FOR THE RADIO ENTHUSIAST . . .

JUNE 1981

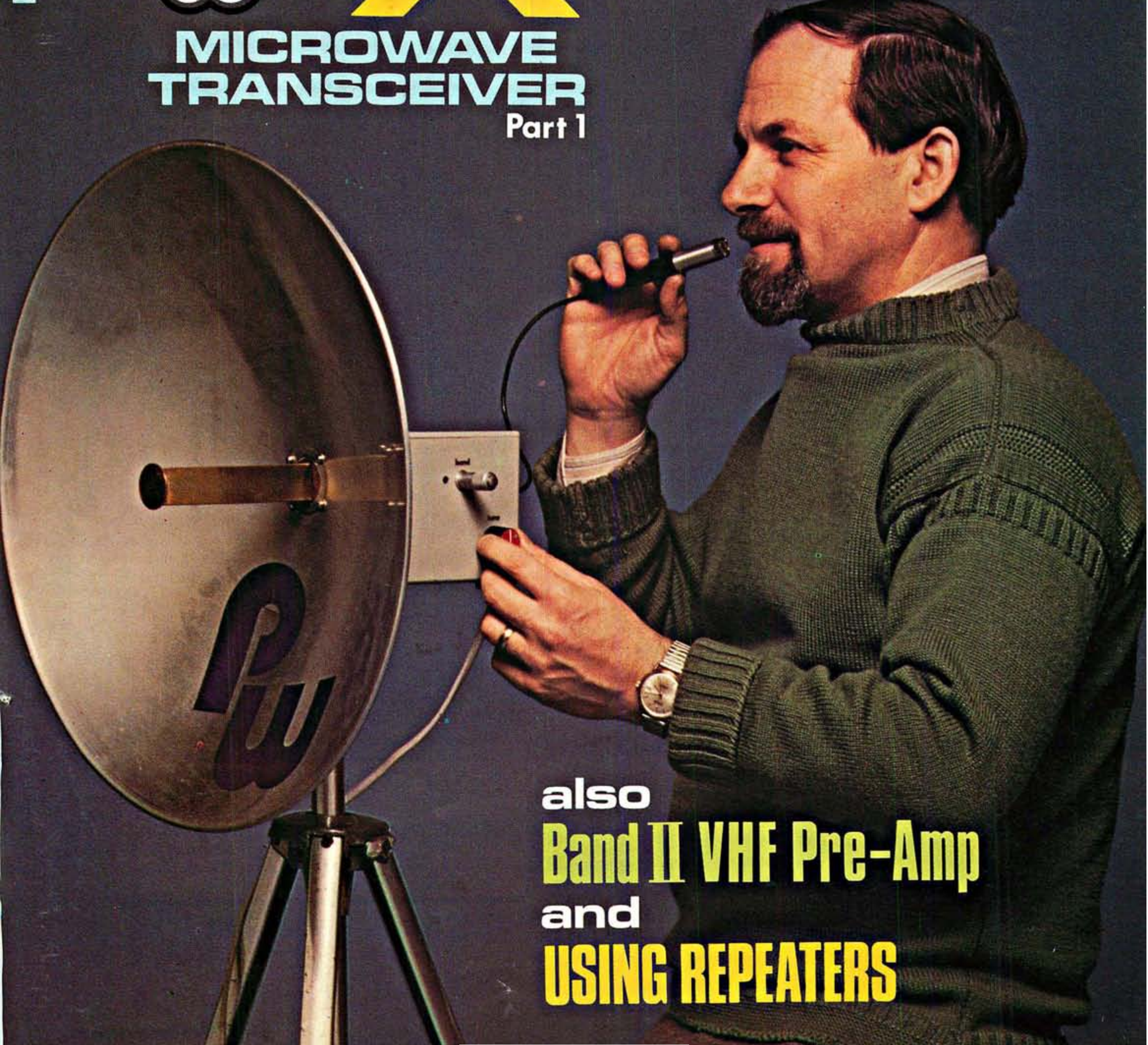
Practical Wireless

Australia $1.25
New Zealand $1.30
Malaysia $4.00

65p

PW 'EXE' MICROWAVE TRANSCEIVER Part 1

SPECIAL OFFER VOLT-CHECK PROBE



also

Band II VHF Pre-Amp

and

USING REPEATERS

30% MORE PRINT AREA

GIANT SUPERPRINTS PLUS FREE FILM

For every one you send for processing by the Practical Wireless Colour Print Service.

Fast, efficient, high quality film processing is now as close to you as your nearest post box. Hundreds of thousands of magazine readers are delighted with this reliable Colour Print Film Service—and the replacement film that comes free every time they use it! So why don't you give it a try?

Here's what you do. Send any make of colour print film inside the envelope enclosed in this issue. Or fill in the coupon below and send it with your colour film in a strong envelope to:

Practical Wireless Colour Print Service, Freepost, Teddington, Middlesex TW11 8BR. No stamp is required.

SEND NO MONEY

We are so confident in the reliability of the service and the quality of our prints, (each one is date stamped with the month and year of developing) that you don't pay until you have received them!

LUXURY COLOUR PRINTS

You will be amazed at the beautiful colours and hi-definition sheen finish of the prints we supply . . . with elegant rounded corners and borderless to give you maximum picture area. And now with the new Giant Superprints you get 30% more picture area than the standard enprints at no extra cost.

UNBEATABLE VALUE

The new Giant Superprints cost you only 17p each and a further charge of £1 is made towards postage and packing. That's all you pay and, when we send your prints, a replacement film, of the size you use, is included absolutely free. That's a saving of up to £2.19.

The offer is limited to the U.K. For Eire, C.I. and B.F.P.O., a handling surcharge will be made.

FREE ALBUM SHEETS

One album voucher is sent with each film we process. Collect 3 vouchers and we send you a set of FREE album sheets to fit into our specially designed album to show off both superprints and standardprints.

MORE BENEFITS TO YOU

You benefit in two additional ways. Firstly, you enjoy a personal service with every care taken over each individual order. And secondly, you pay only for what you get—with no credit vouchers as with many other companies. An invoice comes with your prints, so it is a straight business transaction.

Your prints will normally be despatched within five working days of receipt, but please allow for postal times and possible delays.

Offer exc. Minolta & Sub-miniature film. Roll film 20p surcharge, 400 ASA 20p surcharge. **Superprints can only be produced from Kodacolour II, C41 and Agfa CNS cassette and cartridge film not half frame. Prices correct at time of going to press.**

In the event of any query, please write to: Customer Relations Dept., Colour Print Express Ltd., 19-21 Lower Square, Isleworth, Middlesex, or phone 01-568 6565.

Use this label if you have no envelope, or pass it to a friend. It is used to send your prints and FREE film.

From: Practical Wireless Colour Print Service. Freepost, Teddington, Middlesex. TW11 8BR. Please print my film Superprint/Standard Enprint size (delete size which is not required).

Mr/Ms ________________

Address ________________

____

________ Postcode ________

Practical Wireless

JUNE 1981 VOL. 57 NO. 6 ISSUE 891

contents

WHY BOTHER WITH A LOWE CARD?

By having a Lowe Card, buying equipment, setting up a station is made so easy. Whether you are newly licensed and want your first piece of equipment, or an experienced operator who needs to update, or a guy who wants to widen his listening horizons, then the Lowe Card is your helping hand.

You can buy the equipment you need, when you need it, and spread the cost throughout the year.

JOIN THE FAMILY GET A LOWE CARD

TOO MUCH TROUBLE TO APPLY?

When you apply for your Lowe Electronics Card, you state how much you wish to pay each month. Once your account is approved, you will receive your Card and you can obtain goods up to the value of 24 times your monthly payment. For example, a monthly payment of £20 means that you can have goods up to the value of £480, all at once if you wish.

The total amount outstanding on your account should not exceed 24 times your monthly payment but, as each payment is made, the amount available for your next purchase increases. If, at any time, you wish to increase your monthly payment and have a higher spending limit, ask Lowe Electronics and this can often be arranged on the spot.

And so that you know exactly how you stand, you receive a statement at least four times a year, or at any time on request.

Join the family – get a Lowe Card. Lowe Electronics is the Company for tomorrow's technology today. Ask around, talk with someone who has dealt with us, with our sales staff, with our workshop personnel. Then remember, with your Lowe Card you are part of an organisation dedicated to supplying the needs of the Radio Amateur, the short wave listener and the air or marine band enthusiast.

Get a Lowe Card – join the family . .

ITS SO EASY BY BANKERS ORDER

You may pay by standing order if you have a current account at the Bank or a Post Office Giro account. A Banker's Order Form is included on the opposite page and a Giro Standing Order Form can be supplied on request. Fully complete the Application and Banker's Order Forms opposite and send them to Lowe Electronics or direct to Club 24 Limited.

HOWEVER

If you do not have a bank account, you may pay by cash at any branch of any bank, using a paying-in book which will be sent to you with your Lowe Card. Fully complete the Application Form on the facing page and send it to Lowe Electronics, Chesterfield Road, Matlock, DE4 1LE or direct to Club 24 Limited, Selectapost 24, Claypit Lane, Leeds, LS2 8DY.

As a Lowe Card holder you are eligible for special offers on equipment and accessories: these items are brought to your attention in a News Letter which accompanies your statement.

THE WAY TO HAVE TOMORROWS EQUIPMENT

TODAY

THE LOWE ELECTRONICS BUDGET CARD FACILITY IS OPERATED BY CLUB 24 LTD.

HOW MUCH DOES IT COST?

At the end of each month a small charge is added to the balance owing on your account. This is at present calculated at 2p in the pound (APR 26.8%) for Bankers Order payment accounts, or at $2\frac{1}{4}$p in the pound (APR 30.6%) for payment book accounts. These rates are subject to change at our option.

LOWE ELECTRONICS
CHESTERFIELD ROAD
MATLOCK
DERBYSHIRE
DE4 5LE

CLUB 24
SELECTAPOST 24
CLAYPIT LANE
LEEDS
LS2 8DY

SIMPLE ISN'T IT?

Customer's First Names ....

State Title: Mr Mrs, Miss etc.

Customer's Surname ....

Customer's Address ....

Minimum Monthly Payment £	p	Monthly Pay Multiple	Cr. Limit	Telephone No.
	0 0	× 2 4	= £	

Title | Initials | S | S/C | P | C/S — Do not write in this section

Due Date | Guar | Bank-Code

BANKERS ORDER		PAYMENT BOOK		PLEASE TICK PAYMENT METHOD REQUIRED

EMPLOYMENT DETAILS: If you are married and not in full time Employment please give your Spouse's employment details.

Occupation

How long employed there

Employer's Name and Address

....

If in present occupation less than 3 years please give details of occupation(s) to cover 3 years.

Previous occupation(s) ....

Previous employer's name(s) and address(es) ....

Please tick type of residence

House | Unfurnished Flat | Furnished Flat | Hotel or Lodgings | Living with Parents

Do you own Your Home | Yes | No — How Long at present address

Amount of monthly rent/mortgage £ ....

If under 3 years give previous addresses to cover 3 years

....

How long at previous address(es) ....

Are you married/single — Delete as necessary — If you are Divorced, Widowed Separated, Etc. Please indicate

No. of dependent children:

Please give names of any credit cards you hold — UK callsign

This document contains the terms of a credit agreement. Sign it only if you want to be legally bound by them.

SIGNATURE OF CUSTOMER ....

DATE ....

I hereby apply to open an account with Club 24 and warrant that all the particulars contained on this form are accurate and complete. I understand that Club 24 Ltd. (the Company) may refuse my application but that if it is accepted the conditions set out below will apply. I acknowledge that acceptance of my application will be by means of the issue of a credit card (the Card) by the Company. I am over 18 years of age. I understand that should my application be refused no reason will be given.

LOWE ELECTRONICS.

Bentley Bridge
Chesterfield Rd.
Matlock
Derbyshire DE4 5LE

Credit card facility operated on behalf of Lowe Electronics by:
Club 24 Ltd.
Selectapost 24
Claypit Lane,
Leeds LS2 8DY.
(Registered in England No. 1336850).

A Company jointly controlled by J. Hepworth & Sons Ltd. Forward Trust Ltd.

CREDIT CARD NUMBER	BRANCH
	002

CONDITIONS

1) The Company will open an account in the name of the Customer, and will issue him/her with a credit card in the Company's standard form from time to time. The customer will upon due signature of the card be entitled subject to and in accordance with these conditions to running account credit (as defined in the Consumer Credit Act 1974) with the credit limit shown above.
2) The Card shall at all times remain the property of the Company and the Customer will return it to the Company immediately upon request. If the Card is lost or stolen the Customer will notify the Company immediately (Telephone LEEDS (0532) 30003 and confirm in writing. The Customer shall subject to any statutory provision to the contrary be liable to the Company in respect of the Card by any person whatsoever before receipt by the Company of such written confirmation as aforesaid as if he/she had used the Card personally.
3) The Customer shall make regular monthly payments each of the Minimum Monthly Payment in such manner as the Company may from time to time require on the 1st day in each month commencing on the 1st day of the month following the signing of this agreement. Each of the said monthly payments shall be applied by the Company to the credit of the account in or towards payment firstly of all interest which may on or before the date on which the same shall be so applied have been debited to the account and secondly all other monies debited to the account on or before the said date.
4) The account shall be debited with interest at the rate of 2½% per month (maximum equivalent annual rate 30.6%) on the debit balance from time to time outstanding on the account or such other rate as may be notified to the Card holder when the Card is issued.
5) The whole outstanding debit balance shall become immediately due and payable a) if the customer shall become bankrupt or (subject to any limitations imposed by statute) die or b) upon demand if the Customer shall fail to observe or perform any of these conditions.
6) The Company may terminate the credit facility and cancel the card at any time.
7) The Company shall be entitled from time to time to vary all or any of these conditions including the interest rate referred to in Clause 4 by serving notice on the Customer and any such variation shall become effective immediately upon service of such notice provided that no such variation shall (except insofar as Clause 5 hereof shall be or become applicable) increase the amount or frequency of the monthly payments referred to in Clause 3 hereof.
8) Any notice or demand required or permitted to be served on the Customer hereunder shall be deemed to be properly served if served upon the Customer personally or sent by prepaid post addressed to him/her at the last address notified to the Company and if so sent by second class post shall be conclusively deemed to have been received by him/her within 72 hours of the time of posting.
9) Subject to and in accordance with these conditions the Customer is entitled to credit in relation to payment for goods and/or services supplied by the retailer shown on the reverse of the Card. The Company shall not in any way be liable if the Card is not accepted or honoured by the retailer or any other person.

BANKERS ORDER

Name ....

Address ....

Date.......... Signature ....

TO:

.... Bank Ltd.

Bank Address

....

On receipt of this order please pay £ immediately and £ on the 1st day of each month commencing on the month of .... until cancelled by me in writing.

Pay to:

MIDLAND BANK LTD.
CITY BRANCH, LEEDS
40-27-15

For the credit of:

CLUB 24 LTD.
31087061

Quoting customers name and the following reference number

	This number must be quoted

Please note:
1. This order supersedes all existing orders on the quoted reference number.
2. If you are unable to act on this order please advise us immediately.

SO, YOU'RE NOT BOTHERING WITH A LOWE CARD, BUT JUST LOOK AT PART OF OUR COMPREHENSIVE RANGE OF EQUIPMENT WHICH COULD BE PART OF YOUR STATION

TRIO EQUIPMENT

		Net Inc VAT	Carr.
TS830S	160-10m transceiver with the new bands. Successor to the TS820	639.52	4.50
VFO230	Digital VFO with memories and digital readout	194.45	4.50
AT230	All band ATU and power meter. Matches TS830S	106.72	1.50
SP230	External speaker unit with switched filters	33.14	1.50
DFC230	Digital frequency remote controller. Four memories etc	163.13	1.50
SM220	Station monitor scope	197.80	4.50
R820	The ultimate amateur band receiver	690.00	4.50
VFO180	External VFO	96.60	1.50
TS130S	8 band 200W pep mobile transceiver	491.05	4.50
PS20	AC power supply for TS120/130V	44.85	4.50
PS30	AC power supply for TS120/130S/180S	85.10	4.50
MA5	New TRIO 5 band mobile aerial system. Absolutely complete	74.75	4.50
MC50	Deluxe dual impedance desk microphone	24.15	1.50
LF30A	HF lowpass filter. 1 KW rating	18.40	1.00
TS770E	2m/70cm all mode dual band transceiver. European repeater shifts	730.25	4.50
TR9000	2m synthesised multimode mobile/fixed station transceiver	345.00	4.50
PS20	AC power supply for TR9000	44.85	4.50
BO9	Base plinth for TR9000	32.20	4.50
TR7800	2m FM synthesised mobile/fixed station 25W transceiver	268.00	4.50
SP40	Mobile speaker unit for TR7800, TR9000 and TR8400	26.89	1.50
TR2300	2m FM synthesised portable transceiver	166.75	4.50
VB2300	10W amplifier for TR2300	49.45	1.50
TR2400	2m FM synthesised handheld	198.95	4.50
SMC24	External mic/speaker for 2400	13.80	1.00
ST1	Base stand and quick charger	43.70	1.50
LH1	Hard leather holster type case	18.50	0.50
TR8400	70cm FM synthesised mobile transceiver. 430-440Mhz	279.00	4.50
PS10	Base station power supply for TR8400	63.00	4.50
R1000	Synthesised 200khz-30Mhz receiver. Price includes dc kit fitted	285.20	4.50
HC10	Digital station world time clock	55.20	1.50
HS4	Economy headphones	10.35	0.75

HF GENERAL COVERAGE RECEIVERS

SRX30D	General coverage HF receiver. 200Khz-30Mhz. AM/SSB/CW	195.00	4.50

2m PORTABLES (non TRIO)

AR240A	2m FM 1W synthesised handheld complete with NiCad pack etc	158.00	1.50
AR240	External mic/speaker	10.50	1.00
AR240	Carrying case	4.10	0.50
AR240	12V battery charger. (mains charger included with transceiver)	4.10	0.50
LA2X	2m linear. 10W out for 1W drive. SSB/FM	39.50	1.50

VHF AMATEUR RECEIVERS

AR22	2m FM pocket synthesised receiver 141-149Mhz	83.00	1.50
SR9	2m FM tunable/xtal receiver 144-146Mhz	46.00	1.50
AMR217B	2m FM scanner fitted 8 channels	120.75	1.50

VHF/UHF MONITOR RECEIVER AND SCANNER

SX200	Ultimate scanner 26-88, 108-180, 380-514Mhz AM and FM. The best	237.00	4.50

ROTATORS

AR40	VHF and light HF use only. 5 core cable required	59.80	4.50
	The Super DAIWA range		
DR7500X	For HF 3 element beams. Preset controller. 6 core cable	98.04	4.50
DR7500R	As for DR7500X but using the DAIWA round controller	107.98	4.50
DR7600X	Heavy duty. Will take up to 2 element 40m beam. Preset control	135.00	4.50
DR7600R	As for DR7600X but using the DAIWA round controller	144.90	4.50

MOBILE AERIALS

	HOKUSHIN RANGE		
2E	2m $\frac{5}{8}$ 3.4 dB gain, foldover base	8.50	1.00
2NE	2m $\frac{7}{8}$, 4.5 dB gain, foldover base	13.00	1.00
430E	70cm $\frac{5}{8}$ over $\frac{5}{8}$, 5.5 dB gain	11.50	1.00
Oscar 430	70cm $\frac{5}{8}+\frac{5}{8}+\frac{5}{8}$ supergain mobile aerial	13.80	4.50
320	2m stainless $\frac{1}{4}$ wave on PL259 plug	1.50	1.00
RG4M	Base for all above units inc. coax ready fitted with PL259	3.50	0.75
RB144	2m rubber helical on BNC plug	3.95	0.50
GSS	Heavy duty gutter/boot mount to take RG4M base	3.15	0.50
MB5	Magnetic mount with 5m coax terminated in PL259	7.95	1.00
MA41	2m $\frac{1}{4}$ wave gutter mount aerial complete with whip clamp cable	11.33	1.00
CBA311	2m $\frac{1}{4}$ wave gutter clip aerial complete with cable and plug	5.00	1.00

BASE STATION AERIALS

HF5	80-10m HF vertical. No radials required when on ground post	48.50	4.50
HF5R	Radial kit for use when mast mounting HF5	28.00	4.50
GPV5	High performance 2m base station colinear	29.50	4.50
GPV7	High performance 70cm $\frac{5}{8}+\frac{5}{8}+\frac{5}{8}$ base station colinear	25.30	4.50
GDX2	The classic wideband aerial. 3 dB gain over the range 50-480 Mhz	39.50	4.50
LAB	Air band ground plane aerial	11.50	1.50

AIRBAND RECEIVERS

Regency	Digital flight scan. Full band coverage. No crystal required	215.00	4.50
R512	High performance 8 channel scanner fitted 5 channels	138.00	1.50
R517	Air band portable. Tunable 118-144 Mhz plus crystal control	49.45	1.00

KEYS AND KEYERS

TRX3	Self contained morse practice oscillator	5.85	1.00
LBK	Lightweight brass key	2.80	0.50
HK708	Straight key. Ball bearing pivots. Non skid base	9.66	1.00
MK704	Squeeze paddle	10.50	0.50

POWER AND SWR METERS

	The superb DAIWA range		
CN620A	1.8-150 Mhz cross pointer power and SWR meter. Up to 1KW	52.81	1.25
CN630	140-450 Mhz cross pointer power and SWR meter. Up to 200 W	71.00	1.25
CN650	1.2-2.5 Ghz cross pointer power and SWR meter. Up to 20 W	95.00	1.25
CNA1001A	Fully automatic all band ATU. Includes cross pointer power meter	129.95	1.50
CNA2002	As for CNA1001A but 2KW rating for tuner and power meter	190.00	4.50
SW110A	SWR power meter 1.8-150 Mhz, 0-20 and 0-200 W. Not cross pointer	29.90	1.25
	Other accessories		
HFC55	Handheld 50 Mhz frequency counter. Ideal for 27 Mhz equipment	36.50	1.50
SF250	SWR/power meter and built in frequency counter to 160 Mhz.	45.00	1.50
SWR25	The ever popular twin meter SWR bridge. 1.8-150 Mhz	12.78	1.00
RW151D	Professional 50 ohm dummy load/power meter. 150 W 0-500 Mhz	69.00	1.50
DL20	20 W 50 ohm dummy load. Screws directly on to SO239	6.04	0.50

ANTENNA ACCESSORIES

CS201/TW2	Two way 50 ohm coax switch. 0-500 Mhz	11.98	0.75
CX3A	Three way coax switch. 0.30 Mhz. Receiver or low power tx only	5.59	0.75
FBB9A	1:1 50 ohm balun. 1 KW pep rating. For use as dipole centre	11.50	0.75
Diplexer	Allows single feed line to VHF/UHF aerials. Reduces cable cost	10.50	1.00
EIS	Small egg insulator. Glazed ceramic 40 cm long	0.30	0.25
EIL	Large egg insulator. Glazed ceramic 50 cm long	0.45	0.36
SIL	Ribbed strain insulator for dipole end or centre. 70 cm long	0.35	0.36

SUNDRY GOODIES YOU CAN'T BE WITHOUT

PP1305GS	Regulated PSU. 240V input, 13.8V dc output at 4A. Protected	18.40	1.50
PP1307	Regulated PSU. 240V input, 13.8V dc output at 7A. Protected	32.00	2.00
PP1310	Regulated PSU. 240V input, 13.8V dc output at 10A. Protected.	49.50	4.50
Light scope	Self illuminated X30 microscope for PCB inspection	6.50	0.50
	Essential station test gear		
FXI	Deluxe station wavemeter 700 Khz-250 Mhz. Needed by licencees	28.00	1.00
HFC55	Handheld 50 Mhz frequency counter ideal for 27 Mhz equipment	36.50	1.50
FC5M	5 digit 50 Mhz frequency counter with switched 455 Khz offset	41.40	0.50
FC22A	250 Mhz counter with IF offset. SPECIAL OFFER	49.50	0.75
	Microphones		
DX450	Superb amplified desk mic and station clock. Transmission timer	63.00	1.00
MEX55	Mobile safety mic on flexy arm. Gear lever PTT switch and preamp	32.00	1.00

MIZUHO RACK SYSTEM FOR THE ADVANCED LISTENER

KX2	Top quality 500 Khz-30 Mhz aerial tuner. Perfect match for R1000	29.90	1.50
AX1	Aerial switching system. Handles 6 aerials & 6 receivers	27.03	1.00
APM1	Audio peak and notch filter Variable bandwidth active filters	33.00	1.00
SR1	Mini rack for the system	14.09	1.50
MP1	Rack mount for APM1	5.20	1.00

MIZUHO MODULES

PF1	Audio active filter module	12.54	0.50
MA1	Audio power amp. 1W module	5.29	0.50
VB1	Microphone compressor module	7.71	0.50

THE NEW SHIMIZU SS105S 80-10 METRE SSB/CW TRANSCEIVER

SS105S	80-10m solid state SSB/CW/FM transceiver. Semi kit form	258.75	4.50

NEW NEW NEW. ITEMS TOO NEW TO PUT IN THE PRICE LIST

RM940	New mobile mic with no connections between mic and rig	45.00	1.50
S9	Spare sensor for RM940 mic system	6.50	0.50
M9	Extra mic for RM940 system	13.00	1.50

JOIN THE FAMILY GET A LOWE CARD.

FULL DETAILS FROM:

LOWE ELECTRONICS
CHESTERFIELD ROAD
MATLOCK, DERBYSHIRE
DE4 5LE
TELEPHONE 0629 2817/2430

INTERESTED IN ELECTRONICS?
TRY A ZEDPACK!
COMPONENTS AT A PRICE EVERYONE CAN AFFORD

Z1 300 mixed 1/2 and 1/4 watt **resistors** £1.95
Z2 150 mixed **1 and 2 watt resistors** £1.50
Z3 300 mixed **capacitors,** most types £3.95
Z4 100 mixed **electrolytics** £2.20
Z5 100 mixed **polystyrene caps** £2.20
Z6 300 mixed **printed circuit components** £1.95
Z7 300 mixed **printed circuit resistors** £1.45
Z9 100 mixed miniature ceramic and **plate caps** £1.20
Z10 **25 assorted pots.** £1.50
Z11 **25** assorted **presets,** skeleton etc. £1
Z12 **20** assorted **vdr's** and **thermistors** £1.20
Z13 **1lb mixed hardware.** Nuts, bolts self-tappers, sleeving, etc. £1.20
Z14 **100** mixed, new and marked, full spec. **transistors.** Pack includes:– BC148, BF154, BF274, BC212L, BC238, BC183L, PBC108 and, or lots of similar types. £4.95
Z15 **100** mixed **diodes** including:– zener, power, bridge, signal, germanium, silicon etc. All full spec. £4.95
Z18 **20** assorted zeners, 1 watt and 400mw £1.50
Z20 10 assorted switches. Slide, push-button, multibank, miniature, reed etc. £1.20

Delux FIBREGLASS printed circuit etching kits.
Includes 100 sq. ins. of copperclad F/G board, 1lb ferric chloride, (made for U.S. Army to MIL. SPEC.), 1 dalo etch resist pen, abrasive cleaner, tweezers, etch resist dish and instructions. **OUR PRICE £5.95**
1lb of FeCl. £2.25
150 sq. ins. single sided board. £2.20
150 sq. ins. double sided board. £3.30
UHF, Transistors T.V. TUNER with slow motion drive, AE.skt. and leads. £1.95
100 Miniature **reed switches.** £2.30

MINIATURE MAINS TRANSFORMERS
Top quality. Split bobbin construction will give 4.5V-0-4.5V at 250MA. 1 3/4" × 1 1/2" × 1 1/2", all sorts of uses. **ONLY £1. 3 for £2.50**
PP3 Battery Connectors 10 for 50p

Miniature Press to Make Switches, Red knob. **3 for 50p**
Subminiature S.P.C.O. Slide Switches. **6 for 50p.**
Miniature D.P.C.O. Slide Switches. **6 for 50p.**
Standard **2P, 3 Position** Slide Switch, **4 for 50p.**
4 × **HP11** Battery Holders (2 × 2 Flat type) with leads. **2 for 50p.**
Assorted Fuse Holders including 20mm, P.C. Panel and chassis types. **Pack of 7 for 50p.**
3.5mm Jack Sockets, switched. **Enclosed type.** P.C. or panel mounting. With nuts and washers. **4 for 50p.**

R.C. SUPPRESSORS
250V. 1" × 5/8" × 1/4". Ideal for fluorescent light suppression, car, and relays. Also for snubber networks. **3 for £1**

ALTERNATOR RECTIFIERS
Make lovely **60 amp 150V** bridges. Ideal for **High Power Battery Chargers.** Type 4AFI. **Set of 4** (2 neg. case + 2 pos. case) **£2.**

Special Purchase enables us to offer **Mullard C280 Polyester Capacitors** (Liquorice Allsorts) at the unbeatable price of **£2 for 100 mixed.** These consist of factory clearance lots i.e. spillages, floor sweepings, cosmetic rejects etc. Also **Mullard miniature electrolytics 200 mixed £2.**

TELESCOPIC AERIALS
Chrome on brass, 9 section, 25" extended. Plugs into any 3.5mm jack socket. Ideal for S.W.R., metre, portable TV, etc. **ONLY £1**

5 ASSORTED VIDEO GAME BOARDS, new but bits missing. Contain 100's of useful components. **CMOS, IC's,** Caps, Transistors, sockets, switches etc. **ONLY £3.50.**

Professional quality **TV Plugs** (coax.) Diecast alloy body, **Silver Plated** solid brass centre pin, brass grubscrew fixing for centre conductor. **50p ea, 5 for £2. Ideal for video's.**

UHF MODULATORS
Calibrated to **Channel 36** 625 line UHF. Housed in metal box, 2 1/2" × 2" × 1/2". Complete with **9 feet of coax lead** and **TV plug. 9V** operation, ideal for video games, computers etc. **£2.50 ea** with connection **Data.**

Vernitron FM4 10.7MHz ceramic filters **50p ea, 3 for £1.**

To: **"GEMINI ELECTRONIC COMPONENTS" DEPT PW**
"THE WAREHOUSE" SPEEDWELL ST. LONDON S.E.8.
Please Quote ZED Code Where shown. Send Cheque* or Postal Order. Add **60p** P&P + **15% VAT.**
*Schools etc. SEND OFFICIAL ORDER
ZED PACKS now available for **Callers** at 50 Deptford Broadway, London, S.E.8.

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
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	1X013	15+15	1.00	
	1X014	18+18	0.83	
	1X015	22+22	0.68	
	1X016	25+25	0.60	
	1X017	30+30	0.50	
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	2X013	15+15	1.66	
	2X014	18+18	1.38	
	2X015	22+22	1.13	
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	2X017	30+30	0.83	
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	2X029	220	0.22	
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	3X014	18+18	2.22	
	3X015	22+22	1.81	
	3X016	25+25	1.60	
	3X017	30+30	1.33	
	3X028	110	0.72	
	3X029	220	0.36	
	3X030	240	0.33	
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	4X012	12+12	5.00	
	4X013	15+15	4.00	
	4X014	18+18	3.33	
	4X015	22+22	2.72	
	4X016	25+25	2.40	
	4X017	30+30	2.00	
	4X028	110	1.09	
	4X029	220	0.54	
	4X030	240	0.50	

TYPE	SERIES No.	SECONDARY RMS Volts	Current	PRICE
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	5X014	18+18	4.44	
	5X015	22+22	3.63	
	5X016	25+25	3.20	
	5X017	30+30	2.66	
	5X018	35+35	2.28	
	5X028	110	1.45	
	5X029	220	0.72	
	5X030	240	0.66	
225VA 110x45mm 2.2Kg	6X014	18+18	6.25	**£10.06** +£1.73 P/P +£1.77 VAT
	6X015	22+22	5.11	
	6X016	25+25	4.50	
	6X017	30+30	3.75	
	6X018	35+35	3.21	
	6X026	40+40	2.81	
	6X028	110	2.04	
	6X029	220	1.02	
	6X030	240	0.93	
300VA 110x50mm 2.6Kg	7X016	25+25	6.00	**£11.66** +£1.73 P/P +£2.01 VAT
	7X017	30+30	5.00	
	7X018	35+35	4.28	
	7X026	40+40	3.75	
	7X025	45+45	3.33	
	7X028	110	2.72	
	7X029	220	1.36	
	7X030	240	1.25	
500VA 140x60mm 4Kg	8X017	30+30	8.33	**£15.53** +£2.05 P/P +£2.64
	8X018	35+35	7.14	
	8X026	40+40	6.25	
	8X025	45+45	5.55	
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	8X028	110	4.54	
	8X029	220	2.27	
	8X030	240	2.08	

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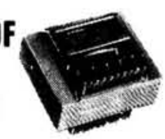

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	P2404	7.5+7.5	0.20	
	P2405	9+9	0.17	
	P2406	12+12	0.12	
	P2407	15+15	0.10	
	P2409	20+20	0.07	
6VA	P3401	3+3	1.00	**£1.91** +£30p P/P +33p VAT
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	P3403	6+6	0.50	
	P3404	7.5+7.5	0.40	
	P3405	9+9	0.33	
	P3406	12+12	0.25	
	P3407	15+15	0.20	
	P3408	17.5+17.5	0.17	
	P3409	20+20	0.15	
	P3410	25+25	0.12	
12VA	P4401	3+3	2.00	**£2.09** +58p P/P +40p VAT
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	P4405	9+9	0.66	
	P4406	12+12	0.50	
	P4407	15+15	0.40	
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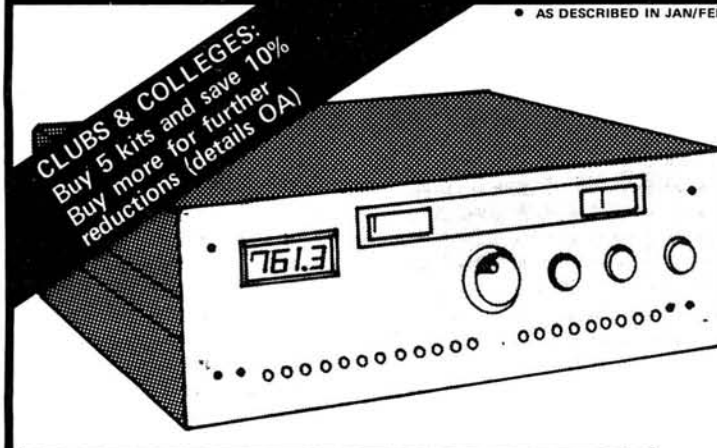

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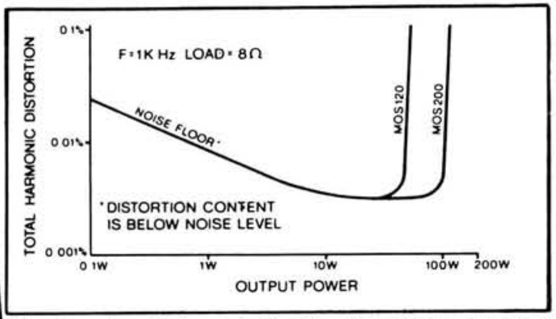

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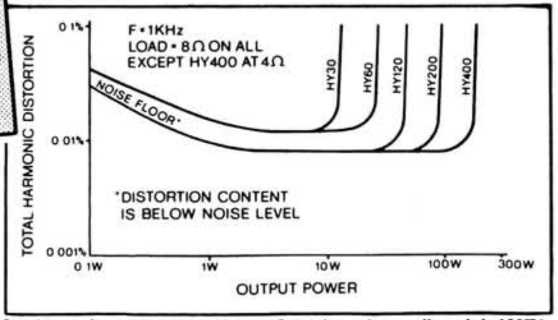
Input impedance both models 100KΩ Frequency response both models 15Hz-100KHz – 3dB



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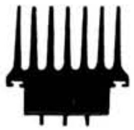

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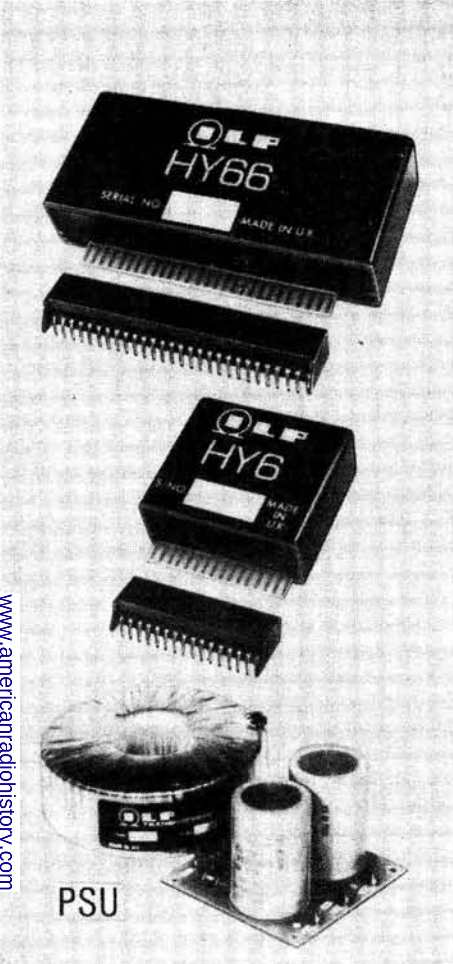

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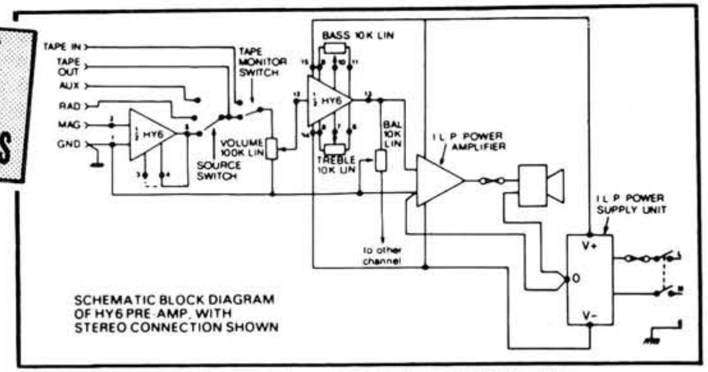

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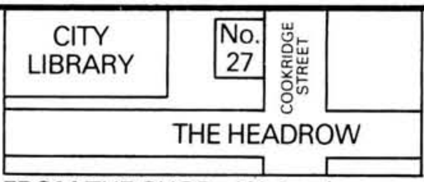

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Changes

OUR MOVE towards radio over the past two years has brought many letters and other messages of encouragement from readers, and we have now decided to devote all of this and future issues of *Practical Wireless* to radio-related topics. I am sure that there will be occasions when it will not be easy to know where to draw the dividing line, for some subjects straddle the border between radio and "non-radio", and we may sometimes stray over a little for the sake of completeness.

