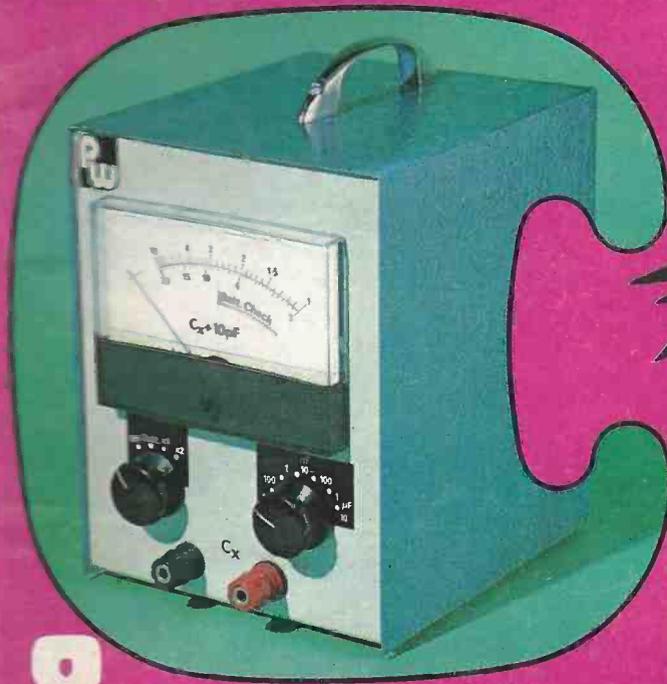


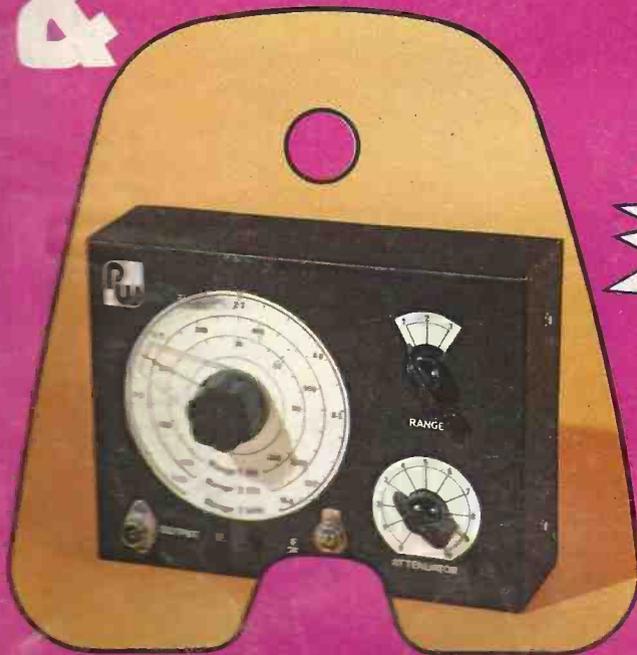
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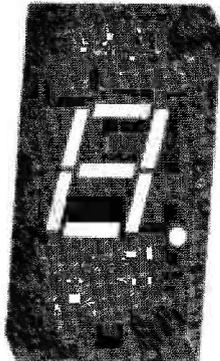
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PRACTICAL WIRELESS

VOL. 52 NO. 5

ISSUE 835

SEPTEMBER 1976

BRITAIN'S PREMIER MAGAZINE FOR THE DO-IT-YOURSELF RADIO AND ELECTRONICS CONSTRUCTOR

EDITOR

Lionel E. Howes, G3AYA

ASSISTANT EDITOR

Eric Dowdeswell, G4AR

ART EDITOR

Peter Metalli

TECHNICAL EDITOR

Terry Carter

PRODUCTION & NEWS EDITOR

Colin Riches

TECHNICAL SUB-EDITOR

Bill Tull

TECHNICAL ARTIST

Alan Martin

SECRETARIAL

Jill Austin

ADVERTS MANAGER

01-261 6275

Roy Smith

CLASSIFIED ADVERTS

01-261 5762

Colin R. Brown

Advertisement correspondence and enquiries to the Advertisement Manager, Roy Smith, Practical Wireless, Kings Reach Tower, Stamford Street, London, SE1 9LS

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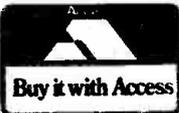
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Incorporating three high flux 8" speaker units. Dep. £5.95 and 8 monthly payments £3.50 (Total) £33.95 Carr. 65p.

TYPE C4/80 80 WATTS. Fitted four 12" highly sensitive high flux speakers with high power voice coils. Approx. size 54" x 14" x 11". Deposit £9.00 and 12 mthly. pymts. £4.00. (Total £57.00) Carr. 85p.

£199.95 carr. £7.50

TDI DISCO CONSOLE

Terms: Dep. £40.00 and 12 monthly payments £15.60 (Total £227.20)

- ★ ILLUMINATED P.U. ARMS
- ★ FULL SIZE B.S.R. Turntables
- ★ SEPARATE MAINS SWITCHES for L. & R. Turntables
- ★ NEON MAINS INDICATORS for all three switches
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£99.95

TD2S STEREO VERSION OF ABOVE

Terms DEPOSIT £20 and 18 fortnightly payments £6.71 (Total £140.78) Carr. £2.00

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Can be supplied with 200w system in lieu of RSC spkrs. for £56 extra. Twin Fabulous specialist range Spkrs in heavy Vynide covered pair cabinets with protective corner pieces and handles. Rating 120 watt R.M.S. each. List Price £150 Pair.

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Dep: £8.95 and 8 mthly payments £4.38 (Total £43.99)	Dep: £5.99 and 8 monthly payments £2.82 (Total £28.95)	Dual Cone. Terms for pairs Dep. £6.98 & 8 mthly payments £3.37. Total £23.94 PAIR SUITABLE ALL PURPOSES

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ALL RSC PRICES INCLUDE VAT

INTEREST on Credit Purchases REFUNDED settled in 3 months

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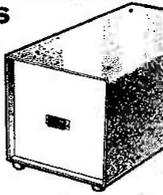
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VA (Watts)	REF NO.	PRICE CASED 2 Pin + Earth	PRICE PLUGS 2 & 3 pin	PRICE OPEN	POST
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200	181	12-87	0-98	9-07	0-97
250	152	14-47	0-98	10-81	1-18

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See catalogue for full range.

VA (Watts)	REF NO.	PRICE CASED 2 & 3 pin	PRICE PLUGS 2 & 3 pin	PRICE OPEN	POST
1500	93	24-87	0-95	20-13	O/A

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VOLTS		MILLIAMPS		REF. NO.	PRICE	POST
3-0-3	—	200	—	238	1-75	0-34
0-6	0-6	500	500	234	1-75	0-34
0-6	0-6	1000	1000	212	2-33	0-46
9-0-9	—	100	—	13	1-75	0-34
0-9	0-9	330	330	235	1-75	0-34

12 & 24 VOLTS

Primary 200-240 Volts.		See catalogue for full range.	
AMPS	REF. NO.	PRICE	POST
12V	24V		
2	1	71	2-64
4	2	18	3-17
6	3	70	4-82
8	4	108	5-65

30 VOLTS

Primary 200/240V		Secondary 12, 15, 20, 24, 30V	
AMPS	REF. NO.	PRICE	POST
0-5	112	2-17	0-61
1	79	2-74	0-66
2	3	4-32	0-72
3	20	5-05	0-85
4	21	5-98	0-85
5	51	7-05	0-95
6	117	7-88	0-97
8	88	10-31	1-18
10	89	10-87	1-18

50 VOLTS

Primary 200/240V		Secondary 19, 25, 33, 40, 50V	
AMPS	REF. NO.	PRICE	POST
0-5	102	2-83	0-61
1	103	3-67	0-76
2	104	5-57	0-85
3	105	6-29	0-85
4	106	8-35	1-08
6	107	13-56	1-18
8	118	14-29	1-44
10	119	18-56	1-86

60 VOLTS

Primary 200/240V		Secondary 24, 30, 48, 60V	
AMPS	REF. NO.	PRICE	POST
0-5	124	2-72	0-72
1	126	4-08	0-72
2	127	5-83	0-85
3	125	8-30	0-97
4	123	9-65	1-18
5	40	10-78	1-18
6	120	13-00	1-36
8	121	16-48	O/A
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Two Amp	Price	Six Amp	Price
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0-100 micro A	580	0-100 micro A	730
0-500 micro A	170	0-500 micro A	200
0-1 mA	170	0-1 mA	200
0-5 mA	170	0-5 mA	200
0-10 mA	6	0-10 mA	6
0-50 mA	0-5	0-50 mA	0-5
0-100 mA	0-5	0-100 mA	0-5
0-500 mA	0-5	0-500 mA	0-5
0-1 Amp	0-5	0-1 Amp	0-5
0-2 Amp	0-5	0-2 Amp	0-5
0-25 Volt	15K	0-25 Volt	15K
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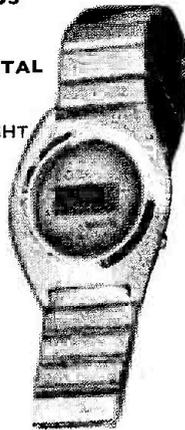
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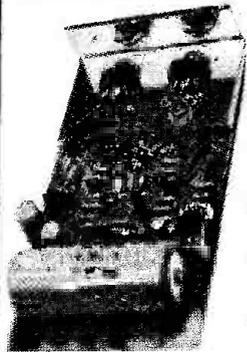
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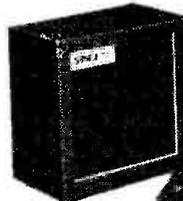
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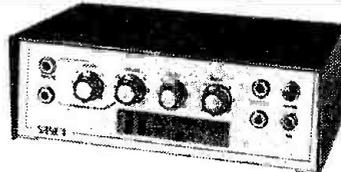
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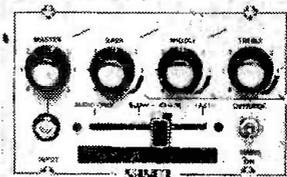
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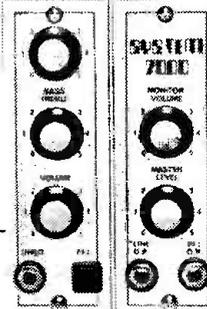
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Name

Address

Mk. 2 DIY Ass. Kit @ £11.80	QUANTITY REQD.	I enclose cheque/PO's for £
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ALMOST 1/2 PRICE OFFER! SOLENT AUDIO SYSTEM

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Solent Mark II Stereo Tuner Amplifier chassis with AM/FM radio covering long medium short and Stereo FM wavebands. Separate Bass and Treble controls. 30 watts total power output (frequency response 25-20,000 Hz) AFC Switching Tape record and playback facilities. Dimensions 18 1/2" x 9" x 3 1/2" The very latest BSR automatic record deck with cue and pause control. Two matching elliptical speaker units.

Order early limited stocks available cash price £69.95. Credit Sale £7.00 deposit 9 monthly payments of £8.00 (Total Credit price £79.50). P. & P. £4.00. Send £11.00 today.

Chassis only available for cash at £49.00 + p. & p. £3.00.

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100 SUB-MINIATURE ASSORTED DISCS 3.3pf to .01uf for 57p.

Please add 20p post and packing on U.K. orders under £2.

MULLARD AUDIO AMPLIFIERS

All in module form, each ready built complete with heat sinks and connection tags, data supplied.

Model 1153 500mW power output £1.10 + 40p post & VAT.

Model 1172 1W. power output £1.35 + 45p post & VAT.

Model EP9000 4 watt power output £2.40 + 50p post & VAT.

EP 9001 twin channel or stereo pre amp. £2.50 + 50p post & VAT.

SMITH'S 24 HR TIMER HEART really the "Autoset" without its plastic case. This is a 24 hr twice on, twice off, clock switch which will repeat until re-programmed. Switches rated at 15 amps. Limited supplies—£3.95 VAT & post 55p each.

SOUND TO LIGHT UNIT

Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450w). Unit in Box all ready to work. £7.95 plus 95p VAT and postage.

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: PPL, PP3, PP4, PP6, PP7, PP9 and others. Kit comprises: main transformer rectifier, smoothing and load resistor condensers and instructions. Real snip at only £1.50 VAT & Postage 50p.

MAINS MOTOR

Precision made—as used in record decks and tape recorders—ideal also for extractor fans, blower, heaters, etc. New and perfect. Snip at 95p + VAT & Postage 35p.

1" stackmotor £1.50 + VAT & postage 35p. 1 1/4" stackmotor £2 + VAT & Postage 40p.

AMMETERS

Ideal for chargers etc. 2" sq. full vision 0-8 amp 95p. 1 1/2" round 0-2 amp 55p, 0-3 amp 65p, 0-4 amp 75p. Post & VAT 25p each.

RELAY BARGAIN

Type 600 relay, 2 changeover one open and one closed contact. Twin 500 ohm coils make this suitable or closing off DC 6v, DC 12v, DC 24v or AC mains using resistor and rectifier. 40c each. Resistor or rectifier 20p extra. Post & VAT 20p.

OVEN THERMOSTAT

Made by the famous Diamond H Company, this has a sensor joined by a capillary to a variable control and when fitted with a knob is ideal for many ovens or processes, 50p each x post and VAT 15p.

SPIT MOTOR

200-250V Induction motor, driving a Carter gearbox with a 1 1/2" output drive shaft running at 5 revs p.m. for roasting chickens, also for driving models—windmills, coloured disc lighting effects, etc. £2.50 plus 50p post and VAT.

RECORD PLAYBACK TAPE HEADS

Individual prices of these are:

- 2 track record playback heads 75p each.
- 4 track record playback heads £1.10 each.

Erased heads are also available separately—

- 2 track 50p—4 track 55p.

MV metal mounting shields 60p each.

2 track heads already fixed on heavy mounting plate with shield £1.85. ALL PLUS 8% VAT.

PRESSURE SWITCH

Containing a 15 amp change over switch operated by a diaphragm which in turn is operated by air pressure through a small metal tube. The operating pressure is adjustable but is set to operate in approx 10in. of water. These are quite low pressure devices and can in fact be operated simply by blowing into the inlet tube. Original use was for washing machine to turn off water when tub has reached correct level but no doubt has many other applications £2.10 each + 25p post & VAT.

MICRO SWITCH BARGAINS

Rated at 5 amps 250 volts, ideal to make a switch panel for a calculator and for dozens of other applications. Parcel of 10 for £1.00, VAT and post paid.

HONEYWELL PUSH BUTTON PANEL MOUNTING MICRO SWITCH

1-2-3 bank, each bank consisting of the changeover micro switch rated at 10 amps 250 volts. Through panel fixing by lock nuts complete with black 1" diameter knob. Prices 1 bank 40p, 2 bank 55p, 3 bank 70p. All VAT and post paid.

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 Goodmans speakers this should sell at about £30—but due to a special bulk buy and as an incentive for you to buy this month we offer the system complete at only £14.00 including VAT and postage.

DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 x 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 6 feet of flex cable. Wired up ready to work. £2.75, VAT & postage 65p.

TWIN OUTPUT POWER PACKS

These have two separately R.C. smoothed outputs so can operate two battery radios on a stereo amp without cross modulation (they will of course operate one radio-tape-cassette-calculator in fact any battery appliance and will save their cost in a few months). Specs: Full wave rectification, double insulated mains transformer—total enclosed in a hard P.V.C. case—three core mains lead—terminal output—when ordering please state output voltage 4 1/2v, 6v, 7 1/2v, 9v, 12v or 24v. Price £3.95. Post and VAT included.

ISA ELECTRICAL PROGRAMMER

Learn in your sleep: Have radio playing and kettle boiling as you awake—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. Price £2.95, VAT & Postage 60p, or with glass front, chrome bezel, £1.50 extra.

THIS MONTH'S SNIP

24V 8AMP BATTERY CHARGER KIT

Full wave rectifier and mains transformer for battery charging operating motor or special instruments etc.
£2.50 VAT and carriage paid.

LIGHT PIPE

A mains operated travelling light array. 24ft. long, it uses 130 miniature bulbs which flash in sequences to make bands of light move along the tube—the tube can be draped around a particular item or set and cannot fail to attract attention—complete kit consists of—24ft. of translucent tubing—140 miniature lamps 8 yards multicore cable—motorised switch, taps for quick connections and full wiring instruction £15 for the complete kit post and V.A.T. paid.

THERMOSTAT WITH THERMOMETER

Made by Honeywell for normal air temperatures 40-80 F (5-25 C). This is a precision instrument with a differential which can be adjusted to better than 1-5 F. A mercury switch breaks on temp. rise. Elegantly styled and encased in an ivory plastic case with clear plastic windows, thermometer above and switch setting scale below—size approx. 3-8" x 3-2" x 1-4" deep—can be mounted on conduit box or directly on wall. Price £2.25 plus 50p Post & VAT.

INFRA RED BINOCULARS

Made for military purposes during and immediately after the last war to enable snipers, vehicle drivers, etc. to see in the dark. The binoculars have to be fed from a high voltage source (5KV approx.) and providing the objects are in the rays of an infra red beam then the binoculars will enable these objects to be seen. Each binocular eye tube contains a complete optical lens system as well as the infra red cell, technical data on which is available. The binoculars are unused, believed to be in good order, in fact they were never issued and are still in original cases, but since they were made a long time ago they can hardly be called new. Sold without guarantee. Price £16.50 per set.

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. Complete kit comprises two special transistors and all parts including probe tube and crystal car-piece, £2.95, twin stetho-set instead of ear-piece 35p, VAT and postage incl. in price.

MICRO RADIO CONSTRUCTORS PARCEL

Not a complete kit but eight matching components for building one as follows:—Embossed plastic case, size 2 1/2" x 2 1/4" x 1 1/2". Twin gang tuning condenser with control knob. Oscillator coil. Set of 4 IF's. Volume control with on/off switch and control knob. Don't miss this terrific bargain only £1.00, VAT and post paid.

ANGLERS AID AND FISH BITE INDICATOR

Provides an audible alarm when the fish bites. Kit of parts and full instructions £2.50 including VAT and post.

TERMS: Where order is under 25 please add 30p surcharge to offset packing expenses.

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ITS 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—its an interesting list and its free—just send S.A.E. Below are a few of the Bargains still available from previous lists.

Motor with Gear Box by Swiss SAIA Company's makers type no. AMY5-A48L. This is standard 220/240v. 50 HZ motor, 15 revs per minute final drive speed, the drive shaft is 4mm dia. fitted with pickup block 8mm square. Price £2.50 + 20p. Post 15p + 2p.

Motor with Gear Box Crouzet, their type no. 392. This is a 115v motor with final drive speed of 15 rpm, anti-clockwise, the drive shaft is 4mm diameter, fitted with removable 8mm pickup drive block. Price £2.50 + 20p. Post 15p + 2p.

Motor with Gear Box made by Smiths, their type no. Q1HG. 200-250v 50 HZ operated, final drive shaft 60 rev per minute. Drive shaft 3-5mm diameter 200mm long with flat. Price £2.00 + 20p. Post 15p + 2p.

Motorized Time Delay. This contains 1/2 rev. per minute motor for 24v 50HZ operation, with incorporated is one way INC clutch made by General Time of USA, makers ref. E15450, A2396 A4. Coupled to the motor is a dial calibrated 0-120 seconds. When coupled to the mains, the motor operates and when the pre-set number of seconds has been reached, the lever will trip the changeover micro-switch. This obviously could be used in photography or in other applications where short duration switching off or on is required. A very expensive piece of equipment, mounted on a frame approx. 2-5" x 3" x 1 1/2" deep with fixing feet. Price £3.50 + 25p. Post 30p + 5p.

Motorized Stud Switch driven by 50v SAIA geared motor at 20v's per minute. This has 24 studs and a common slip ring and will rotate continuously. Obviously has many applications. Ex-equipment but covered by our normal ex-equipment guarantee. Price £1.75 + 14p. Post 20p + 2p.

Mains Instrument Transformer upright mounting, primary tapped every 10v's from 200 to 240v's, 4 secondaries—130v at 175 mA, 160v at 125 mA, 6-3v at 1-5 amp, 6-3v at 2-25 amp. Separate screen brought to the tag panel. Price £4.50 + 30p. Post £1.00 + 8p.

Mains Auto Transformer 100w size chassis mounting with fixing feet, tapings at the high voltage end and at the 115v end. Very well made transformer vacuum impregnated and varnished for quiet operation. Price £1.50 + 12p. Post 80p + 6p.

400w Power Transformer, chassis mounting with fixing feet. Normal 240v 5QHZ primary, tapped 200v and 220v, 2 secondaries 50v's at 7 amps with 36v tapping and 6v's at 8 amps, made by Davensent, this weighs 15lbs and is approx. 5 1/2" x 4 1/2" x 3 1/2". Price £12.50 + £1.00. Post £1.50 + 12p.

250w Isolation Transformer for mounting under the service bench, this is in a normal frame with fixing feet. Very good quality construction with input and output terminal blocks. Price £9.57 + 50p. Post £1.00 + 8p.

EHT Transformer 8-7kv 23 mA's intermittently rated with normal 240v, 50 HZ primary. This is made by Landon Kingsway Ltd., mainly for igniting oil fired boilers, their ref. no. 20/0347/02. This is totally encased with fixing feet, 3 core mains input lead and park plug type e.h.t. output. Price £3.50 + 72p. Post £1.00 + 8p.

Car Battery Trickle Charger, normal mains input, 12v. 1 amp output, totally encased with mounting feet. 3 core mains input lead and output leads terminating with car battery size croc. clips. Price £1.95 + 25p. Post 25p + 3p.

Flexible Drive 12" long with threaded couplers at each end. Price £2 + 16p. Post 30p + 3p.

Gear Train in aluminium housing size approx. 6 1/2" x 3 1/2", 2 brass pillars for motor mounting (1-9" fixing centres), first wheel made of fibre, 3 other steel and brass wheels. Approx. 80 turns of fibre wheel give one turn of final drive shaft which is 1 1/2" dia. rod. Price £1.00 + 8p. Post 40p + 4p.

Relay 3000 Type, coil consists of 3 separate windings, 2 at 400 ohms and 1 at 570 ohms. 7 sets of contacts, 3 of which are changeover, 2 others open when relay closes and the last 2 close when relay closes. Very versatile and useful relay. Price £1.00 + 5p. Post 10p + 1p.

Plug-in 11 Pin Perspex covered Relay, coil operated by 50v. AC or 24v. DC, 3 sets of very heavy duty contacts, gold plated at least 10 amp rating, maker Omron type MK.3P5. Ex-unused equipment, with base. Price £1.00 + 8p. Post 15p + 1p.

Reed Relay, Elliott ref. no. 37229/213. Uses 4 reeds, 2 of which are normally closed, the other 2 normally open. Coil detail—voltage 12 dc., resistance 2-7 Kohms, M.A. approx. 4-6. Price £1.75 + 12p. Post 15p + 1p.

Open Type Relay single screw mounting, 3 heavy duty changeover contacts estimated at 10 amps, coil voltage 50v. AC, 20-25v. DC. Price 75p + 6p.

Latching Relays. Two relays mounted together on a common chassis, size 3" x 1-3" x 2" approx. Two relays are made to latch mechanically so that when one is energised it will stay on although its energising current is removed until the other one is energised, each relay has two pairs of heavy duty gold plated changeover contacts. Coil volts. 48v. AC or 24v. DC. Price £2.50 + 80p. Post 15p + 2p.

NUMICATOR TUBES

For digital instruments, counters, timers, clocks, etc. Hi-vac XN11 Price £1.25 each, Post and VAT paid.

TRANSFORMERS

ALL EX-STOCK—SAME DAY DESPATCH

NO HIDDEN EXTRAS—Prices include VAT and P & P. EXCEPT

† WHERE CARRIAGE WILL BE ACCORDING TO WEIGHT & DISTANCE—BRS.

Electropoil, Audio, accessories, semiconductors, Panel Meters & Multi-Meters

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OR SEND STAMP FOR LISTS.

MAINS ISOLATING

Prim. 120/240V
Sec. 120/240
Centre tap with screen
Ref. VA

Ref.	VA	(Watts)	£
07*	20	4.06	
149	60	5.93	
150	100	6.78	
151	200	10.57	
152	250	12.80	
153	350	15.12	
154	500	17.41	
155	750	23.69†	
156	1000	33.01†	
157	1500	37.68†	
158	2000	42.03†	
159	3000	66.40†	

*115V or 240V Sec. only.

30 VOLT RANGE

Prim. 200-240V
Sec. 0-12-15-20-24-30V

Ref.	Amps	£
112	0.5	2.75
79	1.0	3.58
3	2.0	4.93
20	3.0	6.10
21	4.0	7.03
51	5.0	8.46
117	6.0	9.47
88	8.0	12.49
89	10.0	12.84

60 VOLT RANGE

Prim. 200-240V
Sec. 0-24-30-40-48-60V

Ref.	Amps	£
124	0.5	3.54
126	1.0	4.84
127	2.0	6.78
125	3.0	9.72
123	4.0	11.58
40	5.0	12.54
120	6.0	14.69
121	8.0	17.01†
122	10.0	20.95†
189	12.0	21.87†

12 and or 24 Volt PRIMARY 240-250 VOLTS

Ref.	12v	24v	£
111	0.5	0.25	2.05
71	1.0	0.5	2.71
71	2	1	3.30
68	3	2	4.60
18	4	2	4.07
85	5	3	4.91
70	6	3	5.65
108	8	4	6.52
72	10	5	6.97
17	12	6	7.45
17	16	8	9.27
115	20	10	13.65
187	30	15	17.20
226	60	30	19.08†

HIGH VOLTAGE Mains Isolating

Prim. 200/220 or 400/440
Sec. 100/120 or 200/240
P & P

VA	Ref.	£
60	243	5.91
350	247	13.46
1000	250	28.41†
2000	252	47.65†

AUTO TRANSFORMERS

Ref VA Auto Taps (Watts)

Ref.	VA	Auto Taps	£
113	20	0-115-210-240	2.53
64	75	"	4.16
4	150	0-115-200-220-240	5.54
66	300	"	7.62
67	500	"	11.59
84	1000	"	17.38
93	1500	"	20.54†
95	2000	"	27.44†
73	3000	"	39.46†

CASED AUTO TRANSFORMERS

240V mains lead input & USA 2 pin outlets.

VA	£	Ref
20VA	£4.42	Ref 113V
150VA	£7.90	Ref 4V
500VA	£13.32	Ref 67V
1000VA	£19.86†	Ref 84V
2000VA	£31.01†	Ref 95V

POWER UNIT

Plugs direct into 13A 3pin socket 6-7-5-9V 300mA w/ich multi-plug £3.59.

50 VOLT RANGE

Prim. 200-240V
Sec. 0-19-25-33-40-50V

Ref.	Amps	£
No.	0.5	3.63
102	1.0	4.70
103	1.0	4.70
104	2.0	6.37
105	3.0	7.78
106	4.0	9.97
107	6.0	15.21
118	8.0	16.59
119	10.0	19.17†

SCREENED MINIATURES

Ref	mA	Volts	£
238	200	3-0-3	2.27
212	1A	0-6-0-6	2.66
13	100	9-0-9	2.03
235	330	0-9-0-9	2.12
207	500	0-8-9-0-8-9	2.82
208	1A	0-8-9-0-8-9	4.02
236	200	0-15-0-15	2.03
214	300	0-20-0-20	2.89
221	700	20-12-0-12-20	3.27
206	1A	0-15-20-0-15-20	4.78
203	500	0-15-27-0-15-27	4.27
204	1A	0-15-27-0-15-27	5.33
112	500	12, 15, 20, 24, 30	2.83

BRIDGE RECTIFIERS

50V	2A	0.55
100V	2A	0.61
100V	6A	0.95
200V	1A	0.55
200V	2A	0.67
400V	2A	0.72
400V	4A	0.89
600V	2A	0.78
1000V	2A	0.89
500V	10A(PM 7A6)	2.70

TEST METERS

AVO 8 MK5	£67.33
AVO 72	£26.86
AVO MM5	£23.48
AVO TT 169	£27.34
U4315	£13.93

POWER UNIT

CC12-05 Output Switched 3-4-5-6-7-5-9-12V at 500mA, £5.11.

SWITCHES

SPST TOGGLE 3 FOR	1.06
DPDT TOGGLE 3 FOR	1.30
DPDT SLIDE 6 FOR	1.06

ANTEX SOLDERING IRONS

15W £3.57 18W £3.31 25W £2.99
SOLDERING IRON KIT £4.48
STAND FOR ABOVE £1.49

MAGNETIC TO CERAMIC CARTRIDGE CONVERTOR

OPERATING VOLTAGE 20-45V ONLY £3-17.

COMPONENT PAKS

200 Mixed value resistors (count by weight)
150 Mixed value capacitors (count by weight)
30 Mixed value precision resistors $\frac{1}{4}$ W 2%
15 Assorted pots & pre-sets
10 Reed switches
3 Micro Switches
20 Assorted tag strips
PLEASE STATE PAK REQUIRED
90p PER PAK.

AUDIO KIT 25W

2+25W Amplifiers
1+Pre-Amp
1+Power supply
1+Transformer
1+Front Panel
1+Kit of parts to include on-off switch, neon ind. Stereo headphone socket. Plus Instructions book £32.18.

TEAK AUDIO KIT 25W

Teak veneered cabinet
16 $\frac{1}{2}$ "x11 $\frac{1}{2}$ "x3 $\frac{1}{2}$ ", aluminium chassis, heat sink and front panel brackets plus back panel and sockets etc. £11.21

CARTRIDGES

Magnetic Sonotone 100 £5.31
Ceramic E.E.I. CS 2000 £2.72
ACOS GP93-1 £2.11
TCC AT-55 £4.42

STEREO FM TUNER

fitted with Phase-lock Loop
4 Pre-selected stations supply 20-35V. 90mA Max. £22.72

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DL-707E 0.3" 70p
DL-728E 2 x 0.5" £1.80
DL-727E 2 x 0.5" £1.80

DL-750E 0.6" £1.50
DL-747E 0.6" £1.50
PHOSPHOR DISPLAYS
5LT01 4 x 0.5" £5.80

CLOCK CHIPS
AY-5-1224A £3.50
MK 50253 £5.50
AY-5-1202 £4.76

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CA 3130 (COS/MOS) 75p
741 Minidip 25p
IC SOCKET PINS
100 50p
1000 £4.00

CMOS WITH DISCOUNTS! (Any mix: disc. 10% 25+, 25% 100+)

CA 3130	0.75	4030/14057	0.45	4059/	—	3.60	4098/14528	0.85	14532/4532	1.60
4000/4000	0.15	4031/	1.80	4060/	—	0.90	4099/	1.50	14534/	6.00
4001/4001	0.15	4032/14032	0.85	4061/	16.40	4700/	—	1.50	14536/	2.85
4002/4002	0.15	4033/	1.10	4062/	7.30	7083/	—	4.25	14537/	15.25
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4007/4007	0.15	4035/14035	0.95	4066/14066	0.95	14502/4502	1.00	14541/	1.80	
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4009/14009	0.45	4037/	0.75	4068/14068	0.15	14506/	0.35	14549/	2.95	
4010/14010	0.45	4038/14038	0.85	4069/14069	0.15	14508/4508	2.35	14552/	8.05	
4011/14011	0.15	4039/	2.85	4070/14070	0.15	14510/4510	1.10	14553/	3.50	
4012/14012	0.15	4040/14040	0.85	4071/14071	0.15	14511/4511	1.25	14554/	1.20	
4013/14013	0.45	4041/	0.65	4072/14072	0.15	14512/	1.05	14555/4555	0.70	
4014/14014	0.80	4042/14042	0.65	4073/14073	0.15	14514/4514	2.55	14556/4556	0.70	
4015/14015	0.80	4043/14043	0.80	4075/14075	0.15	14515/4515	2.55	14557/	3.20	
4016/14016	0.45	4044/14044	0.75	4076/14076	1.25	14516/4516	1.10	14558/	0.90	
4017/14017	0.80	4045/	1.15	4077/14077	0.15	14517/	5.40	14559/	2.95	
4018/	0.80	4046/14046	1.10	4078/14078	0.15	14518/4518	1.00	14560/	2.95	
4019/14019	0.45	4047/	0.70	4081/14081	0.15	14520/4520	1.00	14561/	1.55	
4020/14020	0.90	4048/	0.45	4082/14082	0.15	14521/	2.00	14561/	0.45	
4021/14021	0.80	4049/14049	0.45	4085/	0.55	14522/	1.50	14562/	5.25	
4022/14022	0.75	4050/14050	0.45	4086/	0.35	14524/	N/S	14566/	1.20	
4023/14023	0.15	4051/14051	0.75	4089/	0.65	14526/	1.50	14572/	0.35	
4024/14024	0.60	4052/14052	0.75	4093/14093	0.65	14527/4527	1.20	14580/40108	6.00	
4025/14025	0.15	4053/14053	0.75	4094/	1.50	14528/4098	0.85	14581/40181	3.05	
4026/	1.40	4054/	0.95	4095/	0.85	14529/	1.30	14582/40182	1.15	
4027/14027	0.45	4055/	1.05	4096/	0.85	14530/	0.65	14583/	0.71	
4028/14028	0.70	4056/	1.05	4097/	2.95	14531/	1.25	14585/	1.45	
4029/	0.90	4057/	20.35							

Terms: C.W.O. Add VAT to all prices at 8%. Post etc., U.K. 10p per order. Orders processed same day. Official gov't., 'varsity, poly etc. orders welcomed.

GREENBANK ELECTRONICS (Dept. W7P)

94 New Chester Road, New Ferry, Wirral, Merseyside, L62 5AG, England. Tel:—051-645 3391

4-STATION INTERCOM



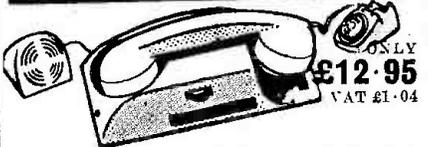
£18.30

Solve your communication problems with this 4-Station Transistor Intercom system (1 master and 3 Subs), in robust plastic cabinets for desk or wall mounting. Call/talk/listen from Master to Subs and Subs to Master. Ideally suitable for Business, Surgery, Schools, Hospitals and Office. Operates on one 9V battery, On/Off switch. Volume control Complete with 3 connecting wires each 66ft. and other accessories. P. & P. 85p.

MAINS INTERCOM NEW MODEL

No batteries—no wires. Just plug in the mains for instant two-way, loud and clear communication. On off switch and volume control. Price £29.24 per pair P. & P. 85p.

NEW! AMERICAN TYPE CRADLE TELEPHONE AMPLIFIER



£12.95

Latest transistorised Telephone Amplifier with detached plug-in speaker. Placing the receiver on to the cradle activates a switch for immediate two-way conversation without holding the handset. Many people can listen at a time. Increase efficiency in office, shop, workshop. Perfect for "conference" calls: leaves the user's hands free to make notes, consult files. No long waiting, saves time with long-distance calls. On/Off switch, volume. Direct tape recording model at £13.95 + VAT £11.12 P. & P. 70p, 10-day price refund guarantee.

WEST LONDON DIRECT SUPPLIES P.W.9
169 KENSINGTON HIGH STREET, LONDON, W8



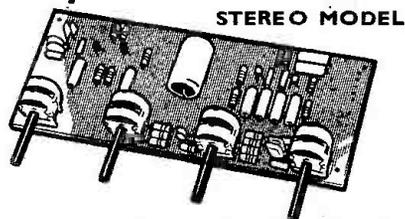
Stirling Sound Products

FROM BI-PRE-PAK

UNIT 1 PRE-AMP/CONTROL

SUPERB VALUE AT

£7.80



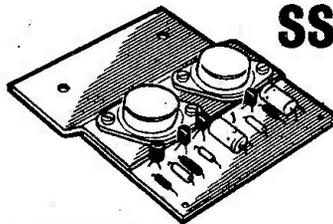
UNIT 1, latest addition in the Stirling Sound range of realistically priced constructional modules is going to assure many many more constructors of obtaining quality where price has prevented it before. UNIT 1 offers full stereo facilities, is guaranteed and easy to connect up.

- Input sensitivity—50 mV, adjustable
- Output—200 mV for 50 mV in
- Bass control—±15 dB at 30 Hz
- Treble control—±15 dB at 10 kHz
- Balance control; volume control; ½" spindles bushed
- Operating voltage—10 to 16V

MADE IN OUR OWN FACTORY IN ESSEX AND SOLD DIRECT

MORE POWER—LESS VAT

SS.140 MK3



**POWER AMP.
Built for hard work**

40 WATTS
R.M.S.
INTO 4Ω

£3.95*

+ 8% V.A.T.

Resulting from research and development, the Mk. 3 version of this most popular power amp. now includes built-in output capacitor with improved stability under severest working conditions. Greatly used for P.A., disco and similar work, SS.140 offers fantastic value for the price.

Build and save with Stirling Sound

BASIC MODULES FOR BUILDING UP TO A STEREO TUNER-AMP
DATA WITH EACH MODULE

● TUNING

SS.201 X Geared variable tuning 88-108 MHz. AFC facility **£5.00**

SS.202 I.F. amp A meter and/or A.F.C. can be connected (size 3" x 2") **£2.65**

SS.203 Stereo decoder
For use with Stirling Sound modules, or with any other good mono F.M. tuning section. A L.E.D. beacon can be added to indicate when a stereo signal is tuned in (Red, 18p) (3" x 2"). **£3.85**

● POWER AMPS

SS.103 Simple I.C. module, 3 W output **£1.75**

SS.103-3 Stereo version of above **£3.75**

SS.105 5 watt amplifier to run from 12V. (3½" x 2" x ½") **£2.25**

SS.110 Mk. 3 Similar to SS.105 but more powerful giving 10W into 4 ohms, using 24 volts **£2.75**

SS.120 Mk. 3 20 watt module when used with 34 volts into 4Ω **£3.25**

SS.125 De-luxe hi-fi amp with only 0.04% distortion at all levels. 50V operation. 25 W R.M.S. out **£5.00**

● CONTROL

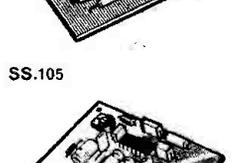
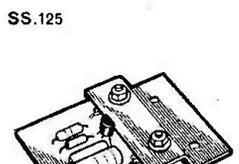
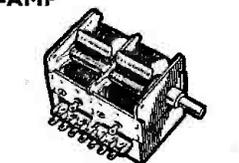
SS.100 Active tone control, stereo ± 15dB cut and boost with suitable network **£1.60**

SS.101 Pre-amp for ceramic p.u., radio & tape with passive tone control details **£1.60**

SS.102 Stereo pre-amp with R.I.A.A. equalisation, mag., p.u., tape and radio in. **£2.25**

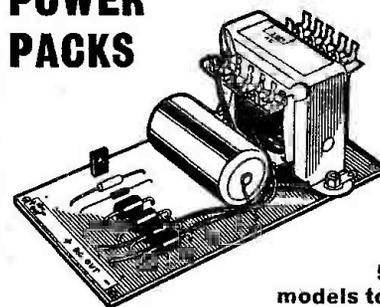
● POWER STABILISER

SS.300 Add this to your unstabilised supply to obtain a steady working voltage from 12 to 50V for your audio system, workbench etc. Money saving and very reliable **£3.25***



£3.25* SS.203

Stirling Sound POWER PACKS



5 models to choose from
Not only do these excellent power packs stand up unflinchingly to hard work, inclusion of a take off point at around 13-15V adds to their usefulness and once again price value is outstanding.

Made to serve for years

SS.312	12V/1A	£3.75*
SS.318	18V/1A	£4.15*
SS.324	24V/1A	£4.60*
SS.334	34V/2A	£5.20*
SS.345	45V/3A	£6.25*

Add 50p for p/p any model.

Direct from the makers and obtainable only from Bi-Pre-Pak Ltd. Stirling Sound products are designed by professional experts and made in our own factory. They are distributed exclusively through Bi-Pre-Pak Ltd.

TERMS OF BUSINESS:

VAT at 12½% must be added to total value of order except for items marked * or (8%) when VAT is to be added at 8%. No VAT on overseas orders. POST & PACKING add 30p for UK orders unless marked otherwise. Minimum mail order acceptable—£1 Overseas orders, add £1 for postage. Any difference will be credited or charged. PRICES subject to alteration without notice. AVAILABILITY All items available at time of going to press when every effort is made to ensure correctness of information.

NEW SHOWROOM

We have extended and added exciting new stocks at our West Road premises. All welcome

Order your Stirling Sound products from
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Co Reg No 820919
222 224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX SSO 9DF.
TELEPHONE: SOUTHEND (0702) 46344

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Please send

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Inc. V.A.T.

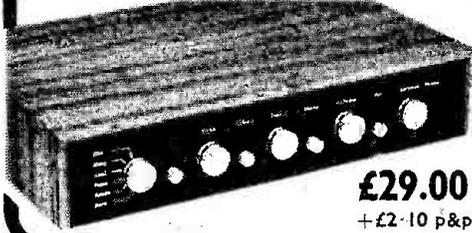
NAME

ADDRESS

.....PWC9

RTVC

Now the VISCOUNT IV 30 x 30 Stereo Amp IN KIT FORM



£29.00
+ £2.10 p&p

For the experienced constructor the Viscount IV amplifier comes complete with teak finished cabinet, front trim panel, knobs and all necessary metalwork. The specification for the NEW 30 x 30 is similar to the complete system offered below, but of course with the bigger output.

STEREO 21



COMPLETE ONLY

£26.95 + p&p £4.05

INCORPORATING A GARRARD DECK
Garrard 3 speed Deck automatic, manual facilities together with stereo cartridge and cueing device.

Stereo 21, easy to assemble audio system kit. No soldering required. The unit is finished in SimiTeak, and the acrylic top presents an unusually interesting variation on the modern deck plinth. Includes - 3 speed deck, automatic manual facilities together with stereo cartridge and cueing device.

Two speakers with cabinets. Amplifier module. Ready built with control panel, speaker leads and full, easy to follow assembly instructions.

Specifications - For the technically minded. Input sensitivity 600mV. Aux. input sensitivity 120mV. Power output 2.7 watts per channel. Output impedance 8-15 ohms. Stereo headphone socket with automatic speaker cutout. Provision for auxiliary inputs - radio, tape, etc., and outputs for taping discs.

Overall Dimensions. Speakers approx 12" x 9" x 5". Complete deck and cover in closed position approx. 15 1/2" x 12" x 8".

Extras if required. Optional Diamond Styli **£1.50**
Specially selected pair of stereo headphones with individual level controls and padded earpieces to give optimum performance **£5.25**

BSR DECKS WITH PLINTHS AT FANTASTIC REDUCTIONS



MP 60 Type (illustrated) Less Cartridge	£17.50 p&p £2.00
C141 (not illustrated) Auto, with Cue Fitted Stereo Cartridge	£11.95 p&p £1.50

All plinths finished in matching Teak veneer.

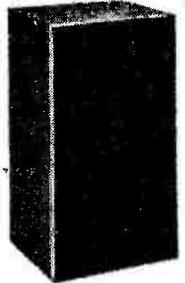
EASY TO BUILD SPEAKER KITS

These superb simulated teak-finished speaker kits have been specially designed by RT-VC for the cost-conscious hi-fi enthusiast who wants top quality speakers but doesn't want to spend the earth. Built to EMI's exacting specification, these new RT-VC speaker kits (350 type kit) incorporate 13" x 8" woofer, 3 1/2" tweeter and matching crossover. Easily put together with just a few basic tools.

Specification (each speaker): Impedance 8 ohms. Power handling 15 watts RMS (30 watts peak). Response 20-20,000 Hz. Size 20" x 11" x 9 3/4" approx. Comparable built units (EMI LE3) sold elsewhere for over £45 pair.

£25.50 pair complete
+ £5.50 p&p

Complete with crossover
Components and circuit
diagram.



EASYBUILD SPEAKER KIT

THE NEW 'COMPACT'

A compact bookshelf speaker system giving a high electro acoustic efficiency for the low powered amplifier. The professional finish can be obtained with the minimum of tools, the infinite baffle type enclosures come ready mitred and professionally finished, and fix together with masking tape till glue dries.

The cabinet measures 12" x 9" x 5" deep approx. finished in simulated teak, incorporating a quality 8" speaker, maximum power handling 7 watts, impedance 8 ohms nominal, magnet size 2 3/8" approx., with 1 1/2" parasitic tweeter.

£7.50
PAIR INCLUSIVE
+ p&p £1.70



EMI 350 KIT

7.50 + £1.70 p&p

Complete with crossover
Components and circuit
diagram

System consists of a 13" x 8" approx. woofer with a 3 1/2" tweeter, crossover components and circuit diagram. Frequency response: 20 Hz to 20 KHz. Power handling 15 watts RMS into 8 ohms. (Peak 30 watts.)

VISCOUNT IV STEREO AMP COMPLETE 20 x 20 SYSTEMS

SYSTEM 1b £80.00

The new 20 + 20 watt Stereo Amplifier incorporating the latest silicon transistor solid state circuitry, the RT-VC VISCOUNT IV gives you a powerful 20 watts RMS per channel into 8 ohms. Superb teak-finished cabinet, with anodised fascia to harmonise with any decor. Polished trim and knobs.

The VISCOUNT IV has a comprehensive range of controls - volume, bass, treble, balance mono/stereo, mode selector, and scratch filter.

Front panel socket for stereo headphones. And a host of sockets at the rear - for left and right speakers, tape recorder, auxiliary, tuner, disc and microphone.

