872	T048		0.20
873	T03 Single Heat Sink		0.26
874	T03 Double Heat Sink		1.35
875	Double Sided Heat Sink		2.65
876	T05/39 Heat Sink		0.15
877	T018 Heat Sink		0.15
878	T01 Heat Sink		0.10
879	T0220 Heat Sink		0.15
880	T066 Transistor Cover		0.14
881	T03 Transistor Cover		0.14

METERS

1305	2" Meter 2 Amps	2.88
1307	2" Meter 50UA	2.88
1308	2" Meter 100UA	2.88
1309	2" Meter 500UA	2.88
1310	2" Meter 1MA	2.88
1311	2" Meter 50 volts	2.88
1312	SWR and FS Meter	9.50
1313	SWR and Power Meter	11.90
1315	Test Meter 20,000 OPV	24.75
1316	Multi Tester RE185M	40.00
1317	Double VU Meter	3.25
1319	100-0-100 UA Meter 45mm	1.90
1320	Min Level Meter 23mm	0.95
1321	VU Meter 40mm	1.96
1322	Test Meter 1000PV	6.50
1323	Test Meter 20,000 OPV	11.40
1324	Test Meter 50,000 OPV	19.75

SWITCHES

1958	Min SPST Toggle Switch	0.70
1959	Min SPDT Toggle Switch	0.75
1960	Min DPDT Toggle Switch	0.80
1961	Min DPDT Centre Off Switch	0.95
1962	Push Button SPST	0.90
1963	Push Button SPDT	0.95
1964	Push Button DPDT	0.98
1965	1P 12W Rotary Switch	0.60
1966	2P 6W Rotary Switch	0.60
1967	3P 4W Rotary Switch	0.60
1968	4P 3W Rotary Switch	0.60
1973	Min DPDT Slide Switch	0.15
1974	Std Slide Switch	0.16
1975	SPST Toggle Switch	0.33
1976	DPDT Toggle Switch	0.46
1977	Rotary On-Off Switch	0.56
1978	Push to Make Switch	0.15
1979	Push to Break Switch	0.19
1981	SPST Rocker Switch (Black)	0.32
1982	SPST Rocker Switch (White)	0.32
1983	SPST Rocker Switch (Blue)	0.32
1984	SPST Rocker Switch (Yellow)	0.32
1985	SPST Rocker Switch (Luminous)	0.32
1986	Sub min SPST Toggle Switch	0.54
1987	Sub min SPDT Toggle Switch	0.58
1988	Sub min DPDT Toggle Switch	0.62
1989	Keyboard 24 way	1.50
1990	Keyboard 40 way	1.60
1991	Keyboard Switch	0.20
1992	Push to Make Switch (metal body)	0.32

BATTERY HOLDERS

200	Batt Holder 2 - HP7 short	0.18
201	Batt Holder 4 - HP7 short	0.19
202	Batt Holder 6 - HP7 short	0.20
203	Batt Holder 4 - HP7 long	0.19
204	PP3 Battery Clips	0.07
205	PP9 Battery Clips	0.12
206	Batt Holder 4 - HP11 long	0.25
207	Batt Holder 4 - HP11 short	0.25
208	Batt Holder 4 - HP2 long	0.30

ETCHANT AND PENS

1610	Dalo Etch Resist Pen	0.90
1611	Ferric Chloride ½lb pack	0.95
1612	Pentel Etch Resist Pen	0.65

SOLDERING EQUIPMENT

1925	12 volt soldering iron MLX	5.46
1927	Multicore solder 22 swg tube	1.00
1928	Multicore solder 22 swg reel	3.50
1929	Multicore solder 18 swg reel	3.50
1930	Desolder braid	0.75
1931	X25 Soldering Iron	4.20
1932	X25 ⅛" replacement Bit	0.50
1933	X25 3/16" replacement Bit	0.50
1934	X25 3/32" replacement Bit	0.50
1935	X25 Replacement Element	1.80
1936	Desolder Pump	5.56
1937	Desolder Pump Nozzles	0.64
1938	SK1 Soldering Kit	7.00
1939	ST3 Iron Stand	1.60
1940	Horizontal IC Desoldering Bit	1.95
1941	Vertical IC Desoldering Bit	1.95
1942	Antex Heat Shunt	0.15
1943	CCN240 Soldering Iron	4.20
1944	CCN240 3/32" Replacement Bit	0.50
1945	CCN240 ⅛" Replacement Bit	0.50
1946	CCN240 3/16" Replacement Bit	0.50
1947	CCN240 Replacement Element	1.90
1948	C240 Soldering Iron	4.20
1949	C240 3/32" Replacement Bit	0.50
1950	C240 ⅛" Replacement Bit	0.50
1951	C240 3/16" Replacement Bit	0.50
1952	C240 Replacement Element	1.70
1953	G Soldering Iron	4.20
1954	Model G 3/32" Replacement Bit	0.50
1955	Model G ⅛" Replacement Bit	0.50
1956	Model G 3/16" Replacement Bit	0.50
1957	Model G Replacement Element	1.90

MAINS PLUGS AND SOCKETS

1618	13 Amp Rubber Plug	0.52
1619	13 Amp Plastic Plug	0.46
1620	13 Amp Free Socket	0.50
1621	13 Amp 2 way Free Socket	1.50
1622	13 Amp 4 way Free Socket	4.20
2019	2 Amp Terminal Block (12 way)	0.24
2020	5 Amp Terminal Block (12 way)	0.24

POTS

1831	1K	Lin Single Pots	29
1832	2K2	Lin Single Pots	29
1833	4K7	Lin Single Pots	29
1834	10K	Lin Single Pots	29
1835	22K	Lin Single Pots	29
1836	47K	Lin Single Pots	29
1837	100K	Lin Single Pots	29
1838	220K	Lin Single Pots	29
1839	470K	Lin Single Pots	29
1840	1M	Lin Single Pots	29
1841	2M2	Lin Single Pots	29
1842	4K7	Log Single Pots	29
1843	10K	Log Single Pots	29
1844	22K	Log Single Pots	29
1845	47K	Log Single Pots	29
1846	100K	Log Single Pots	29
1847	220K	Log Single Pots	29
1848	470K	Log Single Pots	29
1849	1M	Log Single Pots	29
1850	2M2	Log Single Pots	29
1851	4K7	Lin Dual Pots	88
1852	10K	Lin Dual Pots	88
1853	22K	Lin Dual Pots	88
1854	47K	Lin Dual Pots	88
1855	100K	Lin Dual Pots	88
1856	220K	Lin Dual Pots	88
1857	470K	Lin Dual Pots	88
1858	1M	Lin Dual Pots	88
1859	2M2	Lin Dual Pots	88
1860	4K7	Log Dual Pots	88
1861	10K	Log Dual Pots	88
1862	22K	Log Dual Pots	88
1863	47K	Log Dual Pots	88
1864	100K	Log Dual Pots	88
1865	220K	Log Dual Pots	88
1866	470K	Log Dual Pots	88
1867	1M	Log Dual Pots	88
1868	2M2	Log Dual Pots	88
1869			
1870	4K7	Lin switched pots	68
1871	10K	Lin switched pots	68
1872	22K	Lin switched pots	68
1873	47K	Lin switched pots	68
1874	100K	Lin switched pots	68
1875	220K	Lin switched pots	68
1876	470K	Lin switched pots	68
1877	1M	Lin switched pots	68
1878	2M2	Lin switched pots	68
1879	4K7	Log switched pots	68
1880	10K	Log switched pots	68
1881	22K	Log switched pots	68
1882	47K	Log switched pots	68
1883	100K	Log switched pots	68
1884	220K	Log switched pots	68
1885	470K	Log switched pots	68
1886	1M	Log switched pots	68
1887	2M2	Log switched pots	68
1888	100K	Log-Anti Log Dual Pot	88
1889	5K	Log pot 16mm switched	36
1890	5K	Log pot 17mm switched	48
1891	10 ohm wire wound pots		85
1892	22 ohm wire wound pots		85
1893	47 ohm wire wound pots		85
1894	100 ohm wire wound pots		85
1895	220 ohm wire wound pots		85
1896	470 ohm wire wound pots		85
1897	1K ohm wire wound pots		85
1898	2K ohm wire wound pots		85
1899	4K7 ohm wire wound pots		85

MIN PRESETS 9p EACH

1801	100 ohm	Horizontal
1802	220 ohm	Horizontal
1803	470 ohm	Horizontal
1804	1K	Horizontal
1805	2K2	Horizontal
1806	4K7	Horizontal
1807	10K	Horizontal
1808	22K	Horizontal
1809	47K	Horizontal
1810	100K	Horizontal
1811	220K	Horizontal
1812	470K	Horizontal
1813	1M	Horizontal
1814	2M2	Horizontal
1815	4M7	Horizontal
1816	100 ohm	vertical
1817	220 ohm	vertical
1818	470 ohm	vertical
1819	1K	vertical
1820	2K2	vertical
1821	4K7	vertical
1822	10K	vertical
1823	22K	vertical
1824	47K	vertical
1825	100K	vertical
1826	220K	vertical
1827	470K	vertical
1828	1M	vertical
1829	2M2	vertical
1830	4M7	vertical

TRANSFORMERS

2021	6-0-6v 100mA	0.90
2022	9-0-9v 75mA	0.90
2023	12-0-12v 100mA	1.15
2024	0-6v 0-6v 280mA	1.60
2025	0-12v 0-12v 150mA	1.60
2026	6-0-6v 1 Amp	2.40
2027	9-0-9v 1 Amp	2.00
2028	12-0-12v 1 Amp	2.50
2029	15-0-15v 1 Amp	2.75
2031	Multi tap ½ Amp	3.40
2032	Multi tap 1 Amp	4.80
2033	Multi tap 2 Amp	6.40
2034	0-35v 1.7 Amp	4.90
2035	0-55v 2 Amp	6.65
2036	0-17v 750mA	2.85
2037	Min audio output	0.25
2038	min audio driver	0.36
2039	0-20v 1 Amp	3.50
2040	0-45-55v 1.5 Amps	6.45
2041	0-55-65v 1 Amps	8.46
2042	0-25v 2 Amps	4.50
2043	15-0-15 150mA	2.40

2017
PICK UP FOR ACOUSTIC GUITAR
£5.50

2018
TELEPHONE PICK UP COIL
£0.66

TOOLS CROC CLIPS ETC

2001	Insulated croc clips (Red)	0.06
2002	Insulated croc clips (Black)	0.06
2003	1½ insulated croc clips (Red)	0.07
2004	1½ insulated croc clips (Black)	0.07
2005	30 Amp croc clips 100mm per pair	0.74
2006	Test Leads	0.55
2007	Test Lead Kit	1.70
2008	4mm Test Lead Set	1.36
2009	4mm Test Prods Set	0.52
2010	Pincer Action Prod Set	1.40
2011	Cutters	5.50
2012	Pliers	5.20
2013	Croc clip test set	1.00
2014	Resistance sub box	4.30
2015	IC Extraction Tool	0.64
2016	Neon Mains Tester/Screwdriver	0.52

170
QUICK TEST BLOCK 'KEYNECTOR'
£6.50

1617
TO3 TRANSISTOR SOCKET

MAINS FUSES
13A PLUG TYPE

643	1A	**£0.12 each**
644	2A	
645	3A	
646	5A	
647	13A	

CHOOSE FROM OVER 20 TOP QUALITY MODULES

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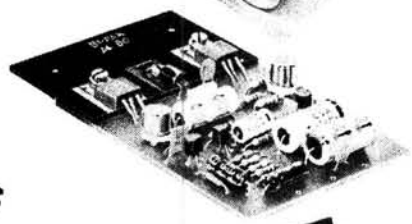
BI-PAK Audio Modules are famous for their variety, quality of design and ruggedness. For over 10 years BI-PAK have been suppliers to manufacturers of high quality audio equipment throughout the world – to date, well over 100,000 modules have been sold – this is why discerning amateur enthusiasts insist on using BI-PAK modules in their equipment. They know that every item is designed and tested to do the job for which it is intended before it leaves the factory. Whatever you are building, there is a kit or module in the BI-PAK range to suit your every need from 5 watts to 125 watts, from amplifiers to equalisers. AND if you cannot see what you require in this advertisement, just write or phone us – we are waiting to help you!

AL20A-30A
AUDIO AMPLIFIER MODULES

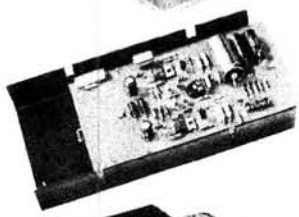
AL80
AUDIO AMPLIFIER MODULE 35 Watts RMS



AL60
AUDIO AMPLIFIER MODULE 25 Watts RMS

PA12
STEREO PRE-AMPLIFIER

AL120
AUDIO AMPLIFIER 50W RMS

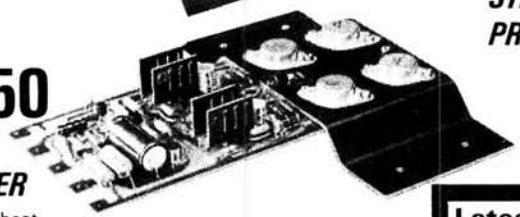


PA100 & PA200
STEREO PRE-AMPLIFIER

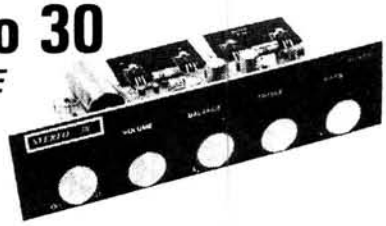
GE100
10 CHANNEL MONOGRAPHIC

AL250
POWER AMPLIFIER

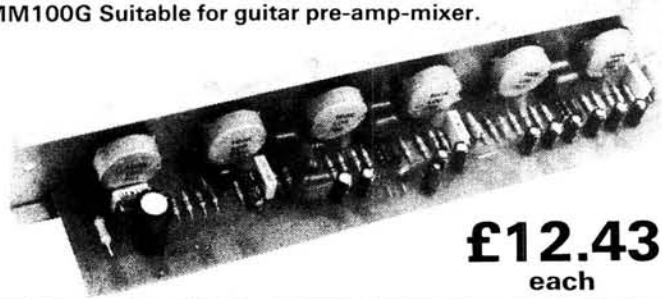
With integral heat sink and short-circuit protection



Stereo 30
COMPLETE AUDIO CHASSIS



Latest addition
MM100 Suitable for disco mixer.
MM100G Suitable for guitar pre-amp-mixer.



£12.43 each

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AMPLIFIERS	
AL10. 3 watt Audio Amplifier Module 22-32v supply.	£3.08
AL20. 5 watt Audio Amplifier Module 22-32v supply.	£3.57
AL30A. 7-10 watt Audio Amplifier Module 22-32v supply.	£4.16
AL60. 15-25 watt Audio Amplifier Module 30-50v supply.	£5.15
AL80. 35 watt Audio Amplifier Module 40-60v supply.	£8.07
AL120. 50 watt Audio Amplifier Module 50-70v supply.	£13.14
AL250. 125 watt Audio Amplifier Module 50-80v supply.	£19.60
STEREO PRE-AMPLIFIERS	
PA12. Supply voltage 22-32v input sensitivity 300mv. Suit: AL10/AL20/AL30.	£8.55
PA100. Supply voltage 24-36v inputs: Tape, Tuner, Mag P.U. Suit: AL60, AL80.	£17.65
PA200. Supply voltage 35-50v inputs: Tape, Tuner, Mag P.U. Suit: AL80/AL120/AL250.	£18.24

BI-KITS

STA5. 5 watts per channel Stereo Amplifier. Kit consisting of: 2×AL20 amplifiers, 1×PA 12 pre-amplifier, 1×PS12 power supply, 1×2036 transformer and necessary wiring diagram. **£19.52**

STA10. 10 watts per channel Stereo Amplifier. Kit consisting of: 2×AL30 amplifiers, 1×PA12 pre-amplifier, 1×PS12 power supply, 1×2036 transformer and necessary wiring diagrams. **£20.63**

STA15. 15 watts per channel Stereo Amplifier. Kit consisting of: 2×AL60 amplifiers, 1×PA100 pre-amplifier, 1×SPM80 power supply, 1×2034 transformer, 2×coupling capacitors for 8 ohms 470mfd 30v and necessary wiring diagram. **£36.76**

BI-KITS

STA25. 25 watts per channel Stereo Amplifier. Kit consisting of: 2×AL60 amplifiers, 1×PA100 pre-amplifier, 1×SPM120/45 power supply, 1×2040 transformer, coupling capacitors for 8 ohms 470 mfd 45v, 1×reservoir capacitor 2200mfd 100v and necessary wiring diagram. **£40.50**

STA35. 35 watts per channel Stereo Amplifier. Kit consisting of: 2×AL80 amplifiers, 1×PA200 pre-amplifier, 1×2035 transformer, 2×coupling capacitors 470mfd at 50v for 8 ohms, 1×reservoir capacitor 2200mfd 100v and necessary wiring diagram. **£45.76**

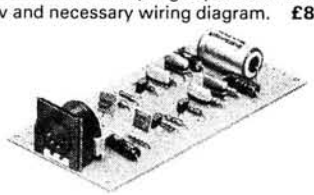
BI-KITS

STA50. 50 watts per channel Stereo Amplifier. Kit consisting of: 2×AL120 amplifiers. 1×PA200 pre-amplifier, 1×2041 transformer, 2×coupling capacitors 1000mfd 63v, 1×SPM120/65, 1×reservoir capacitor 3300mfd 100v and necessary wiring diagram. **£59.89**

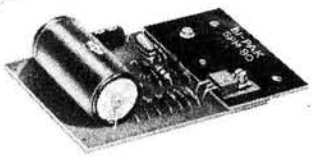
STA100. 100 watts per channel Stereo Amplifier. Kit consisting of: 2×AL250 amplifiers, 1×PA200 pre-amplifier. 2×SPM120/65 power supplies, 2×2041 transformers, 2×coupling capacitors 1000mfd 100v and necessary wiring diagram. **£84.68**

PS12
POWER SUPPLY MODULE

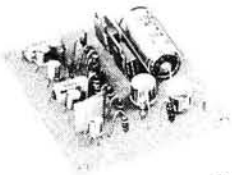
MPA30
MAGNETIC CARTRIDGE PRE-AMPLIFIER



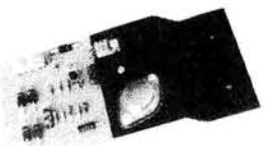
SPM80
STABILISED POWER SUPPLY



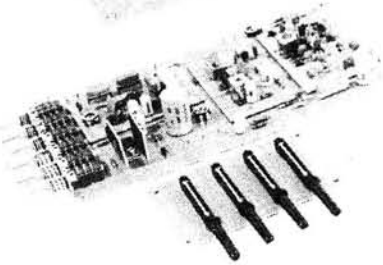
BP124
SIREN ALARM MODULE



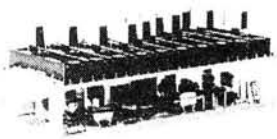
SPM120
STABILISED POWER SUPPLY



S450
STEREO FM TUNER Fitted with phase lock-loop



Mk II
EQUALISER



Transformers are not included with power supplies.
SPM120 Range also require reservoir and output capacitors.

MONO PRE-AMPLIFIERS

MM100. Supply voltage 40-65v inputs: Tape, Mag P.U. Microphone Max output 500mv. **£12.43**

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MISCELLANEOUS

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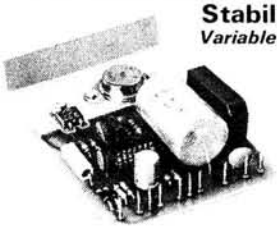
VPS30
REGULATED VARIABLE STABILISED POWER SUPPLY



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Variable from 2-30 volts and 0-2 Amps

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1 – 470 ohm wirewound potentiometer.
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Wiring Diagram Included.

KIT £20 + V.A.T.

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2N4911	NPN	0.27
2N4912	NPN	0.30
2N4913	NPN	0.30
2N4914	NPN	0.32
2N4915	NPN	0.34
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2N6129	NPN	0.25
2N6130	NPN	0.30
2N6131	NPN	0.32
2N6133	PNP	0.32
2N6134	PNP	0.35
2N6487	NPN	0.35
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BD223	PNP	0.30
BD225	PNP	0.30
FT49	NPN	0.25
FT317a	NPN	0.28
FT417a	PNP	0.32
FT417b	PNP	0.34
FT423	NPN	0.40
MJ802	NPN	0.45
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TIP61B	NPN	0.26
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TIP62B	PNP	0.28
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BR25/200v	2.05
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BY164	51

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MISCELLANEOUS

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10	BFY51-BC141	T039	Metal	NPN
5	BC160	T039	Metal	PNP
5	2N3055	T03	Metal	NPN
2	BD312/MJ2955	T03	Metal	PNP
5	TIP29-31	T0220	Plastic	NPN
2	TIP30-32	T0220	Plastic	PNP
10	OC71-76	Germanium		PNP
5	AC128-188	Germanium Metal		PNP
5	AC176	Germanium Metal		NPN
5	OC44-45	Germanium		PNP
5	TIS43-UT46	Unijunction Plastic		
5	2N3819	F.E.T.		
2	MEL11	Photo Transistor Plastic		
2	BD131	T0126	Plastic	NPN
2	BD132	T0126	Plastic	PNP
100	TOTAL			

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Our Special Offer Price **£15.00**

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100	TOTAL

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Code No's mentioned above are given as a guide to the type of device in the pak. The devices themselves are normally unmarked.

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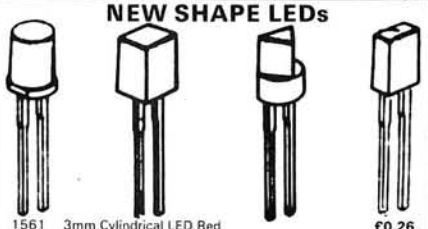

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1565	5mm Cylindrical LED Red	£0.26
1566	5mm Square LED Red	£0.26
1567	5mm Triangular LED Red	£0.26
1568	3mm Cylindrical LED Green	£0.28
1569	3mm Square LED Green	£0.28
1570	3mm Triangular LED Green	£0.28
1571	5mm Rectangular LED Green	£0.28
1572	5mm Cylindrical LED Green	£0.28
1573	5mm Square LED Green	£0.28
1574	5mm Triangular LED Green	£0.28
1575	3mm Cylindrical LED Yellow	£0.28
1576	3mm Square LED Yellow	£0.28
1577	3mm Triangular LED Yellow	£0.28
1578	5mm Rectangular LED Yellow	£0.28
1579	5mm Cylindrical LED Yellow	£0.28
1580	5mm Square LED Yellow	£0.28
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CERAMIC PAKS

Containing a range of first quality miniature ceramic capacitors.

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MC2 40 miniature ceramic capacitors: 5 of each value: 100pf, 120pf, 150pf, 180pf, 220pf, 270pf, 330pf, 390pf. **£1.00**

MC3 40 miniature ceramic capacitors: 5 of each value: 470pf, 560pf, 680pf, 820pf, 1000pf, 1500pf, 2200pf, 3300pf. **£1.00**

MC4 35 miniature ceramic capacitors: 5 of each value: 4700pf, 6800pf, .01uf, .015uf, .022uf, .033uf, .047uf. **£1.00**

SPEAKERS AND CROSSOVERS

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1905	2 way crossover 40w 8 ohms	£2.70
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1914	70mm 80 ohm speaker	£1.20
1915	70mm 8 ohm speaker	£0.95
1916	56mm 8 ohm speaker	£0.65
1917	2½" 8 ohm speaker	£0.75
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1919	5¼" whoofer 4 ohms 10w	£3.90
1920	5¼" whoofer 8 ohms 10w	£3.90
1921	5¼" Dual cone wide range 8 ohms	£5.80
1922	8" Dual cone long throw 8 ohms 15w	£4.84
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DIL SOCKETS

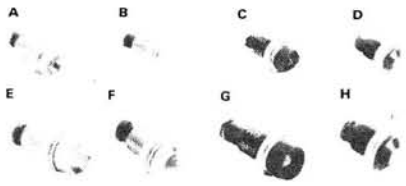
1601 8 Pin £0.09

1602	14 Pin	£0.11	1606	22 Pin	£0.24
1603	16 Pin	£0.12	1607	24 Pin	£0.28
1604	18 Pin	£0.18	1608	28 Pin	£0.32
1605	20 Pin	£0.20	1609	40 Pin	£0.36

LATE ADDITIONS – High Current Transistors

	VCEO	VCBO	I.C. Max	
BFT32	60	80	3A	£0.60
BFT33	80	100	3A	£0.62
BFT34	100	120	3A	£0.65
BFT37	100	120	3A	£0.95
RPYY76A	Infra Red Detector			£0.65

LED CLIPS AND HOUSINGS



1548	LED Plastic clips .125"	£0.15
1549	LED Plastic clips .2"	£0.18
1550	LED Housing (nickel plated) .125"	£0.26
1551	LED Housing (nickel plated) .125"	£0.22
1552	LED Housing (matt black) .125"	£0.37
1553	LED Housing (matt black) .125"	£0.31
1554	LED Housing (nickel plated) .2"	£0.34
1555	LED Housing (nickel plated) .2"	£0.28
1556	LED Housing (matt black) .2"	£0.44
1557	LED Housing (matt black) .2"	£0.36

BULBS AND NEONS

1534	LES Bulb 6v 0.36w	£0.24
1535	LES Bulb 6.5v 1w	£0.24
1536	LES Bulb 14v 0.75w	£0.24
1538	MES Bulb Round 6v .04A	£0.24
1539	MES Bulb Round 6.5v .15A	£0.20
1540	MES Bulb Round 6.5v .3A	£0.20
1541	MES Bulb Round 12.0v .1A	£0.20
1542	MES Bulb Round 12.0v 2.2w	£0.20
1543	Neon Red Round 240v	£0.34
1544	Neon Red Rectangular 240v	£0.34
1545	Neon Orange Rectangular 240v	£0.34
1546	Neon Green Rectangular 240v	£0.34
1547	MES Batten Holder	£0.18

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These paks contain a range of Carbon Film Resistors, assorted into the following groups:

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R3	80 Mixed ¼w 10K ohms-82K ohms	£1.00
R4	80 Mixed ¼w 100K ohms-1M	£1.00
R5	60 Mixed ½w 100 ohms-820 ohms	£1.00
R6	60 Mixed ½w 1K ohms-8.2K ohms	£1.00
R7	60 Mixed ½w 10K ohms-82K ohms	£1.00
R8	60 Mixed ½w 100K ohms-1M	£1.00

TANTALUM BEAD CAPACITORS

401	0.1uf 16v	£0.11	414	47.0uF 16v	£0.55
402	0.22uf 16v	£0.11	415	100uF 10v	£0.62
403	0.33uf 16v	£0.11	416	.1uF 35v	£0.12
404	0.47uF 16v	£0.11	417	.22uF 35v	£0.12
405	0.68uF 16v	£0.11	418	.33uF 35v	£0.12
406	1.0uF 16v	£0.11	419	.47uF 35v	£0.12
407	2.2uF 16v	£0.12	420	.68uF 35v	£0.12
408	3.3uF 16v	£0.13	421	1.0uF 35v	£0.12
409	4.7uF 16v	£0.14	422	2.2uF 35v	£0.13
410	6.8uF 16v	£0.15	423	3.3uF 35v	£0.15
411	10.0uF 16v	£0.16	424	4.7uF 35v	£0.18
412	22.0uF 16v	£0.28	425	6.8uF 35v	£0.30
413	33.0uF 16v	£0.50	426	10.0uF 35v	£0.38

FAIRCHILD/ DARLINGTONS

TYPE	Pol	VCEO	VCBO	I.C.	HFE	CASE	£ p
2N6052	PNP	100v	100v	12A	750-18K	T03	1.50
2N6282	NPN	60v	60v	20A	750-18K	T03	1.25
MJ3000	NPN	60v	60v	10A	1KMN	T03	1.00
SE9300	NPN	60v	60v	10A	1000	T0220	0.90
SE9031	NPN	80v	80v	10A	1000	T0220	0.95
SE9304	NPN	80v	80v	10A	1000	T03	0.95
SE9305	NPN	100v	100v	10A	1000	T03	1.00
SE9401	PNP	80v	80v	10A	1000	T0220	1.10
TIP115	PNP	60v	60v	2A	1A	T0220	0.40
TIP117	PNP	100v	100v	2A	1K	T0220	0.50
TIP120	NPN	60v	60v	5A	1K	T0220	0.60
TIP121	NPN	80v	80v	5A	1K	T0220	0.65
TIP122	NPN	100v	100v	5A	1K	T0220	0.68
TIP126	PNP	80v	80v	5A	1K	T0220	0.70
TIP127	PNP	100v	100v	5A	1K	T0220	0.72

POWER SUPPLIES

137	AC-DC Adaptor 6, 7½, 9 & 12 volts	£3.75
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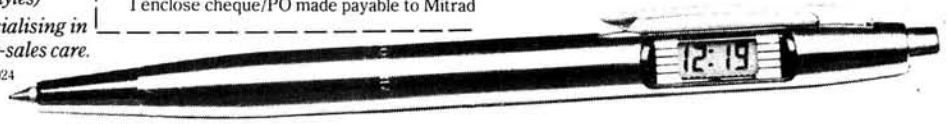
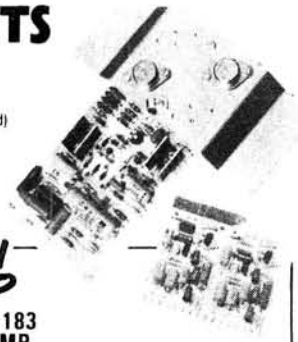


HIGH POWER MODULE KITS



SPECIFICATIONS

Max. Output power ..... 125 watt RMS
Operating voltage (DC) ..... 50-80 Max.
Loads ..... 4-16 ohms
Frequency response Measured at 100 watts 25Hz-20Khz
Sensitivity for 100 watts ..... 400mV @ 47K
Typical T.H.D. @ 50 watts 4 ohms load 0.1%
Dimensions ..... 205 x 90 and 190 x 36mm.

The P.E. power amp kit is a module for high power applications—disco units, guitar amplifiers, public address systems and even high power domestic systems. The unit is protected against short circuiting of the load and is safe in an open circuit condition. A large safety margin exists by use of generously rated components, result, a high powered rugged unit. The PC Board is backprinted, etched and ready to drill for ease of construction, and the aluminium chassis is preformed and ready to use. Supplied with all parts, circuit diagrams and instructions.

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Suitable **Mains Power Supply Unit for 125W.** model **£7.50** plus £3.15 p&p.
Suitable **Twin Transformer Power Supply** for **200W.** model **£13.95** plus £4.00 p&p.

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plus £1.15 p&p (illustrated)

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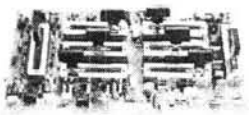
FREE!
MULLARD LP1183 STEREO PREAMP
Original listed price over £5.00. Suitable for ceramic and auxiliary inputs, when you purchase 2 power module kits.

STEREO DISCO PREAMPLIFIER



Matching other modules, suitable for twin deck mixing with P.F.L. output and Mic/Tape input. Ready built, ready to play with circuit diagram and application notes to suit our power module kits.

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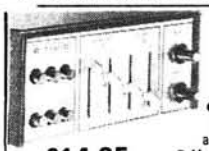

10+10 WATT STEREO HI-FI AMPLIFIER KIT

£14.95 plus £2.90 p&p

- Featuring latest SGS/ATES/TDA 2006 10 watt output I.C.'s with in-built thermal and short circuit protection.
- Mullard Stereo Preamplifer module
- Attractive ready made black vinyl finish cabinet
- Converts to a 20 Watt Disco amplifier

To complete you just supply connecting wire and solder. Features include din input sockets for ceramic cartridge, microphone, tape or tuner. Outputs—tape, speakers and headphones. By the press of a button it transforms into a 20 watt mono disc amplifier with twin deck mixing. The kit incorporates a Mullard LP1183 pre-amp module, plus power amplifier assembly kit and mains power supply. Also featured 4 slider level controls, rotary bass and treble controls and 6 push button switches. Silver finish fascia panel with matching knobs and contrasting ready made black vinyl finish cabinet and ready made metal work. For further information instructions are available price 50p. Free with kit. Size 9" x 8⅜" x 3⅜" approx.

SPECIFICATIONS Suitable for 4 to 8 ohms speakers. Frequency response – 40Hz-20KHz; Input Sensitivity – P.U. 150mV Aux. 200mV Mic. 1.5mV; Tone controls – Bass ± 12db @ 60Hz; Treble ± 12db @ 10KHz; Distortion – 1% typically @ 4 watts; Mains supply – 220-250 volts 50Hz.

30 + 30 WATT STEREO AMPLIFIER BUILT AND TESTED

Viscount IV unit in teak simulate cabinet silver finished rotary controls and pushbuttons with matching fascia, red mains indicator and stereo jack socket. Functions switch for mic magnetic and crystal pickups, tape and auxiliary. Rear panel features fuse holder. DIN speaker and input socket 30 + 30 watts. RMS 60 + 60 watts peak for use with 4 to 8 ohm speakers. Size 14¾" x 10" approx.

READY TO PLAY £32.90 plus £3.80 p&p

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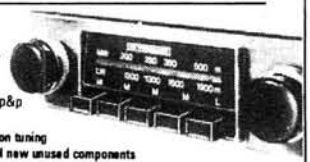

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2 WAVE BAND MW LW
*Easy to build *5 push button tuning
*Modern styling design *All new unused components
*6 watt output *Ready etched & punched P.C.B.
*incorporates suppression circuits *Now with tape input socket

All components and instructions to build the radio, you supply only the wire and solder. Pre-set tuning with five push button options, black illuminated tuning scale, matching control knobs, one combining on/off volume and tone-control, the other for manual tuning.
The P.E. Traveller has a 6 watts output, neg ground and an integrated circuit output stage, a Mullard IF module LP1181 ceramic filter type, pre-aligned and assembled and a Bird pre-aligned push button tuning unit. Fits easily in or under dashboards.

Suitable stainless steel fully retractable locking aerial and speaker (approx. 6" x 4") is available as a kit complete **£1.95** per pack, p&p £1.15

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All components including P.C.B. to convert your ceramic input on the 10+10 amp to magnetic. **£2.00** when purchased with kit featured above. **£4.00** separately inc. p&p.

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LM301H	0.67	KB4431	1.95
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LM348N	1.86	KB4438	2.22
LF351N	0.38	KB4441	1.35
LF353N	0.76	KB4445	1.29
LM374N	3.75	KB4446	2.75
LM380N-14	1.00	KB4448	1.65
LM380N-8	1.00	NE5044N	2.26
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NE565N	1.00	ICL8038CC	4.50
NE566N	1.60	MSL9362	1.75
NE570N	3.85	MSL9363	1.75
SL624	3.28	HA11211	1.95
TBA651	1.81	HA11223	2.15
uA709HC	0.64	HA11225	1.45
uA709PC	0.36	HA12002	1.45
uA710HC	0.65	HA12017	0.80
uA710PC	0.59	HA12402	1.95
uA741CH	0.66	HA12411	1.20
uA741CN	0.27	HA12412	1.55
uA747CN	0.70	LF13741	0.33
uA748CN	0.36	SN76660N	0.80
uA753	2.44		
uA758	2.35		
TBA810AS	1.09		
TBA820M	0.75		
TCA940E	1.80		
TDA1028	2.11		
TDA1029	2.11		
TDA1054	1.45		
TDA1062	1.95		
TDA1072	2.69		
TDA1074A	5.04		
TDA1083	1.95		
TDA1090	3.05		
HA1137	1.20		
HA1196	2.00		
HA1197	1.00		
TDA1220	1.40		
LM1303	0.99		
LM1307	1.55		
MC1310P	1.90		
MC1330	1.20		
MC1350	1.20		
HA1370	1.90		
HA1388	2.75		
TDA1490	1.86		
MC1496P	1.25		
SL1610P	1.60		
SL1611P	1.60		
SL1612P	1.60		
SL1613P	1.89		
SL1620P	2.17		
SL1621P	2.17		
SL1623P	2.24		
SL624C	3.28		
SL1625P	2.17		
SL1626P	2.44		
SL1630P	1.62		
SL1640P	1.89		
SL1641P	1.89		
TDA2002	1.25		
TDA2020	3.00		
ULN2242A	3.05		
ULN2283B	1.00		
CA3080E	0.70		
CA3089E	1.84		
CA3090AQ	3.35		
CA3123E	1.40		
CA3130E	0.80		
CA3130T	0.90		
CA3140E	0.46		
CA3189E	2.20		
MC3357P	2.35		
LM3900N	0.60		
LM3909N	0.68		
LM3914N	2.80		
LM3915N	2.80		
KB4400	0.80		
KB4406	0.60		
KB4412	1.95		

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SAA1056	3.75
SAA1058	3.35
SAA1059	3.35
11C90DC	14.00
LN1232	19.00
LN1242	19.00
MSL2318	3.84
MSM5523	11.30
MSM5524	11.30
MSM5525	7.85
MSM5526	7.85
MSM5527	9.75
MSM55271	9.75
ICM7106CP	9.55
ICM7107CP	9.55
ICM7216B	19.25
ICM7217A	9.50
SP8629	3.85
SP8647	6.00
95H90PC	6.00
HD10551	2.45
HD44015	4.45
HD12009	6.00
HD44752	8.00

CMOS 4000 SERIES

4001	0.17
4000	0.17
4002	0.23
4008	0.80
4009	0.58
4010B	0.58
4011AE	0.20
4011B	0.20
4012	0.55
4013	0.55
4015	0.95
4016	0.52
4017	0.80
4019	0.60
4020B	0.93
4021	0.82
4022	0.90
4023	0.17
4024	0.76
4025	0.17
4026	1.80
4028	0.72
4029	1.00
4030	0.58
4035	1.20
4040	0.83
4042	0.85

TTL N and LSN

7400N	0.13	7443N	1.15	74LS112	0.38	74LS169	2.00
74LS00	0.20	7444N	1.12	74LS113	0.38	74170N	2.30
7401N	0.13	7445N	0.94	74LS114	0.38	74LS170	2.00
74LS01	0.20	7446N	0.94	74118N	0.83	74LS174	1.20
7402N	0.14	7448N	0.56	74120N	1.15	74175N	0.87
74LS02	0.20	74LS48	0.99	74121N	0.42	74LS175	1.10
7403N	0.14	74LS49	0.99	74122N	0.46	74176N	0.75
74LS03	0.20	7451N	0.17	74123N	0.73	74177N	0.78
7404N	0.14	74LS51	0.24	74LS124	1.75	74181N	1.65
74LS04	0.24	7453N	0.17	74125N	0.38	74LS181	3.50
7405N	0.18	7454N	0.17	74LS125	0.44	74LS183	2.10
74LS05	0.26	74LS54	0.24	74126N	0.57	74184N	1.35
7406N	0.28	74LS55	0.24	74LS126	0.44	74185N	1.34
7407N	0.38	7460N	0.17	74128N	0.74	74LS190	0.92
7408N	0.17	74LS63	1.24	74132N	0.73	74192N	1.05
74LS08	0.24	7470N	0.28	74LS132	0.78	74LS192	1.80
7409N	0.17	7472N	0.28	74LS136	0.40	74193N	1.05
74LS09	0.24	7473N	0.32	74LS138	0.60	74LS193	1.80
7410N	0.15	74LS73	0.38	74141N	0.56	74194N	1.05
74LS10	0.24	7474N	0.27	74142N	2.65	74196N	0.99
7411N	0.20	74LS74	0.28	74143N	3.12	74LS196	1.10
74LS11	0.24	7475N	0.38	74144N	3.12	74LS197	1.10
7412N	0.17	7476N	0.37	74LS145	0.97	74198N	1.50
7413N	0.30	74LS76	0.38	74147N	1.75	74199N	1.60
7414N	0.51	74LS78	0.38	74148N	1.09	74LS247	0.93
74LS15	0.24	7480N	0.48	74LS148	1.19	74LS257	1.08
7416N	0.30	7481N	0.86	74150N	0.99	74LS260	1.53
7417N	0.30	7482N	0.69	74151N	0.55	74LS279	0.52
7420N	0.16	7485N	1.04	74LS151	0.84	74LS283	1.20
74LS20	0.24	74LS85	0.99	74153N	0.64	74LS293	0.95
7421N	0.29	74LS86	0.40	74LS153	0.54	74LS365	0.49
74LS21	0.24	7489N	2.05	74154N	0.96	74LS366	0.49
7423N	0.27	7490N	0.33	74155N	0.54	74LS367	0.43
7425N	0.27	74LS90	0.90	74LS155	1.10	74LS368	0.49
7427N	0.27	7491N	0.76	74156N	0.80	74LS374	1.80
74LS27	0.44	74LS91	1.10	74157N	0.67	74LS377	1.95
7428N	0.35	7492N	0.38	74LS157	0.55	74LS379	1.30
74LS28	0.32	74LS92	0.78	74LS158	0.60	74LS393	1.40
7430N	0.17	7493N	0.32	74159N	2.10		
74LS30	0.24	74LS93	0.99	74160N	0.82		
7432N	0.25	7494N	0.78	74LS160	1.30		
74LS32	0.24	7495N	0.65	74161N	0.92		
7437N	0.40	74LS95	1.14	74LS161	0.78		
7438N	0.33	7496N	0.58	74LS162	1.30		
74LS38	0.24	74LS96	1.20	74163N	0.92		
7440N	0.17	7497N	1.85	74LS163	0.78		
74LS40	0.24	74LS107	0.38	74164N	1.04		
7441N	0.74	74109N	0.63	74LS164	1.30		
7442N	0.70	74LS109	0.70	74165N	1.05		
74LS42	0.99	74110N	0.54	74LS165	1.04		
		74111N	0.68	74167N	2.50		

4043	0.85
4044	0.80
4046	1.30
4047	0.99
4049	0.52
4050	0.55
4051	0.65
4052	0.65
4053	0.65
4063	1.09
4066	0.56
4068	0.25
4069	0.20
4070	0.20
4071	0.20
4072	0.20
4073	0.20
4075	0.20
4076	0.90
4077	0.20
4078	0.20
4082	0.20
4093	0.78
4175	0.95
4503	0.69
4506	0.51
4510	0.99
4511	1.49
4512	0.98
4514	2.55
4518	1.03
4520	1.09
4521	2.36
4522	1.49
4529	1.41
4539	1.10
4549	3.50
4554	1.53
4560	2.18
4566	1.59
4568	2.18
4569	3.03
4572	0.30
4585	1.10

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78series	0.95
79series	1.00
78Mseries	0.65
78Lseries	0.35
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78MGT2C	1.75
79MGT2C	1.75
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L200	1.95
TDA1412	0.75
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LM317MP	1.48
LM337MP	1.48

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AM TX:-	
3rd OT 30pF HC25U	1.65
AM/FM RX:-	
3rd OT 30pF HC25U	1.65
FM TX :-	
Fund 20pF HC25U	1.85
Pairs FM	3.25
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32.768 kHz	2.70
100kHZ	3.85
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4.000MHz	2.00
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6.5536MHz	2.10
10.0MHz	2.50
10.6985MHz	2.50
10.7015MHz	2.50
10.245MHz	2.50
10.7MHz	3.00
11.52MHz	2.50
100MHz	3.00

LEDs

5MM RED	0.12
3MM RED CLEAR	0.15
3MM RED	0.15
2.5 X 5MM RED	0.17
5MM GREEN	0.15
3MM GN CLEAR	0.16
3MM GREEN	0.16
2.5 X 5MM GN	0.20
5MM YELLOW	0.15
3MM YELLOW CL	0.16
3MM YELLOW	0.18
2.5 X 5MM YE	0.20
5MM ORANGERED	0.20
5MM ORA CL	0.29
3MM ORANGERED	0.19
2.5 X 5MM ORA	0.24
5MM INFRA RED	0.56
BPW41 IR DET	1.51
IR OPT CPLR	1.44
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SRA1H .5-500MHz	13.35
SRA3 .025-200MHz	10.25

VARICAP TUNING DIODES

BA102	0.30
BA121	0.30
ITT210	0.30
BB204B	0.36
BB105B	0.36
BB109	0.27
MVM125	1.05
BB212	1.95
KV1210	2.45
KV1211	1.75
KV1226	1.95
KV1225	2.75
KV1215	2.55
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SWITCHING AND PIN DIODES

SHOTTKY DIODES

1N6263	0.62
BA182	0.19
BA244	0.17
BA379	0.35
TDA1061	0.95

SIGNAL DIODES & RECTIFIERS

1N4148	0.06
1N4001	0.06
1N4002	0.07
1N5402	0.15
OA91	0.07
AA112	0.25
BRIDGES:	
1A/50V	0.35
6A/200V	0.75

TRANSISTORS

AUDIO DEVICES

BC237	0.08
BC238	0.08
BC239	0.08
BC307	0.08
BC308	0.08
BC309	0.08
BC413	0.10
BC414	0.11
BC415	0.07
BC416	0.08
BC546	0.12
BC556	0.12
BC550	0.12
BC560	0.12
BC639	0.22
BC640	0.23
2SC1775	0.18
2SA872A	0.14
2SD666A	0.30
2SB646A	0.30
2SD668A	0.40
2SB648A	0.40
2SD760	0.45
2SB720	0.45
2SC2546	0.19
2SA1084	0.20
2SC2547	0.19
2SA1085	0.20

AUDIO POWER DEVICES

2SB753	2.34
2SB723	2.34
2SK133	3.00
2SJ 48	3.00
2SK134	3.10
2SK135	3.75
2SJ 50	3.75
BD535	0.52
BD536	0.52
BD377	0.33
BD378	0.33
BD165	0.30
BD166	0.31

SMALL SIGNAL RF DEVICES

BF194	0.18
BF195	0.18
BF224	0.22
BF241	0.18
BF274	0.18
BF440	0.21
BF441	0.21
BF362	0.49
BF395	0.18
BF479	0.66
BF679S	0.55
BFR91	1.33
BFW92	0.60
BFT95	0.99
BFY90	0.90
40238	0.85

RF POWER DEVICES

VN66AF	0.95
2N3866	0.85

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BF256	0.38
2SK55	0.28
2SK168	0.35
J310	0.69
J176	0.65
40823	0.65
40673	3SK51
3SK45	0.49
3SK51	0.54
3SK60	0.58
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BF960	1.24
3SK48	1.64

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All 5mm or less spacing

CERAMIC 50v
2P2,3P3,4P7,6P8
8P2,10P,15P,18P...0.04
22P,27P,33P,47P
56P,68P,82P,100P...0.05
150P,220P,270P
330P,390P,470P...0.055
1N0,2N2,3N3,4N7...0.06
10N (0.01uF)....0.05
22N,47N.....0.06
100N,220N.....0.09

MONOLITHIC CERAMIC
10N,100N.....0.16

FEEDTHRU
1N0 SOLDER IN....0.09

POLYESTER (SIEMENS)
10mm LEAD SPACING
10N,22N,33N.....0.17
47N,68N,100N.....0.19
220N,470N.....0.22
1uF.....0.29

POLYESTER (GENERAL)
10mm LEAD SPACING
10N,15N,22N,33N..0.06
47N,68N,100N.....0.08
220N.....0.11
20mm LEAD SPACING
220N,330N,470N...0.18

MYLAR
5mm LEAD SPACING
1N0,10N,22N,33N..0.08
100N.....0.09
20mm LEAD SPACING
220N,470N..... 0.17

POLYSTYRENE
10P,15P,18P,22P,
27P,47P,56P,68P..0.08
100P,180P,220P,
270P,330P,390P...0.09
470P,680P,820P...0.10
1N0,1N2,1N5,1N8..0.11
2N2,2N7,3N3,3N9..0.12
4N7,5N6,6N8,10N..0.13

TANTALUM BEAD CAPS
16v: 0.22,0.33,
0.68,1.0.....0.18
16v: 2.2,4.7,10..0.19
6v3: 22,47.....0.30
10v: 22,100.....0.35

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(uF/voltage)
1/63,2.2/50,4.7/35
10/16,15/16,22/10
33/6.3.....0.08
22/16,33/10,
47/10.....0.09
10/63,22/50,33/50,
47/16,100/16.....0.10
47/63,100/25,220/16
470/6.3.....0.12
100/63,470/16,
1000/10.....0.18
1000/16,470/63...0.23
1000/63,2200/16..0.30
3300/25.....0.69
1000/100.....0.88
10000/70.....3.00

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10/16.....0.08
4.7/63,22/10,22/16
33/16.....0.09
47/25,100/16.....0.10
100/25.....0.11
1000/16.....0.25
2200/16,1000/25..0.36
1000/35,4700/16..0.45
1000/50.....0.58

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0.25W 1% E12 METAL FILM
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1k, 10k.....0.27

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EF91	1.22	4CX250B	21.75	AD162	0.39	BD138	0.30	2N3055	0.59
EF93	0.65	5R4GY	1.25	AF127	0.32	BD139	0.32	2N3702	0.12
EF94	0.65	5U4G	0.90	AF139	0.42	BD140	0.30	2N3703	0.12
EF95	0.78	6GK6	2.50	AF239	0.42	BD144	1.20	2N3704	0.12
EF183	0.56	6J6	0.65	BC107	0.10	BF115	0.35	2N3705	0.12
EF184	0.56	6JS6C	5.00	BC107B	0.10	BF167	0.24	2N3706	0.12
EL34	1.54	6KD6	4.50	BC108	0.10	BF179	0.34	2N3708	0.12
EL84	0.60	6L6GC	1.75	BC108C	0.10	BF180	0.29	2N5294	0.38
EM84	0.65	6LD20	0.60	BC109B	0.10	BF183	0.29	2N5296	0.48
EZ80	0.48	6LQ6	6.50	BC140	0.31	BF194	0.11	2N5298	0.38
EZ81	0.56	6SN7GT	0.90	BC141	0.25	BF195	0.11		
GZ32	0.76	6V6GT	1.05	BC142	0.21	BF196	0.11	I.C.'s	
GZ33	1.85	7S7	2.00	BC143	0.24	BF197	0.11	MC1307	1.00
GZ34	2.00	12AT7	0.60	BC147	0.09	BF198	0.10	MC1350	1.00
KT61	3.50	12AU7	0.60	BC148	0.09	BF199	0.14	MC1495	3.00
KT66	4.00	12AX7	0.65	BC149	0.09	BF200	0.30	SN76003N	1.65
KT77	5.00	12BA6	0.80	BC157	0.10	BF257	0.28	SN76013N	1.15
KT88	6.00	12BE6	1.05	BC158	0.09	BF258	0.25	SN76013ND	
N78	8.90	12BH7	0.95	BC159	0.09	BF259	0.26		1.15
OA2	0.78	12HG7	3.50	BC160	0.28	BF336	0.34	SN76023N	1.35
PCF80	0.72	85A2	1.20	BC170B	0.10	BFX29	0.30	SN76033N	1.35
PCF802	0.66	90C1	1.69	BC171	0.08	BFX84	0.26	SN76131N	1.30
PCF808	1.48	807	1.09	BC172	0.09	BFX85	0.28	SN76227N	1.05
PCL82	0.68	811A	9.00	BC173B	0.10	BFX86	0.30	SN76660N	0.60
PCL84	0.72	813	11.30	BC182	0.09	BFX88	0.25	TAA661B	1.20
PCL86	0.75	833A	47.85	BC183	0.09	BFY50	0.21	TBA120S	0.70
PCL805	0.80	866A	2.50	BC184LA	0.09	BFY51	0.21	TBA540	1.25
PFL200	1.13	2050A	3.90	BC212	0.09	BFY52	0.25	TBA550Q	1.55
PL504	1.13	5763	3.20	BC212L	0.09	BFY90	0.73	TBA641-B11	
PL508	1.48	5814A	2.75	BC213	0.09	BU105	1.22		1.90

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P&P 50p per order

Many other types available including vintage valves.
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HOME RADIO Components LTD
Dept. PW, P.O. Box 92, 215 London Road,
Mitcham, Surrey. 01-543 5659

NICKEL CADMIUM BATTERIES

	AA (HP7) 0.5AHr	SUB 'C' 1.2AHr	'C' (HP11) 1.65AHr	'C' (HP11) 2.0AHr	'D' (HP2) 4.0AHr	PP3 0.1AHr
1–24	£0.85	£1.38	£1.69	£2.25	£2.97	£3.79
25–49	£0.82	£1.28	£1.58	£2.10	£2.77	
50–99	£0.80	£1.24	£1.52	£2.02	£2.67	
100 up	£0.70	£1.15	£1.41	£1.87	£2.47	

All cells are brand new full spec devices from reputable mnfrs. All Nickel Cadmium cells (except PP3) are supplied complete with solder tags and are **'VENTED' devices** suitable for fast charge.

