

Amateur RADIO

For all two-way radio enthusiasts

**Small Currents and Voltages:
Measuring Small Quantities of Power**



**Construction:
A Power Amplifier for 2m Hand-Helds**

**A User Review:
The Pocom PRM 1200 Packet Decoder**

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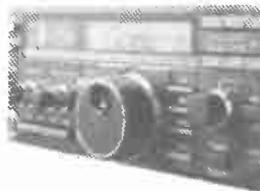
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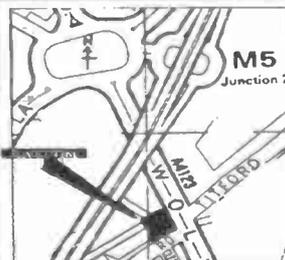
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Amateur Radio Magazines

6 Straight and Level

The latest news, comments and developments on the amateur radio scene

9 WEFAX on the Atari ST

Steven Goodier G4KUB and John Goodier G4KUC look at this decoding software from Kantronics for the Atari ST

13 Project Book

Martin Williams calculates how much power a station needs by multiplying dBW

14 World of Data

Don Field G3XTT with a look at AMTOR and packet mailboxes

16 Bits to Build

George Dobbs G3RJV concludes his two-part article on the Jandek QRP CW transmitter

19 Coming Next Month

20 Second-hand

Hugh Allison G3XSE builds a cheap converter and looks at Satellite TV systems, the Drake R2C Rx and the Scopex RM4D 10A oscilloscope

22 Measuring Small Currents and Voltages

Samuel Dick looks at the problems of making accurate measurements

24 DX Diary

Don Field G3XTT with this month's DX news

28 The Pye M2000 Radiophone Conversion for the 2m Band

Bernard Nock G4BXD converts the Pye M2000 Radiophone for use on 2m

31 Morse Report

Tony Smith G4FAI with his bimonthly look at the world of dots and dashes

32 Short Wave Listener

Trevor Morgan GW4OXB with the latest short wave news

34 On the Beam

Glen Ross G8MWR with news and comment on linearity, repeater abuse and 50MHz

36 One Megabyte Upgrade for the Atari STF Computer

Steven Goodier G4KUB and John Goodier G4KUC upgrade this popular computer

38 The Pocom PRM 1200 Packet Decoder

Ken Michaelson GR3DG reviews Pocom's PRM 1200 packet radio decoder

40 Musings of an Old Timer

An old timer offers some advice as to the most suitable equipment for novices

42 Build a Power Amplifier for 2m Hand-Helds

Harold Goble G4FDQ constructs a simple FM power amplifier

SERVICES

41 Subscription Order Form

46 Free Classified Ads

50 Advertisers' Index

50 Advertising Rates and Information

We regret to inform readers that due to constantly rising production costs, and to enable us to maintain the high standard of content in *Amateur Radio*, the price of the magazine will be £2.55 from this issue



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EL71	4.50
EL81	6.95
EL83	7.50
EL84	0.95
EL84 Mullard	
EL84 Sie-	
EL84 mans	
EL85	4.50
EL86	1.75
EL90	1.75
EL91	4.50
EL95	1.75
EL152	15.00
EL360	6.75
EL500	1.95
EL504	1.95
EL509	5.25
EL509 Mullard	
EL519	6.95
EL802	3.65
EL821	5.95
EL822	12.95
EL830	22.50
EM34	12.50
EM83	1.65
EM84	1.65
EM85	3.95
EM87	2.50
EN32	15.00
EN91	2.25
EN92	4.80
EY51	0.80
EY70	7.50
EY81	2.35
EY82	1.15
EY83	1.50
EY84	0.95
EY86/87	6.65
EY88	0.95
EY91	5.80
EY900A	2.95
EY802	0.70
EY235	1.00
EZ40	3.80
EZ41	3.50
EZ80	0.75
EZ81	1.50
EZ90	1.50
FW4-800	4.50
G55/1K	9.00
G180/2M	6.95
G240/2D	9.00
GC10B	17.50
GC10D	17.50
GC10/4B	
GC10/4E	17.50
GC12/4B	17.50
GD86W	6.00
GDT120M	
GN4	8.50
GN10	15.00
GR10G	4.00
GS10C	16.50
GS10H	12.00
GS12D	12.00
GT1C	9.50
GU20	35.00
GU50	17.50
GXU1	13.50
GXU3	24.00
GXU50SS	
EF73	3.50
EF80	0.55
EF83	3.95
EF85	0.85
EF86	2.50
EF86/CV4085	
GZ37	4.50
HBC90	1.95
HL41	3.50
HL90	3.50
KT8C	7.00
KT33C	3.50
KT36	2.95
KT44	5.95
KT45	5.95
KT61	5.00

KT63	2.95
KT66 USA	
KT66 TEONEX	11.95
KT67	9.00
KT77 Gold line	11.95
KT81	7.00
KT88 USA	12.95
KT88	15.00
KT88 Selectron	
KT88 GEC	22.50
KTW61	2.50
KTW62	2.50
KTW63	2.00
KTZ63	2.50
LB7-20	95.00
LS9B	9.95
M508	195.00
M5143	155.00
M5199	295.00
M8079	6.00
M8082	7.50
M8083	3.25
M8091	7.80
M8096	3.00
M8098	5.50
M8099	5.00
M8136	7.00
M8137	7.95
M8161	9.50
M8162	5.50
M8163	5.50
M8190	4.50
M8195	6.50
M8196	5.50
M8204	5.50
M8223	4.50
M8224	2.00
M8225	3.95
ME1400	3.50
ME1401	9.90
ME1402	29.50
MHLD6	4.00
MP25	195.00
M54B	5.50
MU14	3.50
N37	12.50
N78	9.85
OA2	1.50
OA2WA	2.80
OA3	2.50
OB2	1.90
OB2WA	2.50
OC3	2.90
OD3	2.50
OM4	2.50
OM5B	3.00
OM6	1.75
ORP43	2.50
ORP50	3.95
P61	2.50
PAB3C80	0.95
PC86	0.75
PC88	0.75
PC97	1.10
PC90	1.25
PCC84	0.40
PCC85	0.85
PCC88	0.70
PCC89	0.70
PCC189	0.70
PCC905	0.70
PCC906	0.80
PCFE2	0.90
PCF80	0.65
PCF82	0.60
PCF84	0.85
PCF86	1.20
PCF87	1.20
PCF200	1.80
PCF201	1.80
PCF801	1.35
PCF802	0.85
PCF805	1.25
PCF806	1.25
PCF808	1.25
PCH200	1.50
PCL82	0.85
PCL83	2.50
PCL84	0.75
PCL85	0.80
PCL86	0.85
PCL805	0.90
PD500	5.95
PE25	2.00
PE40D	3.00
PE45	3.00
PE45DD	3.00
PE46	2.00
PLF200	0.85
PL36	1.75
PL38	1.80
PL81	1.25
PL82	0.80
PL83	0.82
PL84	0.78
PL500	1.25
PL504	1.25
PL508	1.50
PL509	4.65
PL519	4.95
PL802	3.50
PL802T	3.50
PL820	2.95
PY32	0.60
PY33	0.50
PY81	0.70
PT82	0.70
PY83	0.70
PY88	0.95
PY500A	1.95
PY500	0.85
PY801	0.65
QB3-300	72.00
QB3-1750	139.50
QB3-1750	280.00
QB5-3500	595.00