We shall take as our broad definition of radio, communication without wires (the "wireless" of our title). What is communicated can take many forms: words, music, pictures, instructions, measurements, etc.,—in a word, information. We shall cover all the applications of radio likely to be of interest to the enthusiast, and the components and techniques used.

★ ★ ★ ★ ★ ★

Technician engineers and engineering technicians are being actively encouraged to get registered now with the Engineering Registration Board (ERB). Some 80 per cent of those with the necessary qualifications to become registered as technician engineers, and around 95 per cent of those eligible to become registered engineering technicians have not yet taken the necessary steps.

The ERB is anxious that all concerned shall not miss the opportunity of being recorded and formally acknowledged as registrants before the establishment of any new "engineering council" as a result of Government decisions regarding the future structure of the profession. Those whose names are entered upon the current registers are almost certain to be accepted by a new authority.

To be fully qualified for registration, an individual must be a member of the appropriate institution—in the case of someone in radio and electronics, this would be the Society of Electronic and Radio Technicians (SERT). The usual reaction when faced with a suggestion that one should pay out subscriptions and join a body of this sort is to ask: "What's in it for me?" The answer in this case is, quite a lot. Each member receives a monthly magazine with news and technical articles, and also a fortnightly newspaper. Lectures and symposiums on various topics are organised in London and the provinces. Having attended a number of these myself, I can vouch for their quality. And there's more besides!

If you think you qualify for membership and registration, and would like further information, write to: SERT, 57-61 Newington Causeway, London SE1 6BL.

Geoff Arnold

services

QUERIES

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

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

PROJECT COST

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

CONSTRUCTION RATING

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

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

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

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

SUBSCRIPTIONS

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

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PART 1

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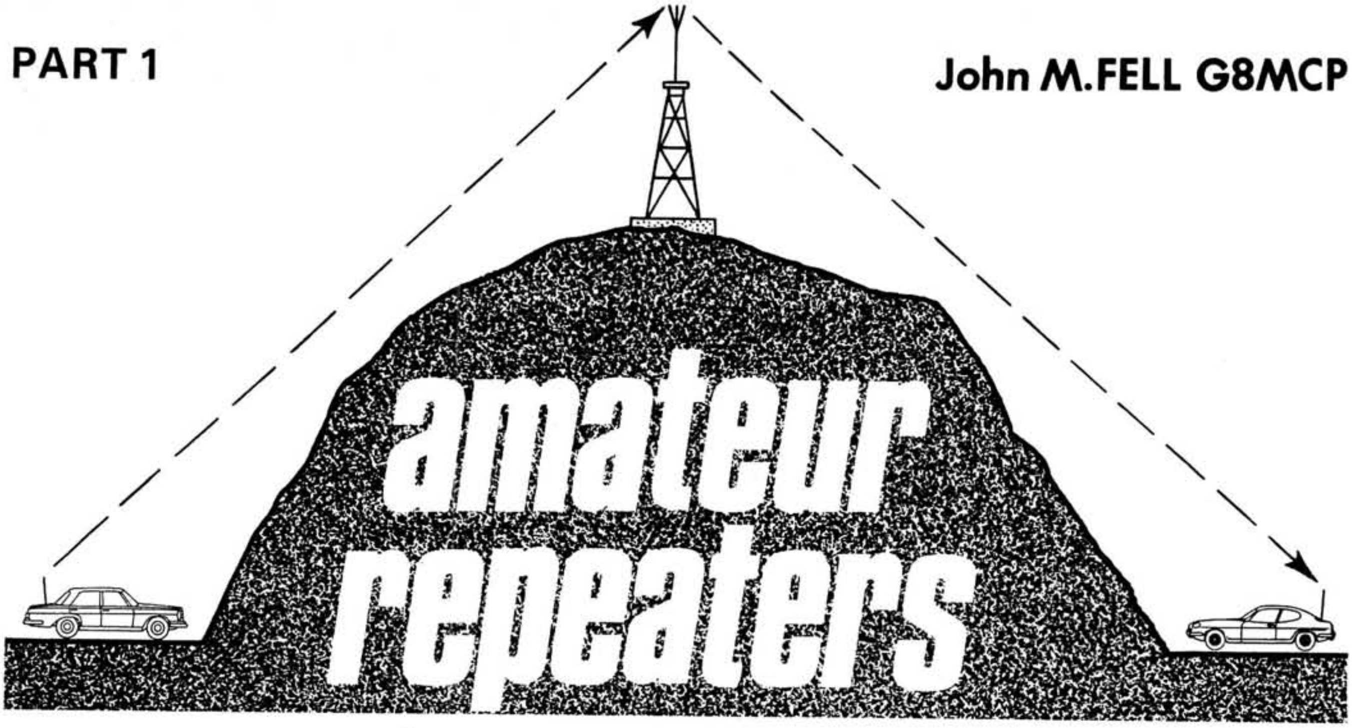


This article is a follow-up to "Using 2 metres" which appeared in the May issue of Practical Wireless. It describes the history and development of the UK amateur repeater network together with an insight into the hardware that forms an average installation.

A repeater is a device designed and built to enhance communications between radio stations normally unable to contact each other due to obstructions such as local terrain or low power. The installation is sited at a prominent location to provide an omni-directional coverage of a specific area, simultaneously retransmitting received signals on a separate closely related frequency.

The UK amateur is currently able to benefit from a network of narrow-band f.m. repeaters constructed, financed and maintained by amateurs, operating in the 2m and 70cm bands with, as will be detailed later, the possibility of units in the lower microwave bands.

Operational Principles

Anyone who has tried to transmit and receive simultaneously on closely related frequencies will be aware of the problems encountered by repeater designers, namely severe de-sensitisation and blocking of the receiver. In order to provide a workable relay system a pair of designated frequencies, separated but still within the amateur bands, are used: one for the repeater reception section and one for the repeater relayed transmissions.

The repeater's reception frequency is known as the INPUT channel and the transmission frequency, the OUTPUT channel. Both 2m and 70cm bandplans show the actual frequencies being used, there being a separation of 600kHz between related INPUT/OUTPUT channels on 2m and 1·6MHz on the 70cm band.

Unfortunately this frequency separation on its own still leaves severe problems of mutual interference. Further isolation can be achieved by separating the transmit and receive antennas, a technique widely used by 70cm repeater builders. Having done this the installation would probably be usable but the blocking point would still be reached with a radiated power output measured in milliwatts!

In order to isolate further the transmitter from the receiver, allowing the use of an effective power output, most repeater designs utilise very selective narrow bandwidth filter systems, usually consisting of multiple section resonant cavities. By very careful design and construction the use of a cavity system will provide reception of weak signals, with minimal blocking effect from the output of the transmitter, and at the same time permitting the use of a single antenna. A typical cavity and multiple section system is shown in Figs. 2 and 3.

As the repeater network is used extensively to enhance the communications of amateur mobile and portable units it is a great advantage to have the radiated signals emanating from the point of reception. Stations using the repeater have then only to peak their received signal to achieve best transmission level into the unit.

The South Dorset 70cm repeater GB3SD in rural surroundings, with Geoff Watts, G8BCH, in attendance

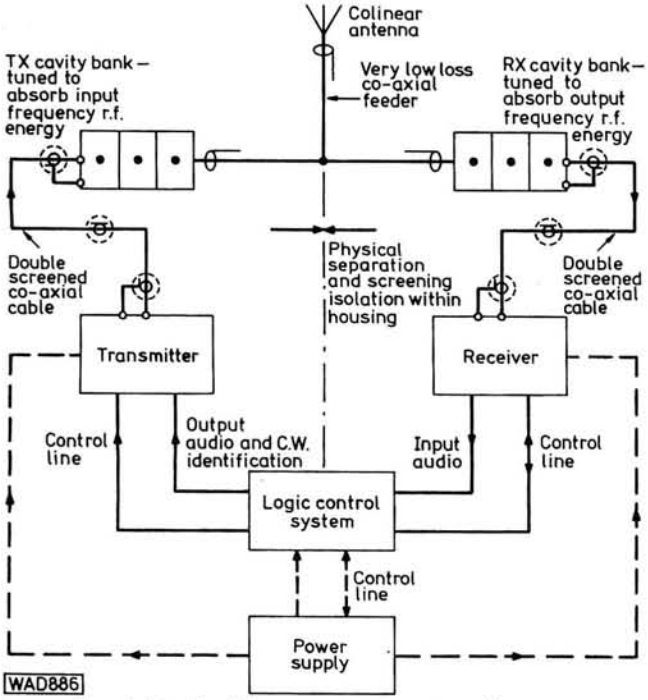


Fig. 1: Typical 2m repeater system diagram

Receiver Section

Inboard of the RX cavity bank is located the repeater receiver, normally consisting of a purpose built narrow bandwidth single channel device featuring highly selective filtering elements, such as high *Q* helical resonators, to remove any residual products of the transmitter output. The receiver is continuously monitoring the input frequency; unlike most amateur equipment this device is normally never switched off, so long-term stability is of paramount importance. It is a great tribute to the designers of amateur repeater equipment that over the many years of continuous service, the down-time due to equipment failure can usually be measured in hours. It must be appreciated that any losses introduced between the antenna and the receiver input, such as occur in the feeder and cavities, reduce the overall effective sensitivity; achievement of the specified e.r.p. by comparison can be readily accommodated by increasing the output from the transmitter p.a. stage. Fig. 4 shows the block diagram layout of the present receiver section of the Dorset 2m repeater GB3SC, designed and built by Chris Down G8MXW.

Transmitter Section

A repeater tends to be "active" for considerable periods of time, and it is again essential for the transmitter section to be capable of maintaining constant output during these sustained levels of activity.

To this end p.a. stages of repeater transmitters are usually built to be capable of delivering several times their required output, allowing them to be under-run. Careful design is required to ensure the effects of thermal build-up do not cause frequency shifts or increases in spurious and harmonic output.

Many repeater installations are co-sited with other radio and television broadcast equipment, sharing the advantages of these lofty sites. It becomes vital then to ensure that the amount of spurious emission from the repeater is kept to a very low level, at a point much lower than normal amateur equipment, and in fact generally to a standard that exceeds commercial type-approved equipment. Whilst making this comparison with commercial standards it is also interesting to note that repeater systems in operation on p.m.r. bands utilise input/output frequency offsets of 5·5MHz, 6·5MHz and 14·5MHz, which considerably eases the requirements for filter isolation and attendant system losses.

The transmitter section also contains the audio processing, modulator and multiplier stages, audio input being derived from the receiver output.

Control System

In order to regulate the activities of the repeater a control system is provided, employing dedicated logic management, universally known to the radio amateur as "the logic".

Several methods of construction have been used by amateur repeater builders from the initial hybrid discrete semiconductor/relay logic through to "state-of-the-art" microprocessor based systems. The adoption of l.s.i. techniques has resulted in readily adaptable comprehensive facilities the equivalent of which was difficult to achieve by previous means. At least one well-known repeater has functioned without problems for 15 months under the control of a Nascom-1 microcomputer!

A logic flow chart is shown in Fig. 5 to illustrate the varied functions of a typical system. It can be seen that in this example the repeater generates a beacon type identification call-sign at 12 w.p.m. every five minutes. During normal operation the logic must acknowledge reception of a 300ms duration, 1750Hz tone, accompanied by well-modulated carrier, before enabling the through audio to the transmitter. Providing the station being relayed

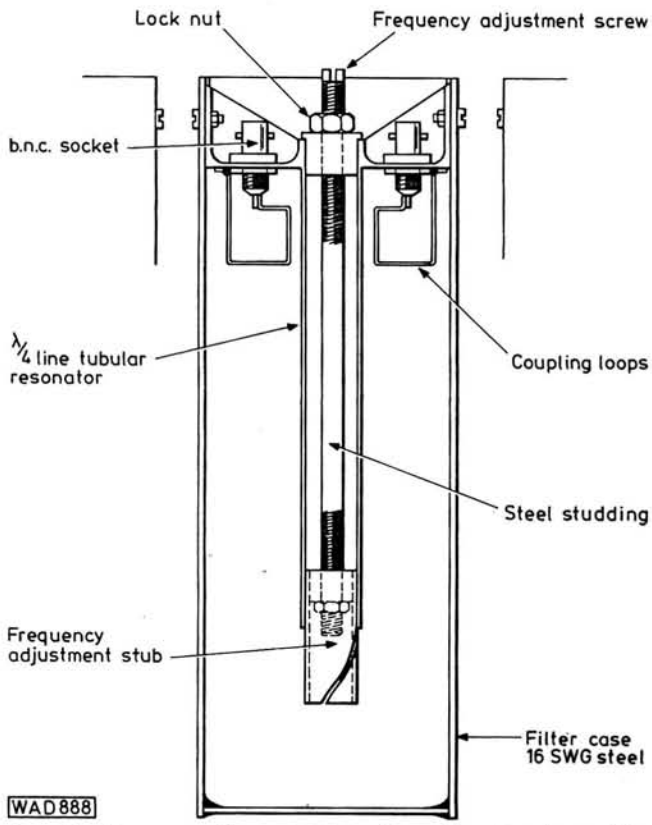


Fig. 2: Cross-section of high *Q* cavity developed by Roy Powers G8CKN. Internal faces are silver plated

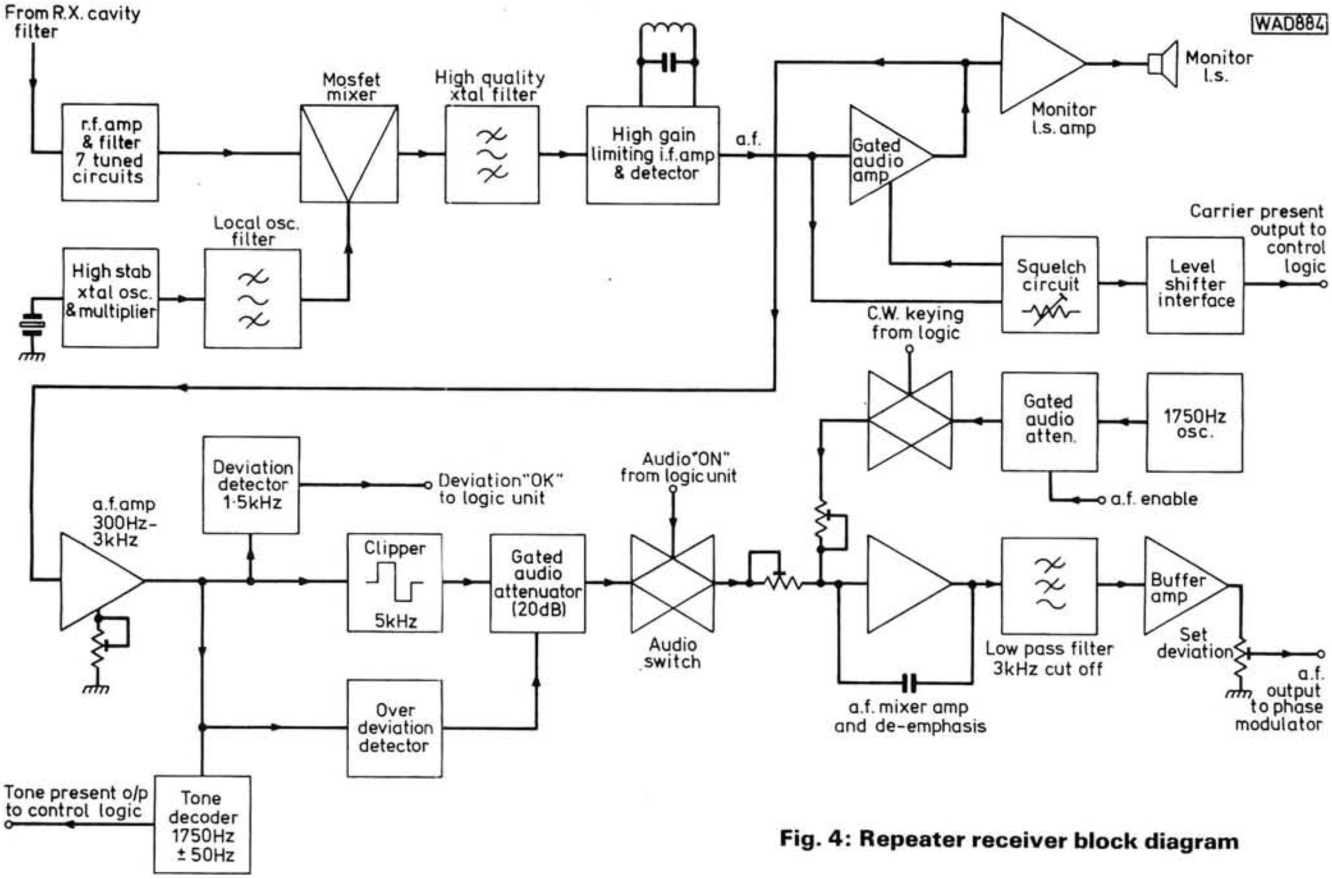


Fig. 4: Repeater receiver block diagram

through the repeater maintains its transmission at a level detectable by the repeater receiver, the logic section will allow re-transmission of signal up until the end of a pre-set time period. At this point the relayed signal is blocked and substituted by alternative information from the control logic. The format for this replacement material varies between repeaters, but typically consists of continuous identification beacon call-signs or the recognisable telephone type "engaged" signal, lasting until the signal received from the station using the repeater ceases.

This action ideally triggers an acknowledgement from the repeater in the form of a Morse character "T" (*dah*) to indicate to the station who has just ceased transmission that he has exceeded his allotted time. Many repeaters do not have this "time-out" facility and rely on the self-discipline of the user. As the repeater can only relay a single transmission at one time it is vital to restrict transmissions to a minimum, allowing maximum use by all stations, and to permit the handling of urgent and emergency traffic.

Should the modulation of the station transmitting into the repeater be of below average deviation, normally resulting in difficult reception, the logic control may again block through audio and go into its beacon mode. An indication is provided, in the form of a Morse letter "D" (*dah dit dit*), after cessation of transmissions, allowing the station to be made aware of its shortcomings.

A correctly designed logic format will allow optimised communications with a minimum of direct control enforcement. Self-regulation is actively encouraged by repeater groups as part of the licence policy of self-tuition in this branch of amateur activities.

Power Supply

The last, but an equally important, component of a repeater installation is its power supply. This device must also be capable of a sustained heavy duty-cycle and be able to provide multiple-level regulated voltage outputs under all conditions.

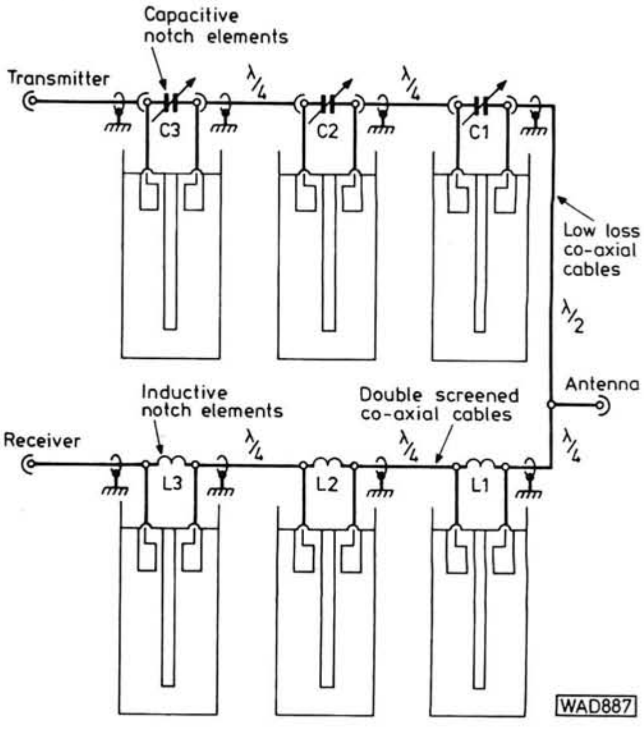
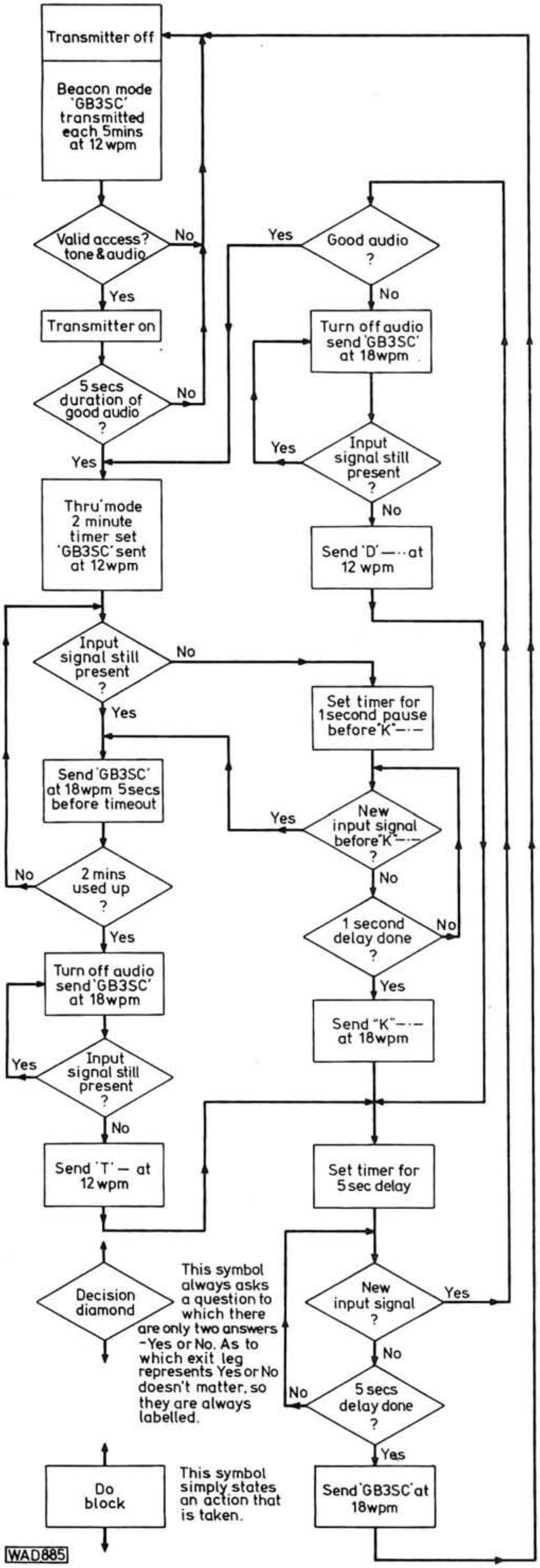
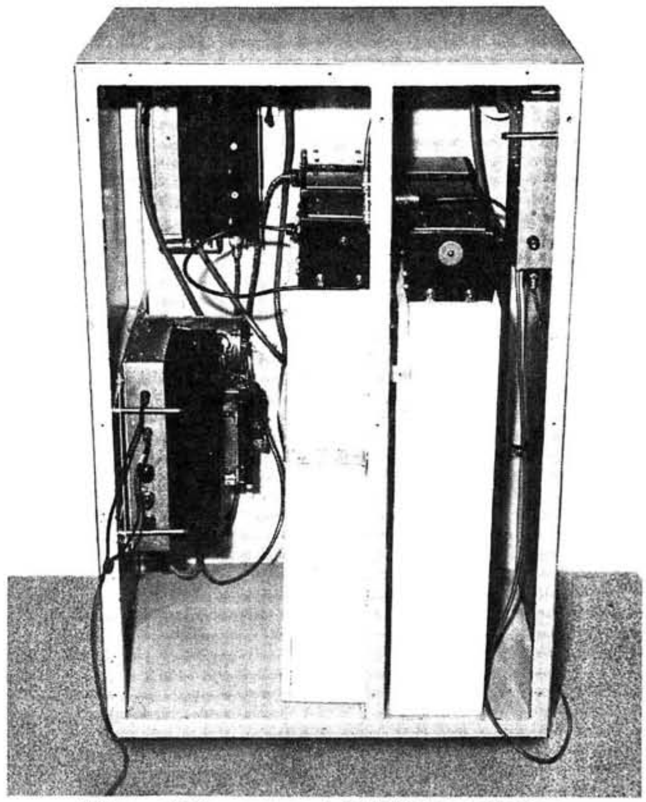


Fig. 3: Multi-section cavity notch filter system



Protection circuits are provided, interlocked with the logic system, to allow uninterrupted supply even in the event of mains failure. A heavy duty battery "back-up" supply is available allowing a continuous duty cycle for several hours in this condition. The logic will normally provide Morse character identification of this situation.

This ability to maintain operation, when all local power has ceased, means that under emergency conditions the repeater would still function and enable the relaying of signals from low power portable stations assisting with necessary emergency communications. Many County Emergency Planning Officers have acknowledged this potentially vital facility by inclusion in their emergency planning manuals.



(Above) The compact GB3SC installation.
Fig. 5 (left): Logic flow chart layout

Installation

As mentioned previously a very high degree of isolation between the input and output is vital for correct operation. An inspection of the system block diagram, Fig. 1, will reveal that double-screened coaxial cables are used to connect the TX and RX units to their associated cavity banks; with an isolation well in excess of 160dB provided by the high *Q* cavity system, the screening integrity of normal coaxial cables (leakage starts at 60dB) has to be increased to prevent isolation bypass. In the same way the physical layout of components within the repeater cabinet affects the ultimate level of isolation. In the photograph of the GB3SC installation the cavity banks can be seen separated by a metallic baffle with the "sensitive" TX and RX elements located in the electrical "cold" area at the rear of the cabinet.

Part Two

The second part of this article will cover remaining items of repeater hardware together with a history of their development and future.

MODS

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

Roger Hall G8TNT (Sam)

No. 7

IC2E

This month's Mods column is devoted entirely to that versatile and extremely popular little rig, the IC2E.

The first mod, which Elaine, G4LFM, our technical sub-editor obtained from Paul, G4HEC, allows the rig to be run from either a 12V power supply or a car battery. The extra components required are:

IC1 7805 voltage regulator
D1 4·3V Zener diode (BZY88 or similar)
C1 2·2µF 16V Tantalum
Misc. Heat sink (piece of solid aluminium 30×20×12mm)
Empty battery pack (part number IC BP4)
Rubber grommet

The first step is to remove all the partitions inside the battery pack, and all the interconnecting straps, apart from the two that snap together i.e. one on each half as in Fig. 1. Both partitions on each side should be removed. When you have done that, drill a small hole in the back of the case and fit the rubber grommet into it.

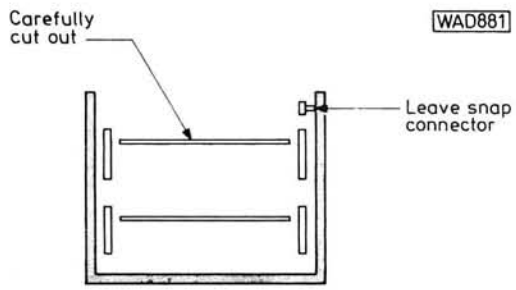


Fig. 1: One half of the battery pack BP4 with dry cell battery partitions to be removed

Now make up the small circuit shown in Fig. 2, using the layout shown in Fig. 3. Then, using double-sided adhesive tape, attach the heatsink and all the components to the front portion of the battery pack. Run the input wires out through the hole in the case so that they can then be used to plug into a 12V power supply or a car's cigar lighter socket. The output wires should be soldered to the appropriate connections inside the battery pack.

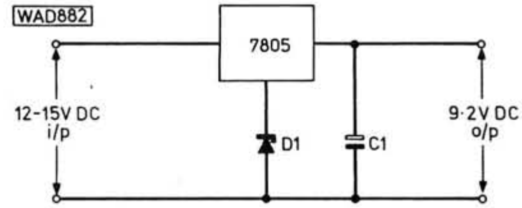


Fig. 2: Circuit diagram of the regulator circuit running from 12V supply

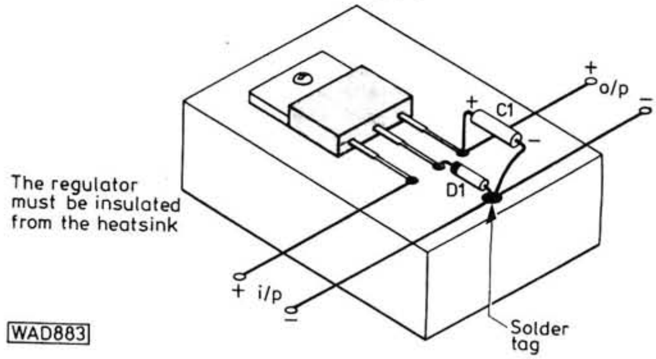


Fig. 3: Physical layout for the components in the battery compartment

Paul has pointed out that the 4·3V Zener in series with the common lead raises the regulator voltage by 4·3V and it is important to make sure that the regulator case is insulated from the heatsink because the common lead is internally connected to the case and, if they should short out, the output would only be 5V.

Mike, G8OQQ, gave me this month's second mod which is somewhat similar to the last one. When the circuit shown in Fig. 4 is built inside the original battery case, the rig can then be plugged into a 12V power supply or a car cigar lighter and the set will then draw its power from the 12V supply on transmit and trickle charge the batteries on receive. The components shown in the shaded area are the ones that are new and to be added to the battery pack.

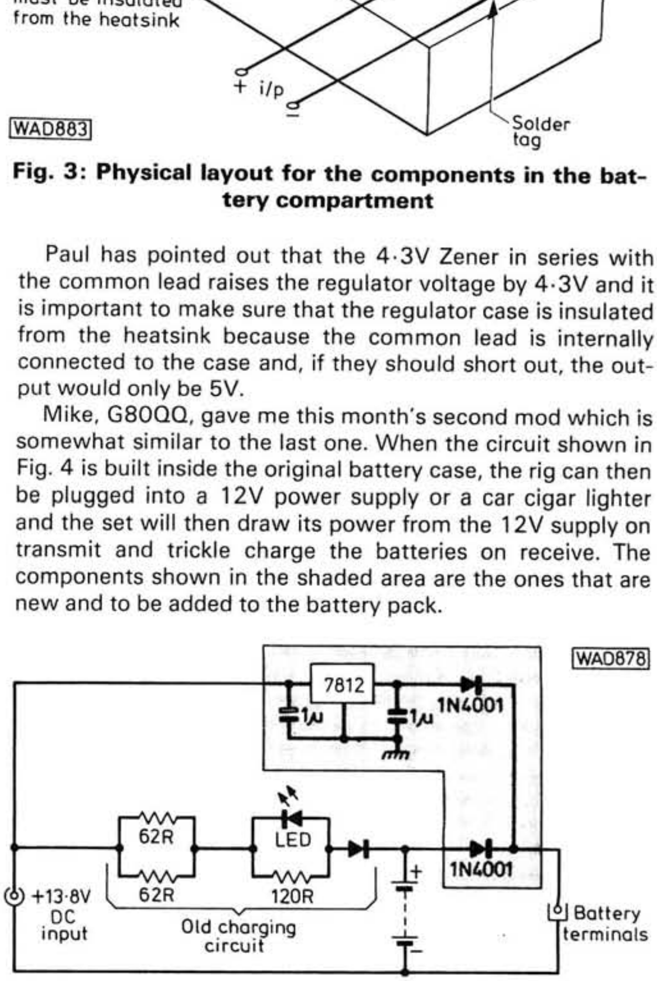


Fig. 4: Circuit diagram with components in the shaded area being additional

Mike did not supply any constructional details, except to say that the 7812 voltage regulator should have its heatsink soldered to the underneath of the metal plate in the battery pack. Because so few components are used, it should not be difficult to fit them into the remaining space in the battery pack.

The last two mods this month were supplied by Thanet Electronics of Herne Bay, the sole Icom importers.

The first one gives semi-reverse repeater i.e. listen on the input, and it is *very* tricky to do. The green interconnecting ribbon is the part of the rig that has to be modified and when

continued on page 35 ▶▶▶

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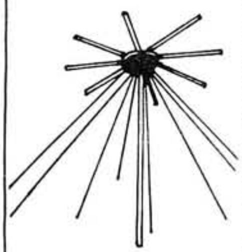

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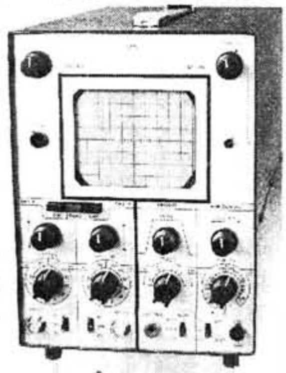

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NEWS NEWS NEWS

Rallies and Events

The Cornwall Technical College at Pool, Camborne, will be the rendezvous for several hundred radio amateurs with their families on Sunday 19 July 1981 when the 18th Rally organised by the Cornish Radio Amateur Club is being held between 1000 and 1700hrs.

There will be the usual opportunities for meeting amateurs from many parts of the country and it is hoped to have on site demonstrations of many aspects of amateur radio, h.f., v.h.f. and u.h.f. installations, r.t.t.y. and the latest aspect of electronics, the home computer. As in previous years there will also be trade stands, with both new and second-hand equipment, bring-and-buy-stall, Raynet stand and refreshments etc.

Further details from: *Ron Ledgerton G2ABC, Westlea, Hugus Road, Threemilestone, Truro, Cornwall TR3 6DF. Tel: (0872) 78393.*

On the 26/27/28 June 1981 it is the intention of the Leeds and District Amateur Radio Society to revive the tradition, started in the mid-1960's, of holding a "Ham Fest". The venue will be the Old Hall Golf Club, Woodhall Lane, Calverley, Pudsey, West Yorks.

The purpose of a "Ham Fest" is to introduce amateur radio to the general public and is also a means of amateur radio enthusiasts throughout the country to indulge their common interest.

As well as all the usual attractions to be found at a radio amateurs' rally, additional family entertainments have been arranged for Friday and Saturday evening, and overnight caravan and camping facilities have been organised.

Further details and tickets for the evening festivities can be obtained from: *Leeds Amateur Radio Shop, Cookridge Street, Leeds or Chris Gledhill, 21 Warrels Place, Bramley, Leeds LS13 3NS, West Yorks. Tel: Pudsey (0532) 567702.*

Equipment News

J. Bull (Electrical) Ltd., equipment and component suppliers, publish a newsletter which covers advance information of new lines, special offers and "too few to advertise" items.

The latest issue (March/April 1981) lists items such as an f.m. monitor, multitester/s.w.r. meter, amplifiers, headphones, motors and many more items of interest to the electronics enthusiast. To obtain a copy of the newsletter just send an s.a.e., or £1.50 which is the subscription rate for 6 issues. The company has recently moved, so please address applications to: *J. Bull (Electrical) Ltd., 34/36 America Lane, Haywards Heath, Sussex RH16 3QU. Tel: (0444) 54563.*

Catalogues

Heathkit, probably the world's largest manufacturer of electronic kits have their latest catalogue available, which gives full details of the extensive range of models available.

The catalogue is obtainable for 25p (in stamps please) from either: *Heath Electronics (UK) Ltd., Bristol Road, Gloucester, or The London Heathkit Centre, 233 Tottenham Court Road, London W1P 9AE.*

South West Aerial Systems have their 1981 catalogue available. Although the catalogue deals mainly with TV and broadcast aerials it also lists useful accessories and aerial hardware.

The catalogue costs 45p and is obtainable from: *South West Aerial Systems, 10 Old Boundary Road, North Dorset SP7 8ND. Tel: (0747) 4370.*

Now available from CSC is a new, free 44-page, full-colour catalogue giving details of the company's extensive range of electronic prototyping, production and testing aids.

New products featured in the catalogue, entitled "Instruments for testing and design", include the LM-3 40-channel triggerable logic monitor, the 4401 frequency standard, and an "Idea box" containing circuit cards, solderless breadboards and power supplies to provide a versatile prototyping aid.

For your copy apply to: *Continental Specialties Corporation, Shire Hill Industrial Estate, Saffron Walden, Essex CB11 3AQ. Tel: (0799) 21682.*

AMSAT–UK Project OSCAR Appeal

No doubt you have already heard of the loss of the latest OSCAR Satellite on 23 May 1980. The cost to the Radio Amateur Satellite Organisation of the United Kingdom was high, some 9 man-years of work, £40,000 in actual cash and £1,000,000 in hardware donated by various well-wishers and AMSAT Groups World-wide. This equipment now lays at the bottom of the Atlantic Ocean off Karou (Devils Island).

This then is an appeal for cash to assist AMSAT–UK to provide £40,000 inside ten months for the European Building Programme for the next bird to fly. The work-team has agreed that they will re-build and in fact have already commenced work.

Any donations received, however small or large, will be sent direct, without administration charges, to the AMSAT–DL Treasurer.

Please send your donation in any form, cash, cheque, P/O's or stamps to: *The Hon. Sec., AMSAT–UK, G3AAJ, 94 Herongate Road, Wanstead Park, London E12 5EQ.* Please mark envelopes AMSAT PROJECT OSCAR and cross cheques AMSAT–UK. Many thanks.

Moved by Popular Demand

The Amateur Radio Retailers Association National Amateur Radio Exhibition which has traditionally been held in Leicester is now so popular with the public that the hall in which it has been held has proved to be too small to cope with the many thousands of people who visit the show.