CHARGERS – single or dual O/P to charge PP3, AA or SUB 'C' cells in 12-14 hrs (chargers will charge 'C' and 'D' cells but with longer charging time). Units supplied complete in plug top case with flying leads. Number of cells (10 max) in series and type **must** be specified for each required O/P when ordering.

SINGLE O/P CHARGER **£5.04**
DUAL O/P CHARGER **£5.72**

TRANSFORMERS – as used in chargers, 2 × 12 volt 0.25 amp secondarys 240v primary, tag connections **£1.57** each.

Data and charging circuits free with orders over £10 otherwise 30p post. P&P 10% if order less than £10, 5% if order over £10. Prices *DO NOT INCLUDE VAT* and this should be added to the total order.

Cheques, P.O.'s Mail Order to:-
SOLID STATE SECURITY,
Dept. (PW), Bradshaw Lane,
Parbold, Wigan, Lancs.
Telephone 02576-3018.

POPULAR KITS AND PARTS

TRANSMITTER SURVEILLANCE
Tiny, easily hidden but which will enable conversation to be picked up with FM radio. Can be made in a matchbox—all electronic parts and circuit. **£2·30.**

RADIO MIKE
Ideal for discos and garden parties, allows complete freedom of movement. Play through FM radio or tuner amp. **£6·90.**

SAFE BLOCK
Mains quick connector will save you valuable time. Features include quick spring connectors, heavy plastic case and auto on and off switch. Complete kit **£1.95.**

LIGHT CHASER
Gives a brilliant display—a psychedelic light show for discos, parties and pop groups. These have three modes of flashing, two chase-patterns and a strobe effect. Total output power 750 watts per channel. Complete kit. **Price £16.** Ready made up **£4 extra.**

FISH BITE INDICATOR enables anglers to set up several lines then sit down and read a book. As soon as one has a bite the loudspeakers emits a shrill note. Kit. **Price £4·90.**

6 WAVEBAND SHORTWAVE RADIO KIT
Bandspread covering 13·5 to 32 metres. Based on circuit which appeared in a recent issue of Radio Constructor. Complete kit. Includes case materials, six transistors, and diodes, condensers, resistors, inductors, switches, etc. Nothing else to buy. If you have an amplifier to connect it to on a pair of high resistance headphones. Price **£11·95.**

SHORT WAVE CRYSTAL RADIO
All the parts to make up the beginner's model. Price **£2·30.** Crystal earpiece **65p.** High resistance headphones (give best results) **£3·75.** Kit includes chassis and front but not case.

RADIO STETHOSCOPE
Easy to fault find—start at the aerial and work towards the speaker — when signal stops you have found the fault. **Complete kit £4·95.**

INTERRUPTED BEAM KIT
This kit enables you to make a switch that will trigger when a steady beam of infra-red or ordinary light is broken. Main components—relay, photo transistor, resistors and caps etc. Circuit diagram but no case, Price **£2·30.**

OUR CAR STARTER AND CHARGER KIT has no doubt saved many motorists from embarrassment in an emergency you can start car off mains or bring your battery up to full charge in a couple of hours. The kit comprises: 250w mains transformer, two 10 amp bridge rectifiers, start/charge switch and full instructions. You can assemble this in the evening, box it up or leave it on the shelf in the garage, whichever suits you best. **Price £11·50** + £2·50 post.

G.P.O. HIGH GAIN AMP/SIGNAL TRACER. In case measuring only 5¼in · 3¼in · 1¼in is an extremely high gain (70DB) solid state amplifier designed for use as a signal tracer on GPO cables etc. With a radio it functions very well as a signal tracer. By connecting a simple coil to the input socket a useful mains cable tracer can be made. Runs on standard 4½v battery and has input, output sockets and on-off volume control, mounted flush on the top. Many other uses include general purpose amp. cueing amp, etc. **An absolute bargain at only £1·85.** Suitable 80 ohm earpiece 69p.

VU METER
Edgewise mounting, through hole size 1⅛" × ¼" approx. These are 100 micro amp f.s.d. 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 **£2·88p.**

BALANCE METER
Edgewise mounting 100 UA centre zero. Price **£2·30p.**

1½" SQUARE PANEL METER
Eagle full vision plastic front, 50 UA. Price **£4·60p** 1 mA Price **€4·03p.**

WATERPROOF HEATING WIRE
60 ohms per yard. This is a heating element wound on a fibre glass coil and then covered with p.v.c. Dozens of uses—around water pipes, under grow boxes in gloves and socks. **23p** metre.

DIAL INDICATOR
As used in tool making and other precision measuring operations, the famous John Bull accurately shows differences of 0·1mm. A beautifully made precision instrument, price in most tool shops would be £12-£15. We have a fair quantity. Price **£9·20p.**

COMPONENT BOARD Ref. W0998.
This is a modern fibre glass board which contains a multitude of very useful parts, most important of which are: 35 assorted diodes and rectifiers including four 3 amp 400v types (made up in a bridge) 8 transistors type BC 107 and 2 type BFY 51 electrolytic condensers, SCR ref. 2N 5062 25 Ouf 100v DC and 100uf 25v DC and over 100 other parts including variable, fixed and wire wound resistors, electrolytic and other condensers. A real snip at **£1·15.**

FRUIT MACHINE HEART. 4 wheels with all fruits, motorised and with solenoids for stopping the wheels with a little ingenuity you can defy your friends getting the "jackpot." **£9·95** + **£4** carriage.

DESOLDERING PUMP
Ideal for removing components from computer boards as well as for service work generally. Price **£6·35.**

4-CORE FLEX CABLE
White pvc for telephone extensions, disco lights, etc. 10 metres **£2**, 100 metres **£15.** Other multicore cable in stock.

MUGGER DETERRENT
A high-note bleeper, push latching switch, plastic case and battery connector. Will scare away any villain and bring help. **£2·50** complete kit.

HUMIDITY SWITCH
American made by Honeywell. The action of this device depends upon the dampness causing a membrane to stretch and trigger a sensitive microswitch. Very sensitive breathing on it for instance will switch it on. Micro 3 amp at 250V a.c. Only **£1·15.**

MINI-MULTI TESTER
Deluxe pocket size precision moving coil instrument, jewelled bearings—2000 o.p.v. mirrored scale.
11 instant range measure:
DC volts 10, 50, 250, 1000.
AC volts 10, 50, 250, 1000.
DC amps 0-100 mA.
Continuity and resistance 0-1 meg ohms in two ranges. Complete with Test Prods and instruction book showing how to measure capacity and inductance as well.
Unbelievable value only **£6·75** + **50p** post and insurance.
FREE Amps ranges kit to enable you to read DC current from 0-10 amps, directly on the 0-10 scale. It's free if you purchase quickly but if you already own a mini-tester and would like one, send **£2·50.**

SUPER HI-FI SPEAKER CABINETS.
Made for an expensive Hi-fi outfit—will suit any decor. Resonance free cut-outs for 8" woofer and 4" tweeter. The front material is carved Dacron, which is thick and does not need to be stuck in and the completed unit is most pleasing. Colour black. Supplied in pairs, price **£6·90** per pair (this is probably less than the original cost of one cabinet) carriage £3 the pair.

CHASSIS BARGAIN

3 wave band radio with stereo amplifier. Made for incorporation in a high-class radiogram, this has a quality of output which can only be described as superb. It is truly hi-fi. The chassis size is approximately 14". Push buttons select long, medium, short and gram. Control are balance, volume, treble and bass. Mains power supply. The output is 6 + 6 watts. Brand new and in perfect working order, offered at less than value of stereo amp alone, namely **£6·90.** Post £2·00.

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 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 **£16** including V.A.T. and postage.
FREE GIFT—Buy this month and you will receive a pair of **Goodman's** elliptical 8" · 5" speakers to match this amplifier.

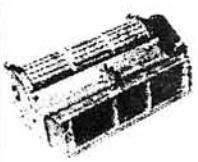
THIS MONTH'S SNIP

THERMOSTAT ASSORTMENT 10 different thermostats. 7 bi-metal types and 3 liquid types. There are the current stats which will open the switch to protect devices against overload, short circuits, etc, or when fitted say in front of the element of a blower heater, the heat would trip the stat if the blower fuses; appliance stats, one for high temperatures, others adjustable over a range of temperatures which could include 0-100 °C. There is also a thermostatic pod which can be immersed, an oven stat, a calibrated boiler stat, finally an ice stat which, fitted to our waterproof heater element, up in the loft could protect your pipes from freezing. Separately, these thermostats would cost round about **£15·00**—however, you can have the parcel for **£2·50.**

WALL MOUNTING THERMOSTAT,
Danfoss, a handsome 2 tone this is intended for living rooms but is just as efficient in a greenhouse or store. It is suitable for normal air temperature range 32F-80F—price **£4·60.**

TANGENTIAL HEATER UNIT

A most efficient and quiet running blower-heater by Solatron—standard replacement in many famous name heaters—comprises mains induction motor—long turbo fan—split heating element and thermostatic safety trip—simply connect to the mains for immediate heat—mount in a simple wooden or metal case or mount direct into base of say kitchen unit. Price **£5·95,** post £1·50. Control switch to give 2kw, 1kw, cold blow or off available 60p extra. 3kw model **£6·95.** Control Switch **95p.**



3 KW Mode
£6·95
+ £1.50 P & P

3-CHANNEL SOUND TO LIGHT KIT

Complete kit of parts for a three-channel sound to light unit controlling over 2,000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for Disco work.
The unit is housed in an attractive two-tone metal case and has controls for each channel, and a master on/off. The audio input and output are by ¼" sockets and three panel mounting fuse holders provide thyristor protection. A four-pin plug and socket facilitate ease of connecting lamps. Special snip price is **£14·95** in kit form or **£19·95** assembled and tested.

8 POWERFUL BATTERY MOTORS

For models, Meccanos, drills, remote control planes, boats, etc. **£2.**

TERMS: Cash with order—but orders under **£10** must add **50p** to offset packing, etc.
BULK ENQUIRIES INVITED. PHONE: 0444-54563.
ACCESS & BARCLAYCARD WELCOMED.

J. Bull [ELECTRICAL] Ltd.

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34-36 AMERICA LANE,
HAYWARDS HEATH SUSSEX.
RH16 3QU

IT'S FREE

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

DUE TO THE HIGH & RISING PRICES OF FUEL many companies and probably many householders are looking around for ways of saving some of this cost. One Company bought a number of fans from us and fitted these on the ceiling of their workshops where the hot air tends to collect and they blow this hot air downwards. Another Company has bought fans from us to suck the exhaust from their oil fired central heaters through a zig zag of asbestos pipes, the asbestos pipes being in a separate chamber which becomes a hot air chamber, the hot air from this is blown through ducting to where ever it is needed. Basically, they have cut out the normal chimney and replaced this with one of our high power extractor fans. If you have any other good ideas on heat cost saving, let us know and we will pass it on to other readers.

EXTRACTOR FANS

Ex-Computer made by Woods of Colchester, ideal also as blower; central heating systems, fume extraction etc. Easy fixing through panel, very powerful 2,500 r.p.m. but quiet running. Choice of 2 sizes, 5" **£5·50,** 6" **£6·50;** post **£1** per fan.

PING PONG BALL BLOWER-UPPERS Have you got to organise a Christmas Party or Charity Fund-Raising Event? Then one always popular way is to have ping pong balls going up and down and being caught. We have some powerful blowers and these should be ideal for this, and of course for more serious purposes. They are 4 stage blowers, coupled to synchronised AC mains motors of approximately ¼ h.p. They have a terrific suction as well as a high velocity blow. Ex computers, price **£26·00.**

TWO MORE BLOWERS Both 'snail' type, one very small and compact and suitable for cooling projectors or other equipment. Impeller size 2" · 1", coupled to mains voltage induction motor, outlet size approximately 1½" · 1¼". Price **£5·50** + 68p. The other is a larger **FLANGED BLOWER** for direct coupling to ducting, outlet size 3½" · 2½" + 1" flange, holed for easy fixing to trunking. Impeller size 5½" · 1½". Powered by 1/12 h.p. mains motor. **£11·75.**

RECHARGEABLE SOLID GEL BATTERY 12v 5 AH new and unused made by or for Elpower Corporation of California. Dimensions, 6" long, 3¾" high and 2½" wide. Regular price of similar batteries, R.S. Components is **£26·00.** Limited quantity available at **£15·80.**

DUAL DIGITAL TIMER Short delay, left timer adjustable 0-2 secs right timer 0-9·9 secs. Made by Techno Instruments Ltd., catalogue no. 010 18/1. We have very little information on these, but they are battery operated, to use you simply set the digital switches in the desired position, turning the rotary indicator to the chosen time. The lamp will light up when the right timer is in operation. Periodic or single action possible. This is a precision instrument 4¼" wide, 1½" high and 5½" deep. We understand that these cost over £60·00 from the Makers. limited quantity only at **£23·00.**

SOLID STATE VARIACS By Lewis and Holtzman Ltd—their "Elvar", 230-240v AC in and out, 10 amp model is cylindrical approximately 3½" diameter 4½" deep. Price **£13·80.** 5 amp model, again cylindrical, 2½" diameter, 4½" deep. Price **£9·20.**

E.H.T. UNITS One of our specialities has always been E.H.T. transformers, and we probably have bigger stocks than most of our contemporaries. It is surprising what uses these high voltages can be put to—killing flies and weeds, lighting central heating boilers, lifting paper, extracting dust, etc. etc. A new one this month is 14·5 KV. (dc) 0·5mA—made by ADVANCE ELECTRONICS—this unit is completely enclosed and has input and output sockets—size of the unit is approximately 6" · 3" · 3½", price **£15 38** post £1.
To remind you of the E.H.T. Transformers we stock, here is a list:

3-4 KV	3 mA	ex equipment **£2 90**
5 KV	5 mA	ex new equipment **£7·15**
5 KV	5 mA	with outer casing and E.H.T. outlets **£9·45**
8·5 KV	10 mA	totally enclosed with E.H.T. outlets **£13·50**

LEDS are used increasingly and are now being recommended for nearly all indicators and for games and novelties. Due to a fortunate purchase, this month we are able to offer 10 red led's for **£1.** These are the small ones equivalent to the TIL 209. Bulk price **£60·00** per 1,000 + V.A.T.

FIG. 8. FLEX is always in demand, especially when doing the Christmas decorations. We are able to offer white Fig. 8 5 amp type on 50 metre roll for **£2·80,** ditto but dark grey with tracer lead, suitable for speaker extensions, 50 metres **£3·38.**

500 WATT MERCURY VAPOUR LAMP Mazda, ref. 90-5104 MAT/V blended. These give a really powerful light but, of course, have to be used with the correct control gear. We are expecting to get this control gear early in the New Year. Price of the lamp is **£3·38** + 38p. Post 50p.

ANTI FROST THERMOSTAT The normal refrigerator type thermostat, switches off as the temperature falls and so is not suitable for anti-frost devices. However, we have the *ice stat*—this switches on as the temperature falls and is set to switch on just above freezing point. It is a skeleton stat so would require boxing, but the price is modest at **£1·10.**

THIN CONNECTING WIRE 500 metre drums, 7 stranded copper core p.v.c. covered available in 10 different colours. Price **£7·15.**

OCTOBER/NOVEMBER CONSTRUCTOR'S SNIP. Here's a super bargain for you. 100 twist drills, regular tool shop price over £50, yours for only **£11·50.** With these you will be able to drill metal, wood, plastic etc from the tiniest holes in P.C.B. right up to about ¼". Don't miss this snip—send your order today.

SUPER BREAKDOWN PARCEL with free gift of a desoldering pump, perhaps the most useful break-down parcel we have ever offered. Consists of 50 nearly all different computer panels on which you will find: over 300 ICs, over 300 diodes, over 200 transistors and many hundred other parts, resistors, condensors, multi turn pots, rectifiers, SCR etc. etc. for only £8·50, which when you deduct the value of the desoldering pump, works out to just a little over 4p per panel, + **£1·27** VAT + £2 post (it's a big parcel).

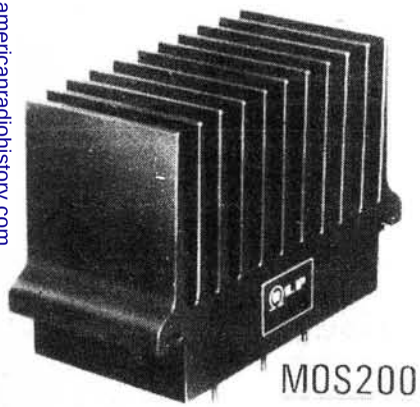
TIME SWITCH BARGAIN Large clear mains frequency controlled clock, which will always show you the correct time + start and stop switches with dials. Complete with knobs **£2·50.**

ILP

SIMPLY AHEAD and staying there

The range grows bigger...better...

New Profile Amplifiers - Two New Series



MOSFET

CHOOSE AN I.L.P MOSFET POWER AMP when it is advantageous to have a faster slew rate, lower distortion at higher frequencies, enhanced thermal stability, the ability to work with complex loads without difficulty and complete absence of cross-over distortion. I.L.P's exclusive encapsulation technique within fully adequate heatsinks has been taken a stage further with specially developed computer-verified 'New Profile' extrusions. These ensure optimum operating efficiency from our new MOSFETS, and are easier to mount. Connection is via five pins on the underside. **I.L.P MOSFETS ARE IDENTICAL IN PERFORMANCE TO THE COSTLIEST AMPLIFIERS IN THIS EXCITING NEW CATEGORY BUT ARE ONLY A FRACTION OF PRICES CHARGED ELSEWHERE.**

Model	Output Power RMS	Distortion Typical at 1KHz	Slew Rate	Rise Time	Signal/Noise Ratio DIN AUDIO	Price & VAT
MOS120	60W into 4-8Ω	0.005%	20V/μs	3μs	100dB	£25.88 + £3.88
MOS200	120W into 4-8Ω	0.005%	20V/μs	3μs	100dB	£33.46 + £5.02

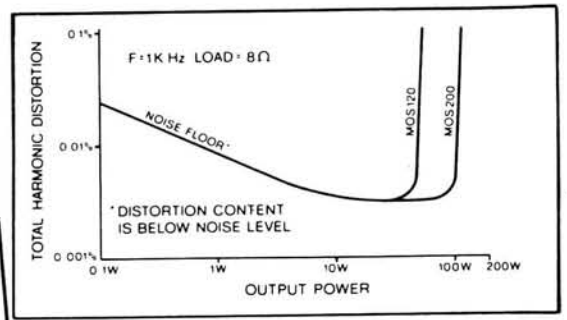
BIPOLAR

STANDARD O/P TRANSISTORS

CHOOSE AN I.L.P BIPOLAR POWER AMP where power and price are first consideration while maintaining optimum performance with hi-fi quality and wide choice of models. From domestic hi-fi to disco and P.A., for instrument amplification, there is an I.L.P Bipolar to fill the bill, and as with our new Mosfets, we have encapsulated Bipolars within our New Profile extrusions with their computer-verified thermal efficiency and improved mounting shoulders. Connections are simple, via five pins on the underside and with our newest pre-amps and power supply units, it becomes easier than ever to have a system layout housed the way you want it.

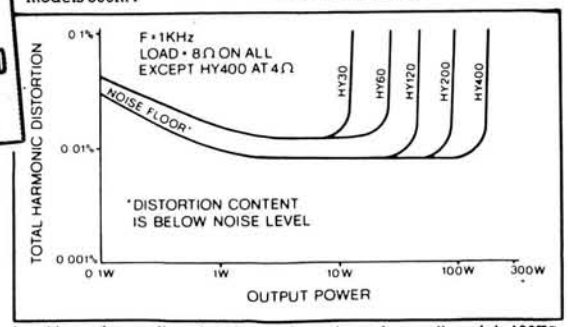
Model	Output Power RMS	Distortion Typical at 1KHz	Slew Rate	Rise Time	Signal/Noise Ratio DIN AUDIO	Price & VAT
HY30	15W into 4-8Ω	0.015%	15V/μs	5μs	100dB	£7.29 + £1.09
HY60	30W into 4-8Ω	0.015%	15V/μs	5μs	100dB	£8.33 + £1.25
HY120	60W into 4-8Ω	0.01%	15V/μs	5μs	100dB	£17.48 + £2.62
HY200	120W into 4-8Ω	0.01%	15V/μs	5μs	100dB	£21.21 + £3.18
HY400	240W into 4Ω	0.01%	15V/μs	5μs	100dB	£31.83 + £4.77

ILP POWER AMPS ARE ENCAPSULATED FOR THERMAL STABILITY AND LONGER LIFE



Load impedance both models 4Ω - ∞ Input sensitivity both models 500mV

Input impedance both models 100KΩ Frequency response both models 15Hz-100KHz – 3dB



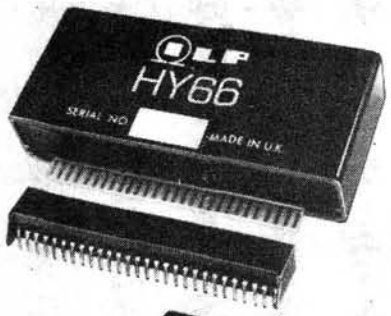
Load impedance all models 4Ω -∞ Input sensitivity all models 500mV

Input impedance all models 100KΩ Frequency response all models 15Hz-50KHz – 3dB

THE NEW PROFILE EXTRUSIONS

The introduction of standard heatsink extrusion for all I.L.P. power amplifiers achieves many advantages: – Research shows they provide optimum thermal dissipation and stability. Slotted shoulders allow easy mounting; standardisation enables us to keep our prices competitive. Surfaces are matt black, anodised for higher thermal conductivity. Extrusions vary in size according to module number.

I L P PRE-AMPS



PSU

HY6 (mono) and **HY66** (stereo) are new to I.L.P's range of advanced audio modules. Their improved characteristics and styling ensure their being compatible with all I.L.P power-amps both MOSFET and BIPOLAR, giving you chance to get the best possible reproduction from yc ir equipment. HY6 and HY66 pre-amps are protected against short circuit and wrong polarity. Full assembly instructions are provided. Mounting boards are available as below.
Sizes – **HY6** – 45 x 20 x 40 mm. **HY66** – 90 x 20 x 40 mm. Active Tone Control circuits provide ±12dB cut and boost. **Inputs Sensitivity** – Mag. PU. –3mV: Mic – selectable 1-12mV: All others 100mV. **Tape O/P** – 100mV: **Main O/P** – 500mV: **Frequency response** – D.C. to 100KHz – 3dB.

HY6 mono £6.44 + 97p VAT Connectors included
HY66 stereo £12.19 + £1.83 VAT Connectors included

B6 Mounting Board for one HY6 78p + 12p VAT
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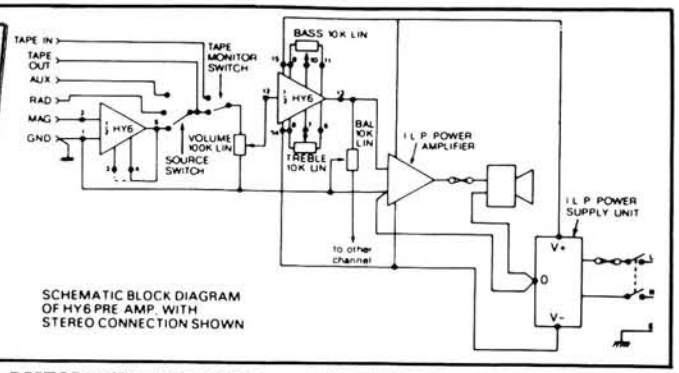

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Round the Clock

TECHNIQUES advance so rapidly in radio and electronics that it is very easy to become blasé about them. Whether each development is viewed as good or bad depends upon an individual's personal preference and experience. For example, I must confess that I still like a receiver to have traditional-style manual tuning, rather than step-up/step-down synthesiser tuning, though I am a convert to digital frequency readout.

Some of these new techniques have far-reaching effects, not always immediately obvious, and this is perhaps nowhere more true than in the case of the change from analogue to digital displays. This was brought home to me recently in a rather unusual way, whilst visiting a relative in hospital. To pass the time, she had been working through a book of puzzles, including the sort where you have to fit six-letter words into an interlocking honeycomb pattern of hexagons. Answers to clues with odd numbers go anti-clockwise and those with even numbers clockwise.

With the clues there was a little drawing to explain this rule, and my first reaction was: "Surely people don't have to be told which are odd numbers and which are even!" Thinking about it a bit more, I realised that it might be more necessary to explain the meaning of clockwise and anti-clockwise, for it would be quite possible for a child nowadays to grow up entirely in a world of digital clocks and watches, at home, at school and in public places. The term "clockwise' could well mean nothing to such a person, but what could you use instead? The instruction to turn a receiver volume control to the right, for instance, would be equivalent to clockwise providing you considered the top of the knob as your reference point. If it was a pointer knob, and the pointer was towards the bottom, you could argue equally well that "to the right" equalled anti-clockwise.

As it happens, quartz analogue watches and clocks have started to become more popular, and the digital tide has been turned, but if this were not so, what a mess we could have got into in giving adjustment and operating instructions for radio and electronic equipment, and many other fields besides. Can you think of an alternative term for clock-wise that is brief and capable of only one interpretation?

* * * * * *

Congratulations to all those who passed the December 1980 Radio Amateurs' Examination especially to our Technical Sub-Editor Elaine Howard who will shortly be adding a G4 to our masthead.

Geoff Arnold

services

QUERIES

While we will always try to assist readers in difficulties with a *Practical Wireless* project, we cannot offer advice on modifications to our designs, nor on commercial radio, TV or electronic equipment. Please address your letters to the **Editor, "Practical Wireless", Westover House, West Quay Road, Poole, Dorset BH15 1JG,** giving a clear description of the problem and enclosing a stamped self-addressed envelope. Only one project per letter please.

Components for our projects are usually available from advertisers. For more difficult items, a source will be suggested in the "Buying Guide" box included in each constructional article.

PROJECT COST

The approximate cost quoted in each constructional article includes the box or case used for the prototype. For some projects the type of case may be critical; if so this will be mentioned in the Buying Guide.

CONSTRUCTION RATING

Each constructional project will in future be given a rating, to guide readers as to its complexity:

Beginner
A project that can be tackled by a beginner who is able to identify components and handle a soldering iron fairly competently. Generally this category will be used for simple projects, but sometimes for more complicated ones of wide appeal. In this case, construction and wiring will be dealt with in some detail.

Intermediate
A project likely to appeal to a wide range of constructors, and requiring only basic test equipment to complete any tests and adjustments. A fair degree of experience in building electronic or radio projects is assumed.

Advanced
A project likely to appeal to an experienced constructor, and often requiring access to workshop facilities and test equipment for construction, testing and alignment. Constructional information will generally be limited to the more critical aspects of the project. Definitely not recommended for a beginner to tackle on his own.

SUBSCRIPTIONS

Subscriptions are available to both home and overseas addresses at £11.80 per annum, from **"Practical Wireless" Subscription Department, Room 2613, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

BACK NUMBERS AND BINDERS

Limited stocks of some recent issues of *PW* are available at 95p each, including post and packing to addresses at home and overseas.

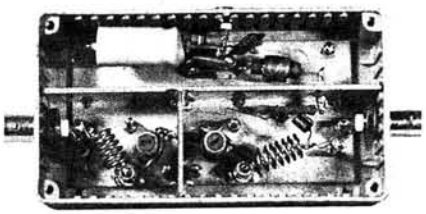
Binders are available (Price £4.30 to UK addresses and overseas, including post and packing) each accommodating one volume of *PW*. Please state the year and volume number for which the binder is required.

Send your orders to **Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF.** All prices include VAT where appropriate.

Please make cheques, postal orders, etc., payable to IPC Magazines Limited.

PRODUCTION LINES

ALAN MARTIN G8ZPW



News from Icom

The IC-240 has had a face lift, enabling operation over the full 2m band without pre-programming. The new set, called the IC-24G, has a combined digital selector and readout visible in the brightest sunlight. All the "works" are exactly the same as the IC-240 which has built an enviable reputation for reliability. Power output is 1 or 10 watts. Channel steps of 12·5kHz and 25kHz, and simplex/repeater/full reverse repeater operation are all selectable from the front panel. Manual tone-burst is provided. The IC-24G will cost £199 including VAT from *Thanet Electronics, 143 Reculver Road, Beltinge, Herne Bay, Kent. Tel: Herne Bay (02273) 63859.* A remote readout and channel-change unit will be available as an optional extra.

2m Base Antenna

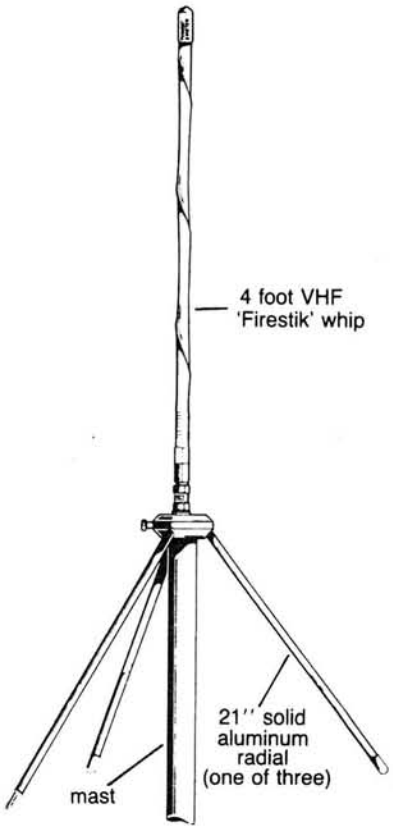
As a development of their original range of rugged CB antennas, the Firestik Antenna Company have recently introduced two v.h.f. vertical base station devices intended for the 2m Amateur and 156MHz Marine/Land Mobile bands.

Both feature a spiral wound wire driven element, bonded onto a fibreglass supporting shaft and fully enclosed in heat shrunk polyolifin sleeving.

The 5λ/8 (physical and electrical) driven element, which comes factory set for optimum match at the band centres, screws into a composite base mount that incorporates a PL-259 coaxial adapter and inserts for three, 534mm long, solid aluminium ground plane radial elements.

The base is recessed to allow mounting of the antennas on a 32mm diameter tubular mast. The coaxial feeder passes up through the tubular support to the feed point connector and is thus protected from the adverse effects of the weather.

Each antenna has a nominal impedance of 50–52 ohms with a quoted gain, over a quarter-wave, of 3dB. Standing wave ratios, measured at band centre, are specified as 1·1 to 1. As supplied the bandwidth of the 2m antenna covers 144MHz to 148MHz and the Marine/Land Mobile version 156·250MHz to 158·715MHz, however instructions are provided to allow "pruning" adjustment to higher frequencies.



Additional points of interest include power handling capability of 400W a.m.–800W p.e.p., a low angle of radiation and an inherent resistance to static noise.

The VAT and carriage inclusive price for the kit is £33.75, and is obtainable from: *Wintjoy Ltd., 103 High Street, Shepperton, Middlesex TW17 9BL. Tel: Walton-on-Thames (093 22) 48145.*

Super Pre-amp

We have recently received a 2m GaAs f.e.t. pre-amplifier for evaluation from R & S Developments. This, their MK II device has been designed for the v.h.f. operator requiring the lowest possible noise figures and best receiver sensitivity.

The unit is available, fully built, in an r.f. tight stove-enamelled diecast box, provided with b.n.c. sockets for in-line connection. An internal regulator supply feeds the circuit with the necessary highly stable voltage; input voltage being in the range 9–15V d.c.

A future "Air Test" will provide the full laboratory test figures but a provisional trial in conjunction with a good "state-of-the-art" transceiver has indicated the effectiveness of this device. R & S quote a gain of 27dB and a noise figure, typically, of 0·6dB! The current price of the pre-amp is £40 plus 80p p&p.

Other products available are a 70cm version of the above with an identical specification, and price, an electronic keyer board for c.w. and an active audio filter board.

Further details of all R & S Developments products can be obtained by sending an s.a.e. to: *20 Beweshill Crescent, Winlaton, Blaydon-on-Tyne, Tyne and Wear NE21 6BW.*

Increase Your "Talk Power"

T & T Electronics have recently introduced a new speech processor called the Persuader. It is simple to install and connects between the microphone and the transmitter.

A switch is provided to switch the unit in or out of circuit as required, when switched in the Persuader will remove unwanted audio frequencies below 300Hz and above 3kHz and will also greatly increase the average level a.f. relative to the peaks. An extra gain of 15dB can be achieved which represents an increase in "talk power" of 32 times.

The input will accept signals over the range 0·5mV to 100mV and is suitable for most standard microphones. Once the "set level" control has been adjusted to show the correct level on the two l.e.d.s, the output will be automatically correct for the rig and microphone being used.

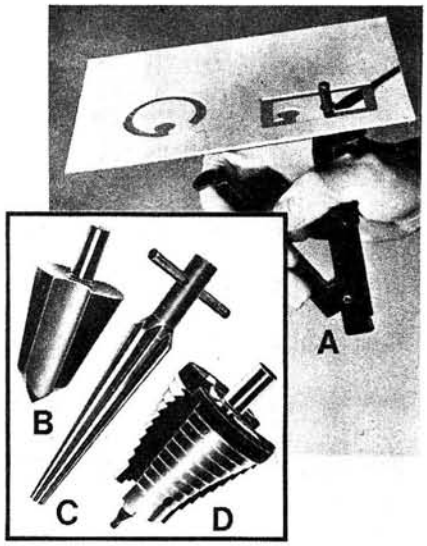
Available at an all inclusive price of £38.18, the Persuader can be obtained from: *T & T Electronics, Green Hayes, Surlingham Lane, Rockland St Mary, Norwich NR14 7HH. Tel: Surlingham (050 88) 632.*

Cut It Out

West Hyde Developments Ltd. has added two new products to its range of cutting tools. Both are hand reamers with integral tommy-bars, one designed for increasing hole sizes to anything from 3·2mm to 12·7mm and the other with a range from 9·7mm to 25·4mm (C in photograph).

Other items in the cutting tool range include matching reamers for use with a hand brace, a range of four Conecut powered reamers with an overall range of finished aperture sizes from 3mm to 52mm (B), the very useful Adel hand-operated nibbling tool, capable of cutting almost any size or shape hole in up to 16-gauge aluminium without distortion (A), and the versatile Bradrad drilling and deburring tool which is available in four sizes to drill and deburr in one operation (D).

For further information and prices contact: *West Hyde Developments Ltd., Unit 9, Park Street Industrial Estate, Aylesbury, Bucks HP20 1ET. Tel: (0296) 20441/5.*



PRODUCTION LINES

ALAN MARTIN G8ZPW

Check It Out

If you want to check that a test pin has a voltage on it the new range of Steinel check probes could provide the ideal means.

The six different models offer a wide choice of ranges and indications from the simplest Volt Check which indicates that a voltage in the range 4·5V to 450V is present and shows either that it is a.c. or d.c. and in the latter case indicates the polarity, to the sophisticated Master Check.

Master Check covers 6V to 450V with discrete l.e.d. indicators for 6, 12, 24, 50, 110, 240 and 415V with polarity indication as well. Like the rest of the checkers these are two-lead devices fully insulated and claimed to be virtually unbreakable.

Steinel also produce an electronic version of the old electrician's standby, the neon screwdriver tester. Called the Mono Check this tool can be used to indicate voltages of between 80 and 250V a.c. and has an internal resistance of 10MΩ and will operate even on a wooden stepladder standing on insulated flooring.

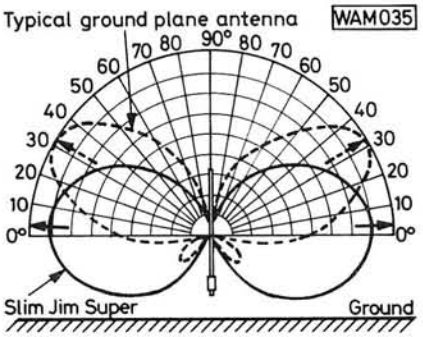
Prices range from £3.21 for the simplest Volt Check to £12.36 for the top of the range Master Check (Inc. VAT).

Further details from *Steinel KG, 288 Chester Road North, Sutton Coldfield, West Midlands B73 6RR. Tel: 021-355 5328.*

New Slimmer Jim

Remember the "Slim Jim" antenna designs published in *Practical Wireless,* which have since become recognised as a highly adaptable standard-setter in antenna design? Well, *PW* contributor, Fred Judd G2BCX, has designed an even slimmer, more versatile omni-directional vertical antenna for 2m, called the "Slim Jim Super" which should prove ideal for mobile, base or even portable operation and measures only 1068mm (42in).

Being a free-space antenna, the "Slim Jim Super" does not rely on the ground-plane effect and can be used on vehicles with fibre-glass bodies or roof tops at full efficiency. All models are weather protected and feature an external sleeve adjuster for minimum v.s.w.r. setting.



Typical vertical radiation patterns

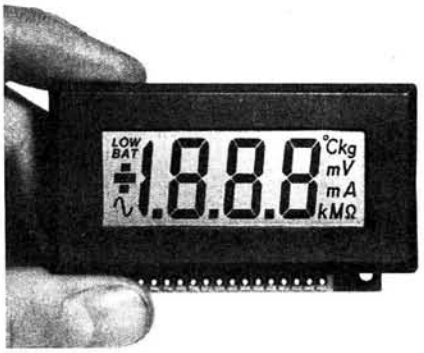
The smaller dimensions and high efficiency have been made possible by a unique high-"Q" helical stub matching system which gives the antenna a claimed 50 per cent greater efficiency over most other ground-plane or single element antennas. Specification details include: gain, 6dB over a typical 5λ/8 ground-plane at a vertical angle of 0 degrees; angle of maximum radiation with respect to ground, five degrees approx.; impedance, 50 ohms; v.s.w.r., average 1.2:1 or less across the band.

Prices which include VAT and carriage are, £17.50 for the "Slim Jim Super", £3.50 for wall/mast mounting bracket and U-clamp, or £21 for both. *Wrenpro Systems, Reedham, Norfolk. Tel: Freethorpe (049 370) 245.*

Ultra Low-Power d.p.m.

Lascar Electronics introduce the DPM-200, a new l.c.d. digital panel meter which is claimed to be the first of a new generation of d.p.m.s, giving at least ten times the battery life of any existing type. A PP3 battery will power the meter for typically two years, if operated for eight hours a day, seven days a week.

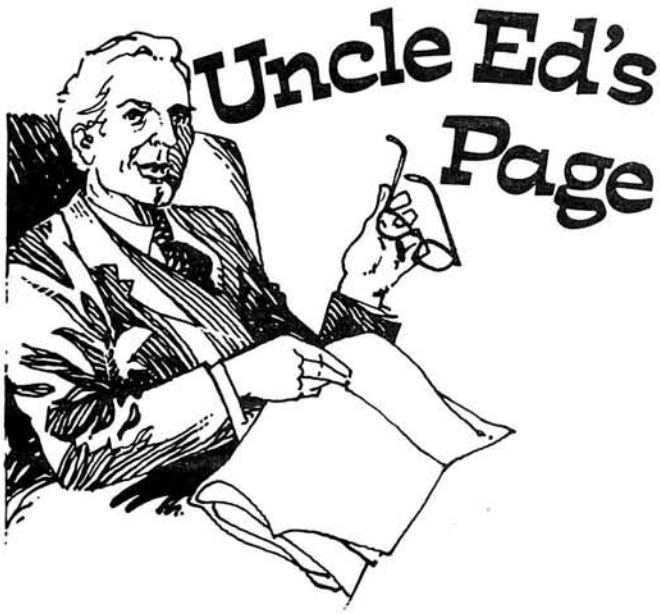
LCD watch manufacturing techniques are used to reduce the depth to a minimum, the meter is fitted into a DIN bezel measuring 72 × 36mm, with large 15mm digits and the display also contains many other useful annunciators.



Other standard features include a digital hold facility, auto-zero, auto-polarity, external band-gap reference for maximum stability, single-rail supply of 5V to 15V d.c. drawing 200μA, programmable decimal points and a 200mV f.s.d.

The data sheet provided with the meter describes 10 small hand-held instruments, including multimeters, thermometer, pH meter, etc.

The VAT and carriage inclusive price of the DPM-200 is £23.51, supplied with a free purpose-built instrument case (normally costing £2.25) with every meter ordered during 1981. Available from: *Lascar Electronics Ltd., Unit 1, Thomasin Road, Burnt Mills, Basildon, Essex SS13 1LH. Tel: (0268) 727383.*



A monthly look at some aspect of the radio/electronics hobby that seems to bug the beginner, or occasionally a more advanced topic seen from an unusual angle.

SINGLE SIDEBAND (s.s.b.) Part 2

Last month, I introduced the ideas of looking at an amplitude-modulated transmission from the point of view of its waveform, and of its frequency spectrum. We had just got as far as saying that we could suppress the carrier and one of the two sidebands as well.

In fact, there are several varieties of "s.s.b." modulation, but the one normally used in the amateur service is as described above. The unwanted sideband and carrier cannot be completely eliminated, but they are usually suppressed to at least 40dB below the peak power of the remaining sideband. As a general rule, most services use lower sideband (l.s.b.) below 10MHz, and upper sideband (u.s.b.) above 10MHz.

If we take the transmission of Fig. 4 last month and suppress the lower sideband and the carrier, we are left with a single transmission, which so far as the distant receiver is concerned, would look exactly the same as an unmodulated carrier from an ordinary a.m. station. If the modulating audio tone was to be keyed in Morse code, the transmitter would effectively be radiating c.w., and in fact this is how many modern amateur multi-mode transmitters produce c.w., because it's much easier than altering the circuitry to product real keyed carrier. Perhaps an example will make the whole thing clearer.

If we take a 20m band s.s.b. transmitter, tuned to a carrier frequency of 14 100kHz and set for u.s.b., and modulate it with a keyed 1kHz tone, it will effectively radiate c.w. on 14 101kHz. To receive this, we need a receiver having a beat frequency oscillator (b.f.o.) to "beat" the incoming signal against, so that it can be detected and turned back into an audio tone. Here, I am going to assume for simplicity that we are using a "straight" (t.r.f.) or direct-conversion receiver rather than the more common superhet, so that the b.f.o. would be set to 14 100kHz, thus replacing the original carrier and reproducing the 1kHz tone. In this arrangement, the b.f.o. could be set to 14 102kHz with the same end result, but this wouldn't necessarily work with a superhet, and certainly not in a transceiver.

If the b.f.o. (or carrier insertion oscillator (c.i.o.), as it is usually called in a s.s.b. receiver) was not set exactly to 14 100kHz, the audio tone coming out of the receiver loudspeaker or 'phones would not be exactly 1kHz. As an example, if the c.i.o. is set to 14 100·2kHz, the audio tone would be 200Hz low, at 800Hz. This wouldn't usually be too important, and indeed a c.w. operator will always tune his receiver to produce the beat note which he favours, unless he is using some sort of fixed-tune audio filter as a selectivity aid.

Consider, though, what would happen if the signal that had to be transmitted consisted of two simultaneous audio tones, one being the second harmonic of the other at, say, 750Hz and 1500Hz. Heard on our receiver with its 200Hz tuning error, these would come out as 550Hz and 1300Hz, and would sound completely different, being rather discordant compared with the smooth sound of a note and its second harmonic. (1300 does not equal 2 × 550, of course.)

What is more commonly transmitted over an s.s.b. link is speech, which is made up of a whole mixture of frequencies, some harmonically related and some not. To tune in such a signal on a receiver is really a two-stage process: 1. Finding the wanted signal; in other words, getting it within the receiver's passband. 2. Resolving the signal—getting the tuning of the c.i.o. close enough to the original carrier frequency to turn the output of the receiver into understandable speech, of acceptable quality.

This final part of the tuning process is difficult to describe on paper, although reasonably easy to demonstrate. I was able to teach my 16-year-old daughter to tune an s.s.b. signal properly with about five minutes practice. The secret, having got the signal to the "intelligible" stage, is to try to get rid of what I can best describe as the "frog-in-the-throat" sound to the distant speaker. A quiet room is essential if you're using a loudspeaker, but headphones are better still. The slower the rate of tune (fewer kHz per turn) of the main or fine tuning controls on the receiver, the easier this will be. A professional s.s.b. receiver will have a fine tune control (often called a "Clarifier") with a swing which may be as little as ±100Hz. Trying to do the same job on an amateur-grade receiver with a fine tune range of ±3kHz or ±5kHz, or even no fine tune control at all, is not easy.

How accurate the c.i.o. frequency must be depends upon the purpose of the link and the experience of the listener. For a receiver forming part of a public telephone service, where the listeners are unskilled and it is more or less essential that the voice at the far end is recognisable, errors of less than 10Hz are desirable, and over 30Hz unacceptable. An experienced s.s.b. operator, on the other hand, can quite easily cope with 100Hz or more off tune, although prolonged listening in such conditions is very wearing.

Sometimes it will prove impossible to banish the "frog-in-the-throat" completely, generally as a result of deficiencies such as intermodulation distortion in the distant transmitter.

If you try to listen to an s.s.b. speech transmission on an ordinary broadcast receiver without a b.f.o., all you will hear is a "monkey chatter" resulting from the sideband components beating against one another, with completely unintelligible results. If you listened on such a receiver to the two-tone transmission I described above, you would hear the difference frequency—750Hz—because the receiver sees the two signals as a "carrier" and a "tone" and extracts the difference. Incidentally, two-tone signals are used to test s.s.b. transmitters, though the tones employed are then **not** harmonically related.

continued on page 28 ▶▶▶

DEAR SIR, It all began like this...

H. A. CROOKES

I thought, Mr Editor, that you might be interested in my initiation into the world of short-wave radio. If you are not—well, you can always make a paper plane with this letter and fly it across the office.

I used to do Photography, actually. I did my own processing and the spare room was not so spare as dark. But somehow I seemed to have more success in ruining the carpet and staining the cat than I did in producing good prints. David Bailey has nothing to fear from me I told myself, and decided to finish with photography for good.

I discussed a divorce with The Wife, scrubbed the cat and turned my thoughts heavenwards—to the Ionosphere. I'd have a go at Amateur Radio, I thought.

The Wife was pleased (well, it's not so messy, is it?) and I did, after all, redecorate the spare room. And, when the carpet dried out the stains seemed to blend in with the pattern; even the cat seemed to have suffered no deep psychological harm. Just the odd twitch, perhaps.

Vision

So I went off and bought a copy of—yes, you've guessed it, *Practical Wireless*. I gazed in wonder at the adverts and the good-looking bloke on the cover and that was it; I couldn't understand the rest. But I persevered and sent for a kit of parts—I would, I decided, build a one-valve set.

Eagerly I waited for the parts to arrive, in my ignorance rewiring the spare room in a frantic fervour. Perhaps I would need a direct supply from the local power station; a supergrid feeder, even.

"He tried to poison himself with photographics," said The Wife, encouraging as ever, "now he's trying to electrocute himself." A man with a vision, I pressed on regardless.

The great day arrived at last and a parcel was delivered—my kit of parts. It was something of an anti-climax, really—not exactly like the BBC main transmitter or as I had imagined. Feverishly, spilling coffee and recklessly smashing the marmalade pot on the floor, I tore the package apart and stood gazing in wonder at the components within.

"He'll never get that lot to work," muttered The Wife. "It took him three months to put a plug on the toaster." O thou of little faith, thought I.

Wire-less

Undaunted, I scooped it all up and retreated to the spare room—now renamed "The Radio Room". True, I lost dignity as I trod an amalgam of glass and marmalade into the carpet, but undaunted I remained. We Radio Enthusiasts are above such mundane concerns.

One hour, one cut thumb and two burnt fingers later I had it all finished and crammed the phones onto my head (I did know that much). Eagerly I twiddled the knobs and got—nothing. Perhaps you know the feeling.

The cat glaring malevolently at me from the safe distance of the window-sill, I desperately rechecked my wiring. Five minutes later (not really that much to a one-valver, is there?), I had discovered the fault—a missing wire. The aerial wire, as a matter of fact.

"Well?" enquired The Wife, "have you got Australia yet?" She fell about in an uncontrolled fit of laughter.

Through a Window

Not having a garden but only a small courtyard created a problem where the aerial was concerned. I decided to overcome it by fixing a pole to the roof of the back door porch.

Taking my tools, the wire, some nails and my life in both hands and warmed by the early morning sunshine, I climbed out of an upstairs window and onto the roof of the porch. The cat could fully appreciate this part of the operation and carefully selected a good vantage point from which to watch. Its golden irises shone as it peered keenly up at me, licking its lips in anticipation of the crash that must surely follow. The Wife—interested as ever—went out shopping.

"Let me know which hospital he's taken to, won't you Mildred?" she called to our neighbour. Very reassuring, The Wife.

To confound them all, I fixed the pole and the aerial and managed to get back into the house unscathed. Okay, I admit to having broken a vase and part of the window-frame in the process but the main thing is that when I plugged in the aerial, the thing *worked*—all one valve of it. And to a Radio Enthusiast, to hear a station on a set that you have built yourself is the very pinnacle of achievement, even if it is in Welsh.

And Now . . .

And since then I've never really looked back, you know. The walls are papered with QSL cards, the courtyard is positively festooned with aerials and, would you believe it, even The Wife is getting interested. The cat, admittedly, exudes an air of haughty disdain; its owners, it evidently considers, have gone bananas.

But the point that I am trying to make, Mr Editor, is that to enjoy our hobby we don't need loads of fancy gear and proper facilities, and certainly not a cat. You just need an understanding wife and a thick skin. If you are not married, you shouldn't be sitting in night after night listening to the radio anyway, of course. But I hope you see what I am getting at.

If it's a wet dismal day and I haven't achieved anything else, I hope I've cheered you up a bit. My one-valver has passed into history now, of course, and my present-day rig is like the flight deck of Concorde by comparison, but that is another story. I'll tell you about it sometime, if you like.

Good listening! ●

kindly note!

Beginners 2m Converter, Sept. 1980

If unwanted coverage and spurious responses are found when using the converter, these may be removed by "taming" the oscillator. Increasing the value of R3 to 330kΩ will effect a cure.

***PW* Sherborne, Nov. 1980**

In Fig. 10, the lead from a.m. antenna socket should go to pin 20 on the f.m. i.f. and a.m. tuner head, not pin 17 as shown.

***PW* Twynham, Jan. 1981**

A short link is required between the left-hand end of R21 (Fig. 17) and the display anodes +5V rail, of the p.c.b. Pins 13 and 14 of IC1 should be linked.

***PW* Tape Slide Controller, Jan./Feb. 1981**

On the component overlay Fig. 10, R33 has been duplicated, the component lying below C17 should be R35, not R33 as shown. In the circuit diagram Fig. 3, the bottom end of R18 should not be connected to 0V, but should be connected to the same point as the wiper. The same applies to R37.

The polarity of C29 is drawn incorrectly on the p.c.b. layout in Fig. 14, the circuit diagram is correct.

Active Receiving Antenna, March 1981

The left-hand end track leadout of potentiometer R7 should **not** be connected to the earth plane. Remove sufficient copper from around this pin to ensure **no** connection is made.

Frequency Allocation Chart, March 1981

We should have made it clear that, with certain exceptions, the allocations shown are either world-wide, or where regional variations occur, those for Region 1 (broadly speaking comprising Europe, Africa and the USSR).

