OCTOBER 1981

FOR THE RADIO ENTHUSIAST ...

Practical Wireless

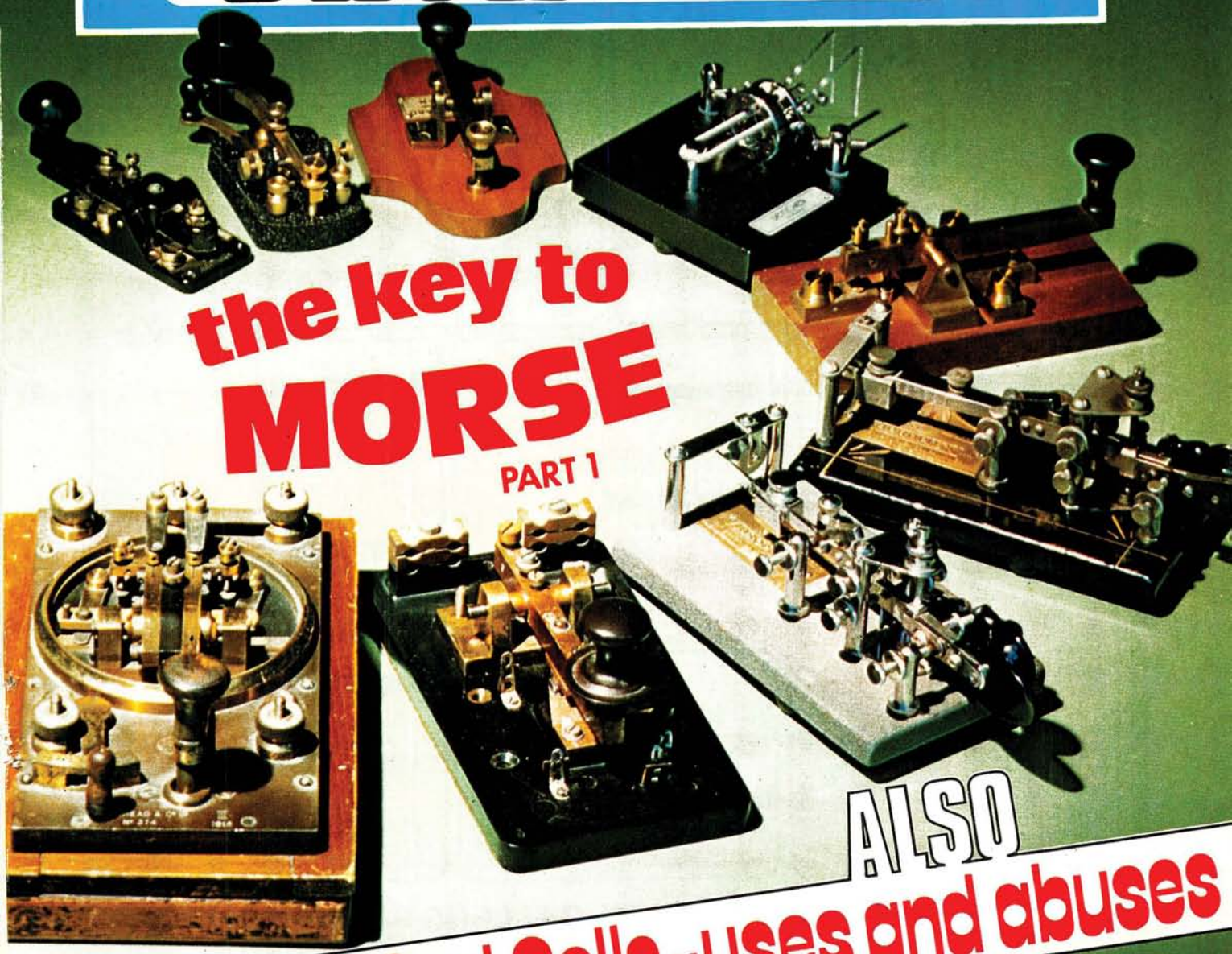
Australia $1.25
New Zealand $1.30
Malaysia $4.50
IR 90p (inc. VAT)

75p

FREE INSIDE

70cm Repeaters

DATACARD



the key to MORSE

PART 1

ALSO

NiCad Cells ~ uses and abuses

WE NOW STOCK DATONG PRODUCTS

Bredhurst electronics

HIGH ST., HANDCROSS, W. SUSSEX 0444 400786

H.F. TRANSCEIVERS

FT 101Z MK III FM
£529
FT 101ZD Mk III FM
£599
inc. VAT.

NEW STANDARD TWINS

C78 70cm F.M. Portable
£219 inc. VAT
C58 2M Multimode
£249 inc. VAT

Accessories:
Mobile tray – Linear – Case – Charger

HANDHELDS FOR 2M

NEW
YAESU FT 208R
£190

AIRBAND RECEIVERS

R517
£49.50
inc. VAT.
Tunes 118-144 MHz

YAESU 2M multimode portable price

FT 290R
£229 inc. VAT
2 VFO's – 10 MEMS – 2·5W – SCAN – DIG. READOUT

V.H.F. SCANNERS

SX 200N
£264 inc. VAT & carriage

BEARCAT 220FB
£258 inc. VAT & carriage

TRANSCEIVERS

H.F.

TRIO TS 130V	£450
SWAN 100 MX	£418
YAESU FT 707S	£454
TRIO TS 130S	£547
TRIO TS 530S	£561
YAESU FT 101Z Mk III	£529
YAESU FT 707	£529
YAESU FT 101ZD Mk III	£599
SWAN ASTRO 150	£613
SWAN 102 BX	£798
YAESU FT 107M	£690
TRIO TS 830S	£726

2M F.M. MOBILES

F.D.K. MULTI 7000 EX	£189
AZDEN PCS 3000	£219
ICOM IC 255E	£255
TRIO TR 7800	£276
TRIO TR 8400 (70 cm)	£329
TRIO TS 7730	p.o.a.

HANDHELD F.M.

ICOM IC2E	£159
YAESU FT 208R	£190
TRIO TR 2300	£166
TRIO TR 2400	£198
STANDARD C78 (70 cm)	£219

MULTIMODES

STANDARD C58 (portable)	£249
YAESU FT 290R (portable)	£229
F.D.K. MULTI 750E	£289
ICOM IC290E	£359
TRIO TR 9000	£371
YAESU FT 480R	£359
ICOM IC 251E	£495
TRIO TR 9500	£482

RECEIVERS

H.F.

YAESU FRG 7	£189
LOWE SRX 30D	£195
TRIO R 1000	£305
YAESU FRG 7700	£309
YAESU FRG 7700M with members	£389
J.R.C. NRD 515 (THE BEST!)	£948

2M F.M./MARINE

SEARCH 9	£45
A.O.R. AR22 (2M ONLY)	£83
F.D.K. TM56B	£89
SX 200N SCANNER	£264
BEARCAT 220FB SCANNER	£258

AIRBAND

R 517 HANDHELD	£49.50
BEARCAT 220FB SCANNER	£258.00
SX 200N SCANNER	£264.00

ACCESSORIES

DRAE POWER SUPPLIES. 13·8V Fully protected

4 AMP CONTINUOUS	£27.95 (£1.50)
6 AMP CONTINUOUS	£44.95 (£2.00)
12 AMP CONTINUOUS	£69.00 (£2.50)
24 AMP CONTINUOUS	£99.00 (£5.00)

MORSE EQUIPMENT

HK 707 Up/Down Key	£10.50 (£0.50)
MK 704 Squeeze Paddle	£10.50 (£0.50)
EK 121 Elbug	£29.95 (£0.75)
EKM 12 Matching side tone monitor	£10.95 (£0.50)
EK 150 Electronic Keyer	£74.00 (—)

ACCESSORIES

SAFETY MICROPHONES

ADONIS MM202S Clip on	£20.95 (£0.50)
ADONIS MM202H Head band + Up/Down	£29.00 (£0.50)
ADONIS MM202FU Swan Kneck + Up/Down	£30.00 (£0.50)
DAIWA RM940 Infra red link	£45.00 (£0.50)

DESK MICROPHONES

YAESU YM34 (Dual Impedance)	£18.80 (£1.50)
TRIO MC50 (Dual Impedance)	£25.76 (£1.50)
SHURE 444D (Dual Impedance)	£29.95 (£1.50)
SHURE 526T series II Power Mic	£39.95 (£1.50)
ADONIS AM502 Compressor Mic	£39.00 (£0.75)
ADONIS AM802 Compressor Mic 30/P's	£59.00 (£0.75)

TEST EQUIPMENT

DRAE WAVE METER 130-450 MHz	
FX1 WAVE METER (700K-250 MHz)	£28.00 (£0.75)
TRIO DM801 Dip Meter (Up to 250 MHz)	£51.00 (£0.75)

DUMMY LOADS

DL 20 (30W Max) PL259	£5.00 (£0.50)
DL 60 (60W Max) PL259	£8.80 (£0.50)
DL 60 (60W Max) N Type	£16.50 (£0.50)
DL 150 (150W Max) PL259	£14.95 (£0.75)
DL 1000 (300W Cont. 1kW Max) PL259	£29.95 (£1.50)

T.V.I. PROBLEMS

YAESU FF 501 DX Low pass filter (1kW)	£22.25 (£0.75)
TRIO LF 30A Low pass filter (1kW)	£19.30 (£0.75)
TV 1 30 Low pass filter (150W)	£5.95 (£0.60)
HP 4A High pass filter (TV down lead)	£5.95 (£0.50)
Ferrite Rings Top quality 1½" dia – Per pair	£0.80 (£0.20)

HEADPHONES

YAESU YH55	£9.95 (£0.50)
YAESU YH77 New lightweight	£10.75 (£0.50)
TRIO H54	£10.35 (£0.50)
TRIO H55 (Luxury 'phones)	£21.85 (£0.50)

SWR/POWER METERS

DAIWA SW 110A	£35.00 (£0.75)
DAIWA CN 620A Cross pointers HF/2M	£52.80 (—)
DAIWA CN 630 Cross pointers 2M/70 cm	£71.00 (—)

Buy it with Access

MAIL ORDER – RETAIL CALLERS 9-5.30 PM.
HIGH ST., HANDCROSS, W. SUSSEX. 0444 400786

BARCLAYCARD VISA

TO ORDER ANY OF THE ABOVE ITEMS SIMPLY WRITE, ENCLOSING A CHEQUE OR PHONE YOUR CREDIT CARD NUMBER

EDITORIAL OFFICES
Practical Wireless
Westover House
West Quay Road
Poole, Dorset BH15 1JG
✆ Poole 71191

Geoff Arnold T.Eng(CEI) G3GSR
Editor

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

Peter Metalli
Art Editor

John Fell G8MCP
Technical Editor

Alan Martin G8ZPW
News & Production Editor

Elaine Howard G4LFM
Technical Sub-Editor

Rob Mackie
Technical Artist

Keith Woodruff
Assistant Art Editor

Sylvia Barrett
Secretarial

ADVERTISEMENT OFFICES
Practical Wireless
King's Reach Tower
Stamford Street
London SE1 9LS
Telex: 915748 MAGDIV-G

Dennis Brough
Advertisement Manager
✆ 01-261 6636
✆ 01-261 6872

Roger Hall G8TNT (Sam)
Ad. Sales Executive
✆ 01-261 6807

Claire Gerrish
Secretary
✆ 01-261 6636

Colin R. Brown
Classified Advertisements
✆ 01-261 5762

Dave Kerindi
Make-up & Copy
✆ 01-261 6570

Practical Wireless

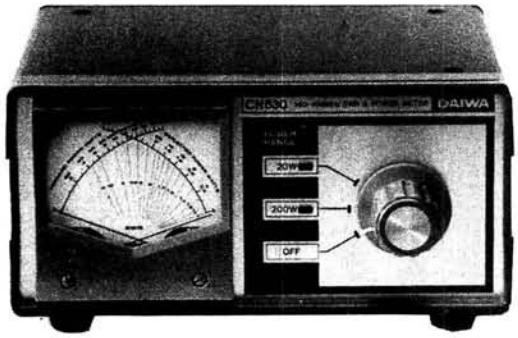
OCTOBER 1981 VOL. 57 NO. 10 ISSUE 895

contents

DAIWA POWER METERS

CN620A	1.8-150 MHz up to 1KW	**£52.81** inc VAT
CN630	140-450 MHz up to 200W	**£71.00** inc VAT
CN650	1.2-2.5 GHz up to 20W	**£95.00** inc VAT

Until recently, the in-line measurement of RF power and SWR involved calculation or the use of two instruments. Now, DAIWA have introduced a range of power meters which provide an elegant solution to the whole problem of RF measurements. Utilising two toriodal current transformers to detect true forward and reflected power, and feeding the outputs to a twin movement meter with crossed pointers, it is now possible to measure forward power (LH scale), reflected power (RH scale) and SWR (where the pointers cross) at a single glance. The DAIWA CN series power meters represent the ultimate power meter for the professional and amateur alike, and are indispensable in the fully equipped station. Three models are currently available covering frequencies right up to 2.5GHz so there's one for you whatever your interests.



CARRIAGE ON METERS **£1.25**
CARRIAGE ON MIKE SYSTEM **£1.50**

KRT100 KRT500 KRT200

POWER SUPPLIES

Meet the

HONOR *family*

KRT100 11 RANGES	**£5.35** inc. VAT
KRT200 18 RANGES	**£9.85** inc. VAT
KRT500 43 RANGES	**£15.60** inc. VAT
carriage KRT100 £1.00	KRT200 & 500 £1.50

THE 3 MODELS

ALL MODELS 240 VOLTS A.C. INPUT.

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

JRC *Japan Radio Co., Ltd.*
Since 1915

NRD 515

The NRD 515 is a PLL-synthesised communications receiver of the highest class featuring advanced radio technology combined with the latest digital techniques.
The new NRD 515 is full of performance advantages including general coverage, all modes of operation, PLL digital VFO for digital tuning, 24-channel frequency memory (option), direct mixing, pass-band tuning, etc. JRC's 65 years of radio communications experience will give you "the world at your fingertips".
The NRD 515 is but a single item from the JRC product range which extends all the way to full marine radio installations for supertankers.

NRD 515 SYNTHESISED HG RECEIVER	**£948.75** inc VAT
NHD 515 MULTI CHANNEL MEMORY UNIT	**£161.00** inc VAT
NVA 515 LOUDSPEAKER	**£27.60** inc VAT
CFL 260 600Hz CW FILTER	**£34.50** inc VAT

LOWE ELECTRONICS
CHESTERFIELD ROAD MATLOCK DE4 5LE TEL 0629 2817

Once again from Trio an absolutely fantastic 2 metre FM Mobile Transceiver. Compact, simple to operate, full 25 watts output – a truly dazzling piece of gear.
Designed by Trio to provide a miniature transceiver, the TR7730 measures 6in wide by 2in high by 8in deep.
In providing both first class performance in transmission and reception Trio engineers have again triumphed.
Switch on your Rig and listen for the outstanding signal from a TR7730.
The five memories, the band and memory scan facility, together with the up/down mike and comprehensive mobile fixing kit make this the rig you have been waiting for.

- 25 watts output in high power position for good mobile communications – 5 watts in low position.
- Five memories for either Simplex or repeater operation. The fifth memory is capable of non-standard
- Memory scan. Automatically locks on an occupied memory channel and resumes scanning when the signal disappears or when the scan switch is pushed. Scan hold or mike push to talk switch cancels the scan function.
- Band scan. The Rig scans the band in either 25 or 5kHz steps and locks on an occupied channel.
- Both mobile mounting bracket and up/down microphone included with the equipment.

the new compact 2 metre fm transceiver

TR-7730 Price to be announced

The TR9500, a 70 cm multimode mobile giving SSB, FM and CW operation in a compact rig based on the phenomenally successful 2 metre 9000. Combining the convenience of FM with the "DX ability" of SSB on the 70 cm band this is the rig all discerning VHF and UHF amateurs have been waiting for. Used alongside your existing 2 metre equipment a new spectrum of contacts becomes available. Repeaters, satellite working, simplex and with the addition of your 2 metre rig Duplex communications are at your finger tips. Of course the matching accessories SP120 speaker, BO-9 system base and PS20 power supply are all available to enable you to build a base station system second to none.

The TR9500 features:
★ FM, USB, LSB and CW.
★ Similar in size to the TR9000.
★ Two digital VFOs.
★ Multiple scan facilities for various modes.
★ 6 memories, 5 for simplex or repeater shift – and the sixth memory for a non-standard offset.
★ Digital frequency display.
★ Covers 430 to 440 MHz.
★ Up/down microphone for manual band scan.
★ RIT (Receiver Incremental Tuning) for SSB and CW.
★ RF gain control.
★ Mobile mounting bracket.
★ Led indicators for on air and busy.

the new 70cm FM, SSB & CW mobile

TR-9500 £472 inc VAT carr £4.50

TRIO

pacesetter in amateur radio

Trio 8400 the new way to 70cm FM mobile, a fully synthesized 430 440MHz 10 watt output, mobile transceiver with memories, 2 separate VFO's all in a truly amazing compact package. Complete with up/down frequency shift microphone and car mounting bracket the TR8400 is the way to go . . . 70cm is on the move.

TR-8400 *70cm FM mobile*

£329.13 inc VAT. Securicor carriage £4.50

TR-9000 The exciting TR-9000 2-metre all-mode transceiver combining the convenience of FM with long distance SSB and CW in a very compact, very affordable package. Because of its compactness the TR-9000 is ideal for mobile installation, add on its fixed station accessories and it becomes the obvious choice for your shack.

TR-9000 *2 Metre Multimode*

£371.91 inc VAT. Carriage by Securicor £4.50

TR-7800 Trio's remarkable TR-7800 2-metre FM mobile transceiver provides all the features you could desire for maximum operating enjoyment. Frequency selection is easier than ever, and the rig incorporates new memory development for repeater shift, priority, and scan. The TR-7800 by Trio, the only FM mobile.

TR-7800 *The Ultimate 2 Metre Mobile FM rig*

£276.00 inc VAT. Carriage by Securicor £4.50

PRICES & SPECIFICATION SUBJECT TO CHANGE WITHOUT NOTICE

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

LE

ICOM

the amateur's professional friends

Several new products from Icom will be introduced onto the market shortly and when we recently saw the prototypes in Japan we realized just how popular they are going to be. Just to wet your appetites here are a couple of examples:–

See us at Castle Donington The Big One!!

IC-290E

£359

See us at Castle Donington The Big One!!

IC-25E

£249

IC-290E TWO METRE MULTIMODE MOBILE

The IC-290E incorporates all the features you could want in a multimode mobile to make it easy to use when driving. A standard 6000kHz repeater offset shift is built into its computer's memory but if necessary this can be altered from the front panel for unusual shifts that may be required (such as say 1.6MHz for some transvertors). There are five programmable memories and these can be used in either simplex or duplex mode. Any one of these memories can also be designated as a PRIORITY CHANNEL which can be checked once every five seconds if you wish for that private message you may be expecting. Scanning can be controlled either from the front panel or from the HM10 microphone. There are options to scan the whole band, any selected part of it, or just the memory channels. You do NOT lose the repeater shift when scanning or using either of the VFOs in simplex. Unlike many of its competitors you do have TWO VFOs which can also prove a very useful feature. Further improvements include a brighter frequency readout, a LED bar-type S-Meter and power output meter and the ideal tuning rates of 25kHz per step on FM and 100Hz per step on SSB. Both these rates can be changed to 1kHz steps by use of the TS button on the front panel. For repeater operation both + and – shifts are available and it is possible to listen on the repeater input channel merely by pressing a button. Internal controls allow you to vary scan speed, scan delay time etc. Semi break-in CW and CW sidetone are also available.

Put all these features into an attractive case, add the world wide renowned ICOM quality and performance, and you must see that this is the choice for you. And just as an extra remember that you get a full two year's warranty if you purchase your transceiver direct from THANET or one of our agents listed in this advertisement.

ICOM HAVE GOT IT RIGHT AGAIN!

Again ICOM seem to have got everything right with its new 25W FM mobile. It is one of the smallest around and yet is packed with features which make it really handy to use while still maintaining the very high quality expected in ICOM transceivers.

Like its bigger multimode brother, the IC-25 has TWO VFOs, FIVE MEMORIES (which can be used in either simplex or duplex mode), a PRIORITY CHANNEL (which can be any one of the frequencies stored in the memories), full DUPLEX and REVERSE DUPLEX operation, and a crystal controlled tone burst. Again the display is brighter and there is a LED Bar-type S-Meter and relative power outputer meter. The choice of the frequency steps is 25kHz and 5kHz. Like the IC-290 multi-scanning functions are available either from the front panel or remotely using the HM-10 scanning microphones.

Again we feel that this beautifully designed and constructed piece of equipment is bound to "sell like hot cakes" – and again remember that if you buy one directly from Thanet you will get a full two year's warranty and any work will be carried out in our excellently equipped workshop. One of our engineers has been out to ICOM in Japan for a two week course to learn the "tricks of the trade".

What about other new products? – well you may well ask but we won't be giving too much away just yet. But how about a 70cm version of the IC-2E and a fully automatic antenna tuner to start off with?

Buy direct from us and get two years warranty on all equipment

WE STOCK CUSHCRAFT ANTENNAS

H.F.			**INC. VAT**
A3	20/15/10	3ele Beam 8dB gain	**£147.00**
ATV5	80-10	Trapped Vertical	**£74.40**
ATV3	20/15/10	Trapped Vertical	**£34.00**
VHF (144MHz)			
A3219		19ele Long 'Boomer' Yagi 16.2dB gain	**£62.00**
214B		14ele Jnr 'Boomer' Yagi 15.2dB gain	**£49.50**
ARX2		Ringo Ranger 6dB gain vertical	**£24.75**
A144-4		4ele Yagi 9.0dB gain	**£16.25**
A144-7		7ele Yagi 10.0dB gain	**£20.31**
A144-11		11ele Yagi 11.3dB gain	**£25.72**
DX120		20ele Array 13.2dB gain	**£47.20**
ARX2B		Ringo Ranger II	**£28.75**
ARB2K		Conversion Kit for Ringo to Mk II version	**£12.75**

WE ALSO STOCK:–

J-BEAM ● MICROWAVE MODULES ● YAESU ● WESTERN RSGB BOOKS ● BEARCAT ● JIL ● TAL ANTENNAS ● VIDEO GENIE

Thanet Electronics

IC-2E
£169

IC-251E

£495

IC-451

£599

The Largest Selling Amateur Transceiver in the World

CHECK THE FEATURES:

FULLY SYNTHESIZED – Covering 144-145 99s in 400 5kHz steps.

POWER OUTPUT – 1.5W with fine 9V rechargeable battery pack as supplied – but lower or higher output available with the optional 6V or 12V packs.

BNC ANTENNA OUTPUT SOCKET – 50 ohms for connecting to another antenna or use the Rubber Duck supplied.

SEND/BATTERY INDICATOR – Lights during transmit, but when battery power falls below 6V it doesn't light indicating the need for a recharge.

FREQUENCY SELECTION – by thumbwheel switches, indicating the frequency.
+5kHz SWITCH – adds 5kHz to the indicated frequency.

DUPLEX SIMPLEX SWITCH – gives simplex or plus 600kHz or minus 600kHz Transmit.

HI-LOW SWITCH – reduces power output from 1.5W to 150mW reducing battery drain.

EXTERNAL MICROPHONE JACK – If you do not wish to use the built-in electret condenser mic an optional microphone/speaker with PTT control can be used. Useful for pocket operation.

EXTERNAL SPEAKER JACK – for speaker or earphone. This little beauty is supplied ready to go complete with nicad battery pack, charger, rubber duck.

A full range of accessories in stock

IC ML1	
10 Watt Mobile Booster for IC2E	**£49.00**
BPS 11 Volt Battery Pack	**£30.50**
BP4 Empty Battery Case For, 6 × AA Cells	**£5.80**
BP3 Standard Battery Pack	**£17.70**
BP2 6 Volt Pack	**£22.00**
BC30 Base Charger For Above	**£37.00**
BC25 Mains Charger As Supplied	**£4.25**
DC1 12 Volt Adapter Pack	**£8.40**
HM9 Speaker/Microphone	**£12.00**
CP1 Mobile Charging Lead	**£3.20**
IC1/2/3 Cases	**£3.60 each**

Icom produce a perfect trio in the VHF base station range ranging from 50 Metres thru 2 Metres to 70cms. Unfortunately you are not able to benefit from the 5M product in this country, but you CAN own the 215E for your 2 Metre station and the 415E for 70cms.

Both are really well designed and engineered multi-mode transceivers capable of being operated from either the mains or a 12 volt supply. Both contain such exciting features soan facilities, automatic selection of the correct repeater shift for the band concerned, full normal and reverse repeater operation, tuning rate selection according to the mode in use, VOX on SSB, continuous power adjustment capability on FM and 3 memory channels. Of course they are both fitted with a crystal controlled tone burst and have twin VFO's as have most of ICOMs fully synthesized transceivers. These two transceivers have now become really popular throughout the World – so why not pop a note on our ansafone for more details?

See us at Castle Donington The Big One!!

Thanet for ICOM

143 RECULVER ROAD, BELTINGE, HERNE BAY, KENT. TEL: (02273) 63859

NOW with TWO YEARS WARRANTY

PROFESSIONAL EQUIPMENT FOR THE AMATEUR

ICOM

See us at Castle Donington The Big One!!

IC720A £849

IC-2KL £799 + psu

See us at Castle Donington The Big One!!

The main problem that the amateur of today has to deal with is deciding just which rig out of the many excellent products available he is going to choose. Technology is advancing at such a rapid rate and getting so sophisticated that many cannot hope to keep up!

Perhaps one way of dealing with the problem is to look at just what each model offers in its basic form without having to lay out even more hard earned cash on "extras'. The IC720A scores very highly when looked at in this light. How many of its competitors have two VFOs as standard or a memory which can be recalled, even when on a different band to the one in use, and result in instant returning AND BANDCHANGING of the transceiver? How many include a really excellent general coverage receiver covering all the way from 100kHz to 30MHz (with provision to transmit there also if you have the correct licence)? How many need no tuning or loading whatsoever and take great care of your PA, should you have a rotten antenna, by cutting the power back to the safe level? How many have an automatic RU which conceals itself when the main tuning dial moved? How many will run full power out for long periods without getting hot enough to boil an egg? How many have band data output to automatically change bands on a solid state linear AND an automatic antenna tuner unit when you are able to add these to your station?

Well you will have to do quite a bit of hunting through the pages of this magazine to find anything to approach the IC-720-A. It may be just a little more expensive than some of the others – but when you remember just how good it is, and of course the excellent reputation for keeping their secondhand value you will see why your choice will have to be an IC-720A!

To complement the excellent IC720A HF Transceiver, ICOM have produced the IC2KL linear amplifier. It is of a similar size and matches the IC720A perfectly. It produces 500W output on SSB, CW, AM and RTTY, needing 80-100W of drive.

As with the IC720A it will operate from 1,6MHz to 30MHz continuously at full output power, but you *still* need an antenna that matches. It will follow the IC720A, automatically changing bands WITH NO TUNING – the operating is done from the prime mover. This automatic facility can be overidden for use on rigs other than the IC720A, but can be added to the IC701 and the IC720. The IC2KL employs a heat pipe cooling system for the heatsink of the power transistors.

This is a new technology used to transfer the heat, has a high conductance, several hundred times that of copper and a very quick response. The use of this system enables a very compact design for which ICOM is the leader.

This advanced design includes protection circuits against Mismatching, Overheating, Overcurrent, Overdriving, Over Output Power and the PA units unbalancing. Its spurious emissions are more than 60dB below peak power output and third order distortion more than 30dB below each tone of a two tone test could a valve linear ever be as good as this?

The IC2KL has a matching power supply the IC2KLPS delivering 40vDC at 25A continuous for 10 minutes maximum.

IC2KLPS (Power Pack) £199.00

AGENTS (PHONE FIRST – evenings and weekends only)

Scotland	Jack GM8GEC (031-665-2420)	Wales	Tony GW3FKO (0874 2772)
North West	Gordon G3LEQ (Knutsford (0565) 4040)	Midlands	Tony G8AVH (021-329-2305)
	Ansafone Service available		

Thanet for ICOM

TWO YEARS WARRANTY ON ALL EQUIPMENT

IC-730

£574

ICOM'S answer to your HF mobile problems – the JC730. This new 80m-10m 8 band transceiver offers 100W output on SSB, AM and CW.

Outstanding receiver performance is achieved by an up-conversion system using a high IF at 39MHz offering excellent image and IF interference rejection, high sensitivity and above all wide dynamic range. Built in Pass Band Shift allows you to continuously adjust the centre frequency of the IF pass band virtually eliminating close channel interference. Dual VFO's with 10Hz, 100Hz, and 1KHz steps allows effortless tuning and whats more a memory is provided for one channel per band. Further convenience circuits are provided such as Noise Blanker, Vox, CW Monitor, APC and SWR Detector to name a few. Provided the IC730 is kept connected to its supply its CPU will remember your instructions even when turned off! Built in fan keeps the finals cool and remember there is no tuning to be done. A built-in Speech Processor boosts talk power on transmit and a switchable RF Pre-Amp is a boon on todays crowded bands. Full metering, WWV reception and connections for transverter and linear control almost completes the IC730's impressive facilities. Use this rig as a high class mobile or with a suitable 13v psu as your main base station. Give us a ring and ask for a full spec. to be sent to you.

IC-202S

£169

The IC-202S is a very well designed 2m SSB portable. It offers 3W pep output on USB, LSB and CW. Large battery capacity (HP11 type) or Nicads if you wish. A special VXO circuit to provide smooth tuning and crystal stability needed for SSB operation on 2m; Each of the four 200kHz band positions allows operation anywhere in 2m (Supplied with 144-144.2 and 144.2-144.4). Top of the band Oscar xtals available for "cross-pond working".

It has a DC socket and SO239 sockets for mobile or base station working barefoot or as a prime mover. Mobile mounting brackets, Nicad packs chargers, cases all available options. You must agree, a very versatile well proved rig. The 70cm twin of the 202S having very similar feature covering the frequency range of 432-435.2MHz. Their versatility is well worth an enquiry.

See us at Castle Donington The Big One!!

IC-24G

£169

The famous IC240 has been improved given a face lift, and renamed the IC24G. Many thousands of 240s are in use, and its popularity is due in part to simplicity of operation, high receiver sensitivity and superb audio on TX and RX. The new IC24G has these and other features. Full 80 channels (at 25kHz spacing) are available and read out is by channel number – selected by easy to operate press button thumbwheel switches. This readout can clearly be seen in the brightest of sunlight. Duplex and reverse duplex is provided along with a crystal controlled tone call Hi-10W and low-1W RF output is available along with a 12½kHz unshift should the new channel spacing be necessary. The old IC240 proved to be the most reliable ng we have ever sold – the IC24G, because it is so similar, looks like following the same pattern.

Remember, for mobile use a rig MUST be easy to operate to be safe. Send for technical details.

Thanet Electronics

143 RECULVER ROAD,
BELTINGE, HERNE BAY, KENT
TEL: 02273 63859

ICOM

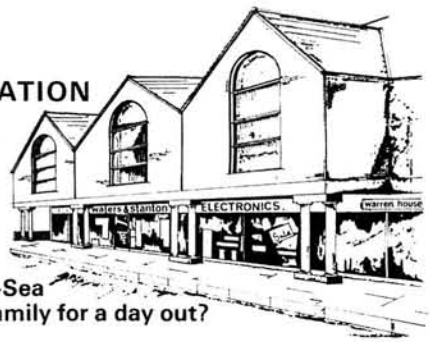
WATERS & STANTON ELECTRONICS

18/20 MAIN ROAD, HOCKLEY,
ESSEX. TEL (0702) 206835

4,000 SQ FT DEVOTED TO RADIO COMMUNICATION

24 HOUR TURN ROUND ON ALL ORDERS!

"SUCH NICE PEOPLE"



5 miles from Southend-on-Sea
Why not bring the whole family for a day out?

FDK
M750E TRANSCEIVER
2M FM-SSB-CW

- ★ 1/10 Watts
- ★ All modes
- ★ Digital readout
- ★ 144-146MHz
- ★ Tone burst
- ★ RF gain control
- ★ Dual FVO
- ★ Up/down Mic
- ★ Hardware kit

SUPER DEAL

£289 (carriage free)
SAE FOR COLOUR LEAFLET

FDK
M700EX TRANSCEIVER
2M FM 25 WATTS

- ★ Synthesized
- ★ 25 & 12½ KHz steps
- ★ Priority scanning
- ★ Variable power
- ★ Digital display
- ★ Tone burst
- ★ Reverse repeater
- ★ Fully protected
- ★ Hardware kit

SUPER DEAL

£189 (carriage free)
SAE FOR COLOUR LEAFLET

AZDEN
2M TRANSCEIVER
UNBEATABLE PRICE
£219
(carriage free)

SUPER DEAL

25 Watts!

- ★ 144-146MHz FM
- ★ Digital readout 25KHz or 12½KHz
- ★ 8 memories (programmable)
- ★ Programmable scanning
- ★ Remote mic control
- ★ Detachable control head
- ★ Complete with all accessories

IMPORTED DIRECT BY US
12 MONTHS WARRANTY

GLOBAL PS15
13·8v 5-6 Amp METERED PSU
£31.95
(carriage £2.00)

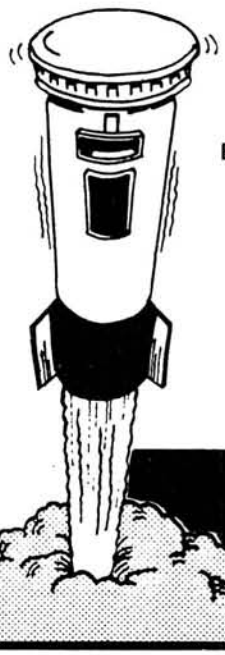
At last a fully metered power supply providing 5-6 amps at 13·8v DC. Made specially for us by one of Japan's foremost manufacturers. Fully protected and with an extremely generous transformer, this unit will power almost any mobile transceiver up to 25 watts. A flick of the switch indicates either volts or amps.

Latest version
SX200 MONITOR
26-500MHz

£260 inc. VAT

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

FASTEST MAIL ORDER SERVICE IN THE BUSINESS



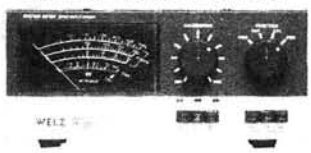
TRIED OUR NEW TECHNICAL BOOK SERVICE?

BY RETURN SERVICE ON ALL STOCK TITLES
(post free)

A Guide to Amateur Radio (18th ed.)	£3.10
Amateur Radio Techniques (7th ed.)	£6.15
Amateur Radio Operating Manual	£4.96
UK Amateur Radio Call Book	£4.37
Radio Amateurs Examination Manual	£2.75
Radio Data Reference Book	£5.00
Amateur Radio Log Book	£2.50
Receiving Log Book	£2.68
Mobile Log Book	£1.15

"WELZ" PROFESSIONAL RF PRODUCTS AT AMATEUR PRICES!

SAE FOR COLOUR LEAFLET



SP300 £79

The SP300 is the most sophisticated in-line RF measuring device available to the amateur. Accurate to between DC and 500MHz at power levels from 1 watt to 1Kw. This unit tells the truth about the actual amount of RF reaching your aerial. Ideal for measuring power and swr curves to very precise standards.

CH-20A
£13.95

The CH-20A is a 2 way coax switch (SO239) to laboratory standards rated at DC-900MHz for an insertion loss of less than 0·1db at up to 1Kw. We guarantee that you won't find anything better at double the price!

SP15M £29.95

The SP15M is a budget price version of the SP300 model having a sensitivity such that it is able to measure power and swr curves from 1 watt to 200 watts. We actually guarantee that you will not be able to buy anything more accurate at the price!

WE CAN SUPPLY ALMOST ANY AMATEUR RADIO PRODUCT
WE HAVE SOME VERY ATTRACTIVE PRICES
WE HAVE FULL SERVICE FACILITIES
WE ARE THE PEOPLE MOST PEOPLE COME TO!

WATERS & STANTON ELECTRONICS

18/20 MAIN ROAD, HOCKLEY,
ESSEX. TEL (0702) 206835

THE UK SPECIALISTS

IN RADIO COMMUNICATIONS FOR THE ENTHUSIAST

1200 CHANNELS! **AR22 VHF FM MONITOR**

AMATEUR MODEL **£83** inc. VAT

(Marine version £89)

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

PROFESSIONAL AIRCRAFT MONITOR

R517 £49.50

(as supplied to pilots, ground crew etc.)

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

FREE

AERIAL & DC KIT WITH EVERY FRG7700 & R1000 RECEIVER

TRIO R1000

COMMUNICATIONS RECEIVER

OUR PRICE £305 (Free Securicor Delivery)

The R1000 has really caused a stir in the receiver market! Its performance matches professional receivers costing many times more and with our new competitive price of £305 it must be the best value on the market today. Full digital readout from 200kHz (actually it operates right down to 20kHz but with reduced sensitivity) means accurate tuning and the 30 position band selector switch means really good bandspread for easy operation. Other features include noise blanker (a really good one!) built-in speaker, digital clock/timer and both 230v AC/12v DC operation. (Yes we include the 12v DC kit free!) Each model is fully checked and delivered anywhere in the U.K. within 24 hours of receipt of payment!

YAESU COMMUNICATIONS RECEIVER

FRG7700 £299

FRG7700MEM £380

Free Securicor Delivery

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

SR9 VHF RECEIVER AMATEUR/ MARINE

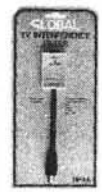
£46 inc. VAT

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

NO MORE TV INTERFERENCE FROM CB OR AMATEUR!

GLOBAL HP4A £5.95

Post free.



If you're suffering T.V. interference, here's a brand new device specially designed and made for us in Japan. The HP4A now offers about 100% cure against TV interference because of its advanced design, yet it has no effect on the picture. Be prepared, keep one handy!

28MHz FM!

NEW AZDEN PCS2800

£179 inc. VAT

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

M161 FM SCANNER AMATEUR OR MARINE MODEL

£59 inc. VAT

This highly compact monitor can be supplied either for the 2 metre amateur band or the marine band. It has the capability of scanning up to 16 channels and hunting out and locking on to any signal that appears. Ideal for mobile or base operation an external 12v DC supply is required but unit has built-in speaker, mobile mounting brackets, etc. The receiver comes with the national calling channel. Additional crystals for channels are £3 each.

SEND 14P FOR OUR FULL CATALOGUE OF EQUIPMENT

MAIL ORDER SLIP to: Waters & Stanton Electronics, Warren House, Main Road, Hockley, Essex.

Name..... **Goods required** .....

Address.....

.....

.....

Please rush me the above. Cheque enclosed for £...../Please charge to credit card No .....

COMPUTERS ● AUDIO ● RADIO ● MUSIC ● LOGIC ● TEST GEAR ● CB ● GAMES ● KITS

BREADBOARD 81

Wednesday 11th November 10 a.m.-6 p.m.
Thursday 12th November 10 a.m.-8 p.m.
Friday 13th November 10 a.m.-6 p.m.
Saturday 14th November 10 a.m.-6 p.m.
Sunday 15th November 10 a.m.-4 p.m.

COMPONENTS ● DEMONSTRATIONS ● SPECIAL OFFERS ● MAGAZINES ● BOOKS

ROYAL HORTICULTURAL SOCIETY'S NEW HALL, GREYCOAT STREET, WESTMINSTER, LONDON S.W.1.

17,000 PEOPLE CAN'T BE WRONG

For 5 days last year they packed the RHS halls for Breadboard '80. All the leading companies were there.....

.....and they're back again this year for BREADBOARD '81.....with larger stands and wider gangways.

Whether you're buying or just browsing, BREADBOARD '81 has something to offer you. The top electronics magazines will be there.

If you're interested in kits, components or computing, BREADBOARD '81 covers it all..... books, bargains and demonstrations. It's all happening at BREADBOARD '81.

Cost of entry will be £2.00 for adults, and £1.00 for children under 14 yrs and O.A.P.s.

To avoid queueing, Advance tickets will be available from:
Advance Tickets BB '81,
Modmags Ltd, 145 Charing Cross Road,
London WC2H 0EE.

Special Advance Booking Price
Adults £1.75, Children under 14 yrs and O.A.P.s 80p

Please send ..... tickets @ £1.75 ..... tickets @ 80p

To .....

.....

.....

I enclose PO/cheque for £ .....

Advance tickets MUST be ordered BEFORE 20th October 1981.

T. POWELL

IONISER KIT

This negative ion generator gives you the power to saturate your home or office with millions of refreshing ions. Without fans or moving parts it puts out a pleasant breeze. A pure flow of ions pours out like water from a fountain, filling your room. The result? Your air feels fresh, pure, crisp and wonderfully refreshing.

All parts, PCB and full instructions **£12.50**
A suitable case, including front panel, neon switch etc **£10.50**

P.W. KITS

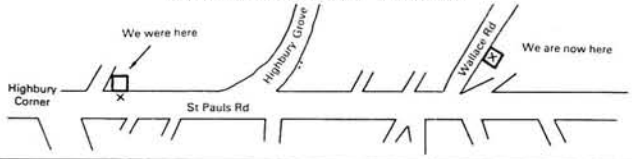
PW NIMBUS – Complete kit still available ..... **£80.00 (without xtals)**
Add-on base unit **£38.00**
Wideband RF Pre-Amp **£7.50**
AF Speech Processor **£18.00**
Beginners 2 meter Convertor **£15.00**
Model Railway Controller **£21.50**
VHF/UHF Repeater Station Timer (Main board only) **£22.50**
Active receiving Antenna **£9.00**
6V to 12V Regulated Convertor **£14.95**
Tape Slide Synchroniser **£41.40**
Automatic Cut Out Power Supply ..... **P.O.A.**
Supplementary Car Audio Amplifier ..... **P.O.A.**

SPECIAL OFFERS

TOSHIBA TA 7205 ..... **£2.50**
PHILIPS SCOPE TUBES – 5" CV 2191/DG 132 ..... **£12.65**
MULLARD COMPUTER ELECTROLYTICS 21,000/40V **£4.50**

All prices include VAT and postage & packing
Callers: Please ring to check availability of kits before calling.

PLEASE NOTE OUR NEW ADDRESS:
Advance Works, 44 Wallace Rd., London N1.
Our 'Phone number is still: 226 1489
HOURS: Mon. to Fri. 9-5.30. Sat. 9-4.30.



The ONE catalogue you MUST have!

- About 2,000 items clearly listed.
- Profusely illustrated throughout.
- Large A-4 size pages.
- Bargain list, order form and 2 coupons each worth 25p if used as directed, all supplied free.

Price £1, plus 50p for post, packing and insurance.

Send cheque or P.O. for £1.50

HOME RADIO Components LTD
Dept. PW, P.O. Box 92, 215 London Road, Mitcham, Surrey. 01-543 5659

PROGRESSIVE RADIO

ALL ORDERS DESPATCHED BY RETURN POST

NICADS. 'AA' size **95p,** 'C' 2AH **£2.60p,** 'D' 1.2AH **£2.40p,** 'D' 4AH **£3.60p.**
BEREC UNIVERSAL NICAD CHARGER, charges 'AA', C or D cells, up to 4 of each type **£9.25p.**
SWITCHES. Min. toggles, SPST 8×5×7mm **42p.** DPDT 8×7×7mm **55p.** DPDT c/off 12×11×9mm **77p.** HEAVY DUTY-DPDT 240VAC 10 Amp **35p.** PUSH TYPE, push on 16×6mm **15p,** push to break version **17p,** MERCURY (TILT) SWITCH, 1"×¼" **35p.**
NSA1198 8½ digit multiplexed displays, com. cath. with data sheet **£1.45p.**
SPECIAL OFFER TIL209 Red LED's 10 for **75p.** 0.2" LEDS, red, yellow, green **10p** each.
MICROPHONE OFFERS: P.A./C.B. hand held mikes with thumb switch + curly lead, 1. 600Ω dynamic **£3.95p,** 2. 600Ω noise cancelling type **£7.25p,** 3. CB power type with volume control **£7.95p. EM103** Electret Condenser Mike, 600Ω, Omni, 50-1600Hz, aluminium case 172 x 22mm with battery **£7.25p.**
ANTEX SOLDERING IRONS: Models C15, CX17 and X25 all **£4.45** each.
STABILISED POWER SUPPLY, 240 vac input 13.8 volts at 3/5 Amps DC output. **£12.25p** + 87p P+P.
JUMPER TEST LEAD SETS. 10 pairs of leads with insulated crocs each end **90p.**
40KHZ TRANSDUCERS, RX/TX **£3.50** pair.
STC BREAK GLASS FIRE ALARM UNITS, new with mounting box **£1.50p.**
MINIATURE SOLID STATE BUZZERS. 2 voltages available, 6 or 12VDC **75p** each, Loud 12 volt buzzers **65p.**
Cash with order please, official orders welcome from schools etc., please add 30p postage and packing. VAT inclusive. New catalogue at printers. Sorry for delay. All S.A.E.'s sent are being held until catalogue is ready.

31, CHEAPSIDE, LIVERPOOL L2 2DY

BI-PAK BARGAINS

"IRRESISTABLE RESISTOR BARGAINS"

Pak No.	Qty.*	Description	Price
SX10	400	Mixed "All Type" Resistors	£1
SX11	400	Pre-formed ¼-½ watt Carbon Resistors	£1
SX12	200	⅛ watt Carbon Resistors	£1
SX13	200	¼ watt Carbon Resistors	£1
SX14	150	½ watt Resistors 22 ohm-2m2 Mixed	£1
SX15	100	1 and 2 watt Resistors 22 ohm-2m2 Mixed	£1

Paks SX12-15 contain a range of Carbon Film Resistors of assorted values from 22 ohms to 2.2 meg. Save pounds on these resistor paks and have a full range to cover your projects.
*Quantities approximate, count by weight.

"CAPABLE CAPACITOR PAKS"

Pak No.	Qty.*	Description	Price
SX16	250	Capacitors Mixed Types	£1
SX17	200	Ceramic Capacitors Miniature Mixed	£1
SX18	100	Mixed Ceramics 22pf-390pf	£1
SX19	100	Mixed Ceramics 470pf-.047uf	£1
SX20	100	Assorted Polyester/Polystyrene Capacitors	£1
SX21	60	Mixed C280 type capacitors metal foil	£1
SX22	100	Electrolytics, all sorts	£1
SX23	50	Quality Electrolytics 50-100mfd.	£1
SX24	20	Tantalum Beads, mixed	£1

*Quantities approximate, count by weight.

AUDIO PLUGS, SOCKETS AND ACCESSORIES

25 pieces of Audio Plugs, Sockets and Connectors to include DIN 180°-240°, Inline 3-6 Pin, Speakers, Phono, Jack, Stereo and Mono, etc. etc. Valued at well over £3 normal. Order No. SX25. Our Price £1.50 per pak. Guaranteed to save you money.

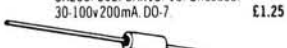
SX26 3 Prs. of 6 pin 240° DIN Plugs and Chassis Sockets.	50p
SX27 1 x Right Angle Stereo Jack Plug 6.3mm plus matching metal chassis mounting socket.	30p
SX28 4 Phono plugs and 2 dual phono connectors.	30p
SX29 1 x 2.5mm Plug to 3.5mm Socket adaptor.	20p
SX30 1 x 3.5mm Plug to 2.5mm Socket adaptor.	20p
SX31 1 x 3.5mm Plug to Phono Socket adaptor.	20p

SX32 1 x Standard Jack Plug to Phono Socket adaptor.	25p
SX33 1 x Toggle Switch SPST Miniature. 125v 10A.	40p
SX34 1xToggle Switch SPDT Miniature. 125v 10A.	40p
SX35 1 x Rocker Switch SPDT Miniature. 240v 5A.	40p
SX36 1 x Right Angle Mono Jack Plug.	15p
SX37 20 pieces. 1, 2 & 4mm plugs and sockets (Banana). Matching colours and sizes.	£1
SX50 10 Assorted Switches. Toggle, Slide, Rocker, Push button.	£1

Guarantee

Satisfaction or your money back has always been BI-PAK's GUARANTEE and it still is. All these Sale items are in stock in quantity and we will despatch the same day as your order is received.

SX40	250 Silicon Diodes—Switching like IN4148 DO-35. All good—uncoded. Worth double our price. 45v 75mA. £1.25
SX41	250 Silicon Diodes—General Purpose. like OA200/202. BAX13/16. Uncoded. 30-100v 200mA. DO-7. £1.25



SX44	10 5A SCR's TO64. 3 x 50v, 3 x 100v, 2 x 200v, 2 x 400v. Super value less than ½ price. £2
SX45	10 5A SCR's TO66. 2 x 50v, 2 x 100v, 4 x 200v, 2 x 400v. All coded. Brand new, a give away at... £2

SEMICONDUCTORS FROM AROUND THE WORLD

100 A Collection of Transistors, Diodes, Rectifiers, Bridges, SCR's Triacs, IC's both Logic and Linear plus Opto's all of which are current everyday usable devices. **100**

Guaranteed Value over £10 at Normal Retail Price

yours for only **£4·00** Data etc. in every pak. Order No. SX56

£1 FREE PAK

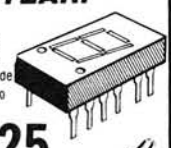
Get a £1 FREE PACK. Orders over £10 excluding VAT. Choose £1 Pack free (or 2 x 50p) add it to your order and save even more money. This offer only applies to this advertisement.

This offer only applies to this advertisement

BI-PAK'S OPTO BARGAIN OF THE YEAR!

Valued at over £10—Normal Retail—we offer you a pack of 25 Opto devices to include LED's Large and Small in Red, Green, Yellow and Clear. 7 Segment Displays both Common Cathode and Common Anode PLUS bubble type displays—like DL-33. Photo Transistors—similar to OCP71 Photo Detectors—like MEL11-12. This whole pack of 25 devices will cost you just

25 **£4·00** **25**



AND we guarantee your money back if you are not completely satisfied. FULL data etc included.

Order No. SX57.

IC SOCKETS
The lowest price ever.

The more you buy the cheaper they come!

Pin	10 off	50 off	100 off
8	75p	£3.00	£5
14	80p	£3.25	£5.50
16	80p	£3.25	£5.50
16*	80p	£3.25	£5.50

Quilled *

BARGAINS

SX42	20 small .125 Red LED's	£1
SX43	10 Rectangular Green LED's .2	£1
SX46	30 Assorted Zener Diodes 250mw-2 watt mixed voltages, all coded. New.	£1
SX47	4 Black Instrument Knobs—winged with pointer ¼" Standard screw. Fit size 29 x 20mm.	50p
SX48	5 Chrome knobs, standard push fit. 15mm.	50p
SX49	20 Assorted Slider Knobs. Black/Chrome, etc.	£1

MORE BARGAINS!

SX51	60 metres PVC covered Hook-up wire single and stranded. Mixed colours.	£1
SX58	25 Assorted TTL Gates 7400 Series. 7401-7460.	£1
SX59	10 Assorted flip Flops and MSI TTL	£1
SX60	20 Assorted Slider Potentiometers	£1
SX61	25 Assorted Potentiometers. Rotary, Dual, etc.	£1
SX62	40 Assorted Pre-Sets Hor/Vert etc.	£1

STILL MORE!

SLIDER POTENTIOMETERS

Plastic 40mm Travel Mono

SX63	5 x 470 ohms Lin	SX67	5 x 47k Lin
SX64	5 x 1k Lin	SX68	5 x 47k Log
SX65	5 x 22k Lin	SX69	5 x 100k Lin
SX66	5 x 22k Log	SX70	5 x 1 meg Lin

All at 50p per pack.

SX71	50 BC108 "Fallouts". Manufacturers out of spec on volts or gain. You test.	£1
SX72	A mixed bundle of Copper clad Board, Fibre glass and paper. Single and double sided. A fantastic bargain.	£1

SX52	6 Black Heatsink will fit TO-3 and TO-220. Ready drilled. Half price value. £1
SX53	1 Power finned Heatsink. This heatsink gives the greatest possible heat dissipation in the smallest space owing to its unique staggered fin design, pre drilled. TO-3 Size 45mm square x 20mm high. 40p
SX54	TO-66 size. 35mm x 30mm x 12mm. 35p
SX55	1 Heat Efficiency Power Finned Heatsink 90mm x 80mm x 35mm High. Drilled to take up to 4 x TO-3 devices £1.50 each

5 watt (RMS) Audio Amp

High Quality audio amplifier Module. Ideal for use in record players, tape recorders, stereo amps and cassette players, etc. Full data and back-up diagrams with each module.

Specification:
● Power Output 5 watts RMS ● Load Impedance 8-16 ohms ● Frequency response 50Hz to 25 KHz—3db ● Sensitivity 70 mv for full output ● Input Impedance 50k ohms ● Size 85 x 64 x 30mm ● Total Harmonic distortion less than 5%

BI-PAK'S give away price

£2.25 each.

You could not Build one for this price.

BI-PAK's COMPLETELY NEW CATALOGUE

Completely re-designed. Full of the type of components you require, plus some very interesting ones you will soon be using and of course, the largest range of semiconductors for the Amateur and Professional you could hope to find.

There are no wasted pages of useless information so often included in Catalogues published nowadays. Just solid facts i.e. price, description and individual features of what we have available. But remember, Bi-Pak's policy has always been to sell quality components at competitive prices and **THAT WE STILL DO.**

BI-PAK'S COMPLETELY **NEW** CATALOGUE is now available to you. You will be amazed how much you can save when you shop for Electronic Components with a Bi-Pak Catalogue. Have one by you all the time—it pays to buy BI-PAK.

To receive your copy send **75p** plus 25p p&p.

SX38	100 Silicon NPN Transistors—all perfect. Coded mixed types with data and eqvt. sheet. No rejects. Real value. £2.50
SX39	100 Silicon PNP Transistors—all perfect. Coded mixed types with data and eqvt. sheet. No rejects. Fantastic value. £2.50

MULLARD. ASZ 17 PNP.
Germ TO-3 Power Trans.

60 VCB	8A	Poss Replacement for
32 VCE	30W	AD130/131/140/149
20 VEB	Hfe 30min	OC25/26/28/35
		2N3613/14/17/2N1533

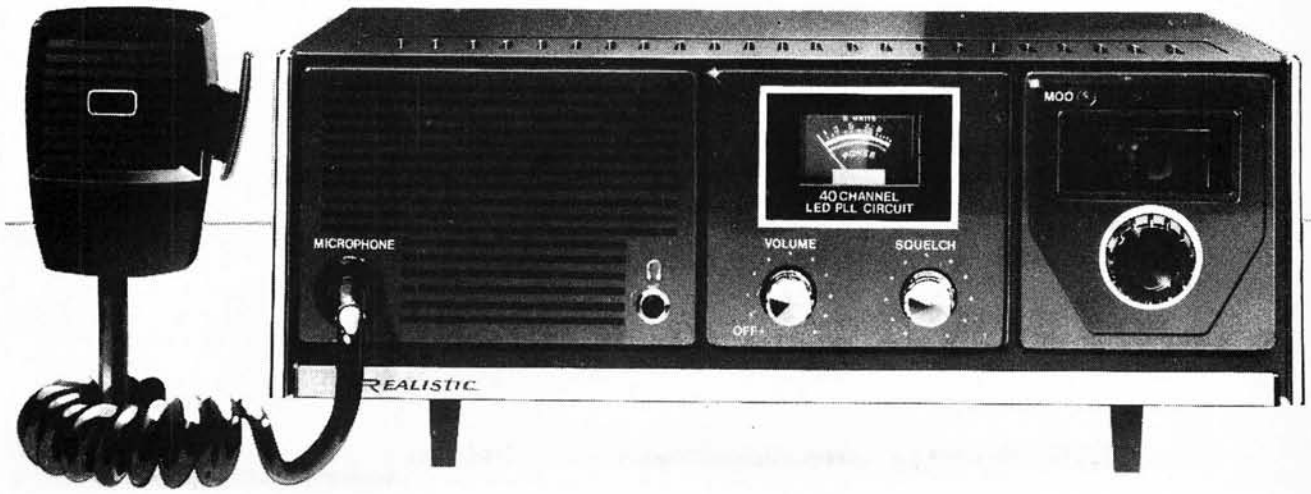
Great Value at **65p** each or 2 for **£1.**

BI-PAK

Send your orders to Dept BI-PAK PO BOX 6 WARE HERTS
SHOP AT 13 BALDOCK ST WARE HERTS
TERMS CASH WITH ORDER SAME DAY DESPATCH ACCESS
BARCLAYCARD ALSO ACCEPTED TEL (0920) 3182 GIRO 388 7006
ADD 15% VAT AND 50p PER ORDER POSTAGE AND PACKING

Use your credit card. Ring us on Ware 3182 NOW and get your order even faster. Goods normally sent 2nd Class Mail.
Remember you must add VAT at 15% to your order Total. Postage add 50p per Total order

CHATTER-BOXES SERVED HERE.



Realistic is the biggest name in Citizens Band Radio and accessories – and you will be able to buy the full range at Tandy – the world's largest retailer of CB equipment!

REALISTIC®

CB from Tandy

Sinclair ZX81 Personal Comp
the heart of a system that grows with you.