SPECIFICATION: 20 watts RMS per channel 40 watts peak. Suitable 8-15 ohms speakers. Total distortion at 10 watts better than 0.2%. Six switched inputs: 1. Magnetic P.U. - 3 millivolts at 47 K ohms (R.I.A.A.); 2. Crystal/ceramic P.U. - 50 millivolts at 50 K ohms (R.I.A.A.); 3, 4, 6. Tape Tuner/Aux. - 140 millivolts at 50 K ohms (flat frequency response); 5. Microphone - 3 millivolts at 50 K ohms (flat frequency response).

CONTROLS: Push button ON/OFF, stereo/mono, scratch filter. 6 position rotary selector. Individual rotary controls for treble, bass, balance and volume. Headphone socket, tape out socket. Aux. mains output. Frequency response: 25 Hz to 25 kHz at full rated output. Signal to noise ratio: better than -50 dB on all inputs. Tone control range: Bass ±15 dB at 50 Hz; Treble ±12 dB at 10 KHz. Power requirements: 250V A.C. mains at 60 watts.

Approx size: 15 1/2" x 3" x 10". MP60 type deck with magnetic cartridge, de luxe plinth and cover. Two Duo Type IIB matched speakers - Enclosure size 18 1/2" x 13 1/2" x 7 1/4" approx. in veneer teak. Drive unit 10" with 2 1/2" tweeter. 12 watts handling 24 watts peak.

Complete System
with these speakers
£80.00
+ £6.50 p&p.

SYSTEM 2 £92.00

Viscount IV amplifier (As System 1a)
MP60 type deck (As System 1a)

Two Duo Type IIB matched speakers

- Enclosure size approx. 27" x 13" x 11 1/2". Finished in teak simulate. Drive units 13" x 8" bass driver, and two 3" (approx.) tweeters. 20 watts RMS, 8 ohms frequency range - 20 Hz to 18,000 Hz.

Complete System with these speakers **£92.00** + £7.60 p&p

PRICES: - SYSTEM 1a
Viscount IV amplifier
£29.00 + £2.10 p&p
2 Duo Type IIB speakers
£34.00 + £6.50 p&p
MP60 type deck with
Mag. cartridge de luxe
plinth and cover
£24.00 + £3.50 p&p
Total if purchased
separately: **£87.00**
Available complete
for only: **£80.00**
+ £6.50 p&p

PRICES: SYSTEM 2
Viscount IV amplifier
£29.00 + £2.10 p&p
2 Duo Type IIB speakers
£48.00 + £7.50 p&p
MP60 type deck with
Mag. cartridge de luxe
plinth and cover
£24.00 + £3.50 p&p
Total if purchased
separately: **£101.00**
Available complete
for only: **£92.00**
+ £7.60 p&p



Scotland P & P Surcharge
System 1a £1.75 System 2 £3.50

Note: 30x30 kit available
only as a separate item.

PUSH BUTTON CAR RADIO KIT— THE TOURIST II



FOR THE EXPERIENCED CONSTRUCTOR WHO CAN SOLDER CORRECTLY ON A PRINTED CIRCUIT BOARD YOU CAN BUILD THIS KIT CORRECTLY

NOW YOU CAN BUILD YOUR OWN PUSH BUTTON CAR RADIO!

This construction kit comprises a fully built and aligned R.F.I.F. module: Printed circuit board, with ready mounted integrated circuit output stage and all other components. The push button tuning mechanism is fully built and tested ready to mate with the printed circuit board. (once it is assembled). NOTE: No test equipment is required for alignment, but remember you must have the ability to solder on a printed circuit board.

TECHNICAL SPECIFICATION

(1) Output 4 watts RMS output. For 12 volt operation on negative or positive earth. (2) Integrated circuit output stage, pre-built three stage IF Module. Controls volume manual tuning and five push buttons for station selection, illuminated tuning scale covering full, medium and long wave bands. Size chassis 7" wide, 2" high and 4 3/4" deep approx. Speaker including baffle and fixing strip
£1.80+45p. p&p. Car Aerial Recommended—fully retractable
£7.40
 +£1.05 p&p.

STEREO CASSETTE TAPE DECK KIT

Kit comprises of ready built cassette tape transport mechanism. Featuring pause control, solenoid assisted auto-stop, 3 digit tape counter, belt-driven balanced fly wheel, DC motor with electronic speed control, ready built and mounted record/replay PC board, and two VU meters, power supply, PC board, mains transformer. Input and output sockets and two level controls. Specification power source 240 AC 50Hz. Output more than 0.5v input mike -65dB. 10KΩ. DIN. -47dB. 100KΩ. Track system 2 channel stereo record play-back. Tape speed, 4.8CM/SEC. Frequency response 50-12,000 Hz signal to noise ratio -42dB. Recording system AC Bias. Erasing system AC erase. Bias frequency 57KHz. Size of mechanism 8" x 5" x 3 1/2" approx: unit easy to mount into your cabinet 3" required to clear base of mechanism approx.



* This is an advanced kit not suitable for those without electrical knowledge and those unable to solder.

£32.50
 + p&p £1.50
 or send SAE for complete details.

NEW PRODUCT DISCO 35 MONO AMPLIFIER

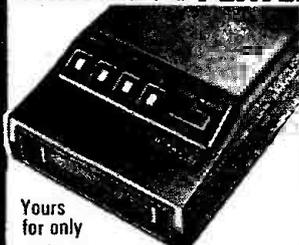
An ideal general purpose 35 watt mono amplifier with full mixing facilities. Suitable for DISCO, PUBLIC ADDRESS & GUITAR/MUSICAL INSTRUMENTS. Unit housed in an attractively styled teak veneered cabinet. 4 Inputs: DISC 1 & DISC 2 (BOTH FOR CERAMIC CARTRIDGES), tape and microphone. CONTROLS: All level mixing controls are fitted with integral switches, push button type. DISC 1 & DISC 2: Volume combined treble filter. TAPE: Volume combined bass booster switch. MASTER: Volume control combined on/off. MIC: Volume combined bass booster switch. INDEPENDENT BASS AND TREBLE CONTROLS.

TECHNICAL SPECIFICATION

Power output: 35RMS into 4 ohms. Speaker: (Suitable for 4 to 15 ohms speakers). Sensitivities: DISC 1 & DISC 2: 30 mv (into 120k RIAA). Treble Filter Switch: 12 db@ 10 KHz. Tape: 100 mv (into 120k Flat). Bass Booster Switch+18 db@ 60 Hz. Mic: 2 mv (equilised for dynamic). Bass Booster Switch+20 db@ 60 Hz. Bass Control: ± 15 db@ 60 Hz. Treble Control: ± 12 db@ 10 KHz
£27.50
 + £1.50 p&p

8 TRACK HOME CARTRIDGE PLAYER

Elegant self selector push button player for use with your stereo system. Compatible with Viscount IV system, Unisound module and the Stereo 21. Technical specification Mains input, 240V. Output sensitivity 125mV.



Yours for only

£12.60 +£1.70 p & p.

SPECIAL OFFER

As above but complete with build yourself Unisound Amplifier Kit (see opposite Panel) + 2 'Compact' easy to build speaker kits (see opposite page) **£24.50** + p & p £2.00

BUILD YOUR OWN STEREO AMPLIFIER

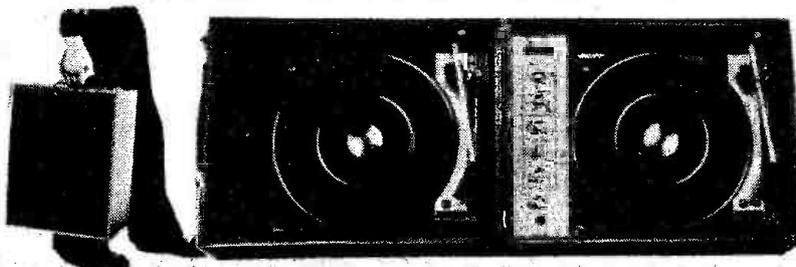


For the man who wants to design his own stereo - here's your chance to start, with Unisound - pre-amp, power amplifier and control panel. - Just simply screw together. 4 watts per channel into 8 ohms. Inputs: 120mV (for ceramic cartridge). The heart of Unisound is high efficiency I.C. monolithic power chips which ensure very low distortion over the audio spectrum. 240V. AC only.

£9.95 + £1.55 p&p

Also available with the 'Compact' (see opposite page) easy build speaker kit £14.50 + £2 p & p

PORTABLE DISCO CONSOLE



TECHNICAL SPECIFICATION:

Pre-amp - Output - 200mV. Auxiliary inputs - 200mV and 750mV into 1 meg. Mic input - 6mV into 100K. 240 volt operation. Turntables capacity - 7", 10" or 12" records. Rumble, wow and flutter Rumble Better than -35dB. Wow Better than 0.2%. Flutter Better than 0.06% (Gaumont kalea meter). Finish - Satin black mainplate with black turntable mat inlaid with brushed aluminium trim. Tonearm and controls in black and brushed aluminium.

Console size -

Unit Closed - 17 3/4" x 13 3/4" x 8 3/4" (app.)
 Unit Open - 35 3/4" x 13 3/4" x 4 3/4" (app.)
 This disco console is ideally matched for the Reliant IV and Disco 50 or any other quality amplifier. The unit is finished in black PVC with contrasting simulated teak edging, diamond spun control knobs with matching control panel.

Yours for only

£55.00 + £6.50 p&p

All prices include VAT at current rates

Mail orders to Acton. Terms C.W.O. All enquiries stamped addressed envelope. Goods not despatched outside U.K.

All items subject to availability. Prices correct at 1st July 1976 and subject to change without notice.

Minimum order on ACCESS/BARCLAYCARD £15



DO NOT SEND CARD

Just write your order giving your credit card number



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 323 EDGWARE ROAD, LONDON W2

Personal Shoppers EDGWARE RD: 9 a.m.-5.30p.m. Half day Thurs
 ACTON: 9.30a.m.-5p.m. Closed all day Wed.

CRESCENT RADIO LTD.

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(also) 13 SOUTH MALL, EDMONTON, N.9

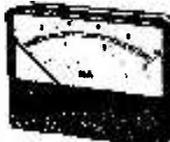
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LONDON N22 4SJ Phone 888-4474

CLEAR PLASTIC PANEL METERS

Size 59mm x 46mm x 35mm these meters require a 38mm hole for mounting.

- ME6 = 0 to 50 micro amp Full Scale
- ME7 = 0 to 100 micro amp Full Scale
- ME8 = 0 to 500 micro amp Full Scale
- ME9 = 0 to 1 m/a Full Scale
- ME10 = 0 to 5 m/a Full Scale
- ME11 = 0 to 10 m/a Full Scale
- ME12 = 0 to 50 m/a Full Scale
- ME13 = 0 to 100 m/a Full Scale
- ME14 = 0 to 500 m/a Full Scale
- ME15 = 0 to 1 amp Full Scale
- ME16 = 0 to 50 volts
- ME17 = 0 to 300 volts
- A.C. Full Scale
- ME18 = "S" Meter
- ME19 = "VU" Meter



OUR PRICE £3.50
+8%

WAFER SWITCHES

- 1 Pole 12 Way
- 2 Pole 2 Way
- 2 Pole 3 Way
- 2 Pole 4 Way
- 2 Pole 6 Way
- 3 Pole 4 Way
- 4 Pole 3 Way



80p each +8%

CRESCENT BUBBLE LIGHT SHOW

This budget system compares very favourably with more sophisticated and higher priced models.

Specification:

Projector—150W convection cooled. At 30ft the projected image is 16ft.

Motor—1 rev. per 2 min.

Liquid Wheel—6in. diameter multi colour.

Our Price £28 + 8%

POWER SUPPLY UNITS + 8%



PP1 switched 3, 4½, 6, 7½, 9 and 12 volts at 500 m/a, with on/off switch and pilot light. Size: 130mm x 55mm x 75mm.
ONLY £4.50

PP2 Switched 6—7½—9 volt Battery Eliminator. Approx. size 2¼" x 2¼" x 3¼". Ideal for cassette recorders £3.25
PP3 Car converter. From 12v Pos. or Neg. to —6—7½—9 volt. Easy to fit and transistor regulated £3.90

LOW VOLTAGE STEREO AMPLIFIER

8 Transistor Stereo Amplifier with Vol'e, Base, Balance and Tone Controls. Approx. 3 watts into 8 ohm per channel needs a 9/12 volt DC supply and is complete on a 2¼" x 7½" P/C board.

Ideal for domestic record players, etc. A Bargain at £5 + 12½% VAT.

ABS PLASTIC BOXES + 8%

Handy boxes for construction projects. Moulded extrusion rails for P.C. or chassis panels, fitted with 1mm front panels.

- 1005 = 105mm x 73mm x 45mm = 55p
- 1006 = 150mm x 75mm x 47mm = 72p
- 1007 = 184mm x 124mm x 60mm = £1.28
- 1021 = 106mm x 74mm x 45mm (sloping front) = 55p

GOODMANS CROSSOVER

Bargain Price Crossovers manufactured by Goodmans for the "Havant" Loudspeaker System. 3 way, 8 ohm. £1 each + 12½% VAT.

LOW NOISE LOW PRICE CASSETTES + 8%

Good quality tape in well made screw type cassettes. Presented in single plastic cases.

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A plastic box with moulded extrusion rails for PC or Chassis panels with metal front plate fitted with four screws (all supplied).

An ideal box to give a small project a professional finish
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- ★ Completely Portable
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Anhydrous ferric chloride in double sealed one pound poly packs. Our Price 65p + P/P + VAT at 8% per lb.

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Three Channel Bass, Middle, Treble, Each channel has its own sensitivity control. Just connect the input of this unit to the loudspeaker terminals of an amplifier and connect three 250V up to 1000W lamps to the output terminals of the unit, and you produce a fascinating sound-light display. (All guaranteed.)

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approx size 60mm x 40mm x 50mm

fixing centres 75mm

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£8.50 each Stereo pair £16.50

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15—240 Watts!

HY5 Pre-amplifier

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

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

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

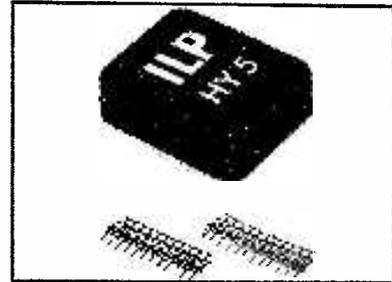
SPECIFICATIONS:

INPUTS: Magnetic Pick-up 3mV; Ceramic Pick-up 30mV; Tuner 100mV; Microphone 10mV; Auxiliary 3-100mV; input impedance 4.7k Ω at 1kHz.

OUTPUTS: Tape 100mV; Main output 500mV R.M.S.
ACTIVE TONE CONTROLS: Treble \pm 12dB at 10kHz; Bass \pm at 100Hz.
DISTORTION: 0.1% at 1kHz. Signal/Noise Ratio 68dB.

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

Price \pounds 4.75 + 59p VAT P&P free.



HY30 15 Watts into 8 Ω

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

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

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

SPECIFICATIONS:

OUTPUT POWER 15W R.M.S. into 8 Ω ; **DISTORTION** 0.1% at 1.5W.
INPUT SENSITIVITY 500mV. **FREQUENCY RESPONSE** 10Hz-16kHz—3dB.
SUPPLY VOLTAGE \pm 18V.

Price \pounds 4.75 + 59p VAT P&P free.



**Available
June '76**

HY50 25 Watts into 8 Ω

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

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

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

SPECIFICATIONS:

INPUT SENSITIVITY 500mV
OUTPUT POWER 25W RMS into 8 Ω **LOAD IMPEDANCE** 4-16 Ω **DISTORTION** 0.04% at 25W at 1kHz

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

SUPPLY VOLTAGE \pm 25V SIZE 105 50 25mm

Price \pounds 6.20 + 77p VAT P&P free.



HY120 60 Watts into 8 Ω

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

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

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

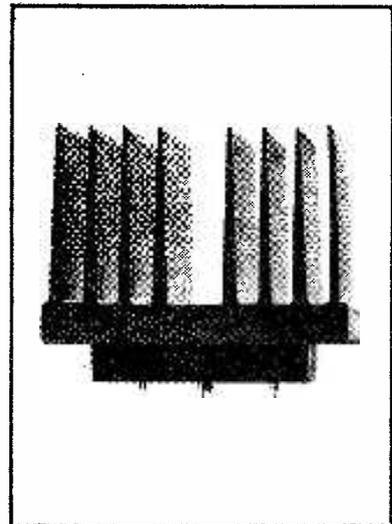
SPECIFICATIONS:

INPUT SENSITIVITY 500mV.
OUTPUT POWER 60W RMS into 8 Ω **LOAD IMPEDANCE** 4-16 Ω **DISTORTION** 0.04% at 60W at 1kHz

SIGNAL/NOISE RATIO 90dB **FREQUENCY RESPONSE** 10Hz-45kHz—3dB **SUPPLY VOLTAGE \pm 35V**

SIZE 114 50 85mm

Price \pounds 14.40 + \pounds 1.16 VAT P&P free.



HY200 120 Watts into 8 Ω

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

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

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

SPECIFICATIONS:

INPUT SENSITIVITY 500mV
OUTPUT POWER 120W RMS into 8 Ω **LOAD IMPEDANCE** 4-16 Ω **DISTORTION** 0.05% at 100W at 1kHz

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

SIZE 114 100 85mm

Price \pounds 21.20 + \pounds 1.70 VAT P&P free.

HY400 240 Watts into 4 Ω

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

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

APPLICATIONS: Public address—Disco—Power slave—Industrial

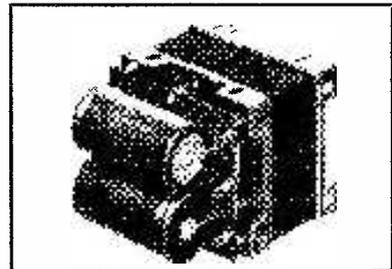
SPECIFICATIONS:

OUTPUT POWER 240W RMS into 4 Ω **LOAD IMPEDANCE** 4-16 Ω **DISTORTION** 0.1% at 240W at 1kHz

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

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

Price \pounds 29.25 + \pounds 2.34 VAT P&P free.



POWER SUPPLIES

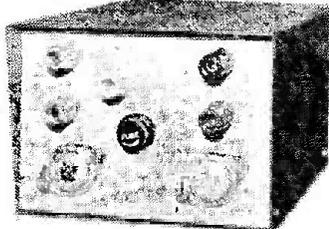
PSU36 suitable for two HY30's \pounds 4.75 plus 59p VAT. P/P free.
PSU50 suitable for two HY50's \pounds 6.20 plus 77p VAT. P/P free.
PSU70 suitable for two HY120's \pounds 12.50 plus \pounds 1.00 VAT. P/P free.
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All above invertors are in kit form but may be purchased built up in metal case and ready for use. Price list sent on receipt of s.a.e. Prices include p. and p.

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240v-50Hz-150 watt inverter with built in battery charger. In event of power failure switches over automatically from battery charging to inverter operation. Cct. as appeared in Dec. 72 P.W. Complete kit of parts (excluding meter) £24.50 plus £1.70p.p.

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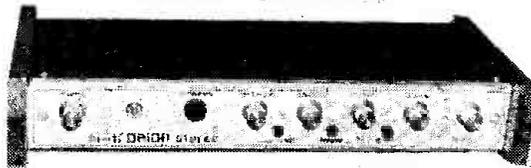
8 watt-12v-Fluorescent light, suitable for tents, caravans, houses, boats and secondary lighting for factories, hotels, &c.
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Both high volume and small order capacity available.

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20 + 20 Watts r.m.s. into 8 ohm load. Distortion less than 0.01% 100Hz-10kHz. Frequency response \pm 1dB 20 Hz to 20kHz. Hum level virtually nil with volume full on.

This is a power amplifier of superb quality incorporating the very latest design features. Professional hi-fi enthusiasts have classed it as fantastic and real value for money. The CCT incorporates a low flux transformer and inputs for disc, tape, tuner, etc.

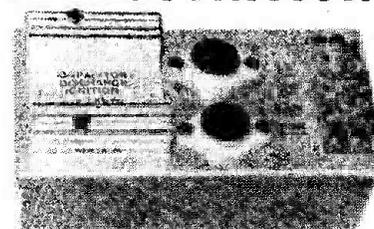
Complete kit of parts including slim line bookend case, silk screened front panel and knobs £47.30 inc. VAT and p. & p.

The bookend case, I.C's and semiconductors, P.C. board, Transformer, etc. may be purchased separately if desired. Send S.A.E. for further information.

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Bookend Amplifier and attractive styled Instrument Cases available. Send S. and A. envelope for Price List.

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EC88	0-88	EH90	1-22	PCF201	0-97	PY800	0-55	30FL14	1-20
EC90	0-84	EL34	1-40	PCF802	1-02	PY801	0-72	30L1/PC84	
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CL33	1-50	EF85	0-45	PC86	0-65	SP61	0-85	6J7M	0-80
CY81	1-00	EF86	0-50	PC88	0-65	T41	1-50	6K5GT	0-30
DAF91	0-40	EF89	0-85	PC97	0-55	U14	0-75	6K7G	0-85
DAF96	0-60	EF91	0-40	PC900	0-55	U25	1-00	6K7M	0-45
DCC90	1-35	EF92	0-50	PCC84	0-45	U26	0-85	6K8G	0-45
DF91	0-40	EF95	0-45	PCC88	0-65	U191	0-75	6K8M	0-70
DF96	0-60	EF98	0-80	PCC89	0-55	UABC80	0-40	6K25	1-00
DK91	0-50	EF183	0-40	PCC189	0-55	UAF42	0-75	6L6G	1-25
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DL92	0-50	EL33	3-00	PCF86	0-65	UBF80	0-50	6Q7M	0-60
DL94	0-85	EL34	0-70	PCF801	0-60	UBF89	0-50	6SL7GT	0-55
DL96	0-55	EL86	0-60	PCF802	0-55	UCC85	0-50	6SLN7GT	0-55
DY86	0-45	EL87	3-40	PCF805	0-90	UCH42	0-80	6SQTGT	0-40
DY87	0-45	EL41	0-90	PCF806	0-80	UCH81	0-80	6U5G	1-50
DY802	0-47	EL42	1-65	PCF808	1-00	UCL82	0-40	6V6G	0-80
EABC80	0-38	EL84	0-85	PCL82	0-45	UCL83	0-70	6V6GT	0-80
EAF42	0-70	EL95	0-60	PCL83	0-70	UF41	0-75	6X4	0-45
EB91	0-30	EM80	0-55	PCL84	0-50	UF89	0-50	6X5G	0-45
EBC33	1-00	EM81	0-60	PCL85	0-60	UL41	0-85	6X6GT	0-55
EBC41	0-75	EM84	0-40	PCL86	0-50	UL84	0-50	7B6	0-80
EBC81	0-40	EM85	1-00	PCL805/85		UY41	0-55	7B7	0-60
EBF80	0-40	EM87	1-00			UY85	0-45	7C5	1-00
EBF83	0-40	EY61	0-45	PD500	1-50	VR105/30	0-40	7C6	1-00
EBF89	0-32	EY86	0-50	PEN45	0-85	VR150/30	0-40	7H7	0-50
EBL31	2-00	EZ40	0-60	PL36	0-83	1R5	0-45	7R7	1-30
ECC91	0-45	EZ41	0-75	PL81	0-55	1R5	0-40	7Y4	0-80
ECC92	0-88	EZ80	0-30	PL82	0-50	1T4	0-40	12A7G	0-45
ECC93	0-88	EZ81	0-31	PL83	0-50	3B4	0-80	12A7T	0-50
ECC94	0-85	GY501	0-90	PL84	0-50	3V4	0-80	12A7U	0-50
ECC95	0-45	GZ30	0-65	PL500	0-85	5R4GY	1-20	12A7V	0-50
ECC98	0-50	GZ32	0-65	PL504	0-85	5U4G	1-25	12A7X	0-50
ECH85	1-50	GZ34	0-75	PL505	0-90	5U4GB	0-70	12AX7	0-50
ECH42	0-85	HN309	1-60	PL509	1-55	5Y3GT	0-65	12BA6	0-50
ECH81	0-35	KT61	3-00	PL802	2-00	5Z4G	0-95	12BE6	0-60
ECH83	0-50	KT66	3-40	PX25	3-50	6/30L2	0-90	30C1	0-40
ECL80	0-60	KT81(7C5)	2-00	PY33	0-63	6AK5	0-45	30C18	1-00
ECL82	0-42	KT81	1-75	PY81	0-50	6AM5	2-00	30C17	1-00
ECL83	0-75	KT88	3-85	PY82	0-45	6AQ5	0-50	30C18	0-90
ECL86	0-55	KTW61	1-50	PY83	0-50	6A87G	1-00	30F5	1-00
ECL800	3-50	MU14	1-00	PY88	0-63	6AT6	0-60	30FL1	1-00
						6AU6	0-40	30FL2	1-00
						6BA6	0-33	30FL14	1-00
						6BE6	0-45	30L15	0-95
						6BH6	0-75	30L17	0-95
						6BJ6	0-75	30P4MR	1-30
						6BQ7A	1-55	30P12	1-00
						6BR7	1-20	30P19	0-95
						6B87	1-40	30PL1	0-95
						6BW6	1-00	30PL13	1-10
						6BW7	1-00	30PL14	1-10
						6C4	0-40	35W4	0-60
						6CD6G	1-60	35Z4GT	0-70
						6CH6	2-20	50CD6G	1-80
						6CW4	3-00	90T	1-00
						6F23	0-90	8181T	17-50
						6F25	1-00	813UBR	7-00
						6F28	0-75	866A	2-00

TRANSISTORS-INTEGRATED CIRCUITS

EXPRESS POSTAGE

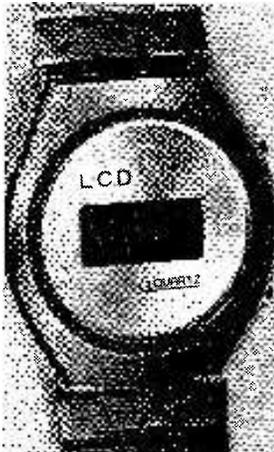
15p per order in UK

All transistors, I.C.'s offered are new and branded. Manufactured by Mullard, Texas, RCA, Ferranti, Motorola, ITT, Fairchild, Lucas, etc. Quantity discounts on application. Send SAE for full lists.

AA119	0-07	BD131	0-42	OA200	0-08	ZTX500	0-13	2N2904	0-20
AAZ13	0-12	BD132	0-50	OA202	0-06	ZTX501	0-15	2N2904A	0-25
AAZ15	0-10	BF115	0-20	OC16	1-00	ZTX503	0-16	2N2905	0-25
AC107	0-51	BF167	0-25	OC20	2-00	ZTX531	0-25	2N2905A	0-25
AC126	0-25	BF173	0-23	OC23	1-25	ZTX550	0-18	2N2906	0-20
AC127	0-35	BF179	0-33	OC25	0-40	IN914	0-08	2N2926	0-12
AC128	0-15	BF180	0-33	OC28	1-00	IN4001	0-06	2N2926	0-18
AC176	0-25	BF181	0-35	OC35	0-75	IN4002	0-07	2N2926	0-15
AC187	0-21	BF194	0-10	OC42	0-40	IN4003	0-08	2N2926	0-45
AC188	0-30	BF195	0-12	OC44	0-20	IN4004	0-08	2N2926	0-91
AC189	0-25	BF197	0-15	OC45	0-20	IN4005	0-10	2N2926	0-65
ADY29	0-75	BF200	0-32	OC71	0-25	IN4007	0-12	2N2926	0-18
AD140	0-50	BF861	0-25	OC72	0-25	IN4009	0-06	2N2926	0-13
AD149	0-75	BF898	0-25	OC76	0-30	IN4148	0-06	2N2926	0-15
AD161	0-44	BFW10	0-61	OC77	0-85	18921	0-07	2N2926	0-11
AD162	0-44	BFX29	0-25	OC81	0-29	182033	0-20	2N2926	0-17
AD175	0-25	BFX88	0-24	OC81D	0-28	182051A	0-20	2N2926	0-08
AF116	0-24	BFY50	0-20	OC81Z	0-75	182100A	0-20	2N2926	0-10
AF117	0-24	BFY51	0-20	OC83	0-80	163010	0-25	2N2926	0-11
AF166	0-48	BFY82	0-20	OC140	1-50	2N696	0-15	2N2926	0-11
AF239	0-44	BR100	0-40	OC170	0-20	2N697	0-10	2N2926	0-88
AFY27	0-40	BY100	0-27	OC171	0-89	2N706	0-10	2N2926	0-50
AFY28	0-36	BY126	0-14	OC200	1-00	2N706A	0-12	2N2926	0-50
BA102	0-25	BY127	0-12	OC201	1-50	2N1181	0-25	2N2926	0-15
BA115	0-10	BZX61 series		OC202	1-50	2N1182	0-24	2N2926	0-20
BC107	0-14			OC203	1-25	2N1302	0-18	2N2926	0-25
BC108	0-18	BZY88 series		OC207	1-20	2N1303	0-19	2N2926	0-25
BC109	0-12			OC208	0-60	2N1304	0-22	2N2926	0-15
BC113	0-15	CR81-05	0-45	OC209	0-55	2N1305	0-22	2N2926	0-18
BC117	0-21	CR81-40	0-65	OC210	0-80	2N1306	0-22	2N2926	0-12
BC143	0-30	CR83-05	0-40	OC211	1-50	2N1307	0-22	2N2926	0-18
BC147	0-10	CR83-40	0-65	OC212	1-50	2N1308	0-22	2N2926	0-12
BC148	0-08	MJE340	0-47	OC213	1-50	2N1309	0-20	2N2926	0-14
BC169C	0-15	MJE370	0-68	OC214	1-50	2N1310	0-20	2N2926	0-20
BC182	0-18	MJE520	0-65	OC215	1-50	2N1311	0-20	2N2926	0-18
BC182L	0-18	MJE2955	1-27	OC2					

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for night time illumination



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**INCLUDES FULL
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Stainless Steel Case and Bracelet included.
(Gold Case and Bracelet £2·64 extra)

Only high quality American modules are used with full UK servicing facilities available.



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2 YEAR
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To: Quartz Watch Offer (Dept. PW)
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Please send a Liquid Crystal/LED Quartz Watch. I have enclosed a cheque/PO/or debit my Barclay/Access card No..... for £32-93LCD/£24-28LED which includes VAT & P.P. (LCD gold case and bracelet include £2·64 extra)

Name

Address

Signature

TRANSFORMERS

MAINS SAFETY ISOLATING Primary 240V. Sec. 120V or 240V.
Please state which type you require.
All types are screened and Centre tapped to earth.

V.A. (watts)	OPEN TYPE	P. & P.		CASED TYPE	SOCKETS		CARR- IAGE	PLUGS FOR CASED TYPE complete set
		£	p		5 amp	15 amp		
50	3-98	62						
100	4-53	70						
200	7-26	80						
250	8-80	1-10						
350	10-59	1-18						
500	12-18	1-34		23-25	1	—	O.A.	1-20
750	18-65	O.A.		30-80	2	—	O.A.	1-20
1000	26-00	O.A.		37-77	2	—	O.A.	2-40
1500	29-65	O.A.		44-30	3	—	O.A.	3-60
2000	35-00	O.A.		51-85	1	1	O.A.	2-70
3000	55-00	O.A.		75-35	3	1	O.A.	5-10

CASED TYPES These are of extremely high quality to British Standard Specification, with resettable fused primary winding, and are fitted with covered outlet sockets. Housed in steel cases with carrying handles and 3ft of 3 core cable.

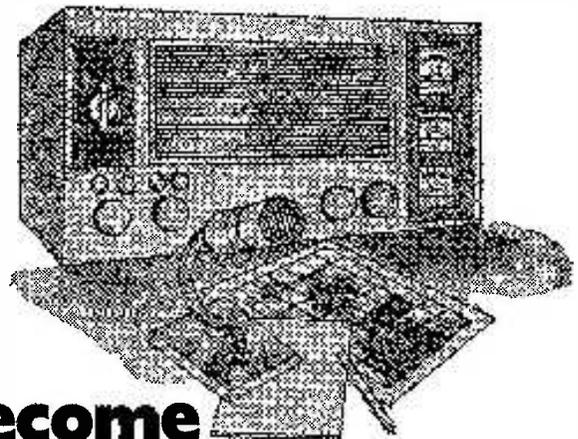
12V or 24V				MINIATURE TRANSFORMERS			
Primary 240V Please state which voltage				Primary voltage 240V			
AMPS	PRICE	P & P		Sec. volts	mA	PRICE	P & P
12V	24V	£	p			£	p
·5	·25	1-30	26	3-0-3	200	1-37	25
1	·5	1-58	45	0-6 x 2	1A	1-80	45
2	1	2-05	45	0-9 x 2	330	1-34	26
4	2	2-52	62	0-9 x 2	500	1-83	45
6	3	3-76	62	0-9 x 2	1A	2-60	52
8	4	4-30	85	0-15 x 2	200	1-30	25
10	5	4-67	85	0-20 x 2	300	1-72	52
12	6	6-35	1-20	0-20 x 2	1A	3-08	72
16	8	9-27	1-20	0-15-27 x 2	1A	3-86	72

SPECIAL OFFER Primary 240V. Sec. 24V. 500m.amp. } 90p + 45p, P. & P.

We manufacture Power Transformers to customers own special requirements, please send details of any Transformer you may require custom built. All queries must be accompanied by S.A.E.

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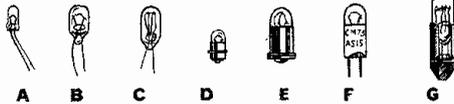
TANGENTIAL BLOWER HEATER

240V 2KW can be switched for two speeds and 1KW Robust and efficient. Aperture $7\frac{1}{2}'' \times 13''$ size overall length $10''$. Price $\pounds 4.25$ plus p. & p. 75p.



DIGITAL DISPLAY INDICATOR

by KGM, Type M4. window size $\frac{1}{2}''$ wide, $1\frac{1}{2}''$ high, depth $1\frac{1}{2}''$, height $3\frac{1}{2}''$ plus front flange ($\frac{1}{2}''$ top and bottom). This is an Acrylic edgelit unit illuminated by 12V flange type bulbs (as our min. lamp type D) Currently sold at $\pounds 14.00$ plus, our price $\pounds 3.95$ inc. lamps, plus p. & p. 35p.



MINIATURE LAMPS

Type	Size (Dia.)	Volt/Curr.	Type	Size (Dia.)	Volt/Curr.
A	3MM	5-6V 60 MA	D	3MM	2-5V 360 MA
B	4MM	4V 250 MA	E	4MM	5-6 60 MA
		5V 60 MA			6V 200 MA
		12V 40 MA			6-3 200 MA
		12V 100 MA			14V 40 MA
		14V 75 MA	F	4MM	2-7V 60 MA
		28V 40 MA			12V 180 MA
		28V 40 MA			14V 80 MA
C	5MM	28V 40 MA			

G Small telephone jack type 6 or 24V Price: Types A-F $\pounds 4.00$ for 25, 50 and upwards 13p each Type G 45p each. p. & p. 20p per order.

RIBBON CABLE

4 way side by side P.V.C. 7 strand red-green-blue-yellow (miniature) 50 metre reels $\pounds 4.50$. 250 metres $\pounds 20$ P & P 70p 50 metres. $\pounds 1.50$ 250 metres.

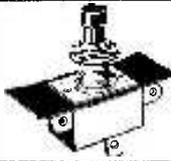
CENTRIFUGAL BLOWER



240V powerful, efficient by Universal Electric. 3,100 r.p.m., inlet dia. $4''$, outlet approx. $2\frac{1}{2}'' \times 2\frac{1}{2}''$, overall width $5''$, overall dia. $5\frac{1}{2}''$. Price $\pounds 4.75$ plus p. & p. 75p.

ARROW SWITCH

Press on/press off, single hole fixing SP ST size $1\frac{1}{2}'' \times \frac{1}{2}''$ prestle extends $\frac{1}{2}''$. Rated $2\frac{1}{2}$ amps. Robust. Price for 5 (min qty.) $\pounds 1.75$. 10 or more 30p each. p. & p. 30p for 5.



MEM LIMIT SWITCH

Snap action 5 amps at 240/410 A.C. size base $3\frac{1}{2}'' \times 1\frac{1}{2}'' \times 1\frac{1}{2}''$ plus heavy duty roller plunger $1\frac{1}{2}''$ ext. or $1''$ when compressed. Very robust for tireless operation, weather proof. Price $\pounds 2.20$ plus p. & p. 25p.

RELAYS

Octal base 2 C/O 6 amp contacts following voltages: 12V a.c. 48V d.c. 110 d.c. 230 a.c., all $\pounds 1.25$ each plus base 15p postage and packing 15p. 11-pin 3 C/O 8 amp contacts, following voltages: 115 a.c. 48 d.c. 24 d.c. all at $\pounds 1.50$ each, base 15p plus 15p p. & p.

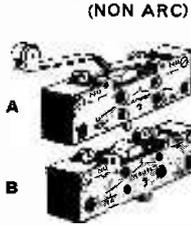


10 K.W. ISOLATION TRANSFORMER

Prim. 200-240V sec. 120-0-120V, size $18'' \times 15'' \times 26''$ high, weight approx. 250lbs. Price $\pounds 110$ inc. VAT delivery charge at cost.

CROUZET MICRO SWITCHES (NON ARC)

Types A/B no. 83-112 n/o or n/c as desired, rating 5 a 240V, size $1\frac{1}{2}'' \times \frac{1}{2}'' \times \frac{1}{2}''$ high. Can be stacked horizontally or vertically, in this mode, top switch can operate multiples. Type A has straight through plunger, whilst Type B is encased at bottom. Makers price approx. $\pounds 1.40$ each, our price 45p each (min. qty. 5) plus 15p per roller (as shown) plus 20p p. & p.



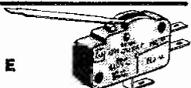
Type C miniature no. 83-132, size $\frac{3}{4}'' \times \frac{1}{2}'' \times \frac{1}{2}''$ high, plus tags, 5 a 250V. Price 30p each (min. 5) Lever $\frac{3}{8}''$ long $19/16''$ long either type 8p each, plus p. & p. 20p.



Type D similar to Type C, but with tags underneath, uses same lever as Type C or can be banked horizontally and double lever (as shown) supplied at 12p. Prices as type C.



Type E no. 83-131, 10 a 250V size $1\frac{1}{2}'' \times \frac{3}{8}'' \times \frac{3}{8}''$ high. 30p each (min. 5) plus lever $1\frac{1}{2}''$ long, 8p each plus p. & p. 20p each.



NORPLEX COPPERCLAD FIBREGLASS

First grade material. 1 & 2 oz. copper size $43'' \times 37''$ thickness double sided $1/32''$, $1/16''$, $3/64''$, single sided $1/32''$ & $3/64''$ all types $\pounds 10$ per sheet. Carriage $\pounds 2$ one sheet plus 50p additional sheets (G.B.).

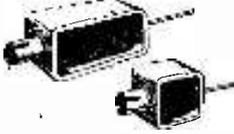
THUMBWHEEL EDGE SWITCHES

(Plessey) ten position 0-9 (single pole ten way) modular, any number may be banked. Contact rating 2a. A.C. or D.C., colour black, size overall 52-58 high x 12 wide x 49 mm deep. P.C. pitch 156. Price $\pounds 1.50$ per unit, end mounting cheeks $\pounds 1.00$ per pair, p. & p. 30p any order.



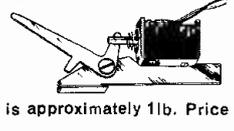
SOLENOID BY WESTOOL

240 a.c. type MM6 3lb pull. $2\frac{1}{2}'' \times 1'' \times 1\frac{1}{2}''$. Travel $1''$. $\pounds 1.50$ each, plus p. & p. 25p.
240 a.c. type MM4 2lb pull. $1\frac{1}{2}'' \times 1\frac{1}{2}'' \times 1''$. Travel $1''$. $\pounds 1.25$ each, plus p. & p. 25p.



MAINS SOLENOIDS

This little unit gives vertical lift of approximately 1in. through hinged "elbow". Bracket incorporates 2 fixing screws. Length of arm, $2\frac{1}{2}''$ 240V. a.c. Pull at coil is approximately 1lb. Price $\pounds 1.25$ plus p. & p. 20p.



ALL PRICES INCLUDE V.A.T.

Whilst we welcome official orders from established companies and Educational Departments, it is no longer practical to invoice goods under $\pounds 10$. Therefore, please remit cash with orders below this amount.

MUFFIN "PANCAKE" FANS

As used in computers and other installations where silent continuous efficient cooling is needed. These fans are 115V, 50Hz drawing only 14 watts $4\frac{1}{2}'' \times 4\frac{1}{2}'' \times 1\frac{1}{2}''$. They can be coupled in pairs for use on 240V dropping resistor can be supplied for 50p. ONLY $\pounds 6.50$ plus p. & p. 50p.



SPRITE "PANCAKE" FANS

Similar to "Muffin", physically smaller, drawing only 9 watts but still giving extremely high efficiency with minimum fuss. 115V 50 Hz can be used in pairs from 240V a.c. dropping resistor supplied for 50p. Size: $3\frac{1}{2}'' \times 3\frac{1}{2}'' \times 1\frac{1}{2}''$. (Large quantity available, special quotations). ONLY $\pounds 4.50$ plus p. & p. 50p.



6 DIGIT 24V d.c. COUNTER

Non re-set 3 watts, size $1\frac{1}{2}'' \times 1'' \times 1\frac{1}{2}''$. Brand new. Plastic encased. Price $\pounds 2.25$ plus p. & p. 25p.

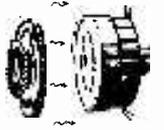


SOLDER GUN BY ETP

240V for instant heat and speedy soldering. 100 watts, built in spot lamp. Price $\pounds 3.50$ plus p. & p. 50p.

BENDIX MAGNETIC CLUTCH

A superb example of Electro-mechanics! The main body is in two sections. The coil section is fixed and has a 3in sleeve. The drive section rotating on the outer perimeters. The uniting plate has 3in ID bearing concentric with main section and 18-tooth cog wheel. When energized transmission is extremely powerful, 24V d.c. at 240 MA. Our price just $\pounds 2.70$ plus 30p p. & p.



PROGRAMME TIMER

12 bank, cam operated micro switches, infinitely variable switching 240V. Speed 15 r.p.m. (4 secs per rev). Price $\pounds 8.95$ plus p. & p. 70p.



SHADED POLE GEARED MOTORS

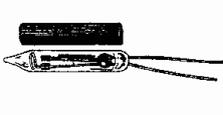
110 r.p.m.

240 a.c., high Torque, approximate overall size $3\frac{1}{2}'' \times 3\frac{1}{2}'' \times 2\frac{1}{2}''$ and spindle dia. $\frac{1}{8}''$. Price $\pounds 3.50$ plus p. & p. 50p.



SYLVANIA SWITCH

Complete with magnet, normally closed, 3 amp vacuum sealed. $1\frac{1}{2}''$ long $\frac{1}{2}''$ dia. 10 for $\pounds 2.50$, 50 for $\pounds 11.00$, 100 for $\pounds 18.00$ plus p. & p. 30p. for 10 to 100.



LIGHT DEPENDENT RESISTORS

Matched pairs, Pioneer type 174 similar to orp 12 resistance 1K to 40K, dia $\frac{1}{8}''$ with $\frac{1}{4}''$ flanges. $\pounds 1.50$ for two pairs (minimum) 10 or more pairs 50p. per pair plus p. & p. 15p.

EDGE CONNECTORS (CINCH)

Single contact sockets, 27 way 15, can be cut to length, moveable end mounts. 10 pieces (minimum) for $\pounds 4.00$ plus p. & p. 25p.

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UNCOLOURED SOUND FROM CRIMSON

In the design particular attention has been paid to the transient response. With a sensible rise-time of 8 μ s, an exceptional slewing-rate of 6V/ μ s, and only 40dB of feedback, transient intermodulation distortion is minimised. A two pole Zobel network gives excellent control into reactive loads resulting in a settling-time of 15 μ s for 8 Ω || 2 μ F.

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CE 60	60 W.r.m.s./8 Ω	$\pounds 14.55$	Inclusive of V.A.T. & post.
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- * T.H.D. .03% typical up to rated power, 1kHz.
- * Frequency response 12Hz-35kHz. -3dB.
- * Unconditionally stable.
- * Signal to noise ratio >110dB.
- * Sensitivity 250mv. into 56k Ω .
- * 14 transistors 4 diodes.
- * Fully protected - load line sensing.
- * D.C. coupled, suitable for ± 15 to 35v.
- * Small size - only 80x120x25mm.
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BI-PAK High quality audio



STEREO FM TUNER

Fitted with Phase Lock-loop Decoder

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

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



OUR PRICE ONLY

£19.95

The 450 Tuner provides instant programme selection at the touch of a button ensuring accurate tuning of 4 pre-selected stations, any of which may be altered as often as you choose, by simply changing the settings of the pre-set controls. Used with your existing audio equipment or with the BI-KITS STEREO 30 or the MK60 Kit etc. Alternatively the PS12 can be used if no suitable supply is available, together with the Transformer T461.

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

STEREO PRE-AMPLIFIER PA 100



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

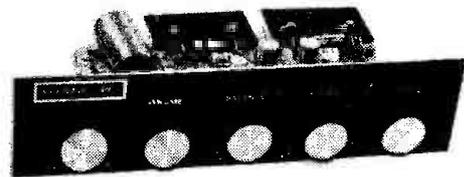
Frequency Response + 1dB
20Hz-20KHz.
Sensitivity of inputs:
1. Tape Input 100mV into 100K ohms
2. Radio Tuner 100mV into 100K ohms
3. Magnetic P.U. 3mV into 50K ohms
P.U. Input equalises to R1AA curve within 1dB from 20Hz to 20KHz. Supply 20-35V at 20mA. Dimensions—209mm x 89mm x 35mm.