Considerable variations occur locally, which are detailed in the official International Table of Frequency Allocations in three columns and nearly 500 footnotes. To give just one example—the 160 metre amateur band—15 European countries can allocate up to 200kHz of additional space to amateurs on a secondary-user basis. In the UK, this is fixed as 1·8–2·0MHz.

It is obviously impossible to detail all these variations in a chart, and where allocations on your Amateur Licence, for instance, differ from the chart, it is the licence which you should follow.

AUDIO POWER AMPLIFIERS

PART 3

M. J. DARBY

In this, the final part of the series, we look at an integrated circuit driver, and two high-power amplifier circuits, one capable of a mean output power of 1·5kW.

Audio Driver

Another way of constructing a high-quality audio amplifier involves the use of an audio power driver integrated circuit. This type of device is not common, but the National Semiconductor LM391N-60 power driver has recently become available through a retail source (Arrow Electronics Ltd., Coptfold Road, Brentwood, CM14 4BN). It can be used in the circuit of Fig. 17 to drive discrete power transistors externally connected as a complementary pair of Darlingtons. The circuit shown will provide an output of 20W into an 8Ω load or 30W into a 4Ω load with a total harmonic distortion of about 0·01% at 1kHz rising to 0·3% at 10kHz. The response is level to ±0·25dB from 20Hz to 20kHz.

The gain of this circuit is determined by the feedback resistors and is equal to (1 + R4/R1) or about 20·6 with the values shown. The input voltage required for full output power is about 614mV for the 20W version with an 8Ω load, and 532mV for the 30W, 4Ω version. If the gain is increased to 200, the distortion is increased to about 0·05% at 1kHz, rising to about 0·14% at 10kHz owing to the reduced amount of negative feedback. The presence of C1 reduces the amplifier gain to unity at zero frequency as previously discussed. The frequency compensation capacitor C4 sets the gain-bandwidth product.

The resistors R7 and R15 in the base circuits of the output transistors remove stored charge in the bases of these components. The 0·22Ω resistors R9 and R12 in the output transistor emitter circuits increase the thermal stability in these stages. The output inductor L1 in parallel with the resistor R10 can be made as a single component by winding about 25 turns of enamelled wire around a 10Ω, 2W resistor; it is required for capacitive loads. The components R11 and C8 form the normal Zobel network.

Pin 8 of the device can provide a current of 5mA to Tr1, whilst pin 5 can sink (that is, accept) a current of 5mA from Tr3. The overall gain of each of these driver transistors and their output transistors must have such a value that, when it is multiplied by the 5mA base current available from the integrated circuit, will enable the required output current to be delivered to the load.

The driver transistors Tr1 and Tr3 in the circuit shown each have a current gain of not less than 40 at a collector current of 0·2A, and the power output devices Tr2 and Tr4 a gain of not less than 30 at 4A. Thus the driver current could reach 40 × 0·005 = 0·2A and the output current 30 × 0·2 = 6A; this exceeds the peak current of 3·87A required into 4Ω for a 30W output and 2·24A into 8 Ω for a 20W output.

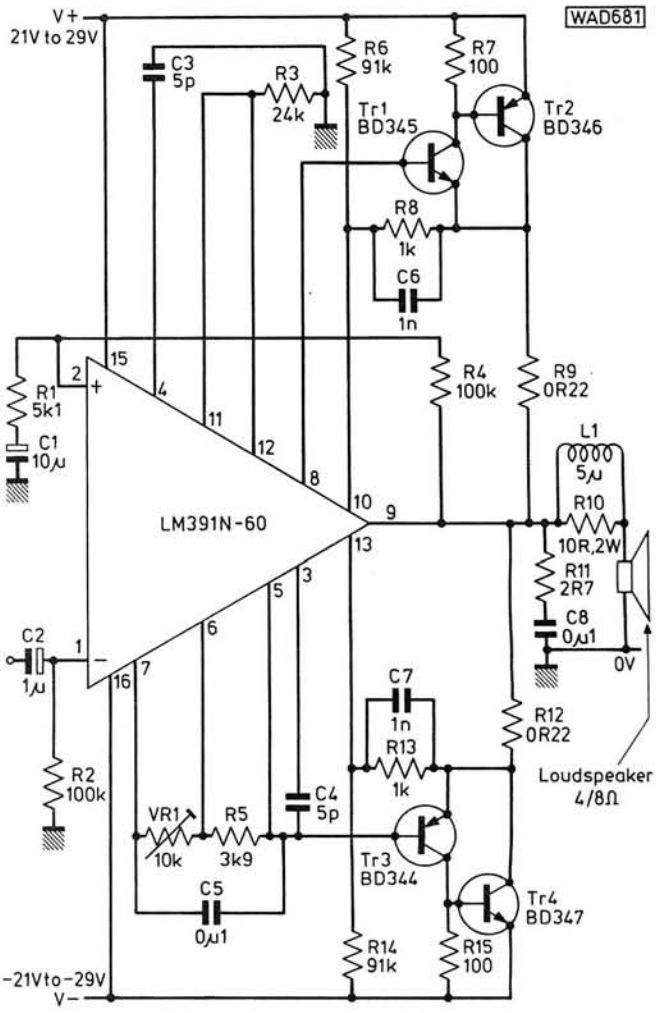


Fig. 17: A power amplifier using an integrated circuit power driver

Any other transistors with ratings of V_{CEO} 60V, I_c 4A and a suitable power rating could be used in the output stages if they satisfy the above condition. The thermal resistance of the heatsink used for each power transistor in the Fig. 17 circuit has been recommended as not more than 4·8°C/W. The driver devices, *Tr1 and* Tr3 do not require heatsinks.

75W Amplifier

The circuit of Fig. 18 shows an amplifier which can operate from ±32V balanced power supplies to feed an output of up to 75W into a 4Ω load. The TIP141 and

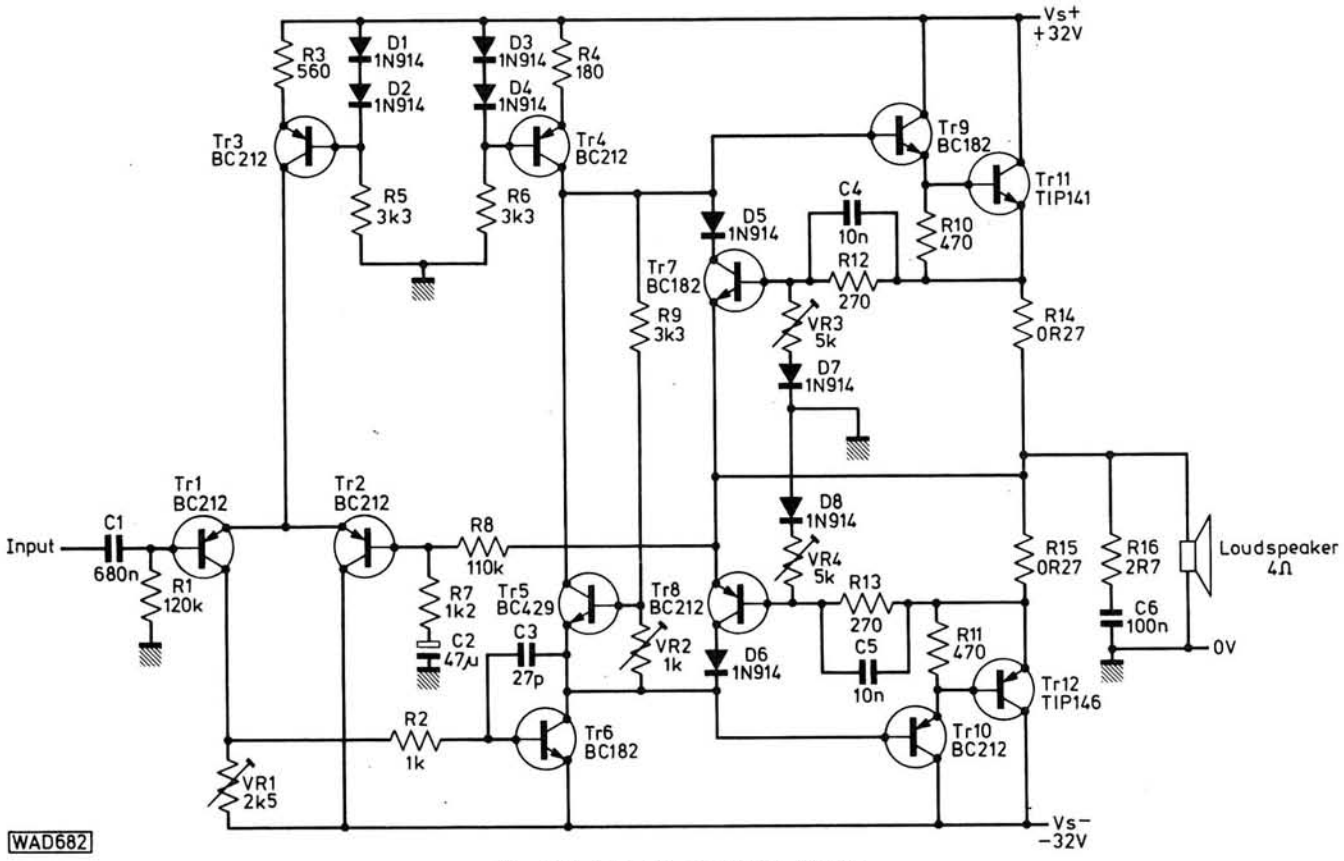


Fig. 18: A 75W amplifier circuit

TIP146 complementary power Darlington devices are used in the output stages, this circuit having been designed by Texas Instruments Limited. As in the case of most amplifiers which are directly coupled to a loudspeaker without a d.c. blocking capacitor, a differential input stage is employed; in the circuit shown, two discrete transistors are employed in this input stage, but a somewhat more expensive dual transistor would provide rather better stabilisation of the circuit with temperature variations.

The constant-current source incorporating Tr3 controls the current to the input stage, whilst the Tr4 circuit controls the constant current in the Tr5 and Tr6 circuits. Tr5 is the V_{BE} multiplier circuit and it is recommended that VR2 is adjusted for a quiescent current in the output stages of 50mA. The Miller capacitor C3 controls the high frequency response and improves stability. The use of the constant-current source of Tr4 in the driver stage increases the rejection of mains hum and enables a high performance to be obtained without the use of a "bootstrap" capacitor. However, the use of a constant-current source providing about 20mA for an adequate drive to the output Darlingtons is not practical owing to the relatively high power involved.

The additional emitter followers Tr9 and Tr10 are therefore used in this circuit between the Tr6 stage and the output Darlingtons. This enables the Tr4 current to be set at a little over 3mA, and Tr4 and Tr6 can be low-power devices.

The circuit of Fig. 18 incorporates automatic limiting of the output current by means of the circuit of Tr7 and Tr8 which limit the current in Tr11 and Tr12 respectively. The current level at which limiting occurs is determined by the settings of VR3 and VR4. If a current of 20A flows in Tr11, this current will develop a voltage of 5·4V across the resistor R14. The components R12, VR3 and D7 act as a potential divider, and if the potential at the base of Tr7 exceeds about 0·6V, this transistor will conduct so that part of the current which would normally flow into the base of Tr9 flows into Tr7. Hence the current in Tr11 is limited to a required maximum value. Similarly the maximum current in Tr12 is set by VR4.

The feedback in this circuit is conventional, the gain being equal to (1 + R8/R7) or about 92 with the values shown.

Ultra-High Power

A circuit which can provide very high power outputs at high currents is shown in Fig. 19. The input part of this circuit is similar to that of Fig. 16, but a MAT-01 ultra-matched dual transistor is used in the input stage. The complementary Darlington pair, Tr6 and Tr7, are 100V devices instead of the 80V devices used as the output devices in Fig. 16. However, in Fig. 19 the Darlingtons are not the output devices, but the output current from each Darlington feeds three 30A power transistors, each with a current-sharing emitter resistor.

If the supply lines are stabilised at ±48V and each output transistor passes 25A, there will be a 5V drop across each emitter resistor. Nevertheless, if the output voltage can swing by ±40V and the peak output current is 75A, this corresponds to a peak power of 3kW or a mean power of 1·5kW. In order to obtain such output levels, the load impedance must be about 0·53Ω; such a low impedance is best obtained by connecting a number of loudspeakers in parallel. A current-limiting circuit like that of Fig. 18 is required, omitted from Fig. 19 for simplicity.

The output transistors shown in Fig. 19 have a 90V V_{CEO} rating, so it is not possible to increase the supply voltages appreciably; higher voltage transistors could be used, but such devices which can deliver high currents are expensive. Each transistor must be mounted on a large

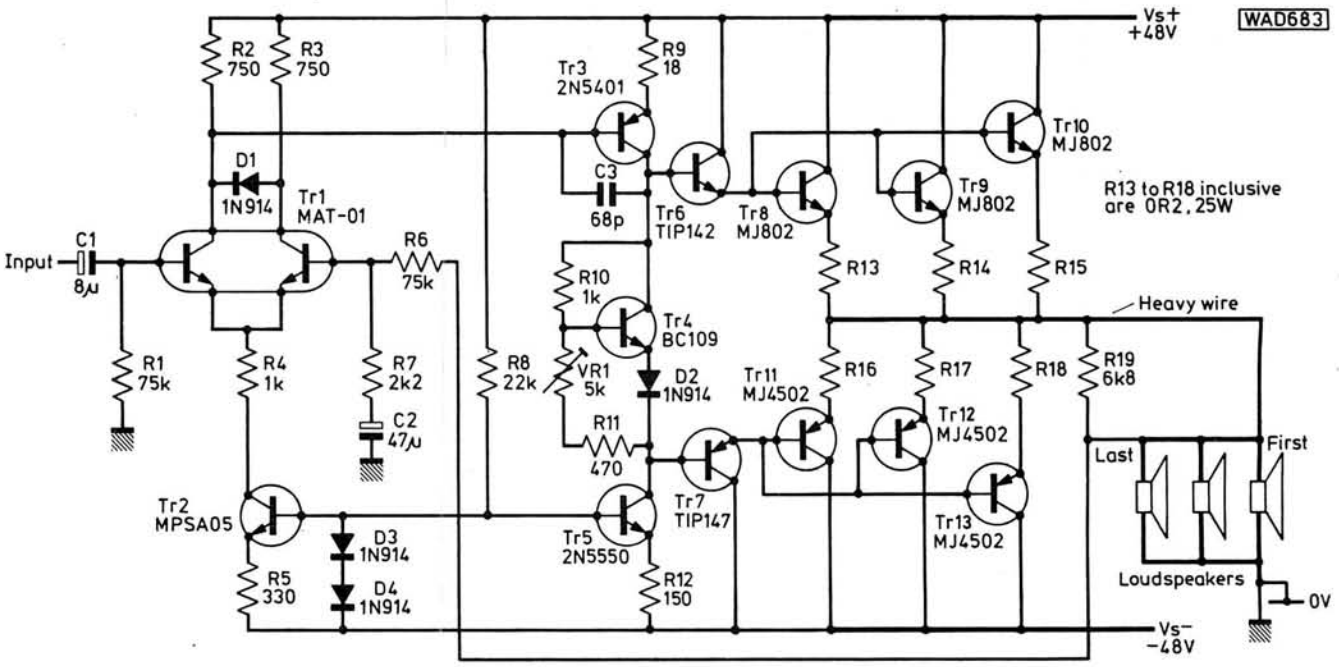


Fig. 19: An amplifier for very high output power levels

heatsink and the Darlington devices must also be mounted on heatsinks. The V_{BE} multiplier device Tr4 should be mounted in thermal contact with these heatsinks. Lower power levels can be obtained by using one or two pairs of complementary output transistors, but the number of output devices which can be used is limited by the current which can be supplied to their bases by Tr6 and Tr7.

The gain of the Fig. 19 circuit is equal to (1 + R6/R7), or about 34 with the values shown. The resistor R19 does not normally have any effect, but if the negative feedback circuit from the speakers should be broken during use, R19 will ensure the feedback level is kept almost unchanged. This arrangement in which the feedback is taken off the last loudspeaker in the chain enables any effects due to the line impedance to be minimised.

This type of circuit is suitable for use as a concert hall amplifier or whenever very high power output levels are required. Distortion is around 0·03% at 1kHz, but increases to about 0·07% at 10kHz. VR1 should be adjusted so that each pair of output transistors passes a quiescent current of some 50mA.

Conclusion

The principles of operation of typical Class B amplifiers have been discussed together with a variety of conventional circuits. No attempt has been made to mention other types of audio amplifier, such as those using VMOS f.e.t.s which can produce very low distortion, or the Class D type (using pulse-width modulation) which offer a very high power efficiency but which produce relatively high levels of distortion (although this may not be true in the case of recent designs). Neither have current dumping amplifiers been examined.

The constructional techniques used when making amplifiers are of much importance. Problems of unwanted oscillation can occur if the input and output circuits are brought into close proximity, whilst inadequate decoupling of the power supply lines can also produce oscillation; decoupling must be effective at very high frequencies as well as at audio and power supply frequencies. Considerable attention must be given to the correct use of earth returns, since if the signal grounding connection is used for the decoupling capacitors, an increased level of third harmonic distortion is likely to arise. The signal ground should be returned directly to the power supply unit and the other ground leads connected together in the amplifier and returned to the power supply ground separately. ●

UNCLE ED'S PAGE

▶▶▶ *continued from page 23*

Internationally agreed symbols are allotted to all the various modulation types, ordinary double sideband amplitude modulation (d.s.b. a.m.) being A3. The letter "A" means amplitude modulation, and the figure "3" means telephony (speech or music). Suffix letters, which at one time were small letters, but are now always capitals, indicate particular varieties of modulation. For s.s.b. with the carrier and one sideband suppressed, the symbol is A3J. This is what I've been talking about this month. Another variety is A3A, which is s.s.b. with the carrier level reduced rather than suppressed. Figures of 16dB or 26dB below the peak power of the remaining sideband are common, with the constant carrier being used for automatic frequency control (a.f.c.) and/or automatic gain control (a.g.c.). This mode was widely used when transmitter and receiver oscillators were not as stable as they are now, though not normally among amateurs.

"Compatible s.s.b.", symbol A3H, comprises one sideband and full carrier. It has the advantage of saving bandwidth whilst still being able to be received on a d.s.b. receiver without a b.f.o. (hence "compatible"), and with less critical tuning. In practice, the carrier level is often reduced by 6dB, giving a power saving at the transmitter without affecting the signal's compatibility.

Transmission of speech via a s.s.b. link does not require the receiver c.i.o. to be **in phase** with the transmitter carrier oscillator, merely on the same frequency. Some types of data transmission do require the two oscillators to be in phase, otherwise the received pulses are distorted.

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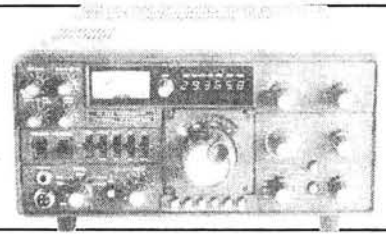

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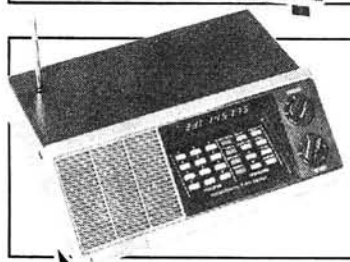

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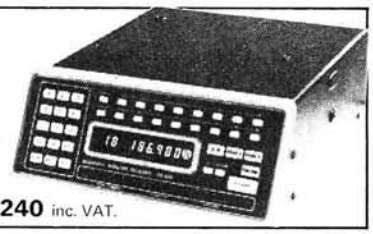

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Understanding Amateur Radio (ARRL)	£4.32
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World Radio TV Handbook, 1981 (Billboard)	£10.62
80m DXing (CTI)	£3.03
99 Ways to Improve Your Short-wave Listening (Sams)	£4.44

Prices include postage, packing and VAT where applicable. Postal terms: cheques/POs with order (not stamps or book tokens). Goods are obtainable (less P & P) at RSGB HQ, 9.30-5pm, Monday – Friday.

The RSGB is the national society representing all UK radio amateurs and membership is open to all interested in the hobby, including listeners. The Society also publishes a complete range of books, log books and maps for the radio amateur. Contact the membership services section for more information about amateur radio, the RSGB and its publications.

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70FM05TR In case you missed October's review of this single channel FM transceiver for 70 cms here are a few details. The receiver sensitivity is typically 0.4μV and uses dual gate MOSFETS and a high quality crystal filter. *The audio output drives an 8Ω speaker.* The transmitter gives 500mW of RF and has a modulator on the pcb. Both boards use readily available crystals and measure a very compact 6" by less than 1¼".
Kit RX £38.50 TX £17.80 — Assembled RX £47.25 TX £25.95

70MC06TR When one channel is not enough then by adding this two pcb set you will have 6 channels on tx/rx. This includes a toneburst for repeaters and a scanner to ease monitoring.
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144SY25B An FM synthesiser for 25KHz steps at 144-146MHz. The output frequencies are 5·5, 11, 22 or 45MHz on receive and 6, 12 or 24MHz on transmit. This will feed most commercial radio telephones and also the **PW NIMBUS.** So for the cost of ten crystal channels you get full band coverage, crystal controlled toneburst, repeater ±600KHz offset, out of lock inhibit and channel selection by channel number.
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INTERESTED? If you would like further details of these and our many other products then send a large SAE (please!) for the latest lists. The above prices include VAT at the current rate but please add 60p p&p on the total order. The prices include all items to make a working pcb module. We do not supply external hardware such as boxes or switches etc. This leaves you free to use the modules in whatever configuration you wish and yet have confidence that the electronics will perform well. We will gladly service any of our products providing it has been built as directed. *We make a small charge for this facility depending on complexity.* Kits when in stock are return of post otherwise 10-14 days. Assembled items 10-20 days.

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IC of the month

Brian DANCE M Sc

Plessey SL6310C

There are quite a wide variety of audio amplifier i.c.s on the market at the present time. They are all basically operational amplifiers which are able to provide moderately high output current with a reasonably high output voltage swing, so that they can feed adequate power to the loudspeaker. The fairly new Plessey SL6310C device can deliver only a small output power level (of the order of 0·5W), but it has the advantage of having two muting pins so that it can be switched off by either a "high" or a "low" voltage being applied to the appropriate pin.

The device requires a low quiescent current of about 5mA (a quoted maximum of 7mA for any device), but obviously needs more power than this when feeding an appreciable signal to a loudspeaker or other load. When muted the current consumption is only about 0·6mA. Therefore this device is very suitable for use with battery power supplies, such as an audio amplifier in a portable radio receiver, or an audio amplifier for hi-fi headphones.

Output Power

As with any audio amplifier, the maximum output power is closely related to the power supply voltage used to drive the device. When fed from a 9V power supply, the SL6310C is guaranteed to be able to deliver at least 400mW into an 8Ω loudspeaker load, a value of 500mW is typical for this type of device. Variation of output power with change in the supply voltage for the 4Ω, 8Ω and 16Ω load impedances is shown in Fig. 1.

The SL6310C is specified for operation over the power supply voltage range of 4·5V to 13V: 13V should be regarded as the upper working limit, so as to allow some tolerance for any supply variation. If the supply potential exceeds 15V, even for a small fraction of a second, the device may be damaged.

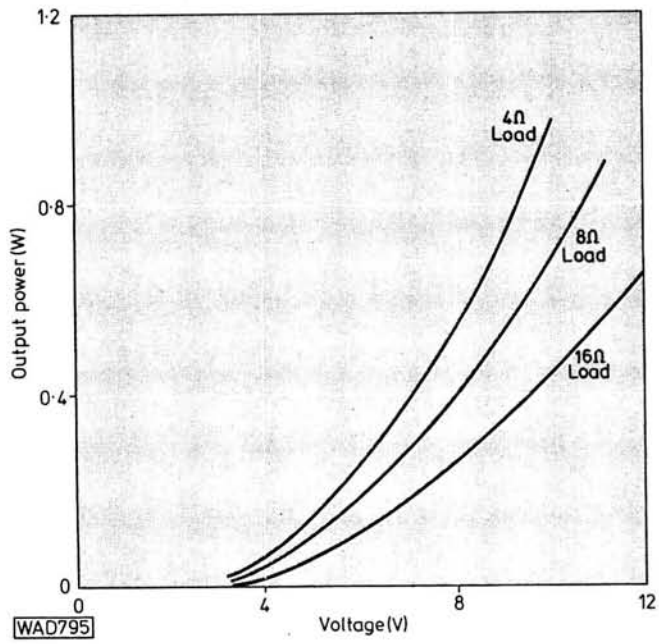

Fig. 1: Output power with varying supply voltage

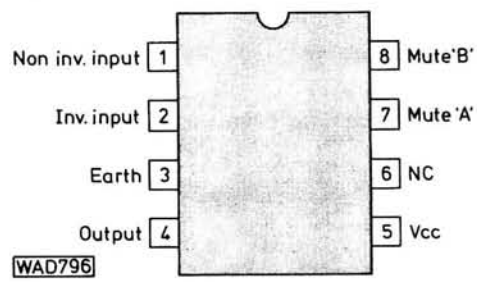

Fig. 2: Pin-outs for 8-pin d.i.l. package

Connections

The SL6310C is available in an 8-pin d.i.l. package with the connections as shown in Fig. 2 and also an 8-lead circular metal i.c. package with connections as in Fig. 3. There are no real differences in performance, although the d.i.l. package can dissipate up to 0·5W and the circular metal package 0·45W both at 85°C.

It may be noted that the device has the usual non-inverting and inverting inputs of an operational amplifier together with the two muting pins whose use will be discussed later.

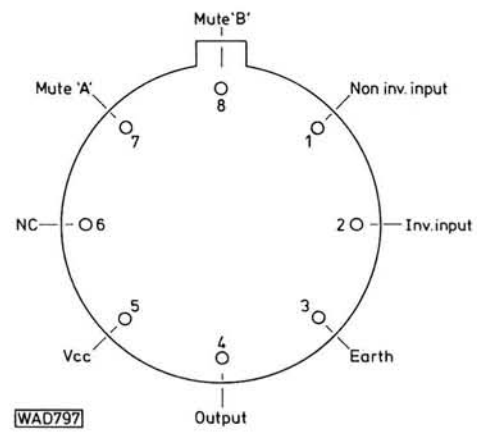

Fig. 3: Pin-outs for circular package

Amplifier Circuit

A simple audio amplifier circuit using the SL6310C is shown in Fig. 4. The input resistors R1 and R2 apply a bias to the non-inverting input of pin 1 of about half the power supply line voltage, and this raises the quiescent output voltage to a similar value so that a maximum output voltage swing can be obtained. The input impedance is approximately equal to R1 in parallel with R2; about 100kΩ with the values shown. The input capacitor pre-

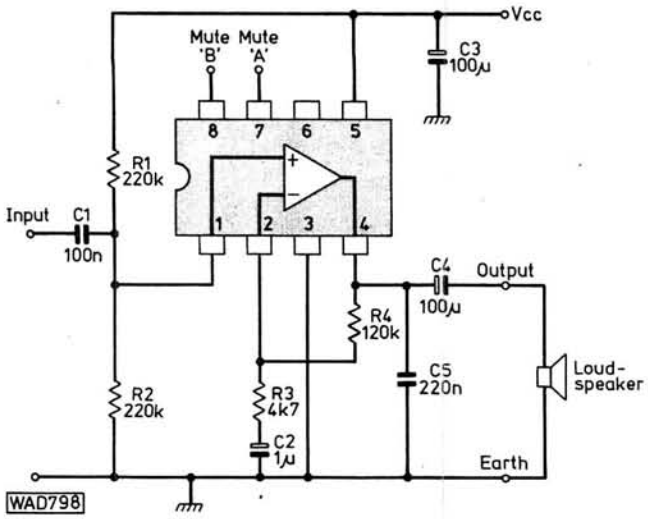

Fig. 4: A simple audio amplifier using the SL6310C

vents the bias voltage from being affected by any input connection made to the device. The input signal is fed to the non-inverting input for convenience so as to keep the input impedance of the circuit high.

The voltage gain of the SL6310C device without feedback is not less than 40dB and is typically 70dB, but the feedback provided by the resistors R3 and R4 reduces this gain. The voltage gain is equal to (R3 + R4)/R3 and the manufacturer recommends that this should be between 3 and 30 for best results.

The gain of the device without feedback falls off at frequencies over 600Hz (shown in Fig. 5). The high frequency response can be reduced by connecting a small capacitor across R4 to provide increased negative feedback at high frequencies. The response at low frequencies is determined by the input and output coupling capacitors and by the capacitor C2.

Muting

If the muting facility of the SL6310C is not required, the two muting connections may be left unconnected as in Fig. 4. If mute control "A" at pin 7 is left open-circuit or connected to a potential within 1V of the positive supply line through a 100kΩ resistor, it will not affect the operation of the circuit. However, when the potential of this pin is reduced to within 1V of the negative supply potential (through a 100kΩ resistor), the audio output from the SL6310C is muted.

Similarly the mute control "B" of pin 8 may be left open-circuit or connected to a potential of less than 1V for normal operation of the amplifier circuit. If a potential of over 2·5V is applied to pin 8, the amplifier will be muted. As the input resistance of the pin 8 circuit is of the order of 100kΩ, this pin is suitable for interfacing with the output of c.m.o.s. logic devices.

It should be noted that the manufacturer recommends that only one of the muting pins be used at any one time. The unused pin should be left unconnected.

The variation of the quiescent supply current required by this amplifier is shown in Fig. 6, for both the muted state (left-hand vertical scale) and for normal non-muted state (right-hand vertical scale).

When an output power of 400mW is being obtained using a 9V power supply and with the gain set to 28dB, the typical total harmonic distortion is 0·4 per cent (with a maximum value of 3 per cent).

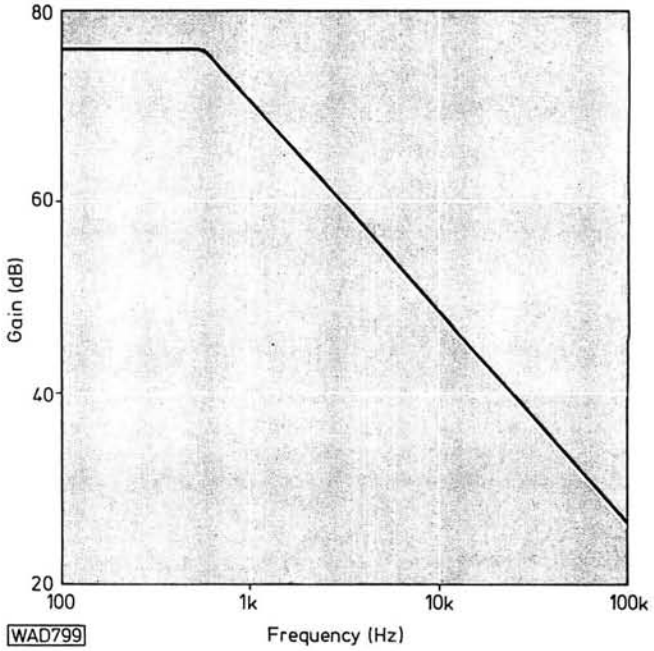

Fig. 5: Open-loop gain versus frequency

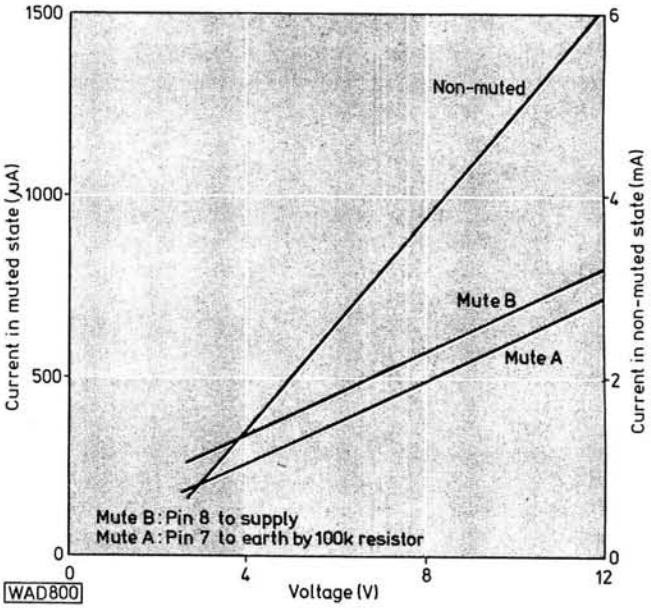

Fig. 6: Quiescent supply current variation

The input bias current from the amplifier is typically 0·2µA with a maximum value of 1µA. This current flows out of pins 1 and 2, since *pnp* transistors are used in the internal input stage of the device.

A switchable audio amplifier circuit of this type can be used when it is necessary to silence the circuit whilst someone is speaking. For example, in an intercom system it could be used to ensure that the audio is muted when one is speaking at the end of the link concerned. The muting could be controlled by the output from a suitable logic circuit device. It would also be possible to silence the amplifier when acoustic feedback from the loudspeaker to a microphone produces a "howl".

continued on page 63 ▶▶▶

NEWS NEWS NEWS

Mobile Rallies

In response to my "Can I Help You" notices in the "News" column, I am receiving club activity information in good time for publication; many thanks to all club secretaries. This will enable me to let readers have a reasonable notice of forthcoming events.

Have you got your diaries out? Yes, then off we go!

Southend and District Radio Society have organised their mobile rally at *Southend Airport Exhibition Centre, Aviation Way, Southend-on-Sea, Essex,* on Sunday, 26 April. Among the many attractions will be bring and buy stalls, aircraft museum, talk-in station, licensed bar, refreshments and parking for 300 cars. Further details from: *F. Thorogood G8ORV, 30 Grange Gardens, Southend-on-Sea, Essex. Tel: (0702) 616239.*

The Drayton Manor Mobile Rally organised by The Midland Amateur Radio Society and Stoke-on-Trent Amateur Radio Society will take place on Sunday, 26 April at Drayton Manor Park near Tamworth, Staffordshire.

The Park is located on the A4091, which is within easy reach of the M1, M5 and M6 motorways, it is well signposted.

There will be all the usual attractions including special entertainments for all the family. Further details and free car stickers are available on request to: *Norman Gutteridge G8BHE, 68 Max Road, Quinton, Birmingham B23 1LB. Tel: 021-422 9787.*

The YMCA Amateur Radio Club in Maidstone are holding their rally on Sunday, 3 May at the *YMCA Sportscentre, Melrose Close, Cripple Street, Maidstone ME15 6BD. Tel: (0622) 43317.*

All the Sportscentre space has been allocated to the rally and there will be a special section for the XYL and YLs. Also this year there will be a licensed bar. Further details from the Sportscentre.

Plymouth Radio Club, following a very successful rally last year, will be holding their fourth annual rally on Sunday, 24 May at their meeting place at *Tamar Secondary School, Paradise Road, Millbridge, Plymouth PL1 5QW.* Further details from: G4KXZ at the club QTH.

G-QRP × 1000

December 1980 represents an important landmark in the history of the G-QRP Club, the organisation devoted to promoting interest and growth in low power amateur radio communication (5 watts or less). The landmark was the enrolment of their 1000th member, John Bazley G3HCT. John, a past President of the RSGB, is a very keen DXer and is currently on the ARRL Honour Roll with 350 countries confirmed.

The G-QRP Club has come a long way since the winter of 1974/75 when "Sprat" No. 1, the Clubs' quarterly bulletin, was published by George Dobbs G3RJV, the founder of the Club, and circulated to just 30 members. By the winter of 1976/77 the membership list stood at 500 and included enthusiasts from all over the world.

The Club has members in 32 countries and all continents. Membership is open to any amateur or s.w.l. in the world with an interest in QRP. The subscription is £3.50 or $9 US, and all enquiries regarding membership should be sent to: *The Secretary, George Dobbs G3RJV, 17 Aspen Drive, Chelmsley Wood, Birmingham B37 7QX.*

Computer Club Call

With computer technology extending into virtually every aspect of electronics, readers may be interested in learning of the activities of the Amateur Computer Club.

The A.C.C., one of the oldest, if not the oldest, amateur computer club in the country (founded 1972), is a national organisation to promote interest in amateur computers and computing, to facilitate the exchange of information and ideas, and to help members with their home computer systems.

A.C.C. membership is currently £4.50 per year, and is open to anyone with an interest in computers and computing. Further details and membership forms are available from (s.a.e. please): *Membership Secretary, Jim MacDonald, 1 Carlton Court, Studley Grange Road, London W7 2LU.*

Offer from Ambit

Ambit International, the component suppliers, have asked me to pass on to readers their standing offer of "free bits" for enthusiasts with viable ideas for equipment designs where the intention is to produce a magazine article at the end of the project.

Further details from: *Ambit International, 200 North Service Road, Brentwood, Essex CM14 4SG. Tel: (0277) 230909.*

Classic by G3VA

The 18th edition of the very popular book, "A Guide to Amateur Radio" by Pat Hawker G3VA is now available.

Priced at £5.20 (£6.18 incl. p&p), the 148-page book can be obtained from: *RSGB, 35 Doughty Street, London WC1N 2AE. Tel: 01-837 8688.*

New Catalogue

Greenweld, the electronic component and equipment suppliers of Southampton, recently published their 1981 catalogue.

New additions this year include kits, r.f. connectors, keyboard switches, new multimeters, many more transistors and i.c.s, etc. Also included are discount vouchers worth 60p, a 1st class reply paid envelope and free bargain list.

The catalogue costs 50p plus 20p p&p and is available from: *Greenweld Electronics Ltd., 443 Millbrook Road, Southampton SO1 0HX. Tel: (0703) 772501.*

New President For SERT

The Council of the Society of Electronic and Radio Technicians recently announced that Mr T. Bryce McCrirrick had accepted an invitation to become President effective from 1 January 1981, in succession to Air Vice-Marshal A. A. Morris who has held office since 1976.

SERT, 57/61 Newington Causeway, London SE1 6BL. Tel: 01-403 2351.

Letters to the Editor intended for publication must be original, and not duplicated to or copied from other publications. We reserve the right to shorten or edit them if necessary.

Letters

CB Australia

Sir: Having suffered the clumsy introduction of 27MHz CB radio in Australia, having seen the profound social advantages of it and having been deeply involved in the debate relating to its continuation and expansion, it is very sad for me to see, as an interested citizen and radio amateur, your magazine taking such a negative attitude to 27MHz CB radio. Australian CB operators and amateurs hope that this form of CB radio will continue with gradual lifting of the restrictions on its use. It is to be effectively policed.

With a little bit of luck, the rest of the world will have 27MHz CB, as its allocation in countries such as Japan spoilt the megahertz for any other use. I hope the British Government is more generous than your magazine suggests, and that a final decision on their part awaits the investigation into the matter being undertaken at present in this country.

F. E. Stewart Mair FRACP VK3BSM
Victoria, Australia

Speech Processor

Sir: You may be interested to learn that the AF Speech Processor design published in *PW,* January 1980, has been a resounding success in Sydney, Australia, where to my own knowledge at least a dozen units are in use.

Users include: Ken VK2VHQ, Reg, 'AKY, Peter 'VJB, Eunice 'VHB, John 'VUZ, Doug 'VVG, John 'VSF, Peter 'AGB, Ted 'LF, Ron ZL3SA, and me, plus a number of CB operators who, because of the illegal use of such equipment, naturally prefer to remain anonymous! The use of CB gear is legal but it may not be modified in any way, and that includes the use of any add-on equipment.

My own 80 metre s.s.b. rig is entirely home-brew and radiates a whole 2 watts p.e.p. via a home-brew transmatch into a half-wave antenna. In recent weeks I have had two ZL contacts plus one into Tasmania, and plenty into Victoria and Queensland.

In all DX contacts, reports indicate a definite improvement in readability, though at the expense of speech quality. However, the 1200 miles to ZL-land on 2 watts s.s.b. on 80m is pretty gratifying in anyone's language. If the going gets really rough, I use a little linear built around a single 2N5590 to put 8 watts up the spout—real QRO stuff. On behalf of those Down Under, thanks for a good design.

Clive S. Wallis VK2VWK/YTC
Miranda, NSW
Australia

Introducing RTTY

Sir: I am writing to compliment you on your recent publication of Jeff Maynard's introduction to radio teletype. If you will permit me, I would like to bring your readers up to date in respect of membership and the activities of the British Amateur Radio Teleprinter Group, which Mr Maynard kindly praised at the end of his article.

At its Annual General Meeting earlier this month, the Group's annual subscription was slightly increased to £2.50, with a joining fee of 50p for new members. The member now responsible for membership matters, from whom further information may be obtained, is:

Mrs Irene Double,
89 Linden Gardens,
Enfield,
Middlesex.

Your readers may also like to know that the times and frequencies of the GB2ATG news bulletins are included in the quarterly Group Newsletter, which all members receive upon joining.

The 1981 BARTG Convention will be held in Harpenden Public Hall on Saturday, 18 July.

Trevor Campbell Davis,
Chairman, BARTG,
London W3

Amateur Radio in NI

Sir: I have just read "Big Muff's" letter in January '81 *PW* and I am appalled at the naivety of his enthusiasm for CB in Northern Ireland. As elsewhere in the UK the problems caused by these head-cases are enormous. Let me give you a few illustrations. How many people are being charged for TV service where the problem is, in fact, 27MHz TVI and find the problem is just as bad when the set is returned? I know several in my own street. This week I was stopped by a police motorcyclist on a country road who thought my $\frac{7}{8}\lambda$ 2-metre whip was for 27MHz. He complained of interference being caused on certain police channels here by "good buddies".

In Northern Ireland we have a very friendly bunch of radio amateurs numbering now about 800 licences. In recent months several of the newly licensed amateurs I have spoken to have turned out to be disillusioned CBers. The RAE classes all around Northern Ireland this winter are overflowing with "good buddies" only too keen to escape the confines of the constant interference, foul language and restricted range of 27MHz. More power to them I say. What really annoys me is that a number of kids are managing to buy (or steal in certain known instances) 145MHz equipment, instead of 27MHz equipment, and pollute our three repeater stations GB3NI, GB3WT and GB3LY with their "30 for a copy" nonsense.

May I take the opportunity of informing "Big Muff' and any other Northern Ireland CB readers of *PW* that the radio amateurs here are not against you. Religion and politics have never had a place in amateur radio. As the chairman of the oldest amateur club in Ireland we would welcome anyone with an interest in radio communication. We meet every Tuesday evening in our clubroom on the fourth floor of the City of Belfast YMCA in Wellington Place. We also meet on Saturday afternoons and our station GI6YM is known worldwide. Last year we made contact with over 3000 stations in all parts of the world.

David Hutchinson
GI4FUM/EI4DJ
City of Belfast YMCA Radio Club

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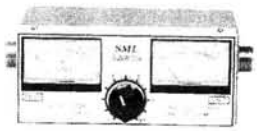

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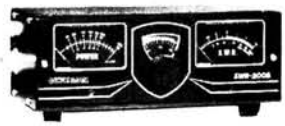

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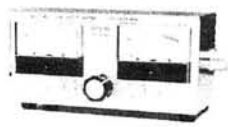

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2m Repeaters

DATACARD

Channel	Repeater Input (MHz)	Repeater Output (MHz)
R0	145·000	145·600
R1	145·025	145·625
R2	145·050	145·650
R3	145·075	145·675
	145·100	145·700
		145·725

0 SS

7 GN

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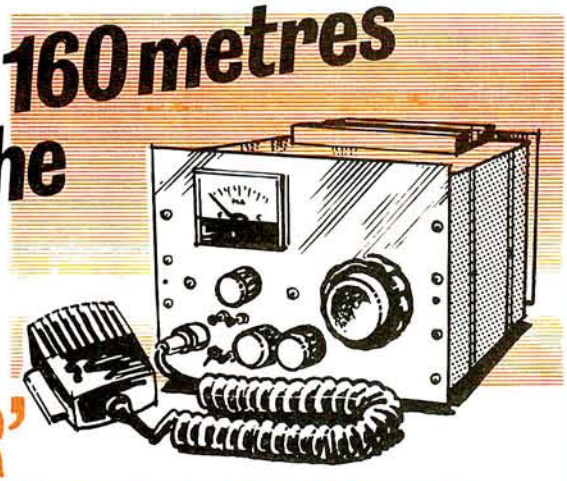


Modular design lets you build and align this rig without need for expensive test gear. Covers sideband and c.w. modes and operates from a 12V d.c. supply

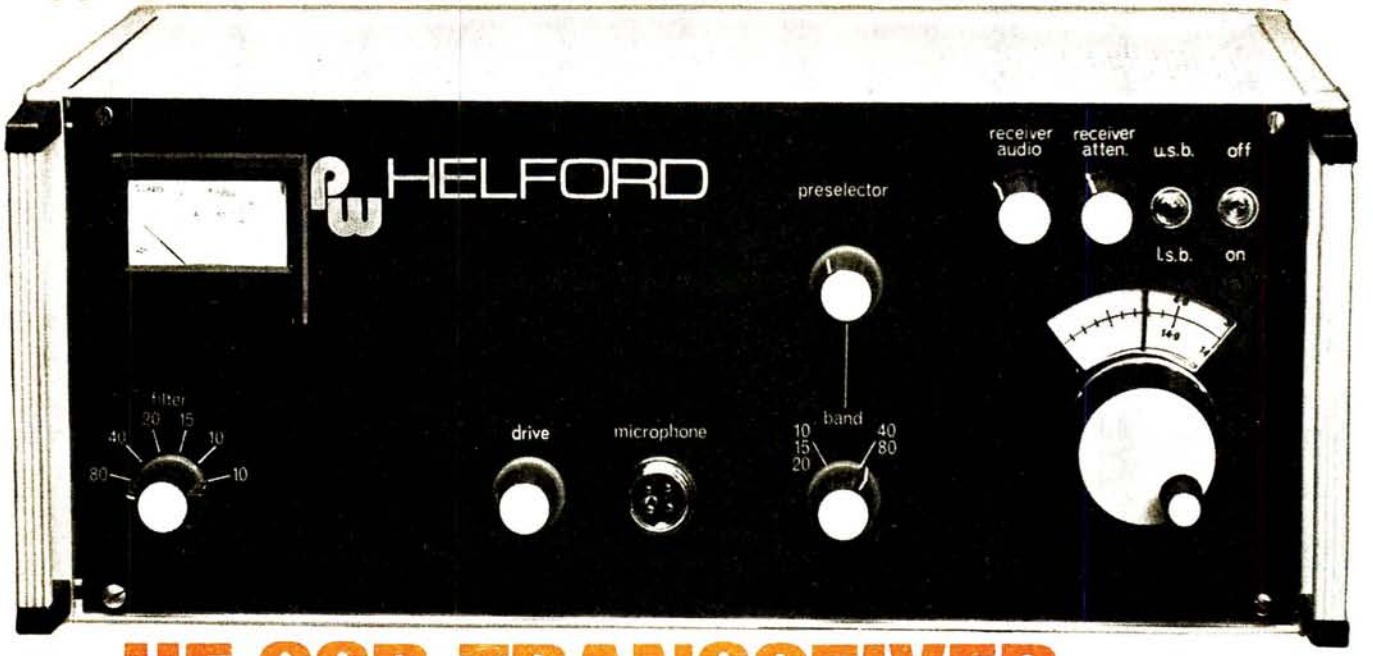
SUPPRESSING & PROTECTING THYRISTORS

The use of thyristors is increasing daily. This series looks at ways of containing the interference which they generate, and of protecting them against destruction

ON SALE 3 APRIL

PW HELFORD

Part 6



HF SSB TRANSCEIVER

Vic Goom G4AMW

By now you should have the basic radio side of the Helford completed leaving the power supply switching and the main metalwork to finish the project.

The p.a. and driver stage bias regulators were covered in an earlier part and the only remaining power supply circuit is the 6V stabiliser. This is a conventional regulated supply using a 7805 5V regulator chip with the common terminal lifted by 1V to give the required 6V. The circuit diagram of the supply is shown in Fig. 27 and the constructional details in Fig. 29. A heatsink is needed and this is of the finned variety having a thermal resistance of 10°C/W.

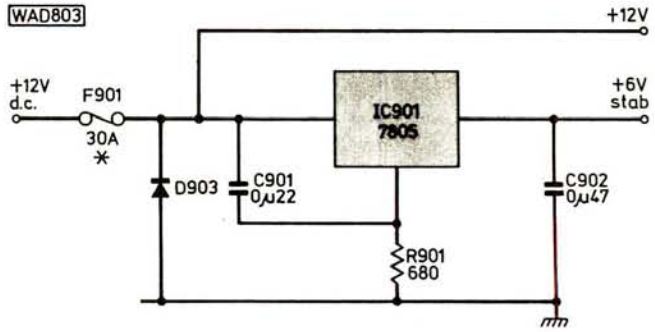


Fig. 27: The circuit diagram of the 6V stabiliser

6V STABILISER

Resistors

¼W 10%

680Ω	1	R901

Capacitors

Polyester

0·22µF	1	C901
0·47µF	1	C902

Semiconductors

Diodes

1N4148	2	D901,902
See text	1	D903

Integrated Circuits

7805	1	IC901

Miscellaneous

Heatsink 10°C/W; Printed circuit board; Insulating kit for IC901; Fuse 30A and holder to suit.

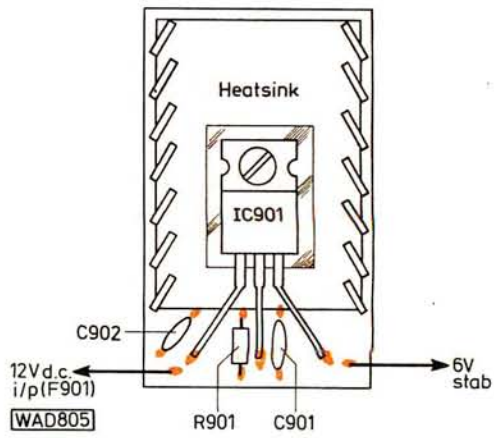


Fig. 28: Full size copper track pattern for the 6V stabiliser board. Fig. 29 (right): Component placement. Components are soldered directly to the copper

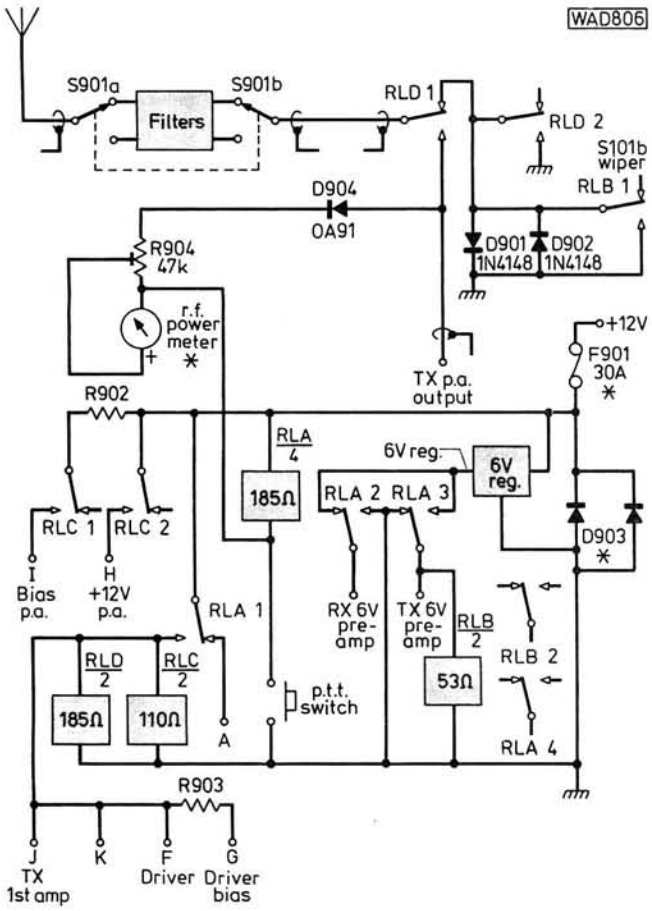
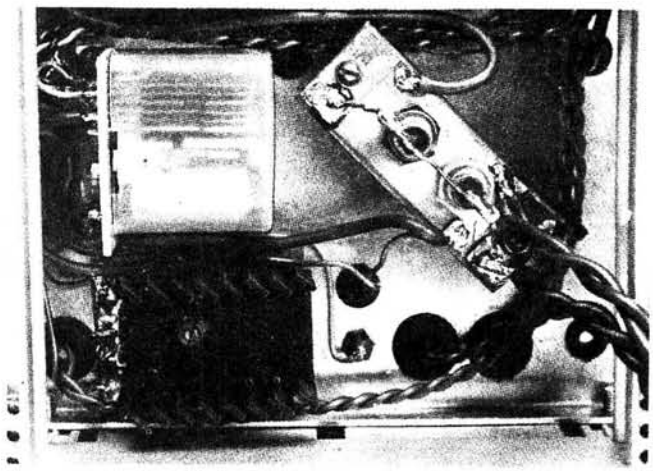


Fig. 30 (above): The circuit for the power switching of the *PW* Helford. D903 can be a single diode of, say, 50A current rating if available. If not then two 26A diodes may be used. The connection points referred to appear in Fig. 31, except F, G, H and I (see text)

Power Supply Switching

The receive/transmit mode of the rig is controlled by switching the d.c. supply rails to the appropriate sections of the circuit and this is carried out by relays operated by the p.t.t. switch. At the same time the antenna is switched to or from the receiver or transmitter. Fig. 30 shows the relay and power supply switching details. The nominal 12V d.c. supply is protected against short-circuits by the protection diode D903. Connections to F, G, H and I in Fig. 30, are made to the appropriate +12V rails on the bias regulators and amplifiers.