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

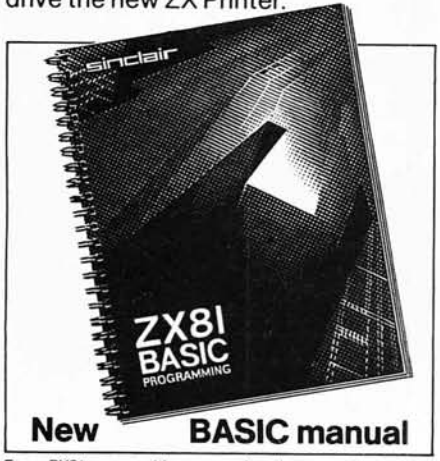
In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price: higher capability
With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, *and* to drive the new ZX Printer.



New BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.95

Higher specification, lower price – how's it done?
Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

New, improved specification

- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

Built: £69.95

Kit or built – it's up to you!
You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.

iter-

Available now- the ZX Printer for only £49.95

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha-numerics *and* highly sophisticated graphics.

A special feature is COPY, which prints out exactly what is on the whole TV screen without the need for further intructions.

At last you can have a hard copy of your program listings – particularly useful when writing or editing programs.

And of course you can print out your results for permanent records or sending to a friend.

Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your computer – using a stackable connector so you *can* plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

16K-byte RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

With the RAM pack, you can also run some of the more sophisticated ZX Software – the Business & Household management systems for example.

How to order your ZX81

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day.

BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access, Barclaycard or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research Ltd, FREEPOST 7, Cambridge, CB2 1YY. **Order**

Qty	Item	Code	Item price £	Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack.	18	49.95	
	Sinclair ZX Printer.	27	49.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

☐ Please tick if you require a VAT receipt TOTAL £

*I enclose a cheque/postal order payable to Sinclair Research Ltd, for £

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable.

Please print.

Name: Mr/Mrs/Miss

Address:

FREEPOST – no stamp needed. Offer applies to UK only. PRW 10

sinclair
ZX81

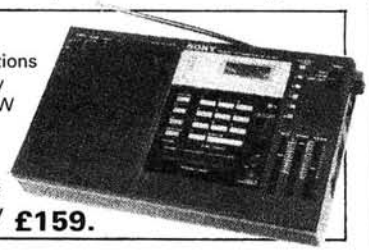
6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Tel: (0276) 66104 & 21282.

AMATEUR RADIO EXCHANGE

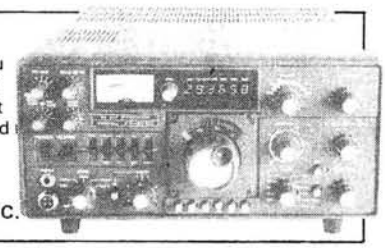
A SPECIAL ANNOUNCEMENT THIS MONTH FOR OUR FRIENDS AND CUSTOMERS IN THE NORTH WEST.

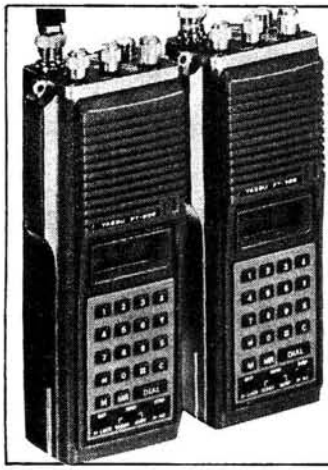
Our first branch outside London is about to open in St. Helens under the management of that well-known technical wizard Mike, G8EWU. As you would expect, he will be stocking a good, representative range of rigs by YAESU, ICOM and TRIO/KENWOOD plus a wide selection of accessories.
*We promise you will be made as welcome at 136 Gladstone Street, St. Helens (**near the Rugby ground**) as you always have been at Ealing. The only thing missing will be Brenda's coffee!*

SONY ICF-2001
This unique HF communications receiver with keyboard entry and LCD covers AM/SSB/CW from 150kc to 30MHz and FM from 76-108MHz with six station memories.
A masterpiece of compact modern technology at only £159.



FT-101 Mk III
The tried and tested Yaesu HF base station, now with audio peak filter and reject notch filter as standard and choice of AM or FM.
PHONE FOR PRICES INCLUDING FREE COOLING FAN AND MIC.





FT-208/FT-708
Yaesu's marvellous new hand-held for either 2m or 70cm operation. Its LCD display (with night lamp feature) is coupled to a 4-bit microprocessor giving 10 memories, up/down scanning in 25 or 50kc steps (manual or auto) plus memory scan and scanning between two desired frequencies, priority channel with search-back, keyboard entry allowing split frequency for non-standard repeaters . . . and lots more.
PHONE FOR PRICES

TRIO/KENWOOD – LATEST MODEL IMPROVEMENTS
Three best-sellers in the range up-rated with new model designations. The TS-520 and TS-820 become the TS-530S and TS-830S respectively, both with all the new bands, IF shift etc . . . and the TR-7800 becomes the TR-7850, now giving 40W out.

PHONE FOR PRICES

YAESU's LATEST . . .
the new all-mode 2m portable FT-290R
So many features *10 memories *Memory scan *2 VFOs *Band scan *Clarifier *FM/LSB/USB/CW *LCD readout *Real S-meter *Priority channel *2.5W out
PHONE FOR PRICE

FRG-7700
Yaesu's latest receiver with FM right across the band now offers all these optional extras *Memory facility *FRT-7700 Aerial Tuning Unit at only **£34.75** *Four VHF converters running from 50MHz up to 170MHz.

BASIC RECEIVER £299 inc. VAT and FREE HELISCAN AERIAL

Converter specifications * Phone for Prices

FRV-7700A	118-130MHz	130-140MHz	140-150MHz
FRV-7700B	118-140MHz	140-150MHz	50-60MHz
FRV-7700C	140-150MHz	150-160MHz	160-170MHz
FRV-7700D	118-130MHz	140-150MHz	70-80MHz

LICENSED CREDIT BROKERS. *Ask for written quotation.
INSTANT HP AND 6 MONTHS NO INTEREST HP TERMS AVAILABLE FOR LICENSED AMATEURS AND BANK/CREDIT CARD HOLDERS.

Buy it with Access · BARCLAYCARD VISA
Credit Card Sales by telephone

Prices are correct as we go to press, but owing to currency fluctuations etc may vary by publication date. Please phone for latest information.
All prices include VAT, but p & p/carriage are extra.

Closed Wednesday, but use our 24-hour Ansafone service

2 NORTHFIELD ROAD, EALING, LONDON, W13 9SY. TEL: 01-579 5311

So easy for Overseas visitors – Northfields is just seven stops from Heathrow on the Piccadilly Line.

TRIO

APPROVED TRIO DEALER

LAR

AUTHORISED ICOM DEALER

SHORT WAVE 'GOOD BUYS'

Buy from the Short Wave Specialists every time . . . you'll get good service from professionals who know your hobby well. For example:

R1000 Communications Receiver for use at home and in your boat or caravan
PRICE
£305.90

SX200N Scanning Receiver 26 MHZ to 512 MHZ
PRICE
£264.00

SRX 30D. The most popular Short Wave listeners receiver. 0.2 – 30 MHZ now with digital readout!
PRICE
£195.00

TS130S
200W pep mobile transceiver, with new bands fitted.
PRICE
£547.40

HERE IS A SELECTION OF TOP BUYS

TRIO EQUIPMENT

HS5	Communications headphones, tailored response	£21.85
HS4	Communications headphones, tailored response	£10.35
LAR	1kW P.E.P. 3-way antenna switch	£16.95
LAR	Antenna traps for multi-band dipole	£12.50

VHF AMATEUR RECEIVERS

SR9	Tuneable/crystal 2m FM receiver 144 146 MHz	£46.00
AMR217B	Scanner. The best mains/battery operated FM Receiver 144-146 MHz	£120.75

VHF/UHF CUSHCRAFT products available

Famous Ringo Ranger 2m co-linear	£32.00
GDX2 VHF/UHF Discone Antenna 50-480MHz	£39.50

NEW HF VERTICAL ANTENNA

HF5	80 10m vertical	£48.50
HF5R	Optional radial kit for roof mounting	£28.00
LAR–Omni-Match S.W.L. Antenna tuner	200KHZ to 30MHZ	£29.95
CX3A	3-way S.W.L. Antenna Switch	£5.50

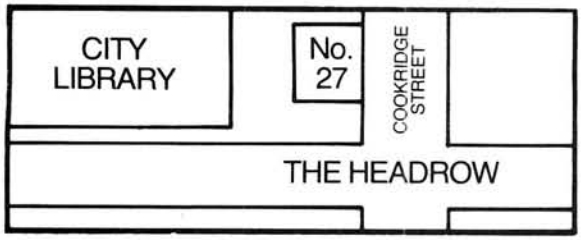
All TRIO and ICOM Transeivers normally in stock. We always have a good selection of second-hand equipment plus a comprehensive range of accessories.

LAR

Leeds Amateur Radio
27 Cookridge Street, Leeds LS2 3AG
Tel: (0532) 452657 (Shop)
Mail Order/Service Department:
60 Green Road, Meanwood, Leeds LS6 4JP.
Tel: (0532) 782224

HOW TO BUY!

By post – or 'phone your Barclaycard, Access or LAR Creditcard number. Alternatively, call in for a chat. The shop is just 10 minutes from Leeds City Station and there's easy parking if you travel by car.
*Instant HP for licensed Amateurs *Extended Credit Terms Available.
A QUOTATION ON ALL CREDIT ITEMS IS AVAILABLE.
*Open 9.15 – 6.00 pm, Saturday 9.15 – 5.30 pm.



FROM THE SHOP – We're close to the station and car parks. Do call in and see Uncle Tom's cabin!

POST NOW!

Send 50p for Catalogue and Price List.

I enclose cheque for £_____ Plus 50p for Brochure*
*delete if not applicable.

to purchase _____

Name _____

Address _____

_____ PW1

Post to: Leeds Amateur Radio, 60 Green Road, Meanwood, Leeds LS6 4JP.

TO BARCLAYCARD/ACCESS/LAR
I authorise you to debit my Barclaycard/Access/LAR Budget Account with the amount of £_____

My No. is | | | | | | | | | | | | | | | | |

Signature _____

TRIO DISTRIBUTOR, LAR are area distributors for CUSHCRAFT, Antenna Specialists, ICOM, Microwave Modules.

comment...

Value for Money

AS THE PAIN in your pocket will no doubt have told you, this month our cover price has been increased to 75p. We are sorry to have to do this, but the rising costs of producing the magazine leave us little option.

What we can do is to try to continue to give you value for money each month, and our 70cm Repeater Datacard (free with this issue) is part of our programme of doing just that. Next month we have yet another free Datacard, this time for the h.f. bands enthusiast, and also eight extra pages with the start of a glossary of radio terms, intended to help the newcomer to the hobby.

As Eric Dowdeswell mentioned in *Amateur Bands* last month, we have recently gone to a smaller type face for *On the Air*, to squeeze more information into that feature. It has been suggested that we could use even smaller type, but we are not too sure how that would be viewed by you readers (if you'll excuse the pun!). The smaller the type, the more difficult it is to decipher in artificial light, or when trying to read on the train. As an experiment we are going to use a smaller type for *On the Air* next month, and will invite your comments on whether you think that we should change to it permanently; whether the value of the extra information is worth making it that much harder to read.

★ ★ ★ ★

The final versions of the Technical Specifications for Citizens' Band radio equipment for use in the UK are now available. See page 26 for further details.

Geoff Arnold

services

QUERIES

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

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

PROJECT COST

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

CONSTRUCTION RATING

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

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

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

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

SUBSCRIPTIONS

Subscriptions are available to both home and overseas addresses at £13.00 per annum, from **"Practical Wireless" Subscription Department, Room 2613, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

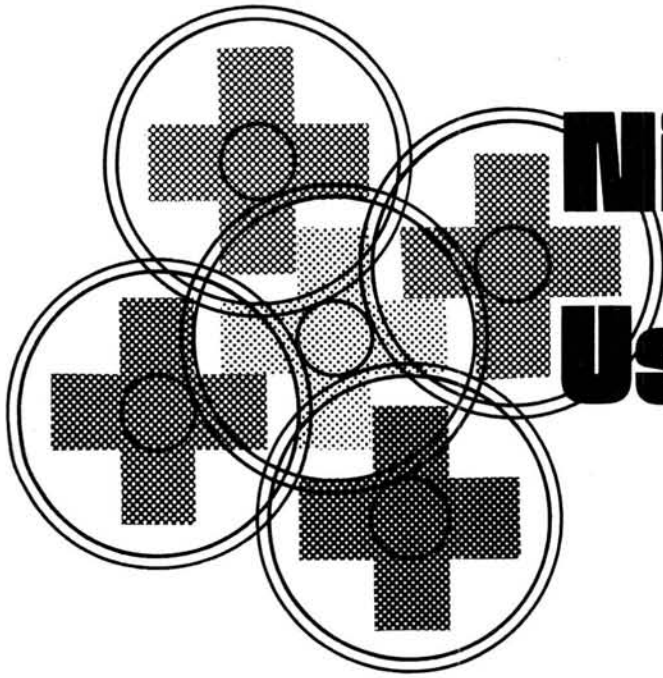
BACK NUMBERS AND BINDERS

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

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

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

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



NiCad CELLS THEIR Uses & Abuses

John WILSON G8KIS

Nickel-cadmium cells (NiCads) were invented soon after the turn of the century, though it's only in the last 20 years or so that they've become commercially available as sealed units. Their popularity today undoubtedly stems from ease of use and the growing demand for portable high-current power sources. Cash saving is also a significant factor now that NiCad cells are relatively cheap. Take a typical set of four "A" sized cells costing about £7 overall. Given reasonable care it should be possible to achieve 1000 charge and discharge cycles, using about £1 worth of mains-derived electricity. To get the same amount of portable power from non-rechargeable alkaline manganese cells, you'd need to buy about 500 sets costing some £700!

Although NiCad cells are obviously far more satisfactory than primary cells for many amateur applications, it's important to understand how they work if they're to be used effectively. It's also important to avoid damaging them by misuse.

Types of Cell

Nickel-cadmium cells exist in two distinct types. The first of these, the so-called "button" cells, are made with conventional plate electrodes and are generally limited in capacity to about 500mAh. They have a relatively high internal resistance and are best suited to applications where high rates of discharge or prolonged overcharging are not required. This form of construction does have one significant advantage—a very low rate of self-discharge, making them ideal for stand-by power in memory circuits. One manufacturer quotes a 63 per cent power retention after five months.

The other more recent type of cell is the sintered plate cylindrical variety which is available in values up to 7Ah. With these cells the electrodes have a very large surface area and the rate of discharge is limited only by the current-carrying capability of the internal connections and by heating effects.

Construction

In each type of cell, electrodes are made from surface treated nickel-plated steel. In the case of the negative electrode, this carries a chemically deposited layer of cadmium metal, whilst the positive one is coated with a nickel hydrate of rather indefinite chemical composition. The electrolyte consists of a solution of potassium hydroxide (KOH) absorbed on a felted nylon separator, though unlike the acid in a lead/acid cell, doesn't actually undergo any net chemical change or alteration in its specific gravity.

Mode of Action

Any secondary cell is in effect a reversible electrochemical system in which chemical energy is converted into electricity during discharge and vice versa during charge. The chemical reaction in NiCads is as follows:

$$2NiO(OH)\,H_2O + Cd \underset{Charge}{\overset{Discharge}{\rightleftharpoons}} 2Ni(OH)_2 + Cd(OH)_2$$

If the cell was only required to operate within these limits, then there would be no problem in manufacturing sealed units. Difficulties arise because of the need to accept a modest rate of overcharge with the consequent production of gas. Once a NiCad cell is fully charged, it has in effect reached the limit of its ability to produce the chemicals shown on the left of the equation. What happens then is that the water in the electrolyte is split up into hydrogen and oxygen (the process that results in "gassing" when open cells are over-charged). With sealed NiCads, the oxygen migrates away from the positive electrode and reacts with the cadmium negative electrode, preventing the evolution of hydrogen. There is a limit to the rate at which oxygen can migrate and hence a limit on the extent to which NiCads can be overcharged. Any further increase

of charging current will result in a build-up of gas pressure which will either cause the cell to vent itself or else explode.

Charging

For button cells, the maximum charge current that can be employed indefinitely is normally quoted as C/10 (where "C" is the nominal capacity in ampere hours). For sintered cells about twice this rate may safely be employed, whilst in the case of some special high-charge cells, a continuous rate of C/3 is acceptable. These figures are based on normal room temperatures. Because the chemical recombination reactions take place more slowly as the temperature is reduced, the maximum rate of continuous overcharging must be reduced accordingly. At −10°C, for example, no NiCad should be left permanently on charge at more than C/20.

Fast Charging

For reasons already discussed, the maximum rates of continuous constant-current charging are determined by a cell's ability to cope with what happens beyond the point of full charge. Until this point very much larger currents, up to 5C in the case of modern fast-charge NiCads, can safely be employed without affecting cell life. The problem here is to detect the point at which the cell is fully charged; not easy in view of its temperature co-efficient voltage (−4mV/°C). For this reason, fast chargers are relatively sophisticated pieces of equipment capable of detecting either an alteration in the rate of change of terminal voltage or else the sudden rise of temperature that accompanies a full charge.

One very recent development is a patented fast charger based on an interesting discovery by Rediffusion Radio Systems. This firm has found that if a NiCad is fast charged using high current pulses alternating with somewhat smaller discharge pulses, then it is possible to detect the end point by monitoring the changes in the cell's terminal voltage. The precise details are obviously a matter of commercial secrecy, but in general it seems that when a NiCad is fully charged the difference between its terminal voltage under current and discharge conditions suddenly increases by some 600 per cent.

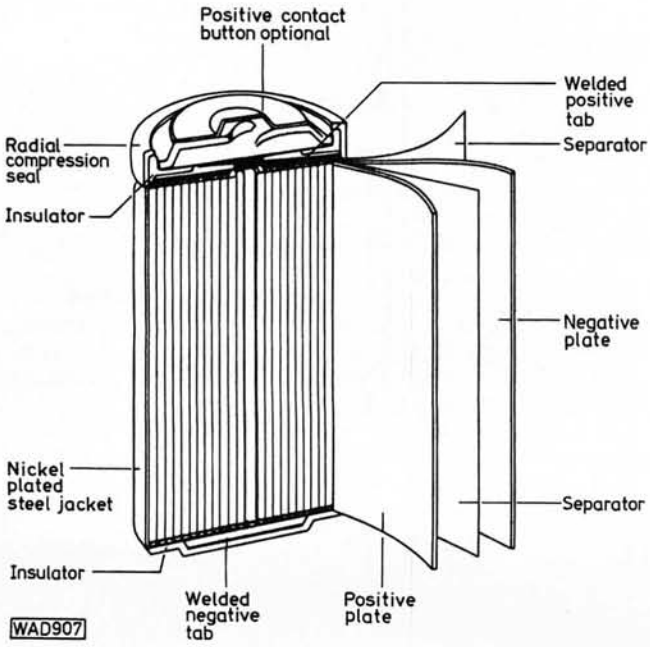


Fig. 1: Typical sintered plate cell

Charge Efficiency

The charge efficiency of any rechargeable cell is the amount of electricity you get out compared to the amount needed for a full charge. In the case of a good quality NiCad this is about 70 per cent. So to provide a full charge at the C/10 rate takes about 14 hours. There are a number of factors that may considerably reduce the efficiency.

All NiCads exhibit a temporary loss of capacity when kept fully charged or when given only a very shallow discharge. Although the "memory" effect can be a problem in stand-by applications, modern cells seem less prone to it than some of the earlier ones. In any case full capacity can be restored by giving the cell a couple of complete charge/discharge cycles.

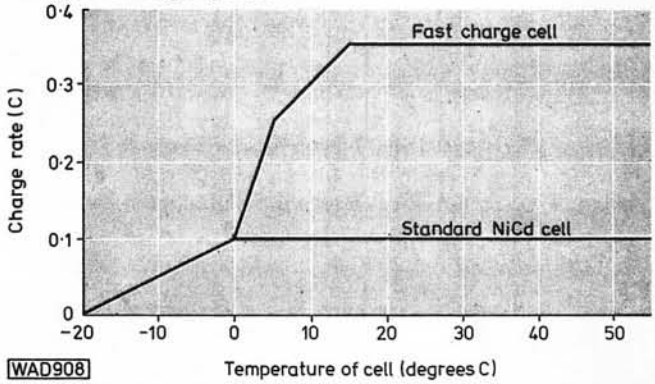


Fig. 2: Maximum continuous overcharge related to temperature

Another problem, known as second plateau effect, is seen in NiCads that have been subject to prolonged overcharge. This is a depression in the discharge voltage curve beyond about 60 per cent discharge. As yet no satisfactory theoretical explanation has been given for this effect, though again it is reversible and appears less prevalent with modern cells.

Raising the temperature, as well as causing a reduction of terminal voltage, also has a detrimental effect on charge efficiency by causing gas to be evolved at an earlier stage in the charge cycle. This means that the cell will not accept a full charge. A standard NiCad, for example, at 50°C will only take 75 per cent of its room temperature capacity. Charging too slowly (less than C/10) also reduces efficiency.

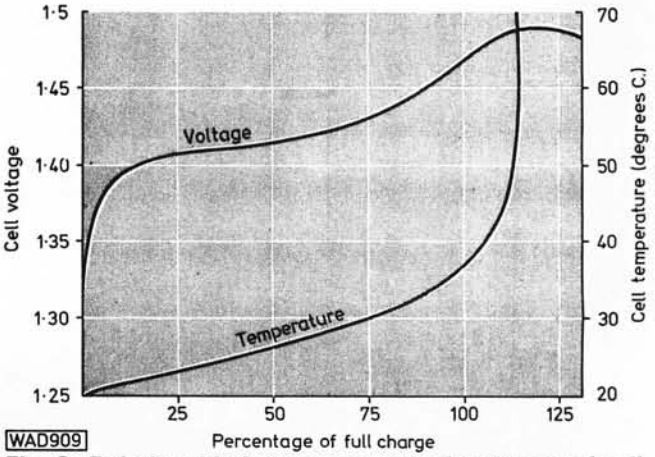


Fig. 3: Relationship between terminal voltage and cell temperature during fast charging

Discharge Characteristics

NiCad cells have a nominal terminal voltage of 1·2V at room temperature, which is maintained fairly well for over three quarters of the discharge cycle. Maximum discharge currents vary between different makes of cell, but continuous rates of 5C to 10C are permissible in the case of cylindrical sintered cells. Because of the extremely low internal resistance of most NiCad cells (0·01Ω is typical for a 1Ah cell), very much higher discharge currents can be drawn under intermittent pulsed conditions.

NiCads should not be fully discharged as this will have an adverse effect on their life expectancy. In the case of series connected cells, this rule applies with even greater force because of the danger of reverse charging the cell of lowest capacity. No two NiCads have exactly the same capacity, and during a complete discharge, one cell inevitably reaches zero voltage before the others. If left in circuit it would then acquire a reverse polarity unless, as in the case of some modern cells, it were fitted with internal diode protection. Reverse charging a NiCad to any appreciable extent causes the evolution of gas and consequent venting or explosion. In normal application the circuit resistance would preclude this happening to a damaging extent. It is nevertheless worth sticking to manufacturers' recommendations and stopping discharge when the battery reaches a terminal voltage corresponding to 1V per cell.

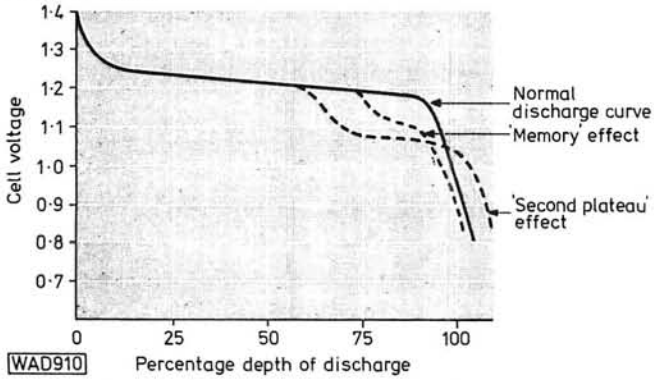


Fig. 4: Discharge curves of a standard NiCad cell

Method of Connection

Series connection is the only satisfactory method of using NiCads, though for reasons already discussed it is important to avoid deep discharges. Parallel connection is to be avoided for a number of reasons. First of all there's a considerable danger that because of variations in terminal voltage and internal resistance, one cell in a parallel combination will draw more charging current than the others. Then, with differing cell capacities, one cell will end up providing all the current towards the end of the discharge cycle.

Life Expectancy

NiCads, like any other piece of equipment, will fail prematurely if maltreated. Furious overcharging, discharging or reverse charging can result in the internal generation of gas which eventually exceeds the pressure that the cell can stand. With non-vented button cells, the pressure shoots up to over 100 p.s.i. and eventually the cell splits in half explosively. **Don't try it, it does even more damage than exploding electrolytics—as the author can testify!** In the case of vented cells, the loss of gas represents loss of electrolyte and hence cell performance. Although cell

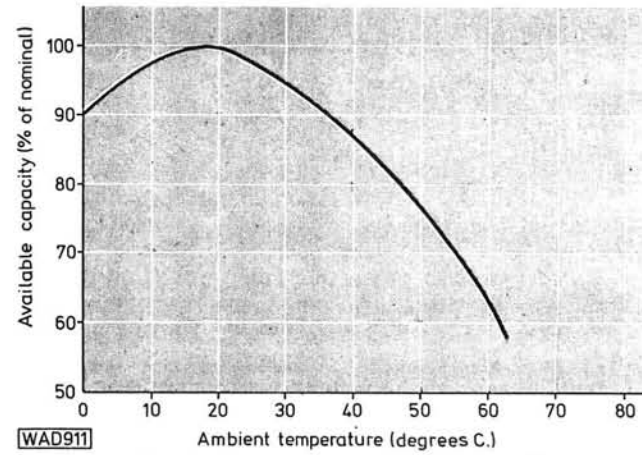


Fig. 5: Effect of temperature on charge efficiency

vents are often self-sealing, once venting has occurred there's a slight but real risk of the cell squirting out caustic liquid all over the inside of your expensive equipment. (This risk also applies when attempting home-rejuvenation of NiCads by injecting new electrolyte.)

High temperatures are the other major factor that affects cell life, and wherever possible NiCads should be stored and operated below 35°C. The most susceptible component is the separator which tends to oxidise and lose its chemical and mechanical integrity. For sustained high-temperature operation, in which charge efficiency isn't a major consideration, there are NiCad cells available using polypropylene separators. These cells will happily operate at temperatures up to 65°C.

Given reasonable temperatures and reasonable charge and discharge rates, the average NiCad will last between 300 and 1000 cycles or else give at least five years service on stand-by. It can also be stored for long periods in either the charged or discharged condition, though after this it may take a few cycles to restore full capacity.

Future Developments

Over the last 20 years, there has been steady if undramatic progress in NiCad cell technology. Memory effects, second plateau effects, the adverse effects of high temperatures and overcharging have been progressively minimised. Cell capacity has been improved, as have storage life and resistance to leakage. There is still room for further improvement in the NiCad system, especially in the area of separator technology and electrode manufacture. Taken together these factors are bound to lead to longer life, higher satisfactory operating temperatures and improved charge/discharge characteristics.

I would like to thank Richard Lambley G8LAM for his help in the preparation of this article. ●

G4JDT
HARVEY

EAST LONDON HAM STORE

G8SYG
DAVE

H. LEXTON LIMITED

191 FRANCIS ROAD LEYTON E.10
TEL 01-558 0854 TELEX 8953609 LEXTON G

RADIO & ELECTRONIC ENGINEERS — **ENGINEERS ALWAYS AVAILABLE ON THE PREMISES**

MAIN (UK) SERVICE CONTRACTOR TO HITACHI SALES (UK) LTD

EXCLUSIVE TO US IN THE UK. 1kW input 600W ssb 350FM 2MTR LINEAR!!

BUILT-IN POWER SUPPLY, ELECTRONIC WARM UP, VARIABLE INPUT ATTENUATOR. ADAPTS EXCITERS FROM 2W-25W. RADIAL BLOWER. LED's FOR READY, TX, OVERLOAD, PTT & RF VOX with VARIABLE DELAY CHOICE OF EIMAC TUBES. 4×150A OR 4C×250B OR 4C×250R. ELECTRONIC PLATE CURRENT FUSE – NO THERMAL DAMAGE OF P.A. TUBE POSSIBLE. SIZE: H.88mm, W.318mm, D.375mm. FROM £460.00.

D 70C	70cms.	10W in – 200W out	£489
D 200S	2mtr.	1kW p.e.p. ssb. (600W FM)	£599
D 200	2mtr.	500W p.e.p. ssb. (350W FM)	£499
D 200C	2mtr.	350W p.e.p. ssb. (160W FM)	£300

All these linears have adjustable inputs and outputs and they are all fully protected.
ALSO AVAILABLE:- 18db Gasfet masthead preamplifier which suits the output of these linears and which is also powered by them via the antenna co-ax.

ICOM PORTABLES

IC2E FM 2m £169.00
IC202 SSB £169.00
IC402 70cm £242.00
All accessories available – see below

ICOM MULTIMODES

IC251 2m £495.00
IC451 70cm £599.00
IC260 2m £299.00
IC290 2m £379.00

ICOM FM MOBILES

IC24G £165.00
IC255 £255.00
IC25E £259.00

ICOM 720A G/C

IC720A 200W £849.00
PS15 Power Supply £95.00
PS20 P/S with speaker £125.00
IC730 See panel, below left

ICOM
HF TRANSCEIVERS

IC730 200W £574.00
IC2KL 500W linear £799.00
IC2KLPS Power supply £199.00

ICOM
ACCESSORIES

BP5 IIV Pack £30.50
BP4 Empty case for 6XAA £5.80
BP3 STO Pack £15.50
BP2 6V Pack £22.00
BC3 Base Charger £37.00
DC1 12V adaptor £8.40
WM9 Mic speaker £12.00
CP1 Mobile Charging load £3.20
LC1/2/3 cases £3.50

★

TRIO/KENWOOD

TS830S HF Transceiver £700.00
TS130S HF Transceiver £530.00
TR8400 UHF Mobile £320.00
TR9500 UHF Multimode £470.00
TR7800 VHF mobile £268.00
TR7840 HP FM 2m POA
TR7730 2m FM TBA
TR9000 £370.00
Many Trio/Kenwood accessories available

YAESU/SOMMERKAMP

FT902DM WARC POA
FT101ZD FM/AM POA
FT707 See below
FP707 Power Supply £109.00
FC707 ATU £88.00
FU707DM VFO £189.00
FT480R 2m Multimode £359.00
FT290 2m Portable multimode
FT207R 2m £170.00
FT767DX Sommerkamp £559.00
FT101ZD Sommerkamp all options £649.00
FT277 Sommerkamp £847.00

All accessories available, including FV902, FC902, YP901P, YK901 POA

FT707+FP707 PSU £610.00

MICROWAVE MODULES

MMA 144V 2m Preamp £34.90
MML 144/25 RF AMP £59.00
MML 144/40 £77.00
MML 144/100S New with Preamp £129.95
MMT 432/144 2-70 Transverter £184.00
MMT 28/144 10m Transverter £99.00

MM 4000 RTTY
SEE IT WORKING AT OUR SHOP
£269.00. Full range stocked.

STANDARD

C8800 2m Mobile £250.00
C7800 70cm Mobile £270.00
C78 70cm Portable £209.00

NEW STANDARD 2m C58 PORTABLE NOW IN

CMB8 Mobile mount £17.95
CPB78 Power amp £65.00
CL8 Carry case £6.95

ROTATORS ETC

DIAWA

DR7600X £135.00
DR7600R £144.00
DR7500R £95.00
KENPRO KR250 £44.00
KR400 POA
HAM IV £145.00
CHANNEL MASTER £42.00
CN620 1·8 150MHz Pwr/swr £52.00
CN2002 2·5 kW PEP auto ATU £190.00
9502B £50.00

SWAN/CUBIC

102BX 235W+PS5 £800.00
103BX WARC 235W £1000.00
PS6 Power Supply £145.00
150MX Digital £561.00
15002 Linear £406.00
ST2A ATU TBA
ST3A ATU TBA
HF Mobile ant £80.00

CUSHCRAFT AMATEUR ANTENNA

HF, A3 20/15/10 3 ele beam 8bD £165.00
ATV3 20, 15, 10 Trapped vertical £38.30
ATV5 10.15.20.40.80 Trapped vertical £83.69
214B 14 ele boomer 15·2db £55.77
ARX 2 Ringo Ranger 6dB vertical £27.86
CS100 Speaker £12.50
A144·44 ele Yagi £18.25
A144·77 ele Yagi £22.82
A144·1111 ele Yagi £28.94
ARX2B Ringo Mk11 £32.29
ARB2K Conversion kit RINGO Mkl to Ringo MkII £14.18

FULL RANGE IN STOCK
SAE CATALOGUE
144+10T+Yagi } OSCAR
144+20T+Yagi }
For vertical and horizontal Oscar specials

JAYBEAM ANTENNAS IN STOCK

RECEIVERS ALL ON SPECIAL OFFER– P.O.A.

R1000 Kenwood
FRG7700 Yaesu
FRG7700 Memory
IC2001L Sony
SEARCH II 2 metre

ALL POA ARE ON SPECIAL OFFER. PHONE HOT LINE ★ 01-556 1415 ★

Let others make an exhibition of themselves, we'll be open through September – including the Saturday and Sunday of the Leicester Exhibition and we will have many special offers.

ALL ACCESSORIES AVAILABLE – PLUGS SKTS CO-AX 2MTR COLINEAR £31.50, 70CM COLINEAR £31.50

Access

PRICES INCLUDE VAT AT THE PRESENT RATE OF 15%
OPEN MON–FRIDAY 9:00–5.30. SATURDAY 10:00–3:00. INSTANT HP FACILITY AVAILABLE
EASY ACCESS M2–M11–M1 NORTH CIRCULAR ROAD–EASY PARKING

BARCLAYCARD VISA

NEWS NEWS NEWS

Rallies and Events

Harlow Mobile Rally, organised by the Harlow & District Amateur Radio Society, will take place on Sunday 27 September at a new venue, the Harlow Sportcentre, Hammarskjold Road, Harlow. There will be all the usual attractions plus facilities for disabled drivers and admission will be 30p.

Further details from: *Rally Secretary, J. P. Dunbar G8FRG, Mark Hall Barn, First Avenue, Harlow, Essex.*

The British Amateur Television Club has organised their Television Exhibition and open day on Sunday 4 October 1981 at the Post House, Leicester. The exhibition will include demonstrations of fast and slow scan TV, lectures, trade stands etc. and a chance to see the video tape the club made for the RSGB on Dud Chapman G6CJ's famous antenna lecture. Starting at 11.00hrs, admission is free and all are welcome.

Bromsgrove & District Amateur Radio Club have arranged for the Bromsgrove Mobile Picnic to be held on Sunday 20 September at Avoncroft College, Bromsgrove.

The event will be a true picnic with no trade stands, but lots of interesting things for the amateur and plenty of attractions for the family.

Further details from: *Mr E. Cotton, tel: (0905) 773181.*

The Telford Mobile Rally and Exhibition will take place, once again, at the Telford New Town Centre Malls, under full cover, on Sunday 13 September.

Opening at 11.00hrs the rally will include all the usual attractions plus the regular free coach service to the famous Ironbridge Gorge Museum sites.

Further details from: *G8DIR, tel: Shrewsbury (0743) 64273, G8UGL, tel: Telford (0952) 584173 or G3UKV, tel: (0952) 55416. All QTHR.*

Glenrothes and District Amateur Radio Club have organised Scotam '81 at the Lomond Centre, Glenrothes, which is just off the Kirkcaldy-Tay Bridge Road, between 11.00 and 17.00hrs on Saturday 12 September.

As this is the first time that the Scottish Amateur Radio Convention has been held in the new town, they have given it a new name, thus Scotam '81.

Further details on the convention are available from: *Ken Horne GM3YBQ, QTHR. Tel: (0592) 65789.*

The Peterborough Radio and Electronics Society are holding their rally at a new venue, the Wirrina Sports Stadium, situated in the middle of Peterborough on a delightful riverside site.

Further details from: *D. T. Wilson G4KSW, 4 Conway Avenue, Peterborough. Tel: (0733) 76238.*

This year's Welsh Amateur Radio Convention, organised by Blackwood Amateur Radio Society, will be held at the usual venue, Oakdale Community College, Blackwood, Gwent on Sunday 27 September.

There will be all the regular attractions to interest the amateur radio enthusiast and the convention will be opened by Mr B. O'Brien G2AMV, President of the RSGB.

Further details from: *B. Davies GW3KYA, tel: (0495) 225825.*

New Exhibition

The Granby Halls, Leicester will be the venue for the "Amateur Radio Exhibition—Leicester", on 23, 24 and 25 October 1981.

Approximately 50 amateur radio dealers will be exhibiting products from manufacturers such as Yaesu, Trio, Icom and Microwave Modules plus many others.

PW Exe

Following the announcement last month of suppliers of components for the *PW* Exe, N. E. Foot G8MCQ, informs me that, in addition to supplying the WG16 flanges he can also offer the 3mm dia. ptfe rod in 75mm lengths.

The WG16 flanges cost £2.00 each plus 35p carriage for the first flange and 10p for each additional flange. The ptfe rod costs 20p per 75mm length and carriage is free if ordered with the flanges.

Further details are available (sae please) from: *N. E. Foot G8MCQ, 29 Wheelers Lane, Bournemouth, Dorset BH11 9QQ.*

Also Pascall Electronics Ltd. inform me that they can supply an alternative r.f. head, called the PMM 1.

The PMM 1 X band module features a Gunn diode oscillator and Schottky mixer device incorporated in a single cavity which may be mechanically tuned with the supplied ptfe screw.

Tunable over the amateur 3cm band the module will produce a typical output of 10mW of microwave energy. The cavity is designed to interface directly with waveguide 16 flanges and in the event of failure of either of the active devices replacements are available.

Costing £43.15 which includes VAT and carriage, the PMM 1 is obtainable from: *Pascall Electronics Ltd., Hawke House, Green Street, Sunbury-on-Thames, Middlesex TW16 6RA. Tel: (093 27) 87418.*

GB3SC Takeover

One beautiful sunny, July day in Bournemouth witnessed the metaphorical takeover of GB3SC by a happy band of mobile amateurs from GB3WR land.

Following a morning of virtual constant activity on SC, a rendezvous was arranged with some *PW* people at a local hostelry, and SC returned to regular users and visitors.

As the photograph shows a very pleasant lunch hour was enjoyed by all, nattering about amateur radio. The characters are, from right to left, Jim G8ZSP, Elaine G4LFM, Brian G8ZVK, John G8MCP, Norman G8YBT, Kevin G4FNI, Gary G8WVR, Nick G4IQX, Paul G8XTZ and yours truly G8ZPW.

For our part, we *PW* staff thoroughly enjoyed meeting some of our readers and particularly appreciated their comments on amateur radio and the magazine.

NEWS NEWS NEWS

RAE Courses

Courses to prepare students for the Radio Amateurs Examination (City and Guilds 765) will be available at the following locations:—

Canterbury—*Canterbury College of Technology, New Dover Road, Canterbury,* commencing September. Course Tutor will be D. J. Bradford G3LCK and details are available from the college, tel: (0227) 66081.

Walsall—*Queen Mary's Grammar School, Walsall (Broadway North Adult Education Centre),* commencing in September. Further details from the Course Tutor, Frank Fear G8CVR, 185 Longwood Road, Aldridge, West Midlands, tel: (0922) 52706.

Barr Beacon Comprehensive School, Walsall, will be running a 10 week short course intended for those who may wish to retake the examination or possess some knowledge of the subject. Commencing in September, the Course Tutor will be Frank Fear G8CVR. Further details from the college, tel: (0922) 21244 ext. 2318.

Kettering—*Latimer School Adult Education Centre, Castle Way, Barton Seagrave, Kettering,* enrolment 7 and 8 September between 19.00 and 20.30hrs. Postal enrolments from 9 September. Further details from the Centre, tel: (0536 72) 4219.

Melton Mowbray—*Melton Mowbray College of Further Education, Ashfordby Road, Melton Mowbray.* Enrolment 8 September, further details from the college or the Course Tutor, K. G. Melton G3WKM, tel: (0664) 68810.

Crawley, West Sussex—*Ifield Evening Centre, Lady Margaret Road, Ifield, Crawley, West Sussex,* starting Monday 21 September and, if demand is sufficient, on Thursdays. Enrolment 7 and 9 September between 19.00 and 21.00hrs, further details from the Course Tutor R. Scrivens G3LNM, tel: (0293) 22540.

Northampton—*Duston Upper School, Northampton,* on Tuesdays at 19.00hrs, commencing 8 September. Further details from the Lecturer, G8LHR, tel: (0604) 499067.

London SW4—*Brixton College, Ferndale Road, London SW4,* tel: 01-737 2323/26. Enrolment 7, 8, 9 and 10 September between 18.30 and 20.30hrs. The Course Tutor will be R. McEwan Reid G4GTO.

Stourbridge—*Stourbridge College of Technology, West Midlands,* starting in September. Further details from Dave Wilson G6ADU, tel: (03843) 73855.

Bath—Full details of the venue and dates from the Course Tutor, Peter Bubb G3UWJ, 58 Greenacres, Bath BA1 4NR, tel: (0225) 27467.

Mid-Kent—*Electrical Dept., Mid-Kent College of Higher and Further Education, Horsted, Chatham, Kent.* Enrolment 7 and 8 September and the Course Tutor will be D. A. Chamberlain G8RPM. Further details from the college.

Latest Repeater News

Microwave Repeaters: Licences have now been issued for the first seven UK repeaters operating on 1296MHz. All are horizontally polarised with a 6MHz offset between input/output (e.g. RM0 = 1291·000MHz input, 1297·000MHz output). By the time this issue of *PW* is published, GB3WX is expected to be operational (all UK repeaters use the GB3 prefix). The repeaters will be sited and coded as follows: Alveston–Nr. Bristol, AA (RM0); Brentwood–Essex, BW (RM6); Crawley–Sussex, CP (RM3); Manchester, MC (RM0); Barkway–Herts, PS (RM3); Reading–Berks, RU (RM9); Brighton, WX (RM9).

Three more potential licences are in the pipeline and then no more will be issued until operational evaluation tests are complete.

UHF Repeaters: Phase 6 u.h.f. 70cm proposals are now before the Home Office, and a late addition GB3XX at Daventry on RB15 has been added to the list previously given in *PW.*

VHF Repeaters: Phase 5 v.h.f. 2m proposals have now been compiled by the RSGB Repeater Working Group and will go before the Home Office in the near future. The final list comprises the following sites and channels: Barnoldswick–Yorks, AE (R5); South Birmingham, AM (R6); North Birmingham, BX (R2); Hastings, ES (R7); Eden Vale, Appleby in Cumbria, EV (R4); Northallerton–North Yorkshire, HG (R1); Lincoln Minster–Lincs, LM (R5); Manchester, MB (R0); Newtown–Powys, PW (R3); Reading, RD (R7); Tyne Valley, Near Hexham–Northumberland, TY (R6); Dartmoor, WD (R4).

Proposed v.h.f. s.s.b. Repeater: Following discussions at the IARU Region 1 triennial conference at Brighton this year, a proposal is to be submitted to the Home Office to allow GB3SF to operate experimentally for a 12 month period only. The results obtained from this unique experiment will be reported back to the next Region 1 conference in 1984. It is to be stressed that GB3SF is a **single-channel** frequency-locked s.s.b. installation and not a linear transponder. The proposal plans to co-site the repeater at the University of Sheffield site of GB3US.

2m Repeater News: GB3WH is moving from its existing site near Abingdon, to a new site to the east of Swindon. At the same time its channel allocation will change from R4 to R2.

And last but not least, application has been made for a new repeater sited at Brill–Bucks on R4 to complement the revised coverage of GB3WH.

Diary Date

Fancy a really nice day out in the country for all the family? Then a visit to Chalk Pits Museum should fit the bill.

On Sunday 27 September, Chalk Pits Museum will be running their second Wireless Day of the year, at which the enthusiast can expect a host of exhibits, working stations and stalls to satisfy his particular interest. For the rest of the family Chalk Pits Museum, situated in 36 acres of West Sussex countryside, has many other attractions including a nature trail, steam engines, country crafts displays, excavated lime drying kilns, roadway through the ages and various railway exhibits. There is also a picnic area, free parking, good local pubs and tearooms.

Members of *Practical Wireless* will be attending and look forward to meeting friends and readers at: *Chalk Pits Museum, Houghton Bridge, Amberley, Arundel, West Sussex BN18 9LT. Tel: Bury (079 881) 370.*

More on page 31

air test

USER REPORTS ON SETS AND SUNDRIES

JIL SX-200N Scanning Monitor

When we tested the SX-200 for our February 1981 issue, it did not show up too well in several respects, though it was afterwards found that the poor selectivity was due to incorrect alignment of the review sample.

Now, JIL have brought out an improved version, the SX-200N, which certainly gave a good account of itself in tests on the air and in the lab. The principal changes incorporated are:

1. Internal layout and construction completely redesigned for easier access for servicing. Several sections now in plug-in modules.
2. The front end up to the start of the 10·7MHz i.f. circuitry is now enclosed in a screening box.
3. The 10·7MHz i.f. filters are now crystal types, instead of ceramic.
4. Audio filtering is better, to eliminate noise from the microprocessor control circuitry, and the audio quality has been improved.

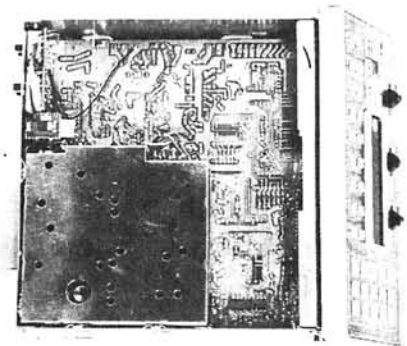
The specifications for the SX-200N are identical to those of its predecessor. The review model met them with little problem, though since GB3SC has been moved to the centre of Bournemouth, I cannot repeat the test with GB3WR mentioned in the SX-200 review. Check measurements on the 2m and 70cm amateur bands produced the following results.

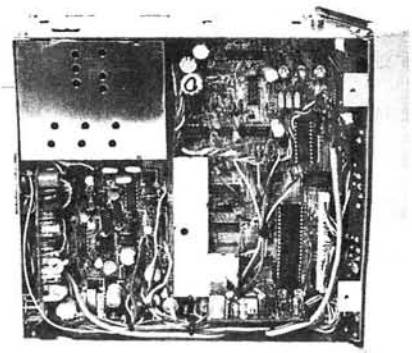
Sensitivity:
2m f.m., 0·25µV p.d. for 12dB SINAD.
2m a.m., 0·6µV p.d. for 12dB SINAD.
70cm f.m., 0·3µV p.d. for 12dB SINAD.
70cm a.m., 0·6µV p.d. for 12dB SINAD.

Adjacent channel selectivity (two generator method) 58dB. Intermodulation response rejection 66dB. Audio output 1·5W into 8Ω, 2·1W into 4Ω, both for 10% distortion.

The Operation Manual for the SX-200N is a considerable improvement over the SX-200, and several paragraphs have been rewritten, though there are still the odd bits of oriental English. Like all scanner operating instructions, it tends to assume that you have handled a scanning receiver before, and doesn't explain the significance of some of the terms used. One thing I complained of in February was the difficulty of stepping just one channel up or down, without the risk of the beast shooting off towards the end of the band. I had a letter from a reader afterwards, pointing out that it was easily accomplished, simply by advancing the squelch control sufficiently to keep the squelch open even with no signal. This certainly works, and is an example of the sort of information that new users could well do with, to get the best out of their scanners, though there are some types of scanning circuits that refuse to change frequency whilst the squelch is open, even if you press the appropriate button.

Should you go to buy an SX-200N, the first thing you'll discover is that on the packing carton, on the receiver, and on the Operation Manual, the type number is still quoted as just plain SX-200 and the front panel arrangement is the same on the two models. So how do you know which it is? Well, the arrangement of controls on the rear panel is different, but that won't be much help for most people. The most obvious difference is in the position of the loudspeaker grille. In the SX-200 it's in the centre of the top, but in the SX-200N it's towards the right-hand front corner.





The JIL SX-200N, with mobile mounting kit and 240V a.c. mains adaptor, costs £267·37 including carriage and VAT from **Garex Electronics, 7 Norvic Road, Marsworth, Tring, Herts, HP23 4LS, telephone Cheddington (0296) 668684,** to whom we offer our thanks for the loan of the review unit.

Geoff Arnold

UK CB Specifications

The final versions of the UK CB specifications: MPT 1320 for the 27MHz service and MPT 1321 for the 934MHz service, have now been published by HMSO. *They* are available, price £1·90 each, via Government Bookshops and through booksellers handling Government Publications.

AMATEUR ELECTRONICS UK

SEE US AT DONNINGTON PARK

G3FIK

Your number one source for YAESU MUSEN

YAESU

SEE US AT DONNINGTON PARK

NEW

FT-101ZD Mk. III

Now from YAESU comes the latest version of the renowned FT-101 – AM/FM option, notch filter, audio peak filter, variable bandwidth – UNBEATABLE VALUE.

£599.00

FT-480R High technology all-mode 2 metre mobile

The most advanced 2 metre mobile available today – USB, LSB, FM, CW full scanning with priority channel, 4 memory channel, dual synthesized VFO system. **£359.00**

FT-707 All solid-state HF mobile transceiver

£529.00

The definitive HF mobile rig, digital, variable IF bandwidth, 100 watts PEP SSB. AM, CW (pictured here with 12 channel memory VFO).

FRG-7 General coverage receiver

A precision built high performance Wadley Loop receiver, rugged and reliable – proved by the tens of thousands in use around the globe.

£199.00

FRG-7700 Synthesized general coverage receiver

The very latest in receiver technology from YAESU. Receives AM (3 band widths), USB, LSB, CW *and* FM – memory option with 12 channels and automatic band selection.

£309.00

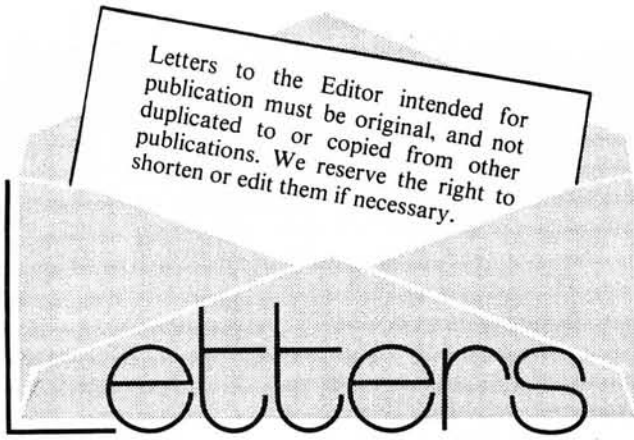
ALL PRICES INCLUDE V.A.T.

Amateur Electronics UK
508-516 Alum Rock Road · Birmingham 8
Telephone: 021-327 1497 or 021-327 6313
Telex: 337045

As from March 1st. our new opening hours are 9.30-5.30 Tues. to Sat. continuous and CLOSED all day Monday.

AGENTS

NORTH WEST – THANET ELECTRONICS LTD, GORDON, G3LEQ. KNUTSFORD (05665) 4040.
WALES & WEST – ROSS CLARE, GW3NWS, "GLENVIEW" NEWPORT ROAD, MAGOR, GWENT (0633) 880 146.
EAST ANGLIA – AMATEUR ELECTRONICS UK – EAST ANGLIA, DR T. THIRST (TIM) G4CTT, NORWICH 06925 865
NORTH EAST – NORTH EAST AMATEUR RADIO, DARLINGTON 0325 55969
SOUTH EAST – AMATEUR ELECTRONICS, UK – COASTAL, CLIFTONVILLE, KENT KEN McINNES, G3FTE, THANET (0843) 291297, 9 a.m. 10.30 p.m.



Cracking the Code

Sir: In his editorial in the July *PW,* Geoff Arnold asks what we think about novice licences and automatic Morse senders and receivers.

As far as novice licences are concerned I feel that they would offer encouragement to those who think the 12 w.p.m. test is light years away from them. I would, however, prefer a 6 w.p.m. speed. Morse at anything below that is really not of much practical use and is frustrating to both sender and receiver. It can't be emphasised too strongly that in the early stages there is nothing that can compare with group practice round an audio oscillator with an experienced leader. Cassettes, tapes and automatic senders are fine for the beginner who is absolutely on his or her own but I would never recommend them in preference to group practice. However, by the time one has reached 6 w.p.m. it is possible to exchange information and a novice licence would give a boost to beginners. Not that group practice should then be dropped, it should be continued in addition to live working—up to 20 or 30 w.p.m. if one wants to be really competent.

As regards Class B licensees using automatic Morse senders and receivers—there seems no more reason against this than there is against RTTY and the wording of the relative International Radio Regulation (Final Acts, WARC Geneva 1979 Article N30/41 No. 6357) does not in fact preclude such permission being given. I must confess, however, that like Geoff Arnold, as an ex-professional radio operator, it seems a bit pointless to me. If we want machine telegraphy then RTTY does it all and Morse was designed for human sending and receiving.

W.M. Dunell G3BYW
Cambridge

Sir: Your question posed in *PW* comment "cracking the code" is one which I myself have always regarded as a quirk in the Class B licence. A licence which while being issued by the Home Office to the recipient for the purpose of "self training in wireless telegraphy" includes therein provision specifically preventing the licensee in practising the sending of Morse code on the same band wherein he is permitted to use voice modulation. The present Class B licence conditions have led to the large number of Class A amateurs on the h.f. bands unable or unwilling to use Morse code. The Home Office licence conditions naturally lead aspiring Class A operators towards the objective of a "once in a lifetime" 12 w.p.m. test, rather than then having the desire or objective of becoming proficient operators well practised in using Morse code, Q codes and other associated skills.

My own proposal following the WARC conference was as follows. The present Class A and Class B licences should remain as they are for the present time. However, an addendum to the Class B licence should be sent to all Class B licensees. After two Class A amateurs have certified that the Class B licensee is sufficiently proficient in receiving Morse code and sending at 4 or 5 w.p.m. in the addenda spaces provided, the completed form should be sent to the Home Office with s.a.e., the upper half stamped and filled, the lower half stamped and returned to the sender granting permission to practise Morse code sending and receiving with Class A amateurs and other "novice" Class B amateurs on 2m, 70cm etc. Whilst using Morse code the suffix /N could be added to the callsign e.g. G8RWY/N. However, in practice, I feel this would be both undesirable and unnecessary. As extra bait to gain c.w. proficiency the permission for Class B licensees to use 4m would be included with the Morse code permission at some future time.

I feel sure the present occupants of 4m will be happy to hear Class B Morse novices on that band and ensure the "novices" have every opportunity to practise their Morse code to get a Class A licence. A query in Morse code would naturally be answered in a similar mode as all Class B's on that band will have already proved a certain ability and willingness to use Morse code.

In the short term this proposal as it stands or slightly modified can be put into effect both easily and quickly, with little cost to the Home Office and no disruption of the present amateur licence arrangements.

In the long term I would hope that the standard of operation shown by the British amateurs to the world, on the h.f. bands, will show an overall improvement. As the knock on effect of practised Morse code operators appearing on the h.f. bands as new Class A licensees takes place I would suspect that of these practised Morse code operators few wouid cease to use Morse upon attaining the required 12 w.p.m. for a Class A licence.

As a Class B operator myself, one who is still struggling to leap past that 12 w.p.m. barrier so that I may start my "self training in wireless telegraphy" as opposed to telephony, I am disappointed with the very large number of Class A operators who have let their Morse code skills totally lapse, and who are unable to help me improve. It is a state of affairs which we "amateurs" ourselves must try to correct before the Home Office decides to raise money by having everyone tested for code proficiency every 12 months.

We must make it clear to the Home Office that it must take corrective measures as soon as possible to improve the standard of self training in wireless telegraphy before more "Hams" join the vocal CB fraternity in declaring code as a "dead duck", totally outmoded method of communication.

J.A. Debrey G8RWY
Bolton

Sir: Re the July issue of *PW* and comments passed by Geoff Arnold i.e. Cracking the code.

Being War-Disabled my right side plus neck is part paralysed.

This last 11 years being house bound I have saved up for equipment, in the hopes of becoming a radio ham, and with the help of RAIBC members and others to encourage me I sat the RAE at home and passed the exam in December, my call sign being G6BGP.

However, now comes the c.w. test before I can really get my one good hand cracking on the h.f. equipment. Like many others in my position who have to take drugs to stabilise my medical condition, I find c.w. far more difficult than the study for the RAE, the reason being our reaction is very much slower than, shall we say, those who enjoy good health.

As my father was at one time a Signals Officer in the RN I

fully appreciate Geoff's point of view regarding c.w. In fact it is like music to my ears to hear it over the air. But alas the reactions to c.w. regardless of how I feel myself, my brain, movement of hands etc., will never be the same, so I feel all Modern Aids to help should be used.