This year the ARRA have decided to move the entire exhibition to a new venue and they have chosen Donnington Park, Castle Donnington, which was the home of pre-war motor racing and now houses the Donnington collection of historic racing cars.

The show this year will open between 10am and 6pm on the 29th, 30th and 31st of October and admission is £1 for adults and 50p for children, which includes admission to the Motor Museum. Parking is plentiful and free, and Donnington Park is just off Junction 24 of the M1 motorway.

PW 'STOUR' TOP-BAND TRANSCEIVER

PART 2

David G. BARRELL G4BMC

Following the outline description of the transceiver and details of Board 1, we continue this month with detailed descriptions and circuit diagrams of Boards 2, 3 and 4.

Board 2—9MHz Oscillator

The oscillator board contains the following circuitry:
1. Crystal oscillator 2Tr1.
2. Buffer amplifier 2Tr2.
3. Broad-band amplifier 2Tr3.

Circuit Description

The oscillator board uses five transistors in all, 2Tr1 and 2Tr2 are duplicated forming two separate oscillator and buffer amplifiers. The +12V to either of these oscillators is switched from the upper/lower switch located on the front panel to give upper or lower sideband. The outputs from both buffer amplifiers are connected via 2C10 to a common broad-band amplifier.

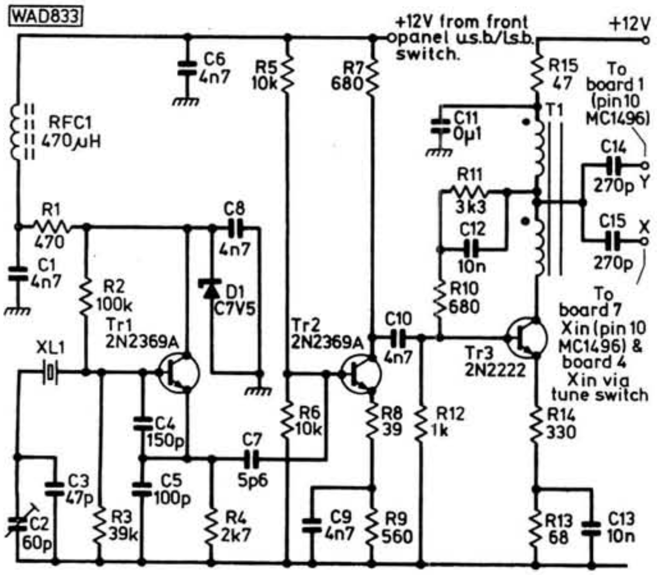


Fig. 6: Circuit diagram of Board 2

The original oscillator board consisted of 2Tr1 and 2Tr2 only, but the output seemed only just sufficient to drive the balanced modulator *or* the product detector. At some stage the author hopes to try a diode ring modulator

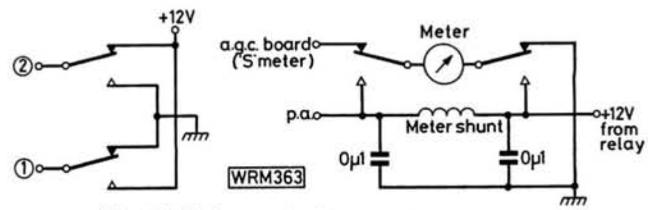


Fig. 7: Relay switching and p.a. supply

where considerably greater drive power will be required. With this in mind a further amplifier 2Tr3 was used in the final board, as shown, which is run at a very low level, with its gain being controlled by 2R14.

The level of injection used seemed at its optimum. A reasonable carrier balance is achieved at this level and there is adequate injection to the product detector. If less than 9MHz output is used then the mic. amp. has to be run at a much higher level, causing considerably more distortion.

Connections to Board 2

X connects to 1. Balanced modulator, Board 7 (X In); 2. Mixer, Board 4 (X In.). (Via front panel switch to give tune facility.)

Y connects to Board 1 product detector.

N.B. The 12V points associated with 2Tr1 and 2Tr2 are switched via a front panel switch to give upper or lower sideband as required. The +12V to 2Tr3 is on at all times.

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.

★ components

BOARD 2

Resistors
¼W 5% Carbon Film

39Ω	2	R8,8a
47Ω	1	R15
68Ω	1	R13
330Ω	1	R14
470Ω	2	R1,1a
560Ω	2	R9,9a
680Ω	3	R7,7a,R10
1kΩ	1	R12
2·7kΩ	2	R4,4a
3·3kΩ	1	R11
10kΩ	4	R5,5a,R6,6a
39kΩ	2	R3,3a
100kΩ	2	R2,2a

Semiconductors

2N2369A	4	Tr1,1a,Tr2,2a
2N2222	1	Tr3
BZX61C7V5	2	D1,1a

Capacitors
Silver Mica

150pF	2	C4,4a
100pF	2	C5,5a

Ceramic Disc

5·6pF	2	C7,7a
47pF	2	C3,3a
270pF	2	C14,15
4·7nF	10	C1,1a,C6,6a,C8,8a,C9,9a, C10,C10a
10nF	2	C12,13
0·1μF	1	C11

Miniature Trimmers

5-65pF	2	C2,2a

Inductors

470μH r.f. choke	2	RFC1,1a
7 turns bifilar wound 22 s.w.g. wire on a Neosid 28–002–27 toroid	1	T1

Miscellaneous
HC18-U plug-in crystals 9001·50kHz (1); 8998·50kHz (1); HC18-U p.c.b. sockets (2); printed circuit board.

Note: Component refs. in text are pre-fixed with the board ref. 2.

Constructional Details

The oscillator is built on double sided glass fibre p.c.b. 2Tr1 and 2Tr2 circuitry is duplicated to provide both upper and lower sideband. The filter is usually purchased complete with both crystals and so it was felt worthwhile to include both in the design. (Some u.s.b. fish phone can at times be quite entertaining and there is the added bonus of being able to check on the distortion products of other s.s.b. signals.)

Accordingly the components 2R1–2R9, 2C1–2C10, 2Tr1–2Tr2, 2D1, 2XL1, and 2RFC1 are duplicated.

If any differences in Xtal tolerance etc. show differing 9MHz output then 2R8 may be adjusted to ensure both upper and lower sideband circuits give approximately the same output.

2T1 is a standard broad-band transformer consisting of 7 turns bifilar wound on a Neosid 28–002–27 toroid.

The oscillator board should be mounted away from the balanced modulator as any stray pick up by this board will degrade the carrier suppression. (The prototype required a screen, as without thinking, these two boards were mounted adjacent to each other.)

Board 3—Filter Board

The filter board contains the following circuitry:
(1) Diode switch 3D1, 2, 3 and 4 switching the input to the pre-filter amplifier.
(2) 3Tr1, pre-filter amplifier.
(3) 9MHz 8 pole crystal filter.
(4) CA3028A 1st i.f. amplifier.
(5) Diode switch 3D7, 8, 9 and 10 switching the output of the CA3028A.
(6) 3Tr2, 9MHz transmit amplifier.

Circuit Description

The diode switch, consisting of 3D1, 2, 3 and 4 is used to switch the two inputs to the pre-filter amplifier, 3Tr1, a 2N2222A. Input X, the transmit line, receives low level double sideband, from the balanced modulator during transmit. During receive this path is blocked and Input Y is switched to 3Tr1 base. This input is from the mixer board and contains the 9MHz i.f. signal.

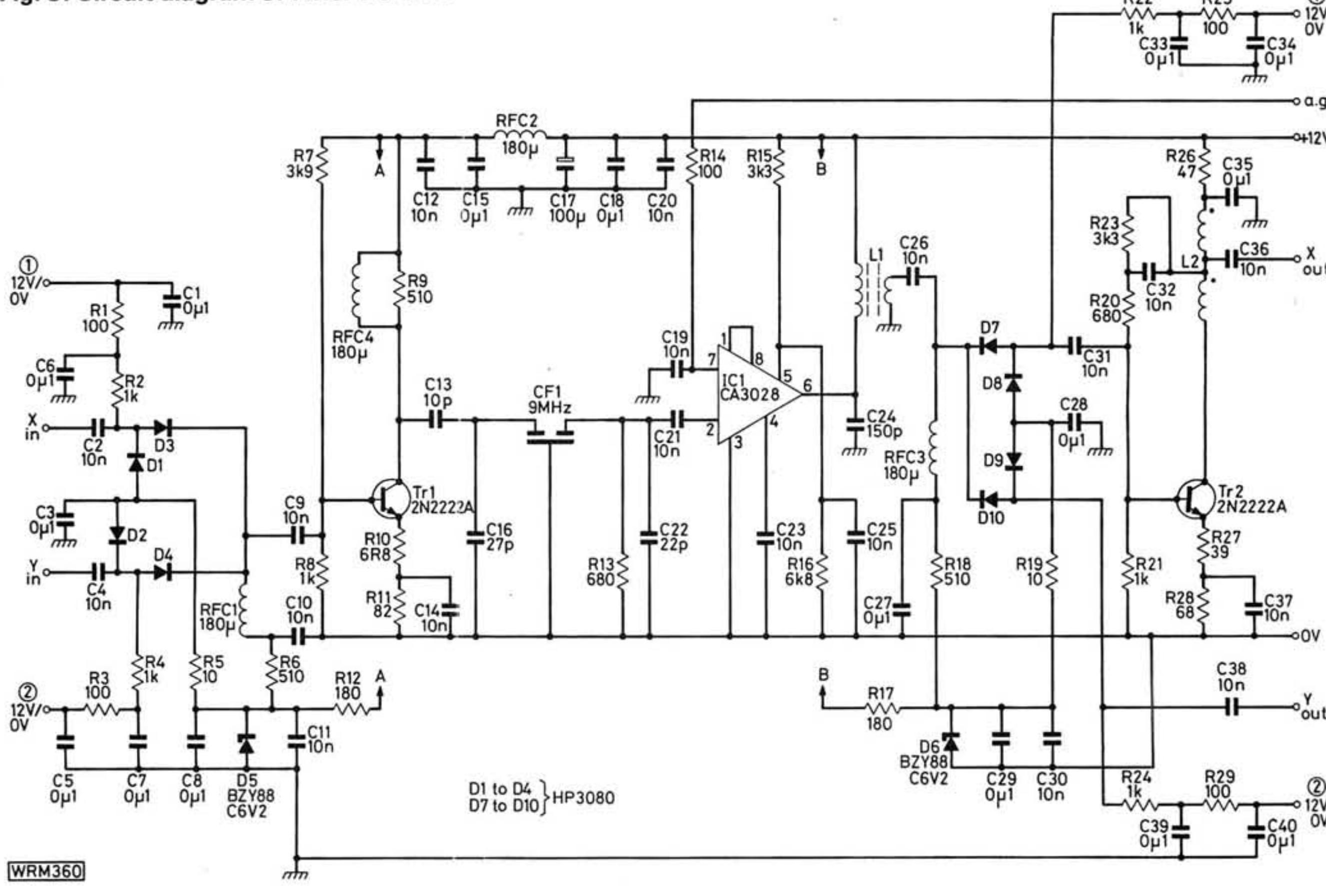
Transistor 3Tr1 consists of a common emitter class A amplifier run at a relatively high standing current, typically 25mA. The original circuitry was much more economical on current consumption but proved the weak point in the receiver chain. When large signals were present this stage seemed to be the one responsible for all the spurious responses encountered. The simple remedy of running 3Tr1 at a much higher standing current, and thus greatly improving its signal handling performance, was the final touch that seemed to transform the receiver. A dual gate f.e.t. was also tried in this stage and, although better than the original bipolar design, was not as good as the final circuitry.

After signals have passed through the filter, during both transmit and receive, a CA3028A is used as the first i.f. amplifier. Most of the receiver gain is required after the filter and a further CA3028A is used during receive.

Automatic gain control is applied to the CA3028 i.c.s via pin 7. The a.g.c. voltage is at its minimum during maximum signal levels. This minimum is in the order of +2V rising to a maximum of +9V during no or low signal conditions. During transmit this line is set at 8·5V via relay connections to the stabilised line.

Inductor 3L1 is resonant at 9MHz, with its resonating capacitor 3C24. This coil was wound on a miniature Neosid HA2 inductance assembly, the same type being

Fig. 8: Circuit diagram of Filter Board 3



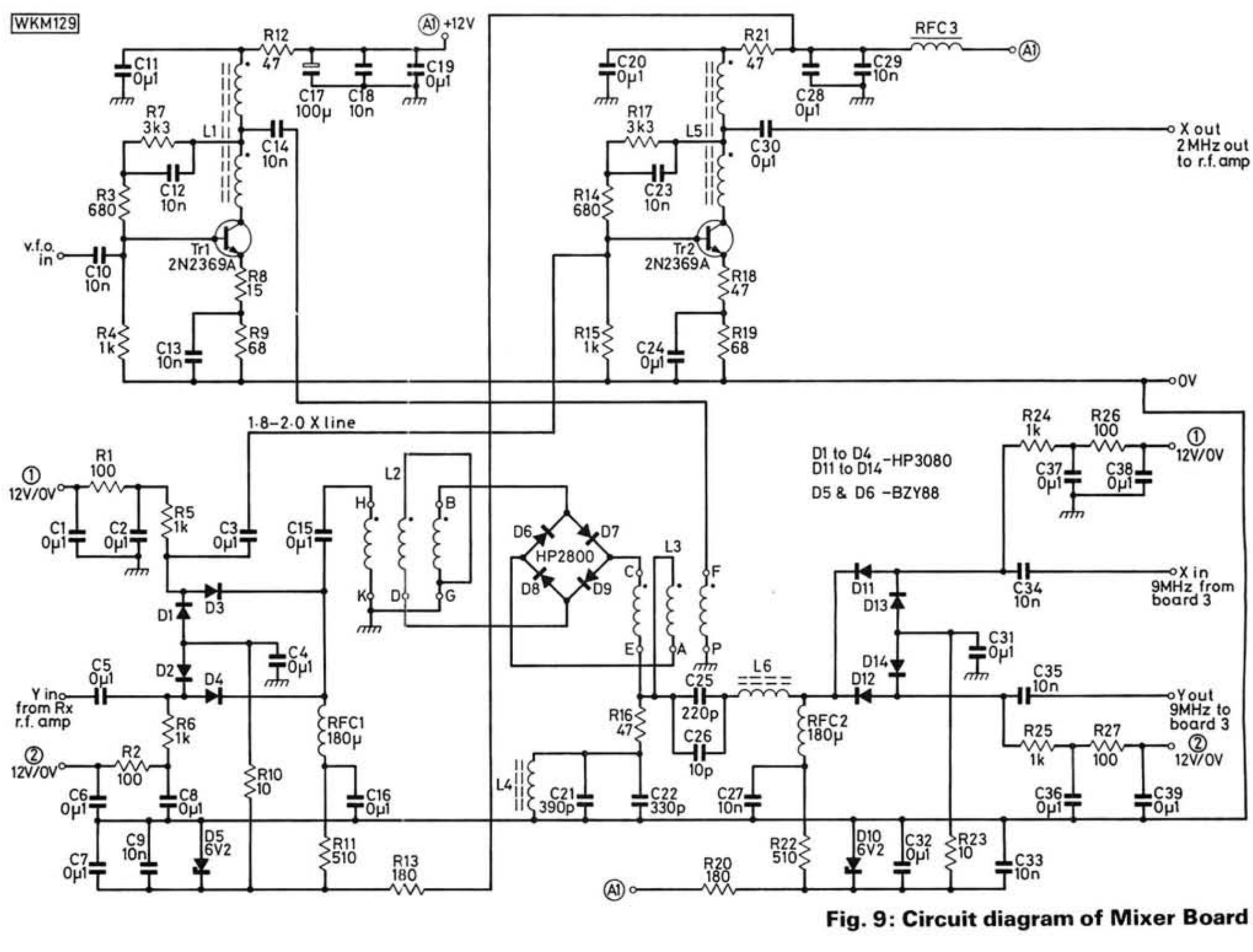


Fig. 9: Circuit diagram of Mixer Board 4

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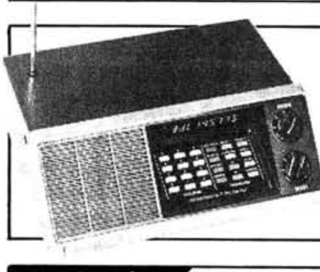

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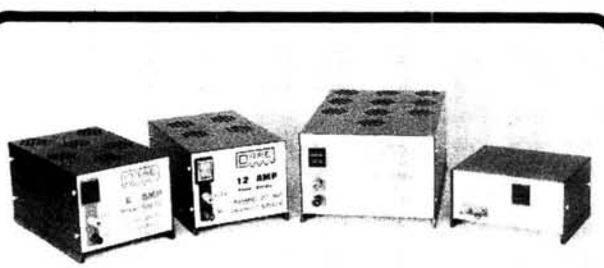

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used in the r.f. board for the 2MHz filter and again on the mixer board. A toroidal coil and variable capacitor were also tried but the eventual method used saved valuable space.

The 9MHz signal is transferred to the diode switch 3D7, 8, 9 and 10 via a link coupling of 2 turns on 3L1 and also via 3C26. During receive this switch transfers the 9MHz i.f. to Board 1, whilst during transmit it routes the 9MHz s.s.b. to 3Tr2.

Operation of Diode Switch

A smaller circuit to that used in the filter and mixer boards is shown in Fig. 10. Capacitors C2 and C4 are the input capacitors whilst Ra and Rb represent 3R1 and 3R2 and 3R4 and 3R3 respectively. The capacitors not shown are for r.f. decoupling only and so do not affect the action of the switch in any way.

Assuming Input X to be in operation then, via relay connections, +6V appears at Point 1 and −6V appears at point 2. It may now be seen that D3 is connected between +6V and 0V through resistors Ra and 3R6. This diode is therefore forward biased and thus signals will pass through C2, D3 and C9. Diode D4, however, is reverse biased and so cannot conduct via Rb. The circuit through Rb, D2 and R5 ensures D1 is reverse biased.

The reverse procedure occurs when −6V appears at Point 1 and +6V appears at Point 2. Diodes D2 and D3 are then reverse biased and signals pass through the switch from Y via C4, D4 and C9.

In the finished design +6V is used as the switch reference voltage, 0V being used in the above explanation. This allows +12V and 0V to appear as ±6V with respect to the +6V reference voltage.

Connections to Filter Board

(1) +12V at 3R26 is joined with wire to +12V entry point adjacent to 3L1. This is then routed to the +12V rail.
(2) "X In" connects to the balanced modulator-board 7 (X Out)—(9MHz d.s.b.).
(3) "Y In" connects to the mixer, Board 4 (Y Out)—(receive 9MHz in).
(4) "X Out" connects to the mixer, Board 4 (X In)—(9MHz s.s.b. transmit).
(5) "Y Out" connects to i.f.—audio board 1 (B)—(9MHz s.s.b. receive).
(6) Switching points 1 are joined together with wire and then taken to relay connections (see Fig. 7).
(7) Switching points 2 are similarly treated.
(8) Automatic gain control a.g.c. to Board 8 a.g.c.

Points A and B are connected together (A to A, B to B) via tracking on the board itself.

Relay Switching

The d.c. switching is shown in Fig. 7 and the same relay connections are used to switch Board 4 (mixer board).

Constructional Notes

Double-sided glass fibre p.c.b. is used with Veropins for all external connections. Radio frequency choke, 3RFC4, is located on the track side of the board and is soldered across 3R9 connections. Care must be taken when mounting the diodes as these are easily fractured. Correct sensing of 3L2 (collector load for 3Tr2) must be observed. Resistors 3R12 and 3R17 must be $\frac{1}{2}$W rating. Inductor 3L2 consists of 7 turns, bifilar wound on a Neosid 28-002-27 toroid.

★ components

BOARD 3

Resistors

$\frac{1}{4}$W 5% Carbon Film

6·8Ω	1	R10
10Ω	2	R5,19
39Ω	1	R27
47Ω	1	R26
68Ω	1	R28
82Ω	1	R11
100Ω	5	R1,3,14,25,29
510Ω	3	R6,9,18
680Ω	2	R13,20
1kΩ	6	R2,4,8,21,22,24
3·3kΩ	2	R15,23
3·9kΩ	1	R7
6·8kΩ	1	R16

$\frac{1}{2}$W 5% Carbon Film

180Ω	2	R12,17

Capacitors

Disc Ceramic		
10nF	19	C2,4,9,10,11,12,14,19,20, 21,23,25,26,30,31,32,36, 37,38
0·1µF	16	C1,3,5,6,7,8,15,18,27,28, 29,33,34,35,39,40
Sub-min. Ceramic		
10pF	1	C13
22pF	1	C22
27pF	1	C16
150pF	1	C24
Tantalum Electrolytic 16V		
100µF	1	C17

Semiconductors

Integrated Circuits		
CA3028A	1	IC1
Transistors		
2N2222A	2	Tr1,2
Diodes		
HP3080	8	D1–4,7–10
BZY88C6V2	2	D5,6

Miscellaneous

180µH min. choke (4); 9MHz crystal filter; YF90H 2·4kHz 8-pole (Interface Quartz Devices); Neosid 28-002-27 toroid; p.c.b.

Note: Component refs. in the text are prefixed with the board ref. 3.

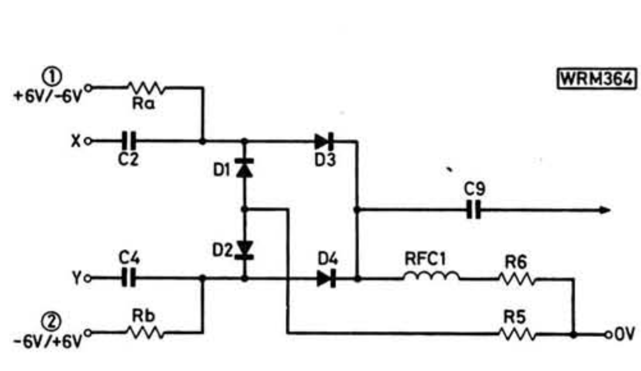

Fig. 10: Explanatory diode switching operation circuit

★ components

BOARD 4

Resistors

$\frac{1}{4}$W 5% Carbon Film

10Ω	2	R10,23
15Ω	1	R8
47Ω	4	R12,16,18,21
68Ω	2	R9,19
100Ω	4	R1,2,26,27
180Ω	2	R13,20
510Ω	2	R11,22
680Ω	2	R3,14
1kΩ	6	R4,5,6,15,24,25
3·3kΩ	2	R7,17

Capacitors

Disc Ceramic

10nF	12	C9,10,12,13,14,18,23,27,29,33,34,35
0·1µF	22	C1–8,11,15,16,19,20,24,28,30,31,32,36,37,38,39

Sub-miniature Ceramic

10pF	1	C26
220pF	1	C25
330pF	1	C22
390pF	1	C21

Tantalum Electrolytic

100µF	1	C17

Semiconductors

Transistors

2N2369A	2	Tr1,2

Diodes

HP2800	4	D6–9
HP3080	8	D1–4, 11–14
BZY88C6V2	2	D5,10

Inductors

180µH min. chokes	2	RFC1,2

Miscellaneous

32 s.w.g. enamelled copper wire; p.c.b. (1); Neosid 28-002-27 toroids (3); Neosid HA2 inductance assemblies (2).

Note: Component refs. in the text are prefixed with the board reference 4.

Board 4—Mixer Board

The mixer board contains within it the following circuitry.

(1) 7MHz broad-band amplifier for v.f.o. amplification (4Tr1).
(2) 2MHz broad-band amplifier for 1st transmit amplifier (4Tr2).
(3) Doubly balanced diode ring mixer using hot carrier diodes.
(4) Diode switch into mixer.
(5) Diode switch out of mixer.

Circuit Description

The v.f.o. signal amplified by 4Tr1 is fed to the diode mixer, during both transmit and receive, via 4C14 and 4L3.

The signals from the receiver r.f. amplifier pass through the diode switch consisting of 4D1, 2, 3 and 4 and then via 4C15 and 4L2 are fed to the mixer. During transmit this switch blocks the receive path and transfers the 2MHz r.f. to 4Tr2.

The amplifier 4Tr2 is a broad-band device and provides the first stage of amplification at 2MHz during transmit. The gain of this stage is set by 4R18 (47Ω).

The diode switch 4D11, 12, 13 and 14 switches the 9MHz s.s.b. into or out of the mixer.

During receive the circuitry 4R16, 4L4, 4C21 and 4C22 is designed to terminate correctly, at 50Ω, any unwanted products produced by the mixer; the required 9MHz signals passing through 4L6, 4C25 and 4C26. Both these circuits should resonate at 9MHz. During transmit the above circuitry acts as a 9MHz filter. The tuning of 4L6 is fairly flat whilst that of 4L4 should peak with a definite response.

Whilst a more simple diode switch could have been used the final circuits ensure that strong signal levels do not produce any spurious mixing effects when passing through the diodes.

The 6V Zener diodes are present to allow a ±6 volt operating point to be used in the above diode switching.

Connections to Mixer Board

(1) Switching points (1) are joined together with wire and then routed to the relay connections as shown in Fig. 7. Switching points (2) are also joined and similarly connected to the relay.
(2) "VFO" is connected to the v.f.o. output.
(3) "X In" connects to "X Out" from the filter, Board 3 (9MHz in).
(4) "Y In" connects to the r.f. amplifier, Board 6 (2MHz receive signals).
(5) A1 and A2 are joined with wire and are then routed to +12V. (They must be connected during both receive and transmit.)
(6) "X Out" connects to band-pass filter FL1. (Low level 2MHz s.s.b.)
(7) "Y Out" connects to the filter, Board 3 (Y In)—(9MHz i.f. signals).

Constructional Details

Double sided glass fibre p.c.b. is used with Veropins for all external connections.

Care must be taken when mounting the diodes as the glass casing will easily fracture if put under stress.

Great care must be taken to ensure the toroidal inductors 4L1, 2, 3 and 5 are correctly connected. The sensing shown on the diagram must be observed. Inductors 4L2 and 4L3 consist of 7 turns of 32 s.w.g. wire bifilar wound on a 28-002-27 toroid. Inductors 4L1 and 4L5 are of the same construction but only 6 turns of wire are required.

The inductors 4L4 and 4L6 are constructed on Neosid miniature HA2 inductance assemblies. In the prototype the number of turns necessary was calculated approximately and then adjusted together with their resonating capacitors. These inductor assemblies are provided with metallic screening cans to avoid any unwanted i.f. breakthrough during receive. Inductors 4L4 and 4L6, together with their resonating capacitors, should be resonant at 9MHz. Points A, B, C and D correspond with those shown on component layout to facilitate diode and transformer connections. Similarly, points 1, 2 and 3 show connections for 4L1 and 4L5. Radio frequency choke, 4RFC3, consists of 20 turns of 32 s.w.g. wire wound on a 28-002-27 toroid.

To be continued

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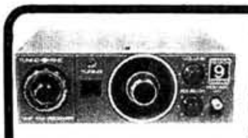

SR9 VHF RECEIVER AMATEUR/ MARINE

£46 inc. VAT

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

PROFESSIONAL AIRCRAFT MONITOR

R517 £49.50

(as supplied to pilots, ground crew etc.)

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

AR22 VHF FM MONITOR
OUR PRICE £83 inc. VAT

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

TRIO R1000

COMMUNICATIONS RECEIVER

OUR PRICE £285 (Free Securicor Delivery)

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

YAESU COMMUNICATIONS RECEIVER

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

Free Securicor Delivery

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

SHORT WAVE LISTENER ATU

AT1000
£31.95
carriage £1.00

SUPER NEW DESIGN 200kHz-30mHz

Here's a brand new ATU specially manufactured for us in Japan. Primarily designed for the Trio R1000 and Yaesu FRG7700, it will match most other current models.
Most modern receivers have very poor front end performance because of their very wide frequency coverage. This results in cross modulation etc. which sounds like a general background jumble of stations obscuring the signals you are trying to receive. If you are feeding your receiver with a random length of wire then matters will be even worse! This unit provides the missing selectivity and the correct match to your receiver. The result, ... A lot of extra stations you have never before heard and the remainder a lot of clearer.

SWR/POWER/FIELD STRENGTH MEASURING METER
SPECIAL OFFER
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As used by CB and Amateur radio operators.

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

STOP TRANSMITTER INTERFERENCE

HP3A £3.50 each
Ferrite Filters £1.00 for 2

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

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.

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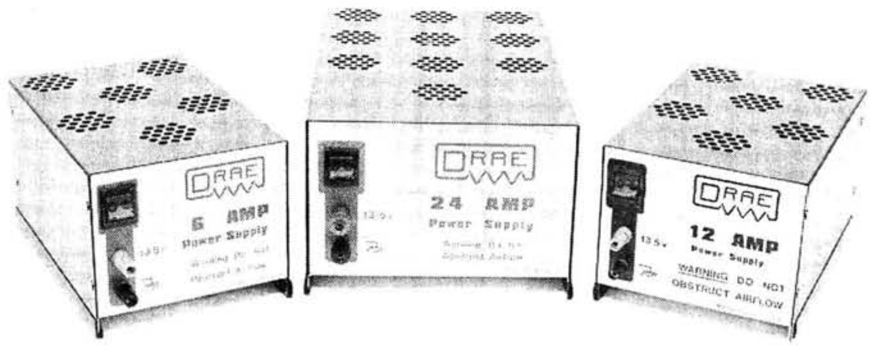
USER REPORTS ON SETS AND SUNDRIES

DRAE High-current Power Supplies



More and more amateur equipment being designed to work from a nominal 12V d.c. supply. The choice of this voltage is to allow the equipment to be used either in a mobile environment or portable, in both cases using a 12V car type battery as the main power source. This poses problems if the equipment is to be used as a base station since the current taken by some of the higher power rigs is beyond the capabilities of most stabilised bench power supplies, especially with an f.m. rig which takes full current continuously on transmit.

However, properly designed and constructed stabilised power supplies capable of running an f.m. rig for long periods are usually expensive and heavy and amateurs have tried to get by with supplies which, while capable of running a side-band rig, are not man enough for an f.m. unit.

A new and enterprising British company, Davtrend, have recently put three power supplies aimed at the amateur market into production. The supplies give a fixed 13·8V d.c. output at either 6A, 12A or 24A depending on the model and all are fully protected for thermal and current overload and overvoltage.

We tested a sample of each and found them to be as good as the manufacturer claimed. The 6A version, which is the basic "building block" of the range, showed a regulation of 0·14 per cent from no load to full load and even overloading it by 66 per cent only produced a drop in output voltage of 11 per cent, although the ripple increased from 67mV to 1·8V pk-pk.

The 6A version didn't seem to mind this sort of overload and even after one hour at full load was not too hot to handle, but the 12A model objected to a 33 per cent overload by shutting down and remaining shut down until it had been switched off for over 60s. At this sort of overload the output voltage dropped to less than half of the full output level and the ripple rose from 67mV to 2·5V. After one hour at 12A load current the case was very hot, emphasising the warning on the front panel label about allowing the free passage of ventilating air.

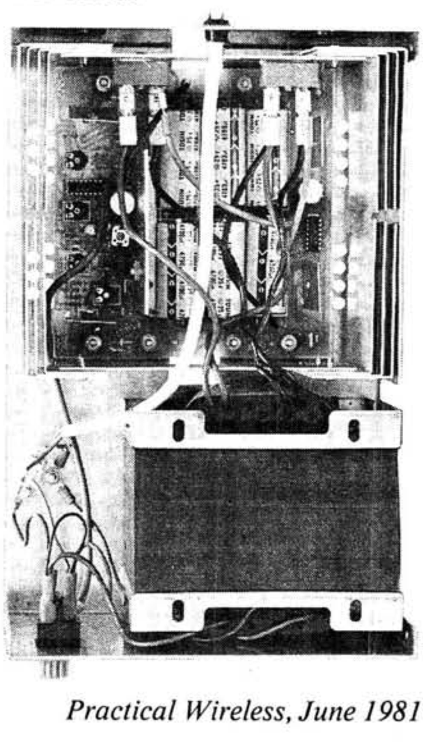
The 24A supply uses basically four of the 6A regulators in parallel with an ingenious load sharing circuit. We had some reservations about the fixing of the large and heavy transformer but the makers have assured us that all those shipped so far by British Rail have arrived intact and this should be adequate proof of the mechanical robustness of the design.

The 24A unit showed a strange oscillation for the first 20 minutes of testing which peaked at a load of 12A and consisted of a 140mV pk-pk sinewave at about 400kHz with a superimposed oscillation, 30mV amplitude at about 12MHz. This all disappeared after about 20 minutes of running leaving the same 40mV of total ripple as the other two models. The regulation of the largest unit was not quite as good as its smaller brothers (0·5 per cent at 16A and 0·4 per cent at half full load current).

All three supplies had a rather strange switch-on characteristic. The initial voltage was around 9·5V which rose to about 12·5V in the first minute or so. After that there was a slow upward drift in voltage so that after one hour the 6A version had a no load output of 14·2V. The slow drift is probably thermal in origin while the initial slow rise can be used to advantage when trying to power-up larger h.f. rigs. Davtrend suggest switching the rig on before switching the p.s.u. on.

The Davtrend DRAE range of stabilised power supplies offer a British designed and manufactured power supply with full protection and good regulation at prices that are very competitive. The 6A model is priced at £44.95 plus £2.00 carriage, the 12A model at £69.00 plus £2.00 and the 24A version at £92:00 plus £3.00. There is also a baby model rated at 4A and costing £27.00. If these prices seem high just remember that you only get what you pay for and power supplies are no exception to the rule.

The DRAE range of power supplies are available from accredited dealers or direct from the manufacturers, **Davtrend, 89 Kimbolton Road, Portsmouth PO3 6DA** who we would like to thank for the loan of the test models.



ICOM IC–24G VHF FM Transceiver

The latest 2m f.m. mobile transceiver from the Icom stable is an uprated version of the renowned IC–240 which has been in production for several years and used by large numbers of radio amateurs.

A glance at the modified front panel reveals the most prominent new feature, the provision of three push-button edge switches with integral decade displays for channel selection. This new feature replaces the 22 position rotary knob of the IC–240 series, allowing selection of the full 2MHz bandwidth on 2m in discrete 25kHz or 12·5kHz steps. The switch displays indicate operation within the upper or lower MHz and the channel of operation.

To allow greater flexibility and ease of mobile operation, a remote cable fed frequency control head is soon to become available. This device, which readily interfaces with the IC–24G, can be installed at any preferred point in the vehicle.

Other front panel controls are kept to a minimum, consisting of VOLUME and SQUELCH rotary knobs, ±600kHz offset and simplex selection toggle switches, together with pushbuttons for activating the 1750Hz repeater tone burst, HI-LOW power selection and 12·5kHz channel width selector. The remaining front panel features include the 8-pin microphone socket allowing the use of the provided 1·3kΩ dynamic microphone or interface to alternative Icom accessories. A conventional moving coil meter is used to indicate received signal strength and relative power output.

Operating the rig in the reviewer's mobile produced no problems, the receiver section being more than adequate to cope with the 10W output of the transmitter, which features protection circuitry to prevent abuse. When operating in reasonably quiet vehicles, use can be made of the internal loudspeaker; however, the 1·5 watts of audio available is more than adequate to drive a suitable 8Ω extension device.

The uncluttered layout of the front panel controls was justified during operation and easy access could be made to all vital functions.

At the VAT inclusive price of £199 the IC–24G represents good value. Our thanks for the loan of the review sample go to **Thanet Electronics, 143 Reculver Road, Beltinge, Herne Bay, Kent. Tel: Herne Bay (02273) 63859** from whom further details may be obtained.

MODS—No. 7

▶▶▶ *continued from page 22*

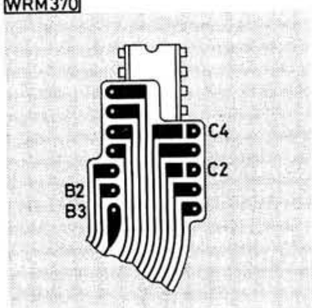


Fig. 5: ▲ Green ribbon cable showing track breaks

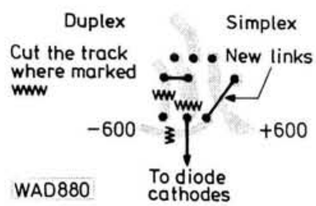


Fig. 6: ▲ ±600 switch shown from component/switch side

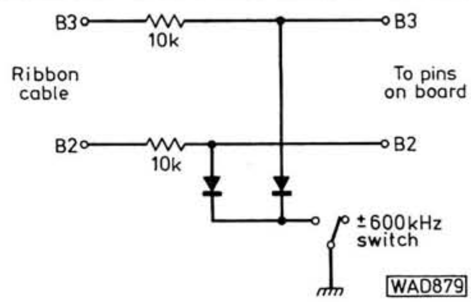


Fig. 7: Circuit to be inserted in the break for semi-reverse repeater mod

you have found the end shown in Fig. 5 you will see why I say that it is a very tricky job. The two inner metallic strips that lead to B2 and B3 have to be cut and the circuit shown in Fig. 7 then has to be inserted in the break. When that's done, the rear of the ±600kHz shift switch has to be modified as in Fig. 6 so that it still gives the normal −600kHz shift for repeater operation, but whenever the +600kHz shift is selected, this gives semi-reverse repeater.

If, after reading the above instructions and after looking inside your 2E, you decide that this mod is more than you can cope with, then Thanet have said that they will do the work for £5 plus post and packing.

The last mod this month extends the frequency range to either 4MHz or 10MHz and although it is quite intricate, it is not as difficult as the last one.

The 4MHz mod, which is useful if you intend to take your rig abroad, is very simple as there is only one tiny joint to be soldered. At junction C2, see Fig. 5, there is a hairline crack, and if it is bridged with a blob of solder, the set will then cover from 144·000MHz to 147·995MHz.