QEE02-5	19.50
QEE03-12	7.95
QEE03-20	35.00
QEE06-40	45.00
QVQ02-6	19.50
QVQ03-10	8.50
QVQ03-10	8.50
Mullard	15.00
QVQ03-20	25.00
QVQ06-40A	27.50
QVQ06-40A	39.50
QVQ07-50	55.00
Mullard	55.00
QZ03-20	2.50
QZ06-40	42.50
Mullard	45.00
QS75-20	1.50
QS95-10	4.85
QS108/45	4.00
QS150/15	6.95
QS150/30	1.15
QS150/40	7.00
QS1205	3.95
QS1213	5.00
QU37	9.50
QVQ3-12	6.80
QVQ5-25	3.50
QVQ6-20	29.50
QVQ8-100B	145.00
QY3-125	85.00
QY4-250	105.00
QY4-400	110.00
R10	4.00
R18	2.50
RG1-240A	14.50
RG3-250A	6.50
RG3-1250A	35.00
RR3-250	15.00
RR3-1250	35.00
S11E12	35.00
S10A/2K	10.00
SI01/300	6.00
SP61	3.50
STV280/40	11.95
TB2-5/300	95.00
TB2-300	195.00
TB3-750	195.00
TB3-2000	415.00
TBL2-300	395.00
TBL2-500	495.00
TD03-10/DF/E	35.00
TT15	45.00
TT21	45.00
TT22	39.00
TT100	69.00
TY2-125A	105.00
TY8-600W	365.00
U19	8.50
U26	0.80
U35	3.50
U37	9.00
U41	6.95
U40	3.00
U82	3.00
U191	0.70
U192	1.00
U193	1.00
U201	2.50
U251	3.50
UABF80	1.00
UAF42	1.95
UBCA1	3.95
UBC81	1.50
UBF80	0.95
UBF89	1.00
UBL21	2.95
UC92	2.50
UCC84	0.70
UCC85	1.00
UCF80	1.00
UCH21	2.50
UCH21	2.50
UCH24	3.95
UCH81	1.95
UCL82	1.75
UCL83	2.50
UF41	2.25
UF42	2.25
UF80	1.75
UF85	2.00
UF89	2.00
UL41	10.00
UL44	3.50
UL84	1.95
UL85	0.85
UU5	3.50
UU6	6.00
UU7	8.00
UU8	9.00
UY41	3.50
UY95	0.70
V235A/1K	250.00
V238A/1K	295.00
V246A/1K	280.00
V246A/2K	315.00

V241C/1K	195.00
V453	12.00
VLS631	10.95
VP4B	9.50
VP41	4.95
VR101	2.50
VR105/302.50	
VR150/302.50	
VL39	2.50
W21	4.50
W61	4.50
W77	5.00
W81M	4.50
W739	1.50
X24	4.50
X41	4.50
X66/X65	4.95
X76M	1.95
XC24	1.50
XC25	0.50
XF47	1.50
XF50	1.50
XG1-2500	75.00
XL628F	7.50
XNP12	2.50
XR1-1600A	49.50
XR1-3200A	79.50
XR1-6400A	149.50
Y65	6.95
YD1100	75.00
YL1020	42.50
YL1060	265.00
YL1060	195.00
YL1070	195.00
YL1071	195.00
YL1290	65.00
Z77	1.20
Z300T	6.00
Z302C	12.00
Z359	9.00
Z700U	9.50
Z759	15.00
Z803U	18.95
ZA1000	12.50
ZA1001	1.90
ZM1001	12.00
ZM1005	8.00
ZM1020	9.50
ZM1021	8.50
ZM1023	7.95
ZM1041	14.00
ZM1082	9.00
ZM1084	10.00
ZM1175	6.50
ZM1202	55.00
ZM1263	4.00
IA3	4.50
IAE4	3.90
IAK2	3.50
IB22	10.00
IB27	55.00
IB3GY	1.95
IB35A	45.00
IK3	2.50
IN5GT	2.50
IP28	25.00
IR5	1.50
IS5	1.90
IA203K	9.00
IA7	4.95
IA8	2.50
IA87	4.50
IACTWA	2.50
IA65	2.00
IA67	2.50
IA6H	3.50
IA6J	3.50
IA6K	1.95
IA6L	2.50
IA6M	0.85
IA6N	3.25
IA6O	4.50
IA6P	1.95
IA6Q	4.15
IA6R	4.15
IA6S	1.95
IA6T	1.95
IA6U	1.95
IA6V	1.95
IA6W	1.95
IA6X	1.95
IA6Y	1.95
IA6Z	1.95
IA7A	1.95
IA7B	1.95
IA7C	1.95
IA7D	1.95
IA7E	1.95
IA7F	1.95
IA7G	1.95
IA7H	1.95
IA7I	1.95
IA7J	1.95
IA7K	1.95
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IA7T	1.95
IA7U	1.95
IA7V	1.95
IA7W	1.95
IA7X	1.95
IA7Y	1.95
IA7Z	1.95
IA8A	1.95
IA8B	1.95
IA8C	1.95
IA8D	1.95
IA8E	1.95
IA8F	1.95
IA8G	1.95
IA8H	1.95
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IA8M	1.95
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IA8O	1.95
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IA8U	1.95
IA8V	1.95
IA8W	1.95
IA8X	1.95
IA8Y	1.95
IA8Z	1.95
IA9A	1.95
IA9B	1.95
IA9C	1.95
IA9D	1.95
IA9E	1.95
IA9F	1.95
IA9G	1.95
IA9H	1.95
IA9I	1.95
IA9J	1.95
IA9K	1.95
IA9L	1.95
IA9M	1.95
IA9N	1.95
IA9O	1.95
IA9P	1.95
IA9Q	1.95
IA9R	1.95
IA9S	1.9

STRAIGHT & LEVEL

LEVEL

JUPITER II

Waters and Stanton Electronics, based in Essex, has just launched Jupiter II, the first full-coverage hand-held scanner/receiver for the UK market.

Jupiter II operates on the bands from 25-550MHz and 800-1300MHz. It is FM or AM switchable and includes 100 memories in five bands. There are ten programmable bandscan memories that have a (FAST) scan rate of twenty channels per second. The Jupiter also features carrier or modulation scan/search and scan/search/lock/skip modes.

The hand-held scanner/receiver has an adjustable antenna and is powered by four AA cells, with direct 12V operation. The retail price is £299.00.

For further information contact *Waters and Stanton Electronics, 18-20 Main Road, Hockley, Essex SS5 4QS. Tel: (0702) 206835.*



Jupiter II: the first full-coverage hand-held scanner receiver for the UK market

IN-LINE FUSE HOLDERS

Rendar Limited, the Bognor-based power and audio component specialist, has introduced two new in-line fuse holders.

The body parts are made from moulded phenolic resin and serrated, making access to fuses quick and easy. The two halves of the unit are joined by a screw thread, ensuring electrical and physical integrity.

Models MF-506M and MF-507M cater for fuse sizes 6.35 x 31.8mm and 5.2 x 20mm.

The current rating is 10 amps at 250V ac, contact resistance is 10Mohm (maximum) at 1 amp. Insulation resistance is 100Mohm (minimum) at 500V dc, and will withstand 1500V ac voltage for one minute.

For further information contact *Rendar Limited, Durban Road, South Bersted, Bognor Regis, West Sussex PO22 9RL. Tel: (0243) 825811.*

HEXFET POWER MOSFETS

International Rectifier has announced that logic-level input HEXFET power MOSFETs, compatible with CMOS and TTL outputs, are now available in DIP and D-PAK packages; they include 60V and 100V devices rated at 1-14 amps. Designated the IRL series, they supplement the TO-220 packages.

Logic-level HEXFETs eliminate the interface circuits needed between the CMOS/TTL logic drivers and the power MOSFETs. The HEXFETs also eliminate snubber components and other protective circuits in order to reduce design costs.

For further information contact *International Rectifier, Hurst Green, Oxted, Surrey RH8 9BB. Tel: (0883) 713215.*

THE TEMCON 100

The Temcon 100, a temperature-controlled soldering iron, is now available from Electronic and Computer Workshop Ltd.

This lightweight 100W iron can be used where applications demand a lot of heat.

With either the 115V or 220-240V versions, the iron can attain a temperature of 420°C maximum. Its features include iron-plated tips, a fireproof lead and an adjustable temperature facility. The unit measures 240mm and weighs 170gm.

For further information contact *Electronic and Computer Workshop Ltd, Unit 1, Cromwell Centre, Stepfield, Witham, Essex CM8 3TH. Tel: (0376) 517413.*

ABIS Rx PREAMP

Nevada Communications has introduced the Abis wide-band low noise receiver preamplifier, designed to plug into any hand-held or be fitted in-line with any base scanner.

This preamp is capable of improving all types of reception by overcoming a common problem associated with wideband coverage: that of amplifying the interference along with the selected frequency.

It is fitted with three switchable bandpass filters which will reject out of band signals, and its lower frequency limit is set to 25MHz.

Built using GaAs FET technology, it also has a variable gain control of -3dB and +20dB. It can be powered both from an internal 9V battery or an external dc supply. The retail price is £79.95.

Nevada Communications has also announced the opening of their new 3,600sq ft showroom adjacent to their existing premises.