The photograph above shows the 6V stabiliser, relay A and the protection diodes D903

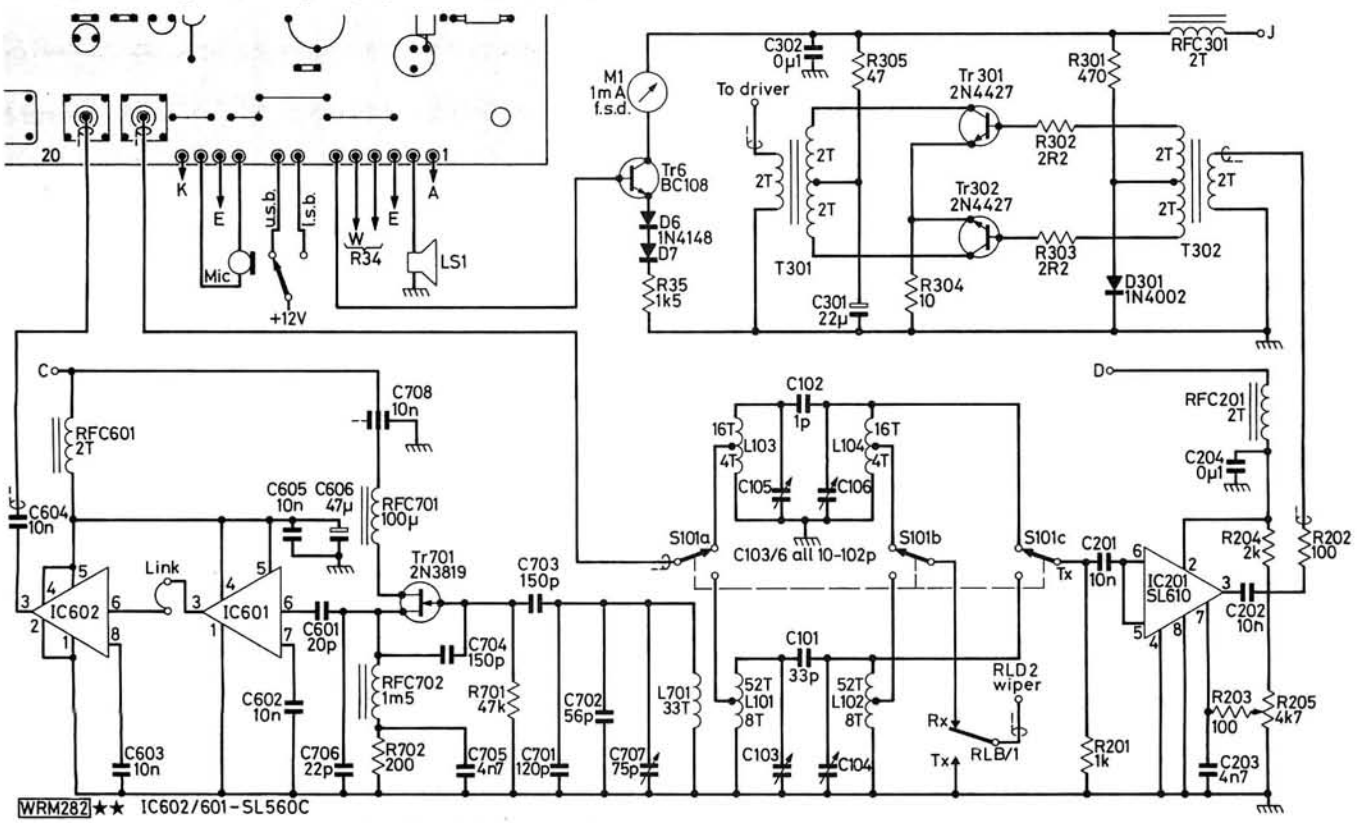


Fig. 31: This is a modified and corrected version of Fig. 5

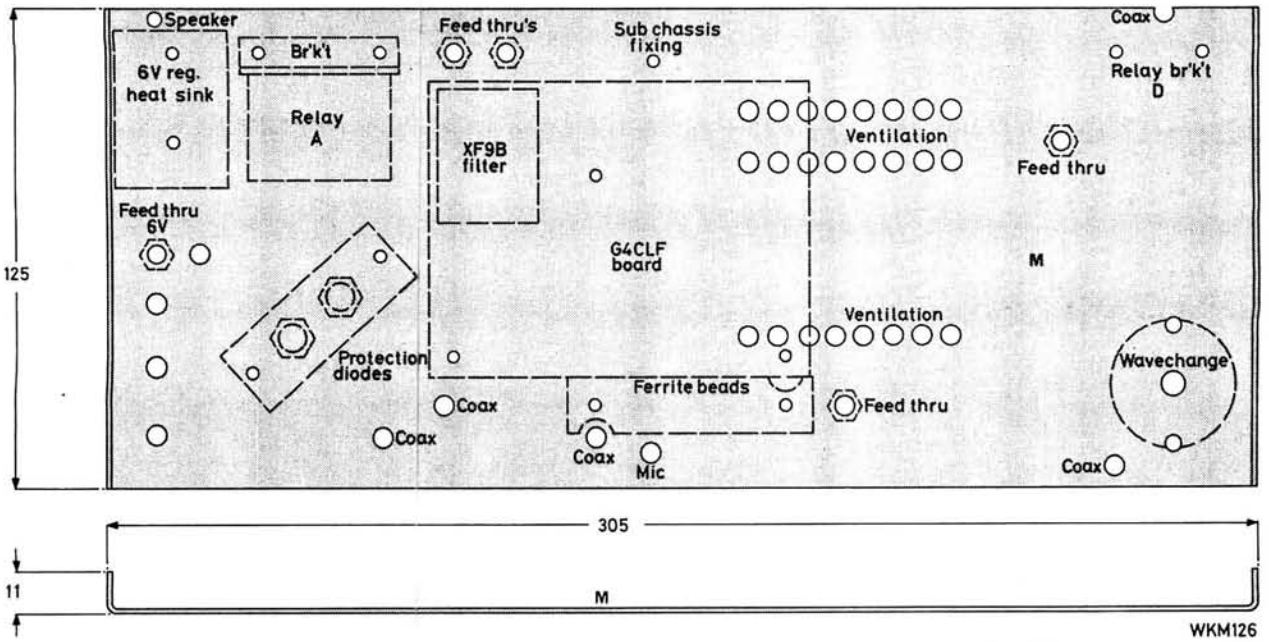


Fig. 32: Details of the rear screen of the *PW* Helford. The picture on the left shows this panel

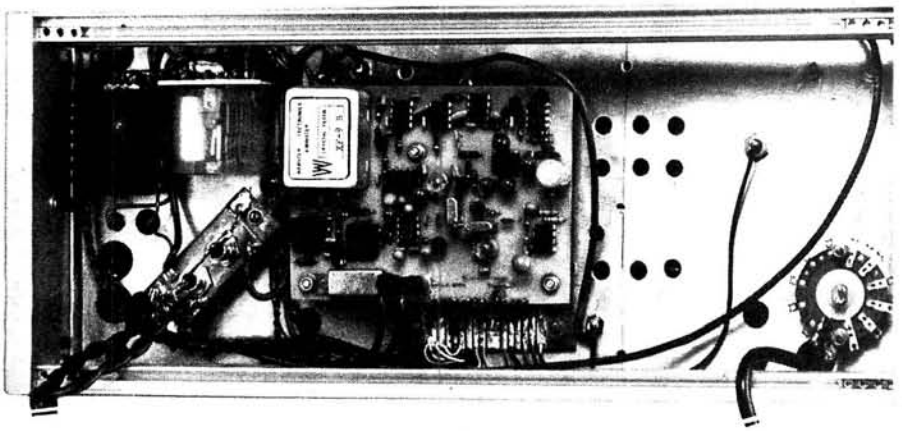
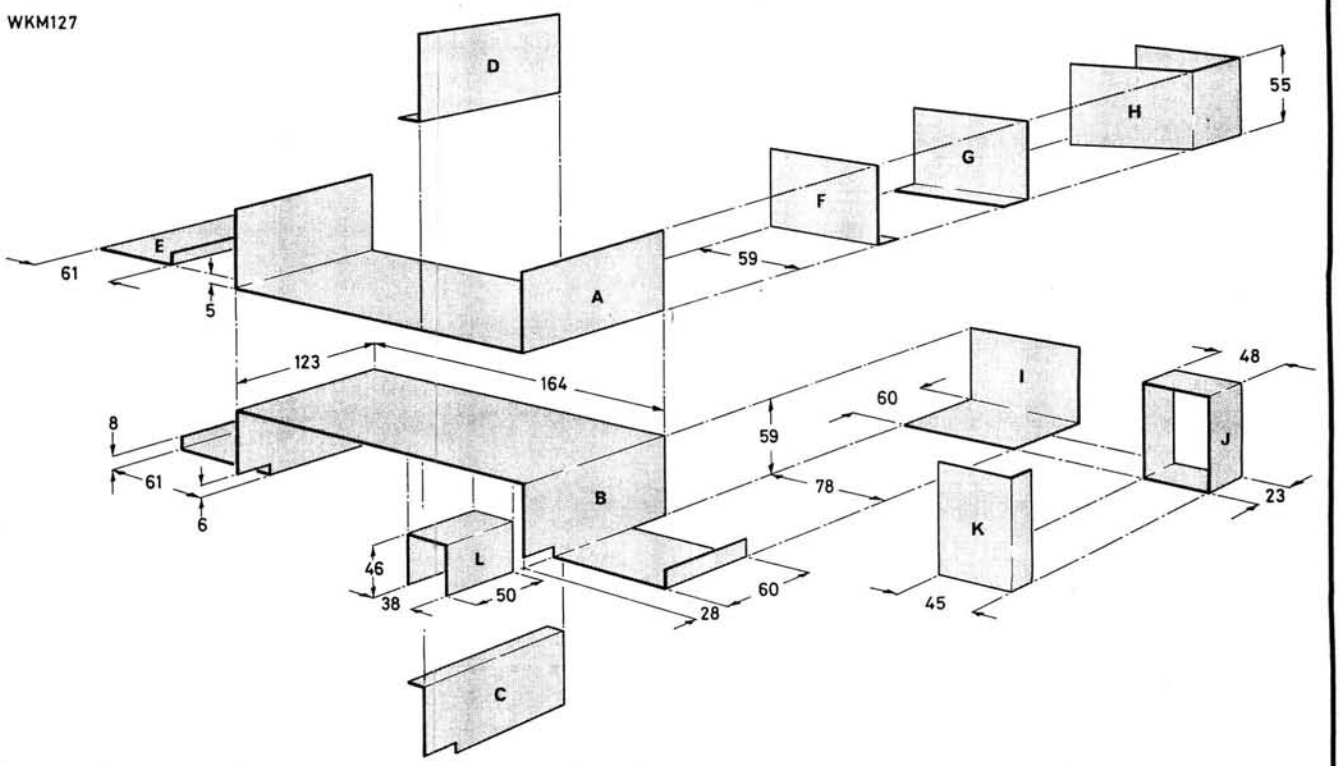


Fig. 33 (below): Exploded view of the various component parts of the *PW* Helford metalwork. These are made from 18 s.w.g. aluminium sheet. Parts H and L are the heatsinks for the two bias regulators

WKM127



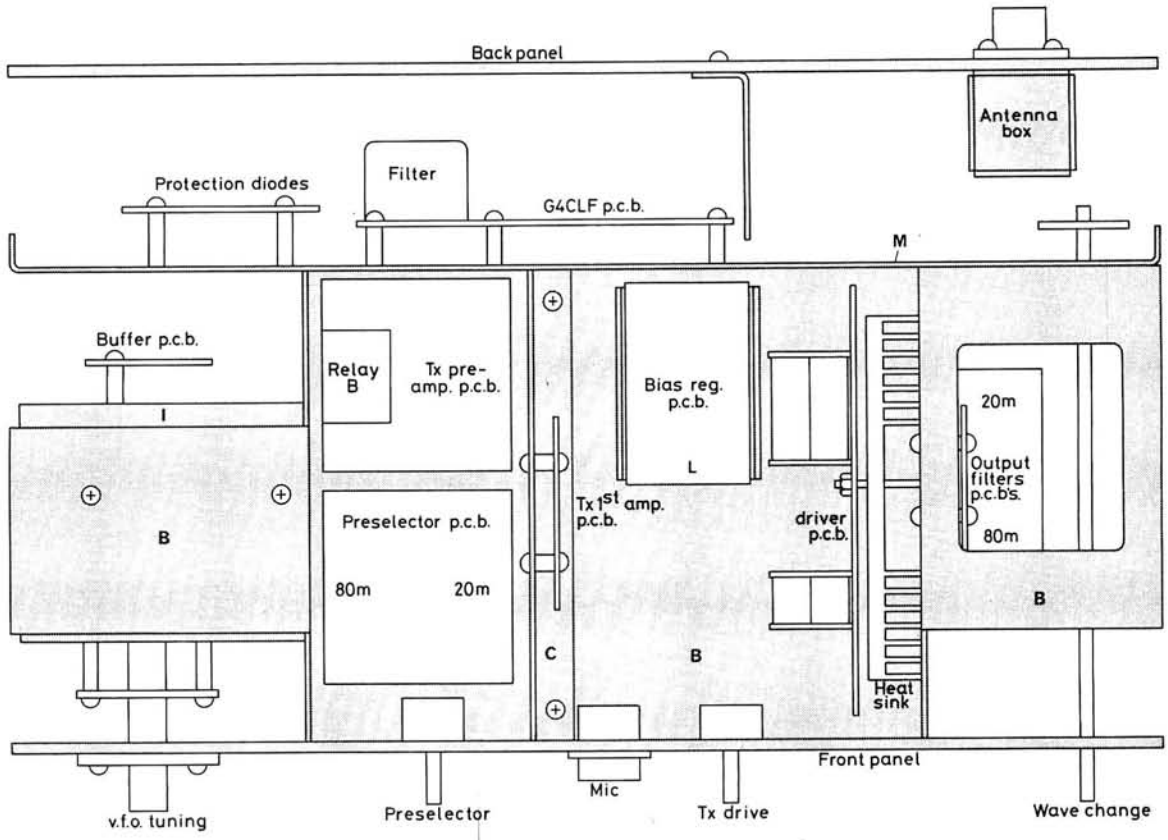
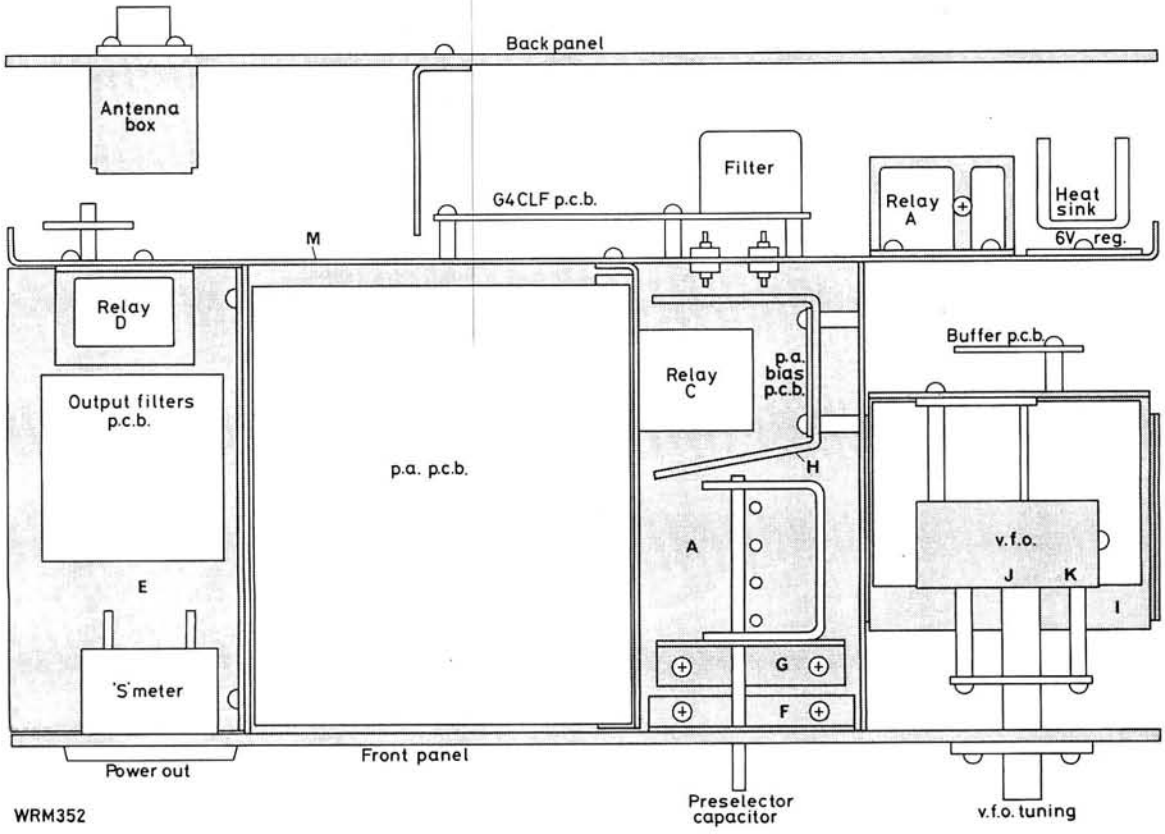


Fig. 34 (above): Underside view of the *PW* Helford case showing how the various screens and p.c.b.s mount. Fig. 35 (below): Top view of the case



Metalwork

The project was designed right from the start to fit into the West Hyde case specified. It is recommended that you stick to this design unless you are satisfied that you know exactly what you are doing and do not expect either the magazine staff or the designers to come to your aid if you run into problems.

The metalwork is built up from 18 s.w.g. sheet aluminium following the drawings given in Figs. 32 to 35. The main sections are screwed to the rails of the case and unless you are really expert at sheet metalwork it pays to make a card replica first to check on the fits. The card patterns can then be used to mark out the aluminium sheet.

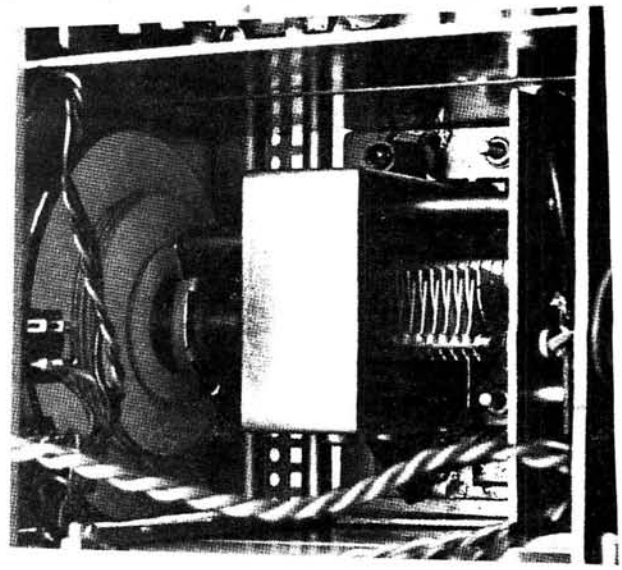
Where leads pass through the metal screens, feed-through capacitors are used except in the case of co-axial cables when grommets should be used to prevent chaffing. Check on the fits and clearances around the various p.c.b.s before the final wiring is completed.

In detailing the various metal screens no dimensions have been given for fixing holes for the p.c.b.s, as it is intended that constructors should use the boards themselves as templates to ensure that the fixing holes are correctly placed.

No details are given of the antenna socket screening box as the dimensions for this will depend upon the socket chosen by the constructor. It should be made from aluminium sheet and be screwed to the rear panel to completely encase the rear of the antenna socket.

Relays should be mounted on suitable brackets and again no details have been given as these will vary from relay to relay.

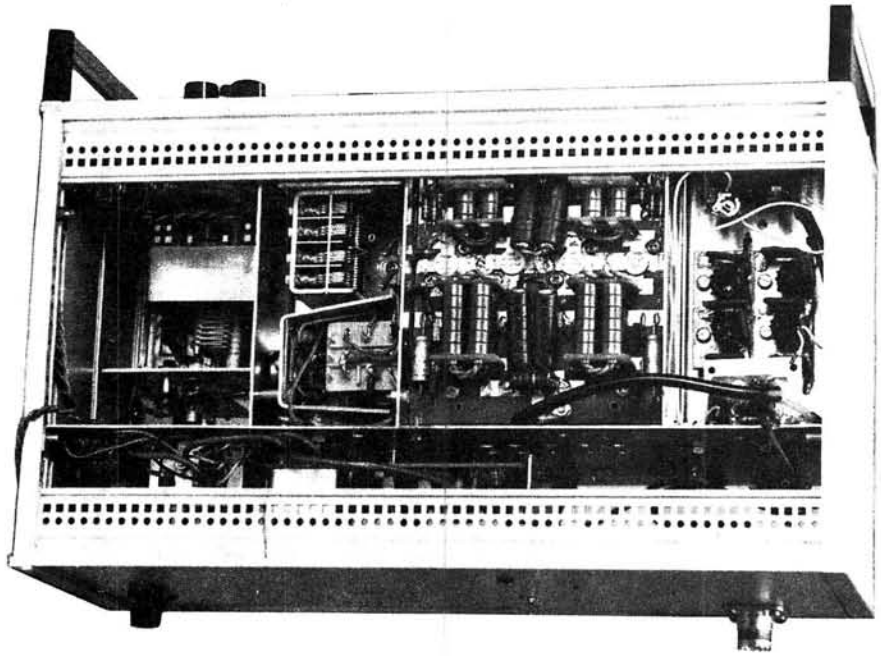
The wave-change switch is long enough to pass through the main screen so as to be able to accommodate future extension of the transceiver. It is advisable to add an extra dummy wafer to the end of the switch behind the main screen to act as an extra bearing for the shaft.



Details of the v.f.o. tuning capacitor mounting bracket (J) together with the dial arrangements

Dial

The dial is made up from layers of card cut into circles and stuck together with double-sided adhesive tape. The dial when complete and marked up is screwed to the flange on the reduction drive. The calibrations should be drawn so as to appear in the window cut-out of the front panel. A transparent film overlay ready calibrated for sticking over the card dial former is available from *PW* Editorial Offices, price 75p including postage.



View of the top of the *PW* Helford with the lid removed. The p.a. is central with the preselector capacitor and the v.f.o. to its left. The speaker is mounted on the lid with its magnet fitting into the space above the v.f.o. capacitor

Readers who intend to operate the Helford 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.

PW Helford Builders' Net

The designer, Vic Goom G4AMW, has started a net on 80m for builders and users of the *PW* Helford. The net is held every Monday evening at about 1930 on 3·72±QRM and will be run either by G4AMW or G3XBZ who will be prepared to answer queries and problems.

Front Panel

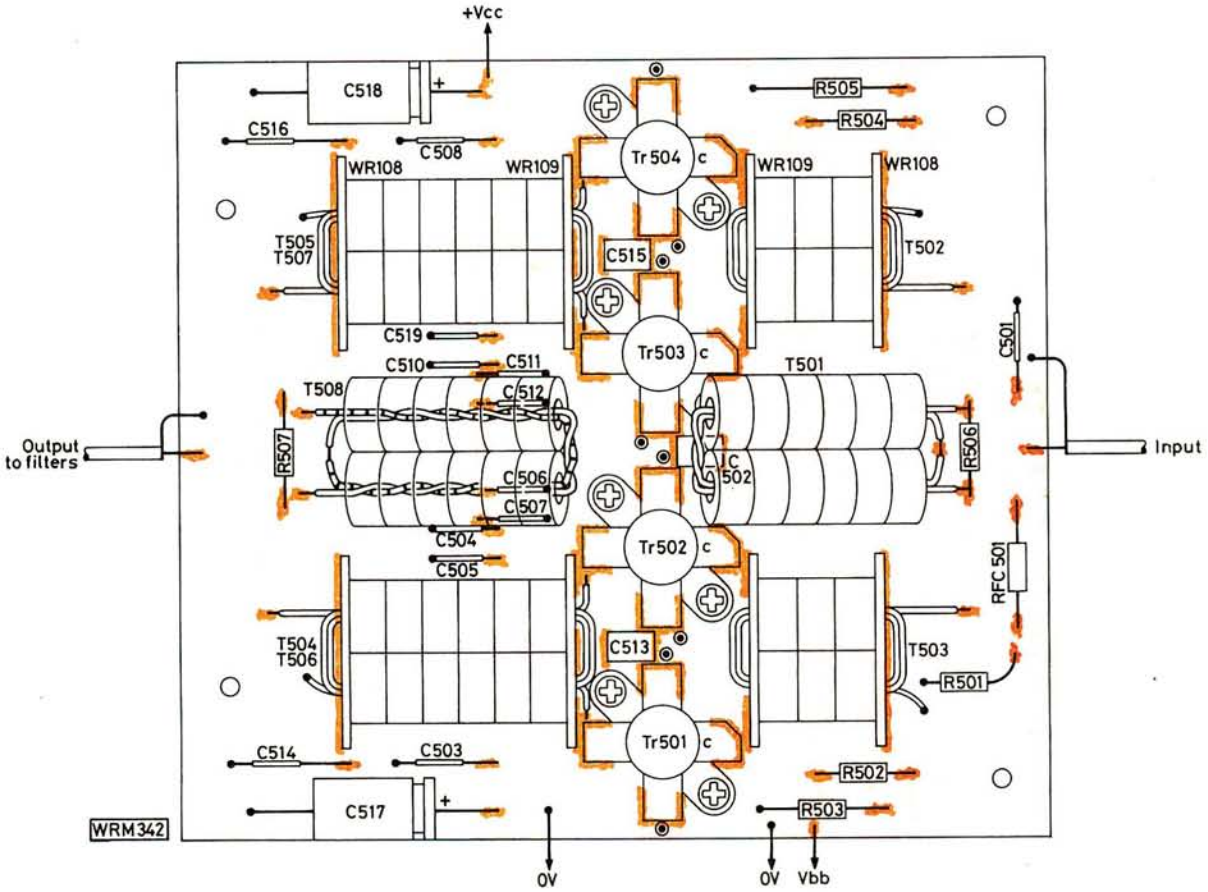
The front panel should be carefully drilled for the switches and other controls and the large cut-out for the meter made. The aperture for the dial must be very carefully cut out and filled to shape. Our prototype front panel was made for us by D. J. Pattle, Juniper, Hillbury Road, Alderholt, Fordingbridge, Hants. For those constructors who wish to make their own front panel a transparent overlay is available from the *PW* Editorial Offices, price £2.00 including postage.

Final Checks

When the final wiring has been finished a complete visual check should be made for possible errors or short-circuits.

All the individual boards should have been checked out before assembly into the case and final setting up can be completed using a suitable dummy load across the antenna socket.

This completes the description of the *PW* Helford as a two-band transceiver. The whole project has been aimed at the advanced constructor to enable him, or her, to build an advanced h.f. transceiver at a reasonable cost.

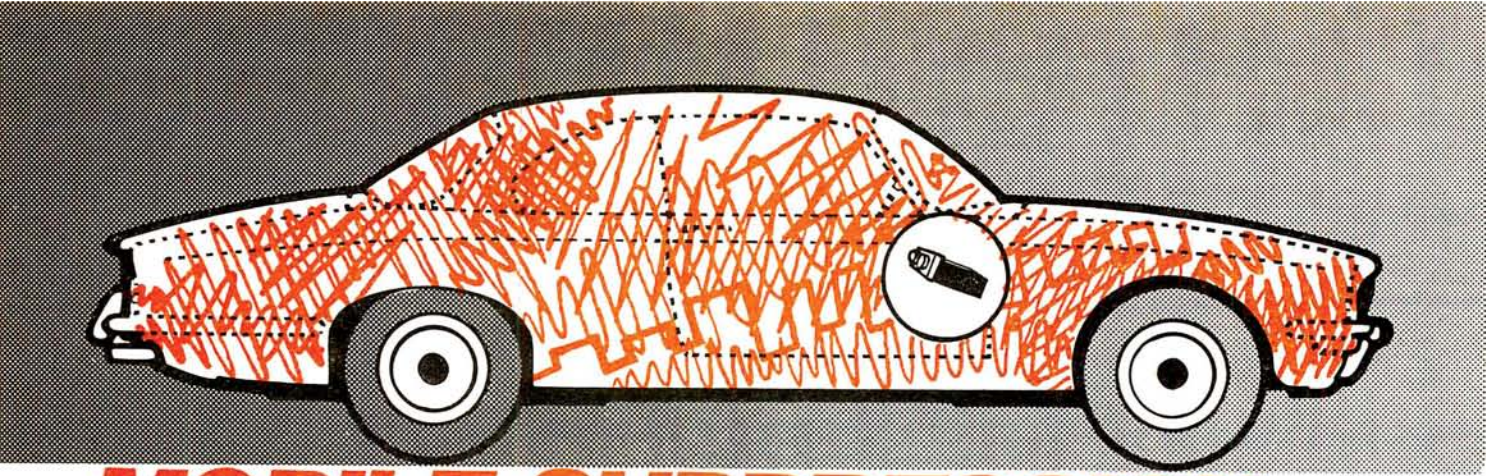


As readers will no doubt have realised, the printed circuit track pattern in Fig. 23: Component placement drawing (page 43 last month), was printed upside down. We therefore repeat it here, with apologies

Future Developments

The *PW* Helford is proving very popular in its present two band form. The author, along with Phil Ciotti G3XBZ is working on additional boards to add further bands to the rig, and these will be published as soon as they are ready and proven.

Read *Practical Wireless* regularly and you will not miss these exciting developments. ●



MOBILE SUPPRESSION TECHNIQUES PART 1

John M. FELL G8MCP

Have you ever installed an item of radio equipment in a vehicle and experienced the effects of radio interference breakthrough? The chances are reasonably high that you have, as a motor vehicle probably represents one of the most hostile of radio environments. It is the object of this article to provide practical information to enable you to identify and cure this unnecessary annoyance. In general, the techniques of suppression that follow apply equally when dealing with all types of broadcast, p.m.r. and amateur band interference at frequencies of up to 450MHz.

Radio Interference

Before commencing with details of corrective techniques it is useful to establish the nature of the problem. The electrical circuit of a vehicle consists of a number of separate circuits inter-connected by the wiring harness. It is normally possible to identify three main circuits: ignition, generation system and accessories. All are capable of creating noise and transmitting this via the wiring loom. The worst offending items are usually those that are the most inductive.

Radio interference is caused by the rapid change or interruption in the flow of alternating or direct current, which forms the basis of normal operation in many items of a vehicle's electrical equipment. These rapid transitions of current flow create the electromagnetic fields that the installed receiving equipment can detect in the same manner as the wanted signal. This results in varying degrees of noise mixing into the signal with effects ranging from intermittent "thumps" to harsh crackling, preventing worth-while reception.

The classic definition identifies noise as "Any unwanted form of energy tending to interfere with the proper and easy reception of wanted signals."

Transmission Methods

The way in which interference energy is transferred to the equipment is by one or more routes. Those most usually encountered are as follows:

(a) Radiated emissions from the offending electrical equipment being directly picked up by the receiving antenna.
(b) Conduction along the vehicle distribution wiring and into the receiver via the power input leads.
(c) Conduction along the vehicle wiring and subsequent radiation coupling into the antenna.
(d) Radiated energy, induced into the conductive elements of the vehicle, re-radiating and coupling into the antenna.
(e) Inadequate screening of the receiver and supply lead de-coupling deficiency, allowing radiation pick-up.

Any attempt at vehicle suppression must embody techniques that will combat all these transmission modes.

Legal Requirement

Standard production vehicles in the UK are only required by law to provide suppression of the ignition system, to prevent interference with domestic radio and television services in the frequency range 40–250MHz. The specified levels of emission and methods of measurement are based on the recommendations of *British Standard Institute 833:1970*. Vehicles produced since the implementation of this legislation, in 1974, must achieve suppression levels as specified and it is a further requirement that the owner must **maintain** the vehicle at this same ex-works standard.

The ability of a vehicle to meet these requirements does not mean that the residual emissions will be at a level that prevents interference breakthrough to the vehicle's own on-board equipment.

Preliminary Checks

Before attempting any work on the suppression of a vehicle, it must be remembered that interference can originate from many external sources and emissions from all of these sources must first be eliminated. Always ensure that the vehicle is positioned in a location well away from fluorescent light fittings, or overhead power transmission lines, as both can produce effects identical in nature to vehicle originated interference.

When investigating broadcast receivers fitted with antenna trimming capacitors check that they can be "peaked" for a maximum signal strength, on a constant level transmission. If a peak cannot be obtained check the antenna and feeder cable for continuity. In the absence of a signal or whilst receiving extremely low-level signals, even an adequately suppressed vehicle can appear noisy.

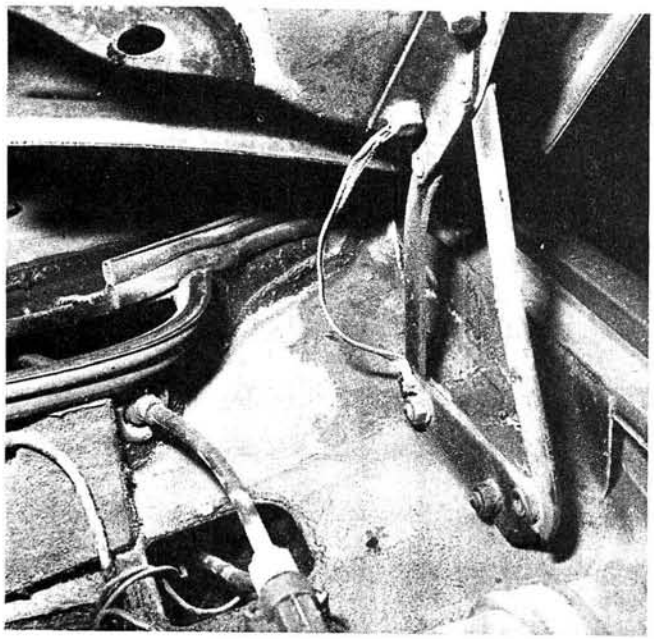
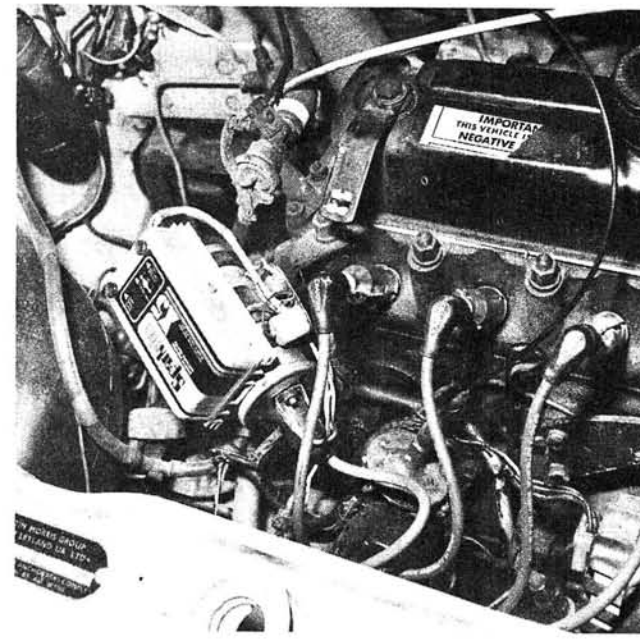


Fig. 1: Additional bonnet bonding strap fitted to an Austin Maxi

At v.h.f. frequencies background noise of a "rushing" nature is an indication of poor signal strength and is not the product of interference. In the same way, when travelling through a built-up area, signal cancellation due to reflections can occur and appear as a noisy signal. In both cases the cure cannot be effected by additional suppression.

Always ensure that the antenna base mounting is bonded to the earthed bodywork at the point at which the feeder cable is connected. Never rely on the outer sheath of the co-axial feeder cable to provide an earth return path for the receiving equipment.

Check the earthing security of the receiving equipment, by temporarily applying an earth braiding strap from the case to a known good earth point on the vehicle bodywork. When using straps it is essential to use the shortest possible length of good quality tinned copper braid. (Refer to the test equipment illustrations for the details of a suitable, temporary, "quick-fit" strap.)



If the interference still cannot be reduced to an acceptable level after these initial checks have been completed it is time to consider the vehicle sub-systems in detail. (Refer next to Fig. 5: Further Suppression.)

Ignition Systems

By far the most frequent cause of vehicle interference is the ignition system. In its normal mode of operation, high tension energy propagates through the system, in turn producing wideband impulse noise within the various component parts.

The audible effect of ignition breakthrough consists of a composite crackling noise, varying with engine revs and not dissimilar to the noise produced by a two-stroke trials motorcycle exhaust. The low tension (l.t.) and high tension (h.t.) circuits contribute to the overall effect.

By fitting a 1μF capacitor between earth and the switch terminal, marked SW or "+" (but never the CB or "–" terminal), the l.t. side of the ignition may be dismissed. It is good practice to fit this component in any event, otherwise there may be unwanted noise when driving through poor

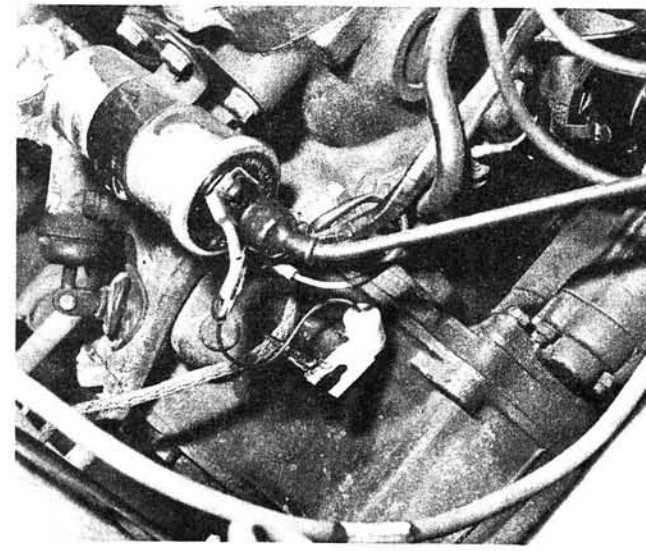
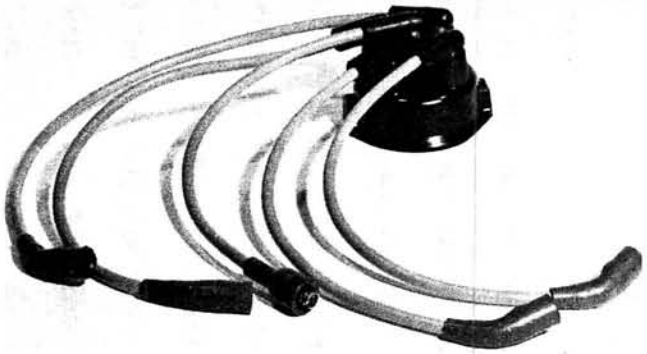


Fig. 2: Temporary quick-fit capacitor connected between the h.t. coil + terminal and earth



signal strength areas. See also suppression of electronic tachometers if interference persists.

The noise created by the h.t. side of the ignition system is at a higher frequency, sharp and spiky in nature and also varying with changes in engine revolutions. Referring to Fig. 5, the initial checks refer mainly to defects created during assembly of the vehicle and are relatively easy to locate and rectify.

Metallic bodywork plays a vital part in screening unwanted emissions from the ignition system. It is essential that all of the bodywork is at a common "earthy" potential, to obtain the best shielding effect. This also includes the engine bonnet which is often found to have been insulated by paint or rust at the hinge points. In persistent cases of interference other items that have been found to re-radiate ignition pulses and that should also be bonded to earth are: the radiator, rocker box cover, air cleaners, and in fact any items in close proximity to the h.t. system that are not earthed.

Once again, in all cases, when bonding to earth use good quality braided conductor straps of the shortest possible length.

Having now eliminated the initial stages it is necessary to turn to the "active" components of the h.t. system.

HT Leads

It is most probable that at some time you have been advised to dispose of all the "carbon impregnated string" or resistive h.t. cable as it is known in the trade, and replace it with "good quality" solid-cored cable with resistive plug cap suppressors.

This course of action not only degrades the suppression of the vehicle above 30MHz, it could render you liable to prosecution under the relevant legislation, as the vehicle may no longer possess the designed degree of suppression provided by the manufacturer at frequencies above 40MHz. Folklore has evolved around resistive h.t. cables and it is wrongly assumed that the higher levels of resistance encountered will reduce the effectiveness of the ignition spark. Initially, resistive carbon h.t. leads required replacement at 18 month intervals to maintain their effectiveness. Leads produced since 1978 have a manufacturers' recommended lifetime of 100 000 miles. The

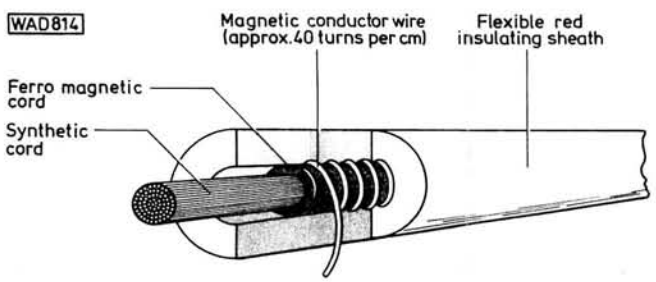


Fig. 3: Cross-sectional view of Sparkrite ferro-inductive h.t. lead

breakdown resistance at the plug points is many orders of magnitude greater than all "in circuit" suppression devices added together.

In suppression terms, copper core h.t. cable, used in conjunction with carbon composition plug caps, behave as lumped constants, useful only at the lower frequencies. At higher frequencies, where the filtering action has little effect, the physical length of the cables approaches that of the received frequency wavelengths and they can, in fact, start to act as individual antennas.

Resistive carbon impregnated leads, on the other hand, possess a distributed capacitance which allows them to act as an RC filter network whose effective suppression increases with rising frequency. Fig. 10, in Part 2, indicates the effectiveness of the various suppression elements across the operating bandwidth.

Many imported vehicles of continental manufacture are fitted with inductively wound h.t. cable which is very effective at v.h.f. frequencies and above, but suppression at low frequencies falls to a very low level. To cure ignition breakthrough in these cases, it will be necessary to fit

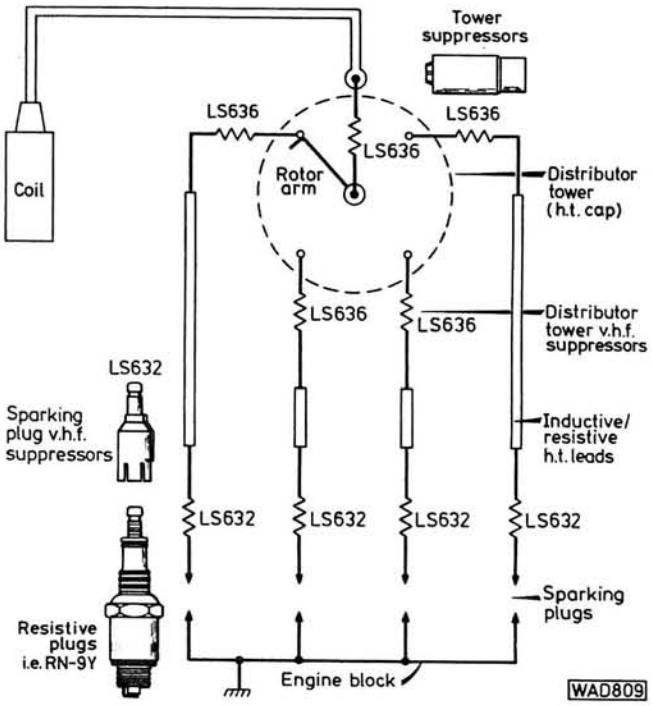


Fig. 4: Block diagram of a fully suppressed h.t. distribution system

additional "in-line" resistive elements. Perhaps a cheaper method would be to replace with carbon impregnated or inductively cored ferrite composition leads such as the Sparkrite type.

In-Line HT Suppression

If ignition interference is still evident at v.h.f. frequencies it will be necessary to fit further "in-line" elements. Start by fitting Lucas LS636 type distributor suppressors to each of the h.t. lead outlets on the distributor cap. Angled versions of the same device are available if space is limited.

This should further reduce the noise breakthrough but if this is still not sufficient, fit an earthed screening can around the distributor cap. It is not necessary to completely enclose the cap, but the swept plane of the rotor

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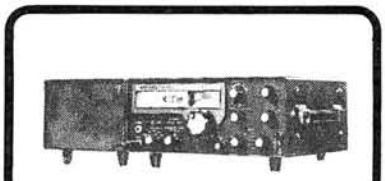

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10–80m. SSB, CW, 240W PIP. Premix VFO. C/W FP200 AC PSU/Speaker.

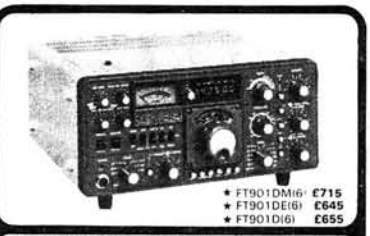
FRG7700

- ★ 150kHz-30MHz no gaps
- ★ SSB-CW-AM and FM
- ★ Up-conversion no preselector
- ★ 12 channel memory option
- ★ Mains and 12 volts dc option
- ★ Clock/timer built-in

From 30MHz to 150KHz (lower at reduced spec.) in 1MHz bands. SSB, CW, AM, FM. On 10m and with a convertor the NBFM detector with squelch plus a noise blanker opens new horizons.
4 filters fitted as standard! SSB, 2·7KHz and FM 15KHz. For AM, 3 positions! Narrow 2·7KHz, Medium 6KHz and Wide 12KHz, with tone control, and switchable AGC.

No preselectors! Up conversion with a 48MHz crystal filtered IF plus dual PLL system provides automatic selection of the input bandpass filter direct from the band selector or memory.
The inbuilt quartz clock/programmable timer has battery back-up.
12 frequencies anywhere within the range may be stored by simply touching the M button, no preselector adjustment, no range switch adjustment. The memory is tunable by ± 1KHz and is kept alive year long by 3 'AA' dry cells.

FRG7700 £309 FRG7700M £389



★ FT901DM(6) £715
★ FT901DE(6) £645
★ FT901D(6) £655

FT902DM £799

10–160m. SSB, CW, AM, FM, 9 bands (DE version £713 D version £724)

★ FT101ZD(6) £515
★ FT101Z(6) £445

FT101ZD £569

10–160m. SSB, CW, AM, Digital 9 bands model. (Analogue version £488.00)

FRG7 £199

0.5-30MHz General Coverage Receiver. 230V AC. 12V DC, · Battery pack. AM/SSB.

PRICES INCLUDE VAT @ 15%

FRG7000 £259

0.25–30MHz General Coverage Receiver. 230V AC. AM/SSB Timer. AM/SSB.

FREE SECURICOR DELIVERY

★ FT107M(6) £625

FT107M £690

160–10m · 2 Aux. SSB, CW, FSK, AM. Memory option. Deluxe 9 band model.

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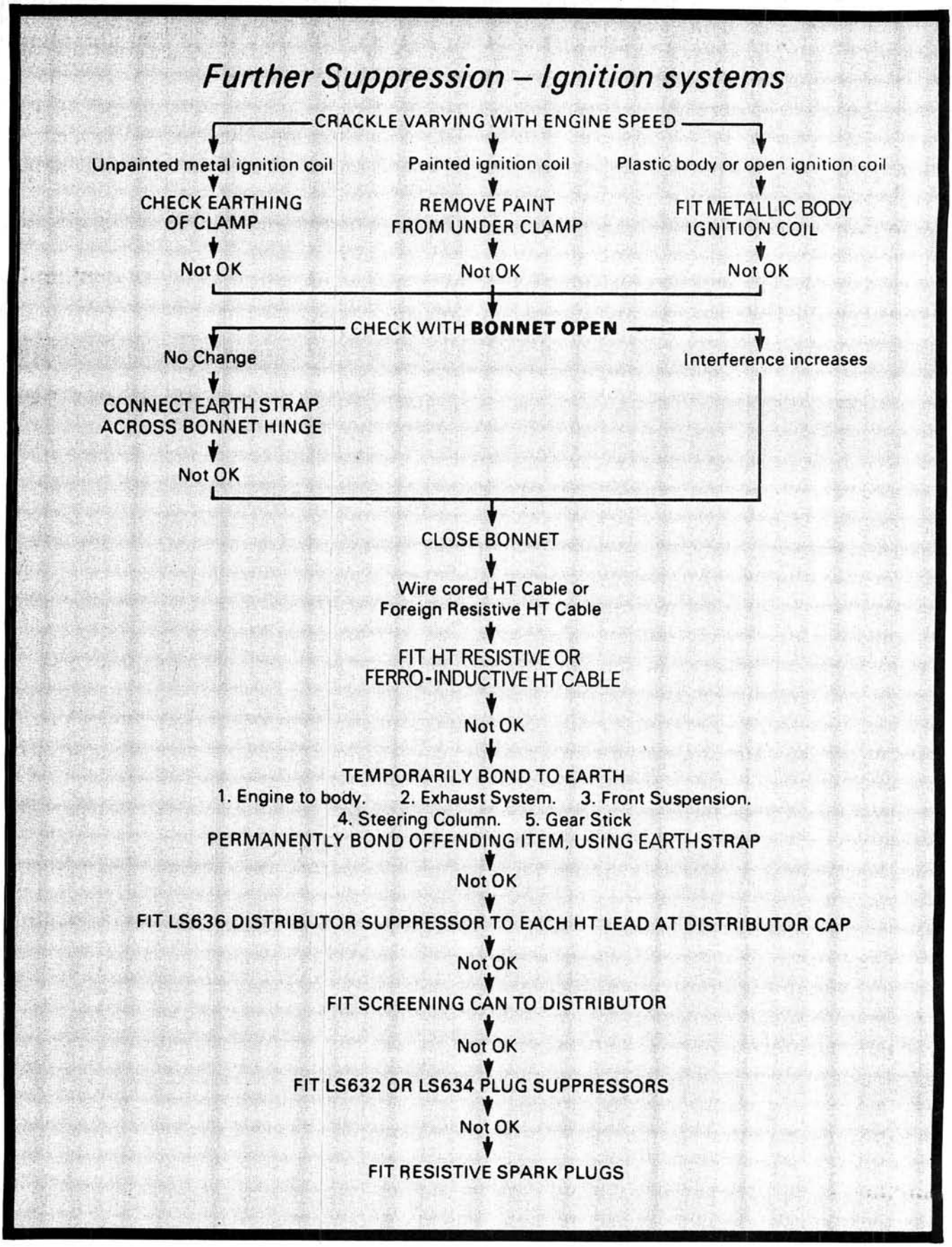


Fig. 5: Flow chart detailing the complete path of h.t. suppression

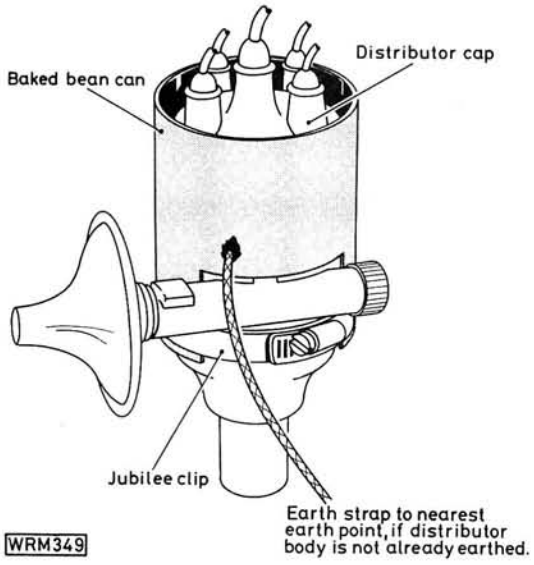


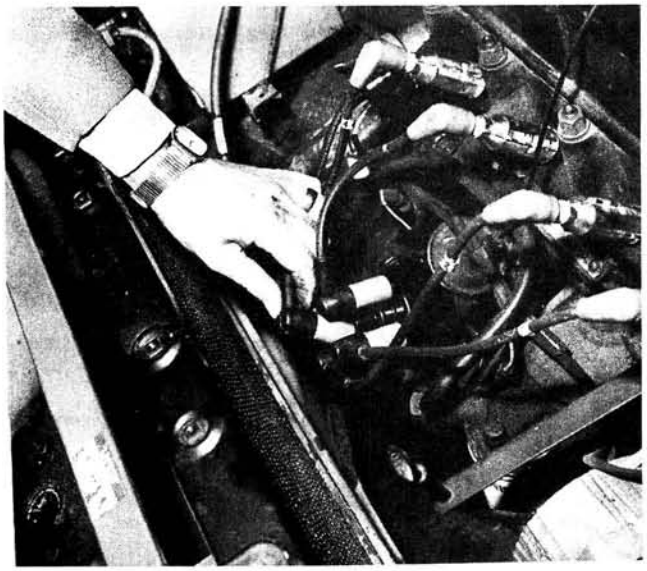
Fig. 6: DIY distributor cap screen. The area screened needs only to cover the plane of the rotor arm

arm must be surrounded by the shield. Fig. 6 shows the construction of a suitable screening device.