In writing this letter, which I do with great difficulty, may I say without the aid of RAIBC members and others it would have been impossible to get even to this point. Now that I have all my h.f. gear plus a 13m Electric Hoist Tower no way am I going to stay a G6, it's G4 or nothing.

R. Hibberd G6BGP
Bournemouth

Sir: With regard to your editorial in July 1981 issue of *PW*, consider this for a proposal for reviewing the Class B licence.

With the Government agreeing to give the general public a slice of the h.f. band in the form of CB on 27MHz without any training whatsoever, why not allow G8 and G6's use of low power (say 10W) on 10 metres.

All the necessary knowledge of transmitter interference is covered in the RAE and by allowing the use of telephony only would give many amateurs a new aspect to the hobby.

There is no doubt that c.w. is being used far less than in the past and it seems that many Class A holders do not consider Class B holders to be proper amateurs.

Give us a chance to prove we are!

B.H. Philipp G6AFD
Sutton, Surrey

Sir: For many years, since childhood in fact, I have held an interest in radio, finding that it gave me far more enjoyment than television ever could. It has always been my ambition to extend my hobby further, firstly by passing the RAE and then moving on to a Class A licence with a Morse pass.

There are however certain aspects of amateur radio that are giving me cause for concern, nagging doubts that keep creeping in to my general thinking, doubts that have been obtained from all sources.

Concern grows at the increasing numbers of v.h.f. mobiles that are being stopped by the police mistaking the operators for CB radio pirates. It is definitely not my wish to be interrogated by the police on a regular basis.

Amateur radio seems to have become an endless stream of competitions devised by local clubs and I recently read that the 2m band at weekends is becoming choked by amateurs swapping competition results with each other. Is this really amateur radio or is it the only way the average ham can maintain an interest, as modern research and experimentation seem to be restricted by high costs?

The recent upsurge in CB radio has shown that there is a very high demand for mobile transceivers and everybody associated with the promotion of CB seems set to cash in on a boom. Talk is now of making the amateur radio licence easier to obtain, c.w. on 2m by automatic senders and a new novice licence, but the change in the format of the RAE in 1979 has gone a long way to assisting many more people to pass the exam and this in itself should be as far as "making it easier" should go. Standards throughout Britain and the world have got to be maintained and any attempt to undermine the licences that are held by amateurs can only be self-destructive to amateur radio as a whole.

To me amateur radio is the ability to contact and converse with people of any race, creed or colour throughout the world (assuming of course they wish to talk to me), in the building of equipment and experiments with different antennas. It will also be an immense pride in the value of the licence I hope to secure in the future.

The future of amateur radio concerns me and casts serious doubts as to where it is going, but it will survive, albeit with some change, but I still believe that the discipline needed to pass the exams is very necessary to the continuance of amateur radio. These exams set the standards.

D. Guest
Farnborough, Hants.

Magic Antennas

Sir: Most of your readers will probably enjoy trying to solve a mystery, especially if it is connected with wireless! So here's a radio conundrum for them to get their teeth into . . . and to see if they come up with the same solution as I did?

Walking round a small town market in the South of England a few days ago I came upon a stall selling what can only be described as "Magic antennas". The vendor had a small portable TV set as well as a radio, and he demonstrated—quite convincingly I must admit—how much better his "Magic antennas" were than the usual type.

First of all, he connected a car radio antenna to the radio, waved it about, and signals were just, and only just, readable. Then he connected his special "Magic" variety—and the sound boomed out, attracting even more to the stall!! He turned to the TV set, and connected a small table-top quad, whereupon a picture covered in snow and obviously very poor could be seen on the screen; he twisted the quad to prove it was doing the best it could, but signals were still hopeless.

Then the "Magic antenna" was plugged in, and—as expected—there was a first-class picture!

The mystery was WHY did the sets NOT work in the first instance, and DID work in the second, which of course was the whole idea of the exercise?

Picking up one of the "Magic antennas", I found it was a tube about 6cm long and 3cm in diameter, with a strip of brown paper pasted around the body—that seemed very suspicious. One end had four solder lugs, to one of which about a yard of wire was soldered. Could it have been nothing more than an electrolytic capacitor? That was certainly what it looked like, but if this was a con-trick, then how on earth did it work?

The market was in a strong signal area, and the TV and radio would pick-up good signals on the proverbial wet piece of string . . . Both the little quad set top and the car radio antennas had screened co-ax cable ending in a screened plug, whereas the special "Magic" antenna had merely a few feet of insulated wire, with the end bared.

So if an attenuator was fixed inside both of the former, the signal input could be reduced until it was only just perceptible no matter how the aerial was swung about—whereas the unscreened wire would pick-up an excellent signal, especially as it was cut to approximately a quarter wave on the v.h.f. f.m. band. Any other suggestions please to the Editor.

D. Byrne G3KPO/GB3WM
Isle of Wight

Repeaters

Sir: Having just read G4AR's column in your July issue I feel moved to reply to some of his comments.

His attitude that anyone who removes the cover from his transceiver and attempts to repair a fault is a brave fool seems to be more suited to CB than amateur radio.

Although some may feel completely incapable of understanding how their Japanese black boxes work I can assure them that there are plenty of amateurs who repair and build their own equipment.

In reply to his comments about repeaters where he suggests that if mobile operators want to work greater distances then they should "improve their mode of operation" surely this is what they are doing by building and using repeaters!

As one of the team of people who designed and constructed the 2m repeater GB3SC I can assure him that there is a very real technical challenge in building repeaters and that amateur designs are very different to commercial practice. One example of this is frequency spacing, with amateur two metre repeaters a 600kHz offset between transmit and receive frequency is used while comparable commercial systems use a 5MHz offset.

A comment on your editorial comment about Class B licensees being allowed to use Morse is that I am in favour of this. Certainly on the bands for which they are licensed as I can see very little difference between Morse coded data and ASCII or Murray coded (RTTY) data.

N. Foot G8MCQ
Bournemouth

G4AR comments

Unfortunately, Nick has hit the proverbial nail right on the head! Amateur radio has become much like CB. Buy a black box on the never-never and just talk into the microphone!, and I repeat my assertion that it is foolhardy to dive inside such boxes when they go wrong, apart from guarantee problems, unless one is quite competent. Obviously Nick comes into this category but I'd like to assure him that he is in the minority today.

I don't decry the immense amount of technical research behind our repeater systems and no doubt we would have 5MHz offset too if our frequency allocations permitted. I still believe that the original work by amateurs on repeaters was prompted by commercial interests.

Police Powers

Sir: Please find enclosed copy of letter between Mr Hazelhurst, my MP, and the Home Office re the proposal to give the police powers of access to amateur stations. As a person with some power, and being an amateur of some standing, I would be obliged if you would kindly note the following.

1. There is in this country no offence of possession of ANY transmitting device, it is its illegal use that is the offence. If the police wish to examine the licence, what is the point when one is not required anyway?
2. How can the police prove in court that the "suspect" was transmitting? Even someone "caught" holding a microphone is no proof, the officer cannot see the energy being radiated.
3. Police officers who claimed to have been trained "in these matters" have arrested me and detained me on the non-existent charge of "possession of a citizens band transceiver". After three hours in a police cell I was released when the Radio Regulatory Department told the police the station was a bona-fide amateur installation. The police have thus proved their inability to examine, in even the simplest of tasks, an amateur station, when they had no right anyway, God help us if they get this power.
4. As you may be aware, many newer transceivers are general coverage, 1·5MHz to 30MHz. They do transmit on 27MHz, if a police officer sees that, what will happen?
5. Do not let the police have the power to demand that you transmit. With my homebrew transceivers, what happens when it won't work? Will I be guilty of failing to provide a specimen of r.f.? Will it be an offence to fail to maintain a transceiver in working order?

Please, I beg you, do everything in your power to prevent this unwanted and unworkable change being added to the amateur licence.

H. Allison G3XSE
Essex

New Clubs

Saffron Walden and District Amateur Radio Society was officially formed on 19 April 1981.

The Society meets every third Wednesday of the month at Debden Village Hall and would like to extend a welcome to local amateurs or anyone with an interest in amateur radio.

Further information can be obtained from either: *Chairman, Adrian Keeble G4HPU, tel: Saffron Walden (0799) 40075, or Secretary, Peter Carter (0799) 21697.*

At a meeting on 22 July 1981 in Iver, Bucks. a number of local amateur TV enthusiasts resolved to form the Home Counties Amateur Television Group.

The Group meets every fourth Wednesday of the month at 20.00hrs at The Swan Hotel, Iver, Bucks. and all interested parties are invited to attend.

Further information from: *Acting Chairman, John Betts G4HMG, tel: Iver (0753) 651652, or Acting Secretary, Mike Sanders G8LES, tel: 01-398 4618.* Both QTHR.

Whatever Next?

Just opened at 2 Princes Street, just behind Oxford Circus in London's West End, is the "Eyeball Bistro Club". When Roger Hall, G8TNT, attended its press day he was pleasantly surprised to find that it was not a dingy little cafe specialising in Arabian dishes, but a restaurant run by David Levi, a radio enthusiast who has worked in electronics for many years, and who hopes to appeal particularly to CB'ers.

David has installed a system that provides each table with a rig and although they are unable to transmit outside the building, they can be used to place orders or to talk to customers at the other tables. Another facility allows you either to listen to the background music or monitor the CB channels as soon as CB becomes legal.

The "Eyeball Bistro Club" will be open from 7am until 2am, seven days a week, and would seem the ideal place to eat if you want to immerse yourself in the world of CB.

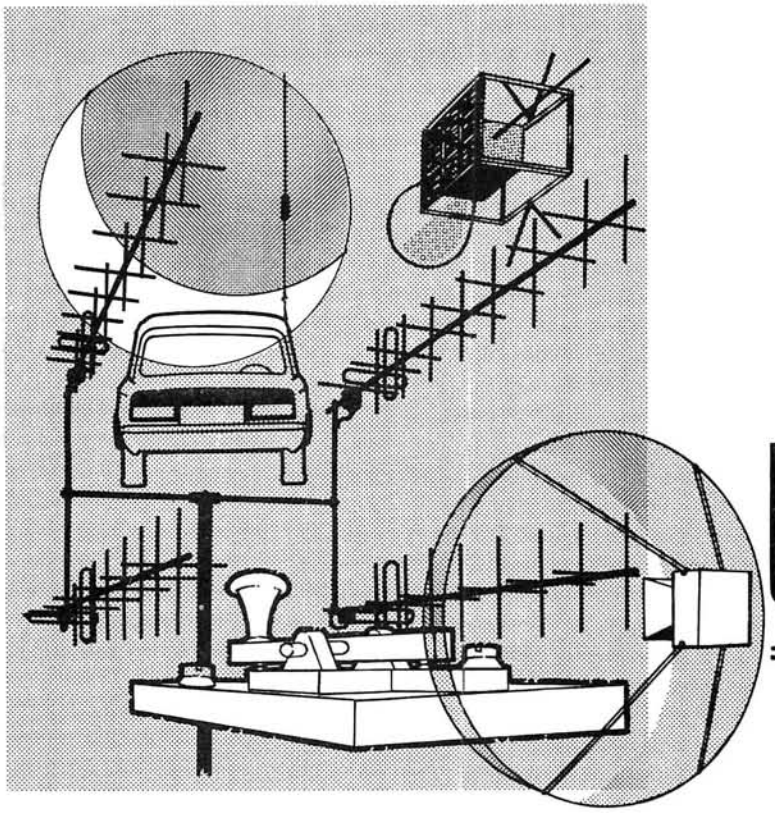
The 1981 Girl Technician Engineer of the Year Award

Somewhere within the UK's electrical and electronic engineering profession and already playing a valuable role in her industry's activities is the 1981 Girl Technician Engineer of the Year; the search is now on to find that very professional young lady.

In this, the fourth year of the Competition, the majority of girl technician engineers and employers are already very much aware of this Award, its prestige and purpose, and the effective boost it can add to the winner's future career prospects.

Nominations for this Award, with its £250 prize, are required no later than 1 October 1981. Last year HRH The Prince of Wales presented the Award, this year the winner will be announced at a ceremony in London at the end of the year.

Further details of the Award, which is sponsored by the Caroline Haslett Memorial Trust and the Institution of Electrical and Electronics Technician Engineers, and copies of the 1981 Award nomination form, are available from: *The Secretary, IEETE, 2 Savoy Hill, London WC2R 0BS. Tel: 01-836 3357.*



Using 70cm

Dick GANDERTON G8VFH
& John M. FELL G8MCP

The 70cm (432MHz) amateur band has shown a healthy increase in available commercial equipment over the past eighteen months together with a corresponding increase in usage.

Unlike the 2m band, the 70cm band is not yet cluttered up and over-used. However there is noticeable pressure from the RSGB to encourage amateurs to use this band instead of adding to the congestion on the 2m band.

Lying halfway to the microwave bands, 70cm u.h.f. does require different design concepts in the equipment used, but with a reasonable range of equipment available to the amateur, along with the possibilities of home construction, especially in the antenna area, the technical difficulties have tended to recede. This article should give you an insight into the u.h.f. band.

A Selection of IARU Region 1 70cm Beacons

Callsign	Frequency	QRA locator	Location
GB3WHA	432·810	AL71d	Crowborough, Sussex
GB3SUT	432·890	ZM31b	Sutton Coldfield, W. Midlands
GB3EM	432·910	ZN32b	Emley Moor, Yorkshire
GB3CTC	432·970	XK64a	Redruth, Cornwall
DL0BQ	432·010	EJ23d	West Germany
DL7HGA	432·035	GM47j	West Germany
OH2NLA	432·370	MU64j	Finland
LA5UHF	432·855	JD25e	Norway
LA1UHF	432·860	FT05a	Norway
LA2UHF	432·870	FX43g	Norway
LA3UHF	432·880	DS80b	Norway
LA4UHF	432·890	CT47c	Norway
OZ7IGY	432·930	GP23c	Denmark
SK4UHF	432·960	HT55j	Sweden
OZ2ALS	432·983	EP79c	Denmark
PA0DSW	433·035	CM35f	Netherlands

The 70cm Band Plan

Like the 2m band, a plan has been worked out for 70cm to avoid potential clashes of interest. Fig. 1 is a reproduction of the IARU Region 1 Band Plan for 70cm as it is used in the UK. This is an important point as in other countries in Region 1 there are several important differences.

All of the operations catered for on 2m are also available on 70cm and the reader is advised to read the article *Using 2 metres* published in *PW* May 1981. Moonbounce, c.w., meteor scatter, TV, Facsimile, RTTY, beacons, satellites and mobile working via repeaters are all possible on 70cm.

Repeaters

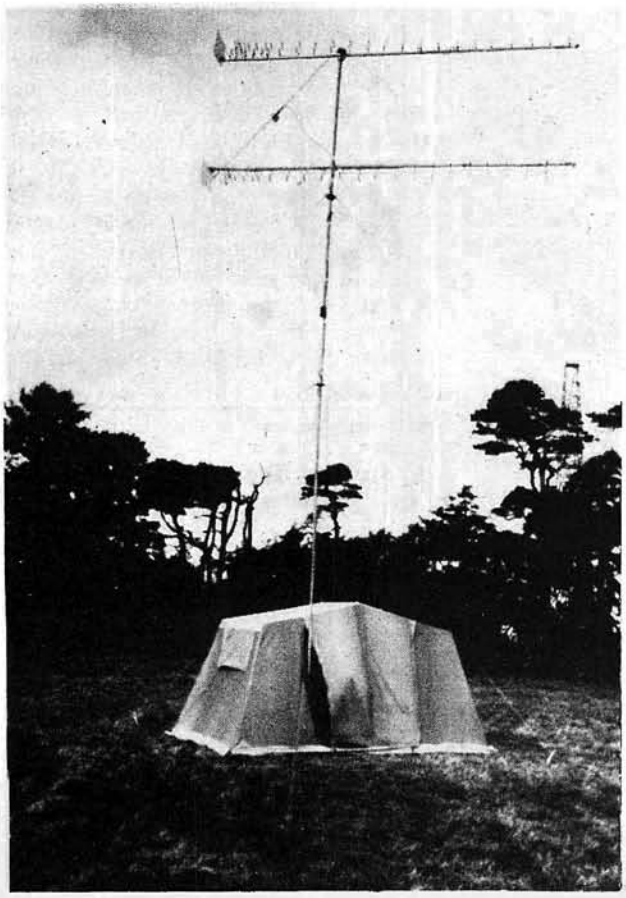
The 70cm repeater network in the UK is even more extensive than the 2m network. This is mainly because in general the coverage at u.h.f. is not as great as at v.h.f. especially mobile to mobile. The repeaters themselves operate in the same manner as their 2m brothers, requiring tone access and similar operating procedures.

The Datacard presented free with this issue shows the position and details of the 70cm network as it was at the end of June 1981. Since then several repeaters have been completed and are now on the air. Their details are given on page 33.

It should be noted that the UK repeaters use a frequency shift of +1·6MHz as against the IARU recommended −1·6MHz shift. This has not so far presented great problems as the UK network is much more extensive than any of its close neighbours. However, to avoid possible clashes the UK does not use RB1, 3, 5, 7 and 9, so allowing Holland to use these channels for its repeaters with the opposite shift. Germany has a large network using a shift of 7·6MHz.

Fig. 1: UK 432–440MHz Band Plan

CW only	432·000– 432·010 432·050	Moonbounce CW calling frequency
SSB and c.w. only	432·200 432·300	UK s.s.b. calling frequency IARU s.s.b. calling frequency
All modes non-channelised	432·600± 432·600 432·700	RTTY working (f.s.k.) RTTY calling frequency FAX calling frequency
Beacon sub-band	432·800– 433·000	Beacon sub-band
FM repeater outputs (UK only)	433·000 433·050 433·100 433·150 433·250 433·275 433·300 433·325 433·350 433·375	RB0 RB2 RB4 RB6 RB10 RB11 RB12/SU12 RTTY repeater and RTTY a.f.s.k. working RB13 RB14 RB15
FM simplex channels	433·200 433·400 433·425 433·450 433·475 433·500	SU8 used by Raynet SU16 SU17 SU18 SU19 SU20 f.m. calling channel
FM repeater inputs (UK only)	434·600 434·650 434·700 434·750 434·850 434·875 434·900 434·925 434·950 434·975	RB0 RB2 RB4 RB6 RB10 RB11 RB12 RB13 RB14 RB15
	434·000– 440·000	Sub-band devoted to UK ATV— frequencies chosen so as to avoid interference to other band users and, in particular, the amateur satellite service.
	435·000– 438·000	Amateur satellite service sub-band



A phased pair of 70cm Quad Loop Yagi antennas in use by the Bournemouth Radio Society during this year's v.h.f. National Field Day. This design, developed by G3JVL, is a widely used home built system for 432MHz

Additional Datacard Information

The repeater GB3NK at Wrotham in Kent is actually situated north of the motorway and the details for GB3IW on the Isle of Wight are as shown on the front of the card.

The following repeaters have become operational since our Datacard was printed.

GB3GY	Grimsby	RB11
GB3OS	Stourbridge	RB2
GB3VH	Hatfield	RB13
GB3YL	Lowestoft	RB14

There are also two repeaters that should be on the air in the next few weeks, these are:

GB3NF	New Forest	RB11
GB3TH	Tamworth	RB13

Four other repeaters will be on the air very soon:

GB3GR	Grantham	RB11
GB3MT	Winter Hill Lancs (RTTY)	RB12
GB3PU	Perth	RB0
GB3SM	Leek	RB13

GB3NN has closed down until a new repeater group can be formed; the old group has gone to Saudi Arabia! Anyone interested should contact Mike Dennison G3XDV, Chairman, RSGB Repeater Working Group, QTHR. ●

PRODUCTION LINES

ALAN MARTIN G8ZPW

AMS Module

I have recently received literature detailing the operation and use of a broadband synchronous detection module produced by Myers Electronic Research.

The AMS module has the ability to resolve any a.m. or s.s.b. radio signals within the working range of 200kHz to 20MHz when preceded with an appropriate front end tuned circuit. For higher operating frequencies the module may be used as the basis for an i.f. system.

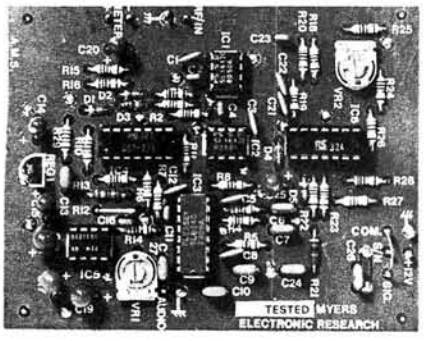
Synchronous detection techniques are not new, but the realisation of a stable system has always dogged experimenters in this field. It is claimed that the AMS module has a high degree of immunity to variations in ambient temperature and supply voltage, and combines several patented design techniques, such as intelligent a.g.c. and signal level referenced muting.

Brief specifications include: basic sensitivity at 5MHz of 5µV for 10dB S+N/N at 50% mod. at 1kHz; maximum input signal handling of 265mV; audio output 1V r.m.s. into 47k; supply requirements 9 to 15V d.c. (60mA at 12V) and an S-meter output is provided.

The module is available ready built or as a comprehensive kit and features four Plessey 1600 series r.f. i.c.s together with discrete components and screen printed p.c.b.

Further information from: *Myers Electronic Research, Customer Services Division, 145a Ashley Road, Hale, Altrincham, Cheshire WA14 2UW.*

Practical Wireless hope to be publishing an article on the techniques of synchronous detection and applications for this device in the near future.

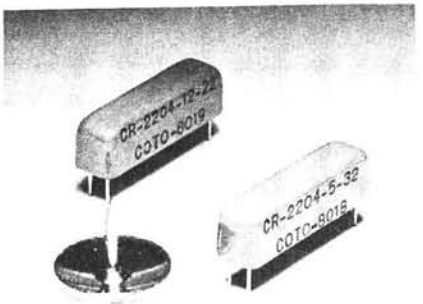


Mini r.f. Switching

Rhopoint Ltd. have available microminiature reed relays that provide excellent switching characteristics for low level r.f. signals in the range 1MHz to 1·2GHz and are designated the CR2200 series.

In operation, the CR2200 reed relays are in many ways superior to PIN diode switches when used in such applications as high speed logic switching, range switching, r.f. attenuator switching and receiver antenna switching.

Other advantages in using the CR2200 series include: low contact resistance and high circuit Q; low circuit capacitance of 0·5pF, reducing coupling effects; simple drive circuits, direct t.t.l. compatibility; and low cost. With a "1A" contact form incorporating a coaxial screen, switching of frequencies up to 1·2GHz is possible, giving, for example, performance figures at 700MHz of 24dB isolation, a v.s.w.r. of 1·2 : 1 and insertion loss of 0·34dB.



The CR2200 reed relays measure only 20 x 5 x 6mm and the VAT inclusive prices are, 5V version £4.47, 12V version £4.81 and are obtainable, if payment is sent with order, from: *Rhopoint Ltd., Delta House, 118 Station Road East, Oxted, Surrey RH8 0AY. Tel: (088 33) 7988.*

Budget Toroids

A leaflet is available from Cotswold Electronics Ltd., describing their "budget range" of toroidal transformers for use by professional and d.i.y. enthusiasts in 30, 60, 100, 160, 230, 330 and 530VA sizes and at prices ranging from £4·55 to £15·80.

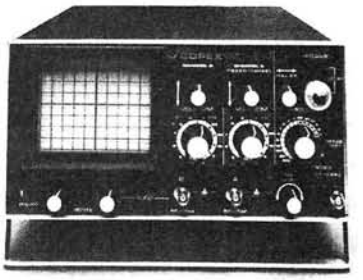
All types are normally supplied with 110, 220 or 240V primary windings but special windings can be supplied on request.

For further details apply to: *Cotswold Electronics Ltd., Unit T.1, Kingsville Road, Kingsditch Trading Estate, Cheltenham GL51 9NX. Tel: (0242) 41313.*

New British Oscilloscope

Scopex Instruments Ltd., the British oscilloscope manufacturer, has introduced a new, highly versatile instrument called the 14D10V. The new instrument has been developed using the very successful 14D10 as a base retaining all its outstanding features and utilising available space on the front panel to accommodate the new facilities.

The 14D10V has been designed primarily for the video and TV service markets, and employs the latest solid state technology devices to provide the first oscilloscope with a TV line selector for under £600.



The main new feature is the facility to trigger onto a video colour waveform via an active TV sync separator and then select any line on the waveform. This is achieved by the simple operation of pressing two push buttons, the instrument automatically triggers off the TV line and the operator can then, by means of a precision potentiometer, select each individual line of the TV waveform to be investigated on the c.r.t. display.

At a price of £290 plus VAT, which includes two probes and carriage (UK mainland), the British *made* 14D10V undoubtedly represents excellent value for money and is obtainable from: *Scopex Instruments Ltd., Pixmore House, Pixmore Avenue, Letchworth, Herts. SG6 1JJ. Tel: (046 26) 72771.*

If you please

Please mention "Production Lines", when applying to manufacturers or suppliers featured on this page.

Lee Electronics Ltd

TELECOM ANTENNAS – YAESU MUSEN – ICOM – F.D.K. – STANDARD Etc.

IT'S "STANDARD" SUMMER TIME

70cm PORTABLE/MOBILE

New From Standard

The C78 UHF FM Synthesized Transportable

C78 £219.50

JUST LOOK AT THE FOLLOWING FEATURES:

- ★ Full 10MHz coverage 430-440MHz in 25kHz steps
- ★ LCD digital readout ★ S and RF power meter
- ★ Programmable repeater shift and tone burst
- ★ 5 Programmable memories for your favourite channels
- ★ Full scanning facilities of vacant or occupied channels
- ★ A full 1W/10W switchable RF power
- ★ Up/down channel control on the microphone
- ★ Can be used from dry cell or rechargeable batteries
- ★ Optional mobile mount and 10W booster available
- ★ ONLY 5"W + 2"H + 7½"D

THE C78 IS MADE TO THE SAME HIGH STANDARD AS THE C8800 AND C7800 SO YOU CAN BE ASSURED OF FIRST CLASS QUALITY AND VALUE FOR MONEY

PRICE: C78 – £219.50, Mounting Bracket – £19.95
Carrying case – £6.95, Linear Amp (10W) – £72.50

YAESU 2m multimode portable
10 mems – 2VFO's – 2.5W **£229**

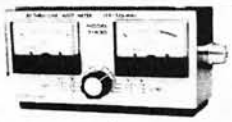
Accessories available: Mobile Mount Bracket Car Adaptor/Charger, Mains Charger.

YAESU FT208

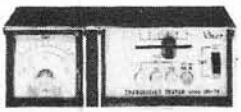
2m Handheld.
LCD display (with nightlight).
10 memories.
25 or 50kHz steps for scanning
Priority channel.

£190

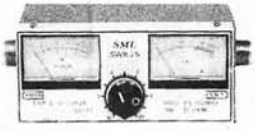
TELECOM ANTENNAS – YAESU MUSEN – ICOM – F.D.K. – STANDARD Etc



T-435: VHF/UHF swr and power meter with 2/20/120 watt through line power measurement **£34.95** inc. VAT. P&P 75p.



UH74 SWR and power meter switchable HF, 2m and 432MHz with remote head at **£16.39** inc. VAT. P&P 75p.



SWR25: This ever-popular twin SWR and Power meter covers 3.5-150MHz at **£12.00** inc. VAT. P&P 50p.

HELICAL ANTENNAS

2m with BNC plug	£4.50
2m with PL259 plug	£4.50
2m for Trio etc.	£4.25
2m with AR240 screw	£4.25

P&P 25p

COAX SWITCHES

★ NEW SA-450 ★

£9.77

High quality coax switch housed in a diecast box with SO239s

Frequency	3.5-500MHz
Loss	0.02dB
Weight	450gms
Max power	2.5kW
Impedance	50ohm

CT-1 Coax toggle, 3 SO239s **£9.77** inc. VAT. P&P 25p.

CT-2 Coax toggle, 2 SO239s, 1 PL259 **£6.85** inc. VAT. P&P 25p.

TS-120 Coax slide switch, 3 SO239s **£6.75** inc. VAT. P&P 25p.

DL-30 Dummy load 25W DC-150MHz **£6.35** inc. VAT. P&P 25p.
T-100 100W Dummy load DC-500MHz **£20.12** inc. VAT. P&P 25p.
T-200 150W Dummy load DC-500MHz **£35.60** inc. VAT. P&P 25p.

NEW PRICE T200 £33.60

2 METRE FM/SSB Portable/Mobile

C58

£235.00

- ★ L.C.D. display for low battery consumption
- ★ 100Hz/1KHz/25/12.5KHz/5KHz
- ★ Five programmable memories
- ★ Rit control for accurate ssb resolution
- ★ Effective noise blanker
- ★ Repeater and reverse repeater off set
- ★ A full one watt R.F. power
- ★ Automatic or manual tone burst
- ★ Full scanning facilities
- ★ Large range of optional accessories
- ★ Up/Down scan control on the microphone
- ★ Now available 25 watt amp **£79.95**

All MICROWAVE MODULES and DATONG products available

400 EDGWARE ROAD
LONDON W2
01-723 5521 Tlx: 298765

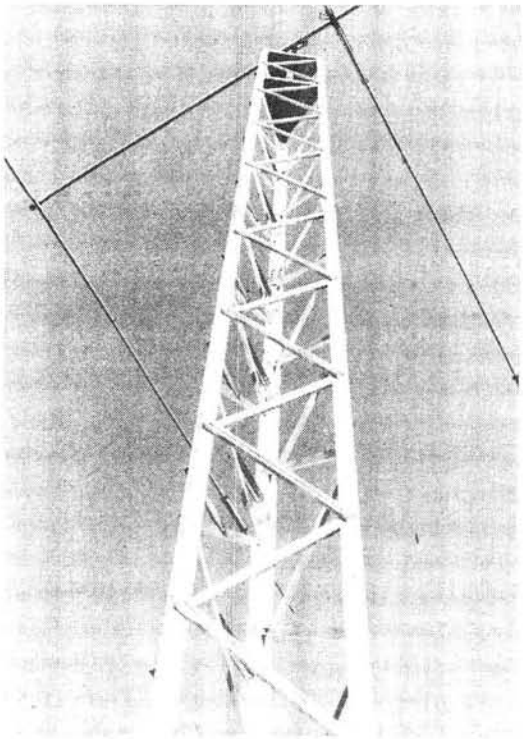
Buy it with Access | BARCLAYCARD VISA

INSTANT H.P. (with Bank Card) & P/EX. WELCOME

Send 25p for full details of our range.

Western

ALUMAST



The **ALUMAST** is a 15in (375mm) wide triangular cross section lattice sectional aluminium mast based on a 10ft (3·05m) section length. It is supplied "knocked-down" in a tubular carton for ease of transport, but can easily be assembled needing no special tools or skills. The system includes top plate with bearing sleeve, rotor plate and a choice of a fixed base frame (FB-1) or one with hinge joints (HB-1) to enable the mast to be pivoted at ground level. Guy brackets are available for use at heights above 30ft.

- Made from high strength corrosion resistant alloy using WESTERN'S EXCLUSIVE 'W' section leg extrusions.
- Easy assembly using bolts and "Nyloc" locking nuts for security.
- Free-standing to 30ft (9·15m) with a typical tri-bander plus VHF/UHF antennas.
- Heights to 200ft (61m) with appropriate guy configurations (ask us for quotes).
- Lightweight – only 25lb (11kg) per 10ft (3·05m) section.
- 30ft (9·15m) mast is delivered in a tube only 10ft 6in (3·2m) long. 6in (0·126m) dia.

A COMPLETE 30ft (9·15m) MAST for 375/PSS/3; HB-1; RMP-1; TP-1 **£240.35**

FULL PRICE LIST

375/PSS/3	30ft mast (3 sections)	£184.00
375/PSS/1	Additional 10ft section	£62.68
HB-1	Hinged base unit	£31.05
FB-1	Fixed base unit	£21.85
RMP-1	Rotor mounting plate	£12.08
TP-1	Top plate with sleeve	£13.23
GB-1	Guy brackets (set of 3)	£11.50

All prices include carriage and VAT at 15%
For Scotland – add £10 extra carriage

Western Electronics (UK) Ltd

FAIRFIELD ESTATE, LOUTH, LINCS LN11 0JH
Tel: Louth (0507) 604955 Telex: 56121 WEST G

All these advantages...

- Instant all-weather starting
- Smoother running
- Continual peak performance
- Longer battery & plug life
- Improved fuel consumption
- Improved acceleration/top speed
- Extended energy storage

..in kit form

SPARKRITE X5 is a high performance, top quality inductive discharge electronic ignition system designed for the electronics D I Y world. It has been tried, tested and proven to be utterly reliable. Assembly only takes 1 2 hours and installation even less due to the patented 'clip on' easy fitting.

The superb technical design of the Sparkrite circuit eliminates problems of the contact breaker. There is no misfire due to contact breaker bounce which is eliminated electronically by a pulse suppression circuit which prevents the unit firing if the points bounce open at high R.P.M. Contact breaker burn is eliminated by reducing the current by 95% of the norm.

There is also a unique extended dwell circuit which allows the coil a longer period of time to store its energy before discharging to the plugs. The unit includes built in static timing light, systems function light, and security changeover switch. Will work all rev counters.

Fits all 12 v negative-earth vehicles with coil/distributor ignition up to 8 cylinders.

THE KIT COMPRISES EVERYTHING NEEDED
Die pressed case. Ready drilled aluminium extruded base and heat sink, coil mounting clips and accessories. All kit components are guaranteed for a period of 2 years from date of purchase. Fully illustrated assembly and installation instructions are included.

Roger Clark the world famous rally driver says "Sparkrite electronic ignition systems are the best you can buy."

Sparkrite
HIGH PERFORMANCE ELECTRONIC IGNITION
Electronics Design Associates, 82 Bath Street, Walsall, WS1 3DE.

Electronics Design Associates, Dept. PW1081
82 Bath Street, Walsall, WS1 3DE. Phone: (0922) 614791

Name _____

Address _____

_____

Phone your order with Access or Barclaycard

Inc. V.A.T. and P.P. | QUANTITY REQ'D.

X5 KIT £16·95 | _____

ACCESS OR BARCLAY CARD No. | _____

I enclose cheque/PO's for £_____

Cheque No.

Send SAE if brochure only required.

PRODUCTION LINES

ALAN MARTIN G8ZPW

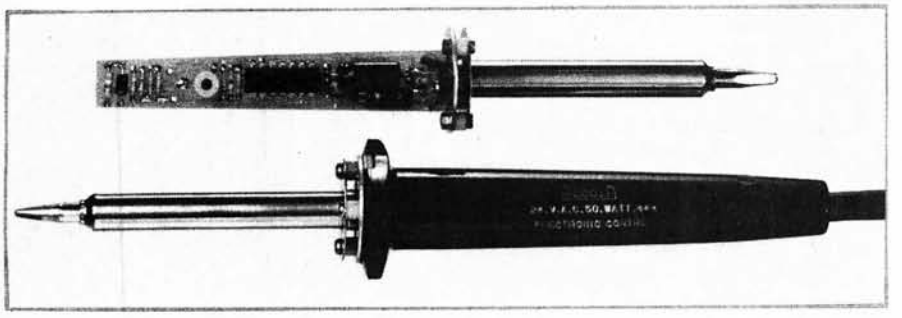
New Soldering Iron

Adcola has introduced a new electronically controlled soldering iron, called the 444, for use with the majority of 24V 50Hz 50VA soldering stations.

The control is achieved by the use of a thermocouple placed between the heating element and the bit/tip. The heart of the control circuit is an i.c. which has been designed to Adcola's specifications and incorporates an op-amp and a zero-switching crossing circuit, which eliminates line interference, and the element design removes any magnetic effect, the temperature is variable between 220°C to 420°C. The 444 is supported by a range of more than ten iron-plated 4·75mm diameter profiles of soldering bits/tips.

As an introduction, Adcola is currently offering two evaluation kits at a special reduced price. Kit 1 comprises of the 444 iron, a selection of five long-life bits/tips and a safety stand for £21·00, and Kit 2 without the safety stand for £17·00. The normal one-off price of the 444 unit is £18·50.

For further information contact: *Adcola Products Ltd., Adcola House, 113 Gauden Road, London SW4 6LH. Tel: 01-622 0291.*



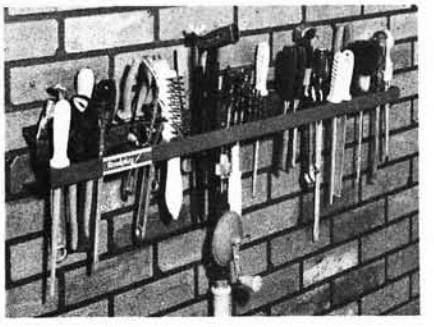
Useful Tool Rack

So often that little job in the workshop can take ages if you have to search through your tool box or bag for a particular tool.

To overcome the problem, the Rawlplug Handy Tool Rack has been designed for wall mounting and provides storage space for over fifty hand tools of various shapes and sizes, from a medium length saw down to a small drill bit. Once it is fixed in place you will not only know where everything is but be able to see whatever you need at a glance.

Made from steel, the tool rack is strong enough to hold even weighty items of equipment, is finished in tough wear-resistant stove enamelled paint and measures just 910 x 100 x 100mm.

Available from most good tool shops, the recommended retail price is £4.99 including VAT and each rack is supplied complete with fixing screws and Rawlplugs.

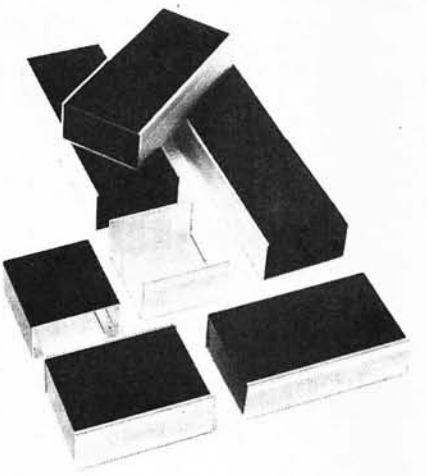


The Rawlplug Co. Ltd., Rawlplug House, London Road, Kingston-upon-Thames, Surrey KT2 6NR. Tel: 01-546 2191.

Nice Case

Recently introduced by Zaerix Electronics Ltd. is the "Tubox" range of cases that are robust, attractively styled and very simple in construction.

The base is an extrusion of extremely rigid anodised aluminium U-section, which measures 70mm wide x 40mm deep and is available in six lengths between 70 and 220mm. The upper edges are formed into retaining lips, into which slides a 1·5mm thick pvc coated cover that is folded to form the end pieces and fixing flanges. The two parts are then secured by four self-tapping screws.



"Tuboxes" are very reasonably priced, and cost between £2·59 and £4·15 plus VAT and 50p p&p.

For further details contact: *Zaerix Electronics Ltd., 46 Westbourne Grove, London W2 5SF. Tel: 01-221 3642.*

40kV Meter Probe

Lightweight, with built-in meter, the LHM-80A from Leader measures up to 40kV d.c. simply and safely. With a 20kΩ per volt input impedance, and an accuracy of ±3%, the LHM-80A is an essential tool for TV servicing and many other applications.

The LHM-80A is made of high impact polystyrene, is 385mm long, weighs 300g and costs £16.00 plus VAT.

Further details from: *Sinclair Electronics Ltd., London Road, St Ives, Huntingdon, Cambs. PE17 4HJ. Tel: (0480) 64646.*

PW 'STOUR' TOP-BAND TRANSCEIVER

PART 5

David G. BARRELL G4BMC

Following the detailed descriptions of Boards 6, 7, 8 and 9 presented in Part 4 we continue with details of the v.f.o. and Filter Boards

Board 10—VFO Board

The v.f.o. contains the following circuitry.
(1) 10Tr1 a 2N3819 oscillator.
(2) 10Tr2 a 2N3819 buffer.
(3) 10Tr3 a further buffer amplifier.

Circuit Description

Transistor 10Tr1, a 2N3819 f.e.t., operates as a grounded drain Colpitts oscillator. This stage is run with a fairly low drain current to minimise the drift on the v.f.o. frequency. No special temperature compensating components were used and the short term drift under normal operating conditions, from switch on, was about 1·5kHz which in practice proved adequate. (The author's commercial rig drifted about the same amount.)

Capacitor 10C5 is a dual-gang 40pF variable capacitor, a portion of which is used in the main tuning, determined by the setting of 10C6. With careful adjustment of 10C4 and 10C6 the frequency and range of the v.f.o. may be determined. The range that the v.f.o. will cover, 7·0–7·3MHz or, as in our case, 7·0–7·5MHz, depends on the setting of 10C6. The particular frequency range covered, 7·0–7·5MHz or 7·1–7·6MHz, may be set by 10C4. The two adjustments are interrelated but gradual tweaking of these two trimmers will give the desired coverage. In the prototype the v.f.o. was made to cover 7MHz to 7·5MHz. This could be decreased but adequate bandspread was available and gave coverage of 1·5MHz–2·0MHz on receive. During transmit the maximum bandwidth is controlled by the available bandwidth from the filters.

It should be noted that without the r.i.t. circuitry connected the v.f.o. is unstable. If r.i.t. is not required components 10C1, 10D1, 10R1, 10C2 and 10RFC1 should be removed. The r.i.t. components are located on a tag strip away from the v.f.o. and may be positioned in any convenient location. The control is d.c. activated and screened cable is not required between the r.i.t. components and point A on the v.f.o. board. With the components shown a frequency variation of ± 2·5kHz is available.

The r.i.t. switching is controlled by a relay as shown in the diagram and is so arranged that the control potentiometer is inoperative during transmit. Solid state switching could of course be used to replace the relay contacts, but as there were spare contacts available it was not thought worthwhile. The r.i.t. may be switched in or out during receive.

The oscillator is source coupled into the gate of 10Tr2 via 10C13, a 10pF silver mica capacitor. Transistor 10Tr2, a grounded drain buffer amplifier, is used to isolate the oscillator stage and to afford some voltage gain. Transistor 10Tr2 couples into 10Tr3 via 10C15, a 100pF ceramic capacitor.

A further common emitter buffer amplifier, 10Tr3, has its gain controlled by 10R11, an 18Ω resistor. The output from 10Tr3 is taken from

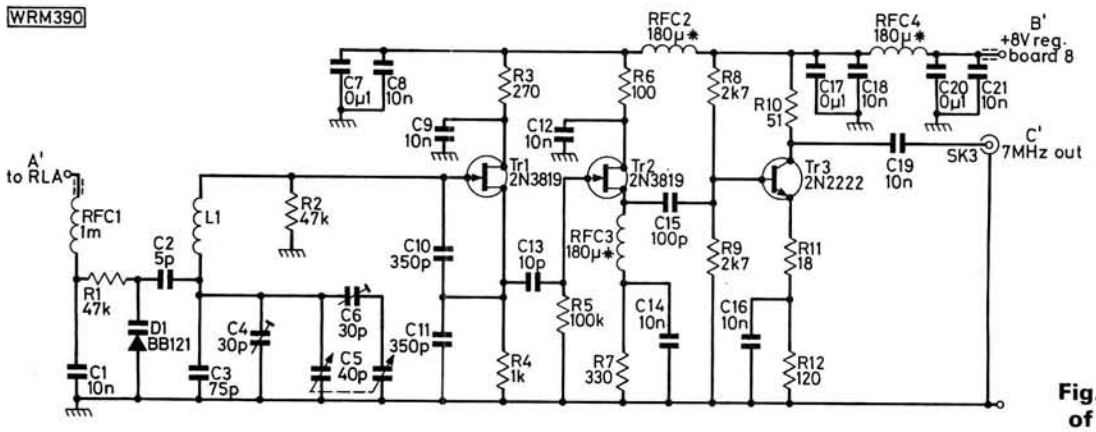
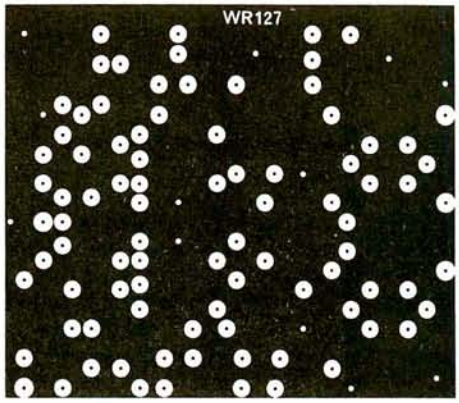
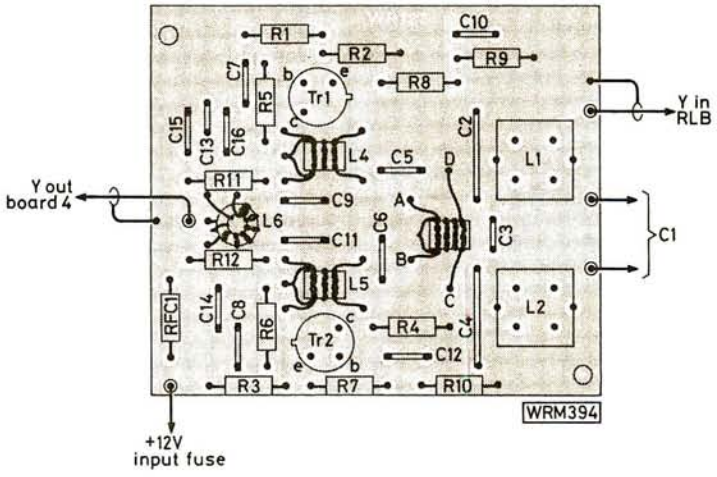


Fig. 32: Circuit diagram of the v.f.o. (Board 10)





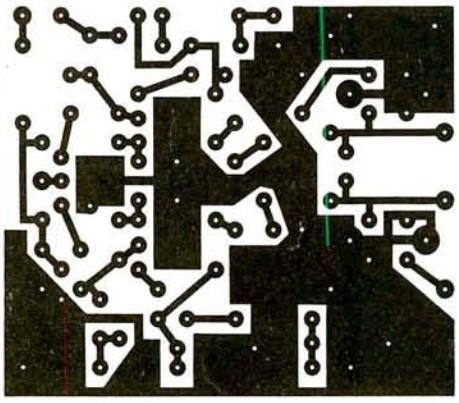


Fig. 33: Component overlay, track pattern and ground-plane of Board 6 shown here full size

its collector via 10C19 to the output socket on the v.f.o. compartment.

Further amplification of the 7MHz v.f.o. was required but as the next stage needed to handle a substantially larger current it was felt that it should not be included in the v.f.o. box due to the heat generated. This stage was in fact located on the mixer board where any such heat generated would not present any problem.

Constructional Details

The original v.f.o. was built in a similar manner to the final version but an aluminium box was used for the enclosure. This proved to be totally unsatisfactory due to movement of the box causing considerable differences in v.f.o. frequency. It is strongly recommended that a die-cast box is used for the housing of this board. All "off board" wiring i.e. wires to 10L1, and any external connections, should be of 20 s.w.g. or larger to avoid any mechanical movement which would in turn cause a change in v.f.o. frequency. The coil itself should be tightly wound on a good quality former and fixed with Araldite or similar adhesive at the top and bottom, again to ensure mechanical stability.

★ components

BOARD 10

Resistors

¼W 5% Carbon Film

18Ω	1	R11
51Ω	1	R10
100Ω	1	R6
120Ω	1	R12
270Ω	1	R3
330Ω	1	R7
1kΩ	1	R4
2·7kΩ	2	R8,9
47kΩ	2	R1,2
100kΩ	1	R5

High stability ¼W 1%

510Ω	2	R16,17
4·7kΩ	2	R14,15

Potentiometer

1kΩ lin.	1	R13

Capacitors

Disc Ceramic

10nF	9	C1,8,9,12, 14,16,18, 19,21
0·1µF	3	C7,17,20

Silver Mica

5pF	1	C2
10pF	1	C13
75pF	1	C3
100pF	1	C15
350pF	2	C10,11

Two-gang Variable Air-spaced

40 + 40pF	1	C5

Air-spaced Trimmers

30pF	2	C4,6

Semiconductors

Transistors

2N2222	1	Tr3
2N3819	2	Tr1,2

Diodes

BB121 varicap	1	D1

Inductors

Radio Frequency Chokes

180µH	3	RFC2,3,4
1mH	1	RFC1

Miscellaneous

Single sided p.c.b. (1).

Note: Component refs. in text are pre-fixed with the board ref. 10.

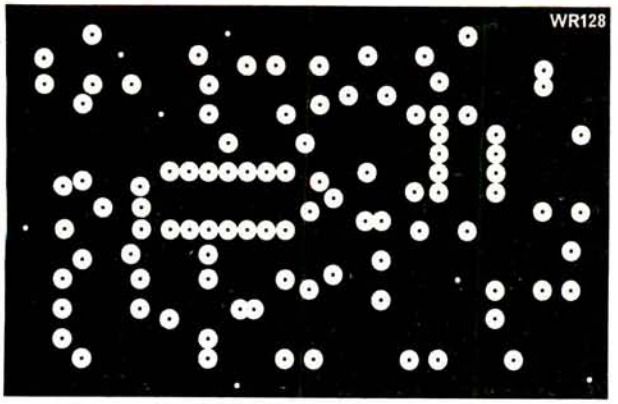
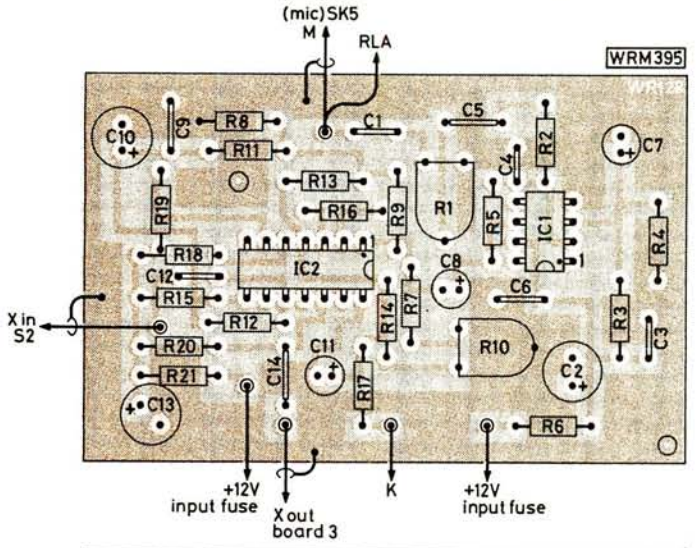
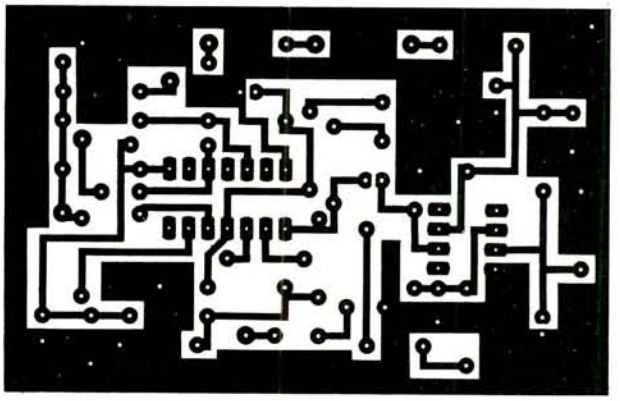


Fig. 35: Component overlay, track pattern and ground-plane of Board 7 shown full size





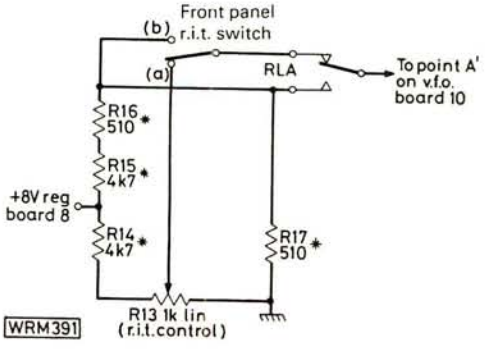


Fig. 34: Sub-circuit of the r.i.t. Points (a) and (b) refer to the switching diagram

The board itself is a single sided glass fibre p.c.b. and should be mounted at all three points as shown. It is important to use single sided p.c.b. to avoid changes in capacitance between tracking and ground plane.

All three transistors should be mounted as close to the board as possible and silver mica capacitors must be used where shown; substituting with the cheaper ceramic types will degrade the stability of the unit.

The main tuning capacitor 10C5 should be firmly secured to the top of the v.f.o. box with holes drilled in the box to allow connections to the fixed vanes. On the prototype the slow motion drive was secured to the box itself and not to the front panel. Any leverage on the tuning knob then tended to move the whole unit, producing very little or no detectable change in frequency. It is worth mentioning that a good quality two gang unit should be purchased for 10C5, with bearings at both ends of the rotor if possible. It is important that the trimmers 10C4 and 10C6 are air-spaced and that they may be adjusted with the lid in position. Holes will have to be drilled to allow for this and the v.f.o. should be set up with the lid of the box secured. In this way the v.f.o. becomes a separate detachable unit with no change in frequency noticeable when enclosed and secured inside the final cabinet. There is nothing worse than having an otherwise stable v.f.o. moving frequency whenever the cabinet casing is removed.

A worthwhile improvement on the prototype would be to encase the variable itself which at the present is left sitting on top of the v.f.o. box.

The following components are not located on the p.c.b.

(1) 10C20, a 0·1μF decoupling capacitor. This component is soldered between the feedthrough capacitor and an earth tag mounted on the fixing of the feedthrough.

(2) 10C3 which is soldered between the bottom of 10L1 and an earth tag.

(3) 10C5.

(4) 10C4 and 10C6.

Due to the physical size of the box used 10C10 and 10C11 were made up from two smaller values each in parallel, i.e. a 200pF and 150pF capacitor. Space is provided on the board for two components in each

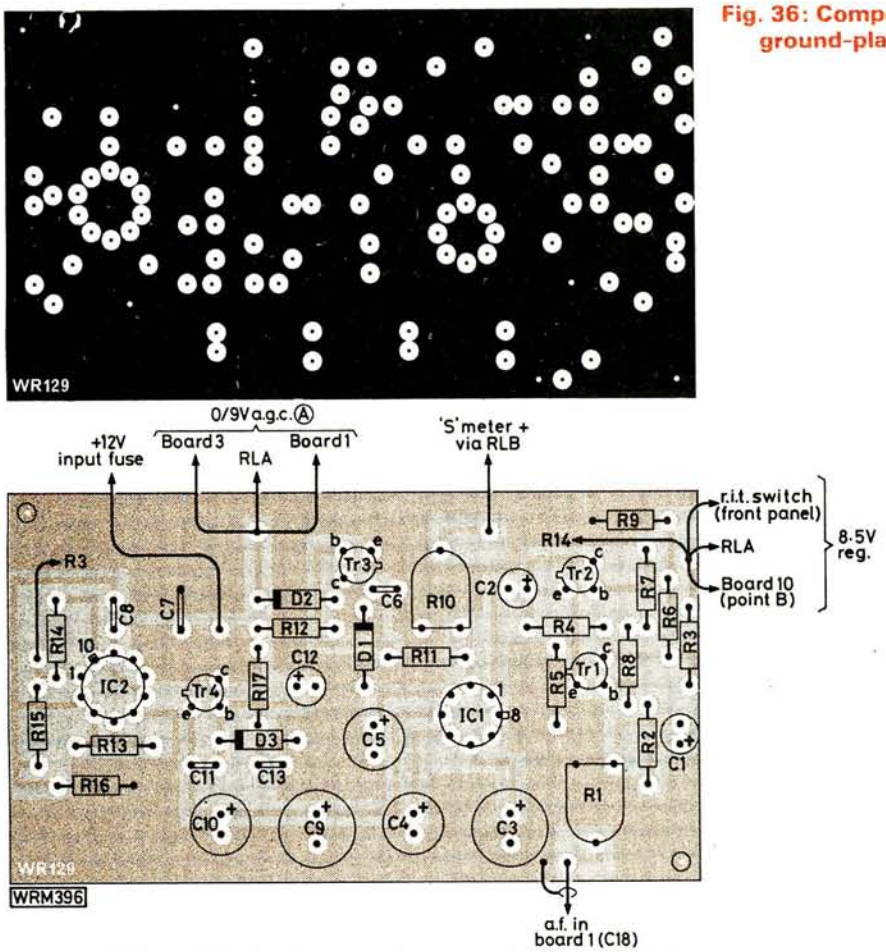


Fig. 36: Component overlay, track pattern and ground-plane of Board 8 shown full size

case. The 350pF capacitors originally purchased by the author were too high and prevented the lid of the v.f.o. box being mounted. If smaller units are available then a single 350pF may be used in each case. However, as stated earlier, it is essential that silver mica capacitors are used.

All components should be mounted with as short a lead length as practicable to ensure best mechanical stability.

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

Summarising Design Considerations for a Stable VFO

(1) Use a stabilised supply to the v.f.o.
(2) Use at least two buffer amplifiers to ensure that "pulling" of the oscillator does not occur.
(3) Operate the oscillator itself at the lowest possible power level.
(4) Ensure all connections are as rigid as possible, using heavy gauge wire where necessary.
(5) Enclose the unit to avoid air flow over tuned circuit components.
(6) Use highest quality components for all tuned circuit elements.
(7) All variable capacitors must be air spaced.
(8) Decouple the oscillator and buffers well to avoid f.m. due to stray r.f. pick-up via h.t. lines.