For further information contact *Nevada Communications, 189 London Road, North End, Portsmouth PO2 9AE. Tel: (0705) 662145.*

PROXIMITY SENSORS FOR PCB MOUNTING

Hamlin have introduced a range of magnetic proximity sensors and actuators, designed to mount directly on to PCBs.

The new sensors feature moulded-in stand-offs to allow PCB cleaning and with a maximum length of 0.9in, they

All the latest news, views, comment and developments on the amateur radio scene

are easy to incorporate within electronic equipment.

The sensors are based on reed switches enclosed in an inert gas and sealed within a glass tube, ensuring that the atmosphere cannot be contaminated.

The 59045-010 sensor and 57045-000 actuator will switch currents of up to 0.25A and voltages of up to 150V dc maximum, while the 59050-010/57050-000 combination will switch currents of up to 0.5A and voltages of 200V dc minimum. Typical operating time is 1.0ms.

For further information contact *Hamlin, Park Road, Diss, Norfolk IP22 3AY. Tel: (0379) 644411.*

FIBRE OPTIC BROCHURE

A new colour brochure of fibre optic products has been published by Five Star Connectors.

Based around the 3M range, it encompasses a high performance range of cables and connectors; a comprehensive mounting kit for both single and multimode connectors; and a simple mechanical splice suitable for joining all 125µm single/multimode cables.

For further information contact *Five Star Connectors, Edinburgh Way, Harlow, Essex CM20 2DF. Tel: (0279) 442851.*

RF SPECTRUM ANALYSER

The Hewlett Packard modular 71100A RF spectrum analyser is now available from Carston Electronics Ltd.

The 71100A comprises a system mainframe that takes up to 8 × 1/8 width plug-ins, a 3/8 width graphics display/controller unit, 2/8 width local oscillator, 10Hz to 300kHz IF section, and a 100Hz to 2.9GHz RF module.

Particularly suited to general communications and satellite broadcasting test applications, the 71100A has a total amplitude range from -134 to +30dBm. The displayed average noise level is below 85dBm from 1kHz to 30kHz, and -125dBm from 1MHz to 2.9GHz.

Its frequency accuracy is ±10kHz and phase noise is -97dBc. The dynamic range is characterised by a second harmonic distortion of less than -70dBc.

For further information contact *Carston Electronics Ltd, 2-6 Queens Road, Teddington, Middlesex TW11 0LR. Tel: 01-943 4477.*

ORYX 50

a general-purpose soldering iron, the Oryx 50, is now available from Electronic & Computer Workshop Ltd.

This 50W iron can be purchased in 24, 50, 115 and 220-240V versions, and has a 240°C to 420°C temperature range. The iron is adjustable to 2% tolerance.

Features include iron-plated tips and a burn-proof lead. The Oryx 50 measures 250mm in length and weighs 75gm

For further information contact *Electronic & Computer Workshop Ltd, Unit 1, Cromwell Centre, Stepfield, Witham, Essex CM8 3TH. Tel: (0376) 517413.*

LOGIC ANALYSER

Thandar Electronics has introduced a combination pod which provides eight channels at 100MHz, or thirty-two channels at 25MHz for use with their TA1000 logic analyser. The pod also adds 5ns glitch capture and glitch triggering to the basic TA1000. As an addition to the TA1000 logic analyser, the pod becomes one of the most flexible combinations available.

The TA1000 is also available as a base unit with either TTL threshold pods, variable threshold pods, or as the new combination pod.

Disassemblers for a range of eight and sixteen bit microprocessors are also available as low cost options. The combination pod costs £195.00, and the TA1000 costs £995.00.

For further information contact *Thandar Electronics Ltd, 2 Glebe Road, Huntingdon, Cambs PE18 7DX. Tel: (0480) 412451.*

JACK-PLUG ADAPTORS

Rendar Ltd has recently announced their new range of adaptors for interconnection between standard and miniature jack plugs, or vice versa.

This compact range of adaptors is available with pole options. The quality adaptors provide flexibility in stereo, mono and other audio and signal interconnection applications.

The 3.5 and 6.3mm adaptors feature smooth hexagonal and straight and cylindrical plastic bodies.

For further information contact *Rendar Limited, Durban Road, South Bersted, Bognor Regis, West Sussex PO22 9RL. Tel: (0243) 825811.*

THE 800 AWARD

The Northampton Radio Club is celebrating Northampton's Royal Charter, granted by Richard I in 1189, by setting up the 800 Award and operating a special event station (GB800) throughout 1989.

To participate in the award you will require a minimum of twenty-five points in the UK, or twenty points elsewhere.

Points awarded for contacts in the Northampton area are as follows: GB800, ten points; G8LED, five points; Northampton Radio Club members, two points; other amateurs, one point.

The award runs until 1 January 1990. Contacts made via repeaters are not eligible. The award can be endorsed for contacts on mixed bands, single band or QRP.

For further information write to: *D Linnell G7CMA, 19 Beech Avenue, Northampton NN3 2HE.*

CALLING RADIO WARRIOR

HMS Warrior 1860, which is berthed at Victory Gate, HM Naval Base, Portsmouth PO1 3QX, is the weekend home of the Fareham Radio Club which broadcasts from the assistant surgeon's cabin.

The aim of the Fareham Radio Club is twofold: to make contact with other radio enthusiasts and tell them about **HMS Warrior 1860**, and

encourage young people to become involved in amateur radio broadcasting.

Contacts have already been made to Russia, the US and as far afield as Brazil and Australia.

The station operates at weekends from 10.30am to 7.30pm from March to October, and 10.30am to 5.00pm from November to February.

For further information contact *Rodney Smith, Fareham Radio Club, 59 High Street, Southwick, Fareham. Tel: (0705) 373572.*

SCOTAM '89

The Scottish Amateur Radio Convention takes place on 16 September from 11.00am to 5.00pm at the Fife Institute of Physical and Recreational Education, Viewfield Road, Glenrothes, Fife.

There will be the usual attractions including an RSGB bookstall, Morse tests, bring and buy stalls, lectures and a talk-in on S22.

This national event for Scottish amateurs will be organised by the Glenrothes and District Amateur Radio Club.

For further information contact *John Hardwick GM4ALA. Tel: (0592) 742763, evenings until 8.00pm.*

CEPT NEWS

CEPT (European Conference of Postal and Telecommunications Authorities) has agreed to set up land mobile communications via an INMARSAT-leased MARECS-B2 satellite located over the Atlantic Ocean.

This service will enable CEPT member organisations to establish two-way telex communications for long-distance road hauliers in Europe.

The proposed system will use the omnidirectional Standard-C earth terminal antenna, measuring 30cm in diameter and 30cm high, which will be mounted on road vehicles. The antenna does not need to be lined up on the MARECS-B2 satellite when in use.

APPEAL FOR HELP

A double murder took place on Thursday, 29 June 1989, near Little Haven, Pembrokeshire, South Wales, when Peter Anthony Dixon and his wife Gwenda Dixon were shot whilst walking the coastal path.

Mr Dixon was a keen amateur radio enthusiast and whilst on holiday in Wales he used the callsign GW0HFQ.

The Dyfed-Powys Police would like to hear from anyone who spoke to him on the radio, which Mr Dixon carried in his car, whilst he was on holiday. The period they are interested in is that between 19 June (the day the Dixons went on holiday) and Thursday, 29 June, which is the day they died.

If you have any information contact either the Dyfed-Powys Police at Haverfordwest, (0437) 3355 or any police station.

NEW BOOK

A new book entitled **An Introduction to Amateur Radio** has just been published. It is written by Ian Poole, who is a regular contributor to this magazine. As the

title suggests, it is a guide to the hobby and can be used to help prepare for the RAE.

The book covers many topics and deals with the more practical aspects of operating on the HF and VHF/UHF bands, as well as covering call signs, codes and jargon likely to be encountered.

The more theoretical topics, such as types of transmission, receivers, transmitters and aerials are also included.

Finally, there is a chapter about starting out in the hobby, setting up a station, and useful ideas about preparing for the licence. The price is £3.50.

An Introduction to Amateur Radio by I D Poole, ISBN 0 85934 202 6, is published by B Babani (Publishing) Ltd, The Grampians, Shepherds Bush Road, London W6 7NF.

FISTS EVENT

The FISTS CW Club will hold their FISTS straight key week from 0001hrs 3 September to 2359hrs 9 September.

This is *not* a contest. All stations are welcome to participate, and FISTS mem-

bers will be invited to submit nominations for the 'Best Fist of the Week'.