Having progressed down the ignition distribution system, the final element in the system and the point at which the h.t. energy is discharged, is at the spark plug. Normal plug caps are made from Bakelite or rubber materials, the latter containing only a spring clip connector. To further reduce the noise level on weak signals at v.h.f. frequencies, the use of a metallic screened plug cap suppressor is recommended. This unit is available in straight or right-angled format and incorporates an in-line inductive resistor within the body shell.

Finally, if noise still remains on low level v.h.f. signals, a special resistive spark plug is available to directly replace most equivalent standard plug ranges. Suppressed plug variants are recognisable by the prefix R in the serial number. For example, the common Champion N9Y would be specified as RN9Y.

Before the ignition system is finished with, it is worthwhile considering the feed to the electronic tachometer, if fitted. The pulse input for this device is normally obtained from the terminal marked CB or "+" on the h.t. coil. As



the cable passes from the electrically noisy area of the engine compartment, through the bulkhead screen, into the interior of the vehicle, it is good practice to fit a 3A in-line choke close to the coil terminal.

Capacitor Discharge Systems—Warning

Before fitting suppression components to the l.t. side of vehicles equipped with electronic ignition, always check the manufacturer's recommendations. Inserting a suppression capacitor between the output lead of such units and earth can cause damage to the drive circuit and destroy the suppressor, due to applied over-voltage.

Charging Systems

The vehicle battery charging system is often found to be a cause of interference. Depending on the age of your vehicle the prime mover in the system will be either a d.c. generator (dynamo), or an alternator, which has an a.c. output that is subsequently rectified by semiconductor diodes.

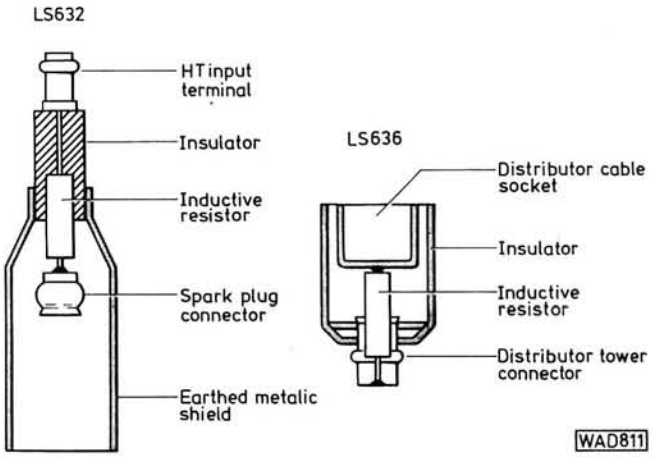


Fig. 7: Cross-sectional view of "in-line" distributor tower and metallic screened plug-cap suppressors

Suppression techniques are similar for both devices, the audible effect produced being recognised as a whine that varies in intensity with variation in engine speed.

Dynamo

For suppression within the h.f. bands up to 30MHz, either a single 1μF or 3μF capacitor must be fitted to the "D" or output terminal of the dynamo. As the received

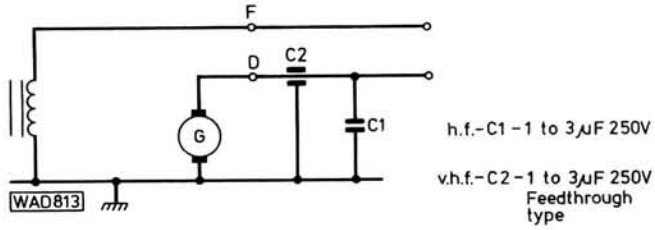
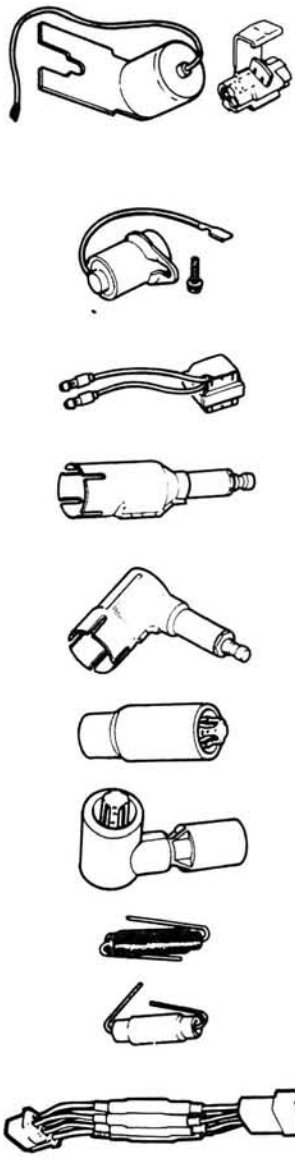
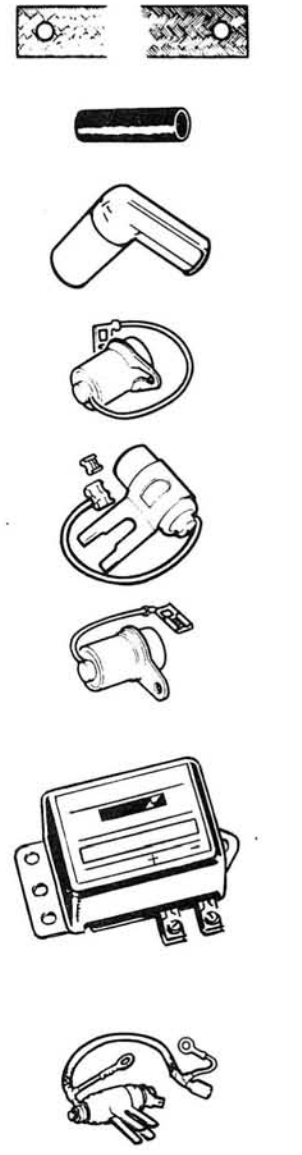


Fig. 8: Dynamo suppression methods

Suppression Range



LS No.	Part No.	Description
LS627	60600385	1 μF Capacitor with connector, for Ignition
LS628	60600386	1 μF Capacitor with connector, for Generator
LS720	60460741	3 μF Capacitor with connector, for Generator
LS629	54200297	3 μF Capacitor for internal mounting on 15-16-17-18 ACR Alternators
LS630	60460085	Inline Choke
LS632	54421964	Straight VHF Plug Suppressor
LS634	54422760	Right Angled VHF Plug Suppressor
LS636	54421441	Straight VHF Distributor Suppressor
LS638	54423567	Right Angled Distributor Suppressor
LS639	60150093	7 A Inline Choke
LS640	60150094	3 A Inline Choke
LS641	60670378	7 A Choke Assembly for 14-15-16W Wiper Motors



LS No.	Part No.	Description
LS642	60670350	General Purpose Bonding Strap
LS646	60460665	Inline Resistor for Wire HT Cables
LS648	60460666	Right Angled Plug Suppressor, with shroud
LS673	54200423	3 μF Capacitor for internal mounting on 23-25 ACR Alternators.
LS680	78139	1 μF Capacitor with Dual Connectors
LS682	54201329	3 μF Capacitor for internal mounting on 20 ACR Alternators
LS721	60946618	8 A Line Filter Insulated case
LS684	60150114	Dynamo Feed through Capacitor

Fig. 9: The Lucas Audio Systems range of suppression components

frequency increases, the suppression effect will decrease, so short lead lengths are essential to maximise the effects. In the range 30–150MHz an additional feed-through type capacitor must be used. Associated with the dynamo system is the separate voltage regulator control box which can cause constant level whine or crackle. This can be cured by connecting a 1μF capacitor from the "D" terminal to earth, or in persistent cases by fitting a line filter (normally available from the dynamo manufacturer).

Alternator

Interference from the alternator system usually only extends over the h.f. frequency bands up to 30MHz.

The characteristic noise produced by an alternator is like that of a dentist's drill and is very distinctive. Again the cure is to fit a 3μF capacitor within the body of the device from the output terminal to earth.

In the concluding part of this article next month, detailed information is given to enable suppression of the remaining electrical equipment and accessories

THE 'WINTON' Stereo Tuner

Part 1

*E. A. RULE

The *PW* Winton Tuner is intended for the more experienced constructor who would like to build a top quality tuner with a specification equal to the best commercial designs available, but at a cost within a sensible domestic budget.

The tuner covers the u.h.f. TV band as well as the normal a.m. and v.h.f. f.m. bands, it also has a limited coverage of the s.w. band. Each tuner section uses the latest techniques available making it suitable for the home constructor who may not have access to sophisticated test equipment.

This may seem a large and complex project, but providing the constructor can solder properly and follow the step-by-step instructions he should be able to produce a tuner equal to those available commercially at much higher prices. Take each section in turn and look upon it as a complete project in its own right, in other words do not treat it as one mammoth project but as a series of smaller ones. Take your time over the various sections, by not rushing, mistakes can be avoided.

The full circuit details are shown in Figs. 1, 2, 3 and 4, with a simplified block and inter-wiring diagram in Fig. 5. These should be referred to as required while reading the general circuit description.

On the front panel the tuner has controls for MANUAL TUNING and DISPLAY FUNCTION, with 13 push-buttons for selecting (from left-to-right): LW, MW, SW, FM, TV, MUTE, AFC, B-W (filter bandwidth selectivity) MANUAL TUNE, and then four pre-set stations which are used in conjunction with the eight pre-set potentiometers to the right of the push-buttons. To the right of the main DISPLAY FUNCTION switch there are four push-buttons which control the various clock functions, i.e., hours set, minutes set, etc. The STAND-BY toggle switch is in the top left-hand part of the panel and to its right is the stereo l.e.d. beacon, to the right of this are two meters, the first indicates the signal strength on all bands and the other indicates the correct tuning point on f.m. and TV. The main digital fluorescent display is to the right of the meters.

The rear panel of the tuner has antenna sockets for a.m., f.m., TV and a DIN socket for audio output. The ferrite antenna rod and mains fuse-holder are also mounted on the rear panel.

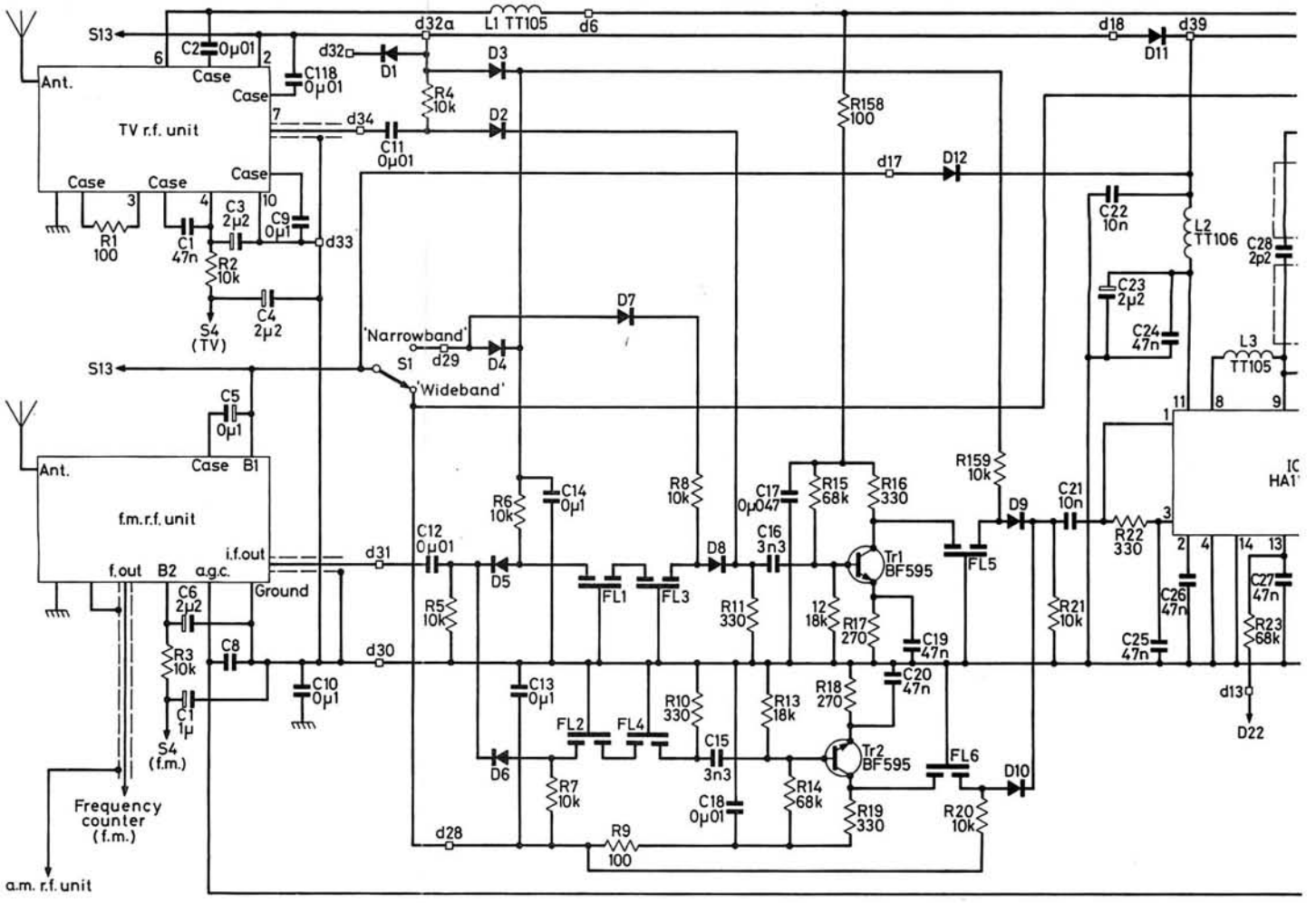
Circuit Description

The f.m. r.f. section is one of the most important parts of any hi-fi tuner system. If the signal is degraded at this point there is nothing that can be done at a later stage to put things right. Received signals can vary in strength from a few microvolts to several hundreds of millivolts when close to a transmitter. The weaker signals must be amplified, without adding any noise or distortion, to a suitable level for the mixer stage, and very strong signals may need to be reduced in level to prevent overload of the mixer.

In practice a range of signals of from one microvolt to around 0·1V could be encountered and this represents a range of 100 000:1 (100dB). Should the r.f. section fail to handle this range of signals then cross-modulation and other undesirable effects could take place. Also, under practical conditions, there would be more than one signal present at any time and the r.f. section has to select the wanted signal and reject all others, so a high degree of r.f. selectivity is also an important requirement. In general the more tuned circuits before the mixer stage the better the rejection of unwanted signals.

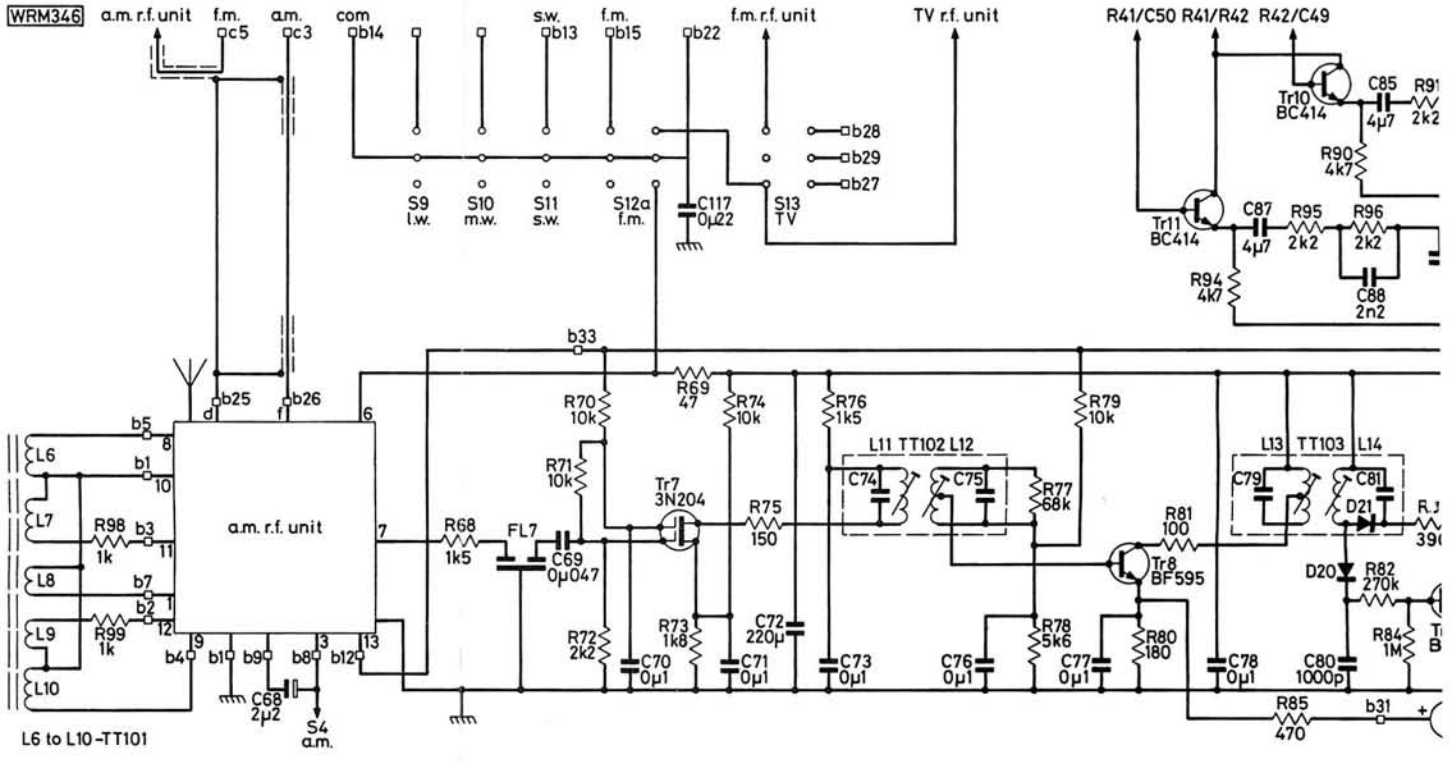
The selected signal is mixed with a local oscillator and the difference between the two (10·7MHz) is the i.f. or intermediate frequency required. All further amplification and processing is carried out at this frequency. As the i.f. amplifier has a narrow bandwidth (approximately 250kHz), to provide good adjacent-channel selectivity the local oscillator must be very stable in frequency, otherwise the resulting i.f. signal would drift out of the i.f. passband and distortion of the signal would result. For the Winton Tuner it was decided to use a commercial r.f. unit in each section. ALPS Electric Co., of Japan specialise in producing top quality r.f. units for many leading hi-fi manufacturers in Japan, although they are not so well-known in the UK. The unit decided upon for f.m. was the FD811U, this uses a dual-gate MOSFET in the r.f. amplifier, and also a dual gate MOSFET in the mixer stage. The input signal from the antenna is passed through a single-tuned circuit to gate 1 of the r.f. amplifier and automatic gain control voltage applied to gate 2. The signal then passes through four

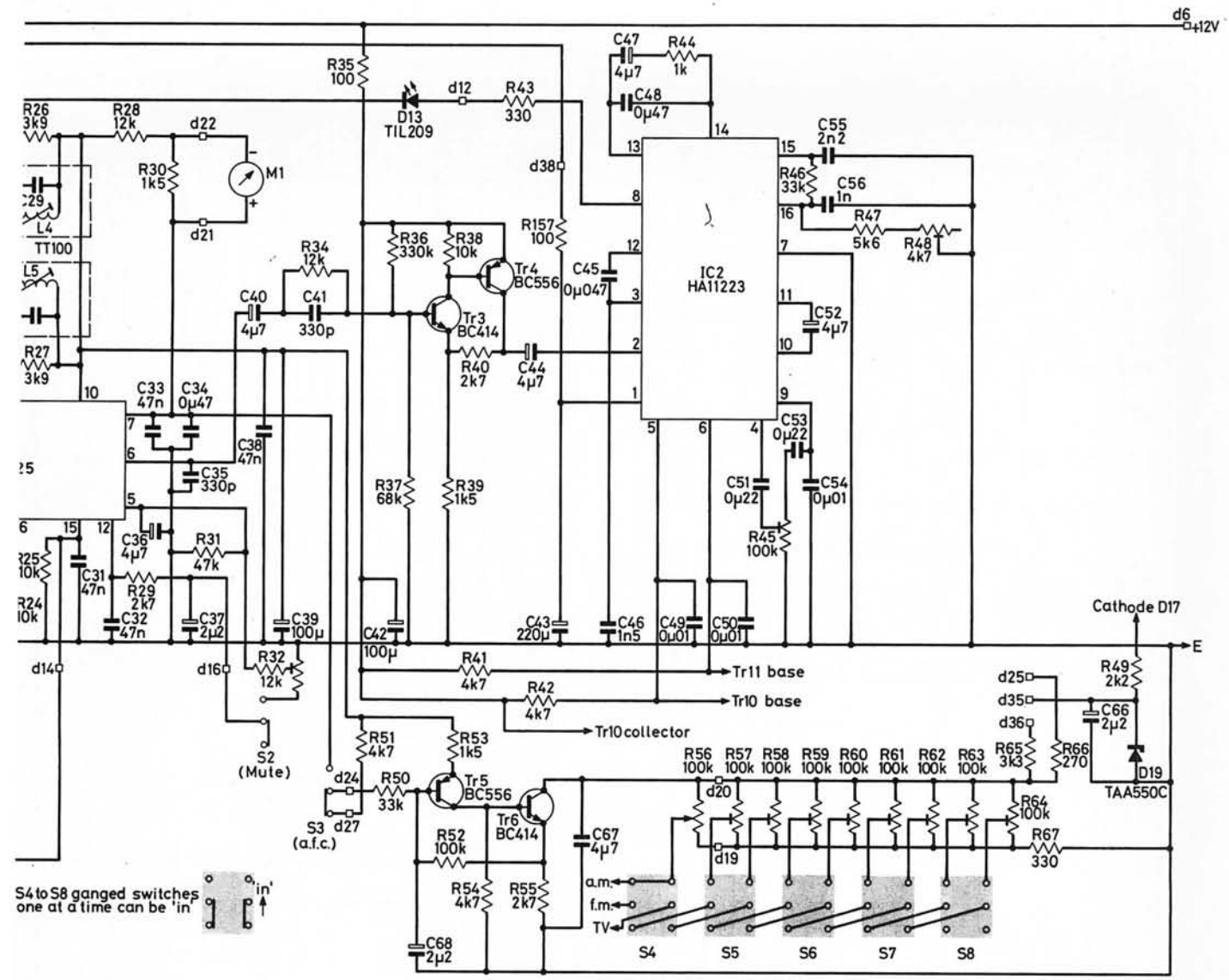
* T&T Electronics

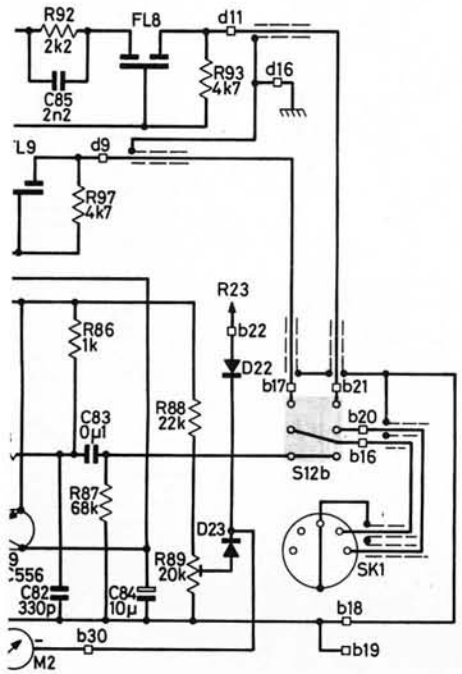


WRM345

FL1 to FL6 – 10·7MHz.
All diodes 1N4148 unless otherwise stated.







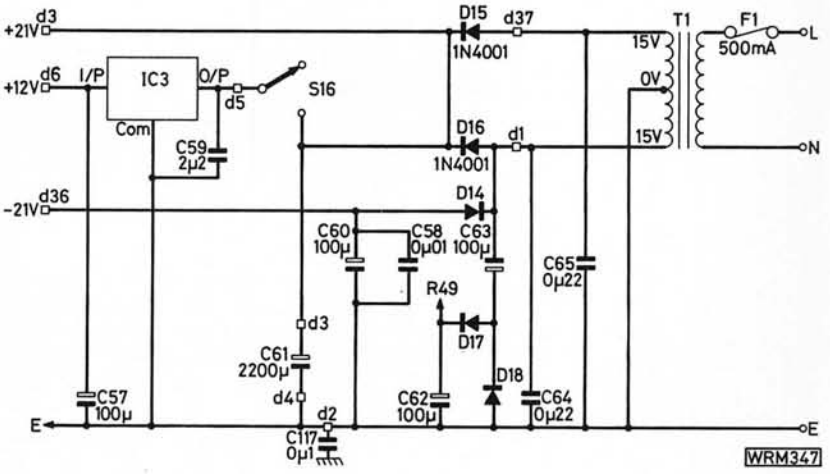


Fig. 1 (top): Circuit diagram of f.m. and TV sections of the *PW* Winton Tuner
Fig. 2 (left): Circuit diagram of a.m. section
Fig. 3 (above): Circuit diagram for *PW* Winton power supply

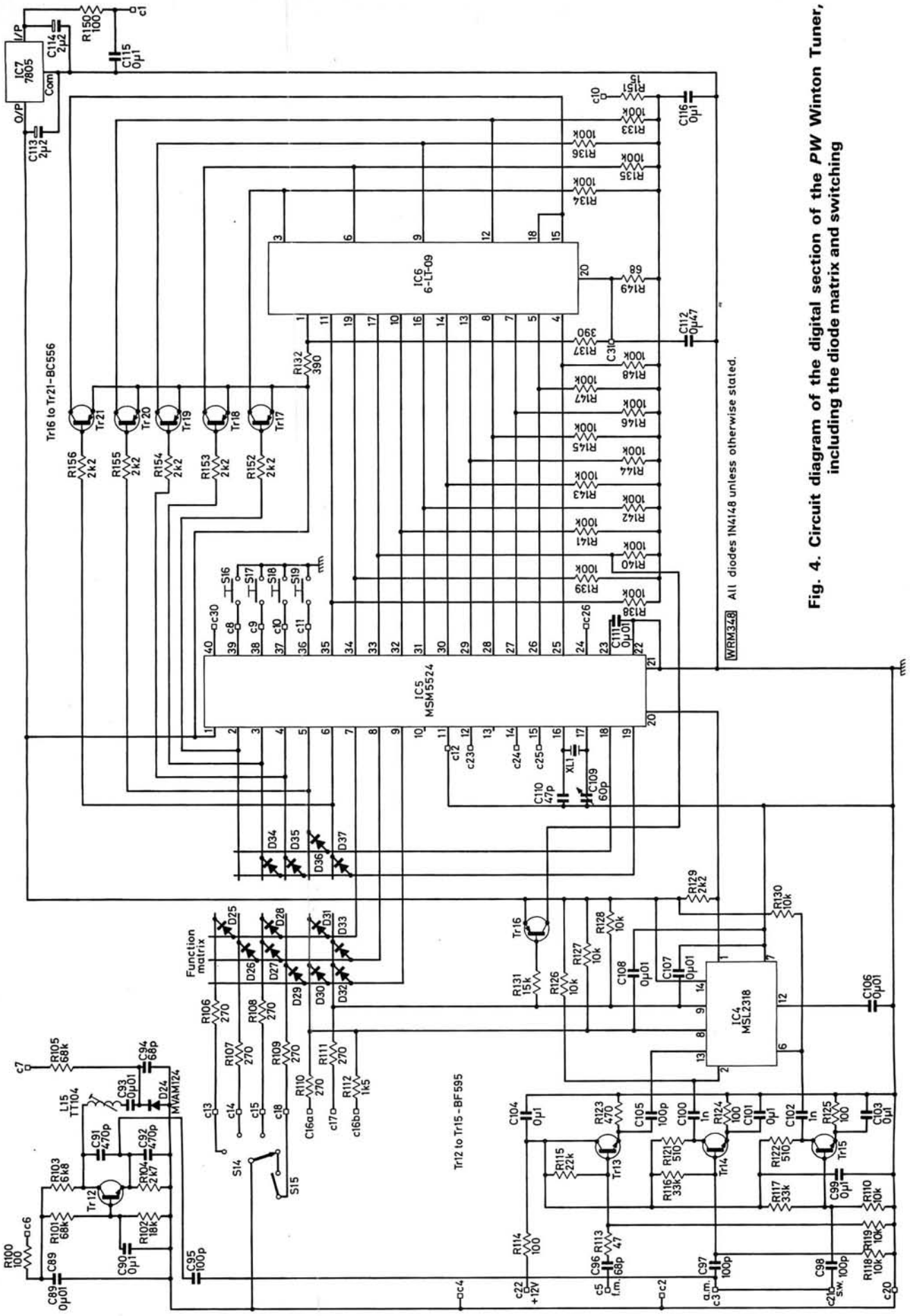


Fig. 4. Circuit diagram of the digital section of the *PW* Winton Tuner, including the diode matrix and switching

bandpass-tuned circuits to gate 1 of the mixer with the oscillator injection on gate 2. To generate the local oscillator signal a transistor is used, followed by a two-stage buffer amplifier which also has a buffered output for feeding into the digital frequency counter. The i.f. signal from the mixer stage passes through another bandpass filter to a single-gate f.e.t. i.f. amplifier stage.

The result of this excellent design is an r.f. section that can handle the very wide range of signal strengths encountered in practice, and can select only the wanted signal out of the many presented to it. The image and spurious signal rejection is over 120dB, the advantage of this high rejection figure is that a high-gain aerial may be used to enable weak signals to be received without the danger of cross-modulation from strong local signals. As all the tuned circuits are varicap tuned this unit also allows pre-set station selection.

The IF Amplifier

The main task of the i.f. amplifier in an f.m. tuner is to provide selectivity, to remove unwanted impulse noise and any other amplitude modulation (a.m.) on the signal. This section also detects the frequency modulated signal and converts it to audio, provides automatic gain control voltages for the r.f. amplifier and also control voltages for automatic frequency control.

In the Winton Tuner the signal from the r.f. unit which is now at the i.f. of 10·7MHz is passed via diode switching circuits to either the wide-band (stereo) or narrow-band (mono) filters. These filters both use a double ceramic filter followed by a transistor amplifier and then another ceramic filter. The output from this section is then passed via a diode switch to the Hitachi HA11225, IC1.

The HA11225 is the latest development in f.m. i.f. integrated circuits, and is similar in many ways to the popular CA3089 family. However, it has a specification that puts it right at the top as far as overall performance goes. For example, it is possible to obtain a recovered audio signal with distortion as low as 0·03 per cent or better, and to achieve this with a signal-to-noise ratio of around 84dB. Compared with the old CA3089 with figures of around 1 per cent distortion and signal-to-noise ratios of 68dB the improvement is quite considerable. The HA11225 also has much better muting circuits, and for this project was considered the best i.c. for use in the Winton Tuner.

The HA11225 has a quadrature detector and by using a double-tuned discriminator circuit (L4, L5) the full benefit of its low distortion is realised. The i.c. provides a delayed a.g.c. voltage for the ALPS tuner unit as well as providing a voltage for a.f.c. The a.f.c. voltage is amplified by transistors Tr5 and Tr6 before being applied to the varicap diode tuning circuits. The recovered audio signal is passed on to the stereo decoder which uses a Hitachi HA11223, (IC2). Two meters are also driven by the HA11225, one for signal strength and the other for a centre-zero tuning indication.

The use of dual selectivity is to optimise the overall performance in either mono or stereo. The bandwidth required for optimum signal-to-noise ratio and distortion with a mono signal is around 180kHz and on a stereo signal is around 280kHz. If the 180kHz bandwidth was used on stereo the signal would be degraded considerably, because the stereo information contained in the sidebands of the transmitted signal would be "chopped off" resulting in poor separation and increased high-frequency distortion. If the 280kHz bandwidth was used for mono it would be much wider than required and let more noise through, resulting in a poor signal-to-noise ratio on weak signals. Most commercial tuners compromise by using a bandwidth somewhere between the two, i.e., normally around 220kHz, this results in reasonable performance but not the best possible. For the Winton Tuner it was decided to provide optimum bandwidth for either type of signal. Two separate sections are used for this and are selected by diode switching controlled by the selectivity switch S1.

Stereo Decoder

The Hitachi HA11223 is the latest development in phase-lock loop stereo demodulator i.c.s. It has very low audio distortion because it makes use of 100 per cent negative feedback, the distortion introduced during the decoding process being less than 0·06 per cent. The signal-to-noise ratio is also exceptional at around 86dB. It has automatic mono/stereo change-over and an output for driving an l.e.d. to indicate that a stereo transmission is being received, it can also be switched for mono operation only. In the Winton Tuner this is done in the narrow i.f. bandwidth mode. It is possible to modify the tuner for stereo reception in the narrow-band position if required.

After the decoding process there exists at the output of the decoder the wanted left- and right-channel audio signals and also spurious signals produced by the decoding process itself. These could cause problems when recording and must be filtered out. The HA11223 uses a phase-shift system to remove the residual 19kHz pilot tone from the output and this would normally be considered enough. However this tuner also makes use of a low-pass filter in the output of each channel to reduce all spurious signals to extremely low levels, these filters are numbered FL8 and FL9 on the circuit diagram.

Only a single pre-set potentiometer R48, requires adjustment to set the correct frequency of the phase-lock loop for optimum stereo separation.

TV Section

The r.f. unit used for the TV section is a modified Mullard U321. This has been modified to provide a 10·7MHz i.f. output suitable for feeding directly into the f.m. i.f. section of the tuner. The i.f. output from the Mullard unit is fed via diode switching to the base of Tr1, the reason for this is that the i.f. output from the Mullard unit is less than the ALPS f.m. unit. To compensate for this difference it was decided to bypass the first two ceramic filters and their 12dB insertion loss. As TV stations are spaced much more widely than f.m. stations the requirements for adjacent-channel selectivity are not so stringent and one ceramic filter is all that is required. The mono section of the i.f. circuits is used for TV, but should stereo TV ever happen it is possible to modify the tuner to receive stereo in the narrow-band position.

Because the Mullard unit has been modified to a lower i.f. frequency than it was designed for there is some reduction in the image rejection and this is now only around 20dB or so, however in practice this is not a problem and switching the a.f.c. on will quickly check if you are on the correct signal. If you are on the image the a.f.c. will push the station off tune, also the difference in signal strength between the image and fundamental is shown clearly on the meter.

The AM Section

The a.m. r.f. section uses a modified ALPS unit FX811B, and this is fitted with the switching required for selecting the various bands. It covers the normal l.w. and

PLEASE NOTE!

As this issue was about to go to press, we learned that, despite previous assurances, the a.m. tuner head FX-811B selected for the *PW* "Winton", had been discontinued by the manufacturer, ALPS Electric Co. Ltd.

We are investigating ways of overcoming the problem, and hope to have some news in time for our next issue.

m.w. and in addition has a s.w. coverage from 3·3MHz to 6·3MHz which includes the 49m broadcast band.

A ferrite antenna is used on the l.w. and m.w. bands but an external antenna is required for s.w. The input signal is fed into the base of a transistor mixer stage, and a separate transistor oscillator and buffer amplifier used with their output fed into the emitter circuit of the mixer. A separate buffer stage is used to provide an output for the digital frequency display unit. The 455kHz i.f. signal is taken from a single-tuned transformer in the mixer collector circuit and passed to the a.m. ceramic i.f. filter FL7. The a.g.c. voltage is applied to the mixer base circuit.

Following the ceramic i.f. filter the signal passes to a dual-gate MOSFET, Tr9. A dual-gate f.e.t. was used in this stage as it was found that a larger range of input signal levels could be handled without distortion due to overload. The signal is fed to gate 1 and the a.g.c. voltage to gate 2. The output from this stage is passed via a double-tuned i.f. transformer L11, L12 to the base of Tr8, this amplifies the signal to a suitable level for feeding to the detector circuit via a single-tuned transformer L13/14. Detection is carried out by diode D21 and the resulting audio passed via C83 to switch S12b. Resistor R83 and C82 form an r.f. filter to prevent any residual i.f. signal reaching the audio stages.

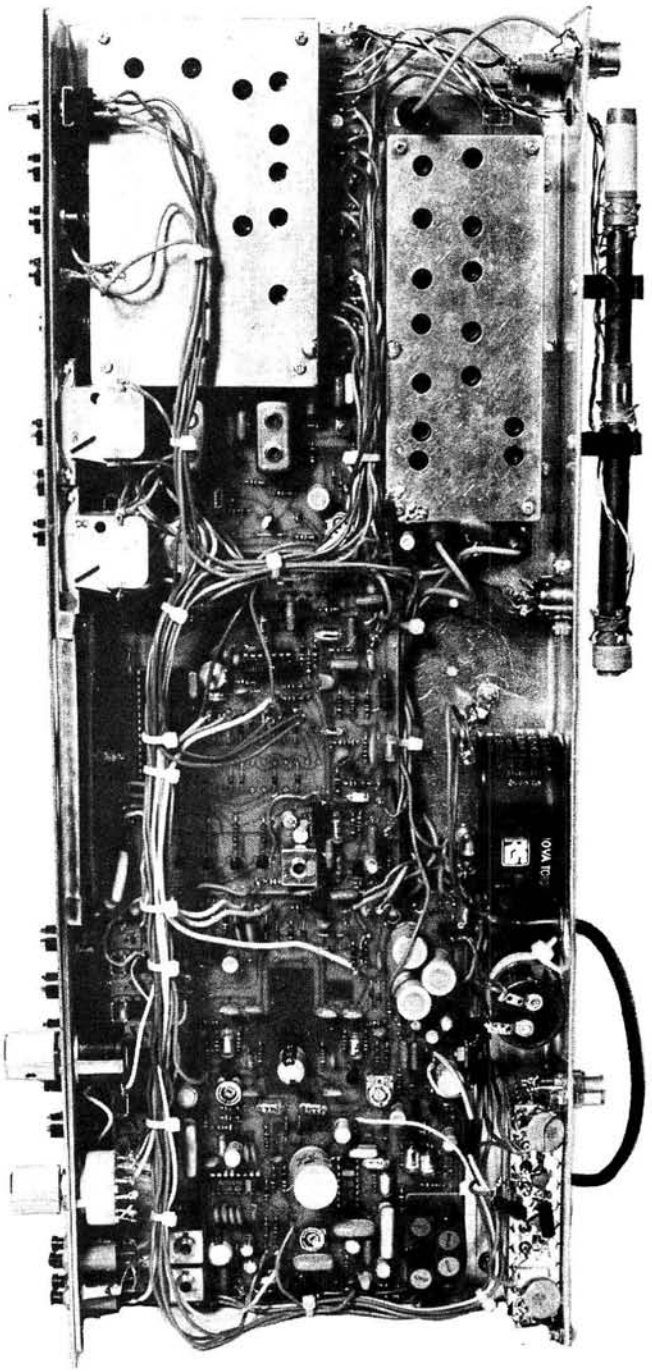
The a.g.c. voltage is produced by diode D20 and is fed to Tr9 which amplifies the a.g.c. voltage to a suitable level to control the various stages. This amplified a.g.c. results in a flatter audio output for a large variation in input signal levels.

Power Supply

Like the *PW* Winton Amplifier, the *PW* Winton Tuner uses a toroidal transformer so that the external magnetic field is kept to a minimum and therefore hum is not induced into the wiring. A standard type of transformer should not be used as the higher magnetic field will degrade the hum-and-noise figures by at least 10dB.

A full-wave rectifier system, D15 and D16 is used for the main d.c. supply and this is smoothed by C61. The unstabilised supply is then fed via S15 (stand-by switch) to IC3 (7812), which stabilises the supply at 12V. This 12V supply is switched to the various circuits via S1, S12a, S13 and "steering diodes" D1–7, D11, D12. These diodes "steer" the voltage into the correct part of the circuit and prevent the voltage being fed back into other circuits which are "off". The use of these diodes greatly simplifies the amount of switching required.

The unstabilised supply is also fed to IC6, which provides a stabilised 5V supply for the l.s.i. A further diode D12 and C60 provide a negative 18V supply for the 6-LT-09 display. Finally a voltage doubler D15 and D16 with C62 and C63 provide approximately 40V for the varicap supply via the special i.c., D17 which stabilises at 30V. The STAND-BY switch S15 is mounted on the front panel and removes the h.t. supply from the tuner in the OFF position and switches the display into the clock mode. No mains switch is provided, as removal of the mains would switch off the clock, and the time and any timer settings would be lost. Those readers who feel that a mains switch should be fitted could fit a suitable switch on the rear panel next to the mains transformer so that the complete tuner can be switched off when going on holiday, etc.



The internal view of the *PW* Winton Tuner

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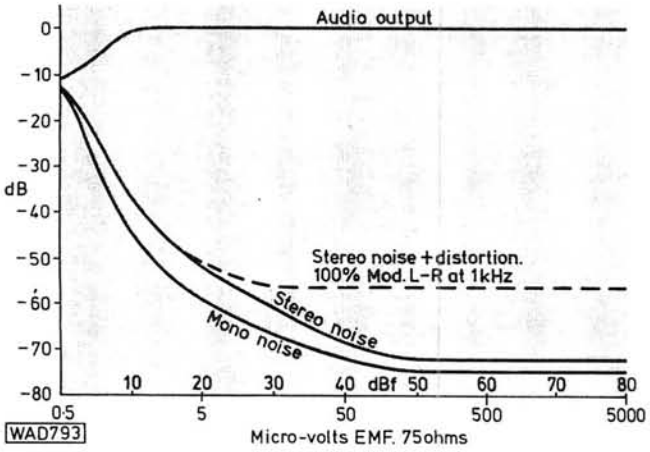
★ specifications

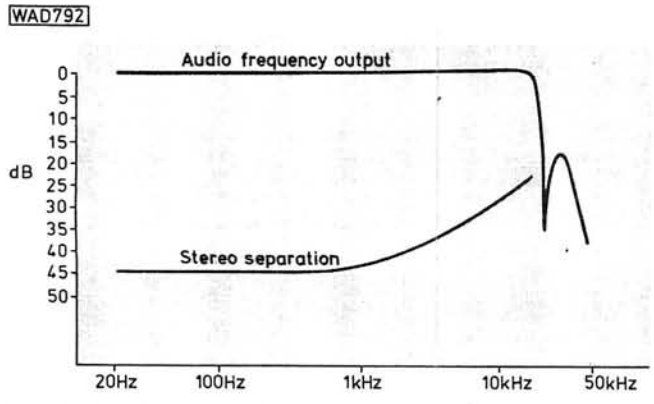
There has recently been introduced a new standard for testing and evaluating the performance of hi-fi f.m. tuners and receivers. This standard is known by the shortened title of IHF–T–200: 1975, and is now accepted world-wide.

One of the most important things to come out of the new standard is that the sensitivity is no longer quoted in microvolts. This is because there was always the possibility of a 6dB error, as more often than not it was never stated if it referred to e.m.f. or p.d. This ambiguity is resolved by expressing sensitivity in terms of available power, this being constant with both IEEE and IEC standardisation. Input signal levels are standardised in terms of dBf, with one femtowatt (10^{-15}W) as the reference level. At a 300Ω impedance level, 1dBf corresponds to 1·1μV open-circuit, or e.m.f., while 120dBf corresponds to 1·1V.

As it was felt a number of readers may be confused by this new standard, the measurements on the f.m. section of the *PW* Winton Tuner have been made using the methods in IHF–T–200 but quoted in both the old microvolts and the new dBf. This should enable the tuner to be compared with most other published specifications.



Graph showing audio output and signal-to-noise and signal-to-noise-plus-distortion on stereo for various input signal levels on 98MHz



Graph showing audio frequency response and separation on stereo

FM

Tuning range: 80–109MHz

Sensitivity:
0·9μV p.d. (10·33dBf) 75Ω for 30dB signal-to-noise-plus-distortion

Stereo sensitivity: 2μV (17·26dBf)

Quieting sensitivity *(50dB signal-to-noise-plus-distortion):*
Mono, 6·3μV (27·23dBf)
Stereo, 20μV (37·26dBf)

Muting level *(adjustable):*
Approx. 25μV (39·20dBf)

Signal-to-noise ratio *(485μV 65dBf):*
Mono, 75dB
Stereo, 73dB

Distortion *(1kHz 100% modulation):*
Mono, 0·15%
Stereo, 0·15%

Distortion *(100Hz):*
Stereo L—R 100% modulation, 0·25%

Distortion (6kHz):
Stereo L—R 100% modulation, 0·2%

Distortion *(de-tuned by ± 100kHz):*
Stereo 1kHz at 100% modulation, L—R not more than 0·5%

Stereo separation:
20Hz–40dB
100Hz–40dB
1kHz–40dB
5kHz–32dB
10kHz–26dB
15kHz–22dB

Spurious r.f. responses:
Image better than 120dB
F1 + ½ i.f. better than 120dB
2F1 — F2 better than 64dB

Audio frequency response:
—1dB for 14Hz–15kHz
—1·5dB for 16kHz

Pilot tone rejection:
Stereo, better than 70dB

Selectivity:	***Wideband***	***Narrow band***
Adjacent	7·5dB	20dB
Alternative	73dB	75dB

Capture ratio:
Wideband, less than 1dB
Narrow band, less than 2dB

AM suppression:
Wideband, better than 60dB
Narrow band, better than 65dB

AFC *(off-set)*:
Less than 20kHz

AFC correction factor: 5

Signal strength meter range:
0·8μV to 1mV

Audio output *(full limiting 100% modulation)*:
280V

Modulation level:
100mV output–33%

TV

Frequency range:
Approx. 460MHz to 860MHz

Channels: 21 to 69

Logging scale reading:
Approx. 200 to 500

Sensitivity:
100μV for 30dB signal-to-noise-plus-distortion

Image rejection: 20dB

AFC correction factor: *Mid-band,* 12

AM

Frequency coverage:
LW, 140kHz to 280kHz
MW, 500kHz to 1625kHz
SW, 3·3MHz to 6·3MHz

Sensitivity *(for 10dB signal-to-noise-plus-distortion)*:
LW, 70μV
MW, 23μV
SW, 16μV

Image rejection: 18dB at 6MHz

Selectivity:
–3dB bandwidth 5kHz
–15dB at ±10kHz
–50dB at ±20kHz

Audio Frequency response:
–3dB at 40Hz and 3kHz
–10dB at 22Hz and 4·5kHz

Distortion:
2% at 1kHz and 30% modulation

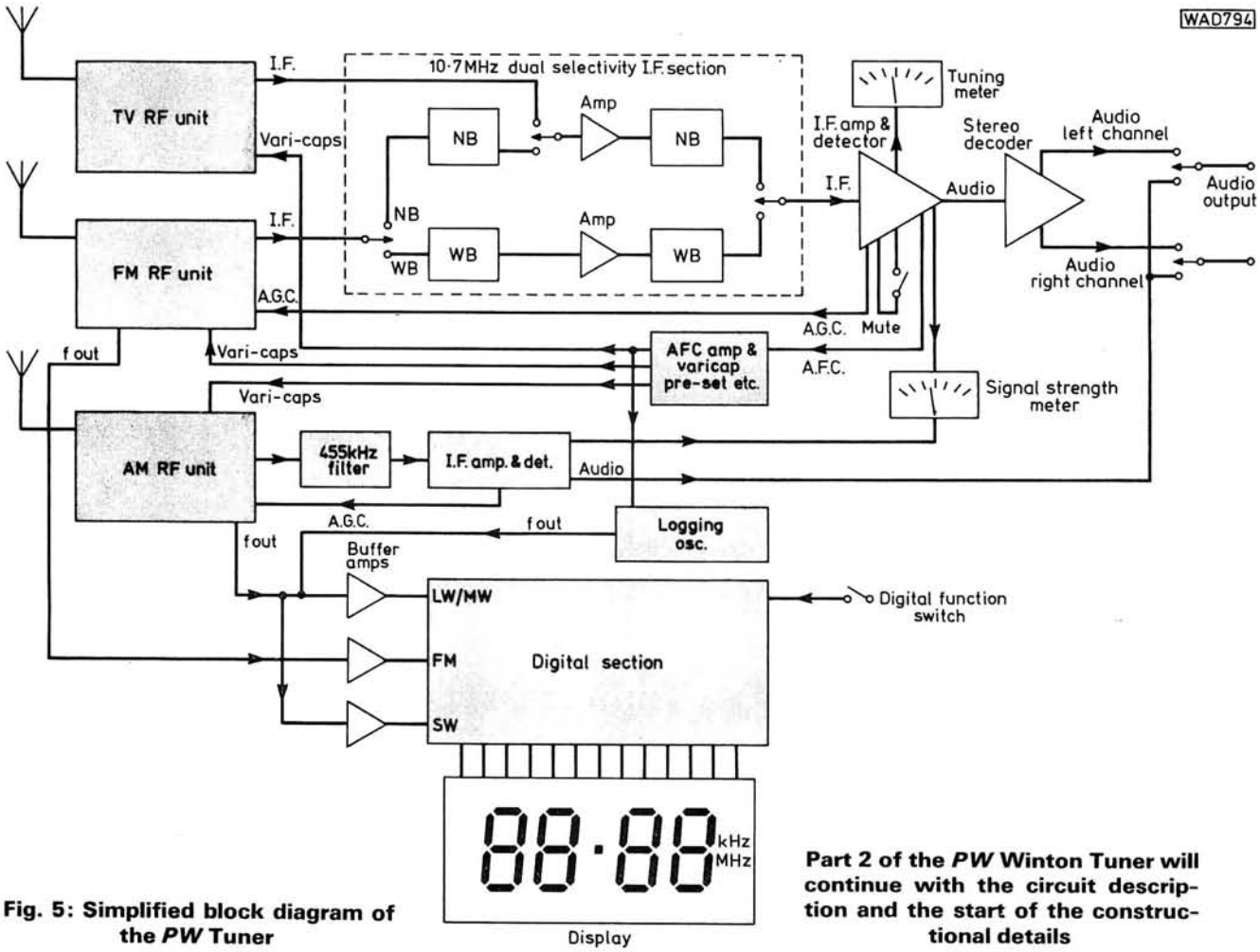


Fig. 5: Simplified block diagram of the *PW* Tuner

Part 2 of the *PW* Winton Tuner will continue with the circuit description and the start of the constructional details

SOUND ADVICE – SOUND VALUE

A GOOD START is essential to short wave listening and expert advice is important in achieving this – So here's some – If you've made up your mind to buy a receiver you should be aware it will perform only as well as the antenna it sees. The old adage regarding wire antennas "As long and as high as you can" is still good, but at best is only good for PEAK PERFORMANCE on one or two frequencies, at worst none.