£13.50 p & p 45p

MK60 AUDIO KIT:
Comprising: 2 x AL60's 1 x SPM80, 1 x BTM80, 1 x PA100, 1 Front panel and knobs. 1 Kit of parts to include on/off switch, neon indicator, stereo headphone sockets plus instruction booklet. **COMPLETE PRICE £27.55 plus 62p postage.**

TEAK 60 AUDIO KIT:
Comprising: Teak veneered cabinet size 163" x 113" x 33", other parts include aluminum chassis, heatsink and front panel bracket plus back panel and appropriate sockets etc. **KIT PRICE £9.20 plus 62p postage.**

STEREO 30 COMPLETE AUDIO CHASSIS



7 + 7 WATTS R.M.S.

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

TRANSFORMER £2.45 plus 62p p & p

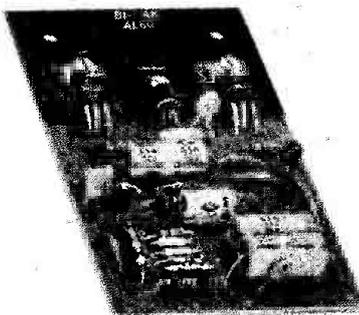
TEAK CASE £3.65 plus 62p p & p.

£15.75 P & P 45p.

AL 60

25 Watts (RMS)

VAT ADD 12 1/2%



- Max Heat Sink temp. 90C.
- Frequency response 20Hz.
- Distortion better than 0.1 at 1kHz.
- Supply voltage 15-50v.
- Thermal Feedback.
- Latest Design Improvements.
- Load—3,4,5, or 16ohms.
- Signal to noise ratio 80db.
- Overall size 63mm. 13mm.

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

ONLY **£3.95**

Stabilised Power Supply Type SPM80

SPM80 is especially designed to power 2 of the AL60 Amplifiers, up to 15 watts (r.m.s.) per channel simultaneously. With the addition of the Mains Transformer BMT80, the unit will provide outputs of up to 1.5A at 35V. Size: 63mm, 105mm, 30mm. Incorporating short circuit protection.

INPUT VOLTAGE 33-40V. A.C.
OUTPUT VOLTAGE 33V. D.C. Nominal
OUTPUT CURRENT 10mA-1.5 amps
OVERLOAD CURRENT 1-7 amps approx.
DIMENSIONS 105mm x 63mm x 30mm
TRANSFORMER BMT80 £2.60 + 62p. postage

£3.00

equipment mono and other modules for Stereo

NOW BI-PAK BRINGS YOU— The AL80 35^{RMS} w power Amp!

ONLY
£6.95
+ 8% VAT



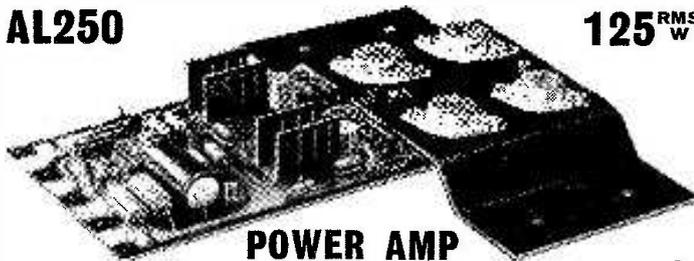
A High Fidelity Power Amplifier with a maximum Power Output of 35 watt R.M.S., which has a maximum operating voltage of 60v. A MUST for all HI-FI users.

Maximum supply voltage	15-60v
Power output for 2% THD	35 watts R.M.S.
Harmonic distortion	0.1%
Load impedance	3-8-16 ohm
Input impedance	50K ohm
Frequency response +3dB	20Hz-40KHz
Sensitivity for 25 watts O/P	280mV R.M.S.
Max. Heat sink temperature	90°C
Dimensions	102mm x 64mm x 15mm
Mounting	2, 4BA fixing holes in heat sink
Fuse requirements	1-5A

AND for those who need more P-O-W-E-R

AL250

125^{RMS} w



POWER AMP

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

SPECIFICATION:

Output Power: 125 watt RMS Continuous	Total harmonic distortion 50 watts into 4 ohms: 0.1%
Operating voltage: 50-80	50 watts into 8 ohms: 0.06%
Loads: 4-16 ohms	S/N ratio: better than 80dBs
Frequency response: 25Hz- 20kHz: Measured at 100 watts	Damping factor, 8 ohms: 65
Sensitivity for 100 watts output at 1kHz: 450mV	Semiconductor complement: 13 transistors 5 diodes
Input impedance: 33K ohms	Overall size: Heatsink width 190mm, length 205mm, height 40mm

ONLY £15.95 + 8% VAT

MPA 30



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

£2.65

**VAT
ADD
12½%**

POSTAGE & PACKING
Postage & Packing add 25p unless otherwise shown. Add extra for airmail. Min. £1.00

AL 20-30 AUDIO AMPLIFIER MODULES



The AL20 and AL30 units are similar in their appearance and in their general specification. However, careful selection of the plastic power devices has resulted in a range of output powers from 5 to 10 watts R.M.S. The versatility of their design makes them ideal for use in record players, tape recorders, stereo amplifiers and cassette and cartridge tape players in the home. Harmonic Distortion $P_o = 3$ watts $f = 0.25\%$ Load Impedance 8-16 ohm

Frequency response $\pm 3dB P_o = 2$ watts 50Hz-25KHz.
Sensitivity for Rated O/P— $V_s = 25v$, $RL = 80$ ohm.
 $f = 1$ kHz 75mV. RMS. Size: 75mm x 63mm x 25mm.

AL20; 5w R.M.S. **£2.65** AL30 10w R.M.S. **£2.95**

NEW

PA12 £6.50

NEW PA12 Stereo Pre-Amplifier completely redesigned for use with AL20-30 Amplifier Modules. Features include on/off volume, Balance, Bass and Treble controls. Complete with tape output.
Frequency Response 20Hz-20KHz (-3dB)
Bass and Treble range $\pm 12dB$
Input Impedance 1 meg ohm
Input Sensitivity 300mV
Supply requirements 24V, 5mA
Size 152mm x 84mm x 33mm

PS12

Power supply for AL20-30, PA12, S450 etc. Input voltage 15-20v A.C. Output voltage 22-30v D.C. Output Current 800 mA Max. Size 60mm x 43mm x 26mm.

Transformer T538 **£2.30**

£1.20

BI-PAK

P.O. BOX 6, WARE, HERTS

Wireless or what?

HISTORICALLY this magazine has always been biased towards radio communications of one sort or another and this is not surprising when you realise we were born on the back of the cat's whisker when the only contact the amateur had with electronics was through the subject of radio and allied matters. The trouble with electronics is that it is one of the most dynamic of the sciences and is constantly broadening its boundaries to provide applications in areas totally removed from what we normally think of as radio.

It would be shortsighted of us if we stuck our heads in the sand and ignored the widening scope available to us. In the past we have received criticisms that we were too much "radio orientated" but was this necessarily a bad thing? After all that is what our name implies! Nevertheless our more established readers will have sensed a change in our policy over the last eight to ten years because it is in this period that we have made great efforts to move into the more general area of electronics. At the same time we have tried to bring a more rational approach to our designs. No longer do we rely on the "junk box"; we try to avoid designs that are birds nest entanglements; the valve (sadly to some of us) is virtually eliminated from our projects; we have introduced the "Easybuild" projects which, although they may be complex concepts, are perfectly straightforward for the home constructor—with limited test resources—to make. More recently it will have been noticed that we are favouring printed circuit designs not only because they leave little possibility for error but because they enable the amateur to make equipment of greater aesthetic appeal. Our Readers' PCB Service has shown how popular this move proved to be!

Without wanting to be complacent we feel that few people would quarrel with this policy of diversification and improvement (apart from the demise of the valve!). We are not, however, without problems and dilemmas. Each month we try to provide as broad a based coverage as possible to please as many readers as we can but within the number of pages there is a limit to what can be published in any one month.

Ideally we would like to cater for the beginner, the established "Ham", the Hi-Fi enthusiast, the disc jockey, the motorist, the photographer, the intellec-

tual and the practical handyman all at the same time but this just is not possible. The problem is compounded by the nature of our projects. On the whole we try to publish designs in their entirety in a single issue but this would immediately debar worthwhile projects such as organs, discotheque systems and other more sophisticated projects like our Video-Writer, which is now in its second part.

We have to continually ask ourselves "should we avoid complex projects just to attempt to please all people all of the time?" We have to assess whether there is likely to be enough appeal for a project to make it a worthwhile proposition; but what is the criterion of a worthwhile project? Should the decision be based on its novelty value, its economics, whether 100 or 10,000 people are likely to make it, or its intrinsic educational value? By and large we try to work on these four basic criteria giving most emphasis to novelty and educational value. Unfortunately electronics is developing at such a rate that educational projects, although desirable, tend to be expensive because they inevitably verge towards the new approach with expensive components. This does not necessarily mean that they are not good value for money but we know that projects costing more than ten or twenty pounds tend to be outside the scope of most readers—particularly if they are relatively inexperienced and loath to take a gamble on their own abilities. (Perhaps our Easybuild policy coupled with the PCB Service helps a bit in that direction!)

In our own minds novelty is a prime requisite for all our projects but is the most difficult to achieve. Most of our regular contributors will know that designing a project is only a small problem compared with coming up with an original idea. Radio is, perhaps, one of the most difficult subjects into which to inject novelty—because it has been around for such a long time—and this brings us back to the beginning of the piece. Without diversification we feel our pages would soon become repetitive and boring but how far and in what way should we diversify?

The important thing is that we satisfy *YOU* the reader and the only way we can do this is via a touch of positive feedback. If you have an axe to grind on the subject why not write in and let us know of your criticisms and/or suggestions.

LIONEL E. HOWES—*Editor*

Doram's catalogue amendment leaflet

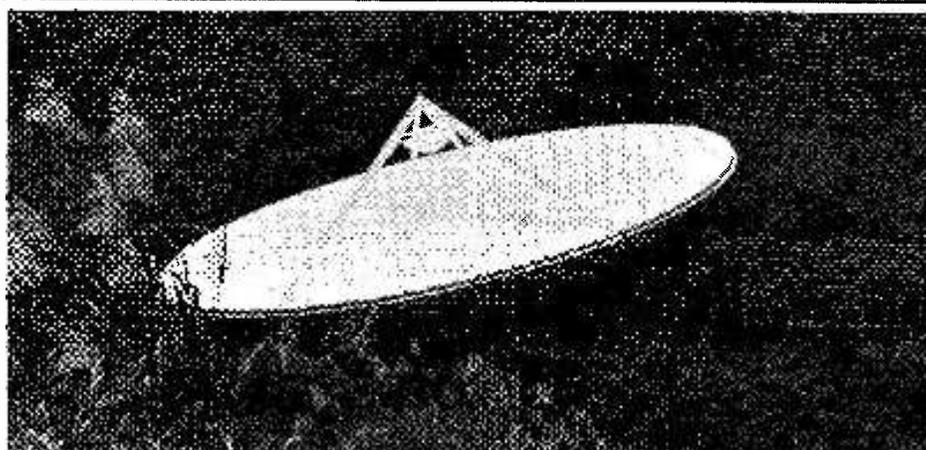
DORAM ELECTRONICS LIMITED, the Leeds-based mail-order distributor of electronic components, kits and radio/hi-fi accessories specifically servicing amateur radio, electronics and hi-fi enthusiasts, announce the introduction of their catalogue amendment leaflet.

The range of "simple-to-construct" kits has also been extended. These are ideal for the beginner and experienced amateur alike. For further information please contact: *Frank Chable, Doram Electronics Limited, P.O. Box TR8, Wellington Road Industrial Estate, Wellington Bridge, Leeds, LS12 2UF. Tel. Leeds (0532) 34222.*

Fiji enters space age

The picture shows the 105ft diameter dish aerial of the earth station at Wailoku, Fiji. Speaking at the opening ceremony recently, Mr. H. Lillicrap, Chairman of Cable and Wireless said, "We expect that within the next decade the volume of international telephone and telex will have increased more than 6-fold."

Operating through an Intelsat IV communication satellite, 22,300 miles over the Pacific, the station provides direct links with both Australia and New Zealand. If needed, further links can be added to places as far apart as Hong Kong and Canada, in the third of the world covered by the Pacific satellite.



Practical Wireless, September 1976

Physics for the 1980s

THE Institute of Physics Education Group, with the Association for Science Education, has arranged a conference on School Physics for the 1980s. It is to be held at Worcester College of Further Education from 1800hr on Friday, September 10th to 1300hr on Sunday, September 12th 1976. Changes in school organisation, the rapid development of comprehensive schools, teaching methods involving mixed ability groups, changes in exams and the relationship between science and society are sufficient guarantee that the place and content of physics courses in schools during the next decade will be significantly different from what they are today—these are the issues the conference will consider. Further details and application forms may be obtained from the *Meetings Officer, The Institute of Physics, 47 Belgrave Square, London SW1.*

New catalogue

MARSHALLS of Cricklewood tell us that they will soon be issuing their new catalogue which comprises 158 pages. It's supposed to be a "bumper" edition, twice the size of their previous one and contains such gems as a new opto section, new range of tools, more semiconductors, a range of varistors and many new accessories. Personal callers can get their catalogue for 30p but if ordered by post, it costs 35p.

P.W. Video-writer

WE have been informed by Marshalls of Cricklewood Broadway, London NW2, that they are offering a special price reduction to PW readers of manufacturers brand components. They are able to supply 6 kits of parts comprising semiconductors and passive components. For example, kit No. 5 comprises the six Texas RAM's and one G.I. ROM for £20.30 (including VAT and P & P). Telephone Marshalls or any of their branches for further details.

TECHNOMATIC Limited, 54 Sandhurst Road, London, NW9 inform us that they are able to supply memories for our Video-Writer project. Type 2102-2 (1 or 2) 4-bit static RAM is £3 including VAT. Type RO-3-2513 ROM (character generator) is £8.50 inc. VAT.

Super hush

AWHILE AGO, JVC introduced their ANRS automatic noise reduction system for reducing background noise and hiss. This well-established system has now been superseded by an even better system known as Super ANRS. Advantage of the new system is that in addition to eliminating tape hiss, it also reduces the distortion caused by too-high recording levels.

JVC claim that with Super ANRS, signal-to-noise ratio is improved and frequency response widened up to 20kHz. The dynamic range of cassette tapes is also extended.

One of the drawbacks of the system is that Super ANRS recorded tapes must be played back on a suitably equipped Super ANRS machine. Also it is difficult to edit the tapes recorded by this method.—*JVC (UK) Limited, Eldonwell Trading Estate, Staples Corner, 6-8 Priestley Way, London, NW2 7AF.*

THE 'OCTAVIA' VARIABLE A.F. SOURCE

N.B. NAUGHTON

THIS UNIT provides an audio frequency output continuously variable over the range 18Hz to 18kHz. Its output is a square wave having a virtually constant amplitude and mark/space ratio at all frequencies. Although the use of TTL i.c.'s makes these desirable qualities available, the unit was designed as a useful, wide range, A.F. source and not as a precision instrument.

A particularly useful feature of the Octavia is its ability to provide a signal exactly one octave removed from the set frequency, by the action of a single switch, whilst in use. The output level and waveform, including rise time, remain as the original signal.

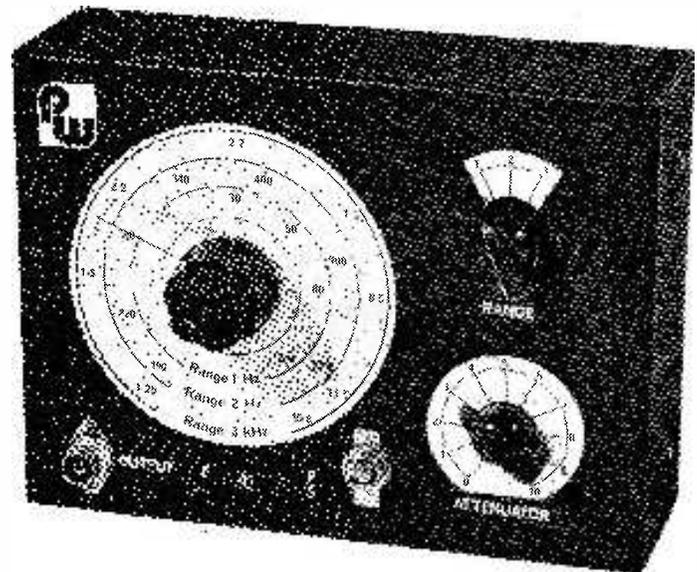
PRINCIPLE OF OPERATION

The design is, perhaps, unusual in that the oscillator frequency is not the frequency indicated by the dial. This is because the waveform of the type of oscillator used varies with frequency, so it provides a variable frequency trigger source only.

The output waveforms are produced by triggering an SN7473 i.c. which contains two J-K Master-Slave bistables. The first divides the oscillator frequency by two and provides the indicated output, the second divides the indicated output by two and gives the signal removed by one octave. Fig. 1 shows the relationships between the oscillator and the divided signals.

To prevent any effects of output loading, the signal is fed to the output socket via buffer amplifiers. These are provided by an SN7400 quad gate i.c.

D.C. coupling of signals is used throughout to avoid reactive degradation and to ensure satisfactory performance when driving T.T.L. circuits.



THE CIRCUIT

The two semiconductor integrated circuits perform the major functions of the unit and these items, plus the discrete components required, are shown in Fig. 2, which is the complete schematic diagram of the circuit.

The oscillator has been described in an earlier PW issue and, assuming range capacitor C1 has been selected, its action is as follows. On switching on, the initial high current through R1 to charge C1 turns Tr1 hard on. The collector voltage of Tr1

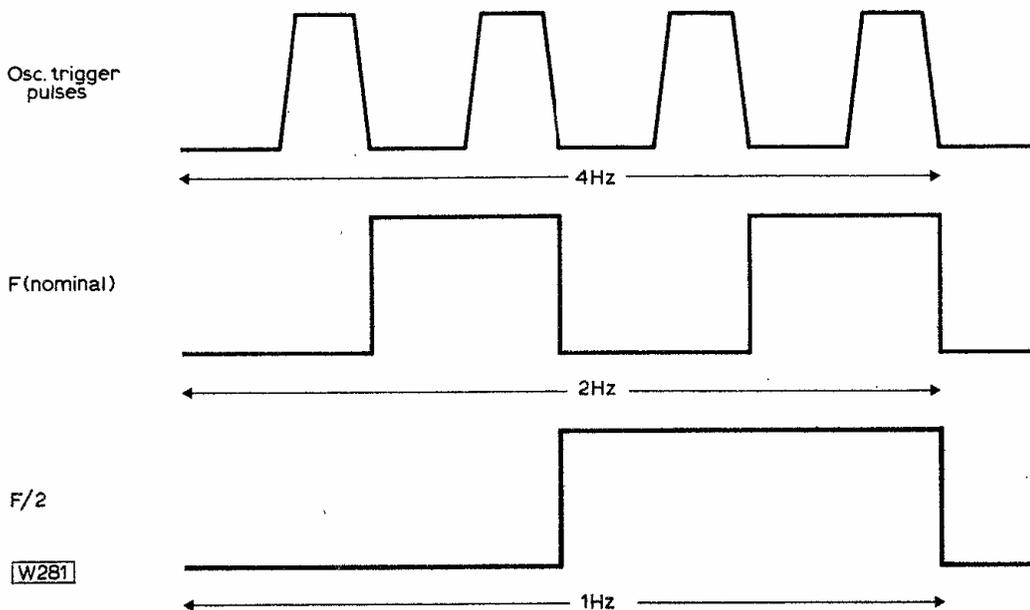
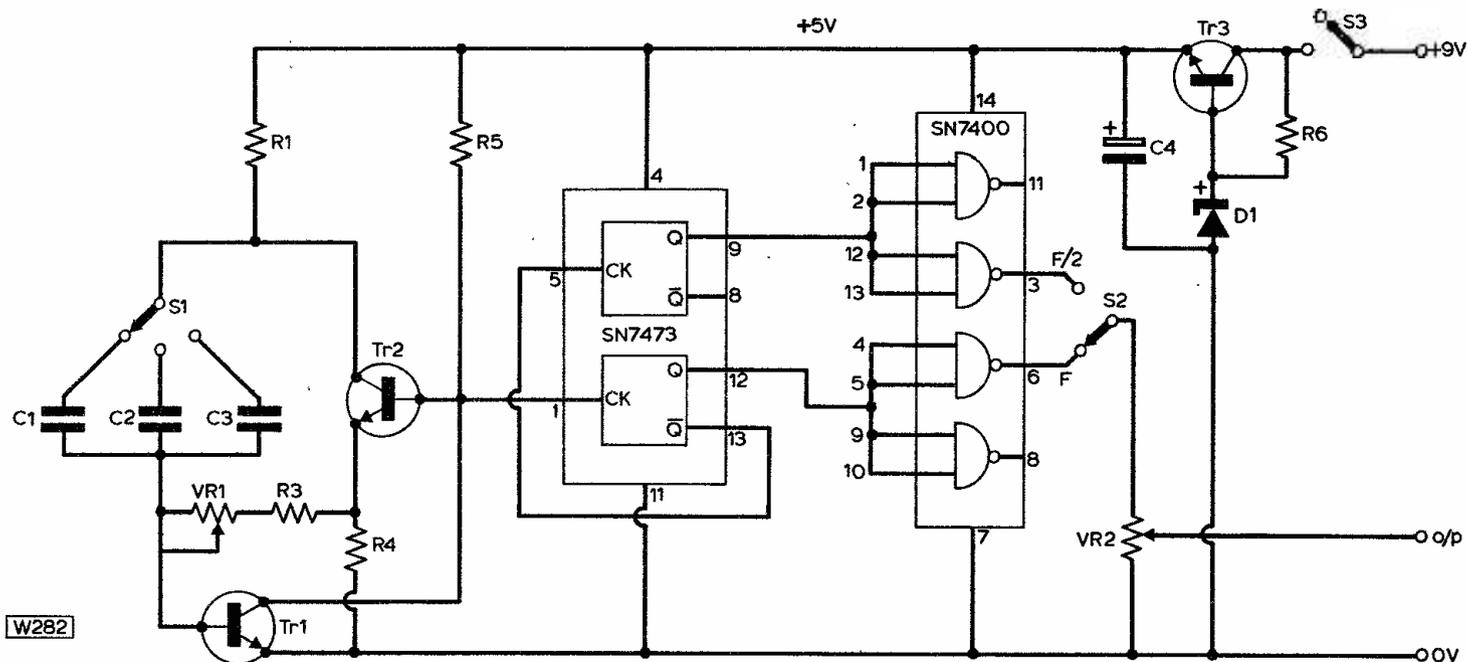


Fig. 1. Idealised waveforms showing the relationship between the oscillator, the nominal frequency as indicated by the dial and the output frequency when the F/2 switch is operated.



W282

Fig. 2. The complete circuit for the unit including the components mounted off the board.

is insufficient to allow Tr2 to conduct. As the charging current decreases, the collector current of Tr1 also decreases and its collector voltage rises to a level where Tr2 can commence conduction. This turn-on process becomes cumulative with capacitor C1 now discharging through Tr2, VR1 and R3. The voltage developed across VR1 and R3 progressively cuts off Tr1, its collector rises and increases the drive to Tr2. This build-up continues until the voltage developed across R4, coupled with the rapid discharging of C1, biases Tr2 into cut off. The cycle then repeats.

Within any range, variations in frequency are dependent on the resistance between the emitter of Tr2 and the base of Tr1. However, if the value is too low, oscillation will not be maintained. A fixed resistor, R3, is included to ensure that the minimum is never reached.

The collector voltage of Tr1 provides the triggering pulses for one section of IC1, being applied to pin 1. The \bar{Q} output at pin 13 drives the second half input, pin 5. The Q outputs of both halves are fed independently to buffers. Pin 12, the first half, to IC2 pins 4,5,9 and 10, whilst pin 9 is taken to IC2 pins 1,2 12 and 13. The outputs of IC2 on pins 3 and 6 are available, by selection at S2, for outputs of the unit. Pin 6 of IC2 is the indicated frequency and pin 3 is half that indicated on the dial. Although all four sections of IC2 are driven no outputs are taken from pins 8 or 11. They are, of course, available for future development by the constructor. The output of the buffers is developed across VR2 which enables the unit to be used with significantly less than the normal output.

The unit is powered by a 9V battery and, to provide the 5V required for the TTL, Tr3, R6, D1 and C4 act as a series stabiliser.

★ components list

Resistors

- R1 2.7K Ω
- R3 100 Ω
- R4 2.7K Ω
- R5 100 Ω
- R6 470 Ω
- All 0.25W 5%
- VR1 250K Carbon, Linear
- VR2 100K Carbon, Linear

Capacitors

- C1 0.01 μ F
- C2 0.1 μ F
- C3 1.0 μ F
- All 5V wkg. tolerance—best available (see text)
- C4 100 μ F 5V min.

Semiconductors

- IC1 SN7473
- IC2 SN7400
- Tr1 BC108
- Tr2 BC108
- Tr3 BC107
- D1 BZY88 C5V6

Miscellaneous

- P.C.B., Readers Service, S1, Single pole, 3 way, S2, Single pole, 2 way, S3, Single pole, on/off, Knobs, to suit spindles, Case, any, Output socket, any.

CONSTRUCTION

Most of the components are mounted on a small printed circuit board, shown full size as Fig. 3. The switches and potentiometers are mounted on the front panel and the range capacitors are mounted between S1 and VR1. The position of the capacitors enables easy removal and replacement to obtain the correct frequency coverage. If tight tolerance capacitors were used they could be mounted anywhere.

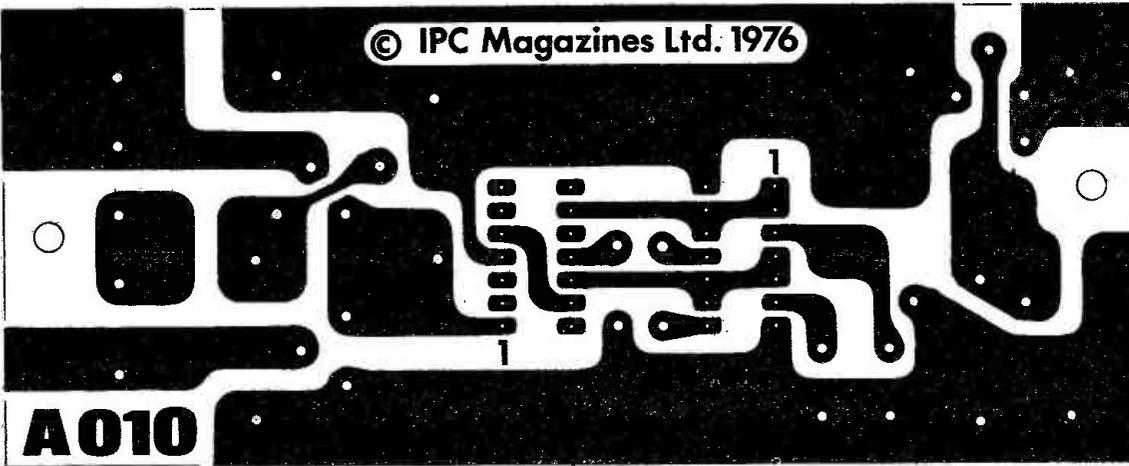
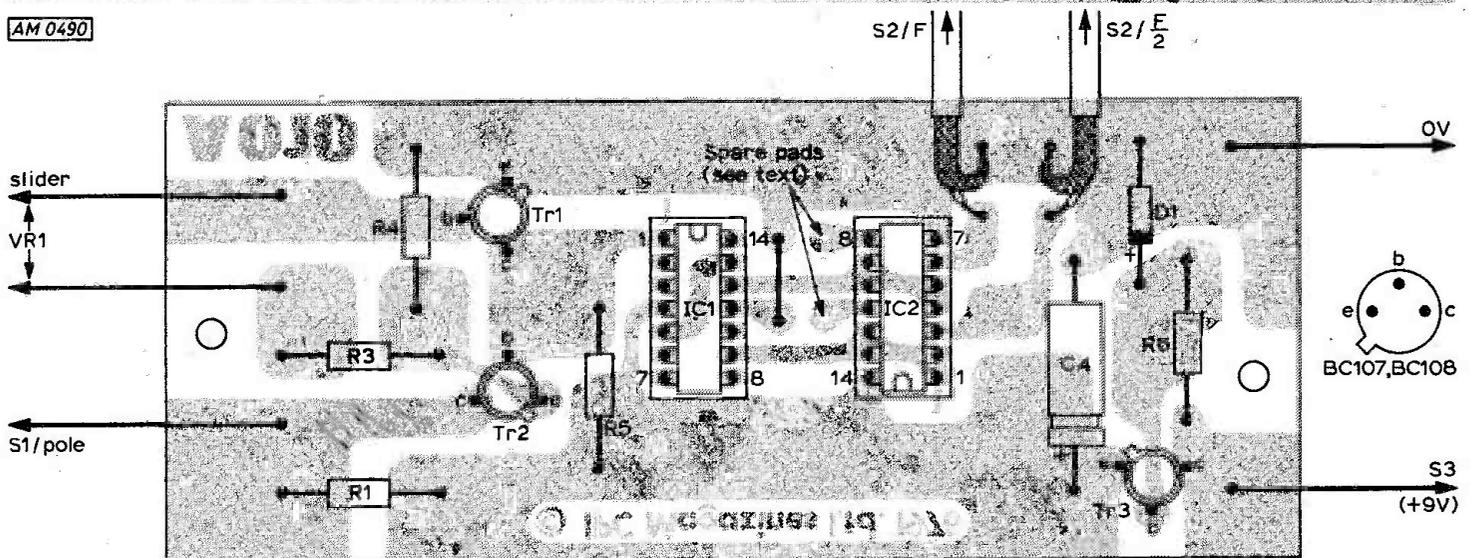


Fig. 3. The printed wiring pattern, drawn full size, ready for tracing on to clad board. Alternatively, the board can be purchased ready to use from our Readers PCB Service.

Fig. 4. Details of the component layout for the board available. The wiring pattern is added to assist correct component insertion.

AM 0490



The assembly of the components to the board presents no difficulty, but, as always, care must be taken to ensure that the integrated circuits are inserted the correct way round before soldering. The use of ic sockets would not prevent incorrect insertion but it would make changing easy.

The box for the unit can be any size, shape or material provided the following two points are taken into account, firstly that the oscillator component leads are kept electrically remote from the output wiring either by physical separation or by screening and secondly that the smaller the front panel the smaller the frequency setting dial.

When selecting a battery to power the unit it should be noted that current consumption of the I.C.s can vary from device to device. Typically, as with the authors unit, this will be about 30mA but it can be considerably higher and the use of a PP9 battery would be an advantage if space permits.

CALIBRATION

If access to an array of test equipment is available, calibration is simple. Just connect the output of the unit to a counter or 'scope, switch on, set to a suitable frequency and mark the dial.

If test equipment is limited, two other methods are available. The first calls for a receptive musical ear and a well tuned piano or organ and relies on matching notes. Tables relating notes to frequency are readily available. The second requires a "standard" audio note, say 400Hz, an audio amplifier and a tape recorder. The setting up sequence then becomes:— Switch on the standard source. Set the Octavia to the same frequency by beating the two outputs together. Switch off the standard. Switch the Octavia to F/2 and tape the output (this will be, of course, 200Hz). Using the tape recording as the standard repeat the process to identify 100Hz etc. By reversing the roles of F and F/2, points on the dial corresponding to 800Hz, 1.6kHz etc can be made. Intermediate settings can be obtained by interpolation.

CONCLUSION

There are numerous occasions when the home constructor requires an audio signal of known frequency for comparison purposes or for driving dividers, multipliers or amplifiers and the Octavia provides an extremely compact and trouble free method of satisfying those requirements. PW

HOTLINES

ON RECENT DEVELOPMENTS

008 ?

Followers of James Bond will recall that in *Goldfinger*, our Jim had a rather special motor car. One of its features was a map which could be used to "track" another vehicle, the other vehicle showing up as a point of light on the road map itself.

We may not be quite up to Jim's standard but we are getting closer, or rather a British company is. They have introduced an ingenious system called "Landfall". Just so that you can show off to your friends, this stands for Links And Nodes Database For Automatic Land Vehicle Location—So there!

First, what does it do? Well, it can locate a vehicle anywhere in Essex and pinpoint it to within 10 metres. A digital processor is used to store all information about the road system in the particular area (we are taking Essex as an example but it could equally well apply to any equivalent area).

The system regards the layout of the roads in its area as a network. Each intersection is termed a Node. Exits from the Nodes are termed Ports. Roads joining the Nodes and Ports are called Links. Every Node and every Port has a special identification number and the distances of all Links in the area are entered and stored. So our memory knows all the points, intersections—in fact everything it needs to accurately plot a position within the area covered.

Vehicles equipped to use the system (such as police cars) have special sensors which provide data on direction and distance travelled. Immediately the vehicle starts its journey, the driver enters his starting Node/Port information into the processor. This is then an automatic continuous process and the processor is continually updated as the location of the vehicle in terms of Ports and Nodes. The information is automatically transmitted to a central control complex and thus a person there could see at a glance the position of all vehicles in the area. They could also see exactly how far a vehicle was from any other point, the direction the vehicle was moving and have an idea of speed etc.

The system is currently being tested and the photograph shows the inside of one of the vehicles. Other equipment used in this study includes an alpha numeric keyboard and display unit, alpha numeric printer, numeric code display and keyboard unit, and a "touch" map.

BRAILLE CALCS . . .

So many people possess electronic calculators these days that their novelty has largely worn off. However, two types which are now being shown in America might be worth a moment's thought. They have been specially designed and built for blind people.

The first type has conventional

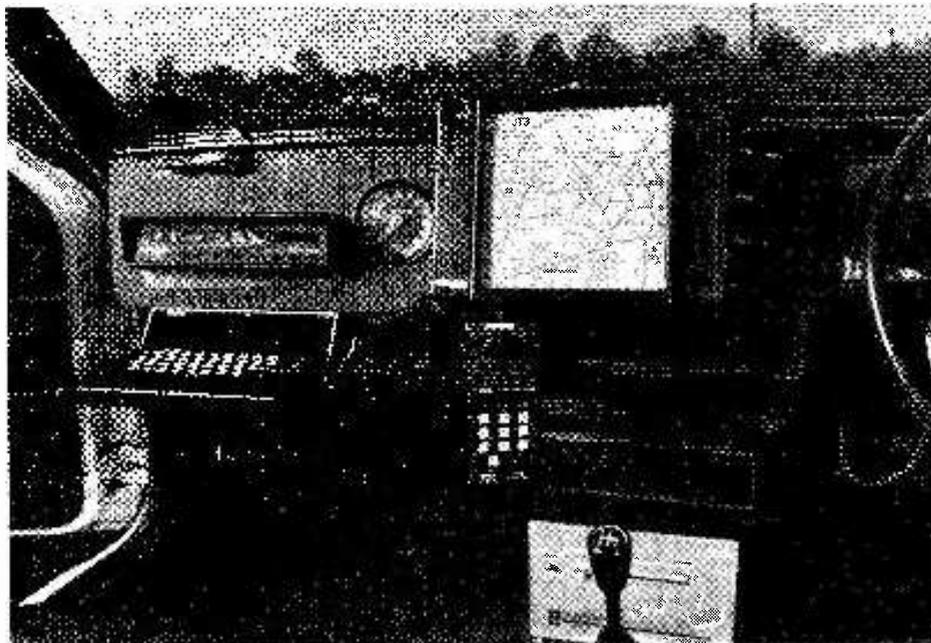
keys arranged in a conventional pattern. The "readout" comprises an array of tiny solenoids which drive small pins. The solenoids and pins are arranged to take up a very small area and are laid out in two columns of three pins in each column. The solenoids are activated by the calculator electronics and the relevant pins for Braille readout are then raised and can be "read" by touch.

When the blind person wants to know the readout (there is also a conventional one at the top of the calculator) he/she simply presses a readout button and the contents of the visual readout are selected, one at a time in the correct order, and fed to the solenoids and thus to the readout pins.

One snag which the designers encountered was that some blind people read faster than others. So the solution was to incorporate a speed control for the readout pins which allows them to give anything from one digit every half second, to one digit every four seconds. The calculator is battery-operated and employs rechargeable batteries.

P.O. RESEARCH

The British Post Office does more than just deliver letters to your door. At its research laboratories there are a number of interesting experiments taking place. One, is to replace carbon granules in a carbon microphone with a plastic diaphragm. The plastic (take a deep breath and then say "polyvinyl-flouride") contains a permanent electrical charge and the membrane of plastic is vibrated by the speech waves to produce minute electrical signals. These are then fed to a solid state amplifier. One possibility is that the new microphones will make telephone handsets of the future smaller and lighter. Presumably, when you hold on for the operator it will save you a lengthy weight!



Ginsberg

ACTIVE ROTATING AERIAL

for 550-2600kHz



F.G.RAYER G3OGR

THIS aerial provides "portable" reception of medium waveband signals, Top Band, and other transmissions up to a frequency of approximately 2.6MHz. It can substitute for an extended or long wire aerial for Amateur or other reception, when the receiver is used in situations where a wire aerial is not available. It can also give improved reception in terms of reducing background noise, which can be severe at some times of day with a long wire on the 160m band, while the directional effects are also helpful on occasions in reducing the strength of interfering signals from a particular direction.

It is intended for use with mains or battery operated communications receivers, and similar receivers which rely on an external aerial, so that they may be operated without a conventional aerial and earth. It could in some cases be coupled to a portable type radio, to improve reception of weak signals.

The ferrite aerial L1, Fig. 1, is tuned by VC2 with C2 in series for the higher frequency band. This gives a low minimum capacitance and reduced swing, and covers about 1150 to 2600kHz. Switch

S1 is closed for the lower frequency band, which connects VC1 and C1 across L1. This band is approximately 550-1150kHz. There are no circuits to gang, tuning being adjusted manually for best reception.

L2 couples to IC1, while gain is controlled by VR1. This allows signal strength to be reduced where local signals may overload the receiver. Output to the receiver is from the isolating capacitor C6, and the unit operates from its own 9V battery. If preferred, it is in order to use a 6V supply but R8 is then omitted.

Front and Case

The member carrying VR1, turning capacitor, and S1 is a 127×51mm piece of aluminium, with a flange to which the insulated board can be bolted as in Fig. 2. VC1/2 is held by three 4BA bolts, which must not project beyond the thickness of the capacitor frame. The front of the plastic box is also held by the bolts fitting S1, VC1/2, and the nut of VR1, so it is as well to drill the box at the same time. Note that the metal panel fits up to the top

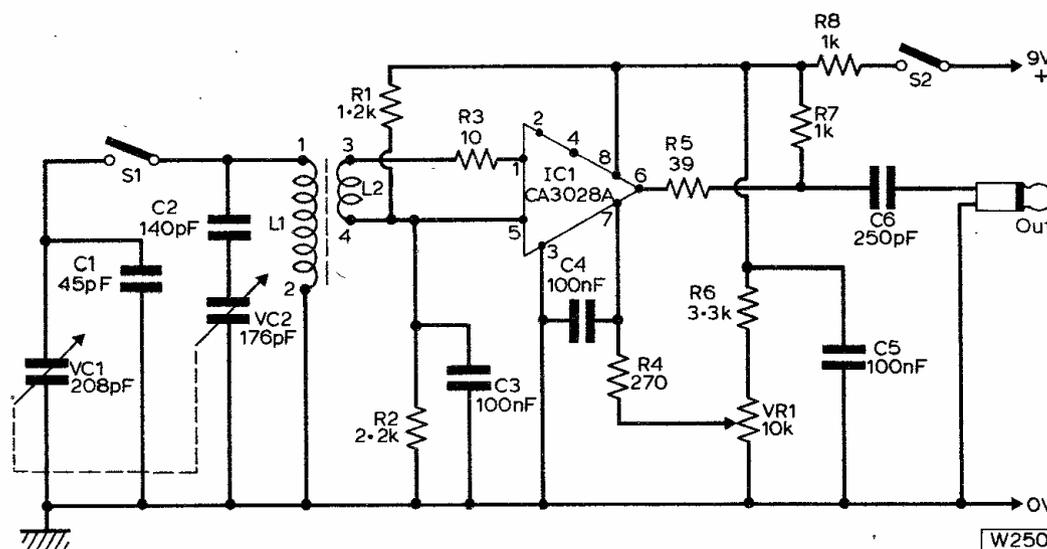
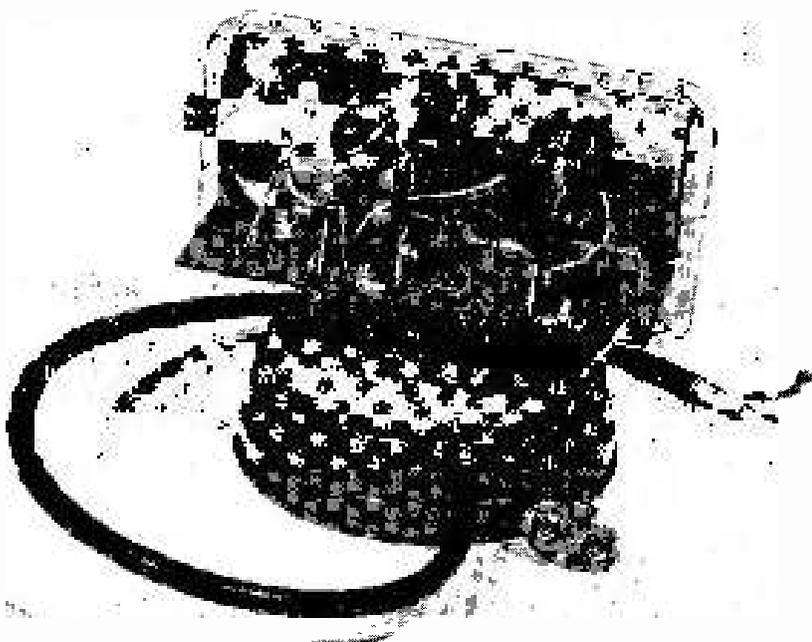


Fig. 1. Complete circuit of the active aerial, which utilizes the CA3028A in the only circuit. Switch S1 provides the HF and LF bands.



Overall photograph taken from the rear showing the layout of the case and the method used to provide the rotation.

Figs. 2 and 4. The rod rests in a notch, and is held with thread.

The beginning of the tuned winding L1, point 1, runs to S1, and the end point 2, to the frame of the tuning capacitor. The small coupling winding, L2 points 3 and 4, is connected to R3 and R1, R2, C3. Since this circuit is tuned individually, it does not have to align with other circuits, and the winding is simply placed to give suitable coverage. To avoid the need to have L2 at the very end of the rod, twenty-two turns are removed from L1. These turns are unwound at end 1. The wire consists of several strands of fine gauge conductor, insulated from each other (Litz) and for proper efficiency all strands must be soldered, and none broken.

With the turning arrangements described, the modified aerial tunes from 550kHz to 2600kHz. The simplest means of adjustment is to tune the receiver to a signal at the LF end of the MW band, close VC1/2, and position L1/2 on the rod to tune this signal in at maximum strength. To simplify tuning, a card scale marked with frequencies should be fitted. These can be taken from the receiver dial, by tuning the active aerial unit to peak up signals or noise, then marking its scale to agree with the receiver.

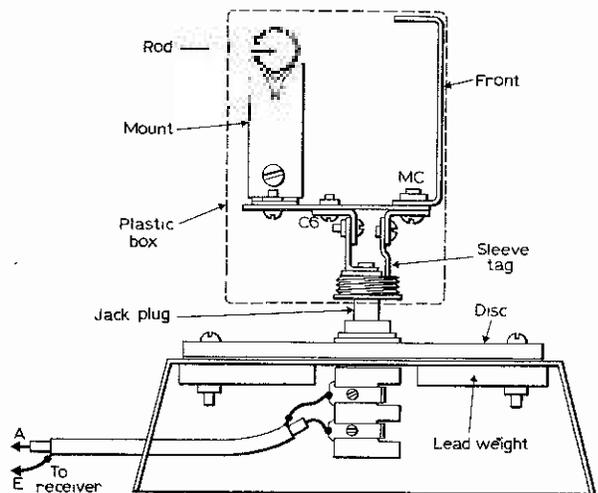
Base Mounting

This is made from a plastic plant pot dish deep enough to accommodate the jack socket with a plywood disc glued and bolted on to strengthen it. It is also advantageous to secure some lead weights inside the dish, to make the whole thing more stable.

A communications or similar type of receiver will generally have provision for a screened co-axial aerial lead although it is not essential to use this type of lead, as two separate insulated wires may also be used. A screened lead should not be unnecessarily long, or of small-diameter microphone or

similar cable, as this can introduce unnecessary RF losses.