In sympathy with the EUCW rules, any station (whether a member or not) being accorded two or more nominations will subsequently receive a certificate from the FISTS CW Club.

All FISTS members worked during this period will qualify towards the FISTS Century Award. The club call (G0IPX or G0IPX/M) will be active.

Suggested QRG: 3.550/3.559, 7027/70295 and 0.55 on HF bands. Club members will also be active on the WARC bands.

For further information contact *E Longdon G3ZQS, 119 Cemetery Road, Darwen, Lancashire BB3 2LZ. Tel: (0254) 703948.*

BARTG

The following changes have recently been announced by BARTG (British Amateur Radio Teledata Group).

The new membership secretary is Ann Reynolds G6ZTF, who will be responsible for membership enrolment and renewal.

Components and software

sales will now be handled by Ted Hatch G3ISD.

BARTG's booklets, including 'Beginners Guides' will now be obtainable from BARTG's editor, Peter Adams G6LZB.

For further information contact *Ian Brothwell G4EAN. Tel: (0602) 592660 or (0602) 262360.*

SPECIAL EVENT STATION

John Huddleston and Andy Swain of Radio Link, Derby Hospital Broadcasting, will be operating a special event station using the call-sign GB1RLD, from Radio Link's outside broadcast caravan at the hospital on 2m VHF.

The dates are as follows: 30 September from 1000 to 1600hrs, and 1 October from 1000 to 1600hrs.

They hope to make over 250 contacts during the event, and each person contacted will receive a special QSL card, via the RSGB mailing service.

For further information contact *John Huddleston, c/o 8 Wilmot Avenue, Chad-desden, Derby DE2 6PL. Tel: (0332) 676822.*

PACKET RADIO FROM THE SPECIALISTS!

Siskin Electronics have a policy of supplying the best range of packet radio equipment available for the radio enthusiast. We have examined the products of many manufacturers and are pleased to be able to offer what must be the widest range of equipment available from just one UK supplier. All prices include VAT and are valid at time of publication.

PACCOMM

TINY 2 with PMS	£119.00
TNC-320 dual port NEW	£179.00
MICROPOWER-2	£149.00
Real Time clock option	£27.95
Printer port option with cable	£34.95
9600 baud adaptor	£95.00

AEA

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WEFAX ON THE ATARI ST

by Steven Goodier G4KUB and John Goodier G4KUG



Many computers are now being used for the reception of coded transmissions such as RTTY, AMTOR, packet radio and Morse code. For example, RTTY is a common form of machine telegraphy whereby text messages are transmitted and received on rolls of paper in page format; this type of transmission is ideally suited for news agencies and is still in common use today by both professionals and radio amateurs alike. The equipment originally used for the transmission and reception of this type of code was large, noisy and heavy, and it was a blessing to all when the first computers were used to decode this type of transmission. Home computers are ideally suited for this purpose and instead of the text being printed on long rolls of paper it is displayed on a monitor and stored in buffers for future use.

As computer technology progressed, packet radio was developed and is now possibly the fastest growing and most sophisticated form of data transmission used by radio amateurs. Packet radio is a subject all of its own, and it is not the intention of this article to delve too deeply into it. The only thing I will say is that the forwarding of mail around the country and the amount of information that can be obtained from the many mailboxes has to be seen to be believed. Radio amateurs have done an extremely good job setting up a complex and efficient data network exchange throughout Great Britain. This network now stretches throughout the world.

The main disadvantage of packet radio is that you need a transmitting licence to take part as it is an interactive form of communication. By the very way it operates it needs an acknowledgement from both the transmitting and receiving stations, you also need an amateur radio callsign to connect to other hams and mailboxes. The main component of packet radio is the Terminal Node Controller or TNC for short; this sits between the computer and transceiver and controls the actions of both. The TNC has its own microprocessor, memory, modem chip and operating system and is more or less a mini computer in a box. Over the last few years TNCs have become more and more sophisticated, and as better operating systems have been introduced the features they have to offer have become more enhanced.

TNCs produced by Kantronics of the United States now offer a feature called WEFAX. This enables the user to receive and display facsimile transmissions on a home computer when used in conjunction with suitable software. This article will explain what is needed to receive and display such transmissions, and is based around a Kantronics KPC-2400 TNC, and 'Pack-Age' fax software written by David Anderson GM4JJJ, which is designed to run on the Atari 520STFM in both high and medium resolution.

What is WEFAX?

Many naval weather service stations and press agencies produce a large

amount of maps, charts and photographs which need to be transmitted to many stations around the world. This is done by a process called facsimile (fax), where a picture is digitised, stored in a computer memory and then transmitted as a series of tones to be unscrambled at the receiver. In the past many of these charts were generated on a rotating drum at a speed of sixty scan lines per minute, but now modern day charts and photographs, digitised and placed in the computer's memory, can be transmitted at the much faster speed of 120 scan lines per minute.

Full size charts are eighteen inches wide and can vary in length from between ten and eighteen inches. Many are hand drawn and consist of a summary of weather conditions, showing such things as atmospheric pressure, surface temperature and wind speed. In addition to these charts, re-digitised satellite photographs are often transmitted and can be quite spectacular, showing cloud cover and land masses. The sources of most of these satellite weather photographs are the METEOSAT and NOAH series of satellites which are constantly orbiting and photographing the Earth's weather.

It must be made clear that all the WEFAX transmissions described in this article, including the satellite photographs, emanate from ground-based transmitters and not directly from the satellites themselves. When the charts and photographs are transmitted some

WEFAX ON THE ATARI ST

resolution is lost, this happens because the transmitting equipment used by the ground station will not support the baud rate needed for full horizontal resolution. Higher definition pictures are not used because modern day equipment must be compatible with older and standard equipment already in use. It could be that sometime in the future higher resolution will be used and the transmission of colour pictures will be possible.

Equipment needed

The fax stations we are interested in transmit on various frequencies from between 30kHz and 30MHz, so it is obvious that the first thing we need for reception is a good general-coverage receiver. This must be both stable (ie, must not drift from the frequency it is tuned to), capable of resolving SSB signals and preferably have a digital readout of frequency. You may be interested in the receiving equipment I used, a Kenwood TS-440S HF transceiver, with general-coverage capability. This was coupled to 30ft of wire erected between the roof and the back of the garden which formed the receiving aerial.

Next in line is the Terminal Node Controller, and this must be a Kantronics product fitted with WEFAX, as the software used has been specifically written to be compatible with this make of TNC; you will also need a small 12V power supply to supply voltage to it. The TNC is the interface between the computer and radio, it accepts audio from the receiver, processes it and converts it into a signal which is fed to the RS232 port of the computer. When issued with the special command 'WEFAX', the TNC converts into a facsimile decoder. Most Kantronics TNCs are now fitted with WEFAX software as standard, the model we tested was a KPC-2400 single port unit, with a 32k ROM operating system and 32k of user RAM.

When the TNC is in WEFAX mode it will continually send pixel bytes to your computer until you either switch it off or send a CTRL-C. When in WEFAX mode the TNC will do nothing else, it is simply too busy handling all the data. The bytes sent to the computer arrive along the receive data line, so the system will work with almost any computer so long as suitable decoding software is available. Thanks to David Anderson of Pack-Age this is now possible for the Atari ST range of computers.

Hardware wiring

Before taking a look at the software, let us detail the interconnections that have to be made between the computer, TNC and receiver.

We must first supply audio to the TNC, this can be taken from either the extension loudspeaker socket or the tape output connection which can be found on the back of most of the modern day receivers. Kantronics supply a ready



Back view of the TNC, showing the various connections

made lead specifically for this job, one end is terminated with a nine-pin D connector, the other end is intended to be plugged into a standard loudspeaker extension socket and is terminated with a 3.5mm jack plug. The nine-pin D connector found on the back of the TNC also carries a number of other input/output lines, but as most of these are intended for full packet radio operation they will not be detailed here.

The next stage is to connect the TNC to the serial port of the Atari ST. Kantronics supply a second lead terminated with a D connector, the other end is bare, so you will have to solder this to a second 25-way D connector which is then plugged into the Atari's RS232 port. It is probably better to purchase a ready made lead as this will save you the problem of having to make your own. Having said that, for WEFAX operation only two connections have to be made; these are RX DATA and GND. Full details of all sockets and their uses can be found in the seventy-page handbook which is supplied with the KPC-2400.

