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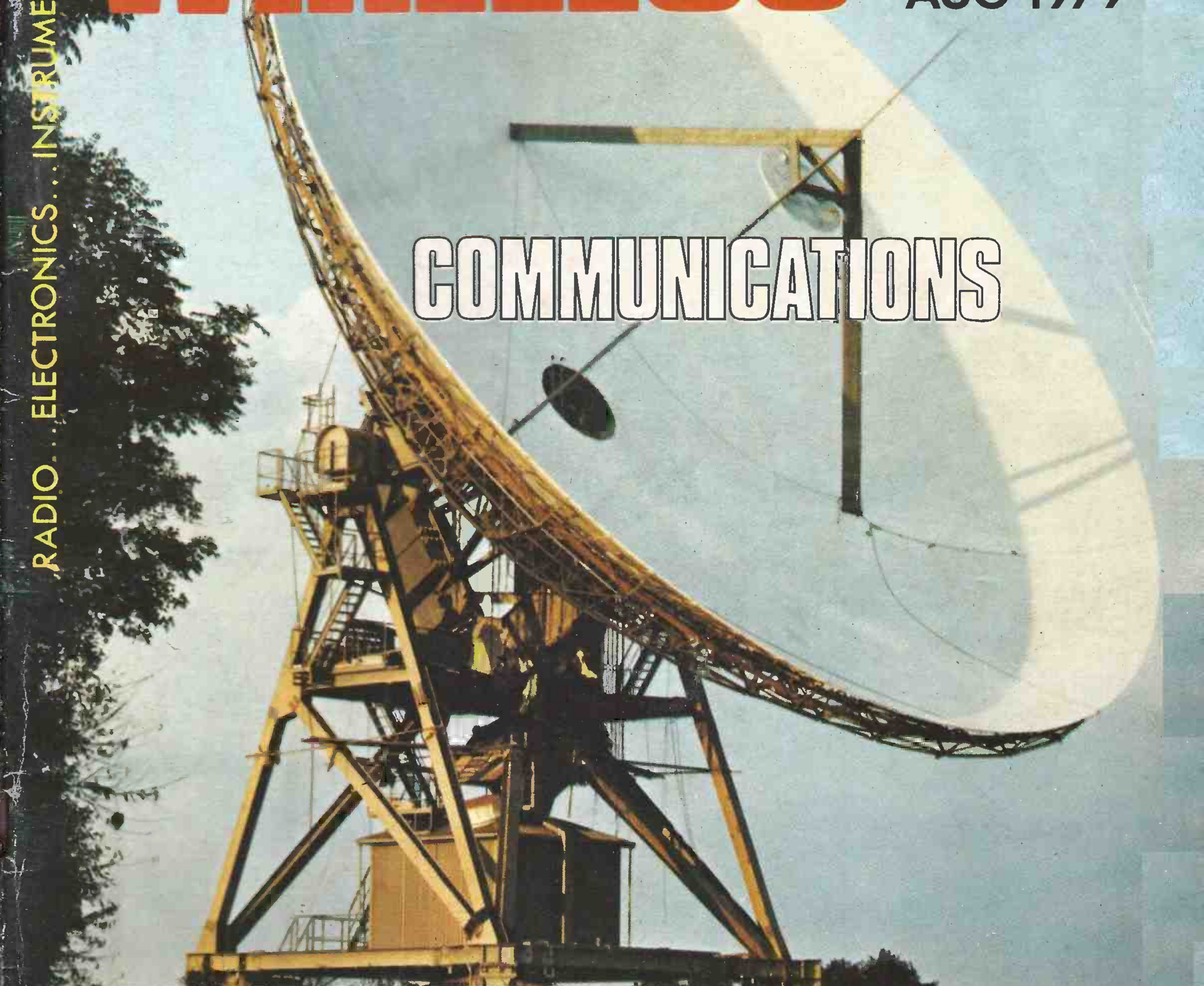
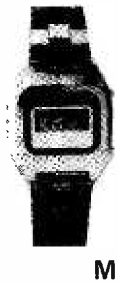


COMMUNICATIONS

AUTOMATIC INTERCOM
SATELLITE COMMUNICATIONS
ULTRASONIC REMOTE CONTROL
LOWE SRX-30 RECEIVER REVIEWED
AERIAL DESIGN WITH SCALE MODELS

QUARTZ LCD 5 Function



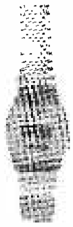
Hours, mins secs., month, date auto calender back-light, quality metal bracelet.

£6.65

Guaranteed same day despatch.
Very slim, only 6mm thick.

M1

SOLAR QUARTZ LCD 5 Function



Genuine solar panel with battery back-up. Hours, mins., secs., day, date. Fully adjustable bracelet. Back-light. Only 7mm thick.

£8.65

Guaranteed same day despatch.

M2

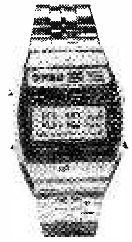
QUARTZ LCD 11 Function SLIM CHRONO

6 digit, 11 functions. Hours, mins., secs., day, date, day of week. 1/100th, 1/10th, secs., 10X secs., mins., Split and lap modes. Back-light, auto calendar. Only 8mm thick. Stainless steel bracelet and back. Adjustable bracelet.
Metac Price

£10.65 Thousands sold!
Guaranteed same day despatch.

M3

QUARTZ LCD ALARM 7 Function



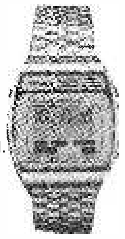
Hours, mins., secs., month, date, day. 6 digits, 3 flags plus continuous display of day and date or seconds. Back-light Only 9mm thick.

£12.65

Guaranteed same day dispatch.

M4

MULTI ALARM 6 Digits 10 Functions

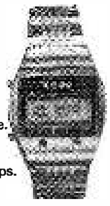


* Hours, mins., secs.
* Months, date, day.
* Basic alarm.
* Memory date alarm.
* Timer alarm with dual.
* Time and 10 country zone.
* Back-light.
* 8mm thick.

£18.65

M5

FRONT-BUTTON Alarm Chrono Dual Time



6 digits, 5 flags, 22 functions. Constant display of hours and mins., plus optional seconds or date display. AM/PM indication, month, date. Continuous display of day. Stop-watch to 12 hours 59·9 secs., in 1/10 second steps. Split and lap timing modes. Dual time zones. Only 8mm thick. Back-light. Fully adjustable open bracelet.
Guaranteed same day dispatch

£22.65

M6

SOLAR QUARTZ LCD Chronograph with Alarm Dual Time Zone Facility

6 digits, 5 flags. 22 functions. Solar panel with battery back-up. 6 basic functions. Stop-watch to 12 hours 59·9 secs.. in 1/10 sec., steps. Split and lap timing modes. Dual time zones. Alarm. 9mm thick. Back-light. Fully adjustable bracelet.

£27.95

M7

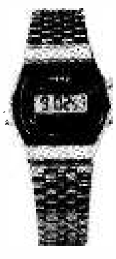
ALARM CHRONO with 9 world time zones

* 6 digits, 5 flags.
* 6 basic functions.
* 8 further time zones.
* Count-down alarm.
* Stop-watch to 12 hours 59·9 secs. in 1/10 sec. steps.
* Split and timing modes.
* Alarm.
* 9 mm thick.
* Back-light.
* Fully adjustable bracelet.

£29.65

M8

SOLAR QUARTZ LCD Chronograph



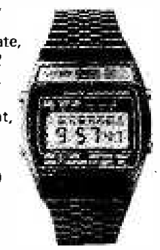
Powered from solar panel with battery back-up. 6 digit, 11 functions. Hours, mins., secs., day, date, day of week. 1/100th, 1/10th, secs., 10X secs., mins. Split and lap modes. Back-light, auto calendar. Only 8mm thick. Stainless steel bracelet and back. Adjustable bracelet.
Metac Price

£12.65

Guaranteed same day despatch.

M9

SEIKO Alarm Chrono



LCD, hours, mins., secs., day of week, month, day and date, 24 hour Alarm, 12 hour chronograph, 1/10th secs., and lap time. Back light, stainless steel, HARDLEX glass.

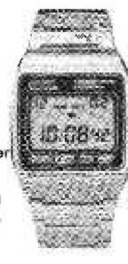
List Price £130.00

METAC PRICE

£105.00

M10

SEIKO MEMORY BANK

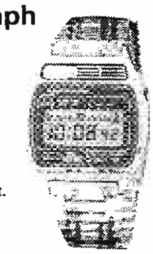


Calendar watch M354
Hours, mins., secs
Month, day, date in 12 or 24 hour format all indicated continuously
Monthly calendar display month, year and all dates for any selected month over 80 year period.
Memory bank function
Any desired dates up to 11 can be stored in advanced
2 year battery life.
Water resistant.

List Price £130
Metac Price **£105**

M11

SEIKO-STYLE Dual time-alarm Chronograph



Mineral glass face.
Battery hatch for DIY battery replacement.
Top quality finish with fully adjustable bracelet.

£35.00

M12

HANIMEX Electronic LED Alarm Clock

Features and Specification:
Hour/minute display. Large LED display with p.m. and alarm on indicator. 24 Hours alarm with on/off control. Display flashing for power loss indication. Repeatable 9-minute snooze. Display bright/dim modes control. Size: 5.15" x 3.93" x 2.36" (131mm x 11mm x 60mm).
Weight: 1.43 lbs (0.65 kg). AC power 220V.

£9.65 Thousands sold!
Mains operated.

Guaranteed same day despatch.

M13

HANIMEX portable LCD clock radio

* Time set & alarm controls.
* Snooze & sleep controls.
* Wake to music or alarm.
* AM/PM indicator.
* Battery operated. No plug required.
* Receives all standard AM radio broadcasts.
* Drawstring carrying case included.
* Back-light.
* Batteries supplied free.
* Quartz crystal controlled.

£17.95

M14

QUARTZ LCD Ladies 5 Function

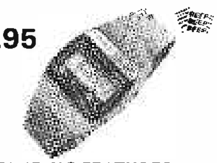
Only 25 x 20mm and 6mm thick.
5 function. Hours, mins., secs., day, date and back light and auto calendar.
Elegant metal bracelet in silver or gold.
State preference.

£9.95

Guaranteed same day despatch.

M15

Price breakthrough only £18.95



OUTSTANDING FEATURES

* **DUAL TIME.** Local time always visible and you can set and recall any other time zone (such as GMT). Also has a light for night viewing.
* **CALENDAR FUNCTIONS** include the date and day in each time zone.
* **CHRONOGRAPH/STOPWATCH** displays up to 12 hours, 59 minutes, and 59.9 seconds.
* On command, stopwatch display freezes to show intermediate (split/lap) time while stopwatch continues to run. Can also switch to and from timekeeping and stopwatch modes without affecting either's operation.
* **ALARM** can be set to anytime within a 24 hour period. At the designated time, a pleasant, but effective buzzer sounds to remind or awaken you!

Guaranteed same day dispatch.

M16

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Payment can be made by sending cheque, postal order, Barclay, Access or American Express card numbers. Write your name, address and the order details clearly, enclose 30p for post and packing or the amount stated. We do not wait to clear your cheque before sending the goods so this will not delay delivery. All products carry 1 year guarantee and full money back 10 day reassurance. Battery fitting service is available at our shops. All prices include VAT.

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

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

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NEWS & VIEWS

FOR OUR CONSTRUCTORS

GENERAL INTEREST

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Our September issue will be published in early August
(for details see page 43)

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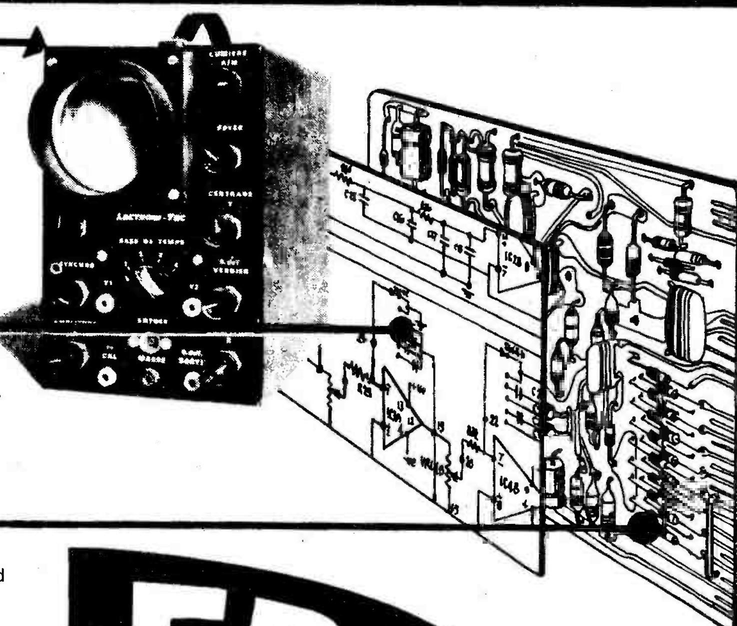

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As space only permits a brief description of these units, we suggest that you contact us for any further details you may require, and to discuss any particular requirements you may have for similar converters etc.,

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10 metre converter having an I.F. output on the 2 metre band. 10 metres is wide open to the entire world at the moment, so don't miss out on the REAL DX.
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PRICE: **£20·25** inc. VAT.
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THIS UNIT IS ALSO AVAILABLE FOR THE 136MHz SATELLITE BAND AND THE 156MHz MARINE BAND.

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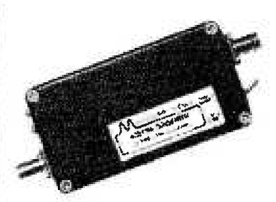

MMC432/28-S PICTURED ABOVE

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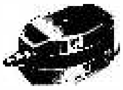

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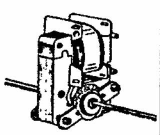


A.C. ELECTRIC MOTORS
2 Pole, 240V, ·2 Amp. Spindle — 1·43 × 0·212in. £1·75. 2 pole, 240V, ·15 Amp. Double spindle — 1·75 × 0·16in. Each £1·50. 2 Pole, 120V. ·5 Amp. Spindle — 0·75 × 0·2in. Two in series =240V. 75p each. Brush Motor. From a Food Mixer 240V, ·3 Amp. High Speed and Powerful. Spindle — 0·5 × 0·25in. £2·95 post 50p each.

BLANK ALUMINIUM CHASSIS, 18 s.w.g. 2½in. sides, 6 × 4in. 95p; 8 × 6in. £1·40; 10 × 7in. £1·55; 14 × 9in. £1·90; 16 × 6in. £1·85; 12 × 3in. £1·20; 16 × 10in. £2·20; 12 × 8in. £1·70.

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

ALUMINIUM ANGLE BRACKET 6 × ¾ × ¾in. 20p.

ALUMINIUM BOXES, MANY SIZES IN STOCK.
4 × 2 × 2in. 86p; 3 × 2 × 1in. 60p; 6 × 4 × 2in. £1; 8 × 6 × 3in. £1·90; 12 × 5 × 3in. £2; 6 × 4 × 4in. £1·30. 10 × 7 × 3in. £2·20.

DE LUXE BSR HI-FI AUTOCHANGER

Plays 12in. 10in. or 7in. records Auto or Manual. A high quality unit backed by BSR reliability with 12 months guarantee. A.C. 200/250V. Size 13½ × 11¼in.
Above motor board 3¾in.
Below motor board 2½in.
With CERAMIC STEREO CARTRIDGE

£18 Post on All Decks £1.

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

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

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

BSR. Disco Single Player Cueing Device 11in. Turntable. Budget price **£19·50**

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

BAKER 50 WATT AMPLIFIER

£59 Post £1

Superior quality ideal for Halls/PA systems. Disco's and Groups. Two inputs with Mixer Volume Controls. Master Bass, Treble and Gain Controls. 50 watts RMS. Three loudspeaker outlets 4, 8, 16 ohm. AC 240V (120V available). Blue wording on black cabinet.

BAKER 150 Watt AMPLIFIER 4 inputs £79.

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

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

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

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

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

MAINS TRANSFORMERS Post 75p

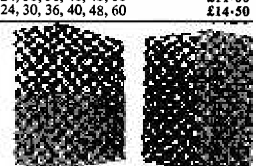
6 VOLT ½ AMP. £1·00 3 AMP. £1·95 9 VOLT 3 AMP. £2·75
12 VOLT 300 MA. £1·00 750 MA. £1·30 20 VOLT 2 AMP. £2·50
30 VOLT 5 AMP. AND 34 VOLT 2 AMP. C.T. £3·45
20 VOLT 1 AMP. £2·00 20-0-20 VOLT 1 AMP. £2·95
30 VOLT 1½ AMP. £2·75 40 VOLT 2 AMP. £2·95 30V 2 AMP. £3
0-20-40-60 VOLT 1 AMP. £3·50 2 × 18 VOLT 6 AMP. £9.
Low Voltage 0-8-12V. 3 AMP £3.
Low Voltage 12-0-12V. 2 AMP £3.

GENERAL PURPOSE LOW VOLTAGE. Voltages available at

2A, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30V	£5·80
1A, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60	£5·80
2A, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60	£8·50
3A, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60	£11·00
5A, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60	£14·50

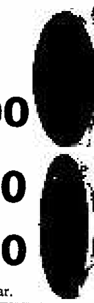
R.C.S. TEAK COMPACT SPEAKERS

13 × 10 × 6in.
50 to 14,000 cps.
10 watts. 4 or 8 ohms.
£16 pair Post £1·50



BAKER SPEAKERS "BIG SOUND"

Post £1 ea.



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

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

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

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

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

E.M.I. 13½ × 8in SPEAKER SALE!

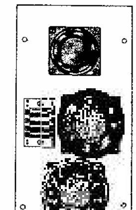
With tweeter. And crossover. 10W. State 3 or 8 ohm. *Illustrated* **£8·95** Post 45p

15W model 8 ohms Bass unit only. **£10·50** Post 65p

GOODMANS 20 Watt Woofer Size 12 × 10in. 4 ohms. Rubber cone surround. Hi-Fi Bass unit. **£9·95** Post 65p

GOODMANS TWIN AXIOM 8 8in. 8 ohm Hi-Fi Twin Cone Special unit **£9·95** Post 50p

R.C.S. MINI MODULE HI-FI KIT 15 × 8¼in 3-way Loudspeaker System, EMI 5in, Bass 5in, Middle 3in. Tweeter with 3-way Crossover and Ready Cut Baffle. Full assembly instructions supplied.
Response = 60 to 20 000cps
12 watt RMS. 8 ohm.
£10.95 per kit. Two kits £20.
Postage 75p. One or two kits.



RADIO COMPONENT SPECIALISTS 337 WHITEHORSE ROAD, CROYDON

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

P.W. JUMBO CLOCK

Kits of parts by the designers of the clock.

Kit A.
Comprising of printed circuit board. **Price £8.96.** V.A.T. and postage included.

Kit B.
Comprising of printed circuit board, case, perspex panel, pillars, transformer and l.e.d.s. **Price £22.72.** V.A.T. and postage included.

Kit C.
Comprising of full kit, excluding mains cable and wire. **Price £29.00.** V.A.T. and postage included.

Two colours of cases are available:– Gloss White & Simulated Black Leather Grain.
Please state colour with order e.g. Kit C/Black.

Full range of R.S. components available (48 hours service)

If you are experiencing difficulty in obtaining certain components for projects please do not hesitate to telephone us.

I.C.'s LM3900 & MC3302

£1.13 per pair Postage and package 20 pence.

V mos transistors. VN66AF

£1.30 each Postage and package 20 pence.

P.C.B'S FOR PRACTICAL WIRELESS PROJECTS

Nov. 78.	Sarum Q Meter	R030	Price £3.30 & 20 pence p & p.
Nov. 78.	S.T.D. Charge Timer	AD212	Price £2.80 & 20 pence p & p.
Nov. 78.	Porch Light Timer	AD222	Price £0.60 & 12 pence p & p.
Nov. 78.	Battery Indicator	AD225	Price £0.60 & 12 pence p & p.
Dec. 78.	Car Radio L.W. Converter	R034	Price £2.35 & 15 pence p & p.
Dec. 78.	Digital Door Chimes	R017	Price £3.78 & 25 pence p & p.
Dec. 78.	Car Radio L.W. Converter	R032	Price £2.62 & 20 pence p & p.
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Jan. 79.	Dorchester	R033	Price £10.80 & 30 pence p & p.
Jan. 79.	Sandbank Met. Det.	R035	Price £3.19 & 20 pence p & p.
Feb. 79.	Hythe Receiver	WR037	Price £5.94 & 20 pence p & p.
March 79.	Hythe Receiver	WR038	Price £2.70 & 20 pence p & p.
March 79.	Soudlite Converter	WK001	Price £5.98 & 20 pence p & p.
March 79.	Tone Burst Generator	R023	Price £1.60 & 15 pence p & p.
March 79.	Wide Band Noise Source	WR036	Price £0.70 & 12 pence p & p.
April 79.	PW 'Winton'	WR039	Price £15.42 & 30 pence p & p.
April 79.	FM Multitester	WR040	Price £2.70 & 15 pence p & p.
May 79.	Car Test Probe	WR042	Price £0.90 & 15 pence p & p.
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May 79.	Inline Crystal Calibrator	WR041	Price £1.58 & 15 pence p & p.
June 79.	Jumbo Clock		Price £8.66 & 30 pence p & p.
June 79.	Logical 0's+X's	WR046/7/8/9	Price £12.00 & 30 pence p & p.
June 79.	Trent	WR050	Price £3.80 & 20 pence p & p.
July 79.	AAM/FM Frequency Readout	WR052	Price £3.42 & 20 pence p & p.
	V.MOS Top Band Transmitter	WR056	Price £3.82 & 20 pence p & p.
	Sound Operated Switch	WK005/6	Price £3.50 & 20 pence p & p.
	Inexpensive A/F Voltmeter	WR055	Price £1.08 & 15 pence p & p.

All prices include V.A.T.

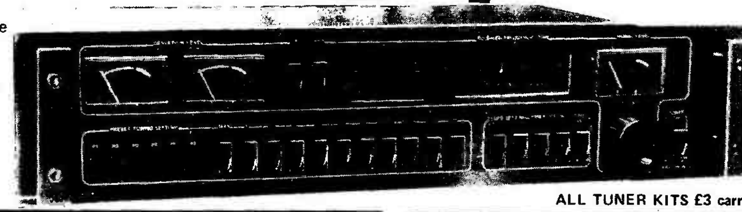
Send orders to: **C. BOWES & CO. LTD., 4, Wood Street, Cheadle, Cheshire SK8 1AQ. Tel. 061-428-4497.**
Please state type number and enclose cheque or postal order.

Tecknowledgey for sale.

The Mark III FM Tuner

DIY Hi-Fi will never seem the same again. Ambit's Mark III tuner system is electrically & visually superior to all others. Some options available, but the illustrated version with reference series modules: £149.00 + £18.62 VAT

With Hyperfi Series modules £185.00 + £23.12



ALL TUNER KITS £3 carriage

Features of the system:

* Precision construction & design of all parts
* Time/frequency display
* State of the art performance with facilities for updates, using modular plug in systems.
* Deviation level calibrator for recording
* All usual tuner features

Digital Dorchester All Band Broadcast Tuner: LW/MW/SW/SW/SW/FM stereo

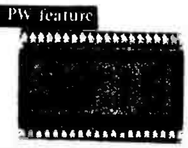
A multiband superhet tuner, constructed using a single IC for RF/IF processing - but with all features you would expect of designs of far greater complexity. The FM section uses a three section (air gang) tuned FET tunerhead, with ceramic IF filters and interstation mute; AM employs a double balanced mixer input stage, with mechanical IF filters - plus a BFO and MOSFET product detector for CW/SSB reception. Styled in a matching unit to the Mark III FM only tuner, employing the same degree of care in mechanical design to enable easy construction. MW/LW reception via a ferrite rod antenna.

Electronics only (PCB and all components thereon)	£33.00 + £4.12 VAT
Complete with digital frequency readout/clock-timer hardware	£99.00 + £12.37 VAT
Complete with MA1023 clock/timer module with dial scale	£66.00 + £8.25 VAT

Hardware packages are available separately if you wish to house your own designs in a professional case structure. Please deduct the cost of electronics from complete prices.

LW MW FM LCD Digital Frequency Display - July PW feature

Update your old radio, or build this into a new design. Or use it as a servicing aid - this low power unit with LCD display reads direct frequency in kHz/MHz, or with usual AM/FM IF offsets for received frequency. Low power LCD means no RFI - 15-20mA at 9v even with the divide by 100 prescalar. FM resolution is 100kHz, AM 1kHz. Sensitivities better than 10mV



Complete kit £19.50 +*£1.56 VAT. Built and tested version £24.00 +*£1.92 VAT

Various other DFM systems described in our catalogue part 2 - including a one chip solution to providing digital display of FRG7 kHz dial, combined with clock/timers etc.

PW SANDBANKS PI METAL LOCATOR

Maintaining our professional approach to home constructor kits, we offer the pulse induction 'Sandbanks'. Now with injection molded casing for greatly improved enviromental sealing. £37.00+ *£2.96vat.

VHF MONITOR RX WITH PLESSEY IC

4/9 channel version of the PW design - but using standard 3rd OT crystals, and TOYO 8 pole crystal filter with matching transformers. Coil sets from our standard range to cover bands from 40 to 200MHz. Complete module kit £31.25 +£3.90vat.

ETI - REMCON RADIO CONTROL

A tried and tested RC system with a full set of supporting hardware from a well known manufacturer. Please send for details - and watch our ads for further news of developments in RC products.

Radio and Audio Modules : The biggest range/ best specs:

EF5801/3/4 6 stage varicap tunerheads with LO feed and various levels of sophistication. New 5804 include pin AGC loop 'on board'. 5801:£17.45+£2.18vat - 5803:£19.75+£2.47vat 5804:£24.95 +£3.18vat. *Frequencies in 40-180MHz on appcn.*

EF5402 4 stage varicap with TDA1062, compound FET/Bipolar input stage, low noise, balanced mixer, pin agc, osc output. A worthy successor to the 5400. £10.75+£1.34vat

The 5402 is available centred on a wide range of frequencies from 30MHz to 180MHz. Non standard units £14.75+£1.84 - 3 weeks.

8319 4 stage varicap tunerhead from Larsholt using MOSFET RF and mixer stages. New temperature compensated oscillator for wide ranges of ambient temperature £13.45+£1.68vat

7252 Complete Larsholt FM tuner less stereo decoder. £26.50+£3.31vat

7253 Stereo FM tunerset from Larsholt with FET head. (as 7252)

944378 Hyperfi stereo decoder. The very best. £19.95+£2.49vat

911223 Pilot cancel stereo decoder, priced to make the MC1310 as obsolete as it now deserves to be.£12.50+£1.56vat

Inotec 1-A fully DC tuned and switched LW/MW/FM stereo tuner to interface with synthesiser control etc.A first! Details OA

COMPONENTS for Radio and Audio ICs, HMOS etc.

The list is too long to attempt here, but AMBIT specializes in all types of semiconductor for radio reception, including devices operating from DC to 5GHz. New low cost SBL1 diode ring mixers (equiv case MD108 etc) -first with HMOS fets, now with a PCB for DC amplifier, and offset sense and protection relay for speakers. See catalogue and updates for most info, pse send an SAE for information on anything you cannot find in catalogues.

Radio ICs	cost	+vat	Stereo ICs	cost	+vat	AF power ICs	cost	+vat
CA3089E	1.94	24	MC1310P	1.50	19	LM380N	1.00	12
CA3189E	2.45	30	uA758	2.20	27	TBA810AS	1.09	14
HA1137W	2.20	27	CA3090A	2.75	34	TDA2002	1.95	24
SN76660	0.75	9	HA1196	3.95	49	TBA820M	0.75	9
TDA1090	3.35	42	HA11223	4.35	54	from the general list:		
TDA1083	1.95	24	KB4437	4.35	54	LEDs:all colours and		
TDA1220	1.40	17	KB2224	2.75	34	low prices		
SL6640	2.75	34	Preamp ICs/switches			2SJ48/2SK134 HMOS		
MC3357	3.12	39	TDA1028	3.50	44	9.90 +£0.80 vat(Pair)		
HA1197W	1.40	17	TDA1029	3.50	44	Signal fets/transistors and		
MC1496	1.25	16	TDA1074	4.14	52	TOKO COILS & FILTERS!		
LM373/4	3.75	49	KB4438	2.22	28			

OSTS: Remember all OSTS stocks are obtained from BS9000 approved sources - your assurance that all devices are very best first quality commercial types. Some LPSN TTL is presently in great demand, so please check by phone before ordering .

TTL:Standard AND LP SchottkY

All prices listed in pence *

	'N'	'LSN'		'N'	'LSN'		'N'	'LSN'		'N'	'LSN'
7400	13	20	7455	35	24	74126	57	44	74185	134	
7401	13	20	7460	17		74128	74		74188	275	
7402	14	20	7463		124	74132	73	78	74190	115	92
7403	14	20	7470	28		74133		29	74191		
7404	14	24	7472	28		74136		40	74192	105	180
7405	18	26	7473	32	38	74138		60	74193	105	180
7406	38		7474	27	38	74139		60	74194	105	187
7407	38		7475	38	40	74141	56		74195	95	137
7408	17	24	7476	37	38	74142	265		74196	99	110
7409	17	24	7478		38	74143	312		74197	85	110
7410	15	24	7480	48		74144	312		74198	150	
7411	20	24	7481	86		74145	65	97	74199	160	
7412	17		7482	69		74147	175		74247		90
7413	30		7483A		110	74148	109	191	74248		90
7414	51		7484	97		74150	99		74249		93
7415		24	7485	104	99	74151	64	84	74251		90
7416	30		7486		40	74153	64	54	74253		105
7417	30		7489	205		74154	96		74257		108
7420	16	24	7490	33	90	74155	54	110	74258		153
7421	29	24	7491	76	110	74156	80	110	74259		420
7422	24	24	7492	38	78	74157	67	55	74260		153
7423	27		7493	32	99	74158		60	74261		353
7425	27		7494	78		74159	210		74266		40
7426	36	27	7495A	65	99	74160	82	130	74273		124
7427	27	29	7496	58	120	74161	92	78	74275		312
7428	35	32	7497	185		74162	92	130	74279		52
7430	17	24	74100	119		74163	92	78	74283		120
7432	25	24	74104	63		74164	104	130	74290		90
7433	40	32	74105	62		74165	105		74293		95
7437	40	24	74107	32	38	74166			74295		120
7438	33	24	74109	63	38	74167	20		74298		100
7440	17	24	74110	54	54	74168			74324		157
7441	74		74111	68		74169		200	74325		242
7442	70	99	74112		38	74170	230	200	74326		247
7443	115		74113		38	74172	625		74327		237
7444	112		74114		38	74173	170		74352		100
7445	94		74116	198		74174	87	120	74353		100
7446	94		74118	83		74175	87	110	74362		715
7447	82	89	74119	119		74176	75		74365		49
7448	56	99	74120	115		74177	78		74366		49
7449		99	74121	25		74180	85		74367		43
7450	17		74122	46	57	74181	165	350	74368		49
7451	17	24	74123	48	73	74182	160		74373		77
7453	17		74124		137	74183		210	74374		77
7454	17	24	74125	38	44	74184	135		74375		60

	'LSN'
74377	124
74378	93
74379	130
74368	37
74390	140
74393	140
74395	139
74396	133
74398	180
74399	150
74445	92
74447	90
74490	140
74668	110
74670	249

VOLTAGE /PSU REGULATORS

7800 series	95p
7900 series	£1
78M series (TO220 pack)	90p
78LCP series	35p
78MGT2C	175p
79MGT2C	175p
723C	65p
NE550A	73p
L200	195p

MAINS FILTERS

1Amp IEC	4.83
6Amp IEC	5.83
5A wirein	3.87

All BS approved

Requests for the next issue of the catalogue now being "booked" for despatch immediately it is ready (about November). Please send 50p to reserve a copy. (Part 3)

IMPORTANT: ALL OSTS PRICES EXCLUDE VAT - CURRENTLY 8% - BUT MAY BE CHANGED BY THE TIME YOU READ THIS. PLEASE REMEMBER TO ADD VAT, and 25p POSTAGE !!

CD4000 CMOS

4000	17p				
4001	17p	4059	563p	4522	149p
4002	17p	4060	115p	4527	157p
4006	109p	4063	109p	4528	102p
4007	18p	4066	53p	4529	141p
4008	80p	4067	400p	4530	90p
4009	58p	4068	25p	4531	141p
4010	58p	4069	20p	4532	125p
4011	17p	4070	20p	4534	614p
4012	17p	4071	20p	4536	380p
4013	55p	4072	20p	4538	150p
4014	95p	4073	20p	4539	110p
4016	52p	4075	20p	4541	141p
4017	80p	4076	90p	4543	174p
4018	80p	4077	20p	4549	399p
4019	60p	4078	20p	4553	440p
4020	93p	4081	20p	4554	153p
4021	82p	4082	20p	4556	77p
4022	90p	4085	82p	4557	386p
4023	17p	4086	82p	4558	117p
4024	76p	4089	150p	4559	388p
4025	17p	4093	50p	4560	218p
4026	180p	4094	190p	4561	65p
4027	55p	4096	105p	4562	530p
4028	72p	4097	372p	4566	159p
4029	100p	4098	110p	4568	281p
4030	58p	4099	122p	4569	303p
4031	250p	4160	90p	4572	25p
4032	100p	4161	90p	4580	600p
4033	145p	4162	90p	4581	319p
4034	200p	4163	90p	4582	164p
4035	120p	4174	104p	4583	84p
4036	250p	4175	95p	4584	63p
4037	100p	4194	95p	4585	100p
4038	105p	4501	23p		
4039	250p	4502	91p		
4040	83p	4503	69p		
4041	90p	4506	51p		
4042	85p	4507	55p		
4043	85p	4508	248p		
4044	80p	4510	99p		
4045	160p	4511	149p		
4046	130p	4512	98p		
4047	99p	4513	206p		
4048	60p	4514	260p		
4049	65p	4515	300p		
4050	55p	4516	125p		
4051	65p	4517	382p		
4052	65p	4518	103p		
4053	65p	4519	57p		
4054	120p	4520	109p		
4055	135p	4521	236p		

Micromarket

6800 series					
6800P	6.50	8216	1.95	2114	£10
6820P	£6	8224	3.50	2708	£
6850P	2.75	8228	4.78	**Development**	
6810P	£4	8251	6.25	MEK6800	£220
6852	3.65	8255	5.40	TK80	£306
8080 series		**MEMORIES**		AMI, Signetics TI, Intersil, Harris etc. OA	
8080	6.30	2102	£1.70		
8212	2.30	2112	£3.40		
		2513	£7.54		
		4027	£5.78		

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LM3909 72p 95H90DC /320MHz 7 80p
11C90DC /650MHz £14.00

ICM7216BIPI 8 decade 10MHz DFM/timer with direct LED drive and all counter features £19.82

ICM7217AIBI 4 decade programmable cntr.	£9.50
ICM7207 clock pulse generator IC	£4.95
ICM7208 7 decade counter/display driver	£14.95
ICM7106CP LCD DVM IC (3½ digit)	£9.55
ICM7106CPK LCD DVM KIT	£24.80
ICM7107CP LED DVM IC	£9.55
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SP8629 divide by 100/200MHz scalar	£4.20
MSL2318 divide by 100 to 175MHz min divide by 10 to 45MHz min	£4.20

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CA3130T	90p	LM339N	66p
CA3140E		LM348N	186p
CA3140T	72p	LM3900N	60p
CA3160E	90p	709HC to5	64p
CA3160T	99p	709PC dil	36p
Op amps		710HC to5	65p
LM301AH	67p	710PC dil	59p
LM301AN	30p	723CN	65p
LM308H	121p	741CH to5	66p
LM308N	97p	741CN 8dil	27p
LM318H	279p	747CN	70p
LM318N	224p	748CN	36p
		NE531T	120p
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5082	7663	yellow CC	
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5032-	7673	green CC	

0.3" Standard HP

5082-	7730	red CA	147p
5082-	7740	red CC	

0.5" Fairchild

FND500	red CC	150p
FND507	red CA	150p

Current news: Work continues apace on our HMOS PA kit, and by the time this is published - we expect to be about to launch the product in a style that matches the Mark III system. The unit uses separate transformers and power supplies, and includes a DC offset sensing circuit combined with slow switch-on using a relay. We introduce the HyperFi FM IF with this advert - and a separate leaflet is available on request with an SAE. All new pricelist revision also available with an SAE. The Mullard DC controlled tone/volume and switch ICs with a 'more than HiFi' specification are in stock at last - together with reams of data (over 50 pages now). Also, RC enthusiasts will be interested to learn that we are supplying parts for various kits now.

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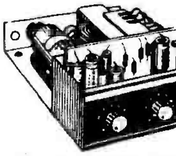

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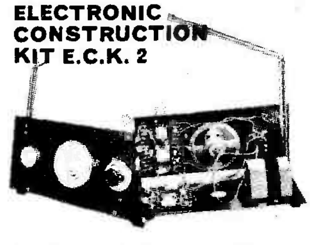

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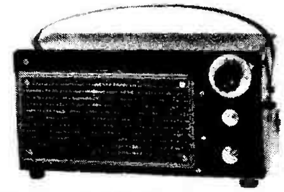

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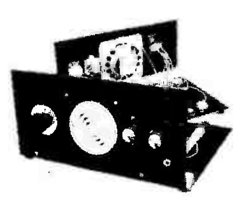

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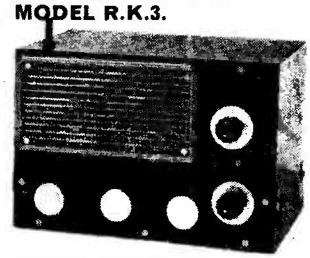

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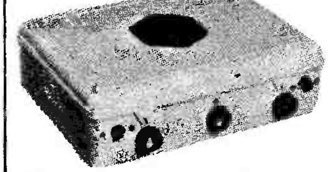

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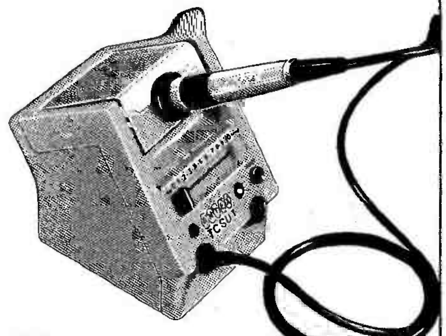
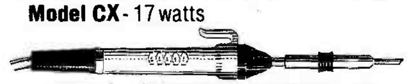
Model TCSU1 Micro Soldering Station



CTC 35watt—

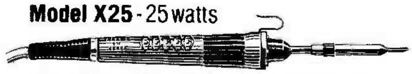
Accurate pin point temperature control between 65° and 400°C. Heating element and sensor built in tip of iron for fast response. Interchangeable slide-on bits from 4.7mm (3/16") down to 0.5mm. Zero voltage switching, no spikes. No magnetic field, no leakage. Supplied with miniature CTC (35-40watt) iron or XTC (50watt). TCSU1 soldering station with XTC or CTC iron **£38.88** including VAT (Nett to Industry). Postage extra.

Model CX - 17 watts



. . . a miniature iron with the element enclosed first in a ceramic shaft, then in a stainless steel. Virtually leak-free. Only 7½" long. Fitted with a 3/32" bit. **£4·37** inclusive of VAT and P.&P. Range of 5 other bits available from ¼" down to 3/64"

Model X25 - 25 watts



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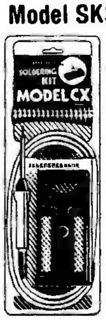
Model SK3 Kit

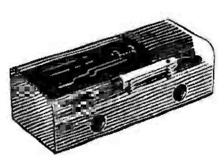


Contains both the model CX230 soldering iron and the stand ST3. Priced at **£6·21** inclusive of VAT and P.&P. It makes an excellent present for the radio amateur, modelmaker or hobbyist.

Model SK4 Kit

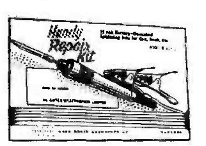
With the model X25/240 general purpose iron and the ST3 stand, this kit is a must for every toolkit in the home. Priced at **£6·21** inclusive of VAT and P.&P.

Model SK1 Kit



This kit contains a 15watt miniature soldering iron, complete with 2 spare bits, a coil of solder, a heat sink and a booklet, 'How to solder'. Priced at **£6.48** inclusive of VAT and P.&P.

Model MLX Kit



The soldering iron in this kit can be operated from any ordinary car battery. It is fitted with 15 feet flexible cable and battery clips. Packed in a strong plastic envelope it can be left in a car, a boat or a caravan ready for soldering in the field. Price **£4.83** inclusive of VAT and P.&P.