The directional effects of the ferrite rod result in maximum signal pick-up when the rod is at right-angles to the bearing of the transmitter. Directivity is not sharp, especially as the unit is not screened against stray pick-up by wiring, but directional



W253

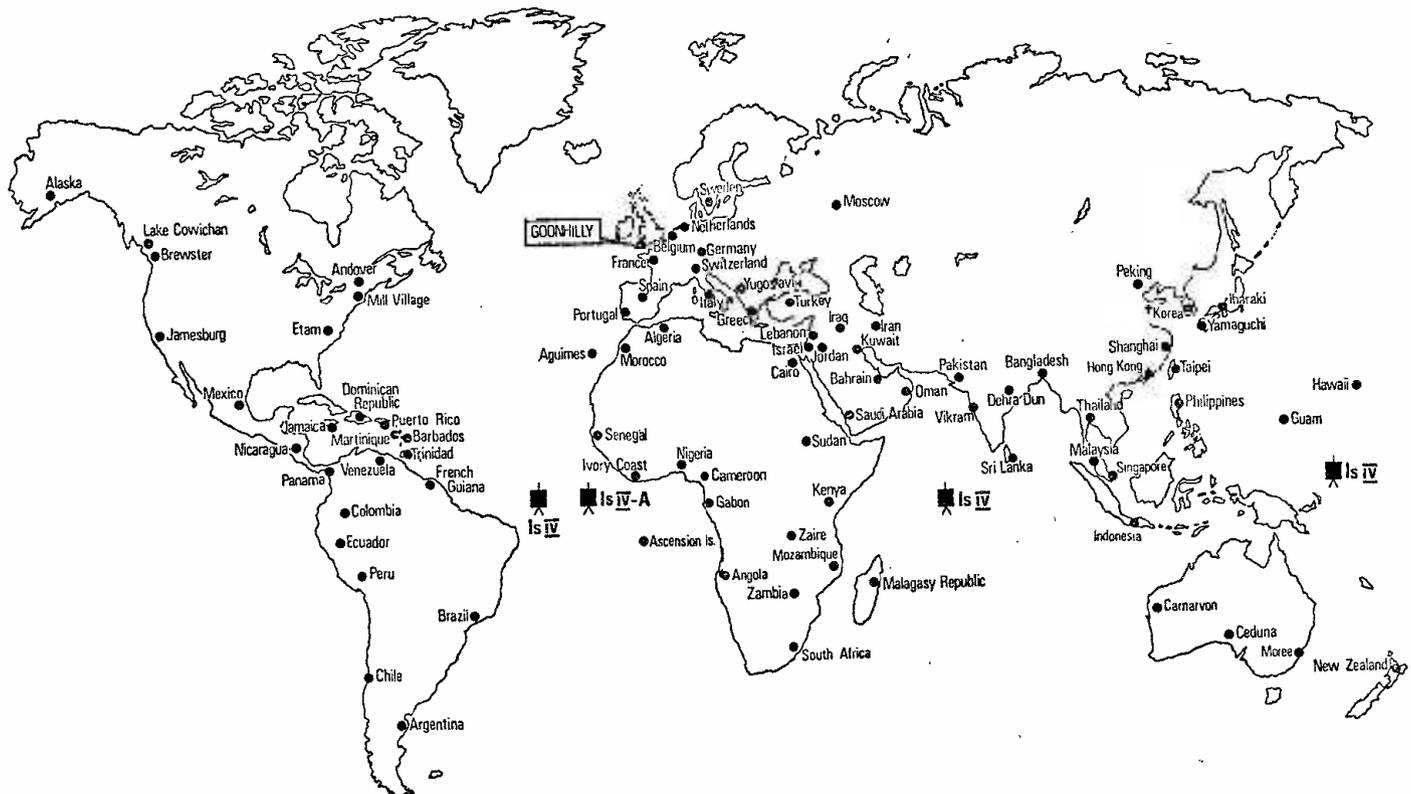
Fig. 4. Sectioned drawing of the case and base. Note the lead weights fixed to the underside of the base to provide a rigid mount for the aerial.

effects will be shown by the receiver tuning meter, as the active aerial unit is rotated. If there is no tuning meter, rotate the aerial if necessary for best reception of the wanted signal, and least interference, as the receiver AVC action will mask the influence of directivity on many signals, when judging receiver audio output volume by ear. P.W.

SATELLITE COMMUNICATIONS

PART 2

Brian DANCE M.Sc



Part I of this article dealt with the history and background of satellite communication and covered the satellites themselves, particularly the Intelsat range of vehicles and their present state of operation (or non-operation). This part will deal with the UK ground stations necessary to utilise the facilities and with the current uses of the system.

Outline drawing showing the receiving stations and countries throughout the world who are using the global satellite service via the commercial Intelsat Link.

GOONHILLY

The ground station in England used for satellite communications is at Goonhilly in Cornwall near to the site of Marconi's original radio telegraph station. Goonhilly and Etam (USA) handle the largest volumes of traffic of all earth stations. Goonhilly began commercial operation on June 28th, 1965, with a steerable aerial in a 90 foot dish reflector. In its first year it had 24 telephone circuits and carried some 40,000 calls—less than a tenth of all intercontinental calls to or from the UK.

Aerial 1 at Goonhilly was re-equipped in 1969 and now operates with the Indian Ocean satellite to provide communications to 25 countries in the Far East, Australia, New Zealand, Japan, Hong Kong, etc. Aerials 2 and 3 at Goonhilly operate with the Atlantic

satellite, communicating with 15 countries on the other side of the Atlantic. There are now 1300 circuits available through Goonhilly, over half of them involving UK traffic. They handle nearly 9 million intercontinental calls per year!

Goonhilly is now part of a global network of 90 ground stations in 64 countries operating a total of over 120 aerials, but the number is rapidly growing. Over 100 countries use satellite services, those without aerials being connected through landlines to other countries. Low noise parametric amplifiers are employed in the receivers with the required 500MHz bandwidth and cooling to minimise noise.

MADLEY

A new earth station is under construction at Madley in Herefordshire. It will probably have 6 aerial dishes in due course, the first of these replacing Aerial 1 at Goonhilly about 1978 to handle all satellite communications to the Far East up to the early 1980s. Aerial 1 at Goonhilly will then be used

for Atlantic work, but will later become a standby when two more aerials at Madley take over the Atlantic work. The Post Office intends to erect a microwave tower at Coldwell near Madley to link the aerials to the national telephone system.

TELEVISION

The use of the Goonhilly aerials for television signals has increased from about 9 hours in 1965 to about 350 hours per year. The demand for intercontinental television (unlike telephone demand) seems to be approaching saturation. Television accounts for under 2% of use, whilst telephone circuits account for about 80%.

COMPARISON WITH CABLE

The boom in intercontinental communications could not have been met without satellites, although one may well ask whether the boom would have occurred if they had not made the facilities available at a reasonable cost. Cables and satellites each have their own advantages for particular applications and places, whilst high frequency radio links have now been greatly improved. The life of a sub-oceanic cable is considerably greater than that of a satellite. Cables have an estimated life of 25 years, satellites of only seven years, although both of these values may be exceeded. It is uneconomic to provide cable links to remote islands, so such regions are best served by satellite or radio links. On the other hand, cables are generally more vulnerable to enemy attack than satellites. Only satellite links can be used to convey all types of signal (telephony, telegraphy, television, data and facsimile) over long distances.

When a signal travels up to a satellite and back to earth, the journey is about 45,000 miles. This inevitably means that there is a delay of about a $\frac{1}{4}$ second or a total delay of $\frac{1}{2}$ second before one obtains a response to any signal. The delay on even the longest cable is only about $\frac{1}{10}$ second. In general the $\frac{1}{2}$ second delay is unimportant in telephone work, although detectable, but can be serious in some types of data transmission.

OTHER APPLICATIONS

Hundreds of ships are lost at sea each year, often without any signal to land. Suitable maritime satellites ("Marisats") can provide reliable communications of the quality one normally meets on land. The first Marisat was launched on February 19th, 1976, for Atlantic use. Some problems have occurred with the commercial circuits, but the other 75% used by the US navy are performing satisfactorily. Another Marisat is due in May for the Pacific area.

In August 1974 a joint programme "Aerosat" was agreed in which the use of satellites for providing high quality communications with aircraft in flight will be investigated. The first satellite is planned for 1978. NASA has also placed satellites (such as Westar 1 and Westar 2) into orbit for communications across the USA. Complete newspapers have been sent in facsimile from Massachusetts to Florida using Westar 1; the newspapers have then been published in Florida.

The ATS-6 satellite over Lake Victoria has been used to re-broadcast domestic television to rural parts of India on 860MHz with FM vision, 625 line signals. Although the beam is directed at India, the signals have been received in Dublin and Sheffield using dish reflectors. Such satellites can be used for educational television in remote areas.

The satellite with the largest number of voice circuits is Satcom-1 with 24,000 circuits, owned by RCA Global Communications and intended to serve the US for telephone traffic. Countries such as Algeria, Brazil and Norway have leased the capacity of transponders on the Intelsat satellites for their own domestic use.

ISD

The availability of global satellite multi-channel links has greatly facilitated International Subscriber Dialling (ISD) in which one can dial international numbers without having to wait for line availability and for operator connection. The ISD system first came to the UK in 1963 when London subscribers were able to dial Paris numbers. In 1970 an ISD service was opened between London and New York.

At present ISD is available from most of the more heavily populated areas to European countries, the USA, Canada, Australia, S. Africa, etc. In rural areas the register translators in the exchanges cannot store enough digits for international calls, but it is hoped that the necessary equipment will be fitted in most areas of the UK by 1980. Intercontinental calls cannot normally be dialled from coin boxes, since the rate of charge is too great. However, there are a few international coin boxes taking only 50p pieces at airports, etc., which provide intercontinental ISD facilities.

ISD calls are charged by means of the meter attached to each telephone line which registers the charge in units of 3p. When a call to Australia is dialled, short audio pulses, which one can hear in the telephone, occur every 1.71 seconds and give rise to a charge of about £1.05 per minute. Similar pulses occur at a much lower frequency on inland calls. In calls to the US and Canada, the pulses occur every 2.4 seconds on weekdays between 6 a.m. and 8 p.m. and every 3.2 seconds at other times (about 75p and 56p per minute respectively). These call rates are not only cheaper than operator connected charges, but one pays only for the time used without a 3 minute minimum. ISD calls of a few seconds duration can be made to other continents for a few pence.

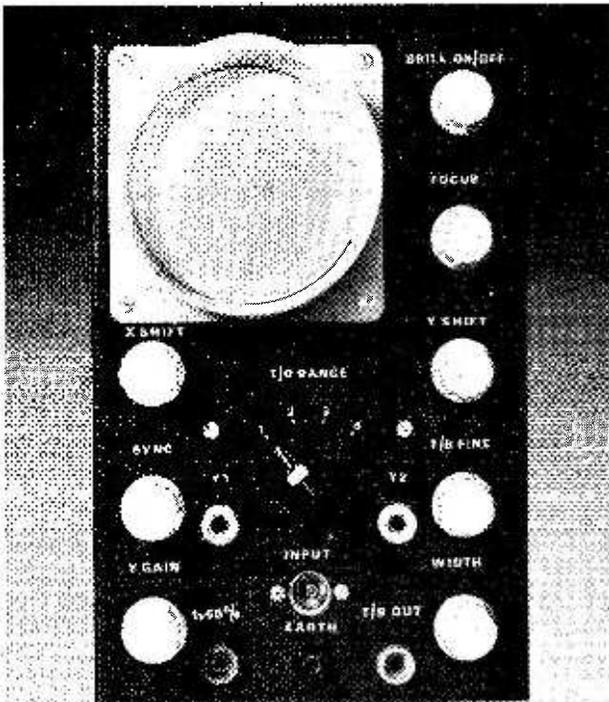
These current charges may be compared with those in pre-satellite days. In 1927 the charge for a 3 minute call to New York was £15, whilst it decreased to £9 in 1936. Even without inflation these charges are obviously well above the current ones. One may also compare the 9 a.m. to 1 p.m. peak rate for inland calls of over 35 miles (namely 3p for 10 seconds) with the intercontinental rates quoted previously. The Australian ISD rate is only about 5.85 times and the US rates 4.17 and 3.13 times the inland charge for a peak rate trunk call.

The amount charged for any international call is shared on an agreed basis between the two countries involved and also with any other country through which the call is switched. Accounting information for ISD calls is stored on magnetic drums, whilst the operator supplies the required information in the case of operator-connected calls. The use of satellite communications greatly simplifies the accounting, since only two countries are normally involved.

Even in the case of a complete New York to Paris colour television link by satellite, the charge is only about £2,600 per hour. Thus the Intelsat satellites do offer communications at reasonable cost over such long distances.

EW

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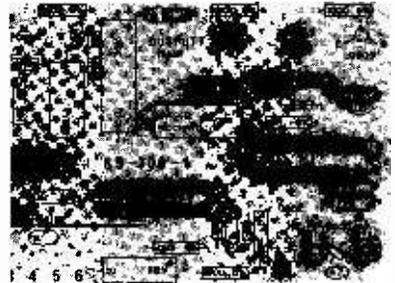
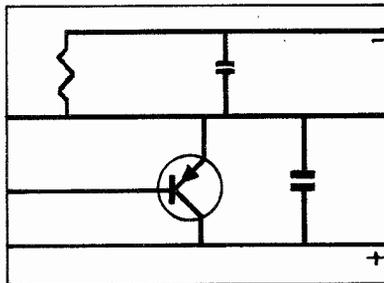
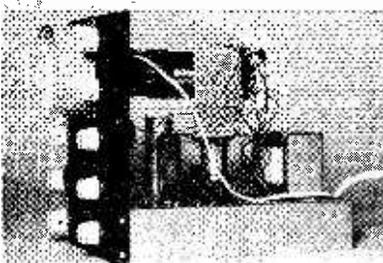


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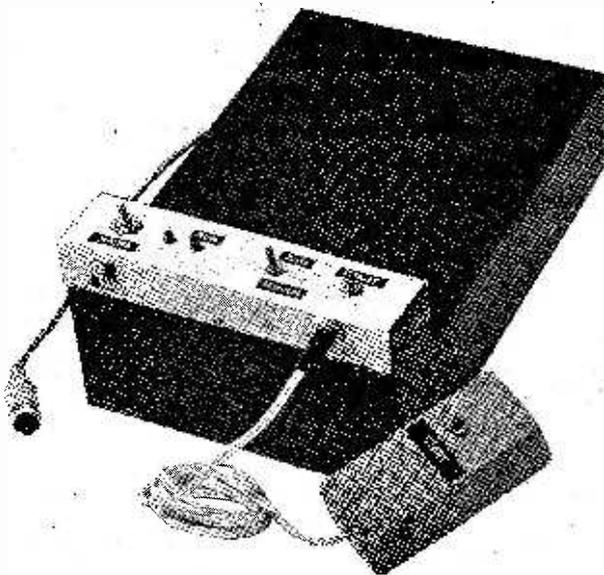
Write to:- British National Radio & Electronics School,
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a ⁶JINGLES⁹ machine

P. W. BOND



JINGLES, sound effects and commercials which are required to provide continuity in a programme are normally recorded on special cartridges. A continuous loop of lubricated $\frac{1}{4}$ in tape is contained within a small box resembling an 8-track cartridge. There is a cue track on a portion of tape where tones are recorded, to be used later by the playback machines. These tones control automatic stopping and cueing of the jingle. Other features of the system include 7 $\frac{1}{2}$ ips playing speed and instant-start solenoid pinch-wheel control. Unfortunately the cost of this system prevents many discotheques, clubs and small broadcasting organisations from using it even though the facilities offered are most attractive.

This project describes how a cassette system, based on the cartridge system, is used to obtain the same features but the "machine" consists of an add-on unit for domestic cassette recorders, the recorder containing all the important electronics required to obtain signals from the cassette.

The add-on unit is merely a kind of VOX control i.e. a signal monitor circuit which takes a signal from the cassette to operate a relay and control the cassette deck motors by interruption, to stop playback, and continuity to the deck's remote control circuit. Most cassette decks are given remote control sockets for allowing recordings to be interrupted and crudely edited by the opening and closing of switch contacts, usually on the microphone. Normally when the remote control plug is not inserted, the motor supply is totally dependent upon the cassette deck itself but controlled by a short-circuit condition when the remote control plug is inserted. In the prototype

(using a Philips EL3302 cassette player) the remote control circuit was in one of the battery supply leads.

Readers are advised to check this point on their machines by inserting a remote control socket and putting a milliammeter in a battery lead and switching to "play". The plug, when inserted, may stop the motors but a small current still flows. This is due to the electronics drawing current. Thus the recorder **must** be switched off when no jingles are required, hence saving battery costs.

The principle of control used here is simply that when a signal from the tape is detected the control relay operates, and one of its contacts holds the remote control loop closed. When the jingle has ended, the relay releases and disconnects the remote control circuit. In this version a second relay is used to cue the jingle, working in conjunction with the control relay. The recording of jingles will be dealt with in the final part of this article, but for explanatory purposes the jingle tape consists of (i) Leader tape (ii) Tone burst, followed by blank tape (iii) First run through of the jingle followed by blank tape etc., all 10 times over, then 30 seconds of blank tape.

After this sequence is ended the unit can be switched off and the remainder of the cassette is used for recording normally. The circuit diagram which shows the prototype circuit fulfilling these requirements is given in Fig. 1.

★ components list

Resistors

R1 105k Ω	R4 1M Ω	R7 47k Ω
R2 8.2k Ω	R5 2.2k Ω	R8 10k Ω
R3 4.7k Ω	R6 5.6k Ω	R9 560 Ω
All 1W 5%		

Capacitors

C1 0.47 μ F polyester	C2 4.7 μ F 12V	C3 1000 μ F 25V
	C4 10 μ F 12V	

Semiconductors

Tr 1, 2, 3, 4 2N2536	TCS 6 BFY51
D1 3.6V zener (BZY88 type)	D2, 3, 4, 5 1N4001
D6 10V zener (BZY88 type)	
LED 1 TIL209 Red	LED2 TIL209 Green

Miscellaneous

Transformers: T1 240V to 0-0-9V 100mA. Relays RLA and RLB (Henry's Radio, type 8A) for 9V operation with two changeover contacts. PCB's (PW Readers PCB Service-see ads). Plywood for cabinet. Aluminium for panel. Terminal pins. Switch S1, single pole push to make. S2, single pole on-off. May be double pole when used on mains unit. Plugs for cassette recorder as required. Plug and socket 3.5mm.

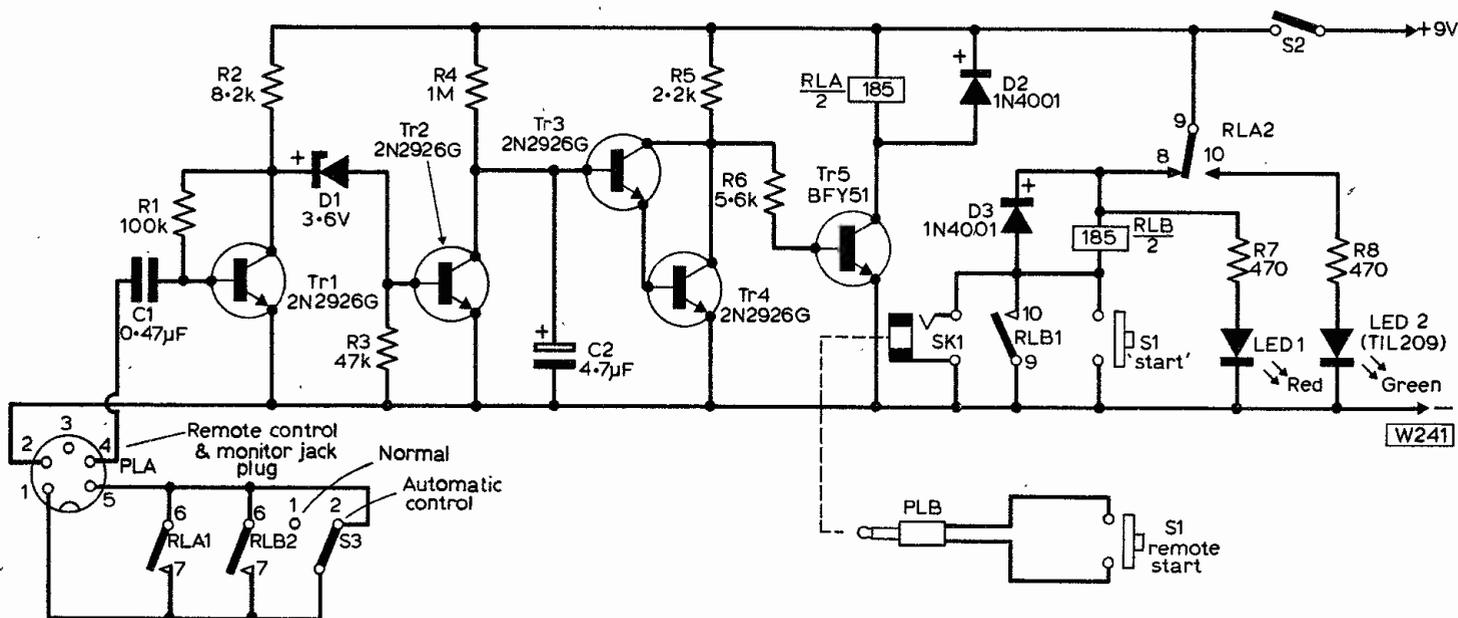


Fig. 1. Full schematic diagram of the unit, including off-board components.

Circuit diagram

With a jingle cassette fully wound on side one, the leader tape starts off the cassette and a burst of tone is replayed when actual tape section is located. Thus the operator presses the start button S1, RLB latches in over its own contact RLBI, and RLB2 shorts the remote control circuit, and the cassette plays. When the tone burst is detected by the replay circuit within the player, it is amplified and fed to its own loudspeaker and monitor sockets. The add-on unit is connected at either of these points, so the tone burst, or any signal from the tape, is fed to the input of the circuit.

Tr1 is normally conducting, but the signal applied to its base via C1 switches the transistor off during negative half cycles. When this occurs Tr1 collector voltage rises and if it rises, above the threshold of D1 by a sufficient amount (4V) Tr2 turns on. The voltage on C2 falls since Tr2 collector voltage falls. Tr3 and Tr4 have a high input impedance and detect any change in the voltage across C2. Hence when a signal is applied to the circuit C2 voltage falls and Tr3 and Tr4 switch off. This voltage rise at Tr4 collector drives Tr5 and RLA which operates on the applied signal. With RLA operated by the tone burst RLB is released, since RLA2 breaks its hold circuit. Contact RLA1 maintains a loop to the cassette deck to let the motors run during a jingle or tone burst.

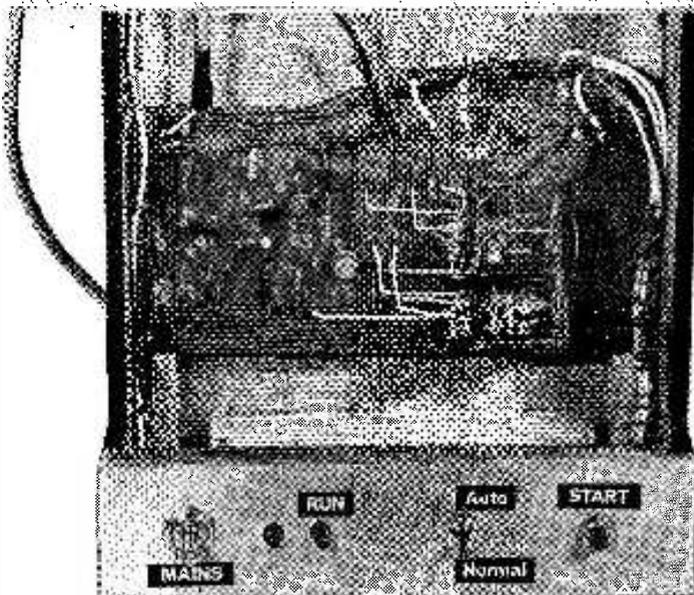
When the tone burst has stopped RLA is released, thus stopping the motors. The value of C2 and R4 ensure that the voltage across C2 rises slowly and the circuit takes a few seconds before RLB actually releases. This feature allows jingles to be played fully before disconnecting the remote control circuit which would otherwise "wow" the last few bars or phrases and sound totally amateurish. When the jingle or effect is required S1 is pressed and the jingle plays within about a $\frac{1}{4}$ second. Note that RLA operates briefly, which serves to hold the remote control circuit until RLA operates with S1 released.

At the end of 10 jingles there is a silent period. Note that prior to insertion of the cassette, if there are three marks on tape then the cassette must be re-wound before jingles are used. Failure to observe

this rule will result in the operator expecting a jingle, pressing the start button and get a peaceful silence! RLA2 is arranged to light an indicator, LED2, on the control panel when the jingle is being replayed and so tells the operator that the cassette deck is working. LED1 indicates that the unit is idle or in a standby condition thus warning the operator that the supply is switched on.

Switch S3 is used to override the control circuit by shorting the remote control circuit of the cassette deck. This allows the cassette deck to work normally, independently of the jingle circuit. This facility is useful when re-winding a jingle cassette without removing the remote control plug.

Photo of the authors unit, built to the drawing information given, showing the lettering on the control panel and the PCB in position at the front end of the plinth.



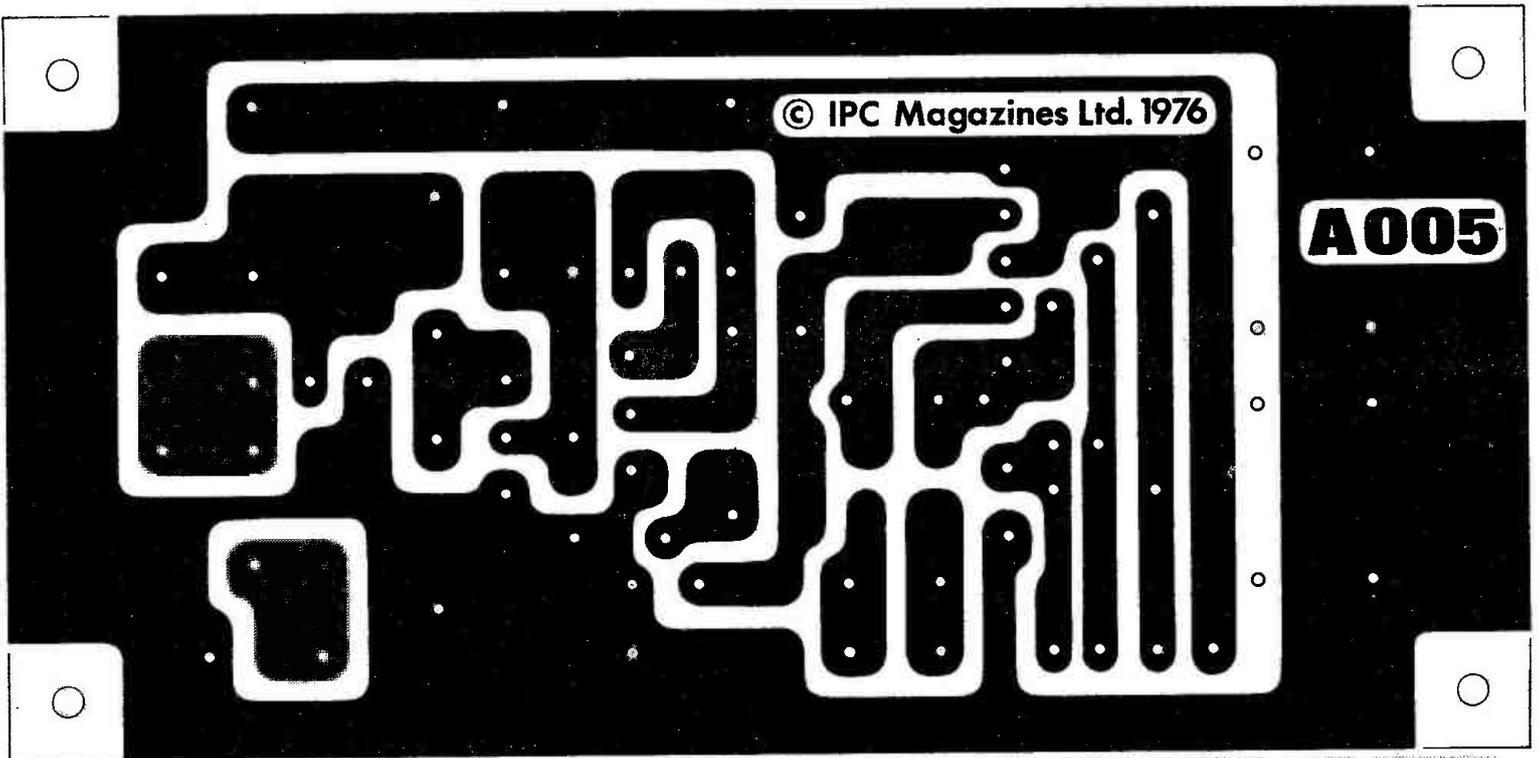
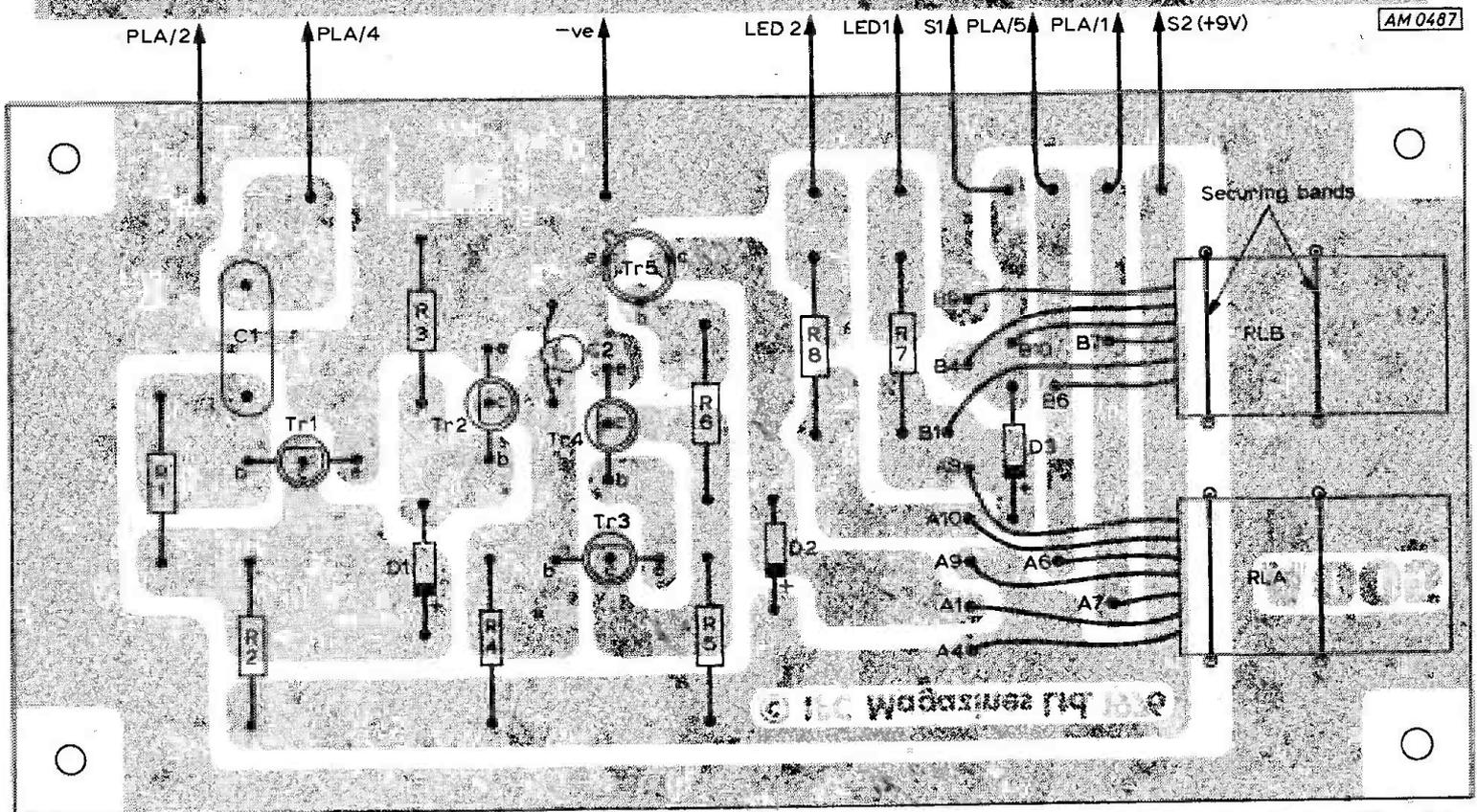


Fig. 2. Wiring pattern, shown full scale, on the PCB.

Fig. 3. Component layout and lead-offs for the board.

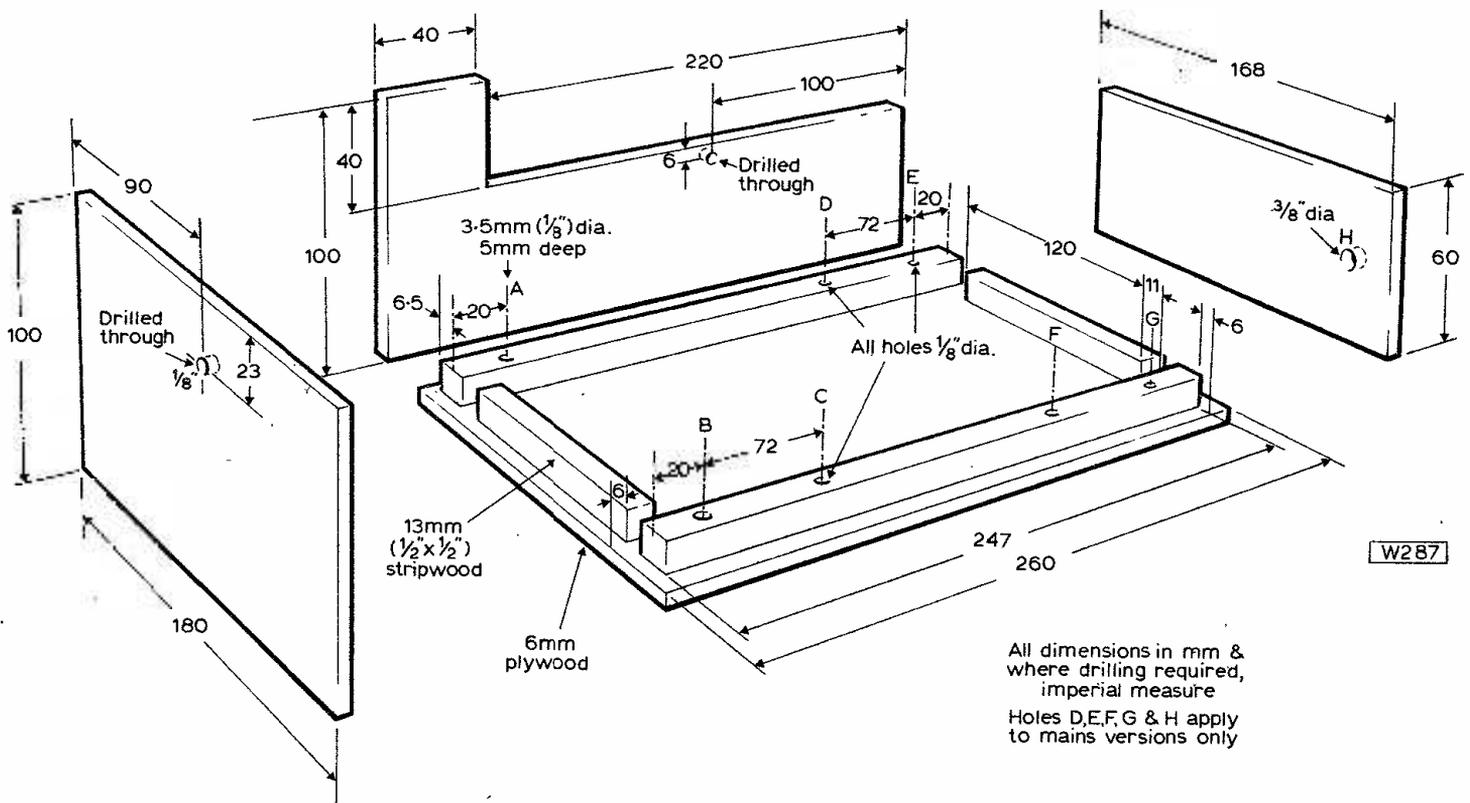


Construction

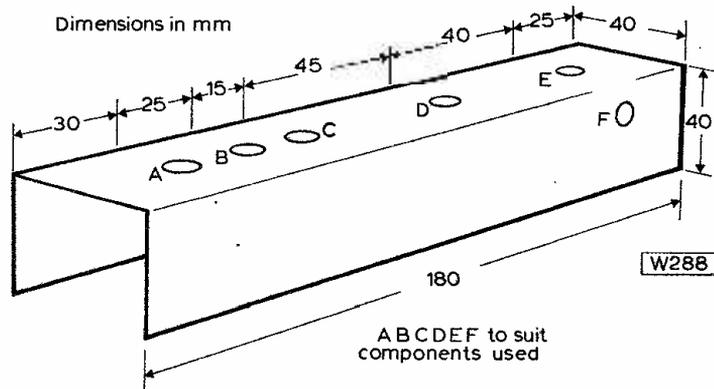
The PCB is shown full size in Fig. 2 with the component layout illustrated in Fig. 3. In order to help the operation the jingle machine control panel must be near to the controls of the cassette recorder.

The plinth Fig. 4 was made from 6mm plywood and 13mm x 13mm (1/2 x 1/2 in) support members which serve as strengthening sections for the sides, front and rear, where they join the base. They also serve as supports for the circuit boards.

Battery leads are twisted together and soldered to a PP9 battery connector. The plugs for the remote control and monitor outputs are terminated using screened wire for the monitor leads and unscreened twin flex for the remote control connection. The plug may be a DIN 240° one which supplies both the remote control and monitor circuits. If the pin numbers correspond to those for the Philips machine, shown in Fig. 1, then wire the plug accordingly. If this is not the case, or doubt exists, it



All dimensions in mm & where drilling required, imperial measure
Holes D,E,F,G & H apply to mains versions only



ABCDEF to suit components used

Fig. 4. Construction details for a plinth as used by the author. The reference to holes for a mains version should be noted for the benefit of a suitable mains supply body which will be given in a later issue.

Fig. 5. Constructional details for the control panel.

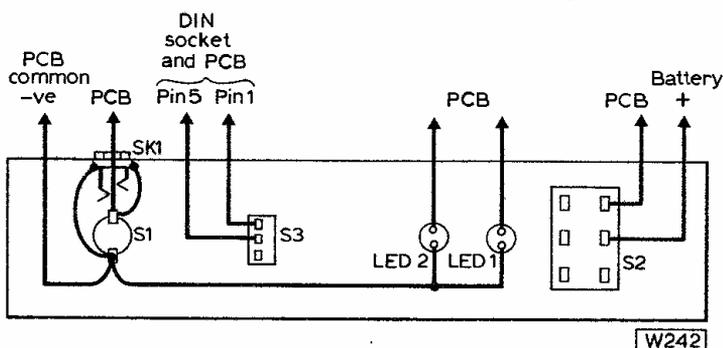
is essential to check in the instruction booklet of the recorder used for the relevant pin connections.

Control panel

The control panel consists of a piece of 18SWG aluminium which is drilled and bent to size as shown in Fig. 5. The lettering should be done in accordance with the photograph.

The components can then be mounted on the panel. LED's may present a problem but the TIL209 type LED's usually have a holder with them when they are purchased. The wiring of the panel is shown in Fig. 6.

Fig. 6. Wiring interconnections for the control panel components.



Testing

When all wiring has been thoroughly checked, place the cover on the plinth. Insert the plugs in the cassette recorder as appropriate and switch on the supply to the unit. The red LED (LED1) should glow. Insert a cassette and switch the jingle player to automatic. Then switch the cassette recorder to play, when nothing should happen. On pressing the start button, the cassette should play and the green LED should glow. Now switch the cassette off at the recorder, either by stop or pause controls. Within a short time the LED 1 should glow and LED 2 should go out. The pause control can be released or switched to play and the cassette will not play. Failure of these tests can be due to wrong wiring, particularly check relay contacts, plugs, etc., or faulty components. Small screws are used on the plinth to secure sides to the cover and then to secure control panel to plinth after correct operation has been confirmed.

Recording and operating

With the remote control and monitor plugs inserted into the sockets of the cassette recorder, insert a cassette into the recorder. Switch S3 to "Normal" and then rewind the cassette until the start of side one is reached. A source of tone is now required to

continued on page 422

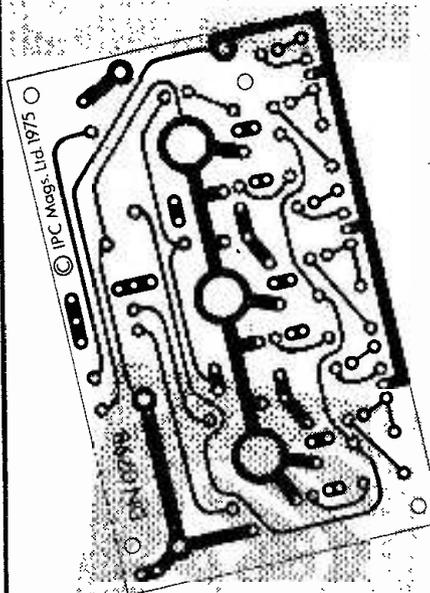
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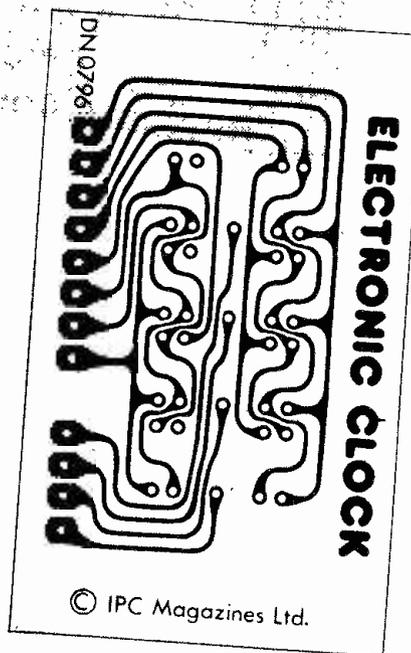
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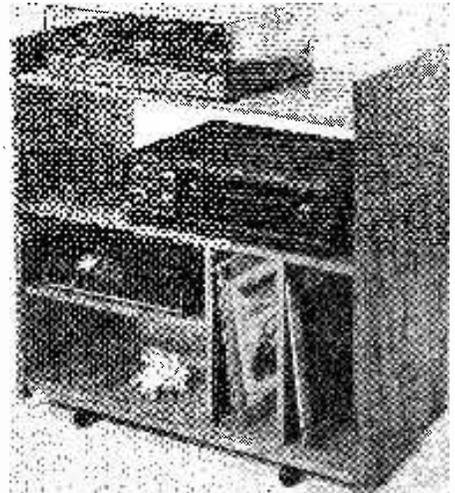
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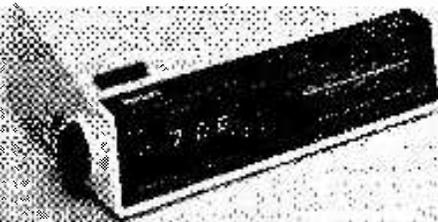
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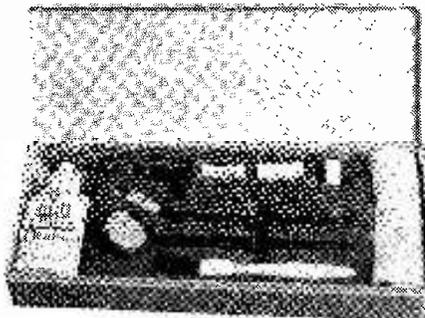
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"Don't play Dirty" say Bib in announcing their new Tape Head Maintenance kit, model 99. It contains anti-static cleaning liquid, cleaning brush and cloth, inspection mirror and cleaning pads for use with the specially designed cleaning tool. This tool has an interchangeable head which permits easy access to tape heads. All these items are contained in a hinged plastic box. Price of the complete kit is £1.98 including VAT.—Bib HiFi Accessories Ltd. (Dept. P.W.) P.O. Box 78, Hemel Hempstead, Herts., HP2 4RH.

STORAGE UNITS

Heathkit have gone into the furniture business! They've announced a range of four storage units—each finished in teak veneer and supplied in kit form. Every cabinet can be assembled in a few minutes using only a screwdriver and all are mounted on a set of "ball" type castors.

Shown in our picture is the 'Shaftesbury Concord' model AE1206 measuring 813mm wide x 787mm high and 394mm deep (32in x 31in x 15½in). Price is £39.50. A similar model but with two sliding doors below, is the 'Shaftesbury Clare' kit, model AE1203, priced at £51.80. Two low-line cabinets (basically as the one illustrated minus the two top shelves) are the 'Shaftesbury Cadby' AE1204 at £36.50 (with doors) and the 'Shaftesbury Cadet AE1205 at £34.80. Sizes of these two are 813mm x 464mm x

NEW VEROBIX

Vero Electronics Limited have announced an addition to their range of plastic Veroboxes.

The sloping front design of the box incorporates an anodised aluminium panel to enable keyboards, switches, meters and other panel mounting components to be readily housed. Dimensions are 4.5" deep x 6.5" x 3". Vero Electronics Limited (Dept. P.W.), Industrial Estate, Chandler's Ford, Eastleigh, Hampshire.

GOULD ADVANCE BETA

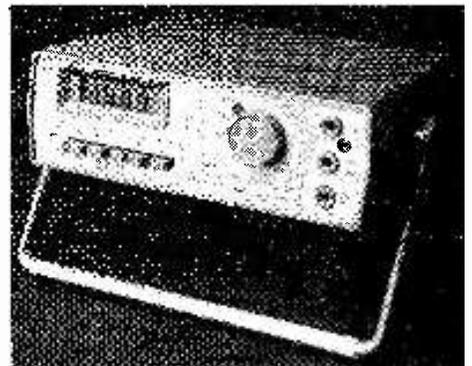
The new Gould Advance Beta is a portable, battery-operated 3½-digit 29-range multimeter using a large, high-contrast liquid-crystal display, based on a single complementary metal oxide semiconductor (C-MOS) IC chip from Motorola for all analogue and digital functions.