Connections to VFO Board

(1) A connects to the r.i.t. circuitry via relay connections as shown in Fig. 34, using ordinary connecting wire.
(2) B connects to 8V stabilised line on a.g.c. board.
(3) C connects to mixer board (v.f.o. in to 4C10).

Filter Boards F1, F2 and F3

The filter boards F1, F2 and F3 are shown in Figs. 37 and 38. These consist of two band-pass filters and one low-pass filter respectively. Due to the broad-band response of the r.f. amplifiers **under no circumstances should the transceiver be used without all three filters present.**

No p.c.b. information is given as the size of the components used will much depend on available silver mica capacitors and the way in which large values are made up. For example, C1 in filter F1 was made up from a 390pF plus a 33pF and a 6·8pF all in parallel. As long as a close value is obtained to the one specified, in this case 430pF, it does not matter how these values are obtained. The p.c.b. layout is not at all critical and the author used an old board for F3, soldering the components to the track side where plenty of isolated connections existed. Inductors L7 and L8 in filter F3 should be mounted at right angles to each other.

As no test equipment was available to align the band-pass filters they were aligned at the centre frequency,

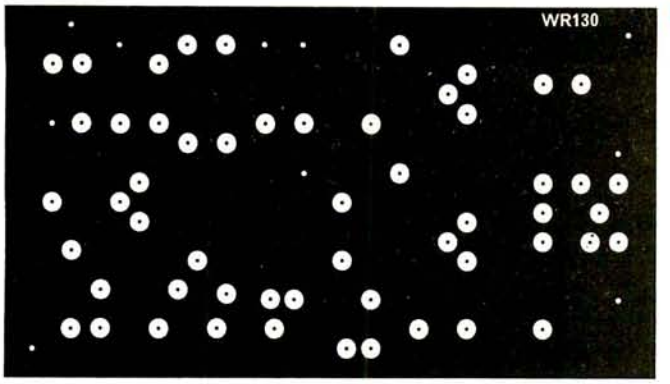
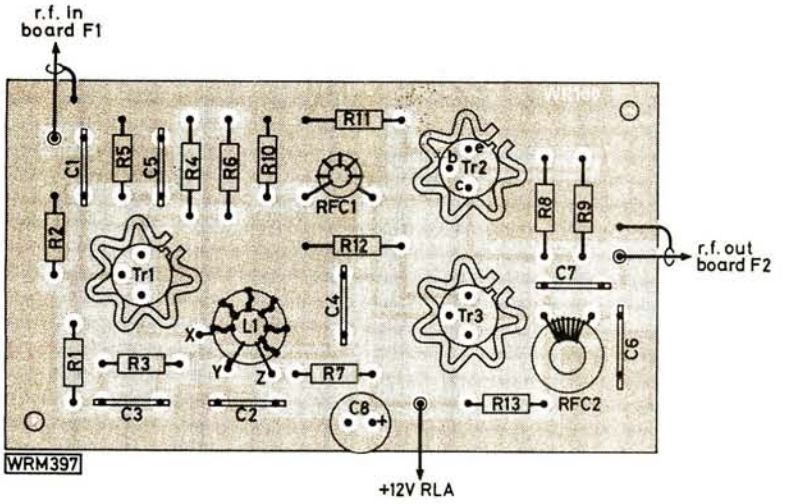
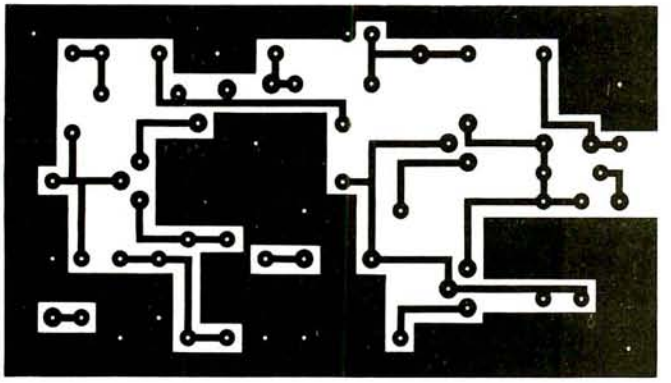


Fig. 39: Component overlay, track pattern and ground-plane of Board 9 shown full size





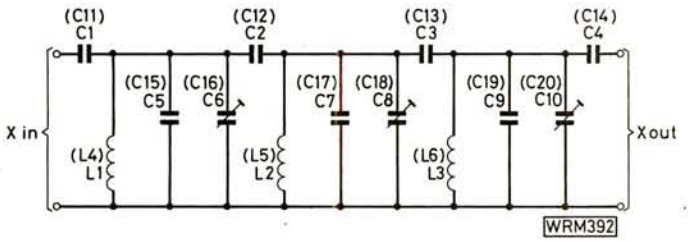


Fig. 37: Circuit diagram of Filter Boards 1 and 2

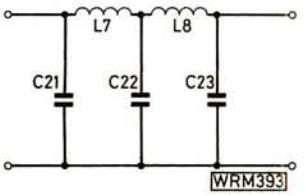


Fig. 38: Circuit diagram of Filter Board 3

★ components

FILTER BOARDS 1, 2, 3

Capacitors

Silvered Mica

82pF	2	C12,13
100pF	1	C3
200pF	1	C2
300pF	2	C15,19
382pF	1	C5
350pF	1	C9
404pF	1	C14
430pF	2	C1,11
432pF	1	C4
620pF	2	C7,17
1600pF	2	C21,23
3200pF	1	C22

Miniature Single Turn

2–60pF	6	C6,8,10, 16,18, 20

Inductors

38 turns 24 s.w.g. en. cu. on Neosid 28–522–31 toroid	6	L1,2,3,4, 5,6
20 turns 22 s.w.g. en. cu. wound on a 16mm dia. insulated tubular former (4·02μH)	2	L7,8

Miscellaneous

Double sided p.c.b. (3).

1·9MHz, and then the trimmer capacitors were tweaked to produce a fairly flat response over the whole of the 1·8 MHz–2·0MHz band. This was accomplished by running full c.w. mode into a dummy load whilst monitoring the p.a. current and swinging the v.f.o. through the necessary range, the aim being to obtain a steady current over the entire band. There is approximately a 2dB loss in power over the original mid-band setting but this is not important.

When the filters are first peaked on the centre frequency there may be too much drive present. This will then give false readings when trying to obtain the flat response. It is therefore suggested that the p.a. current is adjusted to read 3–4 amps maximum when the filters are peaked at the centre frequency (1·9MHz). This may easily be accomplished by inserting a resistor in series with the 9MHz injection into the mixer board, assuming the transceiver is running on the "tune" position.

Next month the final part, mechanical details and switching diagram

AMATEUR RADIO EXHIBITION 81

WHAT?

The NEW Leicester Amateur Radio Exhibition. That's what.

WHERE?

The Granby Halls, "as usual," but with improved facilities including new catering arrangements, easier car parking and quicker admission. That's where.

WHEN?

Friday, Saturday, Sunday, 23, 24, 25 October 1981, 10am-6pm Fri/Sat, 10am-5pm Sun. That's when.

WHO?

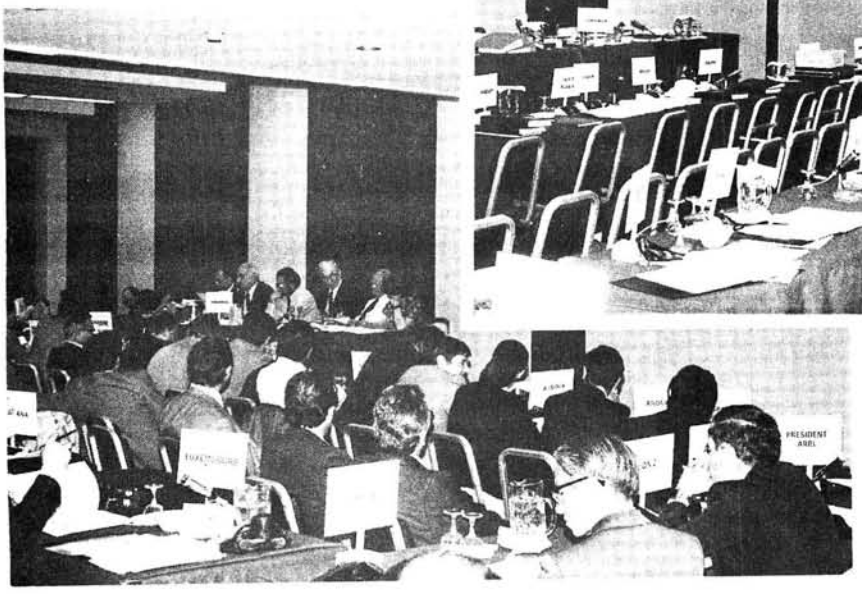
At this independent show you will find some of the best-known retailers in the country. You will also find many specialist traders not previously invited to participate at Leicester. This way you'll have a real chance of finding the rig you want – at a keen price too – and also some of those awkward bits and pieces you're always looking for and can never track down. That's who you'll see there.

WILL THEY SEE YOU?

With talk-in on 2m and 70cm you can't lose your way!

SPECIAL ATTRACTION
BRING AND BUY TO BE RUN BY THE LEICESTER AMATEUR RADIO CLUB.

IARU



Conference Report

Geoff ARNOLD G3GSR

The Hotel Metropole, Brighton, was the venue from 27 April to 1 May of the twelfth triennial conference of the Region 1 Division of the International Amateur Radio Union (IARU). The Division was formed in 1950 to promote the special interests of the member societies in the International Telecommunication Union (ITU) Region 1 (comprising Europe, Africa, and parts of Western Asia plus the whole of the USSR) and to represent their interests at ITU radio conferences. This was the second IARU Conference to be held in the UK, the previous one being in 1960 at Folkestone.

Of the 51 member societies, 38 were represented at the Brighton Conference, the purpose of which was to discuss and reach agreement on changes in amateur bands usage, modes, operating techniques and licensing within the framework of the new Radio Regulations drawn up at the 1979 World Administrative Radio Conference (WARC) of the ITU. The member societies then take these changes back to their own national authorities (equivalent of the British Home Office), to try to persuade them to make whatever alterations or amendments to their amateur licences may be necessary.

Some member societies may signify their dissent from some of the changes, either because they consider that they have special circumstances in their country which make a proposed course of action impractical or undesirable, or because the framework of laws governing radio communication in their country prevents such a change being made. In all, Region 1 societies have over 120 000 licensed members.

Well over a hundred documents containing proposals or comments on technical or operational questions were considered by the three committees at the Brighton Conference. A number of these will be dealt with in future issues of *Practical Wireless*, but the items of immediate interest are as follows:

HF Sub-Committee: An h.f. working group will be set up to consider operating standards and practices (very much like the existing v.h.f. working group). This will include band planning and any other aspect of amateur radio below 30MHz. Dr. J. Allaway G3FKM was elected as the chairman of this new working group. It was felt there are too many contests and their dates are badly co-ordinated. The h.f. working group was asked to monitor this situation.

The following amendments to be made to the Region 1 h.f. band plan:

10·100 – 10·140MHz	c.w. only
10·140 – 10·150MHz	c.w. and RTTY
18·068 – 18·100MHz	c.w. only
18·100 – 18·110MHz	c.w. and RTTY
18·110 – 18·168MHz	c.w. and phone
24·890 – 24·920MHz	c.w. only
24·920 – 24·930MHz	c.w. and RTTY
24·930 – 24·990MHz	c.w. and phone

Electro Magnetic Compatibility: The conference undertook to co-operate with the EMC symposium in 1982 and will support those amateurs involved in preparing the paper for this special session.

28MHz Intruders: Radio regulations are being violated by illegal use of the 28MHz band. All societies will be sending the necessary information to their national administration to help remove the offending stations. The societies should urge the authorities to pay special attention to the identification of these stations.

Operating Standards: The RSGB assisted by MRASZ (Hungary) have agreed to produce a booklet on the precise use of the amateur code. The booklet will be prepared for as wide a distribution as possible.

Common Licence: A permanent working group will be set up in order to look at this in detail. Every society will

provide the working group with the most complete and detailed report. The group should take every opportunity in the future to establish the idea of a common licence.

Amateurs and CB: It was recommended that societies should not encourage mixed amateur and CB events. They should increase efforts to present the technical and educational side of the amateur service in contrast to CB. A very clear and firm distinction must be made between CB operators and radio amateurs. Each society must be on its guard to ensure that authorities do not classify both under the common heading of "leisure frequencies". The amateur service must retain its identity.

"S" Meter Standards: One S-point corresponds to a level difference of 6dB. A meter deviation of S-9 on bands below 30 MHz corresponds to an available power of −73dBm (50μV across 50Ω). On bands above 30MHz this power shall be −93dBm (5μV across 50Ω). The metering system shall be based on quasi-peak detection with an attack time constant of 10ms ±2ms and a decay time constant of at least 500ms.

Morse code speeds: As a basis for calculations the 50-bit keyword "Paris", which includes one 7-bit word space, shall be used.

Emergency Communications: The conference recommended that emergency networks should be formed in those countries where they do not exist. Societies should request their authorities for permission to use amateur frequencies in case of internal emegencies as well as international emergencies. A common procedure should also be used, possibly based on the UK RAYNET manual. Spot frequencies on the h.f. bands would not be pressed for, but use of a code word or Q-code to indicate emergency traffic could be used. That code word or Q-code has not yet been decided. A common form of operator training for message handling is required.

Amateur Radio Promotion: It was agreed that the promotion of amateur radio particularly in developing countries would be valuable.

VHF/microwave Dividing Line: The boundary between v.h.f. and microwaves remains at 1GHz rather than be moved to 3GHz. This is because transmissions on the 1·3 and 2·3GHz bands are still of an experimental nature and best dealt with by the Microwave Managers.

144MHz Band Plan: Any society could adopt a 12·5kHz channel frequency offset for f.m. operation on the 145MHz band. In the event of this being adopted the higher intermediate channel should be given the suffix "X" e.g. S20, S20X, S21, S21X, etc. If any society does intend to implement this system, local manufacturers and importers should be notified as soon as possible.

QTH Locator: The meeting realised the importance of a world-wide locator system in consultation with Regions 2 and 3. This is especially with regard to future satellites.

VHF Emergency Networks: During exercises and nets organised by emergency network organisations on the 144MHz band, frequencies inside the exclusive beacon sub-band should not be used.

Some of the equipment making up GB1IARU

continued on page 69▶▶▶

Next month in PW

FREE DATACARD

Practical Wireless NOV 1981

HF Band Plans

EXPAND YOUR HORIZONS

With Our

HF Converter

& 70cm/2m Converter

ON SALE 2 OCT

EXTRA

A GLOSSARY OF RADIO TERMS PART 1

INTRODUCING SSTV PART 3

M.J.AXSON BA G8WHG

Part 2 of this series investigated the available methods of scan conversion. In this part we continue with a detailed look at received signal processing

At the receiving station, the incoming slow-scan signal has to be converted to fast-scan standards so that the picture may be displayed on a conventional TV receiver.

There are several ways in which this can be accomplished but one tried and proven method is described. Referring to Fig. 15, the incoming SSTV signal, after being fed through a limiting stage, is applied to an A–D converter where each line is converted into digitised information consisting of 128 4-bit words, in the manner previously described in the fast to slow-scan converter. However, there are now two 512-bit shift registers which are used as buffer stores, the digitised information for the first line being stored in the odd-line buffer. This operation, which is controlled by the slow-speed clock, will take 60ms to complete. The information for the second line can then be stored in the even-line buffer. Meanwhile the information for the first line must be loaded from the odd-line buffer into the main memory.

The main memory is made up of a bank of four shift registers, each of which handles 1 bit of the 4-bit word making up the digitised information (Fig. 16). Since the whole frame will be made up of 128 lines each having 128 pixels there will be a total of $128^2 = 16\,384$ 4-bit words so each shift register must have a capacity of 16 384 or 16K bits.

The information in these shift registers is constantly recirculating, that is moving through the register, with the bit from the last location being reinserted in the first location. Fig. 17 illustrates the principle using a 4-bit shift register.

By keeping precise track of the movement of the information through the registers, the line buffers can update the correct section of the main memory as it passes by, this function being performed by the recirculate-update blocks in Fig. 15. This operation is controlled by the high speed clock and the memory recirculates 50 times per second, thus each cycle occupies 20ms. Since the line buffer can transfer its contents to main memory in approx. 64μs there is ample time for the transfer to be made from the odd-line buffer whilst the even-line buffer is being loaded, thus leaving the odd-line buffer free to accept the information for the third line and so on.

The readout from the main memory is continually fed to the later sections of the converter, so that a continuous picture is displayed on the TV set. This picture will only change as new SSTV signals are received and once a good picture is displayed the SSTV input may be turned off and the picture retained for as long as required. Quite apart from the fact that a much brighter picture is obtained this method has a distinct advantage over the original method using P7 phosphor tubes where the image decays unless constantly refreshed by further SSTV signals.

The output from the main memory is first fed to a dummy line doubler. Since the SSTV picture has only 128 lines per frame, obvious dark lines will appear between each line on the bright TV screen. The dummy line doubler outputs each SSTV line twice, greatly improving the display.

All the information is still in digital form, so it is now passed through a D–A converter. The analogue signal is then amplified and used to modulate a u.h.f. carrier; the resulting signal can then be applied to the antenna socket of the normal fast-scan TV set, which does not require any modification.

One point that has not been mentioned is the difference in aspect ratio of the SSTV picture (1:1) and the fast-scan TV screen (4:3), which would result in distortion of the displayed picture. This can be corrected by arranging the timing of the output of the main memory so that no video

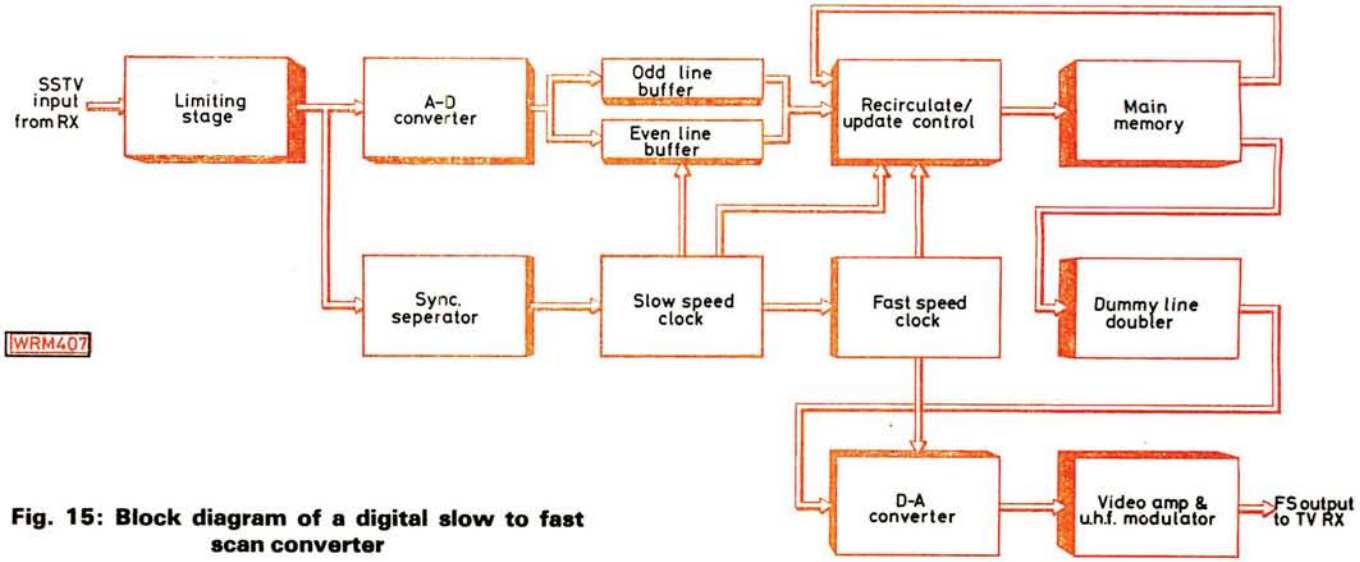


Fig. 15: Block diagram of a digital slow to fast scan converter

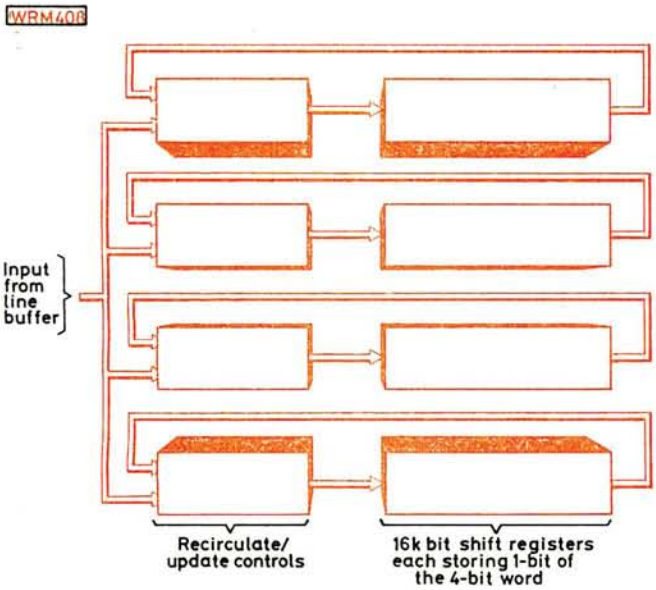


Fig. 16: Organisation of the Main Memory

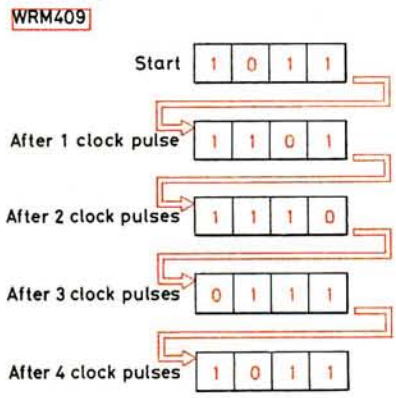


Fig. 17: Principle of recirculating shift register

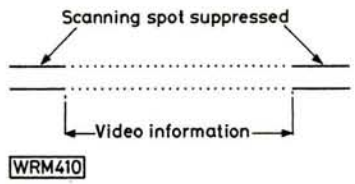


Fig. 18: Correction of Aspect Ratio on the Fast-Scan TV screen

is sent out during the first and last eighths of the fast-scan line period, all being sent in the middle three-quarters, Fig. 18. The scanning spot is suppressed in the non-video periods so that the square picture is framed by a black border at each side which is aesthetically acceptable.

It was along these lines that scan-conversion was developed, but progress in this field was very rapid, and it was not long before the fast-slow and slow-fast scan converters were combined in one unit. This is not only neater and cheaper, for many components are common to both units, but also gives a very considerable advantage on transmission in that by using the full 64K-bit main memory for the fast to slow-scan conversion as well, all 128 lines for the SSTV frame can be taken from one field of the fast-scan camera in 20ms and stored for transmission at the slow-scan speed, rather than being taken a line at a time over the full 7·2s as previously described. This makes the transmission of still pictures of moving subjects possible. If the subject is a person, they no longer have to remain motionless for the SSTV transmission period!

TABLE 4

Tone Scale	5-bit word	Tone Scale	5-bit word
0 (Black)	00000	16	10000
1	00001	17	10001
2	00010	18	10010
3	00011	19	10011
4	00100	20	10100
5	00101	21	10101
6	00110	22	10110
7	00111	23	10111
8	01000	24	11000
9	01001	25	11001
10	01010	26	11010
11	01011	27	11011
12	01100	28	11100
13	01101	29	11101
14	01110	30	11110
15	01111	31 (White)	11111

Such is the basic SSTV system which is capable of providing very good results at moderate cost. However, in this field, just as in any other aspect of Amateur Radio, whilst there are those whose main enjoyment lies in operating, there are others who prefer to experiment and improve the state of the art, and much interesting work is being carried out at the present time.

With the continuing fall in the cost of memory chips, the shift-register memories have generally been superseded by RAM (random access memories), which offer the advantage of individual addressing of the bit storage locations. This facility is being used particularly for the generation of alpha-numeric information in conjunction with microprocessors. This is a very specialised field requiring considerable programming ability and knowledge of microprocessor techniques, and so at the moment is not perhaps for the average amateur, but there are many other areas for him to explore.

Simply increasing the capacity of the main memory in the scan-converter will allow improvements to be made in the picture quality. For example, the analogue SSTV picture is usually digitised into 4-bit words allowing 16 tones of grey to be resolved, but if 5-bit words are used 32 tones can be resolved. Table 4 shows the Binary code for 32 shades of grey.

The main memory would only require the addition of one more 16K shift-register or RAM package to accommodate this, and at current prices this could cost less than £10.00 even if bought new. Obviously the A–D and D–A converters would have to handle 5-bit words, but since even low cost d.i.l. packages have 8-bit capacity, this would not present any great problem. Addition of a further 16K RAM to the main memory would allow the use of 6-bit words giving 64 (2^6) grey tones, which is rather better than the average photograph.

Another possible approach to improved picture quality is to upgrade the resolution by transmitting a greater number of lines and/or pixels per line in each frame. Increasing the size of the main memory to 128K bits would allow the transmission of 256 lines per frame. Best overall definition is obtained however when the horizontal resolution equals the vertical, so really 256 pixels per line should also be transmitted, which increases the size of memory required to 256K bits. There is much scope for experimentation to find the best combination at an acceptable cost.

In part 4 of the series, the transmission of SSTV pictures in colour will be discussed.

ZZZZZZZZZZZ SLEEP TIMER

R.A.PENFOLD

A feature of some clock radios is automatic switch-off after the radio has been operating for some predetermined time: a "sleep" or "snooze" facility as it is often termed. This timer was primarily designed to provide the same facility for an ordinary mains powered cassette radio unit, and it provides nine switch-off delay times. These are from 5 to 45 minutes in 5-minute steps. The unit could be used in the same way with other electrical equipment, such as a portable television or a bedroom lamp.

The Circuit

Although it is possible to obtain timing periods of as much as an hour using an ordinary *CR* timer such as a 555 i.c.-based circuit, the accuracy of such timers is often rather poor and inconsistent. In order to obtain long timing periods the timing capacitor must be charged with a small current, perhaps less than a microamp. So a high leakage current would either give elongated and inconsistent charging times, or leak away all the charge current preventing the circuit from working at all!

In this circuit this problem is overcome by using a *CR* timer circuit to provide a positive clock pulse at 5-minute intervals. A simple digital counter circuit is then used to switch off the timer and the load after the desired number of clock intervals have elapsed. This method gives a level of accuracy and reliability which is more than adequate for the present application. Once one time interval has been set correctly, the others automatically have the same level of accuracy.

The complete circuit diagram of the timer including the mains power supply is shown in Fig. 1. The timing network consists of R1, R2 and C1, with R1 being used to trim the frequency of operation at the appropriate rate. The timing circuit drives a form of Schmitt trigger which is based on two c.m.o.s. 2-input NOR gates, these both have their inputs connected in parallel so that they each act as a simple inverter. When the charge on C1 reaches the transition voltage of gate 1, the coupling will cause gate 1 input to start to go from the low to the high logic state, and the opposite will occur at its output. Gate 2 input will then start to be taken from the high to the low logic state by gate 1 output, and the opposite transition will occur at gate 2 output. As gate 2 output swings positive it couples this positive-going signal to gate 1 input via C4. This speeds up the transition of gate 1 input from the low to the high state, and a regenerative action then takes place which causes gate 2 output to swing quickly fully positive.

This positive-going pulse is used to trigger a simple monostable multivibrator which is produced from the remaining two gates of the 4001 device plus C5 and R5. This uses a standard configuration and produces an output pulse of approximately 100ms in duration. It is this pulse which is used as the clock signal, and it is also used to discharge C1 so that the timing operation starts once

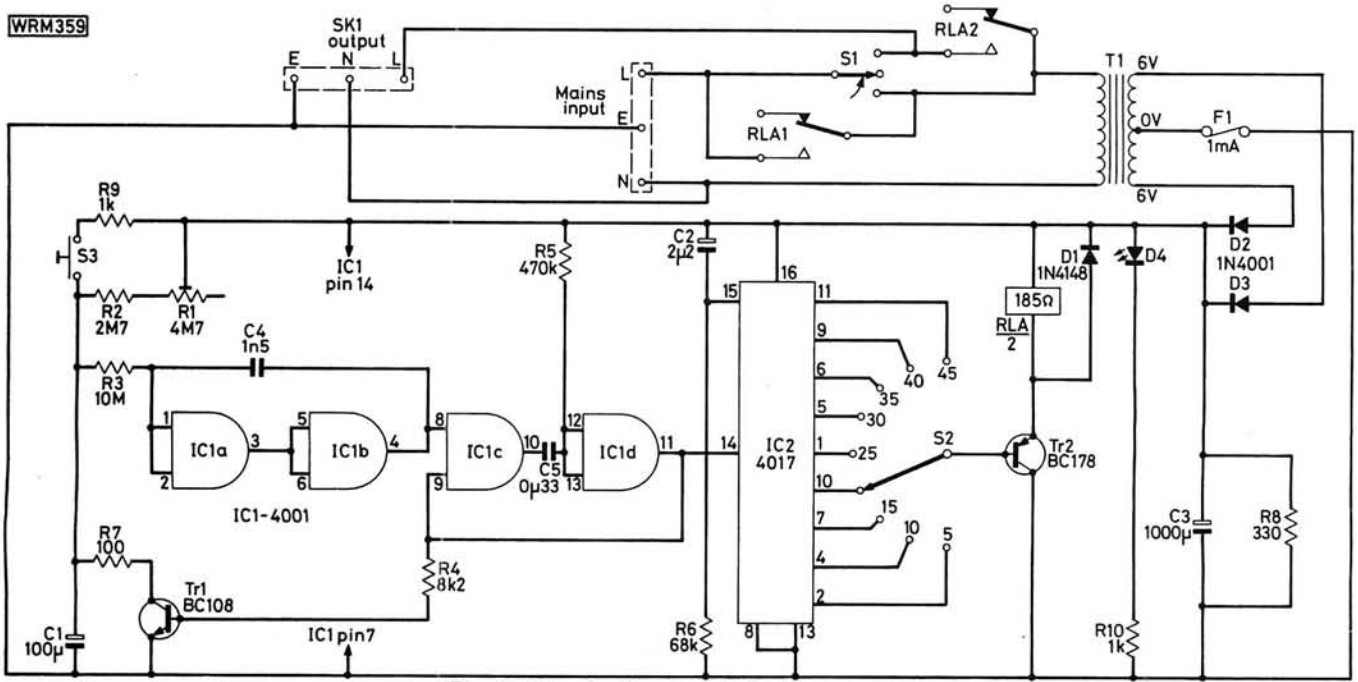


Fig. 1: Circuit diagram of the sleep timer

CONSTRUCTION RATING Intermediate

BUYING GUIDE

Constructors of this project should have no difficulty obtaining the components from advertisers in the magazine

APPROXIMATE COST £20

again from the beginning. Transistor Tr1 is switched hard on by the monostable pulse due to the base current provided through R4, and it then discharges C1 via current limiting resistor R7.

Capacitor C1 will not be totally discharged, there will be a little residual charge remaining on it at the end of the monostable pulse, but this will not significantly affect accuracy. Most other *CR* oscillator circuits produce an initial output cycle which is longer than the subsequent ones by a considerable margin, and that is why this rather unusual oscillator configuration has been adopted here.

It is essential that no significant current is drawn from the timing network by the other oscillator circuitry, and this is achieved here since the input impedance of a c.m.o.s. gate is typically about $10^{12}\Omega$, and the leakage through C4 will be extremely small indeed. A tantalum bead capacitor is specified for C1 since these generally have closer tolerances and lower leakage currents than ordinary electrolytics having similar values and voltage ratings. It should be noted that most ordinary 100µF electrolytics will either not work at all in the C1 position of this circuit, or will give comparatively poor results.

Counter Circuit

The counter circuitry is based on a c.m.o.s. 4017 decade counter and one-of-ten decoder. In this case the "carry-out" output (pin 12) is ignored, as is the "O" output of the decoder section of the device. This output goes to logic *1* at switch on, as the counter is set to zero by the reset pulse produced by C2 and R6. The other nine outputs of the decoder will all be at logic *0*.

One of these nine outputs is coupled to Tr2 base by S2, and regardless of the setting of S2, Tr2 will always be initially switched on and will in turn activate the relay connected as its emitter load.

After the counter has received the first clock pulse the "O" output will go to the low logic state and the "1" output will go high. If S2 is at the "5 minute" setting, output "1" will be connected to Tr2 base, and as it goes high it will switch off Tr2 and the relay. Two normally-open relay contacts are used and when the relay is deactivated these cut off the mains supply to both the timer and the controlled equipment.

If S2 is set to one of the other eight positions, output "1" going to logic *1* will not have any effect. The unit will then carry on functioning with subsequent clock pulses causing outputs "2," "3," "4," etc., to go high in sequence, until the output coupled through to Tr2 base by S2 goes high. The relay is then deactivated, and the timer and load are switched off. Thus S2 can be used to select the number of clock pulses that elapse before the automatic switch off occurs, with the maximum delay being nine clock pulses (45 minutes).

Power for the circuit is obtained from a simple unstabilised mains power supply circuit which has step down and isolation transformer T1 feeding the fullwave rectifier and smoothing circuit consisting of D2, D3 and C3.

Switch S1 is the ON/OFF switch, and this is an unusual

★ components

Resistors

¼W 5% Carbon Film

100Ω	1	R7
330Ω	1	R8
1kΩ	2	R9,10
8·2kΩ	1	R4
68kΩ	1	R6
470kΩ	1	R5

½W 5% Carbon Film

2·7MΩ	1	R2
10MΩ	1	R3

¼W Horizontal Preset

4·7MΩ	1	R1

Capacitors

Ceramic Plate

1·5nF	1	C4
0·33µF	1	C5

Electrolytic Axial 16V

2·2µF	1	C2
1000µF	1	C3

Tantalum Bead 10V

100µF	1	C1

Semiconductors

Integrated Circuits

4001	1	IC1
4017	1	IC2

Transistors

BC108	1	Tr1
BC178	1	Tr2

Diodes

1N4001	2	D2,3
1N4148	1	D1
Red l.e.d.	1	D4

Switches

Sub-miniature s.p.d.t., centre off-biased one way (1); 12-way one-pole rotary switch with adjustable end stop; Push-to-make non-latching switch (1).

Miscellaneous

6–0–6V 100mA miniature mains transformer (1); 152 × 114 × 51mm metallic case (1); Miniature relay RS348-920 two-pole change-over contacts 12V 185Ω coil; 20mm chassis-mounting fuseholder; 100mA fuse; Mains lead; 13A mains socket.

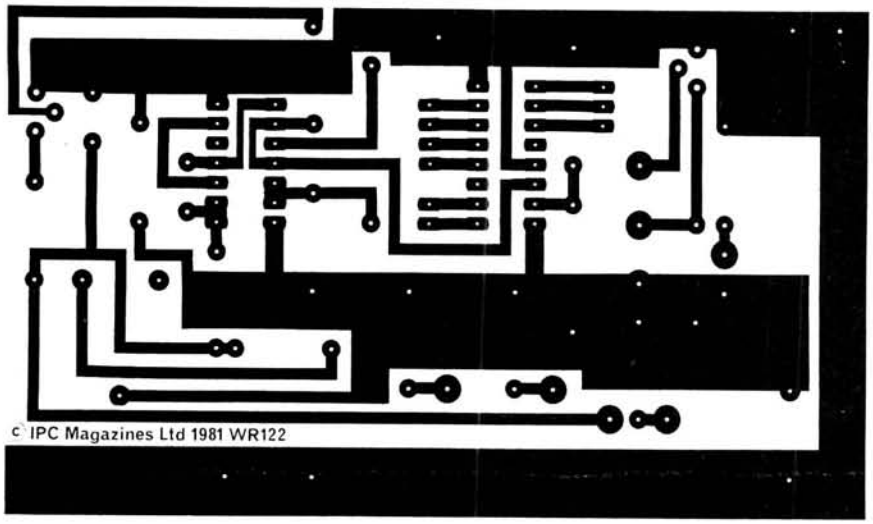
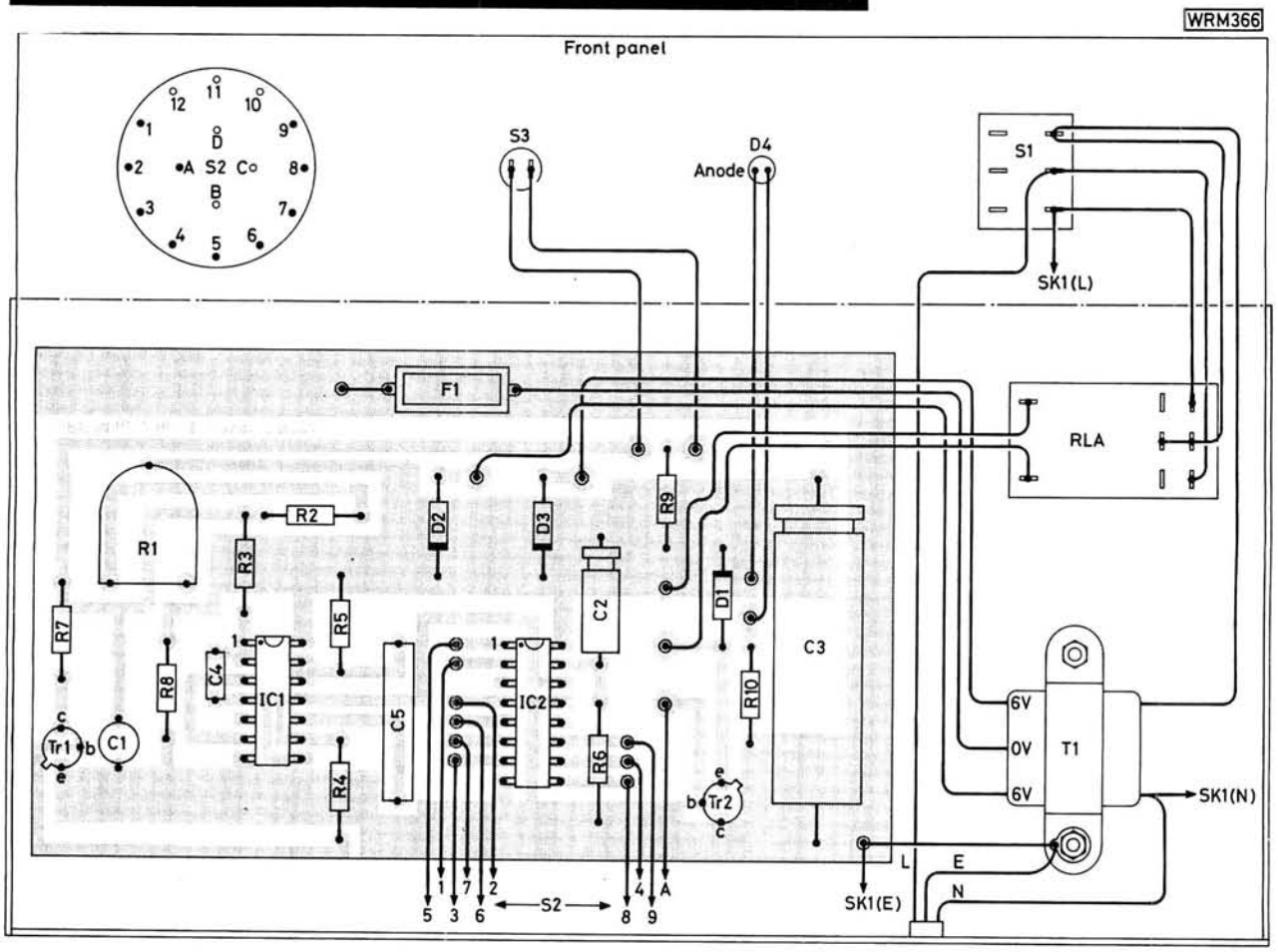


Fig. 2: Full size track pattern and component layout diagrams for the sleep timer, interconnecting wiring shown in the lower diagram



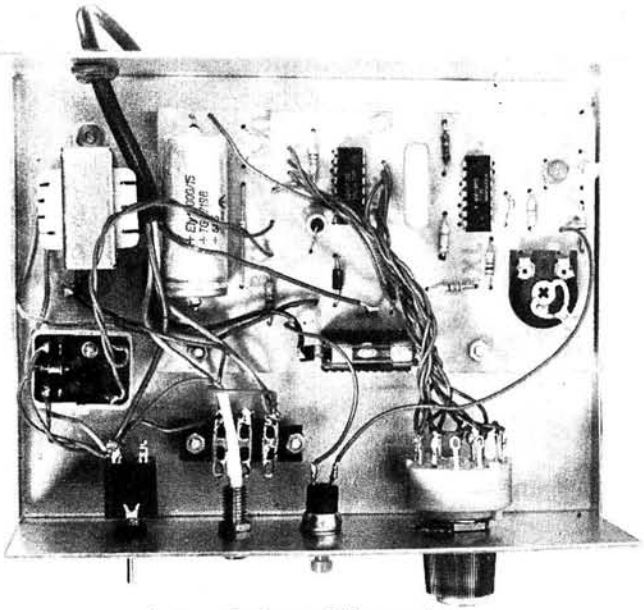
component, being a 3-position toggle switch with s.p.d.t. contacts, spring biased on one side only to the centre-off position. In order to activate the timer it is merely necessary to momentarily set S1 to the biased position. This connects power through to the timer circuit, causing the relay contacts to close and connect the live mains supply to both the timer and load. S1 will return to the off position when it is released, but the relay contacts continue to connect the mains supply to the timer and load until the end of the timing period.

With S1 set to the non-biased position the timer will be bypassed, and the mains supply will be continuously supplied to the load. Relay contact RLA2 will be open and will prevent power from being applied to the timer when S1 is in the bypass position.

If required, the timer can be switched off before the end of a timing interval by operating S3. This shunts R9 across the timing resistance, and increases the clock frequency to a few hertz, causing the unit to turn off within one or two seconds.

Resistor R8 is a bleed resistor which ensures that the supply reservoir capacitor C3 is quickly discharged once the unit switches off. Otherwise the unit may simply cycle continuously since the c.m.o.s. circuitry consumes no significant current, and leakage currents in the circuit are also extremely low. Diode D1 is the normal protective diode which suppresses the high reverse voltage which would otherwise be generated by the relay coil as it de-energised.

The timer is built into a small metal instrument case having approximate outside dimensions of 152 × 114 × 51mm, which is about the smallest size that will comfort-



Internal view of the prototype

ably accommodate all the components. Transformer T1 and the relay are mounted on the chassis section of the case, and the mains output socket is mounted on the lid of the case. All other components are either mounted on the p.c.b. or the front panel. Fig. 2 shows the point to point wiring of the unit.

Mounting relays can be difficult, and assuming that a modern miniature type having a plastics cover is used, probably the easiest method of mounting it is to glue it in place by means of the cover using a high-quality adhesive such as a cyanoacrylate type.

Care should be taken when wiring in mains-carrying leads as an accidental short circuit here could cause costly damage, and a wrong connection could be potentially dangerous. Make certain that the metal cabinet is properly earthed, and that the mains earth connection is carried through to the controlled equipment (assuming that it has an earth lead connection). If the timer is only to be used with a single item of equipment, it can be directly wired to this by way of a tagstrip or connector block. If it is needed for use with various items of equipment, then it will be necessary to fit the mains outlet socket in the lid of the case. The controlled equipment is then simply plugged into the socket. **Ensure a 3A fuse is fitted in the mains plug.**

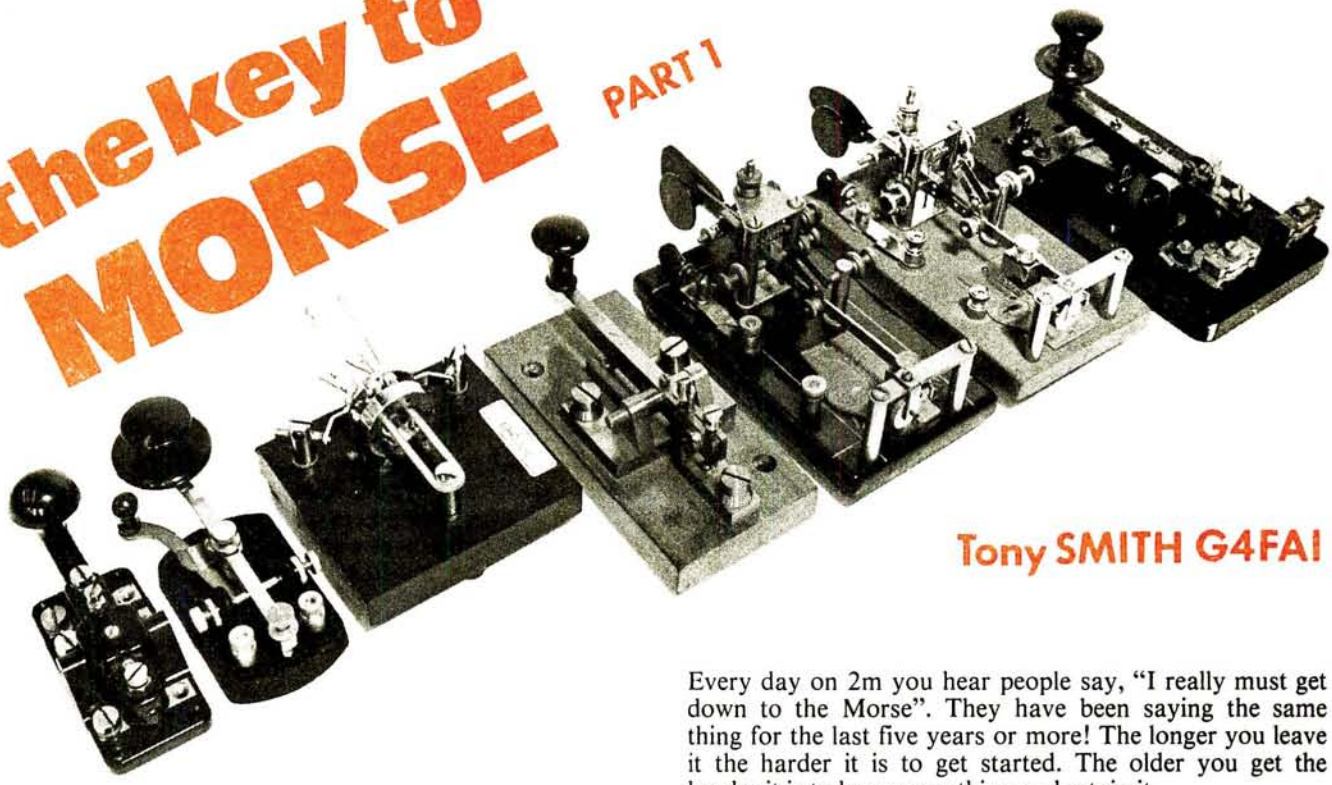
Adjustment

Before connecting the unit to the mains and switching on it is advisable to thoroughly check the wiring for errors, particularly the mains wiring. With S1 set fully anti-clockwise and R1 adjusted for about half maximum resistance, the unit should switch off roughly five minutes after switch on. A note should be made of the actual delay time, and then by empirical means R1 is adjusted to give improved accuracy. The fine adjustment of R1 should be made with the unit set for a longer time delay, say 25 or 30 minutes.

The unit can easily be modified to give time increments other than five minutes by altering the values of the timing components, and the basic time delay is approximately equal to $0{\cdot}65CR$ where C is the timing capacitor (C1) value in microfarads, R is the timing resistance (R1 plus R2) in megohms, answer is in seconds. It is advisable to have a basic delay time of no more than about 10 minutes. If the timing resistance is made up of two or three switched presets, the unit could cover a wide range of delay times in quite small increments. ●

the key to MORSE

PART 1



Tony SMITH G4FAI

Every aspiring radio amateur or existing Class B operator knows about the Morse test. It is an alleged ordeal they have to undergo after months, or even years, of endless disheartening practice, before they can get a Class A licence to operate on the high frequency amateur bands.

Unfortunately some find the process so dispiriting that they give up altogether, and others who do succeed in passing the test pick up their microphones as soon as they get their licence and forget all about the code from that moment on. This is a great pity because undoubtedly they're giving up a major aspect of amateur radio, capable of giving great satisfaction and pleasure, without ever having tried it.

There is a lot more to c.w. than just sending a stream of dots and dashes into the radio spectrum and it's not really so difficult to learn. This short series sets out to tell the beginner something about the world of c.w. and, hopefully, to interest and encourage him (or her) to use the Morse code once the test has been passed.

Learning the Code

First of all you have to learn the code, but there is no sure-fire way to success. There are many aids available: books, record or cassette courses, evening classes, club sessions, slow Morse transmissions over the air, and, that new wonder of the age, the random Morse generator. It is impossible to say that any one way is better than another. Learning is a highly individual process, what may suit one person may not suit another, and it may be a combination of several of these things that brings success for you.

Basic Guidance

There is however some basic advice and guidance which should help anyone—

Once you have passed the Radio Amateurs' Examination don't leave it too long before you take the Morse test. Every day on 2m you hear people say, "I really must get down to the Morse". They have been saying the same thing for the last five years or more! The longer you leave it the harder it is to get started. The older you get the harder it is to learn something and retain it.

Learn to read Morse at 6–8 words per minute before trying to send it. That's the very minimum speed you will require and if you know what it sounds like it will be easier to send. Ideally you should aim for 14 w.p.m. before the test; then when the examiner is testing you at a good conservative 12 w.p.m. there will be no panic and it will all come nice and easy for you.

Practise conscientiously every day. Try setting targets for yourself. If you can receive at 6 w.p.m. decide that you will aim to reach 8 w.p.m. by a certain time. If you can accurately receive at a certain speed for three minutes decide that you will aim to receive at the same speed for six minutes by the end of the week and so on.

When writing down what you are receiving use small letters rather than capitals. As your speed increases the upper limit will tend to be based on your ability to write quickly and writing with capitals is much slower than using ordinary handwriting.

When using recordings or a random generator, or listening to slow Morse on the air, don't worry too much about checking whether you have got it right or not. You might need to know in those very early stages when you have barely learned Morse, but once you have memorised the code and it is just a question of improving your speed, you will know instinctively as you go along whether you are copying correctly or not. Incidentally whether you are practising receiving or sending try to use headphones in the interests of domestic peace. CW is definitely **not** the favourite sound of the non-enthusiast!

Listen On The Air

As soon as you can read about 9–10 w.p.m. start to listen to "on the air" QSOs (contacts). There is plenty of slow Morse on the amateur bands and the first time you copy something like "my name is serge my qth is leningrad" you will begin to understand something of the thrill of communicating with c.w.

Spend as much time as possible "translating" into Morse any words, letters or figures that come into view;

car number plates, road signs, advertisements, labels and so on. This can go on all day whenever the opportunity presents itself. Try to visualise the Morse characters as a whole, e.g. di-di-di-dah for the letter V **not** dot-dot-dot-dash. Say it softly to yourself if you can, but move away slightly from anyone close by if you want to avoid some funny looks!

If you have a small tape recorder it is quite useful to have it playing Morse to you whilst you are doing something else. Some car drivers listen and translate as they are driving. They can ignore it whilst they have to concentrate on some particular driving problem but it is playing all the time and they return to it when they relax again.

Remember that the test covers only plain language and figures. There is no need to learn punctuation and procedural signs, but it is not necessarily a bad thing to learn at least a few of them whilst involved in the basic learning process. Then, when you have passed the test you won't still have some more Morse characters to learn. You can just concentrate on operating techniques and getting on the air.

Learning to Use the Key

Once you feel not too unhappy at receiving 6–8 w.p.m. you will need to master sending before you can take the test. You already know what it sounds like and now you have to imitate it. One's first attempts can sometimes be quite discouraging. It is very easy to pick up bad habits at this stage and great care is needed in forming characters properly. For example the letter C can too easily be sent as NN or the letter L as AI.

One useful method if you have tapes or records, plus a transcript, is to practise sending the transcript and to listen to both your sending and the recording at the same time. This is a good self-regulating system. On the assumption that the recording is good quality Morse you will know that you too are sending good Morse when your signals are beating with the recorded signals. When you are not doing it properly the discord and confusion will tell you so.

Be your own worst critic at this stage and it will pay dividends both during the test and in the years of enjoyment ahead of you.

Avoid using an automatic key during the learning stage. Learn on a hand key since that is what you will have to use for the test. Use a good quality key if that is at all possible. Sometimes you can get a good second-hand one quite reasonably at a club junk sale or at a rally. Sometimes someone will lend you one. To buy a new precision engineered key will cost the earth and it is only to be recommended when you are finally committed to c.w. on a permanent basis. There are however quite reasonable keys available from the East if you have to buy new. Make sure that the one you buy is heavily made, has ball bearings and easily adjustable gap and tension controls.

When keying adjust the gap and the tension to get the best flow when sending. What suits one person will not always suit another. When sending slowly—and this includes 12 w.p.m.—it sometimes helps to have a fairly large gap in order to lessen the chance of sending unwanted dits and dahs. Not too large a gap but enough so that you can hear the key striking as you send with it. With the gap set like this try adjusting the tension whilst sending a series of V's. At one point it will seem much smoother and easier than at others. When you are sending at these speeds there is something quite satisfying in hearing the sound of the key coupled with the sound of your oscillator sending out Morse characters.

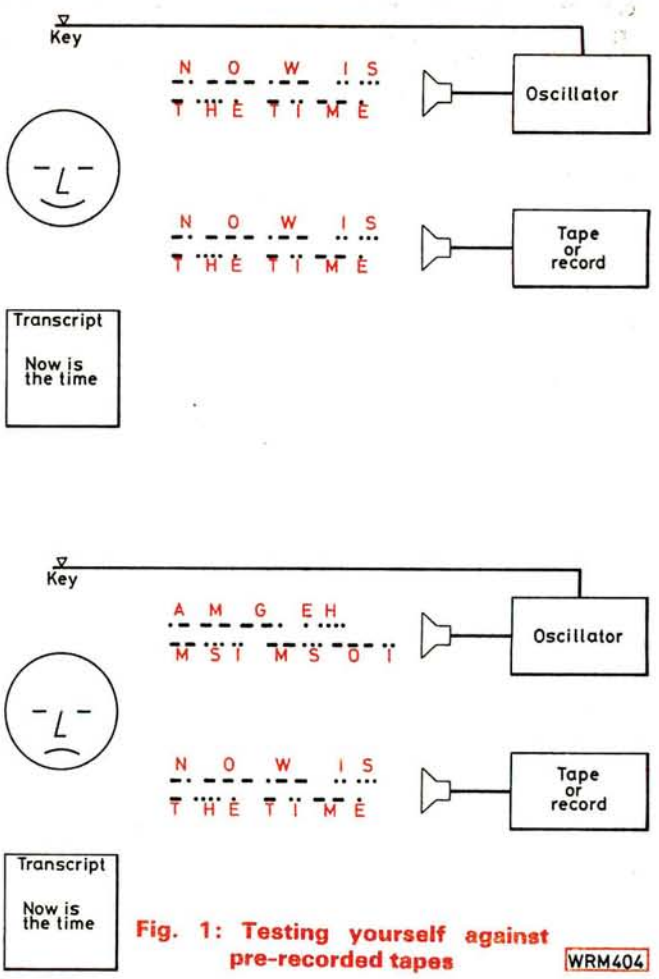


Fig. 1: Testing yourself against pre-recorded tapes WRM404

Try to develop a nice steady rhythm with good spacing. Hold the key with the thumb underneath the edge of the knob, the first finger on the top and the third finger at the side opposite the thumb. Each sender will develop their own way of holding the Morse key and as long as you find it comfortable to send that's all that matters. If you are left handed don't forget to use your left hand to send. Let the wrist act as a hinge between your arm and your hand. Do not keep the hand, wrist and arm rigid. The main keying movement is at the wrist not the fingertips. Keep practising until you can confidently send at 12–14 w.p.m. without hesitation and then you are ready for the test!

Taking the Test

It is quite a moment when you suddenly realise you could be in with a chance if you took the test. Unfortunately there is usually a waiting time after you have applied, depending on where you apply. This is a time however which you can turn to good advantage. You now know when the test is to be and you can plan out just what you are going to do in that time. Firstly review exactly how your performance is now, then decide that by the date of the test you will improve on that performance by a certain amount. Then, give up most of your other recreational activities in order to concentrate on reaching peak performance at your selected speed by the day of the test.

You need to give yourself daily receiving tests similar to those you are expecting on the day. One of the problems with using records or pre-recorded tapes however is that when you have worked through them a few times you begin to remember what is coming next and their value is considerably diminished. If you have a tape recorder you

can trick yourself by re-recording small sections of the track in a different order to that of the original and get a far greater use of the material in this way. You can of course also make your own recordings from "on the air" slow Morse transmissions.

If you know any c.w. operators they will often make tapes for you at the speed you want. Unless you have the use of a tuition course this may be the only way to obtain simulated tests in preparation for the real thing, although some radio clubs will provide such tapes as a service to their members.

You really need enough material to provide a completely different test each day for at least a fortnight beforehand. Whilst practice with random groups of letters is extremely useful in learning the code you should be practising now with plain language. A serious problem to be overcome here is an inclination to anticipate, often wrongly, what is coming next.