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(with accuracy of 2%)

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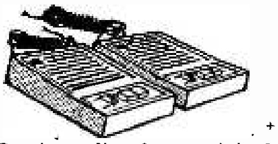

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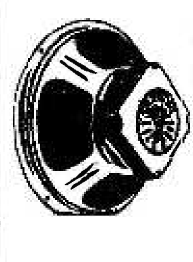

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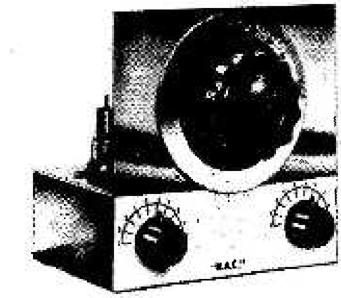

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16172 3 Micro switches **67p**
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16174 5 Metal jack sockets 3 x 3.5 mm 2 x standard switch types **67p**
16175 30 Paper condensers – mixed values **67p**
16176 20 Electrolytics trans types **67p**
16177 1 Pack assorted hardware – Nuts, bolts, grommets etc. **65p**
16178 5 Mains slide switches assorted **67p**
16179 20 Assorted tag strips and panels **65p**
16180 15 Assorted control knobs **67p**
16181 3 Rotary wave change switches **67p**
16182 2 Relays 6-24v operating **67p**
16183 1 Pak copper laminate approx 200 sq inches **65p**
16184 15 Assorted fuses 100 mA 5 amp **65p**
16185 50 Metres PVC sleeving assorted size and colours **65p**

METAL FOIL CAPACITOR PAK

16204 Containing 50 metal foil capacitor like Mullard C280 series. Mixed values ranging from 01uf – 2.2uf. Complete with Identification sheet. **£1.35**

SLIDER PAKS

16190 5 Slider potentiometers mixed values **67p**
16191 6 Slider potentiometers all 470 ohm **67p**
16192 6 Slider potentiometers all 10K ohm 1 in **67p**
16193 6 Slider potentiometers all 22K ohm 1 in **67p**
16194 6 Slider potentiometers all 47K ohm 1 in **67p**
16195 6 Slider potentiometers all 47K log **67p**

TRANSISTORS

Brand New – Fully Guaranteed

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
AC107	£0.23	AD140	£0.64	BC125	£0.19	BC251	£0.17	BF152	£0.28	2N706	£0.11
AC113	£0.21	AD142	£0.91	BC126	£0.25	BC251A	£0.18	BF153	£0.27	2N707	£0.52
AC115	£0.21	AD143	£0.81	BC132	£0.20	BC301	£0.30	BF154	£0.24	2N708	£0.15
AC117	£0.32	AD149	£0.64	BC134	£0.20	BC302	£0.31	BF155	£0.38	2N1302	£0.16
AC117K	£0.36	AD161	£0.37	BC135	£0.17	BC303	£0.30	BF156	£0.32	2N1303	£0.18
AC121	£0.21	AD162	£0.37	BC136	£0.20	BC304	£0.41	BF157	£0.32	2N1304	£0.19
AC122	£0.15	AD161/162	£0.75	BC137	£0.20	BC327	£0.18	BF158	£0.32	2N1305	£0.19
AC125	£0.19	ADT140	£0.59	BC139	£0.35	BC328	£0.17	BF159	£0.32	2N1306	£0.27
AC126	£0.19	AF114	£0.27	BC140	£0.32	BC337	£0.17	BF160	£0.34	2N1307	£0.27
AC127	£0.19	AF115	£0.27	BC141	£0.30	BC338	£0.17	BF162	£0.34	2N1308	£0.32
AC128	£0.17	AF116	£0.27	BC142	£0.24	BC440	£0.32	BF163	£0.34	2N1309	£0.32
AC128K	£0.28	AF117	£0.27	BC143	£0.24	BC441	£0.32	BF164	£0.54	2N1711	£0.22
AC132	£0.21	AF118	£0.43	BC145	£0.52	BC460	£0.41	BF165	£0.54	2N2219	£0.22
AC134	£0.21	AF124	£0.32	BC147	£0.08	BC461	£0.41	BF167	£0.27	2N2221	£0.22
AC137	£0.21	AF125	£0.32	BC148	£0.08	BC447	£0.22	BF173	£0.22	2N2222	£0.22
AC141	£0.23	AF126	£0.32	BC149	£0.08	BC478	£0.22	BF176	£0.41	2N2369	£0.15
AC141K	£0.32	AF127	£0.34	BC150	£0.23	BC479	£0.22	BF177	£0.28	2N2711	£0.24
AC142	£0.21	AF139	£0.37	BC151	£0.25	BC547	£0.11	BF178	£0.28	2N2712	£0.24
AC142K	£0.32	AF178	£0.64	BC152	£0.23	BC548	£0.11	BF179	£0.28	2N2714	£0.24
AC151	£0.21	AF179	£0.64	BC153	£0.28	BC549	£0.11	BD239A/		2N2904	£0.19
AC153	£0.23	AF180	£0.64	BC154	£0.21	BC550	£0.16	240A MP	£1.00	2N2905	£0.19
AC153K	£0.32	AF181	£0.62	BC157	£0.11	BC556	£0.16	BF180	£0.32	2N2906	£0.17
AC154	£0.21	AF186	£0.54	BC158	£0.11	BC557	£0.15	BF181	£0.32	2N2907	£0.22
AC155	£0.21	AF239	£0.41	BC159	£0.11	BC558	£0.14	BF182	£0.32	2N2923	£0.17
AC156	£0.21	AL102	£1.29	BC160	£0.28	BC559	£0.16	BF183	£0.32	2N2924	£0.17
AC157	£0.27	AL103	£1.27	BC161	£0.41	BCY30	£0.59	BF184	£0.22	2N2925	£0.17
AC165	£0.21	ASY26	£0.41	BC167	£0.14	BCY31	£0.59	BF185	£0.22	2N2926G	£0.10
AC166	£0.21	ASY27	£0.43	BC168	£0.14	BCY32	£0.65	BF186	£0.29	2N2926Y	£0.09
AC167	£0.21	ASY28	£0.41	BC169	£0.10	BCY33	£0.59	BF187	£0.28	2N2926O	£0.09
AC168	£0.27	ASY29	£0.41	BC169C	£0.11	BCY34	£0.65	BF188	£0.43	2N2926R	£0.09
AC169	£0.21	ASY50	£0.32	BC170	£0.10	BCY70	£0.16	BF194	£0.11	2N2962B	£0.09
AC171	£0.27	ASY51	£0.32	BC171	£0.10	BCY71	£0.16	BF195	£0.11	2N3053	£0.17
AC176	£0.19	ASY52	£0.32	BC172	£0.10	BCY72	£0.15	BF196	£0.11	2N3054	£0.43
AC176K	£0.28	ASY54	£0.32	BC173	£0.10	BCZ10	£0.65	BF197	£0.14	2N3055	£0.43
AC178	£0.27	ASY55	£0.32	BC174	£0.17	BCZ11	£0.66	BF198	£0.16	2N3402	£0.24
AC179	£0.27	ASY56	£0.32	BC175	£0.39	BCZ12	£0.65	BF199	£0.16	2N3403	£0.24
AC180	£0.21	ASY57	£0.32	BC177	£0.17	BD115	£0.54	MJE340	£0.49	2N3404	£0.33
AC180K	£0.30	ASY58	£0.32	BC178	£0.17	BD116	£0.86	MJE2955	£0.97	2N3405	£0.47
AC181	£0.21	ASY73	£0.32	BC179	£0.17	BD121	£0.70	MJE3055	£0.66	2N3702	£0.09
AC181K	£0.30	AU104	£1.51	BC180	£0.27	BD123	£0.70	TIP29A	£0.43	2N3703	£0.09
AC187	£0.19	AU110	£1.51	BC181	£0.28	BD124	£0.76	TIP29B	£0.45	2N3704	£0.08
AC187K	£0.30	AU113	£1.51	BC182	£0.10	BD131	£0.38	TIP29C	£0.48	2N3705	£0.08
AC188	£0.19	BC107	£0.09	BC182L	£0.10	BD132	£0.38	TIP30A	£0.43	2N3706	£0.09
AC188K	£0.30	BC107A	£0.09	BC183	£0.10	BD131/		TIP30B	£0.45	2N3707	£0.09
ACY17	£0.37	BC107B	£0.10	BC183L	£0.10	132MP	£0.86	TIP30C	£0.48	2N3708	£0.08
ACY18	£0.37	BC107C	£0.11	BC184	£0.10	BD133	£0.43	TIP31A	£0.43	2N3709	£0.08
ACY19	£0.37	BC108	£0.09	BC184L	£0.10	BD135	£0.41	TIP31B	£0.45	2N3710	£0.08
ACY20	£0.37	BC108A	£0.09	BC186	£0.24	BD136	£0.38	TIP31C	£0.48	2N3711	£0.08
ACY21	£0.37	BC108B	£0.10	BC187	£0.24	BD137	£0.38	TIP32A	£0.43	2N3772	£1.73
ACY22	£0.37	BC108C	£0.11	BC207	£0.12	BD138	£0.39	TIP32B	£0.45	2N3773	£2.38
ACY27	£0.37	BC109	£0.09	BC208	£0.12	BD139	£0.39	TIP32C	£0.48	2N3819	£0.19
ACY28	£0.37	BC109B	£0.10	BC209	£0.14	BD140	£0.39	TIP41A	£0.48	2N3820	£0.38
ACY29	£0.54	BC109C	£0.11	BC212	£0.10	BD139/		TIP41B	£0.50	2N3821	£0.65
ACY30	£0.37	BC113	£0.18	BC212L	£0.10	140MP	£0.86	TIP41C	£0.52	2N3823	£0.65
ACY31	£0.37	BC114	£0.18	BC213	£0.10	BF115	£0.24	TIP42A	£0.48	2N3903	£0.11
ACY34	£0.37	BC115	£0.21	BC213L	£0.10	BF117	£0.54	TIP42B	£0.50	2N3904	£0.11
ACY35	£0.37	BC116	£0.21	BC214	£0.10	BF118	£0.84	TIP42C	£0.52	2N3905	£0.11
ACY36	£0.54	AC116A	£0.21	BC214L	£0.10	BF119	£0.84	TIP2955	£0.66	2N3906	£0.11
ACY40	£0.37	BC117	£0.23	BC225	£0.29	BF121	£0.56	TIP3055	£0.54		
ACY41	£0.37	BC118	£0.16	BC226	£0.41	BF123	£0.68	TIS43	£0.24		
ACY44	£0.37	BC119	£0.27	BC227	£0.18	BF125	£0.56	TIS90	£0.20		
AD130	£0.75	BC120	£0.43	BC238	£0.18	BF127	£0.68	UT46	£0.22		

74 SERIES TTL IC'S

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
7400	£0.10	7422	£0.17	7448	£0.60	7489	£1.84	74136	£0.56	74176	£0.63
7401	£0.12	7423	£0.23	7450	£0.12	7490	£0.34	74141	£0.59	74177	£0.63
7402	£0.12	7425	£0.20	7451	£0.12	7491	£0.69	74145	£0.59	74180	£1.62
7403	£0.12	7426	£0.25	7453	£0.12	7492	£0.38	74150	£0.73	74181	£0.63
7404	£0.12	7427	£0.28	7454	£0.12	7493	£0.32	74151	£0.52	74182	£0.76
7405	£0.12	7428	£0.28	7460	£0.12	7494	£0.81	74153	£0.52	74184	£0.76
7405	£0.24	7430	£0.12	7470	£0.27	7495	£0.54	74154	£0.88	74190	£0.73
7407	£0.24	7432	£0.24	7472	£0.22	7496	£0.54	74155	£0.54	74191	£0.67
7408	£0.14	7433	£0.32	7473	£0.27	74100	£0.92	74156	£0.54	74192	£0.65
7409	£0.14	7437	£0.23	7474	£0.27	74104	£0.42	74157	£0.54	74193	£0.63
7410	£0.12	7438	£0.23	7475	£0.31	74106	£0.41	74160	£0.63	74194	£0.67
7411	£0.18	7440	£0.13	7476	£0.27	74107	£0.26	74161	£0.67	74195	£0.65
7412	£0.16	7441	£0.54	7480	£0.48	74110	£0.39	74162	£0.67	74196	£1.13
7413	£0.26	7442	£0.43	7481	£0.92	74111	£0.63	74163	£0.67	74197	£1.13
7414	£0.64	7443	£0.76	7482	£0.73	74118	£0.86	74164	£0.73	74198	£2.00
7416	£0.25	7444	£0.76	7483	£0.63	74119	£1.27	74165	£0.73	74199	£2.00
7417	£0.25	7445	£0.70	7484	£0.95	74121	£0.26	74166	£0.84		
7420	£0.12	7446	£0.65	7485	£0.73	74122	£0.42	74174	£0.70		
7421	£0.22	7447	£0.52	7486	£0.24	74123	£0.43	74175	£0.67		

CMOS IC'S

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
CD4000	£0.15	CD4012	£0.17	CD4022	£0.87	CD4031	£2.16	CD4046	£1.40	CD4071	£0.18
CD4001	£0.16	CD4013	£0.46	CD4023	£0.16	CD4035	£1.08	CD4047	£0.94	CD4072	£0.18
CD4002	£0.17	CD4015	£0.82	CD4024	£0.70	CD4037	£1.03	CD4049	£0.45	CD4081	£0.18
CD4006	£0.99	CD4016	£0.45	CD4025	£0.16	CD4040	£0.95	CD4050	£0.45	CD4082	£0.19
CD4007	£0.18	CD4017	£0.81	CD4026	£1.30	CD4041	£0.82	CD4054	£1.19	CD4510	£1.07
CD4008	£0.99	CD4018	£0.92	CD4027	£0.54	CD4042	£0.78	CD4055	£1.08	CD4511	£1.03
CD4009	£0.49	CD4019	£0.46	CD4028	£0.73	CD4043	£0.95	CD4056	£1.46	CD4516	£1.08
CD4010	£0.52	CD4020	£0.97	CD4029	£0.92	CD4044	£0.89	CD4069	£0.18	CD4518	£1.08
CD4011	£0.16	CD4021	£0.87	CD4030	£0.52	CD4045	£1.51	CD4070	£0.18	CD4520	£1.08

LINEAR IC'S

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
CA3011	£0.90	CA3089	£2.25	LM381	£1.63	NE565	£1.35	72723	£0.49	SL414A	£2.19
CA3014	£1.52	CA3090	£4.05	LM3900	£0.65	NE566	£1.69	UA741C	£0.27	TAA550B	£0.38
CA3018	£0.73	CA3123	£2.14	MC1303L	£0.96	NE567	£1.91	72741	£0.27	TAA621A	£2.25
CA3020	£1.91	CA3130	£1.00	MC1304	£2.14	UA702C	£0.52	741P	£0.22	TAA621B	£2.81
CA3028	£0.90	CA3140	£0.76	MC1310	£1.07	72702	£0.52	UA747C	£0.67	TAA661	£1.69
CA3035	£1.57	LM301	£0.33	MC1312	£2.14	UA703	£0.28	72747	£0.67	TAD100	£1.46
CA3036	£1.12	LM304	£1.73	MC1350	£1.35	UA709	£0.28	UA748	£0.39	TBA540	£2.36
CA3042	£1.69	LM308	£1.12	MC1352	£1.57	72709	£0.52	72748	£0.39	TBA810S	£0.84
CA3043	£2.08	LM309	£1.62	MC1469	£3.19	709P	£0.28	748P	£0.39	TBA810	£1.10
CA3046	£0.79	LM320-5V	£1.62	MC1496	£1.01	UA710C	£0.46	SN76013N	£1.97	TBA820	£0.79
CA3052	£1.80	LM320-12V	£1.62	NE536	£2.99	72710	£0.34	SN76023	£1.97	TBA9200	£2.81
CA3054	£1.24	LM320-15V	£1.62	NE550	£1.03	UA711C	£0.36	SN76110	£1.69	TCA270S	£2.25
CA3075	£1.69	LM320-24V	£1.62	NE555	£0.26	72711	£0.36	SN76115	£2.14		
CA3081	£1.69	LM380	£0.96	NE556	£0.65	UA723C	£0.49	SN76660	£0.84		

DIODES

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
AA110	£0.09	BA173	£0.16	BY127	£0.17	BYZ12	£0.48	OA70	£0.09	SD10	£0.06
AA120	£0.09	BB104	£0.16	BY128	£0.17	BYZ13	£0.43	OA79	£0.11	SD19	£0.06
AA129	£0.09	BAX13	£0.08	BY130	£0.18	BYZ16	£0.44	OA81	£0.11	IN34	£0.08
AAY30	£0.10	BAX16	£0.09	BY133	£0.23	BYZ17	£0.38	OA85	£0.11	IN34A	£0.08
AAZ13	£0.16	BY100	£0.23	BY164	£0.55	BYZ18	£0.38	OA90	£0.11	IN914	£0.06
BA100	£0.11	BY101	£0.23	BY176	£0.84	BYZ19	£0.38	OA91	£0.11	IN916	£0.06
BA102	£0.34	BY105	£0.23	BY206	£0.32	OA5	£0.64	OA95	£0.11	IN414B	£0.06
BA148	£0.16	BY114	£0.23	BYZ10	£0.48	OA10	£0.37	OA182	£0.14	IS44	£0.05
BA154	£0.13	BY124	£0.24	BYZ11	£0.48	OA47	£0.09	OA200	£0.09	IS920	£0.06
BA155	£0.15	BY126	£0.16					DA202	£0.09		

IC PAKS

Manufacturers 'Fall Outs' which include functional and part functional units. These are classed as 'out-of-spec' from the makers very rigid specifications, but are ideal for learning about I.C.'s and experimental work.

16224 100 Gates assorted 7400 01 04 10 50 60 etc **£1.30**
16226 30 MXI assorted types 7441 47 90 154 etc. **£1.30**
16227 30 Assorted Linear types 709 741 747 748 710 588 etc. **£1.68**
16228 8 Assorted types SLI403 76013 76003 etc. **£1.12**
16229 5 IC's 76110 Eqv. to MC13130P MA767 **£1.68**

JUMBO PAK SEMI CONDUCTOR

16222 Transistors Germ and Silicon Rectifiers Diodes Triacs – Thyristors IC's and Zeners. ALL NEW & CODED Approx 100 pieces. Offering the amateur a fantastic bargain pack and an enormous saving. **£2.43**

MAMMOTH I.C. PAK

16223 Approx 200 pieces assorted fall out Integrated circuits including Logic 74 series Linear Audio and DTL Mandy coded devices but some unmarked you to identify. **£1.35**

UNTESTED SEMI-CONDUCTOR PAKS

16130 100 Germ gold bonded OA47 diodes **65p**
16131 150 Germ point contact 100mA OA70 81 diode **65p**
16132 100 Silicon diodes 200mA OA200 **65p**
16133 150 Silicon fast switch diode 25mA IN41 18 **65p**
16134 50 Silicon rectifiers top hat 250mA **65p**
16135 20 Silicon rectifiers stud type 3 amp **65p**
16136 50 400 mW zeners D07 case **65p**
16137 30 NPN transistors BC107 8 plastic **67p**
16138 30 PNP transistors BC177 178 plastic **67p**
16139 25 NPN T039 2N697 2N1711 silicon **65p**
16140 25 PNP T039 2N2905 silicon **65p**
16141 30 NPN T018 2N706 silicon switching **65p**
16142 25 NPN BFY50 51 **65p**
16143 30 NPN plastic 2N3906 silicon **67p**
16144 30 PNP plastic 2N3905 silicon **67p**
16145 30 Germ OC71 PNP **65p**
16146 15 Plastic power 2N3055 NPN T0220 case **£1.30**
16147 10 T03 metal 2N3055 NPN **£1.30**
16149 10 1 amp SCR T039 **£1.30**
16150 8 x 3 amp SCR T066 case **£1.30**

G.P. SWITCHING TRANSISTORS

T018 sim to 2N706 8 BSY27 28 95A. ALL usable devices. No open and shorts. ALSO available in PNP similar to 2N2906 BCY70.
20 for **54p**, 50 for **£1.08**, 100 for **£1.94**, 500 for **£8.64**, 1000 for **£15.12**. When ordering please state NPN or PNP.

SILICON DIODES G.P.

300mW 40PIV (min) sum-min. FULLY TESTED. Ideal for Organ builders.
30 for **54p**, 100 for **£1.62**, 500 for **£5.40**, 1000 for **£9.72**.

SOCKETS

1611	8 Pin DIL	12p
1612	14 Pin DIL	13p
1613	16 Pin DIL	14p
1614	24 Pin DIL	27p
1615	28 Pin DIL	32p
1616	TO18 Transistor	13p
1617	TO3 Transistor	38p
16117	TO5 Transistor	13p

TANTALUM CAPACITORS

3137	1MFD	35V	£0.12
3138	22MFD	35V	£0.12
3139	47MFD	35V	£0.12
3140	1.0MFD	35V	£0.12
3141	2.2MFD	35V	£0.13
3142	4.4MFD	35V	£0.19
3157	3.3MFD	25V	£0.19
3143	10MFD	35V	£0.24
3144	22MFD	16V	£0.24
3156	33MFD	35V	£0.12

SEMICONDUCTORS POTS & IRONS

EXPERIMENTOR BREADBOARDS FROM CSC

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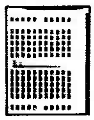
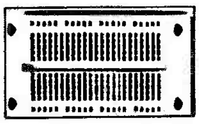
No soldering modular breadboards, simply plug components in and out of letter number identified nickel-silver contact holes. Start small and simply snap-lock boards together to build breadboard of any size.

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

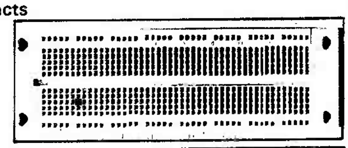
EXP.325. The ideal breadboard for 1 chip circuits. Accepts 8, 14, 16 and up to 22 pin IC's.
ONLY £1·60



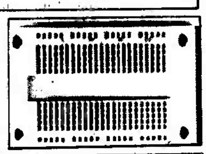
EXP.350. £3·50
270 contact points with two 20-point bus-bars.



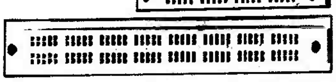
EXP.300.
550 contacts with two 40-point bus-bars.
£5·75



EXP.650 for Micro-processors. **£3·60**



EXP.4B.
More bus-bars.
£2·30



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

POTENTIOMETERS

CARBON POTS (Linear Track)
Single gang with wire end terminations, 6mm × 50mm plastic shaft 10mm bushes supplied with shake proof washer and nut. Tolerance 20% of resistance.

1831 1k ohms	1837 100k ohms
1832 2k2 ohms	1838 220k ohms
1833 4k7 ohms	1839 470k ohms
1834 10k ohms	1840 1 Meg
1835 22k ohms	1841 2M2
1836 47k ohms	**All at 29p each**

CARBON POTS (Log Track)

1842 4k7 ohms	1847 220k ohms
1843 10k ohms	1848 470k ohms
1844 22k ohms	1849 1 Meg
1845 47k ohms	1850 2M2
1846 100k ohms	**All at 29p each**

Designed to fit 2·54mm pitch board. All tracks are linear law.
VC7

1816 100 ohms	1824 47k ohms
1817 220 ohms	1825 100k ohms
1818 470 ohms	1826 220k ohms
1819 1k ohms	1827 470k ohms
1820 2k2 ohms	1828 1 Meg ohms
1821 4k7 ohms	1829 2M2 ohms
1822 10k ohms	1830 4M7 ohms
1823 22k ohms	**All at 10p each**

DUAL CARBON POTS (Log Law)

1860 4k7 ohms	1865 220k ohms
1861 10k ohms	1866 470k ohms
1862 22k ohms	1867 1 Meg
1863 47k ohms	1868 2M2
1864 100k ohms	**All at 97p each**

SINGLE GANG SWITCHED (Lin Law)
These potentiometers are fitted with double pole on-off switches. The switch is incorporated within the rotary action of the pot. Specification of pot is as VC1. Switch rating 1·5 amps at 250v AC.

1870 4k7 ohms	1875 220k ohms
1871 10k ohms	1876 470k ohms
1872 22k ohms	1877 1 Meg
1873 47k ohms	1878 2M2
1874 100k ohms	**All at 73p each**

DUAL GANG LOG-ANTI-LOG POT
1888 Track specification as dual gang pots VC3, but tracks mounted to log-anti-log action 100k ohms **£0·84**

SPECIAL VOLUME CONTROLS
A miniature 16mm type replacement volume control incorporating single pole on-off switch. Resistance value 5k ohms. Tolerance ± 20% 1/8 watt rating.
1889 **£0·30** VC8

MINIATURE ROTARY VOLUME CONTROL
5k ohms log law with on-off switch. 20mm grooved spindle. Tag connections 17mm dia. Supplied with fixing nut. Used mainly for replacement.
1890 **£0·61** VC9

WIRE WOUND POTS
A range of wire wound single gang pots with linear tracks of 1 watt rating, fitted with 10mm bush and supplied with shakeproof washer and nut.
VC6

1891 10 ohms	1896 470 ohms
1892 22 ohms	1897 1k ohms
1893 47 ohms	1898 2k2 ohms
1894 20 ohms	1899 4k7 ohms
1895 220 ohms	**All at 90p each**

SWITCHED POT (Log Track)
Specification as VC2 but track having (log) law.

1879 4k7 ohms	1884 220k ohms
1880 10k ohms	1885 470k ohms
1881 22k ohms	1886 1 Meg
1882 47k ohms	1887 2M2
1883 100k ohms	**All at 73p each**

PRE-SET POTS HORIZONTAL MOUNTING
Miniature type for transistor circuits. The wiper of the preset is provided with a slot for screw driver adjustment. The tags of the preset will fit printed wiring boards with a pitch of 2·54mm. All tracks are linear law.
VC7

1801 100 ohms	1809 47k ohms
1802 220 ohms	1810 100k ohms
1803 470 ohms	1811 220k ohms
1804 1k ohms	1812 470k ohms
1805 2k2 ohms	1813 1 M ohms
1806 4k7 ohms	1814 2M2 ohms
1807 10k ohms	1815 4M7 ohms
1808 22k ohms	**All at 10p each**

PRE-SET POTS VERTICAL MOUNTING
Miniature type for transistor circuits. Wiper adjustment is made by a screw driver slot.

SILICON RECTIFIERS

200mA	**£0·07**
IS920 50v	**£0·07**
IS921 100v	**£0·08**
IS922 150v	**£0·09**
IS923 200v	**£0·10**
IS924 300v	**£0·11**
1 Amp	
IN4001 50v	**£0·05**
IN4002 100v	**£0·06**
IN4003 200v	**£0·07**
IN4004 400v	**£0·08**
IN4005 600v	**£0·09**
IN4006 800v	**£0·10**
IN4007 1000v	**£0·11**
1·5 Amp	
IS015 50v	**£0·10**
IS020 100v	**£0·11**
IS021 200v	**£0·12**
IS023 400v	**£0·14**
IS025 600v	**£0·15**
IS027 800v	**£0·18**
IS029 1000v	**£0·22**
IS031 1200v	**£0·27**
3 Amp	
IN5400 50v	**£0·15**
IN5401 100v	**£0·16**
IN5402 200v	**£0·17**
IN5405 400v	**£0·18**
IN5406 600v	**£0·23**
IN5407 800v	**£0·27**
IN5408 1000v	**£0·32**
10 Amp	
IS10/50 50v	**£0·21**
IS10/100 100v	**£0·23**
IS10/200 200v	**£0·25**
IS10/400 400v	**£0·38**
IS10/600 600v	**£0·45**
IS10/800 800v	**£0·55**
IS10/1000 1000v	**£0·60**
IS10/1200 1200v	**£0·74**
30 Amp	
IS30/50 50v	**£0·60**
IS30/100 100v	**£0·74**
IS30/200 200v	**£1·00**
IS30/400 400v	**£1·35**
IS30/600 600v	**£1·90**
IS30/800 800v	**£2·09**
IS30/1000 1000V	**£2·49**
IS30/1200 1280v	**£3·11**
70 Amp	
IS70/50 50v	**£0·81**
IS70/100 100v	**£0·91**
IS70/200 200v	**£1·30**
IS70/400 400v	**£1·89**
IS70/600 600v	**£2·43**
IS70/800 800v	**£2·70**
IS70/1000 1000v	**£3·24**
BYX38/300 6A 300v	**£0·49**
BYX38/600 6A 600v	**£0·65**
BYX38/300 Rev 6A 300v	**£0·49**
BYX38/600 Rev 6A 600v	**£0·65**

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1943 15 watt high quality soldering iron totally enclosed element in a ceramic shaft fitted with 3/32" bit. **£4·10**
1947 Replacement element for 1943 iron. **£2·05**
1944 Iron coated bit 3/32" for 1943 iron. **£0·50**
1945 Iron coated bit 1/8" for 1943 iron. **£0·50**
1946 Iron coated bit 3/16" for 1943 iron. **£0·50**
1948 General purpose 18 watt iron fitted with iron coated bit. **£3·89**
1952 Replacement element for 1948 iron. **£2·05**
1949 Iron coated bit 3/32" for 1948 iron. **£0·50**
1950 Iron coated bit 1/8" for 1948 iron. **£0·50**
1951 Iron coated bit 3/16" for 1948 iron. **£0·50**
1931 Highly popular x25 25 watt quality soldering iron ceramic shafts to provide near perfect insulation break-down voltage of 1500 volts AC and a leakage current of only 3-5uA and another shaft of stainless steel to ensure strength. **£3·89**
1935 Replacement element for 1931 iron. **£1·73**
1932 Iron coated bit 1/8" for 1931 iron. **£0·54**
1933 Iron coated bit 2/16" for 1931 iron. **£0·54**
1934 Iron coated bit 3/32" for 1931 iron. **£0·54**
1953 SK1 soldering kit – This kit contains 15 watt soldering iron fitted with a 3/16" bit plus two spare bits, a reel of solder, heat-sink and a booklet 'How to solder'. In presentation display box. **£5·99**
1939 ST3 soldering iron stand. Stand made from high grade bakelite material, chromium plated strong steel spring, suitable for all models, includes accommodation for six spare bits and two sponges which serve to keep the soldering iron bits clean. **£1·62**

ZENER DIODES

400 mw (Bzy88) D007 Glass encapsulated range of voltages available. 1·3v, 2·2v, 2·7v, 3·3v, 3·9v, 4·3v, 4·7v, 5·1v, 5·6v, 6·2v, 6·8v, 7·5v, 8·2v, 9·1v, 10v, 11v, 12v, 13v, 15v, 16v, 18v, 20v, 22v, 24v, 27v, 30v, 33v, 39v.
No. Z4 9p ea.

1w-1·5w Plastic and metal encapsulated. Range of voltages available. 1·3v, 2·2v, 2·7v, 3·3v, 3·9v, 4·3v, 4·7v, 5·1v, 5·6v, 6·2v, 6·8v, 7·5v, 8·2v, 9·1v, 10v, 11v, 12v, 13v, 15v, 16v, 18v, 20v, 22v, 24v, 27v, 30v, 33v, 43v, 47v, 51v, 68v, 72v, 75v, 82v, 91v, 100v.
No. Z13 16p ea.

10w Metal stud type S010 case. Range of voltages available. 1·3v, 2·2v, 2·7v, 3·3v, 3·9v, 4·3v, 4·7v, 5·1v, 5·6v, 6·2v, 6·8v, 7·5v, 8·2v, 9·1v, 10v, 11v, 12v, 13v, 15v, 16v, 18v, 20v, 22v, 24v, 27v, 30v, 33v, 43v, 47v, 51v, 68v, 72v, 75v, 82v, 91v, 100v.
No. Z10 38p ea.

THYRISTORS

600ma — TO 18 Case

Volts	No.	Price
10	THY600/10	£0·16
20	THY600/20	£0·17
30	THY600/30	£0·22
50	THY600/50	£0·24
100	THY600/100	£0·27
200	THY600/200	£0·41
400	THY600/400	£0·48

1 amp — TO 5 Case

Volts	No.	Price
50	THY1A/50	£0·28
100	THY1A/100	£0·30
200	THY1A/200	£0·35
400	THY1A/400	£0·41
600	THY1A/600	£0·49
800	THY1A/800	£0·63

3 amp — TO 66 Case

Volts	No.	Price
50	THY3A/50	£0·30
100	THY3A/100	£0·32
200	THY3A/200	£0·36
400	THY3A/400	£0·45
600	THY3A/600	£0·54
800	THY3A/800	£0·70

5 amp — TO 66 Case

Volts	No.	Price
50	THY5A/50	£0·39
100	THY5A/100	£0·49
200	THY5A/200	£0·54
400	THY5A/400	£0·62
600	THY5A/600	£0·75
800	THY5A/800	£0·87

5 amp — TO 220 Case

Volts	No.	Price
400	THY5A/400P	£0·81
600	THY5A/600P	£0·75
800	THY5A/800P	£0·87

7 amp — TO 48 Case

Volts	No.	Price
50	THY7A/50	£0·52
100	THY7A/100	£0·55
200	THY7A/200	£0·62
400	THY7A/400	£0·67
600	THY7A/600	£0·84
800	THY7A/800	£0·99

10 amp — TO 48 Case

Volts	No.	Price
50	THY10A/50	£0·55
100	THY10A/100	£0·62
200	THY10A/200	£0·67
400	THY10A/400	£0·77
600	THY10A/600	£1·07
800	THY10A/800	£1·32

16 amp — TO 48 Case

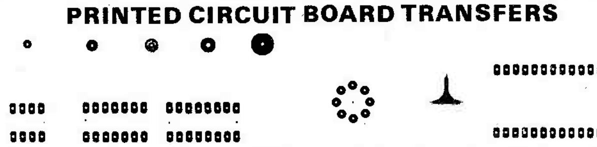
Volts	No.	Price
50	THY16A/50	£0·58
100	THY16A/100	£0·63
200	THY16A/200	£0·67
400	THY16A/400	£0·83
600	THY16A/600	£0·97
800	THY16A/800	£1·50

30 amp — TO 94 Case

Volts	No.	Price
50	THY30A/50	£1·27
100	THY30A/100	£1·54
200	THY30A/200	£1·76
400	THY30A/400	£1·93
600	THY30A/600	£3·78

No.	Price
BT101/500R	£0·86
BT102/500R	£0·86
BT106	£1·35
BT107	£1·00
BT108	£1·06
2N3228	£0·76
2N3535	£0·83
BTX30/50L	£0·36
BTX30/400L	£0·50
C106/4	£0·65

PRINTED CIRCUIT BOARD TRANSFERS



Draw your own boards with the new Bi-Pak etch-resist transfers. Lay the symbols on the board, rub over with a soft pencil. The transfer will adhere to the board. Then complete the circuit with your Bi-Pak etch-resist pen. Each pack contains 11 sheets of transfers, 1 of each as shown below. Illustrations approx ½ size.

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1614	24 pin DIL	£0·27
1615	28 pin DIL	£0·32
1616	TO18 Transistor	£0·13
1617	Tu3 Transistor	£0·38
16117	TO5 Transistor	£0·13

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REGULATORS

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u.a. 7805 TO220	£0·76
u.a. 7812 TO220	£0·76
u.a. 7815 TO220	£0·76
u.a. 7824 TO220	£0·76
u.a. 7818 TO220	£0·76

Negative

u.a. 7905 TO220	£0·86
u.a. 7912 TO220	£0·86
u.a. 7915 TO220	£0·86
u.a. 7924 TO220	£0·86
u.a. 7818 TO220	£0·86
u.a. 723C TO99	£0·49
72723 14 pin DN	£0·49
LM309K TO3	£1·62

BRIDGE RECTIFIERS

SILICON 1 amp

Type	No.	Price
50V RMS	BR1/50	£0·22
100V RMS	BR1/100	£0·24
200V RMS	BR1/200	£0·27
400V RMS	BR1/400	£0·39

SILICON 2 amp

Type	No.	Price
50V RMS	BR2/50	£0·49
100V RMS	BR2/100	£0·52
200V RMS	BR2/200	£0·56
400V RMS	BR2/400	£0·55
1000V RMS	BR2/1000	£0·73

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Communications

OUR theme this month, communications, is a word with differing implications for different people. To a civil engineer, it means roads, railways, airports and docks. To a sociologist, it has to do with contact between individuals. In the field of radio and electronics, it means various ways of establishing that contact at a distance, traditionally by radio or wire, but also, more recently, by infra-red or by fibre-optic cable.

Whether "communications" can really be extended to cover contact between man and machine is arguable; perhaps it's a matter of scale. Where the machine in question is a computer operating in an interactive mode, such as that providing the Post Office Prestel service, it's difficult to call it anything else, though really, I suppose, the user is effectively communicating with the programmers who put the information into the computer originally. This month we have exercised literary licence to extend the use of the term to include "remote control" via ultrasonic links. It is, after all, simply a way of communicating your commands to a TV set, a garage door, or whatever.

Yet another variety of communication of great importance to us is that taking place between our contributors and editorial staff on the one hand, and the readers on the other, via the medium of the magazine. This is, of course, principally a one-way channel, though the feed-back which we get from you is very interesting to us, whether it's complimentary or otherwise!

We have recently been getting quite a few letters and telephone calls from readers having difficulty in getting their copies of *Practical Wireless* each month. First, let me say that we realise only too well the frustrations caused by the magazine being late on sale these past months. As I said a few issues back, I had hoped that we would have been appearing on the scheduled dates long before now, but no sooner do we get over one problem than another crops up. You may rest assured that we are not just sitting back, doing nothing about it—we are trying hard to get things to rights, and hope that the situation will soon improve.

To get back to the difficulty in finding a copy of *PW*, it does appear that there may be some problems in our distribution system, but it is impossible for us to investigate these without some detailed information, covering at least the following points:

1. Name and address of your newsagent or bookstall.
2. Do you have a regular order, or were you wanting to make a casual purchase?
3. When and where did you finally manage to purchase a copy of that particular issue?
4. Do you know of any other newsagents, etc., in the area, who get their copies of *Practical Wireless* earlier than your usual supplier?
5. Has your newsagent had difficulty in getting you a copy of *PW*, even if you place a firm order in advance?

If you are having these problems, I would be very grateful if you could spare the time to write and let us know, with any additional information which you feel might be useful. Please, won't you help us to help you?

PW PERSONALITY

Eric Dowdeswell—"On the Air" Contributor

Of "1918 vintage", Eric was introduced to the mysteries of radio at an early age by his father, and had become a licensed radio amateur by 1939. This, plus his work on mechanical TV projection systems, led him into war service in army wireless workshops around the Middle East, ending up in Istanbul.

There, he met and married a Greek girl, Christine, bringing her home when demob came in 1946. After a spell with Nagard, working on wideband amplifiers and oscilloscopes, Eric decided to become a Flight Radio Officer, and spent 14 years with Sudan Airways in Khartoum. As ST2AR, he notched up over 200 certificates of achievement in working 273 countries on c.w. or s.s.b.

Returning to the UK in 1967, Eric became General Manager of the RSGB for a while, then joined the staff of *Practical Wireless*, remaining until the magazine moved to Poole in 1977, when domestic reasons forced him to stay in London.

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

Diary Date

The British Amateur Radio Teleprinter Group is holding its Annual Convention at the Harpenden Public Hall, Harpenden, Herts, on Saturday 21 July 1979, between 11.00 and 17.00hrs.

There will be trade stalls, bring and buy picture tape factory, demonstrations and lectures, including one by G3PLX, which is expected to attract particular attention.

The venue has been specially chosen for its ease of access from the motorway network and by rail, as well as for its car parking and refreshment facilities. Everyone, members and non-members of BARTG, is welcome.

Further details from: *J. P. G. Jones GW3IGG, Heywood, 40 Lower Quay Road, Hook, Haverfordwest, Dyfed SA62 4LR. Tel: Johnston (Dyfed) 890759.*

BAEC exhibition

The British Amateur Electronics Club will be holding their 14th Amateur Electronics Exhibition, in the Shelter at the centre of the Esplanade, Penarth, S. Glamorgan, between 21 and 28 July 1979. The exhibition will be open from 7.00pm each evening, except Sunday 22 July, and will also open during the afternoon on 21, 22 and 28 July.

The club will be displaying a large number of projects and electronic games built by members. All proceeds from the exhibition will be given to the Cancer Research Campaign.

Will members and prospective new members please note, the Hon Sec, John Margetts has moved from Bristol to Cheltenham. To contact, write to: *J. G. Margetts, Hon Sec, BAEC, 3 Bishopstone Close, Golden Valley, Cheltenham, Gloucester.*

RETRA is moving

RETRA, the Radio and Electrical and Television Retailers' Association moved to new offices in April.

From 23 April the Association's new address and telephone number will be: *RETRA House, 57-61 Newington Causeway, London SE1 6BZ. Tel: 01-403 1463.*

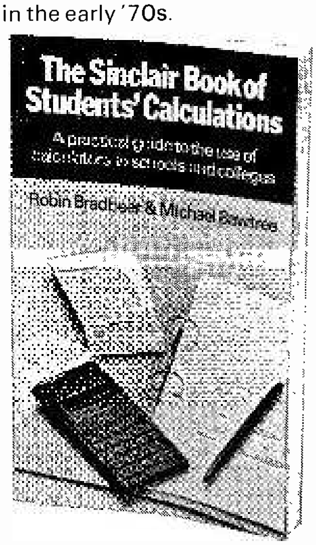
Using your calculator

"Realisation of the educational potential of the electronic calculator has been surprisingly and disappointingly slow" according to the authors of a new paperback book published by Martin Books of Cambridge.

To help stimulate greater interest, electronics lecturer Robin Bradbeer, and maths teacher Michael Bawtree, have written *"The Sinclair Book of Students' Calculations"* for secondary education students and teachers to fully explain the application of calculators across a range of subjects.

The book's introduction gives valuable advice on how to choose between the many types of portable electronic calculator now available. This is followed by four chapters carefully graded in level from basic arithmetic and geometry to advanced problems in statistics, mechanics and higher mathematics. In each chapter the most effective use of the calculator is explained through informative examples.

The final chapter is an introduction to the exciting possibilities of the new generation of programmable calculators, based on the facilities of the new Enterprise programmable calculator from Sinclair, the British company which pioneered calculator miniaturisation in the early '70s.



The Sinclair Book of Students' Calculations is available from most branches of W. H. Smith, Boots, Foyles and leading bookshops throughout the UK, price £1·25, or direct from the publishers: *Martin Books, 8 Market Passage, Cambridge CB2 3PF, at £1·55 inclusive of postage and packing.*

Can you help?

The "Handicapped Aid Programme UK" is an organisation set up to help housebound handicapped people to enjoy the exciting hobby of Short-Wave listening.

The HAPUK would like to hear from anyone who could help, or perhaps has an old or redundant s.w. receiver (working or not) that they may like to give to the organisation, other spares are needed, such as, valves, headphones, variable capacitors, in fact any useful components.

I have two contacts with HAPUK, first the Chairman: *John Rose, 5 Hall Street, Wombwell, Barnsley S73 0JL,* and the North Wales Area Representative: *Les Crowther, 8 Plas Gwyn, Maes-y-Dre, Wrexham, Clwyd LL12 7DW. Tel: (0978) 262668.* Please help if you possibly can.

Sorry!

My apologies to Mr D. J. Pattle, whose address was printed incorrectly in Production Lines on page 51 of the April issue. The correct address is: *D. J. Pattle, Juniper, Hillbury Road, Alderholt, Fordingbridge, Hants. SP6 3BQ. Tel: Fordingbridge 52081.*

RAE courses

North Trafford College of Further Education, is offering another Radio Amateur's course this year, starting in September 1979.

Course ERA1 deals with RAE theory and will be held on Thursday evenings between 18.30 and 21.00hrs. Course ERA2 deals with the Morse code and will be held on Monday evenings between 18.30 and 21.00hrs and the lecturer will be J. T. Beaumont TEng., MITE, MASEE, G3NGD. Enrolment will be on 10, 11, and 12 September 1979, between 18.00 and 20.00hrs.

Further details from: *Course Co-ordinator, North Trafford College of Further Education, Talbot Road, Stretford, Manchester M32 0XH. Tel: 061-872 3731.*

Walsall Education Department is also offering an RAE evening course at: *The Broadway, North Centre, Queen Mary's Grammar School, Sutton Road, Walsall.*

For further details contact: *The Civic Centre. Tel: Walsall (0922) 21244 ext. 2319.*

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

Girls, Girls, Girls again

Following the introduction last year of the highly successful competition to find The Girl Technician Engineer of the Year, The Caroline Haslett Memorial Trust and The Institution of Electrical and Electronics Technician Engineers have decided to repeat the Award in 1979. This electrical and electronic engineering Award carries with it a prize of £250 and the closing date for nominations is 19 September 1979; the announcement of the winner will be made in November.

The engineering industry needs to attract more young people of the highest calibre and the aim to the Award is to focus attention on electrical and electronic engineering as a worthwhile career for women. By selecting the most outstanding girl Technician Engineer—who will have successfully undertaken the necessary technical education and training, and have proved herself capable of holding a responsible job—it is the Award sponsors' express hope that she will, by her example, encourage more girls to enter the electrical and electronic engineering profession.

For further details and copies of the Award nomination form please apply to: *Mrs Eileen Sheldon, IEETE, 2 Savoy Hill, London WC2R 0BS. Tel: 01-836 3357.*

RAE Reprint

A reprint of the complete series—So You Want to Pass the RAE?—including details of the new examination format being introduced this year, is now available.

Order your copy by completing and returning the coupon on page 62.

Free Brochures

The new, Erg six-page, four-colour d.i.l. switch brochure is now available.

It contains full technical specifications on all Erg d.i.l. switches and includes switching configuration diagrams for all types, plus prices.

Copies may be obtained from: *Erg Industrial Corporation Ltd., Luton Road, Dunstable, Beds LU5 4LJ. Tel: (0582) 622141.*

Winslow Component Systems Ltd. have recently produced a comprehensive brochure, describing all their accessories for use with the TO220 power semiconductor package.

Full details of over 30 products are given, including, dimensioned drawings, specifications and photographs. The products feature full fixing kits, insulating kits, heatsinks and sockets, in fact, almost every accessory the TO220 user is likely to need. Available from: *Winslow Component Systems Ltd., Southon House, Edenbridge, Kent. Tel: (0732) 864488.*

Trio Technology

The new Trio TS 180S makes its debut—and what a beauty it is too. Covering the h.f. bands 160—10m this transceiver uses digital frequency control, designed around a dual-circuit phase-locked loop, comprising a 4-bit microcomputer and four memories, usable in transmit or receive modes.

Arrangements allow any of the memory frequencies to be tuned in 20Hz increments up or down, either step-by-step or by scanning, the original stored frequency being retained for instant recall. Its like having four v.f.o.s in addition to the "conventional" analogue v.f.o. with digital read-out. The memories permit split-frequency operation and three of the four provided can be retained by the use of battery back-up.

An inovative single-conversion p.l.l. system improves the spurious characteristics during transmission and reception, making i.f. shift and mono-dial indication possible in any mode.

The dual i.f. filter, when inserted improves receiver S/N ratio and selectivity significantly increasing speech processor efficiency in the transmit (s.s.b.) mode.

Another interesting feature is the tunable noise-blanker. This detects signals mixed with 455kHz and the NB TUNE control selects the noise frequency.

The transmitter p.a. is, as you would expect, fully broadbanded and produces 200 watts p.e.p. output—160 watts c.w.—with a fractional reduction at 28MHz from the 13·8 volt supply.

We will be reviewing this transceiver in *PW* very shortly, so "watch this space".

For further information contact the importers, *Lowe Electronics, 119 Cavendish Road, Matlock, Derbyshire. Tel. (0629) 2430/2817.*

Special events

Yeovil Amateur Radio Club G3CMH, have arranged two special event stations to attend the following functions.

First, International Air Days, RNAS Yeovilton on Friday, 3 August and Saturday, 4 August 1979. Callsign GB3FAA applied for.

Second, Mid-Somerset Show at Shepton Mallet, on Saturday, 18 August and Sunday, 19 August 1979. Callsign GB2MSS applied for.

The club meets at 7.30pm every Thursday at Building 101, Houndstone Camp, Yeovil. For further information write to: *J. W. Howard G4EVI, 127 Goldcroft, Yeovil, Somerset BA21 4DD.*

Club News

Wisbech Radio Club would like to extend a welcome to anyone in the Wisbech Cambridgeshire area, whose interests include amateur radio. The club meets fortnightly at 19.30hrs and the next meetings will be on Monday 9 and 23 July 1979.

Those interested may contact the Secretary, *D. Dunn G8RZN,* most evenings at the club's meeting place: *Five Bells, Parson Drove, Wisbech, Cambs.*

satellite communications into the eighties

Earth Station Expansion and Development

The idea of using satellites for communications had its origins in an article by Arthur C. Clarke who, in 1945, foresaw the potential of satellites in providing worldwide television and speech communications. Since the very beginning, the British telecommunications industry and the British Post Office have been in the forefront of translating that idea into reality.

Today, a large proportion of the intercontinental telecommunications system involves the use of satellites positioned in geosynchronous orbit 36,000km above the Equator; in fact, a continental number dialled from the UK has about a 70% chance of being routed to its destination via satellite. It will be multiplexed with a very large number of similar calls and transmitted to the satellite on a microwave beam in the 6GHz band, the earthward path being in the 4GHz band. Submarine cables also support the system, of course, but cannot really offer the same traffic-handling capabilities, especially in respect of wide-band signals such as colour television, for instance.

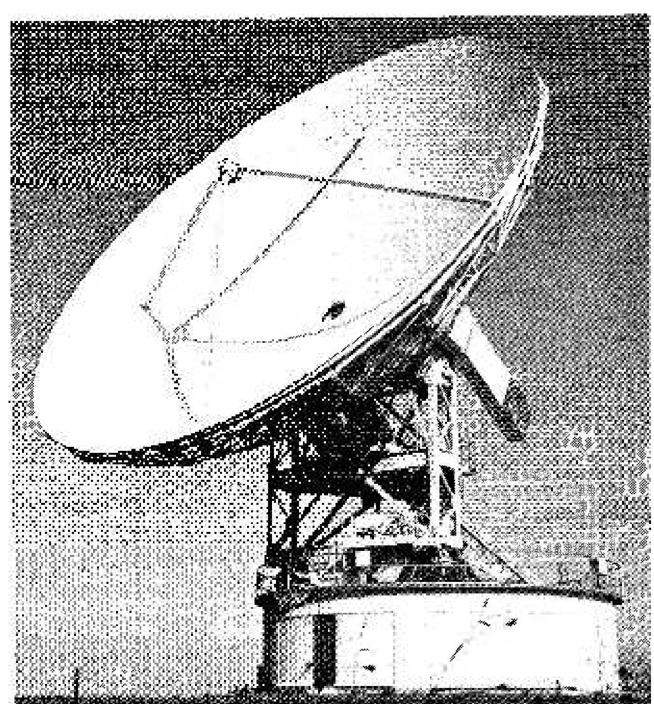
Goonhilly

The British Post Office earth station at Goonhilly in Cornwall is well-known and has provided satellite links over the Atlantic and Indian Oceans for well over ten years. There are now four aerials at Goonhilly—Goonhilly 1, 2 and 3 operate to satellites poised over the Atlantic, where communications traffic between Europe and North America is far heavier than between other regions of the globe. Goonhilly 4 is currently being used for test transmissions to Europe's Orbital Test Satellite, OTS 2—forerunner to the European Communications Satellite, ECS. OTS 2 was launched on 11th May 1978 to prove the technology for digital satellite communications in the 11 and 14GHz frequency bands.

The aerials at Goonhilly are impressive structures indeed, reflector diameters in the case of Goonhilly 1, 2 and 3 being 25–30 metres or around 100ft. However, as the rapacious demands for international telecommunications facilities have been increasing so rapidly during recent years, a need for yet more aerials and associated ground terminal equipment has arisen. Also, as it seems that much of Europe's future telecomms. traffic is to be carried by the ECS, naturally the launch of this satellite will further increase this pressure. With this future expansion in mind, there are sites allocated for another four aerials at Goonhilly. With ECS on the way, and the mighty Intelsat V series of satellites due for launch this year they, together with the new Madley earth station, will certainly be needed.