To test the RS232 lead simply run the VT52 emulator and switch on the TNC, it should produce its sign-on message and this will confirm that data is being received by the computer from the TNC. Once you have the sign-on message type the word DISPLAY and hit return, the KPC-2400 should then display a full list of commands available to the user.

Pack-Age software for the ST

The WEFAX software is contained on a single-sided half megabyte disc, a second disc contains a number of demo pictures. The first thing to do is to run the TEMPLATE TOS program to print out the function key strip for the software. This is printed in two halves using condensed double-strike mode and should work on most Epson compatible printers. The manual is contained in the README file and when printed out produced a five-page handbook which detailed the basic operation of the program. It was felt that the less experienced operator may struggle to get the program to run correctly with the notes provided, but the handbook included with the TNC is fairly comprehensive and details all the wiring and parameters for correct operation for WEFAX reception.

Before the main WEFAX program is run the TNC must be configured for the

correct baud rate, this can be done by using the VT52 emulator. With the emulator program running switch on the TNC, you should be greeted with the usual sign-on message. The only parameter that needs changing is the baud rate, and this is done by typing ABAUD 4800 then pressing return, followed by typing PERM and again hitting return. Now you must switch off the TNC and the Atari ST, we are now ready to run the main program.

Insert the WEFAX disc into drive A and switch on your Atari, after a few seconds the desktop will appear. Pull down the desk menu and click on to the VT52 emulator, switch on the TNC and the sign-on message should appear. It is necessary to enter the following commands: ECHO ON then press return, WEFAX 1280 and again press return, the screen will now fill up with characters. Press UNDO and double click on the WEFAX program. It should be noted that when entering ECHO ON this command will not be printed to the screen since ECHO is off. After the ECHO command is issued input from the keyboard will be shown or ECHOED back on to the monitor.

Once the software has loaded you are greeted with the introductory screen, and are prompted to press any key to start the main program or HELP to display a list of commands implemented by the function keys. When fax is transmitted a sync signal is sent at the beginning of the transmission; this consists of a number of lines of which 95% are black and 5% are white. After hitting any key at the beginning, the WEFAX program starts to look for this sync pattern, and if it is found it will automatically go into receive mode. If the transmission has already started then you can force a display by pressing <F1>, but without the sync pulse at the beginning of the transmission the received picture will almost certainly be out of alignment and wrapped around the screen.

When receiving fax transmissions the program starts to build up the picture line by line starting from the top of the screen and working downwards. A full transmission can take up to fifteen minutes to receive, and can consist of around three to four screens of data. Each screen is stored in memory for later retrieval, these are then used to build up

WEFAX ON THE ATARI ST

a complete picture once all the transmission has been received.

Once the transmission has finished press <F4>, and the program will enter into the playback fax mode. This consists of a number of options for correcting the received pictures and enables you to display all or a large amount of the transmitted image on your monitor. It works by retrieving the previously stored pictures from memory, correcting the aspect ratio and then pasting them on to the screen line by line. Completed screens can now be saved to disc by pressing <F9> or printed by using <F3>. The dumpout routine is for use with Epson compatible printers, and if there is more than one screenful to print, the program will enable you to complete the dumpout without any apparent join.

A word of warning at this stage. The ESCAPE key has two different functions and if pressed at the wrong time will result in you returning to the desktop without a warning box first appearing. I was caught out by this a number of times, and at one point lost a full transmission. It would have been better to use the UNDO key to leave the program and then only after being warned.

Most fax stations transmit at a speed of 120rpm, but occasionally you may come across a slower scan rate such as 60 or 90rpm. Both the TNC and software will cope with this speed, but it does mean leaving the program to reissue a different command to the TNC. This was most annoying, and the software would be more efficient if a Scan Speed Menu was provided which could be used to alter the scan rate without first having to leave the program.

Other options

The program also features a number of other options, all controlled by the function keys. These include inverting the screen <F2>, load screen from disc <F8> and clear memory and wait for sync <F10>. FUNCTION key <F5> has a similar function to that of <F4>, but is used to playback fax in a mirror image. This is useful because some stations transmit negatives, which of course are mirror images and therefore need reversing to produce the correct picture. Also featured is an Auto Timer controlled by <F7>, this enables the program to go into Wait For Sync mode at a given time, it will then receive one full fax transmission for later use.

Screens are saved to disc under FAX1 IMG, FAX2 IMG etc, and can be either reloaded and displayed from the main program, or viewed with the LOOK TOS supplied on the disc. There appeared to be a bug in this program because it would only read the contents of drive A, even though B: was displayed on the screen indicating that drive B had been selected. This slight problem should be cleared up on future releases.

Snapshot utilities can be used to save screen in DEGAS or NEO format by simply running the snapshot program before the main WEFAX or LOOK TOS

software. Pressing <F3> will now produce a screen snapshot instead of a screen dump on to the printer. This is very useful if you wish to edit or change screens before printing. I used the screen grab utility from Signum II and then reloaded the pictures into this program for final sizing and printing which produced excellent results. When screens are printed on either a twenty-four-pin head printer or the Atari laser printer, spectacular images can be produced.

Receiving WEFAX transmissions

WEFAX can be received twenty-four hours a day from transmitters broadcasting from all parts of the world. The number of different stations heard will greatly depend upon your receiver and aerial set-up, but even with my modest 30ft of wire I received transmission from all over Europe, plus the east side of America and Canada. Table 1 shows a short list of stations I received plus a description of the type of transmission broadcast.

Tuning WEFAX transmission can be tricky, and you may need a little practice to get it perfect. First of all, you need to set the receiver to the USB position and tune it to the desired frequency, usually you will find that you have to tune down about 1.7kHz from the published frequency. Watch your monitor as you tune, once the correct spot is found a recognisable picture will start to form.



Test transmission of a meteorological isobar chart sent out by a fax station

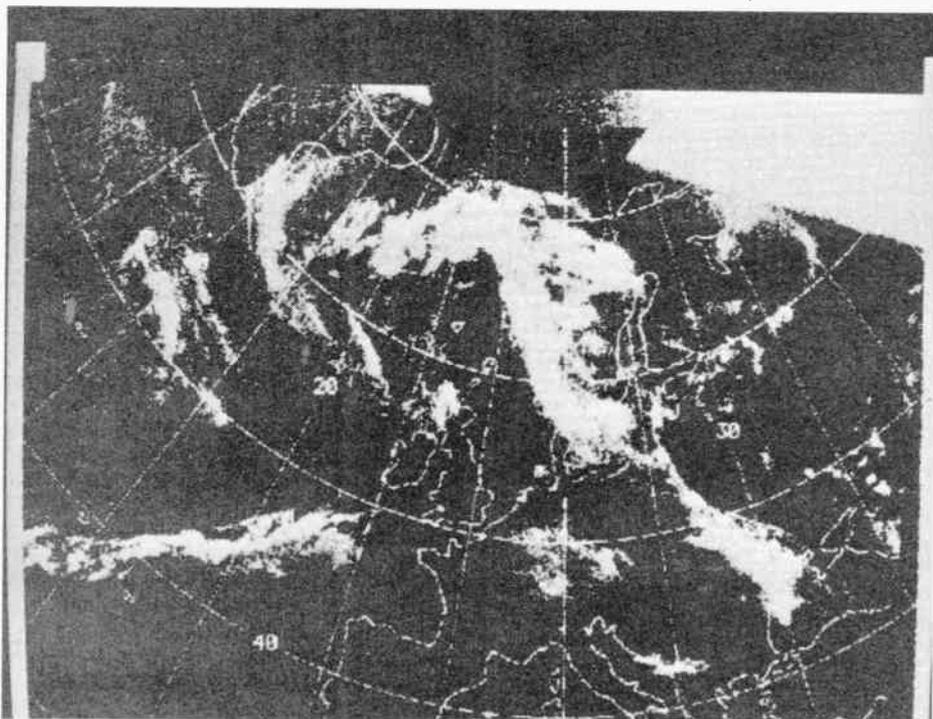
By far the best frequency to try first is 134.2kHz used by DFC-54 Offenbach, Mainflingen, located in Germany. This station spends most of the day transmitting weather charts, but between 1200 and 1315GMT and from around 0100 transmits satellite weather pictures. The quality of these pictures was excellent and no problems were encountered receiving the station's transmissions in the north-west of England. If you are interested in more satellite pictures then try USN, Norfolk, USA on 16.410MHz or 20.015MHz. I understand that this station transmits full Earth disc pictures showing North America plus the usual weather charts at various times throughout the day and night. I must admit the only pictures I received from this station were the usual weather charts.