Suppose you have just written down "it is felt th". What comes next? More than likely the complete word will be "the" so your mind jumps ahead and you put in the letter "e" in anticipation. Suppose however the word turns out to be "thatch", "things", "that", "those" or "three"?

The moment you anticipate and discover you are wrong you're in trouble. You are thrown into confusion and can quite easily miss the next two or three letters before you settle down again.

As you approach the appointed day, therefore, daily tests are most important and unless you can get an experienced operator to help you with live sending a tape recorder really is a necessity for your preparations.

Whilst concentrating on receiving however don't overlook the equal importance of sending. Remember the tip about sending transcripts of recording in order to check both your keying speed and your spacing, and, whilst practising the test **always** be sure to send the error sign after every mistake you make and re-send the whole word or group of figures correctly.

Keep Calm

Finally the big day. Try to get a good night's sleep beforehand and get up early so there's no rush on this day of days. Above all get to the examination centre with plenty of time to spare. The keynote throughout the day should be—keep calm, don't get flustered.

You may well find yourself in a waiting room with several other candidates. Don't be influenced by what anyone else says. There is bound to be one who says

Fig. 3: One of the new random Morse generators for self-tuition

"Well, this is my fourth time here. I hope old so-and-so isn't the examiner today, he's a right shocker!"

Much along these lines reduces some candidates to a state of abject terror. Don't let it happen to you. **You** know what you can do. You're the one who has been working away to bring yourself up to the level when you know you can pass. Keep calm and you will do it. The examiner is never the awful character you hear about. Why should he be? He is merely doing his job. At worst you will get someone who is scrupulously fair who will apply the test exactly in accordance with the regulations—no more, no less.

At best you will get someone who does exactly the same, but who may be more understanding of your state of nerves. The speed of the test is 12 w.p.m. and what is sent to you will not exceed that speed. If there is any slight variation it must be downwards so that is to your advantage.

The regulations say the test will be held in plain language and that is what you will get; no fancy words or phrases, just simple plain language plus groups of figures as a separate part of the test. If you have managed to achieve 14 w.p.m. as suggested you will be surprised how easy to read characters are when they are sent in good Morse in the quiet of the test room. Remember not to anticipate what is coming. Write down what is sent to you, carefully and legibly, and leave gaps for any letters you miss. You should have an opportunity to review what you have received and it may be that you will then recall one or two letters which were missed during the test.

When you get to the sending test take it easy again. You will have a chance to try the key first to get the feel of it. Don't rush your keying. Remember what it sounds like from your practising, send accurately and carefully without thinking about the examiner, and remember to correct any errors you make.

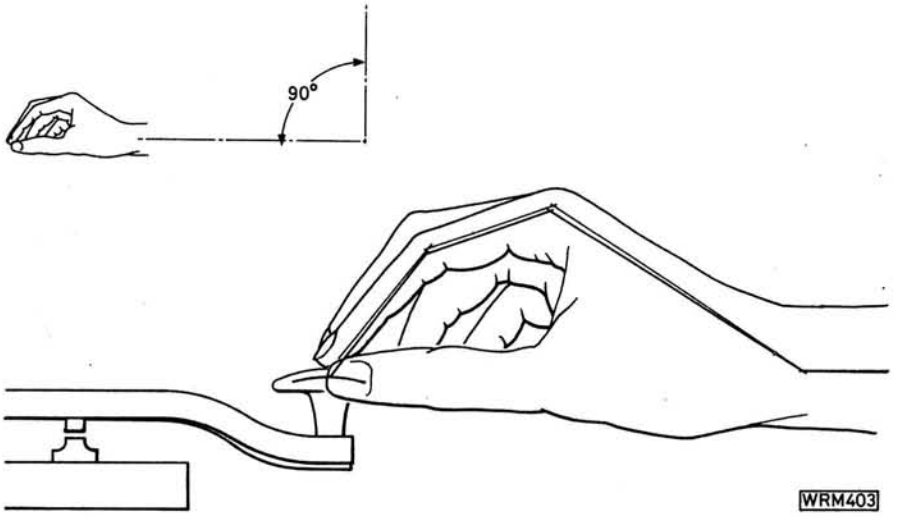


Fig. 2: Holding the Morse key becomes part of the individual style of sending. The arm should be kept at right angles as shown

Slow Morse

Transmissions for beginners can be found daily on the amateur bands. The Radio Society of Great Britain publishes a regularly up-dated list showing the days, times and frequencies of its transmissions. Some European practice sessions may also be heard in the UK.

Popular RSGB Frequencies

Band	MHz	Type of receiver required
2m	144·100–144·390	s.s.b.
	144·625–144·850	s.s.b./f.m.
	145·250–145·550	f.m.
80m	3·525–3·590	s.s.b.
160m	1·808–1·960	s.s.b.

Transmissions from PA0AA

(National Dutch Amateur Radio Station)

Band	MHz	Day/Time	Receiver required
20m	14·100	Fridays at	s.s.b.
80m	3·600	1930GMT	s.s.b.
160m	1·827		s.s.b.

Code proficiency runs at various speeds are also transmitted on the last Friday of each month at 2130GMT.

Transmissions from UBA

The Belgian national society transmits every Monday at 2000 local time (1900 British clock time) on 14·100MHz.

Transmissions from DARC

The German amateur radio club transmits every Tuesday and Friday at 1800GMT on 3·730MHz under the call sign DL0JK although UK reception may not always be satisfactory.

Requirements of the Morse Test

Send & Receive	Time Minutes	Sending errors Corrected	Uncorrected	Receiving errors
36 words	3	4	None	4
10 groups of figures	1½	2	None	2

The words are in plain language without punctuation and average 5 letters per word for counting purposes. The figures are in random groups of 5 figures. Any error should be followed by the error sign (8 dits) and the entire word or group repeated. If the error occurs near the beginning of a word it is preferable to repeat the correctly sent preceding word also. Full details of the test are contained in the leaflet "How to become a Radio Amateur" obtainable, free of charge, from the Home Office, Radio Regulatory Department.

THE MORSE CODE AND SOUND EQUIVALENTS

Spacing and Length of Signals

1. A dash is equal to three dots.
2. The space between the signals which form a letter is equal to one dot.
3. The space between two letters is equal to three dots.
4. The space between two words is equal to seven dots.

Alphabet

A	·—	di-dah	N	—·	dah-dit
B	—···	dah-di-di-dit	O	———	dah-dah-dah
C	—·—·	dah-di-dah-dit	P	·——·	di-dah-dah-dit
D	—··	dah-di-dit	Q	——·—	dah-dah-di-dah
E	·	dit	R	·—·	di-dah-dit
F	··—·	di-di-dah-dit	S	···	di-di-dit
G	——·	dah-dah-dit	T	—	dah
H	····	di-di-di-dit	U	··—	di-di-dah
I	··	di-dit	V	···—	di-di-di-dah
J	·———	di-dah-dah-dah	W	·——	di-dah-dah
K	—·—	dah-di-dah	X	—··—	dah-di-di-dah
L	·—··	di-dah-di-dit	Y	—·——	dah-di-dah-dah
M	——	dah-dah	Z	——··	dah-dah-di-dit

Numerals

1	·————	di-dah-dah-dah-dah	6	—····	dah-di-di-di-dit
2	··———	di-di-dah-dah-dah	7	——···	dah-dah-di-di-dit
3	···——	di-di-di-dah-dah	8	———··	dah-dah-dah-di-dit
4	····—	di-di-di-di-dah	9	————·	dah-dah-dah-dah-dit
5	·····	di-di-di-di-dit	0	—————	dah-dah-dah-dah-dah

Punctuation

Full stop (.)	·—·—·—	di-dah-di-dah-di-dah
Comma (,)	——··——	dah-dah-di-di-dah-dah
Question mark (?)	··——··	di-di-dah-dah-di-dit
Fraction bar or solidus	—··—·	dah-di-di-dah-dit
Double hyphen (=)	—···—	dah-di-di-di-dah
$\overline{CT}$ Commence Traffic	—·—·—	dah-di-dah-di-dah
$\overline{AR}$ End of Transmission	·—·—·	di-dah-di-dah-dit
$\overline{VA}$ End of work	···—·—	di-di-di-dah-di-dah
K Invitation to transmit	—·—	dah-di-dah
Error	·····	di-di-di-di-di-di-di-dit

Abbreviated Numerals

1	·—	di-dah	6	—····	dah-di-di-di-dit
2	··—	di-di-dah	7	—···	dah-di-di-dit
3	···—	di-di-di-dah	8	—··	dah-di-dit
4	····—	di-di-di-di-dah	9	—·	dah-dit
5	·····	di-di-di-di-dit	0	—	dah

Accented Letters

ä	·—·—	di-dah-di-dah	ö	———·	dah-dah-dah-dit
ch	————	dah-dah-dah-dah	ü	··——	di-di-dah-dah
ñ	——·——	dah-dah-di-dah-dah			

You will know there and then if you have passed the test. If by some mischance you do not get through, re-book straight away so as not to lose all that you have gained in recent weeks and months. If you have passed—congratulations and welcome to the club. You are now one of those privileged to roam the amateur h.f. bands at will (assuming you have already passed the RAE) and you are ready to try your newly acquired Morse code on the air.

Next month we will deal with venturing on the air and your first QSO

REMEMBER: When you deal with SMC you get:

The SMC 2-year guarantee on Yaesu. The speedy free Securicor service.
The security of dealing direct with the largest authorised importer.
The spacious, very well equipped, ably staffed test and service facility.
The knowledge that we carry tens of thousands of pounds of spare parts.
Our discreet "instant" H.P. Our personal export documentation scheme.
Our in-person, or over the 'phone, time saving credit card acceptance.
Our honest advice and evaluation of part exchange equipments' worth.
Our deep interest and knowledge in most facets of our common hobby.

AND DO NOT FORGET THE FREE FINANCE SCHEME

Give us a ring for full details (subject to clearance and a minimum of £100 invoice) we will help you to enjoy new regular priced Yaesu, Gem Quad, Ascot, SMCHS, CDE, Hy Gain, Stolle, Channel Master, SMC, Hansen, MFJ, KLM, Mirage, and Hi-Mound – Tomorrow! (You pay only The Cash Price!!!).

POWER UNITS

RU120406 £15
4 amps const. 6 amps surge @ 13.8V. Low ripple. Post £1.50.

RS120810 £30
8 amps const. 10/11 surge @ 13·8V. Full foldback etc. Post £1.50.

SS122535 £99
25 amps const. 35 surge @ 13·8V. Foldback, short circuit proof etc. Post £2.00.

FRG7700 £309
0·15 30MHz General Coverage Receiver. AM/SSB/CW/FM (Memory Version £389)

FT202R £109
1W. 6 chnl. 2m Handheld

FT207R £175
3W. 2m 12½ kHz Synthesized

SALE!

FT208R IN STOCK

FT404R £179
3W. 6 chnl. 70 cms Handheld

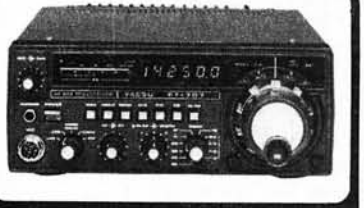
FT708R £199
1W. 70 cms 25kHz Synthesized

FRG7 £199
0°5 30MHz General Coverage Receiver. 230V ac. 12V dc, + Battery pack. AM/SSB

FT290R IN STOCK

FT480R £359
2m, Synthesized. 25, 12½, 1kHz steps FM 1kHz, 100, 10Hz,steps SSB, 10W PEP.

FT780R £409
70cm, Synthesized. 100, 25, 1kHz steps FM. 1kHz, 100, 10Hz steps SSB, 10W PEP



FT707 £529
10–80m. 100W PEP,SSB, AM, CW. Variable IF Bandwidth. Digital. 8 Bander.(10W model £455)

FT1 IN STOCK

★ FT902DE £713.00
★ FT902D £724.50

FT902DM £799
10–160m, SSB, CW, AM, FM, Deluxe Digital, Kayer, fan, variable bandwidth etc.

★ FT101ZDAM £585
★ FT101ZAM £515 ★ FT101ZDFM £599

FT101ZFM £529
10-160m, SSB, CW, Digital, Variable IF width (FM or AM, Digital or Analogue).

PRICES INCLUDE VAT @ 15%

FREE SECURICOR DELIVERY

2 YEAR IMPORTER WARRANTY

SOUTH MIDLANDS COMMUNICATIONS LIMITED

S. M. HOUSE, OSBORNE ROAD, TOTTON, SOUTHAMPTON, SO4 4DN, ENGLAND
Tel: Totton (0703) 867333, Telex: 477351 SMCOMM G, Telegram: "Aerial" Southampton

S.M.C. Agents
G3ZUL Stourbridge (03843) 5917
GM8GEC Edinburgh (031665) 2420
GI3WWY Tandragee (0762) 840656
GI3KDR Bangor (0247) 55162
GW3TMP Pontybodkin (035287) 846/324
GW8EBB Swansea (0792) 872525
GJ4ICD Jersey (0534) 26788
G4EQS Redcar (0642) 480808

LEEDS
S.M.C. (Leeds) BRANCH
LEEDS,
Colin Thomas, G3PSM
257 Otley Road,
Leeds 16, Yorkshire.
Leeds (0532) 782326
9–5.30 Monday–Saturday

CHESTERFIELD
S.M.C. (Jack Tweedy) LTD
CHESTERFIELD,
Roger Baines, G3YBO
102 High Street,
New Whittington, Chesterfield.
Chesterfield (0246) 453340
9–5 Tuesday–Saturday

WOODHALL SPA
S.M.C. (Jack Tweedy) LTD
WOODHALL-SPA,
Jack Tweedy, G3ZY
150 Horncastle Road,
Woodhall Spa, Lincolnshire
Woodhall Spa (0526) 52793
9–5: Tues–Sat (+ appointments)

Photo Acoustics Ltd

MICRO COMMUNICATIONS DIVISION

Number ONE for:–

TR9000

TRIO
ICOM
YAESU
and
FDK

SOUND ADVICE!

Talk to our *experienced* Staff—

G3TGE – DEREK
G3TLE – ROY
G8PWS – STEVE
G8BNR – DICK

TS830S

58 HIGH ST., NEWPORT PAGNELL
BUCKS. TEL: (0908) 610625

255a ST. ALBANS RD.,
WATFORD. TEL: 32006

VISA

CREDIT CHARGE MAIL ORDER

S.E.M.

P.O. BOX 6, CASTLETOWN, ISLE OF MAN.
TEL: MAROWN (0624) 851277

S.E.M. ACTIVE MULTIFILTER
Will improve ANY receiver on ANY mode. Gives "passband tuning" and "Variable selectivity". Switched Hi-pass, Lo-pass, peak or notch. Selectivity 2.5KHz–20Hz tunable from 2.5KHz to 250 Hz. PLUS another notch which can be used in any switch position and covers 100Hz to 10KHz. TRY ONE ON 14 DAYS APPROVAL. **£57.00** ex stock.

S.E.M. EZITUNE
"In my fifty years on the air, this is the most useful gadget I've ever seen". Connects in aerial lead, produces S 9 + (1–170MHz) noise in receiver. Adjust A.T.U. for minimum noise. You have now put an exact 50 ohms load onto your transceiver. Fully protected, you can transmit through it, to save your P.A. and stop QRM. **£25*** ex stock.

S.E.M. TRANZMATCH
The most VERSATILE Ant Matching system. Will match from 15-5000 Ohms BALANCED or UNBALANCED at up to 1kW. Link coupled balun means no connection to the equipment which can cure TVI both ways. SO239 and 4mm connections for co-ax or wire feed. 160–10 metres TRAN Z MATCH **£65.00.** 80–10 metres **£58.00.** EZITUNE built in for **£19.50** extra. (See above for details of Ezitune). NOW IN STOCK AGAIN.

THE SENTINEL AUTO Mk II 2 or 4 metre PRE-AMPLIFIER
These include NEW PROTECTION circuit to give MAXIMUM LEGAL through power rating. Completely new third generation DUAL GATE MOSFET pre-amp giving 1dB N.F. and 20dB gain with GAIN CONTROL and OFF switch (straight through when OFF). The High Q tuned circuits for high selectivity.
Size: 1½" × 2½" × 4" **£25.00*** ex stock. Without RF Switch **£15.**
SENTINEL STANDARD Mk II 2 or 4 metre PRE-AMPLIFIER
Same as the AUTO less R.F. switch 12V 5mA. **£15.00*** ex stock.

PA3
ONE cubic inch miniature 2 metre pre-amplifier. Same circuit as above. **£7.95** ex stock. 70cms versions **£4.00** extra. Marine Band ex stock. Other frequencies to order.

SENTINEL 2 METRE LINEAR POWER AMPLIFIER/PRE-AMPLIFIER
These units use the latest techniques and transistors for highest reliability and performance. Infinite SWR PROTECTED devices. ULTRA LINEAR, all modes. R.F. switched. Same POWER GAIN at lower drive powers. Supply 13.8V nominal. SO239s.
Three models:
1. **SENTINEL 35**
   Twelve times power gain. 3W IN 36W OUT. 4 amps. Max. drive 5W. 6" × 2½" front panel, 4½" deep. **£57.50** ex stock.
2. **SENTINEL 50**
   Five times power gain. 10W IN 50W OUT. Max. drive 16W. Same size as the Sentinel 35. **£69.50** ex stock.
3. **SENTINEL 100**
   Ten times power gain. 10W IN 100W OUT. Max. drive 16W. Size: 6½" × 4", front panel, 3½" deep. 12 amps. **£126.50** ex stock.

All available less pre-amp for **£8.00** less.

SENTINEL H.F. WIDEBAND PRE-AMPLIFIER 2-40MHz 15dB gain. Ideal for 15 and 10 metres and OSCAR OR AN ACTIVE AERIAL 9-12V. Size: 2½" × 1½" × 3". Two versions. **1. STANDARD** Performance as above. **£10.00*** ex stock. **2. AUTO** Same performance as above with a change over relay r.f. operated by your transceiver for direct connection in your aerial co-ax. **£16.93*** ex stock.

FREQUENCY CONVERTERS
SENTINEL DUAL GATE MOSFET 2 METRE CONVERTERS
N.F. 2dB Gain 30dB. IFs 2 metres: 2-4MHz, 4-6MHz, 28-30MHz. 4 metres: 28-28.7MHz. 9-12V. 15mA. **£24.73** ex stock.

SENTINEL X 2 METRE CONVERTER Same as above plus mains power supply. **£28.80** ex stock. 70cm to 28-30MHz **£28.80** ex stock. **SENTINEL L.F. CONVERTER** 10KHz-2MHz IN 28-30MHz OUT. 9-12V. 5mA. **£20.80** ex stock. **SENTINEL TOP BAND CONVERTER** 1.8-2.3MHz IN 14-4.5MHz OUT. 9-12V 5mA **£20.80** ex stock. **S.E.M. IAMBIC KEYER** The ultimate auto keyer using the CURTIS custom LSICMOS chip. Tune and sidetone switching. **£30.00** ex stock. TWIN PADDLE TOUCH KEY **£12.50.** *Means Belling Lee sockets, add £1.90 for SO239s or BNC sockets. Ring or write for more information. Place orders or request information on our Ansaphone at cheap times.

12 MONTHS COMPLETE GUARANTEE
Prices include delivery. C.W.O. or credit card number for same day service.

MORSE TUTOR

The uniquely effective method of improving and maintaining Morse Code proficiency. Effectiveness proven by thousands of users world-wide.

- ★ Practise anywhere, anytime at your convenience.
- ★ Generates a random stream of perfect Morse in five character groups.
- ★ D70's unique "DELAY" control allows you to learn each character with its correct high speed sound. Start with a long delay between each character and as you improve reduce the delay. The speed **within** each character always remains as set on the independent "SPEED" control.
- ★ Features: long life battery operation, compact size, built-in loudspeaker plus personal earpiece.

Price **£49.45**

ACTIVE RECEIVING ANTENNAS

Datong active antennas are ideal for modern broadband communications receivers – especially where space is limited.

- ★ highly sensitive (comparable to full-size dipoles).
- ★ Broadband coverage (below 200 kHz to over 30 MHz).
- ★ needs no tuning, matching or other adjustments.
- ★ two versions AD270 for indoor mounting or AD370 (illustrated) for outdoor use.
- ★ very compact, only 3 metres overall length.
- ★ professional performance standards.

Prices: Model AD270 (indoor use only) **£42.55**
Model AD370 (for outdoor use) **£56.35**
Both prices include mains power unit.

VERY LOW FREQUENCY CONVERTER

If your communications receiver gives poor results below 500 kHz Model VLF is the answer.

- ★ Connects between antenna and receiver input.
- ★ Converts signals between DC and 500 kHz to the range 28 to 28.5 MHz with low noise and high sensitivity.
- ★ Crystal controlled for high stability.
- ★ Quality construction in diecast aluminium box (size 112 x 62 x 31mm), SO239 connectors, LED indicator, in/out switch.
- ★ Operates from internal 9 volt battery or external supply (5-15 volts DC).

Price: only **£25.30**

Our full catalogue plus further details of any product are available free on request.
All prices include VAT and postage and packing.

DATONG ELECTRONICS LIMITED
Spence Mills, Mill Lane, Bramley, Leeds LS13 3HE England.
Tel: (0532) 552461

FIRE!
BURGLARY!
ASSAULT!
INTRUDERS!

Summon help when you require it – not afterwards when its too late!

Protect yourself and family from some of the bad things in life with Wireless Alarm Systems you can install in minutes NOT days, associated with wired systems. Our range of cordless security devices which are of the highest quality for home or business can give you that secret extra protection.

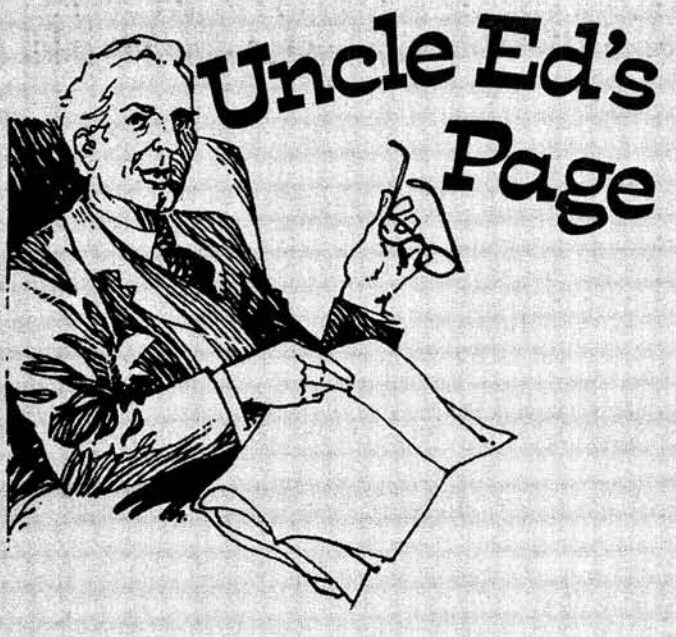
HO & GPO approved equipment available. For the enthusiast, purchase separate transmitter & receiver devices, to build your own equipment.

Send for further details to:

A. R. Williams
Security Aids

Reg. Office,
Park Chambers
7 Inverness Place,
London W2 4RG

Tel. 01-221 1422.



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

ATTENUATORS—2

Well, I dropped a right clanger in August! I don't know what I was thinking of at the time, but formulae for calculating attenuator network values don't use the ratio in decibels; they use either voltage or power ratios. You do find that tables of attenuator network values generally quote decibel ratios though, so I guess I still ought to explain them in the near future.

The circuit which I introduced last month is called, believe it or not, a "T" attenuator. The formulae which you use to calculate the resistor values are shown in Fig. 6, Z being the input and output impedance, and n the ratio of input voltage/output voltage.

For larger amounts of attenuation, the value of R2 becomes very low, and it is easier to adopt a different form of circuit (called a "pi" type, because it looks like the Greek letter π), which gives more manageable resistor values. The "pi" attenuator, and its related formulae, are shown in Fig. 7.

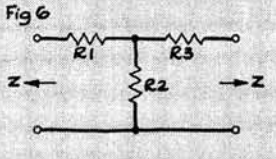
The input and output impedances can still be made to match the source and load, and Fig. 8 gives you some idea of what the source "sees" looking into the attenuator. Incidentally, last month I said for simplicity that the source "saw" the attenuator and load in series. It would be more correct to say that they are in parallel, and Fig. 8 shows this quite clearly.

The values which you work out using either set of formulae seldom correspond with the "preferred values" which resistors are made in nowadays. You will need to use your judgement as to whether you can simply take the nearest preferred value, or have to make up the calculated value from two or more resistors in series/parallel.

In all the attenuator circuits I've shown so far, the bottom line of the diagram represents a continuous wire, which is at about earth potential. Many audio frequency circuits are balanced, so that neither side is earthy, and at any instant, a positive-going signal on one line is balanced by a negative-going signal on the other. If we were to put one of the unbalanced attenuators of Figs. 6 and 7 into a balanced circuit it would upset the operation of the circuit, so we have to devise balanced attenuators instead. This is very simply achieved, by splitting the series resistors in two and putting one half of each in the bottom line. The circuits are then called "H" (Fig. 9) and "D" or "square" or "box" (Fig. 10) attenuators respectively.

For attenuators to work between source and load impedances of unequal values, you'll find formulae and tables in most radio reference books. The higher the load impedance gets, compared with the source impedance, the less you have to worry about the effect that the load will have on the attenuator (see the discussion of Fig. 4 last month). If the load impedance is less than the source impedance, life is more difficult, and sometimes you'll come across an attenuator circuit which is designed to match two circuits with the least possible loss of signal in the process. A typical example is when you want to use a signal generator with a 75Ω output impedance to drive a 50Ω load. The circuit used is called a minimum loss pad, the word pad being another term for an attenuator. The actual loss in such an attenuator depends on the ratio of the source and load impedances.

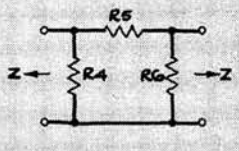
Fig 6



$$R1 = R3 = Z\frac{(n-1)}{(n+1)}$$

$$R2 = \frac{2Zn}{(n^2-1)}$$

Fig 7



$$R4 = R6 = Z\frac{(n+1)}{(n-1)}$$

$$R5 = \frac{Z(n^2-1)}{2n}$$

Fig 8

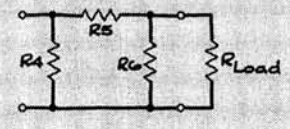


Fig 9

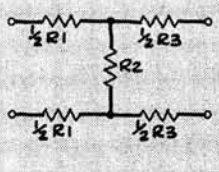


Fig 10

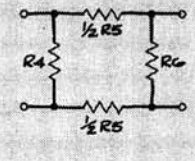
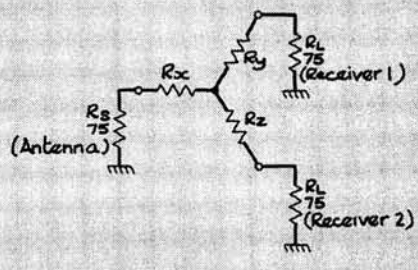


Fig 11



WRM406

Finally, let's touch on another interesting circuit which does a particular sort of matching, but introduces attenuation at the same time. This is a splitter circuit (Fig. 11), often used to feed two TV receivers from one antenna. The antenna and the receivers are each of a nominal 75Ω impedance, and each wants to "see" 75Ω as its load or source. If you just connected the two receivers across the 75Ω coaxial feeder cable, the effective load would be half that, in other words 37·5Ω, and the mismatch would thoroughly upset the whole system. So, you need to put some sort of matching network into the circuit, and that's what R_x, R_y and R_z are there for. In this case, these resistors are nominally 25Ω each, so that looking from R_x towards the two receivers,

continued on page 69▶▶▶

RADIO

SPECIAL PRODUCT REPORT

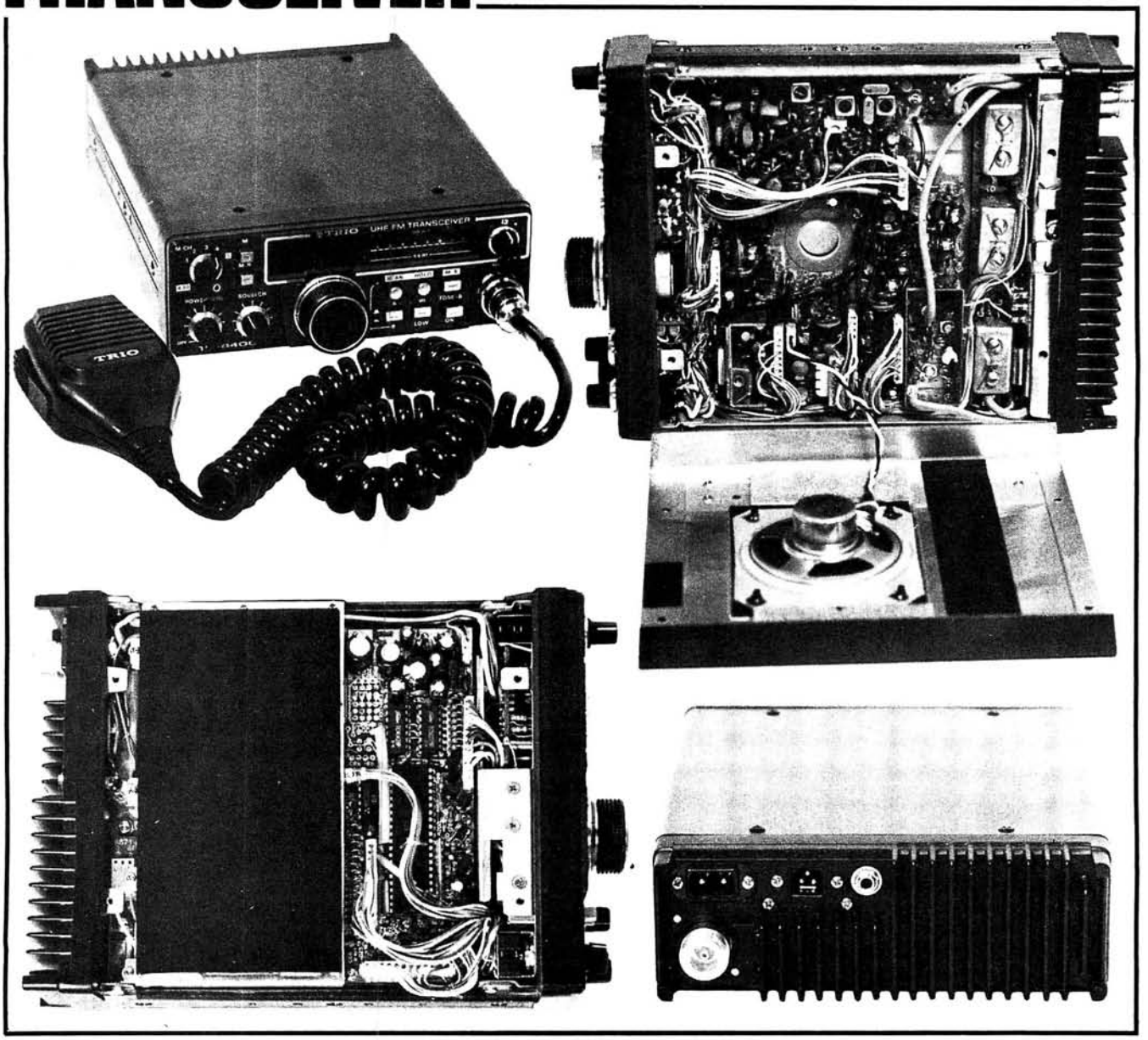
TRIO

TR-8400

70 cm MOBILE FM TRANSCEIVER

The Trio TR-8400 is a microprocessor-controlled f.m. transceiver for the 70cm amateur band. It is small enough for mobile use, but comes with both mobile mounting hardware and tilt foot for base-station use. A matching power supply is available for a.c. mains operation.

Operating frequency is selected by means of a click-type rotary control or by the UP/DOWN buttons on the microphone, both operating in 25kHz steps. Two v.f.o.s. are provided, giving push-button access to two dial-set frequencies. Read-out is on a 4-digit red l.e.d. display approximately 7·5mm high. The usual ± 1·6MHz transmit frequency offsets are available, a warning l.e.d. shows when an offset has been



★ specification

GENERAL

Frequency range: 430·000 to 439·975MHz
Frequency synthesiser: Digitally controlled, phase locked v.c.o.
Mode: FM (F3 – F3E)
Antenna impedance: 50Ω
Supply requirements: 13·8V d.c. ±15% negative earth
Current consumption: 0·45A in receive mode, squelch closed
3·4A in HI transmit
1·4A in LOW transmit
Memory back-up 3mA
Operating temperature: −20° to +50°C
Dimensions: 51·5 × 147·5 × 193mm (excluding projections)
Weight: 1·5kg approx.

RECEIVER

Sensitivity: Better than 1μV for 30dB S/N
Better than 0·4μV for 12dB SINAD
(0·14μV p.d. for 12dB SINAD)
Selectivity: More than 14kHz (−6dB)
Less than 30kHz (−60dB)
Adjacent channel: *(−67dB)*
Intermodulation response rejection: *(−72dB)*
"S" Meter calibration:
l.e.d. No. 1 *(−119dBm) (0·25μV p.d. approx.)*
l.e.d. No. 2 *(−113dBm)*
l.e.d. No. 3 *(−110dBm)*
l.e.d. No. 4 *(−108dBm)*
l.e.d. No. 5 *(−105dBm)*
l.e.d. No. 6 *(−104dBm)*
l.e.d. No. 8 *(−100dBm)*
l.e.d. No. 10 *(−97dBm)*
Squelch sensitivity: 0·35μV (threshold)
(less than 0·08μV)
Audio output: More than 2W into 8Ω
(3W into 8Ω for 10% distortion)

TRANSMITTER

RF output power into 50Ω load: (13·8V d.c. supply)
HI: 10W min.
LOW: 1W approx. (adjustable)
Modulation: Variable reactance direct shift
Frequency tolerance: Better than ±15 p.p.m. over temperature range
Spurious output: HI: Less than −60dB
LOW: Less than −50dB
Deviation (max.): ±5kHz
RPT. Tone-burst frequency: 1750Hz
Microphone: Dynamic 500Ω with p.t.t. and UP/DOWN switches

selected. Further l.e.d.s indicate BUSY (squelch open) and ON AIR (p.t.t. pressed). The S & RF meter is also a l.e.d. bar-type indicator, showing received signal strength or transmitter power output.

A 5-channel memory is provided, the fifth one having the option of storing different transmit and receive frequencies, to allow for non-standard offsets. Scanning of the five memory channels, or of the band 430·000–439·975MHz in 25kHz steps, can be selected. In either mode, scanning is normally at a rate of about eight channels per second, but band-scanning rate can be doubled by holding the scan button in. The scanning stops when a signal is received and restarts when it drops. The 1750Hz tone burst is automatic in operation (duration 0·7s approximately) but can be turned off if not required.

The rear panel of the TR-8400 is mostly taken up with the p.a. heat sink, but also carries the antenna socket (50Ω "N" type), extension loudspeaker socket (8Ω), and connectors for main power and memory back-up supplies. If no separate memory back-up power supply is connected, the memory is fed from the main power supply.

The transmitter uses a double-balanced mixer to achieve low spurious output levels, and the p.a. is a single i.c. The receiver is a double superhet, with i.f.s of 21·6MHz and 455kHz following a 2-stage r.f. amplifier using a dual-gate MOSFET input stage.

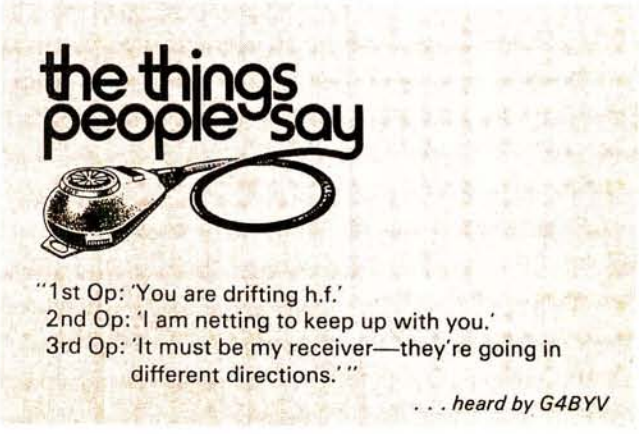
Results

Test measurements made on the receiver are given in italics in the specification table. The review transceiver gave very good results on the air, both as a base station, using a 3-section co-linear, and mobile, where a 2-section co-linear on a gutter-mount was used. Transmitted speech quality was reported excellent, but received quality suffers from the usual downward-facing loudspeaker. An extension speaker is essential if the full potential of the receiver is to be realised. The digital read-out of frequency is dim, certainly too dim for mobile use on a bright day, and the only real solution is to use the memory channels, assuming that you don't travel too far, of course.

So far as I am concerned, the TR-8400 incorporates just about the right number and type of facilities, where memories and scanning are concerned, without making the whole rig too gimmicky. As with any MPU-controlled equipment, the operator is to some extent subservient to the machine, and there are definite routines which must be followed in using the memory, etc. These are laid out reasonably clearly in the Instruction Manual, which includes a block diagram and circuit diagram, but no other servicing information nor even a circuit description.

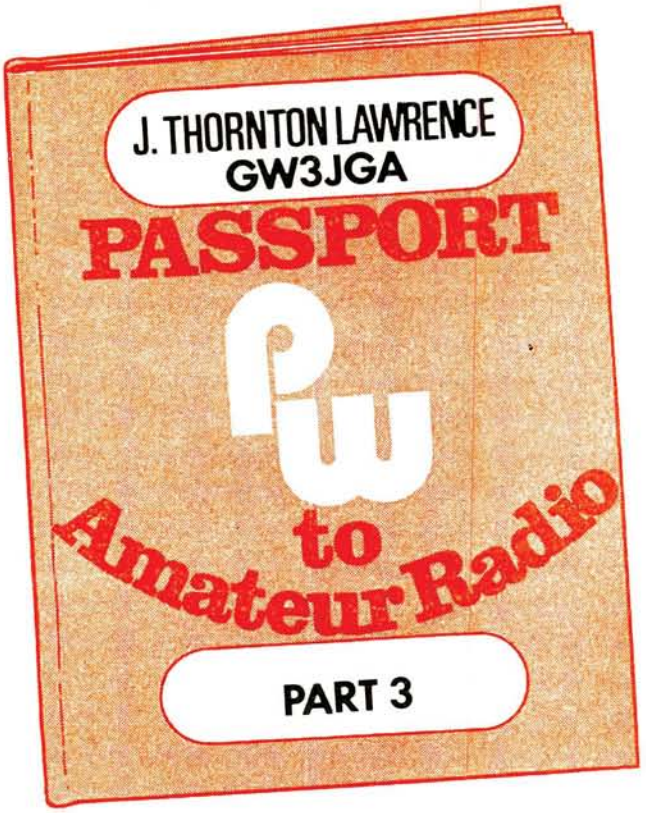
The matching a.c. mains power supply, type PS-10, is designed to act as a mounting base for the TR-8400. It measures 73 × 147 × 180mm, and weighs 3·3kg approximately. It contains separate circuits for the main supply and the memory back-up, the latter being available continuously providing the a.c. mains is connected, regardless of whether the power switch is on or off. The PS-10 also includes a front-facing loudspeaker and a $\frac{1}{4}$in jack for headphones.

The TR-8400 and PS-10 are available from Trio dealers. See advertisements for current prices. Our thanks to **Lowe Electronics, Chesterfield Road, Matlock, Derbys DE4 5LE, telephone Matlock (0629) 2817** for the loan of the review equipment.



"1st Op: 'You are drifting h.f.'
2nd Op: 'I am netting to keep up with you.'
3rd Op: 'It must be my receiver—they're going in different directions.'"

. . . heard by G4BYV



Last month we dealt with arithmetic in the RAE, now we move on to using that arithmetic with electrical units and Ohm's Law.

Basic Electrical Terms and Units

EMF, current, resistance, power, frequency etc., are the basic terms used when describing what is happening in an electrical circuit.

The volt, ampere, ohm, watt, hertz etc., are the basic units used to quantify the various terms.

A clear understanding of terms and units is very important to you in answering the numerical questions in the RAE.

Multiples and Sub-multiples

Some of the electrical units that are used in radio are inconveniently small for practical purposes and so a multiple of the unit is used. Others, for example the henry and the farad, are inconveniently large.

The capacitors and inductors used in radio work have values which are sub-multiples of the farad and henry. You will, therefore, need to be able to recognise multiples and sub-multiples both in words and figures.

Multiples are described by a prefix to the unit in question. For example, 1 Megohm = 1 000 000 ohms = 1MΩ. A list of multiple prefixes is given below.

Prefix letter				Index form
tera	T	one million million	1 000 000 000 000	10^{12}
giga	G	one thousand million	1 000 000 000	10^{9}
mega	M	one million	1 000 000	10^{6}
kilo	k	one thousand	1000	10^{3}
hecto	h	one hundred	100	10^{2}

Sub-multiples are described by a letter prefix in a similar fashion. For example, 1 microfarad = 0·000 001 farad = 1μF. A list of sub-multiple prefixes is given below.

Prefix letter				Index form
deci	d	one tenth	0·1	10^{-1}
centi	c	one hundredth	0·01	10^{-2}
milli	m	one thousandth	0·001	10^{-3}
micro	μ	one millionth	0·000 001	10^{-6}
nano	n	one thousand millionth	0·000 000 001	10^{-9}
pico	p	one million millionth	0·000 000 000 001	10^{-12}

Indices

You will notice from the previous sections that the multiplier and sub-multiplier are written as a figure followed by or preceded by a number of noughts. Using **indices** (or **scientific notation)** we can find a very convenient way of writing these very large or very small numbers.

We can see that, for example:

$10^{2} = 100$ $\quad$ $10^{-2} = 0{\cdot}01$

$10^{3} = 1000$ $\quad$ $10^{-3} = 0{\cdot}001$

$10^{6} = 1\,000\,000$ $\quad$ $10^{-6} = 0{\cdot}000\,001$

Thus the velocity of radio waves, which is 300 000 000 metres/sec., can be more easily written as 3×10^{8} metres/sec. Also a capacitor of 0·000 001 farad can be conveniently written as 1×10^{-6} farad.

Using indices can also help us to change back to a basic unit easily:

10GHz = 10 × 1 000 000 000	$= 10 \times 10^{9}$ hertz
310kV = 310 × 1000	$= 310 \times 10^{3}$ volts
2·7mA = 2·7 ÷ 1000	$= 2{\cdot}7 \times 10^{-3}$ amps
25μA = 25 ÷ 1 000 000	$= 25 \times 10^{-6}$ amps
5pF = 5 ÷ 1 000 000 000 000	$= 5 \times 10^{-12}$ farad
2·2MΩ = 2·2 × 1 000 000	$= 2{\cdot}2 \times 10^{6}$ ohms

Multiplying

When multiplying figures expressed in scientific notation it is only necessary to add the indices. For example:

$(2 \times 10^{4}) \times (4 \times 10^{6}) = 8 \times 10^{10}$

or when negative indices are involved

$10^{4} \times 10^{-6} = 10^{-2}$

$10^{-4} \times 10^{6} = 10^{2}$

$10^{-4} \times 10^{-6} = 10^{-10}$

Dividing

When dividing figures expressed in scientific notation it is only necessary to subtract the indices. For example:

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

or when negative indices are involved

$$\frac{10^{-6}}{10^{-4}} = 10^{-6-(-4)} = 10^{-6+4} = 10^{-2}$$

$$\frac{10^{-6}}{10^{4}} = 10^{-6-4} = 10^{-10}$$

Also

$$\frac{10^{-6}}{10^{4}} = 10^{-6} \times 10^{-4} = 10^{-10}$$

An alternative way to deal with an index quantity that you are dividing by is to change the sign of the index and multiply, by adding the indices—as we did in the last example shown above.

In even simple calculations, using the full decimal number is very cumbersome and so the index form should be used whenever possible. For example:

Calculate the voltage across a 1MΩ (1 Megohm) resistor when a current of 100μA (100 microamps) is flowing through it.

$V = I \times R$

$V = 0{\cdot}0001$ amps $\times$ 1 000 000 ohms

(a difficult calculation to do in your head)

In index form,

$V = 100 \times 10^{-6}$ amp $\times$ 1 $\times$ 10^{6} ohms

$V = 100 \times 1\ (10^{-6\ +\ 6})$

as the indices cancel each other out

$V = 100 \times 1$

$V = 100$ volts

Electric Current

Very briefly, all matter is composed of molecules which in turn are made up of **atoms.** Each atom has a positively charged **nucleus** with balancing negatively charged **electrons** orbiting it.

Current flow through a material is based on the movement of these negatively charged electrons from one atom to another. This depends on how loosely or tightly the electrons in each atom are bound to the nucleus and how much external attraction (applied voltage) there is to move them.

In some materials there is a continual movement of electrons in a random manner from one atom to another and the application of voltage to a piece of wire made of this material will cause a drift of electrons along the wire, known as an **electric current.**

Conventional Current and Electron Flow

Historically it had always been assumed that an electric current flowed from the positive terminal of the supply, through the external circuit and back to the negative terminal. However, with further knowledge of the structure of the atom it became obvious that current was due to the movement of a negative charge towards the positive (as in the radio valve). This apparent contradiction has caused much discussion over the years but the accepted view is as stated previously, **conventional current** flows from the positive to the negative irrespective of the actual method or mechanism of the flow.

You may have noticed that it is also common practice to draw diagrams with the positive supply line at the top of the page and the zero or negative at the bottom. This convention makes it easier to visualise the flow of current always coming vertically down the page through the various parts of the circuit.

Water Flow Analogy

The usual analogy to electrical flow in a circuit is water flow through a pipe. The head of water or pressure represents the **voltage,** the flow of water through the pipe represents the **current** and the resistance to flow, caused by the smallness of the pipe, is equivalent to electrical **resistance.** The analogy also holds good for example when a tap, connected to a full hosepipe, is opened, water flows immediately out of the other end of the pipe and yet it is some time before a particular drop of water leaving the tap emerges from the far end. Similarly, an electric current entering a wire appears at the far end almost instantaneously but the actual "bits" of charge forming the current take an appreciable time to make their way from atom to atom along the whole length of the wire.

Conductors and Insulators

Those materials having atoms with loosely bound electrons, ones which can move easily from atom to atom, have a low resistance to current flow and are known as **conductors.** All metals are conductors though some are far more conductive than others. Those materials having atoms with tightly bound electrons, which only move when under great electrical stress, have a very high resistance to current flow and are known as insulators.

For example, an electric cable has a copper core to allow a free flow of current along its length and a plastic or rubber sleeve to insulate the core and to prevent current from leaking away to adjacent wires or to you, if you happen to be holding it!

Here is a list of typical conductors and insulators:

Conductors	**Insulators**
Silver	Mica
Copper	Quartz
Aluminium	Glass
Brass	Ceramics
Iron	Plastics
Mercury	Rubber
Carbon	Oil
Some liquids	Air

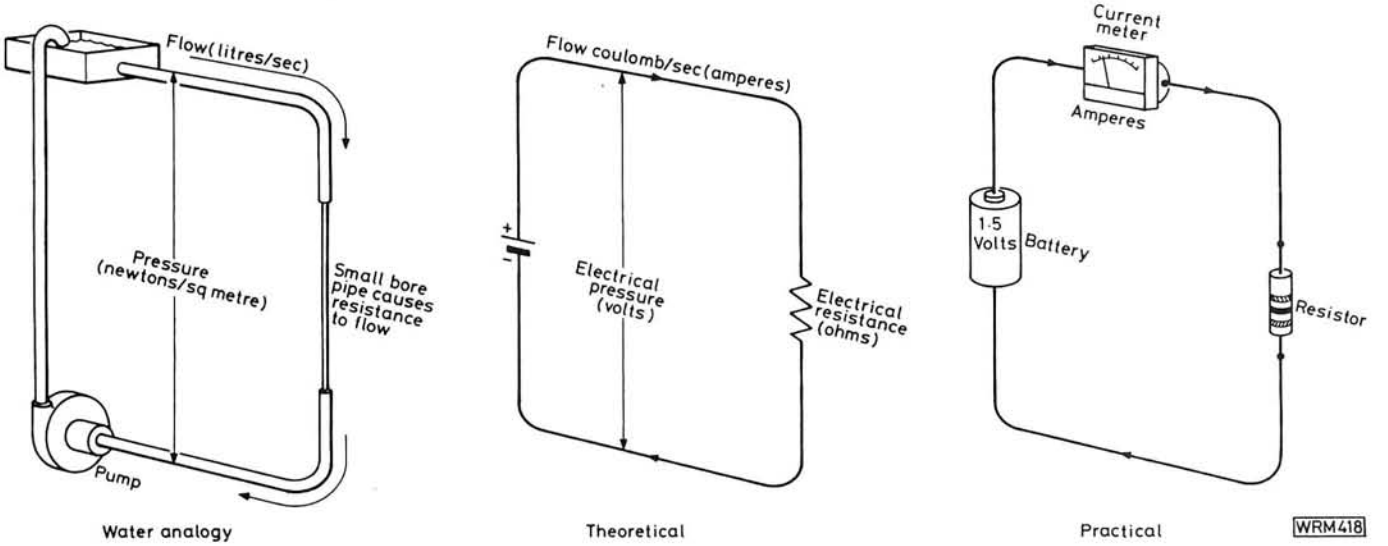


Fig. 7: Similarity between water flow and an electrical circuit

Units and Symbols			
Term	**Symbol**	**Unit**	**Abbreviation**
quantity	q	coulomb	C
current	I	ampere	A
voltage	E or V	volt	V
time	t	second	s
resistance	R	ohm	Ω
capacitance	C	farad	F
inductance	L	henry	H
mutual inductance	M	henry	H
power	W	watt	W
frequency	f	hertz	Hz
wavelength	λ	metre	m

Electrical Units

Quantity: Since all electrons, to whatever kind of atom they belong, carry the same charge, this charge could be visualised as a unit of quantity of electricity. However, it is extremely small and the practical unit of charge is the **coulomb,** symbol **C** (1 coulomb = 6×10^{16} electrons). The number of coulombs or quantity of electricity is usually denoted by the symbol **q.**

Current flow: Continuing with the water flow analogy, water flow may be stated in litres per second; similarly, the flow of electric current, symbol **I,** may be expressed in coulombs per second.

An electric current of one coulomb per second is called an **ampere,** symbol **A.**

Quantity (coulombs) = Current (amperes) × Time (seconds) or in symbols

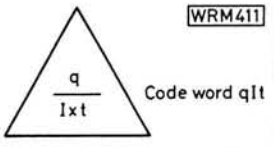
$q = It$

This can also be expressed as:

$I = \frac{q}{t}$

$t = \frac{q}{I}$

A useful memory aid is the triangle; by covering up the unknown quantity, the appropriate formula is shown.



Electrical Pressure: To make an electric current flow through a circuit, a continuous supply of electrons is required; this could be supplied from a **battery** or **generator.** The supply produces an electrical pressure, sometimes called an **electromotive force, e.m.f.,** which forces the current through the circuit. The unit of electrical pressure is the **volt,** symbol **E** or **V.** (Equivalent to head of water or pressure in the water analogy.)

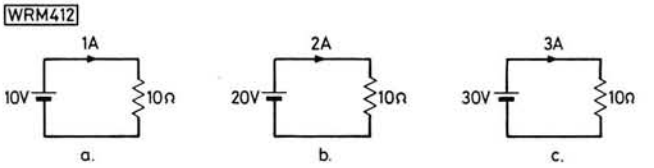
Electrical Resistance: The opposition to current flow in an electrical circuit is called the **resistance** of the circuit, symbol **R.** (Equivalent to the smallness of the pipe in the water analogy), the resistance of a circuit is measured in **ohms,** symbol Ω.

Ohm's Law

Ohm's Law states that for a particular resistor, the ratio of the voltage applied across that resistor, to the current flowing through it, is constant. Thus, if we increase the voltage across the resistor, the current flowing through it will also increase, but the ratio between the two will remain constant. This ratio is known as resistance and is stated in ohms (Ω), thus:

$\frac{\text{Voltage}}{\text{Current}} = \text{Resistance (ohms } \Omega)$

Here is a practical example, the resistance is the same in each circuit, but as the applied voltage is increased, the current flow increases in proportion.

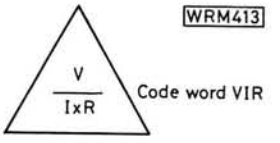


So you have,

$R = \frac{V}{I}$ Resistance = $\frac{\text{Voltage}}{\text{Current}}$

$I = \frac{V}{R}$ Current = $\frac{\text{Voltage}}{\text{Resistance}}$

$V = I \times R$ Voltage = Current × Resistance



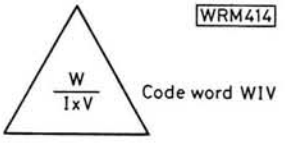
At this stage, a small memory aid is appropriate. Again by covering the unknown quantity, the appropriate formula is shown. From this you can write down the relationships between the three quantities:

Current (I) Voltage (V) and Resistance (R).

Power: When an electric current passes through a resistance the electrical energy is dissipated in the form of heat in the resistance. The amount of power, measured in **watts**—symbol **W,** dissipated in a resistance is the product of the current through it and the voltage across it.

Power (watts) = Current × Voltage

Looking at this, you will no doubt spot the fact that you can write another set of relationships and bring in another memory aid,



Power (watts) $W = I \times V$

but $I = \frac{V}{R}$

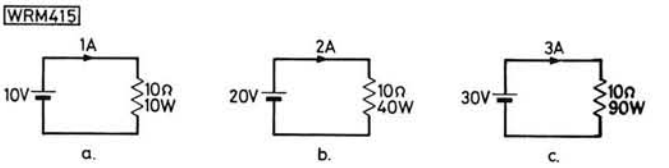
so that $W = \frac{V}{R} \times V = \frac{V^2}{R}$

also $V = I \times R$

so that $W = I \times IR = I^2 R$

Summing up $W = VI = \frac{V^2}{R} = I^2R$

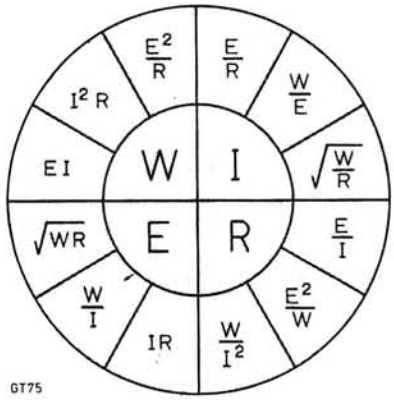
Let's go back to our practical example again and work out the power in the resistor for each increase of battery voltage and current using $W = V \times I$.



You will see that when the voltage (and so the current) doubles, the power increases four times and when the voltage (and current) triples, the power increases nine times.

In other words, the power in the resistor increases as the square of the applied voltage or the current flowing.

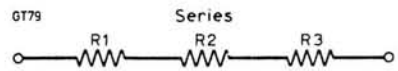
The composite diagram or formulae wheel given below is rather too complex to be a memory aid but it is nevertheless very useful to refer to.



Resistors in Series and Parallel

Now is a good time to look at how resistors behave in **series** and **parallel** combinations.

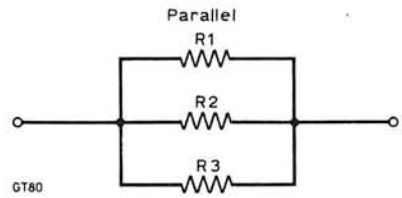
Series circuit: Total resistance $(R_T) = R1 + R2 + R3$



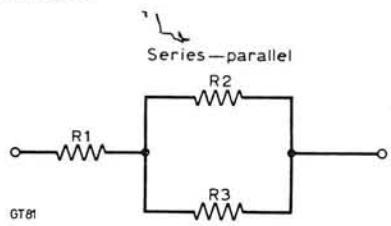
Parallel circuit: $\frac{1}{R_T} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}$

or if there are only two resistors:

$$R_T = \frac{R1 \times R2}{R1 + R2}$$



Where both combinations occur it is known as the **series-parallel case.**

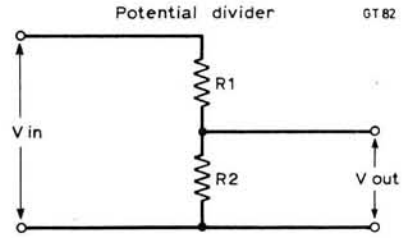


$$R_T = R1 + \frac{R2 \times R3}{R2 + R3}$$

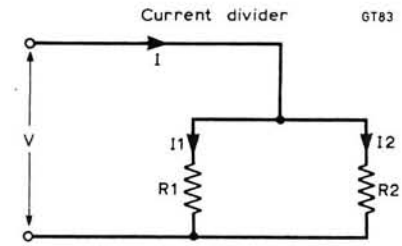
If you can remember the memory aids given previously, you have all that is necessary to sew up the conditions in a d.c. circuit.