The 10MHz mod, which is useful if the rig is to be used as a 70cm transverter driver, is almost as easy. Bridge the crack at C2 as in the previous mod, and then bridge the other crack at C4. Finally, totally remove the brown wire on the small p.c.b. which is directly under the thumbwheel switches. That's it, the rig will now transmit or receive on any frequency between 140MHz and 149·995MHz, but with reduced response at either end of the band, as 10MHz is too large a slice of the spectrum to cover properly.

I'm sorry that the lack of space has meant that the "wanted" feature has had to be held over this month.

If you have any mods that you would like to pass on, or if you would like me to publish a request for a mod for you, then please write to: R. S. Hall, Practical Wireless, King's Reach Tower (Hatfield House), Stamford Street, London SE1 9LS.

73's
Sam G8TNT

Ben J. DUNCAN **Part 2**

Fuses

Fuses are the simplest, cheapest and often the most satisfactory way of protecting power semiconductors. As fusing is most important when thyristor control equipment is mains operated, our attention will be confined to this area. Fig. 11 depicts the blowing times against overload current of common $1\frac{1}{4}$ inch glass fuses. Note that the current is not specified. The "× 20" overload point would refer to 100A passing through a 5A fuse or to 20A passing through a 1A fuse.

Note also the wide tolerance of the fuse ratings. If we subject 5A fuses to a 30A fault current (× 6 overload), a random sampling of these fuses would exhibit blowing times of between 3·5 and 160ms!

When matching a fuse to a triac, the slowest (worst case) blowing time must be taken, i.e.:—the top line of the graph. This can result in nuisance blowing if you happen to use fast blowing specimens, but that is always better than a fuse which may not offer any protection at all.

Suppose we wish to protect a BT139 triac whose I_{TS} curve is shown in Fig. 5. This triac has a 15A $I_{T(RMS)}$ rating and we will assume it is carrying a 10A load. Intuitively it may seem that a 15A fuse would protect the device but by examining Fig. 11 it can be seen that this is not so. At × 1·9 its rated current, (28·5A), a 15A fuse could take over an hour to blow! A 7·5A fuse on the other hand will withstand slightly less than 1·9 × 7·5A, i.e.:—14·00A indefinitely under worst case conditions.

If the triac's r.m.s. current exceeds 15A, it can be seen from Fig. 12 that a 7·5A fuse will take *no longer than 10 seconds* to blow (point A). A 7·5A fuse, then, will not be blown by the nominal 10A load and will probably protect the triac. We can check this by comparing the worst case blowing characteristic of the fuse with the triac's I_{TS} graph (Fig. 5).

Provided the fuse's curve lies below the triac's, the triac will be protected. Point 'A' at 50A marks the transition point where the triac and fuse curves overlap. After this point (fault currents in excess of 55A) the fuses may not protect the triac. Indeed, it is likely that the triac will blow and protect the fuse at higher currents!

Using a smaller fuse value will only give a little more protection at high currents and in addition will cause nuisance blowing at the nominal load current. *Thus a* 7·5A fuse will protect the triac in this application against small and medium overloads only. This is quite acceptable if, say, the load is connected via a 13 or 15A mains socket. The largest load likely to be accidentally connected would then be around 3·5kW.

For $1\frac{1}{4}$ inch glass fuses, a useful rule of the thumb is that a fuse rated at *no more than* 50 per cent of a triac or thyristor's $I_{T(RMS)}$ and $I_{T(AV)}$ ratings respectively will give good protection against small overloads; slightly different percentages apply to 20mm and ceramic bodied fuses.

The potential short circuit current available from a 13A mains outlet lies between 300 and 900A. With this in mind, it's not surprising that the tiny junction area of a thyristor can be destroyed in a few milliseconds by short circuit currents, and that special 'high speed' fuses are required to protect them from such a traumatic experience. High speed fusing, however, is limited by cost and design complexity to areas where short circuits are a common occurrence. The predisposition of incandescent lamps to blow and cause short circuits at the most awkward times makes high speed fusing essential for reliable stage lighting at theatres, rock concerts and fashion shows.

Transient Voltage Protection

Voltage spikes of up to 10kV occur randomly on all mains supplies. The largest voltages are caused by lightning and fortunately do not occur very often and last only for a very short time, typically 2µs. Small transients up to

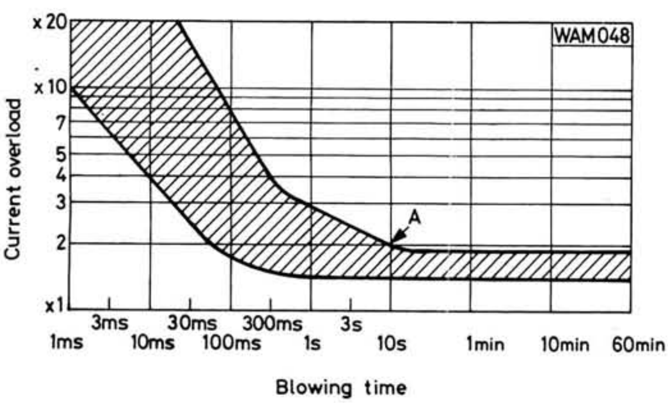


Fig. 11

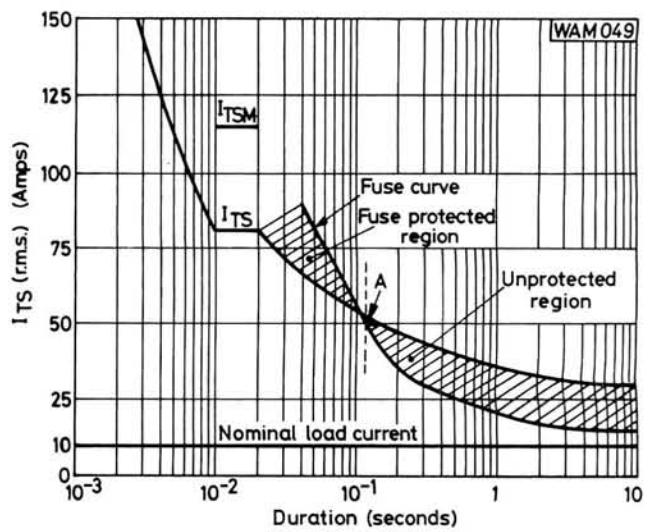


Fig. 12

1kV are caused by the switching of power lines and large capacitive and inductive loads. These generally have longer durations than lightning spikes and can occur many times a day. Although they most frequently occur on supplies that are in or adjacent to factories and workshops, it should be noted that washing machines are hideous generators of high voltage transients.

The very unpredictability of mains transients must lead designers to assume the worst—a 10kV spike may strike any equipment at any time! Unfortunately, triacs and thyristors rated above 600-800V are very expensive.

Alternatively, we can use a triac with a moderate V_{DWM} rating and surround it with a suppression network which will limit the magnitude of worst case transients to safe levels. To reliably attenuate 10kV spikes to less than 400V is impossible in many situations and such a suppression network would certainly be very expensive. Instead, a triac is typically rated at 1·5 to 3 times the peak mains voltage. This is the V_{DWM} rating of course; the V_{DSM} rating will then be around 800-1000V. A reasonably simple suppression network will then provide good protection.

Voltage Dependent Resistor

A useful weapon against transients is the voltage dependent resistor (v.d.r), primarily because of its simplicity. Voltage dependent resistors intended for transient voltage suppression have an extremely non-linear VI characteristic (Fig. 14). When an excessive voltage is applied to such a v.d.r. the resistance at the nominal supply voltage (some 10MΩ) drops momentarily to around 10-0·1Ω. Provided the source impedance of the transient is high, the v.d.r. then acts as the bottom arm of a voltage dividing network and the magnitude of the transient is drastically reduced. Fig. 15 shows how the effectiveness of a v.d.r. varies with the source impedance of the transient.

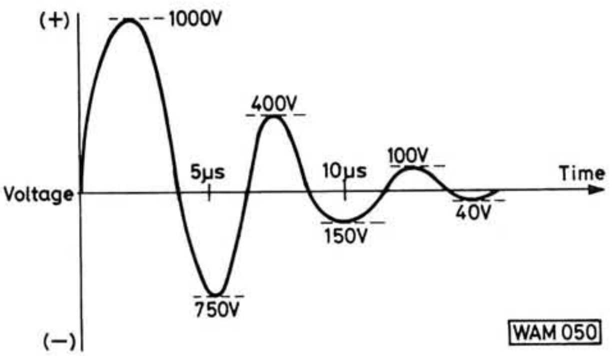
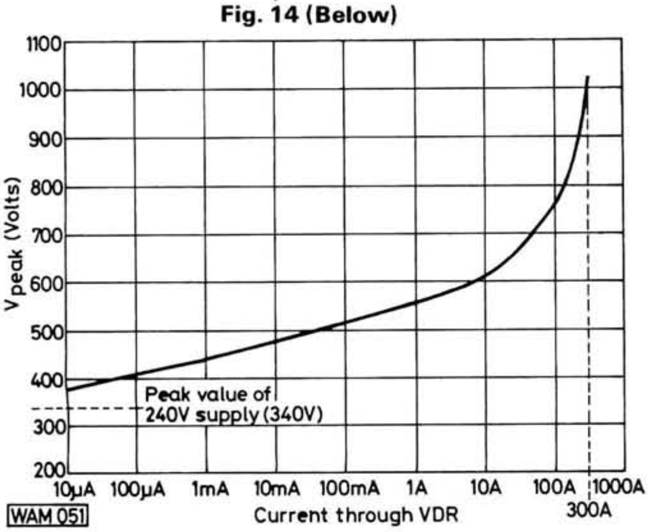


Fig. 14 (Below)



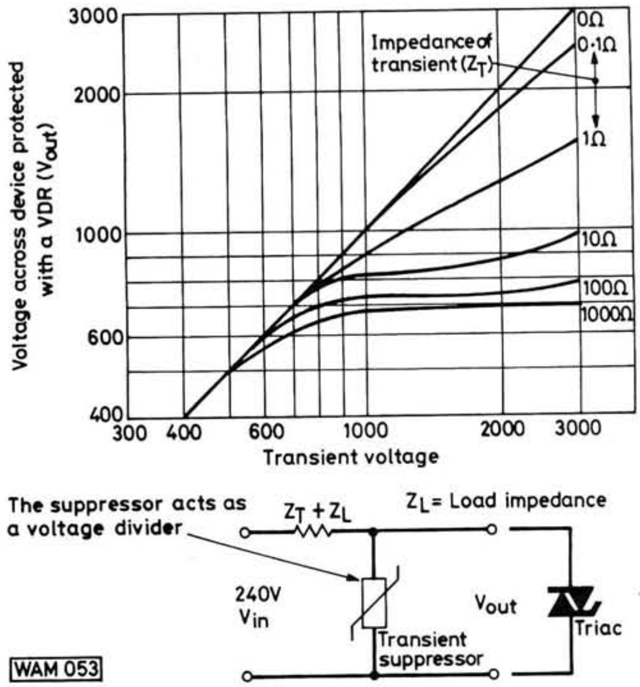
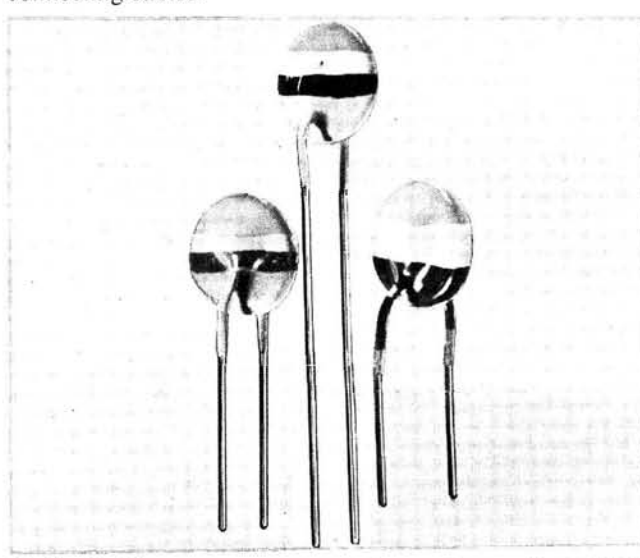


Fig. 15

Note that allowance has been made for impedances as high as 1kΩ; this contrasts strongly with earlier discussions on mains supply impedances, where figures of 1-0·03Ω were mentioned.

The contradiction is due to the high frequency nature of transients. A 5µs transient has a frequency of some 0·2-1MHz (depending on the degree of damping) and at these frequencies the impedance of the mains supply is much higher than at 50Hz. Fig. 16 shows how the impedance of the mains varies with frequency and also gives some typical source impedances for transients over a range of pulse durations.

Fortunately, although these impedances vary widely, the transient must flow through the load to reach a triac or thyristor. (Transient suppression is much more difficult in the case of bridge rectifiers, which are effectively connected across the supply.) Again, the impedance of the load as seen by the transient will be much higher than that at 50Hz, particularly if the load is inductive or has lengthy connecting cables.



Mullard Disc-type asymmetric voltage dependent resistors

	Pulse duration (μs)	Source impedance (Ω)
Rarely occurring high-voltage transients ↑10kV	5	16 ~ 500
	10	8 ~ 250
	50	1·6 ~ 50
	100	0·9 ~ 26
	250	0·5 ~ 10
Regular low-voltage transients ↓200V	500	0·4 ~ 5

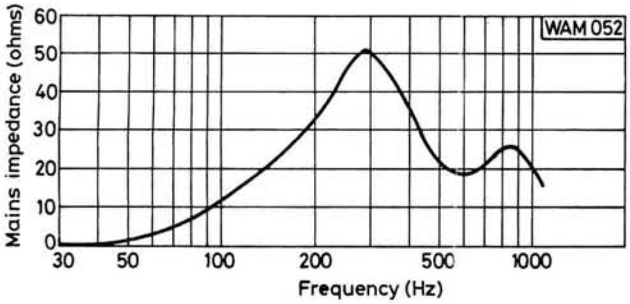


Fig. 16

Fortunately, the largest transients have the highest frequency, see the highest impedance, and are therefore attenuated most. *The effectiveness of a v.d.r. is very dependent on the source impedance of the transient, which is often an unknown factor, as also is the magnitude, duration and occurrence of any mains-borne transient voltage.*

Therefore the degree of protection afforded by a v.d.r. is often unquantifiable. However, adding a large choke in series with the load will make the degree of attenuation more certain. Such a choke will also provide r.f.i. suppression, which will be dealt with shortly. A v.d.r. is also most effective when it is wired as close to the thyristor or triac as possible; lead lengths greater than an inch can limit the minimum impedance of the v.d.r.

Snubbers

Additional protection can be provided with a *CR* network, known as a 'snubber' (Fig. 18). The capacitor acts as a voltage divider in the same manner as a v.d.r., and is most effective at 'snubbing' the fast, and larger, transients because its impedance is inversely proportional to frequency.

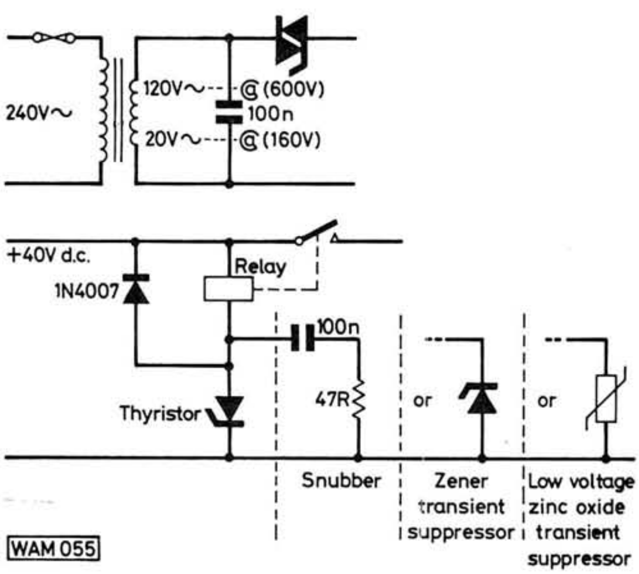


Fig. 17

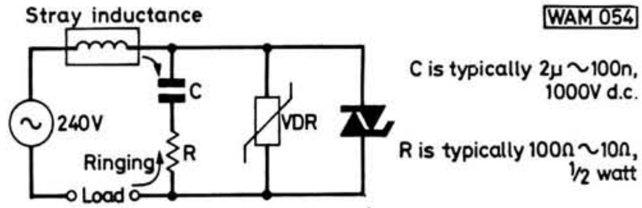


Fig. 18

Unfortunately, its minimum impedance is limited by the need for a series resistor. This prevents the capacitor dumping its charge across the triac when the latter turns on. Such rapid discharging could easily exceed the di/dt rating of the triac. The resistor also prevents any spurious oscillation and ringing which can be readily precipitated by the step waveform of a transient, particularly when the circuit contains inductors.

Stray Inductance

Even stray inductance in wiring can make an *LC* resonant circuit capable of being excited by the fastest transients. The value of the resistor for adequate damping is quite critical. Ringing is unwelcome because the magnitude of the voltage swing could be greater than that of the transient! Ringing has also been known to destroy logic circuitry which is directly connected to the gate terminals of triacs protected by snubbers.

Fortunately, when used in conjunction with a v.d.r., the latter will limit the magnitude of any ringing to safe values in most cases. If in doubt, use a high resistor value, say 100Ω.

A snubber also limits the dv/dt of a transient, thereby protecting a triac or thyristor from accidental turn-on.

A common value for mains snubbers is 100Ω × 100nF. Note that the capacitor must be capable of withstanding mains voltages on a continuous basis—1kV d.c. rating is recommended. Polypropylene, mixed dielectric and polyester capacitors especially designed for mains operation are most suited for use in snubbers.

Low Voltage Systems

Severe voltage transients can also occur in low voltage systems. Transformers, and relays in particular, are usually responsible. Whenever a transformer is switched on or off, a voltage transient occurs at the secondary. This could be an order of magnitude greater than the nominal secondary voltage. The effect is worst at *turn off* and when the transformer is lightly loaded.

Relays

Relays are also particularly troublesome. Basic suppression of these components is shown in Fig. 17; further suppression might be necessary to reduce r.f.i. to acceptable levels. Note that suppressing a transformer secondary will also protect the triac and other components from mains-borne transients, though it does nothing to protect the insulation of the transformer's primary winding. Since triacs and thyristors with 400V V_{RWM}/V_{DWM} ratings are standard and therefore cost little more than those with lower voltage ratings, it is sensible to use them in all low voltage circuits to provide excellent protection against voltage transients, particularly when one considers that 220V transients are by no means unknown in 12V car electrical systems!

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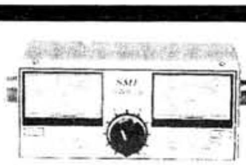

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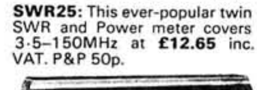

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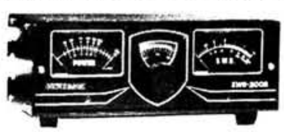

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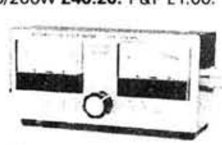

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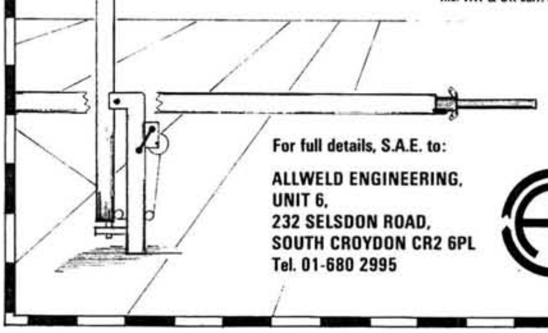

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PW 'EXE' MICROWAVE TRANSCEIVER

Part 1

Dick GANDERTON G8VFH & John M.FELL G8MCP

To the amateur looking for something practical to do during the summer months which does not involve a large outlay of hard earned cash, microwaves offer a possible solution. The *PW* Exe has been designed and developed with the beginner to microwaves in mind and is a complete transceiver and antenna system operating on the 10GHz (3cm) amateur band.

Microwave frequencies start at around 1GHz (1000 MHz) and there are allocations for amateur use at 1·3GHz, 2·3GHz, 5·7GHz, 10GHz and 24GHz, with 47GHz, 75·5GHz, 142GHz and 241GHz allocated at WARC 79 but still to be ratified.

The most popular microwave activity in the UK takes place on the 3cm band using simple wide-band f.m. equipment, as this is by far the easiest mode to get working. However, several enthusiasts have managed to get narrow-band gear running successfully and this does offer many advantages over wide-band equipment, as we shall see later on.

Wide-band f.m. transceivers, such as the *PW* Exe, are generally restricted to line-of-sight operation with the two stations sited on the tops of suitable hills to give clear take-offs over an unobstructed path. The current world record for this type of transmission is around 750km, admittedly between two mountains in the Alps. However, paths of over 100km are regularly worked in the UK using similar equipment to the *PW* Exe.

The System

A simplified system is shown in Fig. 1. A Gunn diode is used in a specially designed resonant cavity to produce low-power oscillations at the desired frequency, in the case of the *PW* Exe this is around 10·2GHz. The design of the cavity is very important otherwise the oscillator will run at other than the desired frequency or may not even oscillate at all.

The frequency of oscillation can be adjusted over quite a wide frequency range by introducing a small ptfe rod into the cavity at the appropriate place relative to the Gunn diode and the walls of the cavity. Varying the supply voltage to the Gunn diode will also shift the operating frequency and it is this property that is used in simple systems to achieve frequency modulation of the carrier.

The modulator is basically a voltage regulator which can be varied by external means, in this case by the audio signal from the microphone or tone generator. Fine tuning is achieved by varying the mean output from the modulator.

The tone, usually around 1kHz, is needed for alignment and setting-up purposes rather than trying to adjust the controls while speaking into the microphone.

Waveguide

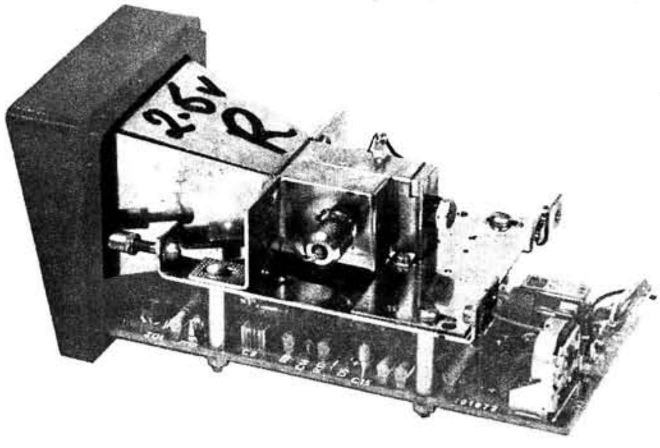
The modulated r.f. output from the cavity, usually in the region of 5 to 10mW, is "piped" along a length of waveguide to the antenna system.

Waveguide is a precision brass, aluminium or copper tube, usually rectangular in cross section, which transmits the signal by a combination of electrical and magnetic fields related to the walls of the guide.

It is not the intention of this series to enter into the theoretical aspects of microwave transmission other than that necessary for the beginner to enable him to build and operate the *PW* Exe satisfactorily. An explanation of the various modes of propagation and operation of waveguide at various microwave frequencies can be found in the *VHF/UHF Manual* published by the RSGB.

The waveguide used at 10GHz is generally "Waveguide 16" and Table 1 gives the basic information for this size.

Flanges are used to connect lengths of waveguide and other pieces of equipment together. There are two basic types of flange, the common rectangular type held together with four bolts and a round type which is easily and quickly detachable by unscrewing the retaining rings. Fig. 3 shows the dimensions of these two waveguide flanges. These types of flange are easily soldered to the ends of the waveguide as required.

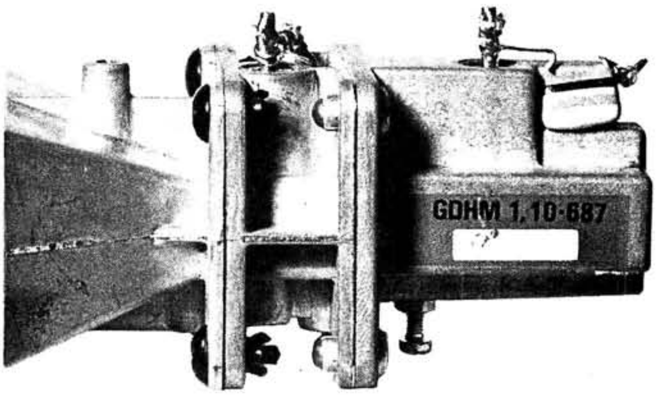


This burglar alarm, made by Wessex Alarms, is readily available on the surplus market. It can be used with the *PW* Exe system by retaining its horn antenna

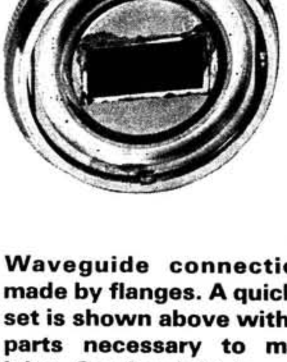
Horns and Dishes

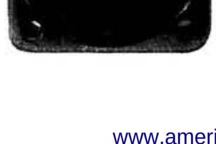
The antennas commonly used vary from simple horns to large parabolic dishes and in general terms the bigger the horn or the larger the dish diameter the greater is the 'gain' of the antenna system. As an example the parabolic dish which is now available from *Practical Wireless* and has been specially produced for use with the *PW* Exe, has a theoretical gain of just over 30dB (× 1000) at 10GHz. However, the greater the gain of the antenna the narrower is the forward beamwidth and for a 30dB dish at 10GHz the beamwidth will be around 5 degrees, necessitating the use of a compass for alignment.

Taking the *PW* Exe parabolic dish and a Gunn oscillator output of 5mW, then the e.r.p. of the system will be 30dB up on 5mW, i.e. 5W!

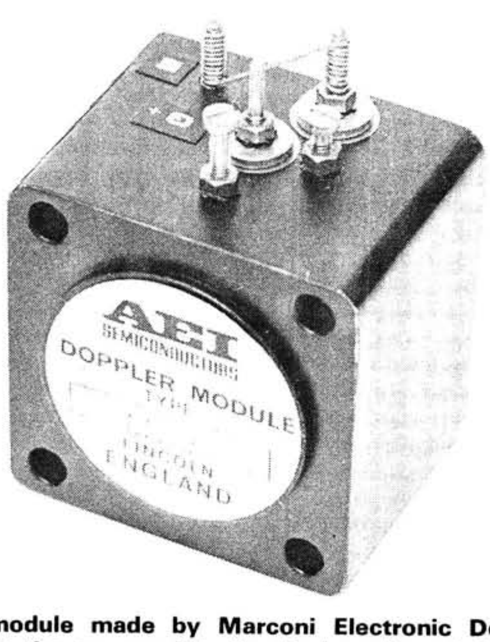


Plessey's GDHM 1 intruder alarm unit was used for most of the prototype *PW* Exe trials. This unit was also used for the *PW* Parkhurst burglar alarm and while proving to be very sensitive and stable, suffers from low r.f. output when re-tuned for amateur band use





Waveguide connections are made by flanges. A quick release set is shown above with the two parts necessary to make the joint. On the right is a standard bolt-up flange for Waveguide 16 and two identical flanges of this type are used to make a connection



This module made by Marconi Electronic Devices (AEI) is the one used in the final version of the *PW* Exe, and has a claimed r.f. output of over 15mW

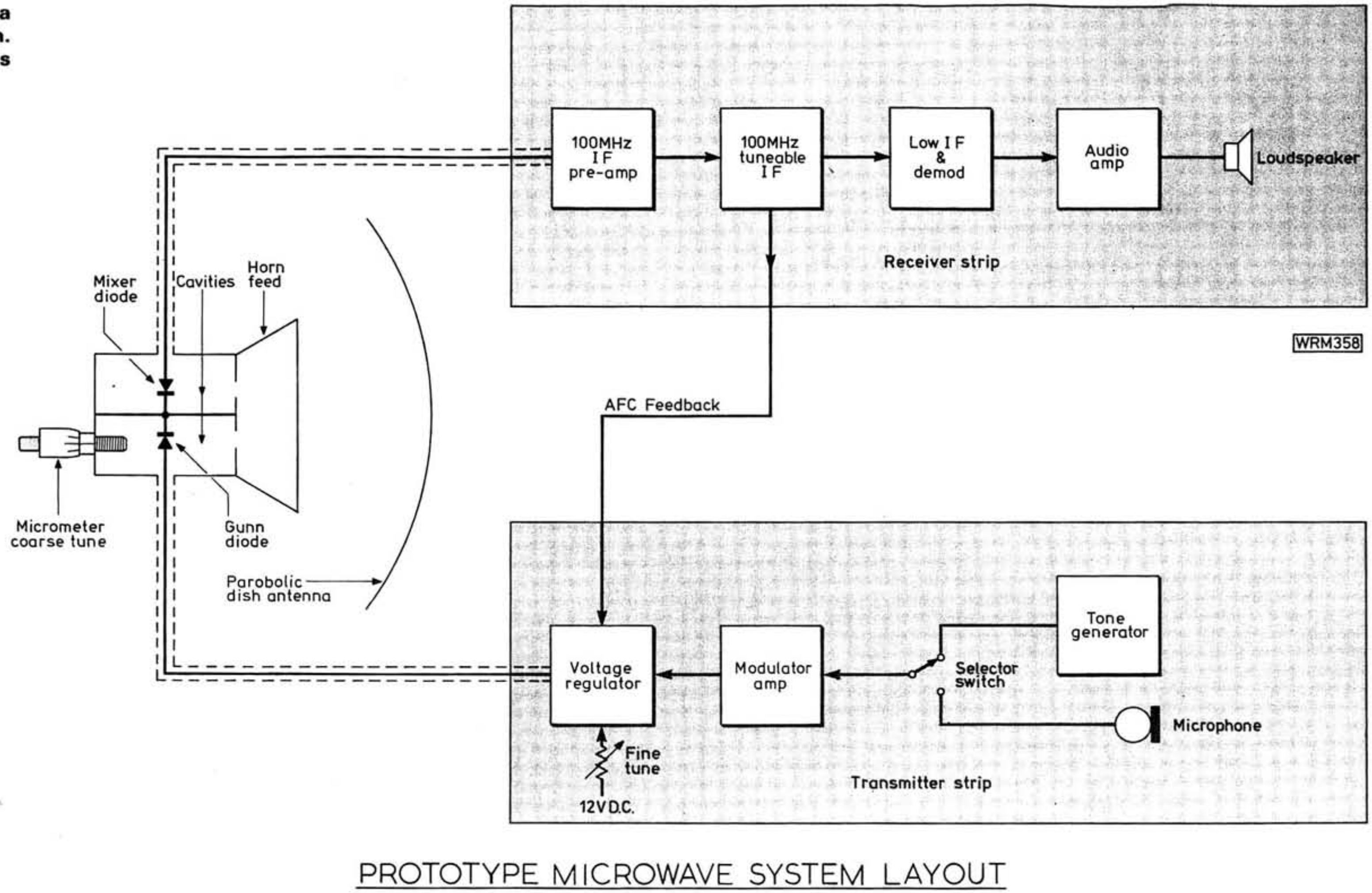


Fig. 1: The block diagram of a simple wideband f.m. system. The *PW* Exe is based on this concept

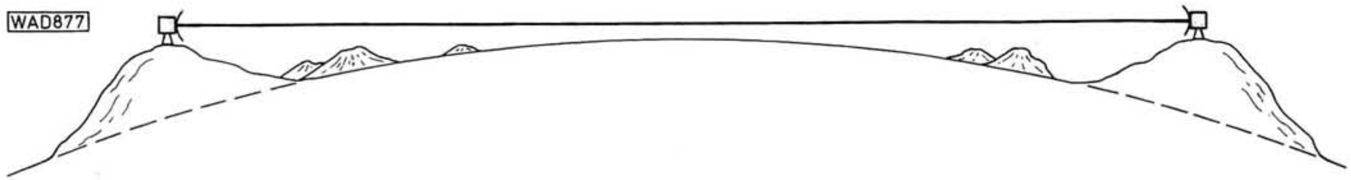


Fig. 2: Wideband f.m. microwave working is based on line-of-sight paths as illustrated in this drawing

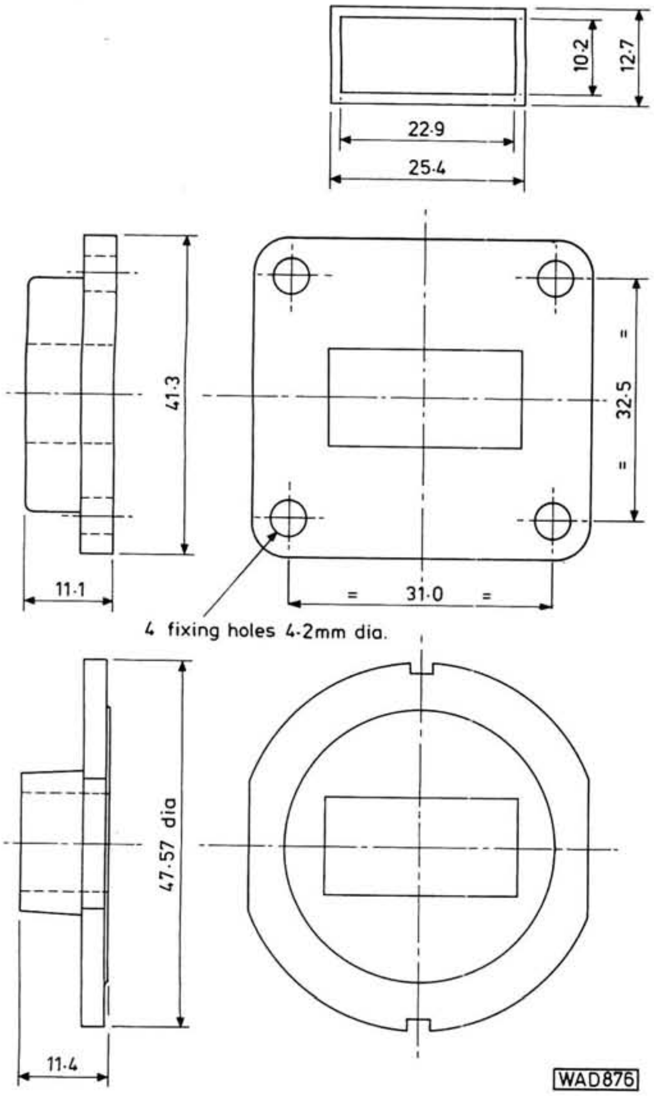


Fig. 3: Waveguide 16 flange details

Table 1. Waveguide 16 specifications at 10·1GHz

Outside mm	Inside mm	Cut-off GHz	λ mm	λg mm
25·4×12·7	22·9×10·2	6·557	29·68	39·06

The Receiver

The receiver side of the simple system comprises a diode mixer, a 100MHz tunable i.f. followed by a 10·7MHz 2nd i.f. and demodulator feeding a simple audio amplifier. A 100MHz pre-amplifier is inserted between the mixer and the 1st i.f. to provide a small amount of gain but mainly to improve the matching between the mixer and the 1st i.f.

The mixer is another waveguide cavity containing a Schottky diode which combines the received signal with a small amount of the transmitted signal to produce a modulated 100MHz signal for the 1st i.f.

Since the mixing process requires a local oscillator frequency set at 100MHz away from the received frequency and also since the local oscillator is also the transmitter, it is apparent that the two stations involved in the QSO must be set to transmit with a frequency difference of 100MHz.

In some microwave units the Gunn oscillator and Schottky mixer are in separate parallel cavities while others have in-line mixers and yet others use the same cavity for both the Gunn oscillator and Schottky mixer.

The separate cavity type, typified by the module made by Wessex Alarms, has a severe disadvantage of "squinting". The receiver input bearing is not on the same alignment as the peak transmitter output.

This is not so bad when a simple horn is used as the antenna, but when used with a dish system means that focusing of the two cavities is not possible. However, many successful units have been made using this module which has the advantage of being cheaply available on the surplus market, and indeed the forerunner of the *PW* Exe used this type of head with a dustbin lid for the dish antenna.

In practical terms the in-line unit, such as the Plessey GDHM1, is very easy to use since the mixer section can be removed from the Gunn oscillator cavity and kept in a safe place while the oscillator is modified. This is important as the Schottky diode is very prone to static damage and the less it is handled the better.

The Plessey unit, primarily designed as a burglar alarm module, as were the other units, features an iris defined cavity. This has the front of the Gunn cavity closed off by a metal plate which has a hole in it to allow the optimum amount of r.f. energy to escape. The size and shape of hole is fairly critical and has to be optimised for maximum output without swamping the mixer diode. The other advantage is that this type of module can be bolted directly onto Waveguide 16—something that is obviously extremely difficult with the two parallel cavities of the Wessex Alarms unit.

The third module that is readily available is made by Marconi Electronic Devices Ltd. (formerly AEI), and is a very compact single cavity module. Again it can be interfaced directly with Waveguide 16.

Any of these units can be used with the *PW* Exe system and details of the necessary simple modifications needed will be given later in the series.

Choice of IF

The main reason for choosing a 1st i.f. of around 100MHz is that tunable units with the necessary performance are readily obtainable in the guise of conventional v.h.f. f.m. radios. In fact the prototype units used a discarded portable radio.

The *PW* Exe has the added facility of a.f.c. of the Gunn diode oscillator to ensure that the overall system performance is not affected by drift in either transceiver.

The a.f.c. is switchable either UP or DOWN to accommodate the other transmitter being higher in frequency or lower in frequency than your transmitter. Only one of the two stations involved in a QSO can use a.f.c.—otherwise both transmitters will be chasing each other—so the a.f.c. loop can be switched out. The a.f.c. signal is taken from the output of the 1st i.f. and used to control the modulator output. This signal is "slugged" otherwise the a.f.c. would attempt to overcome the audio modulation, leaving a clean carrier.