Table 2

Frequency in MHz	Station Details		Time GMT
United Kingdom			
4.24785	Northwood	Maps and Charts, etc	1737
6.43685	Northwood	Maps and Charts, etc	1700
3.2895	Bracknell	Maps and Charts, etc	1700
4.782	Bracknell	Maps and Charts, etc	0900
8.000	Royal Navy Thurso	Maps	1030
West Germany			
134.2 kHz	Offenbach	Maps and Satellite pictures	1100
139.0 kHz	German Press Agency	Photographs	24hr
3.8550	Pinneberg	Weather maps	1745
7.8800	Pinneberg	Weather maps	1746
USA			
20.0150	Norfolk	Weather maps	1400
16.4100	Norfolk	Weather maps	1044
10.8650	Norfolk	Weather maps	1047
Canada			
13.5100	Halifax	Weather maps	1718
Italy			
13.5970	Rome	Weather maps	1540
8.640	Rome	Maps and charts	1540
Spain			
13.5980	Madrid	Maps and charts	1551

All stations were received on a Kenwood TS-440S using a 30ft long wire aerial. The receiver was set to Upper Side Band (USB), and the TNC was issued with the command WEFAX 1280

WEFAX ON THE ATARI ST



Satellite photograph of Europe and the North Atlantic Ocean received from Offenbach, West Germany on 134kHz. The transmitted quality is superb

Just above DFC-54 Offenbach, Mainflingen, is a press agency on 139kHz which transmits photographs most of the day. I found this a very interesting station to monitor, reception was good and a great variety of photographs was received throughout the day.

Latest version 1.21

I had quite a long chat with David Anderson about the points raised in this article and he informs me that his latest version has corrected many of the minor errors I found in the earlier release. I had a chance to briefly try the latest version which now features an improved redisplay which is 50% faster, and a better mirror-image display which now works in realtime without inverting the screen.

The problem with the ESCAPE key has been resolved. ESCAPE will now exit the program at any time, whilst UNDO will now exit the playback fax mode and leave the program waiting for the next transmission. There is still no way of changing the fax speed without first leaving the program, but I understand that this is very difficult to implement when using the Kantronics TNC, and as most fax stations transmit using 120 scan lines per minute (WEFAX 1280), there is little need to keep changing speed anyway.

I also raised the point about the handbook, and Pack-Age will now supply a printed README and FUNCTION key strip on request for those of you without access to a printer.

Congratulations

David Anderson must be congratulated on writing such a fine piece of software for the Atari ST computer. He has now made it possible for the ST user to receive and display facsimile trans-

missions with ease. Overall the package worked very well, I enjoyed receiving transmissions not normally available to me, and it was a thrill to watch satellite weather pictures and press photographs

being built up before my eyes. No bugs were noted in the program and it seemed to work without any unexpected crashes. The criticisms I had regarding the early release have now been dealt with.

The software is available from Pack-Age, Braeside, Urquhart, Crossford, Fife KY12 8QJ, Scotland. It is priced at a very reasonable £15.00 plus £1.00 post and packing. Pack-Age also stock a large range of TNCs, and can advise on your particular needs regarding packet radio and WEFAX reception. Other information can also be obtained from Siskin Electronics, Southampton Road, Hythe, Southampton SO4 5HU, tel: (0703) 849962 (24hr). When writing to either of the above companies please enclose a large SAE for a reply.

I would like to thank both David Anderson of Pack-Age and Phil Bridges of Siskin Electronics for their help with this review.

Finally . . .

Technically, reception of fax requires a licence. If you feel fax reception will become an active part of your hobby, then you are strongly advised to apply for a licence. This can be obtained by sending a cheque for £10.00 to The Secretary, Meteorological Office (Licensing), Room 601, London Road, Bracknell, Berks RG12 2SE. Applications for the above licence should be made by letter.

Pack-Age Fact File

Product	WEFAX decoding software for the Atari ST
Price	£15.00 plus £1.00 post and packing
Supplier	Pack-Age, Braeside, Urquhart, Crossford, Fife, Scotland KY12 8QJ. Tel: (0383) 721169 (24 hour)
Features	<ul style="list-style-type: none"> Displays all standard facsimile formats Works on medium or high resolution monitors Automatically synchronises the fax picture on display Adjusts displayed aspect after reception Prints screens with most dot matrix printers or Atari Laser printer Auto timer allows unattended operation Mirror-image display for correcting some photographs Choice of inverting screen before printing

KPC-2400 Fact File

Product	Kantronics KPC-2400 TNC
Price	£178.00 plus £3.50 post and packing
Suppliers	Siskin Electronics, Southampton Road, Hythe, Southampton SO4 6WQ
Features	<ul style="list-style-type: none"> AX25 packet operation with 300/1200/2400 Rx/Tx WEFAX receive capability Works on all RS-232 and most TTL computers (not just the Atari ST) Built-in mailbox Suitable for both VHF and HF operation 12V dc supply

PROJECT BOOK

by Martin Williams

There seems to be a lot of confusion as to just how much power is indicated by [x]dBW. This has occurred principally since the powers that be started using this term in the licence conditions instead of simply using watts. You will have to work out the answer in watts so why not start there?

On most bands this would be a simple matter but if you are using 50MHz then the dBW bit becomes important. This is

because the power we are allowed to use is the actual radiated power *not* the power generated.

The problem

At first glance this might seem to be one and the same thing but, in fact, it is not. First you have to bear in mind that if you are using a beam of some sort your aerial will have some gain with respect to a dipole. Then you have to take into account the loss in your feeder cable.

A simple example should make this clear. Let us assume that you have a 10W

transmitter feeding an aerial with 6dB gain (reference a dipole) and that the loss in your feeder is 3dB. What is your ERP? Start with the 10W and multiply it by the gain of the aerial, 6dB is a power gain of 4, so we have 40W. Now deduct the loss due to the feeder, 3dB is a loss of 2, and we end up with an ERP of 20W.

As you can see every station is going to have different power, aerial gain and feeder losses. This is why the DTI has gone for the dBW bit.

Let us recalculate using dBW. The transmitter power – reference 1W – is 10dB, the aerial gain – reference a dipole – is 6dB. Add these two and we get 16dB. Now subtract the feeder loss of 3dB and we end up with an ERP of 13dBW.

dBW Watts

1	1.3
2	1.6
3	2.0
4	2.5
5	3.2
6	4.0
7	5.0
8	6.3
9	8.0
10	10.0
11	12.6
12	16.0
13	20.0
14	25.0
15	31.5
16	40.0
17	50.0
18	63.0
19	80.0
20	100.0

dBd Ratio

0	1.0
1.5	1.4
2.0	1.6
2.5	1.8
3.0	2.0
3.5	2.2
4.0	2.5
4.5	2.8
5.0	3.2
5.5	3.5
6.0	4.0
7.0	5.0
8.0	6.3
9.0	7.9
10.0	10.0
11.0	12.6
12.0	15.8

Gain ratio Tx power output

1	200.0
2	100.0
3	66.6
4	50.0
5	40.0
6	33.3
7	28.6
8	25.0
9	22.2
10	20.0
11	18.2
12	16.6

Table 1: RF power in dBW to mean power in watts. The Table may also be used in reverse

Table 2: Aerial gain as power ratio. Note: if aerial gain is given in dB1, subtract 2.1dB from dBd figures

Table 3: Power required to give 100W ERP for various aerial gains after allowing for 3dB feeder losses

The tables

All the information you need is contained in the tables. To save using ridiculous decimal parts of a watt the figures have been rounded slightly. This will not make any significant difference in practice as, to give one example, it is virtually impossible to measure your feeder loss accurately.

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The World of D | A | T | A

BY DON FIELD G3XTT

Although RTTY is popular and, indeed, growing in popularity all the time, it has its limitations. When the QRM starts to build up characters can be lost, and your terminal starts to print out all kinds of rubbish. In this sense RTTY is less effective than CW when the going gets tough, because our ears have a marvellous ability to sort out the sounds we want to listen to, even when they are also picking up all sorts of other sounds (the so-called 'cocktail party' effect). However, in the commercial world, trained CW operators are relatively few and far between these days, and there have been various attempts to improve RTTY to cope with high levels of interference. One of these was TOR, or Teleprinter Over Radio, developed by the Dutch equivalent of our Diplomatic Wireless Service, for passing traffic between Holland and embassies overseas. It was also adopted for maritime purposes where it is known as SITOR.