Potential and Current Dividers

There are two more useful cases which are variations of the d.c. circuit that are worth remembering, namely, the **potential divider** and the **current divider.** The potential divider is useful when setting up bias circuits for the base of a **transistor,** and the current divider when it is required to have currents flowing in two parts of a circuit.



$$Vin = I \times (R1 + R2)$$
$$Vout = I \times R2$$
$$\text{Also } Vout = Vin \times \frac{R2}{R1 + R2}$$



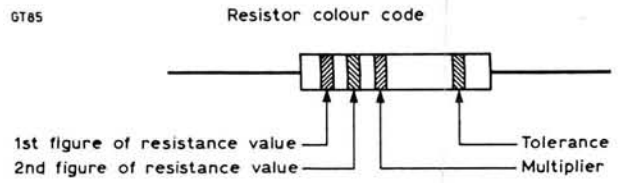
$$I = I1 + I2$$
$$V = I1 \times R1 = I2 \times R2$$
$$I1 = I \times \frac{R2}{R1 + R2}$$
$$I2 = I \times \frac{R1}{R1 + R2}$$

Resistors

Resistors for use in practical circuits use either carbon or a metal to provide the required electrical resistance. In low-power circuits, where the power dissipation is less than one or two watts, carbon resistors are used, the most popular being the carbon film type. In this type the carbon is deposited as a film on a ceramic rod and trimmed, during the manufacture, to the required value. Carbon film resistors are suitable for low and some types of high frequency circuits.

In higher power applications, greater than two watts, wire-wound resistors are used. Here the resistance wire, usually nichrome or manganin alloy, is wound on a ceramic former and the whole is coated with cement (sometimes vitreous enamel) to improve the heat dissipation. Some versions can be bolted down to improve the dissipation further. Due to their inherent and unspecified inductance, wire-wound resistors are not normally used at radio frequencies. They can of course be used in radio transmitters and receivers in voltage dropping or other power circuits providing that they are not actually carrying radio frequency currents.

Special resistors are made for higher power, high frequency use. For example, as a transmitter **dummy load**



COLOUR	1st & 2nd BAND	MULTIPLYING FACTOR	TOLERANCE
BLACK	0	1	—
BROWN	1	10	±1%
RED	2	10^2	±2%
ORANGE	3	10^3	—
YELLOW	4	10^4	—
GREEN	5	10^5	—
BLUE	6	10^6	—
MAUVE	7	10^7	—
GREY	8	10^8	—
WHITE	9	10^9	—
GOLD	—	10^{-1}	± 5%
SILVER	—	10^{-2}	±10%

and these are usually giant versions of the carbon film type. The power dissipation of this type can usually be increased by fan cooling or by immersion in special oil.

The value and tolerance of a resistor is marked on it either in print or by a colour code. A wire-wound resistor may be marked 100Ω ± 5% which tells you that the actual value will be between 95 and 105Ω.

A new method of stating the resistance is given in the BS 1852 resistance code, as shown below:

0·56Ω would be R56
1·0Ω would be 1R0
5·6Ω would be 5R6
56Ω would be 56R
100Ω would be 100R
1kΩ would be 1k0
10MΩ would be 10M

After the value, a further letter is added to indicate the tolerance, F = 1%; G = 2%; J = 5%; K = 10%; M = 20%.

For example:

R56M = 0·56Ω 20%
390RJ = 390Ω 5%
68kK = 68kΩ 10%
1k2F = 1·2kΩ 1%

All other resistors have their value and tolerance marked by colour bands printed on the body of the resistor.

Variable resistors are usually made in the form of a **potentiometer** with connections to both ends of the resistance element and to the sliding connection. Carbon is used as the resistance element in potentiometers of up to about 1 watt rating; higher power versions are almost invariably wire-wound—three watts being a typical power size.

Practical Ohm's Law

Before moving off Ohm's Law and resistance, let us see how it can be applied to calculating the resistance values in a practical circuit. We are going to use an audio frequency amplifier as an example and this is shown in Fig. 8a. As we are only concerned with the d.c. conditions and how they are set up, we can forget about all the a.c. components, the coupling and de-coupling capacitors, leaving

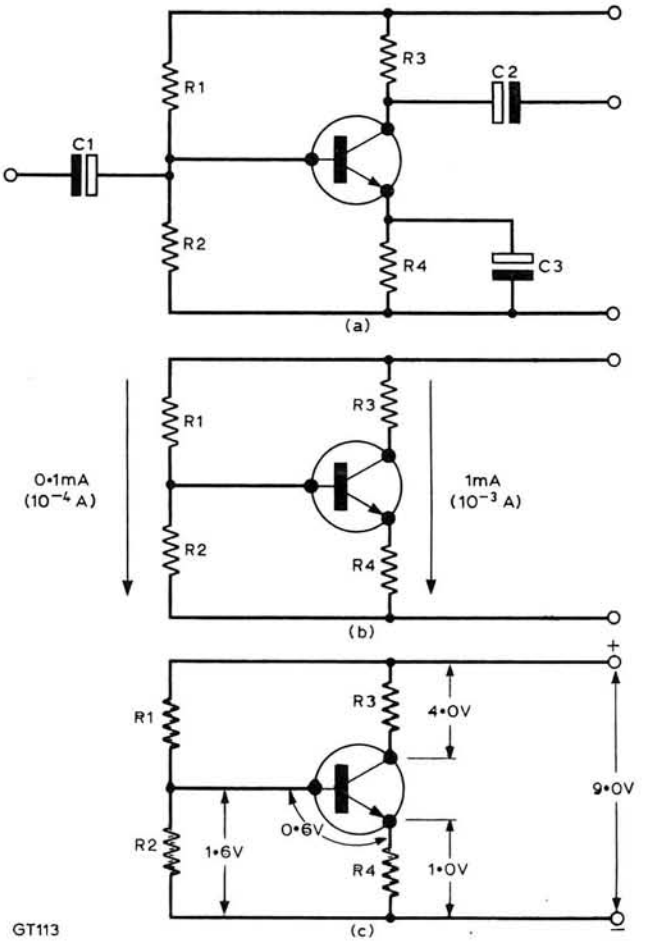


Fig. 8: An audio frequency amplifier

only the d.c. components as shown in Fig. 8b. Most modern small signal transistors have a **beta (d.c. gain)** of 100 or more; this implies a very small base current, sufficiently small that it may be ignored altogether if certain "rule of thumb" conditions are observed.

In a small signal audio frequency transistor amplifier stage, the collector current for optimum gain, noise performance, etc., would be about one to two milliamps, so for simplicity we will choose 1mA (10^{-3}A). Now for the current flowing down the base potential divider, R1 and R2. As a rule of thumb guide this should be a tenth of the collector current, so in our circuit it would be 0·1mA (10^{-4}A). This ensures that this current is large compared with the small bias current of the transistor. The two currents are shown in Fig. 8b.

Now for the voltages in the circuit. First we must know the supply voltage; for our example we will make this 9V. The emitter resistor R4 provides stabilisation of the operating conditions for Tr1. A typical voltage drop across this would be 0·5 to 1V. So again for simplicity we will choose 1V. The collector voltage should sit midway between the emitter voltage +1V and the supply voltage +9V, that is at +5V. This will alllow a signal voltage swing on the collector to go positive by 4V to the supply voltage and negative by 4V to the emitter voltage. Remember, up the page is more positive and down the page is more negative (away from positive!). Finally, the voltage drop across the emitter-base of a silicon transistor is 0·6V so if the emitter is at +1V the base will be at +1·6V.

Now for some sums to work out the value of the resistors; these are taken in reverse order.

$$R4 = \frac{V}{I} = \frac{1V}{10^{-3}A} = 10^3\Omega = 1k\Omega$$

$$R3 = \frac{V}{I} = \frac{4V}{10^{-3}A} = 4 \times 10^3\Omega = 4k\Omega$$

$$R2 = \frac{V}{I} = \frac{1{\cdot}6V}{10^{-4}A} = 1{\cdot}6 \times 10^4\Omega = 16k\Omega$$

$$R1 = \frac{V}{I} = \frac{9-1{\cdot}6V}{10^{-4}A} = \frac{7{\cdot}4V}{10^{-4}A} = 7{\cdot}4 \times 10^4\Omega = 74k\Omega$$

In a practical circuit the value of each resistor would have been chosen from the list of "preferred" values. There are 12 "preferred" values in each decade of the 10% tolerance range of resistors and 24 "preferred" values in the 5% range. 10% (E12) range:
1·0, 1·2, 1·5, 1·8, 2·2, 2·7, 3·3, 3·9, 4·7, 5·6, 6·8, 8·2.
5% (E24) range. All the above values plus:
1·1, 1·3, 1·6, 2·0, 2·4, 3·0, 3·6, 4·3, 5·1, 6·2, 7·5, 9·1.

To complete the exercise let us now specify the preferred values for our circuit.

	R1	R2	R3	R4
Calculated value	74kΩ	16kΩ	4kΩ	1kΩ
5% range (E24)	75kΩ	16kΩ	3·9kΩ	1kΩ
10% range (E12)	68kΩ	15kΩ	3·9kΩ	1kΩ

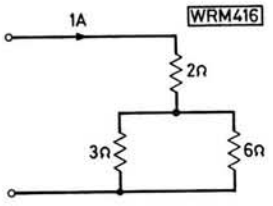
RAE Practice Questions

Here are some typical questions on this section which you may like to try.

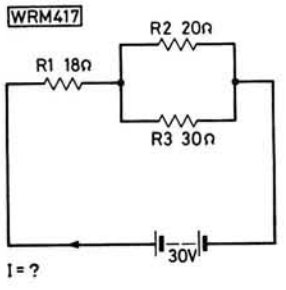
1. The current flowing through a 600Ω resistor when 300 volts are applied across it is:
a. 18mA
b. 200mA
c. 2·0A
d. 0·5A

2. The power consumption of a mobile transmitter drawing 2 amps from a 13 volt supply is:
a. 6·5 watts
b. 26 watts
c. 65 watts
d. 1·414 watts

3. In the current divider shown below, the value of the current in the 6 ohm resistor is:
a. $\frac{1}{4}$ amp
b. $\frac{1}{3}$ amp
c. $\frac{1}{2}$ amp
d. $\frac{2}{3}$ amps



4. What is the total current in the circuit shown below?
a. 1·8 amps
b. 1·5 amps
c. 1 amp
d. 0·5 amp



Next month we will start on Inductance, Capacitance and Alternating Current

Answers.
1. d; 2. b; 3. b; 4. c.

IARU Conference Report

▶▶▶*continued from page 46*

Microwaves: These bands should be specified in terms of frequency rather than wavelength. Therefore the preferred designations of the new microwave bands should be 47, 76, 120, 142 and 241GHz bands. The new bands should have their initial operation centred on 24·192GHz, 76·033GHz, 145·152GHz and 248·832GHz. The preferred operating frequency for 24GHz wideband equipment shall be 24·125GHz and the nominal working frequency for 10GHz narrow band shall be 10·36815GHz.

Frequencies above 1GHz used for communications via moonbounce should use circular polarisation. Transmitted signals except those on 2·3GHz should use right-hand circular polarisation, with opposite polarisation used on 2·3GHz.

The conference station GB1IARU, has already been mentioned in *On the Air* in our August issue. Over 5000 QSOs were made on h.f. and v.h.f, and the station was very popular. For the first time in the UK, the Home Office Radio Regulatory Department gave blanket permission for all licensed delegates to operate the station. On previous occasions, each delegate had to apply individually for a reciprocal licence. All the equipment was loaned by distributors, and the antennas were erected by members of several Sussex amateur radio clubs. ●

Uncle Ed's Page

▶▶▶*continued from page 61*

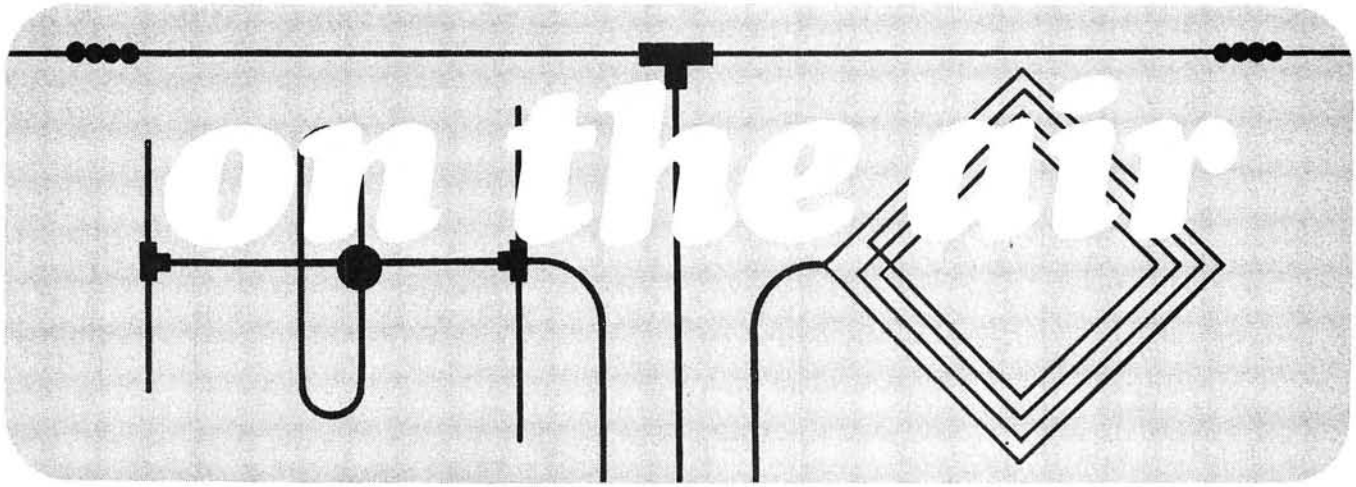
the circuit looks like two lots of 100Ω in parallel (i.e., 50Ω). The antenna therefore "sees" 25Ω in series with 50Ω, making up 75Ω. Clever, isn't it?

You could, of course, add more receivers (providing the antenna signal was large enough to stand the losses) simply by connecting further resistors to the "star" junction. The resistor values required can be worked out from the formula:

$$R = Z\frac{(P-2)}{P}$$

where Z is the circuit impedance (75Ω in our example), and P is the number of ports to the splitter network. "Port" means an input or output connection, so our one antenna/two receivers splitter has three ports.

So far as the signal loss in the splitter is concerned, by simple maths, the signal level at the "star" junction of the three resistors will be $\frac{2}{3}$ of the signal coming from the antenna, $\frac{1}{3}$ being lost across R_x. The signal level at each receiver input will be $\frac{3}{4}$ of that at the "star" junction, and therefore $\frac{1}{2}$ of that at the output of the antenna ($\frac{2}{3} \times \frac{3}{4} = \frac{1}{2}$). As the signal level at each receiver input is half that at the antenna output (remember we are talking about **voltage** here) the **power** fed to each receiver will be a quarter of that coming from the antenna, since power is proportional to voltage squared. Where has the other half of the power gone? It is dissipated in the splitter, a quarter in R_x and an eighth each in R_y and R_z. Using the dreaded decibels, the loss at each receiver input is 6dB, which corresponds to a signal of half the voltage and a quarter of the power that would have been fed to just a single receiver. But more on that subject next month.



Amateur Bands

by Eric Dowdeswell G4AR

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

Advertisements for communications receivers sometimes make a point of emphasising that double or triple frequency conversion is used in the design, as if there were some magic virtue in numbers. This is certainly not so with receivers, but how is the reader whose knowledge of radio theory is a bit sketchy to know this? The very same applies to cameras where the number of lenses is made an advertising feature, all contributing to the light loss, and where the minimum number should be the aim.

In the early days of radio, or should it be "wireless", receivers were "straight", that is the signal was amplified at the signal frequency and then applied to the detector for demodulation into an audio signal. The selectivity depended entirely upon the goodness or "Q" of the tuned circuits, improved by a certain amount of positive feedback. However the losses in the coil formers and other components of the tuned circuits were high, becoming even higher with increasing frequency. Formers were made of Paxolin or Ebonite before ceramics or ptfe and the like were used.

In 1917 the principle of frequency conversion was introduced employing the superheterodyne receiver, or "superhet" as we call it. Here the signal is amplified at signal frequency, and then fed to a mixer stage. An internally generated signal is also fed to the mixer of such a frequency that the intermediate frequency (i.f.) produced is lower than either of the input signals. the diagram of Fig. 1 illustrates this principle. This i.f. is them amplified by one or more stages where losses are low at this frequency. Hence in all superhets the major part of the receiver gain occurs in the i.f. stages.

As the i.f. stages are working at a comparatively low frequency the selectivity of the i.f. tuned circuits is enhanced, a considerable improvement on that of the signal circuits. Thus the i.f. tuned circuits can be tailored to the particular mode of signal being received, a.m., f.m., s.s.b. etc. In practice the tuned circuit, comprising inductance and capacitance, has been superseded by ceramic filters, crystal filters and mechanical filters, although the last does incorporate tuned circuits, all aimed at reducing the signal outside the required band-width by the maximum amount possible (attenuation).

Looking at Fig. 1 again it will be seen that at least two frequencies are produced at the output of the mixer, the sum and difference of the two input frequencies, the difference being chosen in practice, as mentioned already. This i.f. was around 85kHz in the early days, low enough to get the required selectivity. This rapidly gave way to the figure between 450 and 475kHz that we are accustomed to today. Why this value? A good question but it does lie between the medium and long wave bands where there are only marine and aeronautical beacons and where breakthrough from broacasting stations in that range is non-existent.

Higher i.f.s such as 1·4, 1·6, 5·6 and 9MHz have also been used in various applications. Note that the first oscillator signal is invariably higher than the signal frequency, thus obviating any possible trouble from harmonics of the oscillator. Another point is that since two frequencies are produced from the mixer, one of which is passed by the i.f. stages, it is important that the other

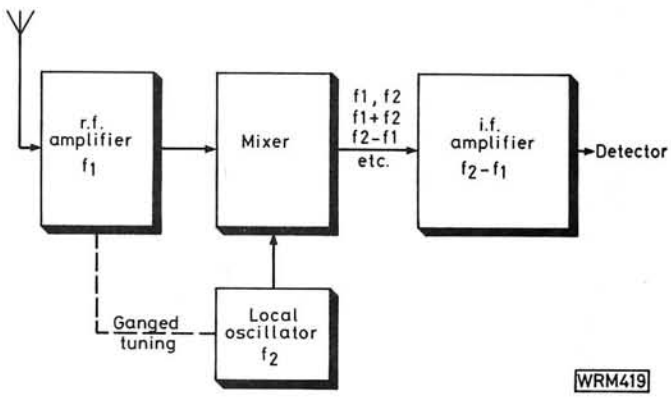


Fig. 1

(second channel or image) is adequately rejected by the signal circuits. This is more effective as the i.f. is increased, or as the number of signal tuned circuits is increased. Hence my continuing diatribe against the use of wideband filters in the front ends of receivers! At the higher frequencies wideband filters are much less effective than multiple tuned circuits against second channel problems, as the buyers of some comparatively expensive sets are finding out. More next month!

In General

In view of the difficulty, if not impossibility, of getting hold of a typical RAE exam paper readers may be interested to know that Dick Benham-Holman G2DYM is prepared to photostat a copy of the Australian paper which has 50 questions (and answers!) very similar to our own RAE and in the same multi-choice format. So, it's £1 for costs and post and packing from "Cobhamden", Beerdown, Uplowman, Tiverton, Devon EX16 7PH. Having had a look at the paper and got them all correct, I'm feeling rather smug at the moment!

Having told **S. M. Beare** of Truro, Cornwall what I thought of the 1155 receiver I get a report from him logging VK's on s.s.b. on the 7MHz band! And on only a few feet of wire for an antenna! Take back all I said. He's studying hard for the RAE and looking for another receiver but he finds the prices a bit much, even for secondhand stuff.

A real old-timer **J. R. Cond,** who used to be BRS1388 before the war, has regaled me with some of his memories of radio in those days. He raises one matter which I remember well but to which the answer has never been given satisfactorily. This was the effect of long delay echos on signals, often seconds, which inferred reflection from beyond our own ionosphere, or multiple reflections. He says that in 1934 the BBC transmitter GSB, with a power of 20kW, radiated morse characters one a minute on three days a week to enable listeners to check for such echoes. In May '36 the transmissions ceased and nothing more was heard of the matter. Anyone got anything to add?

A note from that Grand Old Man of amateur radio G2UV "Uncle Vic", licensed for 60 years, mentions that RAOTA (Radio Amateur Old Timers Assoc) has now decided to admit members who can submit proof of being involved in the hobby for at least 25 years, such as a personal QSL card, the requirement that members should have been licensed has been dropped. More info from Miss May Gadsden, 19 Drummond House, Font Hills, Long Lane, E. Finchley, London N2.

DX-ing

Tom McCrimmon G4LQM, 6 York & Albany Close, Walmer, Deal, Kent tells me of the Royal Naval ARS 21st anniversary award open to all licensed amateurs and s.w. listeners, involving the logging of RNARS members and special event stations. With over 1000 members in 40 odd countries it should not prove too difficult but Tom will tell you more.

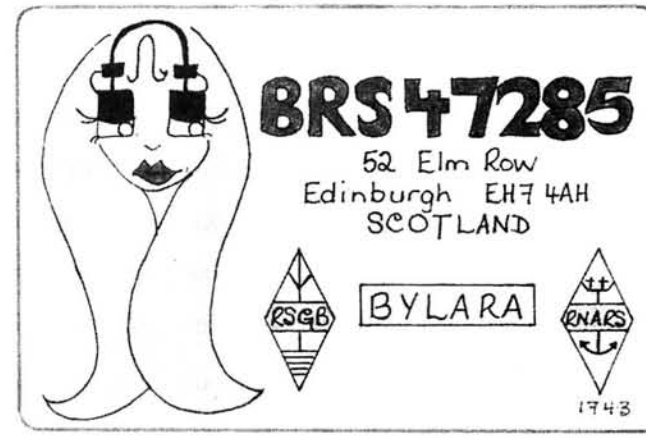
With his "O" level work over **Jon Kempster** has been able to devote more time to his FRG7, dipole for 14MHz and 20m long wire plus a.t.u. From his Berkhamsted, Herts, QTH he found 9K2DR on 15m, 6W8AR, SM4HQO/OH0/OJ0 (phew!), U2Q (QSL Box 88 Moscow), HK0EHU (QSL WD9DZV), FM7AV, XT2AW, C31DU, all on 20m. Sister second op Lorna didn't do too bad either when she could get on the FRG7, with IT9VSY, DA1WA/HB0, VS6CTH and EA8AAY also on 20m.

Robin Bayley (Near Shifnal, Salop) has come back on the scene after a long break dragging out his trusty EC10 to log CT2AP, JY3UMW, KP4CCL, OA8AF, PY7KD, TG9TL and VK2BGT, on 80m of all bands, so he hasn't lost his touch. On 40m it was AP2AD and M1WKD with 7Q7BA raising a rumpus on 20m. Log only from **D. Cox** (London N5) who has a Trio R1000 and a KW2000A (in anticipation?) and is BRS-46978 catching SV0BL, DA1WA/HB0, SU1ER, VP8QI, DU1MAT and TU2JO, 8P6KX, 4S7DJ, XT2AW and SJ9WL (Morokulien) on the 14MHz band while 21MHz produced AP2MQ, C31WK, 5B4IW and 9K2DL.

Like so many of us at this time of the year **Bill Rendell** of Truro has had little time for the receiver what with gardening and the like but did find 6W8AR on 10m at 1600GMT and VP5WJR on 20m at 2030. Another reader greatly frustrated by the high cost of amateur gear is **Stephen Littley** of Seaton in Devon and I agree that it is very difficult for the young newcomer to our hobby. But it's the old story; as long as people go on paying these ridiculous prices they won't come down. If we all went on strike and refused to buy you'd soon see matters change. The same complaints have been raised in *Radcom* but there is never a satisfactory explanation from anyone! However Stephen has one answer, as he intends to make his own QRP c.w. rig when the time comes. Well done, and you won't be disappointed. Stephen's FRG7 (secondhand!) caught SU1AA and 9M2CH on 20m and TR8DX, VS5PP, 9K2DR and 9V1JU on 15m.

David Warr (Weymouth) has been looking at the c.w. end of the bands but hasn't plucked up courage enough to put it in his log. Not to worry OM, it'll come in time. His Trio 9R59DS and G5RV in a half size version and ZL Special on 15m has now been augmented by a vertical trap antenna borrowed from friend G3ZGN and there are plans for a W3DZZ next month! Quite an antenna farm, so far! As a school leaver David is delighted to have got an apprenticeship in electronics and we all wish you the best of luck OM. The RAE in December is the next target. In the meantime he logged HH2PW, SU1AA and 5Z4OT on 10m, CO2OM, D4CBC, DU6GEN, HM1PW, lovely JT0WA, KG4TX, SV0BV/SV5 (QSL PO Box 564 Athens) on Rhodes, TR8WR, VP2MBG, XT2BG all on 15m, and UK0FAD on Sakhalin Is., VS5PM and 9Y4FS outstanding on 20m.

Anne Edmonson of Edinburgh is now BRS47285 I'm glad to report and produces her own handsome QSL cards. She is busy trying to make up an a.t.u but finds the cost of the tuning capacitors rather much for her shallow pocket. The RAE and the code test remain on the agenda for Anne. Her Realistic DX-200 and 9m-long indoor wire dragged in AP2FQ, C6ANU, CP5BJ, CX5BT, EP2TY, OY6FRA (Club station Box 343, Torshavn), and the SV0BV/SV5 on Rhodes, all on 20m s.s.b. with VU2BK on c.w.



This reproduction of Anne Edmondson's QSL card doesn't do justice to the hand drawn golden tresses of the original

Stephen Bowler (Wakefield) plus R1000 and HF5 vertical got PZ5RC, 6W8WA, ZE7JV, EP2TY (QSL Box 83 Esfahan), XT2BG on the 15m band, and OH2BR/OH0, 5B4JP and VK5WR/MM on 20m. First letter from **Philip Morris** of Swansea says he has a CR100 plus 40m-long wire and settled down on 20m to find JW2CF, KG4WM, J3AH, VP9CP, HM1TR, VP1GP, XZ5A, VP2MNQ, VR6TC, HH2A and C5ACJ, while a visit to 15m produced HP3XWV. Having come back to us from W and VE-land **Basil Woodcock** of Leeds switched on to catch up with JT0WA, ST0AS (is this old friend ST2AS?), ZP5PX and KS6O/P/OH0 on 21MHz, with AP2FQ, VK9PF and FR7AI on 14MHz.

A note from **Ed Baker** of the ISWL says the LA boys will be on 160m, 1810 to 1840kHz c.w., during the weekends Nov 13, 15 and Nov 27/29. Ed found XZ5A and that ST0AS on 20m with his SX100. In Grays, Essex, **Len Stockwell** with his FGR7 and tri-bander antenna reports in for the first time. with 20 years s.w.l.ing behind him Len should have no trouble with the RAE next December. His catches include A22BW, A35PN, TU2RK, 9U5JM on 15m with VP2VD, 5N0AAJ on 20m and notable FR0FLO on ten.

The FRG7700 of **Dave Coggins** in Knutsford, Cheshire, has acquired an r.f. amplifier (*PW* Jan 80) which has made the meter read now, especially on 10m! Dave deplores the QRM that surrounded the 7Q7 pile-ups but I'm afraid it's all part of the game OM. Nice one on 10m was the JT0WA who is also OK1DWA for cards, plus D4CBC, FR0FLO, TR8GM, VP8QG, ZD8TC, 3B8DB. On 15m it was ZD8TC again, 3B8AE/3B9, S79NLB (Box 234 Mahe) with unusual GM3MUV/CE0 on Easter Is., TU2GH and XT2AT on 20m. Antennas at Dave's QTH are a two-element quad for 10m and "various others"!

Clubland

Help! I'd need the whole of *PW* if I were to mention every club that has reported in this month! So have selected some of the new ones and others not mentioned too often. Thought they all went to sleep in the summer or went out on field days, or something. PLEASE ensure name and full QTH of PRO,

secretary or whoever is in newsletters. Three this month with no contact address or info on meeting place at all.

Farnborough & District RS. Second and fourth Weds, 1930, the Railway Enthusiasts Club, Hawley Lane, F'borough, Hants, with Sept 23 being constructional contest night, and advance notice of v.h.f. column's Ron Ham attending on Oct 28. Contact Ivor Ireland G4BJQ on Farnborough 43036.

Radio Club of Thanet. That's a new twist on names and, indeed, a new club just formed, meeting at the Birchington Village Centre at 2000 with morse classes earlier at 1930, meeting second and fourth Fridays. Anyone remotely interested in amateur radio will be most welcome says sec I. B. Gane G8HLG at 17 Penhurst Road, Ramsgate, Kent.

Milton Keynes & District RS. Second Monday, 2000, Lovatt Hall, Silver Street, Newport Pagnell, Bucks., although on Sunday Sept 13 there is a d.f. hunt on the 2m band at 1500 hours, with G8MHZ chatting next p.m. on the Raynet organisation. Sunday Sept 20 is a joint d.f. "do" with the Bedford gang. Have a word with D. O. White G3ZPA, Rose Cottage, Shenley Brook End, near Bletchley, Bucks.

Fareham RC. Weds 1930 Portchester Community Centre, Room 12, with programmes including TVI and its cure, 80m club receiver project, and home computers and systems. It's Brian Davey G4ITG, c/o 31 Somervell Drive, Fareham, Hants or 234904.

Mid-Warwickshire ARS. Hello gang! First and third Mons, 2000, 61 Emscote Road, Warwick plus get togethers for code training, d.f. work and constructional projects. This may be in time to tell you of a junk sale Sept 7 (sorry! sale of surplus equipment) and of G8UBC talking on fast scan TV on Sept 21. Have a word with XYL M. E. Palmer G8RZR, 12 Edmunds Close, Woodloes Park, Warwick.

Jersey Amateur Electronics Club. Newsletter received but nary a jot of info if anyone wanted to contact the club! Tony GJ3YLI is mentioned but everyone else seems call-less! Club call is GJ4HXJ.

Verulam ARC. Meteor scatter and other phenomena by G3WZT ought to draw the crowds on Sept 22 at the Charles Morris Memorial Hall, Tyttenhanger Green, Tyttenhanger, near to St Albans at 1930, in fact every fourth Tuesday, while second Tuesdays are informal at RAFA HQ, Victoria St., St Albans. Make a note that G3ROO will chat on QRP s.s.b. operation on Oct 27. G4JKS, who is Hilary Claytonsmith, can be reached at 115 Marshalswick Lane, St Albans, Herts, for more info.

Chiltern ARC. First come, first served will be the format for a visit to the Culham Laboratories on Sept 30 at 1930, restricted to a maximum of 30 bods. Oct 28 worth noting now when a question and answer session on TV1 will be run by an Officer from Brit. Telecom, at factory canteen of J. Hawkins, Victoria Street, High Wycombe, Bucks at 2000. Peter Stears G4LMM, 127 Hushenden Avenue, High Wycombe, Bucks, is the one to contact.

Meirion ARS. First Thursdays, Royal Ship Hotel, Dolgellau, 1930 where a warm welcome awaits one and all. You may be in time to get to a briefing on amateur radio on Sept 3 for benefit of those starting the RAE course at the club. So might as well tell you now of John Knight delivering a talk on Oct 1, subject yet to be chosen but gather it should not be missed. It's PRO Dave Morgan GW4KYZ, Penybont, Gellilydan, Blaenau Ffestiniog, Gwynedd or try Maentwrog 341.

West Kent RS. Sept 4, 2m d.f. foxhunt meeting 2000 behind M & S! All jolly mysterious! But on Sept 18 its Open Night with special display of amateur gear, working h.f. station, book sale and chaps and chappesses to answer the questions, all geared to appeal to the visitor who wants to know all about amateur radio. What an ideal opportunity to get on to the local CB mob and show them what amateur radio communication is all about. Now . . . make a note OCTOBER 2nd. Celebrated astronomer **Jocelyn Burnell,** discoverer of the pulsar phenomenon, will talk on that very subject, and who better? Her present research is on stellar X-ray sources. Worth every effort to attend this one. Contact Brian Castle G4DYF, 6 Pinewood Avenue, Sevenoaks, Kent or try 0732 56708 or office, presumably on 01-432 2256 for details.

Mid-Sussex ARC. All gatherings at QTH of G3ZMS, Marle Place, Leylands Road, Burgess Hill, W. Sussex at 1930. Junk sale on Sept 17 and Ron Roden G4GKO holding forth on his travels on Oct 1. Various informal meetings are also held each month at member's QTH's which is a chance to take along wives/girl friends to taste the rival's refreshments. Some club members have dragged out their old v.h.f. a.m. gear and thoroughly enjoyed QSOs free of all the usual squawkings. Could spread! G3ZMS at the above QTH will fill you in.

Sefton ARC. Special event station GB2NG from Nat. Giro Centre Sept 6th, Bootle, Liverpool, all bands 80m down to 70cm, all modes including RTTY, with great welcome for every visitor. Another chance for the shy to pop in and see what it is all about. Get in touch with Len Gurney G4LBJ, 1 Endborne Road, Orrell Park, L'pool.

North Bristol ARC. Fridays 1930 SHE7 (still don't know what that means!) Braemar Crescent, Northville, Bristol 7. RAE class is now full but otherwise activities are as active as ever. Try W. F. Bidmead G4EUV, 4 Pine Grove, Northville, Bristol 7.

Edgware & District RS. Second and fourth Thursdays at Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware, Middx with slow code practice beforehand, and over the air from G3ASR on 2m and Top Band, plus club net on 1875kHz at 2200 Mondays. Sept 10 is informal while the 24th is booked for the club's project evening. Chairman G3GC has written to the RSGB and Home Office on the practice of the HO to issue calls to special event stations and repeaters that contain a suffix already issued. In this case GB3GC is to be a repeater at Goole. I heartily endorse this protest since our suffixes are unique whether we are G, GB, GJ or anything else, and in general known much better by our calls than our names. It is not as though there were no other options available. What about G7 or G9 or G1??? Why pinch our calls? I'm also writing to the RSGB and HO so why not join in if you also get hot under the collar over this matter.

Maidstone YMCA ARS. As usually happens the Committee was unable to offload its burdens on to other shoulders at recent AGM!, so ploughs on for another year. Club shack is open Friday p.m.s with Sept 3 first RAE class in preparation for next May, with a good idea in an extra class dealing with basic maths on Tuesdays for those feeling in need of a refresher. Main problem though, is the people who turn up half way through the course! Note for the future, Pat Hawker G3VA and BBC video tape of the *The Secret Listeners* is booked for the autumn. Don't miss it. Graham Edy G4AXD is hon. chairman and can tell you more if you contact him at 29 Beech Road, East Malling, Maidstone, Kent, or West Malling 841021.

Cheshunt & District RC. Don't forget RAE at East Herts College Mondays 1900 to 2100 leading to May 82 RAE. Details from chairman of club Jim Sleight G30JI, 18 Coltsfoot Road, Ware, Herts or 0920 4316. Club meets Weds 2000 Church Rooms, Church Lane, Wormley, near Cheshunt, Herts.

Wireless Preservation Society. Another reminder for Sunday Sept 20 get-together with local amateurs at National Wireless Museum, Arreton Manor near Newport IOW, visitors most welcome. Talk-in GB3WM on S22 and GB3IW RB4. Ring G3KPO at Ryde IOW 62513 for more gen. Kick-off 2.30 p.m.

Echelford ARS. ("EARS for short and getting bigger") second Monday and last Thursday 1930 St Martin's Court, Kingston Crescent, Ashford, Middx, with over 30 attending average meeting for talks, junk sales, club projects etc. Regular club nets Sundays and Weds with c.w. net on Tuesdays, Top Band and 2m. Pete Gillett G4JIL, 37 Talbot Road, Isleworth, Middx. or 01-892 6092 will be glad to amplify.

Amateur Radio Club of Nottingham. 1930 Sherwood Community Centre, Mansfield Road, Nottingham every Thursday. Dates for Sept are 10th junk sale, 17th activity night, 24th talk on club's DXpedition plus colour slides.

Kidderminster & District ARC. Phew, a 16-page newsletter to wade through, letters, technical articles, news, ads, a very fine effort indeed by Jayne Parkes. You might be in time for the antenna demo on Sept 2 by Dave Yates G3PGO of the BBC Training Centre. AGM on 16th followed by films on the manufacture of junction transistors and "something big in micro circuits". On the 30th G3ZUL of Stourbridge Repeater Group talks on progress of the project. Contact J. A. Hibbert G4IYU, 11 Juniper Court, Oldnall Road, Kidderminster, Worc.

Conwy Valley ARC. Club HQ the Green Lawns Hotel, May View Road, Colwyn Bay at 1945 second Thursdays. Special event is 1430 meeting on Sunday Oct 4 and visit from RSGB President Basil O'Brien G2AMV at HQ. Meeting on Oct 8 is annual surplus sale with, it is hoped, the many newly-licensed members around to make the most of the occasion. Write to

J. N. Wright GW4KGI, Eleven, Bryn Derwen, Abergele or 823674.

Ipswich RC. Second and last Weds 2000 in the clubroom of the Rose & Crown, 77 Norwich Road, Ipswich. The room is detached from the rest of the pub so juniors need have no qualms in attending. Massive 34-page QUA newsletter reports many successes in RAE and new batch of G4's. The QUA-QUA 2m quad looks very interesting with every constructional detail given. Current excitement concerns participation in s.s.b. Field Day in early September, with ever-popular junk sale on the 30th. Drop a line to Jack Tootill G4IFF, 76 Fircroft Road, Ipswich or (0473) 44047.

Braintree & District ARS. First and third Mondays at the Braintree Community Centre, Victoria Street, Braintree, Essex, next to the bus station, with special junior member meetings on open nights, like Sept 7. Social evening on 18th and AGM on Sept 21. Braintree Tech. College has RAE course Thursday evenings starting mid-Sept so you may not be too late after all. Enrolment Sept 3, 4 between 1630 and 2000. Janet Story, 33 Redwood Close, Witham, Essex can fill in the details.

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

Reports to: Charles Molloy G8BUS
132 Segars Lane, Southport PR8 3JG.

The perennial question of the internal medium wave ferrite rod antenna that is fitted to many receivers these days takes a new twist with a request from reader **Mazar Memon** of Abu Dhabi who asks "can you tell me a way to do away with the ferrite rod antenna?" For the benefit of newcomers to the column it is not possible to use a medium wave loop antenna with a receiver that has an internal antenna of its own. The loop is only effective when it is the only antenna in use.

It is not easy to get rid of the ferrite rod antenna. It means butchering the receiver, so any guarantee will be void. If you are unsuccessful in carrying out the modification then it is rather unlikely that you will find anyone to "repair" the set for you. Even if you do succeed you will probably reduce the resale value so it is really much better to look for a receiver without an internal antenna for use on the medium waves. It is easy to check this. Tune round the band without connecting an external antenna. If you pick up any strong signals then there must be an internal antenna. If the receiver has a metal cabinet then the ferrite rod must be mounted externally on the back or it will not work.

Modifying the Receiver

If you join a loop to a portable and then try to null out a station with it you will find that you do not get a null as the signal is still being picked up by the internal antenna. Why not mount the receiver on a shelf fixed to the centre of the loop in such a way that the nulls of loop and internal antenna coincide. You can then rotate the two together and you are in business. The nulls of a ferrite rod antenna lie along the direction of the rod in opposite directions and the nulls of the loop are at right angles to the plane of the windings.

In spite of the Heath Robinson appearance this arrangement really does work. No need for a coupling winding on the loop as coupling will be by induction between the loop's main winding and the internal antenna. Not only will you now be able to null

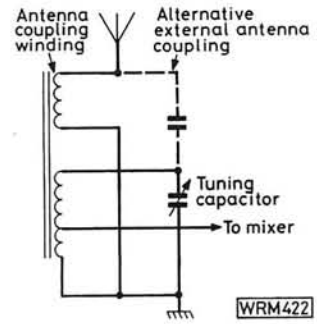


Fig. 1: Antenna coupling winding

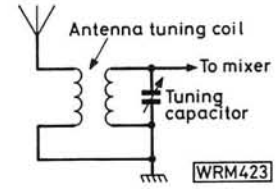


Fig. 2: A typical ferrite rod antenna

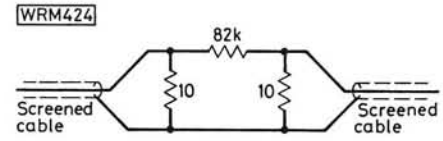


Fig. 3: Receiver output audio attenuator

out interference but you will get a boost to wanted stations as a bonus. This method is suitable for portables but is not really feasible with a large heavy set like the DX160. Operation is simple, tune in the station you want on the receiver, boost the signal with the loop tuning control, rotate loop and receiver together to reduce QRM.

Readers' Letters

Does anyone know of a source of supply for a s.s.b. adaptor for a Grundig Satellit 2000? Disabled reader **R.A. Goulder** of Roehampton picked up a secondhand 2000 in good shape but so far he has been unsuccessful in locating an adaptor. Replies to me please and I will forward them. Our reader has constructed several 20 inch loops for himself and friends and his interest in medium waves is in Spanish DXing.

"The other day I discovered something which I cannot remember ever having seen reported" writes **Duncan Breckels** from Marks Tey in Essex who goes on to say. "The pages in the *World Radio and TV Handbook* that list time signal stations also refer to a station at Allouis in France on 163·84kHz. Knowing that Allouis carried 'France Inter' on 164kHz (1829 metres long wave) I was slightly puzzled wondering why there was no heterodyne. Then I had a hunch, tuned to 164kHz, switched on the b.f.o. and discovered the answer. The transmitter is amplitude modulated with the programme of France Inter and frequency modulated with second pulses. I wonder what the emission code is for this?"

Frankly, I did not believe this until I tried it. You can hear the one second pulses quite clearly with the aid of a b.f.o. and details of the transmission are on page 533 of the 1981 edition of the *WRTH*. "I know that this is one of the easiest signals to receive but I can't remember anyone mentioning its hidden secret before" concludes Duncan.

MAIL ORDER

FROM

by two way FREEPOST

MORSE KEYS

HK 707	Straight Up/Down keyer	£11.44
BK 100	Semi-automatic mechanical bug	£17.88
MK 702	Up/Down keyer on marble base	£22.43
MK 702	Manipulator	£22.43
MK 704	Squeeze paddle	£14.38
MK 705	Squeeze paddle on marble base	£22.43
EKM 1A	Morse code practice oscillator	£8.63
MK 1024	Automatic memory keyer	£135.13
EK 150	Semi/Automatic keyer	£74.75

LINEAR AMPLIFIERS

2M10-80P	144MHz 10W input/80W output with 9dB preamp	£138.00
2M25-150P	144MHz 25W input/150W output with 9dB preamp	£184.00
2M10-150P	144MHz 10W input/150W output with 9dB preamp	£209.88
2M3-150P	144MHz 3W input/150W output with 9dB preamp	£209.88

G. WHIP Mobile Antennas

Tribander 10-20 Slide	£25.88
L.F. Coil 40/80/160 MTS	£6.56
L.F. Whip Telescopic	£4.26
Multimobile 10-20 Auto	£30.48
M/Mobile Coil 40/80/160	£6.56
M/Mobile Whip Telescopic	£4.26
Flexiwhip 10M Mast	£18.11
F/Whip Coils 40/80/160	£6.56
Base Standard	£6.00
Base Heavy Duty	£6.50
Extenarod	£12.00

SHURE MICS

201	Hand ceramic omnidirectional high impedance	£14.49
202	Hand ceramic noise reducing high impedance	£15.18
401A	Hand controlled magnetic high impedance	£16.56
401B	Hand controlled mag. low impedance (200 ohms)	£16.56
444	Desk adjustable height controlled magnetic	£32.43
526T	Desk controlled response transistor preamp	£39.33

DUMMY LOADS

DL20	30W DC-150MHz with PL259 connector	£6.33
T-80	80W DC-500 MHz with SO239 connector	£22.94
T-150	150W DC-500MHz with SO239 connector	£32.78

STILL HELPING WHERE IT HURTS

Here's a list below to make buying easier for you – Work it out yourself – You'll see – It really is easy!

Product	*List Price*	*Deposit*	*12 Payments*
Yaesu FT 902DM	£799	£312	£40.55
Yaesu FRG 7700/S	£309	£119	£15.89
Yaesu FRG 7700/M	£389	£160	£19.01
Yaesu FT 101ZD/FM	£599	£250	£29.05
Yaesu FT 101ZD/AM	£585	£225	£30.02
Yaesu FT 101Z/FM	£529	£190	£28.27
Yaesu FT 101Z/AM	£515	£195	£26.61
Yaesu FL 2100Z	£385	£155	£19.20
Yaesu FT 225RD	£565	£220	£28.76
Yaesu FT 707	£529	£200	£27.49
Yaesu FT 290	£229	£100	£10.82
Standard C78	£219	£99	£10.04
Standard C58	£247	£107	£11.69

Many Other Items Available on Similar Terms
Call for Details

MICROWAVE MODULES

MMT 432/28S	£149.00
MMR 432/144R	£184.00
MMT 28/144	£199.00
MMT 144/28	£99.00
MMC 28/136	£27.90
MMC 28/156	£27.90
MMC 28/144	£27.90
MMC 144/any IF	£27.90
MMC 144/28LO	£29.90
MMC 70/any IF	£27.90
MMC 432/28S	£34.90
MMC 432/144S	£34.90
MMC 1296/any IF	£32.20
MMC 050/500	£69.00
MMA 28 preamp	£14.95
MMA 144V preamp	£34.90
MMV 1296/28	£32.20
MML 144/100 linamp	£142.60
MML 432/100 linamp	£228.85
MML 144/25 linamp	£59.00
MML 432/50 linamp	£119.00
MM2000	£169.00

SWAN CUBIC

ASTRO 103	£799.00
PSU	£139.00
1500Z linear	£399.00
ST1A ATU	£134.00
ST2A ATU	£173.00
ST3 ATU	£122.00

ROTATORS

Skyking SU 4000	£92.00
Skyking 250	£39.50
Emoto 502CXX	£139.75
KR 400RC	£92.85
AR 40	£59.00
KR 950 2A	£50.00
Rotor Bearing	£12.00

*All items VAT and carriage paid.

UNADILLA/REYCO

Antenna Traps–
Precision moulded coil forms stainless – hardware – Aluminium tube irridit finish – Coated aluminium wire. Fully waterproofed.
Available 7/14/21 MHz £11.99

W2AU BALUN

3.5/30 MHz 2.5 Kw with Lighting Arrestor – Suitable Vees, Yagis, Doublets, Quads etc. **£11.99**

STANDARD

C8800 2m, Tcvr	£252.00
C7800 70cms Tcvr	£275.00

DENTRON

GLA 1000 Linear Amp 10/80 1Kw	£295.00
MLA 2500 Linear Amp 10/160 2Kw	£699.00
MT 3000 3Kw Tuner/SWR/Dummy Load	£275.00

USED EQUIPMENT

Over 100 pieces HF/VHF equipment available.
Call for details.

SWR/RF POWER METERS

SWR 25 3.5/170 MHz	£12.94
LEADER LPM 885-HF 1Kw	£58.00
HANSON 3.5/150MHz 200w	£28.75
REECE UHF 74 144/432	£16.28
HANSON FS 500H 1.8/60MHz 2Kw	£67.85
OSKAR SWR 200 3.30 MHz 2Kw	£40.00

FDK Multi 700EX **£199.00**

FDK Multi 750E **£299.00**

Send 30p for our bumper bundle literature

No Quibble Guarantee
Same Day Despatch
All Items Advertised

Choose your AMTECH here

Amtech 100 Mobile Match	£16.95
Amtech 200 Random Wire ATU 10-160m 200w pep	£29.95
Amtech 300 Random and Coax Fed ATU 300w pep	£43.95
Amtech CW 250 – The most outstanding CW filter available	£24.90
Amtech Channelguard – A plug in device to eliminate those unwanted stations Decoder	£15.25
Sender	£7.25
Amtech FM7: FM Demodulator for FRG 7	£11.90

ANTENNAS

Wide range in stock including JAYBEAM – HYGAIN – CUSHCART – ASP TELECON – HOKUSHIN etc.

Bantex 5/8 whip complete antenna	£8. 99
Bantex ¼w whip complete antenna	£3.50

AMCOMM SERVICES

194 NORTHOLT ROAD, SOUTH HARROW, MIDDX.
Telephone: 01-864 1166, 01-422 9585

Opposite South Harrow Tube Station on Piccadilly Line

Showroom Opening Hours
Tuesday to Saturday 9-5.30
Sunday by Appointment

All items over £100 available on easy terms at List Price

NO POSTAGE REQUIRED

AMCOMM SERVICES (PW1),
FREEPOST,
HARROW HA2 0BR.

Please send me.....

at.....enclosed cheque/P.O. for

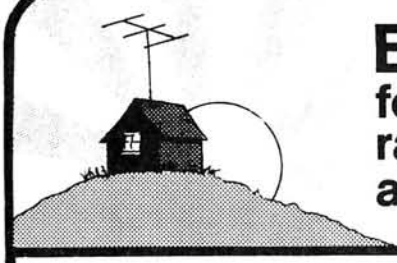
.....or charge my VISA/ACCESS

Nr.....

Name.....

Address.....

..... Post Code .....



Books for radio amateurs

RSGB Publications

A Guide to Amateur Radio (18th edn, paperback)	£3.07
A Guide to Amateur Radio (18th edn, hardback)	£6.32
Amateur Radio Awards (2nd edn)	£3.41
Amateur Radio Techniques (7th edn)	£6.16
OSCAR – Amateur Radio Satellites	£4.50
Radio Amateurs' Examination Manual (8th edn) (1979-81 syllabus)	£2.73
Radio Communication Handbook (5th edn) Vol 1	£10.20
Radio Data Reference Book (4th edn)	£5.02
Test Equipment for the Radio Amateur (2nd edn)	£5.86
Television Interference Manual (2nd edn)	£1.95
VHF/UHF Manual (3rd edn)	£8.70
World at their Fingertips	£4.28
Logbooks	
Amateur Radio Logbook	£2.86
Mobile Logbook	£1.14
Receiving Station Logbook	£2.68
Wall maps	
Great Circle DX Map	£2.12
IARU QTH Locator Map of Europe	£1.34
QTH Locator Map of Western Europe	£1.34
World Prefix Map in full colour	£2.23

Other Publications

A Course in Radio Fundamentals (ARRL)	£3.24
Active Filter Cookbook (Sams)	£12.69
All About Cubical Quad Antennas (RPI)	£2.92
Amateur Television Handbook (BATC)	£2.39
Antenna Anthology (ARRL)	£3.28
ARRL Electronics Data Book	£3.58
Beam Antenna Handbook (RPI)	£4.11
Beginner's Handbook of Amateur Radio (Sams)	£8.26
Better Short Wave Reception (RPI)	£3.33
Care & Feeding of Power Grid Tubes (Varian)	£2.98
CMOS Cookbook (Sams)	£9.59
FM & Repeaters for the Radio Amateur (ARRL)	£3.67
Hints and Kinks for the Radio Amateur (ARRL)	£3.11
Practical Antennas for the Radio Amateur (SCELBI)	£8.02
Radio Frequency Interference (ARRL)	£2.67
RTTY the Easy Way (BARTG)	£1.14
Shortwave Listeners Guide (Sams)	£4.44
Simple Low-cost Wire Antennas (RPI)	£2.83
Single Sideband for the Radio Amateur (ARRL)	£3.32
Solid-state Basics (ARRL)	£3.89
Solid-state Design for the Radio Amateur (ARRL)	£5.56
The ARRL Antenna Book	£3.94
The Complete Handbook of Slow Scan TV (Tab)	£5.76
The Radio Amateur's Handbook, 1981 (ARRL)	£8.56
Understanding Amateur Radio (ARRL)	£4.06
World Atlas (RACI)	£1.91
World Radio TV Handbook, 1981 (Billboard)	£10.62
80m DXing (CTI)	£3.03
99 Ways to Improve Your Short-wave Listening (Sams)	£4.44

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

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

Radio Society of Great Britain
35 Doughty Street, London WC1N 2AE
Telephone 01-837 8688

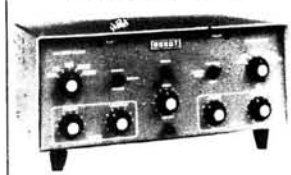
J. BIRKETT

(Partners: J. H. Birkett, J. L. Birkett)
Radio Component Suppliers
25 The Strait, Lincoln. LN2 1 JF
Telephone: 20767

POWERFUL 250 VOLT 50Hz SOLONOID 1" TRAVEL @ £1.50.
MOTORISED 23 WAY ROTORARY STUD SWITCH MOTOR 50 Volt 50Hz Approx. 50 Revs Per Min., Unit very useful for Light Displays, Chasers etc @ **£3.30.**
MERCURY SWITCHES 30p each.
VITALITY LAMPS TUBULAR MBC 28 Volt 0.08 Amp **5p** each, 50 for **£2.**
MBC LAMPHOLDERS with Mounting Bracket 4 for **25p.**
TOGGLE SWITCHES On-Off at 5 for **£1.**
LOW PROFILE SUB-MINIATURE P.C.B. MOUNTING 12 VOLT SPCO RELAY at **60p** each.
4" × 3" FINNED HEAT SINK Drilled for Two 2N 3055 @ **60p.**
TRIACS 100 PIV 2 AMP @ 3 for **60p,** 100 PIV 800mA 4 for **60p.**
MAINS TRANSFORMER 240 Volt Input, Output 24 volt Tapped at 14 volt 1 amp @ **£1.30** (P&P 30p).
ADJUSTABLE 0 TO 100 Sec. TIMER MOTOR 24 Volt 50Hz @ **£1.50.**
1p SLOT MACHINE AND REJECT BUTTON ASSEMBLY with 50 Volt Solonoid and Micro Switch etc. @ **£1.50.**
MOTOR WITH GEAR BOX OPERATING 2 MICRO SWITCHES By Cams 50 Volt AC Price **£2.50.**
TUBULAR M.E.S. LAMPS 60 Volt 3 Watt, 5 Lamps in Series For Mains Operation, at **5p** each, 100 for **£4.**
4700uf 15 v.w. WIRE ENDED ELECTROLYTIC @ 20p.
TOGGLE SWITCHES 2 Pole Make 2 Pole Break 3 for **£1.**
BLACK RENDAR INSTRUMENT KNOBS ¼" Spindle 6 assorted for **£1.**
FRUIT MACHINE MULTI WAY STEPPING RELAYS with Large Switch Contacts Brand New at 2 for **£1.60.**
BRIGHT 4 DIGIT 7 SEGMENT DISPLAY Complete with 5 volt Bulbs and Green Filter, size of Unit 4⅛" × 1⅝". Very useful for counting. Price **£2.60.**
X BAND GUNN DIODES with data @ **£1.65.**
SILCONEX ANALOG SWITCH DG182BA with data @ **£1.30.**
6514/5 CMOS 1024X4 RAM with data @ **£1.60.**
TANTALUM BEAD CAPACITORS .1uf 35v. @ **10p,** .33uf 25v.w., 1 10p, .47uf 35v.w., @ **10p,** 2.2uf 35v.w., @ **10p,** 3.3uf 16v.w., @ **10p,** 4.7uf 16v.w., @ **10p,** 6.8uf 25v.w., @ **10p,** 10uf 10v.w., @ **10p,** 22uf 25v.w., @ **25p,** 47uf 10v.w., @ **30p,** 100uf 20v.w., @ **40p.**
SUB-MINIATURE EMCAP DISCS .01uf 100v.w., @ **5p** each.
VHF FETS J304 @ **30p,** BF 256C @ 4 for **75p.**
TRW UHF POWER TRANSISTORS FT 1200MHz PT 4642 @ **£2.50.**
10X10pf DIFFERENTIAL AIR SPACED TRIMMER @ 22p.
MULLARD H.F-VHF 40 WATT SSB-FM 26 To 70MHz POWER TRANSISTOR with data Type 587 BLY @ **£3.**
MULLARD VHF TRANSISTORS BLY 55 175MHz 4 Watt @ **£2.50.**
MULLARD UHF TRANSISTORS BLY 97 175MHz 4 Watt @ **£3.**
MULLARD UHF TRANSISTOR FT1000MHz BFR 64 @ **£4.**
MULLARD VHF TRANSISTOR 570 BLY 40 Watt SSB-FM with data @ **£8.30.**
MULLARD UHF MODULE 390-512 MHz 12 Volt with data @ **£12.50.**
MINIATURE VARIABLE CAPASCITOR 10 + 10 + 10pf @ **75p.**
FERRANTI TRANSISTORS ZTX 108 or ZTX 213 both @ 6 for **50p.**
TEXAS D.I.L. REED RELAYS @ 40p each.
MINIATURE TUBULAR TANTALUM CAPACITOR 1uf 35v.w., @ **10p,** 6 for **50p.**

Please add 30p for post and packing. Orders over £3 post free.

ROBOT '400' SSTV



State of the art, full brightness, non fading pictures on a normal TV monitor. Full send/receive facilities & easy to operate. Send 14p stamp for details & special prices of new & s/hand SSTV gear.

There are approx 14000 SSTV stations transmitting from 130 countries.

AERO & GENERAL SUPPLIES (SSTV)

Building 33, East Midlands Airport,
Castle Donington, Derby DE7 2SA.
Tel: (0332) 812446. Telex: 37522.

NEW EQUIPMENT AT SPECIAL PRICES

SWAN ASTRO 150 HF Transceiver (RRP £613). **£535** incl. VAT. Plus Delivery £9.