Whichever frequency you tune your receiver to, for PEAK PERFORMANCE on all frequencies you need good matching between your Receiver and Antenna to hear the best from it. If you plan to listen on the high frequency bands up to 30MHz then you know you can't have an antenna for every frequency! Or can you? – Well, not quite! BUT we can offer you MUCH IMPROVED PERFORMANCE from your receiver by using an antenna tuning unit, that will electrically change the length of your antenna to match the frequency you select – In other words – A MATCH AT ALL FREQUENCIES.

You'll see many antennas being advertised under gimmicky names, but when it comes down to it they're only random wires or odd configurations. At the end of the day, if you're expecting the performance the manufacturers specified, then you'll still have to buy an antenna tuning unit.

Tell you what we'll do – we'll prove it to you – we'll give you one ABSOLUTELY FREE when you buy your FRG 7700 or FRG 7700M and we'll give you complete advice on an antenna to suit your available space, which should only cost you a couple of pounds! So let's put the offer in big print for you!

1 YAESU FRG 7700 + AMTECH 200 ATU £309.00
1 YAESU FRG 7700M +AMTECH 300 ATU £389.00
VAT included

What's the difference between the Amtech 200 and Amtech 300? Well both will tune any random length of wire but the Amtech 300 will do a little extra – it will also tune co-axial fed antennas – Their normal selling price? The Amtech 300 **£43.95** – The Amtech 200 **£29.95** – What can you lose? So get cracking MAKE A GOOD START! HAVE PEAK PERFORMANCE FROM THE OFF.

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(TD1 are of 14 gauge copper; TD-P is copper/terylene braid)		
VERTICAL		
DX-5V	10-80 metres; approx 26ft high; slimline	£89.00
BEAM ANTENNAS (and Rotary Dipole)		
DX-31	Rotary dipole for 10, 15, 20m	£46.00
DX-32	2-element beam for 10, 15, 20m	£80.50
DX-33	3- " " " " " "	£121.90
DX-34	4- " " " " " "	£161.00
DX-103	3-element monoband beam for 10m	£74.75
DX-105	5- " " " " "	£97.75

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MODS

IMPORTANT—The ideas presented here are suggestions only, and as they are untried by this magazine, we cannot accept responsibility for any resultant damage, however caused. Before alterations are attempted, care should be taken to ensure that any guarantee is not invalidated, and it should also be borne in mind that modifications usually have an adverse effect on resale prices. In cases where specialist skills or equipment are needed, most dealers will undertake the work for a reasonable fee.

Roger Hall G8TNT (Sam)

No. 5

Trio R-1000

Chris Attrell, a s.w.l. from Brighton, has telephoned me to point out that, although the Trio R-1000 bandwidth mod that I described in Mods No. 3 (January) works perfectly, some readers are justifiably reluctant to cut and resolder wires inside a brand new piece of equipment. He has suggested a far simpler way to achieve the same results.

Just above the plug that has the relevant wires running to it (Fig. 1 Mods 3), is an empty socket. To change the bandwidths from 12kHz (wide) and 6kHz (narrow) to 6kHz (wide) and 2·7kHz (narrow), simply remove the plug from its original socket and replace it in the empty one. This mod is easily reversible when it comes to selling the set, and this is a definite improvement on the original. Thanks Chris.

Standard C8800

I have received numerous letters, telephone calls and "on the air" requests for a reverse repeater mod for the Standard C8800, and I would like to thank John Armstrong G8MVH, who worked on this mod whilst he was running the service department of Lee Electronics before he left to start his own business, for the details.

The mod, which gives full reverse repeater operation, is based on the principle that if, when R1 is selected, pin 7 of plug JL05 is low on receive and high on transmit, then by reversing this to high on receive and low on transmit, the reverse of the standard function can be obtained.

An element of personal choice as an extra switch could be mounted almost anywhere; on the front or back of the rig, underneath, on the microphone, etc. In this instance it has been incorporated using the existing switches and with the minimum of alterations to the circuit.

The additional components that are required are BC182L or equivalent (Tr1) 1 off, 10Ω ½W resistor (R1) 1 off, 1N914 (D1) 1 off. First remove the bottom cover and locate pin 7 of plug JL05. Attached to this pin is a yellow wire that must then be separated from the others and pulled towards the BUSY/VACANT switch, SM01. Now cut this wire, but make sure that the cut is in a position such that once the ends have been bared they will still reach the appropriate pins of SM01.

Next, short together pins 1 and 4 on SM01 with a short piece of insulated wire (Fig. 3), and then solder the yellow wire coming from pin 7 of JL05 to pin 3 of SM01, and then solder the remaining piece of yellow wire to pin 2 of SM01. Solder the emitter of Tr1 to SM01 at either pin 1, pin 4 or to the linking wire.

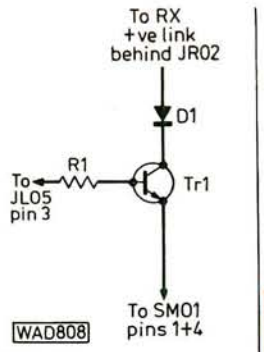


Fig. 1:

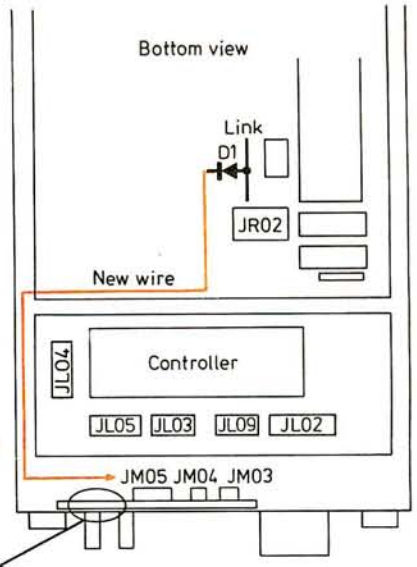
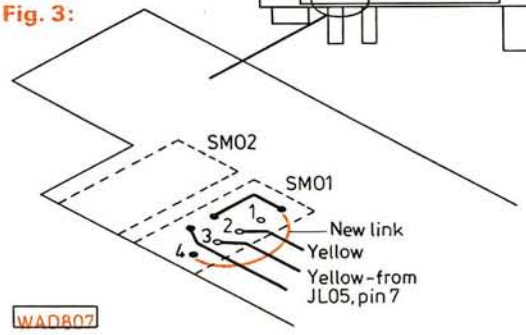


Fig. 2:

Fig. 3:



Just behind JR02 is a link (Fig. 2). Solder the anode of D1 to this link and then cut a new length of insulated wire, and use it to join the cathode of D1 to the collector of Tr1. Keep the cathode of D1 as short as possible and make sure that it is kept well clear of associated circuitry. Run the new wire around the controller board as in Fig. 2. Now solder R1 between the base of Tr1 and pin 3 of JL05.

This small circuit (Tr1, D1 and R1 in Fig. 1) should be self-supporting, if made carefully, but could be made on a small piece of Veroboard and mounted in any convenient position.

If, after having done all this, you find that nothing happens when reverse repeater is selected, don't panic. Some batches of these rigs were fitted with slightly different BUSY/VACANT switches and reversing the wires to pins 2 and 3 should solve the problem.

When modified, the C8800 will operate normally in the simplex and duplex modes, if the BUSY/AUTO/VACANT switch is in the AUTO position. With the switch in the BUSY or VACANT position, duplex (R1) gives reverse repeater. It should be noted that in this mode scan, memory recall, repeater shift (R2 and R30), etc., will be inoperative and the switch must be returned to the AUTO position before these functions will operate.

Wanted

Would whoever left the C7800 reverse repeater mod with Norman G8THJ, at Lee Electronics, please contact either him or me as we no longer have your name and address, and I need to contact you before I can publish the mod. Please write to: R. S. Hall, Practical Wireless, King's Reach Tower (Hatfield House), Stamford Street, London SE1 9LS.

73's
Sam G8TNT

N CONTROL

Dick GANDERTON G8VFH

This is the first of a new series which will look at aspects of systems used for the control of models of all descriptions.

By now most radio control enthusiasts will be aware that as from 1 January 1981 a licence is no longer required for r.c. operation. However you will still have to comply with all the regulations—which were printed on the licence—which you no longer have! Also, from the same date, you may now use the frequencies between 35·005MHz to 35·205MHz, but only for model aircraft control and only with narrow-band f.m. systems. This leaves other modellers, and a good few aircraft types as well, stranded on 27MHz beseiged by an unspecified number of illegal "good buddies".

For some months now the Home Office have been issuing to *bona fide* r.c. clubs a special licence to allow them to monitor 27MHz frequencies for interference. (Listening on 27MHz without such a licence is, according to the Wireless Telegraphy Act, illegal.)

As it could be of immense use to a modeller to monitor the frequency he is about to use I am offering details of a simple monitor based on a cheap Oriental transistor radio.

The original idea and development came from P. A. Julian of Wimborne.

A Radio Control Monitor

In these days of increasing illegal 27MHz activity, it is important that the radio-control operator knows if there is any traffic on his frequency before going on the air. Many enthusiasts do not possess a monitor receiver and often take a chance rather than pay out for an extra piece of equipment. But radio interference can cause loss of control resulting in damage to a valuable model and even possible injury to spectators.

Although a reasonably cheap monitor is available on the market for about £20, it is tuneable and, for those requiring spot-on accuracy, a crystal controlled monitor is the answer. Moreover, a crystal controlled receiver is relatively simple to alter to 35MHz, now that band has been granted by the Home Office for r.c. use, requiring only a change of antenna coil and crystal.

For these reasons, ways of producing a simple but effective monitor were considered.

Circuits

In the end it was decided to attempt to modify an existing portable radio since it is often cheaper to buy a ready-built medium wave set than it is to buy the individual components and assemble them.

Crystals commonly available for r.c. use are for 455kHz i.f.s while transistor radios imported from the Far East also have nominal 455kHz i.f.s and can often be picked up second-hand very reasonably. Attempts were made to modify the front end of one of these, but using as much of the original circuit as possible. Fig. 1 shows a typical front end.

Looking at circuits for r.c. receivers it was seen that two transistors were used in the front end, one as a mixer and the other as the crystal controlled oscillator. To copy this would have involved building at least the oscillator on a

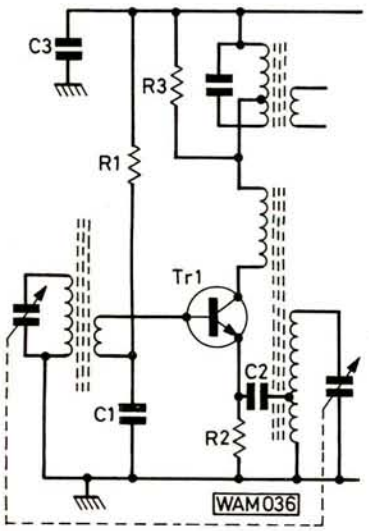


Fig. 1:

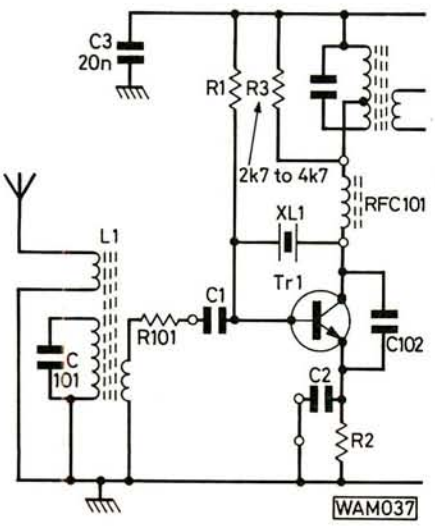


Fig. 2:

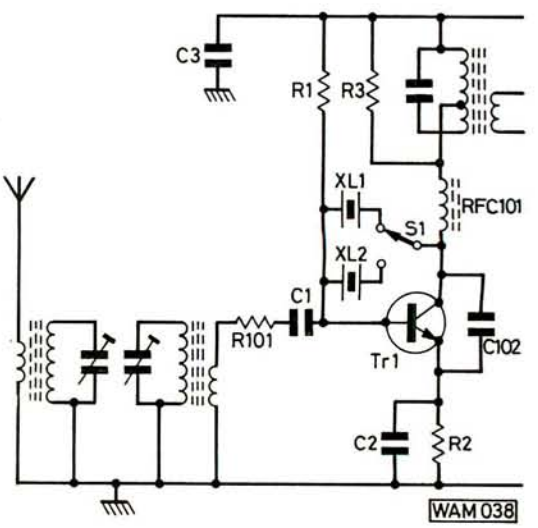


Fig. 3:

separate board and then fixing it to the receiver circuit board, so an unusual mixer/oscillator combination was tried and the original circuit was modified as shown in Fig. 2. This was found to be quite satisfactory since a minimum of extra components was required and even the original mixer/oscillator transistor was used.

At first it was thought that a tuned circuit would be needed between the collector of Tr1 and the first i.f.t. but a small r.f. choke from an old TV proved sufficient. R101 is needed to prevent the aerial tuned circuit from damping and killing oscillation. C102 introduces some feedback and encourages the crystal to oscillate and also helps to overcome the damping effect of L1.

Modifying the Set

It is suggested that the set to be modified should have three i.f. stages (four cans on the circuit board including the oscillator coil) as two stages will probably not be selective enough.

The circuit board should be taken out of the case and the tuning condenser, ferrite rod antenna and oscillator coil carefully removed. Any holes needed for mounting the 27MHz coil and crystal holder can be drilled. The free end of C2 should be connected to earth and RFC101 fitted between the collector of Tr1 and the first i.f. coil. The holes revealed by the removal of the oscillator coil can be used. C102 is best fitted to the underside of the board and soldered between the emitter and collector of Tr1. The base of Tr1 should be connected to the junction of C1 and R1. Unused sections of the printed circuit can be used for making connections where needed. The grounded end of C1 should be disconnected and joined to one end of R101. The antenna coil and crystal holder should be glued in place. The coil can be connected and C101 soldered in place. The crystal holder is wired between the collector and base of Tr1. If there is not enough height between the board and the lid of the case for the crystal to stand upright, then the holder will need to be the type which allows the crystal to be plugged in sideways.

When the modification is complete, check the wiring against the circuit diagram and switch on. When the receive crystal is plugged in, a slight change in noise level should be noticed. Next test by switching on a r.c. transmitter with the correct transmit crystal plugged in and make sure the i.f. transformers are aligned. The antenna coil slug can then be adjusted for maximum signal. The actual telescopic antenna will have to be chosen and fitted to suit the case.

★ components

Resistors
¼W 10%

220Ω	1	R101

Capacitors
Disc Ceramic

22pF	2	C101,102

Miscellaneous
Crystal (see text); Crystal holder; 1A TV choke (RFC101); 7mm coil former; 26 s.w.g. enamelled copper wire; Oriental transistor radio.

Coil Winding Details

Primary	12T 26 s.w.g. on 7mm former
Secondary	3T 26 s.w.g. on 7mm former
Antenna Coupling	3T 26 s.w.g. on 7mm former

Any final adjustments can be made with the transmitter some distance away from the monitor. If there is any instability in operation, try changing the value of R101 but first check C3 and R3, the addition of these components if not in circuit could make quite a difference.

If the set being modified is a l.w./m.w. version, the wave-change switch should be removed or all connections to it carefully cut with a sharp knife. However, this switch could usefully be used to change crystals (Fig. 3) and the l.w. trimmer capacitor could be used in place of C101.

Other improvements in performance include replacing Tr1 with a suitable v.h.f. type (checking whether the original is *pnp* and *npn*), and having an additional tuned circuit as in Fig. 3. It should be possible to alter older British sets using germanium transistors in the same way although the mixer/oscillator transistor may have to be changed for another type such as an OC170. Also note that the i.f. frequency of these older sets will have to be lowered from 465/470kHz to 455kHz unless the older 470kHz i.f. receiver crystals as once produced by Macgregor can be obtained, perhaps second-hand.

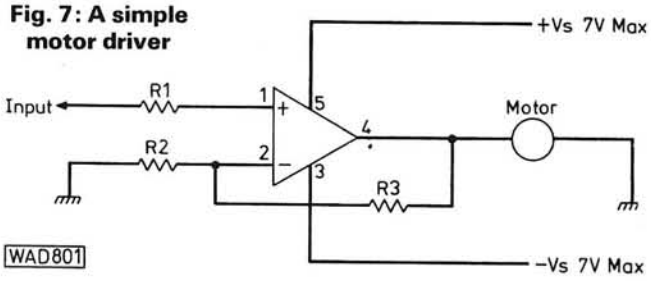
Of course a monitor will not prevent the effects of interference but because this particular type of circuit resembles an r.c. receiver, it will give a very good indication of what an r.c. receiver will "hear". It will even have a similar image response, i.e., the Rx crystal frequency minus 455kHz. Even though this is an a.m. set, it will also give adequate reproduction of an f.m. signal for our purposes. ●

IC OF THE MONTH—SL6310C

▶▶▶ *continued from page 32*

The SL6310C can also be used in applications where a small amount of controlled power is required. Its use in controlling the speed of a small motor is shown in Fig. 7. Balanced ±7V supplies are used here, so that one side of the motor can be connected to ground. No appreciable current will flow through the motor when the two inputs of

Fig. 7: A simple motor driver



the amplifier are at the same potential; that is, when the input is at ground potential. As the input is made positive with respect to ground the motor will rotate in one direction, but when the input is made negative, the motor will rotate in the other direction. Resistors R2 and R3 set the gain and therefore the sensitivity of the circuit.

Availability

The SL6310C device is available from Ambit International Ltd., 200 North Service Road, Brentwood, Essex CM14 4SG. ●

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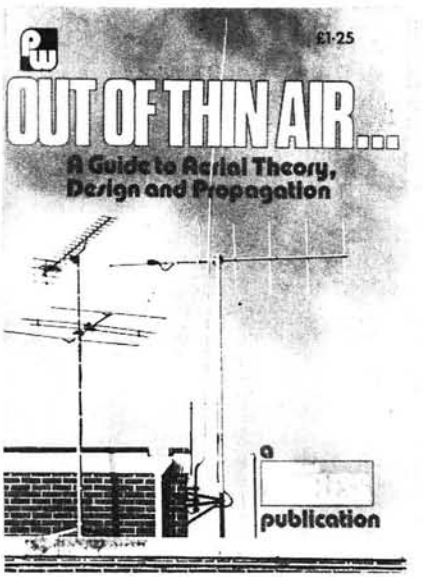

Aerials and aerial accessories are very definitely among the most popular topics covered in *Practical Wireless*. In response to requests from readers, we've reprinted a selection of articles from the past three years, plus two new features—one by Ron Ham on v.h.f. propagation, the other describing the "Ultra-Slim Jim", a new version of that most popular 2-metre aerial design by Fred Judd.

Out of Thin Air has 80 pages, 295 × 216mm, and is available from W. H. Smith price £1.25, or by post from Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF, price £1.50 including postage and packing to UK addresses, or £1.80 by surface mail overseas. Please ensure that your name and address are clearly legible.

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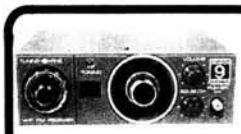


SR9 VHF RECEIVER AMATEUR/ MARINE

£46 inc. VAT

The SR9 must be one of the most popular monitors for 2 metre amateur radio enthusiasts. (Also available as a marine version at the same price). It is fully tuneable across the band with the option of also installing up to 11 xtal controlled channels. Power requirements are 12v DC negative earth at 200ma approx. The unit comes complete with mobile mounting kit and built-in speaker.

PROFESSIONAL AIRCRAFT MONITOR
R517 £49.50
(as supplied to pilots, ground crew etc.)

The R517 is a professional aircraft monitor receiver, having superb sensitivity and capable of tuning across the entire aircraft band 118-143mHz. For easy tuning there is both a coarse and fine tuning control. In addition there is a 3 position switch for selecting xtal controlled channels (xtals £3.00 extra) for your local airport. The unit is completely portable running off self-contained batteries.

AR22 VHF FM MONITOR
OUR PRICE £83 inc. VAT

Truly amazing! The AR22 tunes across the 2 metre FM band 142-148mHz (also includes Police and Fire Brigade) in 5kHz steps. So small it will fit into a shirt pocket and yet nothing is sacrificed in terms of performance. Price includes rechargeable batteries, mains charger, fly aerial etc. You won't find a smaller monitor anywhere.

TRIO R1000
COMMUNICATIONS RECEIVER
OUR PRICE £285 (Free Securicor Delivery)

The R1000 has really caused a stir in the receiver market! Its performance matches professional receivers costing many times more and with our new competitive price of £285 it must be the best value on the market today. Full digital readout from 200kHz (actually it operates right down to 20kHz but with reduced sensitivity) means accurate tuning and the 30 position band selector switch means really good bandspread for easy operation. Other features include noise blanker (a really good one!) built-in speaker, digital clock/timer and both 230v AC/12v DC operation. (Yes we include the 12v DC kit free!) Each model is fully checked and delivered anywhere in the U.K. within 24 hours of receipt of payment!

YAESU COMMUNICATIONS RECEIVER
FRG7700 £309
FRG7700MEM £380
PLUS FREE GLOBAL 3-30mHz Aerial

Free Securicor Delivery

The FR7700 is a new model from Yaesu that replaces the FRG7000. Full coverage is provided between 200kHz and 30mHz with bright digital readout that also doubles as a clock. Features include noise blanker, FM detector, internal speaker, 230 volt AC operation and built-in timer. As an optional extra there is also a memory unit which enables up to 12 selected frequencies to be stored and selected.

PS134 4 AMP 13·8v POWER SUPPLY. STABILISED & SHORT CIRCUIT PROOF
£23 plus £1.50 p&p

This is the power supply that we've been advertising and selling for several months. It really is a robust little unit with a transformer 50% larger than its competitors. Some cheap power supplies get hot, hum and even go bang! This one stays silent and keeps on working. It is fully protectd against short circuit and overload and is capable of delivering 4 amps continually at 13.8v DC. Ideal for transceivers.

SWR/POWER/FIELD STRENGTH MEASURING METER SPECIAL OFFER
£11.95 +60p p&p

As used by CB and Amateur radio operators.

The YW3 is used by amateur radio and CB operators around the World. It's offered to you at a really low price because we import them direct from Japan. It tells you the VSWR, power output and field strength and covers 3.5 to 150mHz. If you want the strongest signal in town – you'll find the YW3 the sure answer.

28MHz FM!

NEW AZDEN PCS2800

£169.00

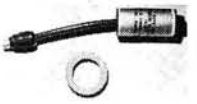
Here's an exciting new 20 watt input (10 watts output) transceiver with a host of features to put it head and shoulders above the competition. Compare its features:– 200 channels, high/low power switch, computer control touch pad, 6 programmable memory channels, automatic band searching, automatic memory scanning, microphone frequency control button, priority channel, digital frequency readout, removable control panel (permits main transceiver to be mounted remotely), slide in mobile bracket, built in speaker and a host of other features. Its high power and very sensitive receiver gives it better coverage than its competitors. Send for details today or come and see our demonstration model.

SX200 MONITOR 26-500MHz

£240 inc. VAT

Here's a really wide coverage receiver going all the way from 26mHz to 500mHz (with just a few gaps).Mains or battery operation, FM or AM, means it can be used just about anywhere for anything. Channel memory, scanning and built-in clock are just a few of its features. If you're interested in amateur radio, aircraft, Police, taxis, etc., then this receiver covers them all.

STOP TRANSMITTER INTERFERENCE



HP3A £3.50 each
Ferrite Filters £1.00 for 2

If you are suffering from or causing transmitter interference to TV or audio equipment, then these are the items for you. Our HP3A TV filter simply plugs into the TV lead and cuts out transmitter interference (ideal for 27MHz). Our ferrite ring filters are ideal for cases of interference to hi-fi systems.

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TR 2300 2m handheld (80 channels) **£166.75**
TR 2400 2m synthesized handheld **£198.00**
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R 820 Simply the best amateur receiver **£690.00**
SRX 30 SSB/AM/CW 0·5-30Mhz **£158.00**
SR 9 144-146 or 156-162Mhz tuneable or xtal **£46.00**
AMR 217B Marine or amateur band 8 channel scanner – xtal **£120.75**
SL 1600 2m 16 channel scanner **£39.50**
FRG 7700 The latest from Yaesu **£389.00**
R 517 Air band portable-tuneable & xtal **£49.45**
SX 200 26-514Mhz scanner, AM and FM **£235.00**

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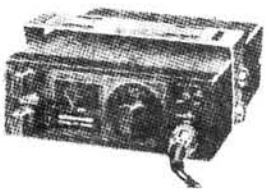
80 channels, 2 metre FM
Mobile Transceiver



Rapid channel change with illuminated read-out, 25KHz steps. Complete with mobile mount and microphone (which also incorporates a volume control). Two versions available – 50W output, switchable down to 2 watts at **£199,** and 10W output switchable down to 1 watt at **£159.** Can be used as base station with a Sommerkamp Power Supply.

SOMMERKAMP TS802
80 channel, 2 metre FM Hand-held Transceiver.

Fully synthesized, switchable reverse scan, digital readout, repeater shift, tone burst. 2 watts output switchable down to 0.2 watts. Price includes leather carry case, flexible aerial and a free battery charger – a bargain at **£129.** Set of Nicads **£10.** £2 post, packing and insurance.

SOMMERKAMP

FRG7 Receiver	**£188**
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FT277ZD HF Transceiver 160-10 metre	**£599**
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FT480 2 metre Mobile Transceiver	**£359**
FT227RAE 2 metre Mobile Transceiver	**£255**
FT307CBM HF Transceiver 160-10 metre	**P.O.A.**
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Will be at most of the rallies in 1981 – come and see us.
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These units come complete, with only three wires to connect. The FDU7 for the Yeasu FRG7 can be fitted in place of the KHz dial, or can be supplied for external use. **(Please state when ordering)** The FDU3 for the SRX30 is supplied for top of the set use only.
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Send for full specifications of our full range of receivers covering from 200KHz to 520MHz. Our secondhand equipment changes daily. Send SAE for up to date lists. Part exchange welcome. Good clean Equipment bought for cash.

Drake
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J.R.C.
NRD515 Solid state synthesised digital receiver 100KHz to 30MHz. £948.

Bearcat 220FB Receiver
Scanning Receiver. 66-88MHz–118-136MHz; 144-148MHz–144-148MHz; 420-450MHz–450-470MHZ, 470-512MHz £258.75.
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air test

USER REPORTS ON SETS AND SUNDRIES

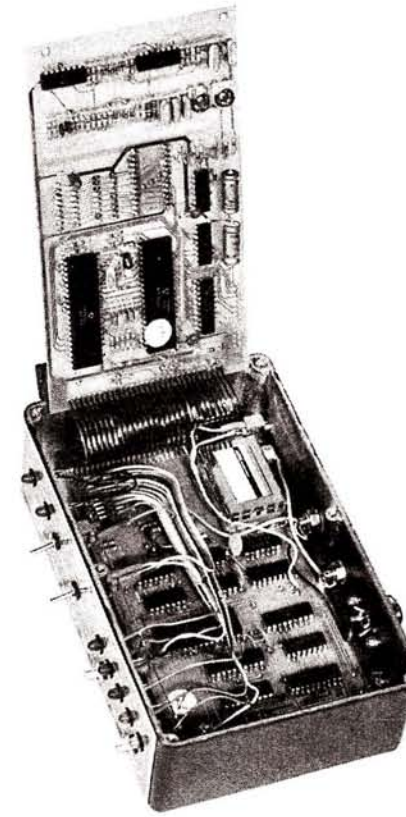
MM2000 RTTY to TV Converter

This unit, which has recently been designed and developed by **Microwave Modules,** is the quickest way for the short-wave listener and licensed amateur to receive RTTY, Murray coded and amateur band ASCII signals (the standard types of transmission used by amateurs). The Converter will receive and convert the four baud rates at present in use by commercial and amateur users. This receive-only device may subsequently whet the appetite for the transmitting scene with its exchange of contacts with other radio amateurs.

The MM2000 converts RTTY signals which then appear, suitably modulated, on u.h.f. TV channel 35 i.e., 583MHz in the commercial TV band. All that is required to use the unit is a signal from a suitable radio receiver and a d.c. supply of 12V. In the reviewers case the output from the receiver is taken from the "record" socket of a Trio R-1000 general coverage receiver. This output is at 30mV, more than ample for this unit; the signal is unaffected by the position of the volume control, so enabling monitoring via the speaker or headphones. One point found with the receiver is that the use of a filter, such as the Datong FL2, narrows the bandwidth and prevents the QRM, ever present on most amateur band RTTY. The minimum bandwidth is 2·7kHz, a little too wide for single-signal reception, which gives the best "copy" on the TV screen.

To return to the Converter. Signals from the receiver are filtered and amplified before being passed to the discriminator: accurate tuning indication of the signal being by means of two l.e.d.s. This method of alignment is very advantageous, when using an ordinary home constructed terminal unit and teleprinter, because overprinting will occur if the receiver is incorrectly tuned. In the Converter this is prevented by the incorporation of an automatic carriage return on RTTY signals. An innovation with this unit is the provision of an "auto-sensing" unit which enables it to sense the correct speed of the code transmission and indicate this on the appropriate l.e.d. for that speed. Manual override selection is also provided, if required.

Should an alternative, special code, be required, this is easily accomplished and involves re-programming of the internal EPROM by loading in a suitable program from cassette tape. So that the unit can be used in countries using positive sync. on the TV signal, a rear-mounted toggle switch is provided, giving instant access to either standard. This switch is a feature recently introduced by the manufacturers, to replace previous "hard-wired" internal links.



The picture information consists of 16 rows, each containing 64 characters and when using a 14in screen TV the characters are easy to read. The receiver used for driving the Converter should be stable and not prone to drift, otherwise continual adjustment of the tuning and b.f.o. will be required to retain the information. It is possible to copy both AFSK and FSK signals with this unit. These signals are easily recognisable: a warbling tone for AFSK and frequency variations for FSK. The actual frequency is varied, noticeably so when the receive b.f.o. is switched on.

Latest state-of-the-art techniques are used in the design of the Converter which employs two microprocessors and 21 i.c.s. All the circuits are built into a black enamelled aluminium die-cast box measuring 187 x 120 x 53mm, and mounted on two glass-fibre p.c.b.s using a plug-in connector technique which makes servicing that much easier.

Connections to the u.h.f. TV monitor and audio input from the receiver are

made by means of phono sockets. The power supply input of 12·5V, at approximately 1A, is by means of a DIN socket. Plugs are supplied with the unit for connection to these sockets.

Operating Procedure

Having powered-up, or cleared the system, the user is presented with a heading line containing the information *"Microwave Modules MM2000 programme 3·4"*. The 45·5 baud l.e.d. illuminates and the Converter is ready to receive Baudot coded signals at this rate. Pushing the SELECT button, steps the speed indicators through 50 and 75 bauds and eventually ASCII together with one of the three-speed l.e.d.s giving sequentially 110, 150 and 300 baud ASCII coded signals.

Further pushing of the SELECT button beyond the 300 baud ASCII point will force the unit into the AUTO SENSE mode for Baudot signals. At all stages user indications of state are provided by front panel mounted l.e.d.s.

During reception of noisy signals or with incorrect speed or shift settings, the microprocessor sampling the incoming signal may not verify the stop bit in its correct position. In these circumstances it will print a full stop on the screen. With the case control in the "on" position and when the unit is receiving Murray coded signals, the microprocessor controller will automatically force the letter shift after 15 consecutive different characters in figure shift. By switching the case control OFF this feature can be overridden, allowing response to letter and figure shift codes as normal.

To prevent the rapid replacement of a previously displaced page, the latest software allows only two consecutive carriage return line-feed operations, when receiving Murray coded signals.

The MM2000 is available at the VAT inclusive price of £169 direct from **Microwave Modules Ltd., Brookfield Drive, Aintree, Liverpool L9 7AN. Tel: 051 523 4011;** or through their many appointed agents.

AR 245 2m Hand-held Transceiver

The latest contestant in the 2-metre hand-held battle stakes is the AR 245 fully synthesised transceiver.

At five watts output this rig must be the most powerful hand-held on the market and, although not quite as small as the IC2E reviewed last December, in terms of watts per cubic centimetre it is an amazing performer.

The transceiver is compact, with the rechargeable battery pack fitted inside the plastics case. Unlike other hand-helds the battery pack is not removeable and this has the disadvantage of not allowing the user to carry a spare fully-charged pack around.

The operating controls are on the top of the case except for the repeater shift and power level switches which are on the back.

The p.t.t. switch is a large pad on the side with the tone-burst button in its centre. This proved to be rather awkward to use as the p.t.t. switch required quite a large pressure to operate, while pushing the tone button at the same time for half-a-second or so and then releasing it without relaxing pressure on the p.t.t. needed some effort. However this was soon mastered and the rig was quite easy to use.

The antenna provided is a telescopic whip which screws into a plain threaded bush on the top. A helical whip is available as an extra if preferred, but the telescopic whip proved to be more than adequate and also very convenient as it retracted completely into the set top.

continued on page 73 ▶▶▶

HF-60 Handy Frequency Counter

The Model HF-60, frequency counter, has recently been made available in the UK by **Lowe Electronics** of Matlock.

The unit is a self-contained, hand-held battery powered device and is capabie of frequency measurements in the range 1kHz to 55MHz. Accuracy is quoted as 0·003 per cent and our bench tests indicate stability to be of a high order for an instrument of this type.

Signal sampling is carried out by means of an extendable telescopic whip antenna, provided as standard, and stored internally for ease of transportation. The proximity of the antenna to the signal source, is determined by the anticipated level and quaintly described by the instruction leaflet: *"when transceiver is with strong power you can be 10m away"!*

Applications, quoted by the manufacturer, include amateur h.f. band emissions, radio control models, including the new aircraft-only band on 35MHz and, **if** and when available in the UK, CB radio.

Internal construction is kept to the briefest minimum, all components being mounted on one single-sided p.c.b. Four i.c.s and approximately twenty discrete components provide the signal processing and five-digit, 7-segment display drive. The remaining 50 per cent of the case is occupied by four AA size dry-cell batteries.

The HF-60 has found itself used for a variety of measurements in our workshop, not least of which was diagnosing the demise of a recent radio controlled Christmas present.

The only problem encountered in operation concerned the position of the side-mounted ON-OFF slide switch which had inadvertantly been enabled when the unit was replaced in its cardboard box. The moral is, leave it where you can see it.

The HF-60 frequency counter is currently available at the very reasonable price of £36.50 including VAT from **Lowe Electronics, Chesterfield Road, Matlock, Derbys. Tel: 0629 2817,** to whom we offer our thanks for the loan of the review sample.

Amateur Radio Shop Tel: 20774

4 Cross Church Street Huddersfield West Yorkshire

ANNOUNCEMENT

LANCASHIRE AGENT. Ted Whittaker G3UUA at 414 Rossendale Road, Burnley, is now our man in Lancashire.
NEW MEMBER OF STAFF. Normal Hodson G3WAH has joined our company, and will be in charge of sales and service of ham equipment etc.

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NEW G4MH MINI BEAM

Price: £77.50 +£2.50 p&p in UK
PACKAGE: beam, rotator, 15m coax UR43, 15m 5 core – **£145.00**

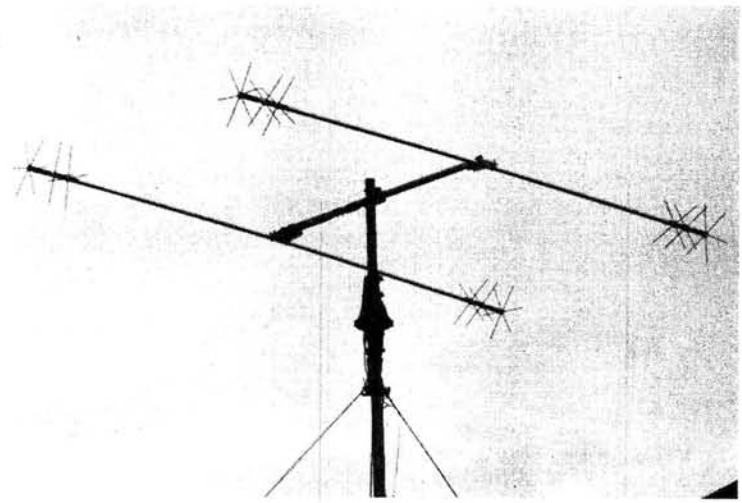
Designed and manufactured in the UK

SPECIFICATION

Element length		11 feet
Boom length		60 inches
Turning radius		7 feet
Operating frequencies		10m, 15m, 20m
Forward gain (ref D pole	1:00)	3·6 dB
SWR at resonance		1·5 to 1:00 maximum
Power rating		1400 watts PEP
Input impedance		50 ohms
Wind resistance		80 mph
Weight		14 lbs

Rotator requirements AR40

SAE for details, Coax UR43, UR67 and 5 core available



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PW1

Boat Engine Hours Counter

F. C. JUDD

Owners of power-driven boats and particularly those with outboard engines are no doubt aware of the importance of regular maintenance and oil changing, etc. For example, the average outboard engine requires a change of gear box oil after a specified number of hours running otherwise damage could result, and repairs and replacement parts are very expensive. Regular spark plug gap adjustment or change of plugs is also necessary as well as greasing and other items of maintenance essential for smooth and reliable running.

All boat engines have to operate under much more arduous conditions than the average motor car engine and as any experienced owner of a power-driven boat will verify, boat engines always seem to fail at the wrong time and in the wrong place, often with the possibility of putting life at risk. Such failures are more often than not due to lack of care and appropriate servicing.

Keeping a record of engine hours run is simple enough if one remembers to do it. Better, therefore, to have a device that doesn't forget and which in the end will more than pay for itself in savings made on repairs.

A version of the engine hour counter described in this article has been used by the writer for several years on a power craft fitted with twin outboard engines. The circuitry has been updated and a suitable five-figure reset counter is readily available. It will operate from a 9V PP9 dry battery or from a 12V supply such as the boat lighting supply.

The Circuitry

The circuit is shown in Fig. 2 and consists of a 555 timer i.c. triggering a pulse circuit Tr1, Tr2 and Tr3 which, in turn, actuates the counter. The counter has five figures, the first three being used to indicate whole hours up to 999 and the two remaining for one-tenth and one-hundredth of an hour respectively. The counter will therefore record to three figures and two decimal places from 000·01 up to 999·99 and can be reset to 000·00 after recording any required number of hours up to 999·99.

The time constants for the 555 consist of R9/R3 with R2 and the two 10µF tantalum capacitors C3 and C4. The timing and duty cycle duration sequence is illustrated in Fig. 1 and begins with a negative going pulse from IC1. This is inverted by Tr1 and drives Tr2, Tr3 on with a 100 millisecond pulse every 36 seconds or 0·01 of an hour. The short duration pulse of 100ms is essential to the operation of the specified counter.

The circuit will operate at any voltage between 9V and about 13V but R9 must be set to obtain the 36-second interval with whatever operating voltage is used. Inaccuracy in timing due to falling battery voltage or temperature effects, etc., will not amount to more than plus or minus one hour in 100 hours, which is nothing to worry about.

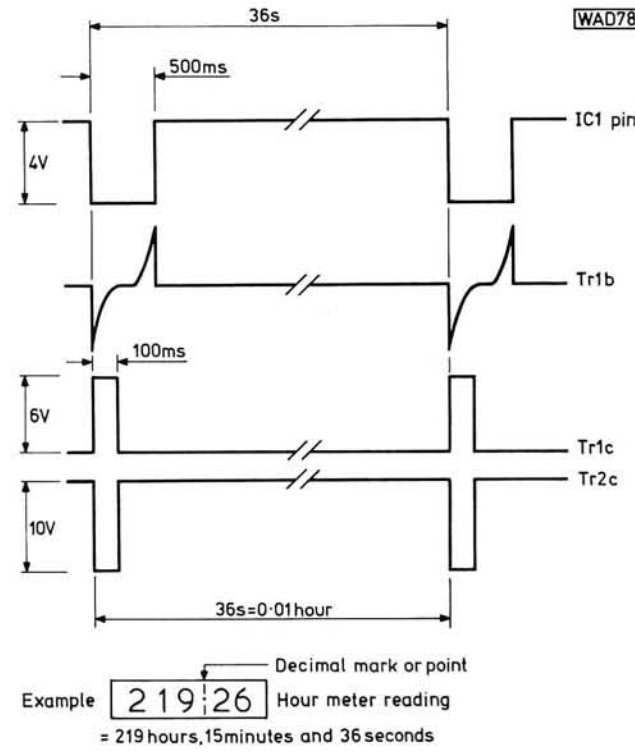


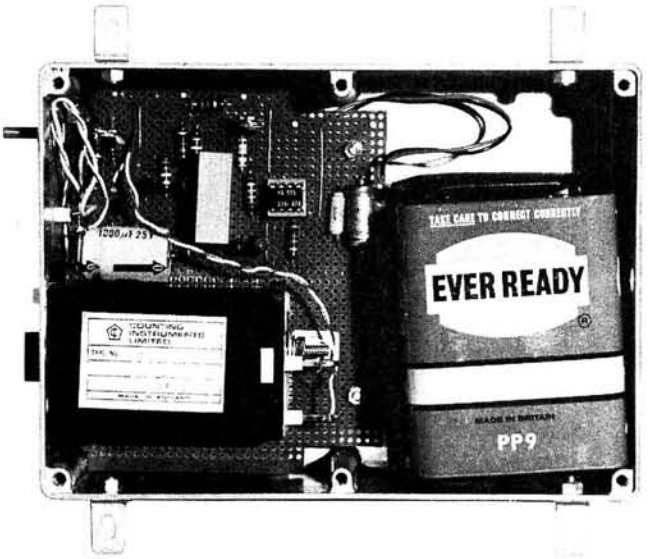
Fig. 1: The timing and duty cycle duration sequence for the counter

Construction

The box chosen for housing the circuitry and counter is also just large enough to accommodate a PP9 battery. A smaller box could be used if the counter is to be operated from an external battery.

Position and mounting of the circuit board and counter within the box is shown in Fig. 3. The case is fitted with right-angled brackets so the unit can be bulkhead mounted. Note that what is normally the lid of the box now becomes the rear panel.

Circuit board tracks and component positions are shown in Fig. 4. Plain matrix board and component-to-component wiring may be used if desired by following the layout given.



Internal view of the prototype engine hours counter. This unit was built using plain matrix board instead of the p.c.b. which was developed from the original layout

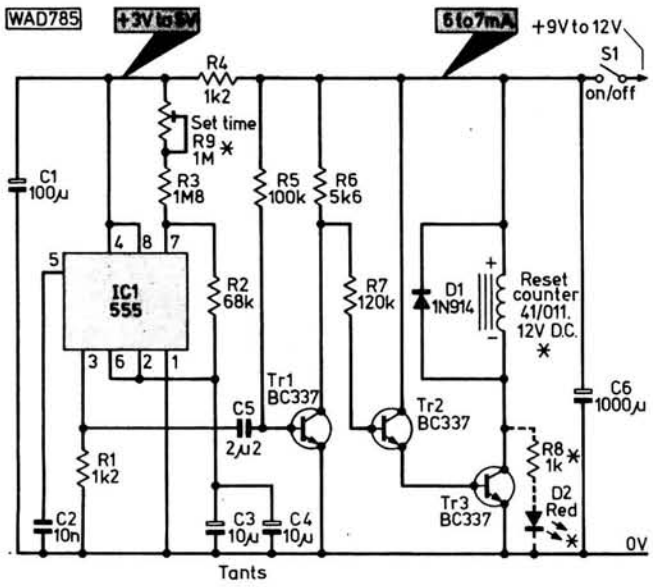
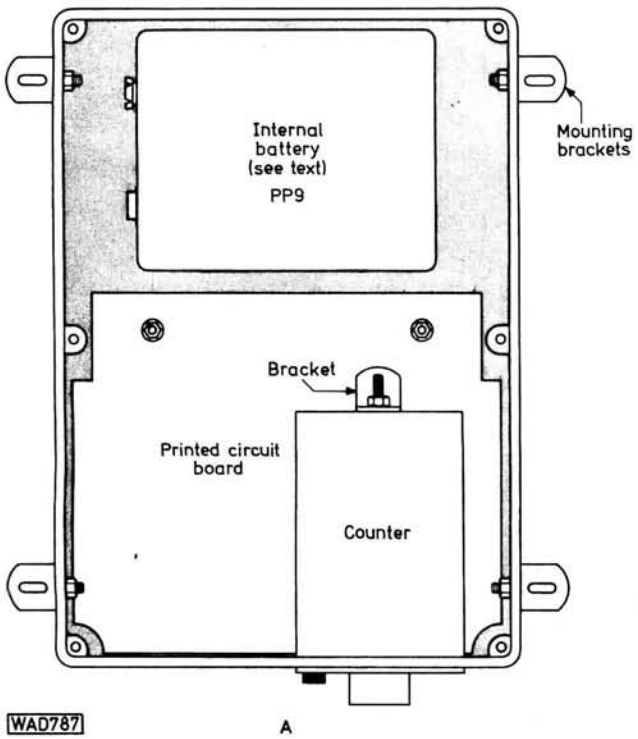
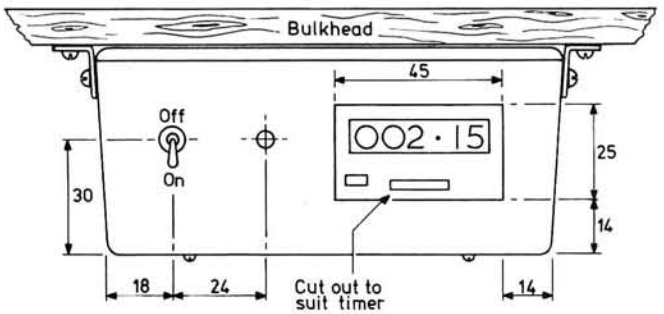
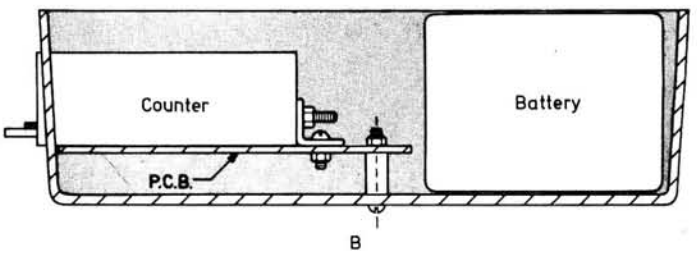


Fig. 2 (left): The circuit diagram of the engine hours counter

Fig. 3 (below): The unit is constructed in a diecast box as shown in this drawing







BOAT ENGINE HOURS COUNTER

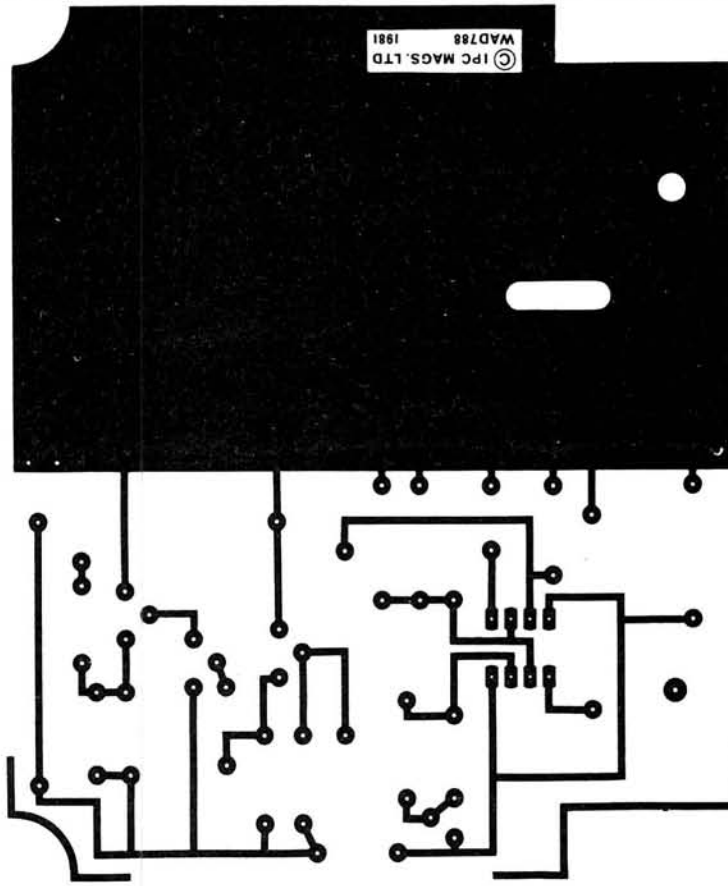
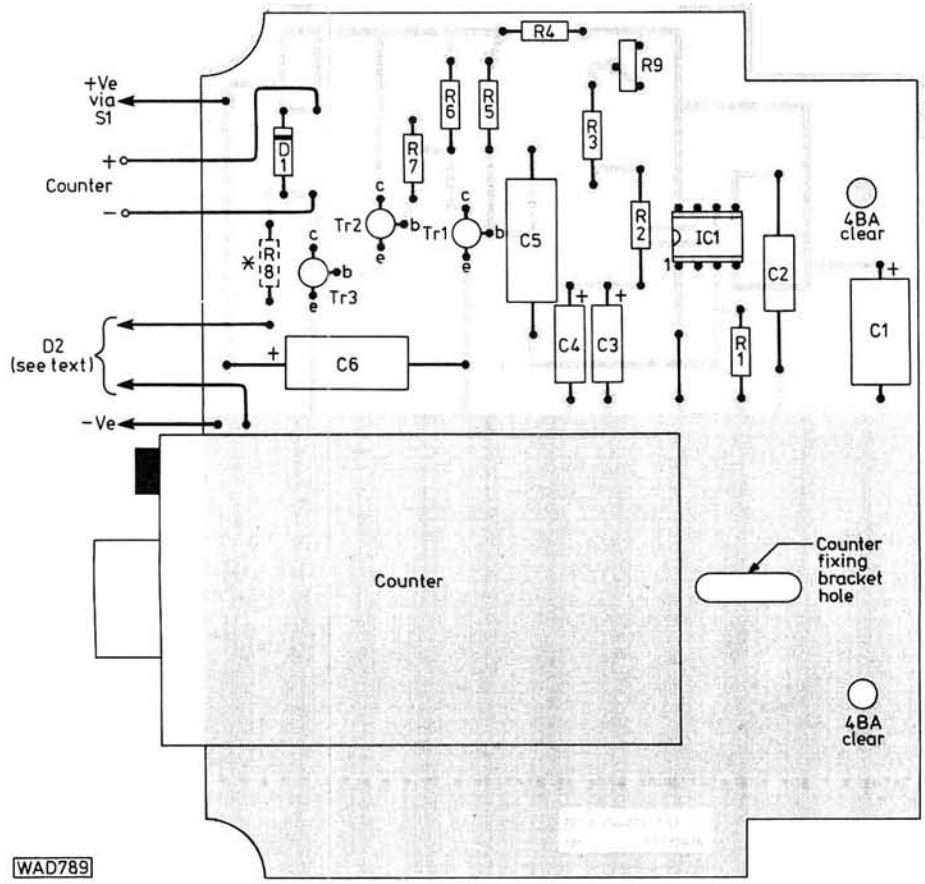


Fig. 4 (above): The copper track pattern of the p.c.b. shown full size. Fig. 5 (below): The component placement for the p.c.b.