Goonhilly 4 and its associated equipment were formally handed over to the Post Office on September 5th, 1978. The prime contractor, Marconi Communication Systems Ltd., also equipped and commissioned Goonhilly 2 and 3 and remain the only British company to have supplied complete earth stations.

The new aerial differs markedly from its older neighbours, principally in that it is smaller at 19 metres. Don't let that fool you into thinking that it is in any way inferior though; its propagation capabilities are just as formidable, but at far higher frequencies, receiving at 11GHz and transmitting at 14GHz. Dealing with such frequencies calls for mechanical accuracy of a very high



Goonhilly 4 (11/14GHz) is currently proving digital satcom. technology with the OTS2 satellite

order, as one might expect. The tolerance of the main reflector surface, for example, is 0·024 inches in a diameter of 62 feet! The aerial is cassegrain in type, the r.f. energy collected by the main reflector being focused not directly onto the "feedhorn" as in the conventional parabolic "dish", but onto a sub-reflector (a *pseudo-hyperboloid* for the geometrically-minded among you) which is supported from the main backing structure by a *tetrapod* (i.e. four legs). The signal is then reflected back along the aerial's axis, through a hole in the main reflector and thence to the waveguide system and down into the terminal equipment in the building below. The transmit signals follow the same route but in the reverse direction, naturally.

Like Goonhilly 3, the aerial is steered by a method known as the "monopulse tracking system". In fairly simple terms, guidance is achieved by sensing abnormal and undesired electromagnetic wave modes in the aerial-feed, which are extracted, analysed and then used to control the aerial's driving motors until a position is achieved at which the unwanted parameters are at a minimum—the aerial should then be pointed directly at the satellite. In the event of a failure of this system, or should the aerial be required to point at another satellite, manual or computer control of the aerial heading is also provided.

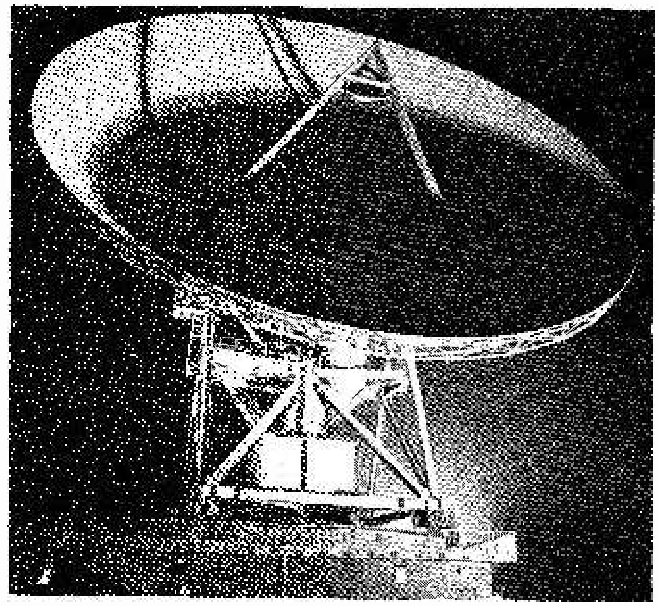
Madley

By 1970, it was clear that a second major earth station complex would be required in Britain. The growth of international communications of all types was, of course, a major factor in deciding to develop a second site—but just as important, perhaps, was the desire to avoid having all the eggs in one basket, particularly when they cost around £6m each! The requirement was for an electrically quiet area, free from radio interference and where the ground was capable of supporting aerials, buildings and ancillary plant (a single air-conditioning chiller compressor unit at Madley weighs around 40 tons, for example).

Eventually, it was a site at Madley, near the city of Hereford, that was selected as most closely matching the overall needs. Madley 1, which became operational at the end of 1978, now operates eastwards into the Indian Ocean Intelsat IVA satellite. This route was previously served by Goonhilly 1, which had been experiencing interference problems from French internal microwave systems and which, having been freed from this task by Madley 1, now assists with the busy Atlantic route. Calls to Africa, Australasia, the Middle East and the Indian sub-continent can all be routed via Madley.

The statistics of Madley 1 are impressive by any standards. The aerial itself, a 32 metre cassegrain type working in the 4/6GHz band, is somewhat larger than those at Goonhilly; but it is the sheer quantity of equipment that makes Madley 1 one of the largest earth stations in the Intelsat system. There are 14 chains of transmitting equipment producing up to seven microwave carrier signals with a standby facility on each, 10 air-cooled klystron power amplifiers with provision for another three to be installed later if required and, in all, 55 chains of receiving equipment—Madley 1 thus has the capability of simultaneous communication with around 40 countries.

The transmitters employed at Madley are of a new design using a 3kW klystron output stage. As the klystron is an essentially narrow-band device only one carrier can be handled by each one. Therefore, at Madley, the transmitter outputs are merged in a combining and selection matrix before being fed on up to the aerial. The use of single carrier klystron amplifiers (also used in Goonhilly 4's 14GHz transmitters, rated at 2kW) is a significant departure from the technology used in Goonhilly 1, 2 and 3 which use a single 10kW travelling-wave tube (t.w.t.) output stage. Being a wide-band device, several carriers previously combined at low power, can be amplified simultaneously.



Madley 1 (4/6GHz) handles traffic via the Indian Ocean satellite

Another important new feature of Madley 1, is the recently-developed "beam waveguide" aerial feed system, also used in Goonhilly 4. This is an arrangement of reflecting surfaces, somewhat in the form of a periscope, which interconnect the main reflector aperture and the equipment at ground level. Three concave surfaces and one plane surface are used; the idea is for polarisation errors occurring at one reflector surface to be cancelled out by errors of opposite characteristics at another. Signal losses are thus kept to a minimum and it becomes possible to locate all the radio equipment at ground level. The aerial itself can be lighter and less bulky while maintenance is, of course, much easier.

Aerial steering is by two systems, the previously described "monopulse" system and also by the "step-track" system. With the 'step-track' system, the 290 ton aerial makes small predetermined movements while the signal power received from the satellite is monitored. The aerial will continue to "step" in elevation and azimuth until the received signal is at a maximum. As it was uncertain whether the "step-track" method would be effective for small angles of elevation (6° in the case of Madley 1 working into the Indian Ocean satellite), it was decided to incorporate both systems into the new station.

The Future

The prospect, then, is one of continuing and rapid expansion. The Intelsat V series of satellites, to be launched this year, will double the system channel capacity to the equivalent of 12,000; the ECS will give Europe its own satellite system; a new global maritime satellite communications system is also on the way. The Space Shuttle will, in due course, make the launching and *servicing* of communication satellites that much easier and cheaper. Small wonder that Madley 2 is under way and due for completion this year, to be closely followed by Madley 3 at the end of 1980.

With satellite communications, the sky is apparently the only limit! ●

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AERIAL DESIGN using scale models

Fred JUDD G2BCX

Much of the initial development work on the "Slim Jim" and ZL series of 2 metre aerials recently described in *PW* (May 1977, April 1978, November 1978) was carried out with the aid of a u.h.f. scale-model aerial performance testing system. This was dealt with in *PW* in January 1978, but has since been much modified with the addition of a visual polar pattern display derived from a surplus 10in radar PPI unit as shown in Fig. 1. Because the above issue of *PW* is now out of print I will again, but briefly, deal with the method of employing ultra high frequency scale models as an aid to the design of aerials as well as performance measurement.

Similar aerials behave in exactly the same way, i.e., they will have the same gain and radiation pattern etc. whether operating at h.f. or u.h.f., so it is possible, for example, to scale down a typical beam aerial intended for operation at, say 28MHz to a small but easily handled model operated at around 500 to 700MHz. At frequencies much higher than this, matching the aerial to a feed cable and the transmitter becomes difficult.

Accurate matching is very important if gain is to be measured but is of little consequence if only radiation patterns are to be demonstrated. A mismatch between feed cable and aerial will not normally affect the radiation pattern, although wrong phasing between coupled radiating elements, such as in colinear arrays, will cause severe pattern distortion.

Transmitter

The first requirement is a "transmitter" which may in fact be a simple self-excited oscillator capable of delivering a few watts of power. Frequency stability is not greatly important as the model aerial to be tested is operated in "receive" mode, and the receiver itself need only be a tuned circuit with a diode rectifier, so as to obtain a rectified (d.c.) signal from the aerial. The distance between the transmitting aerial and the aerial being tested should not be less than about 10 wavelengths at the frequency used, e.g. at 600 MHz this would be about 5 metres (50cm per wavelength).

A circuit of a typical quarter-wavelength line oscillator suitable for a transmitter is shown in Fig. 2. The valve (V) may be any u.h.f. triode with appropriate power rating (on average the r.f. power output will be about 30 to 40 per cent of the d.c. power input). Tone modulation can be obtained by feeding an audio signal of a few volts to the grid via the 100kΩ resistor as shown, although this is only necessary if the model aerial system is to be used for demonstration so that signal variation can be made audible. The transmitting aerial may be a dipole but it is better with a plane reflector as shown in Fig. 3, which will increase the radiated power and confine it to one direction.

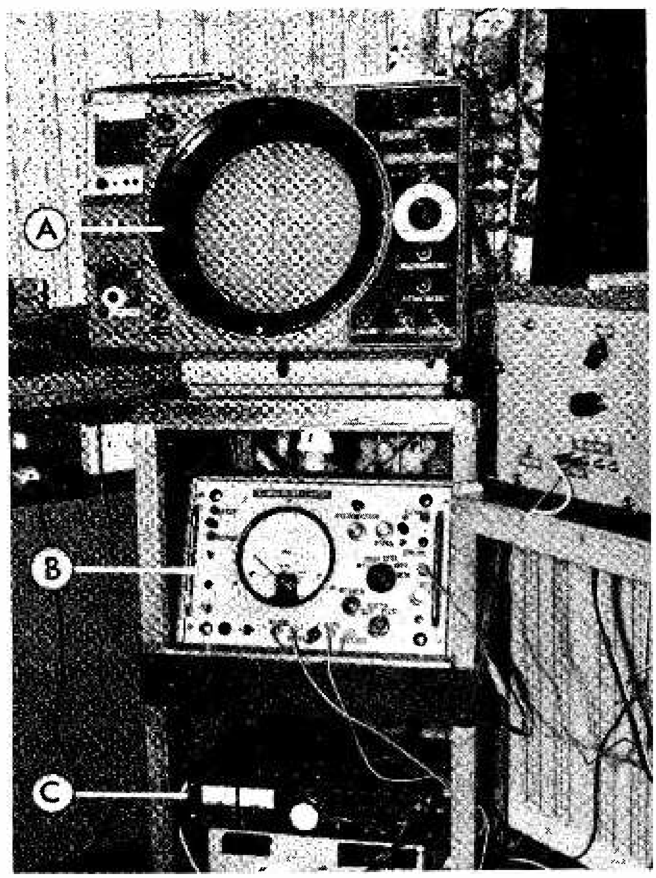


Fig. 1: The author's aerial test console, showing: (A) The PPI (polar pattern indicator) display (B) The linear reading decibel meter (C) Magnetic tape recorder. See text

Polar Pattern Indicator

It so happens that "PPI" stands equally for polar pattern indicator or for its original designation in radar, namely, plan position indicator. The display shown at (A) in the photograph Fig. 1 is in fact a converted marine radar unit. Rebuilt might be a better word, as all the original electronics was stripped out and replaced by solid-state circuitry to provide the special facilities required, as illustrated in the block diagram Fig. 4. The display c.r.t. is 10 inches in diameter and the tube is a long-persistence

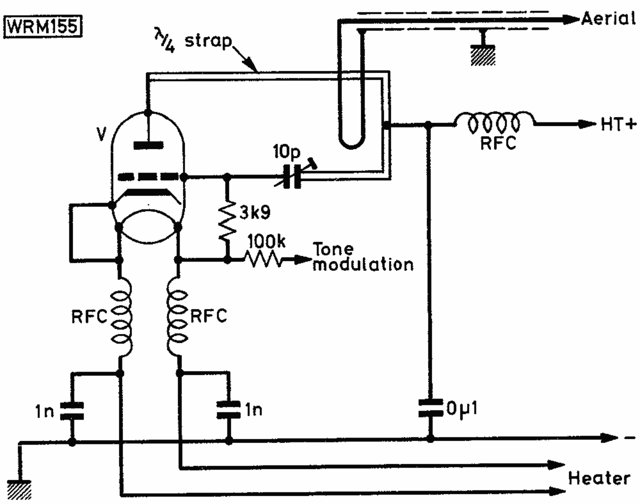


Fig. 2: Suggested circuit for a simple v.h.f. oscillator for use as a transmitter. See text

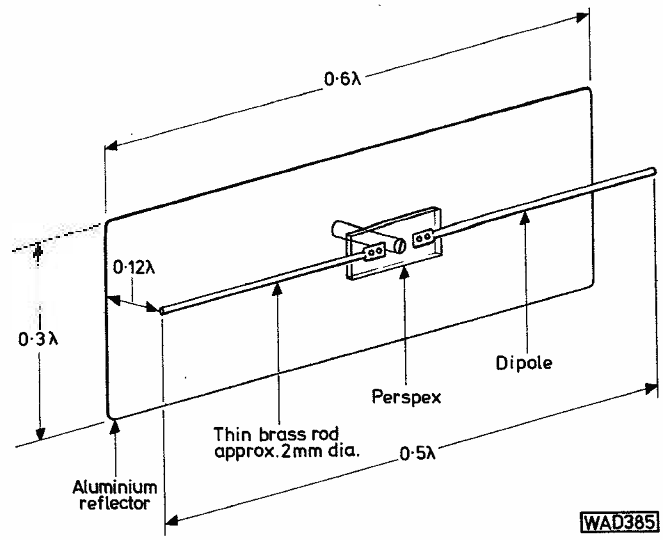


Fig. 3: Aerial for the transmitter, consisting of a dipole with a plane reflector

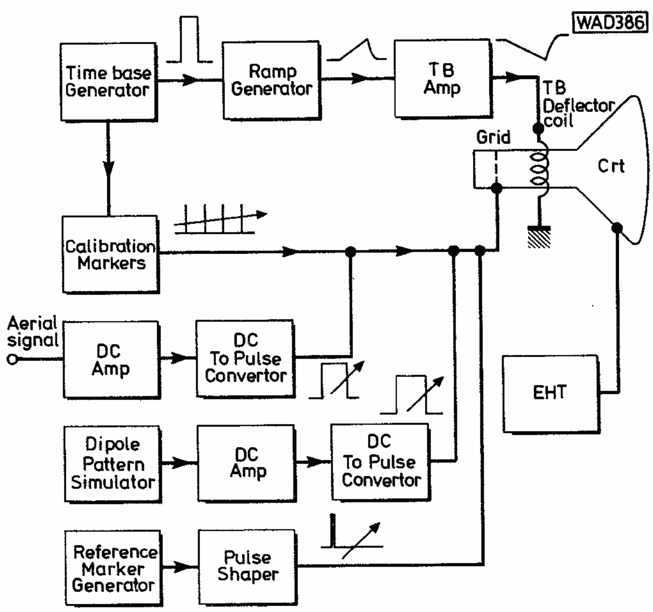
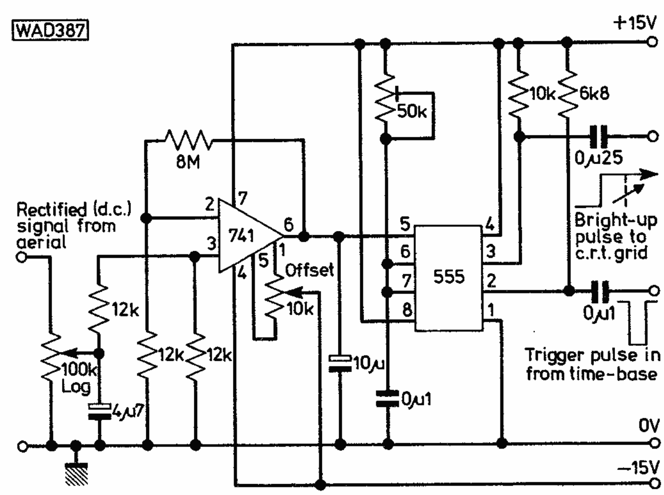


Fig. 4: Block diagram of the polar pattern indicator

Fig. 5: Circuit for converting varying d.c. (rectified r.f.)



type. The timebase deflector coils are motor-driven at one rotation per 3 seconds and the timebase repetition rate is 360Hz, so that in one complete rotation the timebase makes 1080 sweeps.

The signal from the aerial is d.c. (rectified r.f.) and this varies according to the radiation pattern. However, this d.c. signal is converted by the circuit shown in Fig. 5 to a variable-width square pulse which is used to brighten the trace. The amplitude of signal from the aerial is therefore displayed as a bright line every third of a degree. Since the model antenna rotating system is synchronised to the PPI display, the radiation pattern is continuously displayed as a stationary picture. Aerial signal amplitude is also measured by a direct-reading decibel meter (B), seen beneath the display, and this unit also incorporates special circuitry for converting the varying d.c. aerial signal to a correspondingly varying amplitude sinewave at 2000Hz that can be recorded on magnetic tape (C). These signals are demodulated for display on the PPI at another time. In other words, all patterns displayed on the PPI can be tape recorded for reference and displayed again whenever required.

The PPI display has a number of other facilities, such as the "electronic reference dipole" which produces a perfect cosine pattern to any desired amplitude, and there is provision for an electronically produced omni-directional pattern, which can also be set to any amplitude. Other facilities are: fixed calibration markers for linear voltage or linear dB readout and variable marker for establishing amplitude reference or 3dB points on the displayed radiation patterns. The display is equipped with colour filters for photography and also map screens so that patterns can be viewed more realistically with regard to coverage over a given area. The system readout accuracy is to within ±1 degree on angles associated with displayed patterns and to within ± 0·5dB on amplitude.

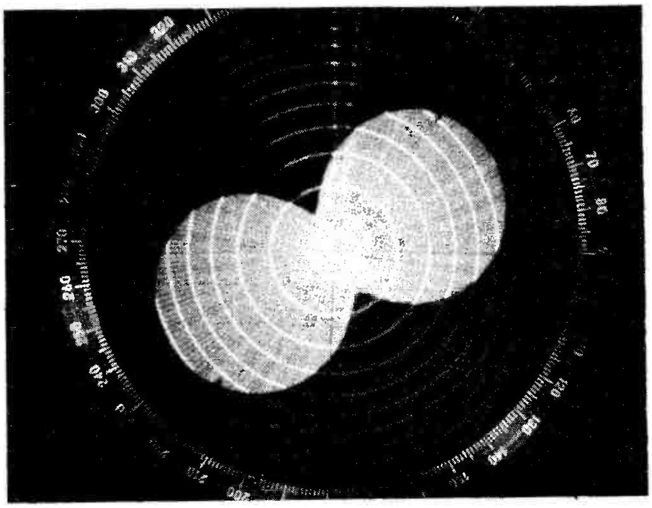


Fig. 6: Electronically generated reference dipole pattern with superimposed amplitude calibration markers

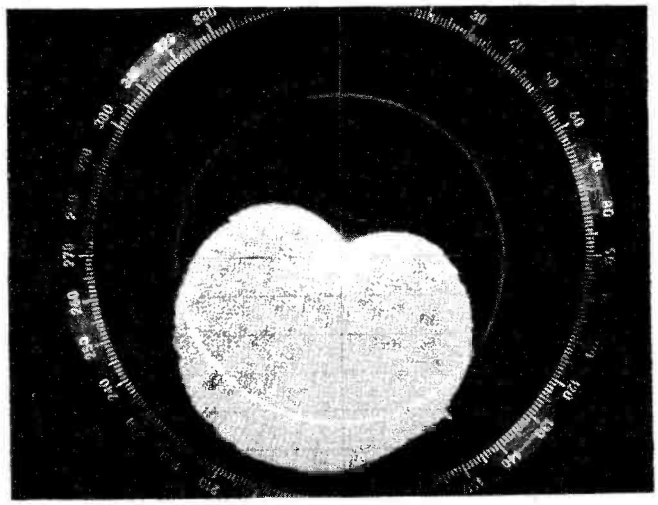


Fig. 8: Radiation pattern (cardioid) of a two-element ZL beam in vertical mode, with 3dB marker ring

Fig. 7: Polar pattern of a two-element ZL beam in horizontal mode with map overlay. Display centre is based on the writer's QTH in Norfolk

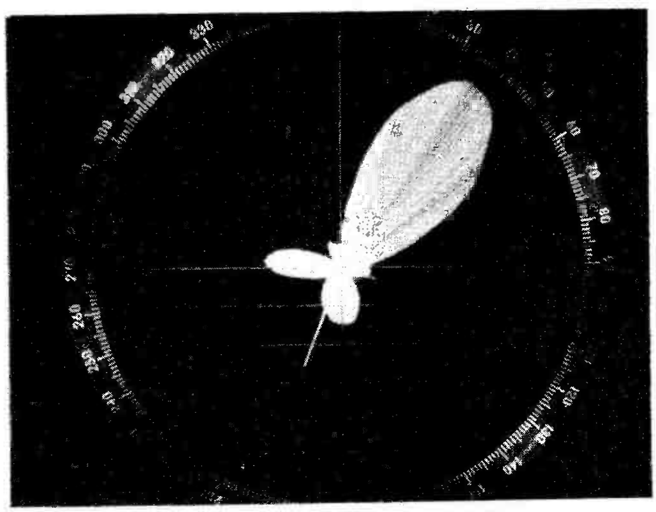


Fig. 9: Pattern from an experimental high-gain beam aerial, which shows that side lobes are too large and therefore the design is not acceptable

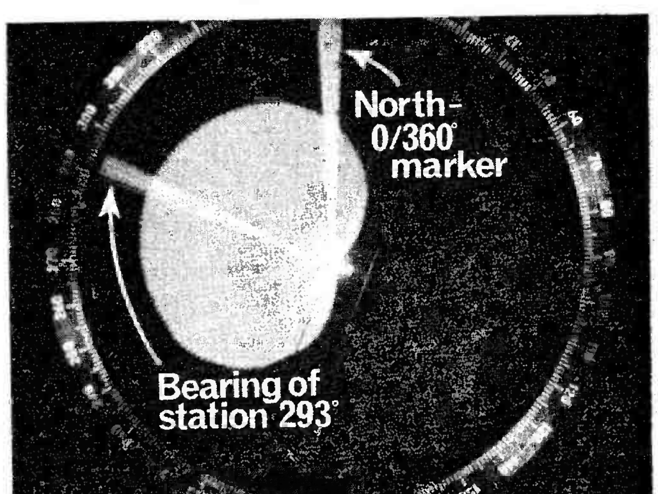


Fig. 10: The PPI display can be used for v.h.f. direction finding in conjunction with a continuously rotating aerial. See text regarding bearing markers

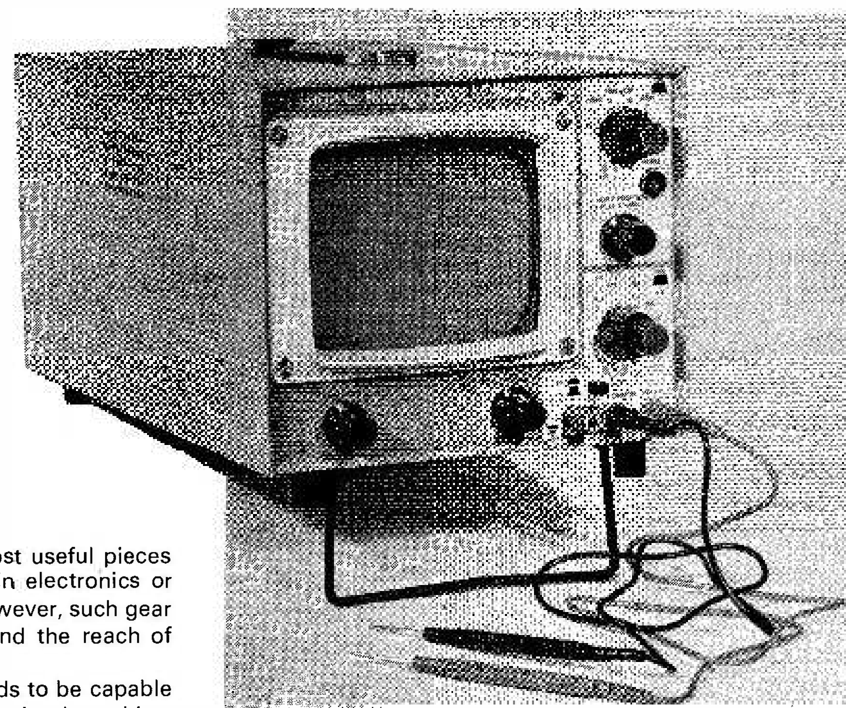
continued on page 33

SPECIAL PRODUCT REPORT

3106C

10 MHz OSCILLOSCOPE

RADAT INDUSTRIES



The oscilloscope is probably one of the most useful pieces of equipment anyone seriously interested in electronics or radio can possess. For most enthusiasts, however, such gear is out of the question as the cost is beyond the reach of most budgets.

For a scope to be of any great use it needs to be capable of looking at signals of 10MHz and, although simple to drive, should offer useful trigger facilities and a wide input range.

Above all the price should be low enough to put the instrument within reach of all but the most impoverished amateur.

The Radat 3106C almost fulfills these criteria except for price. It is a single beam unit with a frequency response of d.c. to 10MHz (6dB) and an input voltage range of 400V.

The display is a flat 8 × 10cm c.r.t. with a graticule ruled at 1cm divisions and rise-time reference lines at 10 and 90 per cent provided. The trace can be rotated to align with the horizontal axis using a preset control mounted on the rear panel. On the instrument tested this control proved adequate and simple to use.

Controls were the barest minimum, a timebase switch, vernier control for the timebase, horizontal trace position and ×5 magnification switch are all that are provided for the timebase. No controls are provided for triggering which is fully automatic. The trigger worked without any problems during the test period and was adequate for simple repetitive waveforms. For looking at more complex waveforms and pulses and edges an independent trigger control would be useful to allow one to look at any part of the waveform, especially with the trace expanded.

The X amplifier controls again are of the simplest, a concentric switched attenuator with the vertical trace position controlled by the centre knob. The attenuator gives X sensitivities ranging from 10mV per cm to 50V per cm in 12 calibrated steps. A push-button selects a.c. or d.c. coupling of the input.

Intensity and focus complete the front panel controls with the mains on-off switch operated by the intensity switch.

In use the instrument was simple to use, the trace locking well with inputs over 1cm deflection on the screen. The trace free-runs when no input is applied or the repetition rate is below 5Hz. The trace was bright enough at all sweep speeds.

★ Specification

Display: 8 × 10cm with 1cm graticule squares
Tube: 130BE/P31
EHT: 1·6kV
VERTICAL AMPLIFIER
Sensitivity: 10mV/cm to 50mV/cm in 12 steps
Bandwidth: DC to 6MHz −3dB; DC to 10MHz −6dB
Risetime: 55ns
Input Impedance: 1MΩ and 30pF
Input: ±400V max.
HORIZONTAL AMPLIFIER
Sensitivity: 720mV/cm to 50V/cm
Bandwidth: DC to 1·5MHz −3dB
X-Y Phase Shift: 5° d.c. to 50kHz
TIME BASE
Range: 0·5μs/cm to 10ms/cm in 6 ranges
Magnifier: ×5 (100ns/cm fastest sweep speed)
Calibration: 5%
Vernier: 12:1 continuous
Trigger Sensitivity: 1cm deflection 10Hz to 8MHz Automatic no manual controls
Power Supplies: 100 to 135V and 200 to 265V 48–440Hz 15W
Dimensions: 182 × 200 × 405mm 4·5kg
Accessories: Main test prods and leads, Handbook
Price: £172.44 inc. 15% VAT and carriage

The instrument reviewed was loaned by Kramer & Co., 9 October Place, Holders Hill Road, London NW4 1EJ. Tel: 01-203 2473.

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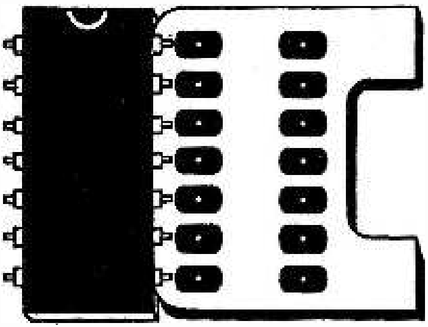


OF THE MONTH 76

Brian DANCE M.Sc

THOMSON-CSF TDE 2608

Thomson-CSF TDE 2608 device is considerably more complex than the well known 555 timer, offering a wider range of facilities. It is especially versatile in its operation, being similar to Thomson-CSF TDB 2068, but can operate over a greater temperature range (−25°C to +85°C).

The connections of the TDE 2608 are shown in Fig. 1 and the internal circuit in block form in Fig. 2, together with a few of the more important external components. Although one can use the device by merely constructing the circuits given, its versatility can only be fully realised if the internal circuit of Fig. 2 is understood.

This comprises an operational amplifier (marked A1 in Fig. 2), a comparator (marked A2), five current generators (marked I_A, I_B, I_C, I_D and I_N and various other amplifiers and components.

The operation may be very briefly summarised by saying that when the potential of the start logic input at pin 5 is raised above a critical value, capacitor C commences to charge due to the small current I_D which is fed to it. The voltage across this capacitor rises and when the voltage at the pin 14 exceeds that at pin 13 the comparator A2 switches so that pin 8 output changes from high to low and the output at pin 6 from low to high. The two outputs return to their original state when the pin 5 voltage is reduced so that the internal transistor Tr2 conducts and the timing capacitor C is discharged. The time delay is equal to the time taken for the current I_D to charge the capacitor C to a voltage equal to that at pin 13.

Detailed Operation

Let us now consider the operation in much more detail. The voltage reference in the base circuit of the transistor T1 causes this device to pass a constant collector current which is taken from the current generator circuits of I_A and I_B. This enables the current generators to pass equal currents (each about 250μA) to pins 11 and 1 respectively.

The current I_B develops a voltage equal to I_B R1 across resistor R1 which is applied to the non-inverting input of the operational amplifier A1. This amplifier and the current generator I_C are in a feedback loop which stabilises with the potentials at pins 1 and 2 equal. The potential is equal to the product of I_C and R2 and remains constant as R2 is changed; thus R2 may be used to set I_C. Quantitatively $I_C = R1\ I_B/R2$.

The bias applied to the current generator I_C is also applied to the generator I_D and the internal circuit of the device is so designed that $I_C = 20\ I_D$. The current I_D is made twenty times smaller than I_C so that timing capacitor C charges relatively slowly and long time delays can easily be obtained. Hence $I_D = R1\ I_B/20R2$.

The constant current I_D flowing to the capacitor C causes the potential across the capacitor to increase linearly with time, this potential V_C being given by the equation $V_C = I_D T/C$ where T is the time for which the current I_D has been passing.

The timed period ends when the potentials at pins 13 and 14 become equal: that is when $I_D\ T/C = R3\ I_A$. Substituting for I_D we obtain $R1\ I_B\ T/20R2\ C = R3\ I_A$ which may be rearranged to show the time delay, T being given by the equation:

$$T = 20CR2\ R3/R1 \text{ (since } I_A \text{ and } I_B \text{ are equal).}$$

In case the reader feels that this is a complex method of charging a capacitor, it should be pointed out that any change in temperature or supply voltage (or some other parameter) will cause almost equal changes in I_A and in I_B and hence a proportional change in I_D. If I_A is increased, the voltage across R3 (= I_A R3) to which the capacitor C must charge to end the timed period also increases, but as the charging current I_D increases in proportion, the timed *period* is unaltered.

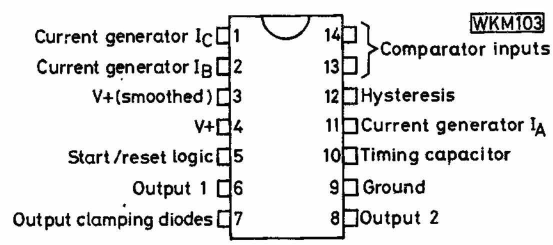


Fig. 1: The connections of the TDE 2068 device

This somewhat complex circuit design enables the time delays to change by only 100 parts per million per °C if only the circuit itself is considered. However, changes in component values due to temperature increase this value to about 500 parts per million per °C. Changes in the supply voltage alter the delay time by about 0·05% per volt. Successive time delays should differ by less than 0·1%.

Power Supply

The TDE 2608 can be operated from a power supply between +15V and +35V applied to pin 3, the supply current being typically 5mA when the pin 5 voltage is low and 3mA when pin 5 is high. Otherwise an alternating potential can be applied to pin 4, in which case a smoothing capacitor will be required between pin 3 and ground.

The output or outputs being used at pin 6 or pin 8 must be returned to a suitable positive line through a resistor or other load. When the output concerned is "low", it can accept a current of 100mA through the load without the output potential rising above +1·5V. Pin 7 is normally connected to the positive supply line to which the load(s) are returned; if the load is inductive, the internal clamping diodes D4 and D5 will then prevent damage to the TDE 2608 from the transient reverse voltages which occur when the current ceases to flow through the load. An example of such an inductive load would be a relay.

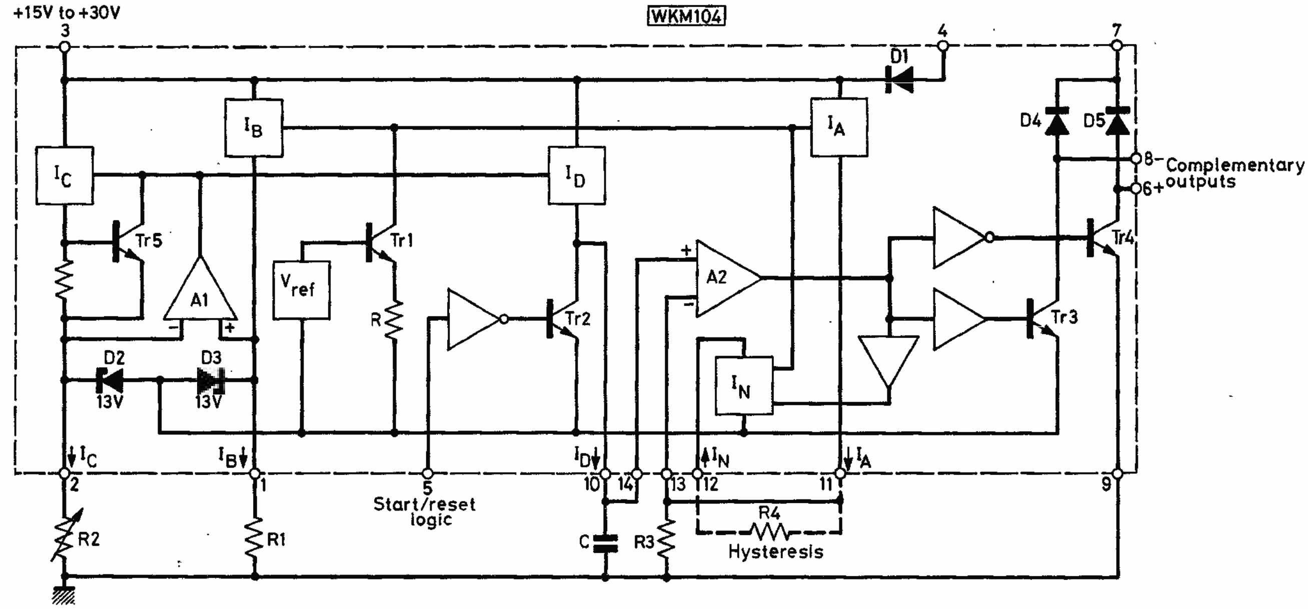


Fig. 2: The internal circuit of the TDE 2608 in block form

Recommended Values

It is recommended that the value of R1 and R3 should not exceed 40kΩ. The value of the timing capacitor charging current at pin 10 should be between 0·5 and 100μA, although the data sheet states that the circuit may operate with a reduced performance with values of this I_D current between 0·1 and 300μA.

Despite the minimum value of the positive supply voltage being given as nominally 15V, the circuit will operate down to 8V if it is designed so that the potential at pin 11 is less than ($V^+ - 2$).

The voltage at pin 5 must be raised to at least +8V to start the timing cycle and must be reduced to no more than +7V to reset the circuit and to discharge the timing capacitor.

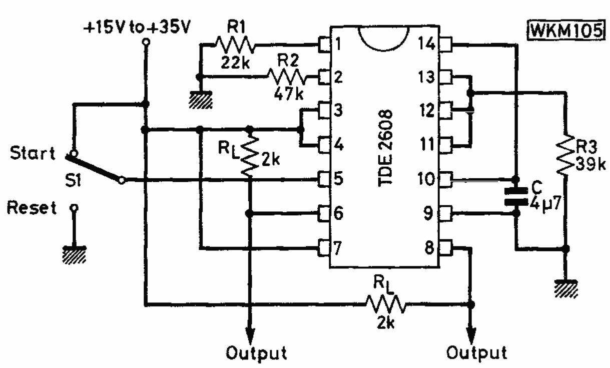


Fig. 3: A typical TDE timer

Hysteresis

Once the potential across the timing capacitor has reached the pin 13 potential and the timed period has elapsed, any small increase in the voltage at pin 13 or any small reduction in that at pin 10 could cause the circuit to revert to its former state. However, this can be prevented by connecting pins 11 and 12 together either directly or by means of a resistor. Part of the current I_A will then be diverted from R3 into pin 12 and so to the current generator I_N; this only occurs after the circuit has switched at the end of the timed period and reduces the pin 13 voltage so that there is no tendency for the circuit to switch back to its former state. Thus the connection between pins 11 and 12 provides some hysteresis so that unwanted switching is prevented.

Typical Timer

A typical timer circuit using the TDE 2608 is shown in Fig. 3; with the values shown the timed period is just under 8 seconds. It is easy to increase this delay by a factor of ten by placing a 2·2kΩ resistor in parallel with the existing resistor R1. Other time delays up to about 16 minutes can be obtained using the values of C, R1, R2 and R3 shown in Fig. 4.

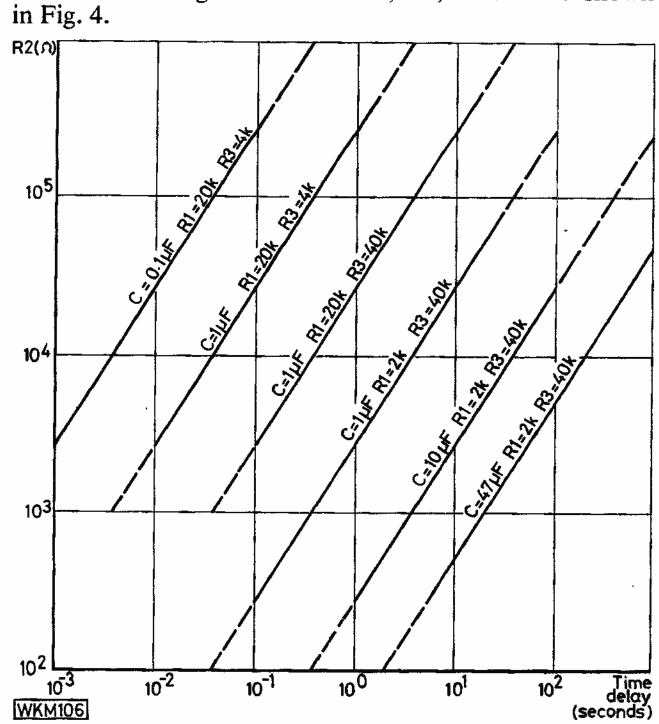


Fig. 4: Time delays available with various component values

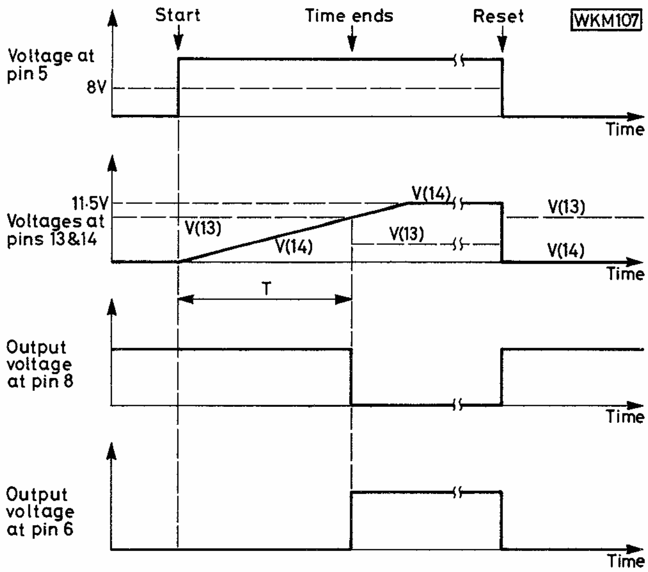


Fig. 5: TDE 2608 timer waveforms

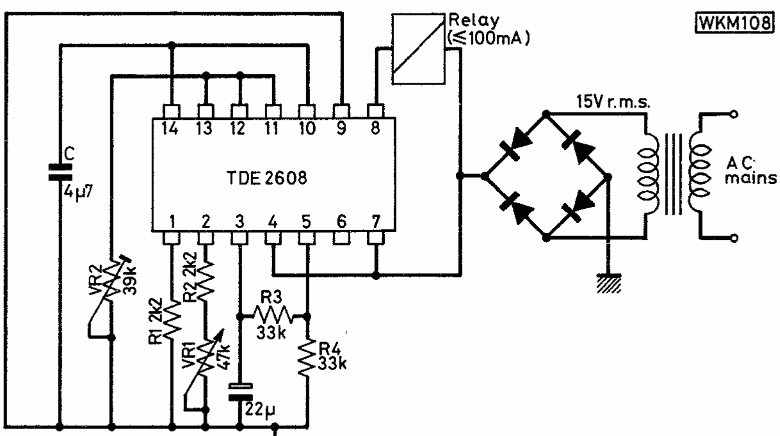


Fig. 6: A power delay circuit

It is important to note that the timing capacitor C should not be an electrolytic, since electrolytic capacitors take a variable leakage current and alter in value with time, to some extent. For optimum stability of delay, C should be a polycarbonate capacitor and R3 a metallic film resistor, but in most applications any non-electrolytic capacitor is satisfactory.

The two load resistors shown are marked 2kΩ in Fig. 3, but naturally their value may be chosen according to the application concerned, provided that it is not so small as to cause a current exceeding 100mA to flow. A small relay may be used as a load, for example.

The circuit waveforms are shown in Fig. 5. It can be seen that when the potential at pin 5 rises above 8V, the voltage at pin 14 commences to rise as the capacitor C charges. When this voltage becomes equal to that at pin 13, the timed period *T* ends and the output voltages change as shown. At the same time, the voltage at pin 13 falls to provide hysteresis. When the pin 5 potential falls, the circuit is reset to its initial state. It should be noted that there is no change in the output voltages when the timed period commences.

In many cases a circuit which provides variable delay times is required. With the circuit of Fig. 3, the time can be made variable by replacing R2 by a 47kΩ potentiometer in series with a 2·2kΩ fixed resistor. A range of time delays around 20:1 can then be obtained by adjusting the potentiometer.

Power Delay Circuit

The circuit of Fig. 6 shows how the TDE 2608 circuit may be used to close a relay after a certain time, following the application of a.c. mains input. This may be used, for example, to apply power through the relay contacts to certain parts of another circuit after the mains power has been applied for long enough to warm up other sections.

If the values shown are used, when the potentiometer VR2 is set to its maximum value, time delays of about 3·7 to 82 seconds may be obtained by the adjustment VR1. VR2 may be set to a lower value for shorter delay times. Pin 5 is connected to a positive potential at all times when the mains voltage is applied.

Function Generator

A circuit which will generate triangular and square waves simultaneously is shown in Fig. 7. The triangular wave rises during the time pin 6 is in the low voltage state,

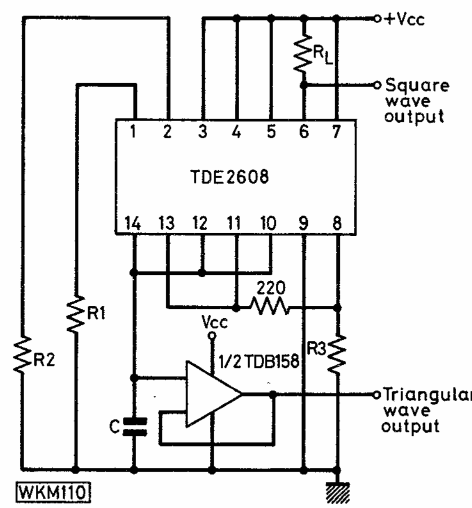


Fig. 7: A waveform generator circuit

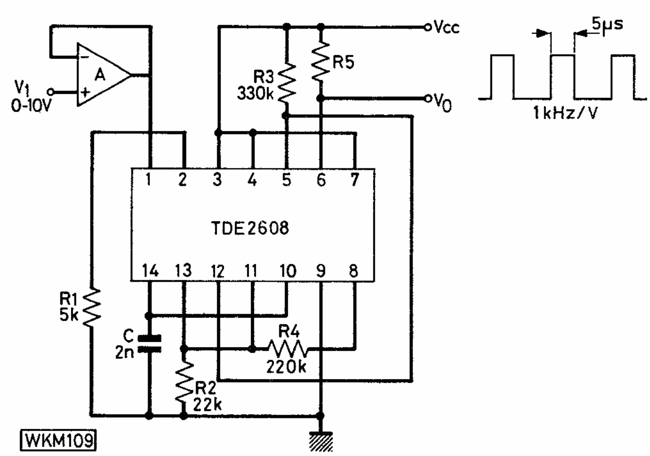


Fig. 8: A voltage-to-frequency converter

this time 20CR3 R1/R2. The falling part of the triangular wave occurs when the pin 6 voltage is high for a time of CR3 I_A/I_N or about 1·8 CR3. The circuit values may be chosen to obtain a wide range of waveform times.

The TDB 158 operational amplifier is used so that the output utilising the triangular wave does not load the part of the circuit containing the timing capacitor C, as this would affect the waveform.

Voltage to Frequency Converter

The circuit of Fig. 8 provides a square wave output proportional to the input voltage to the operational amplifier A (which may be a 741 device). The frequency is equal to 200 V1/R1 R2 C which corresponds to 1kHz per volt. The high part of the output waveform has a period of 5µS and the low voltage part varies with the input voltage.

Better temperature stability can be obtained if R2 is replaced by a Zener diode whose Zener voltage, V_z, is less than 10V. In this case the frequency = $V_I/20\ V_z$ R1 C.