Derivation

AMTOR is a derivation of TOR for the radio amateur, and was pioneered by Peter Martinez G3PLX in the late-70s through a series of articles in **RadComm**, **QST** and elsewhere (see, for example, **RadComm**, August 1979 and June/July 1980). The first AMTOR QSO took place on 2m on 9 September 1978, over a 200km path between G3PLX and G3YYD.

Basically, AMTOR works by sending characters three at a time and waiting for an acknowledgement from the receiving station before carrying on. At this point, various possibilities exist. The receiving station may send an acknowledgement to the effect that it has received the three characters correctly. In this case, the transmitting station sends the next three characters. Alternatively, the receiving station may ask for a retransmission if the characters have been received incorrectly. How does it know? Well, AMTOR characters have seven bits, as against the five in RTTY. The AMTOR character set is chosen from those combinations of bits which have three '0' elements and four '1' elements. All the receiving station has to do is to check whether the characters it receives fit the bill. If they don't, it knows something must be amiss. The final possibility is that no acknowledgement is received by the sending station, in which case, it asks for

a repeat acknowledgement. Actually, there is a bit more to it than this, but that's the guts of how AMTOR works.

As you will realise from the above, AMTOR requires a much more sophisticated terminal than RTTY, and it was the advent of cheap microprocessors which made it a practical proposition. You will realise also that with all these short transmissions zipping back and forth, AMTOR has some fairly demanding timing requirements. This is a problem for some transceivers, although most modern HF rigs are designed to cater for this increasingly popular mode. You may also have spotted that, because AMTOR assumes the two stations in QSO are synchronised in some way, there must be a special way of 'hearing' an AMTOR station and starting the QSO in the first place. This is achieved by having two quite distinct modes of operation within AMTOR, but more of this next month.

It should be clear from what I have said about AMTOR that it is much better suited than conventional RTTY to situations where there is heavy QRM, severe fading, or weak signals. This means, of course, that it is particularly appropriate for use on the HF bands. Like RTTY, as well as being used for realtime QSOs, there is a number of HF AMTOR mailboxes. Some of these also act as gateways to the VHF packet radio network. For bandplanning AMTOR is regarded as a variation of RTTY and shares the same frequency allocations.

AMTOR also has more going for it than packet radio on the HF bands, at least when QRM levels are high. By definition, even the shortest packet will contain callsign information, parity bits etc, even when there is no data to be sent. As a result, a packet transmission will always contain many more characters than the three in an AMTOR transmission, and is therefore much more likely to be

corrupted by interference. Of course, on a quiet band with high signal levels, such as might be found on 15m or 10m, overall throughput can be higher on packet. Packet also has the advantage of being essentially error-free (its protocols are more sophisticated than those of AMTOR) and of carrying full addressing information. Packet can also handle a wider character set than AMTOR which is limited to letters, numbers and a handful of other codes.

Live experience

The debate about which mode is best has been in full-swing for some time now. The DTI, with encouragement from the RSGB, has licensed both packet and AMTOR mailboxes on the HF bands, initially for one year, with the hope that live experience can be gained using the two modes for international and inter-continental forwarding of mailbox traffic originating from and destined for national VHF packet networks. The HF gateways also provide an access to the international mailbox network for amateurs in countries where there is no national VHF mailbox network, eg much of the Middle East and Africa.

The GB7PLX AMTOR mailbox is typical of many of the AMTOR mailboxes to be found on the HF bands (I will try to include a list next time). GB7PLX is run by G3PLX, the station consists of a TS930S, ICS AMT-2 terminal unit, and home-brew computer. There is also a VHF packet node on 2m. The clever thing about Peter's mailbox is that it is able to scan a total of sixteen spot frequencies on the 80, 40, 30, 20, 15 and 10m bands; the TS930S being controlled by the computer. When a call is detected the scan stops, and the caller can then log on to the system and send or read mail in much the same way that readers will be familiar with on the VHF packet network. Indeed,

Table 1

GB7PLX HF Frequencies				
80m	3587.5	3588.0	3588.0	3589.0
40m	7035.0	7036.0		
30m	10140	10146		
20m	14075	14076	14077	14078
15m	21080	21081		
10m	28075			

if you are a VHF packet user you can take advantage of this gateway to send mail abroad. To send a message-to-message to VK4AHD at the VK4BBS mailbox, for example, you would need to address the message:

SP VK4AHD @ VK4BBS.AUS.AMTOR

This message will be routed to the nearest AMTOR gateway (GB7PLX, in the case of the UK), from there to Australia via AMTOR, and onwards to the VK4BBS mailbox by whatever medium is appropriate. Table 1 shows those frequencies which GB7PLX is able to scan (though the current licence covers only 7, 10 and 14MHz), and Table 2 shows those AMTOR mailboxes to which GB7PLX is able to forward, together with the relevant list of country codes.

This should give you an idea of what AMTOR is about, together with how you can take advantage of the system, even if you operate only on VHF packet.

Next month, I will say more about getting started on AMTOR, with some hints and tips on operation.

September contest

The CQ World-wide RTTY Contest takes place on 23-24 September. Activity was high in last year's event and is likely to be even higher this year, with good propagation expected on all bands. The contest runs for forty-eight hours from midnight GMT on the Friday, though single operators are limited to thirty hours of operation in total. Contacts can be made using Baudot, AMTOR, ASCII and AX25 on 80, 40, 20, 15 or 10m, but digipeated QSOs are not allowed. The contest exchange consists of RST and CQ zone, while US and Canadian stations include the state or province. I can supply further details on scoring etc, if required.

At this point, it may be worth including some hints and tips on RTTY contesting, due in the main to John Devoldere ON4UN, who won the BARTG RTTY contests for several years running. Firstly, John recommends filling the various memories of your system with useful contest messages such as:

- 1 (CR)CQ TEST DE G9ZZZ G9ZZZ G9ZZZ CQ TEST AR K;
- 2 (CR)QRZ TEST DE G9ZZZ AR;
- 3 DE G9ZZZ 59914 - 59914 BK;
- 4 (CR)QSL 73 QRZ DE G9ZZZ;
- 5 (CR)PSE REPEAT REPORT BK.

Note: (CR) equals Carriage Return.

This way, the amount of typing you have to do is kept to a minimum. For example, when VK0ZZ answers your CQ you need only send his call, followed by the contents of memory 3 to complete the required contest exchange for the CQWW Contest. The same principle applies in other contests, though when a serial number or time must be inserted, you may need to use a wider combination of memories and insert some of the information manually.

John has a number of other useful tips:

1. Use a dash rather than a space between figure groups (as in the example in message 3). This is because a dash,

GB7PLX Forwarding List

AMTOR Mailboxes

GB7PLX	
SM6GXQ	
SK7CS	
KS5V	Texas
WA8DRZ	California
KB1PJ	Ohio
VK2AGE	Sydney
HB9AK	
PAORYS	
LA9OK	

Country Codes

AUS	Australia
GBR	United Kingdom
IRL	Republic of Ireland
SWE	Sweden
USA	United States

Table 2

like figures, is in figure case. A space is in letters case, which means that extra shift characters have to be sent. This tip will both save time and reduce the chance of your message being corrupted by interference.

2. In those cases where shift characters are lost in the QRM you may get a 'garbage' message, such as:

TOOQRATOOQR

Keep beside you a table showing the corresponding characters in figures and letters shift. Then you will realise immediately that the message should actually read:

59914-59914

This makes perfect sense and means you don't have to ask for a retransmission.

3. Always give the contest exchange in the order required (eg, RST plus zone) and repeat the whole exchange several times if QRM is high. Sending RST several times, followed by zone several times is less likely to get through in full if, for example, QRM only pops up for the first or last half of your transmission.

4. If possible, get the computer program to log for you as well as handling much of the QSO. After all, why use a computer to generate and decode the RTTY signals? Then keep your log by hand.

5. Don't send strings of RYRYRY tuning signals. In these days of computers and TNCs, it really isn't necessary and just adds to the contest QRM.

Happy contesting, and if you have any hints or tips of your own I would be pleased to receive them.