★ components

Resistors

¼W 5% carbon film

1kΩ	1	R8 (see text)
1·2kΩ	2	R1,4
5·6kΩ	1	R6
68kΩ	1	R2
100kΩ	1	R5
120kΩ	1	R7
1·8MΩ	1	R3

Miniature Preset Vertical Mounting

1MΩ	1	R9

Capacitors

Polyester

10nF	1	C2
2·2µF	1	C5

Electrolytic

100µF 16V	1	C1
1000µF 16V	1	C6

Tantalum bead

10µF 16V	2	C3,4

Semiconductors

Diodes

IN914	1	D1
Red l.e.d.	1	D2 (see text)

Transistors

BC337	3	Tr1,2,3

Integrated Circuits

555 timer	1	IC1

Miscellaneous

Diecast box 171 x 121 x 55mm; Counter, 5 figure reset (Counting Instruments Ltd.) Type 41/011. 12V; Miniature s.p.d.t. toggle switch; printed circuit board.

CONSTRUCTION RATING Beginner

BUYING GUIDE

Readers should have little difficulty in obtaining the electronic components for this useful project. The special counter (Type 41/011 12 volts) is available from Counting Instruments Ltd., 5 Elstree Way, Boreham Wood, Herts WD6 1SF. *Practical Wireless* should be mentioned when ordering.

APPROXIMATE COST £22

Operation

If the counter is operated from a 9V internal battery then it is suggested that the optional l.e.d. indicator is not used as it consumes current and would make the total current drawn by the circuit in excess of 10mA. Hence the resistor R8 and the l.e.d. D2 are marked optional although pads for R8 are provided for on the circuit board. If the counter can be operated from a 12V battery (boat lighting battery) then the l.e.d. can be fitted. It will flash *off* each time the counter clicks over. If the boat is equipped with ignition switch type self-start then the voltage for the counter could be obtained via this in which case it will operate automatically when the engine is running. However, the preset R9 must be adjusted according to the voltage used. Set at about halfway and time the counter operation. Increase or decrease R9 so that the counter clicks over once every 36 seconds or 0·01 of an hour. The more precise this timing the more accurate will be long-term readouts. ●

AIR TEST—AR 245

▶▶▶ *continued from page 68*

Frequency selection is by a three-digit thumbwheel switch set into the top panel and proved to be easily operated. The final 5kHz segment of the frequency is set by a small slide switch alongside the thumbwheels. For repeater operation the −600kHz shift is set by a slide switch on the rear panel. A +600kHz shift can also be set. The coverage is 144·000MHz to 147·995MHz in 5kHz steps.

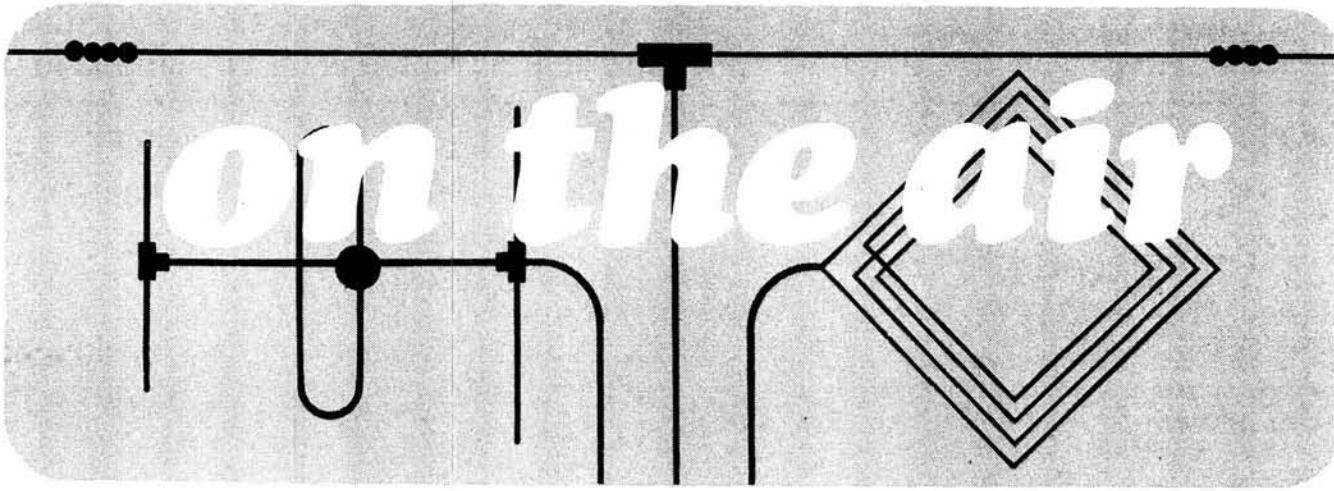
For use with a linear amplifier or different antenna system the r.f. output is also fed to a miniature jack on the top adjacent to the screwed bush.

The ON-OFF switch is operated along with the volume control and, like the squelch is a recessed edge operated knob. A red l.e.d. just above the speaker grille gave an indication of the operation of the p.t.t. switch and also of low battery state. A simple mains charger is supplied as standard equipment and a charging lead to fit a car cigar lighter is available.

The r.f. power output is switchable between a fixed 5W on high power and an internally adjustable 0·5W to 1·5W on the low power setting.

In use the unit proved to be sensitive on receive and with the 5W available on transmit allowed operation through GB3SC over paths of almost 20 miles with no difficulty.

The AR 245 measures 180 x 70 x 50mm and weighs 500g complete. At the current price of £178 including VAT it is available from **Lowe Electronics, Chesterfield Road, Matlock, Derbys. Tel: 0629 2817** to whom we offer our thanks for the loan of the review unit.



Amateur Bands

by Eric Dowdeswell G4AR

Reports to: Eric Dowdeswell G4AR
Silver Firs, Leatherhead Road,
Ashtead, Surrey KT21 2TW.
Logs by bands in alphabetical order.

Among the monthly grumbles and grizzles that reach me in the mail, the most prominent is that concerning the QRM to amateur stations in the 80m band from non-amateur stations. It does not seem to be realised that the amateur's "rights" vary with the band in question, from being a primary service with exclusive rights to a secondary service sharing a band with one or more other services.

A very interesting exercise for the newcomer, and even for those not so new to amateur radio, is to study the frequency limits of amateur bands not only in the UK but in other countries, particularly the United States. In the US, for instance, there are sub-divisions within bands for different classes of licence and for c.w. and telephony operation that are part of the legislation. In the UK there are no legal sub-divisions, the separation between c.w. and telephony having been established many years ago and respected ever since by what is essentially a "gentleman's" agreement. In fact, they have been copied by almost everyone else!

The overall band limits are determined at ITU conferences from time to time, the last one in 1979 coming up with three new h.f. bands, to everyone's surprise! Just what part or parts of a band are allocated to an amateur is a matter for the government or administration concerned. The ITU regulations are littered with hundreds of footnotes making minor amendments to the standard allocations in order to satisfy the demands of many different countries. The Top Band around 160m probably has more variations from country to country than any of the others, with some amateurs allowed the whole spectrum and others only very narrow bands of a few kilohertz, and generally on a secondary basis to safeguard what an administration regards as a more important primary service.

The 80m band in particular is shared with several other services, hence the QRM, and where the amateur service is a secondary one then the amateur is supposed to ensure that he does not interfere with the primary service on that band. Whether he ever does I will leave to your imagination!

Still on 80m, many s.w.l.s do not realise that the US band runs up above our own UK limit of 3·8MHz to 4MHz where many US stations can be heard relatively free from QRM. But the mind boggles at the resulting complications in the US where five classes of licence are linked to separate sub-divisions for c.w., c.w. and telephony, and c.w. plus telephony plus SSTV!

Note should also be made of the practice of some countries of allowing their novice licensees to use the 10m band, the USSR and Australia being typical examples. However the callsign is usually distinctive. One of the best examples of voluntary amateur discipline occurs in the 160m band where US amateurs on c.w. call between 1800kHz and about 1810kHz, listening in what is termed the "DX window" between about 1825kHz and 1830kHz for European and other DX stations. This greatly enhances the chance of a contact with UK stations with their low power limit of 10W.

For those who would like more detailed information on the US bands and sub-divisions, the *Amateur Radio Operating Manual* from the RSGB is essential reading.

DXing

First letter from **S. Bowler** (Wakefield) who has discovered the joy of the amateur bands on his R-1000 receiver, KX2 antenna tuning unit, fed from a 46 metre long wire "mounted in the loft". Some loft, but perhaps it is folded around a bit! An outside vertical is being considered at present, always a good alternative to the conventional horizontal wire. Some of the DX logged included SV0AW/9 on Crete, VP9CP on 21MHz plus ZL3MF and CT2AP on 14MHz. The ZL3 was at 1900GMT over the short path.

David Warr BRS44127 of Weymouth, Dorset let his 9R59DS roam mostly over the 10m band driven by a G5RV aerial system, keeping an eye on the DX net on about 28 880kHz run by G4CHP. Up came OA8CP, 6Y5DA, DU1DPC, J3AH, HK0FBF on San Andres Is, and FM7AV, while on 15m he captured XL3LON special event station in VE-land, FG0FOL/FS, 6W8AR, TG4NX and CP7HLX. The 40m band provided a nice one in H44DX, and ZL4BO with VK2AVA on 80m. Best catch was probably VR6TC on 20m.

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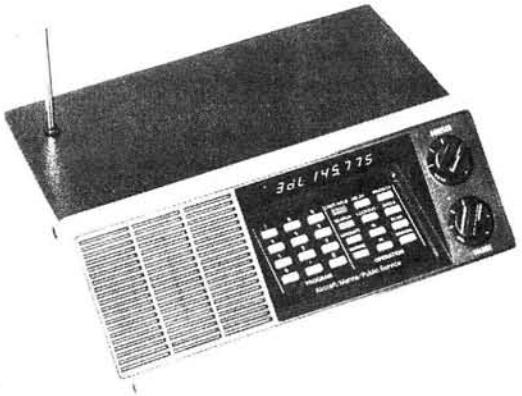

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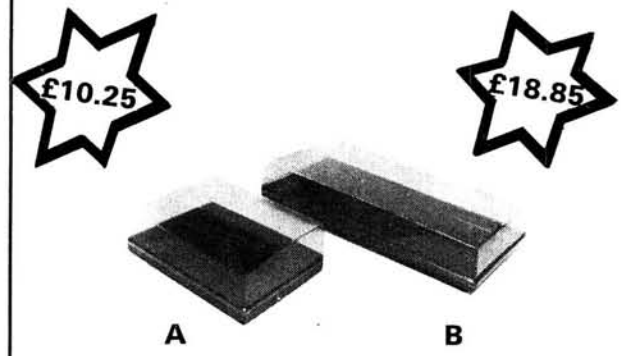

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In Northchurch, Herts, **Jonathan Kempster** BRS45205 has dumped his Vega set for a nice FRG-7 second-hand from local G4DRA which ought to set him on the path for some real DX, like ZK2LS, JY9FW, HP1XOG, CO2RX and 8P6GG on 28MHz, with 14MHz dishing up CR9CT, DU6JM, and HS1AMM, all from dipoles on each band. At the moment O-level exams are keeping Jonathan away from his RAE studies, but I'm sure he knows which is the more important.

Colin Frankland BRS45342 has moved QTH about three miles in the Hull area to a pre-nuptial house where he managed to organise a 27 metre long garden in place of the previous indoor arrangements. Temporarily he has a 23 metre long wire and found a big improvement on the l.f. bands as one would expect. Sole item of interest was 6U25YP in Khartoum celebrating 25 years of independence. Pity I didn't hear this one as I was there at the time, as ST2AR!

It's hello from **Bill Rendell** again, from Truro, and his HRO, considerably improved in performance seemingly by fitting separate r.f. and i.f. gain controls. The 40m band produced the inevitable ZL4BO. On swopping to 20m Bill found C6ANU, J6LOU, the SV0AW/9 who said QSL to Box 299, Iraklion, Crete, VP2AZE (Box 1203, St John's, Antigua), VP2MH and XT2AW. Bill also found the FG0FOL/FS on 15m with FY7AN, J3AAC (QSL W2BJI), S8AAP, VK4NIC/3X (QSL W4FRU), VP5GT on Grand Turk, plus 9X5MH. Just to prove the HRO is no slouch even on 10m Bill logged CO2OM, and TU2IN with QSLs to K3HBP.

In Leeds **Basil Woodcock** is still pondering over a new receiver, considering both the FRG-7700 and R-1000. In the meantime his SRX-30 plus 40 metre long horizontal wire (oh, that it could be vertical!) and a.t.u., sought out VK4NIC/3X, 3B8AE/3B9 on Rodriguez Is, FG0FOL/FS from the YASME DXpedition (anyone NOT heard him?), and VP5STA/HK1 all on 10m s.s.b., sole interesting one on 15m being P29NAB. On 20m KH6ATI and TJ1AY appeared, with a nice one in AP2ZR on 80m. **Ed Baker** (Cramlington, Northumberland, took time off from editing ISWL mag *Monitor* to tell me about N6YK/VP2A heard on both 40m and 80m s.s.b., with the latter band also coming up with AP2ZR, A7XD, HI8RF, JA5ANP, J3AM, 8P6OS and 9V4VU, all on his SX100 and 20 metre long wire. 40m also saw FM0FJE, HC1FF, and 6W8AR, with 20m contributing FR0FLO, KC4MS and VU2RHK. For the lucky ones who may have copped JT0LAJ and FYU, Ed says to send cards to Box 180, Ulan Bator, Mongolia, and the best of luck! I shouldn't be so cynical since I have three JT QSLs for QSOs some years ago now!

Now to our two lively lads **John** and **Steven Goodier** in Marple, near Stockport, G4KUC and G4KUB respectively, who have given up s.s.b. operation with their FT101Z and now concentrate just on c.w! That really warms the cockles of my old heart! A 600Hz filter has been fitted to the i.f. stages for improved c.w. reception. I have suggested that they have a go in some of the c.w. contests that take place in the next few months. All good experience. Best worked so far on 21MHz with a vertical antenna is ZL2AP.

Dave Coggins in Knutsford, Cheshire, admits to overdoing it a bit over Christmas and the New Year and I'm not talking about DXing! Serious intentions are to get cracking on SSTV very soon. In the meantime VKs on 80m have been logged around 1900GMT with favourite spot on 3675kHz more or less, with VK2AVA, VK3CR, VK3XI, VK3BM, VK4AZX mostly working Europe and the UK. Dave keeps an ear open for Australian time signal station VNG on 7500kHz during the daytime and on 4500kHz in the early evenings as an indication of likely conditions on the 3·5MHz and 7MHz bands. Both Bill Rendell and Dave mentioned what appeared to be a big aurora on December 19 when very short skip working was observed on the 10m band.

Other DX copied by Dave included CR9CT (QSL G3KDB), J20CN (QSL K2FV), J73PP, KG6DX, 3B8DB and 9G1DY on 10m. 15m turned up DU1CK, FK8CR and J3AE. Equally good DX, on 40m, included H44DX, J3AAE, KL7AY and OX3ZM with, finally on 160m c.w., it was HB9BZA, OH0NA and OL1BCJ.

The Clubs

Merion ARS. Following the January write-up on this club in *PW*, a technician from BBC Wales organised a live TV interview with Dave Morgan, now GW4KYZ, who spoke on amateur radio generally and the Merion club, followed by an inevitable question on CB matters. Since starting last year the club has five new GW4s, with five more taking the December RAE. Interested? then write to Dave at Penybont, Gellilydan, Blaenau Ffestiniog, Gwynedd.

Sunderland & District ARC. A new one for Sunderland, previously devoid of a club, meeting at the Brewery Yard, Westbourne Road, Sunderland on Monday evenings at 7.30pm. All interested in radio and electronics most welcome to come along to a programme that includes code classes and RAE instruction. Contact: Dave Holland, 17 Egerton Road, West Harten, South Shields or ring South Shields 551045.

Bury RS. Make a note of March 10, with G8GTP advising on getting started on the 23cm band being one of the regular second Tuesday of the month meetings at 7.30pm. On other Tuesdays it is code classes and practice and club constructional projects, with 25 attending present RAE lectures. Contact: Chris Marcroft G4JAG, 24 Lancaster Avenue, Ramsbottom, Bury or Ramsbottom (070682) 2168. The meeting place is Mosses Community Centre, Cecil Street, Bury.

Braintree & District ARS. First and third Mondays at 7.45pm, at Braintree Community Centre, Victoria Street, next to the bus station (the Nag's Head is not very far away!). On March 16, G4HFR discourses on Airfield Communications and Navigation Systems, and make an advanced note of the trip to Radio Orwell on May 28. Janet Storey, 33 Redwood Close, Witham, Essex CM8 2PL will be delighted to expand on the club's activities.

Worcester & District ARC. At least eight members got their tickets following last May's RAE. One got into the game following QRM from the Hon Sec's rig! Meetings Mondays at the Old Pheasant, New Street, Worcester at 8pm. Special note: mobile rally on July 12 will be at a new venue of Droitwich. Contact: Hon Sec Mike Tittensor G4EKG, 16 Durcott Road, Evesham, Worcs or Evesham 41105.

Chesham & District ARS. Recently resurrected, the club meets Wednesdays at 8pm, Chesham Whitehill Centre with negotiations under way for something permanent. New members and visitors will be welcomed with open arms but in the meantime contact Hon Treasurer Andy Scott G8PUC at 8 Lynton Road, Chesham or (02-405) 5625 or try a call over the air.

Grafton RS. This old-established club is moving home to the Five Bells, East End Road, Finchley, London N2 with second and fourth Fridays at 8pm to be noted. An extensive programme for the coming year is being formulated, but in the meantime more members are being sought. Have a QSO with John Thomson G8SYD on 01-959 8785 or drop a line to 70a Deans Lane, Edgware, Middx HA8 9NN.

Ipswich RC. Another group moving into new premises

by the time this appears. Second and last Wednesdays 8pm at the Rose & Crown, 77 Norwich Road, Ipswich with assurances that clubroom is detached from public bars and juniors just as welcome as anyone else. Club has many projects under way like RAE and code classes, but Jack Tootill G4IFF, 76 Fircroft Road, Ipswich IP1 6PX will gladly tell you all, or try (0473) 44047. Excellent club magazine *QUA* carries many articles on diverse aspects of amateur radio, the secret being the carrying of extensive advertising by both local and nationally-known radio dealers. Other clubs seldom seem to take advantage of this means of extra support.

Sutton & Cheam RS. Members are looking forward to the annual Dinner/Dance at the Woodstock Hotel, North Cheam, Surrey on Saturday, April 4, and by all accounts it ought to be quite a night. Next regular meeting is on Friday, March 13, when Dick Biddulph talks on safety in the shack, at the Sutton College of Liberal Arts. The annual constructional contest sees the judging on the 27th at the Banstead Institute. For more info on what happens where, contact G. Brind G4CMU, 26 Grange Meadow, Banstead, Surrey. (Thinks: Now that my office is in Sutton (IPC Business Press), I ought to drop in on this mob some time!)

Midland ARS. The University of Aston, Room 118, is the venue of a meeting on March 24 when Ray Withers G4KZH should be holding forth on repeaters at 7.30pm. A membership drive is under way so a note to G8ODT at 138 Hillside Road, Great Barr, Birmingham B43 6QN will get you all the details.

Exmoor RC. A series of projects for the younger and less experienced member is underway, like a code oscillator for the G8s wanting to get their G4s, all part of a programme of diverse club activities including club station G8SSS now on the air. Meetings 7.30pm every Thursday at Loughrigg, East Street, South Molton, but still awaiting her RAE result is secretary Pat Jemmison, Homedale, Brayford, near Barnstaple, N. Devon, or Brayford 327.

Wolverhampton ARS. Club's contest team took first place in September's 144MHz contest with call GW8BHH/P so v.h.f. enthusiasm runs high every Monday evening at 8pm at Neachells Cottage, Stockwell End, Tettenhall where club station is G8TA. March 9 is natternight with the 16th devoted to organising the Wolverhampton Fiesta on May 28/30 next. More from John Cook G8EDG, 75 Windmill Lane, Castlecroft, Wolverhampton WV3 8HN.

Verulam ARC. Advance notice of a talk by no less than G3XAP on aerial systems for the l.f. bands, not to be missed on any account. Club contact Hilary Claytonsmith G4JKS was delighted to see YL Column in the Jan *PW* but considerably deflated when it failed to appear in Feb! *(Note: This is one of a series of new features, each appearing every three or four months. Ed.)* Meetings fourth Tuesday at Charles Morris Memorial Hall, Tyttenhanger Green, Tyttenhanger, which is near to St Albans, around 7.30pm will do.

Exeter ARS. Second Monday sees the club at the Community Centre, St David's Hill, Exeter at 7.30pm and for March it is D. Sellars G3PVB holding forth on propagation matters. Locals can get update info on the EARS 2m network at 7.30pm on Tuesdays. PRO is Geoff Draper BRS44198, 1 Carlyon Close, Heavitree, Exeter EX1 3AZ.

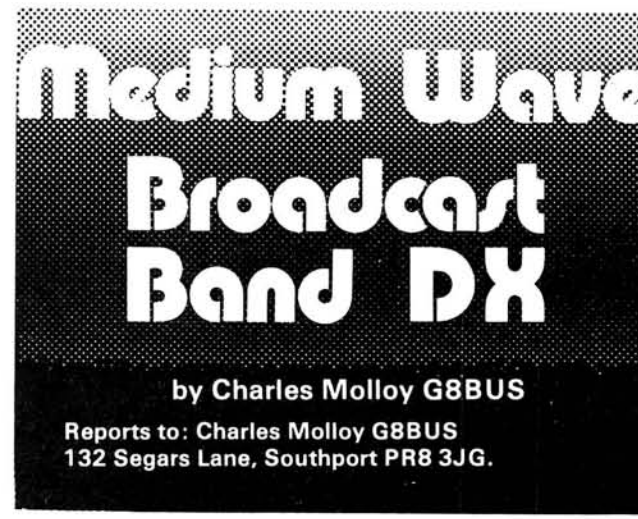
Waterside SWRC. Blackfield Community Centre at 7pm fourth Tuesday generally with lecture and informal discussion plus activity with club station G4JNY. So if you are in the Hythe, Fawley or New Forest area try Clive Sanders G4KCM, 35 Forest Edge Estate, Fawley, Southampton, Hants SO4 1FN, which is also Fawley 893200.

East Antrim ARC. Just a year old the club meets second Tuesdays at Carntall Hall, near Mossley, at 8pm with wide range of activities to suit all tastes. Jim Welsh GI4JXM at 20 Bryantang Brae, Doagh, Ballyclare, Co Antrim BT39 0RJ will be glad to provide more details. Incidentally, if any EI readers want to know more about the national EI society I can put them on the right path.

Bolsover ARS. Also quite young but thriving, the club welcomes visitors every Wednesday at around 8pm at the Angel Hotel, Bolsover, where RAE classes ought to be well under way now, with first entrants in the forthcoming May exam. Waiting to elucidate is Allan Turford G8HPQ, 103 Hilltop, Bolsover, Derbys S44 6NJ or Chesterfield 824972.

Mexborough & District ARS. Where Ian Abel G3ZHI will welcome you at 7pm any Friday night at the Dolcliff Hall, Dolcliff Road, Mexborough, with activities including a club station on the air, code classes and fascinating surplus gear sales from time to time. Ian lives at 9 Grove Terrace, Maltby, Rotherham, Yorks, or ring 0709 814911.

Now an appeal to editors or others responsible for the production of club newsletters and such like. PLEASE put the FULL name and address of the person to be contacted by visitors or prospective members, plus a telephone number, together with full details of where and when the club meets, all in a prominent place on the first page of the newsletter. This should be followed by a list of forthcoming events and if your committee hasn't organised such a list, chuck 'em out! Newsletters tend to go far beyond the area of the club and to put "contact Fred G4XXX QTHR" is just not good enough. Ta.



When a reader asked recently: "How do you tune a loop?", it struck me that while we have covered the problems of loop antenna construction in some depth in recent issues, little attention has gone to actually using one. Why do we need a loop, what does it do, how do we use it, what are its limitations? These are the questions that come to mind.

Tuning a Loop

A loop is both tuneable and directional. These are the features that we make use of. By tuneable I mean that the main winding and the tuning capacitor together form a tuned circuit which can be made to resonate at the fre-

quency we are listening to. Set the receiver to the desired station; now adjust the loop tuning control for maximum output. Since a loop gives a boost to a chosen frequency then clearly it possesses selectivity, and when you connect a loop to a receiver you provide additional selectivity over and above that of the receiver.

We could use an aperiodic or untuned loop. Disconnect the tuning capacitor and you now have an untuned loop. The signals applied to the receiver will be weaker and no preference is given to any of them. In short, no selectivity and reduced pick-up. We are better off with a tuned loop.

Directional Effect

A loop has maximum pick-up along the plane of its windings, and little or no pick-up at right angles to the windings. There are two maxima in opposite directions to one another. There are also two nulls, which are the directions of minimum pick-up and these too lie in opposite directions to each other. It is the nulls that interest us and they are quite sharp compared to the maxima which are rather broad.

Tune your receiver to a channel with more than one station on it, say 585kHz after dark. In the UK you will hear Madrid mixed with Vienna. Peak up the loop with its tuning control and then slowly turn the loop (rotate it about its vertical axis). You will find that with the loop in one position Vienna will disappear leaving Madrid in the clear, while in another position Vienna will be on its own. What we are doing is to null-out an unwanted station so that we can listen to a wanted one on the same frequency. We are reducing co-channel interference and a loop will do this, provided the wanted and unwanted signals are in different directions.

This is not the end of the story of the loop antenna by any means, though if we used one just to reduce co-channel QRM then it would be well worth the effort involved in making it. Next month we will see how, on occasion, a loop will deal with static, with electrical interference, adjacent channel interference, receiver overloading, sideband splatter and even how it can occasionally perform as a selective attenuator or as a substitute for a tuneable audio notch filter. We will also look at its limitations: what a loop antenna will not do and why it is that you cannot use a loop with a portable receiver.

BBC Radio Wales

Dave Morgan GW4KYZ tells me that he was interviewed by BBC Radio Wales last December 12 when they did a programme from Blaenau Ffestiniog. The producer was rather interested in propagation, particularly as he had a request to send greetings to North America. He asked Dave if he could help in finding out how far his programme went out, and Dave in turn is asking readers of *Practical Wireless* for assistance.

Anyone living outside the service area of the transmission on 882kHz (340m) and who picked up the programme on December 12, as well as readers who have had long-distance reception of Radio Wales at any other time, are invited to send details to Dave Morgan, Penybont, Gellilydan, Blaenau Ffestiniog, Gwynedd, Wales. No doubt Dave will let us know the results in due course.

To my knowledge Radio Wales on 882kHz is logged regularly by DXers in eastern USA, and it ought to be audible under favourable conditions as far as Australia and New Zealand. It is interference rather than propagation that limits the range of signals on the medium waves. The only other two provisos are that there should be a path of darkness between Tx and Rx and the Great Circle track between the two should not pass near either of the earth's magnetic poles.

DX from the East

In order to minimise interference (QRM) when DXing on the medium waves it is desirable to use a selective receiver and a m.w. loop antenna. One can also make use of the different channel spacing used in Region 2 (the Americas) to look for DX in parts of the band where it lies between European channels and this idea was pursued in the January issue. Is there anything else that can be done to combat QRM?

If you attempt to listen to Asia during the evening you are not likely to be successful. Apart from the high level of QRM, many of the countries you are looking for sign-off much earlier than Europeans because they are in time zones ahead of Europe. India is $5\frac{1}{2}$ hours ahead of GMT, the United Arab Emirates are on GMT + 4, Saudi Arabia GMT + 3, while many Middle East countries use GMT + 2.

There is a compensation though. Although these broadcasters close down earlier in the evening they also start up earlier in the morning and this is the time to catch them when QRM is light. The further east they are the earlier they appear. Six in the morning local time in Pakistan is the start of their domestic programmes and this corresponds to 0100 GMT.

Look for India on 747kHz and 1314kHz, Pakistan on 927kHz, Saudi Arabia on 1512kHz (Jeddah) and 1521kHz (Duba). Muscat Oman on 1242kHz and the BBC relay on Oman on 1413kHz have been heard as early as midnight, Dubai on 1481kHz by 0230, Instanbul

Another from Boston (WITS)

A regular from New York City (WINS)

on 1017kHz and Diyakabir 1067kHz both in Turkey have been logged at 0300 sign-on. Tel Aviv (Israel) has been heard before 0200 on 1287kHz. The BBC relay in Cyprus on 720kHz has been picked up at various times, while Bulgaria is in the clear on 747kHz before Holland starts tuning up around 0420.

One should remember that as the days lengthen, long-range DXing to the east will cease, but more about summer DXing next time.

DX Heard

Reader **Rhys Thomas** (Bridgend) bought a new Trio R-1000 last August, which he uses with a "40 inch" loop. By September he had logged a number of North Americans and he sent me three QSLs which he thought might be of interest to readers. They are WINS New York City on 1010kHz, WITS in Boston on 1510kHz and CBGY in Gander on 750kHz. Thanks for the loan of the cards Rhys, I'm sure readers will be interested in what can be heard with the latest in receivers.

Saudi Arabia has attracted the attention of **Harold Emblem** (Mirfield) since he came out of hospital. Between 2250 and the 2300 sign-off it is possible to hear Riyadh on 585kHz, Jeddah on 1512kHz and Duba on 1521kHz, all carrying the home service programme. Best wishes for a speedy recovery Harold. Local radio is the attraction for **Roy Patrick** (Derby) who says that 15 locals are audible at his QTH. Roy draws attention to the new BBC Radio Lincolnshire on 1368kHz and to Radio Norfolk 855kHz, both of whom come in well, while the low power R Norfolk relay at King's Lynn on 1602kHz is just audible.

A Hallicrafters SX100 and 39 metre long wire were used by old-timer **Ed Baker** of Cramlington in Northumberland to pull in CJYQ 930kHz with a fair to good signal during December. WNEW New York on 1130kHz was fair with Euro QRM nearly all the time, Dakar Senegal on 764kHz was weak/fair when Switzerland signs off, Radio Ougadougou in Upper Volta (tentative), Radio Margarita was heard on 1020kHz and Radio Globo Brazil on 1220kHz, while the BBC relay in Cyprus put in a good signal in English on 1323kHz from 0300 onwards.

Thanks for the log Ed. Readers will note the method of reporting where the terms good, fair, weak are used instead of SINPO or SIO codes, and I think you will agree that it gives quite an adequate picture to other DXers of what was heard.

CBGY is in Newfoundland

Short Wave Broadcast Bands

by Charles Molloy G8BUS

Reports: as for medium wave DX, but please keep separate.

"I want to buy a short-wave radio, but when I went to the shop there was such a choice and I do not know anything about it, so I did not know what to choose," writes reader **W. Tomlins,** who goes on to ask: "Can I listen to all these foreign places on just a radio, without an antenna on the roof and a lot of fancy equipment". The answer is Yes. The modern portable radio with its whip antenna will pick up broadcasts from all over the world, and if you get one with digital readout which shows the frequency of the station you are listening to on a digital clock type display, then you will have no difficulty tuning around the crowded short-wave bands. Most modern receivers fall into one of two types. These are portables and communications receivers, and it should be useful to newcomers to the hobby if we have a look at what each has to offer.

Portables

The portable type of receiver is the one for the growing band of listeners who are turning to the short waves for an additional or alternative source of entertainment. The receiver is self-contained with its whip antenna and can be used anywhere, indoors or outdoors, except of course where it is screened as it might be away from the window in a steel-framed building or in a car or caravan. Among the more expensive sets in this class are the Panasonic RF2200 (a *PW* reader recently used one to listen to Radio New Zealand) and the Grundig Satellit 1400, and there are a number of others in the same price range. Less expensive ones include the Grundig Yacht Boy, Panasonic R1105 and the Russian-made Vega and Selena receivers.

Communications Receivers

If you want to listen to radio amateurs then your set must be able to receive single sideband (s.s.b.). If you are interested in Morse (c.w.) then you need a set with a beat frequency oscillator (b.f.o.). If you want to try DXing, i.e., listening to distant and weak stations which may not have much programme value, then you need a sensitive set with good selectivity which will function properly when connected to an outdoor antenna—some portables only work well with their whip. All this points to a communications receiver which may also be equipped with a noise limiter, an input attenuator and additional panel controls such as r.f. gain, a.g.c. on/off, which make it possible to squeeze the last drop of DX out of a receiver.

Sets currently available that fall into this category are the Yaesu FRG-7700, the Trio R-1000 and the Lowe SRX-30.

Portable or Communications?

It is not normally feasible to convert a portable to receive s.s.b. or Morse, or to work with a long wire if the particular set does not like this type of antenna. There are a few sets though like the Grundig Satellit 2400 and Panasonic RF2600 which will receive s.s.b.

Personally, I would go for the communications set, but then I am a DXer as well as a short-wave listener, and I have two good outdoor antennas. If you are unable or unwilling to put up an outdoor antenna then a portable may be the receiver for you and you will be able to take it with you when you go on holiday. I have to make do with a domestic portable or car radio when away from home.

DX Seasons

"Could you tell me what has happened to the Voice of Chile and Radio Japan—they seem to have disappeared," enquires reader **L. Harding.** The propagation of short waves through the ionosphere varies according to whether the path between transmitter and receiver is in daylight or darkness, and to a lesser extent whether it is summer or winter. What you hear over a particular path in the evening will depend on the time of year, since on one occasion it may be daytime and on the other it may be dark. Broadcasters divide the year into four "seasons" starting in March, May, September and November which are the occasions for a great shuffle around of frequencies to keep up with the advancing seasons. Generally there will be a move towards higher frequencies in March and May and to lower ones in the autumn.

A short-wave frequency list only gives details of channels that are in use by individual broadcasters at some time of the day or year. An up-to-date schedule from a radio station is required to keep up with changes in frequencies and programme timing. The majority of international broadcasters will supply a schedule on request.

This information can also be found in the *World Radio and TV Handbook Newsletter* which comes out three times a year as an up-dater, or from the magazine *Voices* (PO Box 226, Helsinki 17, Finland) or from DX programmes such as *Sweden Calling DXers* which is on the air in English on Tuesdays, or from the bulletins of DX clubs.

Lightning Arresters

From Sheffield comes a query from **Trevor Corns** who writes: "Have read that it is wise to fix up a lightning arrester on antenna but can't find out where to get one or exactly what to do with it—no doubt you have a lively imagination and will tell me." I don't know where you can get one as they seem to have gone out of fashion these days. Perhaps a reader will help. In the early days of radio it was usual to earth an outdoor antenna when not in use. In our household we had a large knife switch for this purpose, plus some sort of spark gap made from two bolts mounted on brackets fixed to a piece of wood.

A lightning arrester will not protect your gear from a direct hit or even a near miss. During a thunderstorm the antenna may become charged to several hundred volts and you need some sort of device such as a neon tube or spark gap to discharge it. It is dangerous to interfere with an antenna during a thunderstorm, even to the extent of unplugging it from the receiver.

Spurious Responses

John Cook G4GAR writes: "It is often interesting, when a transmission pops up in a receiver somewhere it has no right to be, to try and work out why." But one really needs more information than was published about Mark Slater's discovery of BBC1 TV sound on approximately 13 700kHz in the February *PW* to be able to do much more than guess.

John starts off by assuming a receiver i.f. of 450kHz. The BBC1 TV sound is on 41·5MHz which would require an oscillator harmonic of 41 950kHz to produce an i.f. signal at 450kHz. This corresponds to a fundamental on 41 950/3 = 13 983kHz which would occur when the receiver is tuned to 13 533 (13 983 − 450). Is this near enough to the place where he finds it, to fit? concludes John. A rather ingenious guess!

Readers' Letters

A newly-acquired Eddystone EC10 has a small circular dial to the right of the main scale which puzzles reader **G. R. Ellis.** This is a logging dial and is used in conjunction with the pointer and bottom scale marked 0, 100, 200, 300, 400, 500 to provide 500 logging points. If you are tuned to a station and want to be able to return to it in the future then look at the circular dial which may, for exam-

Two QSL cards lent by Martin Whittington of Dartford: The Voice of Free China (Taiwan) 15 270kHz and Radio Kuwait 11 665kHz

ple, display 65. Then look at the main pointer which may be a little more than half-way between 200 and 300. The log scale reading is now 265 and if you want to come back to your station then switch to the correct band, set the log scale to 265 and rock the tuning knob slightly and you should locate the station. Our reader would like to contact anyone who has more information on the EC10. Replies direct to G. R. Ellis, 41 Brooke Road, Princes Risborough, Bucks HP17 9HJ.

In reply to **James Reilly** of Bangor. The BRT 400 is a 14-valve communications receiver of 1952 vintage and is now only available second-hand. A Christmas present of a Datong Active Antenna to use with his FRG-7 enabled **Conrad Fox** (West Auckland) to pull in RAE Argentina on 11 710kHz with a programme in English at 2215 and VLQ9 Brisbane of the ABC domestic s.w. service on 9660kHz at 1201. A couple of nice catches Conrad. Welcome to the column, hope to hear from you again.

VHF Bands

by Ron Ham BRS15744

Reports to: Ron Ham BRS15744
Faraday, Greyfriars, Storrington,
Sussex RH20 4HE.

The propagation of radio waves is so very dependent upon the behaviour of the sun and the structure of the earth's atmosphere that readers, who are unfamiliar with this aspect of the subject, should find it well worth while taking a look at the astronomical books in their local library.

Solar

Both **Cmdr Henry Hatfield,** Sevenoaks and I recorded a variety of solar bursts on December 23, 24, 25, 28, 29 and January 2, 10, 11, 14, 15 and 16, and a noise storm on December 26 and 27. On the 26th, Henry, using his spectrohelioscope found six sunspot groups, one of which was very active and no doubt responsible for the prevailing noise storm. The solar noise was so strong on the 26th that my pen was at f.s.d. while the sun passed through my aerial beam. Towards the end of the observation, the sun, which was low in the sky, went (relatively speaking) behind a ridge of the South Downs near my home, and drew a profile of the hill in radio noise on my recording chart. Although the low sun made visual observation difficult for **Ted Waring,** Bristol, he did count 42 spots on December 15, 20 on the 18th, 34 on the 27th, 20 on January 1, 12 on the 3rd and 25 on the 10th. Henry recorded a lot of solar noise at 198MHz on the 29th, and at 1313 on January 16, we both recorded a very strong solar burst, lasting 2·5 minutes, at 136 and 143MHz. Henry also recorded it, although less intense, at 198MHz.

Aurora

Despite varying reports about the length of the auroral disturbance on December 19, I think it fair to say that the conditions prevailed, by changing degrees of intensity, from about 1400 to midnight. Between 1844 and 2023, **John Cooper** G8NGO, Cowfold, Sussex, worked GI5MPS and heard GI8UPV, worked GM8BDX, GM8DMZ and GM8TKA on 2m s.s.b., and could still hear auroral signals when he closed down at 2340.

On arrival home for the Christmas break, **Jonathan Brisley** G8YQZ, Peterborough, switched on his rig and heard: "Weird whispering signals on the s.s.b. end of 2m." He then swung his beam north, found a spare frequency and began calling "CQ Aurora". After his first contact with GM8OFV at 1623, the QSOs came thick and fast and by 1930 he had worked three Ds, five northern Gs, two GJs, a GM, a GW, two OZs, 10 PA0s and three SMs. Jonathan's best DX was SM7DVR at 910km during the Scandinavian peak, which he estimates was between 1755 and 1815. During this event, Jonathan, who uses an Icom IC260E, a Lunar linear p.a. and a 10-element Yagi at 10m a.g.l., added two more countries to his list. **Mark Hattam** G4KGA, Hereford, listening to auroral signals for the first time, heard seven Gs, two GWs, F and PA0 between 1830 and 1930, and **George Grzebieniak** RS41733, London, heard two Ds, two GMs, and two PA0s between 1650 and 1830, and his best DX was OF3XU at 730km. Readers not familiar with auroral propagation should bear in mind that these DX signals have been reflected from an area of temporary ionisation in the earth's polar atmosphere, resulting from a disturbance on the sun.

Meteor Scatter

Another form of temporary ionisation is caused by the large numbers of tiny meteor particles (often described as shooting stars) that burn up daily within the earth's atmosphere.

On December 14, John Cooper had an s.s.b. contact on 2m via meteor trail reflection with SM0IOT who received John's signal spread over two pings and 12 bursts; the longest burst was seven seconds and the QSO took 25 minutes to complete. John also worked YU2IO and on the 13th, EA3LL via the same mode and during the Quadrantid meteor shower on January 4 he worked two YUs.

The 10m Band

Conditions on 10m remained generally good between December 16 and January 19 with daily contacts around the world. Mark Hattam is QSL manager of the Oxford University Radio Society's club station G3OUR, and says that this callsign often attracts a pile-up of stations from the USA. Among the many interesting 10m QSOs was one between PJ2KI on the Island of Curaçao and DL3YAO at 1340 on December 28. Both stations were very strong with me and when the QSO finished there was a pile-up of stations calling the PJ who then worked G3RZX and a YL station, G4IQY in Manchester who gave him 59.

I heard JA stations during the early mornings of December 16, 17, 27 and January 4 and 18, VKs on December 19, 25, 26, 29 and January 1, 2, 5, 6, 9, 12, 16 and 17, and ZL on January 10. The band was generally quiet around 0850 on the 20th and at 0906 on the 25th I heard strong echoes on a German signal and a QSO between UA3ACE (56) and VK5NOA (52). Strong echoes, this time on G stations, were again heard at 0915 on the 29th and 0930 on January 9. During the 35-day period between December 16 and January 19, I received signals from the International Beacon Project stations in Bahrain A9XC on 34 days, Bermuda VP9BA (mainly at midday) 30 days, Cyprus 5B4CY 29 days, Germany DL0IGI 35 days and DK0TE 21 days, and Mauritius 3B8MS 15 days. Although Ted Waring's results are similar to mine he frequently heard the beacons in Florida W4ESY and

South Africa ZS6DN and ZS6PW, and on a few days, Canada VE2TEN.

"Excellent reception of USSR in the mornings and very many USA from noon onwards," writes **Harold Brodribb,** St Leonards-on-Sea, Sussex, on January 6 which about sums it up. Harold also keeps an ear on those strong harmonics which come up in the 10m band from lower frequency broadcast stations, and one of his favourites is Alma Ata on 29·800MHz. George Grzebieniak has purchased a new 10m converter and on December 26 he listened to stations in LA, VK, 9K and 9Y.

Tropospheric

Like George Grzebieniak, I first noticed a tropospheric disturbance around 2000 on December 23 and while he was listening to signals from PA0 on 2m, I heard GW mobiles working through the Bristol Channel repeater GB3BC, R6, and a 529 signal from the Sutton Coldfield beacon GB3SUT, on 70cm. At 0830 on the 24th I again heard GW mobiles through GB3BC, and local stations working through the Crawley repeater GB3BP, also on R6, talking about hearing signals from the Continental repeaters. A little later at 0948, George heard GW8ELR on s.s.b. During the afternoon of the 24th, while the atmospheric pressure (30·2in or 1022mb) was slowly falling, **Phil Hodson** G8RBY, Melton Mowbray, using a TS700G with home-brew BF900 pre-amplifier and modified mixer board, a home-brew linear with 2 × 4CX250Bs and a 10-element Yagi at 14 metres a.g.l., soon had one Belgian and eight German stations on 2m s.s.b. in his log.

Although the pressure shot up again at noon on the 27th to 30·5in (1032mb), and did not begin to fall until midday on the 30th, the expected lift in v.h.f. conditions was disappointing. At 1516 on the 28th, George heard G8MJO/P on 2m s.s.b. at 230km, and around 2300 on the 30th he received s.s.b. signals on 70cm from DF1EQ, DF3EE and GW8GKF. Throughout the 28th, 29th and 30th, I received signals averaging 539 from GB3SUT with only a dipole feeding my receiver. This was repeated on January 5 and 12 when short periods of very high pressure were ending. George has now installed a barometer in his shack to give him an early warning of a v.h.f. lift. At 1345 on January 1, I listened to an interesting QSO through GB3BP, R6, between SM6YF/MM on a Swedish motor vessel in the English Channel, near Eastbourne, heading for Liverpool and G4FNL/M, followed by G8XZP/A in central Brighton.

Between 2100 and 2125 on December 30, **Simon Hamer,** Presteigne, Wales, using a Grundig Sattellit 1400 receiver, heard three French stations in Band II, and from 1815 to 2031 on January 11 he listened to programmes from the two London IBA stations, Capital Radio and LBC, BBC Radio Solent and two French stations between 94MHz and 98MHz.

Horizontal FM

Mitch Tribe G8PMT, Lancing, was one of the founder members of the "Southern Horizontal FM Group" which, like many other such groups in the UK is growing rapidly. "There is a tremendous interest in horizontal f.m.," said Mitch, who along with other group organisers is hoping to arrange a national contest later in the year. Although Mitch lives in Sussex, and behind a chunk of the South Downs, he has already worked stations in 40 counties using 50 watts to an 8-element Yagi, and during the evening of January 5, G8PVH worked a station in north Yorkshire from his home in Alton, Hampshire. A national net on 144·670MHz is active on Mondays at 1930, and s.w.l. reports to stations over 100 miles away are always welcome.

RTTY

"I am avidly interested in DX RTTY, yet it seems rare to hear RTTY stations active during lift conditions," writes Phil Hodson, who runs the full legal power into a 10-element beam. Phil is also keen to try RTTY via meteor scatter and will be pleased to arrange skeds with, as Phil puts it: "Anyone else daft enough to sit up all night." Many people think us daft Phil, but it is experiments like you propose that puts the radio amateurs at the top of the DX league. Mitch Tribe is also active on RTTY, v.h.f. and u.h.f. 144·6MHz and 432·6MHz and local nets 145·3MHz and 433·3MHz respectively. Mitch often uses a Creed 7E teleprinter from which he has made punch tapes of CQs, contest CQs and basic station gen to use on his automatic tape transmitter. Like Phil, Mitch is always looking for skeds and s.w.l. reports are always welcome. I hope to be active in this field very soon, because I have purchased a Microwave Modules MM2000 RTTY to TV converter, but owing to the pressure of work on this manuscript, I have not had time to play, so watch this space next time folks.

News Items

Congratulations to Mark Hattam, who passed the Morse test last April and the RAE in May and is now active on all bands from 1·8MHz to 1296MHz with the callsign G4KGA. Mark is a student at Oxford University and, during term, is often on the air from the club station, G3OUR or as G4KGA/A.

Congratulations also to **Arthur Poulter,** who passed the RAE last May and now sports the callsign G8XMG, and will no doubt be in QSO with his son, Derek G3WHK, who lives nearby. Derek is now operational on all bands and was delighted to work Spain on 70cm from his home in Morden, Surrey, last November.

For readers who require a working knowledge of astronomy, including our subjects, such as aurora, the earth's atmosphere and the sun, I can thoroughly recommend a new book. *The Practical Astronomer* by Colin A. Ronan, Pan Books ISBN 0 330 26231 9.

National Astronomy Week, 1981, will be held from April 20 to 26 to mark the bicentenary of the discovery of the planet Uranus in 1781 by the amateur astronomer, William Herschel. This is the first British attempt to make the science of astronomy and its achievements more widely known. More information available from Don Miles, 15 Bevan Road, Lovedean, Portsmouth, Hants PO8 9QH.

Congratulations to **Margaret** and **Richard Brownlow,** Brighton, on passing their Morse tests on January 2 and changing their G8 callsigns for G4LCU and G4LCV respectively. Also to **Barry Ainsworth** G4GPW, Lancing, on receiving the Cycle 21 Crossband Award from The Six Meter Amateur Radio Operators of Region 2, in appreciation of his 6m work in the true spirit of amateur radio.

The Barking Radio and Electronics Society are holding their 144MHz contest between 1300 and 1700 on March 29. There are sections for all licensed operators residing in Essex, another for those living outside the county, and one for all s.w.l.s. Certificates will be awarded to the winners and two runners-up in each section. The address for more information and contest logs is A. L. Sammons G8IZN, 80 Lyndhurst Gardens, Essex IG11 9XZ.

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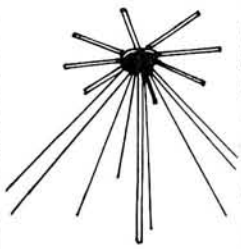

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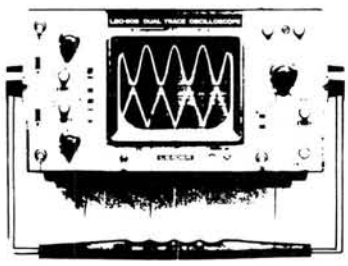

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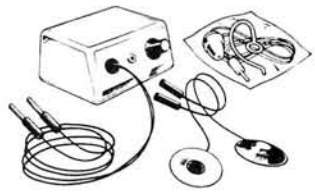

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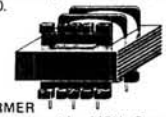

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TV

by Ron Ham BRS15744

Reports: as for VHF Bands, but please keep separate.

"I must thank you very warmly for the television instrument you have put into Downing Street. What a marvellous discovery you have made! When I look at the transmissions I feel that the most wonderful miracle is being done under my eye," wrote Prime Minister Ramsay MacDonald to Mr Baird on 5 April, 1930. I found this letter published in a 50-year-old copy of *Television*, the then official organ of The Television Society, who pointed out that: "Mr MacDonald was one of the first to come to the Baird studios to be televised." These were the days of the mechanical disc receiver and subjects were transmitted by the Baird Company from Brookman's Park, some six years before the BBC began broadcasting with a 405-line system. Now we enthusiasts have sophisticated equipment and go looking for pictures, not over a limited area, but from stations in other parts of the world.

Pictures via F2

The usual mixture of smeary pictures appeared on Ch. R1, 49·75MHz, via the F2 region of the ionosphere on December 21, 24, 26, 27, 31 and January 4. Like **Sam Faulkner,** I tried to sort out a mixture of what looked like a music programme, sports and a cartoon film between 0830 and 1000 on the 21st, and a good assortment of test cards, various electronic patterns and the one Sam photographed (Fig. 1) between 0800 and 0900 on the 26th. From 1125 to 1200 on the 22nd, **T. Ampi** saw two types of Russian test card and at 1130, a clock appeared showing 1430, followed by the caption, familiar to most DXers, "HOBOCTN". Around 1500 on the 24th, he received pictures from Poland, Programme 1, on both Channels R1 and R2, 59·25MHz. At 0856 on the 24th there was a blurred caption on R1, followed by what looked like a monk talking, and at 0930 on the 27th the prevailing smeary pictures became clear and I saw a male programme presenter, with an almost bald head and glasses, showing books followed by a possibly Russian caption.

At 0928 on the 31st, unreadable captions were rising over a street shot and moving cars were visible. On the 27th, Sam received bursts of American 525-line video on Ch. A2, 55·25MHz, at 1515, and by 1530 strong but blurred and rather ghostly pictures were seen, possibly a variety programme or an early morning children's show. Sam could see two men on stage, then a YL singer and some cartoon characters until about 1540. Between 1220 and 1251 on the 30th, Sam received strong colour bars and chequer-board and Cadena test cards from RTVE, Spain, on Ch. E3, 55·25MHz, and between 1215 and 1300 on the 31st both Sam and T. Ampi received test cards from ORF Austria on E2, and Sam received signals from TVP Poland on Ch. R1.