The TDE 2608 is a very versatile device which is available from Phoenix Electronics Ltd., 139 Havant Road, Drayton, Portsmouth PO6 2AA.

AERIAL DESIGN USING SCALE MODELS

continued from page 28

The photographs Figs. 6–10 were taken with a Polaroid 350 camera, using a lens aperture of about f/16 and exposure time equivalent to one rotation of the timebase, i.e. about 3 seconds. The facilities of the display are illustrated as well as actual patterns from model aerials and the captions provide a short explanation of each photo. The pattern of the 2-element ZL Special in vertical mode (Fig. 8) may be of particular interest to users of this aerial, as it has a virtually perfect cardioid shape which makes it very suitable for v.h.f. direction finding because of the very well-defined null to the rear. In fact it is used by a certain authority for this purpose.

The pattern in Fig. 9 is from an experimental high-gain beam aerial using a square-loop radiator, a square-loop parasitic reflector and a series of parasitic directors. The square-loop reflector proved to be inefficient, however, as is the case with Quad aerials, owing to the large lobes to the rear. This was replaced by a larger plane reflector which almost completely eliminated the spurious lobes and provided a greater forward gain.

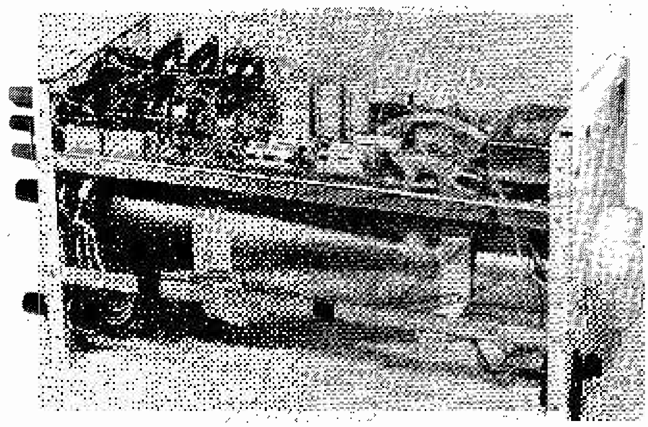
Experimental work of this nature can be carried out very rapidly with scale models, in conjunction with the PPI display described in the foregoing paragraphs. This set-up has been put to good use in the design and development of numerous v.h.f. aerials, some of which *PW* readers are already familiar with, the latest being a colinear version of the "Slim Jim" which it is hoped to publish shortly.

Direction Finding

The PPI display can also be used in conjunction with full-size 2 metre aerials, not only for performance measurement etc., but for direction finding as well. It can be coupled to an aerial that rotates continuously in synchronism with the rotation of the timebase. The signals from the aerial are taken to a sensing circuit that provides a short duration squarewave when the signal from a particular direction is at maximum amplitude. The bright arc produced on the display by this squarewave is about 5 degrees wide and its centre denotes the actual bearing. A similar bright arc is produced for a "north" or 0/360 degree reference. The photo in Fig. 10 shows an actual readout from a station bearing 290 degrees with respect to north or 0/360 degrees. Directions of stations obtained with this system are to within better than 2 degrees and a bearing can be registered even if a signal is present for only 5 or 6 seconds. Continuous rotation of the aerial is obtained by an inductive loop coupling method devised by the author, and which with continued development, may prove to be the means of achieving a low-cost beam aerial rotation system.

SPECIAL PRODUCT REPORT—SCOPE

continued from page 29



A set of plain test leads with plain prods fitted was supplied and plugged firmly into the input terminals mounted on the front panel. No provision was made for using a b.n.c. plug such as would be fitted to a 10:1 passive divider probe. This is a pity since the instrument is good enough to warrant the use of such an accessory.

The scope was well constructed and the case dismantled easily to give access to the single printed circuit board.

Most important, the instruction manual gives full circuit diagrams and instructions for servicing and setting up the instrument. The instructions are excellent, taking the user through the use of the scope and explaining what it can do, how the circuits work and how to get the most out of it.

Dick Ganderton

KINDLY NOTE!

"Logical Noughts and Crosses" Part 2, June 1979

The following constructional information was unfortunately missed:

Fig. 10 Component placement layout for PCB 2: After inserting components and links as shown, use insulated wire to connect all like numbered pins to top end of appropriate resistor. Link positive supply to all i.c. top left hand pins and negative supply to all i.c. bottom right hand pins.

Fig. 8 Component placement layout for PCB 1: After inserting components and links as shown, use insulated wire to link i.c. pins as shown:—

IC 2.4 — IC 10.20 — IC 7.3
IC 2.9 — IC 10.18 — IC 5.13
IC 4.1 — IC 10.6 — IC 5.11
IC 4.13 — IC 10.4 — IC 5.5
IC 5.2 — IC 14.2
IC 5.4 — IC 12.5
IC 6.1 — IC 10.22 — IC 7.2
IC 6.9 — IC 10.16 — IC 7.13
IC 7.5 — IC 10.8

Positive supply to all top left hand pins, negative supply to all bottom right hand pins.

Reset to IC 10.1 — IC 10.13 — IC 11.1 — IC 13.9 — IC 14.1 — IC 15.1.

Fig. 5 Component placement layout for PCB 3: Connect positive supply to one dropping resistor (top end).

TELEPHONE BELL REPEATER

B. BARNARD

It is surprising how many domestic problems and irritations can be overcome by the sensible application of quite simple electronic technology.

One such problem in many households is the difficulty—sometimes impossibility—of hearing the telephone bell when one is working in some remote part of the house.

I found, particularly when working in the garden or garage and alone in the house, that the phone bell was quite inaudible and any calls remained unanswered. They might have been important, and as I do get a fair number of important telephone calls, it became a major source of worry.

TV Phones

In my case there was another aspect. The phone is installed in the hall which is adjacent to the room in which we do our listening and viewing. With normal listening levels, we can hear the phone when it rings, but whenever a phone rings off-stage as part of a TV programme (we have hi-fi sound from the TV) we are often halfway out of our seats before identifying the source of the noise. This can be very irritating and a clear, immediate indication of the source adds greatly to relaxation and enjoyment of programmes.

I suspect that this problem applies in many households and the Telephone Bell Repeater is a simple and reasonably cheap answer. Apart from the relay, most of the components will be found in the average experimenter's spares box: the values of resistors and capacitors are not particularly critical and all the transistors are commonly used types.

No connection whatever is made to the telephone instrument or its wiring. The method employed is to pick up the sound of the ringing bell with a cheap crystal microphone which is mounted on a plinth on which the phone stands. The audio signal from the microphone is amplified and then applied to a d.c. amplifier which operates the relay: the relay contacts make and break the circuits of independent battery-operated visual audible indicators.

Circuit Operation

The circuit of the unit is shown in Figure 1. Tr1 and Tr2 are audio amplifiers and provide sufficient drive to operate the d.c. amplifiers Tr3, Tr4 and Tr5 so that they activate the relay in the collector circuit of the final *pnp* transistor. There is nothing sophisticated about the circuit, the design being largely dictated by the components available in my spares box and considerable variations are permissible as we are not concerned with distortion—high gain, however, is required so that the system will be stable and certain in operation. Another reason for high gain is that the unit should work off the low pitched "hooting" telephone and this it does quite satisfactorily.

No attempt has been made to equalise the microphone input circuit as would have to be done for normal audio use. In this particular application, we are concerned only with the sound from a telephone bell which is of quite high frequency and the rising characteristic of the crystal microphone is an advantage in that it gives a useful output at the frequencies we want and a lower output for lower

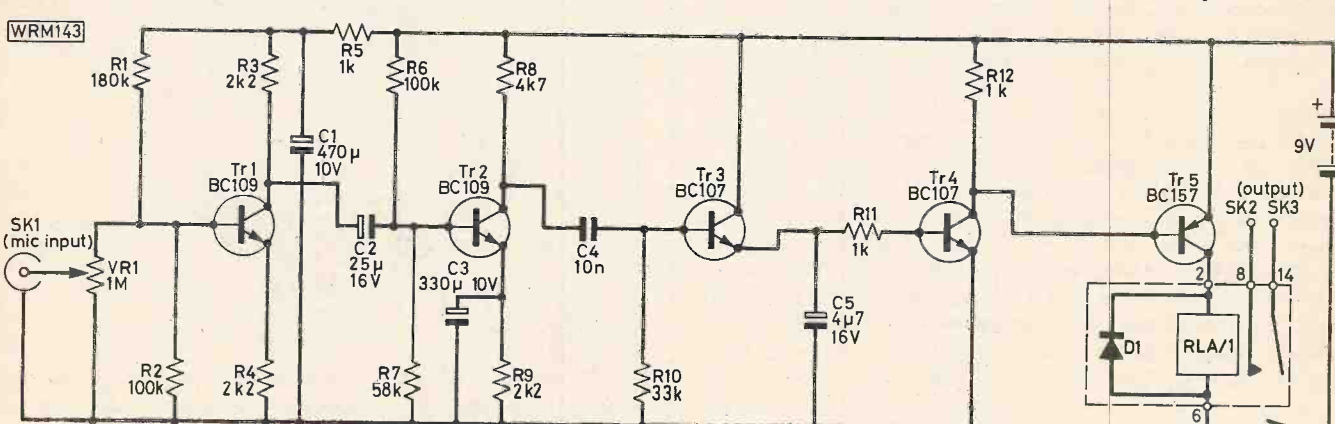
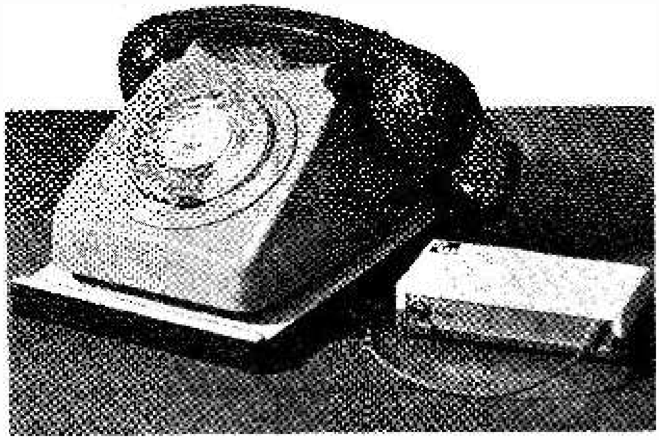


Fig. 1: Circuit diagram of the telephone bell repeater amplifier. D1 is fitted inside the relay specified but if a different relay is used then a diode (1N4148) must be fitted across the coil



The telephone sits on the home-made plinth with the amplifier unit alongside

pitched extraneous noises which might occur in the vicinity of the telephone. For much the same reason, the 10nF coupling capacitor between the a.c. and d.c. stages is quite small—but if you have the lower pitched telephone, this can be increased to about 0·1μF with advantage.

The amplifier is battery-operated, and the quiescent current is about 2 milliamps rising to some 50 milliamps when the bell signal is applied.

The complete system comprises the amplifier, relay and battery in one box, the microphone plinth on which the telephone stands and a red indicator lamp with separate 4·5 volt battery housed in a small box. The microphone is plugged into the amplifier by means of a screened cable and miniature jack plug: the relay contact connections are taken to choc-strip connectors fixed to the rear of the amplifier container to which suitable extension wiring to the indicator can easily be joined.

Where a bell is required for outside use, extension leads are run to a convenient window frame which is drilled and a normal sized jack socket is fitted. The bell and its battery can then be plugged in as required. Obviously, some weather protection must be devised for the jack socket.

The construction of the microphone plinth is quite simple: it consists of a piece of hardboard about 12mm larger all round than the telephone instrument. Wood fillets are glued to the front and rear of the upper side to prevent the telephone slipping off. The edges of the lower side are strengthened with wood struts 18mm wide and of sufficient depth to allow the microphone to clear the table top on which it stands. These struts are covered with non-slip rubber so there is no tendency for the whole assembly to slip about when dialling.

A hole is cut in the hardboard large enough to accept the face of the microphone which is held in place by a single piece of strong wire clamped on either side by two small nuts and bolts. The microphone screened cable is held against the underside of the hardboard by a short length of adhesive tape and is then lead out through a hole in the rear. With the standard type of telephone, the hole for the microphone is located well to the front of the plinth so that it coincides with the bell position just beneath the telephone dial. I have fitted a small piece of foam rubber around the face of the microphone to cut out extraneous sounds.

The layout, construction and position of the visible warning device is a matter for each individual constructor. I was lucky enough to have on hand a small cigarette box 120 × 95 × 38mm deep which is just the right size to hold a 1289 pocket lamp battery and comfortably takes on its front face a miniature red lamp indicator assembly. A light gauge twin-core flex emerges from the rear and connects with the extension wiring to the relay contacts. The unit sits on top of one of my stereo speakers and is neat and unobtrusive.

The bell and its battery, since they are not likely to be part of the house furnishings, can be a rather crude arrangement and, in my case, consists of a piece of plywood with the bell fixed to one side and the battery strapped to the other: a hook at the top enables it to be hung from a convenient nail when in use. The device is unplugged and brought indoors when not in use as this avoids problems of arranging weather protection.

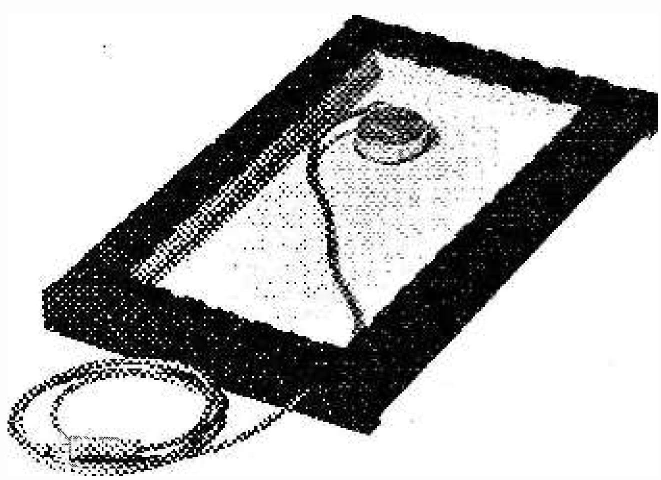
Relays

Relays are available in a number of different types with different specifications, and although a d.i.l. reed relay with only one set of contacts has been used for the unit shown, the prototype used a different type with two sets of contacts. A larger case was used along with Veroboard instead of a p.c.b.

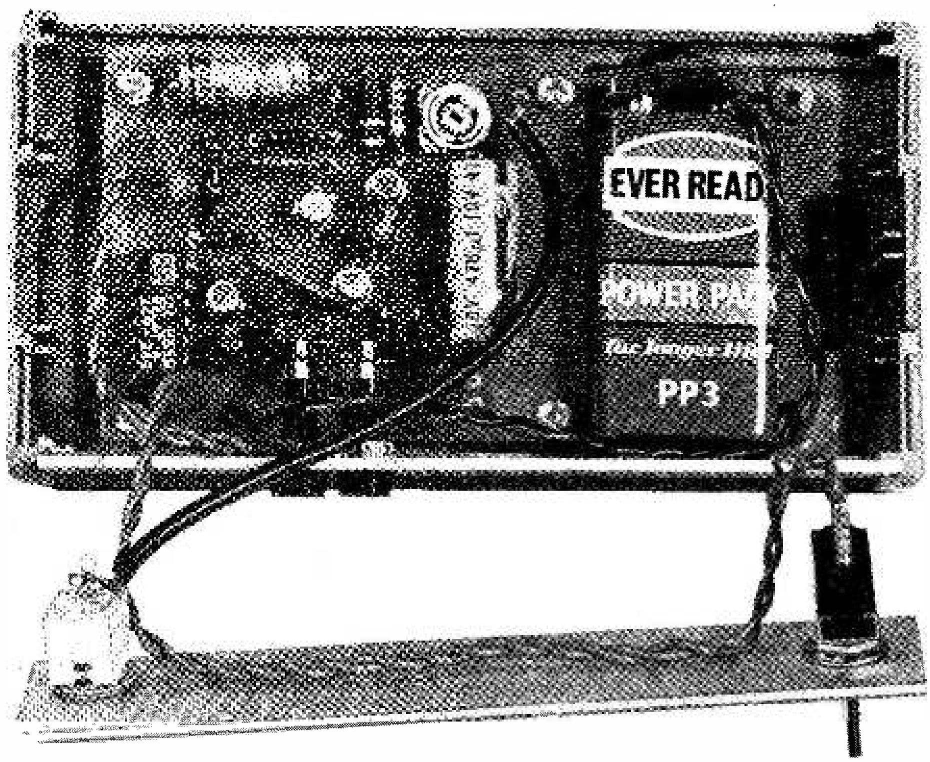
Alternative Relays

One relay suitable for this application operates in the voltage range of 5·5—17 volts and is generally referred to as the "12 volt type". In addition to this information, the d.c. resistance of the coil should be of the order of 184 ohms. The contacts themselves are rated in the order of 1 amp at considerably higher voltages than are used in this system so there is no reason why more than one indicating device should not be connected to one set of contacts provided you do not mind them operating simultaneously. In choosing the relay, therefore, there is no reason to go beyond two sets of contacts.

There is another point worth mentioning. If you happen to have on hand a 27 volt relay (coil resistance 700 ohms) or can buy one very cheaply from a surplus stores, then by all means try it. In the early work on this system, I used one and it worked satisfactorily, albeit a little sluggish in operation but, as the load current on the contacts is so small, this is of little importance.



The plinth is made from plywood or hardboard with rubber edging to prevent it slipping about when dialling. The crystal microphone insert is fitted into a cut-out in the base and is positioned so that it is underneath the bell



The printed circuit board fits neatly into the plastics Verobox together with the PP3 size battery. The board is held in position by four 6BA screws. Care must be taken when positioning the output sockets to ensure that they will clear components on the p.c.b.

Testing

Having completed the constructional work some bench tests are necessary.

Plug in the microphone jack and connect the visual indicator to its relay contacts: connect the battery and switch on. Set VR1 to maximum and *gently* stroke the face of the microphone with a finger. The relay should close and the lamp come on.

If this does not happen, check the constructional work for a fault. Another possibility is that the relay will close but remains on permanently: this almost certainly indicates that the amplifier is unstable and, in the absence of a fault condition, it is worth trying some decoupling in the supply lead to the first two stages. Another possibility is hum or noise introduced by poor connections to the microphone screened lead.

The next step is to connect a milliammeter in the battery lead and check the no-signal current, which should be about 2 milliamps, the actual value depending on the transistors used and the value of components chosen.

Now check the system on a signal. After a little experimenting, I found that a tin mug or china saucer "rattled" with a screwdriver, produced a sound closely approximating to that of a telephone bell and enabled sensible bench tests to be done.

Adjust VR1 to maximum and hold the mug about two feet from the face of the microphone: for each strike of the screwdriver against the mug, the relay should close, the indicator lamp light up and the milliammeter flick up to about 50 to 60 milliamps.

When these simple tests have been satisfactorily completed, back off VR1 to its halfway position and transfer all the units to their final installation positions.

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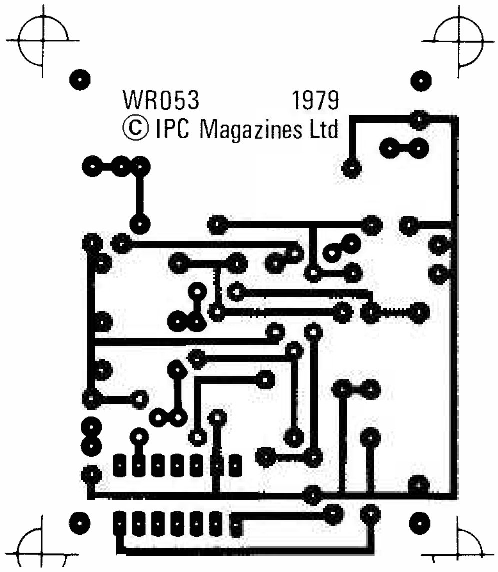


Fig. 2: The printed circuit board copper track pattern is shown full size

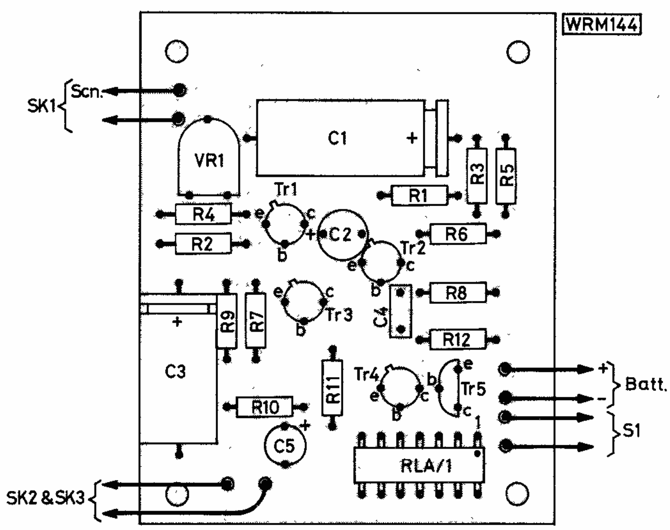


Fig. 3: The component placement for the p.c.b.

PRODUCTION LINES

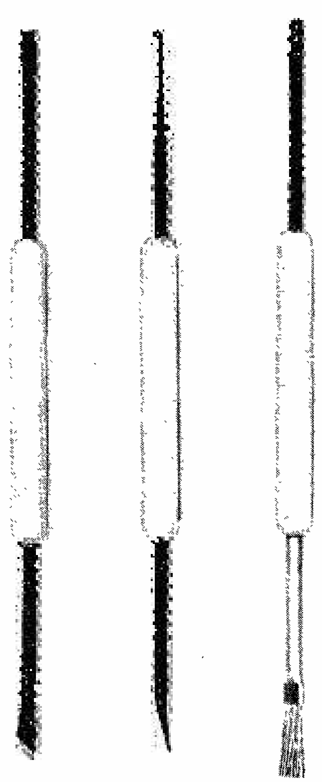
alan martin

Soldering aids

A set of three double ended soldering aids has been introduced by Adcola Products Ltd., manufactured in non-tinning steel with white plastic hexagonal handles.

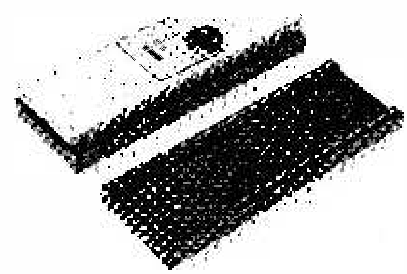
The fork/brush tool can be used for wire twisting, unwinding, cleaning components and p.c.b.s, prior to soldering—the hook/spike tool can be used as an extractor to clean holes and for chassis marking—the knife/scraper is useful for removing surplus solder, solder altering and repairing.

The solder aid tool set is priced at £2.50. Further details may be obtained from *Adcola Products Ltd., Adcola House, Gauden Road, London SW4 6LH. Tel: 01-622 0291.*



15% VAT

Readers should check prices of items mentioned on this page.



IC sockets

Winslow Component Systems Ltd., the Kent based semiconductor accessory manufacturer, announce the recent launch of a brand new range of i.c. sockets.

Featuring low profile, glass reinforced polyester bodies—they have been designed to exceed the most stringent criteria demanded by today's high technology microprocessor user and yet are manufactured to be price attractive, even in consumer markets.

The phosphor bronze anti-wicking contacts are available in either gold or bright acid tin plated in 8-14-16-18-20-22-24-40 ways. Prices over the range are approximately between 15 and 60p.

Further details and technical data are available from: *Winslow Component Systems Ltd., Southon House, Edenbridge, Kent. Tel: (0732) 864488.*

Low-loss trimmers

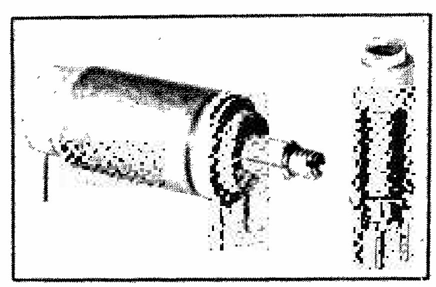
Two new tubular trimmer-capacitors with PTFE dielectric and silver-plated brass rotor and stator have been added to the range offered by Jackson Brothers (London) Ltd. Both show very low losses at v.h.f. and u.h.f. frequencies, and their multi-turn screwdriver adjustment permits the very precise setting required by electronic instruments and professional communications equipment.

The "Type 430" capacitor has minimum capacitance below 2pF, capacitance swing 30pF, and setting-resolution around 2pF per complete turn. Deviation from linearity is under 1%. The "Type 430" is horizontal mounting and its diameter is 6·3mm and maximum length is 38·9mm (at minimum capacitance).

The smaller "V" 3-pin trimmer is vertical mounting, diameter is 6·3mm and maximum height is 31·8mm. Minimum capacitance is below 2pF, swing 25pF and setting-resolution around 1pF per turn.

Both trimmers show excellent resistance to shock and vibration and remain stable at temperatures from −40°C to +70°C.

Further information from: *Jackson Brothers (London) Ltd., Kingsway, Waddon, Croydon CR9 4DG. Tel: 01-681 2754/7.*

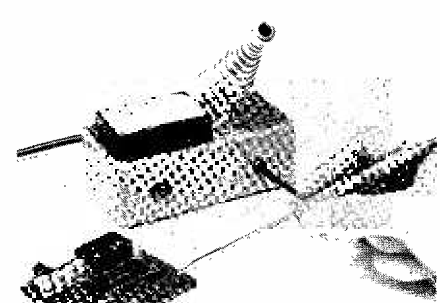


Mini soldering station

Toolrange Ltd. have recently introduced the "Oryx PSU-6", a complete soldering station in miniature.

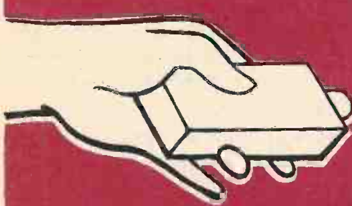
Ideal for work on micro-miniature circuitry, it has a fully isolated and fused transformer for safe operation, a miniature coil-spring iron rest with stainless steel insert, and a sponge tray for tip cleaning.

The base, which has non-slip feet, a burnproof aluminium cover—to which solder will not adhere, an indicator lamp and measures only 120 x 65 x 50mm. The 6V, 6W iron has a stainless steel shaft, longlife element and a slide-on nickel plated tip only 2·4mm in diameter.



This well styled product represents excellent value at £9.95 plus VAT.

Available from: *Toolrange Ltd., Upton Road, Reading RG3 4JA. Tel: (0734) 29446 or 22245.*



ULTRASONIC REMOTE CONTROL

M. J. DARBY

There are a number of ways by which a piece of equipment can be controlled at a distance without using connecting wires. Signals may, of course, be conveyed to the equipment as radio waves or microwaves using a suitable radio transmitter and receiver; indeed, this is the only satisfactory solution in many cases, such as model aeroplanes and model boats which move some considerable distance away from the person controlling the movement. Unfortunately, however, the transmitter and receiver can be fairly complex and expensive, and an operator licence is required before such equipment can be used.

It is not usually very practical to use light waves, since daylight will normally prevent a satisfactory communications channel being established. In television remote control systems, the current trend is for an infra-red link to be employed, since it is easy to provide the many channels of communication required to select stations, control volume, brilliance, colour, etc., over a reasonable distance in any room. However, infra-red systems are not always the simplest type of circuit for an inexperienced person to construct and a suitable filter is required to prevent daylight from falling onto the photocell in the receiver.

The circuits to be described have been chosen so that they are some of the simplest possible ones which can be made to operate reliably by anyone with little or no previous experience with remote control systems. There are no critical adjustments to be made and the component count is quite small.

The main problem imposed by the use of an ultrasonic link is the limited range which is possible. One cannot quote a definite value of the maximum range; generally it will be between 10 and 20 metres with the simple circuits discussed, but much depends on the gain provided by the particular integrated circuit used as even devices of the same type number can vary considerably in gain. In addition, the range can vary with various types of surroundings; if used in a corridor, the range is likely to be increased owing to the reflection of the waves from the transmitter unit towards the receiver. The range is limited by the attenuation of the waves as they pass through the air.

Ultrasonic waves are, of course, just like sound waves except that they have such a high frequency that humans cannot hear them. However, many animals including dogs, cats and small rodents can clearly hear them. Indeed, it is possible to remove vermin from premises by using a relatively high power ultrasonic generator, but this is not the purpose of the circuit described in this article. Never-the-less, the writer has found that most dogs will prick up their ears when the transmitter is switched on, and it would doubtless be possible to train a dog to come inside a house when the transmitter is operated without the need for the receiver.

The simple circuit to be described has been designed to cause a relay to close at a remote point. The closing of the relay can be used to cause any desired operation to be performed. For example, it could be used to signal to a person in a garden shed that he is wanted in the house.

If one mounts an ultrasonic transmitter unit on the bumper of your car, you could use the emitted waves to cause the garage door to open automatically when you arrive home. Similarly the door could be shut automatically as you leave home, but a suitable motorised door opening system would be required. The driver would not need to leave his car seat as a short pulse of an ultrasonic signal will cause automatic operation of the door.

A simple form of intruder alarm can also be made. The transmitter is placed on one side of a corridor and the receiver on the other side. When the ultrasonic beam is interrupted by a person, the relay in the receiver will open and can be made to initiate an alarm. One advantage of the use of an ultrasonic system is that the intruder will not know he has been detected unless the alarm is deliberately designed to sound in the area concerned to scare the intruder away.

The Transducers

A small ultrasonic transducer is required for use in the transmitter and a similar one in the receiver unit. These transducers are quite small, about 14mm diameter by 11mm long, and have two terminals. They contain piezo-electric ceramic bimorph elements mounted so as to minimise any mechanical damping. Each transducer has a natural mechanical resonant frequency and can be used only at frequencies close to this resonant frequency.

The circuits shown were designed using transducers resonant at a frequency of 40kHz, but they have also been successfully used with 25kHz transducers. The 40kHz transducers are rather more directional than the 25kHz types, but 40kHz waves are attenuated more rapidly in air than 25kHz waves. However, it is doubtful if most users would really notice very much difference between the performance of the two types of transducer.

In order to generate ultrasonic waves in air, an alternating voltage, usually a sine or square-wave, is applied across the terminals of the transmitter transducer. The frequency of this signal must be quite close to the resonant frequency of the transducer if a high efficiency is to be obtained. The transmitting transducer can be driven from a signal generator, but it will usually be much more convenient to make one of the simple circuits to be described in a small box incorporating the battery as well.

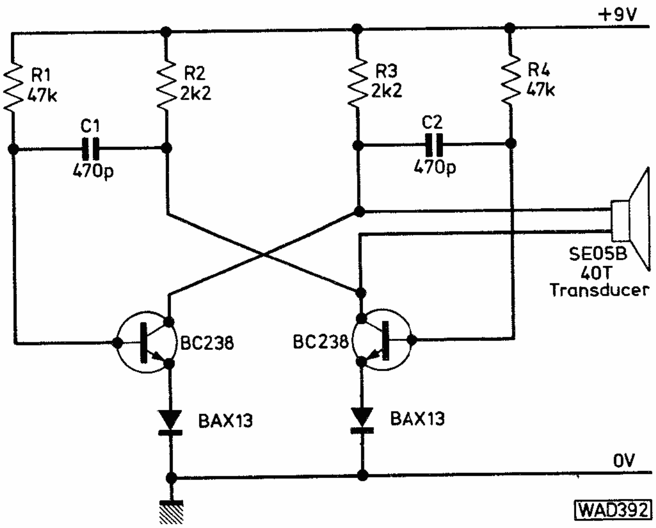


Fig. 1: Discrete component circuit to provide an ultrasonic signal

The transducers used are SE05B 40T for the transmitter and SE05B 40R for the receiver operating at 40kHz and are available from Hall Electronics, 48 Avondale Road, Leyton, London E17 8JG. Somewhat similar 25kHz types are also available from this same supplier.

In the case of the 25kHz transducers, there is only one type, which is suitable for either the transmitter or for the receiver. However, with the 40kHz types optimum results will be obtained if the type with the suffix "T" is used in the transmitter and that with the suffix "R" in the receiver. The 40T and 40R transducers differ in that the 40R is much more sharply resonant in frequency, but if a wider frequency response is required, the 40R type can be damped by a suitable parallel resistor of about 3·3kΩ with a reduction in the sensitivity.

One connection of the transducer is directly connected to the case of the device, which should be earthed. Otherwise the two connections are interchangeable. The connections are at the back of the device so that the metal grille at the front is left clear for the passage of ultrasonic waves to or from the internal ceramic element.

Transmitter Circuits

The transmitter circuit must employ a low power oscillator which can provide a sine or a square-waveform of a few volts r.m.s. across the transmitter transducer at the correct frequency.

(i) Discrete component circuit. An astable multivibrator circuit capable of feeding an ultrasonic transducer with a square-wave is shown in Fig. 1. The resonance of the transducer automatically triggers the multivibrator circuit so that it operates at the transducer resonant frequency; no oscillator tuning is therefore required. The two BAX13 diodes can be omitted if a low supply voltage is to be used, but in this case the intensity of the ultrasonic waves emitted from the transducer will be reduced and hence the maximum range will be somewhat smaller.

(ii) Integrated circuit transmitter. An ultrasonic transmitter unit using the well-known 555 timer is shown in Fig. 2. The potentiometer VR1 is a preset type which is used for tuning the frequency of oscillation of the 555 circuit to match the resonant frequency of the transducer used. The adjustment is not critical and can be made by adjusting VR1 for maximum current from the power supply line, but it is better to adjust the transmitter for maximum signal to the receiver as described later.

An alternative type of integrated circuit transmitter unit can be made using a 4011 integrated circuit with two of the four NAND gates as standard type of c.m.o.s. oscillator and the other two NAND gates as output buffers feeding the transmitter transducer in push-pull.

The Receiver

When ultrasonic waves from the transmitter transducer fall on the receiver transducer, a very small alternating voltage at the ultrasonic frequency is produced across the terminals of the receiver transducer. This may be considerably less than a millivolt and must therefore be amplified before it will operate a relay.

Although one can use about seven transistors in a discrete component amplifier and demodulator as the receiver, a very much simpler circuit can be made using one or more integrated circuits. Amplification at the ultrasonic frequency can be easily carried out by the use of an integrated circuit designed for radio or television intermediate frequency amplification, but a power amplifier is required for the operation of a relay of moderate size.

LM1808 Integrated Circuit

The National Semiconductor LM1808 is an 18 pin dual-in-line integrated circuit which contains an amplifier intended for use as a television i.f. amplifier, a volume control circuit and a power amplifier stage on the same silicon chip. The circuit of Fig. 3 shows how this device can be used without any other amplifier devices to close a 12V relay when ultrasonic waves fall on the receiving transducer.

When ultrasonic waves at resonant frequency fall onto receiver, a small alternating voltage at this frequency is applied to the internal amplifier between pins 12 and 13. Pin 12 is tied to ground as far as alternating voltages are concerned by means of the capacitor C5, but the steady bias voltage from pin 12 is applied through R2 to the input at pin 13 so that the amplifier can operate correctly.

The output from the 40kHz amplifier at pin 9 is applied through C4 to the diode pump circuit consisting of D1 and D2 together with the capacitor C3. The diode pump circuit is effectively a demodulator circuit which converts the 40kHz alternating voltage from pin 9 into a steady voltage which appears across C3. Thus when ultrasonic waves fall onto the transducer, the junction of D1 and C3 becomes negative.

A current flows from the positive supply line through the resistor R3 into the inverting input of the power amplifier stage at pin 16. The flow of this bias current results in a

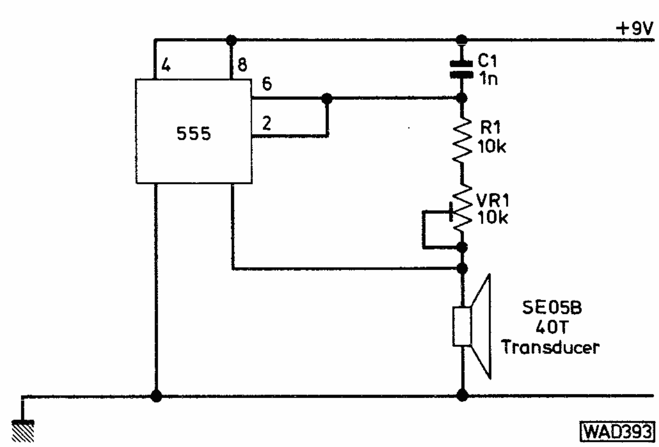


Fig. 2: Ultrasonic generator circuit using a 555 timer

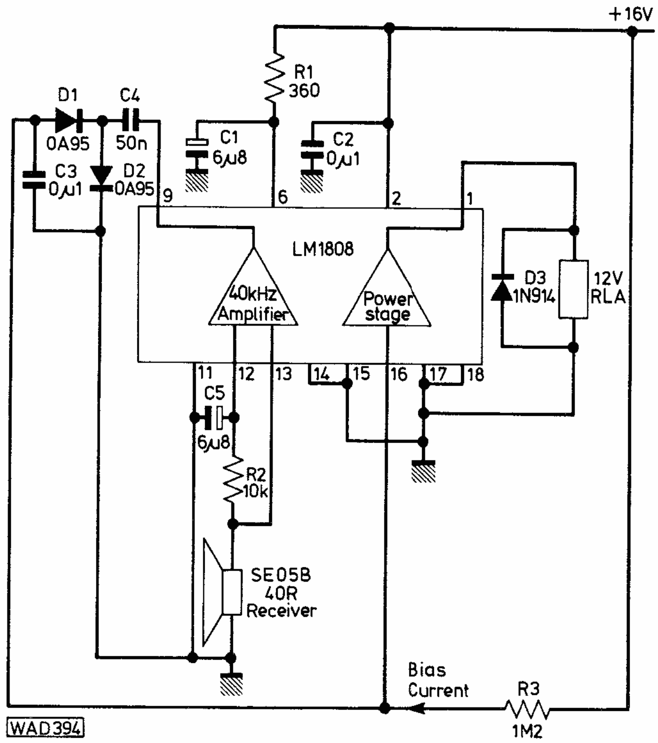


Fig. 3: Receiver circuit using an LM1808 integrated circuit

quiescent voltage of about +2V at the output of the power amplifier stage at pin 1 when no ultrasonic waves are falling onto the transducer. Pin 16 cannot become more positive than about +0·3V, since if the potential at this pin should tend to rise above this value, a current would flow through D1 and D2 to ground; these diodes are germanium types which operate at low forward conduction voltages.

The quiescent voltage of about +2V at pin 1 is not enough to cause the relay to close. However, when the upper end of C3 becomes negative due to ultrasonic waves falling on the transducer, this negative voltage is applied to the inverting input of the power amplifier at pin 16 and the output at pin 1 rises to about +13V so that the relay closes. The diode D3 by-passes the voltage transients developed when the current ceases to flow through the inductive relay coil. If D3 is omitted, these transients could damage the power amplifier stage of the LM1808 device.

It is normally required that the relay will open again when the ultrasonic waves no longer fall on the receiving transducer. A relay should therefore be selected which will open when the potential across its coil falls to +2V. If one wishes to use a relay which does not open when the coil voltage falls to this value, one should include either a low voltage zener diode in between the relay and pin 1 or alternatively up to three forward biased silicon diodes so that the quiescent voltage across the relay is reduced to below +2V.

General Comments

Good decoupling is very desirable with such a high gain circuit. The electrolytic decoupling capacitors (6·8μF) suggested are much higher than would be used when the LM1808 is used as an intermediate frequency amplifier simply because the operating frequency in this ultrasonic application is much less than in the television application for which the device is primarily intended. The LM1808 has been designed for use from a 24V supply, but the +16V supply has been found to be suitable for this application.

As shown in Fig. 5, the SEO5B 40R transducer is sharply resonant when no load is connected across it. In the circuit of Fig. 3, however, the resistor R2 is effectively connected across the transducer and reduces its mechanical Q factor so that the matching of the transmitter and receiver resonant transducer frequencies becomes much less critical. This resistor is, in any case, required to provide the appropriate bias as already discussed.

The volume control section of the LM1808 device is not employed in this application. The power amplifier section of the LM1808 incorporates protection both against short circuiting of the output and against an excessive rise in the temperature of the silicon chip. The use of the resistor R1 in Fig. 3 is essential, since the voltage at pin 6 is stabilised by the internal circuit at between 10·5 and 12·5V and no attempt must be made to try to increase the potential of this pin above the stabilised value.

The Relay

The LM1808 device can switch enough power to operate a substantial relay of the type which often fits into an octal socket. The coil resistance should not be less than about 120Ω so that the current from pin 1 is kept to a reasonable value and dissipation in the LM1808 is minimised. However, this enables a relay to be used which can switch up to about 10A at reasonably high a.c. voltages.

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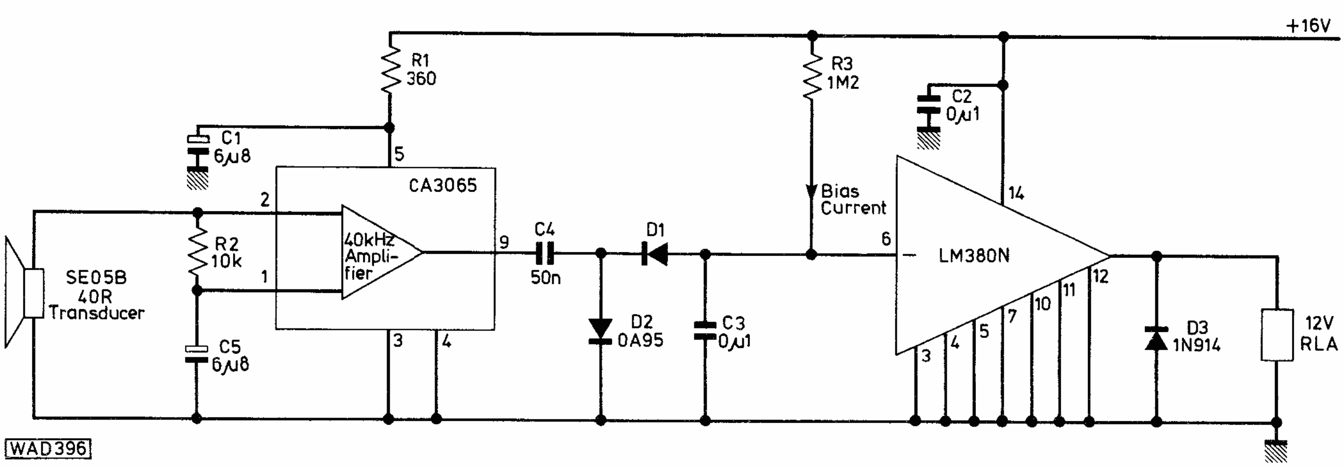


Fig. 4: Circuit using the 3065 and LM380 integrated circuits

Changes in BROADCAST-BAND LISTENING on Short Waves

PART 2

Jonathan MARKS

One point which soon becomes apparent when tuning in to short-wave broadcasting stations is the overcrowding problem. Thousands of stations are competing for only a few frequencies, with resulting mutual interference. The problem is not helped by the presence of jamming transmitters which "broadcast" white noise or distorted music thus blocking a large number of frequencies. Their existence is due to politics and the fear by some governments that listeners will tune in to broadcasts from abroad which disagree with the party line.

Hopefully, the situation should improve with the World Administrative Radio Conference (WARC) 1979 in Geneva which will re-examine frequency allocations. Some are optimistic, forecasting a doubling of existing broadcasting space. But one wonders whether all the military and point-to-point services will be quite so eager to give up their s.w. frequencies in favour of satellite links, as the optimists suppose.

In 1977, the Home Office invited members of the public to send in their suggestions and observations for WARC. Two prominent British clubs, the World DX Club and the Twickenham DX Club, accepted this offer and a number of their members, professionally involved with radio communications, got together to compile a 39-page document of proposals, including a survey of active jamming stations in the broadcast bands. This has since been submitted to the Home Office for examination.

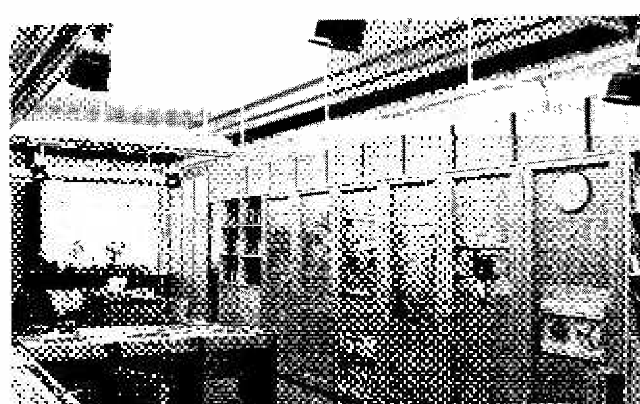
Studios and Equipment

The s.w. stations themselves seem rather optimistic about the media's future. Some still run from ancient studios far inferior to those used by their country's domestic service, yet the standard of presentation is often amazing. In the past five years though, many stations have moved to more modern studios or have renovated the old ones. The Austrian Radio External Service for example, moved in 1976 from wooden "barracks" in down-town Vienna to brand-new studios in the television centre, making it one of the most modern stations in Europe. Likewise, Adventist World Radio in Portugal uses extremely expensive studio facilities to make its religious programmes. Meanwhile at Radio Budapest, work goes on to convert an old tenement block near the broadcasting house into studios for the s.w. service.

All international s.w. stations use reel-to-reel tape machines running at a speed of $7\frac{1}{2}$ or 15 i.p.s. (19 or 38 cm/s), a point to bear in mind if you ever send a station a tape, as few can accommodate the domestic $3\frac{3}{4}$ i.p.s. (9·5 cm/s) very easily. In addition, the Voice of America in Washington uses instant-start cartridges for correspondents' despatches during news programmes, in order to facilitate easy "flow" and fast continuity. The identifying signals which most stations use before each transmission, to help the listener tune in, are also on endless-loop cartridges, being triggered automatically if the landline from the studio fails. In most cases, stations keep a recording of their output using a very slow-speed tape machine. Tape is usually kept for about a month before being erased, while written scripts are filed for between two and four years.

Broadcast channels on s.w. are 5kHz apart, which means the audio range a station can put out is very limited and far from hi-fi. Still, this is perfectly adequate for speech, which forms the main output from most stations. Music does suffer, however, not only because of the limited audio range, but also because the ionosphere itself introduces fading and phase distortion which sometimes make listening to music programmes very trying.