The 7-segment, 10mm-high display used on the Beta digital multimeter uses field-effect reflective liquid-crystal digits so the instrument can be used equally well indoors or for field measurements. Only four trimmers are incorporated, three for recalibration of the DC and resistance ranges and one for the AC ranges.

The C-MOS circuitry and the liquid crystal display enable a set of four SP11 'C' cells to provide over 300h. use, representing up to 10 weeks' use under normal conditions.

As evidence of the high reliability resulting from the fewer components and low current consumption, Gould Advance is offering a 2-year guarantee on Beta.

This unit has five DC voltage ranges (200mV–1kV), five AC voltage ranges (200mV–750V), six DC and six AC current ranges (200µA–2A, with a 10A range via a



separate unprotected input), and six resistance ranges (200Ω–20MΩ), fully protected to 250V r.m.s. Basic accuracy of the Beta is ±0.2%.

Optional extras include a temperature probe for direct-reading temperature measurements between –20°C and +120°C with an accuracy of ±1°C, an RF probe (40mV–30V, with a 3dB bandwidth of 20kHz–500MHz in a 50Ω coaxial system), a high-voltage probe (1kV to 40kV), a battery eliminator and a carrying case.

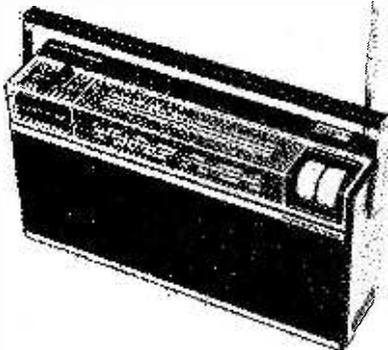
Beta is supplied in a rugged metal case measuring 246mm wide x 180mm deep x 72mm high. Weight is 1.4kg. Price is £99 plus VAT.—Gould Advance Ltd., (Dept. P.W.) Roebuck Road, Hainault, Essex.

EAGLE STEREO RECEIVER

Eagle International have added a new AM/FM tuner-amplifier/stereo receiver—the R2020 to their 2000 series. Driving 20W RMS per channel, it has provision for connection of two turntables, outputs for two pairs of speakers and tape facilities allowing two tape decks to be used for alternative recording/playback.

Functions are selected via an arrangement of push buttons on the front panel. Audio section has a quoted S/N ratio of 64dB. Total harmonic distortion for rated output is less than 0.2% and frequency response is quoted as 15Hz–36kHz ± 2 dB. The housing is of teak veneer with recessed louvres and brushed metal fascia. Price is £126.40. *Eagle International (Dept. P.W.), Precision Centre, Hesther Park Drive, Wembley, HA0 1SU.*

NORMENDE'S 'GLOBEMASTER'



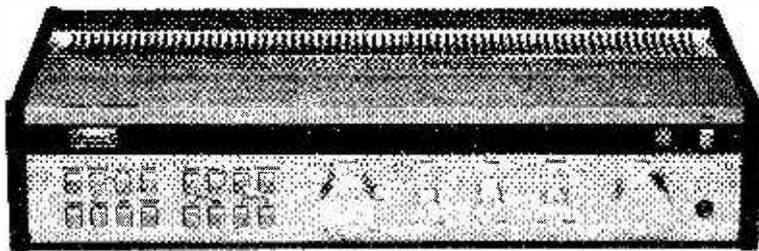
The new Normende 'Globemaster' 6-band portable priced at £78.60.

Normende have announced the return of the Globemaster battery/mains portable radio. It was dropped some time ago after the company's introduction of the larger 'Galaxy' range.

The Globemaster covers MW, LW, VHF and three SW bands—49m, 19m and 16-41m continuous. Tuning is by thumbwheel and a tuning meter which doubles as a battery condition meter. On short-wave bandspread, a second thumb-wheel enables fine tuning. On FM working there is a switchable AFC. Output on batteries is 2W and on mains 4W.

The recommended retail price of the Globemaster, which is finished in black with brushed aluminium, is £78.60. Distributors in G.B. are: *Vessco Vision & Radio Ltd. (Dept. P.W.), 4 Blackwater Way, Ash Road, Aldershot, Hants., GU12 4DL.*

Practical Wireless, September 1976



The Eagle stereo receiver model R2020. Price is £126.40.

WIDEBAND AMPLIFIER

A VHF/UHF wideband distribution amplifier for FM and TV has been introduced by Labgear. Type CM6049 can be employed as a 6-band amplifier and its full output is capable of feeding external splitters to tap-off units for even more outputs. Bandwidth is 40-860MHz and full output provides a gain of 4.0dB. Isolation between outputs is better than 36dB. Input source and output load impedance are 75 ohms and noise figure typically 7dB. Provision is made for powering Labgear masthead pre-amplifiers at 16V 3mA or 24V 30mA.

Further information and prices may be obtained from *Labgear Limited (Dept. P.W.), Abbey Walk, Cambridge, CB1 2RQ.*

NEW PHILIPS I.C.E.

Latest in-car unit for Philips is the AC 860 radio/cassette player. It replaces the models RN642/RN712 and Philips have developed a new tape transport mechanism for the machine which cuts the number of moving parts from 600 to about 140. The AC 860 also has a new improved Super Turnclock system which enables a single button to select and lock on to 6 pre-tuned stations. Other features include: I.A.C. (Interference Absorption Circuit) which helps to cut all passing car interference on FM and reduces own-car suppression to a minimum. Three band radio (LW/MW/FM stereo). FM stereo indicator. Stereo cassette play facility. 2 channel (2 x 5W) output. Treble and bass controls. Fast wind and rewind controls. Auto stop at end of tape and auto-switching to radio at end of cassette playback. Price is £198.96 including VAT. *Philips Electrical Limited, (Dept. PW) Century House, Shaftesbury Avenue, London, WC2H 8AS.*

AVOMETER 73

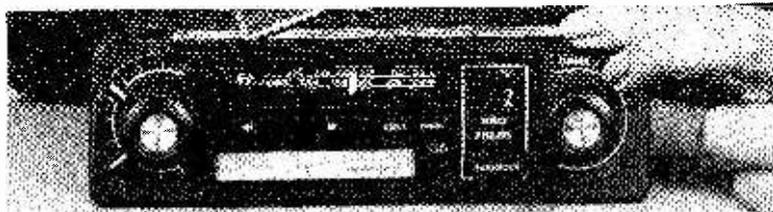


Avo's latest meter—the Avometer Model 73.

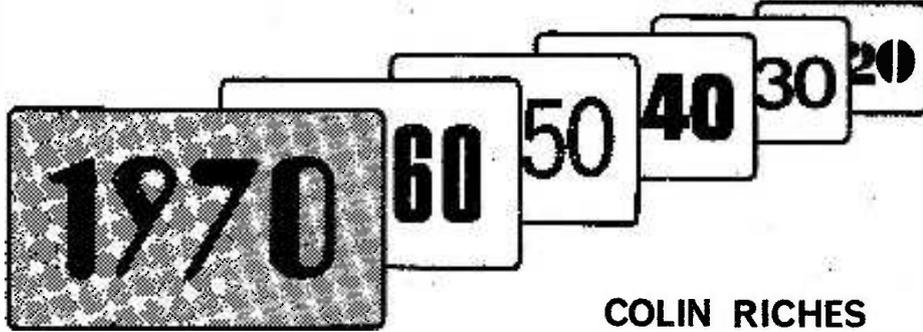
Avo recently announced their Avometer Model 73. It combines wide-range coverage with small size and an overload protection system. Ranges include 150mV to 750V d.c., 7.5V to 750V a.c. 75 μ A to 3A d.c., 3mA to 3A a.c. and 2k Ω to 20M Ω . Sensitivities are quoted as 20k Ω /volt d.c. and 2k Ω /volt a.c. Frequency bandwidth is over 50kHz on many ranges.

The Model 73 comes complete with leads, prods, clips and full operating instructions. A range of accessories, which includes a carrying case, plug-in shunts and a 30kV d.c. probe is available.

Price of this new meter is £33 plus VAT.—*Avo Limited (Dept. P.W.), Archcliffe Road, Dover, Kent, CT17 9EN.*



GOING BACK...



COLIN RICHES

1923 Receiver

SEVERAL readers have approached me asking if it would be possible to publish designs to enable them to build up vintage receivers using vintage components. Well, from time-to-time, I hope to publish circuits with component values so that you can do just this. Last month we had the "Everyman Four"—this month we have a compact HF amplifier receiver. In this circuit the three electrode valve (tack your pick!) is used to amplify the HF oscillations before they are detected. The anode circuit contains the coil L2, the circuit being completed, partly by the self-capacity of the coil and partly by the capacity between filament and anode of the valve. One could use either slider-type inductances or variometers.

L1 will vary obviously according to the wavelengths to be received. For MW it could be a 4in diameter tube 5in long wound for 4½in with No. 24 enamelled wire. L2 could be 4in diameter, 8in long wound for a distance of 7in with No. 24 enamelled copper wire.

In 1923, if one wanted to receive Paris on 2,600 metres, L1 was wound on a 4in diameter former 11in long. Windings were 10½in with No. 24 enamelled cop-

per wire. L2 was of similar size but some additional inductance had to be connected in series with it. It was suggested therefore that a non-variable coil of similar specification was connected in series with this variable inductance.

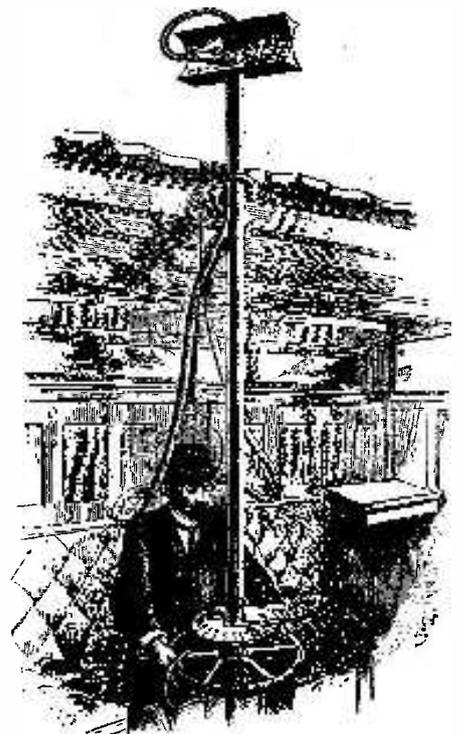
To operate the receiver both L1 and L2 should be adjusted until the loudest signals are obtained. Careful adjustment of R1 and the crystal detector D1 will obviously improve signals.

Components required are: L1 (slider-type inductance) L2 (larger slider-type inductance) R1 (filament rheostat of 7-10Ω.) V1 (three-electrode valve) B1 (6V accumulator) B2 (40 to 80V HT battery) D1 (crystal detector) Phones (high-resistance type).

Pre-Radar!

IN the year 1897 noises were being made about a device for locating fog-signals at sea and one of our Going Back readers has sent me some information on a device available at that time—perhaps it could even be called the 'forerunner of radar'!

In those days, even as it is now, it was difficult, when at sea, to determine the direction from which sounds came, so if another ship's fog horn was sounding, it could almost be coming from any



of the 360 points of the compass. American scientists dreamed up a device which would seem to have solved the problem. (see picture).

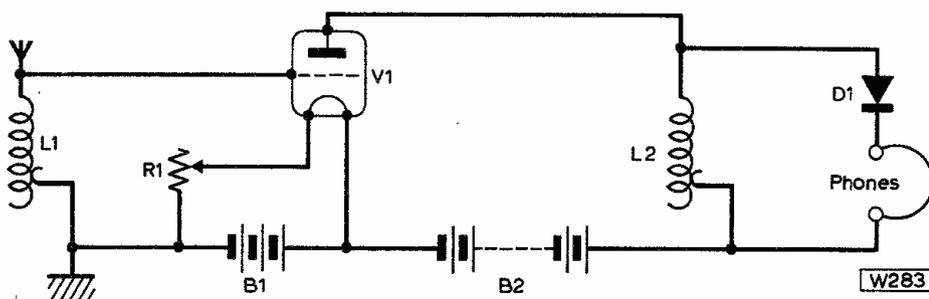
The device comprised a vane, like a radar antenna, mounted on a vertical pole so that it could have a clean sweep of the horizon. On each side of this vane was a sound pick-up tube which had pipes connecting it to the ears of the operator who would be situated in a cabin below the apparatus. The convex surfaces of the vane acted as reflectors to their own receiver tubes. To locate the direction of a sound in fog, the vane was rotated by means of a hand wheel until sound was heard in one ear only. It was then turned until sound was heard in the other ear. The two positions of the vane were indicated on a dial just above the handwheel and the direction from which the sounds came was exactly mid-way between them.

Believe it or not, many trials with this unit in thick fog were very successful and the apparatus was installed on the U.S.S. Indiana and several vessels of the mercantile marine.

Vintage CQ

EQUIPMENT WANTED

... An Ormond Disc Drive with escutcheon to complete a Burgone Olympic 3 receiver (1932-1933).—S. Woods, 9 Portalfield, Stalham, Norwich, Norfolk.



One valve/crystal receiver.

FEATURING:-

CAR ELECTRONICS

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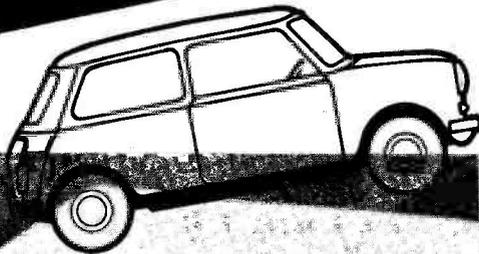
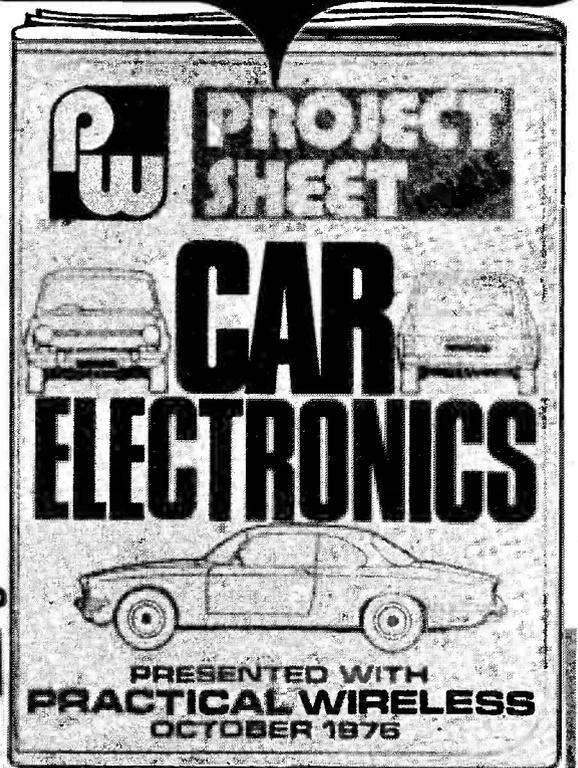
All your "Upper Bracket" cars have their electronics built in at the factory but that doesn't mean that owners of slightly less expensive models must do without.

Our next issues will cover many of those extras, starting with a free project sheet detailing a "Hazard Flasher" and an "Intermittent Wiper Action" control. In the magazine itself we describe an easy-read, easy-build "Digital Clock" and "Anti-Theft Devices" to protect all the loose items.

Also included are our usual general interest features and projects.

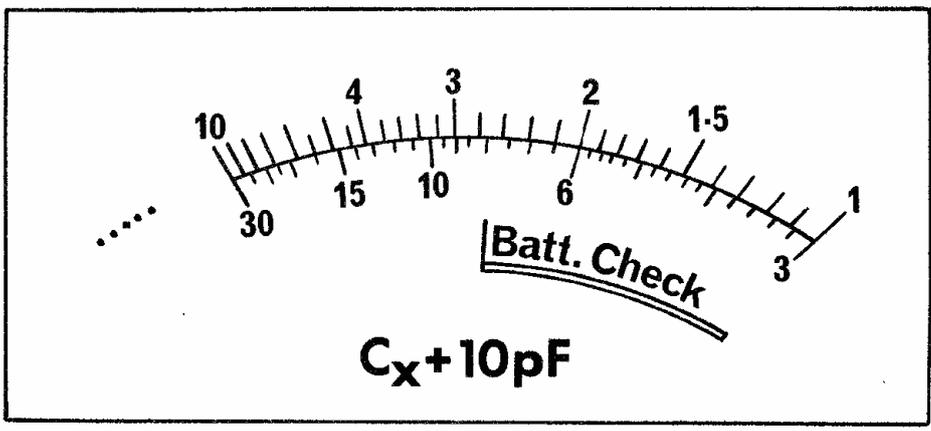
Free Inside

**ON SALE IN
SEPTEMBER**



a wide CAPAC

I. HICKMAN



THIS instrument was designed to measure capacitance from 1pF to 30 μ F, providing a direct read-out of the measured value without the manipulation of balance controls. For this reason, it is more convenient in use than a Capacitance Bridge.

It also provides a bias of 3V d.c. across the capacitor under test. Although this is low enough to be suitable for any type of capacitor, including 3V working disc ceramics, it is larger than the test waveform and no voltage reversals are experienced by the capacitor under test.

DESIGN PRINCIPLES

Fig. 1 is a block diagram of the instrument. The mode of operation is by measuring the amplitude of a test wave-form after it has been attenuated by a passive lag CR network, of which the capacitor is the CAPACITOR UNDER TEST (C.U.T.).

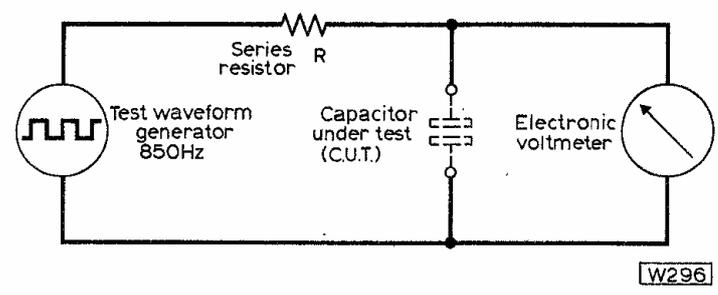
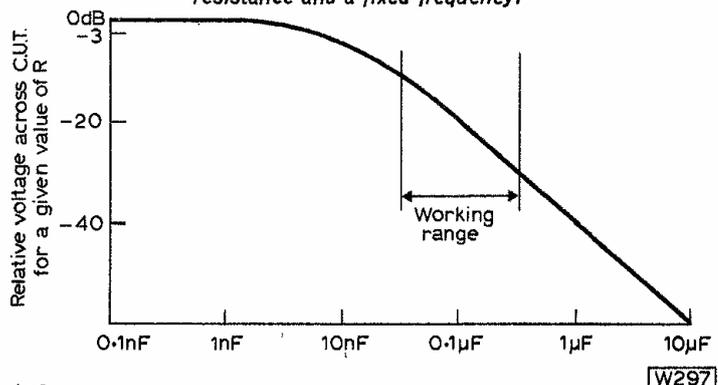


Fig. 1. Block diagram showing the three main divisions of the unit.

The relation between the alternating voltage input to the measuring section and the value of the capacitance under test at a constant test frequency is shown in Fig. 2. It does, of course, have the same shape as the curve of output voltage versus frequency for a mixed capacitor.

Fig. 2. Curve of output voltage against capacitance for a fixed value of resistance and a fixed frequency.



If the circuit (which covers 10 to 1 in capacitance value on any one range) worked on the part of the curve of output voltage versus capacitance value indicated in Fig. 2, the meter deflection would be inversely proportional to capacitance. This has two advantages. Firstly, the resolution for small values of capacitance is much improved. Secondly, the meter will always be deflected whilst the instrument is switched on but not in use, a useful indication that it needs switching off!

However, with this arrangement the resolution for larger values of capacitance would suffer unduly and two steps are taken to prevent this.

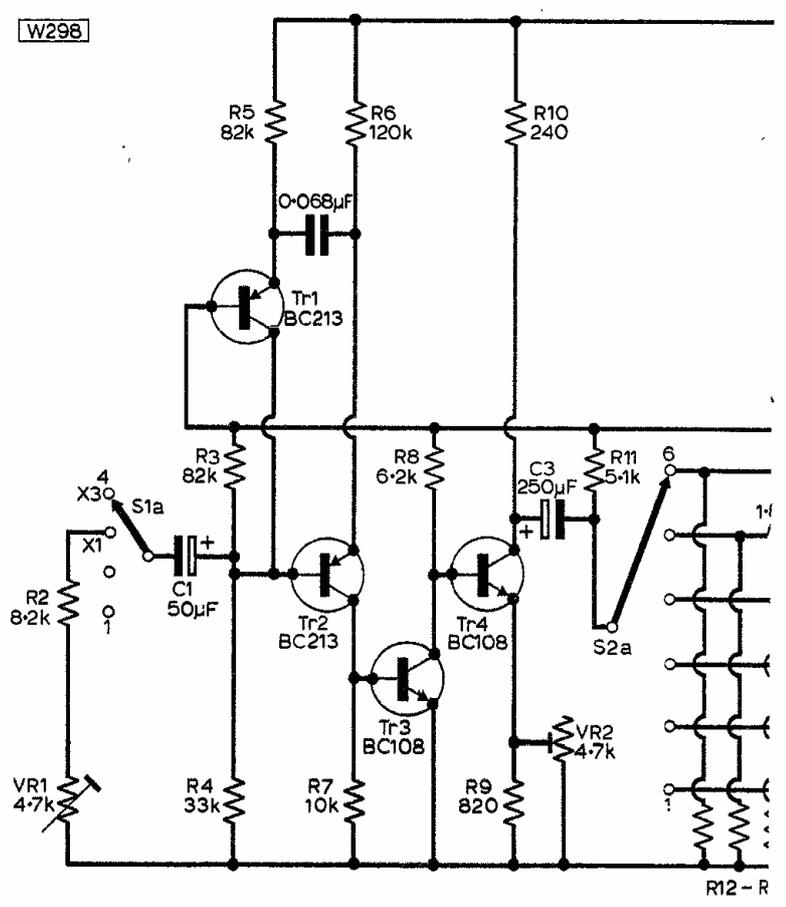
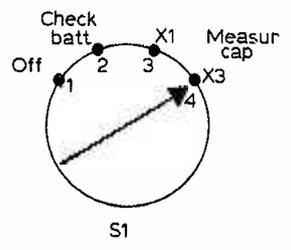
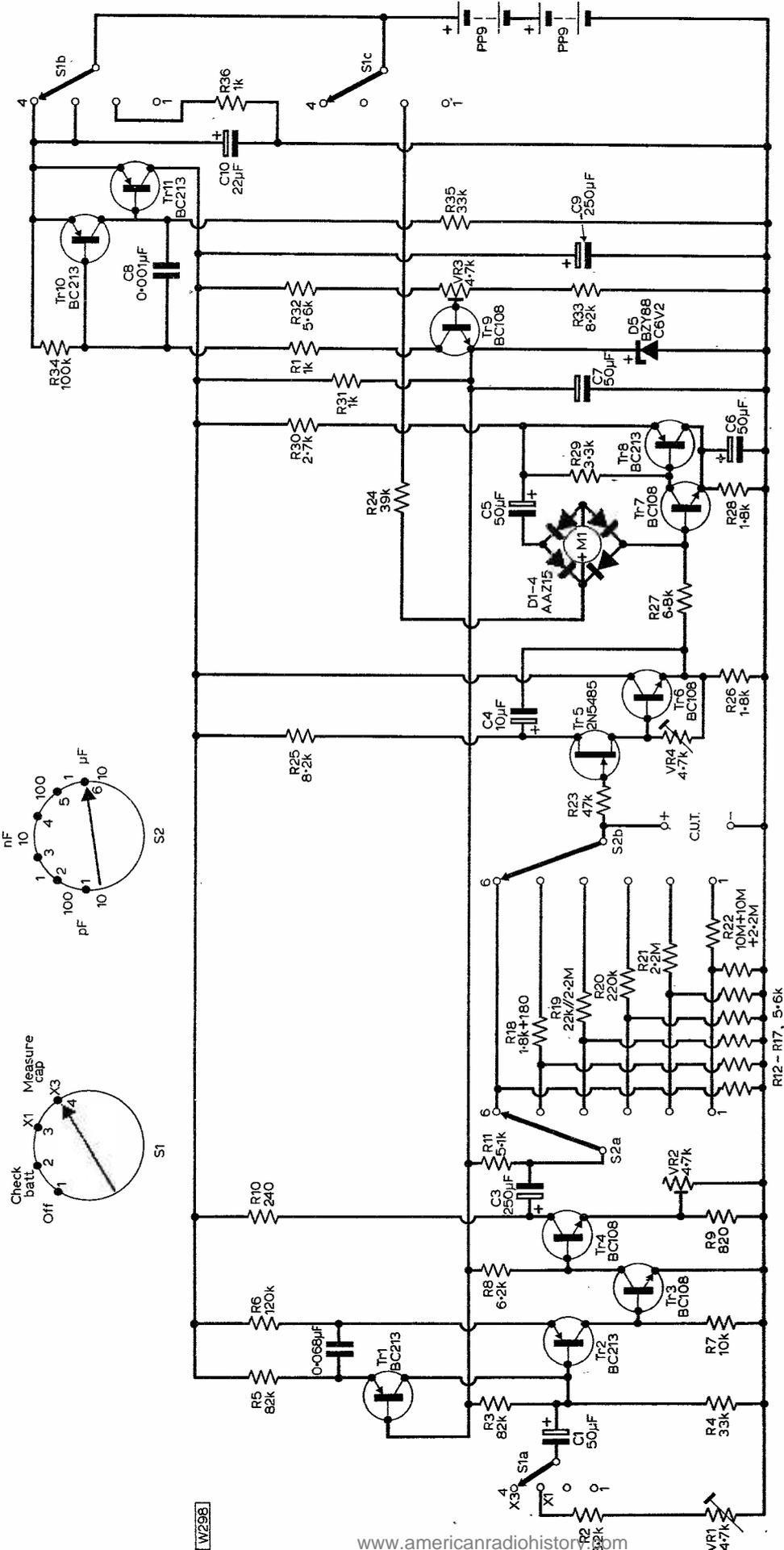


Fig. 3. Full schematic diagram of the meter including on-board and chassis mounted components.



Practical Wireless, September 1976

Practical Wireless, September 1976

I'M NEW TO THIS GAME, BUT....



... my grandfather bought his first bits and pieces from Home Radio of Mitcham 30 years ago—and he still relies on them! So does my father. It's not surprising that I've been bitten by the same bug. When Dad saw how keen I was on electronic gadgets he bought me a Home Radio Components catalogue. Between you and me I think he was getting fed up with me keep borrowing his! I must say it really is a smashing book. I spend hours poring over it deciding what I shall save up for next. Although I can't afford to spend much yet Home Radio treat me like a millionaire. I've been told that it's a small family business that hasn't grown too big to care for the amateur constructor.

Another thing I like about Home Radio is that if I have any queries or problems I can go right to the man at the top. On several occasions I've found him jolly helpful. Let me tell you a bit more about this catalogue. It lists about 5,000 items and has about 2,000 pictures (so they tell me—I haven't actually counted them) and it's laid out so clearly that even I can find my way around it easily. It also tells you all about their Deposit Credit Scheme which I will be able to join as soon as I'm eighteen. I find it quite exciting to think that I shall then be able to pick up the phone on a Sunday night and read over my order to their answerphone machine, and by Monday my gear will be on its way to me. I can hardly wait!

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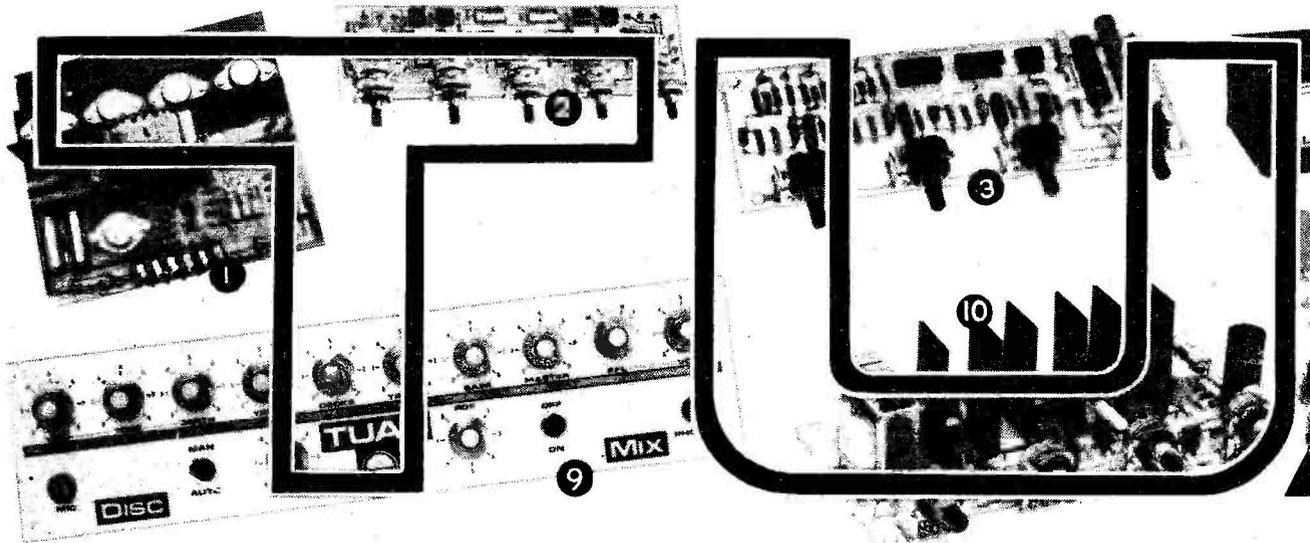


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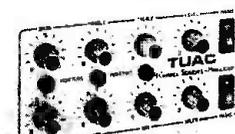
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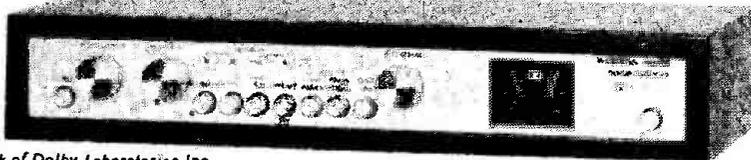
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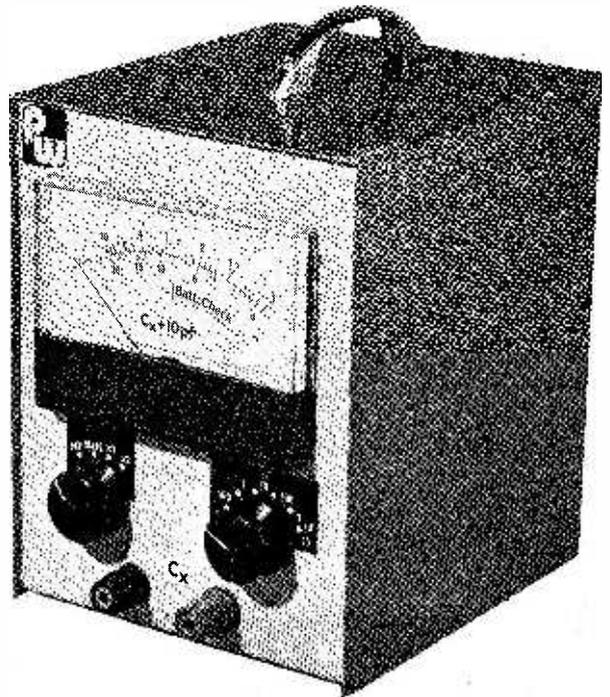
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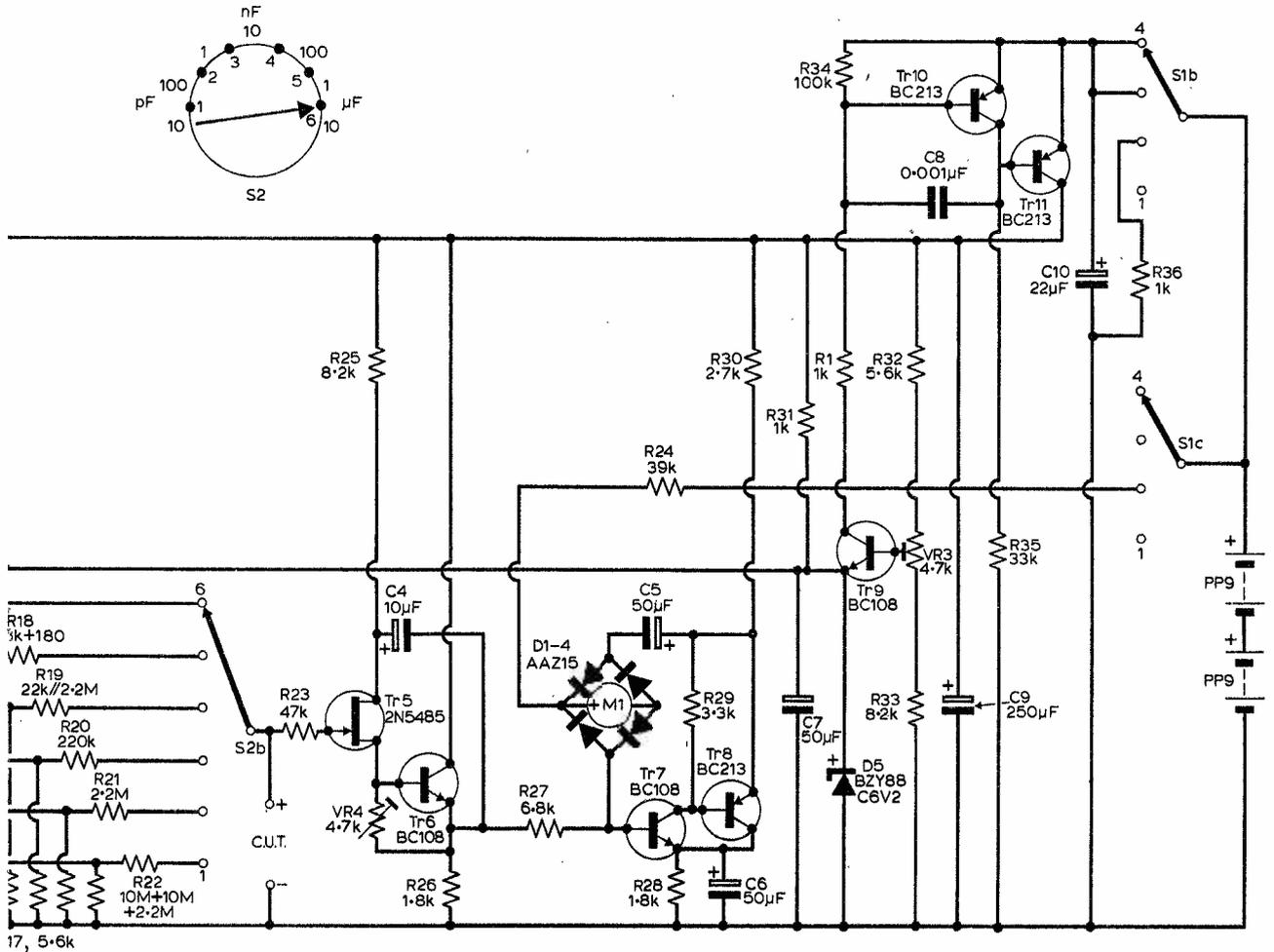
INTEGREX LTD.

range CAPACITANCE METER



Firstly, two test frequencies are provided, one being 3 times lower than the other. Thus, for example, on the 1 to 10 μ F range, for values greater than 3 μ F, the lower frequency can be used, giving a full scale reading of 3 μ F on a second scale. This scale is calibrated over a 10 to 1 range, permitting capacitors up to 30 μ F to be measured.

Fig. 3. Full schematic diagram of the meter including on-board and chassis mounted components.



Secondly, by moving the range of the curve in Fig. 2 over which the instrument operates to the left, the scale for lower values of capacitance can be slightly compressed, as the operating range now partly covers the shoulder of the curve. This results in an improvement of resolution for higher values of capacitance and in fact the scale shape (apart from reading right to left) closely approximates the ideal logarithmic shape. This law, like the C and D scales of a slide rule, provides a constant percentage reading accuracy or resolution.

Of course, as the test wave form is actually a square wave, the foregoing comments apply primarily to its fundamental component, but the harmonics do not affect the argument and a stable amplitude square wave is more easily generated than a stable amplitude sine wave.

DETAILS OF THE CIRCUIT —

Fig. 3 shows the full circuit diagram of the instrument. The operation is as follows. Tr1 and Tr2 form an emitter coupled multivibrator. These conduct alternately and the combined emitter currents flow through Tr1 and R4 or through Tr2 and R7. The voltage produced across R4, fed back to C2 via TR2, determines the voltage through which C2 has to charge and discharge and hence the frequency. However, the effective value of resistance in the collector circuit of Tr1 consists of R3 in parallel with R4 and R2 plus VR1 when selected, setting the two operating frequencies. The voltage across R7 turns on Tr3 on alternate half cycles, thus driving the base of Tr4 with a square wave switching between 0 and 6.2V. R9 thus defines a square wave current delivered by Tr4 to the parallel combination of R10, R11 and R12. This is equivalent to an ideal voltage source behind 220Ω and is fed to the capacitor under test. On other ranges, resistors R18 or R19 etc. are added to increase the source resistance to 2.2KΩ, 22KΩ etc. up to a maximum of 22MΩ.

The C.U.T. attenuates the applied test wave form by some amount, depending on its capacitance and the source resistance which has been selected at S2. With the latter in position 6 and S1A in position 3, 1μF causes just that attenuation which results in the meter reading full scale. Larger capacitances will reduce the reading and since the meter is scaled in capacitance, their value can be read directly from the 1 to 10 scale or from the 3 to 30 scale with S1 at position 4. Note that with the test terminals open circuit, the meter will read off scale to the right. The exception to this is the 10 to 100 pF scale.

There is, of course, some residual capacitance associated with S2B, the test terminals and Tr5 input. By careful layout and with short wiring this can be kept to under 10pF. Just sufficient extra capacitance is then added to the positive test terminal (the negative one is connected directly to the front panel to give a reading of 10pF i.e. full scale, with nothing connected to the test terminals. The instrument thus reads 10pF high on all scales, so that a reading of 100pF is obtained with a C.U.T. of 90pF, whilst a reading of 11pF corresponds to a C.U.T. of 1pF. This arrangement extends the range of the instrument by a factor of ten. For capacitances of 1000pF or greater, there is no point in subtracting 10pF from the reading, as the instrument does not pretend to an accuracy greater than one or two per cent.

★ components list

Resistors

R1	1kΩ	R19b	2.2MΩ 1%
R2	8.2kΩ	R20	220kΩ 1%
R3	82kΩ	R21	2.2MΩ 1%
R4	33kΩ	R22a	10MΩ 1%
R5	82kΩ	R22b	10MΩ 1%
R6	120kΩ	R22c	2.2MΩ 1%
R7	10kΩ	R23	47kΩ
R8	6.2kΩ	R24	39kΩ
R9	820Ω	R25	8.2kΩ
R10	240Ω 1%	R26	1.8kΩ
R11	5.1kΩ 1%	R27	6.8kΩ
R12	5.6kΩ 1%	R28	1.8kΩ
R13	5.6kΩ 1%	R29	3.3kΩ
R14	5.6kΩ 1%	R30	2.7kΩ
R15	5.6kΩ 1%	R31	1kΩ
R16	5.6kΩ 1%	R32	5.6kΩ
R17	5.6kΩ 1%	R33	8.2kΩ
R18a	1.8kΩ 1%	R34	100kΩ
R18b	180Ω 1%	R35	33kΩ
R19a	22kΩ 1%	R36	1kΩ
VR1	4.7kΩ Min. skel. vert.		
VR2	4.7kΩ Min. skel. vert.		
VR3	4.7kΩ Min. skel. vert.		
VR4	4.7kΩ Min. skel. vert.		

Capacitors

C1	50μF	C6	50μF
C2	0.068μF	C7	50μF
C3	250μF	C8	0.001μF
C4	10μF	C9	250μF
C5	50μF	C10	22μF

Semiconductors

Tr1	BC213L	Tr9	BC108
Tr2	BC213L	Tr10	BC213L
Tr3	BC108	Tr11	BC213L
Tr4	BC108	D1	AAZ15
Tr5	2N5485	D2	AAZ15
Tr6	BC108	D3	AAZ15
Tr7	BC108	D4	AAZ15
Tr8	BC213L	D5	BZY88 C6V2

Miscellaneous

PCB, Readers Service. Meter, 100μA fsd. S1, 3 pole 4 way. S2, 2 pole 6 way 2 wafers

The meter amplifier is driven by the low input capacitance buffer stage Tr5 and Tr6. As FET Tr5 is biased via R11 and the resistance network selected by S2, it imposes no shunt input resistance across the C.U.T. and its input capacitance is kept low by the source-follower connection with the drain bootstrapped by Tr6. The gate of Tr5 is biased at about +3.5V and this bias is convenient when measuring electrolytic capacitors, which should be connected in the polarity indicated in Fig. 3. Large electrolytics and 3V working high K ceramic capacitances will exhibit appreciable leakage current. This will not upset the biasing of Tr5, since when these capacitors are being measured, the source resistance of the bias circuit is low with S2 in position 4, 5 or 6.

The signal from Tr5 is applied to the meter circuit, which consists of a common emitter amplifier Tr7 with AC shunt feedback via the meter. High loop gain is ensured by Tr8, which effectively multiplies the value of Tr7's collector load R30 by bootstrapping. The collector current of Tr8 is returned to the emitter of Tr7 to stabilise the DC conditions of the two transistors. C6 prevents this degeneration

occurring at AC, thus maintaining high loop gain in the main NFB loop via the meter. The meter is also used to indicate the state of the batteries in position 2 of S1.

The whole instrument runs from stabilised supplies of 6.2V and 12V. Tr9 is an error amplifier which compares the 12V stabilised rail with the 6.2V reference voltage across D5. VT9 turns on just sufficiently to cause Tr10 to absorb some of the base current available to the pass transistor Tr11 via R35. The remaining base current is just sufficient to enable Tr11 to maintain its collector at 12V.

This circuit has several advantages over more conventional stabiliser circuits. It operates down to a battery voltage of 12.5V or less, enabling maximum life to be obtained from the batteries. It is positively self-starting, yet the reference D5 is fed from the stabilised output, ensuring good stabilisation and the very high loop gain ensures excellent regulation. Since the drain on the +6.2V supply is small and constant, it can be taken from across the reference zener D5. Note that C8, C9 and C10 are all essential to ensure the stability of the stabiliser under all conditions.

CONSTRUCTION —

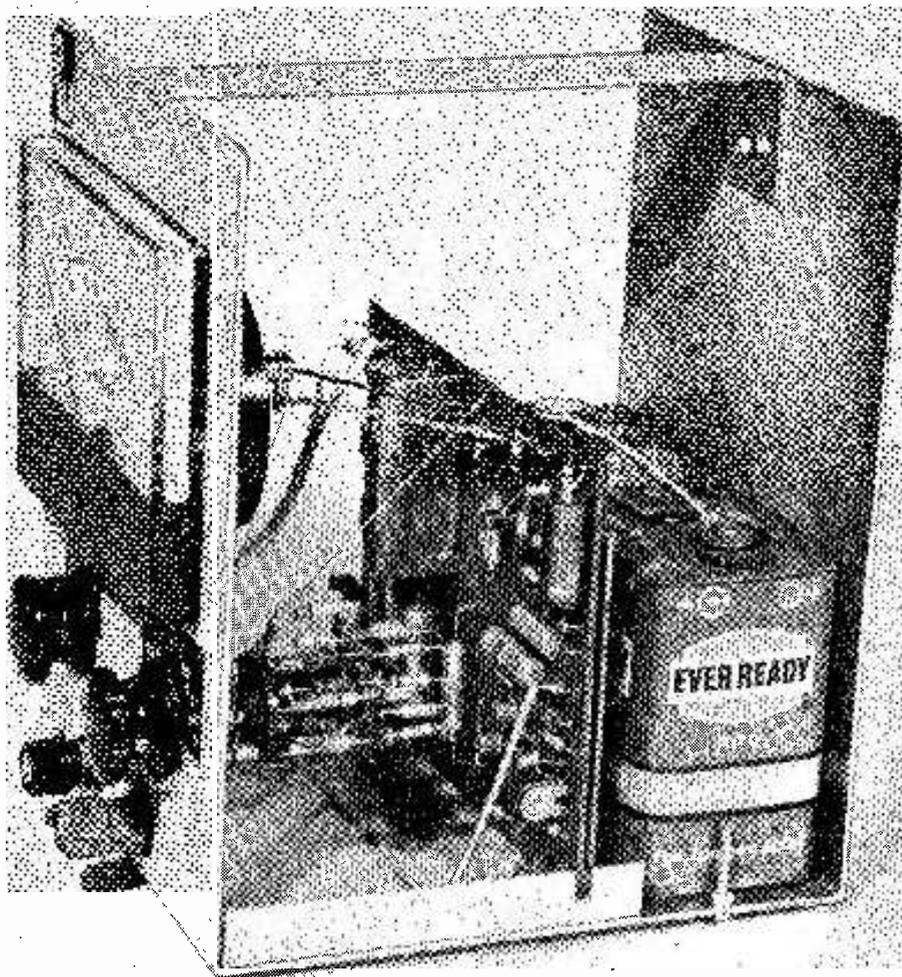
Any suitable metal case may be used, but it will be found convenient to mount the test terminals near the bottom of the front panel with the switches S1 and S2 above them and the meter above that. Wiring from the wiper of S2B to the positive test terminal and to R23 and Tr5 must be short and direct, as in the photograph.