NEC CQ P2200E 2M FM Transceiver 3 Watts out (9 Channels) **£135** incl VAT. Plus Delivery £2.

SADELTA TABLE MICS (Fitted Processor and Pre. amp. **£27** incl VAT and Delivery.

Quality crystals for 2 metres HC25/U £1.65 each incl. VAT.

S0	TX 12·0833	RX 44·7666	R4	TX 12·0916	RX 45·0000
S23	TX 12·1312	RX 44·9583	R5	TX 12·0937	RX 45·0083
R0	TX 12·0833	RX 44·9666	R6	TX 12·0958	RX 45·0166
R3	TX 12·0895	RX 44·0895	R7	TX 12·0979	RX 45·0250
R8	TX 12·1000	RX 45·0333	R9	TX 12·1020	RX 45·4166

VALVES EL84/6BQ5 70p each incl. VAT. EF184/6EJ7 80p each incl. VAT. Please add 20p for post and packing for any quantity.

WE STOCK COMPONENTS, HARDWARE, CABLES, ANTENNAS Etc.
NEC SWAN/CUBIC FDK YAESU MICROWAVE MODULES
DAVTREND WELTZ etc.

William Munro (Invergordon) Limited
100 High Street, Invergordon, Ross-shire IV18 0DN
Tel: 0349 852351 **Access Barclaycard** **Telex: 75265**

Short Wave Broadcast Bands

by Charles Molloy G8BUS

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

Long Wave Loops

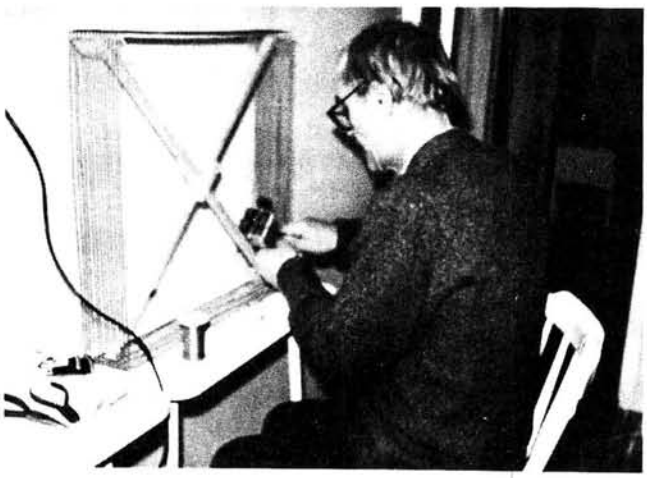
From Alicante in Spain comes an interesting letter from expatriate **Ian Miller** who wants to listen to BBC Radio 4 on 200kHz (1500m) on the longwaves. "Trials here in Spain make it clear that local QRM indicates some sort of directional antenna is necessary. There is also interference from Morocco (Azilal) which although 9kHz off, has 800kW pouring out and is relatively near." Ian wants to construct a longwave loop and he wonders if there is a formula available to calculate the inductance of a loop so that he can work out the frequency coverage with various combinations of varicaps and loop turns.

The standard formula for the inductance of a solenoid can be adapted to loops as follows:-

$$L = \frac{4\pi N^2 A}{1000B} \text{ microhenries.}$$

where N = number of turns
A = area enclosed by one turn, in sq cm.
B = width of winding in cm.

It is worth remembering that inductance is only one of the factors involved. The loop has a self capacitance which depends on the spacing between the turns and this can affect the tuning range. If the coupling between the two windings is tight then the impedance/reactance of the feeder and receiver input can be reflected into the loop to detune it. Loop construction is largely a question of trial and error but the formula will give a guide to the number of turns required.



Reader R. A. Goulder and his loop

Tape Recorder Connections

Reader **G.N.B. Corry,** G8RSD, likes to have a tape recorder joined to his receiver while he is DXing and he does this by inserting an attenuator in the lead between the receiver earpiece socket and the recorder microphone socket (Fig. 3.). "This means listening via the cassette monitor socket for tuning the receiver" observes our reader. He reckons that lower distortion will be obtained this way than by the normal method of connecting a lead from the recorder to the 8 ohm receiver output.

DX Heard

Local radio DXing interests **Ted Jones** of Woking in Surrey who says "I play around with my portable radio on the medium waves and have picked up Manx Radio on 1368kHz (219m), Radio Solent on 999kHz (300m), Radio Victory in Portsmouth on 1170kHz (256m) and Radio Brighton on 1485kHz (202m)". Manx Radio is increasing power and should soon be heard further afield. It has been logged in Japan, believe it or not!

Duncan Breckels reports hearing Algeria on both 531kHz and 549kHz, the BBC Carfax experimental transmission on 526·5kHz, Devonair (Torbay) on 954kHz (314m) as well as a BBC harmonic on 1620kHz (twice 810kHz).

In spite of the lowering sunspot number, fadeouts on the short waves have increased recently. SWLs who are new to these bands have been surprised and disappointed when their favourite programme which normally may come roaring in, has suddenly disappeared or is reduced in quality and strength so that the programme is hardly worth listening to. Why does this happen and is there anything we can do to combat it?

Broadcasting on the short waves is almost entirely by means of radio waves that have travelled away from the earth's surface into the ionosphere where they are refracted, or bent, so that they return to earth with little reduction in strength some considerable distance from the transmitter. The ground wave is attenuated rapidly at these frequencies and it is only if you live fairly close to the transmitter that you will receive the programmes this way.

Ionosphere

The ionosphere, located some 160 to 640km above the earth's surface, consists of rarified gas, kept in electrically charged state by radiation from the sun. It is because it is electrically charged (ionised) that it refracts radio waves and its ability to do so varies in sympathy with the amount of radiation from the sun. There are regular, predictable changes between day and night, winter and summer and the maximum and minimum of the eleven year sunspot cycle.

There are also unpredictable periods when reception is poor or non-existent which are caused by hard radiation (X-rays) from the sun. Fadeouts, sudden ionospheric disturbances (s.i.d.s) occur during the daytime and do not last long but are usually followed by a period of world wide unsettled reception. There is nothing that you can do during an s.i.d. but in the period that follows you may be able to improve reception by trying a lower frequency band. If the broadcast you want is on the 31m, 25m and 19m bands and reception is normally best on 19m, then try 25m or even 31m. You may find that reception is a bit better there.

Some DXers monitor the frequency standard station WWV in the United States which can be found on 10MHz, 15MHz and 20MHz. It gives ionospheric information at 18 minutes past the hour. I have made little use of this facility for if reception is poor you probably won't hear WWV and if it is good then why bother? Details of this service are obtainable from WWV, 2000 East County Road, Fort Collins, Colorado 80524, USA. I was going to leave it at that when it occurred to me that readers might be interested in a dodge I use occasionally when conditions are poor and I really want to hear a broadcast.

Diversity Reception

At first sight there would appear to be little for the DXer or s.w.l. in this type of anti-fading set-up. Space Diversity, the system used commercially, uses two or more antennas spaced

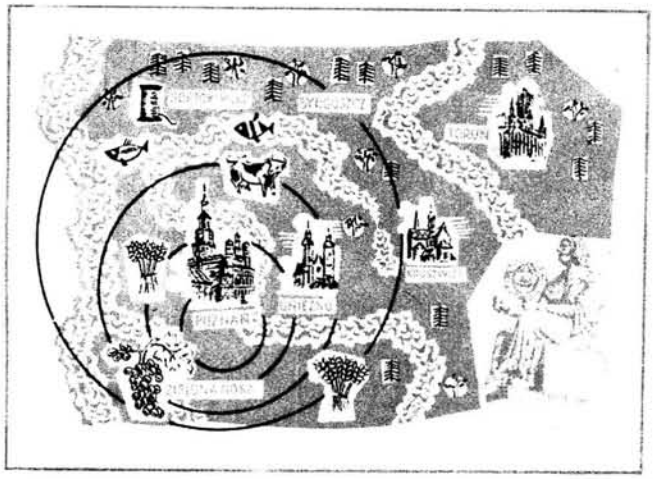
several wavelengths apart, each feeding a separate receiver. The receiver outputs are combined in such a way that the strongest signal at any instant is the one heard at the single loudspeaker and since it is unlikely that the fading pattern on the slightly different paths from each path to the transmitter will be identical, the system is effective at countering the effects of fading.

There is also frequency diversity, which requires two or more transmitters operating on frequencies some way apart. This condition is often met on the s.w. broadcast bands where it is quite common to find the same broadcast on two or three bands at the same time.

No need for special gear at the receiving end. The simplest of receivers will do: last time I used my Vega 204 with whip and the BRT400. Place the two loudspeakers close together. Tune in the wanted signal from one band on one set and turn down the volume. Tune in on the second band with the second receiver and adjust the audio level slightly lower than normal. Now turn up the audio gain on the first set and the operation is complete. Your ear will automatically select the louder of the two signals at any moment and if you listen from the far side of the room you will get best results. A rather crude but effective way of achieving an improvement when conditions are poor.

Broadcasts Heard

"What is Radio Polonia?" asks **R. W. Dunn** of Pyford in Surrey who picked up a broadcast with this announcement on his Panasonic DR28. Radio Polonia is the official title of the external service from Poland. Until recently it was called Radio Warsaw. I don't think the change is an improvement as the new title brings a vision of sausages!



A QSL card from Radio Warsaw

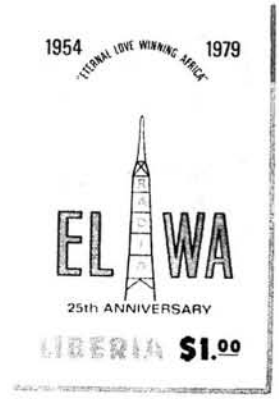
Radio New Zealand has come in regularly at 0655 at 15·845MHz for **Stuart Perry** (London), who uses an SRX30 and 22 metre longwire with antenna tuning unit. Stuart enclosed three international reply coupons with his report and back came a QSL card in 14 days. The 11 metre band has attracted **T. E. Flint** of Skelmersdale in Lancashire. Using his SX200 with an f.m. tape antenna, he heard the Voice of America (Greenville USA) on 26·04MHz at 1500.

"This is a transmission for circuit adjustment purposes" was picked up on approx 13·98MHz by **Andrew Scott** who asks what the exact purpose of this transmission is. This is not a broadcasting station. It is a commercial station and it is illegal to listen deliberately to this type of station. The recording is used so that engineers can set up the circuit or perhaps just as an interval signal prior to use.

ELWA

Fourteen year old **David Chadwick** of Bury would like to know more about Radio ELWA which is located at Monrovia in Liberia. He wonders if this station broadcasts in English.

Radio ELWA is a religious station which has been on the air for many years. Its broadcasts are intended for reception in Africa and the home service, which is in English, is on the air from 1900 to 2300 on 4765kHz on the 60m band. The English part of the international service can be found on 11·86MHz in the 25m band from 1345 to 1630 on Sundays and daily from 2015 to 2115. The station does QSL (3 IRCs for an airmail reply) its address being Radio ELWA, Box 192, Monrovia, Liberia.



A postage stamp commemorating the 25th anniversary of Radio ELWA

Readers' Letters

ZL2TKT, who is **A. C. Verry,** writes to say that he enjoys reading about other people's DX, their equipment etc. His receiver is an Eddystone 750 with a forced change to digital readout, through wear. It is worth fitting digital readout to some old receivers. I rarely look at the scale on my BRT400 these days and there is a certain fascination in watching the numbers change on the digital display.

"I am a regular reader of your column" writes **E. D. F. Dawson** from Salisbury in Zimbabwe who goes on to express surprise that many new receivers do not have antenna tuners. He refers to the *PW* report in the March 1981 edition which mentioned that the FRG7700 did not like a directly connected longwire above 2MHz. "Presumably it does not have a built-in trimmer." Modern solid state receivers do not have the same dynamic range as the older valve types which is a nice way of saying they overload easier. The modern receivers though are extremely sensitive and will pull in stations from all over the world with quite a short antenna such as a whip.

Reader **T. W. G. Elsenham** refers to the Fisk Solariscope which used to be available in radio shops. It is a cylinder with a map of the world printed on the outside. Over the cylinder you place a second, transparent cylinder, one for each month of the year, which has shadow markings on it. By rotating the outer cylinder over the inner you can find out which parts of the earth are in darkness at any hour. A very useful device for the DXer which although no longer available new, can sometimes be seen on offer in the small ads columns.

VHF Bands

by Ron Ham BRS15744

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

Although the sun has been relatively quiet and 10m conditions generally poor, my readers have been as busy as their spare time permits getting the most out of the extensive Sporadic-E disturbances which have influenced the range of radio signals between 30 and 80MHz and at times 30 to 150MHz.

Solar

Despite the fact that **Ted Waring,** Bristol, counted 22 sunspots on June 21, 56 on the 27th, 22 on July 3, 5 on the 6th, 44 on the 10th and 63 on the 13th, as far as radio noise is concerned, the sun between June 20 and July 20 was quiet. **Cmdr Henry Hatfield,** Sevenoaks and I recorded varying degrees of solar radio noise, at 136 and 143MHz respectively, between June 23 and 27 and again on July 12 and 19. This combined optical and radio observation adds more weight to the argument that not all visible sunspots are active and that only by consistent observations of the sun with all means, optical, radio, X-ray etc., will we ever fully understand the complexities of our own variable star.

The 10m Band

Very little DX appeared on the 10m band between June 21 and July 20 and at times the band was absolutely dead. During this 30 day period I received signals from the International Beacon Project stations in Bahrain A9XC on 11 days, Cyprus 5B4CY 9 days, Germany DL0IGI 12 days and DK0TE 2 days, Norway LA5TEN 4 days and South Africa ZS6PW 4 days. The few signals from DK0TE and LA5TEN were mainly due to Sporadic-E disturbances. Ted Waring's beacon log is similar to mine with the addition of ZS6DN on a few days and for the first time I heard, possibly a new South African beacon, ZS3HL on about 28·23MHz, at 0930 on July 2 and Ted heard it at 1453 on the 13th.

A copy of *10 Metre News and Views* is available, for just a s.a.e., from Jeff Harris G3LWM, The Oaks, Cricketfield Lane, Bishops Stortford, Herts. This most interesting gen. sheet is prepared by G3LWM, G3YPZ and G3ZEV and printed by Jeff using a PET 2001 computer and a Centronics 308 Printer.

RTTY

Congratulations to **Phil Hodson** G8RBY, Melton Mowbray, who made his first time 2 way RTTY contact north of the border with **Jack Wilson** GM3KJF in Ayr on 2m during June 12. In the period June 21 to July 20 I received signals from 50 RTTY stations on 20m spread over 10 countries, CN, DL, EA, F, I, HB9, OE, OH, SM and UT. I also copied 2-way contacts between HB9BFU and I8AZQ around 0930 on June 27, OH3CV/OHO1 and I0EMV at 0940 on the 30th, DJ5QU and SM5FXG around the same time on July 16, not forgetting a CQ from a YL Jacquie and OM Regis team F6EFX/F6DXY from Avignon at 0852 on the 19th and a QSO between DJ2MJ and EA4QR around 0918 on the 20th.

Sporadic-E

During the big Sporadic-E disturbance on June 11, **David Appleyard,** Uppsala, Sweden, heard Jimmy Young on BBC Radio 2 between 1100 and 1200 on 88·45MHz with his Panasonic DR49 receiver. David sent me an interesting tape recording of this Band II opening which also included signals he received from French and Italian stations.

East-European broadcast stations were very strong between 66 and 73MHz during the Sporadic-E disturbances on June 24, 29 and July 8, 9, 10, 15 and 20 when I counted 16, 10, 29, 23, 38, 39 and 32 of these stations respectively, as well as a variety of continental radiotelephone signals between 40 and 50MHz. **Harold Brodribb,** St Leonards-on-Sea, Sussex, using an ex-RAF RL85 communications receiver, also heard these strong broadcast signals on July 6, 8 and 9 and at 1620 on the 8th he counted 32 stations.

The disturbance on July 10 was extensive and spread to Band II in the afternoon and the 2m band during the early evening. **John Williams,** Cheltenham, using a 1957 Ekco A320 receiver with its internal antenna and a Fidelity RAD26 with its telescopic antenna, received several broadcast stations from Spain between 92 and 98MHz and **Robert Ventress,** Storrington, Sussex, using a Bang-Olufsen 1600 and a set top dipole heard at least a dozen signals from Spanish stations between 1600 and 1700. In Hinckley, Leicester, **Mark Lynn,** using a Grundig Concert Boy 1100 and a Sony CF47L, both with their own telescopic antennas, logged about 40 stations, excluding BBC 2, 3, and 4, mainly from Italy and Spain between 87 and 100MHz. "Even some BBC and IBA local stations were blotted out by these signals" writes Mark who has also heard AFN Madrid on 100·2MHz. Between 1520 and 1700 GMT, Phil Hodson G8RBY, worked 7 Spanish stations on 2m f.m. and heard a Portuguese mobile in Lisbon, and **Petra Suckling** G4KGC worked a 2m station in Gibraltar and was told that a CN was working into the UK. Phil's total count was 27 different Spanish stations heard on 2m including the pre-fix 'EC' which he says is the Spanish novice licence.

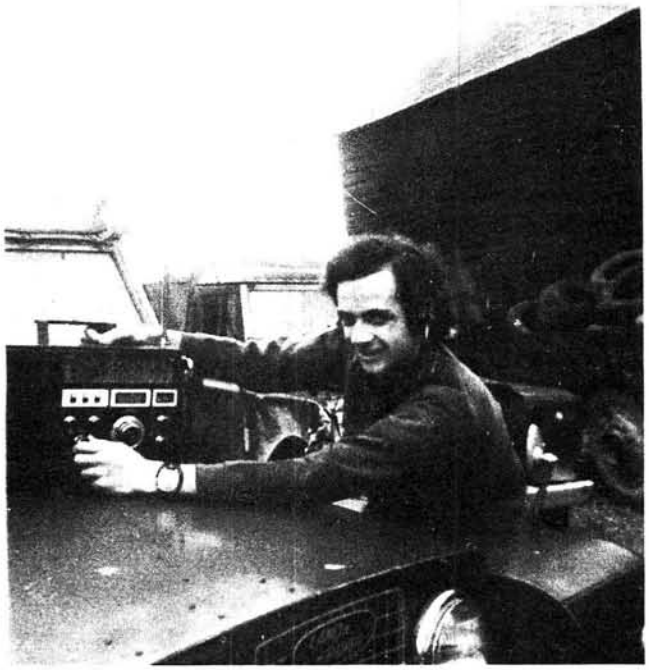
"This was the best ever day I've experienced for DXing especially on v.h.f. f.m." writes **Ed Baker,** Cramlington, Northumberland, who also received about a dozen stations from Spain in Band II between 1500 and 1800. Ed, who uses a Hallicrafters SX62A communications receiver and a dipole antenna cut to 95MHz, at 30ft a.g.l., also logged stations from Czechoslovakia, Hungary and Poland between 66 and 72MHz.

Also up north, **R. C. Taylor,** Glasgow, using an Armstrong 624 fed by an indoor dipole, logged about 14 stations, mainly Spanish, in Band II and among the programmes he heard were Beethoven's 4th Piano Concerto, the Everley Brothers, Rupert Holmes and the Mamas and Papas and Glen Miller. During the evenings of June 21, 22 and July 7 and 13, **Simon Hamer,** Presteigne, heard a variety of programmes in Band II from stations in Belgium and France and BBC locals London, Medway and Solent and ILR stations Capitol, LBC and Thames Valley and between 2100 and 2200 on the 9th, ILR, Radio Trent.

VHF NFD

During the week-end of July 4, 5, contest enthusiasts from all over the UK took to the high spots to compete in the RSGB's VHF National Field Day. Tropospheric conditions were good for the event with a steady atmospheric pressure of 30·1 inches (1019mb) and the competitors took advantage of this. **Les Sawford,** from one of the Portsmouth contest groups using the call-sign G8NEH/P and situated on Telegraph Hill, Winchester, told me that their station made 216 contacts on 2m and 76 on 70 cm. On 2m they were using a FT221 and a 9 element Tonna, with a Trio 9000, Microwave Modules Transverter and crossed Yagis on 70cm. This group worked all UK pre-fixes, plus EI, F, ON and PA0 on 2m with very good reports from GM and the Channel Islands, and central France their best on 70cm.

One of the microwave specialists, **Ron Allen** G2DSP, decided to give out a few points for the event and from his home at sea level in Bognor Regis, with an Icom 202 and a HB9CV antenna 1·5m off the floor, he worked 25 stations, the first in Leek, Staffordshire. The Worthing and District Amateur Radio Club entered 4 stations and from their site, high on the South Downs, they made 132 contacts on 4m (G3YHM/P), 490 on 2m (G3WOR/P), over 100 on 70cm (G4FNL/P) and over 30 on 23cm (G3LQI/P). During the event our Technical Editor **John Fell** G8MCP worked a GD and heard GM. **Elaine Howard**



Simon Hamer with his Land Rover and receiver often used for mobile DXing

G4LFM, our Technical Sub-Editor, used her skills on the key with the Bournemouth Radio Society who had stations on 2m, G2BRS/P, 70cm, G3VPC/P and 23cm, G4GTH/P. During the event they worked over 300 stations on 2m, over 70 on 70cm and 23 on 23cm with best DX being 283km.

Tropospheric

The high atmospheric pressure for NFD continued for two more days and then the v.h.f. bands opened up. Around 1820 on July 6, **Kevin Piper** G8TGM, using an IC202S, a 36 watt linear and a 9-element Tonna, worked EI3VDE/P from his home in Bognor Regis and around 2230 on the 7th he worked EI4AED on 2m s.s.b. Early on the 8th, John Fell worked G3ZPU in Bradford, W. Yorks, initially via the re-sited Bournemouth repeater, GB3SC R1. "At first" said John, "the Bradford station thought he was working through the Stoke-on-Trent repeater, GB3VT, also on R1".

At 0050 on the 7th, I received strong signals from the Birmingham repeater GB3BM R5 and at 0100 I heard GW8YSU coming through the Brighton repeater GB3SR R3. By 0800 signals from GW mobiles were pounding in via the Bristol Channel repeater GB3BC R6 in addition to a French station in Armentières and a G8 in West Cornwall.

News Items

May I remind all microwave buffs, especially those hundreds of you who have purchased the *PW* dishes, to send in reports and tell me about your progress in this exciting field because the range of my column is from 30 to 10 000MHz.

The "Worked All Britain" contest manager, **Del Roberts** G4FQO, 12, Chestnut Ave, Cranwell, Lincs NG34 8HT, has arranged a v.h.f. phone contest for f.m./s.s.b. to take place between 0900 and 2100 GMT on September 19th. Details and rules for the event are available from Del on receipt of an s.a.e. The leading stations in both the receiving and transmitting sections will receive awards.

On Sunday July 5, several members of the Brighton and Chichester amateur radio clubs used their 2m mobile gear to assist the organisers of a sponsored walk centred on the Chalk Pits Museum in Amberley, Sussex. While this was going on about 15 members of the Rover P4 Drivers Club displayed their cars in the museum and among them were **Fred Mance** G8MHX from Farnham, in a 1963 Rover 95 and **Paul Reed** G6BMX from Paddington in a 1963 Rover 110. At home Fred has a TS700 feeding an 8-element Yagi mounted on a Stolle rotator for 2m and for the Rover 110, Paul has a FT202R and a mag. mount antenna on the roof. Another group of visitors from Brighton included **Fred Whittington** who specialises in printing QSL cards and **John Sumner,** formerly BRS 1162 back in the 1930s and later held the call-signs VP9SS, VP4LX and VP7NF.

During the glorious summer's evening of July 8, with temperatures in the 80s, nearly 100 people attended the Chichester and District Amateur Radio Society's mobile rally, some 600ft a.s.l. on the Sussex Downs in a field opposite the main grandstand of Goodwood Race Course. Among the visitors were members of the Brighton, Portsmouth and Worthing clubs.

The UK Horizontal FM Group are holding a contest on 2m between 0900 and 1700 GMT on October 18. This event is open to both licensed amateurs and s.w.l.s. Log sheets, entries and further information, s.a.e. please, available from Mitch Tribe G8PMT, QTHR. Certificates will be awarded to the leading scorers and runners up for single-operator stations, multi-op stations and s.w.l.s.

At 0045 on June 23, **Bob Richardson** G3WRD, of the UKHFMG, worked LA6HL and says that more stations in Norway are keen to work horizontally polarised f.m., so keep an ear that way readers.

Bernard Salter G8POQ, uses a F2T Auto and a dipole at 30ft a.g.l. on 2m but is not on the air a lot because he is building the radio section of a Lancaster bomber and is looking for 2 ex-RAF power units Type 32a and 34a in any condition. If anyone can help, drop Bernard a line, QTHR.

Paul Martin G8LZS, a member of the Southern UK FM Group, visited the Chalk Pits Museum on his way to the Sussex Mobile Rally on July 19th and told me that at home he uses home-brew equipment on both 2m and 70cm, feeding crossed Yagis on both bands and is often heard working through his local 70cm repeater, GB3BK RB11. Another visitor that day was **Paul Stracey** G4HEC, who worked 5 stations from a vantage point on the South Downs, through the repeaters at Brighton GB3SR R3, Crawley GB3BP R6, Hampshire GB3SN R5 and Maidstone GB3KN R4. At his home in Poole, Dorset, Paul uses a FT101E and home-brew dipole for 20 and 10m, a Microwave Modules Transverter and a 10XY antenna for 70cm. Paul is frequently heard through his local 2m repeater, GB3SC R1.

Members of the Chichester Amateur Radio Club set up an amateur station with the special call-sign GB2CHI, in the Guildhall museum, on July 17/18, as part of the Chichester 906 year Festival. During the two days they made 120 contacts in 24 countries, on 20 and 15m, with their FT401 and a 3 element tribander antenna at 13·5m a.g.l. Some 230 visitors saw the station and the exhibition of vintage radio gear laid on by the Chichester club.

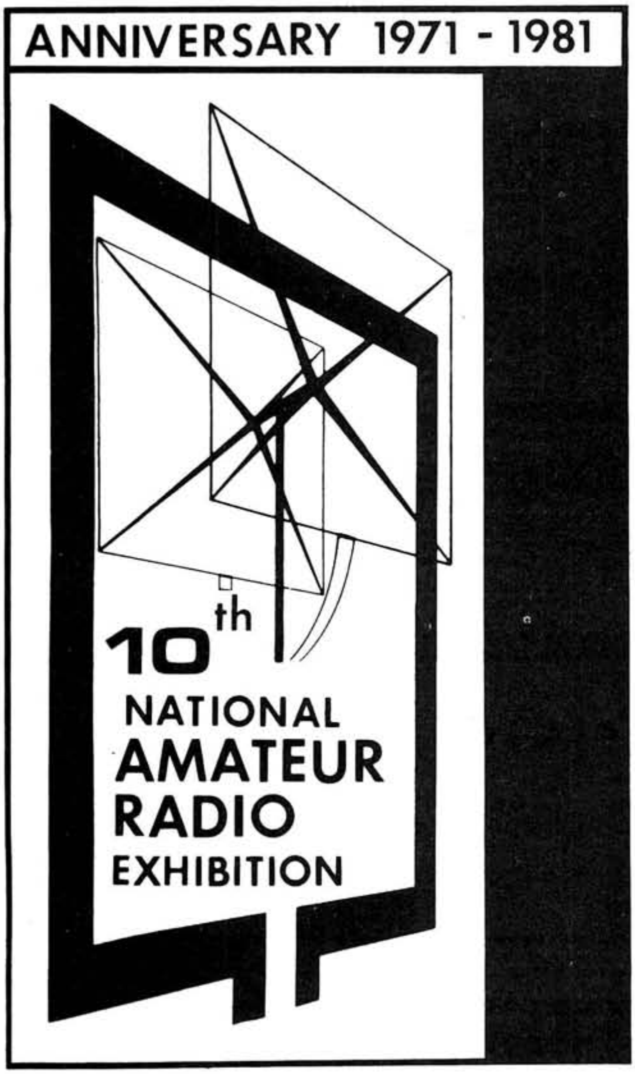
Once again I look forward to meeting many of my readers and friends at the Special Wireless Day to be held at the Chalk Pits Museum, by Amberley railway station, Sussex, on Sunday September 27.

TV

by Ron Ham BRS15744

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

Instead of calling the disturbances Sporadic-E, I reckon a few of the recent events should be called Super-E, especially when Band I pictures from the Middle-East and Nigeria were received in Cambridge and the Midlands respectively, and television sound was heard in Sussex from the Caribbean.



THE AMATEUR RADIO RETAILERS ASSOCIATION EXHIBITION

THIS YEAR AT CASTLE DONINGTON

HOME OF THE DONINGTON MOTOR MUSEUM

THURSDAY 29th OCTOBER
FRIDAY 30th OCTOBER
SATURDAY 31st OCTOBER

ADMISSION TO THE SHOW £1
(includes entry to the museum)

Certain dealers will be refunding admission cost on sales over £30.

FREE CAR PARK

WELCOME TO DONINGTON

In 1971, following two or three years with no national amateur radio shows, a group of concerned dealers got their heads together and formed an association with the sole aim of putting on a really representative amateur radio exhibition in the Midlands. The result was the formation of the A.R.R.A. and the first National Amateur Radio Exhibition at the Granby Halls in Leicester. Everyone now knows that the show went from strength to strength over the years, but in our tenth year it is obvious from comments received from visitors to the show that serious drawbacks arose as the attendance figures increased.

You will remember with horror, the state of Granby Halls at last year's show. No one could be content with such a place and we are delighted to tell you that the show has been moved this year to a superb new site at Castle Donington. All the problems of Leicester have been overcome by the move, and you will no doubt see the wisdom and necessity for leaving Granby Halls behind us.

HOW TO GET THERE

Access to Donington is easy. Simply leave the M1 motorway at exit 24 (East Midlands Airport) and follow the signs to Donington Park. You need only travel about a mile and a half along quiet country roads; quite a contrast to fighting with Leicester city centre traffic.

PARKING

Parking. You remember the parking in Leicester— At Donington Park there are 2· acres of free parking right at the exhibition hall entrance. Say no more.

FACILITIES

Cleanliness. The main complaint by visitors and exhibitors alike. When you pass through the plate glass doors, cross the carpeted entrance hall and enter the well lit, clean, warm halls at Donington, you will be amazed at the difference.

Facilities in general. Clean toilets and a well staffed permanent restaurant will be quite a change from Leicester, where you needed wellington boots before you dared venture into the toilets.

FOR YOU

At Donington, all the main dealers and importers will be putting on an even bigger and better display of all the best for the Radio Amateur and Enthusiast.

The only complaint is likely to be from wives and girl friends who may miss the stands selling dolls, balloons and souvenirs. The ARRA felt that these stands were not in keeping with Amateur Radio and, accordingly, have not allocated them space.

PLUS

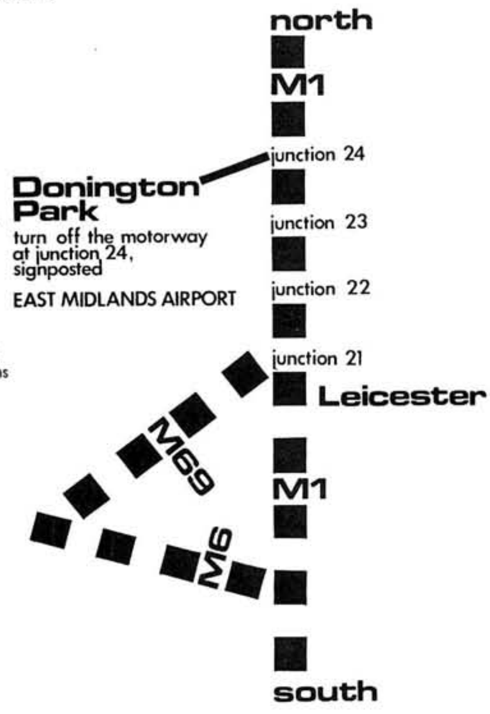
Add to all this the fact that since the new exhibition is taking place at the home of the Donington Motor Museum, and the entrance charge also includes entry to the Museum, you have full and free access to one of the finest collections of historic motoring in the country.

APPEARING AT THE SHOW

Absonglen
Amateur Electronics
Amateur Radio Shop
Amsat-UK
Arrow Electronics
B. Bamber Electronics
BATC
Bredhurst Electronics
J. Birkett
C. B. Electronics
CP Developments
Datong Electronics
Electro Supplies
Eley Electronics
R. J. Finch
F. R. Galka
Grove House Electronics
Isherwoods Electronics
International Short Wave League
Jaybeam
John's Radio
JPS
LAR Modules
Lowe Electronics
M B Radio
Micro-Print
Minffordds
Modular Electronics
Newton Engraving
Packer Communications
PM Electronic Services
PLM Communications Supplies
Quartslab
RAIBC
Radio Shack
RSGB
SGS Electronics
Short Wave Magazine
Sota Communications Systems
South Midlands Communications
SMC Jack Tweedy Limited
Stephens-James Limited
Strumech Limited
Taurus Electrical Services
A. H. Thacker & Sons Ltd.
Thanet Electronics
Tricon Supply Company
Waters & Stanton
Western Electronics
Wilson Valves

the Nunsfield House A.R.G. will provide

talk in on S22 & SU8



THE RECEIVER FOR LF, MF & HF .....

Drake R-7 Synthesized, General Coverage Receiver

Model 1240

Full general coverage reception, 0-30 MHz, with no gaps or range crystals required.

Continuous tuning all the way from vlf thru hf. Superb state-of-the-art performance on a-m, ssb, RTTY, and cw —and it transceives with the Drake TR-7.

SEE US AT CASTLE DONNINGTON 29-30-31st OCTOBER

★ THE BIG SHOW WITH ALL THE BARGAINS

Access

RADIO SHACK LTD.

188 BROADHURST GARDENS, LONDON NW6 3AY

BARCLAYCARD VISA

Giro Account No. 5887151 Telephone: 01-624 7174 Cables: Radio Shack, NW6.

Telex: 23718

Mullard Modules

LP1171	LP1179	LP1186	LP1157
IF. Strip	AM.FM Front end	varicap	Med & Long tuner
Pair £5.75		£5.00	£2.50

Complete with Data

Foster Dynamic Microphones
200 ohm impedence: £1.75 Pair
Moving coil Complete on Chassis

Ultra Sonic Transducers 40KC/S
Complete on 18" Screened cable £1.75 each Pairs £2.95

Ultra sonic Transmitter
Complete unit (uncased requires 1.5V) £3.25

Stereo Cassette Tape Heads
Quality replacement for most recorders with mounting plate. Record/Replay £2.80

Hewlett – Packard Displays (5082-7650) HIGH EFFICIENCY & VERY BRIGHT

Half inch red common anode definitely the brightest will replace (DL707)

Excellent character appearance, evenly lighted segments, wide viewing angle, body colour improves 'Off' segment contrast. Categorized for luminous intensity, use of like categories yields a uniform display. Consumption as low as 3mA per segment, designed for multiplex operation. Standard 14 pin dual-in-line package configuration.

ONLY £1.00 each

SET OF 6 £5

Monsanto
Half inch +1 Display
High Intensity £1 each
set of 4 £3.50
Common anode 14 Pin Dil

Vero Computer Frames
19×8" with 64 runners & guides.
List price £43. Our price £17.95.

National 4116 Dynamic (16K RAM)
200 N/Seconds £1.95
Less 10% per 4. 15% per 8.

All items new stock – delivery by return post
All items inclusive of VAT & Post Paid. **Quantity Discounts** 15% per 10. 20% per 50.

SCOOP ONLY £29.95 + V.A.T.

Professional ASCII Keyboards

The 'CHERRY' Computer Keyboard

BRITISH MADE
- 52 KEY 7 BIT ASCII CODED
- POSITIVE STROBE +5V - 12V
- FULL ASCII CHARACTERS
- PARALLEL OUTPUT WITH STROBE
- POWER LIGHT ON CONTROL
- CHIP BY GENERAL INSTRUMENT (G.I.) TTL OUTPUT
- SUPERBLY MADE SIZE 13 x 5.5 x 1.5 ins.
- BLACK KEYS WITH WHITE LEDGENS
- ESCAPE. SHIFT. RETURN & RESET KEYS
- CONTROL. REPEAT & BELL

Complete with DATA

Ideal for use with **TANGERINE, TRITON, TUSCAN, APPLE and most computers.** Ex-Stock from HENRY'S

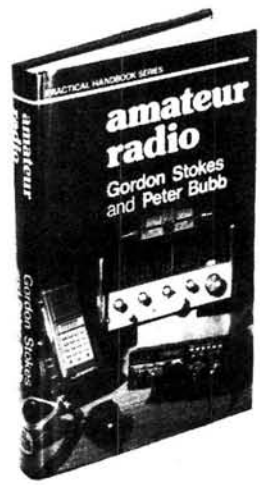
This is definitely the BEST BUY FULLY GUARANTEED Supplied BRAND NEW in manufacturers original packing Just post remittance total £35.95 (incl. V.A.T. & Post)

HENRY'S
404 Edgware Road, London, W2, England. 01-723-1008

JUST PUBLISHED

amateur radio

Gordon Stokes and Peter Bubb



All the background information you need to pass the Radio Amateurs' Examination and gain an Amateur Radio Licence for receiving and transmitting signals.

Comprehensive coverage of semiconductors, modulation, receivers, transmitters, antennas, transmission lines, HF and VHF signals and measurement of voltage and frequency, with an introduction to operating procedures and practices and safety factors.

Fully illustrated with drawings and photographs.

From leading bookshops **£8.95**

LUTTERWORTH PRESS
Luke House, Farnham Road, Guildford, Surrey

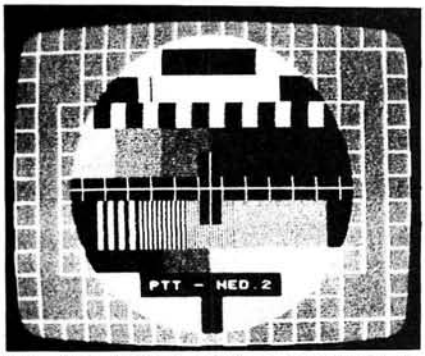


Fig. 1a: Dutch station received in Rugby by Nicholas Brown

Fig. 1b: UK TV station received by Nicholas Brown

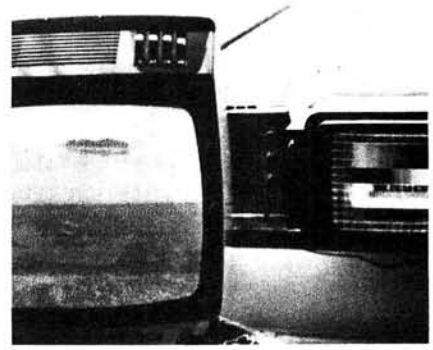


Fig. 2: RAI-I left and Grunten right received by David Appleyard

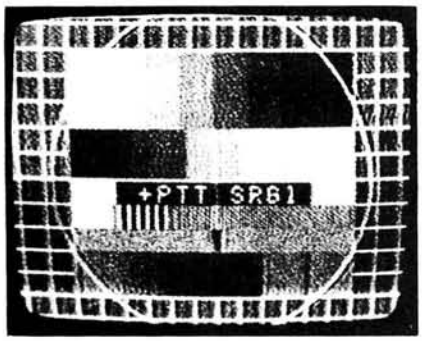


Fig. 3: Signal from Switzerland received by David Appleyard

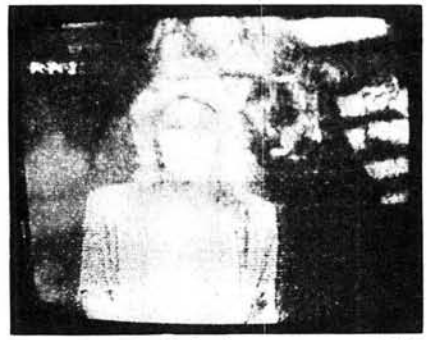


Fig. 4: English lesson on RAI received by David Appleyard

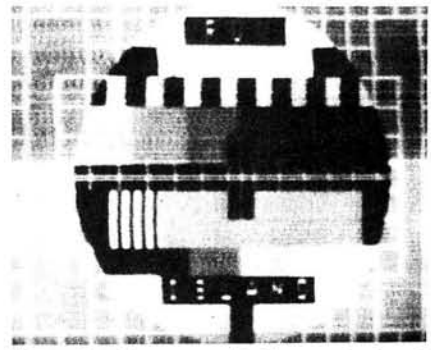


Fig. 5: Test card from Iceland received by Ron Ham

Amateur Television

From Melbourne, Australia, **Wenlock Burton,** who has been DXing for about a year, has received amateur TV pictures via the repeaters VK2RTV near Sydney, VK3RTV Melbourne, VK5RTV Adelaide and VK7RTV on the north-west coast of Tasmania. Wenlock says that the repeaters have vision inputs between 442 and 444MHz, sound inputs between 447 and 449MHz and outputs in a temporary amateur band, 576-585MHz.

Tropospheric

During the morning of April 16, **Nicholas Brown,** Rugby, received strong pictures from Holland on Channel 27 and Tyne Tees on Ch. 29, Figs. 1(a) and (b), and for the camera enthusiasts, Nick took these two pictures at a distance of 0·8m from a 14in. portable, using 1/15 second at f2. At 0835 on June 22 and for most of July 7, I received strong pictures from the IBA transmitter at Lichfield on Ch. 8 with only a dipole antenna feeding my receiver.

During the evening of the 7th there was co-channel interference on some BBC and IBA u.h.f. signals. **Cyril Willis,** Ely, Cambridge, received Radio Telefis Eireann on Ch. 29, and at 1815, **Brian Renforth,** Chippenham, received strong colour bars from Channel TV on Ch. 41 along with many negative image pictures from TDF 1 and RTL. Around 2300, **Simon Hamer,** Presteigne, received weak colour pictures from ITV (Crystal Palace) on Ch. 23 and ITV Anglia (Sandy Heath) on Ch. 24.

Sporadic-E

Nicholas Brown received his first Sporadic-E signals of the 1981 season from RTP Portugal on Ch. E2 and RTVE Spain on Chs. E2 and E3 between 1735 and 1830 on May 14, from Poland Ch. R1 and Sweden Chs. E2 and 3 on the 21st, and Iceland and Spain on the 25th. During the openings on June 2, 7, 9, 10 and 11 he identified test cards from stations in Austria, Czechoslovakia, East and West Germany, Finland, Hungary, Iceland, Italy, Norway NRK, Bagn, Gamlemsveten, Hemnes, Melhus and Steigen, Poland, Portugal, Sweden, Switzerland, Russia and Yugoslavia. Between June 23 and July 4, Brian Renforth watched an old war film, a talent show, *The New Avengers* with Spanish sub-titles and cartoons from RTVE, News and a music programme with YL announcer from TSS CCCP1, church service and news from RAI Italy and *To The Manor Born* with Swedish sub-titles from TV1 Sverige. Brian has installed a new indoor horizontal wire antenna for DXTV comprising two sections, one 3·66m long and the other 760mm long separated by a 150mm insulator where the feeder is connected, with the shortest side to the earth connection of the antenna socket.

Between 0825 and 1035GMT on June 19, **David Appleyard,** Uppsala, Sweden, Fig. 2, received test cards from Italy, Fig. 3, Budapest, an Elvis Presley film from an unidentified station on Ch. E2 and the caption ARD-ZDF on E2 from West Germany. At 0745GMT on June 27, David received the +PTT SRG1 test card from Switzerland, Fig. 4, on Ch. E2 and a boxing match on Ch. R1. Around this time I saw the end of a film, made by ATV, from Poland followed by another film about helicopters. At 1200 on June 19, **Sam Faulkner,** Burton-on-Trent, received pictures from a Spanish regional network "TELE MURCIA" on Ch. E3. "This caption is normally radiated several times before the news" writes Sam, who now poses us TV DXers a problem:

"Colour bars of full screen length have again been appearing between the 1A and E3 vision channels (53·75-55·25MHz). The signals are often strong and usually accompanied by RAI and JRT Yugoslavia and were seen at 1710 on June 25, 1815 on July 5, from 1620 on July 8 and up to 2000 on July 9," says Sam, who continued: "Between 1830 and 1930 on July 10, instead of the usual bars I received a caption with the station ID, NCT below the names 'UDINE' O and possibly 'CONPLE' O."

"Have you seen the grey scale between 1a and E3?" writes Cyril Willis on July 8 and continues "I think it is NCT as I saw their caption followed by the bars the other night." Any more ideas readers? Around 1800 on July 4, Sam received pictures from NVT, Sokoto, Nigeria on Ch. E3. "The Sokoto caption was followed by a music programme *The Great Band of Africa*

followed at 1815 by a 'soap opera' with national participants. At 1830 a clock appeared giving local time, 1930, again the Sokoto caption and a news programme with an African newscaster," writes Sam. At 1700 on the 8th, Cyril Willis saw an Arab station on Ch. E3 with a male announcer in front of a starry background followed by rock music and large Arabic writing. Well done both of you that really is good DX. From 1635 on the 8th, **Harold Brodribb,** St. Leonards-on-Sea, watched a film on Ch. R1 about walking in the country and forests, and at 1655 he saw a roadside village name "BODAK ZIRCO" and the end of film with copyright MTV. At this point, like Harold, I saw the adverts with captions "TV HIRADO" and "MAHART", and at 1807 the caption "TV REKLAM".

John Thompson, Gillingham, Kent, also saw this caption on the 8th, along with test cards from RAI Italy sometimes in colour, Skopje TV Yugoslavia on Ch. E4 and good colour pictures and sound from an operatic recital by a YL on Ch. R2. John now uses a JVC CX 610 GB receiver and has added another element to his existing Band I "H" antenna. At 1419 on the 9th he received one of the Russian test cards on R2 and JRT Belgrade on R3. At 1425 John received colour pictures and sound from "TV POLSKA" and at 1500 a weaker signal from RTBF 1 Belgium on Ch. E3.

Sam Faulkner received pictures up to Ch. IC 82·5MHz around 1630 on the 9th and Ch. R4 85·25MHz at 1630 on the 10th. At midday on the 10th, Harold Brodribb, Brian Renforth and I saw the Spanish card "Control Central RTVE", and Harold saw a clock at 1150 showing 1350 and a test card from RTVE with Santiago 2 on it. Band I was full of stations and between 1330 and 1400, I received test cards from ORF Austria, YLE HLKI Finland, GRUNTEN, RAI Italy, in monochrome and the Russian RS-KH test card in colour. Conditions were simply fantastic on the 10th with, as Sam said: "Signals often at incredible strength." Sam was still receiving pictures from RTVE on Ch. E3, 55·25MHz, after midnight and was able to see Radio Telefis Eireann 1 Ch. 1B just before closedown. Like Sam several of us saw the JRT Yugoslavia test card and bits of their programmes.

At 2230, **Hugh Cocks,** near Battle, Sussex, turned his 5-element beam to 250 degrees and received sound on his SX200 receiver from Puerto-Rico TV on Ch. A2, 69·75MHz. "Beginners luck" said Hugh, because he only purchased the SX200 that afternoon and said that it is a very good receiver for propagation monitoring on specific frequencies.

Like the rest of us, Hugh also received pictures from most of Europe, expecially Spain, earlier in the day. During the afternoon of the 15th, Band I was again full of television pictures and I received test cards from PTT NED 2 Holland, RAI-1 Italy, RS-KH Russia, JRT-ZGRB (Zagreb) Yugoslavia and captions "TV REKLAM" "NAVA CERRADA RTVE", "STAFETA" behind a male announcer and "RTV" behind a YL announcer. Just before 1500 the caption "3 CRONICA 3" appeared and at 1500 I saw adverts in colour followed by the start of a film with the caption "Learning Corporation of America".

Like many of us, Brian Renforth is also interested in the programme content of our DX stations and writes: "I think this is one of the most interesting parts of DXing especially when you see GB programmes." Around 1830 on July 4, Brian watched *Puff the Magic Dragon* followed by a pop music programme, and during the evening of the 7th he saw a News programme from RTVE. From 1600 on the 8th he watched a Volley Ball game from TVR Rumania and the news programme "TELE-JOURNAL" at 2000. During this period Brian saw *It's a Knockout* from JRT-BGRO (Beograd) and at 2050 he watched a space programme from RAI.

Signals from Poland were very strong at 1600 on the 9th and a YL announcer gave programme details followed by the caption "TELEWIZJA POLSKA TP Program 1". At 1950 on the 10th Brian watched perfect pictures from RTVE of a programme called *Vale Preverer* about avoiding the dangers of bleach, electricity, matches and tablets, etc., to children and at 2030 he saw the caption "TD BARCELONA" over the newscaster's right shoulder. On July 14, Brian logged test cards from Czechoslovakia, Italy and Portugal and saw the cartoon *Pixie and Dixie* from RTVE. Also, at 1830, news from Portugal followed by a clock with "OMEGA" on the right hand side showing 1930.

During another extensive Sporadic-E opening on July 20, Band I was wide open from about 0915 to 2200 when a variety of pictures (often in colour) were mixing together, and at times I caught a glimpse of test cards from Russia, Spain and Sweden. At 1121, **Derek Knight,** using a JVC CX 610GB in Storrington, received the caption "EESTI-TV TALLINN", and at 1920 I saw part of a war film, frequently in colour, with sub-titles from one of the stations coming up on Ch. R2.

Although **George Grzebieniak** RS 41733, London, is using a temporary Band I dipole, inside his shack, he still managed to receive pictures from Russia on July 9, Italy on the 10th and 11th and Algeria, Italy, Spain and Yugoslavia on the 15th. Down in Wales on June 23, Simon Hamer saw a studio beauty contest fighting for predominance on his screen with a film about modern European buildings and a Spanish national costume dance, followed later by a caption "Via Satellite", and like Brian Renforth, Simon saw *The New Avengers*. Between 1815 and 1900 on July 8, he watched the film *Mighty Mouse* and later a map of France with a "BEOGRAD" Yugoslavia caption. Among the many pictures he received on the 10th were adverts, cartoons and interviews, mainly from Italy.

Sporadic-E Down Under

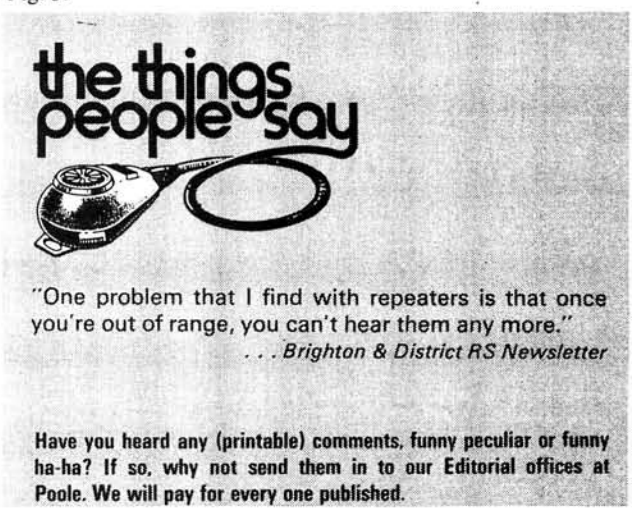
During our winter months, November to February, our readers in Australia were enjoying their Sporadic-E season and Wenlock Burton says that he and fellow DXers **Norman Felge,** Melbourne and **Robert Copeman,** Sydney, received pictures from China, New Zealand and the USSR in Band I. Wenlock used 12in. and 4·5in. Philips receivers for v.h.f. TV fed with a combined 4-element Band I/III array.

Other Stations

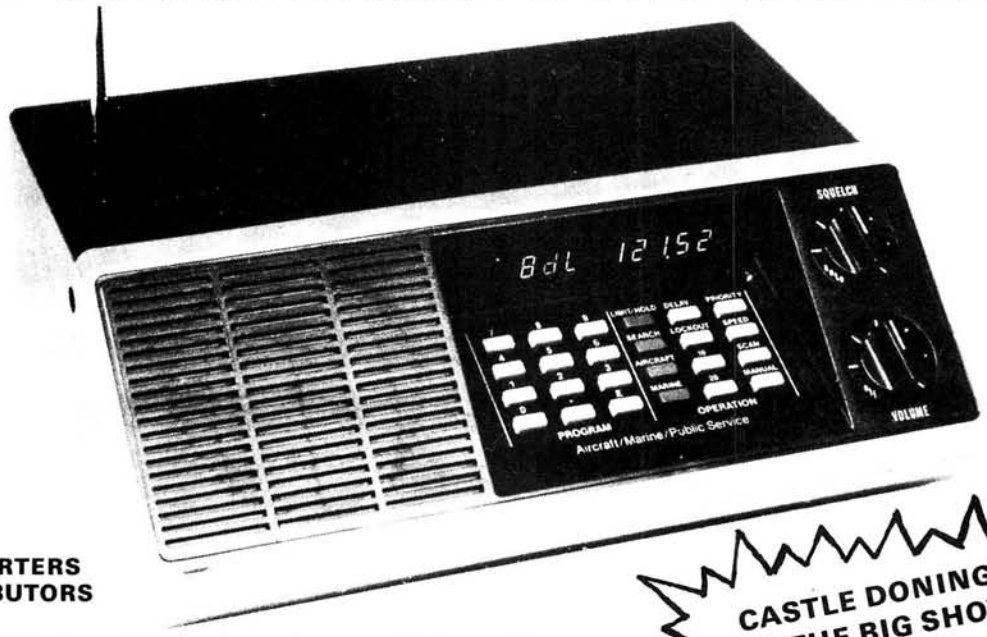
Down in Littlehampton, **Sid Talbot** G8FCX has modified and strengthened his antenna system and now has an Antiference combined Band I/III array, horizontally mounted for DXTV, a crossed 12 for 70cm, a 9-element Tonna and a Ringo Ranger for 2m, all rotatable by a Stolle and mounted 21 metres a.g.l. on top of a 4-storey building. Sid mainly uses a JVC 3040 receiver for DXTV but has recently purchased an ELC 2060 tuner head which covers Bands I, II, III and u.h.f. and feeds into the i.f. of his Hitachi P32.

On July 5, **Dave Oxnard,** a reader from Sweden, visited the Chalk Pits Museum at Amberley, Sussex, where he told me that at home he uses a 14in. Hitachi and a 10in. National receiver for DXTV, both fed from a variety of antennas. During the last week in June, Dave received very strong pictures from RTVE Spain and Sweden and commented about the strength of the colour bars carrying the words, "Control Central RTVE". Dave also saw a Church service and the normal RTVE test card.

According to reports the majority of our Sporadic-E enhanced signals come from Europe, Russia and Scandinavia, but with the aid of a rotatable beam and superb conditions, at 1300 on June 11, I received a strong test card from RUU, Iceland, Fig. 5.



THE VERSATILE BEARCAT 220FB



UK IMPORTERS & DISTRIBUTORS

CASTLE DONINGTON THE BIG SHOW

30p STAMPS FOR DETAILS INCLUDING ALL OUR OTHER LINES

Access

RADIO SHACK LTD.