To help punch their signals through the noise more clearly, most s.w. stations employ compressors and filters before the signal from the studio is fed into the transmitters. The compressor is designed in the same way as the automatic level control in a tape recorder, turning the studio signal level up on quiet music passages and down again during loud orchestral sequences. This ensures that the transmitter is almost 100 per cent modulated (i.e. working at maximum efficiency) for most of the air-time. The filters cut the upper audio frequencies, which are not permitted if the station is to remain within the 5kHz channel allocation. Some stations also boost the remaining treble frequencies to enable voices to be more easily understood through white-noise jamming.



Austrian Radio continuity suite (SW Service). Note the slow-running tape machine under the clock for 24-hour recording of studio output

Photo courtesy ORF, Vienna

Transmitters

Short-wave stations these days find themselves in an unofficial power race whether they like it or not. Ten years ago, stations with 100kW were giants, now 500kW is thought by many to be the normal working power for each transmitter! Such high power operation brings its own headaches. Getting a reliable high voltage power supply is often difficult and running costs are high. Electric arcing in the final power stage of these huge transmitters, where the anode is at a potential of several kilovolts, is a serious problem: HCJB, a religious station in Quito, Ecuador, has had to redesign a new 500kW transmitter to prevent arcing when it is used at exceptionally high altitudes up in the Andes mountains. There have been a number of cases where engineers have received lethal shocks while undertaking maintenance on the transmitter or aerials. Sometimes a transmitter has been overloaded and caught fire!

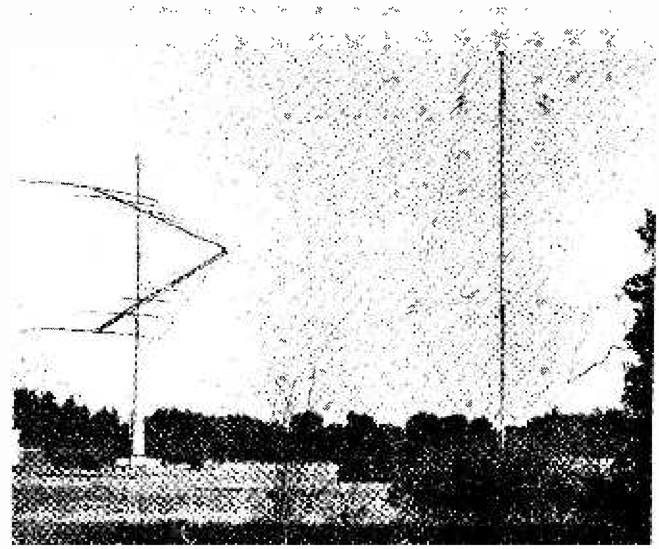
Choosing a transmitter site presents further problems. Ideally it should have a high water table for good soil conductivity, something which FEBA in the Seychelles solved by putting the antennae on the beach! For the majority of broadcasters though it means a compromise. Quite often there is fierce hostility from local residents near the transmitters when they discover the station's output breaking through over their hi-fi equipment or causing weird effects on electrical equipment. One landlord in the Netherlands though, whose pub stands not far away from Radio Nederlands transmitting complex in Lopik, tuned up a number of coils of wire, connecting the ends to light bulbs. The strong radio frequency power in the vicinity is enough to provide him with free lighting 24 hours a day!

Once on the air, the engineers have to make sure that the transmitters remain on the correct frequency without wandering and are not putting out a distorted signal. Hence most broadcasting organisations run a monitoring service in another part of the country. This set-up checks the station's output regularly and, in the case of s.w. monitoring, is often done for other stations abroad on an exchange basis. Probably the most famous monitoring station in the world is at Caversham, near Reading, home of the BBC Monitoring Service, which not only does the former tasks but also monitors the content of news bulletins from s.w. stations abroad to provide a very important independent news source.

In order to overcome some reception problems in distant countries, several stations have constructed relay transmitters nearer the target zone. Deutsche Welle, the Voice of Germany, for example, serves much of its African audience via transmitters in Kigali, Rwanda. These remote transmitters are fed by landline, s.w. single sideband links, or more recently via satellite. However, the relay bases bring with them problems, when some governments suddenly object to the presence of foreign transmitters in their country, putting out material over which they have no control. This has happened in many cases, notably between China and Albania. Radio Peking has been using the transmitters of Radio Tirana, Albania, for many years for broadcasts beamed to North America. At the beginning of 1978, however, relations between the two countries became strained and in July the relay of Peking was stopped by the Albanians. Whether it will ever start again depends on politics.

Future Developments

So what of the future? At present some broadcasters are looking towards single sideband (s.s.b.), a mode of transmission which amateur radio operators have been using for years. The advantages include reduced



Two aerials at the Austrian Radio Transmitting Centre in Moosbrun, Lower Austria. On the left, a log-periodic for beaming signals to distant targets, on the right an omni-directional cage antenna for European broadcasts

Photo courtesy ORF, Vienna

bandwidth, the possible use of less transmitter power, and clearer music and speech which is less susceptible to distortion by the ionosphere on the signal's path between transmitter and receiver. But there are problems. For the SWL it means a new receiver with an extremely stable reference oscillator to receive the transmissions, far more stable in fact than SWLs use to listen to s.s.b. on the amateur bands. For if the receiver drifts only slightly during a musical programme the music changes key and the results are awful! Technology is there to overcome this, but at present it is expensive. So for the time being, s.s.b. broadcasts from stations such as the Swiss Broadcasting Corporation are experimental and beamed to North America, where listeners own the most up-to-date equipment. Meanwhile, ordinary a.m. broadcasts will remain for a long time yet, especially to developing countries.

However, there might be a rival to s.s.b., the so-called digital system, and experiments are at present under way. Here, the studio signal is analysed, broken down into very small time segments, and the amplitude of each segment is then described in number form. These numbers or digits in the form of tones, are then broadcast by the s.w. transmitter. The receiver at the other end performs the reverse process, using the digital information to reconstruct the studio signal. The results are an excellent quality signal instead of the usual clipped and distorted transmission via conventional means, with superb fidelity and the minimum of interference. Of course, it needs a special receiver to pick up digital broadcasts, but then so does s.s.b., and with most of the money these days in digital research, integrated circuits for digital radios could beat s.s.b. research to the post.

Other ideas include programme labelling. A frequency modulated (f.m.) signal is encoded into the original amplitude modulated (a.m.) signal, which would not interfere with the programme material on existing sets. Cheap, simple circuitry could be incorporated into the average radio to identify the encoded f.m. signal and by changing the form of the latter with each language you could programme your s.w. radio of the future to check, for example, all the English-language broadcasts in the 49 metre band at any particular time. The technology for this is already with us!

continued on page 64

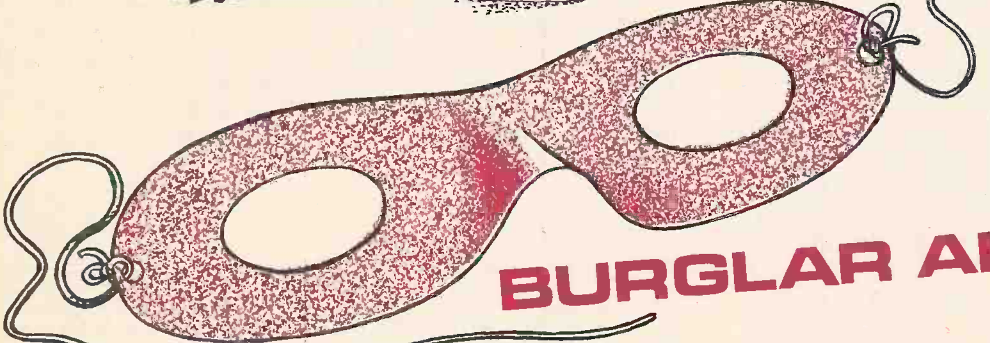
NEXT MONTH IN...

practical WIRELESS

SPECIAL PULL-OUT FEATURE

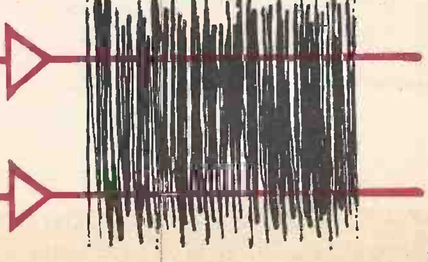
YOUR HOLIDAY radio & tv guide

Do you have trouble finding your favourite radio programmes when you are sitting sunning yourself on the beach? Then you definitely need our guide to help you tune into the local transmitter. National and local radio stations as well as TV transmitters are pin-pointed on our special maps.



Stop Thief!! A new series describing not how to build a simple alarm that wouldn't stop a granny, but how to design an effective and *individual security system.* Basic approach, devices and installations (basic or to BSI standard) are discussed in detail.

BURGLAR ALARMS



BUILDING DISCO CABINETS

Automatic Intercom

PART 1

Keith CUMMINS

Are you embarrassed and annoyed to be dragged away from a good book or your favourite programme only to find that your caller is a smooth-talking hawker, intent on selling you something you cannot afford and don't even want? If you are, or you want simply to tackle an interesting and reasonably technical project that will provide an additional and useful facility about the house (or that of an elderly relative, perhaps?)—you might consider getting your tools together and starting work on *PW*'s Automatic Intercom.

The system is designed to provide two-way speech, completely automatically, between the front door of a house and a convenient position inside; the lounge or kitchen, for example. The remote door-unit originates an electronic call-tone which gives instant warning of the caller's presence. The occupant, having determined the visitor's identity, can then decide to open the door or otherwise as he sees fit.

Enhanced Security

The intercom affords obvious advantages, foremost among these, naturally, being that of enhanced security for one's home and family. One is able to diplomatically discover a caller's name and the purpose of his visit without opening (or even approaching) the front door—an important consideration in these days of increased petty crime. Therefore the system described in this article is worthy of serious consideration, particularly if you own one of those modern, mainly-glass front doors that were designed to be aesthetically pleasing rather than as an effective barrier to entry. If the logic of fitting good locks and chains to a structurally weak door is lost on you as well as on me, this system may provide a reassuring answer! You may even find that, after dark, the illuminated door-unit will, in itself, act as a deterrent to the nuisance caller. The implications to the elderly or chairbound are quite obvious, particularly when all that is necessary is to keep within reach of a microphone.

Automatic

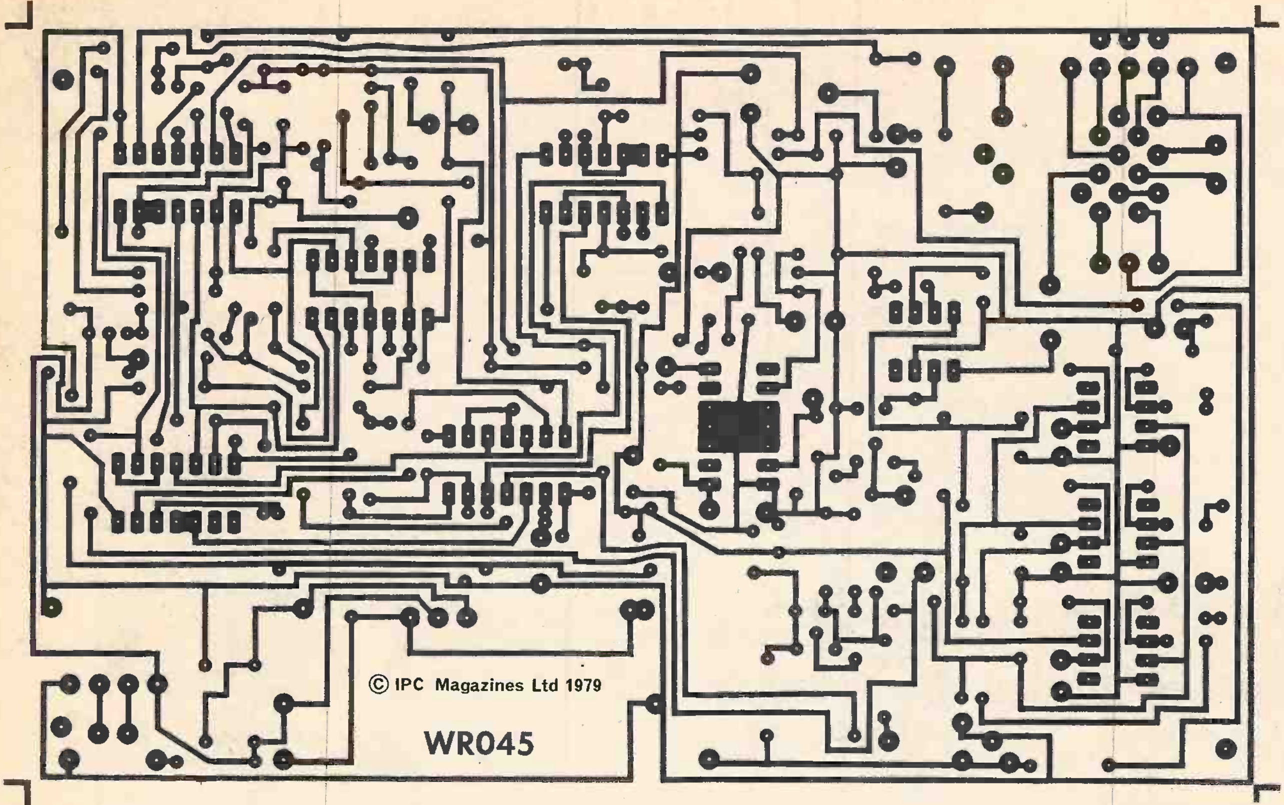
Why *automatic?* Mainly because under most conditions, the caller having "opened" the system with his push at the door-unit button, there will be no further need for a lot of fiddly button-pressing, in order to conduct a normal visitor-occupant chat. The direction of speech is determined by the system itself sensing whether it is the caller or the occupant who is doing the talking, changing the speech-flow accordingly and closing the system down fifteen seconds after conversation ceases. The system will not then reopen without another push at a button—so if a motor-mower is being used a few feet from the door-unit, its melodic rattle will not be unavoidably relayed into the house interior!

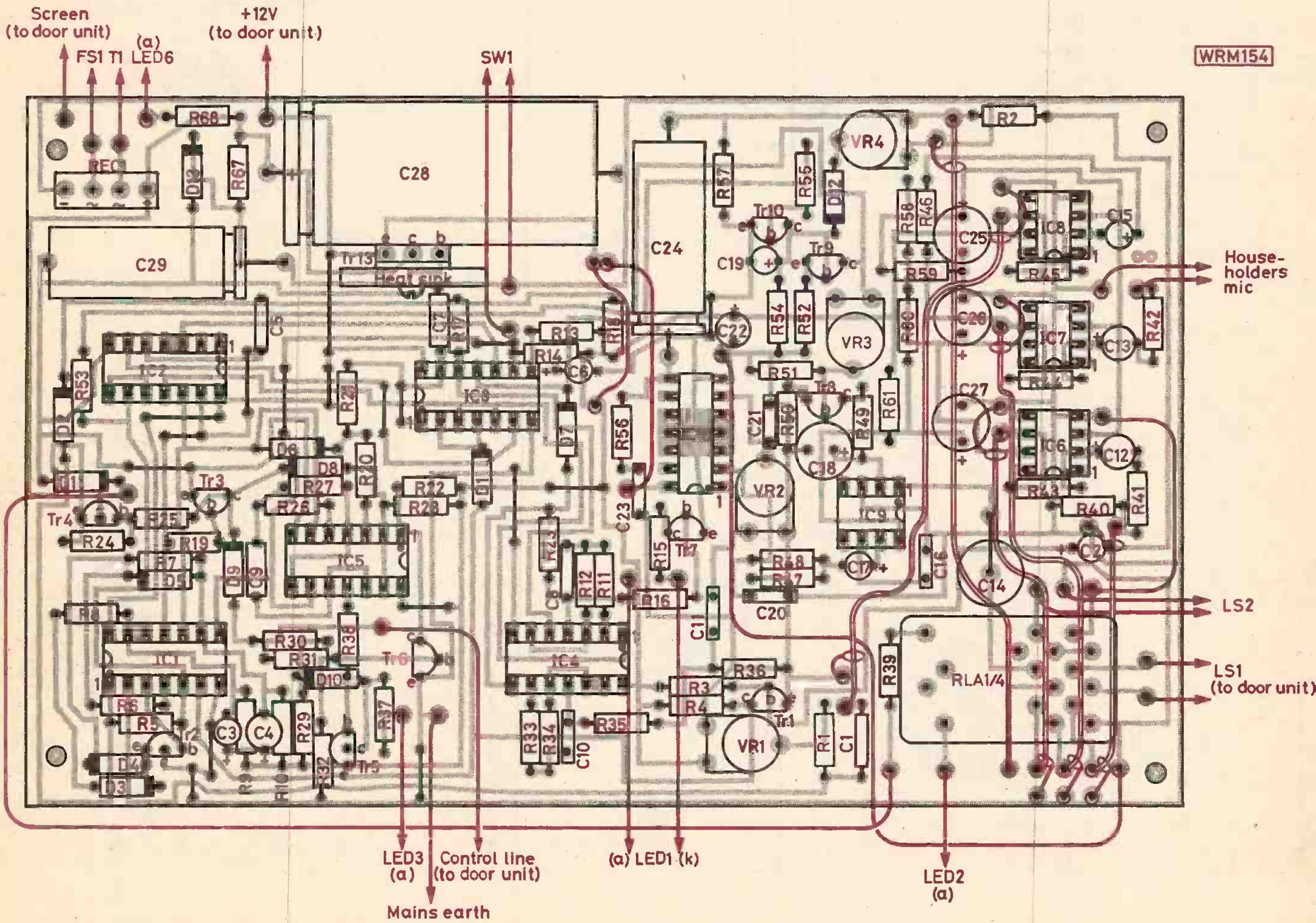
Other worthwhile features include a manual override button on the indoor main unit so that events on the door-step can be monitored or, alternatively, so that it is always the householder who has the last word! The system also incorporates an automatic gain control which will maintain a nearly constant volume under practical conditions—two potentiometers enable the a.g.c. characteristic to be "trimmed" to suit a particular environment, be it central London or a rustic porch. If someone calls while you are out, the event is "remembered" and a flashing "call" indicator remains flashing until cancelled by the householder, on his return.

Integrated Circuits

The reader will probably appreciate that, to provide the facilities and automatic control described is a complex process. In fact, the intercom is rendered practically viable and cost-effective only by the use of integrated circuits—ten i.c.s are used, five in the control logic and five in the audio circuitry. Fortunately, most of these are reasonably priced; the CMOS chips particularly so.

Two considerations led to the choice of CMOS devices: the high input impedance allows for simple long time-constant circuits, and a common +12V supply can be used for both logic and audio components. Transistors





Printed circuit board details for the main unit. The copper track pattern is shown full-size at the top with the component placement drawing underneath. Note: C17 is a non-polarised ceramic capacitor

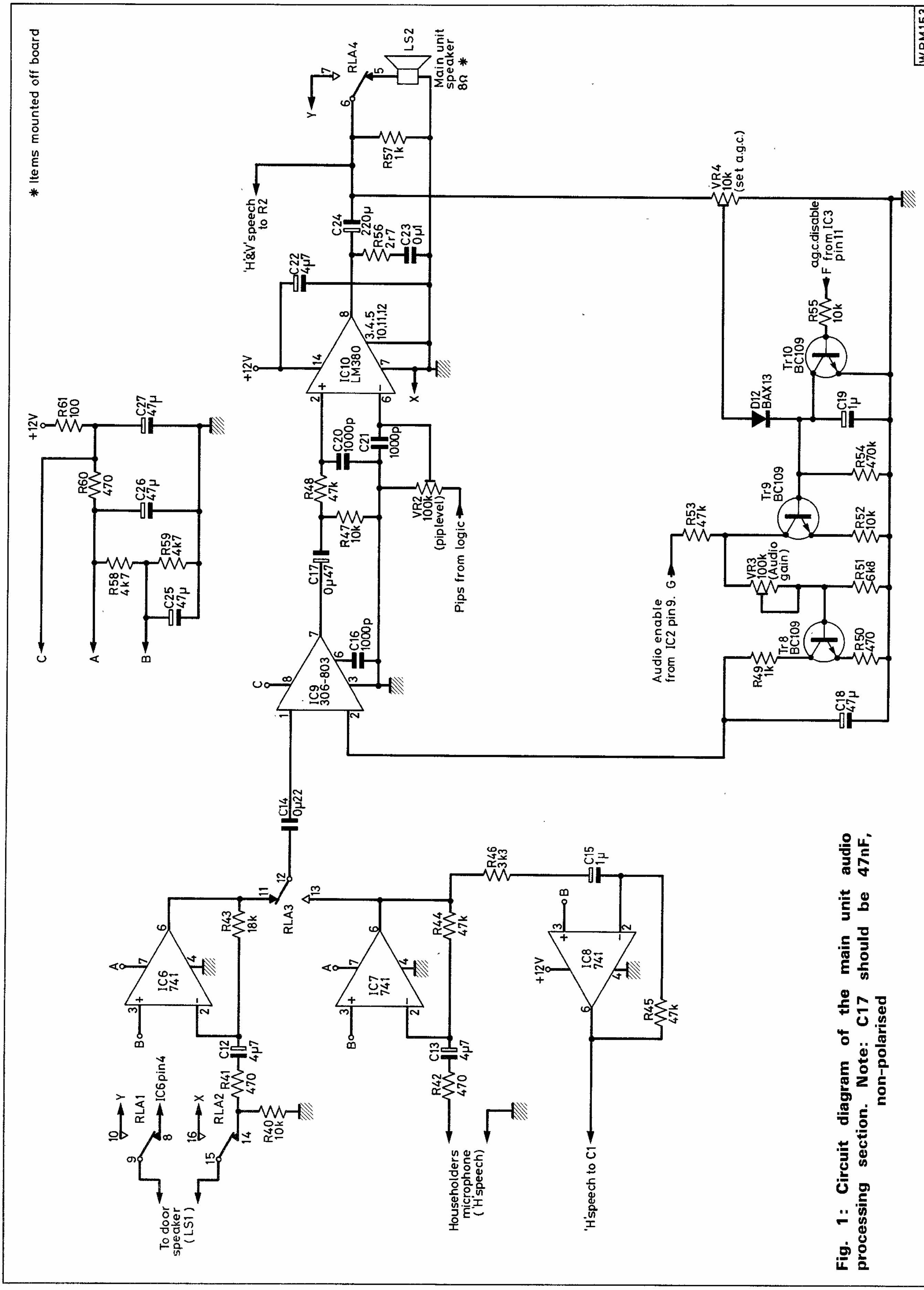


Fig. 1: Circuit diagram of the main unit audio processing section. Note: C17 should be 47nF, non-polarised

are used peripherally to buffer the CMOS logic and to perform certain functions in the a.g.c. circuitry.

As a constructional project, the intercom provides an interesting combination of digital and analogue techniques—not all constructors are familiar with both, and either may present "new ground". It is convenient that, for ease of description, the circuit may be broken down into these same two areas: control and call-tone generation (digital) and the audio-processing components (analogue). The audio circuit is shown in Fig. 1 and is mounted, together with the logic components, on the p.c.b. within the main unit.

Door unit

However, before considering these major areas of the design, it would be best to deal with the much simpler door-unit (Fig. 2) and the cable which connects it with the main unit. Five connections are required between the door and main units and these are conveniently provided by a screened four-core cable; care was naturally taken to devise a system which depends upon only a single cable connection between the two units. The screen is used, fairly obviously, to provide a common earth connection between the units: the four inner conductors provide a speech pair (kept separate from other functions in order to avoid noise and hum), the +12V supply and the "control line", which conditions the logic in the main unit and provides the appropriate indications to the caller.

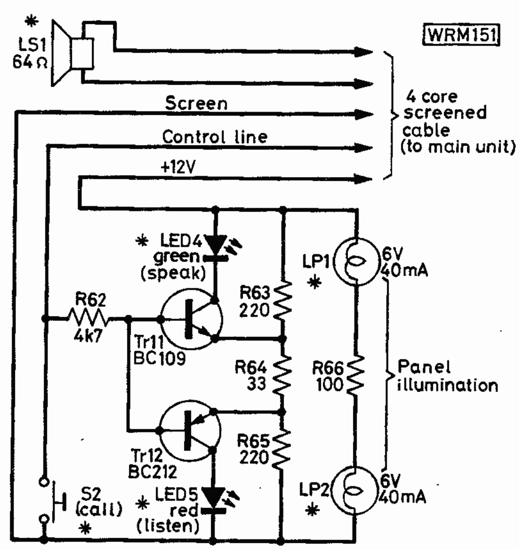


Fig. 2: Circuit of door unit. Starred items are mounted on front panel

The unit itself consists of a 64Ω loudspeaker (doubling as a microphone), the indicator circuit which responds to the d.c. voltage present on the control line, and the power supply to the two 6V lamps.

In the quiescent "standby" condition, the control line is at approximately +6V ("half-rail"). If it moves positively (towards "rail"), Tr11 turns on and LED4 lights, whereas if it moves negatively (towards earth) Tr12 turns on and LED5 illuminates; thus "Speak Now" and "Listen" are signalled to the caller. Push-button S2, which the caller presses on first arrival, short-circuits the control line to earth causing the "Listen" l.e.d. to light and the logic circuitry in the main unit to produce the call-tone, alerting the attention of the householder. Resistors R63, 64 and 65 bias the emitters of Tr11 and Tr12 slightly either side of +6V; therefore, if the control line is at half-rail neither l.e.d. illuminates. R62 limits the base current in these two transistors. R66 reduces the applied voltage to the 6V lamps in order to increase their life.

Audio

The audio circuit is shown in Fig. 1, and uses three 741 op. amps (IC6, 7, 8), an MC3340P variable attenuator (IC9) and an LM380 as the audio output chip (IC10). IC9 is controlled by Tr8, 9, 10 and provides the a.g.c. The direction of speech through the system is switched by a miniature relay, RLA, and its contacts are all shown in Fig. 1. Their method of connection has been carefully chosen to avoid feedback problems—for example, the earth return of the door-unit speaker is switched through to the earthing of the output chip IC10, and contacts RLA1 and RLA4 are effectively in cascade when the door speaker is used as a microphone, resulting in excellent isolation between input and output.

With RLA de-energised, the 64Ω door speaker is used as a microphone and is connected to earth and the inverting input of IC6 via R41 and C12. The gain of IC6 is determined mainly by the ratio R43:R41—in this case, approximately 32dB. It is contact RLA3 which connects the output of IC6 to the input of IC9, the variable attenuator, and thence to the output stage and the main-unit speaker, via contact RLA4.

Considering the circuit in greater detail, the three 741 op. amps have their non-inverting inputs biased to half-rail by the common divider network R58-59, this bias rail being decoupled by C25. Because all the inverting inputs are a.c. coupled, the outputs will stand at half-rail because of the 100% d.c. feedback applied through R43, 44 and 45. As the difference in d.c. voltage between the outputs of the three op. amps is therefore negligible, the input to IC9 via C14 can be directly switched by contact RLA3 without clicks in the audio output.

The speech from the door-unit ("V" speech) is amplified by IC6 (32dB) and that from the householders microphone ("H" speech) by IC7 which is arranged to have a higher gain (R44:42 ≏ 40dB). An output additional to that which is fed to IC9 via contact RLA3 is taken to IC8 which provides another 23dB gain. Thus "H" speech from the microphone, amplified by a total of 63dB, it taken to the logic circuits (via C1) which recognise its source and energise RLA. The contacts of RLA then route the speech so that the householder can address the caller.

Automatic gain control is accomplished by IC9 (more of this later) before the signal is passed to the non-inverting input of IC10 via C17, R47, R48 and C20 which form an audio filter restricting the speech bandwidth roughly to the limits imposed by a normal telephony system. C17 and R47 attenuate low frequencies while R48 and C20 form a low-pass filter with a cut-off frequency of around 3kHz. The output from IC10, which has a gain of the order of 50dB, is fed via contact RLA4 to whichever speaker is selected by the logic—naturally, these are both inductive loads and the Zobel network R56/C23 compensates for this so that the LM380 sees a constant and resistive load. An additional output from IC10 is taken to the logic circuits so that the end of speech in either direction is recognised, and the system returned to the "standby" mode 15 seconds later. The LM380 is also used to amplify the pips generated by the logic when S2 is operated by a visitor; they are fed via VR2, the pip volume control, to the inverting input of IC10 avoiding the need to buffer both pips and audio.

Resistors

¼W 5%

2·7Ω	1	R56
33Ω	1	R64
100Ω	3	R39, 61, 66
220Ω	4	R15, 37, 63, 65
470Ω	7	R8, 30, 41, 42, 50, 60, 68
1KΩ	4	R24, 49, 57, 67
2·2kΩ	2	R7, 32
3·3kΩ	2	R25, 46
4·7kΩ	5	R29, 31, 58, 59, 62
6·8kΩ	2	R2, 51
10kΩ	10	R6, 16, 19, 21, 36, 38, 40, 47, 52, 55
18kΩ	1	R43
47kΩ	5	R34, 44, 45, 48, 53
100kΩ	10	R4, 11 14, 17, 20, 22, 23, 26, 28, 33
470kΩ	3	R3, 35, 54
1MΩ	4	R1, 12, 13, 18

¼W 10%

1·5MΩ	3	R5, 9, 27
3·3MΩ	1	R10

Potentiometers

Miniature pre-sets (horizontal mounting) 0·1W

10kΩ	1	VR4
100kΩ	3	VR1, 2, 3

Capacitors

Ceramic

1nF	4	C11, 16, 20, 21
10nF	1	C10
22nF	1	C8
47nF	1	C17
0·1μF	4	C1, 5, 7, 23

Polycarbonate

0·22μF	1	C14
0·33μF	1	C9

35V tantalum bead

0·22μF	1	C2
0·47μF	2	C3, 6
1μF	2	C15, 19
4·7μF	4	C4, 12, 13, 22

16V electrolytic

220μF	2	C24, 29

25V electrolytic

47μF	4	C18, 25, 26, 27
2200μF	1	C28

Semiconductors

Integrated circuits

LM380	1	IC10
MC3340P	1	IC9
741	3	IC6, 7, 8
4000BE	1	IC2
4011BE	3	IC3, 4, 5
4093BE	1	IC1

Light-emitting diodes

3mm yellow	1	LED6
5mm green	2	LED2, 4
5mm red	2	LED3, 5
5mm yellow	1	LED1

Diodes

BZY88C12	1	D13
1N4001	12	D1-12

Transistors

BC109	8	Tr1, 3, 6, 7, 8, 9, 10, 11
BC212L	4	Tr2, 4, 5, 12
TIP31	1	Tr13

Bridge rectifier

BY164	1	REC1

Switches

Min toggle s.p.d.t.	1	S3
Push-to-make, s.p.	2	S1, 2

DIL sockets

8-way	4	for IC6, 7, 8, 9
14-way	3	for IC3, 4, 5
14-way (low-profile)	2	for IC1, 2

NB: IC10 is soldered directly to the p.c.b.

Miscellaneous

64Ω 66mm dia. loudspeaker (1). 8Ω 5in × 3in loudspeaker (1). Mains transformer 14V 1A (Greenweld XO27 or similar) (1). 200Ω microphone (1). Cases—188 × 110 × 60 (Vero 65-2522K or similar) (1). 120 × 98 × 45 (Greenweld V216, 219 or similar) (1). "Continental" type 185Ω 4-pole c/o relay (1), plus 0·1in p.c.b. mounting socket (1). 6V 0·36W T1½ L.E.S. lamps (2), plus clear lampholders (2). 400mA 20mm antisurge fuse (1), plus holder (1). Main unit p.c.b. (1). Door unit p.c.b. (1).* Equipment wire for interconnections, sleeving, terminal pins, 3-core mains lead, 4-core screened cable for interconnecting units, grommets, polystyrene foam, aluminium strip, nuts, bolts, washers and adhesives as required.

* Door unit components can be constructed onto Veroboard if desired.

Gain control

Now we come to the a.g.c. circuit. A third output from IC10 is taken to VR4 ("Set a.g.c.") and is then rectified by D12, charging C19 to a voltage proportional to the speech level—but only if Tr10 is not turned on. The a.g.c. must be disabled while the call-pips are being produced so that C19 does not become overcharged. If this occurred and the householder answered immediately, his speech would be severely attenuated before the a.g.c. system recovered. Tr10 is therefore turned on by the logic while the pips are being produced, effectively disabling the a.g.c. system and avoiding the problem.

The overall gain of the speech path depends on the d.c. potential applied to pin 2 of IC9, for it is this that determines the gain of the device. When the system is activated, either by a caller at the front door or by the householder pressing the "override" button on the main-unit, the logic sends an "audio enable" command to the a.g.c. circuit. This takes the form of approximately +11V (or logic "high") applied to the base of Tr8 via R53 and VR3; Tr8 then turns on to a degree determined by the setting of VR3, pulling down the potential on pin 2 of IC9 and enabling it to pass the audio signal to the input of IC10. It is, then, this conduction through Tr8 that determines the gain of IC9 and therefore VR3 is the master gain control of the system. The voltage across C19, which depends on the signal voltage rectified by D12, progressively turns Tr9 on, reducing the voltage at the junction of R53 and VR3 and turning Tr8 off, consequently lowering the overall gain. The degree of volume compression (or the percentage change in the system gain brought about by a given rise or fall in the audio level at the output of IC10) is set by VR4 ("Set a.g.c.").

Of course, it is not simply the degree of a.g.c. that is important, but the manner in which it is applied. Obviously, it is necessary for the a.g.c. to react quickly to a sudden increase in volume (i.e. have a fast attack) and to decay at a slower rate; this is so that each syllable is not attacked individually. This produces a most unnatural effect! C18 has been chosen, together with C19, to produce the required a.g.c. characteristic.

Power Supplies

Before passing on to the logic itself, it might be best to briefly consider the power supply arrangements as these are fairly standard and uncomplicated, using a Zener-stabilised emitter-follower as a series regulator. The circuit is shown in Fig. 3.

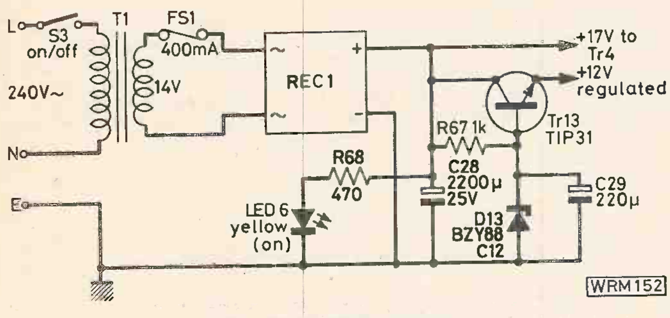


Fig. 3: Power supply

Approximately 14V a.c. from the mains transformer T1 is rectified by REC1 to produce a +17V supply, smoothed by C28. This 17V directly feeds the coil of RLA, the collector of Tr13 and also supplies the current feed to the Zener D13 via R67. It is the stabilised voltage across D13 further smoothed by C29 that is applied to the base of Tr13—the stabilised +12V is then obtained from the emitter of Tr13.

It is also worth noting the rail filtering network (Fig. 1) (R61, C27, R60, C26) which supplies the early stages of audio amplification. It is required in order to prevent feedback snags and "glitches" from the logic which would produce clicking in the audio output.

Next Instalment

The project is concluded in Part 2, in which we shall describe the operation of the logic side of the system. The second instalment will also include the constructional drawings and details of how to set up the intercom on completion.

Follow-up to THE PW VMOS TRANSMITTER

Readers who are building the Top-Band VMOS Transmitter featured in our July issue may be interested in the arrangements made on the prototype for push-to-talk operation, via the 4-pole microphone input.

The best way of incorporating this facility would be to use a miniature changeover relay of the Siemens type and to switch the 0V to ground via the push-to-talk switch embodied in the microphone case. Where the microphone lead is supplied with separate insulated conductors for this purpose—ie. where there is no common connection to the audio circuit—it is possible to switch the 12V supply directly. However, having regard to the possibility of a fault condition causing heavy current to flow, the best approach would still be to employ a relay for this function.

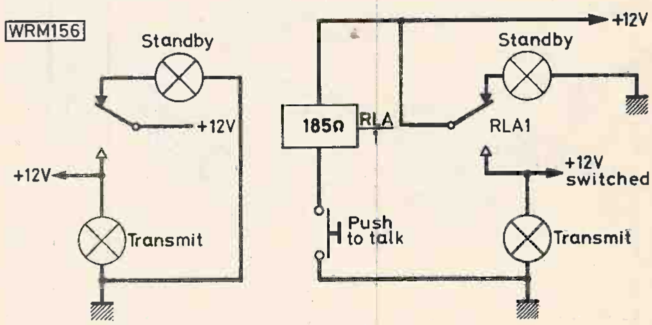


Fig. 1: (Left) Simple toggle switch wiring. Fig. 2: (Right) Wiring for p.t.t. facility using a relay

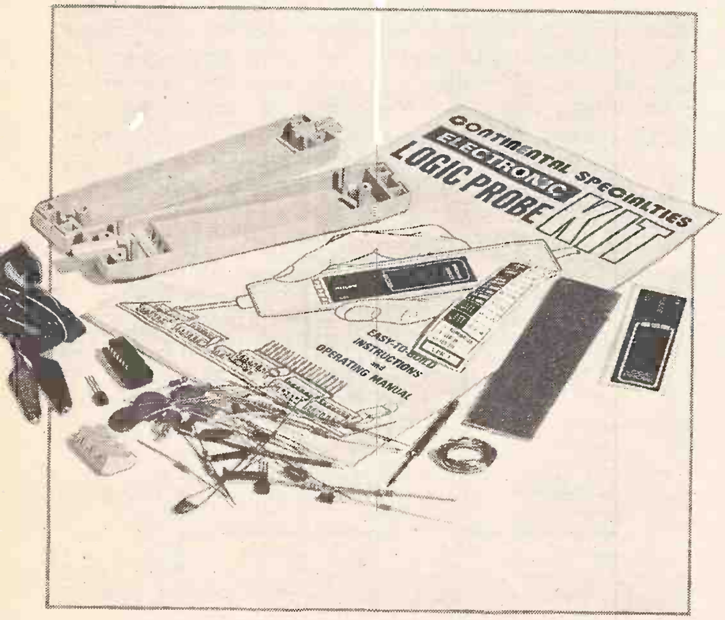
In the drawings, Fig. 1 shows the simple wiring of a toggle switch which is used to key the transmitter. If p.t.t. is required, Fig. 2 should be used as a working basis. The 4-pole socket can be any suitable type, such as a Tuchel or similar Japanese equivalent, often fitted to Trio or Yaesu transceivers and readily available as a "service spare." ●

DUE TO THE RECENT INCREASE IN VAT, READERS SHOULD CHECK WITH ADVERTISERS FOR CURRENT PRICES

SPECIAL INTRODUCTORY OFFER

Logic Probe Kit

Checking out digital circuits can be very difficult especially if they are complex and operate at high speeds. The usual test gear available to the amateur is not ideal as the main interest lies in edges and pulses and changes of logic states rather than analogue signals and voltages. Hence the multimeter and single beam scope are of little or no use in troubleshooting the problems of these circuits.



★ Specification

Input impedance: 3kΩ.
Detectable pulse width: 300 nanoseconds minimum.
Threshold: Logic '1' 0·7 Vcc.
Logic '0' 0·3 Vcc.
Input frequency: 1·5MHz maximum.
Input voltage: ±50V continuous. 120V a.c. for less than 15 seconds.
Pulse detector: High-speed pulse train or single events (positive or negative transitions). Active pulse stretcher 0·1 seconds.
Power: 5V Vcc at 30mA or 15V Vcc at 40mA. 25V maximum, Reversal protection.
Physical size: 147 x 25·4 x 17·8mm, weight 85 grams.
Power leads: 61mm with colour coded insulated clips.

A logic probe is the answer enabling you to rapidly check the logic conditions at any point on the circuit. These probes are normally expensive but with the introduction of the CSC Logic Probe Kit LPK-1 it is now within the budget of most enthusiasts to own one of these useful tools.

Practical Wireless reviewed this kit in the July issue and found it to be easy to build and extremely useful when completed. The indication of the state of the test point is by three l.e.d.s.

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Cut Round Dotted Line

BI-FET Integrated Circuits

D. F. BOWERS B Sc

Although the MOSFET has made a tremendous impact upon digital i.c. design, the benefits of f.e.t.s to linear i.c.s have not been forgotten.

The junction f.e.t. is the most common device in linear applications, but until recently f.e.t.s integrated on the same chip as bipolar transistors have been noted for their unpredictable characteristics. Although monolithic devices, such as operational amplifiers, have often incorporated JFETS in their design, their use has generally been restricted to such applications as constant-current generators—as in the case of the 301 and 4136. Operational amplifiers requiring the very low input currents which JFETS can offer have usually been hybrid types, where the f.e.t.s are diffused on a separate piece of silicon, although there have been monolithic devices, such as the μA740 and NE536, with less-than-ideal d.c. characteristics.

The development of the BI-FET process has done much to alter this situation, but before going into more detail, it is worth examining the benefits f.e.t.s can provide.

It has already been stated that the very high input impedance exhibited by the f.e.t. can reduce the input currents of operational amplifiers to mere picoamps. Additionally, the f.e.t. has a much lower transconductance than the bipolar transistor which, although poor from the d.c. characteristics aspect, makes a significant increase in speed possible. More speed can be obtained by replacing slow, lateral *pnp* transistors with *p*-channel JFETS or MOSFETS. Furthermore, f.e.t.s make excellent current sources, a feature which is fully exploited in i.c. design to improve the gain of common-emitter stages, the linearity of common-collector stages and the rejection capabilities of long-tailed pairs.

Another use of the f.e.t. is as an analogue switch—a characteristic used extensively in the design of multiplexers, chopper amplifiers and sample/hold devices. In short, the f.e.t. makes possible many designs which would otherwise be quite impractical using bipolar transistors.

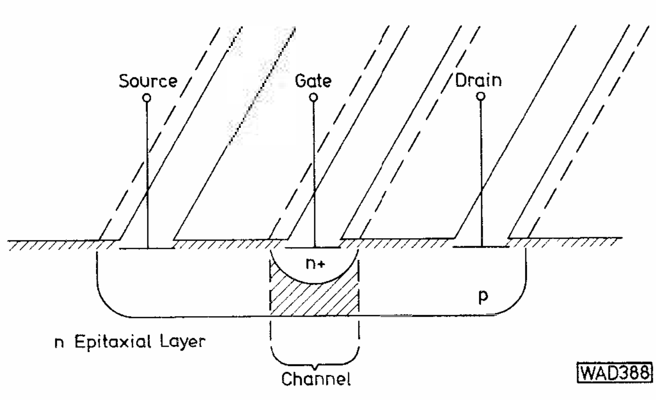


Fig. 1

The BI-FET process, introduced in 1975 by National Semiconductor, provides a means of integrating well-matched JFETS on the same silicon chip as bipolar transistors.

A typical integrated JFET, produced by the old diffused process, is shown in Fig. 1. Here the successive doping is achieved by "soaking" the silicon wafer in vapour of the required (*p* or *n*) impurity at high temperature. As can be seen, the channel thickness of the f.e.t.—a critical factor in the determination of its ultimate characteristics—is very much dependent on the diffusion length of the gate, which is difficult to control. This situation is aggravated by the necessity to produce a very thin channel to keep the pinch-off voltage (analogous to the Vbe of a bipolar transistor) to reasonable proportions.

Ion Implantation

To overcome this problem, the ion implantation process has been developed (see Fig. 2). With this system, the critical doping is achieved by bombarding the silicon wafers with a controlled flow of high-energy dopant ions, derived from an arrangement which is, in essence, a giant mass-spectrometer.

Ion implantation is in fact extremely useful wherever shallow doped regions need to be produced with high accuracy, and has applications outside the production of precision f.e.t.s.

The BI-FET Process

A typical *p*-channel JFET formed by the BI-FET (Bipolar compatible field-effect transistor) process is shown in Fig. 3. This type is the most common, since bipolar integrated circuits are almost always diffused on an *n*-type epi-layer, which forms part of the gate (the remainder being produced by implanting a thin *n*-type layer on top of the channel). This "sandwich" arrangement provides a very low pinch-off (<2V) and the implant process ensures repeatable characteristics.

Besides the extra processing steps, the only major disadvantage of the BI-FET is that the lower gate section has an increased leakage to the substrate and isolation walls, which can be troublesome at high temperatures.

Operational amplifiers can greatly benefit from the use of f.e.t.s and there are several BI-FET op. amp. families currently on the market.

The first series of BI-FET op. amps. to be introduced was the 155/156/157 range (designated 355/356/357 for commercial applications) by National Semiconductor and shown in Fig. 4. This series featured offset drifts as low as 5μV per °C and input currents as low as 30pA. The

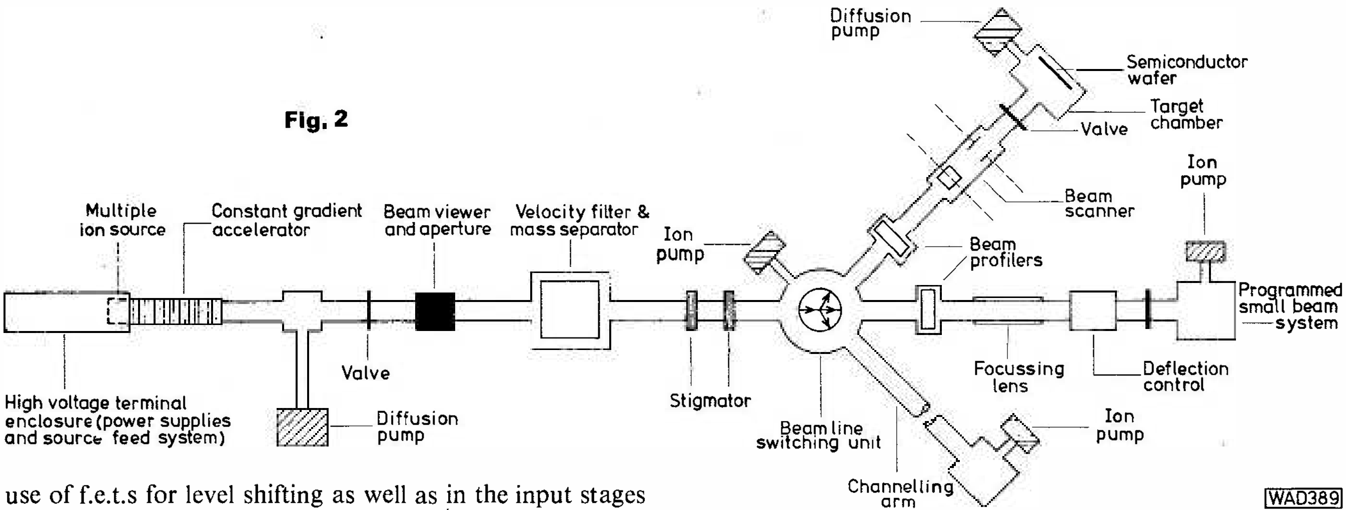


Fig. 2

use of f.e.t.s for level shifting as well as in the input stages makes the amplifiers quite fast, the 156/356 having a slew rate of 12V/µS. The 155/355 is a low power version with lower speed and the 157/357 a high-speed compensated version.