The *PW* Exe

Fig. 4 shows the complete circuit of the *PW* Exe transceiver. Extensive use has been made of 741 op.amps. to simplify the design, and the audio processing for both the transmitter and receiver are contained on one p.c.b. along with the 2nd i.f. and demodulator.

Use has been made of the Ambit EF5803 high performance Band II tuner head. This covers the frequency range 88 to 108MHz and for the *PW* Exe we will be using it at around 102MHz. As a bonus, when you cannot find anyone to talk to, you can retune the 1st i.f. to receive normal v.h.f. f.m. broadcasts—which might help to placate the XYL. The fine tuning supply for the varicap tuning diodes is obtained from the 9 volt stabiliser on the a.f. processing board.

9V Stabiliser

This stabiliser uses a 741 op.amp. feeding a BC108 transistor, Tr1. The non-inverting input of the op.amp. is held at 3·3V by Zener diode D1 and the inverting input picks off a portion of the output at the wiper of R5. As the action of the op.amp. is to try to hold the two inputs at the same potential the output is regulated by the 741 to achieve this end. The 9V stabilised output from Tr1 is used for the i.f. tuning supply, the "S" meter reference and, if it is fitted, the supply to the 100MHz pre-amplifier.

The 2nd i.f. uses the familiar CA3089E (or HA1137W) i.c. as the main 10·7MHz amplification, limiting and function stage. Two stages of 10·7MHz amplification with two-pole ceramic filters precede the i.c. while the a.f.c. signal is taken directly from pin 7 of IC6. The output from the demodulator section of IC6 is taken via the volume control to an LM380N audio amplifier i.c., IC5, to provide up to 2 watts of audio output into an 8Ω loudspeaker. To avoid any problems associated with the large currents

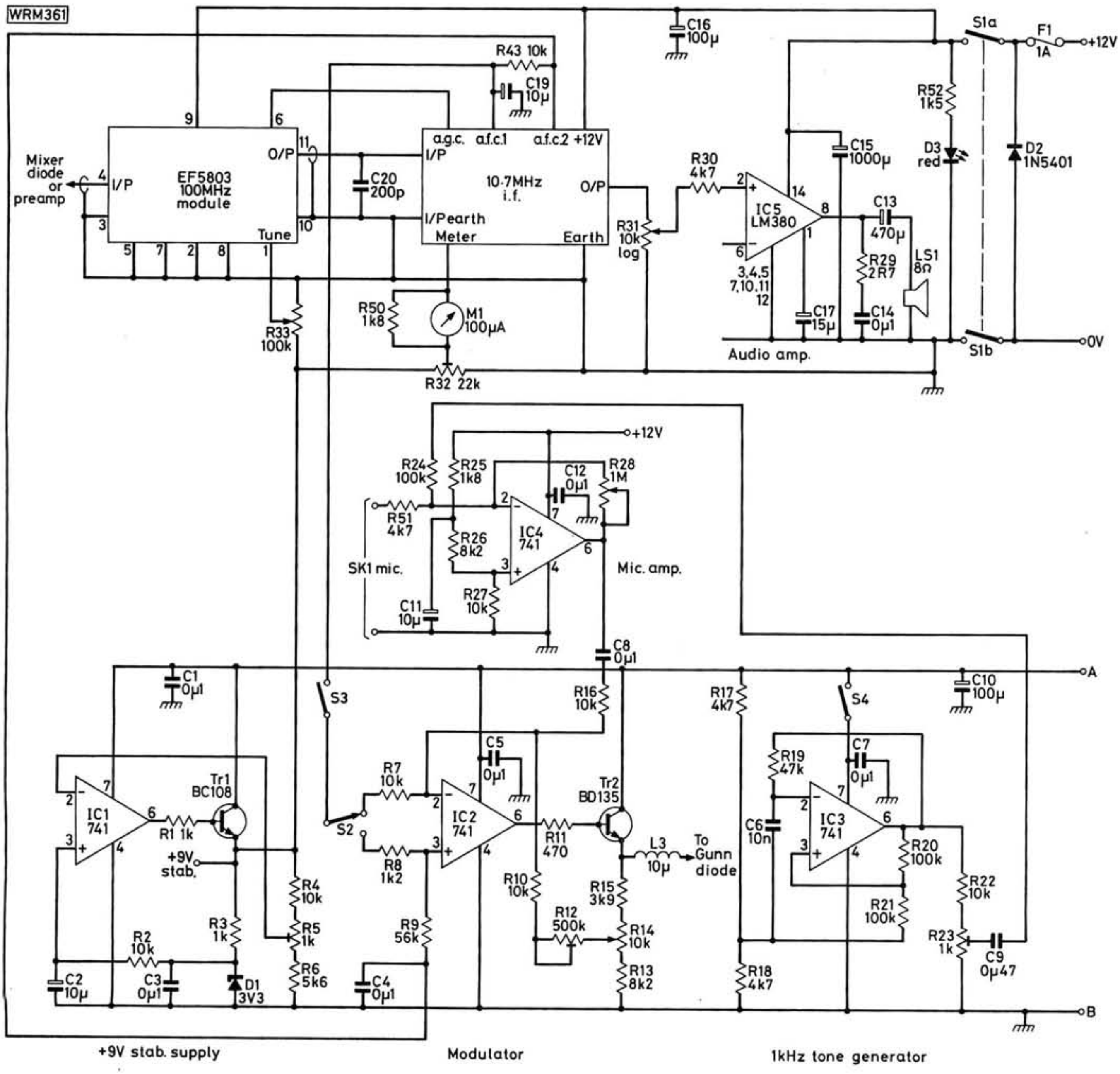


Fig. 4: The complete circuit diagram of the *PW* Exe transceiver. The 100MHz module is a high performance Band II tunerhead made by Ambit International. The 10·7MHz i.f. is shown in detail in Fig. 5

CONSTRUCTION RATING Intermediate

BUYING GUIDE

This project has been designed for the beginner in microwaves, but obviously not for the complete novice. As the project is described we will indicate the sources of supply for those components which are of a specialised nature. However, we have tried to ensure that only readily available components are specified. A considerable saving over the total cost quoted below can be made by careful buying of parts.

APPROXIMATE COST £85

Readers who intend to operate the *PW* Exe 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.

flowing in the supply lines to the LM380N, it is fed separately from the rest of the audio processing board.

Modulator

The modulator is a variation on the 9V stabiliser already described. To cope with the higher current taken by the Gunn diode a BD135 is used as the output device. Unlike the 9V stabiliser the output of the modulator is required to vary according to the applied a.f. signal on its input and also to the a.f.c. signal from the 2nd i.f. The non-inverting input of IC2 is referred to the reference at pin 10 of IC6 so that any drift in the 2nd i.f. chip is also referred to the modulator. The a.f.c. signal is switched to either input depending on which sense a.f.c. is needed. The main audio input signal is then fed to the inverting input and this causes the output voltage of the modulator to vary in sympathy.

As shifting the voltage on the Gunn diode alters its operating frequency, the resulting r.f. output is a carrier at around 10·2GHz frequency modulated with a deviation of up to 75kHz.

Microphone Amplifier

The microphone signal is processed by a simple amplifier based around IC4 which also acts as a mixer to enable the 1kHz tone from the tone generator to be fed to the modulator stage at the required level. Altering the gain of the microphone amplifier by adjusting R28 allows the deviation of the r.f. output to be varied.

Tone Generator

The 1kHz tone, which is necessary to provide continuous modulation during setting up for a QSO, is generated by a simple squarewave generator based on another 741 op.amp. IC3. This circuit can be switched off when not required and the level of 1kHz output signal can be adjusted by R23.

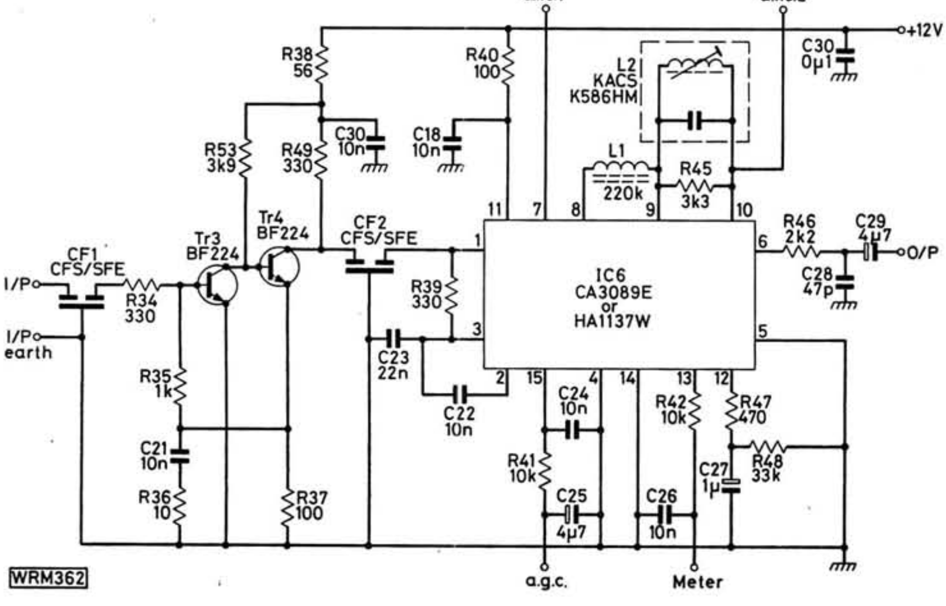


Fig. 5: The circuit diagram of the 10·7MHz i.f. unit. This is based on a circuit by Ambit International

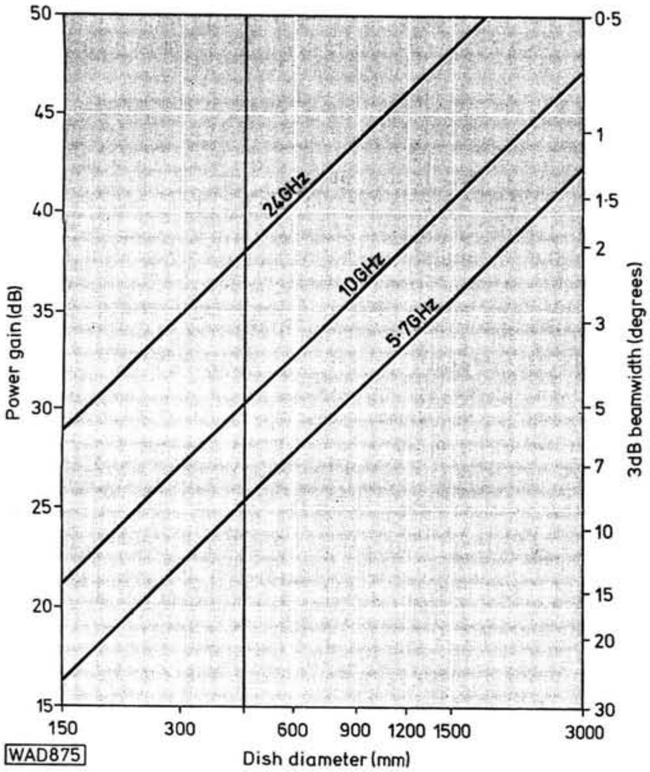


Fig. 6: This graph shows the effect of the diameter of a parabolic metal dish on its gain and bandwidth

Antenna System

For the simplest type of antenna a horn is difficult to beat. However, most people associate microwaves with parabolic dishes and undoubtedly a dish offers the chance of higher gains without making the equipment unwieldy.

For the *PW* Exe, which is intended to be fully portable, it was felt that a 460mm diameter spun aluminium dish with a focal length of 128mm offered a reasonable gain figure without putting the cost up too much—and also allowed it to be carried in a normal car without displacing the occupants.

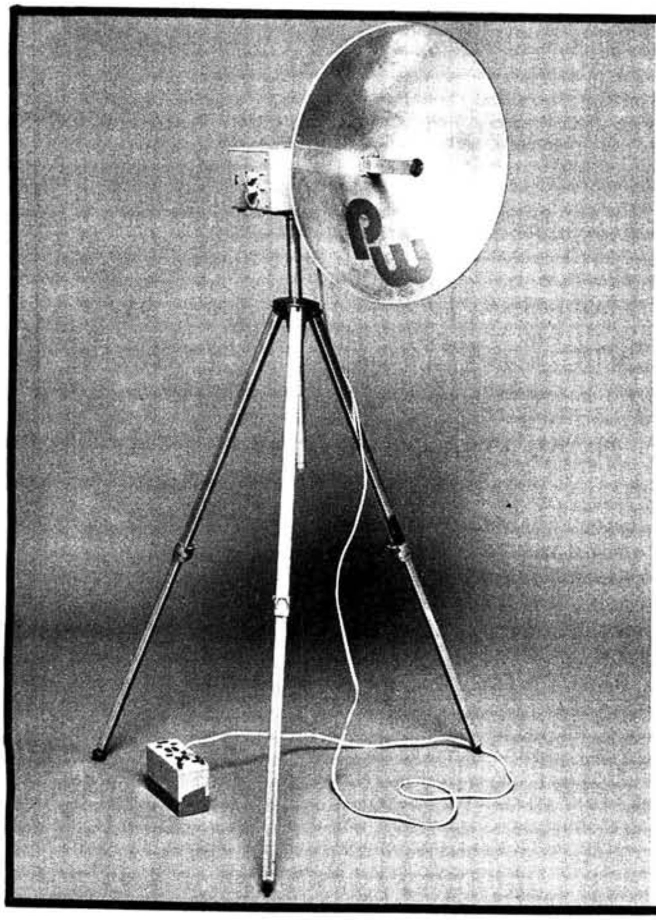
We have arranged for a supply of these dishes to be available through *Practical Wireless* and this will be announced elsewhere in this issue.

The dish is fed from the rear by a simple "Penny Feed" system originally developed by G4ALN. This is easy to construct and adjust and gives excellent results. For this type of feed the dish must have a focal length to diameter ratio of between 0·25 and 0·3 and we have designed the *PW* dish to have this ratio set at 0·28.

The equipment is housed in a standard diecast box and powered from a 12V re-chargeable battery. This allows it to be fully portable, an essential requirement for line-of-sight path working in this country. It is also possible to run it from a 12V car battery if you can get the vehicle near enough to the operating site.

Part 2

In Part 2 we will commence the construction of the *PW* Exe starting with the interesting and different part—the microwave head and antenna.



PW PARABOLIC DISH SPECIAL ANNOUNCEMENT

The antenna system designed for the *PW* Exe uses a specially designed and spun aluminium parabolic dish. *Practical Wireless* has made arrangements for the supply of this special item and we will have stocks available on our stand at the RSGB Exhibition at Alexandra Palace.

Although designed primarily for the *PW* Exe project, this 128mm focal length, 460mm diameter black anodised aluminium dish should be useful for many other projects in the future, some of which are more than just "pie in the sky".

The price of this special offer parabolic dish is £7·50 and to enable us to judge the demand we would appreciate some indication in writing of your interest. This will in no way commit you to actually purchasing a dish.

For those readers unable to get to "Ally Pally" we are investigating methods of packaging the dishes for shipment through the post and we will be announcing details of this next month.

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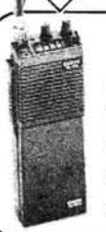

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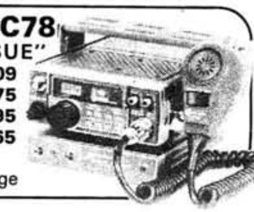

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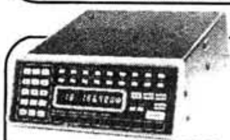

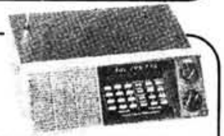

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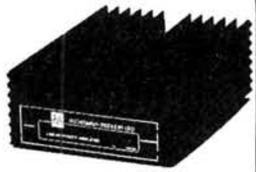

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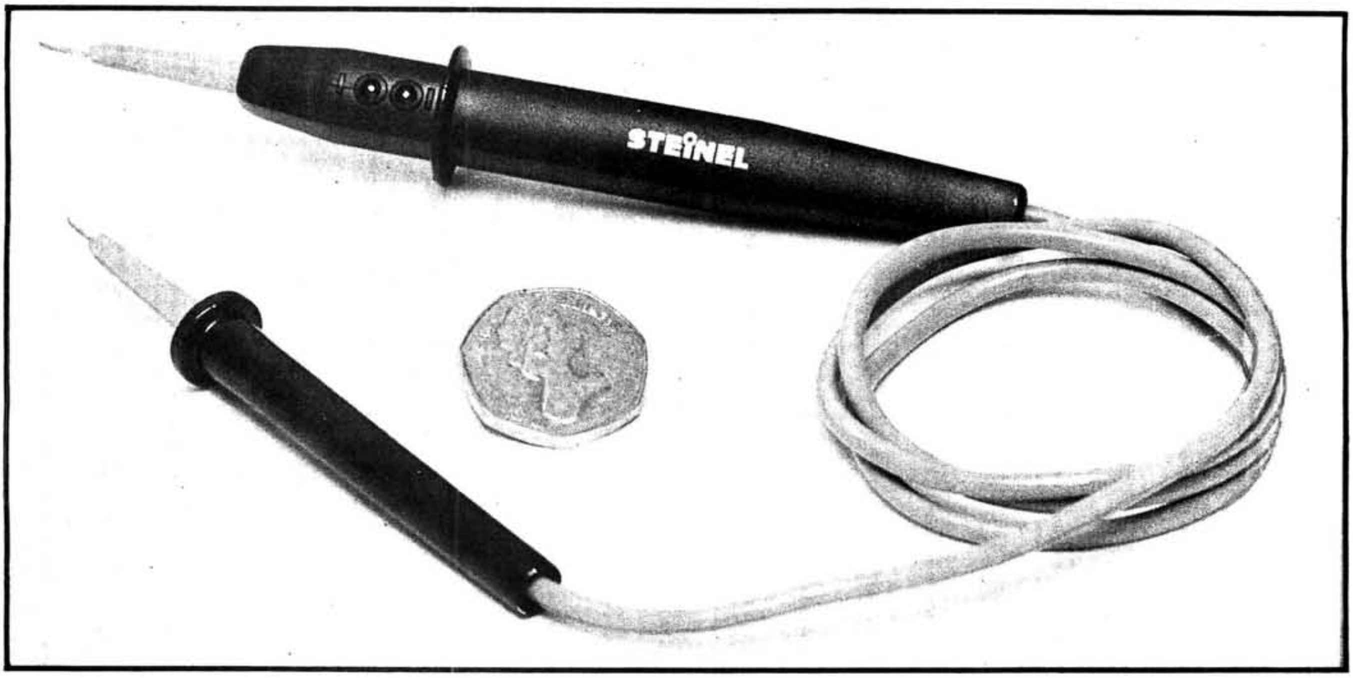

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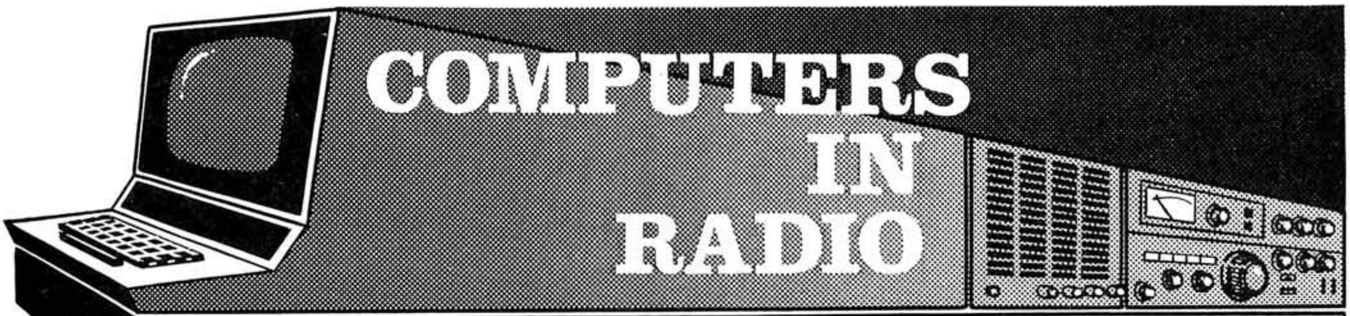

INTRODUCING THE MICROCOMPUTER — 2

by Mervyn J. Axson BA G8WHG

Computers don't just handle numbers, they can also deal with words and alphanumeric strings, such as callsigns and QTH locators. We showed in Part 1 how a number was represented in the program by a letter, e.g., "R" represented the value of the resistance. "R" is termed a "numeric variable". A variable may be named by any single letter or any letter followed by a second letter or number, e.g., A, AB and A2 are all valid numeric variable names. Similarly, there are "string variables" and they are distinguished by having a "$" sign after the variable name, e.g., A$, AB$ and A2$.

To see how this may be used, let us design a program to convert a QTH locator to latitude and longitude. First, consider how we do this manually using the QTH locator ZN61A as an example. The longitude is given by the first letter, Z, the second figure, 1, and the final letter, A. Looking up in the published tables, we find that Z is 01° 00'W and 1A is +54'W so the longitude is 01° 54'W. Similarly, the second letter, N, both figures, 61, and the final letter, A, give the latitude as 53° 30'N − $16\frac{1}{4}$'N = 53° $13\frac{3}{4}$'N (Table 1). Inspection of the map will show that this is just south of Buxton in Derbyshire at a place called Harpur Hill, and ZN61A is in fact the QTH locator of the repeater GB3HH.

We could use a similar method with the computer by writing a "look-up" table into its memory, but this is rather a cumbersome way and the computer does offer facilities to make the conversion more elegantly. The writers of BASIC included a number of built-in functions that we may make use of. For example, the statement PRINT ASC(X$) will output the ASCII numeric value of the first character of the string X$ (Table 2), whilst VAL(X$) will give the numeric value of the string, e.g., if we consider two strings of single characters, Y$ = "A" and Z$ = "2", ASC(Y$) gives 65 and VAL(Z$) gives 2. We can use these functions to convert the QTH locator into a series of numbers which can be manipulated to give the required answer.

First of all we must get the locator into the computer:

```
1010 INPUT "QTH LOCATOR"; A$
```

We now want to break the string ZN61A down into the individual letters and numbers and then apply ASC or VAL as the case may be. There is another function in BASIC that will do this. It looks complicated, MID$(X$,I,J), but is really quite simple. It gives a new string from X$ starting at the Ith character for J characters, e.g., for the string ZN61A, MID$(A$,1,1) will give "Z", MID$(A$,2,1) will give "N" and so on. We can combine this with ASC and VAL.

```
1020   L1 = ASC(MID$(A$,1,1))
1030   L2 = ASC(MID$(A$,2,1))
1040   N1 = VAL(MID$(A$,3,1))
1050   N2 = VAL(MID$(A$,4,1))
1060   L3 = ASC(MID$(A$,5,1))
```

"ZN61A" has now become 90, 78, 6, 1, 65. Just one point before we start manipulating these numbers. Latitude and longitude are usually expressed in degrees and minutes, but the program will be simpler if we work in decimal degrees e.g. express 30' as 0·5 and so on. We can convert back to degrees and minutes for the print-out.

Let us extract the latitude first. The value of the second letter should vary from 40·5 for "A" to 65·5 for "Z" whereas the ASCII code varies from 65 for "A" to 90 for "Z", a difference of 24·5 for each letter. It follows that if we subtract 24·5 from the ASCII code we have the right answer.

```
1080   LET L2 = L2–24·5
```

L2, which in this example is ASC(N) or 78, has now become 53·5. We now have to make the correction as indicated by the figures and final letter. Since N1 and N2 are 61 and fall between 61–70 we should subtract 0·271 from L2 (the decimal equivalent of $16\frac{1}{4}$'). We can use an ON----GOTO statement, but first we must ensure that we obtain the correct values:

```
1090   I = N1 + 1
1100   IF N2=Ø THEN I=I–1
```

Line 1090 is needed because N1 runs from Ø to 8 and I must start at 1, but this gives the wrong value when N2 = Ø so we add line 1100. This is an IF----THEN statement and only operates if N2 does equal Ø.

```
1110   ON I GOTO 1120, 1130, 1140, 1150, 1160, 1170,
       1180, 1190
1120   LET L2 = L2 + ·479 : GOTO 1200
1130   LET L2 = L2 + ·354 : GOTO 1200
1140   LET L2 = L2 + ·229 : GOTO 1200
1150   LET L2 = L2 + ·0875 : GOTO 1200
1160   LET L2 = L2 — ·021 : GOTO 1200
1170   LET L2 = L2 — ·146 : GOTO 1200
1180   LET L2 = L2 — ·271 : GOTO 1200
1190   LET L2 = L2 — ·396
```

Note the colon (:) in lines 1120 to 1180, followed by GOTO 1200. Without this if I had any value less than 8, all the following lines would also operate, which would be most undesirable!

L2 now contains the correct answer if the final letter

Table 1. Conversion of QTH locator to latitude and longitude

LATITUDE

Second letter	Mid-square latitude	Figures	Increment of latitude, Final letter A,B,H	C,G,J	D,E,F
A	40°30'N	01–10	+28¾'N	+26¼'N	+23¾'N
B	41°30'N	11–20	+21¼'N	+18¾'N	+16¼'N
C	42°30'N	21–30	+13¾'N	+11¼'N	+08¾'N
D	43°30'N	31–40	+06¼'N	+03¾'N	+01¼'N
E	44°30'N	41–50	−01¼'N	−03¾'N	−06¼'N
F	45°30'N	51–60	−08¾'N	−11¼'N	−13¾'N
G	46°30'N	61–70	−16¼'N	−18¾'N	−21¼'N
H	47°30'N	71–80	−23¾'N	−26¼'N	−28¾'N
I	48°30'N				
J	49°30'N				
K	50°30'N				
L	51°30'N				
M	52°30'N				
N	53°30'N				
O	54°30'N				
P	55°30'N				
Q	56°30'N				
R	57°30'N				
S	58°30'N				
T	59°30'N				
U	60°30'N				
V	61°30'N				
W	62°30'N				
X	63°30'N				
Y	64°30'N				
Z	65°30'N				

LONGITUDE

First letter	Mid-square longitude	Second figure	Increment of longitude, Final letter F,G,H	A,E,J	B,C,D
A	01°00'E				
B	03°00'E				
C	05°00'E				
D	07°00'E	1	−58'E	−54'E	−50'E
E	09°00'E	2	−46'E	−42'E	−38'E
F	11°00'E	3	−34'E	−30'E	−26'E
G	13°00'E	4	−22'E	−18'E	−14'E
H	15°00'E	5	−10'E	−06'E	−02'E
I	17°00'E	6	+02'E	+06'E	+10'E
J	19°00'E	7	+14'E	+18'E	+22'E
K	21°00'E	8	+26'E	+30'E	+34'E
L	23°00'E	9	+38'E	+42'E	+46'E
M	25°00'E	0	+50'E	+54'E	+58'E
N	27°00'E				
O	29°00'E				
P	31°00'E				
Q	33°00'E				
R	35°00'E	1	+58'W	+54'W	+50'W
S	37°00'E	2	+46'W	+42'W	+38'W
T	39°00'E	3	+34'W	+30'W	+26'W
		4	+22'W	+18'W	+14'W
U	11°00'W	5	+10'W	+06'W	+02'W
V	09°00'W	6	−02'W	−06'W	−10'W
W	07°00'W	7	−14'W	−18'W	−22'W
X	05°00'W	8	−26'W	−30'W	−34'W
Y	03°00'W	9	−38'W	−42'W	−46'W
Z	01°00'W	0	−50'W	−54'W	−58'W

Example:
ZN61A
Long 01° 00'W + 54'W = 01° 54'W
Lat 53° 30'N − 16¼'N = 53° 13¾'N

(L3) was A, B or H. In the example chosen it was, but if L3 had been C, G or J a further 2½' or 0·042 should be subtracted and for L3 equals D, E or F the deduction required would be 0·083, so:—

```
1200  IF L3=65 OR L3=66 OR L3=72 GOTO 1230
1210  IF L3=67 OR L3=71 OR L3=74 THEN
      L2=L2−·042 : GOTO 1230
1220  L2=L2−·083
```

We have introduced several new ideas here. There is an IF---GOTO statement in line 1190. This works in the same way as an IF----THEN but transfers operation to another line. You will also note that several conditions can be specified and if any one is true the statement will operate. Line 1200 is an IF----THEN incorporating the same principle, but since the THEN is used to modify L2, we need another statement to transfer operations. A colon (:) separates the two statements and the second (GOTO 1230) will only be reached if one of the tests in the IF----THEN is true. We have now tested to see if L3 = A, B, C, G, H or J, made any necessary correction and transferred operation if it did, so if line 1210 has been reached, L3 must be D, E or F and we simply subtract 0·083 from L2.

L2 now is the latitude of the QTH locator in decimal degrees and we want it in the form of degrees and minutes. The whole number part of L2 is degrees and the decimal part multiplied by 60 will be the value of minutes. We can separate them by using the INT function which cuts out the part of a number after the decimal point e.g. INT(2·55) = 2 and by subtracting 2 from 2·55 leaves 0·55, so we program:—

```
1230  LET A=INT(L2)
1240  LET B=(L2−A) * 60
```

We can now put a PRINT statement further on in the

Table 2. ASCII Character codes for letters

Character	Code	Character	Code
A	65	N	78
B	66	O	79
C	67	P	80
D	68	Q	81
E	69	R	82
F	70	S	83
G	71	T	84
H	72	U	85
I	73	V	86
J	74	W	87
K	75	X	88
L	76	Y	89
M	77	Z	90

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```
1000 PRINTCHR$(147)
1010 INPUT"QTH LOCATOR";A$
1020 L1=ASC(MID$(A$,1,1))
1030 L2=ASC(MID$(A$,2,1))
1040 N1=VAL(MID$(A$,3,1))
1050 N2=VAL(MID$(A$,4,1))
1060 L3=ASC(MID$(A$,5,1))
1080 LET L2=L2-24.5
1090 LET I=N1+1
1100 IF N2=0 THEN I=I-1
1110 ON I GOTO 1120,1130,1140,1150,1160,1170,1180,1190
1120 LET L2=L2+.479 : GOTO1200
1130 LET L2=L2+.354 : GOTO1200
1140 LET L2=L2+.229 : GOTO1200
1150 LET L2=L2+.0875 : GOTO1200
1160 LET L2=L2-.021 : GOTO1200
1170 LET L2=L2-.146 : GOTO1200
1180 LET L2=L2-.271 : GOTO1200
1190 LET L2=L2-.396
1200 IF L3=65 OR L3=66 OR L3=72 GOTO 1230
1210 IF L3=67 OR L3=71 OR L3=74 THEN L2=L2-.042:GOTO 1230
1220 L2=L2-.083
1230 LET A=INT(L2)
1240 LET B=(L2-A)*60
1250 IF L1<85 THEN LET L1=2*(L1-64)-1:B$="EAST":GOTO1270
1260 LET L1=2*(90-L1)+1:B$="WEST"
1270 LET N2=N2-1
1280 IF N2=-1 THEN N2=9
1290 IFB$="WEST" GOTO 1350
1300 LET L4=-58+(N2*12)
1310 IF L3>69 AND L3<73 GOTO 1340
1320 IF L3>65 AND L3<69 THEN L4=L4+8 : GOTO 1390
1330 L4=L4+4
1340 GOTO 1390
1350 LET L4=58-(N2*12)
1360 IF L3>69 AND L3<73 GOTO 1390
1370 IF L3>65 AND L3<69 THEN L4=L4-8 : GOTO 1390
1380 L4=I 4-4
1390 L4=L4/60
1400 L1=L1+L4
1410 LET C=INT(L1)
1420 LET D=(L1-C)*60
5000 PRINT
5010 PRINT
5020 PRINT"LONGITUDE = ";C;"DEGREES";INT(D);"MINUTES ";B$
5030 PRINT
5040 PRINT"LATITUDE = ";A;"DEGREES";INT(B);"MINUTES NORTH"
READY.


RUN OF PROGRAM


QTH LOCATOR ? ZN61A


LONGITUDE =  1 DEGREES 54 MINUTES WEST

LATITUDE =  53 DEGREES 13 MINUTES NORTH
```

Fig. 1

program to output the information—note all QTH locator latitudes are North.

```
5040  PRINT"LATITUDE = ";A;"DEGREES";B;"MINUTES NORTH"
```

A similar process is now carried out to extract the longitude information from the QTH locator, but using different parameters. The value represented by the first letter (L1) varies from 01° 00′East for "A" to 39° 00′East for "T", incrementing in steps of two degrees per letter, and then "U" = 11° 00′West decrementing by two degrees per letter to "Z" = 01° 00′West (Table 1). We therefore first test the ASC value of L1 to see if it is a letter from A to T when we apply one correction, but if the letter is U to Z we apply another:

```
1250  IF L1 < 85 THEN L1 = 2*(L1–64)–1 : B$ = "EAST" : GOTO
      1270
1260  LET L1 = 2*(90–L1) + 1 : B$ = "WEST"
```

If you try the two formulae out on a calculator, you will find that the value of L1 agrees with Table 1.

Again we use different corrections for the second figure and last letter for East and West longitudes. We will calculate these in minutes (as Table 1) and then convert to decimals before applying them to L1. N2 has values of 1 to Ø but for our purpose it would be better if it ran from Ø to 9, for a simple formula like L4 = –58 + (N2*12) will give the values –58 to +50 for the values of N2. Similarly, L4 = 58 – (N2*12) makes the values run from +58 to –50 (Table 1). Further corrections for the value of the last letter are applied if necessary and the output is formatted, just as was done for the latitude.