S2 should be a two wafer switch and R12 to R22 can be mounted on it as the wafers are spaced apart. R22 is built up of three separate resistors in order to minimise the stray capacitance which shunts it. This is important to preserve reasonable accuracy on the 10 to 100pF range. It is for this reason that R12 to R17 are not replaced by a single resistor from S2A wiper to earth. As shown, they prevent any capacitive feed through of test waveform from S2A to contacts 2 to 6 of S2A and thence across S2B to the C.U.T. Note also the screen on the PCB.

The batteries should be mounted in the base of the case, preferably in a reasonably central position, so that the instrument is stable when standing and feels well balanced when carried. A mains power supply may be incorporated in place of the batteries, but in this case, care must be taken that it is totally screened from the circuitry of Fig. 3, otherwise hum pick-up will be troublesome on the lower capacitance ranges.

Provided the layout of Figs. 4 and 5 is adopted, no difficulties should be experienced, as only comparatively low frequencies are involved. The wave form generator runs at 850Hz approx. on the $\times 1$ range. The circuitry is constructed on a 5.4in \times 4in printed circuit board. Fig. 4 shows the printed circuit layout, viewed from the copper side. It can be transferred to the board blank by placing it over the board with a piece of carbon paper in between and then tracing the PC tracks firmly with an HB pencil. Provided the copper has been well cleaned beforehand, the carbon paper will mark the copper clearly enough to be easily visible in an oblique light. For cleaning the

Photograph 1 The inside of the case showing the authors method of assembly. Note particularly the direct wiring from the points to the meter and switches in order to minimise the effect of stray capacitance.



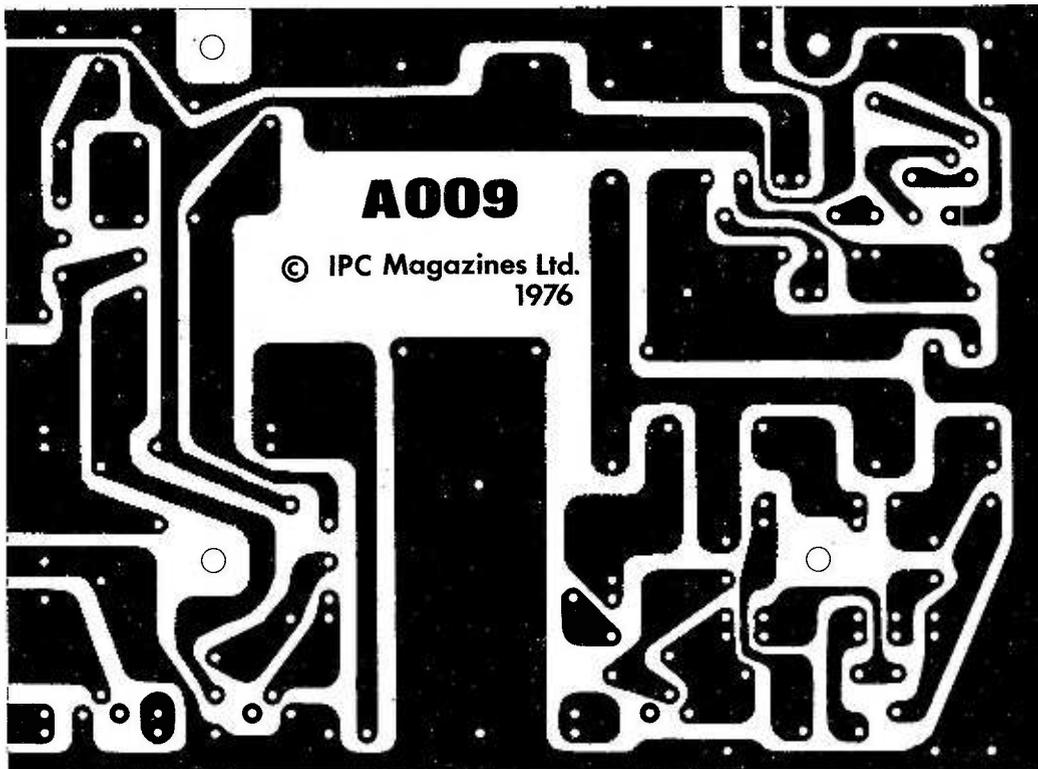


Fig. 4. Etched wiring pattern, drawn full scale to allow easy transference to clad board for the do-it-yourselfer

copper, a piece of well used "Scotchbrite" green kitchen scouring cloth, used wet, is ideal. The tracks should next be marked in with a suitable ferric chloride resist (the author used brushing cellulose as sold for touching up car paintwork). After etching, which takes about half an hour, wash the board well. If cellulose paint has been used, it can be removed with Polystrippa paint stripper. Wash the board well again and dry.

Fig. 5 shows the component layout and it is best to assemble all the components and pins to the board straightaway. The track side of the board can then be lightly varnished to prevent the copper tarnishing. The completed PC panel was mounted with spacers on two brackets secured to the base of the case. These brackets also served to retain the batteries. R36 is mounted on S1 and R24 between S1 and the positive meter terminal.

CALIBRATION —

The accuracy of the capacitance meter in use depends entirely on the care with which the calibration is carried out. Undoubtedly the best way is with the aid of a Standard Decade Capacitor Box. Your local Technical College may well permit you to use one of theirs, on their premises during normal hours of course. Failing this, a good sort through the junk box may unearth some 1 per cent capacitors, enabling you to fix the main scale points. Series and parallel combinations of these will provide other values, permitting the 1 to 10 scale to be calibrated in its entirety.

However, having completed the construction of the instrument, the first job is to check that it is all basically operational, so set the four preset pots to mid position and connect it to an 18V supply. Check that there is 6.2V across D5 and adjust VR3 so that the stabilised voltage across C9 is 12V. Check that this is maintained from 18V supply down to at least 12.5V. Check that the square wave at Tr3 collector is approximately 6V peak to peak. The voltage at Tr8 emitter should read 6.3V, adjust VR4 to achieve this. Check that with S2A in position 6 and no capacitor connected to the test terminals, the meter reads off scale. R10 to R22 should, ideally, all be 1 per cent, but good accuracy will be obtained if ElectroSil TR5 2 per cent resistors are used, as around 90 per cent of these are in fact within 1 per cent. The resistors for the 10-100pF range, R22, should be checked on a resistance bridge. All other resistors should be 5 per cent carbon film type.

Calibrating the meter can lead to disaster, so the following procedure, which minimises the risk of foreign particles getting into the movement, is recommended. Connect 0.03 μ F to the test terminals, set S1 and S2 to position 4. Adjust VR2 for full scale reading on the meter. Reduce the capacitance at the test terminals to 0.01 μ F and set S1 to position 3. Set VR1 for full scale reading on the meter. Next increase the capacitance across the test terminals in increments of 0.001 μ F to 0.02 μ F, then 0.002 μ F increments to 0.04 μ F, 0.005 μ F up to 0.06 μ F and 0.01 μ F up to 0.1 μ F. At each step, note the meter reading against its original scale. Now remove the

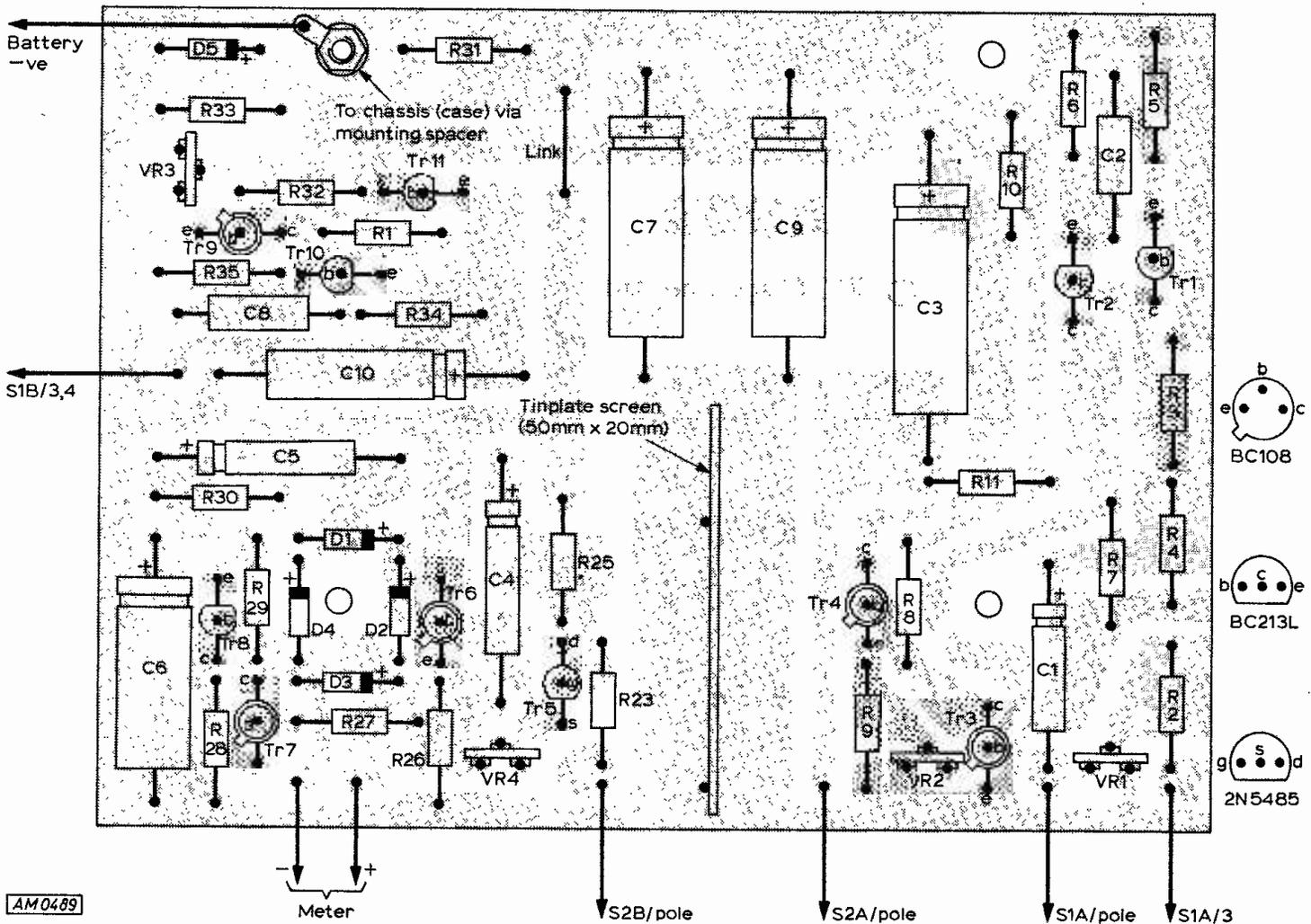


Fig. 5. The component layout detail for the board at Fig. 4. The wiring patterns are shown to assist correct location of the components. Note the screen between R9 and R26.

meter from the instrument and in a clean dust-free environment remove the scale plate from the meter, immediately replacing the meter front. With a sharp edge, remove the numbers from the meter scale, together with any other unwanted lettering, but leave the original scale. Spray the scale with one thin coat of matt white primer. Allow to dry and check that the original scale markings can still be seen. Apply further coats until the markings are just discernible under a strong light. Now calibrate the scale from 1 to 10 using the list of readings already taken. Add a second scale under the first, marked 3 to 30. Add a battery check indications at 2/3 FSD and replace the scale in the meter.

This method of calibrating the meter not only minimises the risk of damaging it, but also avoids the draughts difficulty. When calibrating a meter directly, particularly the larger ones, an almost imperceptible draught in the room can offset the pointer enough to cause serious errors.

Alternatively, the ready to use meter scale in the heading can be fitted over the existing meter scale. This scale is specifically designed to fit the 4¹/₄in x 3¹/₄in 100 μ A meter obtainable from Messrs. Dzubias, of Bolton (see advertisement in this magazine). To fit the scale first remove the meter front by easing it off over the small retaining pips. Next, carefully

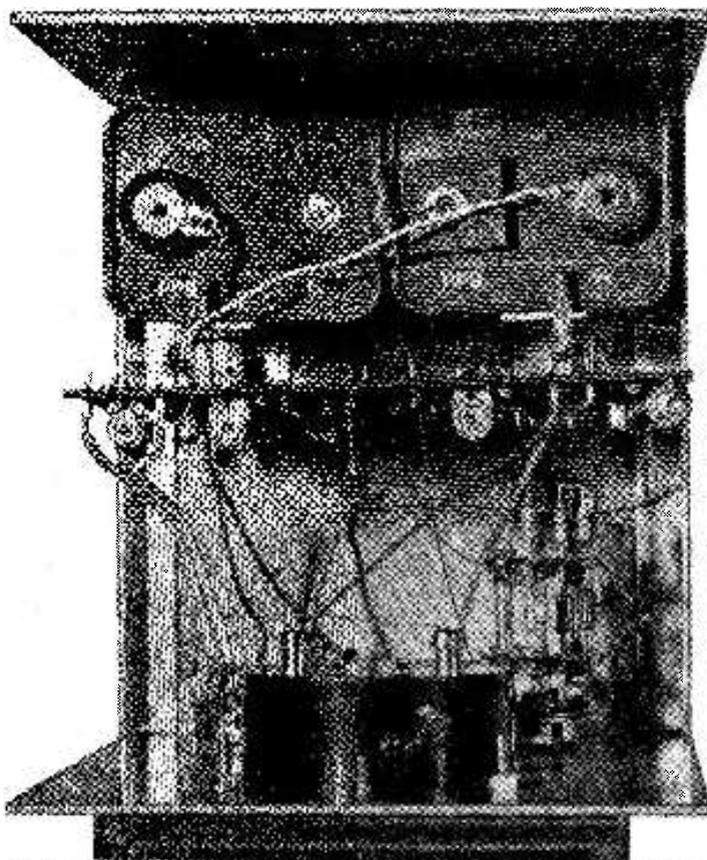
remove the meter scale and replace the meter front temporarily. Stick the special scale in place using the minimum amount of adhesive thinly spread over the whole area of the original scale, to prevent wrinkling. Water based adhesives are best avoided, as they will soak through and make the printing on the back show. For the same reason, the adhesive should be allowed to become tacky before placing the new scale in position. When complete, replace the scale in the meter. The whole operation should be carried out on a clean sheet of paper, well away from the workbench or anywhere else where metal filings or dust may be lurking.

To set up the instrument when using the ready printed scale, proceed as follows. Zero the meter at the centre of the five dots. Set S1 to $\times 1$ and select the 10-100nF range. Connect a 1 per cent 10nF (0.01 μ F) capacitor to the test terminals and adjust VR2 for full scale reading on the meter. Now set the range switch to 1-10nF and the meter should read 10 on the upper scale. If it reads high switch off and zero the meter to one of the left hand dots. Then switch on and repeat this paragraph.

Conversely, if the meter reads lower than 10, switch off and zero the meter to one of the right-hand dots. In this way, it should be possible to match the scale exactly, but if the reading at 10 is

still low, wire a 3·3nF capacitor in parallel with C2. If still high, C2 must be reduced by 5 per cent instead—say 0·056 μ F plus 6·8nF. It is unlikely that further adjustments will be required but if they are, repeat the procedure of the last two paragraphs.

Replace the meter in the instrument. With nothing connected to the test terminals, switch S2 to position 1 (10-100pF). The meter should read slightly over full scale. Solder a piece of stiff wire or brass sheet to the positive terminal and bend it toward the front panel, to achieve a full scale reading. After adjusting it, move the hands well out of the way, as grasping even the insulated part of the terminal is equivalent to connecting a capacitor of three or four pF. Finally, check that at position 2 of S1, the meter reads at the check batteries limit with a supply of 12·5V. If not, adjust R37.



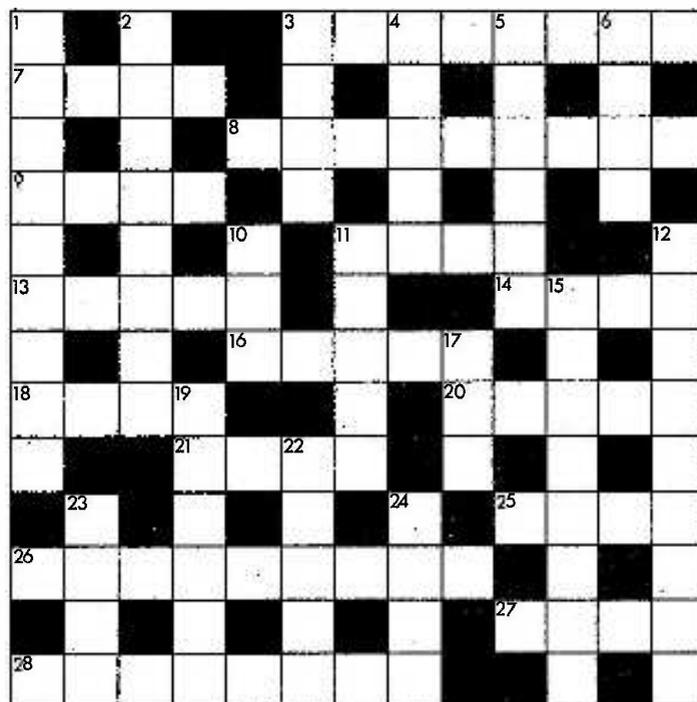
Photograph 2. Another view inside the case to emphasise the direct wiring required between components and to show a possible location of the batteries.

USING THE FINISHED METER —

This is simplicity itself! Connect the capacitor to be measured to the terminals, observing polarity if it is an electrolytic and set S1 to $\times 1$. If the meter reads over full scale turn S2 anti-clockwise; if off scale to the left, turn S2 clockwise. The exact value of the capacitor can now be read from the scale, e.g. if the meter reads 2·2 with S2 in position 4, the C.U.T. is 22nF or 0·022 μ F. If the meter reads between 3 and 10, better resolution is provided by setting S1 to position 4 and reading on the 3-30 scale.

PW

PW TECHNICAL CROSS PUZZLE No.15



ACROSS

- 3 Feelers about reception? (8)
- 7 Song aerials Les removed? (4)
- 8 Bell-ringer with the electrical password? (9)
- 9 Eric broadcast as a cake-decorator? (4)
- 11 Guilty or not of pale modulation? (4)
- 13 Cut-out made by a big combine? (5)
- 14 Temper extra German insulation? (4)
- 16 Batteries replaced these in some relay systems? (5)
- 18 Save oscillation for a big pot? (4)
- 20 Zero volume in the musical section? (5)
- 21 Call sign of anyone? (4)
- 25 Quarrel with its backing being very loud? (4)
- 26 Sort of accent actors like to transmit? (9)
- 27 Its knobs alone won a contest! (4)
- 28 Wyatt to sharpen audio equipment? (8)

DOWN

- 1 Unseen greeting of various lengths . . . (5, 4)
- 2 . . . in the age of steam! (8)
- 3 Power unit that's the origin of cat's whiskers? (4)
- 4 Type of water? Try a transformer of it, lad! (5)
- 5 Drink, point north, and cater for vibration! (6)
- 6 No valve starters returned to Bristol area? (4)
- 10 And the remainder have shorted! (3)
- 11 Make a call after 22 Down? (5)
- 12 Nothing wrong with this component? (9)
- 15 Sales cut a twist over electric pieces? (8)
- 17 Original home of ham? (3)
- 19 Get the right pitch for tent reception? (6)
- 22 Very small before 11 Down? (5)
- 23 German girl in their magnetic field? (4)
- 24 His leads are about solid in water! (4)

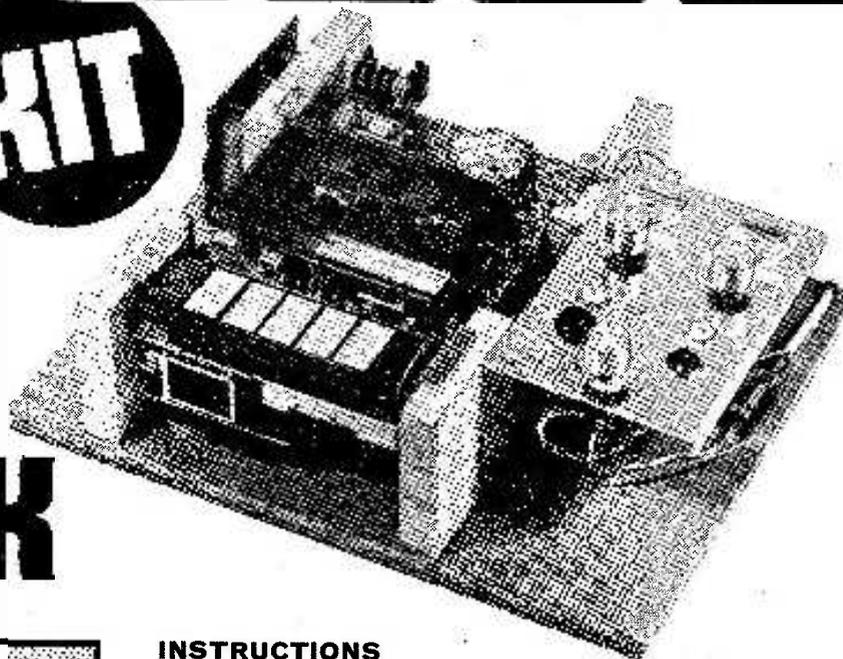
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**SPECIAL
PRODUCT
REPORT**

RTVC

KIT

**STEREO
CASSETTE
TAPE DECK**



MAIN SPECIFICATION

Power Input	220/240V 50Hz
Audio Output	At least 0.5V RMS
Tape Speed	4.8cm/s (1 $\frac{1}{2}$ in.)
Frequency Response	50Hz to 12kHz (3dB)
Recording Bias	57kHz
Motor	DC with electronic speed control
Auto Cut-off	Operative on all forward or reverse functions and in event of tape fault
Tape Counter	Push to re-set 3 digit
Dimensions	Deck mechanism 8 x 5 x 3 $\frac{1}{2}$ in.

INSTRUCTIONS

RT-VC rightly recommended that the constructor should be familiar with this type of equipment and able to solder properly. They point out that alleged faults are frequently due to bad soldering or wrong wiring. The instruction sheet supplied with the kit is to the usual high standard of RT-VC so that a constructor with any experience at all ought not to run into any trouble. I would have liked two copies of the instructions, to avoid having to continually turn the sheet over when the instructions referred to figures on the other side! I photocopied mine very early on in the proceedings!

The only error of any consequence in the instructions concerned the diagram showing the operating keys. This was immediately obvious when it came to operating the keys. They are, in fact, in the following order:—Record, Fast re-wind, Fast wind, Play, Stop-eject and Pause. A note is being added to the instruction sheets.

Apart from the kit the only other items needed are a mains lead, mains fuse (optional) and a cabinet or mounting board. **RT-VC cannot supply anything other than the kit.** It should be stressed that the constructor is going to spend more time producing a suitable cabinet to house the completed kit than he is in the wiring! From experience, the following points should be noted, complementing the instructions.

CONSTRUCTION

A wooden baseboard 12 $\frac{1}{2}$ x 10in. was used on which the deck mechanism, transformer and auto shut-off board were mounted. The pots, sockets, mains switch and meters were all mounted symmetrically on an aluminium panel 6 x 4in. fixed to the right-hand side of the deck. See the photograph. Wooden blocks 3in. high and 3in. long lifted the deck to provide adequate clearance underneath and allowed the wiring to run from the PCB board on the deck to the auto shut-off board and the control panel. It is possible to add blocks to the wooden runners on which the deck is mounted when received. When time allows wooden panels will be added to complete the cabinet.

One slight alteration to the instructions was to mount the auto shut-off PCB with the board outside so that the lettered pins faced outwards facilitating the wiring operation. Now, one very important point! Before finally fixing the deck it is essential to drill holes in the baseboard to coincide with the positions of the six pre-set pots on the main PCB or it will be quite impossible to adjust them later, as is

CORRESPONDENCE received by PW following the publication of the article on the 'Ascot' stereo cassette recorder/player in December 1975 indicated that a large number of readers would have made the project if they had been able to buy a kit of parts. In many cases the high cost of buying by post from several suppliers was sufficient to act as a deterrent. If any of those readers are still interested in such a project then the RT-VC Stereo Cassette Tape Deck Kit is going to fill the bill.

More than that, in fact, because 'kit' is not really a true description of what actually arrives in the package. The cassette deck mechanism is complete with a PCB which carries all the circuitry for the play/record preamplifiers for both channels plus the bias oscillator and other wiring. There is a separate PCB wired for the power supply and auto shut-off circuits, and a separate mains transformer. The remaining components supplied consist of two potentiometers, two level (VU) meters, two microphone sockets, a DIN socket for input/output connections, a mains on/off switch and a stereo headphone socket. This socket has a leaf switch attached which can be ignored, or removed.

It was not possible to check all the claimed characteristics of the kit but the more important ones were investigated and found to be satisfactory including frequency response, output level, and general mechanical performance. The main purpose of this review was to see if the kit supplied could be turned into a high quality stereo cassette player/recorder.

required in the instructions. This was a bit tedious but well worthwhile in the end. Alternatively a hole about 3 x 2in. would probably suffice.

The wiring instructions were quite clear and logical and the wiring operation took a leisurely three hours. If any other layout is used, which is permissible, some of the lead lengths will need amending.

ADJUSTMENTS

After checking the wiring the unit was switched on and the voltage to the main PCB checked. This was 13V which seemed reasonable although the correct value is not mentioned in the text, although I feel it ought to be. The operation of the various keys revealed the error in the instructions mentioned earlier. One is advised to connect the deck to the resident hi-fi amplifier for audio checks but in fact the headphone socket is quite adequate for all the tests required. Apart from the fact that the hi-fi is usually in a room elsewhere! A stereo tape was put in and the keys checked.

The adjustments required are to the six pre-set pots and the azimuth setting of the record/play head. The instructions are adequate albeit a bit terse. An example:—'set bias pre-set controls 5 and 6 to their mid-track position'. A little more information here would have been welcome. The azimuth adjustment is for 'maximising output level on high frequency notes' but unless one has a proper tape I would suggest that the head be left alone. The factory-set position turned out to be about right. The adjustment is the spring-loaded screw on the left of the head, which is not too clear in the photo on the instruction sheet.

A test signal of 60mV at 1kHz is required to be fed in and taped while setting two of the pre-sets for the OVU positions on the level meters. When this is done the correct part of the tape is played back and the remaining two pots adjusted for the OVU positions as before. No problems were encountered while making these adjustments as instructed. If you don't happen to have such a test signal it is suggested that the BBC test transmissions are used or even the inter-station noise from an FM tuner. As an experiment an audio tone was used from a communications receiver, beating the BFO against a steady carrier on the medium wave band, and using the high impedance headphone output. After a bit of playing about with the volume control the right level was found and the adjustments made quite satisfactorily.

The output level on a pair of 8Ω stereo headphones was adequate but the level can be changed by altering the ratio of the resistor divider on the headphone socket.

CONCLUSIONS

The kit is excellent value for money. The wiring is quite straightforward and the necessary adjustments easy to make even without any special equipment. Remember however, that YOU have to provide, and probably make, the cabinet unless it is fitted into an existing cabinet with other equipment. Do not ask or expect help from RT-VC in this connection. I was delighted with the performance of the kit when it was finally connected to the domestic hi-fi. Left was left and right was right, thank goodness! I can recommend the kit to anyone other than the complete beginner but do follow the instructions carefully as obviously a lot of work has gone into their preparation.

The kit, price £32.50, can be obtained by calling at either 323 Edgware Road, London W2, or 21c High Street, Acton, London W3 6NG. It can also be obtained by post from the Acton address but add RT-VC to the address and £1.50 to the cheque to cover post and packing. Pw

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PRACTICAL WIRELESS
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JINGLE MACHINE—continued from page 404

record the cue tone on the cassette. This can be derived from an oscillator, set to about 1kHz, or alternatively, a tone may be obtained from Hi-Fi test records or even the Greenwich Time Signal may be used. Switch the cassette recorder to play and wait until the leader tape has passed over and the recording tape is reached. The tone source is then connected to the record sockets and about one second of this signal is recorded.

Rewind the cassette once more but then switch S3 to "Auto" which brings the jingle machine into use, also switch on the supply to the unit. With the cassette recorder switched to "Play" operate the start button. The cassette will play, and then be switched off, a few seconds after the end of the tone burst. The jingle can now be recorded with S3 switched to "Normal", once this is completed the cassette can be replayed with S3 on "Auto" so that the cassette recorder switches off automatically once the jingle is over. The jingle can be repeated a further nine times, then the cassette is left blank for 15 seconds. Proceed then to use the cassette for recording other material.

After the last jingle, use a chinagraph pencil, or poster paint, to mark the end of the jingle section of the cassette as this helps to prevent the section of tape containing other material being played instead of the jingle. Suitable jingles and sound effects can be taken from records.

Label the cassette case on the opposite edge to the normal title section on the plastic lid. Print either an index number appropriate to that jingle or use an abbreviated form of the title. Then whenever jingles are needed, the cassettes are stored close at hand with the jingle title showing instead of the cassette titles.

Prior to the jingles being used the cassettes are fully re-wound and cued using the tone burst. Then when required, the jingle is played by merely inserting into the player, jingle machine on automatic, and supply on. Switch the cassette recorder to play, then at the appropriate time operate the start button whereupon the jingle will play. When completed, remove the cassette and check for the mark denoting the end, re-cue if necessary, and replace the cassette in the rack.

The remote control unit may be built using a small plastic container which has a single press switch inside. This is wired to a 3.5mm jack plug for insertion into socket SK1. This is ideal when the jingle machine cannot be accommodated on the console. Pw

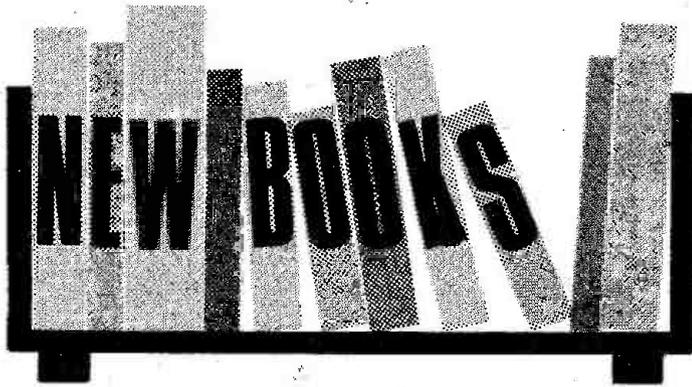
See October issue for a mains power unit.

KINDLY NOTE!

CASSETTE POWER SUPPLY FOR CARS. AUGUST 1976.

The circuit diagram (Fig. 1.) has an error in that the base of Tr3 has been connected to the wrong end of R3. It should not go to the positive output line but to the emitter of Tr1. The PCB layout is correctly drawn in this instance.

However, there is an error on the wiring pattern in the area above the IPC mark. The two vertical holes, battery positive and Fl, must be isolated from the rest of the pattern. Boards supplied by our Readers PCB Service will be correct.



RESISTOR SELECTION HANDBOOK

By B. B. Babani
 Published by Babani Press,
 The Grampians, Shepherds Bush Road, London, W6
 7NF.
 48 pages 17cms x 10.5cms
 Price 60p

THIS book tells you in English, German, French, Dutch, Italian, Spanish, Portuguese, Danish, Swedish and Norwegian, how to combine two preferred values to obtain any required values of resistance. Some information about fixed resistors, standard ranges, colour codes and markings are also included together with a section on power ratings of fixed resistors. The book which obtained some of its material from *Electronics Australia*, is completed by an item on resistor calculation formulae.



ELECTRONIC CIRCUITS FOR MODEL RAILWAYS

By M. H. Babani, B.Sc. (Eng)
 Published by Babani Press,
 The Grampians, Shepherds Bush Road, London, W6
 7NF
 91 pages 18cms x 10.5cms
 Price 85p

THE book begins with constructional details of a simple model train control and a controller with simulated inertia. The reader is then told how to build a signal system, how to suppress RF interference from model railways and supply lighting for model trains. Further projects include a high-power controller, an electronic steam whistle and a "chuffer".

A list of semiconductor equivalents is included together with details of available nickel-cadmium batteries and cells.



AUDIO ENTHUSIASTS HANDBOOK

By B. B. Babani
 Published by Bernards (Publishers) Ltd.,
 The Grampians, Shepherds Bush Road, London, W6
 7NF.
 96 pages 18cms x 10.5cms
 Price 85p

THE Contents of this book, which includes material previously published in *Electronics Australia* magazine are: record/playback curve; stylus compliance, mass, etc; disc recordings—then and now; how do we evaluate loudness?; how compatible is compatible?; more about acoustic feedback; what's all this about Hi-Fi?; amplifier power ratings; less noise—more dynamic range; why the elliptical stylus?; stereo tape track standards; compensating sideways drag; equipment performance—some typical figures; how to control volume on a supplementary speaker; recording 78 r.p.m. discs with minimal background noise, and pickup tracking error—cause, effect and cure.

Practical Wireless, September 1976

TELEVISION

IN THE SEPTEMBER ISSUE

● UP-CONVERTER

What do you do if you want to receive 625-line v.h.f. signals (say from the continent or via a cable distribution system) and can't get a set with v.h.f.? The answer is to use a v.h.f./u.h.f. up-converter. Full details next month of a practical design.

● DEALING WITH INTERMITTENT FAULTS

The most difficult faults to deal with are those that come and go intermittently—and in fact may even never be seen by the service engineer! They can in particular take up a greatly disproportionate amount of workshop time. E. Trundle describes in detail his experiences in tackling this type of fault, and puts forward the "positive diagnosis philosophy"—proving that the fault has in fact been eliminated.

● THE SAMPLEDOT SYSTEM

The bandwidth required for normal TV transmissions is enormous compared with other forms of radio communication. Many suggestions have in the past been made for ways of reducing this bandwidth. The Sampledot system developed by the American General Electric Company could be the first to become a practical proposition.

● SERVICING FEATURES

The Mini Vox 11in. portable was imported in great quantities in the early 70s and is well worth restoring. Full details of common faults and how to deal with them. Also a guide to faults encountered on the GEC C2110 series solid-state colour chassis.

● TALKING ABOUT COLOUR CRTs

Is the tube going or not? Does the degaussing system work? What's the difference between hard and soft focusing? These and many other points are covered by Harold et al. this month.

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DW 'Easybuild'

VIDEO-WRITER

PART 2

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

WRITING PRINCIPLES

Whether the unit reads or writes is determined by the signal level on the link between the Write Control block and the RAM (see Fig. 2). This is the R/W (Read/NOT Write) line. Normally this line is kept at a logic level "L" which enables the system to read out of the memory. Last month's explanations of the READ cycle assumed that this was the case. There are 6 data lines feeding into the Random Access Memory and when R/W is at level "1" the RAM

will take no notice of signals on the data lines but if the logic level falls to a "0" the logic conditions of the data line will be latched onto whatever part of the RAM's memory is being addressed by the Address Counter.

Imagine the system operating in slow motion. The Address Counter will be telling the RAM to give out data, from each of its address locations, to produce the right character in the correct position on the television screen one after the other. Let's say we

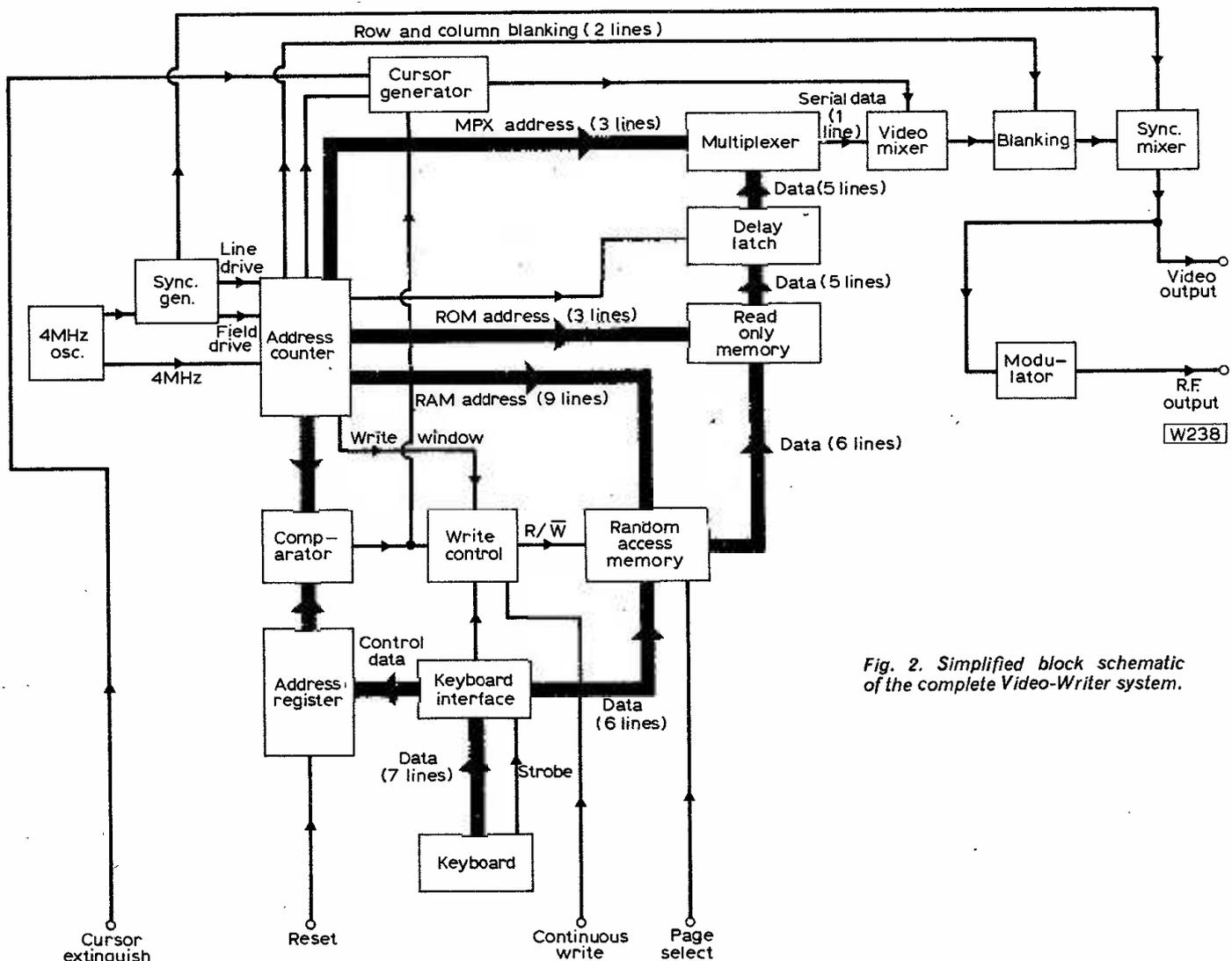


Fig. 2. Simplified block schematic of the complete Video-Writer system.

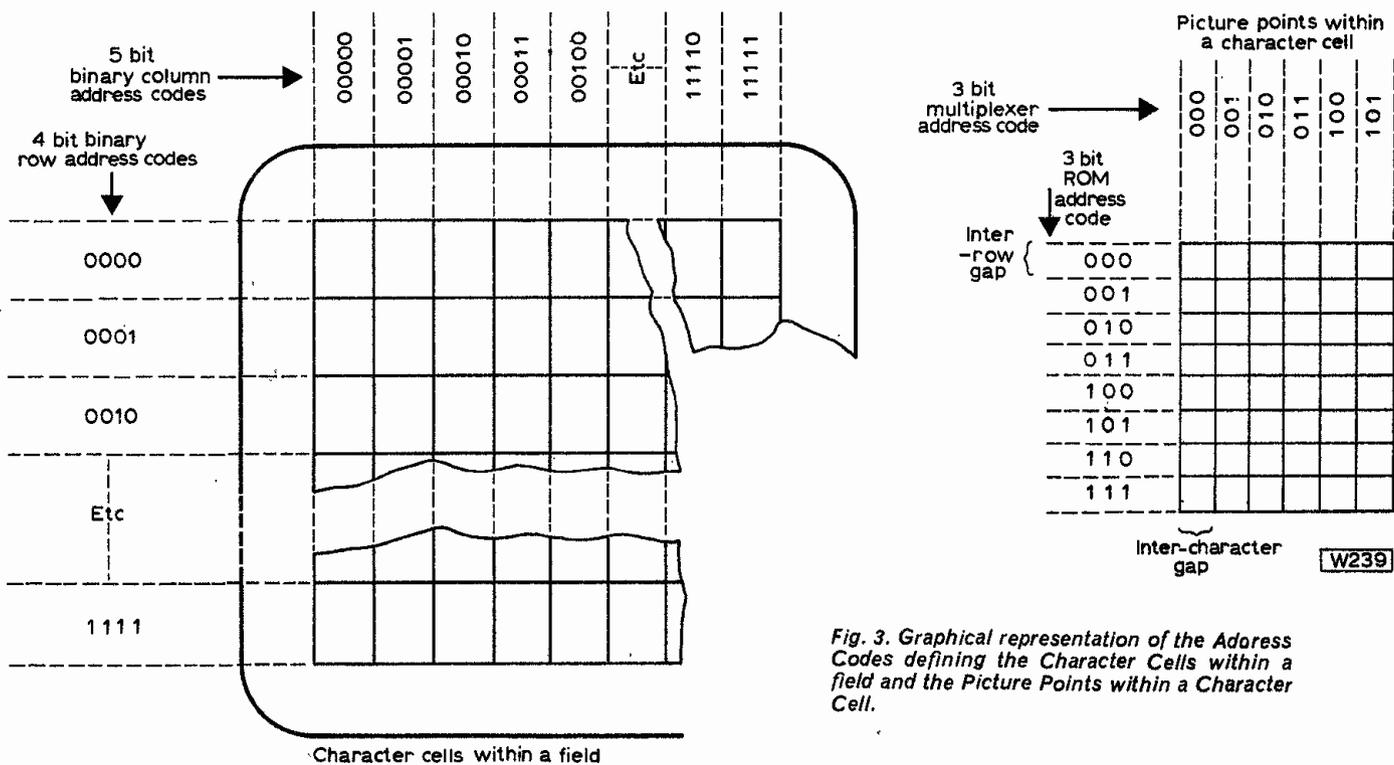


Fig. 3. Graphical representation of the Address Codes defining the Character Cells within a field and the Picture Points within a Character Cell.

want to type in an extra character in the first column of the third row of characters. This character would be held in the position of memory with the address 0010 (Row) and 0000 (Column) (see Fig 3). We have to arrange that the data to describe the character (say the letter E) is placed on the input lines to the RAM. This is done by pressing the correct key of the keyboard and the ASCII code 000101 (see Fig 4) is put on the data lines as soon as the key is depressed and is held there for as long as the key is pressed. Remember that the R/W is normally at "1" and the RAM will take no notice of the data. This is just as well, because the address is changing all the time and if the RAM did not ignore the data until some special signal comes along we would write the letter E into every location of the memory, thus filling the screen with Es!

The RAM will only accept the data when the R/W signal goes to "0" and we arrange for this to happen at the moment the output from the Address Counter is interrogating the position of the memory into which we wish to place this data. This is easily done by making use of a second type of binary counter called an Address register. This counter has 5 stages, exactly matching the five stages in the Address Counter, which describe the Column Addresses to the RAM and it also has 4 stages to match the Row Address Counters in the Address Counter. The Binary states of the stages of the Address Register are static (i.e. do not change) until we depress the line feed key of the keyboard, press a character key or spacer bar. If any of these happen the Row or Column Address Registers will count up by one (Increment) except in the case of reverse operation when the Registers count downwards and will decrement. The registers thus hold the address of the position of the next character to be printed on the screen. More will be said about this portion of the system later.

The nine address lines from the Register are fed to a COMPARATOR which compares them with the 9 RAM Address lines from the Address Counter.

Only when the Address Counter output exactly matches the output of the Address Register will the Comparator give an output signal. This signal is fed through the Write Control unit in which the pulse is shortened to occur in the centre of the address code duration (it is also inhibited at certain portions of the addressing cycle by the Write Window signal which comes from the Address Counter—again more about this later). The processed signal becomes our R/W and causes the latter line to drop to logic level "0" at the exact moment we are addressing the memory for the position on the screen we wish the character to occur. The 6 data lines are thus recorded in that location of memory and in no other place.

CURSOR SIGNAL

It should now become clear as to how we generate the Cursor signal. This is a chequered pattern which is superimposed on the screen in the position which will be the next place to accept a character. This is defined by the output of the Comparator. The Comparator output will be "1" every time there is an address coincidence i.e. for the full duration of the TV raster line on every raster line of the cell in question. If we superimposed this coincidence signal on our final video we would make the whole of the cell WHITE. While this would do it is a simple matter, in practice, to break up the signal to provide the chequered effect. This is done by gating the output of the Comparator with signals from the Address Counter within the Cursor Generator Circuitry. This compound signal can be over-riden by the "Cursor Extinguish" signal which is controlled by a switch on the front panel of the instrument.

KEYBOARD STROBE

We have oversimplified the output of the keyboard unit slightly. It is true that depressing the correct key will produce the ASCII code but it is possible that there may be internal delays in the generation of each bit of the code. It is therefore necessary to

have a slightly delayed "STROBE" signal generated by the keyboard which is used to tell the rest of the system that it can accept the data as being valid. In the prototype unit there was approximately 1.5mS delay between the data being set up and the strobe signal starting. This is ample delay as the minimum required by the system is 2μS AFTER the data has reached a stable condition. There is no maximum delay.