This range is now sourced by many manufacturers, some of whom have developed their own proprietary BI-FETS. Fairchild are introducing the µAF771/772/774 series of BI-FETS and Motorola have also developed devices of their own. Texas Instruments have launched a complete BI-FET family which includes low-noise devices optimised for audio applications and National have recently introduced a new low-cost series (LF351/353/347) as well as a 741 with f.e.t. input, designated LF13741.

Progress is still continuing, but two improvements are especially worthy of attention. Despite ion implantation, BI-FET operational amplifiers still have a higher input offset voltage than bipolar types, and for precision applications at the upper end of the market, both Texas and National have developed a laser-less trimming process known as "Zener-zap", which also provides offsets of less than 0·5mV for use on their proprietary BI-FET series.

Another problem is that f.e.t. input currents tend to double for every 10°C increase in junction temperature, a property which can prove awkward at high ambient temperatures or in cases where the internal (chip) dissipation rises steeply.

Fairchild produce devices with copper lead frames which act as efficient heat sinks to alleviate the latter problem and Precision Monolithics have developed an ingenious input-current cancellation system which employs current "mirrors" to lower input currents at high temperatures.

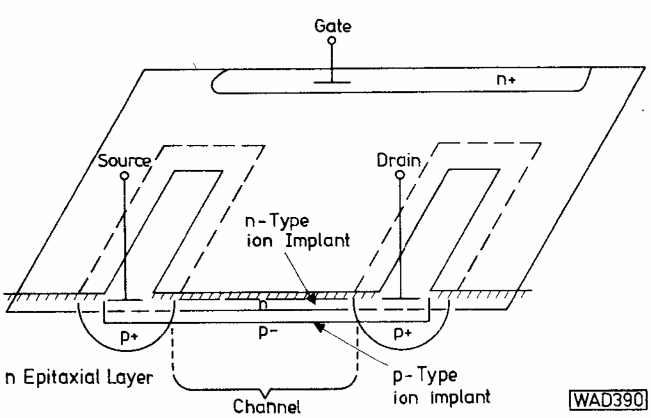
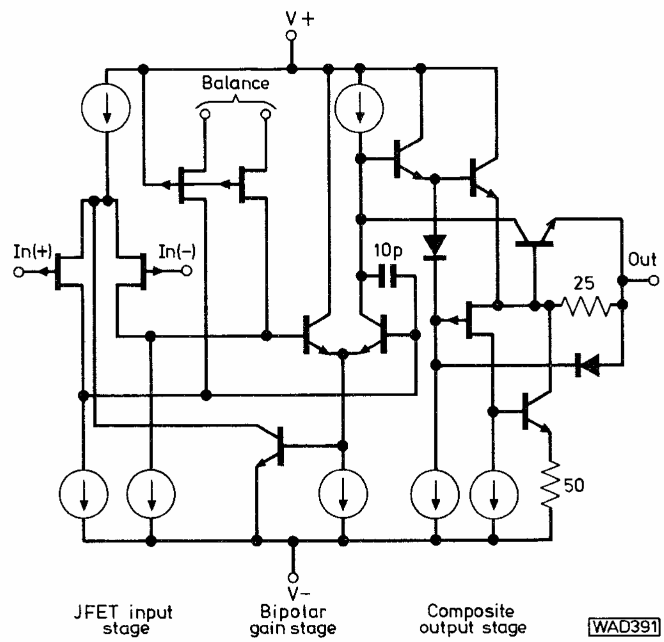


Fig. 3

Fig. 4: (Below)



Overall Impact

It can be seen that BI-FET operational amplifiers have been produced to satisfy all sectors of the industry, and it would appear inevitable that the low-cost devices will become readily available to the amateur. The advantages of high-speed, low-noise and low input currents make them eminently suitable for most general-purpose applications. It must be made clear, however, that with the larger chip area and new technology, BI-FETS will not be as cheap as 741s!

The BI-FET technology is by no means confined to the production of operational amplifiers; devices such as comparators, instrumentation amplifiers and sample-and-hold circuits have all been produced. Analogue switches are also in production and have several advantages over conventional m.o.s. types, including lower "on" resistance and freedom from static discharge problems.

It seems certain that an increasing proportion of the linear i.c. market will ultimately be claimed by BI-FETS—a view which is obviously held by the manufacturers, who are investing quite heavily in BI-FET production. ●

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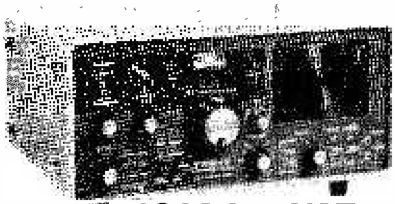

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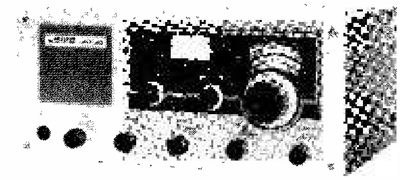

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The SRX30 is definitely not so pretty as the FRG7 and lacks the nice looks of the latter. Obviously, the manufacturers have spent less money on the front panel design and this is reflected in the price. Also, mechanically it has less of a solid feel to it. But, whichever model you choose, you'll not be disappointed. Both have passed our stringent pre-delivery tests and, yes, a few of both models do fail. So if you really want to be sure that your receiver is performing at its best, buy from us – all our staff are amateur radio enthusiasts and will ensure that the receiver you select is working as well as the one they themselves would wish to own.

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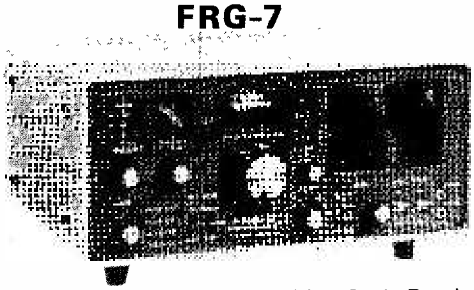

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THE PW 'TRENT' 150W BROADBAND H.F. LINEAR AMPLIFIER

PART TWO

The following data is a resumé of the basic design considerations involved in the early stages of the "Trent" amplifier.

Input Voltage Transformation Ratio

Typical values are given in Table 1, obtained from the expression $Z_{in} = R + jX(\Omega)$

In order to achieve a good match at high frequency, Z_{in} is considered at 25MHz. The *real* part at this frequency is $1{\cdot}5\Omega$, which means that for a push-pull configuration it is 3Ω between the two transistor bases.

The voltage transformation ratio is determined by

$$n = \sqrt{\frac{50}{3}} \simeq 4$$

$$n_{in} = 4$$

Output Voltage Transformation Ratio

The transistor equivalent output circuit is given in Fig. 10. With $C_c \simeq 270pF$

$$R_c = \frac{(V_{cc} - V_{sat})^2}{2P_o}$$

where V_{cc} is the collector voltage $= 13{\cdot}5V$
V_{sat} = r.f. saturation voltage $= 1{\cdot}0V$
P_o = output power for one transistor (75W)
$R_c = 1{\cdot}1\Omega$

The output transformer matches $2 \times Z_{out}$ to 50Ω for the push-pull configuration. The voltage transformation ratio is defined by

$$n = \sqrt{\frac{50}{2{\cdot}2}} = 4{\cdot}7 \simeq 5$$

In fact, it was discovered empirically that the best ratio is $n = 4$.

Transformer Types

Since the input and output transformation ratios are 4, we can use the small, practical transformer shown in Fig. 8 (Part 1). The low impedance winding always consists of one turn, which limits the available impedance transformation ratio to 1, 4, 9.

Transformer Volume Estimation

Output Transformer

The ferrite used is 4C6 material, manufactured by R.T.C., whose reference is 14/9/5 — 4C6 4322.020.97.180. The relative permeability is 120 ±20%, and dimensions are shown in Fig. 11.

Table 1

Zin = R + JX (Ω) Typical values WAD381

F(MHz)	2	5	10	15	20	25	30
R(Ω)	15	8	5	3	2	1·5	1·2
X(Ω)	−8	−11	−7·5	−5	−4	−3·5	−3

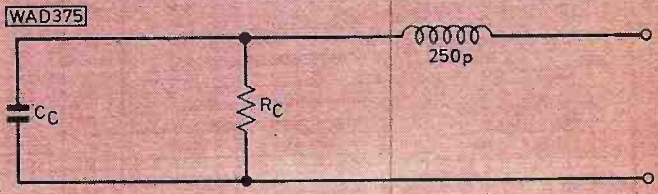


Fig. 10: Transistor equivalent output circuit

The primary inductance can be calculated from the following formula

$$L_p = \mu_o \mu_r n^2 \frac{S}{l} \quad \text{.............................. Eq. 1}$$

where L_p is the inductance in henries
$\mu_o = 4\pi 10^{-7}$
μ_r is the relative permeability
S is the ferrite cross-section (m^2)
l is the average length of lines of force (m)
n is the number of turns

The value of L_p must be chosen high, but not higher than necessary, otherwise the performance at the top end of the band will be degraded.

So, we take

$$2\pi L_p F_{min.} \simeq 3R$$

in which R = load impedance (50Ω)
$F_{min.} = 2MHz$
$$L_p = \frac{150}{2\pi 2\ 10^6} = 12\mu H$$

The ferrite cross-section is:

$$S = N\, l\, \frac{D-d}{2}$$

in which N is the number of toroids
$$S = N\ 5\ 10^{-3}\ 2{\cdot}5\ 10^{-3} = 1{\cdot}25\ 10^{-5} N\ (m^2)$$

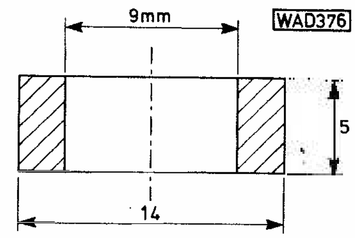


Fig. 11: Section of output transformer toroid

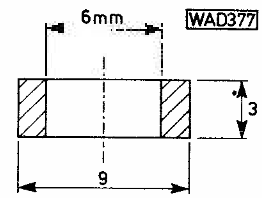


Fig. 12: Section of input transformer toroid

From Eq. 1 we can calculate N:

$$N = \frac{L_p l}{\mu_o \mu_r n^2\ 1{\cdot}25\ 10^{-5}}$$
$$= \frac{12\ 10^{-6}\ 36{\cdot}1\ 10^{-3}}{4\pi 10^{-7}\ 120\ 16\ 12{\cdot}5\ 10^{-5}}$$
$$N \simeq 14 \text{ toroids.}$$

In fact, 16 cores are used, which give
$$L_p = 13{\cdot}7\mu H \text{ and } S = 2\ 10^{-4}\ (m)^2$$

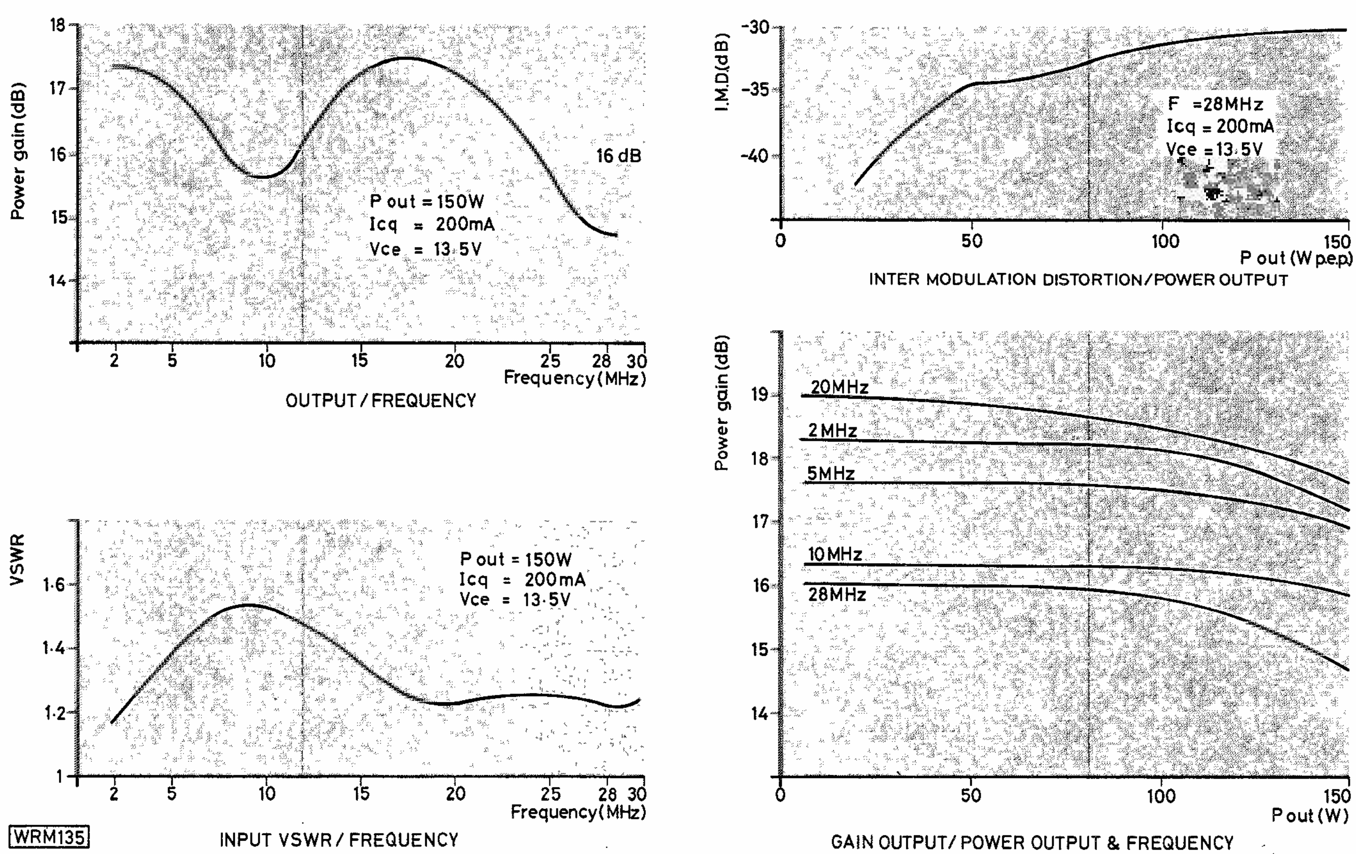


Fig. 13: Typical performance characteristics of the *PW* "Trent" prototypes

The highest toroid losses occur in this case at 2MHz under large-signal conditions. The power loss density, i.e., the power loss related to the unit of volume versus the maximum induction and the frequency, is given by R.T.C. in their relevant data. The maximum induction $\hat{B}$ can be calculated with the following formula:

$$\hat{B} = \frac{\hat{V}}{2\pi F S_n} \quad \text{Eq. 2}$$

in which $\hat{B}$ = maximum induction (T)
S = ferrite cross-section (m^2)
n = number of turns
$\hat{V}$ = max. value of voltage across n turns (V)
F = frequency

$\hat{V}$ is given by:

$$V = \sqrt{2P_oR_L} \quad \text{Eq. 3}$$

where P_o is the output power
$R_L = 50\Omega$

$$\hat{V} = \sqrt{2\ 150\ 50} = 122{\cdot}5V$$

$$\hat{B} = \frac{122{\cdot}5}{2\pi 2\ 10^6\ 2\ 10^{-4}} = 1{\cdot}2\ 10^{-2}\,T$$

For $\hat{B}$ = 12mT and F = 2MHz the power loss density is $2\ 10^2 mW/cm^{-3}$.

The ferrite volume is:

$$\hat{V} = \frac{\pi}{4}(D^2 - d^2)hN$$
$$= \frac{\pi}{4}(14^2 - 9^2)\ 5\ 16\ 10^{-3}$$
$$= 7{\cdot}2cm^3$$

This gives a loss $\propto$:

$$\propto = 2\ 10^2\ 7{\cdot}2 = 1440mW \text{ or } \frac{1{\cdot}4}{150} = 1\%$$

This 0·05dB loss in the ferrite is quite acceptable.

Input Transformer

The ferrite used for the input transformer is 4C6 material by R.T.C., whose reference is Tore 9/6/3 — 4C6 4322.020.97170. Its relative permeability is 120 ±20%.

The toroid dimensions are given in Fig. 12. In order to contain these, a transformer with a primary inductance at 2MHz of:

$$2\pi L_p F_{min.} \simeq R_s \quad \text{Eq. 4}$$

where $R_s = 50\Omega$

is used. This inductance is compensated at low frequencies by the circuit of Fig. 14, and Fig. 15 is the Smith chart.

From Eq. 4:

$$L_p \simeq \frac{50}{2\pi 2\ 10^6} = 4\mu H$$

The ferrite cross-section S is:

$$S = N\ \frac{D-d}{2}h$$
$$= N\ 1{\cdot}5\ 10^{-3}.\ 3\ 10^{-3}$$
$$= 4{\cdot}5N\ 10^{-6}\ (m^2)$$

where N is the number of toroids.

The average length of the line of force l is:

$$l = \pi\frac{D+d}{2}$$
$$= \pi\ 7{\cdot}5\ 10^{-3}$$
$$= 23{\cdot}6\ 10^3\ (m)$$

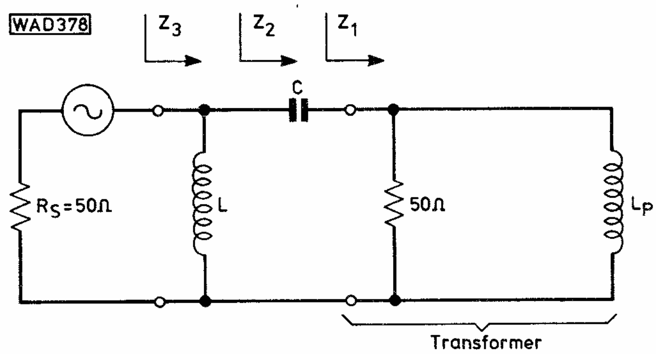


Fig. 14: Low-frequency compensation circuit for input transformer inductance

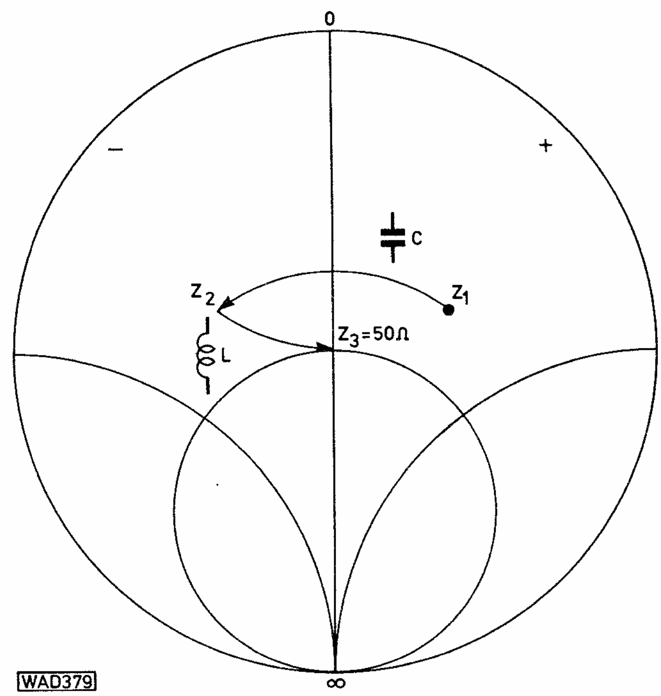


Fig. 15: Smith Chart plot for the circuit of Fig. 14

N may be calculated from Eq. 1:

$$N = \pi\frac{L_p l}{\mu_o \mu_r n^2\ 4{\cdot}5\ 10^{-6}}$$
$$= \frac{4\ 10^{-6}\ 23{\cdot}6\ 10^{-3}}{4\pi 10^{-7}\ 120\ 16\ 4{\cdot}5\ 10^{-6}}$$
$$N = 8{\cdot}7 \simeq 9$$

In fact, we used N = 10 toroids, which means $L_p = 4{\cdot}6\mu H$.

By using the same reasoning and formula as for the output transformer:

$$P_{in} \simeq 3W\ @\ 2MHz$$

$$\hat{V}\sqrt{2P_{in}R} = \sqrt{2.3.50} = 17{\cdot}3V$$

$$\hat{B} = \frac{\hat{V}}{2\pi F S_n}$$

$$= \frac{17{\cdot}3}{2\pi 2\ 10^6\ 4{\cdot}5\ 10^{-5}\ 4}$$

$$= 7{\cdot}6\ 10^{-3}\ \mathrm{T}$$

For $\hat{B}$ = 8mT and F = 2MHz the power loss density is 70mW.cm^{-3}.

The ferrite volume is:

$$V = \frac{\pi}{4}(D^2 - d^2)hN$$

$$= \frac{\pi}{4}(9^2 - 6^2)3\ 10\ 10^{-3}$$

$$= 1\mathrm{cm}^3$$

This gives a loss $\propto$:

$$\propto = 70 \times 1 = 70\mathrm{mW\ or\ } \frac{70}{3000} = 2{\cdot}3\%$$

This 0·1dB loss in the ferrite is acceptable.

Modifications

For those interested in a more sophisticated biasing arrangement for the amplifier, the circuit of Fig. 16 may provide a working basis. This produces a lower internal resistance than that originally shown.

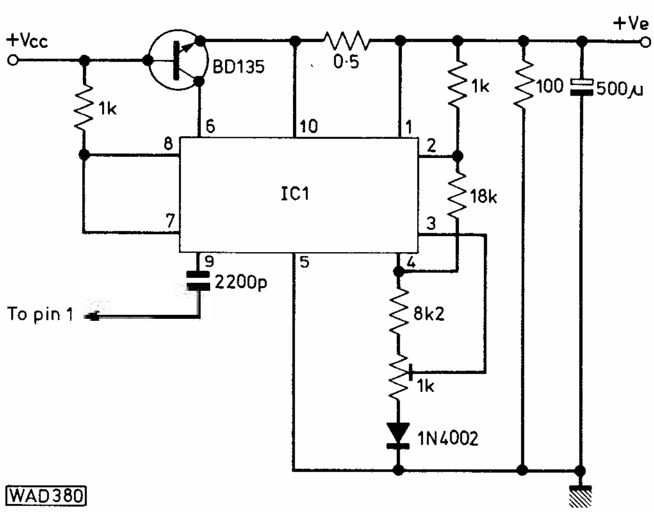


Fig. 16: Alternative biasing circuit offering a lower internal resistance. IC1 is a 723 voltage regulator. The diode should be mounted in the same manner as shown for D2 in Figs. 5 and 7 (Part 1). All resistors can be ½ watt rating

Changing the relative permeability of the input transformer ferrites (to, say, 400) will give a better balance with regard to the signal applied to the transistors. Devices are available (with a μ_r of 400) from the supplier quoted in the components list in Part 1, and are of Ceramic Magnetics manufacture. ●

TELEPHONE BELL REPEATER

continued from Page 36

★ components

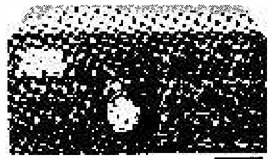
Resistors		
¼W ±5%		
1kΩ	3	R5, 11, 12
2·2kΩ	3	R3, 4, 9
4·7kΩ	1	R8
33kΩ	1	R10
56kΩ	1	R7
100kΩ	2	R2, 6
180kΩ	1	R1
Potentiometers		
1MΩ	1	VR1 *Min. skeleton preset*
Capacitors		
Electrolytic axial lead		
330μF 10V	1	C3
470μF 10V	1	C1
Tantalum bead		
4·7μF 16V	1	C5
25μF 16V	1	C2
Disc ceramic		
10nF	1	C4
Semiconductors		
Transistors		
BC107	2	Tr3, 4
BC109	2	Tr1, 2
BC157	1	Tr5
Miscellaneous		
Case Verobox 221 (125 × 65 × 30mm). Miniature toggle switch s.p. 3·5mm jack and plug. 2mm plug and socket (2). Battery clip for PP3. Reed relay d.i.l. 5V s.p. (RS349-383 or similar), p.c.b. Crystal microphone insert.		

It now remains to set VR1 so that the system actuates on the sound of the telephone bell. Persuade a co-operative friend to dial your number and when the bell rings, adjust VR1 so that the relay closes and opens at the start and end of each ring. Leave VR1 at the minimum position where this happens as this will reduce the battery drain on signal and also make the system less susceptible to extraneous sounds.

Other Applications

I believe that individual experimenters will find other applications for this type of system to deal with individual domestic problems; one other that I have found useful is to relay the warning buzzer on the electric cooker—which is scarcely audible outside the kitchen—to the lounge so that it is possible to sit in relaxed comfort, confident that the small lamp beside you will tell you when the cooker needs attention. For people who are hard of hearing the possibilities are considerable.

These other applications often involve much less intense sounds than the phone bell and it is seldom possible to fix the microphone so close to the sound source: for this reason gain will be required. It will be noticed that in the phone bell application, Tr1 contributes no gain at all as its emitter resistor is not by-passed; in fact it serves to raise the impedance to approach that of the microphone and makes the setting of VR1 less critical: to obtain extra gain for special applications it is only necessary to connect about 250μF across Tr1 emitter resistor. Connected this way, I found it quite easy to make the indicator lamp follow the ticking of the kitchen clock! ●



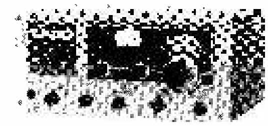
R820

The ultimate in receiver design. **Trio R820.**
With more features than ever before available in a ham band receiver. This triple-conversion (8·83 MHz, 455 KHz and 50 KHz I.F.s.) receiver, covering all amateur bands from 160 through 10 metres, as well as several short wave broadcast bands, features digital and analog frequency readouts, notch filter, I.F. shift, variable bandwidth tuning, sharp I.F. filters, noise blanker, stepped R.F. attenuator, 25 KHz calibrator, and many other features providing more operating conveniences than any other ham band receiver. Price **£790·00**, including V.A.T. Carriage £3·50.

SP820

Matching speaker to fit the R820, with built-in filters, 8 ohms impedance.
Price **£39·00**, including V.A.T. Carriage £1·16.

SRX30

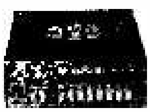


The SRX-30 represents a new step forward for the keen short wave listener or the radio amateur who needs to tune frequencies outside the amateur bands.
In the past, the performance of general coverage receivers has been limited by the dificulty inherent in setting to a known frequency – OK, so you know that Radio Peking is on 8547 KHz but how do you set the receiver dial?
The SRX-30, due to application of new technology solves the problem by utilising a drift cancelling loop system converting to a very high (40 MHz) first IF so as to remove image interference problems. This is followed by a stable VFO controlled tunable second IF with excellent reset accuracy. The frequency range covered by the SRX-30 is 500 KHz – 30 MHz in thirty bands, each 1 MHz wide. If you wish to tune to say 14250 KHz, simply set the MHz dial to 14, the KHz dial to 250 and there you are, no fuss, no twiddling, no need to use calibrators, etc. (remember the drift cancelling system).
The SRX-30 is housed in a rugged metal case and operates from 240V ac mains or 12V dc supply. Reception modes are USB/LSB/AM/CW to cater for all HF operation and the receiver is equally at home on VHF using an external convertor.
This receiver combines small size, accurate readout, ease of use, all mode operation, mains/battery power supply and excellent performance at a remarkably low price.
See it, use it and you will like it.

Price **£178·00** including V.A.T. Carriage £3·50.

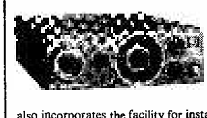
FS10

The FS10 VHF FM monitor receiver is a high performance unit in such a small lightweight package that it will fit into a pocket. The receiver is available in two versions, to cover 70-80 MHz or 130-170 MHz and is therefore suitable for all amateur radio, marine radio or business radio use.
The FS10 automatically scans up to ten crystal controlled channels, stopping on any channel where a signal is present. Manual selection of any channel is also provided. Complete with rechargeable battery pack, charger and personal earphone with provision for external antenna.
Price **£82·00**, including V.A.T., crystals extra. (Fitted ten channels **£107·25**, including V.A.T.) Carriage 86p.



AMR217B

The AMR217B VHF FM monitor is an outstanding receiver suitable for either the 2 metre amateur band or the VHF marine FM band and can be supplied for either band on request. The AMR217B has an eight channel scanning facility and can also accommodate up to ten additional switched channels to extend its versatility even further. The receiver is extremely sensitive and is one of the best monitor receivers available to either the amateur or professional user. It is completely self-contained with a built-in speaker and operates from 240V AC mains or 12V DC supplies. A matching mobile mount is supplied to allow easy installation in boat or car.
price **£120·75**, including V.A.T. (fitted 8 crystals). Carriage £1·06.

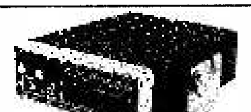


SR9

The SR9 represents the finest value for money ever offered in the FM monitor receiver market. Available in two versions to suit the 2 metre amateur band or the VHF marine FM band the SR9 gives fully tunable coverage of either band and also incorporates the facility for installing optional crystals which will provide up to eleven fixed channels for the most popular frequencies.
The SR9 is completely self-contained with built-in speaker and requires only 12V DC at around 200 mA to operate. Mounting hardware is provided for easy installation anywhere.
Price **£46·00**, including V.A.T. Carriage 86p.

AP12

The AP12 is a 12 channel crystal controlled airband monitor receiver covering a frequency range from 108 to 136 MHz which utilises a micro-computer which automatically peaks the R.F. oscillator and mixer stages in accordance with the crystal frequency in use. This means that you can install crystals for any frequency in the entire band without any drop in performance. Supplied complete with rechargeable battery pack, charger and personal earphone.
Price **£89·70**, including V.A.T. Fitted 12 channels: **£118·45**, including V.A.T. Carriage 86p.



R512

The R512 airband receiver is a high performance unit which automatically scans up to eight crystal controlled channels. The receiver will stop on any channel on which there is a transmission, stepping on again at the end of transmission. You may lock the receiver onto any channel of your choice for continuous monitoring and if any channel should be more or less permanently occupied you may also lock out the channel to permit scanning of other channels. These facilities are available on any or all channels.
Covering the full band from 108-136 MHz, the R512 is completely self-contained including built-in speaker and is supplied with mains and 12V DC power leads, whip antenna, mobile mounting bracket and personal earphone.
Price including five fitted channels is **£138·00**, including V.A.T. Carriage £1·06.

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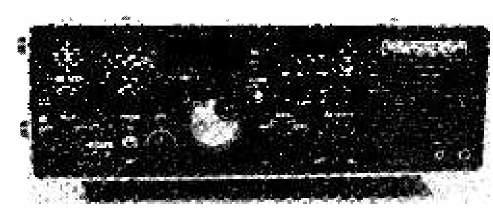

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RADIO SPECIAL PRODUCT REPORT

LOWE ELECTRONICS LTD.

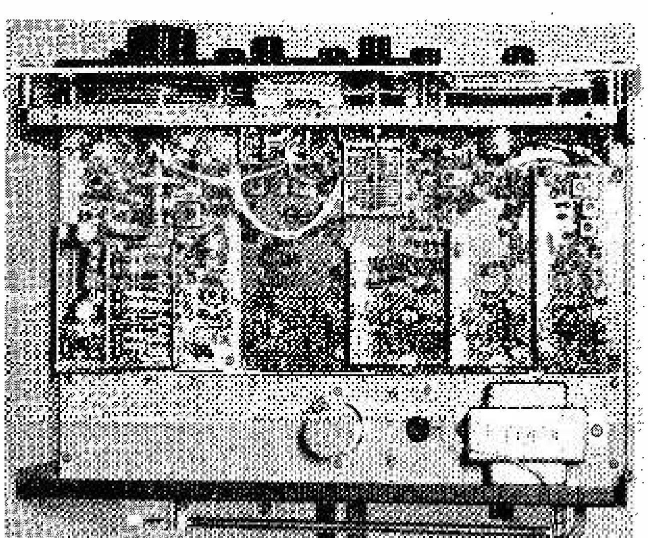
SRX~30 GENERAL COVERAGE RECEIVER

The Lowe SRX-30 is a general coverage receiver, principally for the serious short-wave listener and covers the range 500kHz to 30MHz.

A variety of "on-air" tests were made with this equipment using both long wire and beam aerials and in all respects, save perhaps the actual audio quality it performed well. Selectivity was quite adequate in all but the most difficult cases of crowding and the overall stability of the receiver was particularly good.

In conjunction with a Trio transmitter, many contacts were made with W, VK and several of the more exotic countries and the SRX-30 gave a good account of itself throughout—lacking only in bandspread, of course, which is to be expected in most receivers of this type.

Several converters were tried with the receiver, and here some little difficulty was experienced. It is not possible to disconnect the telescopic aerial fitted to the receiver, unless one is prepared to get inside and unsolder it, and this can, under strong-signal conditions, cause breakthrough of 10m signals. The aerial input arrangements too may cause some problems if outboard converters are to be used and a simple solution would be to fit an SO239 coaxial socket and detach the fixed telescopic aerial altogether.



The controls of the SRX-30 are all mounted on the front panel and are widely spaced ensuring that even the largest hands do not get tangled up. The tuning unit is mounted on the front panel at the top right and has the pre-selector, MHz tune and kHz tune controls with the concentric tuning scales visible through the window above the kHz knob. The dials are illuminated and were easy to read, the MHz dial being calibrated into distinct separate 1MHz bands while the kHz dial is calibrated from 000 to 1000 in steps of 10. The kHz control is operated via a 6:1 slow motion drive which proved to be smooth in action. This made the tuning of the set relatively easy and it was possible to return to a frequency, even after an appreciable time, without any great difficulty.

Like most modern communications receivers the SRX-30 uses the Wadley Loop triple-conversion superheterodyne system which was fully described in the July issue of *Practical Wireless*. The front end of this receiver was remarkably stable, making tuning a pleasure.

The pre-selector was also simple to operate with no dials or drums to worry about, the knob being merely turned until maximum signal is found. An r.f. attenuator control is fitted which provides some 30dB of attenuation in the fully clockwise position.

A clear S meter, illuminated when the supply is on, is mounted next to the tuning dial and proved easy to read.

The Clarify control, calibrated from −5 to +5 gives fine tuning over a frequency range of ±3kHz to enable the pitch of a station operating on s.s.b. or c.w. to be accurately set.

The audio side of this receiver is a bit of a let-down and certainly did not match the rest of the set. Using the small internal speaker was a disappointment, the quality of reproduction being poor. This is probably a function of the speaker used and its mounting in the metal cabinet, as, using an

★ specifications

Frequency Coverage: 0·5 to 30MHz in 1MHz bands with 10kHz graduations on dial
Reception Modes: CW, USB and AM
Sensitivity: At least 10dB (S+N) N under following conditions:

Mode	*Frequency*	*Input Level*
SSB	0·5–2MHz	1·0µV
	2–30MHz	0·3µV
AM	0·5–2MHz	3·0µV
	2–30MHz	1·0µV

(AM: 1000Hz at 30% modulation)

These voltages are half the open circuit signal generator voltage, i.e., the voltage read on the meter of a HP Model 606 Generator
Output: 200mW output on SSB at 2MHz with input signal of 0·5µV and 2W output with 5µV input
Audio Distortion: Less than 5% at 2 watts
Calibration Accuracy: Within 5kHz at all frequencies
Bandwidth (–6dB): SSB 3kHz ±25%; AM 5·5kHz ±25%.
Image Rejection: Greater than 50dB
IF Rejection: Greater than 50dB at f_d below 20MHz. Greater than 40dB at f_d above 20MHz
Antenna: External connection to terminal strip (75Ω input impedance-unbalanced). A self-contained telescoping whip is provided for strong local signals
Audio Output Provisions: Internal 8Ω speaker. A phone jack on the front panel which disables the internal speaker
Power Supply: 100, 117, 220, 240V a.c. 50-60Hz; External 12V d.c. supply connected via rear panel connector
Current Consumption: Less than 100mA quiescent at 12V d.c.
Clarifier: Tunes minimum of ±2KHz and maximum of ±5kHz
Size: 325mm W. 230mm D. 140mm H
Weight: 5kg

external speaker, which plugs into a socket on the rear panel, improved the audio quality.

The small telescopic whip aerial mounted on the rear panel and hinged so as to be stowable when not in use was useful but proved to be a nuisance when not in use as it cannot be disconnected from the aerial input to the set. A useful modification might be to make the whip dismountable if not required.

Construction is of a sound standard throughout, the majority of components being mounted on glass-fibre printed circuit boards.

The instruction book was rather spartan with no maintenance information given and only a roughly drawn circuit diagram included on a separate sheet.

The main attraction of the SRX-30 must be its simplicity of operation, especially for the newcomer to the hobby. It is a pity that the audio performance does not do the r.f. side justice.

Prices

SRX–30 receiver £178·00 including 15% VAT. The SRX–30 receiver reviewed was kindly loaned by Lowe Electronics Ltd., 119 Cavendish Road, Matlock, Derbyshire. Tel: 0629 2430, and we would like to thank them for their invaluable assistance in this respect.

ULTRASONIC REMOTE CONTROL

continued from page 40

If it is not required to switch more than 5A at up to 250 a.c., one can select a Keyswitch relay type MS1B which has a 12V, 26mA coil. Thus the use of this relay ensures that the supply current is kept quite small.

Other Devices

The LM1808 device is equivalent to an CA3065 television sound i.f. device and an LM380 power amplifier in a single package, although there are minor differences in the volume control circuit—which is not used in the ultrasonic application. The circuit of Fig. 4 shows a receiver which uses the 3065 and the LM380 as separate devices, but it is equivalent to the circuit of Fig. 3. The CA3065 is a 14 pin dual-in-line amplifier. The LM380N is a 14 pin dual-in-line device, but a miniature version is also obtainable as the LM380N-8 in an 8 pin d.i.l. package.

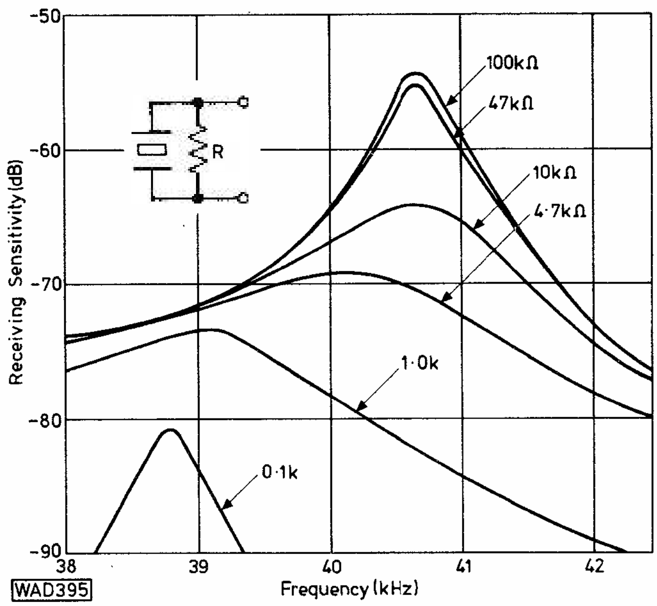


Fig. 5: Graph showing the response of the SEO5B 40R ultrasonic receiver

If the transmitter circuit of Fig. 2 is used, it will be necessary to adjust the potentiometer VR1 so that the frequency of oscillation of the 555 circuit matches that of the two transducers used in the system as closely as possible. This can best be done by connecting a sensitive voltmeter of high impedance across C3 of either Fig. 3 or Fig. 4.

When the transducers are placed close together with power applied to both of the circuits, the voltmeter should read a few volts. The transducers should now be separated and pointed away from one another until the meter deflection decreases. The preset VR1 in the transmitter should now be adjusted for maximum deflection of the meter in the receiver circuit. If necessary, this process should be repeated with the transducers spaced farther apart until the control is set in its most sensitive position. It is also possible to carry out this adjustment using a 100mA f.s.d. meter in series with the relay or by using a voltmeter across the relay.

Conclusion

Various circuit options have been given so that the reader has some choice. The circuit using the LM1808 is more compact than the Fig. 4 circuit, but the CA3065 and LM380N are more readily obtainable. ●

BC BAND LISTENING

continued from page 42

BBC External Services Control Room, Bush House, London, responsible for the co-ordination of all the simultaneous language broadcasts leaving Bush House

Photo courtesy BBC

Satellite broadcasts of world-wide television are also possible now, but here technology is over-ruled by other factors. Most broadcasting organisations have enough problems scraping money together to finance programmes for licence-fee paying domestic viewers, let alone free TV programmes for viewers abroad. Secondly, politics is such that countries with different social systems would no doubt be loath to let their people have free access to possibly contradictory propaganda from abroad via a TV antenna dish pointed upwards to a satellite. This method, remember, is far more difficult to jam.

In the meantime, s.w. broadcasting is the cheapest, most immediate and direct form of international communications. It will never overtake the popularity of the local radio station, but for those who take an interest in events beyond their back garden, s.w. radio will be there for a long time to come.

List of Publications for Further Reading

1. *World Radio TV Handbook and World DX Guide* edited by Jens Frost. Published by Billboard publications, and available through bookshops.
2. *DX Catalogue.* A list of free courses for the DXer and SWL offered on request by Radio Nederland, PO Box 222, Hilversum, Holland.
3. *List of Broadcasting Stations for Europe.* Up-to-date schedule of frequencies registered by International stations at the International Frequency Registration Board. Sent free of charge by the Austrian Radio Technical Department, A-1136 Vienna, Austria.
4. *European DX Council Reporting Guide.* Hints on making out useful reception reports in English and a number of other languages. Enquiries (with one International Reply Coupon) to EDXC, Postfach 25 03 25, D-4630 Bochum 25, Federal Republic of Germany.

List of organisations involved with Broadcast Listening

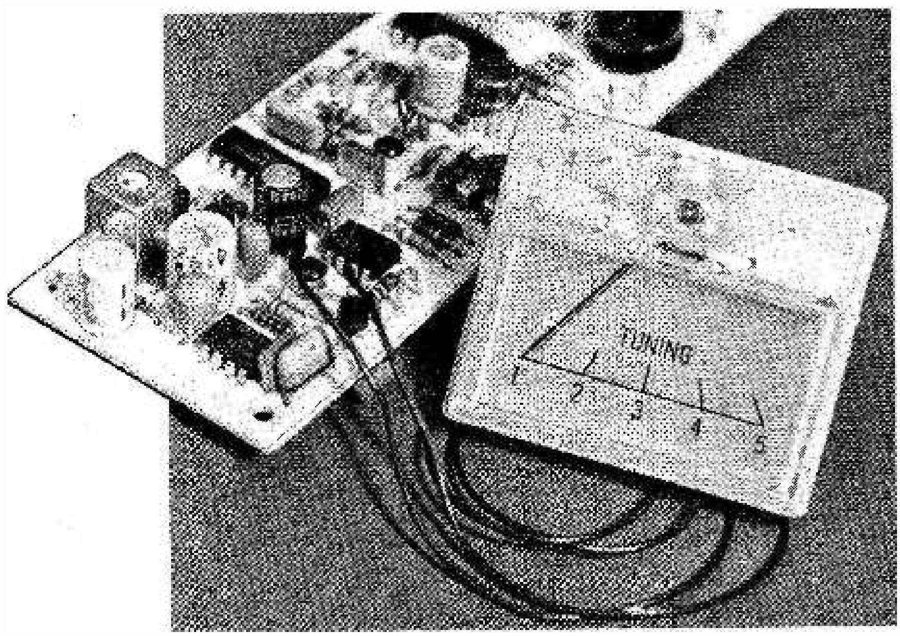
1. International SW League, 1 Grove Road, Lydney, Glos. GL15 5EP.
2. Twickenham DX Club, 37a Pope's Grove, Twickenham TW1 4JZ.
3. European DX Council, Postfach 25 03 25, D-4630 Bochum 25, Federal Republic of Germany.
4. Handicapped Aid Programme (UK), c/o Mr John Rose, 5 Hall Street, Wombwell, Barnsley, Yorkshire. This very worthwhile organisation is also in need of volunteers with or without technical experience.
5. UK DX Camp, c/o J. Marks, 12 South Bailey, Durham DH1 3EE.
6. Danish SW Clubs International, Greve Strandvej 144, DK-2670 Greve Strand, Denmark.

Since the above are non-profit-making organisations, please enclose return postage with all enquiries. ●

Follow-up to PW Sandbanks METAL DETECTOR No. 2

P. J. WALES

Response from readers to the *PW* "Sandbanks" article of January 1979 has taken two forms, faults which cannot be located, and requests for variations on the theme. The most common fault reported has been that of the output of IC4 going negative when a large piece of metal is brought near the search coil. A few letters were selected at random and the writers were asked to send the offending p.c.b. in for examination. In only one case was the 709 faulty. This particular device is running in its fastest possible mode, and so all stray capacitance and inductance around it should be at a minimum. This means that the i.c. must **not** be a socket, and it should preferably be a TO5 version. All of the associated components should have short leads and be mounted as close to the board as possible. If these precautions are observed, it is very unlikely that IC4 will go unstable.



Power Supply Problems

The second phenomenon which can cause the output to go negative is poor power supply regulation. If your "Sandbanks" has this problem, then check the −5V rail and the +12V rail. If they are more than one volt out then that is the fault. If they are correct, then try adjusting VR1 whilst monitoring the 12V rail. If it varies or if it is low anyway then that is the fault. The cure is not so easy to find, but is frequently due to either the 709 or the 741 taking too much current, so disconnect pin 7 on each i.c. and measure the current. The 709 should take 2·6mA and the 741, 1·7mA. If either or both is taking more then change them, but the figures are only manufacturers' typical figures, the devices are not faulty.

A very large number of these circuits have been tested, and less than one per cent of them have had to have any changes made to the circuit values as published in *PW*. The only fault that it has not been possible to cure was that of drift. The circuit should remain absolutely stable once set, and if any reader has had this problem and cured it, the author will be very pleased to hear from him or her.