```
1270  LET N2 = N2–1
1280  IF N2 = –1 THEN N2 = 9
1290  IF B$ = "WEST" GOTO 1350
1300  LET L4 = – 58 + (N2*12)
1310  IF L3 > 69 AND L3 < 73 GOTO 1390
1320  IF L3 > 65 AND L3 < 69 THEN L4  = L4 + 8 : GOTO 1390
1330  L4 = L4 + 4
1340  GOTO 1390
1350  LET L4 = 58 – (N2*12)
1360  IF L3 > 69 AND L3 < 73 GOTO 1390
1370  IF L3 > 65 AND L3 < 69 THEN L4 = L4 – 8 : GOTO 1390
1380  L4 = L4 – 4
1390  L4 = L4/60
1400  L1 = L1 + L4
1410  LET C = INT(L1)
1420  LET D = (L1–C)*60
5020  PRINT"LONGITUDE = ";C;"DEGREES";D;"MINUTES";B$
```

We now have a complete program! It may seem rather cumbersome but in practice it works quickly. Virtually as soon as you press the RETURN key after entering the QTH locator the answer appears on the screen. The completed program is shown in Fig. 1. A couple of PRINT statements have been added to tidy up the output and B and D in lines 5020 and 5040 have been changed to INT(B) and INT(D) so as to stop the computer printing out something like 13·4200091 minutes, which is pointless and irritating.

In the next article we will add the facility to work out how far from your home station the QTH locator is and then add means to use the program for log keeping in a contest.

RADIO SPECIAL PRODUCT REPORT

STANDARD C78

70cm FM TRANSPORTABLE TRANSCEIVER

It is now almost a year since we reviewed Standard's 70cm mobile f.m. transceiver and when the C78 portable rig was announced we were eager to get our hands on one to see if it maintained the high standards set by the C7800. We were not disappointed.

The C78 is one of several new 70cm rigs to be released onto the UK market by the big Japanese manufacturers and it differs from any of the competition in that it is a portable transceiver first and a mobile one second. In this respect it is complementary to, and does not replace, the C7800.

For portable use it can be run from internal batteries, either ten NiCads or nine HP7 dry cells and with the sensitive receiver fitted should perform very well when used slung from one's shoulder in its carrying case and fitted with its "rubber duck" antenna. To get the best results it had to be held away from the body but this was not difficult. The overall size of the basic transceiver was small enough to be convenient but the controls were not unduly cramped.

The main controls were on the top panel (or front panel depending on whether you were portable or had it installed in its bracket for mobile use). The general impression of the controls was that they were a miniature version of the C7800 with a similar push button keypad for controlling the main operations. Channel selection is by a single knob which shifts the frequency up or down in steps of 50 or 25kHz as determined by a switch on the back.

Access to this switch along with the batteries and memory back-up selection switch is through a large hatch which is held in place by a screw with a slot large enough to accept a coin. This hatch proved awkward to open and close but once the NiCads were in place and the switches set there was no need to open it again. The back panel carries a slide switch to select the light for the meter and give a battery check using the meter, a socket to accept a small plug for battery charging, the main antenna socket (SO239), the external power socket and a small push button to reset the MPU in case of malfunction.

On-off and volume are controlled from one knob while the squelch control is by another matching knob. Tone for repeater operation is by depressing the keypad marked CALL and another pad switches the battery saver on.

There are two slide switches beside the microphone socket to control the scanning functions and simplex, repeater and reverse repeater working. Unlike the C7800 this rig is equipped with this useful function which makes repeater operation much easier.

The C78 has six memories, five can be used to store any channel in the rig's 10MHz range while the sixth is used to store the required repeater shift. In the case of the UK repeaters this memory would be programmed at 1·6MHz and it is vital to remember that if you let the NiCads run down or forget to change the dry cells—or even if you have no batteries fitted and use it from an external source, this shift must be re-programmed before you can use a repeater.

The scanning control can be set to scan either a 1MHz section of the band or to scan the five memories for either busy or vacant channels or auto with a fixed pause on a busy channel. It is not possible to scan the memories when the rig is set for repeater operation and in this mode all the memory controls are locked. This means that if you have programmed repeater frequencies into the memories it is necessary to revert to simplex mode before another channel can be retrieved.

The liquid crystal display shows the receiver frequency selected and changes, when the p.t.t. is pressed, to show transmit frequency. This is very useful for repeater working. A small analogue meter doubles as an 'S' meter for receive and a power meter on transmit.

As with the other Standard products an excellently produced handbook comes with the equipment and contains full operating information as well as complete maintenance, repair and alignment details.

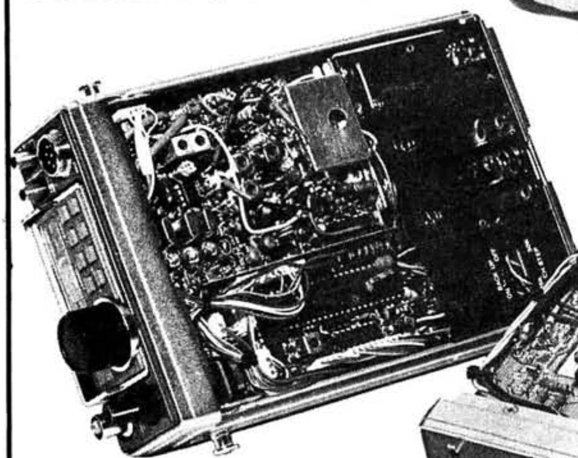
The construction of the C78 and its associated equipment is well up to the standard set by the C7800 and based on a year's experience with that rig this newcomer should prove to be reliable and stable.

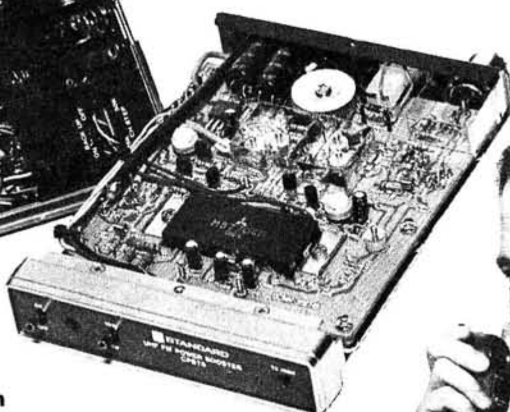
For those amateurs who want to use their rig as a mobile rig, a base station as well as a portable transceiver Standard have produced a matching r.f. power amplifier which

STANDARD C78

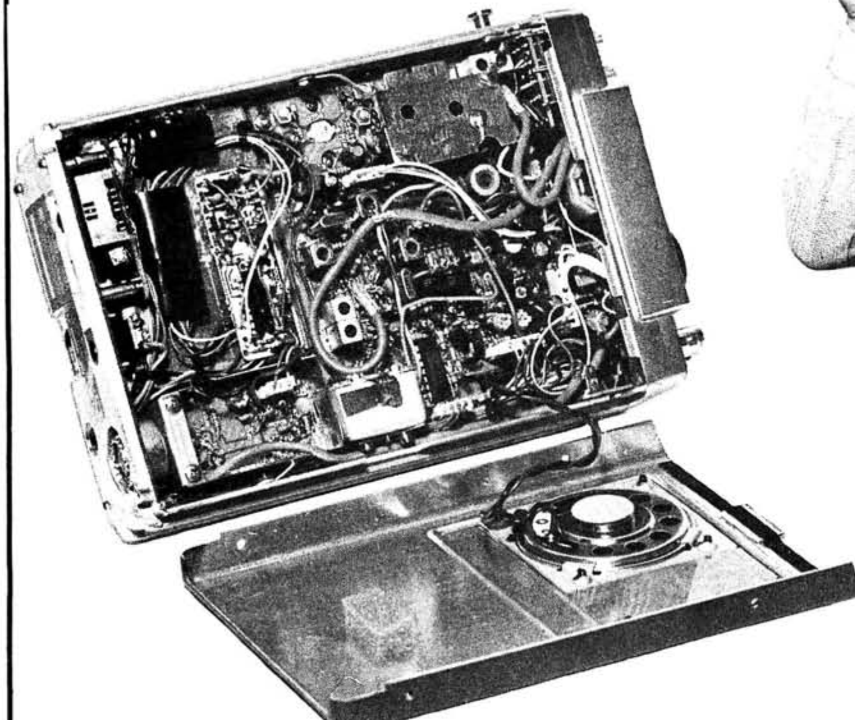
The battery compartment lid is removed using a small coin

The C78 slides into its special bracket, making all connections at the same time





Construction is of the same high standard as the C7800

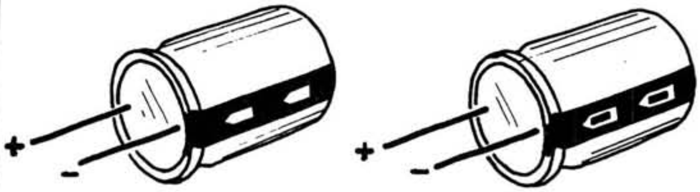


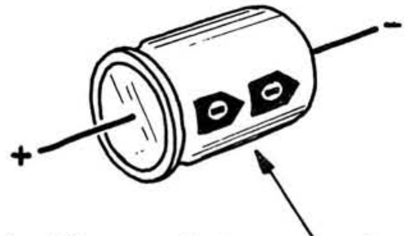
continued on page 70 ▶▶▶

CONSTRUCTOR'S SKETCHBOOK

Polarised Components

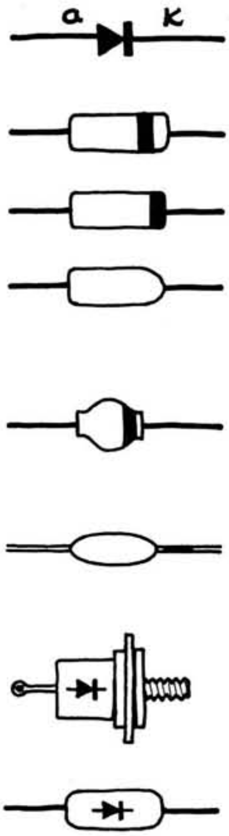
Multi-section tag-ended electrolytic capacitors will have the tags colour-coded, and identified in a table printed on the can, the can is usually connected to the common negative.





For double-ended capacitors, the can is always negative, regardless of any other markings or the colour of the bung.

Electrolytic Capacitors



Coloured band indicates the cathode end.

Diodes

'+' signs adjacent to positive lead.

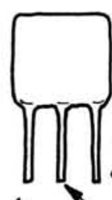
Coloured spot

Coloured bands

When the spot is facing you, the positive lead is on the right.

Tantalum bead capacitors

And some unpolarised ones

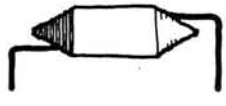


Ceramic filters are symmetrical, and can be inserted either way round in the p.c.b.

Output or input.

Input or output.

Earth.



On polystyrene capacitors a red end indicates the outer foil, and the capacitor should be wired in so that this lead is towards the more earthy end, regardless of polarity.

WRM367

PRODUCTION LINES

ALAN MARTIN G8ZPW

The Latest Rigs!

Just received, is red-hot information on the introduction of three new rigs, one each from Yaesu, Standard and Trio.

Yaesu's FT-290 (FT-490 in Japan) is a 2m portable transceiver whose main features include: 2 v.f.o.s; 10 memories; memory scan; bandscan; priority channel; 25W output; l.c.d. display; needle indicated S-meter and measures 195 × 150 × 58mm.

Hopefully, further information will be available, when this issue is published, from: *Amateur Radio Exchange, 2 Northfield Road, Ealing, London W13 9SY. Tel: 01-579 5311.*

The **Standard** C-85 is a 2m v.h.f. version of their C-78 portable/mobile 70cm transceiver, as mentioned in "Production Lines" (March 1981) and reviewed in this issue.

Main features are: 5 memories; auto-scan; manual Up/Down scan via the microphone; automatic calling channel selector, memory scan; busy/free/vacant scan switch; 3-position simplex/repeater switch; battery save facility; MHz shift button and 1W output for portable operation. Also available is the interconnecting mounting bracket which provides direct plug-in power and signal connections and a 10W linear amplifier for mobile operation.

Further information from: *Lee Electronics Ltd., 400 Edgware Road, London W2. Tel: 01-723 5521.*

Trio have just announced that they will be introducing the TR-9500 70cm all mode (f.m., u.s.b., c.w. and l.s.b.) transceiver based on, and almost identical to, the very popular TR-9000 2m all mode transceiver.

Some of the main features are: 2 v.f.o.s; N-type antenna socket; 6 memory channels; memory scan plus various other scan modes; MHz step button; switchable 10W Hi, 1W Lo power output; and also possesses a large bright green 5-digit l.e.d. display.

Information on the TR-9500 will hopefully be available sometime in May from: *Lowe Electronics Ltd., Chesterfield Road, Matlock, Derbyshire. Tel: (0629) 2817/2430.*

I am afraid that at the time of going to press, details of price and availability of these three rigs was not available.

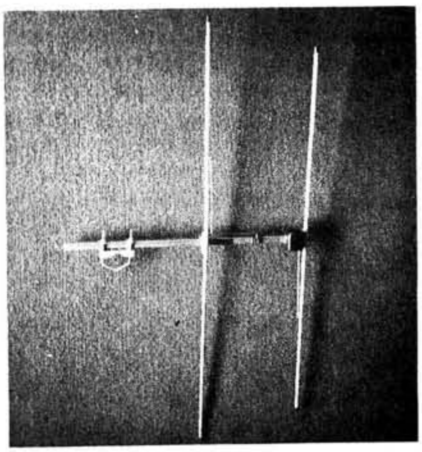
HB9CV

I am informed of the availability of a reasonably priced, compact beam antenna for 2m based on the renowned HB9CV design.

This 2-element antenna features a double-gamma match system enabling rapid adjustment for lowest s.w.r. matching. With its directional properties this antenna will provide very effective gain over normal vertical omni-directional antennas. Its compact nature makes it ideal for use in portable situations and for direction finding hunts.

Details are available for phasing a pair of these antennas together to provide a very potent performance.

The HB9CV antenna, with its 4dB gain over a dipole, probably represents the best combination of physical size to gain. It is constructed of high quality materials and costs only £7.50 plus £2.50 p&p from: *The CQ Centre, 10 Merton Park Parade, Kingston Road, London SW19. Tel: 01-543 5150.*



VHF Monitor

Northern Communications introduce a v.h.f. f.m. monitor receiver, called the "Wolf 1200".

This full coverage 2m (144-146MHz) receiver features v.f.o. tuning via a dual-speed slow motion drive and also has provision for twelve optional crystal controlled channels.

The crystals are generally available and cost between £2.50 and £3.50 per channel depending on type and specification. Fitting is simple, the holders being accessed through a cover plate on the underside of the unit and no special tools are required.

The main facility of the unit is the auto-scan function of the twelve crystal controlled channels. Busy channel indication is by any one of twelve l.e.d.s arranged in a circle on the v.f.o. tuning knob.

When, in operation, the signal disappears the receiver holds for a short period, then proceeds with its scan. Any of the channels may, of course, be selected and held manually.

Measuring 190 × 150 × 150mm, the unit sensitivity is 0·5μV/12dB and requires a low current 12V d.c. (−ve earth) power source.

The "Wolf 1200" costs £46.00, which includes VAT and p&p, as does a marine band version, the "Wolf 1200/M" and both are available from: *Northern Communications, 303 Claremount Road, Claremount, Halifax, West Yorkshire HX3 6AW. Tel: (0422) 40792.*

SUPPLEMENTARY CAR AUDIO AMPLIFIER

Keith CUMMINS

This amplifier is designed to feed a loudspeaker at the rear of a car fitted with stereo speakers in the front doors. Passengers in the back seat cannot always hear adequately when the front speakers are situated in the doors and partially masked by the driver and front-seat passenger.

The supplementary amplifier provides a further three watts r.m.s. of audio power at the rear of the car, in either "mono" or "ambio" mode (this will be described later), selectable by a switch accessible to the driver. No internal connections need to be made to the existing stereo equipment. In the case when the car radio supply is not switched via the "services" position of the ignition switch, an on/off switch should be fitted. The system is designed assuming the use of a 4Ω speaker throughout.

Mono/Ambio Facility

If the left and right channel signals from a stereo source are added (i.e. "summed together") we obtain a mono signal. The mono signal contains all the components of the original stereo signals, but of course, the directional information is lost. Our amplifier provides a mono signal as one of its two switchable options, and this has proved to be a useful facility for passengers travelling in the rear of the car.

If the left- and right-hand are subtracted from one another we obtain a "difference" signal. When this signal is reproduced from behind those listeners to what is otherwise a conventional stereo system, we have an "ambio system". This produces signals predominantly associated with the ambience or reverberation present in the original stereo. This really constitutes a primitive "surround-sound" system, which despite its simplicity can yield impressive results on a variety of programme sources. It is well known that stereo, confined to the inside of a car, can be very effective. The same considerations apply to the ambiophonic sound presented by the use of a difference signal at the rear. The ambio effect is the other switchable option provided by the supplementary amplifier.

Why The Choice?

The ambio system is best demonstrated when there are no passengers trying to listen intently in the back seat. The reason is quite simple, if the source signal is mono (the left signal is equal to the right) as is m.w. and l.w. radio or mono tape playing, the difference between the channels is zero and the ambio signal vanishes!

The same applies to a mid-stage singer in a stereo signal. His voice will not be reproduced through the rear channel, although the difference signals from the band will be present. Announcers are affected in the same way. If these "centre" or mono signals are to be heard from the rear speaker, the supplementary amplifier has to be switched to mono so that the centre signals from the two stereo channels add together instead of cancelling each other out.

Another element of choice occurs if a noisy stereo radio signal is being received. Because the stereo difference signal in the f.m. transmission is the first to be affected by indifferent reception conditions, noise will be present in the ambio channel to a much higher degree than in the stereo channels. This can lead to a ridiculous situation: imagine a news broadcast on a noisy stereo transmission!

Since the stereo transmission is effectively mono during a news broadcast, there will be no audio from the rear but a large background hiss will be present if reception conditions are poor. Switching the supplementary amplifier to mono results in the noise cancelling out, and the announcer being clearly reproduced from the rear channel. This mode of operation is probably the best compromise if stereo reception is indifferent—but not bad enough to warrant switching to mono.

CONSTRUCTION RATING **Beginner**

BUYING GUIDE

Constructors of this project should have no difficulty in obtaining the components. Maplin Electronics can supply the TDA2030 i.c. and the box, while a study of the advertisements in this issue will provide sources for the other components.

APPROXIMATE COST **£6**

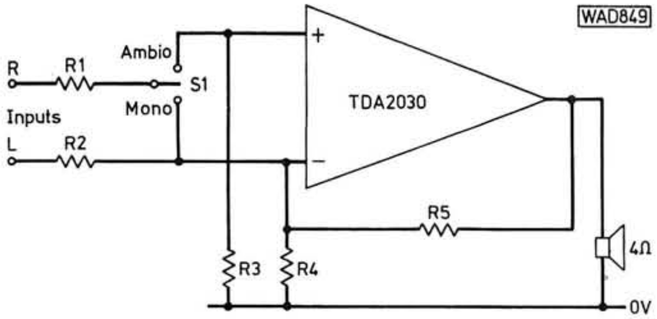


Fig. 1: A simplified diagram of the system

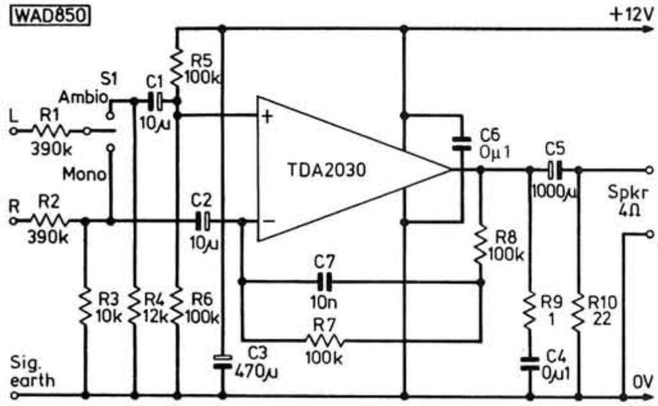


Fig. 2: The circuit diagram of the supplementary car audio amplifier

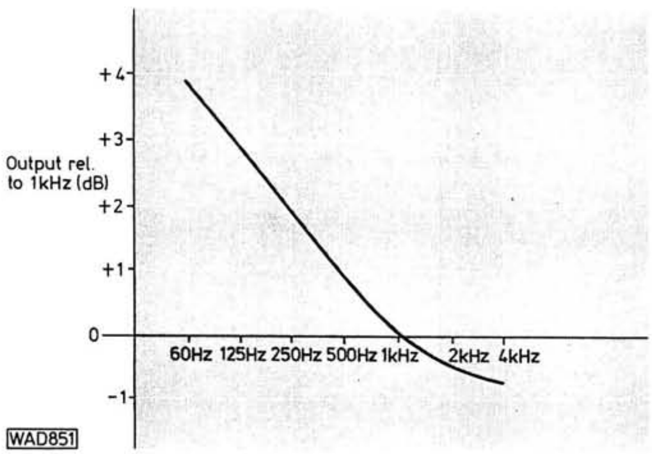
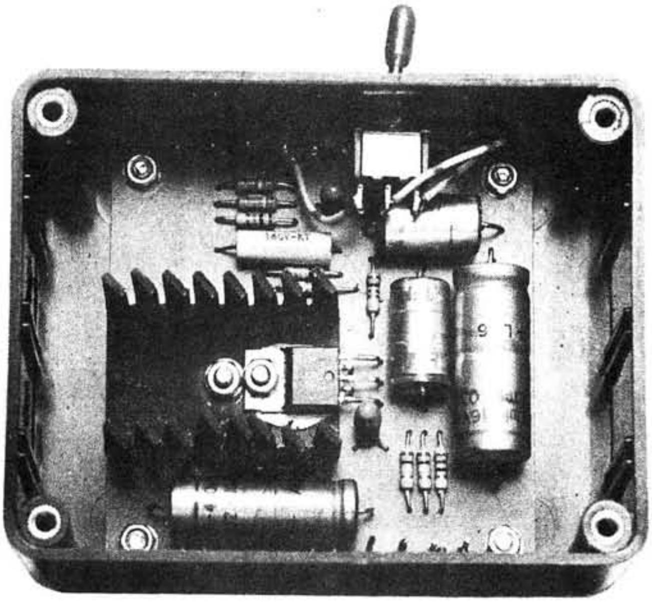


Fig. 3: Frequency response graph

Circuit Description

The design of the amplifier is substantially simplified by the use of the SGS-ATES audio chip type TDA2030. This device is virtually a power op-amp, capable of driving a 4Ω load, but having the usual inverting and non-inverting inputs of a conventional op-amp. This enables the sum and difference switching associated with mono and ambio operation to be very simple, as we shall see later.

The system is shown simplified in Fig. 1, the two stereo channels are introduced at L and R. The signals are taken directly from the existing speaker outputs of the car stereo. Matters such as biasing etc., are not shown in Fig. 1 for simplicity. The first consideration is mono operation; in this case signal L is equal to signal R. The output to the loudspeakers has to be equal to L or R, **not** L plus R.



Therefore L and R each have to provide one half of the drive necessary to produce a loudspeaker output equal to that already present at one of the stereo speakers. Thus, the gain from either L or R to the output has to be 0·5, and from basic op-amp theory this determines that R1=R2=2R5.

For ambio operation the R signal is fed to the non-inverting input of IC1, the drives therefore are in opposite phase and subtract from one another. Note that R3 and R4 are included to provide attenuation of the signals to the "front-end" of IC1, which would otherwise be overloaded by the approximately ±5V swing of signal at L and R.

★ components

Resistors
¼W 5% Carbon

1Ω	1	R9
22Ω	1	R10
10kΩ	1	R3
12kΩ	1	R4
100kΩ	4	R5,6,7,8
390kΩ	2	R1,2

Capacitors
Polyester

10nF	1	C7
0·1µF	2	C4,6

Axial Electrolytic 16V

470µF	1	C3
1000µF	1	C5

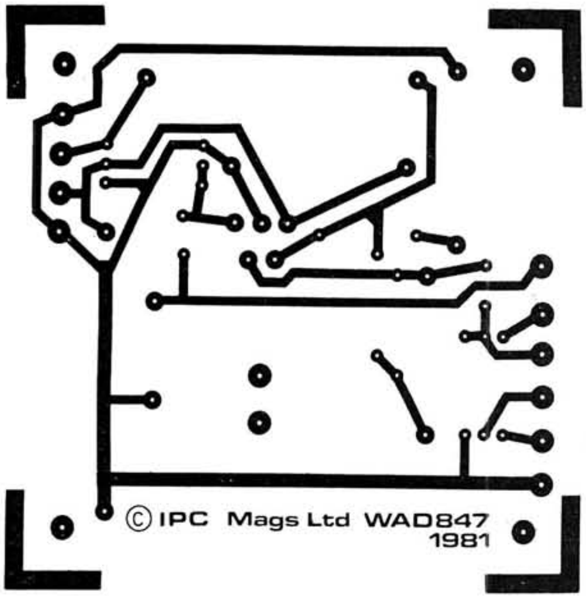
Tantalum Electrolytic 16V

10µF	2	C1,2

Semiconductors
Integrated Circuits

TDA2030	1	IC1

Miscellaneous
Plastics box 100 × 76 × 41 mm; s.p.d.t. switch.



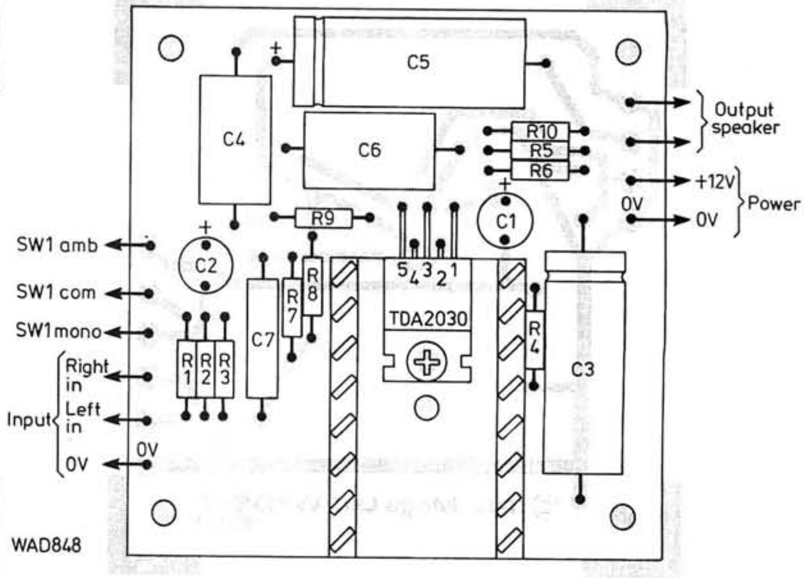


Fig. 4 (above): The copper track pattern for the p.c.b. shown full size. Fig. 5 (above right): The component placement drawing for the supplementary car audio amplifier printed circuit board

Detailed Design

The full circuit is shown in Fig. 2. Resistors R5 and R6 bias the non-inverting input of IC1 to "half-rail". The output is d.c. coupled to the inverting input via R7 and R8. The d.c. feedback is therefore 100 per cent and the op-amp d.c. level sets itself to the bias at the junction of R5 and R6. The audio signals are coupled into IC1 via C1 and C2. Otherwise the function of the input arrangement is exactly as described previously.

The feedback resistance is split into two parts, R7 and R8. The effect of R7 connected in parallel with C3 is shown in the response curve in Fig. 3. It will be seen that the unity gain referred to earlier only occurs at low frequencies; at higher frequencies the gain is reduced by a calculated 4·5dB. The effect of this is two-fold, on ambio operation high frequencies (i.e. difference signals) tend to predominate, and the attenuation of upper frequencies produces a more natural ambio sound.

On mono the rear signal is given a bass lift; this appears to be no disadvantage. The ear is not particularly directional at low frequencies and the overall impression is that of having a better bass response. Signal intelligibility is certainly not impaired.

Zobel Network

A Zobel network formed by C4 and R9 assists in reflecting a purely resistive load into IC1 at all audio frequencies. The standing d.c. is blocked from the loudspeaker by C5. Resistor R10 provides a d.c. path for charging C5 should the speaker be disconnected, but its use is not strictly essential. Lastly capacitor C6 is connected directly across the supply rail, close to IC1, and is included to provide h.f. decoupling preventing instability.

Note the differences in efficiency of the additional speaker and the originals may be compensated by changing the value of R8. The recommended limits are 82kΩ and 120kΩ.

Construction

This unit may be built into either a plastics or an aluminium box. Layout is uncritical, apart from the position of C6 (mentioned earlier). The TDA2030 has its tab connected to negative supply, so for heat sinking the i.c. may be bolted directly to the box without an insulating washer. All very convenient and easy. ●

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, KDK, 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 NEW

RU120406 £15
4 amps cont. 6 surge @ 13·8V. Regulated supply

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

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

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

FT202R £109
1W. 6 chnl. 2m Handheld

FT207R £195
3W. 2m 12½ kHz Synthesized

NEW

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

FT708R £199
1W. 70 cms 25kHz Synthesized

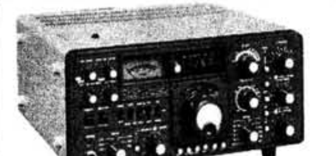
FRG7 £199
0°5 30MHz General Coverage Receiver. 230V ac. 12V dc, + Battery pack. AM/SSB

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

NEW

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. (10V model £455.)



★ FT902DE £713.00
★ FT902D £724.50

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

NEW

★ FT1012AM £515
★ FT1012FM £529
★ FT1012DAM £585

FT101ZDFM £599
10-160m, SSB, CW, Digital, Variable IF bandwidth (FM or AM, Digital or Analogue).

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HOTLINES

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

Good News

First, the good news. A German company is producing a chip for electronic organs. Called the SAA 1900, it costs the equivalent of only £2·20 and is a truly remarkable piece of musical electronic wizardry.

Requiring only 15 or so external components, it offers a frequency accuracy of +0·07 per cent, and has an electronic scanner section that scans 56 organ keys. Square wave tones are notorious for generating key clicks because of the fast rise and fall times of the wave shape. To get round this, the manufacturers have thoughtfully included current sources on the chip. These help to keep the output from these square wave sources reasonably constant about a mean value.

Now for the bad news: the price is for orders of 10 000 chips!

Chipped Wireless

A radio receiver on a chip has long been of interest to the hobbyist, dating back to the Mullard TAD100, and progressing to the still popular ZN414 t.r.f. device. But now there's a newer i.c. that promises great things for the entertainment f.m. receiver of the future. The whole thing is integrated onto a chip size 3·5 × 3·5mm, and that's everything from the antenna input to the audio output.

The chip does require one tuneable circuit, some 14 small, disc ceramic capacitors plus, of course, a power supply. Apart from this very small size, factory adjustments made to receivers using this chip should be reduced to a mere two; it is calculated that manufacturers currently have to make, on average, some 12 adjustments to f.m. receivers. With very much smaller size, less factory adjustments, and far fewer production costs as the receiver is virtually 'ready-built' on the chip, one hopes that smaller, better and less expensive f.m. receivers are on the way.

The i.c. makers have shown great cunning in the design of this receiver. First, they've dropped the i.f. frequency from the usual 10·7MHz, right down to 70kHz (that's metal detector territory, stranger!). In this way, all those hard to integrate tuned circuits using inductance and capacitance are eliminated, and simple resistance/capacitance is employed.

A system of frequency feedback is used which minimises audio distortion. The +75kHz i.f. swing, common in Europe, would mean problems without this feedback, which effectively reduces the i.f. swing to +15kHz.

Another nice piece of design incorporated is a new muting system. It makes use of the correlation between the original signal and a delayed, inverted version of it. At the selected or tuned signal frequency, both of these signals in the mute system match, giving a big, positive correlation. The resultant, demodulated audio signal is therefore fed to the a.f. output. Where detuning occurs (signals other than the desired one), the correlation between the two is very much less, and the demodulated signal is squelched.

No particularly exotic process is used in fabricating the chip, which employs ordinary, established, bipolar technology. The circuit draws some 9mA at 6V, but will work on d.c. voltages between 3V and 18V.

Vertical Power

The power f.e.t. has been with us for some time, but the word 'power' might have a different meaning when applied to the latest of this species. These new devices, designated vertical f.e.t.s, have ratings 600 or 800V, with currents of 20A or 60A. Frequencies mentioned are 10MHz (for the 20A f.e.t.) and 5MHz. One-off prices can be anything from $50 to $300. With one of these devices, a disco group could do nasty things to speakers; and listeners.

Shapeless Silicon—1

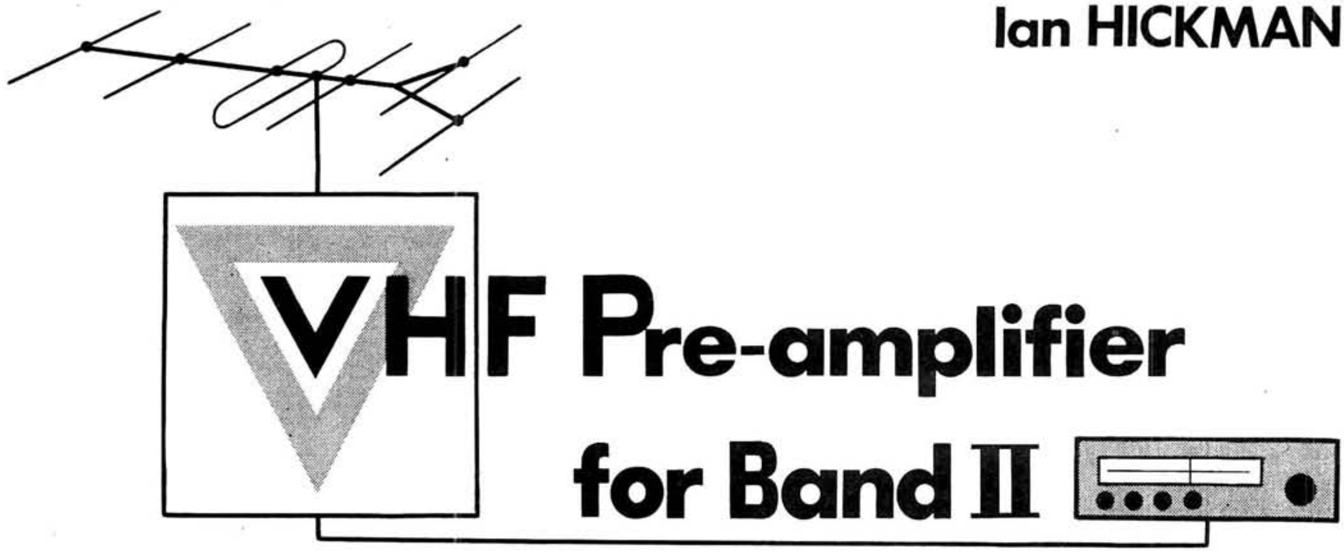
For those who have an interest in power from the sun, the 'in' words for 1981 are Amorphous Silicon. At least one $25 million contract is in effect to develop light cells using this material. Efficiency, always the problem with light cells, is claimed to be less than 7 per cent. The break even conversion percentage is 8 per cent. One interesting point is cell size. Two major contenders in this area are using different approaches, and very different cell sizes. One quotes 12 × 12mm; the other 4·2 × 4·2mm, which really is very small. Schottky barrier junction is used by one manufacturer, while the other is trying pin junctions.

Shapeless Silicon—2

So much for happenings in America. Meanwhile, back in the land of the Samuria, a very large Japanese concern is thinking about building a special plant to manufacture amorphous silicon solar cells, and is talking some $50 million for the plant. The Japanese are thinking in terms of using these cells, not so much for military or industry, but for consumer use. It is envisaged that the cells will be used in radios, watches and calculators. In fact, by Christmas of this year, rumour has it that the plant will be alive and well, and producing enough cells to power a million calculators every month! They use something like one-hundredth the amount of silicon required for a single-crystal cell, and although their efficiency is admittedly low (barely 5 per cent under a fluorescent light), this is still high enough to charge the nickel-cadmium batteries. Meanwhile-yet-again, up in the land of Robbie Burns, an experimental liquid crystal display has been produced which is addressed by amorphous silicon thin film transistors arranged in a matrix. The display is very small, 22 × 16mm. The 5 × 7 array comprises individual elements 2 × 2mm. The current drawn by each device is only a miserly 5μA. From all this world-wide activity, amorphous silicon devices look like becoming quite important in the future. Watch this space.

Ginsberg

Ian HICKMAN



VHF Pre-amplifier for Band II

When busy in his home laboratory, the author almost invariably listens to Radio 3 or at least uses it as background music. Following the disastrous wavelength changes which catapulted Radio 3 to the wrong end of the m.w. band, reception on 247m proved (quite predictably) totally inadequate after dark. A superannuated v.h.f. set was therefore unearthed and pressed into service. Actually, the said 'v.h.f. set' is the tuner section of an old two track reel-to-reel tape recorder (remember the Collaro 'Tape Transcriptor'?), complete with Tobey and Dinsdale power amplifier and a 125mm monitor speaker all in a 'portable' box. The f.m. tuner is of the pulse counter variety, a type popular with home constructors before the days of stereo.

Unfortunately, this f.m. receiver proved insufficiently sensitive for the author's QTH, due largely to a ridge some five miles away shading it from the Rowridge transmitter. Reception was OK in fine settled weather, but the author's home is further shaded by mixed woodland directly adjacent. Wet soggy trees waving about in the wind make splendid variable attenuators at v.h.f. and as they range up to heights twice that of the house it was not possible to site an antenna to look over the top of them.

As the basic problem was simply a shortage of signal, extra gain is all that was needed and rather than undertaking modifications to the old tape recorder, it seemed simpler to make a 'go-faster' pre-amplifier.

The Circuitry

The pre-amplifier was constructed in a plastics box with a Belling Lee coaxial socket for its input and a short length of 75Ω coaxial cable terminated in a Belling Lee plug for its output, although other socket styles could be used if required. It was thus simply a matter of unplugging the antenna (a simple half-wave dipole in a corner of the shack) from the tape recorder, plugging it into the pre-amplifier and plugging the pre-amplifier output lead back into the tape recorder antenna socket.

The extra gain solved the author's reception problems at a stroke and the pre-amplifier will not only help in situations where basic f.m. reception is poor, but should also be most useful in cases where the signal is perfectly adequate

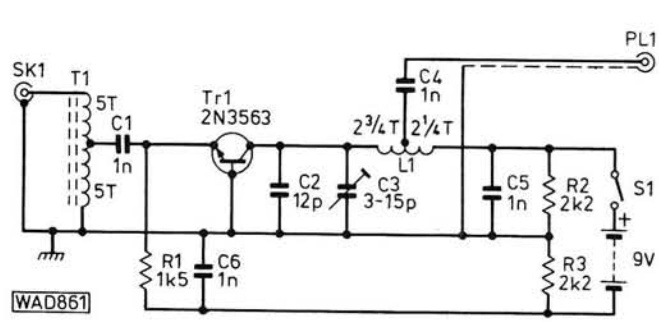
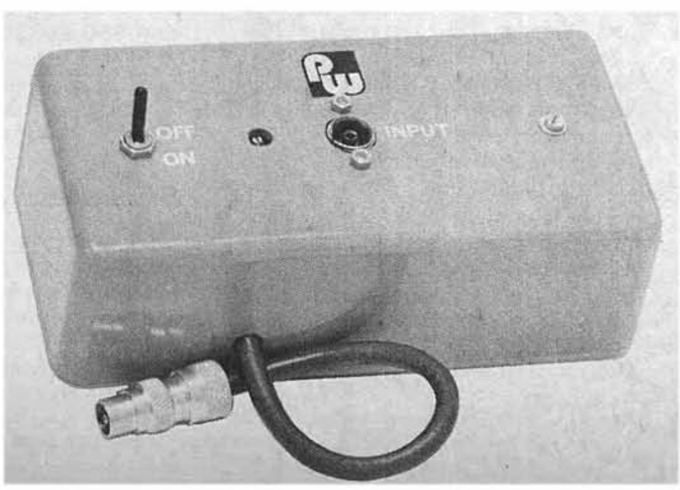


Fig. 1: The circuit diagram of the v.h.f. pre-amplifier

for mono reception but not quite good enough for stereo.

The circuit used (Fig. 1) was chosen to provide a modest gain of around 12dB with only one tuned circuit to be set up. The very simple circuit configuration—a single grounded base stage—and the modest gain result in completely stable performance under all conditions. T1 and its 2:1 turns ratio transforms the nominal 75Ω antenna impedance down to 19Ω and the signal is then applied to the emitter of Tr1 via C1. The collector tuned circuit consists of L1, resonated with C2 plus C3; C5 is a large decoupling capacitor and approximates to a short circuit at v.h.f. The output is tapped off of L1 via the d.c. blocking capacitor C4.



Construction

The circuit was constructed on an odd scrap of single-sided copperclad board, which was used as a ground plane. The Belling Lee input socket was mounted directly on the board using long 6BA screws, which were also used to secure the finished amplifier in the box. The trimmer C3 was mounted so that it could be adjusted from the outside of the box via a hole near the input socket. The decoupling capacitors C5 and C6 are soldered directly to the ground plane and also used as mounting points for the resistors.

If you are used to v.h.f. work, any other suitable construction technique may be used, but if you are not it is best to stick closely to the arrangements shown. After all, at 100MHz, the reactance of an inch of wire is around 16Ω so if you string your components up with long leads, you are connecting inductive reactance of tens of ohms in series with them!

On the mechanical side, it is important to have the braid of the coaxial cable firmly anchored to the ground plane, otherwise twisting of the lead will break the joint of the inner to C4. Tease the braid out to one side of the cable, trim to a spade shape and pre-tin. The braid can then be firmly soldered to the ground plane (also pre-tinned) without danger of melting the polythene insulation of the inner, if a hot soldering iron and a little care are used. When construction is complete, make a careful visual inspection to ensure that all is as intended.

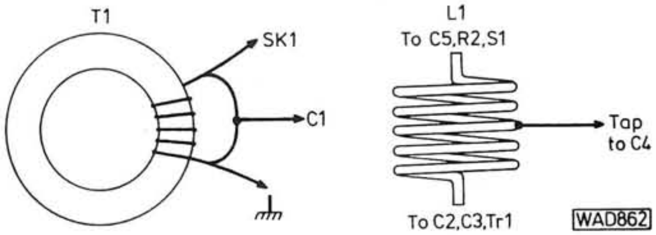


Fig. 3: T1 is a toroidal transformer consisting of 5 turns of 36 s.w.g. bifilar wound on a B64290 A36 × 1 toroid. L1 is 5 turns 20 s.w.g. 6·4mm diameter tapped at 2¼ turns

★ components

Resistors		
¼W 5%		
1·5kΩ	1	R1
2·2kΩ	2	R2,3
Capacitors		
Ceramic		
1nF	5	C1,2,4,5,6
Solid dielectric trimmer		
2–22pF	1	C3
Semiconductors		
Transistors		
2N3563	1	Tr1