By making use of this strobe signal one could economise by not using a conventional keyboard and simply use seven toggle switches, together with a push button, to enter data. The data would be set in ASCII code on the seven switches (remember we only need the least significant six bits for memory but the seventh bit is required for control functions) and the strobe simulated by the push button—which would have to be protected against contact bounce. A circuit for such a system will be shown at the end of the series.

KEYBOARD INTERFACE

This circuit accepts all seven data lines from the keyboard, together with the strobe, and passes the least significant six bits directly to the RAM data inputs without any processing whatsoever. It does, however, use all seven bits of data to decide which are WRITING and which are NON-WRITING codes. The strobe, together with the address coincidence signal, is used as the prime source of the R/W signal, as already discussed, and the keyboard interface over-rides the write command when a non-writing code is generated from the keyboard, e.g. Line Feed, Carriage Return, Forward/Reverse or Cursor Step. Apart from inhibiting the Write Command on these control signals it decodes and feeds them to the Address Register on four separate lines.

ADDRESS REGISTER

This comprises two binary counting chains. One is a five bit counter describing the position of a cell in a particular row (column address) and the other a four bit counter defining the row on the page. They differ from conventional counters because they are reversible (i.e. respond to an UP/DOWN command) to enable Forward/Reverse operation. They are also "Dead End" counters. This means that when the outputs are "All Ones" when counting upwards the

counter stops in that condition instead of cycling round again for a second or third time. Likewise when counting downwards they stop when they reach "All Noughts". Without this "Dead End" facility there would be a danger of "over-writing" a line of text if one inadvertently ran off the end of that line.

All stages of the Address Registers can be reset to Zero by means of the "Reset" signal generated from a front panel push button. This is a quick way of starting at Address 00000 (Column) 0000 (Row) which is the top left hand cell on the page, the normal starting point for writing.

The signals from the Keyboard Interface act on the Address Registers as follows:

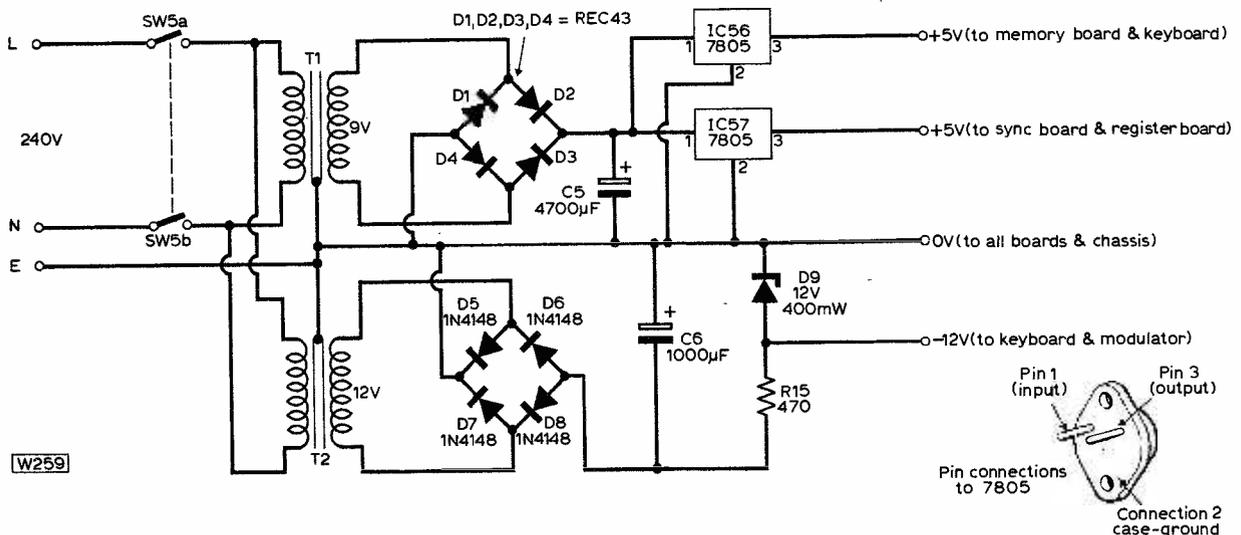
Line Feed	Increments the Row Address Register
Carriage Return	Resets the Column Address Register to 00000
Forward/Reverse	Toggles a flip flop which changes the direction of both the Row and Column Address Registers
Character Step	This is a combined signal generated from Cursor Step and any WRITING code (e.g. a character or a character space) and increments the Column Address Register.

CONSTRUCTION

We can now start detailed construction instructions and as we go through the system we shall describe the workings of the various stages in more detail.

The system comprises three printed circuit boards and an aluminium plate holding the power supply components in place. These four "Modules" are mounted above a main aluminium chassis by screws and spacers. The Clare Pendar keyboard, used in the prototype, has a certain amount of circuitry associated with it but this is integral to the keyboard as purchased and need not be considered at this stage.

Fig. 5. The schematic diagram of the power supply to provide the two voltage levels at their correct currents.



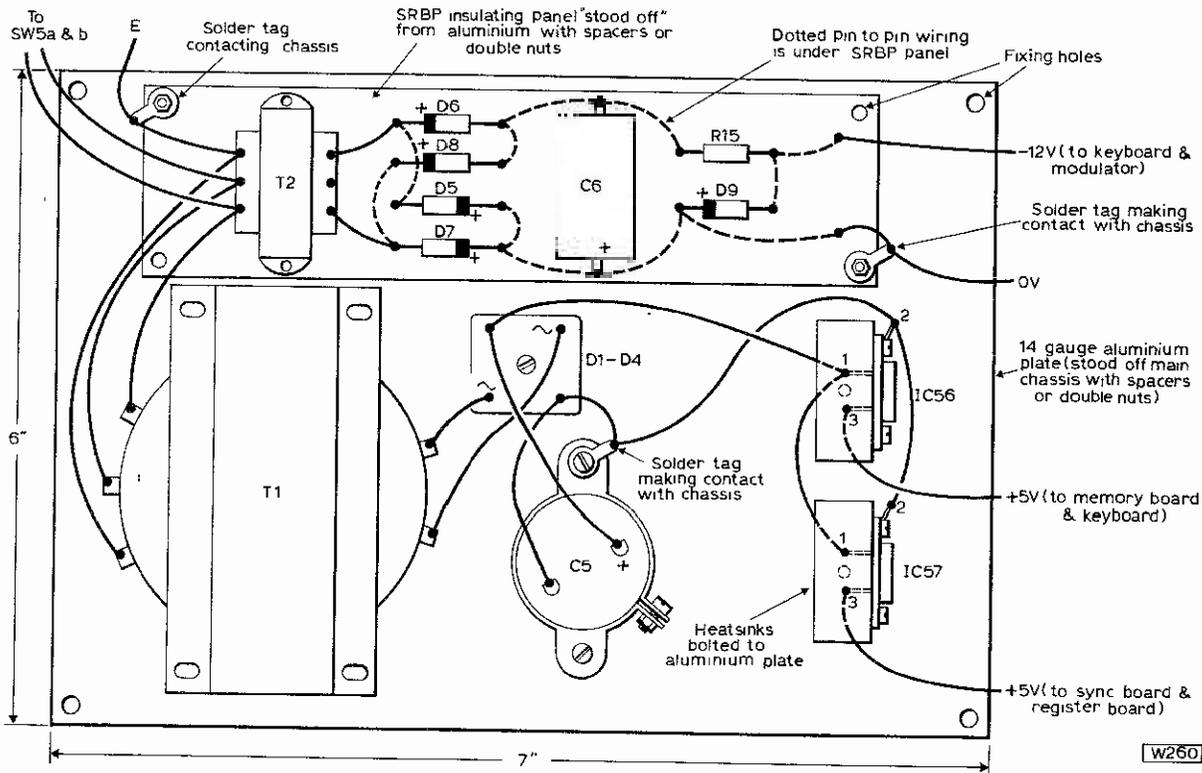


Fig. 6. The component layout for the power supply board. Although the bridge rectifier for the 5V supply is shown as square it is in order to use in-line units provided they meet the electrical spec. and will fit.

Apart from the keyboard and modulator units the only power requirement is +5V at an average current of about 1.5A (peaking for short durations to 2A). The specified keyboard needs an extra power rail, nominally -12V at a few milliamps, as well as the +5V rail. If alternative keyboards, or toggle switches, are used the -12V rail may not be needed. The specified "Crofton" modulator requires a -12V rail and the power unit we describe is capable of providing sufficient current for both modulator and keyboard.

POWER SUPPLY UNIT

Fig 5 shows that the +5V and -12V rails are totally independent.

The +5V supply requires a generously rated transformer capable of supplying 9V at up to 2A rms. This is fed to a 3A bridge rectifier and a smoothing capacitor, then split to feed two separate "7805" five volt regulator ICs. Two are used because a single regulator would have difficulty in handling the current requirement for the whole unit. The regulators are bolted to small heatsinks which, in turn, are fixed to the aluminium base plate.

The -12V supply originates from a 6.0-6V, 100mA transformer with the centre tap unused. This is bolted to an SRBP board on which the rest of the components are mounted with pins. Because the current required is small it is possible to use 1N4148 diodes as rectifiers and the nominal -12V is obtained by tapping across a 400mW zener diode.

It is suggested that the power unit be built first, following the layout of Fig. 6, as it can then be used to test the other three boards as they are built.

Next month we shall continue the construction and operation detail.

★ components list

Power Supply Unit

Resistors

R15 470Ω 10% ¼W.

Capacitors

C5 4,700µF 25V min.

C6 1,000µF 50V min.

Semiconductors

D1 }
D2 } 3A, 100V; encapsulated bridge rectifier.
D3 } R.S. Components type REC 43 or equivalent.
D4 }

D5 1N4148

D6 1N4148

D7 1N4148

D8 1N4148

D9 12V zener, 400mW.

IC56 7805. 5V regulator, TO-3 case.

IC57 7805. 5V regulator, TO-3 case.

Miscellaneous

7" x 6" 14 gauge aluminium for base. 7" x 2" SRBP for 12V supply board. Board pins. Solder tags. 2 small heatsinks for TO-3, Home Radio type TR89 or similar. 2 Pole, mains rated switch (S5). Transformer, mains in, 9V at 2A out, Douglas type MT-3-AT tapped between 15V and 24V or similar (T1). Transformer, mains in, 12V at 100mA out, could be 6-0-6V with centre tap open circuit (T2).

EXHIBITION of Military & Civilian RADIO at Horsham Museum

BILL TULL



ANOTHER raining Bank Holiday—what shall we do? How about a museum? Want to lose the kids for a couple of hours? Take them to a museum. Any museum, doesn't really matter, as long as it achieves its purpose—as an excuse. Well that was probably the old idea of trips to a museum when they were dark and foreboding places, but today things have changed, as I found out during the Spring Bank Holiday this year.

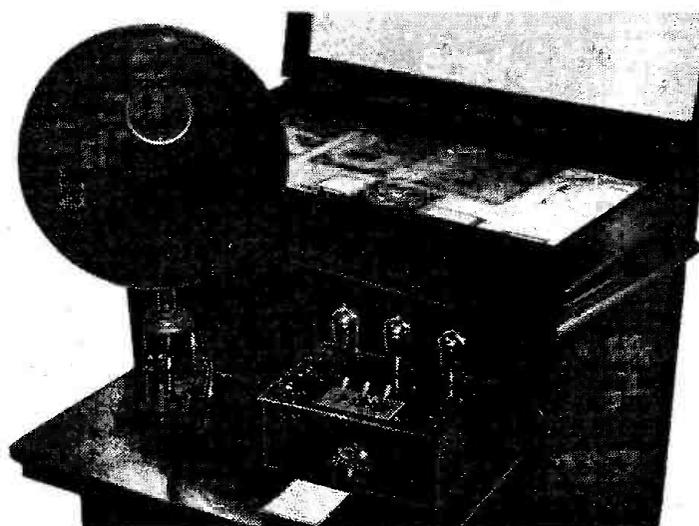
I was in Horsham, Sussex, a small town about 20 miles from Worthing, where I visited the local museum which is housed in a 16th century timber

framed house in the Causeway. Expecting the usual sort of displays, I was pleasantly surprised to find an exhibition of civilian and military radio dating back to the early part of the century. This of course was only one part of the museum, the remaining sections depicted local shops of a bygone age such as a saddlers, wheelwrights and blacksmiths. Also amongst the collections was a display of bicycles ranging from the Victorian hobby-horse to the safety bicycle of Edwardian days.

However to get back to the collection which especially interests all of us, the various pieces of equipment were lent to the museum by Mr Ron Ham of Storrington, who compiled the collection from various enthusiasts including himself, the Worthing ATC, and local collectors.

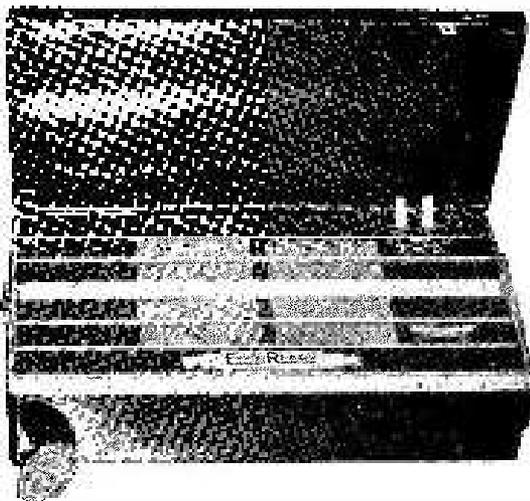
Spark transmitter

The first photograph would at first sight appear to be a high quality piece of transmitting equipment suited to the home of a well-to-do country gentleman during the second decade of this century. In fact it's a first World War service issue for use by the infantry



in the trenches. It's a spark transmitter receiver and requires an aerial of up to 80 yards to obtain any sort of transmitting distance. Cabinet is in solid mahogany or similar wood with solid brass contacts and terminals. The finish is superb and was originally built by Marconi. Notice the circuit diagram on the underside of the lid—useful for in-trench repairs!

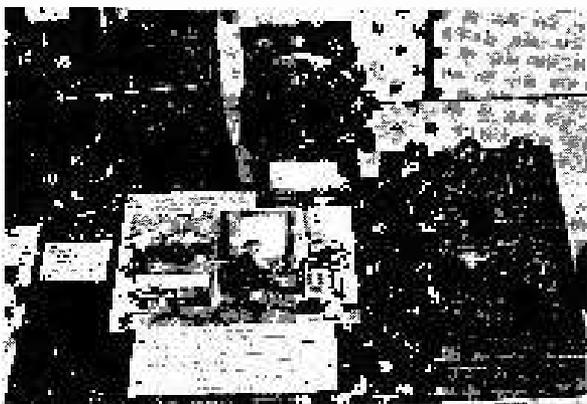
After the first World War, amplification equipment took on a new trendy image, and the second photograph shows an audio amplifier with matching loud-speaker! Both were made in America in the 1920s by Magnavox Co. The amplifier used three bright emitter valves each with a separate variable filament control and an individual switch for each stage. The large pot at the base of the Horn speaker is the energising coil, and to its left is the output transformer. Situated behind the amplifier and speaker is a cabinet of old periodicals published in the early 1920s, and Broadcast Licences dating back to 1923.



produced by the Ever-Ready company only nine years later in 1940. The relevant size can be judged by the 50p piece along side the model. Needless to say the Ever-Ready model created quite a stir when introduced and was made possible by the use of miniature glass valves and a certain amount of 'shoe horning'.

Military equipment

At the onset of the second World War, military equipment in the transmitting/receiving fields was quite bulky but reasonably reliable. Possibly those who served in tanks will remember the next picture which is of the famous '19' set used throughout the war. However the particular thing about this model is that although manufactured by the Canadian Electric Co, the dial markings are in both English

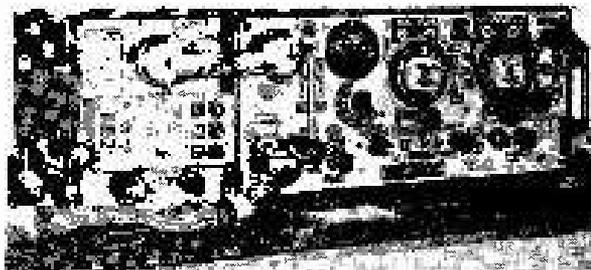


One of the latter is a licence for the Home Constructor! and cost ten shillings. An interesting point is that before this licence could be issued the apparatus had to be approved by the BBC. Most of these licences came from the collector and original recipient Mr Cyril Lagen.

Record breaker

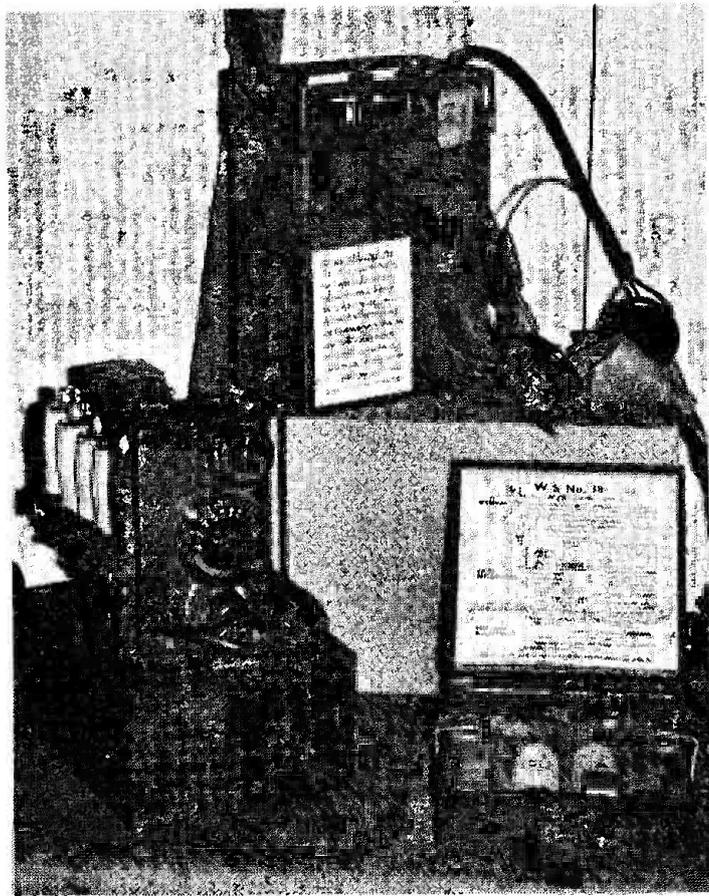
Moving on a few years to the mid thirties, the next photograph depicts the late Miss Nell Corry G2YL and some of her radio equipment, all of which was home made in her Surrey home. She is particularly remembered for her part in creating radio history on the 27th October 1935. On this day she managed to contact six radio stations situated in six continents. Also shown is the morse key that she used for this attempt, her car radio badge and tuning capacitor.

A little before this time, in about 1931, Pye launched on an unsuspecting public, their first 'portable' model. No Trades description act in those days! As it weighs at least 30lbs it is hardly portable and required an accumulator, multi-tap 120V battery and a grid bias battery to drive it. The accumulator would have to be recharged at 3 to 4 day intervals, when it would have been carried to the local shops or garage to be charged. The other two batteries lasted on average about five months. A useful fitment to this set was a metal turntable fitted to the base of the set, which allowed the receiver to be rotated for accurate, and best reception. Compare this description with the next photograph. This was

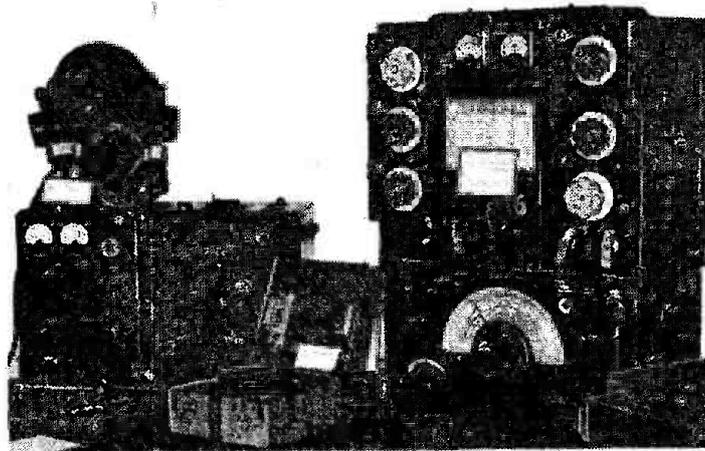


and Russian. The explanation is that during the offences the tanks could be operated by either British troops or our 'allies'—can't quite see that happening today! Shown in the next photograph is the '38' infantry set which was carried on the shoulder and was complete with throat microphone and headphones that could be worn under the helmet. In the foreground is a box of spare valves with instructions for 'fault-finding'.

Moving up into the air now, the RAF at this time was equipped with two very well known pieces. For the 'Spitfires' the TR9-F transmitter/receiver was used in early wartime planes and derived its power



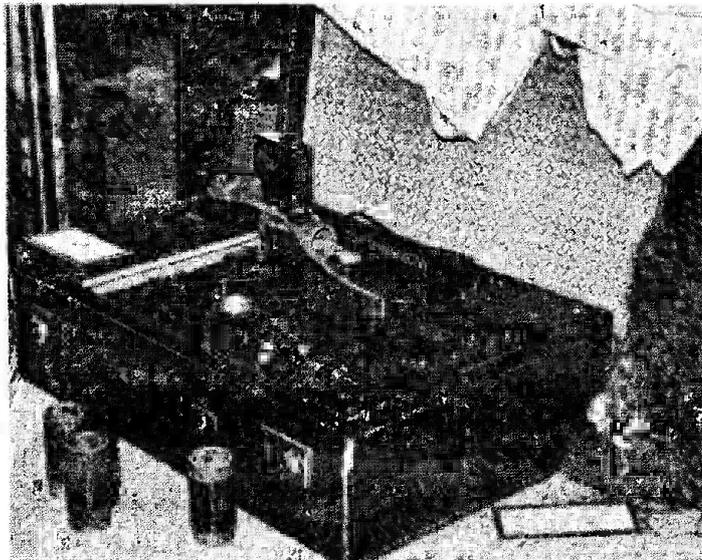
from a single HT battery, a grid-bias battery and an accumulator. If the pilot had to bale out in a hurry, a special jack plug was invented that released itself, so preventing the pilot from coming to an unfortunate end. This model is shown to the left



of the next photograph, while to the right is the equipment used in Lancaster bombers. These were the T1154 transmitter above, and the R1155 receiver below.

Equipment for spies

The final photograph shows radio equipment used by SOE (Strategic Operations Executive) agents. In other words equipment used by spies! The large suitcase model, the B2 was carried around by agents and covered only by a thin layer of clothing as shown here. The morse key, which is a very small affair, is sited in the top left hand corner, while the aerial is a thin piece of wire, perhaps five feet long attached to the nearest convenient spot. Alternative coils can



be seen in the foreground, the total weight of the equipment is quite astounding considering the distances it had to be carried.

Repeat performance

There were many other notable pieces in this display, but space has limited us to these models. Unfortunately the exhibition has now finished at the Horsham Museum, but will be on display again at the Worthing Museum. The dates for this latter exhibition will be from August 10th and run for about six weeks, and will include several new items such as two pre-war Philips radio sets, an army signalling unit employing an Aldis lamp and a special aircraft morse key used in war-time Lancaster bombers,

PW

KINDLY NOTE!

Digital Frequency Meter, June/July 1976

The four display boards required for this project are now available from the PW Readers pcb Service. The Ref. number is A004 and the price for four-off is £3.32, and one-off £1.01. Both prices are inclusive of p&p and VAT.

The following points should also be noted in connection with this project:

R7 should be 10Ω (Fig. 7)

R3 and not R1 should be 1W (component list)

Breaks should be made in the tracks of the main board (Fig. 11) at the following points: W51, X51, Y51 and all seven tracks under IC10.



quency spectrum (it need not be 27MHz) the RSGB would not only place themselves in a strong position by being able to recommend to the Government what restrictions on licensing etc should be introduced, but would do their members a service by providing a means of communication to those many members of the public who could usefully use such a facility and who are at present frustrated by the licensing system. If membership of the RSGB were made a condition precedent to the obtaining of a CB licence the RSGB would have a lot to gain by making its proposals to the Government at the earliest possible opportunity. **J. B. Howell-Pryce** (Oxford).

stupid prank I soon had an official visit by the GPO who, after ordering me to switch off my transmitter, proceeded to take down the description and serial numbers of my domestic radio equipment (I used to be a compulsive collector of all the latest transistor radios and recorders that came out!) that happened to be in the lounge at the time, where I had the transmitter.

When my case came up(!) the magistrates fined me £75 + £50 costs, and as if that was not enough, they confiscated my much-loved transmitter (naturally) and they also confiscated my dear EC10 receiver. They also took my old record player and my field-strength meter and tried to get a high-quality reel-to-reel recorder a cassette recorder and a portable radio. **T. W. Hillyard** (Northampton).

Let this be a warning to all potential illegal transmitter operators. We fully agree with the action taken by the GPO, who, as can be seen above, are not fooling—Ed.

CB for UK

I read with interest your leader in the July issue of PW, particularly as I have just returned from the United States where I was able to observe the current CB "craze" at first hand. Whilst agreeing in the main with your comments I feel I must make some observations.

The 27MHz band allocated to CB users has been divided into 23 channels, channel 9 of which has been reserved as an emergency channel and channel 19 of which is commonly regarded for use by highway users. Although channel 19 was certainly busy there was little evidence that the amount of traffic was causing serious communications difficulties, mainly due I suspect to the limitation in the range of CB mobiles to about 5 miles. There is apparently a proposal to increase the number of channels to around eighty by introducing SSB. Provided a similar system of channelling is introduced in Britain, with or without SSB, I cannot see that there would be any serious problem with overcrowding on the band.

There is no doubt that in the state of North Carolina at least the CB facility is regarded as a "good thing", not least by the Police force who monitor and record all transmissions on Channel 9.

If the RSGB would take the initiative and press the Government to introduce a CB band on the lines of the American system somewhere in the radio fre-

You've been warned

I have taken PW since 1963 and have, in general always agreed in principle to the contents therein.

However, I received the July magazine today and eagerly opened the pages to the Leader Article which was about the inevitable UK "Citizen's Band", and was motivated to write to you by the phrase: "There should be very stiff penalties for pirate stations...".

Now before I am swotted down with a good solid piece of irrevocably conceived "and so there *****-well should be" please allow me to say that every man has his story to tell, and would you kindly let me relate my experiences to you, the backbone of wireless, which simply means all the readers of Practical Wireless.

Some years ago I experimented with very-low-power transmitters on the MW-Band (on 1562kHz and, Caroline was not on, on 1187kHz). I used a good Crystal Drive Unit with an oven, the thermostat of which was adjusted critically to obtain exceptional accuracy. (The crystals were fine-tuned in the evening to the distant signals that appeared on the two channels used; typically an accuracy of one cycle in one minute could be achieved, even after taking into account the fact that two distant signals themselves were at times fluttering somewhat).

Because of someone playing a

Model control v. CB

I recently joined the United Kingdom Citizen's Band Campaign, not being very technical, it is probably the only way that I shall get on the air. It also coincides with my belief that radio should be free of unnecessary restrictions. This depends on whether we ever get CB licences in the UK, because I think we shall have a very hard fight, especially on the 27MHz band.

The real opposition will come from the Model Control fraternity, because it seems that in the UK our Home Office have given them practically exclusive rights to all channels between 26.96-27.28MHz.

The UKCBC have an information sheet 2 which suggests that for Europe there are 6 channels exclusive for Model Control and 2 shared.

You might say why not use other bands or even VHF or UHF, but I think it would lose the international appeal if we did not have the same as Europe and USA namely the 27MHz band. Though I agree the chances of the

skip being OK and to be able to hold a signal on a crowded band are limited, nevertheless the appeal is there.

So I would say before we have a Citizen's Band in this country an agreement will have to be made with the Model Control Fraternity.

The *Practical Wireless* has a full page written by the Editor, who says that there will be a Citizen's Band in the UK, but doesn't say when, and suggests that there be a condition of membership of the RSGB (I am a member £8 per yr.) before any licence is issued. All I can say is what about the other Radio and Recording Clubs providing they are not too snooty to embrace CB members.

You have to remember that in USA and Canada and no doubt in Europe, the CB clubs are big business with glossy magazines, why shouldn't some of the existing clubs get in on the act.

Finally I must admit that we do not have distance problems like they have in USA and Canada and emergency systems like REACT would be useful but not really necessary. However, there are the old, disabled, and the lonely who could benefit from CB radio and I am all for it, especially as we are now at the bottom of the propagation cycle and reception is bound to improve.—**Stan Playle** (Welwyn Garden City)

Cheap-at-the-price

I feel bound to comment on Mr. Dowdeswell's tacit support of the comments made by A. J. Lees and G4CEX in the May edition of *Practical Wireless*.

It may be that the former has not read the technical topics in Radio Communication, nor has he seen the many simpler articles published therein. Nevertheless, he must be aware that the Radio Society of Great Britain is not simply a publishing house, it exists for the furtherance of Amateur Radio Communication and Experimentation. If G4CEX wishes to retain frequency, repeater, beacon, and mote facilities after 1979 which the Society has obtained for all amateurs at its own expense, then it is his duty to rejoin the Society and to willingly give his annual subscription of £8

which after all represents the cost of motoring 100 miles.

Let him also buy the new copy of the Handbook which when published will undoubtedly be as complete a guide as the last edition was to the subject in which he is interested.—**W. M. Miller** (Cambridge)

Valves?

In writing this rather critical letter, about the magazine *Practical Wireless*, I believe I am voicing the attitude of many people who now buy it only rarely, while in the past, they used to buy it each month. The reason is that although it is titled *Practical Wireless*, there isn't any "wireless" in it. In case you are not aware, wireless sets use valves, not semiconductors. Nowadays it seems that your magazine contains nothing but electronic gimmickery, with no sign of any wireless circuitry anywhere. If you intend to keep to the present policy of making little or no difference between the two magazines, namely, *Practical Wireless* and *Practical Electronics*, then there is little point in being two.

By the way, don't think that I am what you might call elderly, I have just passed the thirty mark, but it would seem from your magazine that you are aiming exclusively at the under-twenty group.—**Alexander Dodd** (Glasgow)

2 metre repeater

May I express my growing concern for the sanity of our 2m VHF Band. In the past two years, 2m has been eroded from an interesting, friendly, experimental, amateur band, to an unsociable mess of channelised/Mobilised debris.

The introduction of Simplex working was quite bad enough, (instigated, perhaps by the "black-box" fraternity), but the new onset of repeaters, requiring not one, but two channels is just about the last straw.

It is in fact difficult to appreciate how consistently operating

through a repeater can fulfil the licence conditions i.e. "self training in the art of telecommunications", (even worse with a "black-box"). After all does the amount of mobile activity on 2m justify the dedication of so much air space.

In view of all this, would it not be possible to negotiate for the 4m band to be available to G83's and kill two birds, as it were?

- 1) Populate a 'dead' band
- 2) Organise a VHF band with no repeaters, and no channelised segments.

A band of this type is still very necessary for the newly licenced man who wants to be an amateur, rather than a push button operator, whilst not delving into the "microwave oven".—**E. Watt** (Kidsgrove)

CB in Canada

I feel I must comment on your editorial in the July edition of *PW* about Citizen Band Radio. I must congratulate you on your comments about linking CB in the UK with the RSGB for proper instruction of licencees. I lived in Canada for some time and I was the proud owner of a CB licence, but I must point out that even though an awful lot of people operate Citizens Band radio's the power output to the RF stage in these sets is only 5W.

In my experience of CB the only time I got a feeling of overcrowding on the 23 channels we worked on was when the skip came in. In my opinion though the pro's far outweigh the con's for CB radio, so that when I arrived in Canada for the first time I obtained a CB radio and through this I met a lot of people and made a lot of friends. I found that it is much more entertaining than television and on a Sunday night we held a net in our district which is just like being on a giant telephone party line. One more thing before I close, I was a member of REACT an emergency club who's sole aim is to provide instant radio communication in the event of any accident or emergency.

Citizen Band radio can't come to Britain fast enough for my liking, and I would like to apply for my licence now.—**Ian Mclean** (Renfrewshire)

Practical Wireless, September 1976

SUPERSOUND 13 HI-FI MONO AMPLIFIER



A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 8 ohms. Frequency response 12Hz 30KHz \pm 3db. Fully integrated pre-amplifier stage with separate Volume, Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3" high x 6" wide x 7 1/4" deep. AC 200/250V. PRICE £13.75. P. & P. £1.00.

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A.C. mains 200-240 v. U.S. 115 v. Heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up: 2 x ECL86 Triode Pentodes. 1 x EZ80 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300mV for full peak output of 4 watts per channel (8 watts mono), into 8 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11" x 4" d. Overall height including valves 5". Ready built & tested to a high standard. £12.40. P. & P. £1.30.

HARVERSONIC STEREO 44



A solid state stereo amplifier chassis, with an output of 3-4 watts per channel into 8 ohm speakers. Using the latest high technology integrated circuit amplifiers with built in short term thermal overload protection. All components including rectifier smoothing capacitor, fuse, tone control, volume controls, 2 pin din sockets & 5 pin din tape rec. play socket are mounted on the printed circuit panel size approx. 9 1/2" x 2 1/2" x 1" max. depth. Supplied brand new & tested, with knobs, brushed anodised aluminium 2 way escutcheon (to allow the amplifier to be mounted horizontally or vertically) at only £7.50 plus 50p P. & P. Mains transformer with an output of 17v a/c at 500mA can be supplied at £1.50 + 40p P. & P. if required. Full connection details supplied.

VYNAIR & BEXINE SPEAKERS & CABINET FABRICS app. 84 in. wide. Our price £1.50 yd. length. P. & P. 50p per yd. (min. 1 yd.). S.A.E. for samples.

BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0-210-240v. Secondary combinations 0-5-10-15-20-25-30-35-40-60v. half wave at 1 amp. or 10-0-10, 20-0-20, 30-0-30v. at 2amps full wave. Size 3in. long x 3 1/4in. wide x 3in. deep. Price £2.90 P. & P. 90p.

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GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER

For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9-18v. battery or from H.T. line 200/300v. Frequency response 10Hz-20KHz. Gain 26dB. Solid encapsulation size 1 1/2" x 1 1/2" x 1/2". Brand new complete with instructions. Price £1.60. P. & P. 15p.

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SIZE 2" x 3" x 1 1/2" ready built. Pre-aligned and tested. Sens. 20-560 mV for 9-18V neg. earth operation. Can be fitted to almost any FM VHF radio or tuner. Stereo beacon light can be fitted if required. Full details and instructions (inclusive of hints and tips) supplied. £5.62 plus 20p. P. & P. Stereo beacon light if required 40p extra.



QUALITY RECORD PLAYER AMPLIFIER MK. II A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 8 ohm speaker. Size 7in. wide x 8in. deep x 6in. high. Ready built and tested. PRICE £6.20. P. & P. 90p. ALSO AVAILABLE mounted on board with output transformer and speaker. PRICE £7.30. P. & P. £1.

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Enjoy fabulous stereo radio at this low introductory price!

Designed and styled to match our 10 + 10 amplifier but will suit any other standard stereo amplifier. The design incorporates the very latest circuitry techniques with high-gain, low noise IF stages. Automatic frequency control to "lock-on" station and prevent drift. IC stereo decoder for maximum stereo separation. L.E.D. for stereo beacon indicator. Nominal output of tuner 100mV. Approximate size 12 1/2" wide x 8" deep by 2 1/2" high. Supplied ready built, fully tested and fully guaranteed. A/C Mains 200/240V (not available in kit form). **SPECIAL OFFER £22.50 + £1.40 p. & p.**

LATEST ACOG GP91/180 mono compatible cartridge with t/c stylus for LP/EP/78. Universal mounting bracket. £1.60 P. & P. 18p.

CERAMIC STEREO CARTRIDGE. Universal Mounting brackets and turnover stylus. 70mV per channel output. ONLY £1.90 + 18p P. and P.

SONOTONE STANO COMPATIBLE STEREO CARTRIDGE T/O stylus Diamond Stereo LP and Sapphire 78. ONLY £2.36 P. & P. 10p. Also available fitted with twin Diamond T/O stylus for Stereo LP. £2.86. P. & P. 18p.

LATEST CRYSTAL T/O STEREO/COMPATIBLE CARTRIDGE for EP/LP/Stereo/78. £1.80 P. & P. 18p.

LATEST T/O MONO COMPATIBLE CARTRIDGE for playing EP/LP/78 mono or stereo records on mono equipment. Only £1.58. P. & P. 18p.

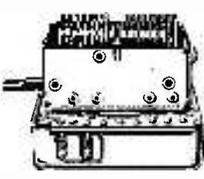
ALL-PURPOSE POWER SUPPLY UNIT 200/240v. A.C. input. Four switched fully smoothed D.C. outputs giving 6v. and 7 1/2v. and 9v. and 12v. at 1 amp on load. Fitted insulated output terminals and pilot lamp indicator. Hammer finish metal case overall size 6" x 3 1/2" x 2 1/2". Ready built and tested. **PRICE £5.75 P. & P. 85p.**

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covering 88-108 M/Hz. 10-7 M/Hz I.F. output. 7-8 Volt + earth. Supplied pre-aligned, with full circuit diagram. Connection details supplied. Beautifully made with precision-gear FM gang and 323F1 + 323F1 A.M. Tuning gang only £3.15 + P. & P. 35p.



PRECISION MADE

Push Button Switch bank. 8 Buttons giving 16 S/P C/O Interlocked switches plus 1 Cancel Button Plus 3 d/p c/o. Overall size 5" x 2 1/2" x 1". Supplied complete with chrome finished switch buttons. 2 for £1.50 + 20p P. & P.

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Beautifully made, simulated teak finish enclosure with attractive slatted front. Size 16 1/2" high x 10 1/2" wide x 9" deep (approx.). Fitted with E.M.I. Ceramic Magnet 13" x 8" bass unit, H.F. tweeter unit and crossover. AVAILABLE IN NOMINAL 4 Ohm, 8 Ohm or 16 Ohm Impedance (state which). **OUR PRICE £12.00** each Carr. £1.90. Cabinet Available Separately £7.25. Carr. £1.40. Also available in 8 ohms with EMI 13" x 8" bass speaker with parasitic tweeter £10.25. Carr. £1.90.

LOUDSPEAKER BARGAINS

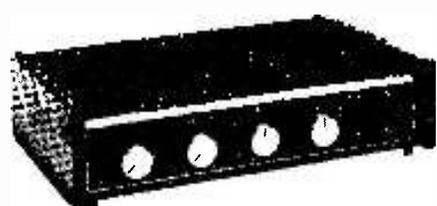
5in. 3 ohm £1.45. P. & P. 35p. 7 x 4in. 3 ohm £1.69. P. & P. 48p. 10 x 6in. 3 or 15 ohm £2.50. P. & P. 75p. E.M.I. 8 x 5in. 3 ohm with high flux magnet £2.06. P. & P. 50p. E.M.I. tweeter. Approx. 3 1/2". Available 3 or 8 or 15 ohms, £2.00 + 25p. P. & P.

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Size 11 1/2" x 14 1/2" x 1 1/2" deep. Weight 19oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Response 40Hz-20KHz. Can be mounted on ceilings, walls, doors, under tables, etc., and used with or without baffle. Send S.A.E. for full details. Only £7.25 each + p. & p. (one 75p, two 90p).

Now also available 8" - 8 ohm 10 watts, r.m.s. 20 watt peak 40 Hz-20,000 Hz. Overall depth 1". Ideal for Hi-Fi or for use in cars £4.90 + p. & p. (one 35p, two 65p).

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A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Very simple to modify to suit magnetic cartridge—instructions included. Output stage for any speakers from 8 to 15 ohms. Compact design, all parts supplied including drilled metalwork high quality ready drilled printed circuit board with component identification clearly marked, smart brushed anodised aluminium front panel with matching knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification: Power output: 14 watts r.m.s. per channel into 8 ohms. Frequency response \pm 3dB 12-30,000 Hz. Sensitivity: better than 80mV into 1M Ω . Full power bandwidth: \pm 3dB 12-15,000 Hz. Bass boost approx. to \pm 12dB. Treble cut approx. to -16dB. Negative feedback 18dB over main amp. Power requirements 35v. at 1.0 amp. Overall Size 12" w. x 8" d. x 2 1/2" h.

Fully detailed 7 page construction manual and parts list free with kit or send 25p plus large S.A.E.

AMPLIFIER KIT £13.50 P. & P. 65p (Magnetic input components 33p extra)

POWER PACK KIT £4.85 P. & P. 85p

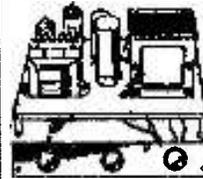
CABINET £4.85 P. & P. 85p

SPECIAL OFFER—only £22.50 if all 3 items ordered at one time plus £1 p. & p.

Full after sales service

Also available ready built and tested £29.25. P. & P. £1.

Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc. and will then provide mixing and fading facilities for medium powered Hi-Fi Discotheque use, etc.



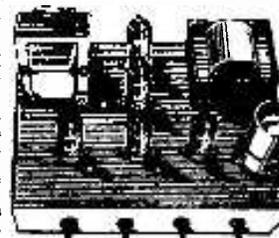
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AMATEUR BANDS

by Eric Dowdeswell G4AR

IF you get the feeling that this month's effort is being written from an unusual angle, you could be right! I'm afraid your's truly is flat on his back in hospital after an operation to "decompress" the spine. Ugh! Soon I hope to be able to stand upright again instead of resembling Old Father Time! The major part of my anatomy is horizontally polarised, but from time to time my stub end becomes vertically polarised!

Someone has suggested that I pass the time with a transceiver but since every other patient in the ward seems to have his own portable TV I don't think I'd be very popular!

I do hope that those of you who aspire to an Amateur licence will not drop everything after reading the Editor's piece on Citizen's Band matters, in the July issue. I have always maintained that the authorities will never issue such "mail order" permits in this country. Anyone with a genuine reason for requiring receive/transmit radio facilities can already get the appropriate licence from the Home Office.

The CB in the USA is in utter chaos with what should be a short range walkie-talkie type of service developing into a trans-continental operation with very high power and sophisticated aerial systems! You can be sure that a lot of the pro-CB hot air comes from those whose main interest is not necessarily the same as that of the potential CB'er.

J. Griffin, residing in Darlington, writes to mention a few of the highlights of the 48 years he has enjoyed in amateur radio. His earliest logging was of Marconi himself from his yacht in the Med! Pity he didn't have a tape recorder handy! Present set is a Codar CR70A but decent aerials are a problem.

Don't forget OM that in "difficult" situations there is no need to use 16SWG copper wire. Enamelled 24SWG wire is just about invisible. Buttons can be used as insulators between the wire and say a length of black twine. A small weight on the end of the twine, a few twirls and the aerial can be high up in a tree or on top of a roof. Put the reel of wire on a screwdriver blade and it will run off easily. Keep the wire away from walls, buildings etc., until it enters the shack and don't forget to use an ATU!

Dennis Anderson eventually got his 62 set going but soon returned to the DX150A using a 20m dipole.

QRM from local colour TV's is still a problem in spite of experiments with various suppressors and filters. **Robin Bayley**, near Wolverhampton, is now A9203 and studying furiously for his RAE which he hopes will get him on the air in '77.

Andrew Swiffin, A8063, reports again after an absence of six months due to 'A' level duties. Current project is a portable receiver with converters into a car radio covering 2 to 160m. Andrew suggests all ex-readers of this feature now having callsigns should form a 'PW net' on 80m on Sunday mornings. Good idea, although I'd feel guilty at not being able to join in at the moment!

Those of you waiting impatiently for the article on SSTV by Paul Barker might like to write to MK Products, 5 Lancashire Drive, Belmont, Durham for information on their various PCB's and other bits and pieces that Paul has used in his monitor. MK Products happen to be G3LIV and G3DRI so they ought to know something about this SSTV lark!

I usually find something of interest in 'TARS TALK', magazine of the Torbay ARS. Unusually, they accept Associate members for a very reasonable 75p a year which includes the magazine. Try raising them on the new Torbay net on 3758kHz at 09.30 every morning. If a local "regular" doesn't report in for three consecutive days enquiries are made to see if all is well. Sounds like a good basis for keeping some of our lonely Senior Citizens in touch with the outside world. Write to Fred Bolton, G3VTQ, 23 Waverley Road, Newton Abbott, South Devon for more on TARS.

Another active group is the West of Scotland ARS which, at its AGM, elected GM3EDZ as President, GM3AXX as Chairman and George Milne, GM4BLO as Secretary. Club rooms and station GM4AGG at 22 Robertson Street, Glasgow, G2 8DU, are open every Friday at 7.30 pm so get along there or write to George at 22 Norse Road, Scotstown, Glasgow. SWL's are very active in the club so don't be shy if you haven't got a callsign!

Apologies if I have not answered all those who have written in but I should be upright again in a couple of weeks and, hopefully, be able to bash the typewriter again!