Response Speed

To get the very best from your "Sandbanks" several things can be optimised, but the first step is to fit a printed circuit coil, as described in the April 1979 issue. This really does increase the sensitivity to gold and silver tremendously. Having fitted this and made the appropriate changes to the sampling circuit, the next improvement is in the response speed. This is defined by two things, the pulse rate of IC1, and the integration time of IC5. The pulse rate can be increased to 500Hz by changing C2 to 33nF. This change allows the integration capacitor C12 to be reduced from 0·47µF to 47nF. The circuit now is 10 times as fast as it was and will detect a coin being thrown through the coil.

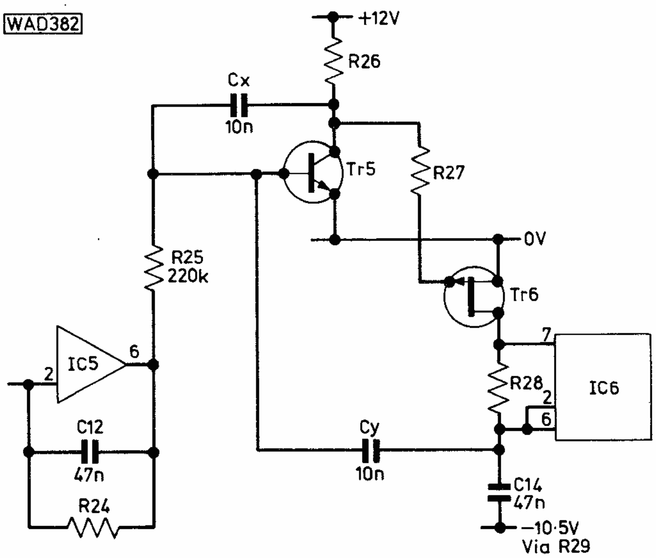


Fig. 1: Improving the audio quality. Only those components with values indicated are subject to change

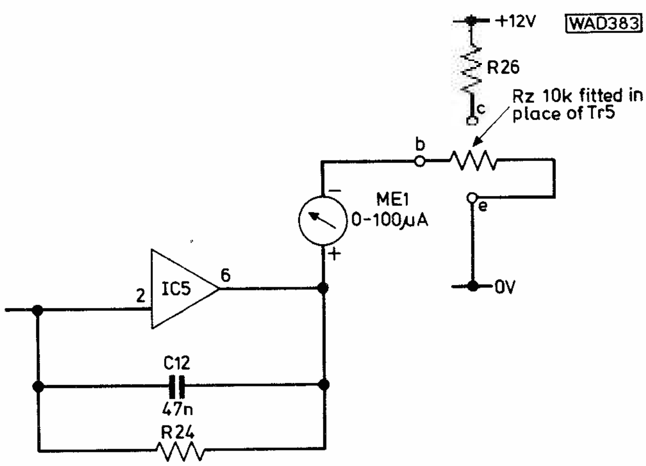


Fig. 2: Providing a meter readout instead of the audio indication

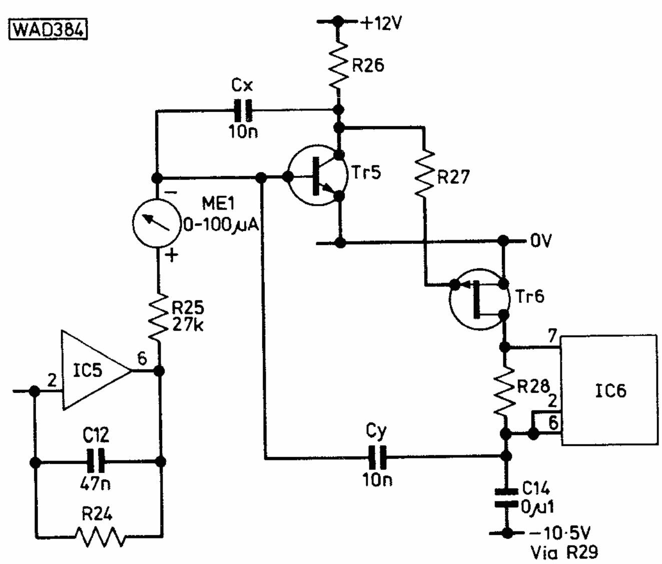


Fig. 3: Providing a meter readout but retaining the audio indication

Audio Changes

Checking the machine's performance now, will prove that the next step of improving the quality of the audio is a good one to take. The first problem with the audio is that it is too low in frequency, and when a coin is detected at maximum range, the change in audio frequency is so slow that it is very easy to have passed the coin and miss it. To remedy this, change R25 to 220kΩ and C14 to 47nF. This now gives a much higher pitch but the tone comes on too fast and it is very difficult to tell how deep the find is by the tone. It is also very unstable due to the short integration time of IC5. The instability can be cured by wiring C_X (10nF) from base to collector of Tr5 on the back of the p.c.b. The speed of the audio can be corrected by wiring another 10nF, C_Y on the back of the board, this time between pin 2 of IC6 and the base of Tr5. This has a great feedback effect and now the audio is super-smooth from a fast clicking to a very high pitch indeed (Fig. 1).

Having got the audio working correctly, the next step is to balance all of the tolerances in the circuit. This should be effective for 95 per cent of all "Sandbanks" but if it does not work on yours, then do not worry, your machine is still very powerful.

To peak the sensitivity, connect a meter between the output of IC4 and the 0V rail. Set the audio, with no metal near the coil, to about half-pitch. Adjust VR1 so that the audio is at its lowest frequency with the meter reading between 0V and 8V. If the meter reads outside these limits when at the lowest pitch, then re-adjust VR1 for 0·5V and leave it there; it is very near the optimum setting at this point. If you can get a minimum between 0 and 8V then expect to see about 5V typically.

Meter Option

Some readers have requested a meter option for the "Sandbanks", but adding one which will improve the sensitivity is not easy. Ambit International do make a suitable meter, scaled "1" to "5" and legended "Tuning", and with a bit of fiddling it should be possible to fit this into the end of the handle. There are two different ways to wire this into the circuit; the easiest way is if you intend to discard the audio stage completely. This makes the machine more sensitive, but you do have to watch the meter all of the time. If this is the way you want to do it, then remove Tr5 and R25. Solder a 10kΩ resistor R_Z between the base and emitter connections in the p.c.b. and connect the meter into the holes for R25 (Fig. 2).

To retain the audio stage, it is necessary to build the audio modifications as previously detailed, but leave out R25, and leave C14 as 0·1μF. R25 now becomes a 27kΩ but the meter is connected in series with it, and measures the base current of Tr5. It will be found when adjusting VR2, that the meter will just leave the "1" mark before the audio starts. This is the correct position for VR2 and so it is easy to verify that the setting has not changed when the machine is in use (Fig. 3).

Component Problems

The demand for the "Sandbanks" kit was much greater than was anticipated and so Ambit have had some problems in supplying some of the less common parts of the kit, such as IC2, which has been modified in some kits. The biggest problem has been the supply of the cases, but I am assured that these are available now, and so if you were disappointed before, it is worth contacting Ambit again.

HOTLINES

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

Whistle Stop

A popular circuit in many electronics construction journals is the sound switch. A bright young man in America has come up with the idea of taking things a step further in order to aid handicapped people. He's brought out a "Whistle Switch".

The basic idea is simple, you just whistle and the device switches from one state to another—from on to off and/or vice versa. A step further than that has been to include a digital display and to make the instrument a multi-channel, multi-purpose unit. The arrangement causes the digital display to illuminate a series of numbers in sequence—1, 2, 3, 4 and so on. When the desired number, corresponding to the task required, comes up, it only needs a whistle to cause the unit to switch on or off. Thus one could have a light turned on or off, television receiver switched, telephone answered, nurse called, etc.

Believe it or not, there's even circuitry that allows the unit to be tailor-tweeked to your own particular brand of whistle, from bass to contralto (actually adjustable from around 800Hz to 2·5kHz). The first few have sold in the US for just under $1,000 and patents have been applied for. Not available in the UK as far as I know.

Micro Magic

The integrated circuit designers are always trying to make yesterday's i.c.s obsolete. The problem for us, the users, is that they succeed all too well—and all too often. The very latest piece of micro magic to come my way is a new breed of linear creatures that will function effectively and efficiently right down to a miserly 1V power supply. They're not delicate little specialities, either, and will work over the temperature range from −55°C to +125°C (means you can listen to the miniature receiver you make with them in both the oven and the refrigerator!).

At present, only sketchy details have arrived, but the i.c.s do look very interesting. For example, there's mention of a high performance op amp which needs only 1·2V. A device with similar function performance to a Darlington circuit can provide a 20mA output current but only takes a diminutive 10µA of standby current.

Television Developments

I was interested to read a report from America giving figures for the consumer section of the electronics, radio and TV markets. According to the report, video tape recorders will hit around 400,000 this year on projected figures. Colour receivers are topping around 710,000 per month, while radio receivers (a.m./f.m.) dropped a little and could only manage a mere 1·3 million sets—per month.

In the other direction, a German company is forecasting a growth potential for projection colour television receivers. Up until now, acceptance (or perhaps purchases) have been slow, but the company has confidently launched a new projection receiver with some impressive technical claims.

First, the projected colour image is very clear and extremely bright—some 140 candelas per square metre (about 40 foot-lamberts). This intensity would make it easily and clearly visible even in daylight. The image size is some 965 by 1270mm. Hi-fi buffs will be relieved to hear that the projector is capable of providing 14W of high quality sound. The estimated price tag is around the £1,900 mark. Can you imagine a 1 × 1·25 metre version of Crossroads or Coronation Street? No way Brothers, no way!

Optical Fibres

It never ceases to amaze me—the speed at which things happen electronically. Signals being whizzed round computers in thousandths, even millionths of a second. Having admitted difficulty in visualizing that, you can imagine my gasp of credulity on hearing of happenings at the famous Bell Labs. Apparently (or should that be transparently) they've got this 700 metres-plus length of single mode optical fibre that's only nine meagre micrometres in diameter. And current experiments are showing the possibility of transmitting digital information along this fibre at the rate of 200 gigabits per second! The one watt laser doing this generates pulses only five picoseconds wide with little or no broadening. When the laser power was stepped up to 60W, problems arose with smearing at the output end of the fibre.

If someone had shot a 60W pulse loaded with 200 gigabits of information down my fibre, I reckon I'd be smearing, too.

Cheaper Printers

Home computer addicts will be pleased to hear of a new printer launched recently in America. It can print at 150 characters per second and is claimed to give "letter quality copy". It's a dot matrix printer, but the makers tell that the dots print so close that they overlap thus avoiding the "broken up image" appearance of many units of this type. Price on the US market is less than $3,000, which is very much cheaper than the popular daisy wheel printers.

Ginsberg

ON THE AIR

by Eric Dowdeswell G4AR

I have always been concerned over the fact that one can pass the Radio Amateurs' Examination and get on the air with a 400W p.e.p. transmitter without ever having touched a transmitter before, or a receiver for that matter. While the commercial "black boxes" that almost every newly-licensed amateur seems to start up with these days are pretty foolproof, they can still be tuned wrongly leading to severe interference to TV sets over a wide area. Whether h.f. or v.h.f. bands are used is immaterial.

Even with the transmitter properly run and operating into a well-matched aerial system, the sheer power output can be just as harmful to neighbouring TVs. Complaints roll in, tempers get frayed, and the inexperienced operator wonders if there is anything he can do about it. Many just give up when faced with this problem, as evidenced by the ads in our magazines for the sale of almost brand-new equipment by recently licensed amateurs.

Surely there cannot be any justification for the present system other than bureaucratic convenience. The ideal practical examination of a would-be licence holder is totally impossible today, but we did have a much better way of bringing up the amateur operator in days gone by. Such a method deserves consideration by those who deprecate the present "appliance operator" syndrome which can only deprive the amateur of his "experimental" status, the sole justification for the amateur licence in this country.

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

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

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

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

It is also a very good stick with which to beat the amateur when the third-world countries, in particular, start grabbing the frequencies at the World Administrative Radio Conference in Geneva later this year.

So, I wonder if there is any hope of reviving the "artificial aerial" licence which existed before the last war, whereby permission was granted to use transmitting equipment with a dummy aerial load in order to gain experience with operating transmitters and knowledge of the equipment, thus virtually eliminating the objectionable QRM caused by the present system. A licensed amateur could verify that such work had been carried out before a full licence was granted.

Alternatively, a novice type licence for, say, c.w./telephony operation on a maximum of 25W input for six months for the h.f. bands, or 10W on telephony on the v.h.f. bands, with the log book as evidence of experience. Some intermediate step in our present licensing procedure is badly wanted. Considering some of the questions I get asked by newly licensed operators I wouldn't trust them with a walkie-talkie!

From all Around

Congratulations are in order this month for **Phil Charlesworth** of Southport, who dropped his BRS41107 in favour of G8SNG and wisely is swotting on the code to get his G4 as soon as possible. He uses PA0AA on Friday evenings for code practice around 1930hrs on 1827, 3600 and 14 100kHz following news bulletins on telephony.

Felicitations too for **Ed Phillips** living in Wales who passed his RAE in December. He has a TCS8 receiver for the time being, but would feel happier if he had a handbook. He lives at Rhos-Y-Coed, Rosebush, Clunderwen, Dyfed, and feeds his set from a 90ft wire and a.t.u.

Keith Taylor is 12 and hopes to take his RAE this year, but as I have pointed out many times, the exam is now a costly exercise and since Keith cannot get a ticket for another couple of years he'd be well advised to hang on and make sure he passes at the first attempt in a year or so's time. For the moment Keith has an R1155 and 75ft of aerial but mentions that he has a 300ft garden and a 60ft tree at the far end! Bliss, indeed, in Camborne, Cornwall.

Edgar Powell (Canton, Cardiff) joins the fray with a BC779, a version of the famous Super Pro, but he's stuck a three-valve preselector in front which, probably, helps not at all! Anyway, I've suggested trying it in and out of circuit on such as JX9WT, Jan Mayen Island, one of Edgar's better bits of DX. A sour note from **John Powell** (Southwold, Suffolk) abroad for very many years but happy to pick up *PW* again and re-arouse his interest in the amateur bands again. He's written twice to the RSGB for info on joining same and guidance on local reps and clubs but to no avail. This is the sort of treatment that is calculated to put a newcomer off amateur radio for good but I'm sure John is made of sterner stuff.

Regular writer **Bill Rendell** down in Truro, Cornwall, reveals that his AR3 set plus preselector has a total of 17 knobs! He reckons a newcomer would need a two-day course on it before getting any results. From his DX log it's obvious that Bill screws every circuit to the maximum from such a simple outfit. He wants me to keep on urging readers to use the long wire plus a.t.u. for best results, which I'll be pleased to do! At 336 Bocking Church Street, Braintree, Essex, **R. Oliver** has an EC10 Mk 1 and has problems with drift and wonders if anyone has any ideas on how to cure the trouble. Write to him direct.

About DX

Both **Lawrence Woolf** GJ3RAX (St. Brelade, Jersey) and **Bob Round** (Camborne, Cornwall) were kind enough to send me lists of the American callsign prefixes following my comments on AG5H. Pretty obviously things are completely out of hand over there in that field. AC3 was a time-honoured prefix for Tibet but now becomes commonplace, a great pity. Incidentally, I wonder what happens when our own G8ZZZ gets issued in the not too distant future!

John and **Steven Goodier** have been chasing UA0I, North Pole DX-expedition around 21 181kHz without luck, but did find A35RB on Tonga and lovely FW8AD in the Willis & Fortuna Islands, a pretty rare catch. J3AAE (an old Japanese callsign!) popped up from Grenada while VK0PK on MacQuarrie Is. is not one that is heard very often. All these were on 20m s.s.b. **Pete Lucas,** Padarn Hall, Great Darkgate Street, Aberystwyth, Dyfed, has an AR88 but is *sans* manual or circuit, so can anyone oblige? Pete wisely leaves the heaters on most of the time to cut drift, always a good idea with valved sets, if one can stand the electricity bill! Anyway, he logged J28BN (QSL F6UYG), FG7XA, S79MC and FR7BJ on 10m s.s.b. so he's not doing so badly.

In Loscoe, Derbys, **"C.P." Palfreyman** got out his old and trusty 0-V-1 t.r.f. set (a two-valve set, detector and audio stage for those who are not so very old) and looked for some interesting c.w. finding VP9JC on 40m, HI8LC and ZL1AJU on 20m and EA8QP on the 15m band, using indoor dipoles! **Peter Hawkes** and his DX160 found VO1OB on 80m and VP8QG on 20m s.s.b. but feels he could do with a better receiver. Don't throw it away, will you, OM? I've still got several young readers on my waiting list for a set!

Bill Rendell, already mentioned, still seeks islands as his main target and came up with OH0NA, Aaland Is, quite close but still not heard all that often, VK0PK on MacQuarrie Is. and "find of the year" VR6TC on Pitcairn, all 20m s.s.b. On 15m OK3TAB/D2A in Angola (QSL OK3ALE) was interesting for Bill as was VK1FT of which there are very few around. **Dennis Sheppard** reports on RTTY matters from Sheerness, Kent, once again with finds on 10, 15 and 20m like JA1JDD, PY2YFG and TI3DJT (10m), AL7J (Alaska), A4XFW and HI8JSM on 15m and KL7JHD, PS7JA and VR6BJ on Pitcairn for his 20m DX, although Dennis has since reported trouble with the 20m band on his receiver.

The Drake of **Bernard Hughes** (Worcester) is earning its keep with things like CO3VR, VP2ABC and VP5GT on 80m, CO2GS, HK0BBD on 40m and BV2B, JT1BG, VQ9TC and TA1SU on the 20m band. In West Wickham, Kent, **John Dainty** has been having problems with Band 1 TV breakthrough on his SSR1 receiver via the i.f. stage working in the region of 45MHz. Any suggestions would be welcome.

A couple of quickies. **Lee Humphrey,** 49 Altwood Road, Maidenhead, Berks, would like circuit/manual on the R1155 receiver, while **Alan Billingham,** BRS40845, 3 Hale Carr Grove, Heysham, Lancs, is anxious to contact other amateur band listeners in his area.

Club Info

Edgware and District RS, second and fourth Thursday of the month at the Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware, at 8pm where Morse instruction is given to suit those present. Slow Morse also from club station G3ASR on Top Band and 2m. Details of this and forthcoming meetings from Sec. Dennis Lisney G3MNO, 119 Draycott Avenue, Kenton, Middx. 01-907 1237.

If you live in the **Stevenage** area your RS meets first and third Thursdays at 8pm at the British Aerospace QTH, Gunnels Wood Road, Stevenage, Herts. A DF hunt takes place on July 12 and July 19 sees the h.f. and v.h.f. equipment being given a workout at the club. Contact Peter Byrne G8MCV, EM2.3 Hitchin Exchange or ring 0462 4231 in working hours.

Now a first notice of the **Derby ARS** Mobile Rally on August 12 which should not be missed if there is any chance of getting there. Details from Jenny Shadlow G4EYM, 19 Portreath Drive, Darley Abbey, Derby. A fox hunt (radio, not animal!) is planned for July 10 by the **Bury RS** with an electronic and radio brains trust on August 14. The club meets at Mosses Centre, Cecil Street, Bury, every Tuesday night and visitors are doubly welcome. The club has an operational FT101 G3BRS and extensive library so contact M. Bainbridge G4GSY, 7 Rothbury Close, Bury, Lancs.

I am still getting letters either too early so that the news content is out of date by the time it would be published, or too late to meet the **15th of the month** deadline. General letters not involving publication are welcome at any time, of course.

From the Logs

B. Hughes:—80m CO3VR VP2ABC VP5GT ZF2CL ZB2CJ **40m** CO2GS FY7BC HK0BBD **20m** A7XAH BV2B J3AAE JT1BG S2BTF VR6HI VQ9TC **15m** C6ANU FR7ZN HS1ABD TJ1BB **10m** KC4B VK9NI 4M5A 6T2NI

J. Dainty:—20m D4HXA ZL2QY ZF1SV

D. Sheppard:—RTTY 20m JH1HWN KL7JHD PS7JA VR6BJ ZP5CD 3D2BM **15m** AL7J (Alaska) A4XFW HI8JSM YV2BSV 5N2ZBH **10m** JA1JDD PY2YFG TI3DJT YV2RD

W. Rendell:—80m YV5ANS ZF2CL ZL4AP 6W8DY **20m** C5ABM J6LFZ (St. Lucia) KB6EX VK0PK VP2KT VP2VGI VP8PU VP9JR VR6TC XT2AV **15m** C6ANU J6LFZ OK3TAB/D2A (Angola) SU1DP VK1FT VP2MDG VP8SB YB6IB 6W8DY

P. Hawkes:—20m VP8QG **15m** 8P6FU

C. Palfreyman:—c.w. 80m UA9CM **40m** LU8DQ VP9JC **20m** HI8LC ZL1AJU **15m** EA8QP

J. & S. Goodier:—20m A35RB (Tonga) D4CBS FW8AD J3AAE VK0PK 3D2ER (Fiji) 5T5ZR **15m** TU2ID **10m** YB0ADW ZE1AD

P. Lucas:—20m VS5TX (Box 980 Brunei) **10m** J28BN FG7XA S79MC FR7BJ

All reports in s.s.b. unless indicated otherwise.

MEDIUM WAVE DX

by Charles Molloy G8BUS

Long Wave Across the World is the name of a 12-page booklet written by Adrian Peterson and published by the Australian Radio DX Club. It traces the history of broadcasting on the long waves in Europe, the Americas, Asia and Australia, and is illustrated with reproductions of QSL cards, early photographs and even a set of postage stamps.

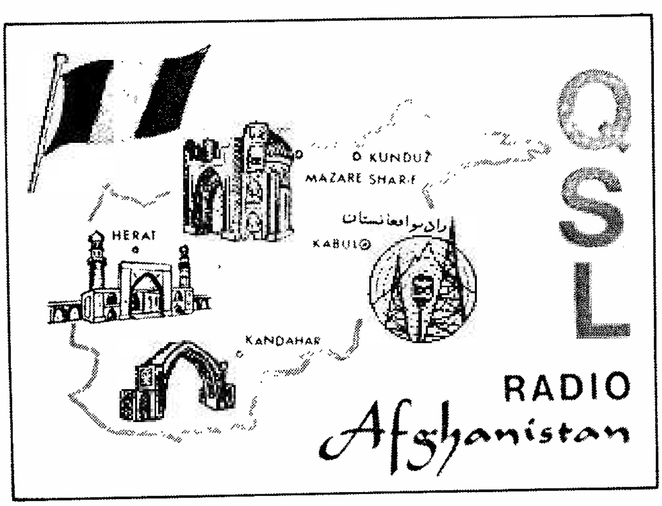
Broadcasting on the long waves was much more extensive during the early days of radio than it is now—the consequence of the longer daytime range of l.f. stations compared with those on the medium waves and the absence of short-wave broadcasting which had not yet been developed. It will come as a surprise to many to learn that there was l.w. broadcasting during the 1920s in Ceylon, Hongkong , India, Afghanistan, Brazil and Chile.

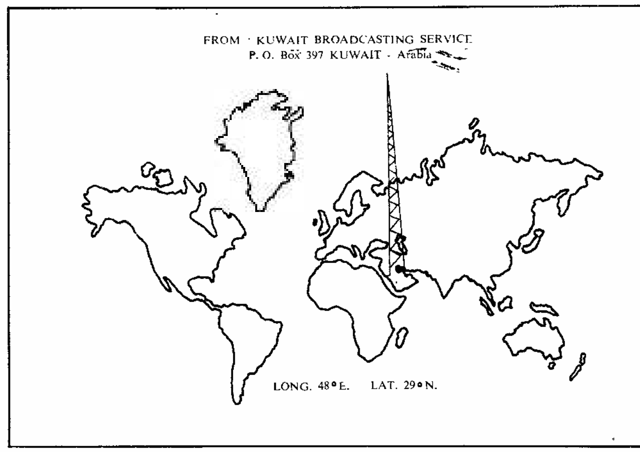
This booklet makes absorbing reading and I would recommend it to anyone interested in the early days of broadcasting. It is obtainable from the Australian Radio DX Club, PO Box 54, Melton South, Victoria 3338, Australia for six International Reply Coupons (or US $2.00) airmail or 4 IRCs ($1.00) seamail to anywhere in the world.

Ramadan

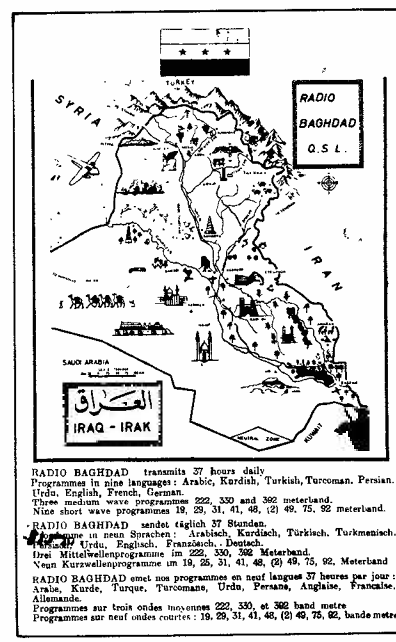
In 1979, the month of Ramadan starts on 26 July and ends on 24 August, some 10 days earlier than last year. This advance through the calendar occurs annually because the Moslem year is based on the lunar month rather than on the calendar month as in the west. It has the effect of moving Ramadan through the seasons of the year in a 33-year cycle.

During Ramadan, broadcasting in Moslem countries continues throughout the night. The majority of the states involved are in Time Zones ahead of GMT and conse-





quently, sign-off normally occurs before European QRM has had a chance to subside. Of course sign-on is earlier too but during this time of the year much of the path from the more easterly countries will be in daylight and reception will not be possible. The occurrence of Ramadan in the summer is therefore a welcome event, at any rate to the DXing fraternity who do not have to participate in the rigours of fasting through the long hours of daylight!



DX to be Heard

In past years I have listed some of the easier stations and also a few of the more difficult ones that might be picked up. This year, owing to the Geneva Plan and its almost universal non-observance in the Middle East, it is anyone's guess what will be heard during Ramadan 1979. Reports from readers will be very welcome as these will give an indication what Ramadan will mean to the m.w. DXer in the future.

One spin-off from the current situation is the production of 1kHz heterodynes between stations operating on the pre-Geneva channels and those on the new channels which are 1kHz higher. Tune round the band after dark and you should hear a number of 1kHz "hets" on the low frequency side of European broadcasts. They reveal the presence of a station 1kHz below this strong local signal. Make a note of the **weak** hets and go back to them later on when hopefully the European may have signed off. You may then be on to some real DX.

The following is a list of the authorised frequencies of the stronger stations in the Arab world. Look for Algeria on 549, 576, 891 and 981kHz, Egypt on 621 and 1107, Kuwait on 540, 1134 and 1341, Libya on 828, 1125 and 1251, Morocco on 612, 963 and 1044, Turkey on 1017 and 1062, Tunisia on 630 and 1566, Syria on 747 and 783, and Saudi Arabia on 585 and 882. Do not forget the long waves. Azilal in Morocco is on 209kHz, Tipaza in Algeria is on 254kHz and Turkey is on 182 and 245kHz.

Identification

The identification of Middle East stations can be a problem. The language is Arabic except in Turkey and Iran, which is a help. Listen for Burasi in Turkish. Burasi Turkiyem Sesi Radyosu is the Voice of Turkey. In Farsi (Persian) Inja Teheran means Here is Teheran. The key word in Arabic is Huna. Huna al Kuwait means This is Kuwait, also there is Sowt el Arab, the Voice of Arabs, from Egypt.

Reception Reports

A few years ago an enterprising DXer in Germany produced an Arabic reception report form complete with vocabulary, which really is an example of dedication to a hobby. Problems could arise though if it fell into the hands of a DXer who did not realise that Arabic is written from right to left! I have never used anything but English when writing to the Middle East as it seems to be widely understood. The problem is not so much the language to use as what to put into the report. "Arab music and singing" is not really much use. Time signals, news bulletins, station identification, clock chimes (Egypt uses the Post Office clock in Cairo), are the sort of items to look for, but if you really pick up something special then a short tape recording sent to the station is really the only way to be sure, in spite of the cost.

Language Identification

Last month, reader **S. Donnelly** raised the question of key words and their use as an aid to identifying a foreign language. This brought to mind the Foreign Language Recognition Course which was produced by the now defunct Radio Canada Short Wave Club. The course is still available on tape, either as a cassette or reel-to-reel, for £1.98 through the British or Canadian branches of the Handicapped Aid Programme. It is compiled by the well-known author, linguist and DXer, Dr Richard E. Wood. It plays for over 80 minutes, gives spoken examples of 55 different languages and includes key words and hints on pronunciation. Broadcasts examples are made from studio tapes and not from over-the-air recordings.

Further information about this and other Radio Canada SW Club tapes can be obtained, for return postage from the HAP, 5 Hall St, Wombwell, Barnsley, S. Yorkshire S73 0JL or direct from CHAP, RR3, Colbourne, Ontario, Canada KOK ISO. Proceeds from the sale of these tapes are used to finance the world-wide activities of the Handicapped Aid Programme which includes the introduction of the handicapped or housebound to the hobby of DXing.

Language identification is of some importance to the m.w. DXer as interval signals are infrequently used on this band and national anthems are generally played only at the end of a day's transmission. It is possible to become quite adept with language recognition even to the extent of being able to identify the particular brand of Spanish spoken in some regions of South America. The harsh and clipped variety spoken in Venezuela is often heard on the m.w.s and is easily recognisable.

BROADCAST BANDS

SHORT-WAVE BROADCASTS

by Charles Molloy G8BUS

A note from **Jonathan Marks** of Austrian Short Wave Panorama mentions the new schedule for this well-known English DX programme. It is now on the air on Sundays at 0900 GMT on 6155 and 7170kHz (Europe) 9770 (SE Europe), 21 610 (Australasia and SE Asia), at 1805 on 6155 (Europe), 15 435 (E Africa), 15 560 (Middle East), 21 740 (S Africa), at 2305 on 5945 and 9770 (N America), 12 015 (S America). Reception reports and comments on the new timings can be sent to Austrian SW Panorama, Austrian Radio SW Service, A-1136 Vienna, Austria. *(See also Part 2 of Jonathan's article on Short Wave Broadcasting in this issue—Ed.)*

Frequency—Wavelength Conversion

Retired reader **Dorothy Porter** (Broxbourne) collects old radios from rummage sales etc., and she is currently using a Convair 1 receiver which is marked out from 13 metres to 1800 metres. She wonders if there is a table available which gives the equivalent values for metres and kHz. I hope Table 1 will fill the need. It is based on the formula: frequency times wavelength = 300 000 so that:

$$\text{kHz} = \frac{300\,000}{\text{metres}} \quad \text{and metres} = \frac{300\,000}{\text{kHz}}$$

13m and 16m Bands

The 13 and 16 metre bands, which cover 21 450 to 21 750kHz and 17 700 to 17 900kHz respectively, are long-distance daytime bands. They go dead at night, but during daytime signals from all over the world can be heard. Radio Australia on 21 570 and 21 680kHz together with Radio Japan on 21 610, 17 710 and 17 810kHz are to be heard at breakfast time, while Radio New Zealand is on 17 770 until 0815. Later in the day, try for Radio Pakistan on 21 485 and 17 830, Radio RSA on 21 535 and 17 780, Sri Lanka on 17 850, Kuwait on 21 600, Lebanon on 17 710 and Radio Bangladesh on 21 670kHz.

There is some DX to be heard during the late evening on 16m from stations to the west, as the path in this direction is still mainly in daylight. Look for R. Havana Cuba on 17 750 and 17 855, Sao Paulo, Brasil on 17 815, Voice of Chile on 17 715. HCJB in Quito, Ecuador is normally conspicuous at this time but services from this

station have had to be severely restricted as a result of a drought. This has affected the station's hydroelectric power station according to a report in Sweden Calling DXers.

The move to higher frequencies which is demonstrated by the amount of activity on the 11m band is also apparent on 16m and 13m. New channels are opening up, such as the Voice of Greece on 21 455 and 21 655 so it is worthwhile tuning carefully round both bands.

Table 1
Frequency/Wavelength Conversion Short, Tropical, Medium and Long wave Bands

Band	kHz	Metres
11m	25 600—26 100	11·72—11·49
13m	21 450—21 750	13·99—13·79
16m	17 700—17 900	16·95—16·76
19m	15 100—15 450	19·87—19·42
25m	11 700—11 975	25·64—25·05
31m	9500—9775	31·58—30·69
41m	7100—7300	42·25—41·10
49m	5950—6200	50·42—48·39
60m	4750—5060	63·16—59·29
75m	3900—4000	76·92—75·00
90m	3200—3400	93·75—88·24
120m	2300—2500	130·43—120·00
Medium Waves	531—1602	564·97—187·26
Long Waves	155—281	1935—1068

Digital Readout

"Is there a frequency counter on the market that would serve as a frequency readout for my receiver?" asks **C. Smith** of Pembroke, who admits to being confused by some of the adverts in current literature. The situation is rather confusing, mainly because an ordinary frequency counter will not do the job properly.

A frequency counter adds up the number of complete cycles occurring in a short period of time, and displays the result as the number of kHz (complete cycles in one second × 1000). It is a marvellous product of modern technology, and on the face of it all one has to do is to join a counter to the receiver. Problems arise though when you try to do this. If you attempt to measure the incoming signal at some point, say at the input to the mixer, then there will be no display at all until you tune in a station! Moreover, there will be problems when measuring weak stations and the counter may get confused if there is interference. Why not measure the local oscillator (l.o.), whose strength is constant (more or less), and which is always generating something that can be measured? This is what is done but you will get an incorrect display because the frequency of the l.o. is not the same as the station the receiver is tuned to. The l.o. is usually higher than the incoming signal by the value of the intermediate frequency (i.f.). For example, if the i.f. is 465kHz and the receiver is tuned to 6055kHz then the l.o. will be generating 6055 + 465 = 6520kHz. Well, all you have to do is to subtract 465 from the value displayed, but if your mental arithmetic is anything like mine you will soon run into trouble. You could use a pocket calculator but this will be tedious if you are tuning around the band a lot. What you need is a counter that will do the subtraction for you. Such a counter would have an "offset" equal to the receiver's i.f.

Offset Counters

Chips are being produced that can be programmed by means of diodes to give one of a number of offsets. Ambit International (2 Gresham Road, Brentwood, Essex) produce an offset counter based on the OKI MSM5524 while Lowe Electronics (119 Cavendish Avenue, Matlock, Derbyshire) advertise a readout suitable for use with the Trio 9R59D or E. Rocquaine (Aldebaran, Le Coudre, Rocquaine, Guernsey, CI) offer their RG-3 frequency counter kit with an additional p.c.b., the RQ-30M which will "correct for any offset". All of the above advertise in *PW*.

For those wanting to build their own counters, two designs have appeared in *Practical Wireless*. The *PW* "Gillingham", published in the October 1978 issue with further information in May 1979, covered the band from medium waves up to 30MHz. The final page of the original article shows how to connect a counter to the local oscillator, and gives details of a suitable buffer amplifier should one be required. The second design, AM/FM Frequency Readout, appeared in the July 1979 issue and is based on another OKI integrated circuit, the MSM 5526. This unit is intended for the m.f. and v.h.f. broadcast bands only, and may therefore have limited appeal for readers of this column.

It cannot be long before all but the cheapest receivers will be equipped with digital readout. The cost will, to some degree, be balanced by the saving in tuning scales, drive mechanisms and bandspread arrangements. In the meantime, those of us like reader C. Smith will look around to see if there is any way we can up-date our existing gear.

Readers' Letters

Reader **Cliff Middleton** (Nottingham), who retired recently, has taken up DXing and he writes to say that he would like to be able to choose a country, set up a frequency and know that he is listening to the country of his choice. It is not too difficult to set a receiver onto a precise frequency, either by means of a crystal calibrator or with the aid of digital readout. To guarantee reception on any particular path is another matter. Propagation on the short waves is variable and this is one factor that makes the hobby so interesting. If you could tune in and be certain of perfect reception then DXing would soon lose interest, for me at any rate.

"Could you give me details of the Standard Frequency Transmissions on the h.f. bands?" asks **Roger Shepherd** of Whitstable, who uses a National Panasonic RF1105 with telescopic aerial. These stations are to be found on 2·5MHz, 5MHz, 10MHz, 15MHz and 20MHz, where they can be identified by the continuous clock ticking type of pulses they transmit. They are very useful for receiver calibration. 2·5MHz is the upper limit of the 120m band; 5MHz is within the 60m band; 10MHz is at the h.f. end of the 31m band; 15MHz below the l.f. end of the 19m band. These stations have been covered more fully in recent issues of this column especially in October 1978.

Radio New Zealand

Mrs D. L. Bonar (High Wycombe) has a National Panasonic RF2200 Direct Readout receiver and she says "This little portable with telescopic aerial surprises me." DX heard includes South America, Australia and Japan, but New Zealand has still to be logged. It is a difficult country to hear in the UK as the transmitters are low power (7·5kW) and they are not beamed to Europe.

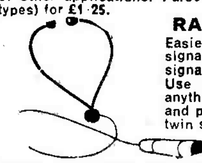
WINDSCREEN WIPER CONTROL

Vary speed of your wiper to suit conditions. All parts and instructions to make **£3·75.**

MICRO SWITCH BARGAINS

Rated at 5 amps 250V. Ideal to make a switch panel for a calculator and for dozens of other applications. Parcel of 10 (two types) for **£1·25.**

RADIO STETHOSCOPE



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

MULTISPEED MOTORS

Six speeds are available 500, 800 and 1,000 r.p.m. and 7,000, 9,000 and 11,000 r.p.m. Shaft is $\frac{1}{4}$ in. diameter and approximately 1 in. long. 230/240V. Its speed may be further controlled with the use of our Thyristor controller. Very powerful and useful motor size approx. 2 in. dia. × 5 in. long. Price **£2·50**

6 DIGIT COUNTER

One pulse at mains voltage moves 1 digit—not resettable—real bargain @ **50p.**

MAINS BLOWER

The Torrin—quiet but powerful outlet size $2\frac{1}{2}$ x $1\frac{3}{4}$ for cooling equipment etc. will extract of outlet is blowing outwards price **£5·50.** Other models from **£2·00.**

INDUCTION MOTORS

One illustrated is our reference MM11 made for ITT $\frac{3}{4}$ slack $1\frac{1}{2}$ spindle **£2·25.** $\frac{1}{2}$ stack model **£1·75.** 1 stack **£2·75.** $1\frac{1}{2}$ stack **£3·25.**

EXTACTOR FAN

Ex computers—made by Woods of Colchester. Ideal for fixing through panel—reasonably quiet running—very powerful 2500 rpm. Choice of two sizes 5" or $6\frac{1}{2}$" dia. **£5. £6.**

MAIN RELAYS

With triple 10 amp changeover contacts—operating coil wound for 230V a.c. Chassis mounting one screw fixing. Price **£1·25.**

BURGLAR ALARM ITEMS

(Circuit free on application)

Trigger mats 24" × 18"	£2·45
13" × 10"	£1·95
Relay 24 volt	95p
9-12 volt	95p
Alarm Bell 24 volt	£7·50
9-12 volt	£2·25
Mains	on application
Reset, Switch, ordinary	45p
Secret type with key	95p
Wire—100 metres	£1·50
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MERCURY BATTERIES

Bank of 7 Mercury cells type 625 which are approx. $\frac{5}{8}$in. diameter by $\frac{1}{4}$in. thick in plastic tube giving a total of 10·7V.

Being in a plastic tube it is very easy to break up the battery into separate cells and use these for radio control and similar equipment. Carton of 25 batteries **£1·60.**

PP3/PP9 REPLACEMENT

Japanese made in plastic container with leads size 2in. × $1\frac{1}{2}$in. × $1\frac{1}{2}$in., this is ideal to power a calculator or radio. It has a full wave rectifier and smoothed output of 9V suitable for loading of up to 100mA. **£2·53.**

MAINS TRANSISTOR PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9 and others. Kit comprises: mains transformer, rectifier, smoothing and load resistor, condensers and instructions. Real snip at only **£1·95.**

DRILL CONTROLLER

Electronically changes speed from approximately 10 revs to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. **£3·45**

Made up model £1·00 extra

8 POWERFUL BATTERY MOTORS

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

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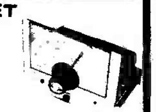
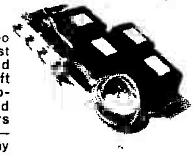
Self priming, portable, fits drill or electric motor, pumps up to 200 gallons per hour depending upon revs. Virtually uncorrodable, use to suck water, oil, petrol, fertiliser, chemicals, anything liquid. Hose connectors each end. **£2.**

SHORTWAVE CRYSTAL SET



Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 10, 25, 29, 31 metre bands. Kit contains chassis front panel and all the parts **£1·94**—crystal earphone **55p** including VAT and postage.

MULLARD UNILEX



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

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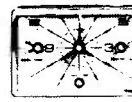
American made by Honeywell. The action of this device depends upon the dampness causing a membrane to stretch and trigger a sensitive micro-switch, quide sensitive – breathing on it for instance will switch it on. Micro 3 amp. at 250V a.c.

DELAY SWITCH

Mains operated—delay can be accurately set with pointers knob for periods of up to $2\frac{1}{2}$ hrs. 2 contacts suitable to switch 10 amps—second contact opens few minutes after 1st contact **£1·50**

25A ELECTRIC PROGRAMMER

Learn in your sleep. Have radio playing and kettle boiling as you wake—switch on lights to ward off intruders—have a warm house to come home to. All these and many other things you can do if you invest in an electrical programmer Clock by famous maker with 15 amp on/off switch. Switch-on time can be set anywhere to stay on up to 6 hours independent 60 minute memory jogger. A beautiful unit. **£4.50**



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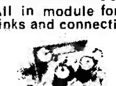
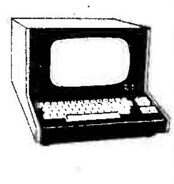
All in module form, each ready built complete with heat sinks and connection tags, data supplied Model 1153 500mW, power, output **£1·69.**



Model 1175–10 watts power output **£3·94**
Model 1172 1W. power output **£2·25.**
Model EP9000 4 watt power ouput **£2·90**
EP 9001 twin channel or stereo pre-amp **£2·90.**

Absolutely brand new, in fact still in the makers packing cases. The H1200 primarily is a VDU with Ascii Keyboard, but it has many features which makes it ideal for almost any application from main frame to home MPU systems. Main features are:



* 1920 Characters (80 c 24 lines)
* V24/RS232 Interface
* Selectable Baud Rates (110-9600)
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Sorry our quantity price does not apply to these but we welcome trade enquiries and where possible some small discount will be given, Price for the Terminal **£350** + £24 Carriage.

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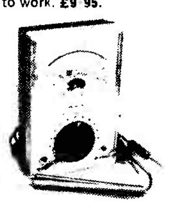
Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450W). Unit in box all ready to work. **£9·95.**



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AC volts 10, 50, 250, 1000
DC amps 0-1mA and 0-100 mA
Continuity and resistance 0-150K ohms.

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TERMS: Cash with order—but orders under **£6** must add **50p** to offset packing, etc.
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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.

TELEPHONE ANSWERING MACHINES

We supply these machines on the understanding they are broken up or at least not used for their original purpose. The machines are second hand but so far as we can see they are complete and quite possibly in good working order. We do not test them but guarantee to replace any part of the machine should it be missing or faulty.

This Month's Snip is a brand new two piece intercom. with 50ft inter-connecting lead. Master station and sub-station in neat cream coloured cases suitable for office or home or as a baby alarm etc. These are new stock but some we understand may need slight attention. Offered at half regular price only **£3·74.**

Portable Fluorescent Lamp Ideal for camping but really a must for you if you are a motorist. You never know when you need a light and unlike the average torch this lamp will illuminate the whole engine. With a lead which you can plug into the car lighter socket thus its saving internal batteries. A real bargain complete with 9" tube ready to operate. Price **£7·99.**

Setting up a Weather Station? We have two only professional Anemonitors. Quite complete i.e. a generator with its rotating cups weather proofed for mounting on a mast, and the ma instrument which directly indicates wind speeds of up to 100 mph. Furthermore there is a facility for setting off an alarm should the wind speed reach a pre-determined level (adjustable) say 80 mph. These are brand new and complete with handbook. Price **£189.**

Enamelled Copper Wire Available on one pound reels or four ounce reels. We keep a stock of even numbered sizes but will also get odd numbered sizes to order. Price for 10, 12, 14, 16, 18 SWG **£2·70** per pound, **81p** per quarter pound. 30, 32, 34 **£3·24** per pound. 36, 38, 40 **£3·78** + **28p** per pound, **£1·26** per quarter pound. Thinner sizes also available to order price on request.

Want a Cheap Electric Fan We can offer the $\frac{3}{4}$" stack induction motor with a 6" 5 bladed fan, mount this on a stiff wire frame or a piece of handy angle and you will be able to keep yourself cool this summer.

Want a Million Resistors These are $\frac{1}{4}$ watt, 1 watt and 2 watt types, all neatly packed in boxes with values clearly marked. Resistors themselves are colour coded and are perfectly standard, not every value of the range is included but they are reasonably spread over and there is not an unreasonably quantity of any one value. Ideal stock for retail shop or service depot. Price **£1,000** + VAT.

Service Engineers Assortment I.F.'s and OSC Coils Standard for many Jap and Hong Kong portable radios and cassettes etc. 100 assorted price **£5·60.**

Heating Pad 11" × $8\frac{1}{4}$", wafer thin 250 watt. Price £1·16.

Heat and Light Lamp 500 watt tubular like a short fluorescent tube, ideal for paint drying etc. Price **£3·95** + **20p,** post and special packing £1·25.

Radiomobile Car Radio 12 volt L & M push button operation. **£28·12.**

Car Radio L & M and with F.M. good quality, Far Eastern make 12 volts. Price **£19·85.**

Mains Transformer 30 volts 2 amp secondary upright mounting, primary and secondary wound on separate bobbins for additional safety. Price **£3·84.**

Relay Plug In, 3 changeover in clear plastic case 12 volt D.C. or 25 volt A.C., (or 3 volt D.C.) same price.