My best results began at 0815 on January 4, when I heard weak sync pulses on Ch. R1 with my R216 communications receiver and saw several strong bursts of picture, which looked like a film about students, on my JVC. At 0910 the bursts were showing, first a man with a bear and then with a donkey. By 0914, a youth choir was

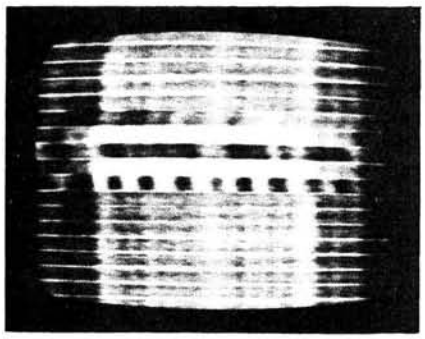

Fig. 1: An electronic test pattern seen by Sam Faulkner on December 26

Fig. 2: SSTV picture from ZS6BTD received by Sam Faulkner

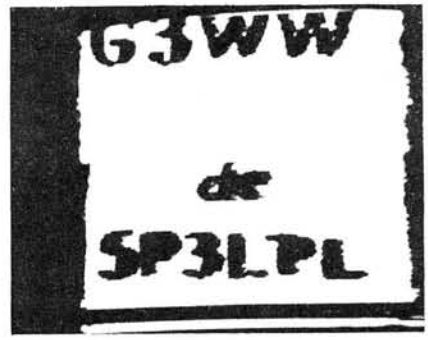

Fig. 3: Call received by Richard Thurlow G3WW from SP3LPL on 20m

Fig. 4: Self portrait of SP3LPL received by Richard Thurlow on SSTV

Fig. 5: Picture from DL6HP recorded on cassette by Richard Thurlow

Fig. 6: DF2TV's self portrait relayed by WA8YJU, both on 20m SSTV

solidly on screen and at 0918 a male singer, backed with female dancers, was performing on a lavish set. From 0925 a YL announcer was sitting at the right of a small TV screen with a large letter "A" in the bottom right-hand corner until 0926, when a full-screen caption, "BIS" followed by WTOREK PROGRAM I and a male announcer appeared. By 0932, WTOREK PROGRAM II was seen followed by a pianist at a grand piano with a YL singer and just before it faded out at 0939, a strong caption "STUDIO GAMA" was seen.

Tropospheric

During the evening of December 23 there was considerable patterning on several u.h.f. television channels and at times, as the prevailing tropospheric disturbance ebbed and flowed, there was total absorption of the signal. For most of the evening and the morning of the 24th, I received strong pictures from the IBA transmitter at Lichfield on Ch. 8, 189MHz, with only a dipole aerial feeding my receiver. At 1230, T. Ampi received pictures from France on Ch. 46, and between 1300 and 1500 from the Belgian Stations BRT on Chs. 47 and 62, RTB on Ch. 52, and Germany WDR on Chs. 48 and 53.

Meteor Scatter

Both **Harold Brodribb** and Sam Faulkner received many brief, sometimes 1- or 2 -second, bursts of picture on Channels E2 and R1 during the Quadrantid meteor shower on January 3 and 4, and at times the bursts were long enough for Sam to identify cartoon pictures.

SSTV

"Still quite a lot of interesting activity found on the SSTV calling channel, 28·680MHz and often 29·180MHz, when the band is busy," writes Sam Faulkner, who logged Ws 1, 2, 3, 4, 5, 8, 9 and 0 between December 14 and January 10. At 1535 on December 25 he logged VE3DDB, and at 1500 on January 4, VE1KG, both in Nova Scotia. Sam says that VE3EGO is on between 1600 and 1700 most weekends with colour transmissions. Pictures from I7PQD and OH5RM were both seen between 1300 and 1400 on December 21, and HK3DBQ, Bogota, new to SSTV, was seen at 1700 on the 22nd and 23rd. Around 1230 on January 4, Sam received pictures from ZS6BTD (Fig. 2), in Johannesburg, who was then transmitting pictures of himself and equipment identified simultaneously on the screen by his name and callsign.

A fine Christmas present for **Richard Thurlow** G3WW, March, Cambs, came on December 24 when he had a two-way SSTV QSO with YO8FR on 28·680MHz, giving Richard his 106th country, Roumania. His 107th was notched up on December 29 and 30, when HB9AZY set up his SSTV equipment at 4U1ITU on 14·230MHz, and gave a new country to the world, including G3GRJ and G3IAD. **Nevil Jackson** G3IAD, has already added four new countries to his "2nd in the world 2 × SSTV DXCC" and Richard holds No. 3. On November 25, SP3LPL called Richard on 20m (Fig. 3), and while in QSO he sent a picture of himself (Fig. 4) which was received by Richard, on his Robot 400 + 2 memories, through heavy interference. On the same day he also received a picture from the West German station, DL6HP (Fig. 5), which he recorded on an audio cassette tape. Another interesting aspect of SSTV is to receive a self-portrait replay such as that in Fig. 6. This had been sent from DF2TV in Germany to WA8YJU in Michigan, and recorded by Richard during the replay from across the Atlantic.

Why the Sinclair ZX80 is Britain's best-selling

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* Unique syntax check. A cursor identifies errors immediately.
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* Up to 26 single dimension arrays.
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* Variable names of any length.
* BASIC language also handles full Boolean arithmetic, condition expressions, etc.
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* PEEK and POKE enable entry of machine code instructions.
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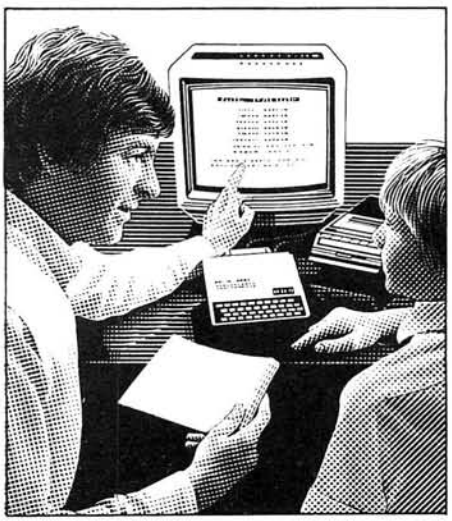

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If the specifications of the Sinclair ZX80 mean little to you – don't worry. They're all explained in the specially-written 128-page book (free with every ZX80). The book makes learning easy, exciting and enjoyable, and represents a complete course in BASIC programming – from first principles to complex programs.

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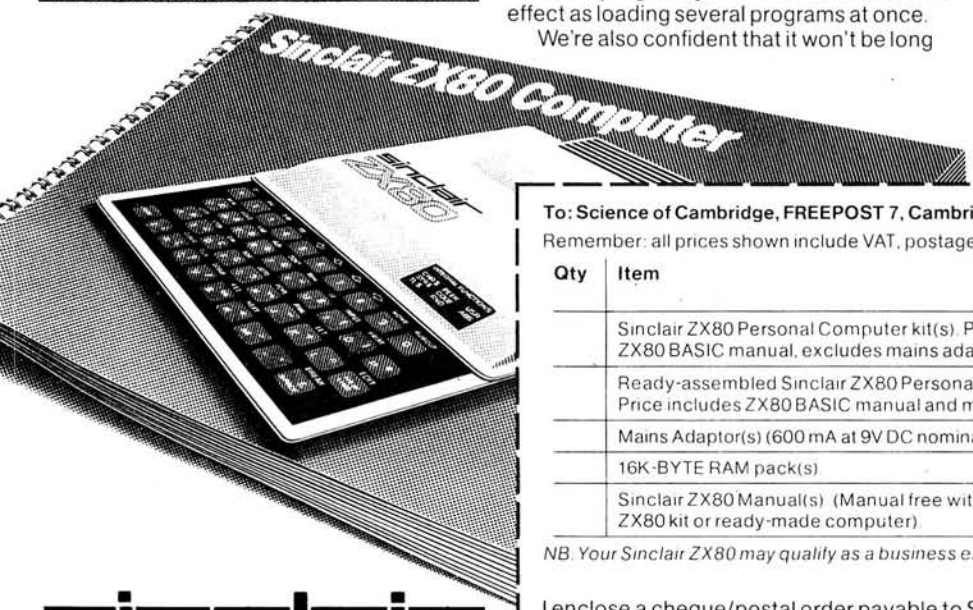

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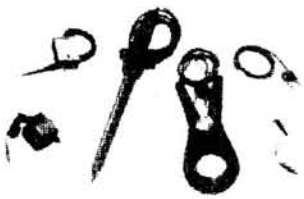

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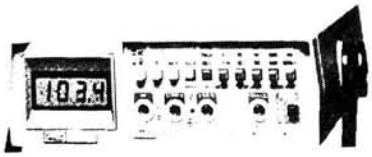

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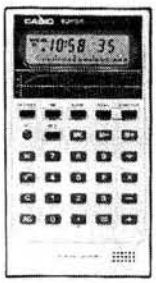

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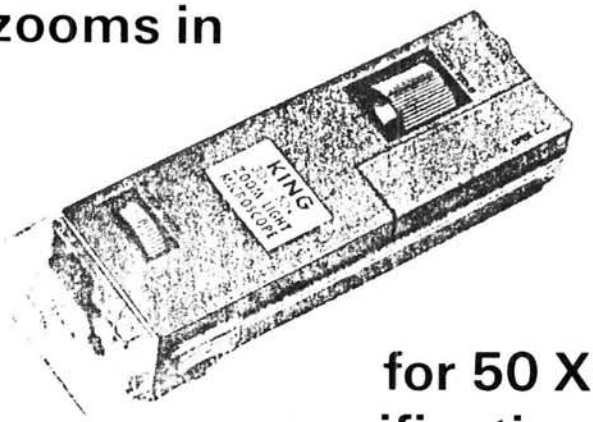
MICROSCOPE

Illuminated pocket microscope — zooms in



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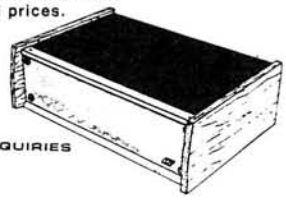

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Pri 220/240V sec 0-24-30-40-48-60V. Voltages available 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 or 24V-0-24V or 30V-0-30V.

Ref	Amps 60V	Amps 30V	Price	P&P
124	.5	1	**4.27**	1.20
126	1	2	**6.50**	1.20
127	2	4	**8.36**	1.60
125	3	6	**12.10**	1.72
123	4	8	**13.77**	1.96
40	5	10	**17.42**	1.84
120	6	12	**19.87**	2.04
121	8	16	**27.92**	O.A.
122	10	20	**32.51**	O.A.
189	12	24	**37.47**	O.A.

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

Ref	Amps 12V	Amps 24V	Price	P&P
111	0 5	0 25	**2.42**	0.95
213	1 0	0 5	**2.90**	1.00
71	2	1	**3.86**	1.00
18	4	2	**4.46**	1.20
85	0 5	2 5	**6.16**	1.20
70	6	3	**6.99**	1.20
108	8	4	**8.16**	1.44
72	10	5	**8.93**	1.60
116	12	6	**9.89**	1.60
17	16	8	**11.79**	1.72
115	20	10	**15.37**	1.84
187	30	15	**19.72**	2.04
226	60	30	**40.41**	O.A.

SCREENED MINIATURES

Ref	mA	Volts	£	P&P
238	200	3-0-3	**2.83**	0.50
212	1A, 1A	0-6, 0-6	**3.14**	1.00
13	100	9-0-9	**2.35**	0.50
235	330, 330	0-9, 0-9	**2.19**	0.60
207	500, 500	0-8-9, 0-8-9	**3.05**	0.95
208	1A, 1A	0-8-9, 0-8-9	**3.88**	1.20
236	200, 200	0-15, 0-15	**2.19**	0.60
214	300, 300	0-20, 0-20	**3.08**	1.00
221	700 (DC)	20-12-0-12-20	**3.75**	1.00
206	1A, 1A	0-15-20	**5.09**	1.20
203	500, 500	0-15-27	**4.39**	1.20
204	1A, 1A	0-15-27	**6.84**	1.20
239	50	12-0-12	**2.88**	0.50
234	500	6-0-6	**2.19**	0.44

Send 20p stamps for Catalogue. Prices correct 1/1/81.

AUTO TRANSFORMERS
Voltages available: 105, 115, 190, 200, 210, 220, 230, 240, for step up and step down.

Ref.	VA (Watts)	£	P&P
113*	15	**2.73**	1.00
64	80	**4.41**	1.20
4	150	**5.89**	1.20
53	350	**10.08**	1.44
67	500	**12.09**	1.84
84	1000	**20.64**	2.20
93	1500	**25.61**	O.A.
95	2000	**38.31**	O.A.
73	3000	**65.13**	O.A.
80S	4000	**84.55**	O.A.
57S	5000	**98.45**	O.A.

*0, 115, 220, 240.

END OF LINE OFFERS
B7 – 0-110-120-240V 20V **£1.80** 70p
M616 – 0-240V: Screen 1) 13-0-13 1A. 2) 12V 150ma **£1.50** £1.20
M708 – 6k to 3Ω matching trans. 5 watt **90p** 95p
M679 – 240V, 36V 1.6A **£3.00** 80p
M865 – 100V Line to 4Ω 10 watts **£1.90** £1.00
M1020 – 0-240V 12-0-12V @ 50ma **75p** 50p
M1126 – 120/240V: 9-0-9V @ 1A **£1.79** 60p

15V ct Range (7.5-0-7.5)

Ref			P & P
171	500mA	**2.30**	0.60
172	1A	**3.26**	1.00
173	2A	**3.95**	1.00
174	3A	**4.13**	1.20
175	4A	**6.30**	1.20

NEW RANGE TRANSFORMERS
2 windings 0-36V-48V/36V-0-36Vm 48V-0-48V 72V or 96V.

Amps	Ref.	Price	P&P
1	430	**4.88**	1.20
1.0	431	**8.12**	1.44
2.0	432	**13.35**	1.22
3.0	433	**16.17**	1.96
4.0	434	**20.65**	2.04
5.0	435	**29.30**	2.20
6.0	436	**36.69**	O.A.
8.0	437	**40.03**	O.A.

Split Bobbin Type
0-12-15-20-24-30V
Ref 009 1 Amp **£2.98** P & P £1.10
Ref 010 2 Amp **£4.62** P & P £1.10

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AVO TI169 in circuit transistor tester	**£45.00**
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DA211 L.C.D.	**£47.00**
DA212 L.C.D.	**£67.00**

All Avos Meggers and accessories available.
P&P £1.32 VAT 15%

SPECIAL OFFER
Multimeter 20KΩ B/V – with combined audio/I.F. test oscillator at 1 KHz and 465 KHz AC/DC to 1000 volts DC current to 500mA resistance to 1M. Size 160×97×40mm
£8.50 P & P £1.00 VAT 15%.

EDUCATIONAL METERS (Moving Coil)
0-10A, 0-15V, 0-30V. Freestanding large scale easily read meters with top screw terminals for quick connections. **£4.50** P&P 66p+VAT. Size 75×78mm scale.

Burglar Alarm: ultrasonic 20ft range, no installation costs, key operated; built in siren (external can be added). Looks like a speaker. **£98.00** P&P £2.00 + VAT.

Antex Soldering Irons CCN240 15W & 25W **£4.58** each. Safety Stand **£1.75** P&P 52p each.

P.W. Purbeck oscilloscope transformer 250-0-250; 6·3V; 12·9V (author approved) **£9.42** £1·04

Soldering Iron – 25W to BS spec. **£1·75** P&P 30p+VAT
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Telephones – Latest model, brand new, boxed, 2 tone grey **£11·50** P&P £1·20+VAT.

Metal Oxide Resistors – ¼W 5% **£1.00** per 100. **30p** P&P +VAT.
390Ω/470Ω/510Ω/560Ω/820Ω/1K/1K1/1K2/1K6
1KB/2K/2K4/3K/16K/20K/22K/24K/47K/82K/100K
110K/120/120K/130K/180K/220K/270K/300K
Use instead of Carbon Film (100's only)

PANEL METERS

43mm × 43mm		82mm × 78mm	
0-50μA	**6·20**	0-50μA	**6·70**
0-500μA	**5·95**	0-500μA	**6·70**
0-1mA	**5·95**	0-1mA	**6·70**
0-30V	**5·95**	0-30V	**6·70**

VU ind Panel 40mm × 40mm or 48mm × 45mm 250 μF fsd **VU** edge SV041 centre zero 250 μF **£2·60**
Carriage 76p VAT 15%

MAINS ELIMINATORS
Plugs into 13A socket or 6, 9, 12V @ 300ma **£4.60.** P&P 60p + VAT.

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100V 25A	**£1.80**	500V
100V 50A	**£2.20**	PM7A6
200V 2A	**£0.52**	12A
200V 4A	**£0.75**	**£3·75**
400V 1A	**£0.25**	
400A 4A	**£0.98**	P&P 20p
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Type	P/out	Gain	Volts	Freq.	Price
2N3866	1w	10dB	28	175MHz	**£0.92**
2N4427	1w	10dB	12	175MHz	**£1.06**
2N3553	2.5w	9dB	28	175MHz	**£1.17**
2N5913	2w	7dB	12	470MHz	**£1.61**
SD1127	4w	12dB	12	175MHz	**£2.42**
2N6080	4w	12dB	12	175MHz	**£4.72**
SD1143	10w	10dB	12	175MHz	**£6.90**
2N6081	15w	6.3dB	12	175MHz	**£7.48**
2N6082	25w	5.7dB	12	175MHz	**£8.63**
2N6084	40w	4.5dB	12	175MHz	**£12.65**
SD1428	45w	6.5dB	12	175MHz	**£13.28**
SD1416	70w	5.7dB	12	175MHz	**£24.15**
SD1477	100w	6.0dB+	12	175MHz	**£28.75**
2N5590	10w	5.2dB	13.6	175MHz	**£8.33**
2N5591	25w	4.4dB	13.6	175MHz	**£7.49**
2N5944	2w	9dB	12	470MHz	**£6.78**
2N5945	4w	8dB	12	470MHz	**£8.63**
SD1135	5w	7.5dB	12	470MHz	**£5.20**
SD1136	10w	6dB	12	470MHz	**£7.77**
2N5946	10w	6dB	12	470MHz	**£10.93**
SD1088	25w	6.8dB	12	470MHz	**£18.40**
SD1089	40w	4.3dB	12	470MHz	**£25.30**
SD1434	50w	6.0dB	12	470MHz	**£28.45**

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2N5914 RCA 12v 470MHz 2w 7dB **£4.60**
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Tefler PTFE 1·10pF **33p.** 7mm or Stripline. DAU PTFE Film 1·9pF or 1·5·18pF **28p.** Surplus 2·5-25pF 10mm **15p.**
SPRAGUE (Grade 1) Mica Trimmers (500v) for R.F. Amps. 2·5-7pF **81p.** 4-20pF **86p.** 7-40pF **86p.** 16-100pF **98p.** 25-150pF **£1.09.** 40-200pF **£1.15.**
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PA2 Preamplifier for 2 meters, using the latest UHF stripline MOSFET the BF900. 1½" square for fitting in the rig. 50Ω in/out imp. Only **£8.05** with instructions.
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CPM LINEAR AMPS with full RF Changeover size 82×102mm preamp can be fitted in RX.
SPEC AS FOR PM Series. Specify CPM type and add **£7.48** to PM series prices.

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POLYESTER RADIAL LEAD CAPACITORS: 250V; 10n, 15n, 22n, 27n **6p;** 33n, 47n, 68n, 100n **7p;** 150n, 220n **10p;** 330n, 470n **13p;** 680n **19p;** 1µ **23p;** 1µ5 **40p;** 2µ2 **46p.**

ULTRASONIC TRANSDUCERS **350p** per pair.

ELECTROLYTIC CAPACITORS (Values in µF). **500V:** 10 **52p;** 47 **78p; 250V:** 100 **65p; 63V:** 0 47, 1 0, 1 5, 2 2, 3 3, **8p;** 4 7 **9p;** 6 8 10 **10p;** 15, 22 **12p;** 33 **15p;** 47 **12p;** 100 **19p;** 1000 **70p; 50V:** 47 **12p;** 68 **20p;** 220 **24p;** 470 **32p;** 2200 **90p; 40V:** 4·7, 15, 22, **9p;** 3300 **90p;** 4700 **120p; 25V:** 1 5, 6 8, 10, 22 **8p;** 33 **9p;** 47 **8p;** 100 **11p;** 150 **12p;** 220 **15p;** 330 **22p;** 470 **25p;** 680, 1000 **34p;** 2200 **50p;** 3300 **76p;** 4700 **92p; 16V:** 40, 47, 100 **9p;** 125 **12p;** 220 **13p;** 470 **20p;** 680 **34p;** 1000 **27p;** 1500 **31p;** 2200 **36p;** 3300 **74p;** 4700 **79p.**
TAG-END TYPE: 450V: 100µF **65p; 70V:** 4700 **245p; 64V:** 3300 **198p;** 2200 **139p; 50V:** 3300 **154p;** 2200 **110p; 40V:** 4700 **160p; 25V:** 10,000 **320p;** 15,000 **345p.**

TANTALUM BEAD CAPACITORS:
35V: 0 1µ, 0 22, 0 33 **15p;** 0 47, 0 68, 1 0, 1 5 **16p;** 2 2, 3 3 **18p;** 4 7, 6 8 **22p;** 10 **28p; 16V:** 2 2, 3 3,**16p;** 4 7, 6 8, 10 **18p;** 15 **36p;** 22 **30p;** 33, 47 **40p;** 100 **75p; 10V:** 15, 22 **26p;** 33, 47 **35p;** 100 **55p.**

POTENTIOMETERS: Carbon Track

0 25W log & Linear Valves.	
470Ω, 680Ω 1K, 2K (Lin only) Single	29p
5KΩ to 2MΩ Single gang	29p
5KΩ to 2MΩ Single with D/P switch	69p
5KΩ to 2MΩ Dual gang	88p
1W Wirewound 5CΩ-20K	115p

POLYESTER (MYLAR) CAPACITORS:
100V: 1nF, 2n, 4n, 4n7, 10n **6p;** 15nF, 22n, 30n, 40, 47 **7p;** 56, 100n, 200 **9p; 50V:** 470nF **12p.**

SLIDER POTENTIOMETERS

0 25W log and linear values 60mm track	
5KΩ 500KΩ Single gang	70p
10KΩ 500KΩ Dual gang	110p
Self-Stick graduated Alum. Bezels	36p

CERAMIC CAPACITORS 50V
Range: 0 5pf to 10nf **4p**
15nF, 22nF, 33nF, 47nF **5p** 100nF **7p**

PRESET POTENTIOMETERS

0 1W 50Ω-2 2M Mini. Vert. & Horiz.	7p
0 25W 100Ω-3 3MΩ Horiz. larger	10p
0 25W 250Ω-4 7MΩ Vert.	10p

POLYSTYRENE CAPACITORS
10pF to 1nF, **8p** 1·5nF to 12nF, **10p.**

RESISTORS-5% carbon, High Stab. Miniature, Low Noise.

Range	Val.	1-99	100+
0 25W 2Ω2-4M7	E24	2p	1p
0 5W 2Ω2-5M1	E12	2p	1p
1W 2Ω2-10M	E12	5p	3p
2% Metal Film 10Ω-1M	E24	6p	4p
1% 0 5W 51Ω-1M	E24	10p	8p

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

OPTO ELECTRONICS

LEDs plus clip		3½ Digit LCD	675
TIL209 Red	13	4 Digit LCD	750
TIL211 Grn	18	OCP71	120
TIL212 Yel	18	ORP12	86
2" Red	14	2N5777	45
2" Green or Yellow	18	(Infra Red Emitter)	
Rectangular LED's		LD271	41
Red, Green, Yellow		TIL32	58
with bezel	29	Detector	
7 Seg. Displays Red		SFH205	91
3" C Cath	99	TIL78	60
3" C Anod	99		
3" +1 Red or Grn	150		
5" C Cath	115		
5" C Anod	115		
6" C Cath	180		
8" Orange	275		
Burgraph 10 seg.	225		

CRYSTALS

100KHz	300
455KHz	370
1MHz	295
1 008M	295
1 6MHz	395

VEROBOARDS: 0 1"

	Clad	Plain
2½×3¾"	66p	47p
2½×5"	75p	
3¾×3¾"	75p	
3¾×5"	86p	72p
3¾×17"	290p	192p
4¾×17"	390p	—
Pkt of 36 pins		20p
Spot face cutter		107p
Pin insertion tool		147p

'VQ' Board **150p**
'DIP' Board **330p**
Vero Strip **144p**

PROTO – DECs
Veroblock **375p**
S-DeC **350p**
Eurobreadboard **520p**
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Fibre Glass	Single-sided	Double-sided	SRBP 9 5"×8 5"
6"×6"	90p	110p	95p
6"×12"	150p	200p	

FERRIC CHLORIDE
1 lb **195p** +40p p&p

DALO ETCH RESIST PEN plus Spare Tip **95p**

SOLDERCON PINS
100 pins **60p;**
500 pins **275p**

VERO WIRING PEN + spool **285p**

DIL SOCKETS

	Low profile	Wire wrap
8 pin	10p	25p
14 pin	10p	35p
16 pin	10p	46p
18 pin	16p	52p
20 pin	22p	65p
22 pin	25p	70p
24 pin	30p	78p
28 pin	35p	85p
36 pin	—	105p
40 pin	40p	109p

EDGE CONNECTORS TEXAS

	1	156
2 10 way		82p
2 15 way		98p
2 18 way	140p	120p
2 22 way	150p	125p
2 25 way	165p	160p
2 30 way	188p	
2 36 way	197p	
2 40 way	205p	
2 43 way	250p	

DENCO COILS

Dual Purpose 'DP'		B9A Valve Base	40p
VALVE TYPE		RDT2	100p
Ranges: 1-5 Bl. Yl.		RFC 5 chokes	120p
Rd. Wht.	106p	RFC 7 (19mH)	133p
6-7 B, Y, R	95p	1FT 13/14/15/16	
1-5 Green	130p	17	110p
'T'-type (Transistor		1FT 18/1 6	116p
Tuning).		1FT 18/465	132p
		TOC1	110p
Ranges: 1-5 Bl. Yl.		MW 5FR	112p
Rd. Wht.	128p	MW/LW 5FR	134p

JACKSONS VARIABLE CAPS.

Dielectric		0-2-365pF with slow	
100/300pF	205p	motion Drive	450p
500pF	250p	00-2-208/176	395p
6:1 Ball Drive		,, ,, with slow	
4511/DAF	145p	motion drive	410p
Dial Drive 4103		C804: 5pF; 10	250p
6:1/36:1	775p	25pF	250p
Drum 54mm	55p	50pF	250p
0-1-365pF	325p	100:150pF	335p
00-2-365pF	395p	'L' 3×310pF	725p
00-2-500pF	550p	00-3×25pF	550p

TRANSISTORS

AC125	35	BC477	40	BU208	200	ZTX107	11
AC126	25	BC516	40	E421	250	ZTX109	12
AC127	25	BC517	40	MD8001	250	ZTX300	13
AC128	25	BC547	14	MJ400	150	ZTX301	16
AC141	30	BC548	14	MJ491	175	ZTX302	16
AC142	30	BC549C	14	MJ2955	90	ZTX303	25
AC176	28	BC557	15	MJE340	54	ZTX304	17
ACY17	70	BC558	15	MJE370	100	ZTX314	25
ACY18	70	BC559	15	MJE371	100	ZTX326	30
ACY19	75	BCY70	16	MJE2955	99	ZTX341	30
ACY20	75	BCY71	18	MJE3055	70	ZTX500	14
ACY21	75	BCY72	20	MPF102	66	ZTX501	15
ACY22	60	BD131	48	MPF103	36	ZTX502	15
ACY28	75	BD132	48	MPF104	36	ZTX503	18
ACY39	85	BD133	60	MPF105	36	ZTX504	25
AD149	79	BD135	45	MPF106	40	ZTX531	25
AD161	42	BD136	40	MPSA05	25	ZTX550	25
AD162	42	BD137	40	MPSA06	25	2N697	23
AF106	70	BD138	40	MPSA12	32	2N698	40
AF118	95	BD139	40	MPSA55	30	2N699	48
AF139	40	BD140	40	MPSA56	30	2N706A	19
AF178	75	BD144	198	MPSA70	25	2N708	19
AF239	78	BD145	198	MPSU06	55	2N918	35
BC107	10	BD205	110	OC26	170	2N1131	24
BC107B	12	BD214	115	OC28	130	2N1132	24
BC108	10	BD245	45	OC35	125	2N1303	60
BC108B	12	BD378	70	OC36	120	2N1304	65
BC108C	12	BD434	55	OC41	120	2N1305	60
BC109	10	BD517	75	OC42	120	2N1671B	160
BC109B	12	BD695A	85	OC43	55	2N2219A	28
BC109C	12	BD696A	85	OC44	120	2N2220A	26
BC140	30	BDY56	180	OC45	40	2N2221A	25
BC142	30	BF115	35	OC70	40	2N2222A	25
BC143	30	BF167	29	OC71	40	2N2369A	17
BC147	9	BF180	38	OC72	40	2N2646	45
BC147B	10	BF194	12	OC74	50	2N2904	28
BC148	9	BF195	12	OC76	50	2N2905A	26
BC148B	10	BF196	12	OC81	50	2N2906	26
BC148C	10	BF197	12	OC82	50	2N2907A	26
BC149	9	BF198	16	OC83	40	2N2926G	10
BC149C	10	BF199	18	OC84	40	2N3053	26
BC153	27	BF200	30	OC140	110	2N3054	58
BC154	27	BF224	24	OC170	85	2N3055	48
BC157	10	BF244	30	OC171	85	2N3442	140
BC158	10	BF245	28	OC200	85	2N3663	15
BC159	11	BF244B	30	TIP29	34	2N3702	10
BC160	45	BF256	35	TIP29A	36	2N3703	10
BC167	10	BF257	32	TIP29B	56	2N3704	10
BC168C	10	BF258	32	TIP29C	60	2N3705	10
BC169C	10	BF259	35	TIP30	48	2N3706	10
BC170	15	BF274	42	TIP30C	58	2N3707	10
BC172	11	BF336	40	TIP31A	45	2N3708	10
BC173	11	BF451	35	TIP31C	55	2N3709	10
BC177	20	BF594	30	TIP32A	48	2N3710	10
BC178	20	BF595	39	TIP32C	60	2N3711	10
BC179	20	BFR39	23	TIP33A	65	2N3771	179
BC181	20	BFR40	23	TIP33C	78	2N3772	195
BC182	10	BFR41	23	TIP34A	74	2N3773	270
BC183	10	BFR79	23	TIP34C	88	2N3819	22
BC184	10	BFR80	24	TIP35A	160	2N3820	45
BC182L	10	BFR81	25	TIP35C	185	2N3822	65
BC183L	10	BFR98	105	TIP36A	170	2N3823	65
BC184L	10	BFX29	28	TIP36C	199	2N3866	90
BC187	26	BFX84	26	TIP41A	55	2N3903	18
BC212	10	BFX85	28	TIP41B	68	2N3904	18
BC212L	10	BFX86	28	TIP42A	60	2N3905	15
BC213	10	BFX87	28	TIP42B	75	2N3906	17
BC213L	10	BFX88	28	TIP120	90	2N4037	46
BC214	10	BFY50	23	TIP121	99	2N4058	10
BC214L	10	BFY51	23	TIP142	120	2N4061	10
BC236	10	BFY52	23	TIP147	120	2N4062	10
BC237	14	BFY56	32	TIP2955	60	2N4427	80
BC307B	15	BFY64	35	TIP3055	60	2N4859	78
BC308B	16	BFY81	120	TIS43	32	2N4871	55
BC327	15	BRY39	40	TIS44	45	2N5172	18
BC338	15	BSX20	20	TIS45	45	2N5179	45
BC441	34	BSY95A	25	TIS88A	50	2N5191	75
BC461	34	BU105	170	TIS90	30	2N5305	24
		BU205	190	TIS91	32	2N5457	36

2N5458	36
2N5485	36
2N5642	750
2N5777	45
2N6027	32
3N128	112
3N140	112
40311	60
40313	125
40315	68
40316	85
40361	50
40362	50
40408	95
40411	280
40467	95
40468	60
40594	90
40595	98
40603	90
40673	95

74LS (TEXAS)

74LS00	13	LS124	180
LS01	13	LS125	45
LS02	15	LS126	45
LS03	15	LS132	60
LS04	16	LS136	55
LS05	23	LS138	70
LS08	22	LS139	70
LS09	23	LS151	90
LS10	20	LS153	85
LS11	32	LS155	75
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		LS399	230
		LS447	195
		LS490	245
		LS668	105
		LS670	270
		LS673	750
		LS674	850

VOLTAGE REGULATORS

1A +ve 5V, 12V 15, 18, 24V	60p
1A –ve	65p
100mA –ve 5V 6, 8, 12, 15V	30p
100mA –ve	65p
LM309K	135p
LM317K	350p
LM323K	635p
LM723	38p
78H05	595p
78HG05	650p
79HG	850p
TBA625B	80p

BRIDGE RECTIFIERS

1A/50V	20
1A/100V	22
1A/400V	29
2A/50V	35
2A/400V	46
2A/600V	65
6A/100V	83
6A/400V	95
10A/200V	215
10A/600V	350
25A/200V	240
25A/600V	395
BY164	56
VM18 DIL	50

SCRs THYRISTORS

1A/200V	58
5A/100V	32
5A/400V	40
5A/600V	48
8A/300V	60
8A/600V	95
12A/400V	95
12A/800V	188
BT106	150
BT116	180
C106D	38
TIC44	24
TIC47	35
2N4444	130

TRIACS

3A/100V	48
3A/400V	56
3A/800V	85p
8A/100V	60
8A/400V	69
8A/800V	115
12A/100V	78
12A/400V	82
12A/800V	135
16A/400V	105
16A/800V	220
25A/400V	185
25A/800V	295
30A/400V	525
T2800D	120

DIAC
ST2 **25p**

DIODES

AA119	15
BY100	24
BY127	12
CR033	250
OA9	40
OA70	12
OA79	15
OA81	15
OA85	15
OA90	8
OA91	8
OA95	8
OA200	8
OA202	8
1N914	4
1N916	5
1N4001/2	5
1N4003/4	6
1N4005/6	6
1N4007	7
1N4148	4
3A/100V	15
3A/400V	16
3A/600V	17
3A/1000V	19
6A/400V	50
6A/800V	65

NOISE DIODE
Z5J **180**

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

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BB106	40

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702	75	LM301A	26	S556B	275
709C 8 pin	35	LM308T	95	SAB3210	275
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733	75	LM318	240	SN76003N	240
741 8 pin	17	LM324	50	SN76013N	170
747C 14 pin	78	LM339	70	SN76018	148
748C 8 pin	36	LM348	90	SN76023N	170
753 8 pin	185	LM349	115	SN76033N	195
810	159	LM379	415	SN76115N	115
AY-1-0212	595	LM380	80	SN76131	125
AY-1-1313A	660	LM381N	145	SN76227N	95
AY-1-1320	225	LM381AN	195	SN76477	175
AY-1-5050	99	LM382	125	SN76660	120
AY-1-5051	160	LM386	99	SP8629	299
AY-1-6721/6	210	LM387	120	TAA621AX1	250
AY-3-1270	840	LM389	99	TAA661A	155
AY-3-8500	390	LM733	75	TAD100	159
AY-3-8910	850	LM1458	45	TBA120S	70
AY-5-1224A	235	LM3900	60	TBA540	220
AY-5-1230	450	LM3909N	70	TBA550Q	330
AY-5-1315	595	LM3911	125	TBA641-A12/	
AY-5-1317A	639	LM3914	240	BX1 or BX11	250
AY-5-3500	350	LM3915	240	TBA651	190
AY-5-4007D	450	LM13600	135	TBA800	90
AY-5-8100	735	M252AA	625	TBA810S	95
CA3011	110	M253AA	1150	TBA820	70
CA3014	157	MC1303	88	TBA920Q	260
CA3018	68	MC1304P	260	TCA965	120
CA3020	186	MC1310P	150	TDA1004	290
CA3023	191	MC1494	694	TDA1008	310
CA3028A	80	MC1495	350	TDA1022	575
CA3035	235	MC1496L	92	TDA1024	105
CA3036	115	MC1596	225	TDA2020	320
CA3043	275	MC1710	79	TL061CP	46
CA3045	365	MC3302	150	TL062CP	90
CA3046	71	MC3340P	120	TL064CN	159
CA3048	214	MC3360P	120	TL071CP	45
CA3059	195	MC3401	52	TL072CP	90
CA3075	213	MC3405	150	TL074CN	140
CA3080E	65	MFC6040	97	TL081CP	42
CA3081	190	MK50398	635	TL082CP	70
CA3089E	215	MM5303	635	TL083CP	95
CA3090AQ	375	MM5307	1275	TL084CN	120
CA3123	150	MM57160	520	UAA170	170
CA3130	90	MSM5526	820	UAA180	170
CA3140	48	NE515	275	XR2206	350
ICL7106	795	NE543K	210	XR2266	750
ICL7107	975	NE544	185	ZN414	95
ICL8038CC	340	NE555	22	ZN424E	130
ICM7205	1150	NE556DB•	55	ZN425E	415
ICM7215	1050	NE560	325	ZN1034	200
ICM7216A	1950	NE561	398	ZN1040E	685
ICM7216B	1950	NE562B	410		
ICM7216C	1950	NE564	435		
ICM7217A	790	NE565A	120		
ICM7555	89	NE566	180		
LD130	452	NE567V	170		
LF356	90	NE570	450		
LM10	395	NE571	420		
		RC4136D	110		

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2114-450n	175
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6551	785
6800	650
6810	360
6821	500
6850	485
6852	485
8080A	499
8085A	1195
81LS95	125
81LS96	125
81LS97	125
8251	700
8253	1275
8T26A	190
8T28A	195
8T95N	160
8T97N	150
AY-3-1015	420
AY-5-1013	365
AY-5-2376	750
MC1488	90
MC1489	90
MC14411	950
MC14412	1250
MK4027-2	450
RO-3-2513	600
SFF96364E	950
SFC71301	820
TMS2716-3	1050
TMS6011	365
TMS9900J	3500
Z80CPU 2 5	650
Z80ACPU 4M	825
Z80PIO	440
Z80APIO	575
Z80CTC	440
Z80A CTC	575
74S132	138
74S138	240
74S158	240
74S188	210
74S189	158
74S194	360
74S241	540
74S262	850
74S287	325
74S288	210
74S470	325
74S472	1150
74S475	825

TTL 74 (TEXAS)

7400	11	7489	205	74181	280
7401	11	90	42	74182	85
7402	11	91	84	74184	130
7403	14	92	50	74185	130
7404	14	93	57	74188	310
7405	18	94	85	74190	130
7406	36	95	70	74191	120
7407	36	96	80	74192	120
7408	17	97	176	74193	120
7409	20	100	130	74194	102
7410	17	104	64	74195	75
7411	25	105	62	74196	99
7412	20	107	34	74197	88
7413	32	109	60	74198	160
7414	38	110	54	74221	150
7416	30	111	68	74246	150
7417	30	112	70	74247	151
7420	19	116	180	74248	189
7421	38	118	85	74249	189
7422	25	119	120	74251	110
7423	28	120	75	74265	66
7425	28	121	35	74273	267
7426	43	122	50	74278	249
7427	32	123	65	74279	99
7428	35	125	50	74298	185
7430	19	126	45	75108	350
7432	27	128	65	75150	140
7433	36	132	55	75450	95
7437	35	136	65	75451	70
7438	32	141	75	75454	225
7440	20	142	185	75491	89
7441	68	143	250	75492	95
7442	58	144	250		
7443	120	145	90		
7444	116	147	150		
7445	105	148	125		
7446	132	150	130		
7447	72	151	70		
7448	75	153	70		
7450	20	154	120		
7451	20	155	75		
7453	20	156	75		
7454	20	157	70		
7460	20	159	165		
7470	40	160	99		
7472	30	161	99		
7473	35	162	99		
7474	34	163	99		
7475	56	164	120		
7476	40	165	120		
7480	52	166	130		
7481	120	167	205		
7482	75	170	205		
7483	90	172	375		
7484	99	173	110		
7485	105	174	100		
7486	33	175	82		
		176	80		
		177	85		
		178	110		
		180	90		

CMOS*

4000	14	4028	92	4162	115
4001	14	4029	98	4163	115
4002	15	4030	55	4174	110
4006	86	4031	185	4175	120
4007	19	4032	125	4194	115
4008	76	4033	175	4408	790
4009	46	4034	213	4409	790
4010	50	4035	95	4410	750
4011	18	4036	275	4411	950
4012	24	4037	115	4412	1250
4013	43	4038	110	4415	480
4014	80	4039	299	4419	280
4015	82	4040	85	4422	570
4016	35	4041	80	4433	995
4017	70	4042	70	4435	850
4018	76	4043	80	4440	999
4019	42	4044	80	4450	350
4020	85	4045	175	4451	350
4021	90	4046	96	4490	350
4022	85	4047	98	4500	850
4023	24	4048	65	4501	28
4024	60	4049	35	4502	105
4025	24	4050	38	4503	65
4026	170	4051	86	4504	120
4027	45	4052	86	4506	75
		4053	86	4508	280
		4054	130	4510	85
		4055	130	4511	98
		4056	135	4512	98
		4058		4513	225
		4059	575	4514	220
		4060	110	4515	250
		4061	1225	4516	90
		4062	995	4517	415
		4063	120	4518	90
		4066	46	4519	80
		4067	430	4520	90
		4068	26	4521	210
		4069	22	4522	150
		4070	25	4526	98
		4071	25	4527	125
		4072	25	4528	100
		4073	25	4529	150
		4075	23	4530	90
		4076	85	4531	130
		4077	30	4532	120
		4078	28	4534	510
		4081	26	4536	310
		4082	25	4538	145
		4085	90	4539	120
		4086	90	4541	150
		4089	150	4543	150
		4093	53	4544	200
		4094	210	4549	395
		4095	95	4553	399
		4096	95	4554	192
		4097	340	4555	85
		4098	115	4556	60
		4099	150	4557	425
		4160	115	4558	174
		4161	115		

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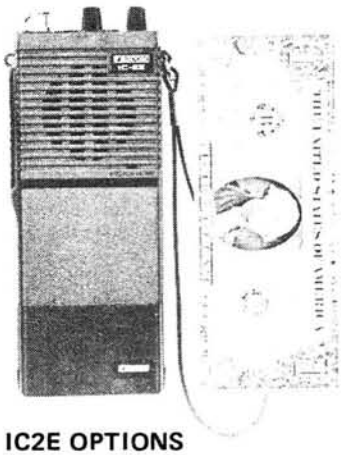
It's Small- but very Sensitive

IC-2E Handy Talky £159 INCL.



CHECK THE FEATURES

FULLY SYNTHESIZED – covering 144-145.995 in 400 5kHz steps.
POWER OUTPUT – 1.5W with the 9V rechargeable battery pack as supplied – but lower or higher output available with the optional 6V or 12V packs.
BNC ANTENNA OUTPUT SOCKET – 50 ohms for connecting to another antenna or use the Rubber Duck supplied.

SEND/BATTERY INDICATOR – Lights during transmit, but when battery power falls below 6V it doesn't light indicating the need for a recharge.
FREQUENCY SELECTION – by thumbwheel switches, indicating the frequency.

+5kHz SWITCH – adds 5kHz to the indicated frequency.
DUPLEX SIMPLEX SWITCH – gives simplex or plus 600kHz or minus 600 kHz Transmit.
HI-LOW SWITCH – reduces power output from 1.5W to 150mW reducing battery drain.
EXTERNAL MICROPHONE JACK – If you do not wish to use the built-in electret condenser mic an optional microphone/speaker with PTT control can be used. Useful for pocket operation.
EXTERNAL SPEAKER JACK – for speaker or earphone.
This little beauty is supplied ready to go complete with nicad battery pack, charger, rubber duck.

IC2E OPTIONS

BATTERY PACKS

ICBP3	9 VOLT PACK (AS FITTED) REPLACEMENT	£15.50
ICBP2	(7.2 VOLT) (1 WATT)	£22.00
ICBP4	EMPTY CASE (WILL TAKE SIX 'AA' SIZE NI-CADS)	£5.00
ICBP5	11 VOLT PACK (2-3 WATTS)	£30.50

CHARGERS ETC

IC-DC1	9 VOLT REGULATOR PACK	£7.50
IC-CP1	CAR CHARGER LEAD WITH CIGAR PLUG	£2.75
IC-BC25	CHARGER FOR BP3 AS SUPPLIED	£3.70
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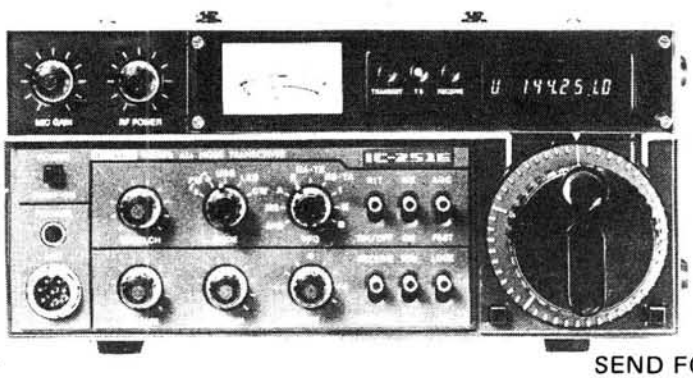

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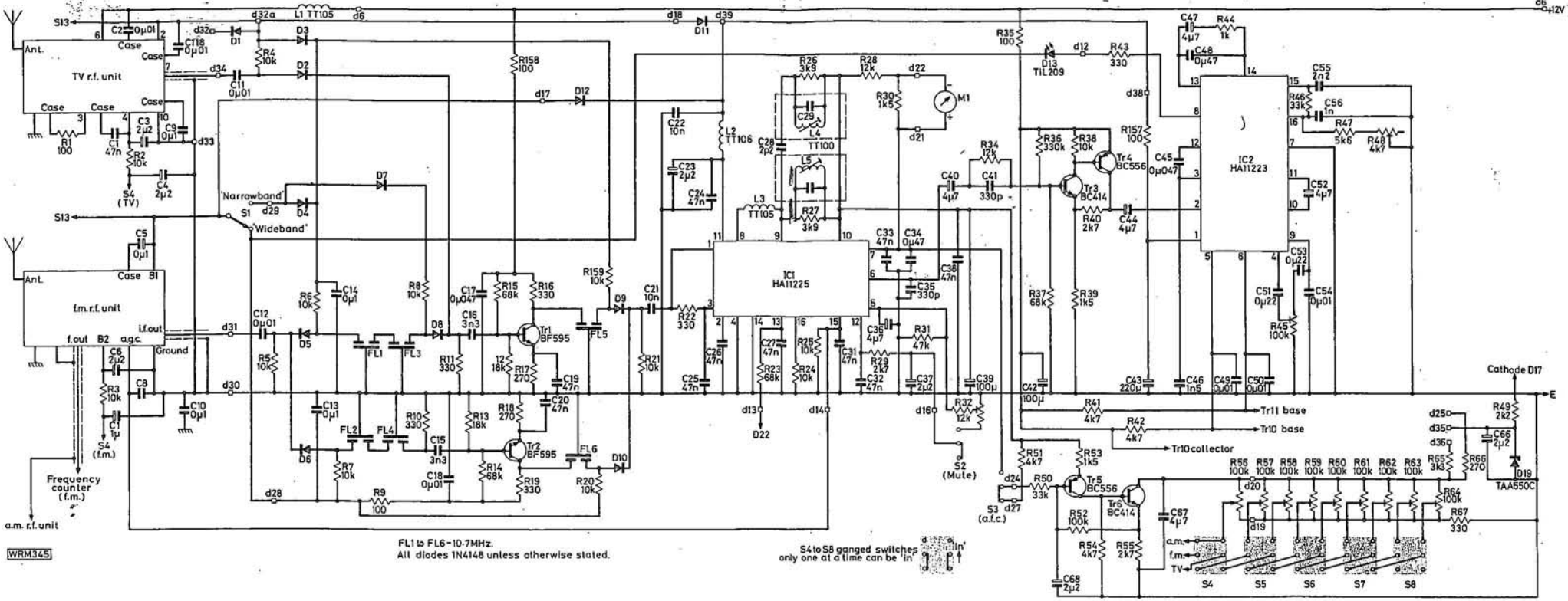

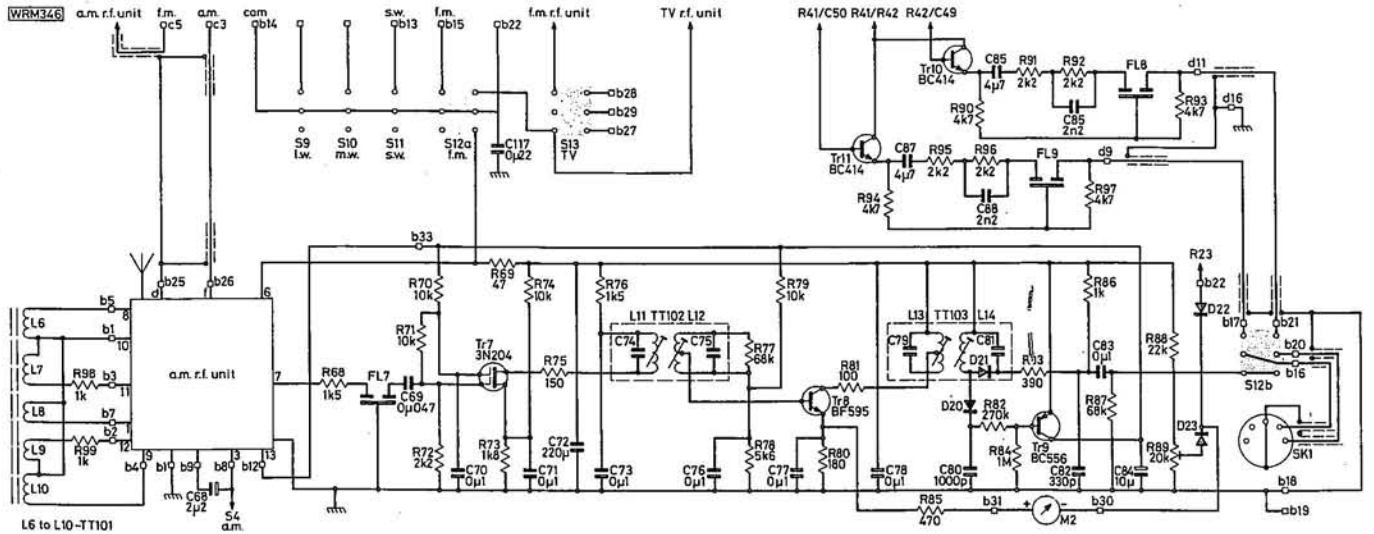

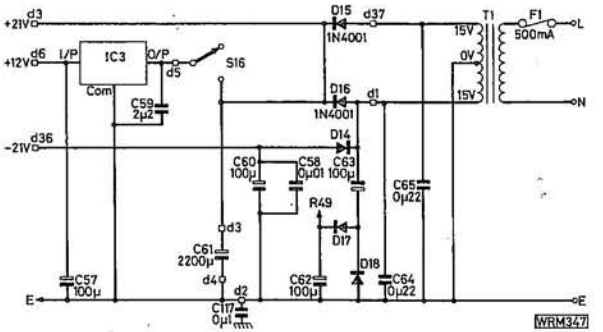

Fig. 1 (top): Circuit diagram of f.m. and TV sections of the *PW* Winton Tuner
Fig. 2 (left): Circuit diagram of a.m. section
Fig. 3 (above): Circuit diagram for *PW* Winton power supply