188 BROADHURST GARDENS, LONDON NW6 3AY

BARCLAYCARD VISA

Giro Account No. 5887151 Telephone: 01-624 7174 Cables: Radio Shack, NW6. Telex: 23718

PM COMPONENTS LTD. VALVE & COMPONENTS SPECIALISTS

BARCLAYCARD VISA

DEPT. P, CONINGSBY HOUSE, WROTHAM RD, MEOPHAM, KENT DA13 0HN

Buy it with Access

PHONE 0474 813225. TELEX 965966 WEST ST G

NEW BRANDED VALVES

A2087	11.50	ECF804	6.00	EY86/87	2.00	PCL83	2.00	5U4GB	1.50	6L7	0.55	BD140	0.30	MRF450A	
A2134	9.00	ECF812	1.20	EY88	0.60	PCL84	0.76	5V4G	0.85	6U8	0.60	BD144	1.20		11.50
A2293	7.20	ECH3	2.50	EZ80	0.56	PCL85	0.80	5Z4G	0.85	6V6GT	0.90	BF115	0.35	MRF475	2.50
A2900	10.90	ECH35	1.50	EZ81	0.56	PCL86	0.76	6AB7	0.60	7B7	1.40	BF167	0.24	MRF477	9.50
DAF91	0.45	ECH42	1.00	EZ90	0.96	PCL200	1.60	6AB8	0.66	7S7	2.00	BF179	0.34	OC71	0.22
DAF96	0.65	ECH81	0.58	G1/371K		PCL805	0.80	6AC7	1.00	11E2	15.50	BF180	0.29	R20088	1.70
DF91	0.45	ECH84	0.93		30.00	PD500	2.95	6AF4A	1.20	12AC6	0.80	BF183	0.29	R2010B	1.70
DF92	0.60	ECL80	0.66	G55/1K	8.00	PFL200	1.13	6AG7	1.20	12AD6	0.80	BF194	0.11	R2540	2.48
DF96	0.65	ECL82	0.58	G120/1B	8.00	PL36	1.05	6AH6	1.00	12AE6	0.85	BF195	0.11	TIP29	0.40
DK91	0.90	ECL84	0.74	GS10C	12.00	PL81A	0.74	6AJ7	1.00	12AE6	0.85	BF196	0.11	TIP29C	0.42
DK92	1.20	ECL86	0.74	GXU50	12.50	PL84	0.65	6AK6	2.00	12AG8	1.50	BF197	0.11	TIP30C	0.43
DK96	1.00	EF37A	3.60	GY501	1.20	PL500	1.12	6AL5	0.52	12AH8	5.50	BF198	0.10	TIP31C	0.42
DL92	0.60	EF39	2.00	GZ30	0.85	PL504	1.20	6AM4	2.50	12AT6	0.59	BF199	0.14	TIP32C	0.42
DL94	1.20	EF42	1.95	GZ32	0.85	PL508	1.48	6AM5	6.00	12AT7	0.55	BF200	0.30	TIP41C	0.45
DL96	1.00	EF55	2.25	GZ33	3.25	PL509	2.30	6AM6	1.30	12AT7WA		BF257	0.28	TIP42C	0.47
DLS10	9.00	EF80	0.48	GZ34	2.00	PL519	2.60	6AN5	2.00		1.50	BF258	0.25	TIP47	0.65
DLS16	10.00	EF83	3.50	GZ37	4.00	PL802	2.50	6AN8A	2.50	12AU6	0.60	BF259	0.26	TIP2955	0.84
DY86/87	0.55	EF85	0.48	KT61	3.50	PY81	0.65	6AQ5	0.82	12AU7	0.55	BF336	0.34	TIP3055	0.60
DY802	0.60	EF86	0.70	KT66 USA		PY88	0.74	6AS5	1.50	12AV6	0.80	BFX29	0.30	TIS91	0.20
E55L	14.00	EF89	0.75		4.95	PY500A	1.35	6AS6	3.50	12AX7	0.55	BFX84	0.26	2N3054	0.59
E80CC	4.75	EF91	1.22	KT66 UK	9.00	PY800	0.65	6AS7G	4.50	12AX7WA		BFX85	0.28	2N3055	0.59
E80F	6.25	EF92	2.50	KT77	5.00	PY801	0.65	6AT6	0.80		1.50	BFX86	0.30	2N3702	0.12
E81CC	3.90	EF93	0.65	KT88 USA		QQV02-6		6AU6	0.55	12AY7	4.00	BFX88	0.25	2N3703	0.12
E82CC	1.50	EF94	0.55		6.00		10.50	6AV6	0.72	12AZ7A	1.50	BFY50	0.21	2N3704	0.12
E83CC	1.50	EF183	0.56	KT88 UK		QQV03-10		6AW8A	2.50	12B4A	1.60	BFY51	0.21	2N3705	0.12
E83F	2.50	EF184	0.56		11.50		2.50	6BA6	0.50	12BA6	0.75	BFY52	0.25	2N3706	0.12
E86C	6.00	EH90	0.65	KTW61	1.50	QQV03-20A		6BA7	3.75	12BE6	1.05	BFY90	0.73	2N3708	0.12
E88C	4.00	EK90	0.65	M8079	6.00		12.25	6BA8A	3.50	12BH7	0.95	BT106	1.00	2N5294	0.38
E88CC	2.60	EL33	2.50	M8083	3.25	QQV06-40A		6BE6	0.50	12BL6	0.70	BT108	1.22	2N5296	0.48
E130L	13.00	EL34	1.54	M8100	2.85		13.95	6BD6	1.00	12C8GT	0.70	BT116	1.20	2N5298	0.38
E180F	5.25	EL34 Mullard		M8137	2.85	QS150/45		6BH6	1.60	12E1	16.50	BU105	1.22	2N5496	0.66
E182CC	4.50		2.45	M8162	3.85		7.00	6BJ6	1.05	12GN7	3.25	BU108	1.69	2SA715	0.95
E280F	19.50	EL36	1.60	M8225	1.20	QS1200	3.15	6BN7	3.50	12HG7A	3.25	BU124	1.00	2SC495	0.80
E283CC	8.25	EL37	9.00	ME1400	4.00	QS1209	1.50	6BN8	0.85	12SL7	1.50	RU126	1.22	2SC496	0.80
E810F	8.25	EL38	4.50	N78	8.90	QS1212	3.20	6BR7	3.75	12SN7GT		BU205	1.30	2SC1173	1.15
EABC80	0.56	EL41	1.50	OA2	0.60	QV03-12	3.50	6BR8A	1.20		1.85	BU208	1.39	2SC1306	1.25
EAF42	1.40	EL81	2.05	OB2	0.65	TY2-125A		6BS7	3.30	13D8	3.20	BU208A	1.52	2SC1307	1.85
EB91	0.52	EL82	0.58	PC86	0.80		45.00	6BW6	4.50	30FL2	0.95	BU326A	1.42	2SC1449	0.80
EBC81	0.85	EL84	0.60	PC88	0.80	U19	11.95	6BZ6	2.00	40KD6	2.80	MJE340	0.40	2SC1678	1.25
EBC89	0.85	EL85	3.85	PC92	0.85	UCH81	0.65	6C4	0.45	85A1	5.40				
EC90	0.45	EL86	0.80	PC97	0.95	UCL82	0.76	6CL6	1.50	85A2	1.20				
ECC81	0.55	EL90	0.82	PC900	0.85	UF80	0.80	6EA8	0.80	90C1	1.69				
ECC82	0.55	ELL91	6.00	PCF80	0.70	UL84	0.78	6F6G	2.00	90CG	10.85				
ECC83	0.60	EL360	9.00	PCF82	0.60	YL1020	29.00	6F28	1.25	92AG	9.00				
ECC85	0.60	EM80	0.70	PCF86	1.20	Z759	9.00	6GH8A	0.80	92AV	9.00				
ECC88	0.65	EM81	0.70	PCF200	1.35	Z803U	12.50	6GK6	1.00	807	1.50				
ECC91	0.65	EM84	0.70	PCF201	1.35	ZM1001	5.00	6H6	1.00	811A	9.00				
ECC804	0.40	EM85	0.85	PCF801	0.92	1X2B	1.15	6HF5	4.50	813	11.30				
ECC807	1.30	EM87	1.10	PCF802	0.72	2C51	0.80	6J5GT	0.75	833A	47.85				
ECC808	2.00	EMM803	2.50	PCF805	1.80	2D21	0.95	6J6	0.55	5636	3.00				
ECF80	0.65	EN91	0.95	PCF808	1.48	2K25	10.00	6J7GT	1.00	5642	5.00				
ECF82	0.60	EN92	4.00	PCH200	1.10	4CX250B		6JS6C	2.55	5651	1.75				
ECF86	1.50	EY84	8.00	PCL82	0.74		26.60	6K7	0.70	5670	3.50				
						4CX350A		6KD6	3.95	5687	8.15				
							39.90	6L6GC	1.75	5696	2.55				
						5U4G	0.85	6L6GT	1.10	5718	3.50				

INTEGRATED CIRCUITS

AN214Q	2.50	LC7120	3.50	MC1495	3.00
AN240	2.80	LC7130	3.50	ML231B	1.75
LA4031P	2.70	MB3712	2.50	SL901B	4.35
LA4400	4.15	MC1307P	1.00	SN76003N	1.65
LC7120	3.50	MC1330P	0.76	SN76013N	1.65
LC7130	3.50	MC1349	1.20	SN76023N	1.35
MB3712	2.50	MC1495	3.00	SN76033N	1.35
MC1307P	1.00	ML231B	1.75	SN76131N	1.30
MC1330P	0.76	SL901B	4.35	SN76666N	0.60
MC1349	1.20	SN76003N	1.65	TAA550	0.70
MC1495	3.00	SN76013N	1.65	TAA661B	0.25
ML231B	1.75	SN76023N	1.35	TA7120	1.20
SL901B	4.35	SN76033N	1.35	TA7130	1.85
SN76003N	1.65	SN76131N	1.30	TA7204	1.50
SN76013N	1.65	SN76666N	0.60	TA7205AP	2.15
SN76023N	1.35	TAA550	0.70	TA7222	1.95
SN76033N	1.35	TAA661B	0.25	TA7310	1.80
SN76131N	1.30	TA7120	1.20	TBA120S	1.80
SN76666N	0.60	TA7130	1.85	TBA520Q	0.70
TAA550	0.70	TA7204	1.50	TBA530	1.10
TAA661B	0.25	TA7205AP	2.15	TBA540	1.10
TA7120	1.20	TA7222	1.95	TBA550Q	1.25
TA7130	1.85	TA7310	1.80	TBA800	1.45
TA7204	1.50	TBA120S	1.80	TBA810S	0.89
TA7205AP	2.15	TBA520Q	0.70	TBA920Q	1.35
TA7222	1.95	TBA530	1.10	TDA1004A	1.65
TA7310	1.80	TBA540	1.10	TDA1170	2.20
TBA120S	1.80	TBA550Q	1.25	TDA1190	1.95
TBA520Q	0.70	TBA800	1.45	TDA1327	2.15
TBA530	1.10	TBA810S	0.89	TDA1412	1.70
TBA540	1.10	TBA920Q	1.35	TDA2020	0.85
TBA550Q	1.25	TDA1004A	1.65	TDA2030	2.45
TBA800	1.45	TDA1170	2.20	TDA2532	2.80
TBA810S	0.89	TDA1190	1.95	TDA2540	2.40
TBA920Q	1.35	TDA1327	2.15	TDA2590	2.15
TDA1004A	1.65	TDA1412	1.70	TDA2600	2.95
TDA1170	2.20	TDA2020	0.85	TDA2611A	2.95
TDA1190	1.95	TDA2030	2.45	UPC566H	1.95
TDA1327	2.15	TDA2532	2.80	UPC575C2	2.95
TDA1412	1.70	TDA2540	2.40	UPC1001H	2.95
TDA2020	0.85	TDA2590	2.15	UPC1025	3.95
TDA2030	2.45	TDA2600	2.95	UPC1156H	2.50
TDA2532	2.80	TDA2611A	2.95	UPC1365C	2.15
TDA2540	2.40	UPC566H	1.95		3.95
TDA2590	2.15	UPC575C2	2.95		
TDA2600	2.95	UPC1001H	2.95		
TDA2611A	2.95	UPC1025	3.95		
UPC566H	1.95	UPC1156H	2.50		
UPC575C2	2.95	UPC1365C	2.15		
UPC1001H	2.95		3.95		
UPC1025	3.95				
UPC1156H	2.50				
UPC1365C	2.15				
	3.95				

SEMICONDUCTORS

AC126	0.22	BC158	0.09
AC127	0.22	BC159	0.09
AC128	0.28	BC160	0.28
AC141K	0.34	BC170B	0.10
AC176	0.22	BC171	0.08
AC176K	0.31	BC172	0.09
AC187	0.26	BC173B	0.10
AC187K	0.28	BC182	0.09
AC188	0.22	BC183	0.09
AD149	0.70	BC184LA	0.09
AD161	0.39	BC212	0.09
AD161/2	1.04	BC212L	0.09
AD162	0.39	BC213	0.09
AF124	0.34	BC213L	0.09
AF125	0.32	BC214	0.09
AF126	0.32	BC214L	0.09
AF127	0.32	BC237	0.09
AF139	0.42	BC238	0.08
AF239	0.42	BC307	0.09
AU106	2.06	BC327	0.10
AU107	1.75	BC337	0.10
AU110	2.00	BC461	0.30
AU113	1.48	BC478	0.20
BC107	0.10	BC547	0.10
BC107B	0.10	BC548	0.10
BC108	0.10	BC549A	0.08
BC108C	0.10	BC557	0.07
BC109B	0.10	BC558	0.07
BC140	0.31	BD131	0.32
BC141	0.25	BD132	0.35
BC142	0.21	BD133	0.40
BC143	0.24	BD135	0.30
BC147	0.09	BD136	0.30
BC148	0.09	BD137	0.28
BC149	0.09	BD138	0.30
BC157	0.10	BD129	0.32

Many other items available
Please phone send list for quote

CALLERS WELCOME

★ Entrance on ★ Hours

Wrotham Rd. (A227) Mon.-Fri. 9.30-5.30

Near Meopham Stn. Saturday 9.30-12.00

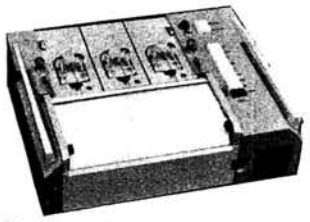
P. & P. 50p. Please add V.A.T. at 15%

★ 24-HOUR ANSAPHONE SERVICE ★

FAST RESPONSE STRIP CHART RECORDERS

Made in USSR

Series H3020



Basic error: 2.5%
Sensitivity: 8mA F.S.D.
Response: 0.2 sec.
Width of each channel:
Single and three-pen recorders: 80mm
Five-pen recorders: 50mm

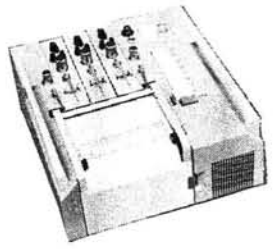
Chart speeds, selected by push buttons: 0.1-0.2-0.5-1.0-2.5-5.0-12.5-25 mm/sec.
Chart drive: 200-250V 50Hz
Recording: Syphon pen directly attached to moving coil frames. Curvlinear co-ordinates.
Equipment: Marker pen, timer pen, paper footage indicator, 5 rolls of paper, connectors, ink etc.

H3020-1 (Single pen): 285mm wide x 384mm deep x 165mm high ..... **PRICE £46**
H3020-3 (Three pen): 475mm wide x 384mm deep x 165mm high ..... **PRICE £69**
H3020-5 (Five pen): 475mm wide x 384mm deep x 185mm high ..... **PRICE £105**

All recorders supplied complete in a sturdy custom built wooden carrying case. Carriage: £10.00 per recorder.

SPECIAL OFFER

Series H327



Polarized moving iron movements with syphon pens directly attached. Built-in solid state amplifier (one per channel) provides 8 calibrated sensitivity steps. Two marker pens are provided.
Basic error 4%. Frequency response from DC to 100Hz 2dB.

Sensitivity: 0.02 - 0.05 - 0.1 - 0.2 - 0.5 - 1 - 2 - 5 volts/cm
Width of each recording channel: 40mm
Chart drive: 220-250V 50Hz
Chart speeds: 1-2-5-10-50-125-250mm/sec.

Type H3271-1. Single pen: Dimensions: 259 x 384 x 165mm Weight 15 kilos ..... **PRICE £92**
Type H327-3. Three pen: Dimensions 335 x 384 x 165mm Weight 20 kilos ..... **PRICE £230**
Type H327-5. Five pen: Dimensions 425 x 385 x 165mm Weight 25 kilos ..... **PRICE £380**

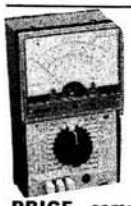
Carriage: £10.00 per recorder.

Prices include 15% VAT

Send your orders to:

MARCO TRADING,
The Old School, Edstaston,
WEM, Shropshire SY4 5RJ.
Tel: Whixall (094872) 464/465

Send for list of other reduced equipment and component lists. Official orders welcome. Wholesale prices upon request. Callers at our office welcome.



MULTIMETER – TYPE U4324 – 20,000 O.P.N.

D.C. Current:	0.06-0.6-60-600mA-3A
A.C. Current:	0.3-3-30-300mA-3A
D.C. Voltage:	0.6-1.2-3-12-30-60-120-600-1200V
A.C. Voltage:	3-6-15-60-150-300-600-900V
Resistance:	500Ω-5-50-500kΩ
Accuracy:	d.c. 2.5%: A.C. 4% (of F.S.D.)

PRICE complete with test leads and fibreboard storage case **£10.50** INCLUSIVE OF VAT. Packing and postage £1.20

AH ELECTRONICS

20 BARBY LANE, HILLMORTON,
RUGBY, WARWICKSHIRE CV22 5QJ.
TEL: 76473 EVE 71066.

Mail Order Only or callers by appointment.
All prices include VAT but add 50p post & packing.

VHF RF POWER TRANSISTORS:–

Type	Gain (db)	Output	Volts	Freq. (MHz)	Price
2N6083	5.7	30w	12	175	**£6.50**
PT4555	8	25w	12	150	**£4.00**
SD1212-6	8.2	3w min.	12	175	**£2.50**
PT4556	7	40w	12	80	**£4.50**
PT4236A	10	1w min.	12	175	**£0.75**
PT4236B	10	11w	12	88	**£3.00**
PT4236C	6	35w	12	88	**£4.50**
2N5070	13	25w pep	24	30	**£5.00**
BFW16A	10	1w	12	175	**£0.75**
2N3866	10	1w	28	175	**£0.75**

CB 27MHz RF POWER TRANSISTORS:–
2SC2028 **£1.90,** 2SC2078 **£2.90,** 2SC1306 **£2.75,** 2SC1307 **£3.25.**
TA7205P 6 watt audio IC 12v. ex-new equipment & tested **£1.50.**
TDA1010 9 watt audio IC @ 14v. single in line type **£1.50 ea.**
MDA800 8 amp 50 volt bridge rectifier OK for 12 volt PSU **70p ea.**
LOW PROFILE RELAY 12 volt 2 pole change over OK for 50 watts RF @145MHz. New **only £2.25.**
FETS/MOSFETS:–
3SK51 (40673) **70p,** 3SK60 (sim. 3N204) **80p,** 3SK88 26db gain 1.1db NF @ 150MHz **£1.40,** BFR84 18db 3db nf @ 200MHz **75p,** E5565 (2N3919) **30p,** TIS88A **40p,** BF256 **38p,** 2N4381 "P" chan. **40p.**
BIPOLAR VHF/UHF RF AMPS:–
BF166 **25p,** BF180 **30p,** BFY90 **95p,** BF152 **15p,** BF576 (pnp 1200MHz ft) **20p,** 2N4957 (pnp UHF RF amp. 3½db nf @ 1GHz) **30p,** ST2110 (2N918 BSX20) **15p.**
VHF/UHF SWITCHING DIODES BA243 (VHF) **20p.** BA244 (UHF) **25p.**
VHF/UHF VARICAP DIODES ITT210 **20p,** BB105 **set of 4 60p,** BB141 **25p.**
TIL209B LEDS ¼" dia. "red" **only 10p, 10 for 75p.**
PL259 PLUGS 50p, reducers for UR43/UR76 **15p.**
SO239 SOCKETS 50p. PL258 couplers **60p.**
BNC 50 Ohm flange sockets **70p.**
CO-AXIAL disc ceramics 100pf 100 volt OK UHF/SHF decoupling-pkt **20 for 25p.**
10.7MHz CRYSTAL FILTER ±3.5KHz @ 3db, 910 ohm. ITT024DE/923L **£7.00.**
10.7MHz CRYSTAL FILTER ±7½KHz @ 3db, 910 ohm. LQU/445/901B ex-equipment **£6.00.**
10.7MHz CRYSTAL FILTER SSB type BP4133 (LSB only available), 200 ohm imp. small size 38×18×15mm. New **£4.00 each.**
21.4MHz CRYSTAL FILTER ±7½KHz @ 3db. imp. approx. 2k ohm. New **£5.00.**
2 KILO BOX BROKEN CAR RADIO BOARDS OK for spares **£3.00** plus £1.50 pp.
OXLEY PTFE FEEDTHROUGH INSULATORS 4mm hole size **6p each. 25 for £1.00.**
GLASS FEEDTHROUGH INSULATORS solder in type silver plated requires 4mm hole **60p per 100.**
1000pf 500v. FEEDTHROUGH CAPACITORS solder in type requires 3½mm hole **30p per 10.**
MIXED DISC CERAMIC CAPS. 1 to 220pf bag of 100, ideal for the VHF constructor. All Erie miniature types **£1.40 per 100.**
MIXED BAG RESISTORS all ¼ watt vertical pre-formed type with long leads. Bag of 250 plus **£1.60.**
BALUN CORE 2 hole type 13×8×8mm **15p each, 10 for 80p.**
48.00MHz HC6/U crystals. New **£2.00 each.**
1000pf 250v LEEDLESS DISC CERAMICS 5mm dia. **10 for 25p.**

Coming shortly two meter linear amps 60 & 80 watt output in kit form or ready built. Watch this space or ring for details.

MAIL ORDER ADVERTISING

British Code of Advertising Practice

Advertisements in this publication are required to conform to the British Code of Advertising Practice. In respect of mail order advertisements where money is paid in advance, the code requires advertisers to fulfil orders within 28 days, unless a longer delivery period is stated. Where goods are returned undamaged within seven days, the purchaser's money must be refunded. Please retain proof of postage/despatch, as this may be needed.

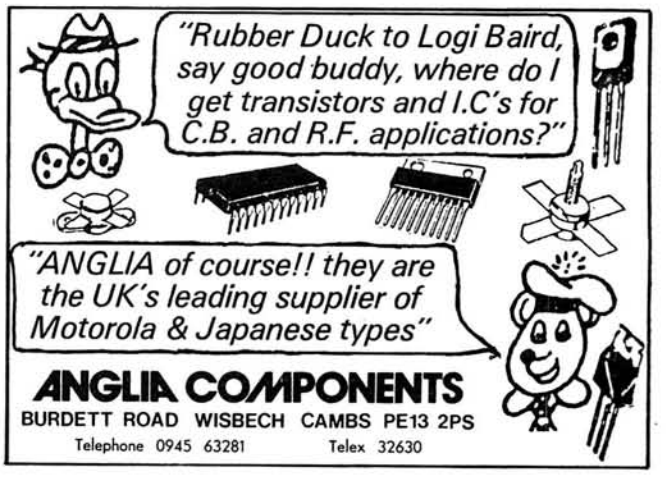
Mail Order Protection Scheme

If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, PRACTICAL WIRELESS will consider you for compensation if the Advertiser should become insolvent or bankrupt, provided:

(1) You have not received the goods or had your money returned; and
(2) You write to the Publisher of PRACTICAL WIRELESS summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

Please do not wait until the last moment to inform us. When you write, we will tell you how to make your claim and what evidence of payment is required. We guarantee to meet claims from readers made in accordance with the above procedure as soon as possible after the Advertiser has been declared bankrupt or insolvent.

This guarantee covers only advance payment sent in direct response to an advertisement in this magazine not, for example payment made in response to catalogues etc, received as a result of answering such advertisements. Classified advertisements are excluded.



When replying to Classified Advertisements please ensure:

(A) That you have clearly stated your requirements.

(B) That you have enclosed the right remittance.

(C) That your name and address is written in block capitals, and

(D) That your letter is correctly addressed to the advertiser.

This will assist advertisers in processing and despatching orders with the minimum of delay.

SMALL ADS

The prepaid rate for classified advertisements is 28 pence per word (minimum 12 words), box number 60p extra. Semi-display setting £9.50 per single column centimetre (minimum 2·5 cms). All cheques, postal orders etc., to be made payable to Practical Wireless and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance should be sent to the Classified Advertisement Manager, Practical Wireless, Room 2337, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

NOTICE TO READERS

Whilst prices of goods shown in advertisements are correct at the time of closing for press, readers are advised to check with the advertiser both prices and availability of goods before ordering from non-current issues of the magazine.

Receivers and Components

BALLARD'S OF TUNBRIDGE WELLS have moved to 54 Grosvenor Road, no lists. S.A.E. all enquiries phone Tunbridge Wells 31803.

BRAND NEW COMPONENTS BY RETURN

HIGH STABILITY RESISTORS.
¼W Carbon Film E12 Series 1R-10M. (E24 2R-6M2)—**1p**
½W, ¼W & 1W Metal Film E12 Series 10R-2M2—**2p**
METAL FILM ¼w 1% E12 series 10R to 1MO—**3p**
CAPACITORS.
MULLARD Min. Ceramic E12 100V 2% 1.8pf. to 47pf.—**3p**
2% 56pf. to 330pf.—**4p**. 10% 390pf. to 4700pf.—**4p**
Plate Ceramic 50V Wkg. Vertical Mounting.
E12 22pf. to 1000pf. & E6 1K5pf. to 47Kpf.—**2p**
Miniature Polyester 250V Wkg. Vertical Mounting.
.01, .015, .022, .033, .047 & 068 mfds.—**4p**
0.1—**5p**. 0.15 & 0.22—**6p**. 0.33 & 0.47—**8p**
0.68—**11p**. 1.0—**15p**. 1.5—**20p**. 2.2—**22p**
ELECTROLYTIC. Wire Ended (Mfds/Volts).

0.47/50	5p	22/25	6p	100/25	7p	470/25	11p
1.0/50	5p	22/50	6p	100/50	8p	470/40	16p
2.2/50	5p	47/16	6p	220/16	8p	1000/15	15p
4.7/50	5p	47/25	6p	220/25	8p	1000/25	18p
10/50	5p	47/50	6p	220/50	10p	1000/40	35p
22/16	6p	100/16	7p	470/16	11p	2200/16	20p

TANTALUM BEAD SUBMINIATURE ELECTROLYTICS.
0.1, 0.22, 0.47, 1.0, 2.2 @ 35V & 4.7 @ 6.3V—**14p**
4.7/16V & 25V—**15p**. 10/16 & 22/6—**20p**. 10/25—**29p**
10/35V, 22/16V, 47/6.3V, 68/3V & 100/3V—**30p**
15/25, 22/25, 47/10—**35p**. 47/16—**80p**. 220/16—**£1.20**
Polystyrene 63V Wkg. E12 Series Long Axial Wires.
10 pf. to 820 pf.—**3p**. 1000 pf. to 10,000pf.—**4p**
TRANSISTORS.

BC107/8/9	10p	BC182L	8p	BF197	10p
BC147/8/9	10p	BC184L	8p	BFY50/51/52	18p
BC157/8/9	10p	BC212L	8p	BFX88	25p
BC547C/8C/9C	7p	BCY70	15p	2N2926	7p
BC557C/8C/9C	7p	BF194	10p	2N3055	50p

8 Pin D.I.L. i.c's 741 Op/amp.—**18p**. 555 Timer—**24p**
Holders 8 pin—**9p**. 14 Pin—**12p**. 16 Pin—**14p**. 28 Pin—**25p**
40 Pin—**30p**.
DIODES (p.i.v./amps).

75/25mA	1N4148	2p	1250/1A	BY127	10p
100/1A	1N4002	4p	400/3A	1N5404	14p
800/1A	1N4006	6p	60/1.5A	S1M1	5p
1000/1A	1N4007	7p	30/150mA	AAY32	12p

ZENER DIODES.
E24 Series 3V3 to 33V 400mW—**8p**. 1W—**14p**
L.E.D.'s 3 mm. & 5 mm. Red—**10p**. Green, Yellow—**14p**
Grommets for 3 mm.—**1½p**. Holders for 5 mm.—**2p**
FUSES. 20 mm. Glass. 100mA to 5A. Q.B.—**3p**. A/S.—**5p**
VOLTAGE REGULATORS +. 5V, 8V, 12V, 15V 100mA.—**35p**
5V, 8V, 12V, 15V, 18V & 24V 0.5A—**60p**. 1A—**65p**
PRESET POTENTIOMETERS
50mW & ¼W 100R to 1MO—**7p**.
PAIRS BATTERY SNAPS PP3—**5p**. PP9—**10p**

THE C. R. SUPPLY CO.
127, Chesterfield Road, Sheffield S8 0RN.
V.A.T. Inclusive Prices, Postage 15p
(FREE over £5.00)

CRYSTALS MADE TO ORDER within 6 weeks. 4-105MHz, wires or pins. £3.90 each inclusive. Hartley Crystals, Green Lane, Milford, Godalming, Surrey GU8 5BG.

CRYSTALS Brand new high-precision. You benefit from very large stocks held for industrial supplies. All normal freq standards, baud rates, MPU, and all magazine projects inc: HC33/U: 1·0, **£3·75**, 2·5625 MHz, **£3·50**. HC18/U: 4·0, 5·0, 6·0, 7·0, 8·0, 9·0, 10·0, 10·7, 12·0, 15·0, 16·0, 18·0, 20·0, 38·6667 MHz, **£3·35**. Selected freqs stocked in Glider, Marine and 27 MHz bands. Any freq made to order in 8 weeks from **£4·10**. 2-3 week service available.
FILTERS Your best source for 6 and 8 pole and monolithics for AM, CW, SSB, FM, on 455 kHz, 1·6, 9·0, 10·7, 21·4 MHz, etc.
Prices inc. VAT and UK post. SAE lists.
P. R. GOLLEDGE ELECTRONICS
G3EDW, Merriott, Somerset, TA16 5NS.
Tel: 0460 73718

RADIO, TELEVISION, industrial valves. Free lists. Access. Barclaycard. Vintage Wireless Co., 64 Broad Street, Bristol BS16 5NL. (0272) 565472.

VALVES

Radio – T.V. – Industrial – Transmitting
Projector Lamps and Semiconductors
We Dispatch Valves to all parts of the world by return of post, Air or Sea mail, 6000 Types in stock, 1930 to 1976. Obsolete types a speciality. List 60p. Quotations S.A.E. Open to callers Monday to Saturday 9.30 to 5.00 closed Wednesday 1.00. We wish to purchase all types of new and boxed Valves, Projector Lamps and Semiconductors.
COX RADIO (SUSSEX) LTD.
Dept. P.W. The Parade, East Wittering,
Sussex PO20 8BN
West Wittering 2023 (STD Code 024366)

WE REPAIR/RESTORE valve type communication receivers with a one year guarantee. For a free quote telephone Corby 61697. Vintage British Radio Components Co., 22 Thurso Walk, Corby, Northants.

BOURNEMOUTH/BOSCOMBE. Electronic components specialists for 33 years. Forresters (National Radio Supplies) late Holdenhurst Rd. now at 36, Ashley Rd., Boscombe. Tel. 302204. Closed Weds.

Southern Valve Co.,
2nd Floor, 6 Potters Road, New Barnet, Herts.
Tel: 01-440 8641 for current prices & availability, all popular valves stocked. SAE Lists. Cash with order. Same Day Postal Despatch. Telephone afternoons preferred. Not Thursday.

Valves, Tubes, Aerials etc by LEADING-MAKERS. Send SAE Lists or Phone for current prices. Counter or MAIL ORDER. NO COD. Speedy Despatch assured. No order under £1.
Philip Bearman, 6 Potters Road, New Barnet, Herts.
Tel: 01-449 1934/5 (1934 Recording Machine).
Closed Thursday. Telephone for Shop Hours.

T.V. PRE AMP with built in TVI filter £16.10. See August issue for other TVI filters. Apex Enterprises, 329 Welford Road, Leicester. 0533 704284.

VHF TUNERS.
140-150MHz. 10.7MHz IF mechanically tuned (inc s/m drive) Mosfet RF amplifier section **£8.75** inc pp. Identical 65-75MHz versions ideal 4M/E. Europe Fm band and airband models available. 10.7MHz Wideband FM IF module **£4.00.**
50-300MHz converter 28-30MHz tunable IF **£9.**
SAE Data, Lists.
H. Cocks, Cripps Corner, Robertsbridge, Sussex.
Tel. 058083 317.

1920's ONWARD valves, wireless. 1000s modern components. Lists 25p. S.A.E. Sole Electronics, PW, 37 Stanley Street, Ormskirk, Lancs.

Aerials

COPPER AERIAL WIRE 14swg hard drawn 70' £5.34. 140' £8.84 inc. VAT. Postage £1.75 T.M.P. Electronics, Supplies, Britannia Stores, Leeswood, Nr. Mold. N. Wales.

ANTI-TVI TRAP DIPOLES
1981 Range: Shortwave Listener Aerials
Indoor models **£14.50 & £27.50**
Outdoor models **£30.00 & £36.00**
Lists 10 × 8 in 17p SAE, Aerial Guide **50p**
Indoor and Invisible Aerials **£3.50**
Callers Welcome Tel: 03986-215
G2DYM, Uplowman, Tiverton, Devon.

Books and Publications

OUT OF PRINT BOOK SERVICE. 17 Fairwater Grove (E), Cardiff. Send S.a.e. for details.

BOOKS. By Newnes and other publishers. Electronics, radio etc. **SPECIAL OFFER 20% off** catalogue price. Limited stocks. SAE for details. ZL Communications, Cantley, Nr. Norwich, Norfolk NR13 3RT.

STATION LOGBOOKS with invaluable reference information **£2.25.** Mobile Minilogs **80p.** Callsign Window Stickers **£1.50.** Beauprint, Meltham Road, Honley, Huddersfield. Trade/Club enquiries welcome. Tel. 0484-662824.

Record Accessories

STYLI. Cartridges for Music Centres, etc., Free list no. 30 for S.A.E. includes Leads, Mikes, Phones etc. Felstead Electronics, Longley Lane, Gatley, Cheadle Ches., SK8 4EE.

SERVICES

OSCILLOSCOPE repair and calibration. Quick service, competitive rates. W.I.R. Electronics 01-367-6816.

Courses

COURSES. Radio Amateurs Examination. City & Guilds, pass this important examination and obtain your G8 licence, with an RRC Home Study Course. For details of this and other courses (GCE, professional examinations etc) write or phone. The Rapid Results College, Dept. JX1, Tuition House, London SW19 4DS. Tel: 01-947 7272 (Careers Advisory Service) or for prospectus requests ring 01-946 1102 (24 hr Recordacall).

PLEASE MENTION PRACTICAL WIRELESS WHEN REPLYING TO ADVERTISEMENTS

Service Sheets

G.T. **TECHNICAL INFORMATION SERVICE**
76 CHURCH ST., LARKHALL, LANARKS.

Any full size service sheet – still only £1 + s.a.e.

Thousands of different sheets & manuals in stock (many of these only obtainable from us)

Repair data your named T.V. £6 (with circuits £8)

Domestic Equipment, exploded diags, circs, etc. in 2 huge binders £26.50

S.A.E. for free newsletter, price lists, any quotation, bargain offers, unique T.V. publications. 2 big catalogues list thousands service sheets/manuals plus £4 vouchers for **£2** + large s.a.e. Complete British Colour TV circuits, etc. in 3 huge binders only **£39.50.**

Phone: 0698 883334 anytime. Callers 4–6 pm weekdays, Sat. after 10.

30,000 SERVICE SHEETS IN STOCK
COLOUR MANUALS ALSO AVAILABLE

TV Monos, Radios **£1.25** – Tuners **£1.25** – Tape Recorders, Record Players, Transistors from **£1.25** – Car Radio **£2.00** + S.A.E. – Stereograms, Radiograms from **£1.25** – Except Colour TV Circuits from **£2.** – State, if circuit will do, if sheets are not in stock. All TV sheets are full length 24 x 12", not in Bits & Pieces. All other Data full lengths. Free Fault Finding Chart or TV Catalogue with order. Crossed P.O.s returned, if sheets not in stock. S.A.E. please.

C. CARANNA
71, Beaufort Park, London NW11 6BX
01-458 4882 (Mail Order)

SERVICE SHEETS, Radio, TV etc., 10,000 models. Catalogue 25p, plus S.A.E. with orders, enquiries, TELRAY, 5 Henderson Street, Preston PR1 7XP.

SERVICE SHEETS from 50p and S.A.E. Catalogue 25p and S.A.E. Hamilton Radio, 47 Bohemia Road, St. Leonards, Sussex.

Wanted

ELECTRONIC COMPONENTS PURCHASED. All types considered – Must be new. Send detailed list – Offer by return – WALTONS, 55A Worcester Street, Wolverhampton.

NEW RSGB MEMBER seeks communications receiver, age/beauty unimportant provided functional. Amberley 3263.

WE BUY SURPLUS ELECTRONIC COMPONENTS, PCB's etc, for cash. Tel: (0703) 785862.

WANTED. January 1980 issue of Practical Wireless. McBain, 18 Byron House, Halesowen, West Midlands.

For Sale

FOR SALE. ICOM 2m. transceiver IC22A 6S & 5R channels good cont. £100.00 2M P.A. 40 watts £25.00. Western antenna switch 4 way. £8.00. S.E.M. HF auto pre-amp £10.00. Tel. 0703 842000.

SATELLIT 2100 World Portable with SSB unit, headphones, instructions. £120. Buyer collects. Box 154.

YAESU FRG 7000 rarely used, excellent condition. £200.00 o.n.o. Delivered 50 miles Aberystwyth. Aberystwyth 828961.

ICOM 260E, Multimode boxed as new £275. P.S.U. £15. Phone Stafford 47818 daytime.

NEW BACK ISSUES of "Practical Wireless" available 90p each post free. Cheque or uncrossed P/O returned if not in stock. Bell's Television Service, 190 Kings Road, Harrogate, N. Yorks. Tel: (0423) 55885.

YAESU F.R.G. 7700 receiver brand new, unwanted gift £270. Ring Richmond, North Yorks 4469.

Personal

CHRISTIAN SINGLES HOLIDAYS. Weekend houseparties, friendship, contacts nationwide. C.F.F. Dept/B89, Edenthorpe, Doncaster.

Educational

CAREERS in Marine Electronics, Courses commencing September and January. Further details, The Nautical College, Fleetwood FY7 8JS. Tel. 03917 79123.

TELEVISION COMPUTER RADIOCOMMUNICATIONS & RADAR SERVICING

TWO YEAR full-time Modular Diploma course to include a high percentage of practical work.

- ELECTRONIC PRINCIPLES
- MONO TV & CCTV
- COLOUR TV & VCR
- MICROELECTRONICS & DIGITAL TECHNIQUES
- MICROPROCESSORS & COMPUTERS
- RADIOCOMMUNICATIONS & RADAR

Each of the above Modules are 13 weeks in duration. Individual Modules can be arranged for applicants with suitable electronics background.

Tuition fees (UK & Overseas) £1500 per year (i.e. £500 per Module).

Next session starts September 14th

Prospectus from:

LONDON ELECTRONICS COLLEGE

Dept: PP, 20 Penywern Road, London SW5 9SU. Tel: 01-373 8721.

ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

Please insert the advertisement below in the next available issue of Practical Wireless for ..... insertions

I enclose Cheque/P.O. for £.....

(Cheques and Postal Orders should be crossed Lloyds Bank Ltd. and made payable to Practical Wireless).

NAME.....

ADDRESS .....

.....

Send to: Classified Advertisement Manager
PRACTICAL WIRELESS,
Classified Advertisement Dept., Rm. 2337, King's Reach Tower, Stamford Street, London SE1 9LS **Telephone 01-261 5846**

Rate
28p per word, minimum 12 words. Box No. **60p** extra.

9/81

EDUCATIONAL CONTINUED

TECHNICAL TRAINING

Get the training you need to move up into a higher paid job. Take the first step now—write or phone ICS for details of ICS specialist homestudy courses on Radio, TV, Audio Eng. and Servicing, Electronics, Computers, also self-build radio kits. Full details from:

ICS SCHOOL OF ELECTRONICS
Dept. 277M Intertext House, London SW8 4UJ
Tel. 01-622 9911 (all hours)
State if under 18

CITY & GUILDS EXAMS

Study for success with ICS. An ICS homestudy course will ensure that you pass your C. & G. exams. Special courses for: Telecoms, Technicians, Electrical Installations, Radio, TV & Electronics Technicians, Radio Amateurs. Full details from:

ICS SCHOOL OF ELECTRONICS
Dept. 277M Intertext House, London SW8 4UJ
Tel. 01-622 9911 (all hours)
State if under 18

COLOUR TV SERVICING

Learn the techniques of servicing Colour TV sets through new homestudy course approved by leading manufacturers. Covers principles, practice and alignment with numerous illustrations and diagrams. Other courses for radio and audio servicing. Full details from:

ICS SCHOOL OF ELECTRONICS
Dept. 277M Intertext House, London SW8 4UJ
Tel. 01-622 9911 (all hours)
State if under 18

Miscellaneous

WAVEGUIDE, FLANGES & DISHES. All standard sizes & alloys stock. Special sizes to order. Call Earth Stations, 01-228-7876. 22 Howie Street, London SW11 4AR.

7400's NEW FROM 7p. Send SAE lists 'Saktes Music, 1a Manor Road, Bishopsteignton, Devon. TQ14 9SU. Tel. 06267 78856.

C.W.A.S. ALARM. Send now for the latest discount catalogue of Professional Burglar Alarm Equipment. C.W.A.S. Alarm, 11 Denbrook Walk, Bradford BD4 0QS, W. Yorks. Phone 0274 682674.

TIME WRONG?

MSF CLOCK is ALWAYS CORRECT – never gains or loses, SELF SETTING at switch-on, 8 digits show Date, Hours, Minutes and Seconds, auto GMT/BST and leap year, also parallel BCD output, receives Rugby 60KHz atomic time signals, built-in antenna, 1000Km range, GET the TIME RIGHT. **£62.80.**

LOSING DX UNDER QRM? DIG it OUT with a Tunable Audio Notch Filter, between your receiver and speaker, BOOST your DX/QRM ratio, 40dB notch, hear WEAK DX, **£13.80.**

CAN'T FIND DX? Get SPOT-ON with a Crystal Calibrator, between your antenna and receiver, 1MHz, 100, 25KHz MARKERS, **£23.80.**

Each fun-to-build kit includes all parts, printed circuit, case, instructions, postage etc, money back assurance so GET yours NOW.

CAMBRIDGE KITS
45 (PX) Old School Lane, Milton, Cambridge.

SUPERB INSTRUMENT CASES by Bazelli, manufactured from P.V.C. Faced steel. Hundreds of people and industrial users are choosing the cases they require from our vast range. Competitive prices start at a low £1.05. Chassis punching facilities at very competitive prices. 400 models to choose from. Suppliers only to Industry and the Trade. BAZELLI, (Dept No. 25), St. Wilfrid's, Foundry Lane, Halton, Lancaster LA1 6LT.

MORSE CODE TUITION AIDS

Cassette A: 1-12 w.p.m. for amateur radio examination.
Cassette B: 12-24 w.p.m. for professional examination preparation. Each Cassette are type C90.
Morse Key and Buzzer unit for sending practice.
Price each Cassette (including booklets) **£4·75.** Morse Key and Buzzer **£4·75.**
Prices include postage etc. Overseas Airmail £1·50 extra.

MHEL ELECTRONICS (Dept 2), 12 Longshore Way, Milton, Portsmouth PO4 8LS.

QSL CARDS £4.50 100 P/P S.A.E. 6×4" for samples. McLelland, 42 Lancaster Road, Marsh Green, Wigan, Lancs. Tel. 217087.

MULLARD LP1164 AM/FM I.F. modules guaranteed unused £1.50 each or ten for £10. P.P. C.W.O. Tennex, Stock Road, Industrial Estate, Southend, Essex.

THE SCIENTIFIC WIRE COMPANY

PO Box 30, London E.4
Telephone 01 531 1568

ENAMELLED COPPER WIRE

SWG	1 lb	8 oz	4 oz	2 oz
8 to 29	2.76	1.50	0.80	0.60
30 to 34	3.20	1.80	0.90	0.70
35 to 39	3.40	2.00	1.10	0.80
40 to 43	4.75	2.60	2.00	1.42
44 to 47	5.90	3.40	2.39	2.00
48 to 49	15.96	9.58	6.38	3.69

SILVER PLATED COPPER WIRE

14 to 30	6.50	3.75	2.20	1.40

TINNED COPPER WIRE

14 to 30	3.85	2.36	1.34	0.90

Prices incl. P&P and VAT. Orders under £2 add 20p.
SAE for list of Copper/Resistance Wire.
Dealer enquiries welcome.
Reg. Office 22, Coningsby Gardens.

ELECTRONIC KITS. Largest range of kits in the U.K. Everything from stroboscopic lights to transmitters, at unbeatable prices. Send S.A.E. for free catalogue to: EASTLING ELECTRONICS (Kits), 64b Hawthorne Road, Winton, Bournemouth.

PRE-PACKED. Screws, nuts, washer, solder tags studding. Send for price list. A1 Sales (PW), P.O. Box 402, London SW6 6LU.

UH AIRCRAFT FREQUENCIES LIST including spot frequencies of airports, air traffic control services, weather reports, navigation beacons, etc. £1. UK Marine Frequencies List including spot frequencies of coast stations, (plus broadcast times) port operations, navigation beacons, etc. £1. International Distress Frequencies Chart 75p. Prices include postage, same day despatch. PLH Electronics, 20 Vallis Road, Frome, Somerset BA11 3EH.

PARAPHYSICS JOURNAL (Russian translations): psychotronic generators, Kirlianography, gravity lasers, telekinesis. Details: SAE 4 × 9" Paralab, Downton, Wilts.

ICOM TRIO/KENWOOD OWNERS. Very informative separate newsletters. Details S.A.S.E. G3RKC QTHR.

SOUND INVESTMENT

Replacement tape heads from Monolith could mean a big improvement in sound quality from your tape recorder. A full catalogue is available, price 50p, which features a wide range of heads for cassette and reel to reel machines, as well as replacement motors, tape transports, etc.

Universal cassette heads to EIAJ standard, hole centres 17mm apart, 12mm from head face:

B12-02	Mono record/playback	£ 4.62
B24-01	Stereo playback	£ 4.62
B24-02	Stereo r/p	£ 7.66
B24-07	Stereo r/p for Dolby systems	£ 9.05
C42RPH20	Stereo r/p sendust head, suitable for chrome & metal tapes	£10.67
C42RPH04	Stereo r/p glass ferrite, the ultimate long life, high performance head	£13.34
C42RPS18	Stereo twin gap r/p long life head for record monitoring	£28.99
C21ES18	Mono/Stereo erase head	£ 2.13
C44RPH03	Four channel/track r/p	£15.15
C22ES04	Twin half track erase	£ 5.43

Ex stock deliveries, all prices include VAT. Post and packing 40p.

MONOLITH
electronic products

The Monolith Electronics Co. Ltd., 5/7 Church Street, Crewkerne, Somerset TA18 7HR. Tel: 0460 74321. Telex: 46306 MONLTH G.

ELDON

We have for years supplied industry and individuals alike, with all kinds of enclosures, from plastic to stainless steel, from one off to one thousand and one off.
The COMPACT range (illustrated) is usually available by return of post in ABS poly-carbonate or aluminium. Another advantage is that they are sealed with a rubber gasket giving dust and water protection to IP 65 (BS 5490).
If you like to order, want a brochure or just have an enclosure problem you would like to discuss, please contact:

PETER HUGHES
or
JENNY CHEETAHM

ELDON electric limited
Lovett Road, Staines, TW18 3AH.
Tel. Staines (0784) 61851 Telex: 934717.

MIGHTY NINETY PACKS ALL 90p Ea. Inc. VAT.

BUY SIX PACKS AND GET A SEVENTH PACK FREE!
POSTAGE UP TO 4 PACKS 15p PER PACK. 5 PACKS OR MORE POST FREE.

MN1	300 ¼ watt pre-formed resistors.	**MN31**	15 assorted trimmer caps.
MN2	200 ½ and ¼ watt resistors.	**MN32**	15 30pF beehive trimmers.
MN3	100 1 and 2 watt resistors.	**MN34**	25 min. glass reed switch.
MN4	50 wire wound resistors.	**MN40**	50 polystyrene capacitors.
MN5	100 metal oxide resistors.	**MN42**	10 BC107 transistors.
MN6	12 assorted potentiometers.	**MN43**	10 BC108 transistors.
MN7	25 assorted pre-set resistors.	**MN44**	10 slide switches sp/co.
MN8	50 assorted electrolytic caps.	**MN51**	10 ·2" red led.
MN9	100 assorted ceramic caps.	**MN52**	10 ·125" red led.
MN10	100 mixed caps, poly, ceramic, elect, mica, etc.	**MN53**	20 0·1 mfd 25V ceramic disc.
MN13	20 assorted transistors.	**MN54**	20 0·01 mfd 25V ceramic disc.
MN14	40 1N4148 diodes.	**MN58**	2 × CA723 voltage reg.
MN22	8 ·2" LED's with clips 4 red, 2 yellow, 2 green).	**MN61**	3 × TIP32 transistor.
		MN62	3 × TIP31 transistor.
MN23	1lb nuts, screws, washers, etc.	**MN63**	30 mixed polyester caps., C280, Siemens, etc.

Microwave Modules as described in Practical Wireless "Exe". Project (Wessex Alarms) complete with horn. **£8.00** + 50p postage.

CHORDGATE LTD (Dept C)
75 Faringdon Road, Swindon, Wilts. Tel. (0793) 33877
Retail premises at above address.

OFF THE SHELF DELIVERY ON THESE ®

FLUKE

BRAND NEW FROM FLUKE . . . NOW AVAILABLE THE 8024A HAND HELD DMM

This model incorporates all the features of the 8020A but in addition has:

A peak hold switch which can be used in AC or DC for volts and current functions.

Audible continuity testing and level detection for sensing logic levels.

A temperature (°C) range for use with a thermocouple.

£155

Carriage and Insurance £3

The following accessories are in stock now

Y8008 Touch and Hold Probe	**£29.00**
80K-40 High Voltage Probe	**£51.00**
81RF RF Probe to 100 MHZ	**£35.00**
80T-150C Temperature Probe (C)	**£66.00**
80I-600 Clamp-on AC Current Probe	**£61.00**
80J-10 Current Probe	**£22.00**

HERE IT IS . . . THE EVER POPULAR 8022A HAND-HELD DMM

Consider the following features:
6 resistance ranges from 200 ohm-20 ohms.
8 current ranges from 2mA-2A AC/DC.
10 voltage ranges from 200 mv-1000v DC-200 mc-750V AC.
Pocket size – weighing only 370 gms.
Full overload protection – will withstand 6kv spikes.
Rugged construction – virtually indestructable.
Meets tough military specs. – drop proof.
In line, pushbutton operation for single-handed useage.
Incorporates low power cmos chip for low power consumption.
All this plus a 2-year full guarantee.

£89

Carriage and Insurance £3

Soft carrying case £8 extra

Even more sophisticated the Fluke 8020A.
Identical in most respects to the 8022A but in addition incorporates a conductance range from 2mS-200nS.

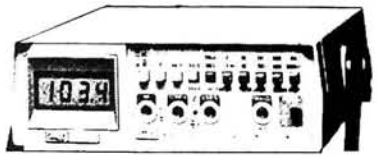
Price £125

Carriage and Insurance £3.00

A handsome soft carrying case is included (this model only)

OFF THE SHELF DELIVERY ON THESE ®

FLUKE



8010A AND 8012A BENCH MODEL D.M.M.s

The 8010A is a general purpose, bench/portable digital multimeter with more functions and features than ever offered for such a low price. Its companion, the 8012A, has identical characteristics except that it has two additional low resistance ranges, 2Ω and 20Ω to replace the 8010A's 10 ampere current range.
The 8010A and 8012A feature:
10 voltage ranges from 200mv-1000v dc. 200mv-75v ac.
3 conductance ranges from 2mS-200nS.
6 resistance ranges from 200Ω-20mΩ – the 8012A has two additional resistance ranges 2Ω and 20Ω.
10 current ranges from 200μA-2A AC/DC – the 8010A has two additional current ranges 10A AC and 10A DC.

80 10A **£167** 80 12A **£218**

Carriage and Insurance £3.

The 8010A is also available with two rechargeable Nicad size C batteries installed in option –01 a+ **£193.00.**

PLEASE ADD 15% VAT TO ALL ORDERS except where items marked "VAT Included". CALLERS WELCOME.
We are open 9 a.m.-6 p.m. Monday-Saturdays. We carry a very large selection of electronic components and electro-mechanical items. Special quotations on quantities.

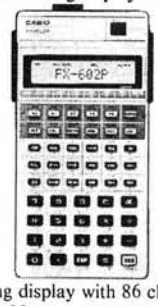
ELECTRO-TECH COMPONENTS LTD.

364 EDGWARE ROAD, LONDON, W.2. TEL: 01-723 5667

THE LAST WORD IN POCKET CALCULATORS

The ultra-capacity calculator with "Computer Talk" programming via upper and lower case dot matrix scrolling display

CASIO FX602P



- **88 memories, up to 512 steps**
- **Full memory retention**
- **A variety of jump commands**
- **Up to 9 sub-routines, up to 9 levels**
- **33 parentheses**

RRP £84.95 **ONLY £74.95**

- LCD alpha/numeric (dot matrix) scrolling display with 86 characters
- Variable range of input capacity from 32 program steps with 88 independent memories to 512 steps with 22 memories.
- Memory and program retention when switched off.
- Up to 10 pairs of unconditional jumps (GOTO). Manual jump (GOTO).
- Conditional jumps and count jumps. Indirect addressing.
- Up to 9 subroutines, up to 9 depths (levels).
- 50 built-in functions, all usable in programs.
- PAM (Perfect Algebraic Method) with 33 parentheses at 11 levels.
- An almost infinite number of programs can be stored on cassette tape via optional FA-1 adapter. (Price £19.95).
- Two lithium batteries last approx. 660 hours (continuous) with Auto Power Off after approx. 6 minutes non-use.
- Dims: 9.6 × 71 × 141.2mm ($\frac{3}{8}$ × $2\frac{3}{4}$ × $5\frac{1}{2}$''). Wallet.

Send 20p for details of Casio's best selling products.
Including:-
FX3500P. 38 step programmable for **only £22.95.**
CA90 and CA901. Calculator alarm watches with Digital Space Invader Game, Stopwatch, Dual Time **from £19.95.**
VL-1. Mini synthesiser with Record/Playback, 5 instrument voices, 10 rhythm accompaniments etc. **Only £35.95.**

PRICES include VAT, P&P. Return of post service. Send cheque, P.O. or phone your ACCESS or BARCLAYCARD number to/

TEMPUS Dept. PW, Beaumont Centre, 164-167 East Road, Cambridge CB1 1DB. Tel: 0223 312866.

BECOME A RADIO AMATEUR

Learn how to become a radio amateur in contact with the whole world. We give skilled preparation for the G.P.O. licence.
No previous knowledge required.

Free! Brochure without obligation to :–

British National Radio & Electronic School
READING, BERKS. RG1 1BR

Name . . . . . .
Address . . . . . .
. . . . . .
. . . . . .
PW/10/815 BLOCK CAPS PLEASE

INDEX TO ADVERTISERS

Published on approximately the 7th of each month by IPC Magazines Limited, Westover House, West Quay Road, POOLE, Dorset BH15 1JG. Printed in England by Chapel River Press, Andover, Hants. Sole Agents for Australia and New Zealand – Gordon and Gotch (Asia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions INLAND and OVERSEAS £13·00 payable to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex. PRACTICAL WIRELESS is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

INTRODUCING THE NEW "READY TO GO" SOLDERING IRON WITH BUILT-IN FINGER PROTECTION FROM

ANTEX

Models XS-BP (25 watt) and CS-BP (17 watt) have moulded-on safety plugs, 'unbreakable' handles and detachable hooks-cum-finger-protectors.
High class insulation by ceramic shaft, negligible leakage.
Long life iron and nickel plated bits, easily interchanged, slide on or off stainless steel shafts which enclose the heating elements for maximum efficiency of heat transfer.
Both models available for 240v, 115v, 24v or 12 volt. R.S.P. £5.30 plus V.A.T.

ANTEX LIMITED, Mayflower House, Plymouth, Devon PL1 1BR. Telephone: (0752) 667377.

STOP PRESS MAPLIN ROAD SHOWS

Friday 25th September
Grainger Room
Newcastle Centre Hotel
New Bridge Street,
Newcastle-upon-Tyne

Saturday 26th September
Rosebery Room
Grosvenor Centre Hotel
Grosvenor Street
Edinburgh

Sunday 27th September
Ullswater Room
Portland Hotel
3 Portland Street
Piccadilly Gardens
Manchester

Monday 28th September
The Malvern Suite
Birmingham Centre Hotel
New Street
Birmingham

Tuesday 29th September
The Riverside Suite
Hotel Nelson
Prince of Wales Road
Norwich

For further details phone 0702 554155

in SOUTHEND
284 London Road
Westcliff-on-Sea
Essex
Tel: (0702) 554000
(Closed Mondays)

in HAMMERSMITH
159-161 King Street
Hammersmith
London W6
Tel: 01-748 0926
(Closed Mondays)

For personal service visit one of our stores.
Our new store at Hammersmith is conveniently situated near the end of the M4 and the North and South Circular Roads.
There is excellent street parking on meters a few steps away and Hammersmith Underground Station is nearby. Call in and see us soon.

in our CATALOGUE
320 big pages packed with data and pictures of over 5,500 items

Over 100,000 copies sold already!
Don't miss out on your copy.
On sale now in all branches WH Smith price £1.
In case of difficulty check the coupon below.

by MAIL ORDER
A fast service You can rely on

- ✲ Same day service on in-stock lines
- ✲ Very large percentage of our stock lines in stock
- ✲ All prices include VAT
- ✲ Large range of all the most useful components
- ✲ First class reply paid envelope with every order
- ✲ Quality components—no rejects—no re-marks
- ✲ Competitive prices
- ✲ Your money is safe with a reputable company

On price, service, stock, quality and security it makes sense now more than ever to make MAPLIN your first choice for components every time!

make it easy... with MAPLIN

The Maplin Matinée
Amazing value for only £299.95 plus £99.50 for cabinet if required
(Carriage Extra)

Easy to build, superb specification. Comparable with organs selling for up to £1,000.

Post this coupon now.
Please send me a copy of your 320 page catalogue. I enclose £1.25 (incl. 25p p&p). If I am not completely satisfied I may return the catalogue to you and have my money refunded. If you live outside the U.K. send £1.68 or 12 International Reply Coupons.

Name _____
Address _____

PW1081

MAPLIN ELECTRONIC SUPPLIES LTD.

All mail to: **P.O. Box 3, Rayleigh, Essex SS6 8LR. Tel: Southend (0702) 554155 Sales: (0702) 552911**