Mercury Operated Switch Glass encapsultated, 15 amp with 12" very flexible leads. Price **£1·62.**

Special Multi-Core Cables 14·0076 cores. PVC insulated and colour coded and each core with metal screen, PVC outer cover. The following types in stock, 4 core **75p,** 6 core **90p,** 7 core **£1·15,** 12 core **£1·50.** All per metre + VAT. Cut to any length, carriage extra if order under £6.

0-1mA Panel Meter Flush mounting and in a waterproof case made for American equipment, scale divided into zones but not numbered. Price **£2·70.**

Tape Head Cleaners Suitable for any cassette or reel to reel machine, special fluid (Isopropyl alcohol) in felt tipped dispenser. Price **35p.**

Uniselector Base mounting Tamsa 9 pole 12 way 50 volt operation. Price **£4·86.**

Plug in Uniselector Ref No: AP 212958 definitely a piece of precision equipment, it measures approximately 5" high × $1\frac{1}{4}$" wide x 1" thick, plugs into a 20 pin base. Probable cost would be at least £20 each. We only have a few. **£5·40.**

Redoing Your Living Room? If you are thinking of making a log effect fire piece, we have the fibre glass tops, which when lit up give the full log effect. Size approximately 17" × $10\frac{1}{2}$". Price **£2·35.**

Papst Motors Sometimes described as the motor with the built in fly wheel. These are used in many good quality tape recorders and in other equipment where wow and flutter has been reduced to a minimum. We have five different motors in stock, these are all physically about the same size (about 3" dia. x $2\frac{1}{4}$" deep). We quote their type numbers but we have no other technical information. Price includes the capacitor required.

HSZ 20.50 – 4-540D dual voltage 125/220 50Hz
Price **£7·50** + 60p + 50p p.p.

HSZ 20.50 – 4-255D 110V	50/60Hz	**£5·50** + 44p + 50p p.p.
KLZ 20.50 – 4-540D 220V	50Hz	**£7·50** + 60p + 80p p.p.
KLZ 20.50 – 4-425D 115V	60Hz	**£5·50** + 44p + 50p p.p.
KLZ 20.50 – 4-468D 110V	50Hz	**£5·50** + 44p + 50p p.p.

Battery Condition Tester Suitable for most batteries. That is zinc carbon types, mercury, manganese, nicad, silver oxide and alkaline batteries. The tester puts dummy lead on the battery and the meter scale indicates the condition by settling in a zone labelled 'Replace' 'Weak' or 'Good' etc. Complete in case, size approximately $3\frac{3}{4}$" × $6\frac{1}{2}$" × 2" with leads prods and instructions. Price **£5·95.**

Torque Motors Elico (USA make) ref no: NCH3/1 1600 1/30 horse 150V 50Hz brand new condition. Unused spares for computers. Price **£5·95.**

Two Track Record/Playback Heads For transistor circuits with separate erase head. Special offer this month **£1·08.**

Cassette Mechanism Jap made to rigid specification. These will fit many music centres and cassette players. Chassis size approx. $4\frac{1}{2}$" wide x $5\frac{1}{2}$" deep. 6V motor and tape position counter at the rear. The six levers for 'play', 'fast forward', 'rewind', 'stop', 'record' and 'eject' are all at the front, as is the auto mechanism to stop the motor when tape end is reached. These are new and unused and have stereo heads. Limited quantity, Price **£15·25.**

COOKER CLOCKS

All are less knobs and glass fronts, but you will no doubt be able to take these from the clock you are replacing. Replacements for Tricity and other well known cookers, these are also suitable for other timed switching operations, all are 230/40 working, with switches rating at 25-30 amps famous makes.

Cat. No. 5856 L 40 amp, large clear dial size 5" x $3\frac{1}{4}$" approximately. Made by Lux Time Canada Ltd. This has a normal stop and start facility plus 60 second minute minder. Price **£2·60.**

Cat. No. DDS 0663/2 made by Smiths, dial size approximately 40" x 3" this has the clock on the right hand side and the stop and start switches on the left hand side. There is no minute minder. Price **£1·62** + 12p.

A. D. Scholifield (South Shields) has been listening to the new RNZ outlet on 17 770kHz between 0630 and 0815 with QRM at times from Radio RSA. He also picked up the transmission on 15 345kHz on one occasion at 0340. Details of receiver and aerial were not given. Reception reports to RNZ should go to the Overseas Programmes Manager, RNZ, PO Box 2092, Wellington, NZ accompanied by two IRCs.

The B40 Receiver

"I must tear you off a strip for advising John Markey to connect a 50pF variable across his B40 r.f. stage. Severe misalignment would be the result," writes **A. J. Dixon** from Weymouth, who goes on to say that the anti-crossmodulation control on this set is a pretty useless gimmick and is best removed. Well, the capacitance will only be 50pF when the vanes are fully meshed; in the minimum position there should only be a few picofarads in circuit. The anti-crossmodulation control, which must be unique on receivers, applies an adjustable positive potential to the control grid of the first r.f. valve and this should, I think, have some effect on crossmodulation. Has anyone tried using this control? Perhaps it was intended for use in close proximity to a transmitter such as would occur on board ship. Reader **Roderick Williams** would like to form a club for B40 owners, replies direct to Roderick please, who lives at 54 Woodlands Avenue, Talgarth, Brecon, Powys LD3 0AT, not forgetting to enclose return postage.

VHF BANDS

by Ron Ham BRS15744

Although no major v.h.f. disturbance took place between April 18 and May 21, my readers, as usual, concentrated their efforts on the many less important events which often occur and may otherwise have passed by unrecorded, showing once again that the v.h.f. bands are never dull.

Solar

An eleven-day period of solar activity began on April 24 when **Cmdr Henry Hatfield**, Sevenoaks (on 136MHz) and myself (on 146MHz) recorded a mild noise storm followed by four days of small, short-duration bursts. Further noise storms were recorded on April 29 and May 1 and a few individual bursts again on the 4th and 5th. **Robin Knight,** South East Essex Astronomical Society, recorded solar noise at 60MHz on April 29 and at 134MHz when they were testing their new radio telescope. Henry Hatfield received three bursts of solar noise at 1296MHz between 0800 and 1000 on the 30th and, later in the day, he saw five sunspot groups with his spectrohelioscope, two of which were large groups accompanied by five long filaments and two arched filaments. Henry saw another arched filament on May 2 and was delighted when, at 1250, he recorded a burst of noise at both 1296 and 136MHz giving him his first positive correlation between these two widely-separated radio frequencies.

The 134MHz instrument now in use by SEEAS comprises a Yagi aerial, home-brew BFW10 f.e.t.pre-amplifier, Microwave Modules converter, an early Eddystone communications receiver, followed by a 741 d.c. amplifier driving an Evershed and Vignoles pen recorder. Robin Knight told me that the members of SEEAS all thoroughly enjoyed Henry Hatfield's talk, early in May, about his spectrohelioscope and radio telescopes. Further bursts of solar noise were recorded on May 12, 14 and 19 at 136 and 146MHz, and at 1500 on the 18th a 10 minute burst was recorded at 60MHz.

The brief auroral event during the late afternoon of April 25, reported by **John Branegan** GM8OXQ, Saline, Fife, was no doubt caused by the solar storm on the previous day.

The 10 Metre Band

The solar activity also upset the 10m band, because frequent checks between 0700 on the 22nd and 1100 on the 24th, found the band dead, as it was at midday on the 25th and early on the 26th. Strange things were happening, because at midday on the 26th and early on the 27th, the only signal I heard on 10m came from the Cyprus beacon, 5B4CY. The band was also dead during the early mornings on the 28th, 29th and 30th, confirmed by **Ron Nugent** G2FTS, Polegate, Sussex, yet, at times on these days it would open up, as **Steve Harris** RS41444, Goring-by-Sea, Sussex, pointed out. During the evening of the 29th he received strong c.w. signals from PY2ZBO and PY5EG. While in France, Steve held the call-sign F6LUC, and now, at home he enjoys listening on the DX bands with a Trio 9R59D fed with a Hygain, 18 AVT/WB-A vertical aerial. For portable use he has a National Panasonic DR28, which he also uses for Band II DX.

Gordon Goodyer, Petworth, has changed his rig to a Drake R4B, fed with a long wire in the loft for 80m and a dipole for 20 and 10m, and is delighted with the set's performance on all bands. **Neil Clarke** BRS34306, Knottingley, West Yorks, has heard strong signals from the Mauritius beacon, 3B8MS, on its new frequency, 28·210MHz and, like myself, has frequently heard the beacons in Bahrain A9XC, Cyprus 5B4CY and much less frequently, the German beacon, DL0IGI. Neil also reports hearing a new beacon around 1700 on 28·315MHz, sending its call-sign, ZS6DN, every 18 seconds. Strong signals, often peaking 599, were heard from the Cyprus beacon around 1300 on April 27 and 30, May 3, 4, 10, 13, 14, 16 and 18.

From the USA

John Keegan is now back in Steyning, Sussex, after a 6 month business trip to New York. While there, John used a 40-channel scanner for CB listening and often heard families returning home in their cars, with mum, at home, as base station net controller. "It's not uncommon" said John, "to see homes with high, ground-plane aerials for their 5 watt rigs, or notices on highway bridges telling motorists which CB channel to use if help is required." Like most of us, John has mixed feelings about CB, because, at times, in the cities the band is unusable through overcrowding. "On the other hand," he said "it's a godsend on the highway, if you are in real trouble, like a puncture, breakdown or witness an accident, you reach for your CB and call 'Smokey' for help".

DX TV

With the 1979 sporadic-E season close to hand it was not surprising to see bursts of test card from Poland on Channel R1, 49·75MHz, at 0815 on April 24, 0752 on the 27th, and 0807 on May 2. At midday on May 18, I feel sure an F2 opening to Scandinavia occurred, because I received strong test cards from Norway, Melhus, on E2 and Sweden, TV1 on E3 but none of the usual evidence of Sp.E. This event gave me a chance to try my new National Panasonic T5001G, with a vertical dipole on the European v.h.f TV band, channels 2-4, 48-68MHz, and I am very pleased with its performance. **Ian Roberts,** Glenstantia, Rep. South Africa, writes "F2 has been monitored as usual and has been quiet of late, but suddenly picked up on April 23 with Spain on E2 and Italy on 1A. On the 24th, Spain was again very strong." Many thanks for the report Ian, and congratulations on passing your Morse test.

The first real sporadic-E disturbance of 1979 took place during the afternoon of May 21 when **John Matthews** G3WZT, Horsham, worked YU and SV on 2m s.s.b. and **Ian Rennison,** also in Horsham, received Italian Television pictures on his JVC 3040 and heard many Italian f.m. broadcast stations in Band II. **Peter Penfold** in nearby West Chiltington, also using a 3040, watched Italian adverts, **Guy Stanbury** received pictures from Rumania and Spain, and I saw a cartoon film from Poland on Channel R1.

CQ Air Cadets

David Whitfield, G8RVK, Worthing, is busy building a unit to change his 2m Yagi from horizontal to vertical and back again and hopes in the near future to start constructing gear for 10GHz. David, himself a Sergeant cadet in the Worthing 45F squadron, ATC, wishes to contact any readers who are also in the Air Training Corps with a view to having skeds with them and possibly a regular net.

DX Ladder?

John Cleaton G4GHA, Wareham, Dorset, uses a Trio 700S and a linear to a 6-element quad aerial and gets a great deal of enjoyment just listening around the bands. John also suggests that we should run a Countries or QRA Squares ladder; what about it readers? Let me know how you feel on this one.

Satellites

"OSCAR 7B is working well" writes John Branegan, "I have quite a few QSOs with old and new friends. OSCAR 8J is as good as ever" and several new stations have come on who John hopes to work. All of them, old friends and new, will have to get used to a new call-sign because he has passed his Morse test and by now may be a GM4.

Tropospheric

Throughout the period, April 18 to May 20, v.h.f. conditions were generally good, because, for at least 23 days, the atmospheric pressure was above 30·0in and at times reached 30·4in. Continental broadcast stations were just audible in Band II on April 21, amd I received pictures from Lichfield on Channel 8, 189MHz, and strong signals through the Bristol Channel repeater GB3BC, R6. On the same day, **Alan Baker** G4GNX, Newhaven, was working into France on 2m s.s.b., and between 1300 and 1600 on the 22nd he made c.w. contacts on 2m with ON5FF, ON5UN and F6FDR. At 2022 on the 27th, F6AID worked Alan via the Brighton repeater GB3SR, R3, and around 2200 on the 29th, Ron Nugent, **Dermot Cronin** G4GRO, on the Royal Sovereign Light and G4GNX had a round-table QSO, first among themselves and then with F1FHA in Paris via GB3SR.

Conditions were good on May 5 and 6 for a Continental 2m contest and during the evening of the 5th, G4GNX worked F1ENH/P, two ONs and a PA0 on 2m s.s.b., and ON7DV on c.w. **John Cooper** G8NGO, Cowfold, Sussex, worked 23 stations, including four ONs, three PAOs, a DJ and PA0NIE/LX/P in Luxembourg on s.s.b. during the same event. John is eagerly awaiting QSL cards for his many contacts on 2m because he is after the QRA Locator Square Award offered by the RSGB.

I heard an interesting QSO during the early afternoon on May 9 between EA2OZ/MM aboard ship in the English Channel and G8PTC/push-bike mobile, near Croydon, through the Hampshire repeater GB3SN, R5. On May 13, John Cooper worked 29 French stations and a GU, all with 12 watts, and heard DJ and PA0 on 2m s.s.b. Both **Derek Knight,** Storrington, Sussex, using a Sharp stereo and **John Bugler,** Wimborne, Dorset, using a Grundig Yacht Boy, reported that Band II was open to the Continent and northern UK for most of the 13th and 14th. Also on the 14th, I heard signals through the Malvern Hills repeater GB3MH, R3 and a QSO between G8PMU, Hornchurch, Essex and G8RAL/P, Southend, via the Bristol Channel repeater. F3NW and G4GNX took advantage of these conditions for a QSO through the new French repeater FZ2VHF, at Boulogne on R5. By now this repeater, situated some 210 metres a.s.l., should be running about 50 watts and your reports will be welcomed by F2XO and F3NW, QTHR.

BBC Programme for Sussex Amateurs

Seven members representing the Brighton and District Radio Society, the Mid-Sussex Amateur Radio Society and the Worthing and District Amateur Radio Club met producer Ian Collington at the studios of BBC Radio Brighton on May 14 to inaugurate a fortnightly programme for radio amateurs in the Radio Brighton area.

A joint broadcasting committee consisting of one delegate from each club was formed and the first programme, aptly named *Call-Sign* and presented by Ron Ham, was then recorded and transmitted at 1848 on the 16th. Future programmes of ten minute duration will be planned by committee members, **Nigel Hewitt** G8JFT, Brighton, **Jack Brooker** G3JMB, Mid-Sussex and **Bob Jones** G3YIQ, Worthing and presented by Ron Ham.

First recording of *Call-Sign* in the Radio Brighton studio. Left to right . . . Ron Ham and Ian Collington and programme guests, Eric Godsmark G5CO, Alan Baker G4GNX and Ron Kingstone G4HHB

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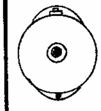
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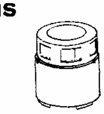
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50. BC 107-8-9 TRANSISTORS assorted untested @ **57p.**
50. AC 128 TRANSISTORS Branded but untested @ **57p.**
50. 1 AMP THYRISTORS untested @ **£1.**
25. 5 AMP STUD MOUNTING THYRISTORS untested @ **75p.**
50p. OC 71 TRANSISTORS untested @ **75p.**
25. 10 AMP STUD MOUNTING SILICON DIODES untested @ **57p.**
10. 20 AMP STUD MOUNTING SILICON DIODES untested @ **57p.**
50. VARI-CAP DIODES like BA 102 untested @ **57p.**
100 MULLARD C280 CAPACITORS assorted @ **57p.**
LED's TIL 209 @ 6 for **50p,** ·2" type Red @ 6 for **70p.**
50. 2 watt ZENERS untested assorted @ **57p.**
X BAND GUNN DIODES CXY 11A @ **£3** each.
VERNITRON FM4 10·7 MHz FILTERS at **50p,** 3 for **£1.**
ERIE REDCAP ·oluf 100v.w. **MINIATURE CAPACITORS** @ **5p** each.
10 AMP S.C.R.'s 100 PIV @ **25p,** 400 PIV @ **50p,** 800 PIV @ **60p.**
R. F. SIGNAL TRANSISTORS AF 239 @ **50p,** 2N 5179 @ **50p,** BF 362 @ **25p,** 2N 5180 @ **50p,** BFY 90 @ **50p,** MPS 6514 @ **10p,** BF 177 @ **15p.**
200 ASSORTED ¼, ½ RESISTORS. for **75p.**
COIL FORMERS 3/16" Dia. with core at 6 for **25p.**
SOLID DILECTRIC VARIABLES 195+80pf @ **40p** each.
SUB-MINIATURE TANTALUM CAPACITORS 4·7uf 10v.w. @ 6 for **25p.**
DAU TRIMMERS 2 To 9pf @ **15p,** 3 To 35pf @ **15p,** 6 To 45pf @ **15p,** 0 To 125pf @ **15p,** 8 To 140pf @ **15p.**
SILICON DIODES 50 PIV 2½ amp @ **7p,** 6 for **25p.**
400mW ZENERS unmarked good. 3·6v, 6·8v, 10v, 11v, 12v, 13v, 16v, 18v, 24v, 30v, 33v, 36volt. All at 10 for **40p.**
MULLARD TRANSISTORS BC 548, BC 549 Both **10p** ea. 8 for **50p.**
10 ASSORTED PUSH BUTTON BANKS less knobs for **£1·30.**
VHF TUBULAR TRIMMERS 6pf @ **10p,** 15pf @ **18p,** 8pf @ **10p.**
MINIATURE VARIABLE CAPACITORS 5pf @ **75p,** 10pf @ **75p,** 30pf @ **85p,** 125+125pf @ **55p,** 100+200pf @ **55p,** 200+300pf @ **55p.**
10 ASSORTED SLIDER POTENTIOMETERS for **£1.**
CRYSTAL FILTER 10·7MHz 910 ohm B.W. ± 7·5 KHz @ **£5.**
1000pf SOLDER-IN FEED THRU CAPACITORS @ **20p** doz.
30. ASSORTED 10XAJ CRYSTALS @ **£1·10, 20. FT 243 CRYSTALS** assorted @ **£1·10, 20. FT 271A CRYSTALS** assorted @ **£1·10.**
MINIATURE BUTTERFLY PRE-SET VARIABLES Spindles easily extended. 25×25pf @ **50p,** 38×38pf @ **60p,** 38×38pf. Wide Spaced @ **65p.**
600 MHz FREQUENCY COUNTERS HFC 600 S.A.E. for leaflet @ **£115.**
CRYSTALS. 10X type 8010 KHz @ **40p,** 100 KHz plus 1 MHz @ **£2.**
WIRE ENDED GLASS CRYSTALS. 28 KHz, 28·5 KHz, 29·75 KHz, 31·5 KHz. All at **50p** each.
HC6U type CRYSTALS. 37.7777, 38.1481, 38.3333, 39.6667, 39.7037, 39.7407, 39.8889, 40.37, 40.111111, 40.2963, 41.11111, 44.3, 45.7, 45.9, 46.1, 46.3, 46.5, 46.612, 46.7, 48.3, 50.1 MHz. All **50p** each, or 3 for **£1·30.**
MINIATURE NON POLARISED CAPACITORS 1uf 63v.w. @ **5p,** 4·7uf 63v.w. @ **10p,** 10uf 63v.w. @ **15p.**
MIDGET AIRSPACED TRIMMERS 3 To 20pf @ **15p** each.

Please add 20p for post and packing on U.K. orders under £2. Overseas postage at cost.

WATFORD ELECTRONICS

33/35, CARDIFF ROAD, WATFORD, HERTS, ENGLAND
MAIL ORDER, CALLERS WELCOME. Tel. Watford 40588/9

ALL DEVICES BRAND NEW. FULL SPEC. AND FULLY GUARANTEED. ORDERS DESPATCHED BY RETURN OF POST. TERMS OF BUSINESS: CASH/CHEQUE/P.O.s OR BANKERS DRAFT WITH ORDER. GOVERNMENT AND EDUCATIONAL INSTITUTIONS OFFICIAL ORDERS ACCEPTED. TRADE AND EXPORT INQUIRY WELCOME. P & P ADD 30p* TO ALL ORDERS UNDER £10·00. OVERSEAS ORDERS POSTAGE AT COST.

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POLYESTER CAPACITORS: (Axial Lead Type)
400V: 1nF, 1n5, 2n2, 3n3, 4n7, 6n8, 10n, 15n, **9p**; 18n **10p**; 22n, 33n **11p**; 47n, 68n **14p**; 100n **17p**; 150n, 220n **24p**; 330n, 470n **41p**; 680n **48p**; 1μF **64p**; 2·2μ **82p**.
160V: 10nF, 12n, 39n, 100n, 150n, 220n **11p**; 330n, 470n **19p**; 680n, 1μF **22p**; 2·2μF **32p**; 4·7μF **36p**.
1000V: 10n, 15n **20p**; 22n **22p**; 47n **26p**; 100n **38p**; 470n **53p**; 1μF **175p**.

POLYESTER RADIAL LEAD CAPACITORS: 250V; 10n, 15n, 22n, 27n **5p**; 33n, 47n, 68n, 100n **7p**; 150n **10p**; 220n, 330n **13p**; 470n **17p**; 680n **19p**; 1μ **22p**; 1μ5 **30p**; 2μ2 **34p**.

ULTRASONIC TRANSDUCERS* **450p** per pair

ELECTROLYTIC CAPACITORS: Axial lead type (Values are in μF). **500V:** 10 **40p**; 47 **68p**; **250V:** 100 **65p**; **63V:** 0·47, 1·0, 1·5, 2·2, 2·5, 3·3, 4·7, 6·8, 8, 10, 15, 22 **8p**; 32, 47, 50 **12p**; 63, 100, **27p**; **50V:** 1·0 **7p**; 50, 100, 220 **25p**; 470 **32p**; 1000 **50p**; **40V:** 22, 33μF **8p**; 100 **12p**; 2200, 3300 **68p**; 4700 **85p**; **35V:** 10, 33 **7p**; 330, 470 **32p**; 1000 **50p**; **25V:** 10, 22, 47 **6p**; 80, 100, 160 **8p**; 220, 250 **13p**; 470, 640 **25p**; 1000 **27p**; 1500 **30p**; 2200 **45p**; 3300 **62p**; 4700 **74p**; **16V:** 10, 40, 47, 68 **7p**; 100, 125 **8p**; 220, 330 **14p**; 470 **16p**; 1000, 1500 **20p**; 2200 **34p**; **10V:** 100 **6p**; 640 **12p**; 1000 **14p**.
TAG-END TYPE: 70V: 4700 **135p**; **64V:** 2200 **95p**; **50V:** 10,000 **225p**; 3300 **95p**; 2500 **65p**; 3300, 4700 **70p**; 15,000 **299p**; **25V:** 4700 **74p**; 2000 **48p**; **40V:** 2000+2000 **95p**.

TANTALUM BEAD CAPACITORS
35V: 0·1μF, 0·22, 0·33, 0·47, 0·68, 1·0, 2·2μF, 3·3, 4·7, 6·8, **25V:** 1·5, 10. **20V:** 1·5μ. - **16V:** 10μF **13p** each.
16V: 15μ, 22 **25p**; 47, 100, 220 **40p**.
10V: 15μ, 22, 33 **20p**; 100 **35p**; **6V:** 47μ, 68, 100 **30p**; **3V:** 100 **20p**.

POTENTIOMETERS (AB or EGEN)
Carbon Track, 0·25W Log & 0·5W Linear values.

500Ω, 1K & 2K (LIN ONLY) Single	**27p**
5KΩ 602MΩ single gang	**27p**
5KΩ 602MΩ single gang D/P switch	**65p**
5KΩ 602MΩ dual gang stereo	**78p**

MYLAR FILM CAPACITORS

100V: 0·001, 0·002, 0·005, 0·01μF	**6p**
0·015, 0·02, 0·03, 0·04, 0·05, 0·056μF	**7p**
0·1μF, 0·2 **9p**. **50V:** 0·47μF	**12p**

SLIDER POTENTIOMETERS
0·25W log and linear values 60mm track

5KΩ 500KΩ Single gang	**70p**
10KΩ 500KΩ Dual gang	**80p**
Self-Stick graduated Alum. Bezels	**25p**

CERAMIC CAPACITORS 50V
Range: 0·5pF to 10nF **3p**
15nF, 22nF, 33nF, 47nF **4p** 100nF **6p**

PRESET POTENTIOMETERS

0·1W 50Ω-2·2M Mini. Vert. & Horiz.		**8p**
0·25W 100Ω-3·3MΩ Horiz.	larger	**10p**
0·25W 250Ω-4·7MΩ Vert.		**10p**

POLYSTYRENE CAPACITORS:
10pF to 1nF, **8p.** 1·5nF to 47nF **10p.**

JACKSONS VARIABLE CAPS.

Dielectric			
100/300pF	**140p**	0 2 365pF with slow	
500pF	**165p**	motion Drive	**325p**
6:1 Ball Drive		00 208/176	**285p**
4511/DAF	**115p***	„ „ with slow	
Dial Drive 4103		motion drive	**325p**
6:1/36:1	**650p***	C804-5pF; 10; 15; 25;	
Drum 54mm	**30p***	50pF	**175p***
0-1-365pF	**245p**	100, 150pF	**235p***
00 2 365pF	**275p**	'L' 3x310pF	**495p**
00-2-500pF	**525p**	00-3x25pF	**430p**

RESISTORS–Erie make 5% carbon
Miniature High Stability, Low Noise

RANGE	Val.	1-99	100+
0·25W 2·2Ω-4·7M	E24	**1·5p**	**1p**
0·5W 2·2Ω-4·7M	E12	**2p**	**1·5p**
1W 2·2Ω-10M	E12	**5p**	**4p**
2% Metal Film 10Ω-1M		**6p**	**4p**
1% 0·5W 51Ω-1M	E24	**10p**	**8p**

COMPUTER HARDWARE*

		4047	**750p**
2102-2	**225p**	74S188	**185p**
2111	**195p**	74S262	**895p**
2112-2N	**250p**	74S287	**325p**
2114	**695p**	74S470	**325p**
2513	**650p**	74S475	**825p**
2708	**775p**	81LS95	**125p**
27L08	**995p**	81LS96	**125p**
2716	**1650p**	81LS97	**125p**
AY-5-2376	**920p**	MC1488	**85p**
CP1610*	**920p**	MC1489	**90p**
TMS6011	**355p**	Z80 2·5MHz	**1050p**
4027	**325p**	Z80 5MHz	**1450p**

SILVER MICA (pF)
3·3, 4·7, 6·8, 8·2, 10, 12, 18, 22, 27, 33, 39, 47, 50, 68, 75, 82, 85, 100, 120, 150, 180, 200, 220 **9p.**
250, 270, 300, 330, 360, 390, 470, 600 & 820pF **16p** each.
1000, 2000pF **20p.**

TRIMMERS miniature
2·5pF; 3-10pF;
3-30pF; 3-50pF **22p**
5-25pF; 65pF 88pF **30p**

COMPRESSION

3-40pF; 10-80pF	**30p**
25-200pF	**33p**
100-500pF	**45p**

GAS & SMOKE DETECTORS
TGS812 or 813 **415***

RF CHOKES 1μF, 4·7, 10, 22, 47, 100, 220, 470, 750, 1mH, 2·5, 5, 10mH **35p.** 35mH, 100mH **60p.**

CRYSTALS*

100kHz	**385p**
455kHz	**385p**
1MHz	**323p**
1·008MHz	**323p**
1·80MHz	**385p**
1·832MHz	**362p**
1·6MHz	**395p**
3·2768MHz	**323p**
4MHz	**290p**
4·032MHz	**323p**
4·433619M	**135p**
5·0MHz	**355p**
6·5536MHz	**200p**
7·680MHz	**323p**
9·375MHz	**323p**
10MHz	**323p**
10·7MHz	**323p**
12MHz	**392p**
14·318118M	**300p**
18MHz	**323p**
18·432M	**33p**
20MHz	**362p**
27·648MHz	**350p**
48MHz	**323p**
100MHz	**300p**

TRANSFORMERS* (mains Prim. 220-240V)
6-0-6V 100mA; 9-0-9V 75mA; 12-0-12V 75mA **95p.**
8VA type: 6V-·5A 6V-·5A; 9V-·4A 9V-·4A; 12V-·3A 12V-·3A; 15V-·25A 15V-·25A **195p.**
12VA: 4·5-1·3A 4·5V-1·3A; 6V-1·2A 6V-1·2A 12V-·5A 12V-·5A **220p** (20p p&p)
24VA: 6V-1·5A 6V-1·5A; 9V-1·2A 9V-1·2A; 12V-1A 12V-1A; 15-·8A 15-·8A; 20V-·6A 20V-·6A **290p** (45p p&p)
50VA: 6V-4A 6V-4A; 9V-2·5A 9V-2·5A; 12V-2A 12V-2A; 15V-1·5A 15V-1·5A; 20V-1·2A 20V-1·2A; 25V-1A 25V-1A; 30V-·8A 30V-·8A **350p** (50p p&p)
100VA: 12V-4A 12V-4A; 15V-3A 15V-3A; 20V-2·5A 20V-2·5A; 30V-1·5A 30V-1·5A; 40V-1·25A 40V-1·25A; 50V-1A 50V-1A **650p** (60p p&p)
(N.B. P&P charge to be added above our normal postal charge.)

DENCO COILS

Dual Purpose 'DP'		B9A Valve Base	**25p**
VALVE TYPE		RDT2	**92p**
Ranges: 1-5 Bl. Yl.		RFC 5 chokes	**91p**
Rd. Wht.	**86p**	RFC 7(19mH)	**96p**
6-7 B, Y, R	**76p**	1FT 13/14/15/16	
1-5 Green	**92p**	17	**85p**
'T'-type (Transistor		1FT 18/1·6	**92p**
Tuning).		1FT 18/465	**104p**
Ranges: 1-5 Bl. Yl.		TOC1	**86p**
Rd. Wht.	**93p**	MW 5FR	**82p**
		MW/LW 5FR	**103p**

TRANSISTORS (p)

AC107*	28
AC117*	35
AC125*	20
AC126*	20
AC127*	20
AC128*	20
AC141*	24
AC141K*	38
AC142*	24
AC142K*	38
AC176*	24
AC187*	24
AC188*	24
ACY17*	40
ACY18	40
ACY19	40
ACY20	40
ACY21*	35
ACY22*	40
ACY28*	40
ACY39	78
AD149*	70
AD161*	42
AD162*	42
AF106	50
AF114*	50
AF115*	50
AF116*	50
AF117*	50
AF118*	65
AF121*	48
AF124*	55
AF125*	35
AF126*	50
AF127*	35
AF139*	35
AF178*	70
AF180*	70
AF239*	42
AFZ12	126
ASY26*	40
ASY27*	45
ASY50*	95
ASY76*	95
BC107*	9
BC107B*	10
BC108*	9
BC108B*	10
BC108C*	12
BC109	9
BC109B*	12
BC109C*	12
BC113	20
BC114	20
BC115	20
BC116	20
BC117	20
BC118	20
BC119*	28
BC134	20
BC135	20
BC136	18
BC137	20
BC140*	35
BC142*	30
BC143*	30
BC147	8
BC147B	10
BC148	8
BC148B	10
BC148C	10
BC149	8
BC149C	10
BC153	27
BC154	27
BC157	10
BC158	11
BC159	11
BC160*	42
BC167A	11
BC168C	12
BC169C	14
BC170	18
BC171	11
BC172	11
BC173	12

BC177*	18
BC178*	16
BC179*	18
BC181	20
BC182	9
BC183	9
BC184	9
BC182L	11
BC183L	10
BC184L	11
BC186*	21
BC187*	28
BC212	10
BC212L	11
BC213	10
BC213L	12
BC214	10
BC214K	14
BC214L	13
BC307B	20
BC308	13
BC308B	20
BC327	15
BC328	15
BC338	12
BC441*	36
BC461*	36
BC477*	25
BC547	12
BC548	12
BC549C	13
BC557	15
BC558	20
BC569	20
BCY30*	57
BCY34*	75
BCY39*	80
BCY40*	78
BCY42*	48
BCY43*	85
BCY58*	90
BCY59*	90
BCY70*	18
BCY71*	20
BCY72*	20
BCY78*	25
BCZ10*	145
BCZ11*	145
BD112*	95
BD115*	65
BD121*	78
BD123*	98
BD124*	115
BD131*	45
BD132*	45
BD133*	43
BD135*	38
BD136*	38
BD137*	36
BD138*	50
BD139*	40
BD140*	36
BD142*	59
BD144*	198
BD145*	198
BD181*	125
BD205*	110
BD222*	75
BD378*	65
BD434*	42
BD517*	65
BD695A*	65
BD696A*	65
BDY11*	220
BDY17*	195
BDY56*	156
BDY60*	110
BDY61*	165
BF115*	34
BF154*	25
BF158*	29
BF160*	30
BF161*	60
BF167*	30
BF173*	25
BF177*	24
BF178*	25

BF179*	30
BF180*	35
BF181*	35
BF182*	35
BF183*	35
BF184*	38
BF194	12
BF195	12
BF196	12
BF197	14
BF198	18
BF199	18
BF200*	32
BF244A	18
BF244	29
BF244B	30
BF256*	60
BF257*	30
BF258*	30
BF259*	30
BF274	18
BF336	35
BF394	27
BF594	40
BF595	38
BFR39	25
BFR40	25
BFR41	28
BFR79	28
BFR80	28
BFR81	28
BFR98	105
BFX29*	26
BFX84*	26
BFX85*	28
BFX86*	28
BFX87*	28
BFX88*	28
BFY18*	50
BFY50*	20
BFY51*	20
BFY52*	20
BFY53*	28
BFY55*	45
BFY56*	45
BFY64*	40
BFY71*	20
BFY81*	45
BSX20*	18
BSX29*	45
BSX78*	55
BSY95A	18
BSZ26*	75
BU105*	140
BU205	190
BU208	225
E113	95
E176*	115
E421	150
MD8001	158
ME1120	25
ME4102	10
ME6002	10
MJ400*	90
MJ491*	160
MJ2955*	105
MJE340*	54
MJE370*	58
MJE371*	60
MJE520*	65
MJE521*	74
MJE2955*	105
MJE3055*	70
MPF102	66
MPF103	36
MPF104	36
MPF105	36
MPF106	40
MPF107	50
MPS3904	40
MPSA05	25
MPSA06	25
MPSA12	42
MPSA55	25
MPSA56	25
MPSA70	34

MPSU02	58
MPSU05	50
MPSU06	56
MPSU52	65
MPSU55	55
MPSU56	60
MPU131*	39
OC23*	170
OC25*	170
OC26*	170
OC28*	150
OC29*	160
OC35*	130
OC36*	130
OC41*	48
OC42*	48
OC43*	55
OC44*	31
OC45*	28
OC46*	28
OC70*	28
OC71*	28
OC72*	45
OC74*	55
OC76*	36
OC77*	76
OC79*	76
OC81*	50
OC82*	50
OC83*	48
OC84*	44
OC122*	75
OC123*	75
OC139*	110
OC140*	110
OC141*	110
OC170*	85
OC171*	75
OC200*	85
OC201*	75
OC202	95
OC203*	85
OC204*	85
SJE5039*	95
TIP29	43
TIP29A	44
TIP29B	56
TIP29C	60
TIP30	47
TIP30A	50
TIP30B	64
TIP30C	65
TIP31*	50
TIP31A*	52
TIP31B*	58
TIP31C*	65
TIP32*	55
TIP32A*	58
TIP32B*	70
TIP32C*	75
TIP33*	80
TIP33A*	85
TIP33B*	100
TIP33C*	105
TIP34*	85
TIP34A*	85
TIP34B*	110
TIP34C*	110
TIP35*	179
TIP35A*	185
TIP35B*	195
TIP35C*	220
TIP36*	210
TIP36A*	220
TIP36B*	230
TIP36C*	255
TIP41A*	66
TIP41B*	73
TIP42A	72
TIP42B*	82
TIP2955*	65
TIP3055*	65
TIS43	34
TIS44	45
TIS45	45
TIS46	45

TIS47	50
TIS48	50
TIS49	50
TIS50	47
TIS60	52
TIS62	52
TIS74	47
TIS88A	00
TIS90	20
TIS91	24
ZTX107	12
ZTX108	12
ZTX109	14
ZTX212	28
ZTX300	13
ZTX301	15
ZTX302	20
ZTX303	25
ZTX304	24
ZTX311	17
ZTX314	24
ZTX320	30
ZTX326	40
ZTX341	20
ZTX500	15
ZTX501	15
ZTX502	19
ZTX503	15
ZTX504	25
ZTX531	25
ZTX550	25
40250*	85
40251*	97
40311*	60
40313*	125
40315*	55
40316*	85
40317*	52
40319*	71
40320*	56
40323*	60
40324*	85
40362*	48
40406*	65
40407*	52
40408*	70
40411*	295
40412*	65
40467*	95
40594*	90
40595*	98
40603*	65
40411*	295
40412*	65
40467*	95
40594*	90
40595*	98
40603*	65
40636*	125
40673*	68
2N697*	25
2N698*	44
2N699*	54
2N706A*	18
2N707*	39
2N708*	19
2N914*	32
2N916*	27
2N918*	40
2N920*	51
2N1131*	22
2N1132*	22
2N1303*	50
2N1304*	50
2N1305*	28
2N1306*	35
2N1307*	50
2N1308*	46
2N1613*	23
2N1670*	150
2N1671B*	215
2N2160*	350
2N2217*	43
2N2218A*	34
2N2219A*	22
2N2220A*	26
2N2221A	23

2N2222A*	20
2N2303*	45
2N2368*	21
2N2369A*	15
2N2483*	28
2N2484*	25
2N2646*	48
2N2784	55
2N2846*	140
2N2894*	35
2N2904*	22
2N2905A*	22
2N2906*	22
2N2907*	22
2N2907A*	22
2N2926G	10
2N3011*	24
2N3053*	20
2N3054*	55
2N3055*	48
2N3108	32
2N3442*	146
2N3504	55
2N3563	20
2N3614*	199
2N3615*	199
2N3663*	26
2N3702	11
2N3703	11
2N3704	11
2N3705	11
2N3706	11
2N3707	11
2N3708	11
2N3709	11
2N3710	16
2N3711	12
2N3713*	215
2N3715*	250
2N3822	130
2N3771	233
2N3772*	195
2N3773*	288
2N3819	22
2N3820	45
2N3822	130
2N3823*	95
2N3824*	70
2N3866*	90
2N3903	20
2N3904	18
2N3905	18
2N3906	17
2N4037*	52
2N4041*	80
2N4058*	17
2N4061	17
2N4062	17
2N4064*	120
2N4069	45
2N4236	145
2N4286	20
2N4289	20
2N4427*	75
2N4859	65
2N4922*	55
2N5135	42
2N5136	42
2N5138	20
2N5172	25
2N5179*	60
2N5180*	80
2N5191*	70
2N5305*	40
2N5457	32
2N5458	32
2N5459	32
2N5485	35
2N5642*	750
2N5777	45
2N6027	40
2N6109	50
3N128*	112
3N140	112

Matched Pair 20p extra

LINEAR IC'S

702*	75	LD130*	452	NE566*	160
709C 8 pin*	35	LF365*	98	NE567V*	170
710*	67	LM301A*	30	NE571*	420
723* 14 pin	39	LM308T*	110	RC4136D*	120
741* 8 pin	18	LM311H*	120	SAD1024*	1350
747C 14 pin*	78	LM318H*	205	SG3402*	295
748C 8 pin*	36	LM324A*	68	SN76003N	170
753 8 pin*	150	LM339	70	SN76013N	140
810*	159	LM348*	90	SN7601B*	148
AY-1-0212	580	LM349*	125	SN76023N	140
AY-1-1313A*	660	LM379*	375	SN76033N	175
AY-1-1320	315	LM380	80	SN76115N	215
AY-1-5050	190	LM381N	145	SN76131*	110
AY-1-5051	145	LM381AN	248	SN76227N	115
AY-1-6721/6	195	LM382	125	SN76477*	225
AY-3-1015*	560	LM733*	125	SN76660	90
AY-3-8500*	390	LM1458*	50	SP8629*	450
AY-5-1013*	450	LM3900*	60		
AY-5-1224A*	260	LM3909N*	70	TAA621AX1	250
AY-5-1230*	450	LM3911*	125	TAA661A	155
AY-5-1315	560	M252AA*	750	TAD100	159
AY-5-1317A	630	M253AA*	795	TBA120S	70
AY-5-3500*	510	MC1303	88	TBA540	220
AY-5-4007D*	638	MC1304P	260	TBA550Q	330
AY-5-8100*	735	MC1310P	150	TBA641-A12/	
CA3014*	137	MC1312PQ	195	BX1 or BX11	250
CA3018*	68	MC1458*	50	TBA651	180
CA3020	170	MC1495*	350	TBA800	90
CA3023	170	MC1496L*	92	TBA810S	95
CA3028A*	80	MC1710	79	TBA820	70
CA3035	240	MC3340P*	120	TBA920Q	260
CA3036	110	MC3360P	120	TCA965*	210
CA3043	190	MC3401	52	TDA1008*	310
CA3045*	140	MC3403*	135	TDA1022	575
CA3046*	71	MFC6040*	97	TDA2020	320
CA3048	210	MK50253*	650	TL061C*	76
CA3075	175	MK50362*	650	TL062CP*	125
CA3080E*	70	MK50398*	635	TL064CN*	199
CA3081*	190	MM5303*	635	TL072CP*	125
CA3089E	210	MM5307*	1275	TL074CN*	199
CA3090AQ	398	MM57160*	620	TL081CP*	48
CA3123	200	MSM5526*	850	TL082CP*	96
CA3130*	85	NE543K*	210	TL083CP*	105
CA3140*	70	NE544*	185	TL084CP*	130
ICL7106*	795*	NE555*	22		
ICL7107*	975	NE556DB*	60	UAA170	198
ICL8038CC*	340	NE560*	325	UAA180	198
ICM7205*	1150	NE561*	395	ZN414	90
ICM7215*	1025	NE562B*	410	ZN424E	130
ICM7217A*	790	NE564*	425	ZN425E*	415
ICM7555*	89	NE565A*	120	ZN1034*	200

TTL 74* (TEXAS)

7400	11	7475	38	74153	64	74265	63
7401	11	7476	36	74154	96	74273	320
7402	11	7480	48	74155	53	74278	240
7403	12	7481	86	74156	80	74279	119
7404	12	7482	69	74157	65	74283	173
7405	18	7483	72	74159	185	74284	385
7406	28	7484	95	74160	82	74285	395
7407	38	7485	75	74161	92	74290	125
7408	17	7486	31	74162	92	74293	125
7409	17	7489	140	74163	92	74297	236
7410	11	7490	30	74164	105	74283	173
7411	20	7491	75	74165	105	74284	385
7412	17	7492	38	74166	140	74285	395
7413	30	7493	32	74167	200	74290	125
7414	45	7494	78	74170	185	74293	125
7416	30	7495	65	74172	625	74297	236
7417	30	7496	57	74173	120	74298	185
7420	16	7497	189	74174	87	74365	128
7421	29	74100	119	74175	87	74366	118
7422	17	74104	62	74176	75	74367	124
7423	27	74105	62	74177	78	74368	124
7425	27	74107	29	74178	153	74390	184
7426	36	74109	54	74179		74393	184
7427	27	74110	54	74180	85	74490	198
7428	35	74111	68	74181	165	75150	175
7430	17	74112	125	74182	88	75491	92
7432	25	74116	198	74184	135	75492	92
7433	40	74118	83	74185	135		
7437	30	74119	149	74188	275		
7438	33	74120	115	74190	95		
7440	15	74121	25	74191	95		
7441	74	74122	46	74192	98		
7442	68	74123	48	74193	98		
7443	115	74125	38	74194	98		
7444	112	74126	57	74195	98		
7445	94	74128	74	74196	93		
7446	94	74132	73	74197	80		
7447	57	74136	65	74198	150		
7448	56	74141	56	74199	150		
7450	17	74142	209	74221	132		
7451	17	74143	314	74246	204		
7453	17	74144	314	74247	204		
7454	17	74145	65	74248	240		
7460	17	74147	175	74249	204		
7470	28	74148	109	74251	125		
7472	25	74150	99				
7473	32	74151	64				
7474	25						

CMOS*

4000	13	4021	95	4072	21	4507	55
4001	13	4022	85	4073	21	4508	298
4002	15	4023	22	4075	23	4510	99
4006	87	4024	66	4076	85	4511	150
4007	18	4025	19	4077	40	4512	98
4008	82	4026	180	4078	21	4513	206
4009	38	4027	45	4081	20	4514	265
4010	38	4028	81	4082	21	4515	299
4011	18	4029	99	4085	74	4516	120
4012	18	4030	58	4086	73	4517	382
4013	42	4031	205	4089	150	4518	102
4014	80	4032	100	4093	78	4519	55
4015	82	4033	145	4094	190	4520	108
4016	45	4034	116	4095	105	4521	228
4017	82	4035	111	4096	105	4522	149
4018	87	4036	335	4097	372	4526	149
4019	48	4037	100	4098	110	4527	152
4020	99	4038	108	4099	145	4528	99
		4039	320	4160	109	4529	145
		4040	105	4161	109	4530	85
		4041	80	4162	109	4531	135
		4042	75	4163	109	4532	115
		4043	94	4174	110	4534	575
		4044	95	4175	99	4536	365
		4045	145	4194	108	4538	142
		4046	128	4408	720	4539	105
		4047	87	4409	720	4541	135
		4048	58	4410	720	4543	155
		4049	48	4411	958	4549	375
		4050	48	4412V	1380	4550	398
		4051	72	4415F	795	4554	150
		4052	73	4415V	795	4556	72
		4053	72	4419	280	4557	451
		4054	110	4422	545	4558	105
		4055	128	4433	995	4559	375
		4056	135	4435	825	4560	210
		4057	1950	4440	1275	4561	65
		4059	480	4450	295	4562	533
		4060	115	4451	296	4566	155
		4061	1425	4452		4568	268
		4062	995	4490F	695	4569	280
		4063	110	4490V	525	4572	26
		4066	58	4501	19	4580	594
		4067	380	4502	120	4581	297
		4068	22	4503	69	4582	130
		4069	20	4555	75	4583	75
		4070	32	4506	51	4584	63
		4071	21			4585	105

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