Miscellaneous		
Min. s.p.s.t. toggle switch; Coaxial socket; Coaxial plug; Plastics box 50 × 63 × 125mm; Toroid (see text); single-sided copper-clad p.c.b. material 37 × 50mm; Battery clip.		

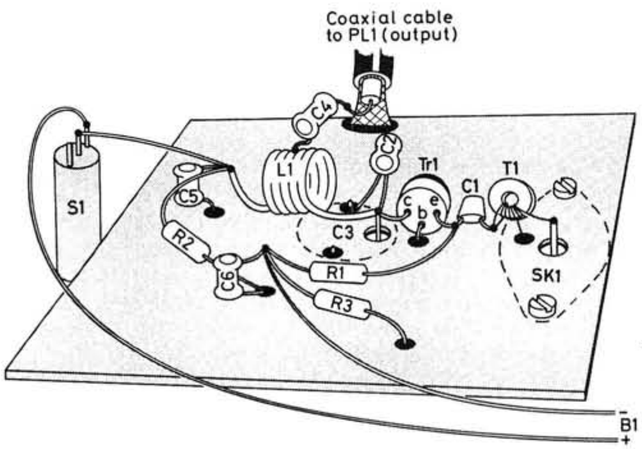
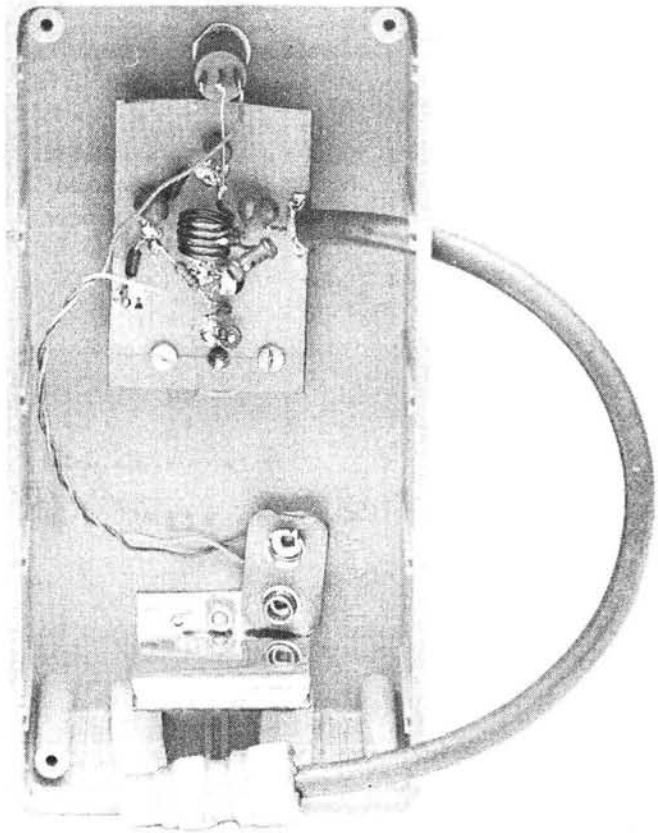


Fig. 2: The layout of the components is critical and this drawing should be followed for the best results. The picture on the right shows the completed prototype amplifier

Setting Up

Alignment is really very simple—one of the advantages of the design—and is accomplished with the aid of the receiver with which the pre-amplifier is to be used. With the antenna connected to the existing receiver, switch on and tune in a station in the middle of the broadcast part of the band. Fit a battery to the complete amplifier, switch on and connect the output to the receiver in place of the antenna. Next cut the leads of a small 75Ω or 68Ω resistor down to 10mm and bend them towards each other so that the resistor can be clipped between the inner and outer of the pre-amplifier's coaxial input socket. Also connect to the inner a short length, say 225mm of wire.

Provided the tuning of the receiver has not been touched, adjusting C3 should bring in the same station,



but with a rather noisy signal. If the signal is barely discernible, the length of wire may be increased; conversely, if a good clear signal is obtained over most of the range of C3, the length should be reduced. The aim is to use that length which is just enough to provide a slightly noisy signal when C3 is correctly tuned. The decrease of noise when C3 *is* correctly tuned is then very obvious. Then simply remove the piece of wire and the resistor from the input socket, connect the proper antenna and enjoy the improved reception.

Note that although the pre-amplifier provides a fair amount of gain, it contributes only a very limited amount of extra selectivity. This cannot be otherwise, since the fixed tuning has to be broad enough to cover the whole of the broadcast part of the f.m. band. It may therefore be advisable to adjust the antenna orientation to minimise pick-up from the direction of any adjacent main road if your f.m. receiver has limited selectivity and dynamic range—otherwise interference from land mobile installations such as police cars could possibly be experienced. This is, however, unlikely with any good modern design of f.m. receiver.

Moving the tapping point C4 along L1 towards the collector end will reduce the gain and increase the bandwidth. Conversely, moving it towards C5 will increase the gain at the expense of reduced bandwidth, though it is best not to try to screw too much gain out of the circuit, otherwise the noise figure and dynamic range could suffer if, unusually, the v.h.f. set has a poor input v.s.w.r.

In any case, if the tapping point is changed after the setting up procedure described above, the setting of C3 should be rechecked. For the vast majority of applications the circuit as described is optimum.

CONSTRUCTION RATING **Beginner**

BUYING GUIDE

Readers should have no difficulty in obtaining the components for this project. The toroid used for T1 was originally an FX2073 but this is now difficult to obtain and a B64290 A36 × 1 core from Electrovalue is suggested. The size of the core is 5mm o.d. × 2·9mm i.d. × 1·2mm thick.

APPROXIMATE COST **£4**

Of course, if the f.m. receiver already has very high sensitivity and a good noise figure and the signal is still not adequate, an add-on amplifier *will not help*. The only solution in such a case is a better antenna mounted at a greater height.

However, the majority of receivers definitely benefit from additional gain—after all, high sensitivity costs money and most manufacturers are loath to increase the cost of their receivers when the majority of users don't need the extra performance. ●

STANDARD C78

▶▶▶ *continued from page 57*

★ specifications

Frequency range:	430 to 440MHz
Mode:	FM (F3)
Antenna impedance:	50 ohms
Supply requirements:	13·8V d.c. external; 10 off HP7 NiCad cells or 9 off HP7 dry cells
Operating supply range:	9·6 to 16V d.c. negative earth
Power consumption:	600mA transmit (1W; 50Ω) 25mA standby (battery saver)
Dimensions:	129 × 52 × 191mm
Weight:	1·45kg (with batteries)

RECEIVER

Sensitivity:	0·45μV 12dB SINAD 0·56μV 20dB quietened signal *(0·16μV 12dB SINAD; 0·13μV with pre-amp)*
Selectivity:	Better than 60dB
Pass bandwidth:	±7·5kHz
Squelch sensitivity:	0·2μV *(0·09μV 6dB hysteresis)*
Audio output:	0·7W (8Ω with 10% t.h.d.) *(1·6W; 1W at clipping)*

TRANSMITTER

RF output power:	1W into 50Ω*(1W; 1W and 13W with p.a. added)*
Spurious outputs:	−60dB
Modulation:	Reactance modulation
Deviation:	±5kHz max.
Audio response:	300Hz to 3kHz

Test equipment

Marconi r.f. power meter and dummy load; Marconi audio power meter and dummy load; Racal 9081 synthesised signal generator; Sinadder SINAD meter.

Test results are shown in italics.

incorporates a pre-amplifier as well. Our measurements on the pre-amp showed that it provided worthwhile gain and this was shown to advantage during the exceptional lift conditions this February when several long-distance contacts from Verwood were made including a mobile station in Sheffield via GB3MK (135 miles) and a contact via GB3CH (150 miles). From Verwood GB3DY could be heard but not accessed.

The p.a. bolts under the mobile fixing rack which in itself is novel in design. The C78 can be slid into the rack when it automatically makes the connections for the antenna and power leads, release being effected by pushing two levers at the side, when a spring pushes the rig forward.

Output from the p.a. was measured at 13W on high power and 1W on the low power setting.

Price

The Standard C78 costs £209.50. The p.a. costs £65.00; Bracket £17.75 and Case £6.95 all inc. VAT.

The Standard C78 was loaned by Lee Electronics, 400 Edgware Road, London W2. Tel: 01-723 5521 and we would like to thank them for their co-operation.

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- ★ AUTOMATIC LETTER SHIFT
- ★ STORED "RY" TEST FUNCTION
- ★ UPPER AND LOWER CASE DISPLAY FOR ASCII

SPECIFICATION

Modes of operation:	Amateur standard ASCII: 110, 150 and 300 baud Murray coded RTTY: 45.5, 50 and 75 baud IN EACH OF THESE MODES THE RECEIVE CONVERTER WILL ACCEPT FSK AND AFSK SIGNALS	TV (UHF OUTPUT) socket:	Phono
		Keyboard socket:	25 way DB25
		Power socket/transceive control:	5 pin DIN
		External terminal unit socket:	8 pin DIN
Transmit shift:	170 Hz	Power requirements:	12.5V · 800mA
Message storage capacity:	1000 characters	Weight:	1Kg (2lb 2oz)
Audio input socket:	Phono	Overall size:	187 × 120 × 53 mm ($7\frac{3}{8} \times 4\frac{3}{4} \times 2''$)
Video output socket:	Phono		

DESCRIPTION

This MM4000 unit, when simply connected to any HF or VHF transceiver, a standard UHF TV set, and an ASC11 keyboard, provides a complete data communication capability at a cost of less than half of any similar system. The MM4000 contains a terminal unit, a microprocessor controlled TV interface and the necessary transmit tone generators to enable live transceive communication of RTTY and ASCII, with the minimum of ancillary equipment.
An exceptionally useful facility is provided, in that the user can enter and recall any message or information due to the inclusion of a dedicated message store.
This facility makes the unit particularly useful as this may be used for CQ calls, station details or general short messages. This facility has a total capacity of 1000 characters.
The unit utilises 2 microprocessors, 4 memory integrated circuits and 19 other I.C.'s.
All circuitry is constructed on two high quality glass-fibre printed circuit boards, and protection against reverse polarity is included.
The unit is housed in a highly durable black diecast enclosure, and all necessary plugs are supplied.

PRICES: MM4000 £269 inc. VAT (p&p £2), OR WITH KEYBOARD £299 inc. VAT (p&p £4).

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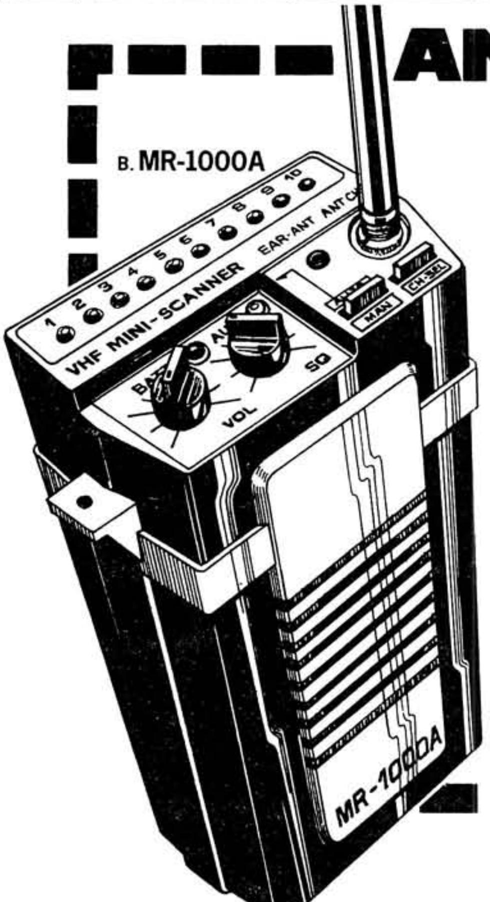
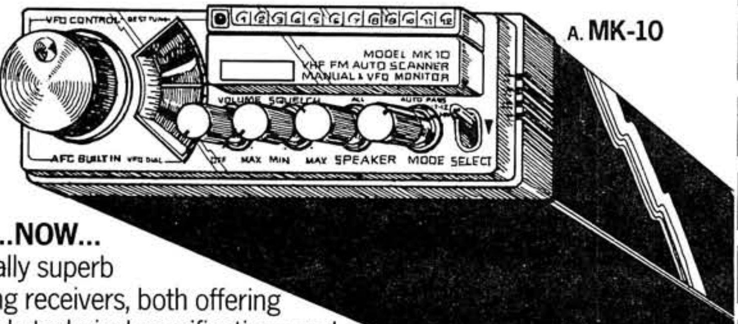


A. MK-10



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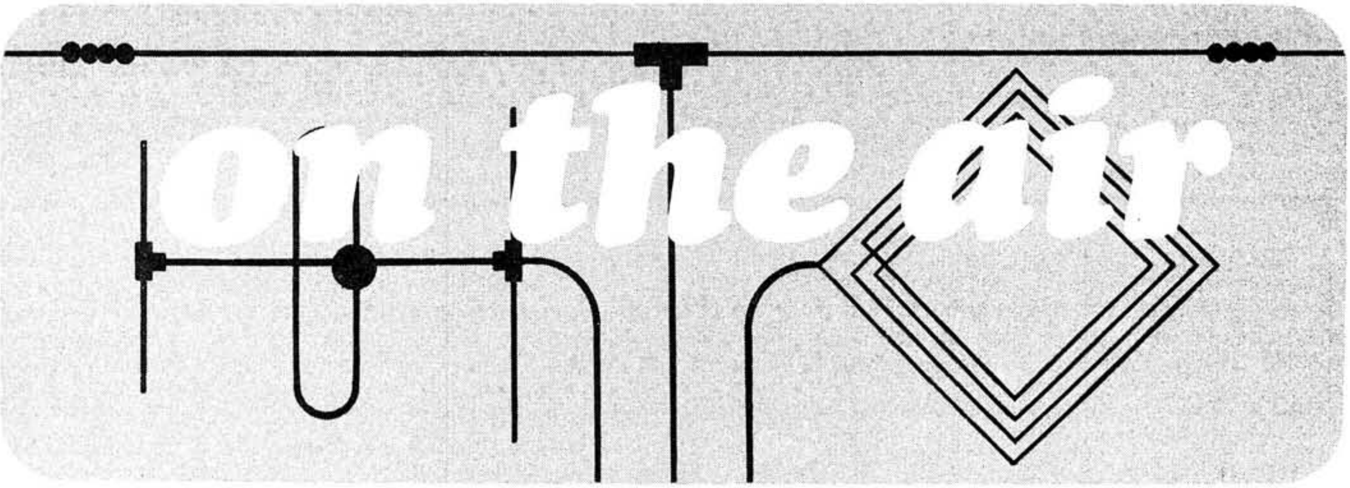


Amateur Bands

by Eric Dowdeswell G4AR

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

Pursuing last month's theme on selectivity in communications receivers, the heart of such a set is really the i.f. filter in the output circuit of the mixer stage, since it virtually determines the overall selectivity of the set. Any extra cost involved in getting a better filter at this point is money well spent.

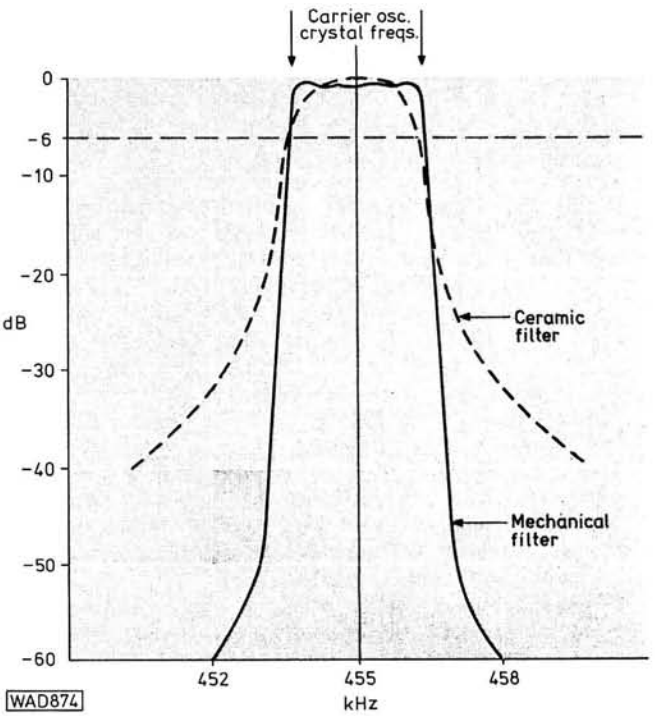
Two important parameters for an i.f. filter are the width of the passband, usually measured at points either side of the nominal frequency of the filter where the output drops by 6dB, and the corresponding bandwidth at 60dB down, see the diagram. The 2·7kHz bandwidth often quoted for the bandwidth of a filter intended for s.s.b. reception may seem an odd figure but it is derived from the fact that in the audio circuits of s.s.b. transmitters and transceivers the speech is attenuated below 300Hz and above 3000Hz, this bandwidth of 3000–300Hz, or 2·7kHz, being generally accepted as the minimum for satisfactory speech communication.

A separate filter should be available for the reception of a.m. signals and another for c.w. use. The "skirt" at 60dB down is a very important factor, since it decides on how well a filter will reject strong signals in the adjacent channels, and that is the whole purpose of the filter. This is where we come to the differences between a good mechanical or crystal i.f. filter and the popular ceramic ones. Popular with the set manufacturers that is, since such filters are very cheap and can be fitted and forgotten. Whether they are really suitable for the user's purpose is another matter. Generally speaking, they are not.

The diagram also shows a typical response curve for a ceramic i.f. filter as fitted to a popular current communications receiver. It can be seen that the skirts are pretty poor compared with the mechanical filter and that is where the set fails to eliminate the annoying chatter experienced from adjacent strong signals. Listening to a receiver with a good i.f. filter is quite a revelation compared to some of the sets on the market today.

Cheaper sets often have only a fixed bandwidth i.f. chain more suited to a.m. reception than s.s.b. It is a compromise and the results make this obvious. This is not to say that the set is not good value for money. The beginner may well start on such a receiver but it is not long before he wants something better.

A good i.f. filter is not cheap, over £20 probably, but there are others around for a few pounds where the bandwidth at the top is quoted as 2·7kHz all right, but no mention made of the performance at 60dB down. When buying an i.f. filter to install in an existing set make sure the input and output impedances match those of the existing filter or a mismatch will occur, ruining the performance of the new filter.



The response curve of a typical mechanical i.f. filter at 455kHz is shown above. Compare with that of a ceramic filter noting the difference in the bandwidth of the skirts. The placement of the frequencies of the carrier oscillator crystals is very critical if good results are to be obtained on s.s.b.

If the new filter is offered with a pair of matching crystals for the associated carrier insertion oscillator (c.i.o.) or beat frequency oscillator (b.f.o.), do not hesitate to buy these at the same time in spite of the extra cost. These may be switched for optimum upper- or lower-sideband reception and thus eliminate the fiddling that is necessary with tuned b.f.o.s. A small trimming capacitor on each crystal will put it on the precise frequency which is so very important, but seldom achieved.

One last point. If the top of the i.f. filter characteristic is reasonably flat then the audio response will be flat between the designed limits of 300 and 3000Hz. But if the top of the curve is peaky as with many ceramic filters then this will be reflected in the audio response, which, again, is most undesirable.

Active Clubs

Several club secretaries have again commented on the number of active, but illegal, CBers who have made enquiries seeking information on club activities as a result of seeing these notes in *PW*.

It seems that these CBers fall into two classes, those who feel that radio communication must have something more to offer than simply talking from car to car as most CBers seem to be doing, and those who want to do it legally, possibly under pressure from friends or relatives. One father wrote to me saying he had expressly forbidden his son to take up CB but was prepared to buy him a good receiver to get him started in amateur radio.

Clubs should make very sure every effort is made to encourage such CBers and potential amateurs by welcoming them to the club and offering every assistance. What about a letter to your local newspaper inviting CBers to take a look at the club some time?

Wirral & District ARC. May 6 is v.h.f. DF trials time in preparation for the big event on July 8, with a talk on radio and TV QRM from the fountainhead, a member of the British Telecomms Radio Interference Staff, this on May 13. On the 27th Derek Roger G3UOO holds forth on computers. Meeting in the Dining Room of the Concourse Sports Centre at West Kirby at 8pm usually. Ian Brooks G8PMW at 28 Paignton Road, Wallasey will fill you in, by letter or on 051 639 5666.

Stevenage & District ARS. Membership now running at highest ever figure of 72, being double that of a year ago. Interesting breakdown of members' standing shows 11 Class A, 28 Class B and 33 unlicensed. Two RAE classes obviously help, the Dec exam passing five of seven entrants, with 17 expected to take the exam this month. Trevor Tugwell G8KMV, 11 The Dell, Stevenage, Herts, can give you all the details of meetings, etc.

Cheshunt & District RC. Every Wed evening at 8pm in the Church Rooms, Church Lane, Wormley, near Cheshunt, Herts with details from Jim Sleight G3OJI of 18 Coltsfoot Road, Ware, Herts, or 0920 4316. May 6 is RAE revision night with relaxation on the 13th with a natter night and code practice. May 20 sees illustrated talk on Sierra Leone by Roger G8DJU.

Worcester & District ARC. Advance notice of a change of venue for the annual rally, formerly the Upton rally, now to be held at Droitwich High School, three miles from junction 5 on the M5 on Sunday July 12. More traders and more fun for all the family seems to be the theme this year. More rally info from Mike Tittensor G4EKG, 16 Durcott Road, Evesham, Worcs which is also Evesham 41105, or Tony Blissett G8NSL on Worcester 620507.

Rolls-Royce Sports & Social Club. Meetings on the first Wednesday at 8pm in the club at Barnoldswick with much info from secretary Les Logan G4ILG, 19 Fenton Avenue, Barnoldswick, Colne, Lancs, who can also tell you all about the club rally, its first mobile effort, on June 28 between 11am and 6pm, at the club which is situated 10 miles north of Burnley and six miles south of Skipton between the A59 and A56. All the usual amenities, trade stands, talk-in and family attractions.

Kidderminster & District ARC. May 26 is contact night for the club with its twin town in N. Germany, the Husum ARC, but before that there is a film show night on the 12th. You'll have guessed from this that meetings are held fortnightly at 8pm on Tuesday, the venue being the Aggborough Community Centre, Hoo Road, Kidderminster, if you can get past the karate class apparently! New sec is Malcolm Perry G8AKX, 216 Marlpool Lane, Kidderminster.

Cheltenham ARA. Meets first Thursday and third Friday at the Old Bakery, Chester Walk, Clarence Street, Cheltenham with May 7 seeing G8JXS discoursing on Raynet in Glos, with a natter night on the 15th, and advance warning of G4ASR talking on the 1980 transatlantic scatter tests, not to be missed. According to *CARA News* Jack G3AUU made six consecutive contacts on 10 and 15m one day that would have been good for WAC but he didn't really try to do that! Secretary is G4ILI, G. Cratchley but no QTH in *News* so it's QTHR I'm afraid.

Exeter ARS. Informal meetings first, third and fourth Mondays at the Scout Hut, Emmanuel Road, Exeter with the club busy preparing the station for the celebrations at the beginning of August for the International Year of Disabled People. Club stations are G4ARE and GB3EX, but more details from G.W. Draper, 1 Carlyon Close, Heavitree, Exeter.

Bournemouth RS. A stroke of luck for the club! A double booking at the usual venue meant looking for a temporary alternative, found at the Coach House Motel, Ferndown. A newly-built extension with its own entrance and usual offices proved perfect with the management offering a free drink to all those attending the first meeting there, and all at no charge! Looks like it will become the permanent QTH for the club. Unfortunately latest edition of well-produced Newsletter doesn't go as far as the May meetings but why not contact G.T. Lloyd G8GTB, 49 Kingston Road, Poole, Dorset or Poole 83093.

Denby Dale & District ARC. Another rally date, Sunday June 21 at Shelley High School on the B6116 from 11am. Access from M1 junctions 38 or 39 or junctions 23 or 29 from the M62. Talk-in GB4CDD on S22 or GB8CDD on SU8. All the fun of the fair on which Jack Clegg G3FQH, 8 Hillside, Leak Hall Lane, Denby Dale, Huddersfield will gladly elucidate.

Ipswich RC. Last warning on the East Suffolk Wireless Revival on Sunday May 24 at the sports ground of the Ipswich Area Civil Service Sports Assoc, Straight Road, Ipswich. In case that is not enough it is adjacent to the Suffolk Show Ground. Specialised features are a transceiver clinic and antenna testing range with visitors invited to bring along their gear for checking. Catering facilities and plenty of attractions for the family and friends. RSGB bookstall, Raynet display, USAF fire-fighting display, the lot! Jack Tootill G4IFF at 76 Fircroft Road, Ipswich can give more info if you need it. Or try him on (0473) 44047. Another fixture for this busy club is the 2m v.h.f. DF hunt on Wednesday June 10, a new venture, with meeting of club at the Rose & Crown, 77 Norwich Road, Ipswich afterwards. This is the spot to go on the second and last Wednesdays at 8pm, but worry Jack about further details.

Edgware & District RS. Second and fourth Thursdays 8pm at Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware. Provisional programme on

May 7 is the RSGB Open Door feature on amateur radio, while on the 27th an informal discussion will centre on proposals for a restricted section in the v.h.f. field-day. The club net at 10pm on Mondays 1875kHz can get you up to date on happenings or contact Howard Drury G4HMD, 39 Wemborough Road, Stanmore, Middx or try 01-952 6462.

Radio Amateur Invalid & Blind Club. Much involved in the International Year of Disabled People with the international weekend on the air August 1 to 3, with many clubs organising stations for this event. Sad news from club magazine *Radial* of the death of John Morris G3ABG, organiser of the WAB award which meant many practical donations to RAIBC. Invalid amateurs whether licensed or listeners are welcome to join the club, as are supporters who can do so much for members. Try Frances Woolley G3LWY, 9 Rannoch Court, Adelaide Road, Surbiton, Surrey, she will tell you how to join or help.

Chesham & District ARS. Andy Scott G8PUC, 8 Lynton Road, Chesham, Bucks says club is still meeting Wednesdays at the Chesham Whitehill Centre at 8pm while search continues for alternative accommodation. Second Wed is a bit more informal than other gatherings it seems, but don't let that put you off visiting Chesham. Andy's telephone is (02405) 5625, or try club nets: 2m f.m. Sundays 1130am on S20 QSYing to S21 when possible, and 2m s.s.b. Mondays 9.30pm, 144·3MHz or thereabouts.

North Bristol ARC. Every Friday at 7.30pm at SHE7, 7 Braemar Crescent, Northville, Bristol 7 with RAE classes, Morse instruction and lots more, with a mobile picnic in the offing. Let Ted Bidmead G4EUV, 4 Pine Grove, Northville, Bristol 7 put you more in the picture, or Bristol 691685.

Southdown ARS. First Monday at Chaseley Home for Disabled Ex-Servicemen, Southcliff, Eastbourne, E Sussex for 8pm start. Club station is G3WQK. Secretary R.E. Holtham G4EKS, 2 Benbow Avenue, Eastbourne can fill in the gaps like telling you about forthcoming meetings. He is also Eastbourne 32777.

Midland ARS. Tom Brady G8GAZ, 57 Green Lane, Great Barr, Birmingham B43 says previous notes on club have brought several calls from interested local amateurs as well as from some CBers who, hopefully, will be set on the right path. Special call GB4MAR was issued on occasion of club's Golden Jubilee this year. Seems meetings at University of Aston have come to an end so contact Tom for latest gen (021-357 1924).

Maidstone ARS. Rally is on May 3 but this note may be too late, but you never know. Anyway a date you must keep is with Martin Emmerson G3OQD talking on colour SSTV on May 15, with the 29th being AGM time. Meetings Fridays at YMCA Sports Centre, Melrose Close, Cripple Street, Loose, Maidstone, Kent where there is much activity in shack at any time. Graham Edy G4AXD says several new members recruited as result of odd note in *PW*. He is at 29 Beech Road, East Malling, Maidstone, Kent, also home of West Malling 841021.

DX Time

DX nets on the various bands have enabled **Basil Woodcock** (Leeds) to find some new ones like VR6TC on 10m and CE0AE on 15m s.s.b., mentioning the DK2OC net on 10m at about 1100 onwards as pretty good. Other stuff on 10m was D68AM, VP8QG, KG4ET and YB1AEE. Highly dodgy on 20m was YI1BGD but KG6RN, TU2HG and 4S7EA seemed OK. The 40m band produced 6Y5SW and TG8IIA, finishing with FM7AU on 80m.

Mike Howard (Chadderton, near Oldham) went to town on 160m s.s.b. in the CQ WW DX test copying three EAs, a number of Americans, UL7LDL, UP2BAW and VP2EV, with a loaded groundplane. The 80m band was positively bouncing with AG6BK reputed to be on Guam, AP2GS, FG7BG, FM7WS, JA6XMM, J28AM, KH6ND, KL7JEF, N0NU/CE0A, VK3NIC/3X, ZL1BUS and many more equally good. The 20m band showed up with XT2AY, 9N1MM, A22ZM, D68AM, S79RD, TR8MX, VQ9NN, ZD8RH and 9U5JM, with 10m offering A51PN, CR9AH, P29NRL, TL8CN and VS6IC.

Aches and pains have not helped **Bill Rendell** in Feoch, near Truro, with his DXing lately, but he did manage C6ANI, TI2VVR and VP2MO on 80m, the Seaview Expedition ON4AXA/MM when 160m west of Cape Verde Is. on 20m, with VK3NIC/3X, and ZK1AC. While on 15m J6LOU, VK4NIC/3X again and ZD8RH came through. Interesting ones on 10m were S83T, TU2JD, VP5TCI and VP8BB. The VP5 may be QSLed through Box 78 on Grand Turk.

Dennis Sheppard (Earl Shilton, Leics) found RTTY DX good enough to push aside his v.h.f. and u.h.f. gear to reach for the typewriter and tell me about C5ACL, CE3AA, DU7EM, FO8GX, FP8HL, TU2JJ, VK2ZN, ZL2AAV and lots more on 20m. NP4AT, VE2DTS and 9K2GR were pulled in on 15m plus TR8WR and YV5GSZ on 10m. Dennis needs a 6EV7 valve urgently, can anyone help?

The AR88 of **Keith Taylor** in Camborne, Cornwall has been acting up but it didn't stop him logging UP2BAW on Top Band, JA1KSS, ZL1BQD and DU1DB on 80, 9Y4LL, 5N9GM and HH2DF on 20m. A QSO between TF3KCC and WA1EKV on 10m revealed that they were using just one watt apiece!

I have received information on the 24-hour activity of GB1IARU during the conference at Brighton but it is just too late, activity ending on May 1 as this issue is due out.

Colin Frankland BRS45342 (Hull) hasn't been able to get near to his RX much lately so had to be content with 6W8AR on 15m and YZ9CRM who said QSL to YU2HDE. So the Trio 9R59DS plus Codar PR30 preselector and dipole will have to wait for another day.

In Knutsford, Cheshire, **Dave Coggins** has been hard at it on his new Yaesu FRG-7700 and finds the memory facility handy for keeping a watch on several bands, using an inverted "V" on 10m. There he found HM0U, H44PT, KH6SB, VK3NIC/3X, 6W8AR and 9J2KO. A brief visit to 20m revealed FO8GL on Rangiroa Atoll, KX6SS on Majuro Atoll (Box 654), and N6HR/KX6.

Although concentrating on forthcoming exams, **David Warr** (Weymouth, Dorset) played with his 9R59DS from time to time using a G5RV antenna from 160 to 10m plus a ZL Special on 15m. OH2BNP and RA3DKE arrived on 160m with HK0FBF and VP5EE for good ones on 80m. HR1MZM, TL8CN, VP2MGT, YS1EM and 8P6OR were good enough to copy on the 40m band. Skipping 20m David went on to find FM0FOL, H44AP, KG4DI, VS6CI, VU2IF, VK9ZD and ZD7BW lurking around on 10m.

BRS33915 in **Brian Russell** in Runcorn, Cheshire who now has an FRG-7 which he finds inferior to his old JR310 as far as the amateur bands are concerned, where country total on s.s.b. is 307 confirmed! Latest cards were from Kingman Reef and Palmyra. Antennas are a 3-element vertical array for 10/15/20m and 40m delta loop also used as a long wire, open-ended.

Another reminder. Make sure logs reach me a few days before the 15th of the month so as to be as up-to-date as possible. General letters are welcome at any time of course.

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

Reports to: Charles Molloy G8BUS
132 Segars Lane, Southport PR8 3JG.

The two Europeans on 182kHz (1648m), which is channel 4 in the Geneva Plan, have now left this frequency after a period of testing. Europe No. 1 which is located in Saarland in West Germany has moved up 3kHz to 185kHz while Oranienburg in the DDR has shifted down by the same amount to 179kHz leaving a "space" of 6kHz between the two with the old channel in the middle. Hopefully these moves are permanent as 182kHz is now free of local QRM for the DXer to explore.

Long-wave DX

Ankara in Turkey transmits on 182kHz with a power of 1200kW. It is on the air from 0255 to 2300 and should be audible between sunset and sign-off. At this time of the year it will not be heard when it comes on the air at 0255 since the eastern Mediterranean area will be in daylight. You need a path of darkness between transmitter and receiver, just as on the medium waves. Alma Ata in Kazakhistan (Asiatic USSR) has a 250kW outlet on 182kHz which might just be audible when it signs-on at midnight.

Reader **John McHugh** (Putney) is interested in the long waves. He picked up Radio Algiers on 254kHz (1181m) which comes in well at his QTH, and has a programme in English daily at 2100.

Although not DX, the Polish broadcaster on 227kHz (1322m) is interesting as it pumps 2 megawatts into a 646 metre-tall vertical antenna which is claimed to be the highest in use by any broadcaster in the world. The station was honoured by a special postage stamp issued by Poland in 1979.

DXing in Summer

Many DXers believe the medium waves to be a winter-only band but this is not so, for it is between the spring and autumn equinoxes that the advantages of early morning DXing can be exploited. Reader **K. Lewis** of Pensilva in Cornwall writes: "I have noticed that around dawn in summer is a good time for m.w. DXing, as European stations weaken or fade out before DX stations in the Americas." He also mentions EAJ50 Radio Las Palmas in the Canary Islands on 1008kHz which is normally swamped by Holland on the same channel but can be logged with careful use of a loop in summer. DX heard by K. Lewis during the summer of 1980 included CHCM Marystown on 560kHz, VOCM St John's 590, CHYQ Musgravetown 670, CIYQ Grand Falls 680, and CKVO Clarenville 710, all in Newfoundland; Radio Reloj in San Juan, Puerto Rico on 580kHz, The Voice of Cuba in English (beamed to the United States) on 600kHz, Radio Jornal 940kHz and Radio Tupi 1280kHz both in Rio de Janeiro, and Radio Globo, São Paulo, Brazil on 1100kHz.

June is probably the best month of the year for DXing the east coast of North America as the DX peaks up and fades in just before the arrival of darkness at the transmitter, while at the DXer's end of the path there is a complete absence of Eastern European QRM as these stations are in daylight while QRM from Western Europe is fading out with the arrival of sunrise. You have to be quick with North America as the "opening" only lasts for half an hour or so, but Latin Americans, in particular Brazil, can be heard for a longer period and with a very strong signal at times. It really is worth the effort to get out of bed to try the band and any static that is around can usually be reduced or eliminated with a loop.

Loop Antennas

It might seem from what has been covered in the last two issues that the medium wave loop has some affinity with the cure-all medicine popular at one time in the Wild West, but of course there are snags.

A loop will pick up less signal than a long wire i.e. it has a smaller aperture. This does not matter too much as a lot of DX on the medium waves is quite strong, at any rate on the peaks of the fading cycle, but if you do want to listen to a very weak signal that is clear of interference and static then you will do better with a long wire and a.t.u. than with a loop.

If your wanted and unwanted stations are in the same direction then a loop will not separate them. Nor will it help with two stations that lie in opposite directions, since the loop has two nulls 180 degrees apart. This is a serious problem as it means that you cannot separate North American DX from European QRM that lies directly behind.

If there are three stations on a frequency, all in different directions, then a loop can only suppress one of them. You cannot fix up two loops using each in turn to null-out a station, which brings me to the most serious problem affecting loops. You cannot use a loop with a portable or any other receiver that has an internal antenna of its own.

Details of a l.w. station on a postage stamp

Loops and Portables

A loop will only perform satisfactorily when it is the sole antenna in use. If you connect a loop to a receiver with its own internal antenna and if you then null-out a station with the loop, the unwanted station will still be picked up by the internal antenna. The overall effect is—no null. There is nothing wrong with the loop. It is the internal antenna that is masking the directional properties of the loop. In reply to **L. Barry** of Cork who asks for a design for a loop that will really work with a portable, I'm

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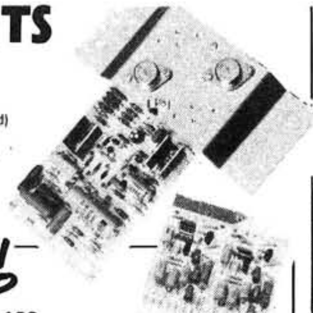

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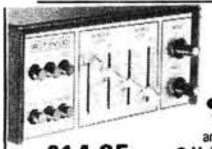

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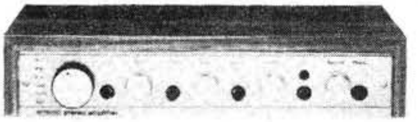

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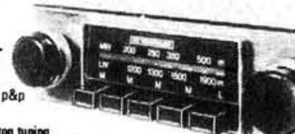

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afraid that there isn't one. You could mount the portable on the loop in the way described in the February issue but at best this is only a makeshift arrangement.

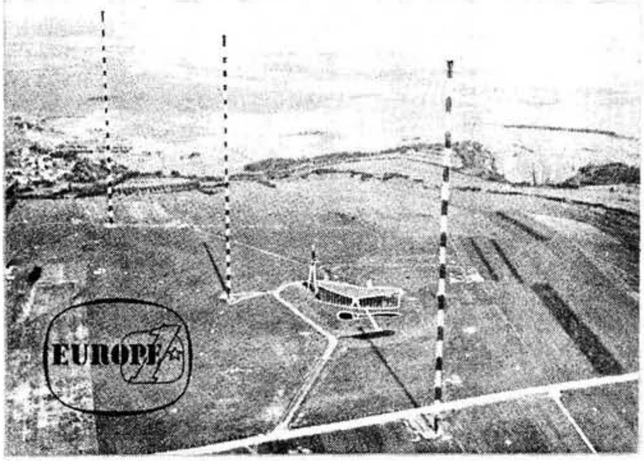
It is not only portables that have an internal antenna. The manufacturers of some modern communications type receivers thoughtfully provide a medium waveband plus ferrite rod antenna so that the s.w. DXer can listen to his local station if he wants to. After all, who would want communications facilities on the medium waves? It is easy to check if there is an internal antenna. Tune round the medium waves and if you can pick up a number of stations without connecting an external antenna then there must be an internal one.