Log extracts

R. Bayley:- 80m HP3AU JA1JRK UA9CM (CW)
40m JX2HK UP8AA PY7PO (CW) 20m PZ1DR
VE8RE FL8CE (CW)

D. Anderson:- 20m JG10QZ KZ5HP TG9LL VK7BC
YS1ACS 15m CX6AM KP4ECH TJ1BB ZP5WM
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Richard Allan RA82 Kit	pair	£59.40
Richard Allan RA82L Kit	pair	£65.70
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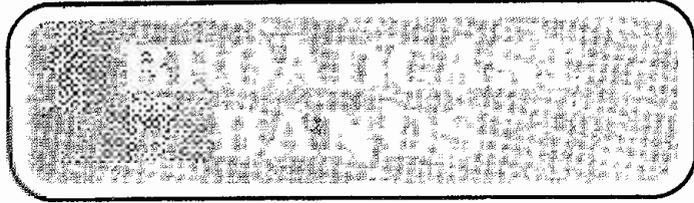
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SHORT WAVE BROADCASTS

by *Derek Bell*

THIAM CHEE MING from Kuala Lumpur, Malaysia opens this month's column with a comprehensive log that shows us the type of signals that our fellow DXers on the other side of the globe can pull in. Alongside this Thiam includes a snippet of station news.

- Burma Broadcasting on 9725 at 0700
- Voice of Indonesia on 11970 at 0900
- Radio Thailand on 11905 at 0415
- FEBA Seychelles on 15270 at 0410

The last logging, that of FEBA, was a test transmission that was to investigate the paths into East Africa. Indeed the FEBA organisation has quoted an address in EA which to me indicates that they are fairly certain that a signal into that continent is a feasible proposition and that is PO Box 21163, Nairobi, Kenya, or if you want to contact "head office" write to PO Box 234, Seychelles, Indian Ocean. Having given details of the signal heard, the SINPO rating, details of your set, aerial etc, along with time and date, name and address, FEBA will send you a QSL.

These items will, I hope, satisfy the curiosity of **David Burnett** of Liverpool who was asking how to obtain QSLs. David's other question was about International Reply Coupons. These can be obtained from the Post Office but beware, if you use the air letter form nothing can be enclosed in it. David on his Vega Selena picked up Radio Grenada and would like to know the address, which is PO Box 34, Morne Rouge, St. Georges, Grenada.

In Inverness **John McCleod** has recently had quite a surprise when he had a QSL from Radio Peace and Progress. This took twenty four days to return, and as John says a letter takes eleven days each way between here and the USSR then the report must have gone through the channels in two days! Another item of station news concerns Trans World Radio, Monte Carlo on 7100 from 0920 and on 9525 at 0940 and asking for listener's reports for the "DX special" programme. This item is from **Robin Bayley** of Kingswood School, Albrighton. I personally can chip in with a small item that perhaps has some significance. Radio Iran took the unusually expensive step of advertising their summer schedules in the personal column of a quality Sunday newspaper recently. The reason behind this is a little puzzling since most stations are suffering from a cutback in budgets but on reflection Iran is one of the oil producing states so perhaps money is not so tight there.

Turning now to the people who are DXers and I must confess that this is a deep interest of mine

since I always enjoy meeting and talking to like minds, a new club "Thames DX Club" craves your attention. This has just been formed and the organiser D. A. Binns, Bargara, Wycombe Road, Stokenchurch, High Wycombe has asked that the club be given a mention and since 1976 is World DX club year I am only too pleased to oblige.

Recently part of this column was taken up with a chat on outdoor aerials of the long wire type, so a long letter from **Andrew Sharpe** of Rowlands Gill, Tyne and Wear, finishes by asking if plastic-covered clothes line is an efficient means of securing an aerial to a tree. Yes, I would say with reservations, since a lot of these lines have a metal wire core and should the aerial wire in due time pull through the insulation and make contact with the metal core then problems could ensue. **A. B. Devitt**, on the other hand, would like to know if an 'L' shape long wire has any advantages over a simple straight one. The answer could be 'yes' since the maximum signal is gathered from, say, east and west of a north-south running wire, to which is added the omni-directional signals from the vertical part.

The European DX Council runs a scheme the sole purpose of which is to help the handicapped DXer/SWL. I would however like to extend that to licensed Amateurs, if I may be permitted to say so! (How about the RAIBC? A.E.D.) **Fred Singleton** of 8 Rodsley Close, Holmall Estate, Chesterfield is seeking back numbers of electrical, wireless and electronic publications. Fred recently had to retire at an early age due to illness and to pass the time has renewed his ticket, but would like to catch up on the latest state of our hobby so if you have any old mags cluttering the house please bung them in the post.

Another item of transmitter news that almost went unnoticed was the winding up of the overseas service of the New Zealand Broadcasting system. This was not given the publicity that many stations get when they just reduce their coverage. It seems a pity that this was the case since we DXers deserve a chance to voice a protest if one of (for the UK) the choice DX stations closes.

David Sewell of Peterborough has sent a choice list for those who are African radio enthusiasts. Unfortunately David has not sent details of his set or aerial but despite this his reported times and frequencies are useful for those whose logbooks are thin on African stations.

- Radio Mali on 4783 at 2255
 - Radio Diffusion Mauritanie on 4850 at 2340
 - Voix de la Revolution Dahomey on 4870 at 2235
 - Radio Diffusion du Tchad on 4904 at 2305
- So to close I will wish best 73s to you and yours.

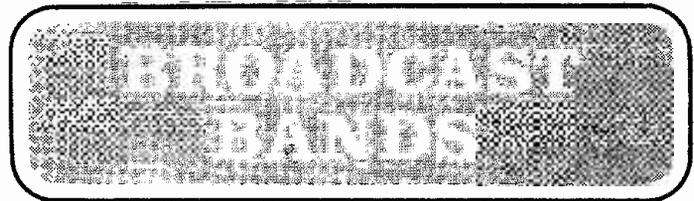
BROADCAST BANDS

Short Wave reports by the 15th of the month to Derek Bell c/o Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD.

Medium Wave Logs to Charles Molloy, 132 Segars Lane, Southport, PR8 3JG.

AMATEUR BANDS

Logs covering any Amateur band/s in band alphabetical order by the 25th of the month to Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashstead, Surrey, KT21 2TW.



MEDIUM WAVE DX

by CHARLES MOLLOY

READER Glyn Morgan of Tredegar in Gwent is still active on the medium waves with his HA230 communications receiver and 40ft long-wire aerial. His best catch recently has been the 20kW outlet at Nouakchott in Mauritania which was heard at 2300 on 1349kHz. This station is not often heard in the UK. Nearer to home, the Irish Speaking Radio (Radio na Gaeltachta) was heard on two different frequencies. On 1250kHz Donegal was logged with interference from both Dublin the English and Tripoli, Libya in Arabic (1000kW) while on 962kHz Kerry was heard just before it signed-off at 2100. Glyn mentions hearing an unidentified Arabic speaking station between the European channels 1562kHz and 1578kHz. This is probably Sharjah in the United Arab Emirates situated in the Persian Gulf area, which broadcasts on 1575kHz with a power of 50kW and is usually a good signal in the UK.

The month of Ramadam, the ninth in the Moslem calendar, starts on August 27th this year and for the medium wave DXer it marks the beginning of a four week period during which broadcasts from the Middle East are prominent on the band. Countries in this area are in time zones some two to four hours ahead of GMT and consequently many of their broadcasting stations will have closed down for the night, by the time it is late evening in the UK and European QRM is beginning to subside. During Ramadam nearly every Arabic speaking station will be on an extended schedule while some will remain on the air all night. The DXer who listens after 2230 GMT will have the opportunity of picking-up countries not normally heard from this area while newcomers should be able to hear stations from North Africa without difficulty, even when using a domestic portable receiver.

Listen for Algiers on 890kHz and 980kHz; Tangiers on 1232kHz; Tunis on 629kHz and 962kHz; the two 1000kW outlets in Libya on 1124kHz (El Beida) and 1250kHz (Tripoli); Cairo on 620kHz and Kuwait on 134kHz. On the long waves Tipaza in Algeria on 251kHz (in English at 1900) and Azilal in Morocco on 209kHz should be located without difficulty. Readers using a portable receiver should rotate it to make use of the directional aerial and reduce interference. Among the more difficult ones are Kuwait on 539kHz, Cairo on 710kHz, Riyadh in Saudi Arabia on 587kHz, Damascus on 665kHz,

Baghdad 760kHz, Zahedan in Iran 775kHz, Tartus in Syria 782kHz, Abu Dhabi 809kHz, Damman in Saudi Arabia 885kHz, Qatar 952kHz, Kermanshah in Iran 985kHz, Taiz in Yemen on approx. 1005kHz, Hyderabad in Pakistan 1010kHz, Istanbul 1016kHz, Kabul in Afghanistan 1280kHz and Dubai on 1480kHz.

Now is a good time to inspect and if necessary overhaul your outdoor aerial. A gradual deterioration in performance can occur un-noticed and sometimes poor results can be traced to a break where the downlead joins the aerial wire and when insulated wire is used the break can occur under the insulation and not be apparent to a visual inspection. If co-ax cable is used and taken out of doors, it should end in a sealed terminal box and the end of the cable should be dipped in hot wax to prevent water creepage. Stranded copper wire is usually recommended for aeriels and while this is essential when transmitting, the writer has found that the plastic covered steel wire on sale in garden shops, is quite adequate for medium wave reception. This wire is normally sold in coils but it can be obtained in small drums and it is a boon in exposed locations where gales can easily cause damage.

Robin Bayley writes again from Albrighton in Staffordshire with news of his first North American capture. Using a Marconi tuner-amplifier and a longwire aerial he logged CJON in St John's Newfoundland on 930kHz. Congratulations Robin, I hope this will be the first of many transatlantic stations in your log book. **J. W. F. McLaren** from Galashiels has not been so lucky. He says "WINS on 1010kHz seems to elude me despite all night watches". Keep trying. Some nights North Americans come roaring in while on others, not a single one can be heard. **R. Wyres** of Birmingham enquires about the PW Loop Aerial and Balanced FET Pre-amplifier. The article appeared in the April 1973 issue of Practical Wireless, which is now out of print. Bound volumes of PW are kept in main libraries and Xerox copies of articles can often be obtained from the library for a small charge.

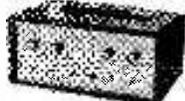
Alan Spencer, who writes from Ryhall in Lincolnshire, has been DXing on the medium waves for only a week. Using a Prinzsound RTR16 with internal aerial he logged Trans World Radio in Monte Carlo on 1466kHz at 2000 with a programme in French followed by another in an unidentified language. (Hungarian is scheduled at 2000).

Alan asks for details of the sort of programme information that should be given in a reception report to a MW station. The report should contain sufficient detail to enable the station staff to identify their own programme. Station slogans, news items, weather reports, details of adverts (jingles), titles of programmes but not of pieces of music, will convince the station that the DXer really did hear their broadcast. The ten minutes from 5 to the hour to 5 past, is often productive when listening to North American DX but no fixed period of time can be specified and the DXer will have to use his own judgement when deciding when he has collected enough for a report. If a tape recording is made of the station announcement it can be played back several times to help the DXer to copy down all the details.

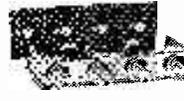
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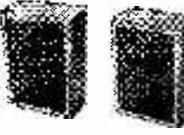
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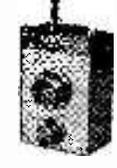
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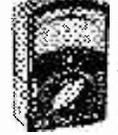


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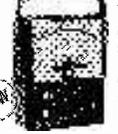
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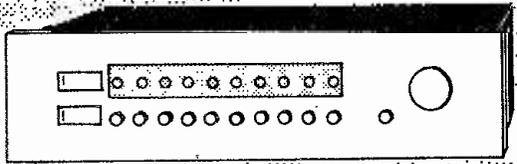
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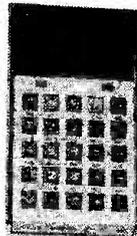
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A1065 1.25	ECL80 0.60	GT1C 5.00	PL508 0.95	U25 1.00	UL84 0.50	3V4 0.85	6AM6 0.60	6C4 0.40	6K8GT 0.55	7B7 0.80
AR8 0.60	ECL82 0.40	GY501 0.80	PL509 1.35	U26 0.80	UY41 0.50	5B/254M 0.50	6AN8 0.70	6C6 0.50	6L6M 1.90	7Y4 0.80
ARP3 0.60	ECL83 0.75	GZ32 0.65	PL802 1.85	U27 1.00	UY85 0.50	5B/255M 5.00	6AQ5 0.55	6C6B 0.50	6L7G 0.40	9D2 0.60
ATP4 0.50	ECL86 0.60	GZ34 0.80	PY33 0.60	U191 0.75	VR105/30 0.45	5B/258M 5.00	6AQ5W 0.70	6CH6 1.60	6SA7 0.55	9D6 0.50
B12H 3.00	EF36 0.65	GZ37 1.00	PY80 0.60	U801 0.80	VR150/30 0.45	5B/258M 5.00	6AS6 0.80	6CL6 0.75	6SC7 0.75	11E2 0.60
DAF96 0.60	EF37A 1.10	KT66 3.00	PY81/800 0.50	UABCB0 0.45	X61M 1.50	5R4GY 1.00	6AS7G 1.00	6D6 0.50	6S7 0.55	12A6 0.60
DF96 0.60	EF40 0.70	KT88 4.00	PY82 0.45	UAF42 0.70	X66 0.75	5U4G 0.55	6AT6 0.60	6EA8 0.75	6SJ7 0.60	12A7 0.45
DK96 0.75	EF41 0.75	MH4 1.00	PY83 0.50	UBC41 0.60	X66 0.75	5V4G 0.85	6AT6 0.60	6F7 1.10	6SJ7GT 0.60	12A7 0.35
DL92 0.50	EF80 0.35	ML6 0.70	PY88 0.50	UBF80 0.50	Z800U 3.00	5Y3GT 0.60	6AV6 0.50	6F8G 0.75	6SK7 0.60	12AX7 0.35
DL96 0.70	EF83 1.25	OA2 0.45	PY80 1.10	UBF89 0.50	Z801U 3.00	5Z3 1.20	6AX4GT 0.75	6F8G 0.75	6SL7 1.00	12BA6 0.50
DY86/87 0.45	EF85 0.40	OB2 0.45	PY801 0.55	UBL1 1.00	Z900T 1.50	5Z4G 0.60	6F33 3.50	6F8G 0.75	6SL7GT 0.55	12BE6 0.55
EA50 0.40	EF86 0.40	PABC80 0.70	QQV03-10 1.70	UCC85 0.50	IL4 0.55	5Z4G 0.65	6H6 0.45	6H6 0.45	6SN7GT 0.55	12BH7 0.55
EABC80 0.40	EF86 0.40	PC86 0.65	QQV06-40A 14.00	UCF80 0.80	IR5 0.50	6AB7 0.60	6J4WA 1.25	6J4WA 1.25	6SQ7 0.60	12C8 0.60
EAF42 0.70	EF89 0.35	PC88 0.65	QV03-12 1.70	UCH42 0.80	IS4 0.35	6AC7 0.60	6J5 0.65	6J5 0.65	6SQ7 0.60	12K5 1.50
EB91 0.30	EF89 0.35	PC88 0.65	SC1/400 3.60	UCH81 0.50	IS5 0.35	6AH6 0.70	6J6 0.35	6J6 0.35	6V6GT 0.60	12K7GT 0.55
EBC33 1.00	EL81 0.80	PC89 0.65	SC1/600 5.50	UCL82 0.45	IT4 0.35	6AK5 0.45	6J7 0.65	6J7 0.65	6X4 0.45	12K8GT 0.75
EBC41 0.75	EL84 0.35	PCC189 0.60	SP61 5.50	UCL83 0.70	IX2B 0.75	6AK8 0.40	6K7 0.40	6K7 0.40	6X5G 0.40	12Q7GT 0.50
EBF80 0.40	EL85 0.80	PCF200 0.95	IT21 6.00	UCL83 0.70	IX2B 0.75	6AL5 0.30	6K8GT 0.80	6K8GT 0.80	6X5G 0.40	12SA7GT 0.80
EBF80 0.40	EL85 0.80	PCF201 0.90		UCL83 0.70	IX2B 0.75	6AL5W 0.60	6K7 0.40	6K7 0.40	6X5G 0.40	12SG7 0.55
EBF83 0.45	EL85 0.80	PCF201 0.90		UCL83 0.70	IX2B 0.75	6AM5 1.00	6K7 0.40	6K7 0.40	6X5G 0.40	12SJT 0.55
EBF89 0.40	EL89 0.50	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	12UJ 0.40
EC52 0.40	EL91 1.00	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	14S7 1.00
ECC81 0.45	EL95 0.70	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	19AQ5 0.70
ECC82 0.35	EL95 0.70	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	19G3 8.00
ECC83 0.35	EL95 0.70	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	19G6 6.50
ECC84 0.35	EM31 0.70	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	19H5 15.00
ECC85 0.45	EM80 0.55	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	20P3 0.60
ECC86 1.25	EM84 0.40	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	20P4 1.10
ECC88 0.55	EM87 1.00	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	25L6GT 0.70
ECC189 0.80	EY81 0.45	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30C15 1.00
ECF80 0.45	EY86/87 0.45	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30C17 1.10
ECF82 0.45	EY88 0.50	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30F5 1.00
ECF801 0.75	EZ40 0.70	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30FL1 1.10
ECF804 2.50	EZ40 0.70	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30FL12 1.10
ECH42 0.85	EZ41 0.75	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30L15 1.00
ECH81 0.40	EZ80 0.30	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30L17 1.00
ECH84 0.60	EZ81 0.35	PCF201 0.90		UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30P12 1.00

A lot of these valves are imported and prices vary for each delivery, so we reserve the right to change prices for new stock when unavoidable.

PL508 0.95	U25 1.00	UL84 0.50	3V4 0.85	6AM6 0.60	6C4 0.40	6K8GT 0.55	7B7 0.80
PL509 1.35	U26 0.80	UY41 0.50	5B/254M 0.50	6AN8 0.70	6C6 0.50	6L6M 1.90	7Y4 0.80
PL802 1.85	U27 1.00	UY85 0.50	5B/255M 5.00	6AQ5 0.55	6C6B 0.50	6L7G 0.40	9D2 0.60
PY33 0.60	U191 0.75	VR105/30 0.45	5B/258M 5.00	6AQ5W 0.70	6CH6 1.60	6SA7 0.55	9D6 0.50
PY80 0.60	U801 0.80	VR150/30 0.45	5B/258M 5.00	6AS6 0.80	6CL6 0.75	6SC7 0.75	11E2 0.60
PY81/800 0.50	UABCB0 0.45	X61M 1.50	5R4GY 1.00	6AS7G 1.00	6D6 0.50	6S7 0.55	12A6 0.60
PY82 0.45	UAF42 0.70	X66 0.75	5U4G 0.55	6AT6 0.60	6EA8 0.75	6SJ7 0.60	12A7 0.45
PY83 0.50	UBC41 0.60	X66 0.75	5V4G 0.85	6AT6 0.60	6F7 1.10	6SJ7GT 0.60	12A7 0.35
PY88 0.50	UBF80 0.50	Z800U 3.00	5Y3GT 0.60	6AV6 0.50	6F8G 0.75	6SK7 0.60	12AX7 0.35
PY80 1.10	UBF89 0.50	Z801U 3.00	5Z3 1.20	6AX4GT 0.75	6F8G 0.75	6SL7 1.00	12BA6 0.50
PY801 0.55	UBL1 1.00	Z900T 1.50	5Z4G 0.60	6F33 3.50	6F8G 0.75	6SL7GT 0.55	12BE6 0.55
QQV03-10 1.70	UCC85 0.50	IL4 0.55	5Z4G 0.65	6H6 0.45	6H6 0.45	6SN7GT 0.55	12BH7 0.55
QQV06-40A 14.00	UCF80 0.80	IR5 0.50	6AB7 0.60	6J4WA 1.25	6J4WA 1.25	6SQ7 0.60	12C8 0.60
QV03-12 1.70	UCH42 0.80	IS4 0.35	6AC7 0.60	6J5 0.65	6J5 0.65	6SQ7 0.60	12K5 1.50
SC1/400 3.60	UCH81 0.50	IS5 0.35	6AH6 0.70	6J6 0.35	6J6 0.35	6V6GT 0.60	12K7GT 0.55
SC1/600 5.50	UCL82 0.45	IT4 0.35	6AK5 0.45	6J7 0.65	6J7 0.65	6X4 0.45	12K8GT 0.75
SP61 5.50	UCL83 0.70	IX2B 0.75	6AK8 0.40	6K7 0.40	6K7 0.40	6X5G 0.40	12Q7GT 0.50
IT21 6.00	UCL83 0.70	IX2B 0.75	6AL5 0.30	6K8GT 0.80	6K8GT 0.80	6X5G 0.40	12SA7GT 0.80
	UCL83 0.70	IX2B 0.75	6AL5W 0.60	6K7 0.40	6K7 0.40	6X5G 0.40	12SG7 0.55
	UCL83 0.70	IX2B 0.75	6AM5 1.00	6K7 0.40	6K7 0.40	6X5G 0.40	12SJT 0.55
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	12UJ 0.40
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	14S7 1.00
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	19AQ5 0.70
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	19G3 8.00
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	19G6 6.50
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	19H5 15.00
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	20P3 0.60
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	20P4 1.10
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	25L6GT 0.70
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30C15 1.00
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30C17 1.10
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30F5 1.00
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30FL1 1.10
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30FL12 1.10
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30L15 1.00
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30L17 1.00
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30P12 1.00
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30P19 1.00
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30PL13 1.10
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	30PL14 1.10
	UCL83 0.70	IX2B 0.75		6K7 0.40	6K7 0.40	6X5G 0.40	35L6GT 0.80

TRANSISTORS

AAZ12-BAY10	AF118	BC172	CRS3/40	OC29	OC206	2N4058
AC113	AF124	BC172A	CRS25/025	OC35	ZR11	2N4061
AC126	AF125	BCY12A	GET115	OC36	ZR21	2N4172
AC127	AF126	BCY33	GET116	OC42	ZR22	2N5295
AC128	AF127	BCY72	GEX66	OC44	2N456A	3N126
AC176	AF139	BCY72	NKT222	OC45	2N525	3N128
AC176	AF178	BF115	NKT404	OC70	2N696	3N154
AC176	AF186	BF167	NKT404	OC73	2N708	3N159
AC176	AF239	BF173	OA5	OC75	2N918	SX754
AC176	AFZ12	BF185	OA7	OC78	2N1305	2S303
AC176	AFZ26	BFY51	OA7	OC78D	2N1307	T12082
AC176	AFZ28	BFY52	OA7	OC81	2N1309	40235
AD149	BC107	BSY27	OA79	OC82	2N2062	40250
AD161	BC108	BSY95A	OA91	OC82DM	2N2411	40251
AD162	BC109	BY100	OA200	OC83	2N2989	IN23A
AD211	BC113	BY216	OA200	OC83B	2N3053	IN25
AD212	BC116	CRS1/20	OA202	OC139	2N3054	IN38A
AF114	BC118	CRS3/30	OA202	OC140	2N3055	IN43
AF115	BC136	CRS3/10	OC22	OC170	2N3391	IN70
AF116	BC137	CRS3/20	OC25	OC172	2N3730	IN677
AF117	BC14					

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Four inputs. Four way mixing, master volume, treble and bass controls. Suits all speakers. This professional quality amplifier chassis is suitable for all groups, disco, P.A., where high quality power is required. 5 speaker outputs. A/C mains operated. Slave output. Produced by demand for a quality valve amplifier. Send for details
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ELAC 9 + 5in. HI-FI SPEAKER TYPE 59RM
This famous unit now available, 10 watts, 8 ohm.

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8" ELAC HI-FI SPEAKER

Dual cone plasticised roll surround. Large ceramic magnet. 50-16,000 cps: Bass resonance 55 cps. 8 ohm impedance. 10 watts. **£3-95**
Post 40p

10in round **£4-95.**

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MODEL "A". 20 x 13 x 12in. For 12 in. dia. or **£11-25** Post 10in. speaker. 95p Illustrated

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MODEL "C". 30 x 20 x 12in. Reflex cabinet will accept 1-12in. bass unit, 1-5in. mid range, 1-3in. tweeter. Teak finish. Grooved front **£21-50** Carr. £3

LOUDSPEAKER CABINET WADDING 18in. wide, 25p ft.

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STEREO VERSION OF ABOVE **£6-85.**

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OFFERING 1001 USES for every type of heating and drying applications in the home, garage, greenhouse, factory (available in manufacturing quantities). Approx. size 10 1/2 x 8 1/2 x 1/4 in. Operating voltage 200/250V. a.c. 250 watts approx. Printed circuit element enclosed in asbestos fitted with connecting wires. Completely flexible providing safe Black heat. British-made for use in photocopyers and print drying equipment.

Ideal for home handymen and experimenters. Suitable for Heating Pads, Food Warmers, Convector Heaters, etc. Must be clamped between two sheets of metal or asbestos, etc., to make efficient clothes dryers, towel rails—ideal for airing cupboards. Ideal for anti-frost device for the garage—preventing frozen radiators or acting as oil sump heater. Use in greenhouse for seed raising and plant protection. Invaluable aid for bird houses, incubators, etc., etc. Can be used in series for lower heat. Or in parallel for higher heat applications.

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Post 60p
30-14,500 c/s, 12in. double cone, woofer and tweeter come together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c/s rated 25 watts. NOTE: 3 or 8 or 15 ohms must be stated.

Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£13**

Please state 3 or 8 or 15 ohms. Post 50p

BAKER SPEAKERS "BIG SOUND"

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

GROUP "25" **£8-95**
12in 30 watt 3, 8 or 15 ohms. Post 50p

GROUP "35" **£10-50**
12in 40 watt 3, 8 or 15 ohms. Post 50p

GROUP "50/12" **£14-50**
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GROUP "50/15" **£19-50**
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All purpose transistorised. Ideal for Groups, Disco and P.A. 4 inputs speech and music. 4-way mixing. Output 8/15 ohm A.C. mains. Separate treble and bass controls. Guaranteed. Details S.A.E.

£68 Carr. £1-00

Latest 50 watt Model **£49**

100 WATT DISCO AMPLIFIER CHASSIS MADE BY JENNINGS MUSICAL INSTRUMENTS

4 speaker outputs, vol., treble, bass controls **£52** Carr. £1

QUALITY LOUDSPEAKER ENCLOSURE

Teak veneered 3/4 in thick wood cabinet. Size 18 1/2 in x 18 1/2 in x 8 1/2 in. Weight 23lb. This cabinet features a wide mesh Silver Grill covering a separate compartment for mounting Tweeters or Mid-Range Horn. The fully sealed bass compartment is cut out for 6 1/2 in Woofer. £7-50. Carr. 85p. Rosewood Version **£8 50.** Carr. 85p. Baffle could be cut for larger speaker.

P.W. SOUND TO LIGHT DISPLAY

Complete kit of parts with R.C.S. printed circuit. Three channels. 800 to 1,000 watt each. As featured in December Practical Wireless. Price **£12-50** Cabinet extra £3.

8 inch PHILIPS LOUDSPEAKER

4 ohm. 4 watt. ceramic magnet **£1-95**

MAINS TRANSFORMERS

6 VOLT 1/2 AMP. £1-00 3 AMP. £1-40
12 VOLT 300 MA. £1-00 750 MA. £1-30
30 VOLT 5AMP. AND 34 VOLT 2AMP C.T. £3.45
20 VOLT 1/2 AMP. £1-75 1 AMP. £2-00 3AMP. £2-20
20-0-20 VOLT 1AMP. £2 30 VOLT 1 1/2 AMP. £1-75

E.M.I. TAPE MOTOR 4 pole, 240 v. Size 3 1/2 x 2 1/2 in. 1200 rpm. Spindle 1/4 in. diameter. 120v version £1. **£1-85** Post 45p

E.M.I. GRAM MOTOR 240V a.c. 2,400 rpm 2-pole. Size 2 1/2 x 2 1/2 in. Collaro gram motor 240v. £1.50 **£1-25** Post 35p

BAKER DISCO SPEAKERS HIGH QUALITY—BRITISH MADE 2 x 12" CABINETS

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

50 WATT R.M.S. **£43** Carr. £2

70 WATT R.M.S. **£46** Carr. £2

100 WATT R.M.S. **£59** Carr. £3



1 x 15" + 1 x 12" 100 WATT CABINET Size 36" x 24" x 15" **£65-00.** Carr. £5
Ideal for Disco, Ogran or PA work. High quality. Full range.

SUPERB HI-FI 12in 25 watts

A high quality loudspeaker, its remarkable low cone resonance ensures clear reproduction of the deepest bass. Fitted with a special copper drive and concentric tweeter cone resulting in full range reproduction with remarkable efficiency in the upper register. Bass Resonance 25cps Flux Density 16,500 gauss Useful response 20-17,000cps 8 or 15 ohms models.

£16-30 Post 80p

AUDITORIUM 12in. 35 watts

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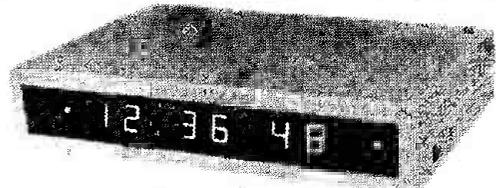
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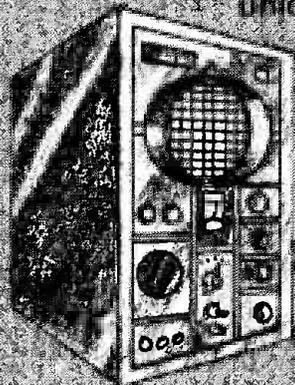
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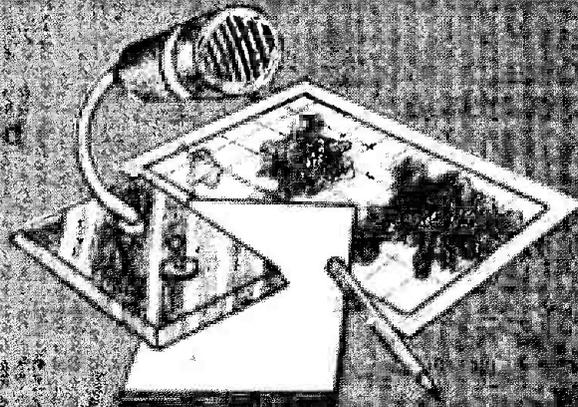
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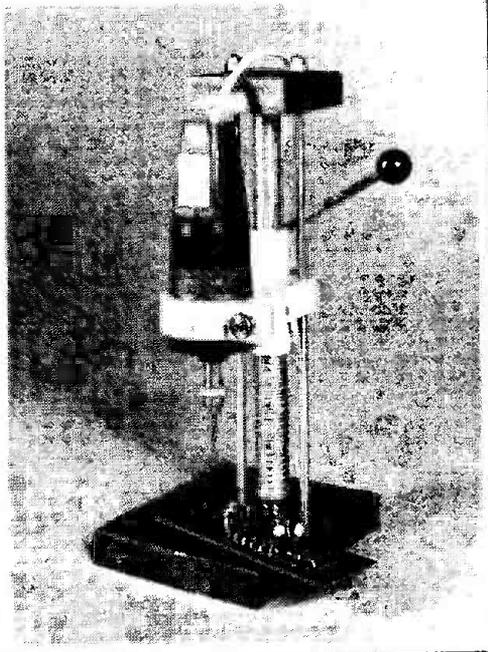
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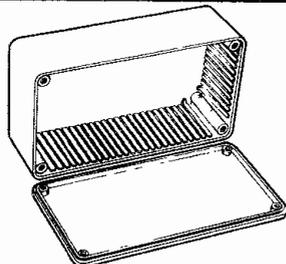
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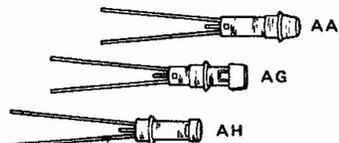
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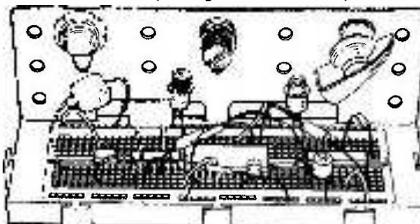
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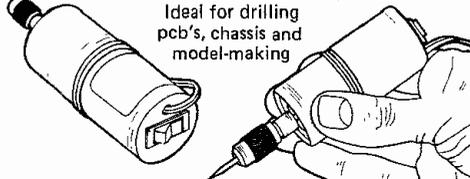
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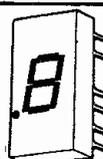
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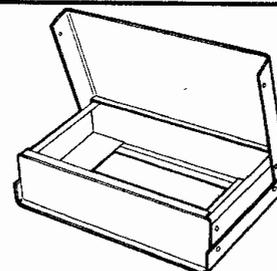


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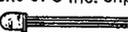


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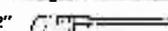
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BC108C*	12	BD133*	60	MJE2855*	95	TIP33C*	130	2N2219A*	24	40412	42
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BC116	18	BD141*	55	MPSA07	32	TIP36*	370	2N2484*	30	40576	11
BC117	20	BD145*	53	MPSA70	32	TIP41A*	68	2N5485	41	40594	11
BC118	15	BDY11	115	MPU131*	39	TIP41B*	73	2N2646	41	40603*	58
BC119	25	BDY17	135	NKT270	26	TIP42*	78	2N2904*	20	40636	110
BC135	13	BDY60*	75	NKT275	26	TIP42B*	79	2N2904A*	24	40673*	55
BC136	15	BF115*	22	OC23*	144	TIP2955*	65	2N2906*	18	Matched	
BC137	15	BF154	18	OC25*	48	TIP3055*	60	2N2907*	20	Pair	
				OC26*	48	TIS43	18	2N2907A*	22	10p extra	
				OC28*	58	TIS44	18	2N2926G*	12		

TTL 74*

7400	13	7474	37	74154	172	74155	80
7401	13	7475	37	74156	80	74157	92
7402	14	7476	37	74159	225	74160	216
7403	16	7480	50	74161	216	74162	216
7404	20	7481	114	74163	216	74164	152
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7406	44	7483	95	74167	362	74168	246
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(Continued from opposite side)

DIODES		BRIDGE RECTIFIERS		SCR's*	
AAZ15	15p	1A50V	21p	1A50V	38p
AEY11	70p	1A100V	29p	1A100V	42p
BA100	19p	1A200V	26p	1A200V	47p
BY126	12p	1A400V	31p	1A600V	52p
BY127	5p	1A600V	34p	3A50V	70p
IN916	12p	2A200V	49p	3A100V	43p
OA9	9p	2A400V	49p	3A200V	55p
OA10	49p	2A600V	56p	3A400V	74p
OA47	8p	2A800V	64p	3A600V	89p
OA70	8p	4A100V	50p	5A400V	90p
OA79	10p	4A200V	59p	7A400V	125p
OA81	6p	4A400V	70p	C106D	50p
OA86	10p	4A800V	108p	MCR101	29p
OA90	6p	8A100V	73p	TIC44	29p
OA91	6p	8A200V	84p	2N4444	191p
OA95	3p	8A400V*	94p		
OA200	3p	BY122	54p		
OA202	3p	BY164	54p		
PL4004	24p				
IN914	4p	ZENERS		TRIACS*	
IN4001/2	3p	Rng. 3-3V-32V	9p	3A400V	100p
IN4003	4p	400mV	9p	6A400V	120p
IN4004/5	6p	1-3V	17p	8A400V	150p
IN4006/7	7p	VARICAPS		10A500V	185p
IN4148	5p	MVAM1	270p	15A400V	240p
3A/100V	13p	MVAM2	265p	15A500V	280p
3A/400V	14p	BB105B	23p	40430	99p
3A/600V	15p	Noise Diode		40669	95p
3A/1000V	25p	25J	105p	DIAC*	
				ST2	20p

OPTO ELECTRONICS*		VOLTAGE REGULATORS *		
LEDs + Clip	DL704	75p	723C	45p
TIL209 Red	DL707	75p	TBA625B	95p
0-2" Red	DL727	180p	TO3 Type	
Yellow, Green	DL728	180p	1A 5V	140p
Amber	DL747	180p	1A 12V	140p
OCP 70	XAN345	3" Green	1A 15V	150p
OCP 71	6" Green	1A 18V	185p	
OCP 12	MAN3610	170p	LM309K	150p
ORP 12	MAN3640	170p	MVR5	160p
ORP 61	Minitron		MVR12	160p
2N5777	3015F	110p		

ALUM. BOXES with lid*		CRYSTAL LAPEL MIKE	
2 1/2 x 5 1/2"	46p	Mike	46p
4 x 4 1/2"	46p	Insert	34p
4 x 2 1/2 x 1 1/2"	46p	SPEAKERS	
4 x 5 1/2 x 1 1/2"	54p	8Ω 0.3W	40p
4 x 2 1/2 x 2"	46p	8Ω 25"	65p
5 x 2 1/2"	40p	2.5; 3"	58p
5 x 4 1/2"	78p	64Ω 2-5"	65p
7 x 5 x 2 1/2"	84p	4Ω 4"	125p
8 x 6 x 3"	106p	10 x 4 1/2 x 3"	110p
10 x 7 x 3"	122p	12 x 5 x 3"	120p
10 x 4 1/2 x 3"	110p	12 x 8 x 3"	180p

COPPER CLAD BOARDS*	
SRBP 8-75 x 9-5"	48p
Fibre Glass 6 x 6"	64p
Fibre Glass 6 x 12"	115p

FERRIC CHLORIDE* 1lb bag	
Anhydrous 65p + 30p p. & p.	

DALO ETCH RESIST	
PEN* + spare tip	69p

VEROBOARD* Pitch		
0-1	0-15	0-15
(copper clad)	(plain)	
2 1/2 x 3 1/2"	24p	15p
2 1/2 x 5"	35p	29p
3 1/2 x 3 1/2"	35p	29p
3 1/2 x 5"	41p	29p
2 1/2 x 1 1/2"	105p	73p
3 1/2 x 1 1/2"	145p	115p
4 1/2 x 1 1/2"	185p	110p
Pkt of 36 pins		28p
Spot face cutter		52p
Pin insertion tool		72p

BATTERY CONNECTORS	
Polarised PP3 6p; PP9 9p	

VERNIER DIALS* (Precision)	
VD1 8:1 Ratio 36mm	160p
VD2 8:1 Ratio 50mm	190p
VD3 8:1 Ratio 70mm	220p

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KNOBS* fit 1/2" shaft with grub screws, except K2 (push fit) & K8 (for sliders).	
K1 Black or White pointer type	1p
K2 Slim silvered aluminium	16p
K4 Black serrated. Metal top with line indicator 33mm diam.	30p
K4A As above but 25mm diam.	16p
K5 Black fluted metal top and skirt calibrated 0-10. 37mm diam.	21p
K6 PK2 as K5, pointer on skirt	30p
K7 Black, knurled, tapered. Metal top & skirt. Calif. 0-10, 30mm	22p
K8 Black or silvered for slider pot	5p
K9 Solid Aluminium, Amplifier Knob, Professional type, with etch line indicator 16-5 x 12mm diam.	24p
K10 As above but tapered 18-5 x 17mm diam.	26p
K11 Aluminium, (Top Hat) Knurled body with 18-5mm skirt. Knotted Attractive	30p

PANEL METERS* Full scale	
59 x 46 x 35mm req. 1 1/2" hole	
0-50μA	0-100mA
0-100μA	0-500mA
0-500μA	0-1 Amp
0-1mA	0-50V DC
0-5mA	0-300V DC
0-10mA	"S"
0-50mA	"VU"
Price £3-05 each.	
108 x 82-5 x 38mm req. 60mm panel hole	
0-50μA; 0-100μA; 0-500μA	£4-40

DUAL VU METERS (150μA approx) £4-65	
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TRANSFORMERS* (Mains Prim. 220-240V)	
6-0-6V 100mA	50p
9-0-9V 100mA	85p
12-0-12V 100mA	88p
15-0-15V 100mA	185p
0-12 0-12V 150mA	160p
0-6 0-6V 280mA	170p
0-12 0-12V 0-5A	198p
24-0-24V 0-5A	198p
9-0-9V 1A	245p
15-0-15-5A	200p
15-0-15V 1A	245p
18-0-18V 1A	275p
30-24-20-15-12-0 1A	
Multi tappings	325p
30-24-20-15-12-0 2A multi tap	345p
(Please add 48p p&p charge to all prices marked +, above our normal postal charge.)	

JACK PLUGS		SOCKETS	
Screened chrome	Plastic body	Open metal	Moulded with break contacts
2-5mm	16p	8p	8p
3-5mm	14p	16p	8p
MONO	19p	13p	17p
STEREO	28p	15p	22p

DIN		Plugs		Sockets	
2 pin Loudspeaker					
3, 4, 5 (180° & 240°)		12p		8p	

CO-AXIAL (TV)		14p		10p	
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PHONO		8p		5p (Single)	
assorted colours					
Metal screened		12p		10p (Triple)	

BANANA		4mm		7p	

LAMP HOLDERS AND LAMPS*	
LES HOLDER Dome shaped, Red, Blue, Green, Yellow, White	14p
LES BULBS 6v and 12v	9p
MES HOLDERS Chrome cover, Red or Amber, Jewelled top	50p
MES BULBS 3-5V 6V 12V	8p
NEONS Mains, Sealed with Resistor. Sq. Top, Red or Grn. Round Top Red 22p Neon with leads, 95V AC (No resistor) 9p	

SWITCHES*		SLIDE 250V:	
TOGGLE: 2A, 250V	1A DP	10p	
SPST	1A DP C/O	12p	
DPDT	1A DP	9p	
4 pole on/off	4 pole/2 way	15p	
SUB-MIN TOGGLE	PUSH BUTTON		
SP changeover	Spring loaded		
SPST on/off	SPST on/off	55p	
DPDT 6 tag	DPDT C/over	65p	
DPDT Centre off	DPDT 6 Tag	85p	

SWITCHES* PUSH BUTTON:	
Miniature Non Locking	
Push to Make	15p
Push to Break	25p
ROCKER (white): 10A 250V	
SP changeover centre off	25p
ROCKER: (black) on/off 10A 250V	20p
ROCKER: (illuminated) (white) lights when on. 3A 240V	46p
ROTARY: (ADJUSTABLE STOP) 1 pole/2-12 way, 2p/2-6W, 3p/2-4W, 4p/2-3W	30p
ROTARY: Mains 250V AC, 4 Amp	28p

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1000 p.i.v. at 20A forward current, reverse polarity (i.e. Stud Anode).

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Made in USSR

Sensitivity:
20,000Ω/V DC
2,000Ω/V AC

Ranges:—
DC current: 50-100-500μA 1-5-25-100-500mA-2.5A
AC current: 0.5-1-5-25-100-500mA-2.5A

DC Voltage: 75mV-1-2.5-5-10-25-100-250-500-1000V

AC Voltage: 1-2.5-5-10-25-100-250-500-1000V

DC Resistance: 300Ω-5-50-500kΩ

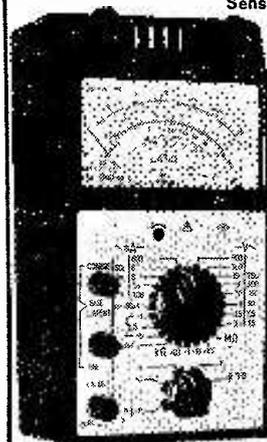
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Accuracy: 2.5% FSD D.C.; 4% FSD A.C.

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Made in USSR

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16700Ω/V D.C.,
330Ω/V A.C.

Ranges:
D.C. current: 0.06-0.6-6-60-600mA
A.C. current: 0.3-3-30-300mA
D.C. Voltage: 0.3-1.5-6-30-60-150-300-900V

A.C. Voltage: 1.5-7.5-30-150-300-750V

Resistance: 2-20-200kΩ-2MΩ

Transistor collector cut-off current 60μA

Transistor D.C. current gain in two ranges 10-350

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4.0% A.C.

5% D.C. current gain

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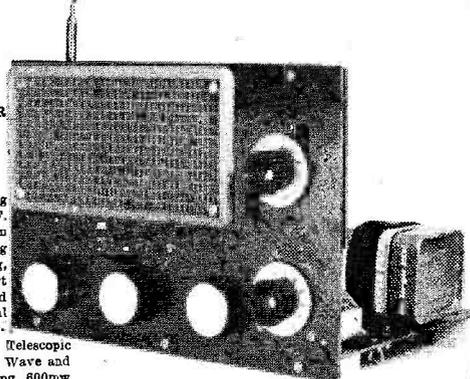
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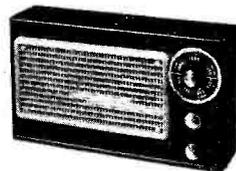
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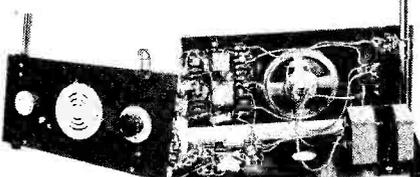


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ECK 2

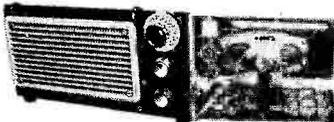
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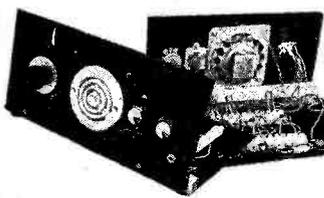
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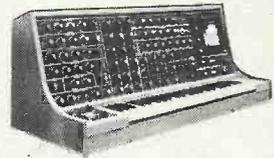
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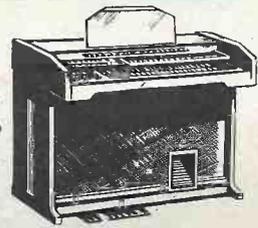
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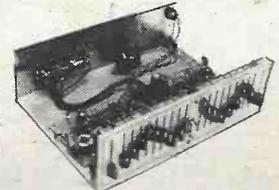


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