Readers' Letters

"Do the weather or tropospheric conditions affect m.w. reception?" asks reader **John Quinne.** The weather has no effect on propagation though I have heard of complaints of a rustling noise from outdoor antennas during heavy rain, presumably the result of some build-up of electrical charge in the antenna wire. Thunderstorms of course cause static (atmospherics) which can be troublesome at times.

John, who lives in Sligo in Ireland, wonders too if the seasons have any effect on reception as he used to have a good signal from Manx Radio and he cannot hear it at all now. The seasons should have no effect at all on ground-wave propagation but they do have a considerable effect on sky-wave propagation. The ionosphere, which reflects DX signals, is created by solar radiation and the amount of this radiation reaching higher latitudes will vary throughout the year. Manx Radio incidentally, has been experimenting with directional antennas which could be the cause of the problem.

"Do you know what the Morse is that you pick up on the medium waves?" asks **Mark Hattam.** They are radio beacons and a few of them operate on the medium waves including a couple in the UK. Normally they do not interfere with broadcasting but they do appear amongst DX. A conspicuous one is on 930kHz which transmits SW (··· ·--) and is located at Vohma in Estonia. The letters transmitted are not callsigns but are related to the beacon's location, for example LIC (·-·· ·· -·-·) is near Lichfield.



Europe No. 1, now on 185kHz

DX Heard

An unidentified Arabic-speaking station has appeared on 927kHz and so far as I can measure, it is on a bearing due south of the UK. The announcement/music at 2300 appears to be a recording which leads DXer **Harold Emblem** to suggest it might be Al Faleh which used to be on 1611kHz and came from a ship anchored at Tripoli in Libya. The broadcast could also be a Free Sahara station operating within Morocco, and some of the music does have a Berber flavour about it. It is quite a strong signal and can be heard when Brussels on 927kHz signs-off for the night.

Harold also picked up Sfax in Tunisia on 981kHz, Jeddah in Saudi Arabia with a good signal on 1512kHz at 2300 just before sign-off and a much weaker signal from Dubai, also in Saudi Arabia.

Short Wave Broadcast Bands

by Charles Molloy G8BUS

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

Last month we examined the half-wave dipole which has a resonant length and therefore is a single-band antenna, so far as the international broadcast bands are concerned. We also had a look at the end-fed antenna normally referred to as a "long wire" by DXers. Probably the most useful antenna for DXing though is the inverted "L", which we will now look at in detail.

Inverted "L"

As the name suggests this antenna looks like an upside-down letter "L". It is easy to erect, one end going to the roof and the far end going to a mast, tree or another building. The downlead which is part of the antenna is vertical, and the top is horizontal so the antenna will respond to both vertically and horizontally polarised waves. The downlead and top can be made from a single piece of wire thus avoiding a soldered joint at the insulator nearest the house.

Dimensions are not important as the antenna is non-resonant, but it should be as high up as possible. The antenna is also virtually omni-directional i.e. there are no blind spots or directions of poor reception even along the length of the horizontal portion. Any wire that is mechanically strong will do for a receiving antenna. I use the plastics-covered steel wire on sale in gardening shops which is strong, corrosion-proof and has minimal wind

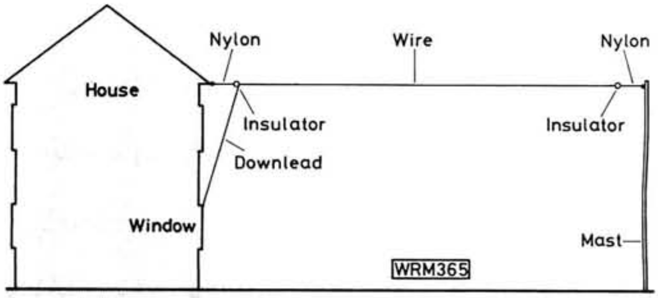


Fig. 1: The Inverted "L" Antenna

resistance since the diameter is small. Nylon cord is used from the insulators to the suspension points and if one of these is a tree then a pulley with a weight on the end of the cord will help prevent breakages.

Matching

Since the inverted "L" is non-resonant its impedance will change considerably as we tune across the short waves. An a.t.u. (antenna tuning unit) connected between receiver and antenna will give quite a boost to signal strength at some frequencies, the only snag is that you have to adjust it every time you change bands.

An earth connection may give improved reception; it depends a lot on the receiver and the band in use. It is always worth trying one especially for the Tropical Bands. An earth clip connected to a water pipe where it comes out of the ground will provide a good earth, assuming the pipe is metal. Do not use the mains earth as you will probably pick up electrical interference or TV buzz, and keep away from gas pipes!

Lightning Protection

My request in the April issue for sources of supply for lightning arrestors brought a reply from reader **K. Lewis** (Pensilva, Cornwall) who purchased one by post last summer from South Midlands Communications Ltd who advertise in *PW*. Two types are available: a spark-gap model and a more expensive gas type. Our reader has mounted his spark-gap outdoors on the supporting pole of his 27 metre-long wire. It is protected from the weather by a plastics cover and connected so that the feeder is earthed via the spark-gap using a length of copper wire running to a rod pushed into the ground. In order to protect the receiver from a direct hit, the antenna is always unplugged from the a.t.u. when the equipment is not in use.

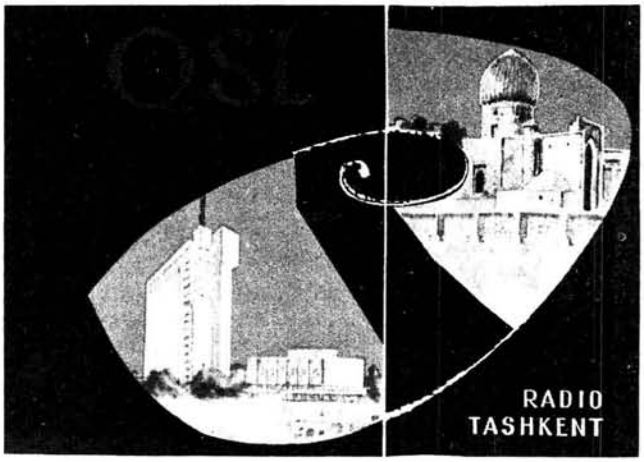
Pat Painting G3OUC describes the lightning protection system he uses with his 14 metre-tall vertical. Although designed for use on the 80m and 160m amateur bands he thinks it may be of interest to DXers. "A heavy-duty choke about 2·5mH is connected from the antenna input to ground." This allows static charges to leak away but does not interfere with the r.f. signals. This choke is permanently connected. Pat agrees that a direct hit would destroy the system but the choke makes this less likely by leaking away any build up of high static voltages. He suggests another method of protection which is to use a voltage dependent resistor (v.d.r.) with a rating of about 100V, connected across the receiver antenna and earth input. Reader K. Lewis refers to a similar arrangement using a pair of 1N4148 diodes, which comes from *A Guide To Amateur Radio* by Pat Hawker G3VA (RSGB).

Media Network Booklist

Media Network is the new name for Radio Netherlands' *DX Juke Box,* the English section of which is produced and presented by Jonathan Marks. The booklist, which has just come out, is divided into three sections. These cover: books, periodicals and tapes of interest to the short-wave programme listener and DXer; books for those with an interest in amateur radio (usually of a technical nature) which can be applied to broadcast band listening; books of general interest to the s.w.l. The booklist can be obtained free of charge from Radio Netherlands, PO Box 222, 1200 JG Hilversum, Holland.

Media Network/DX Juke Box has improved no end with Jonathan at the helm and I rarely miss the 25-minute session which can be heard on the 16m band at 2050 on Thursdays. A schedule of times and frequencies of transmission from Radio Netherlands is obtainable from the above address.

Two QSLs from reader Harry Stacey's collection



An attractive QSL from Uzbekistan

A recent card from Afghanistan

11 Metre Band (25 600 to 26 100kHz)

It is some time since we had a look at this band. Frankly I expected activity on it to decline now that we have reached (passed?) the maximum of the current sunspot cycle. Far from it! New stations are still appearing, the latest being R. Finland on 25 950kHz and R. Algiers on 25 680kHz. Radio Algiers has been hopping around the bands like a grasshopper these days so its appearance on 11 metres is not so surprising.

The following list is of stations that have been logged recently in Europe: Tel Aviv, Israel on 25 605kHz and 25 640kHz; Radio Netherlands, Madagascar Relay 25 650; BBC (UK) 25 650; Radio Liberty (Portugal) 25 690; NRK Norway 25 730; Radio RSA 25 790; Radio France International (RFI) 25 820; Voice of America, Tangiers Relay 25 880; RFI 25 900; AFRTS Philippines Relay 26 000; HCJB Ecuador 26 020; VOA Greenville 26 040; BRT Belgium, Flemish Service 26 050kHz.

Some receivers may not reach 11 metres but if you can, try this band. You won't hear anything after dark, though, this is a daytime only band.

Readers' Letters

"I was interested in your comment about reception using quite a simple aerial," writes **Harry Stacey** from Eastbourne, who goes on to list some of his catches using a Vega Spidola 250 receiver with 900mm telescopic antenna. A selection from his list reveals Radio Argentina on 11 710kHz, R. Afghanistan 15 075, R. Australia 9570, CBC Northern Quebec Service 11 720, Radio Clarin (Dominica) 11 700, FEBE Seychelles 11 860, R. Free Grenada 15 105, R. Korea 6480, R. Pyongyang 6576, Voice of Saudi Arabia 11 855, R. Tashkent 9540 and TWR Swaziland 11 760kHz. World-wide reception and a good example of the capabilities of the modern solid-state portable receiver.

In reply to **C. J. Graham** (Ecclefechan), who is a newcomer to short-wave listening, try using your Sanyo receiver with its own antenna. Place the receiver near a window for maximum pick-up and keep it away from the TV which generates interference on the short-waves. An outdoor antenna is unnecessary for short-wave programme listening unless you have a lot of electrical interference indoors.

DX Heard

An Aiwa 926 stereo radio cassette with two short-wave bands, 2·3 to 7MHz and 7MHz to 22 MHz and telescopic antenna is in use at Swansea by **Philip Morris** who reports hearing R. Australia on 21 680kHz at 1900, Voice of the Islamic Republic of Iran on 9022kHz at 1950 and All India Radio on 11 620kHz at 2115. AIR announced that their *DX Circle* is now on the air on the second and fourth Mondays of the month at 2115. A radio cassette with s.w. bands would appear to be a good buy for the s.w.l. as there will be no difficulty in taping broadcasts with that kind of rig.

An SRX-30 receiver, a.t.u. and Philips reel-to-reel tape recorder are in use by **G. R. Ellis** (Princes Risborough), who reports excellent reception before sunrise of Radio New Zealand on 15 485kHz and of Radio Australia on 21 630kHz at 1800. Over-the-air information from the latter mentioned a cyclone on March 5 which caused antenna damage at the Carnarvon transmitter site. All programmes were being transmitted from Shepperton on a temporary basis.

VHF Bands

by Ron Ham BRS15744

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

Between this and my associated television column I deal with frequencies increasing from 28 to 10 000MHz, or if you prefer another aspect of it, wavelengths decreasing from 10m to 3cm. The recently published *PW Frequency Allocation Chart* shows eight amateur bands within this range and we all know that each band has its own particular problems, so, whichever one you use and how you solve those problems is always of interest to your fellow readers and myself.

Solar

Both **Cmdr Henry Hatfield,** Sevenoaks, Kent and I recorded several small bursts of solar radio noise at 136 and 143MHz respectively on February 23, 24 and March 3 and 6, and noise storms on February 27, 28 and March 2 (Fig. 1). Therefore it was not surprising that the BBC World Service reported ionospheric disturbances during the early hours and again at 1600 on the 27th and an extensive aurora manifested itself between about 1230 and 1900 on March 5. Owing to the predominantly cloudy skies, Henry could seldom use his spectrohelioscope, but **Ted Waring,** Bristol, had a little more luck and counted 34 sunspots on February 17, 47 on March 1, 32 on the 8th and 42 on the 12th.

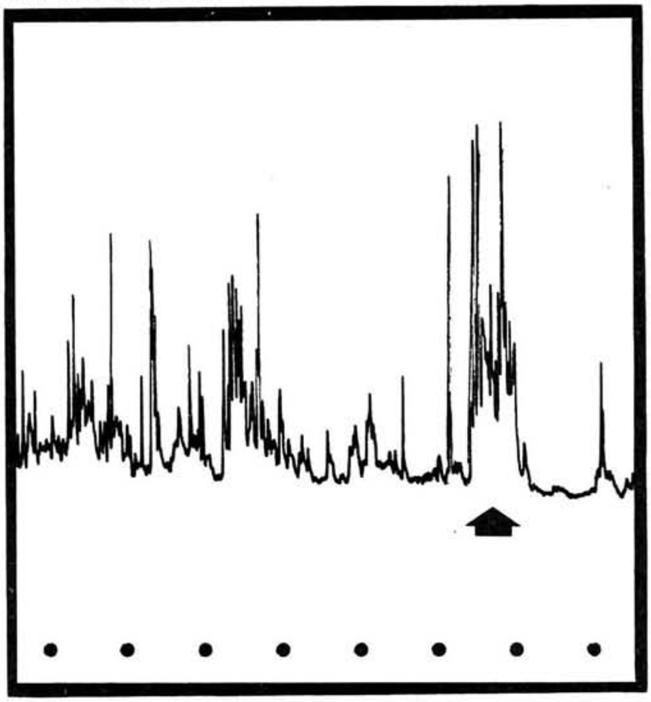


Fig. 1

Aurora

As the auroral conditions ebbed and flowed throughout the afternoon of March 5, my readers made some interesting observations. **John Cooper** G8NGO, Cowfold, Sussex, heard auroral reflected signals in the 2m band from stations in Germany, Holland and Scotland, and during the event made s.s.b. contact with EI6DL, GI5MPS and GM4JLY. Later, while John was making one of his regular skeds with F1FJT, near Rouen, he learnt that the French station first noticed the aurora at 1553 when he heard a rough tone on the signal from the 2m beacon at Wrotham GB2VHF. He then went on to work stations in northern England, Denmark and Germany, and heard a station in Scotland. Also in the south, **Roy Bannister** G4GPX, Lancing, Sussex, worked several DJs, three GIs, four GMs, several PAs, an ON and stations in northern-G and GW on the key. **Barry Ainsworth** G4GPW, in nearby Sompting, heard auroral signals from northern-G during the early afternoon and GI and GM in the early evening. Around 1730, **Alan Baker** G4GNX, Newhaven, was visiting the shack of G4JGJ/MA in Brighton and heard tone-A signals from EI, G, GW and PA.

"I worked some auroral contacts for the first time ever and found them exciting and weird," writes **Phil Hodson** G8RBY, Melton Mowbray, who, between 1700 and 2028 had auroral QSOs with four GMs and a GI, but then Phil experienced the hardest luck of all. Between 1700 and

1730 he heard a UR2??? calling him several times but could not resolve any more and finally convinced himself he was hearing things. However, three people have asked him since why he didn't work the Russian station who was calling him.

The 10m Band

Apart from a few periods between February 27 and March 5, when 10m was quiet owing to the prevailing ionospheric disturbance, the band was generally very active between February 18 and March 16. During this 27-day period I received signals from the International Beacon Project stations in Bahrain A9XC on 21 days, Cyprus 5B4CY on 15 days, Germany DL0IGI on 27 days and DK0TE on 10 days and Ted Waring logged the Canadian beacon VE2TEN, on 13 days between February 17 and March 12 and the South African beacon ZS6DN on 11 days. Periodically between February 22 and March 1, **Stephen Bowler** RS46105, Wakefield, using his Trio R-1000 and a long wire antenna, heard the prefixes LZ, HZ, PY, VP5, YO, YV, ZE, 5N0 and 8P6 and one of the predominant features I noticed was the very strong signals from Japanese stations during the early mornings on most days. Around 0900 on February 24, I received armchair-copy signals from JA3IWA and JL1MEX when they worked into DJ, and from JE1OAV at 0903 on the 26th when he worked G4HQE, OE1CI and YU7AJV straight off.

At 0952 on March 1, a rock-crushing JA1SGX was calling CQ French contest, and at 0856 on the 2nd, several strong JAs were knocking off QSOs with stations in EA, UK, YU and 4Z4. Although many signals were fading during the early morning of the 3rd, JE1PGW was very strong, and like the other JAs on the band was calling CQ Europe, as was JA2BVZ at 0929 on the 4th. I received signals from VK around 0900 on February 18 and 24, and March 6 and 9. "Only a few stations heard at 1030 on March 5," writes **Harold Brodribb,** St Leonards-on-Sea, Sussex, who also noticed lots of distortion (could have been auroral Harold), and although by 1730 the band was almost completely blacked out, it was back to normal on the 6th.

RTTY

Around 0900 on February 24, I received solid copy both ways when DF5FW was in RTTY contact with UV3FD. At 0930 on the 25th I watched the print-out on the screen reveal that SM0EUI was calling CQ, to which ON4LH replied. It is fascinating to watch as the MM2000 RTTY to TV converter changes the twittering RTTY signals from my FR-101 to a readable text on the screen. During the period February 19 to March 16, I logged 95 RTTY stations from D, EA, F, G, GI, GM, GW, HB, I, LA, OE, OK, ON, SM, UK and W, 31 of these were Italians and 19 were Germans. At 0828 on February 28, I received both sides of a QSO between I6GMQ and W5PTD, and at 0908 on March 3 a QSO between I3UAZ and GM4JHQ. Around 0915 on the 5th, the words "I am a catholic parish priest . . . running 100 watts to a quad and using a PET computer for RTTY." were printed on the screen, but this signal was broken up when another strong station came on the air. Early on the 6th I read a message from a French station saying that he was using some vintage gear, a Hallicrafters "Sky Champion" receiver and some ex-US Army wartime equipment for RTTY.

The bulk of the RTTY signals I receive are around 14 090kHz, but at 1143 on March 8 I received copy from OE5BYL, my first on 15m and at 1230 I watched the RTTY news on 144·6MHz, transmitted on this occasion by G8GOJ. Incidentally, this is an ideal way of getting the forthcoming week's orbital predictions for the amateur satellites OSCARs 7 and 8. There always seems to be RTTY activity on 20m. In a mere 13 minutes between 0813 and 0826 on the 14th, for example, I logged signals from two German, an Italian and two Spanish stations, showing just how simple this system is for the s.w.l. to enjoy RTTY.

My first signal from Northern Ireland was GI4AHP in Belfast at 1308 on March 9, my first LA came at 0940 on the 15th and my first GW on the 16th. During an all-Sussex Raynet operation "Exercise Flood" on February 14 and 15, microprocessor-controlled teleprinters were used under simulated emergency conditions to communicate between the Emergency Planning Officer's HQs at Chichester and Lewes. The boffins behind the Raynet teleprinter net are John Brandhuber G8GQQ and Steve Simms G8NFZ. "We usually operate around 144·6MHz with 45·5 baud, but there are plans to take the speed up to 300 baud," said **John Houlihan** G4BLJ, who was among those who tested the teleprinter links under truly portable conditions in the wind and rain.

Tropospheric

Although v.h.f. conditions were generally poor between February 18 and March 16, memories of the late January opening still linger in readers' minds. **Nick Brown,** Rugby, heard v.h.f. stereo from two Dutch stations, Veronica and VPRO, during the afternoon of January 30 on his Sony STR232L tuner amplifier with a 300Ω ribbon-type antenna tacked to the wall. Like many of us **Simon Hamer,** Presteigne, is keen on finding the DX when conditions are poor and often pops one of his Grundig receivers into his Land Rover and drives to a high spot on the hills for a DXpedition. By this method he has been entertained by programmes from Radio Telefis Eireann 1 and 2 and v.h.f. stations from the northwest of England. Such an expedition is always worthwhile, and it is surprising how much can be heard from a high point because local interference is negligible (unlike built-up areas) and signal paths are often uninterrupted. Back home between 2050 and 2130 on February 19, Simon received signals from the Independent Local Radio stations Capital, LBC and Thames Valley, BBC Radios London and Solent and weak signals from Lille and a German station. He also heard Radio Solent and Capital Radio again during the evenings of the 22nd and 24th.

News Items

The Sussex Repeater Group are planning to move the Crawley 2m repeater GB3BP R6, to a site nearer Horsham to give greater coverage of the north Sussex and south Surrey areas. The group also have equipment ready for two 23cm repeaters, one for Crawley on RM3 and one for Brighton on RM9.

The membership of the Worthing and District Amateur Radio Society has grown to almost 100 and the average attendance at their weekly meetings is over 40. Their programme includes computers, h.f., RTTY, slow and fast scan TV, v.h.f. and microwaves. New members and visitors are welcome at 1930 on Tuesday evenings at the Pond Lane Amenity Centre, Durrington.

Barry Ainsworth is now active on 70cm with a Yaesu FT-901DM, a Modular Electronics transverter and a 14-element Sky-Beam from his home in Sompting, Sussex and despite the poor conditions for the contest on March 8, Barry worked a station in Belgium.

As from March 1, Alan Baker G4GNX became the RSGB's Area Representative for Brighton and District. Recently, Alan was in contact with an LA on 20m and learnt that the Norwegian Class-B licence, prefix LB, is for c.w. only and that their v.h.f. enthusiasts are always pleased to work stations in the UK, so keep a look out readers when there is a lift on.

"As from May 1 we change the name of the programme *DX Juke Box* to *Media Network,"* writes **Jonathan Marks** from the English section of Radio Nederland. Jonathan is both producer and presenter of *Media Network,* and further details can be obtained from him at Radio Nederland, PO Box 222, 1200JG Hilversum, Holland. The programme is broadcast each Thursday, and European listeners should tune in at 0948 and 1348GMT.

West Sussex Raynet are pleased to announce the formation of a new group called Mid-Sussex Raynet to cover the Mid-Sussex area. Although support for the new group is very good, new members are still required in the rural areas to liaise at parish level for emergency planning. Those interested should contact either John Houlihan G4BLJ or the new group controller, Clive Spark G8VKQ, both QTHR.

Another Wireless Day will be held at the Chalk Pits Museum, Houghton Bridge, Amberley, near Arundel, West Sussex on Sunday June 7, and I look forward to meeting some of you there.

Some Lerwick Radio Club members: (standing) Peter, Ian GM8PNP, Stanley GM3ZNM, Roger GM4BBL, Dave GM4RSJ, Arthur GM8TLO, and Billy GM8RUI, (sitting) Bobby, John GM4AGX, John GM3HTH, Wilbert GM3WCH and Tommy GM8SOP

The Lerwick Radio Club, formed in 1967, meet every Wednesday in a room provided by their local council, at the Islesburgh Community Centre, King Harold Street, Lerwick.

In 1979, with a generous grant from the Leisure and Recreation department of the Shetland Islands Council, the club purchased a Yaesu FT-101Z transceiver, FC-901 tuning unit, WD3ZZ trap dipole, DX-SV trap vertical, Icom 245E 2m transceiver, Jaybeam 6-element 2m quad and an antenna rotator.

The Club, with its own call-sign, GM3ZET, has about twenty members with ages ranging from Peter, the youngest at 16, to John, GM3HTH, the oldest at 80, fondly known as the "father figure" by his fellow members.

Although the Club's main activity is v.h.f. operated by Tommy, GM8SOP, they always look for QSOs on the h.f. bands. One of their important functions was back in 1969 when the club used a special call-sign, GB2ZET, to mark the Quincentenary of Shetland passing from Scandinavian to British rule.

TV

by Ron Ham BRS15744

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

It is important to remember that during a Sporadic-E disturbance or a tropospheric opening, the DXTV pictures are usually very strong for several hours giving ample opportunity to record the event. If you have a camera handy, be patient and try for a meaningful picture, such as a clock with the station ident (Fig. 1), or programme captions (Figs. 2 and 3), or test cards (Fig. 4). Test cards usually precede the start of the day's programmes, and clocks and captions often appear on or around the hour and half hour.

Tropospheric

Although the atmospheric pressure between February 18 and March 16 was generally below 30·0in (1015mb) and not good for DXTV, there was a brief lift on February 24 and 25 which was observed in Uppsala, Sweden, by **David Appleyard** who, at 0740 on the 25th, received the YLE-HLKI test card (Fig. 4), on Channel 7 from the Finnish TV station in Turku some 200 miles away. For this, David used the telescopic antenna attached to his National portable receiver which was sitting on the window-sill of his fifth floor flat. This is very interesting, David, because the period from midnight on the 23rd to midday on the 26th was the only time my barograph showed the pressure above 30in and favouring DX.

"For TV reception I use a Wolsey 'Colour King' bowtie array, a Jostykit HF 385 antenna amplifier and a Panasonic TR 1401G which will tune down to 435·5MHz for Amateur TV transmissions without modification," writes **Nick Brown** from Rugby. Nick received his first ATV pictures from G8DLX during the evening of January 30 and from G3YQC on the 31st. Another station active on 70cm with ATV equipment is **Robin Stevens** G8XEU, operating from his home in High Salvington, Sussex.

Band I

Like many other readers, **Harold Brodribb,** St Leonards-on-Sea, also keeps an "ear" on Band I (41–68MHz approx) with a communications receiver, and heard the vision buzz on Channel R1 49·75MHz, on February 17, 18 and March 3, and on Channel E2 48·25MHz, on March 1 and 4. Harold also heard the vision signal on Channel E3 55·25MHz, at 1715 on February 28 and held a picture on E2 at 0900 on March 1. I noted frequent bursts of test card, mainly from Poland, on R1 during the early mornings of March 5, 7, 9 and 13 which I suspect is early Sporadic-E and the usual smeary, unidentifiable signals, typical of an "F2" opening between 0830 and 0900 on March 3.

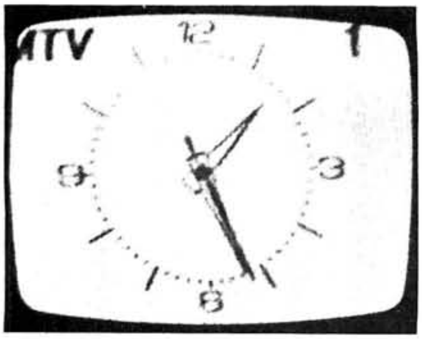


Fig. 1: Clock with Hungarian ident received by Paul Farrugia during the 1980 Sporadic-E season

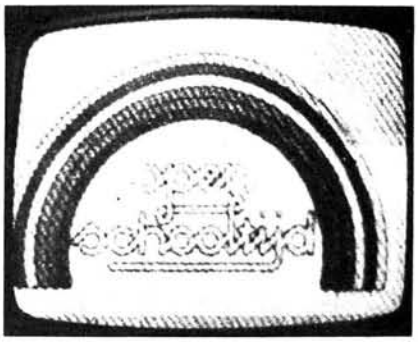


Fig. 2: Dutch programme caption received by the author during a tropospheric opening in November 1979

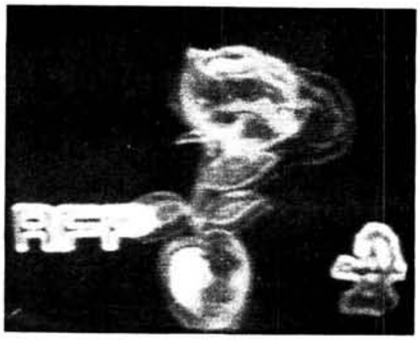


Fig. 3: Programme caption from France received by Paul Farrugia during a tropospheric opening in October 1980

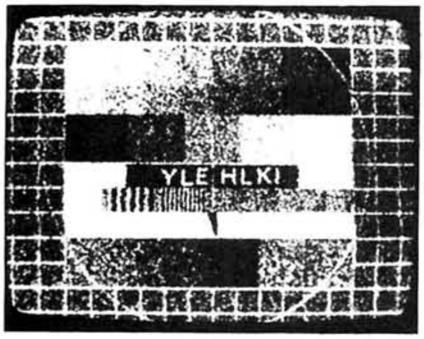
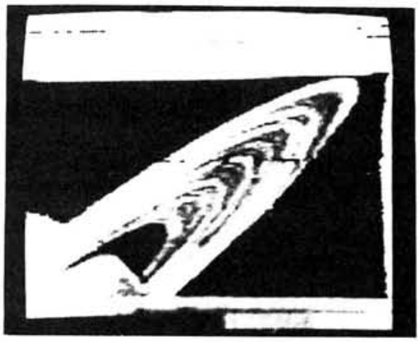
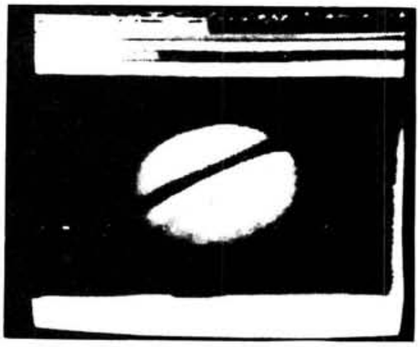


Fig. 4: Test card from Finland received by David Appleyard in Sweden on February 25





Figs. 5 & 6: Pictures of the planet Saturn, taken by the *Voyager* space craft and received via SSTV by Sam Faulkner from W0TV

Disturbed Conditions

"A very strange and mysterious phenomenon occurred during the early evening of March 5," writes **Sam Faulkner,** Burton-on-Trent, who, while beaming north-east on 53·75MHz received strong, unintelligible, out-of-sync video, accompanied by static and rumbling noises. As you suggest in your letter, Sam, there was an aurora borealis in progress at the time (see *VHF Bands)*. Sam first noted these conditions at 1745, after finding the 10m band had closed earlier than usual and then found that, as the video on 53·75MHz became stronger around 1830, South American stations came up on 10m, but everything had gone by 1915. The vision signal on 53·75 may well have come from Italy on Channel 1A.

SSTV

On most days Sam Faulkner looks for Slow Scan Television signals between 1700 and 1800, and during the period from February 1 to March 3 he noted that signals from the east coast of America were, in addition to pictures from Ws 1, 2, 3, 4, 6, 8, 9, 0, HK3, VE3, VE6, KP4, DF and DK, consistently seen. During openings to the west coast, Sam received pictures from KA6CDK on 29 178kHz and K6AEP on 28 683kHz on February 22, WB6ILU on March 6 and N6WQ on the 8th. "Spectacular video was often received from the mid-west, with callsigns WB0UFE on February 15, KB9LU 18th, K9ILA 22nd and March 8, WA0PKD on 22nd, 28th and March 6, WD9IPX 28th, WB0UNB 28th and March 8, WA0PEP, WB0WKQ and WD0EZK on March 3, K0LSW 6th and N9AWR on the 7th and 8th", said Sam, who also used the comparatively new SSTV channel, 29 180kHz, on February 22 to log VE6PW calling WA6RIN. On March 7 he saw VE3DDB working a German station on 28 395kHz.

Although Sam, not surprisingly, found 10m conditions poor after 1700 on March 4 and 5, SSTV was particularly good from the mid-west and west-coast on the 6th, with American communications around 43/44MHz coming through up to 1730. Around 1740 on December 3, Sam received pictures of the planet Saturn, taken by the *Voyager* space craft and sent by SSTV from W0TV to K1IDM (Figs. 5 and 6). Another of Sam's interests is photography, and he likes to take such pictures so that he can build a photographic record of his station's achievements. **John Townsend** G4ILY, Steyning, Sussex, uses an FT-707 and a home-brew monitor for SSTV and is hoping to develop a computerised system for transmitting his pictures.

Hopeful?

While going through some old wartime journals, I found the following snip, headed "Colour Television Sets!" in the January 1945 issue of *Practical Wireless:*

"According to Mr J.L. Baird, a combined sound and television set for the home, with colour television and stereoscopic effect, is likely to be produced after the war for about fifty pounds. Mr Baird was also of the opinion that with mass production the price of a black and white receiving set may well become much less — possibly in the neighbourhood of fifteen pounds."

New! Sinclair ZX81 Personal Computer.

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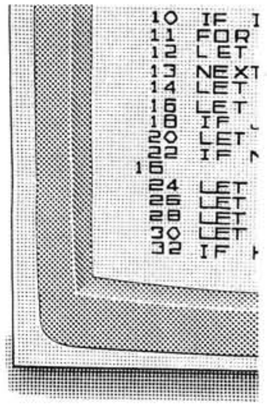

Built: £69.95 complete

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And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, or to select a program off a cassette through the keyboard.

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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!

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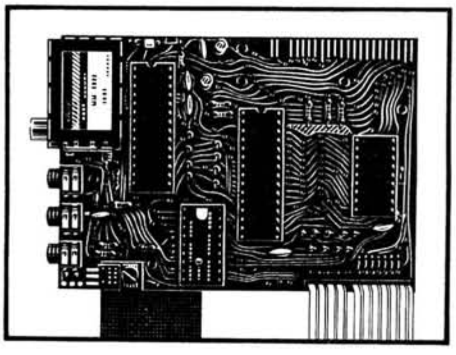
Kit or built – it's up to you!

The picture shows dramatically 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.



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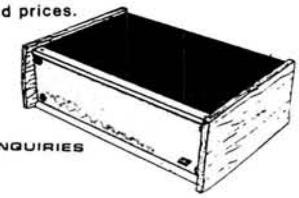

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127	2	4	**8.36**	1.60
125	3	6	**12.10**	1.72
123	4	8	**13.77**	1.96
40	5	10	**17.42**	1.84
120	6	12	**19.87**	2.04
121	8	16	**27.92**	O.A.
122	10	20	**32.51**	O.A.
189	12	24	**37.47**	O.A.

12 OR 24V OR 12-0-12V
Pri 220-240 volts

Ref	Amps 12V	Amps 24V	Price	P&P
111	0 5	0 25	**2·42**	0.95
213	1 0	0 5	**2·90**	1.00
71	2	1	**3·86**	1.00
18	4	2	**4·46**	1.20
85	0 5	2 5	**6·16**	1.20
70	6	3	**6·99**	1.20
108	8	4	**8·16**	1.44
72	10	5	**8·93**	1.60
116	12	6	**9·89**	1.60
17	16	8	**11·79**	1.72
115	20	10	**15.87**	1.84
187	30	15	**19.72**	2.04
226	60	30	**40.41**	O.A.

SCREENED MINIATURES

Ref	mA	Volts	£	P&P
238	200	3-0-3	**2·83**	0.50
212	1A, 1A	0-6, 0-6	**3·14**	1.00
13	100	9-0-9	**2·35**	0.50
235	330, 330	0-9, 0-9	**2·19**	0.60
207	500, 500	0-8-9, 0-8-9	**3·05**	0.95
208	1A, 1A	0-8-9, 0-8-9	**3·88**	1.20
236	200, 200	0-15, 0-15	**2·19**	0.60
214	300, 300	0-20, 0-20	**3·08**	1.00
221	700 (DC)	20-12-0-12-20	**3·75**	1.00
206	1A, 1A	0-15-20	**5.09**	1.20
203	500, 500	0-15-27	**4.39**	1.20
204	1A, 1A	0-15-27	**6.84**	1.20
239	50	12-0-12	**2·88**	0.50
234	500	6-0-6	**2·19**	0·44

Send 20p stamps for Catalogue. Prices correct 1/1/81.

AUTO TRANSFORMERS
Voltages available: 105, 115, 190, 200, 210, 220, 230, 240, for step up and step down.

Ref.	VA (Watts)	£	P&P
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64	80	**4.41**	1.20
4	150	**5.89**	1.20
53	350	**10.00**	1.44
67	500	**12.09**	1.84
84	1000	**20.64**	2.20
93	1500	**25.61**	O.A.
95	2000	**38.31**	O.A.
73	3000	**65.13**	O.A.
80S	4000	**84.55**	O.A.
57S	5000	**98.45**	O.A.

•0, 115, 220, 240.

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15V CT Range (7.5V-0-7.5V)

Ref			P & P
171	500 mA	**2·30**	0.60
172	1A	**3·26**	1.00
173	2A	**3·95**	1.00
174	3A	**4·13**	1.20
175	4A	**6·30**	1.20

NEW RANGE TRANSFORMERS
Pri 120/240V
2 windings 0-36V-48V/36V-0-36Vm 48V-0-48V 72V or 96V.

Amps	Ref.	Price	P&P
1.0	431	**8.12**	1.44
2.0	432	**13.35**	1.22
3.0	433	**16.17**	1.96
4.0	434	**20.65**	2.04
5.0	435	**29.30**	2.20
6.0	436	**36.69**	O.A.
8.0	437	**40.03**	O.A.

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CHECK THE FEATURES

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