ARRL computer conference papers

As I continue to browse through the papers from last year's ARRL conference, some interesting snippets have turned up. One paper describes what its authors rightly term, 'A totally awesome high-speed packet radio I/O interface for the IBM PC XT/AT/386 and Macintosh II computers.' The device is, in fact, a plug-in card for these computers which will handle two 56kpbs and ten slower speed (9600bps or less) channels via interrupts without main processor intervention. The development is targeted at high-speed network nodes of the future and certainly promises a dramatic advance in

forwarding speeds along the main routes. As the authors say, 'The availability of such speeds would also open up the possibility of digital voice so that a mail message could include a short voice message, as well as text (and graphics, of course).' Further development was planned for 1989, so it will be interesting to see how far they have gone when this year's conference comes round.

Another paper which took my interest mentioned binary to text data conversion. Although eight-bit data can be transferred across the existing packet network by going into transparent mode, problems can occur, the ideal would be to convert to seven-bit ASCII which can then be sent in the normal manner. The paper proposed a variable length encoding scheme (Radix 95) which would permit this to happen. As in all these things, what is technically possible and what is finally adopted by the users can be quite different, so it remains to be seen whether Radix 95 will ever see the light of day in amateur usage. Indeed, I sometimes wonder how many users are really interested in sending anything other than plain text over the packet network.

Next month, I will cover some of the papers given at the RSGB's Dataspace Symposium at Surrey University.

Books

There seems to be a dearth of useful books on datacommunications, many of them being at a very involved technical level. For a basic and well-written introduction to datacommunications generally, I can recommend **Understanding Data Communications**, published by Howard Sams & Company. A much cheaper edition, identical in every way, is available from Tandy stores under the 'radio shack' banner.

If you want to delve into TCP/IP, then the definitive text is **Internetworking with TCP/IP** by Douglas Comer, published by Prentice Hall in 1988. The snag is the price, at £18.95.

That's it for this month. As always, if there is anything you want to see included, or if you have some news which would be of interest to other readers, please drop me a line c/o the editorial office.

BITS TO BUILD

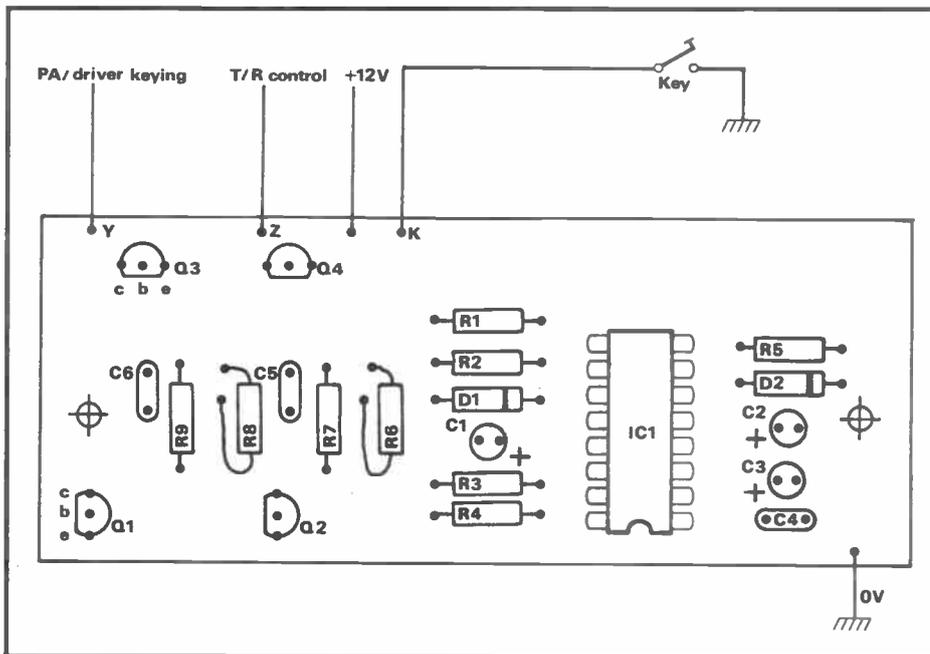


Fig 3: JD010 CW/TR switch layout diagram

T/R Switch Parts List

Resistors (all 0.25W)

R1 100k	R2 47k	R3 10k	R4 10k
R5 330k	R6 4k7	R7 560R	R8 4k7
R9 560R			

Capacitors

C1 220nF	tantalum bead
C2 2 μ 2	tantalum bead
C3 4 μ 7	radial electrolytic
C4 100nF	ceramic
C5 100nF	ceramic
C6 100nF	ceramic

Semi Conductors

IC1	4049B CMOS hex inverter
Q1,Q2	BC182
Q3,Q4	BC327
D1,D2	1N4148

Miscellaneous

- 16 pin DIL socket
- Five 1mm terminal pins
- PCB

module is simple to build, although care must be taken to ensure that the pins of IC1 are correctly placed on the board; pins 1 and 16 face each other at the end of the package marked with the indentation. The correct placing of diodes D1 and D2 is also essential.

Once built, the module is easy to test with a voltmeter set to read 12V, or more. Connect a 12V supply to the board between the points marked '12V' and '0V'. Begin by connecting the meter between 0V and point Y. Keying point K to ground will result in the voltage at Y following the switching action of the key. Connect the meter between point Z and ground. Keying point K will switch on the 12V at Z, which will be switched off shortly after the keying action ceases.

Joining the modules

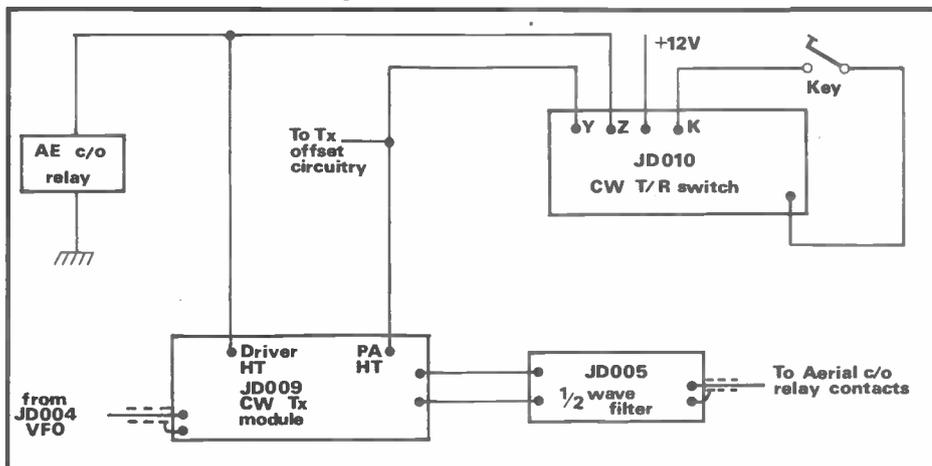
The Jandek module interconnections to produce a basic transmitter are shown in Fig 4. The VFO, transmitter and filter are connected 'in line', and the T/R switch module is used to control the functions. The VFO must be directly powered from the 12V supply and remain on at all times. Switching a VFO on and off is asking for trouble, because the worst drift in a VFO circuit usually occurs when, and just after, switching on the supply. Look at the block diagram in Fig 4 and consider what happens when the key is depressed.

The relay used to switch the antenna from receive to transmit must be wired so that the non-energised condition switches the antenna to the receiver. So, in the key-up state the VFO is running, the relay is non-energised, and the receiver is connected to the antenna. One problem here is that the receiver will hear the VFO, which will impede the copying of received stations.

When the key is pressed down the voltages appear at points Y and Z on the T/R module. Z is used to energise the relay and switches the antenna from the receiver to the output of the filter module. Z is also used to provide the supply to the driver stage on the transmit module. Point Y is used to key the PA of the transmit module. Thus, the transmitter module is switched on and the keying of the transmitter is performed by the supply to the PA stage.

What about the problem of the VFO being heard in the receiver? Y is also used for the frequency offsetting of the VFO module. The VFO module has a facility for fine tuning with varicap diodes via a voltage change. This facility may be used to 'offset' the transmit and receive frequencies. That is, the VFO frequency is not the same on transmit and receive. If the receive condition of the VFO offset is such that the signal cannot be heard in the receiver, then the problem of the signal interfering with received signals is removed. However, this does mean that a 'spot switch' is required to net the transmitter to the receiver. In the receive state, this switch provides the frequency offset on the VFO normally used in the transmit state. This

Fig 4: The basic transmitter arrangement



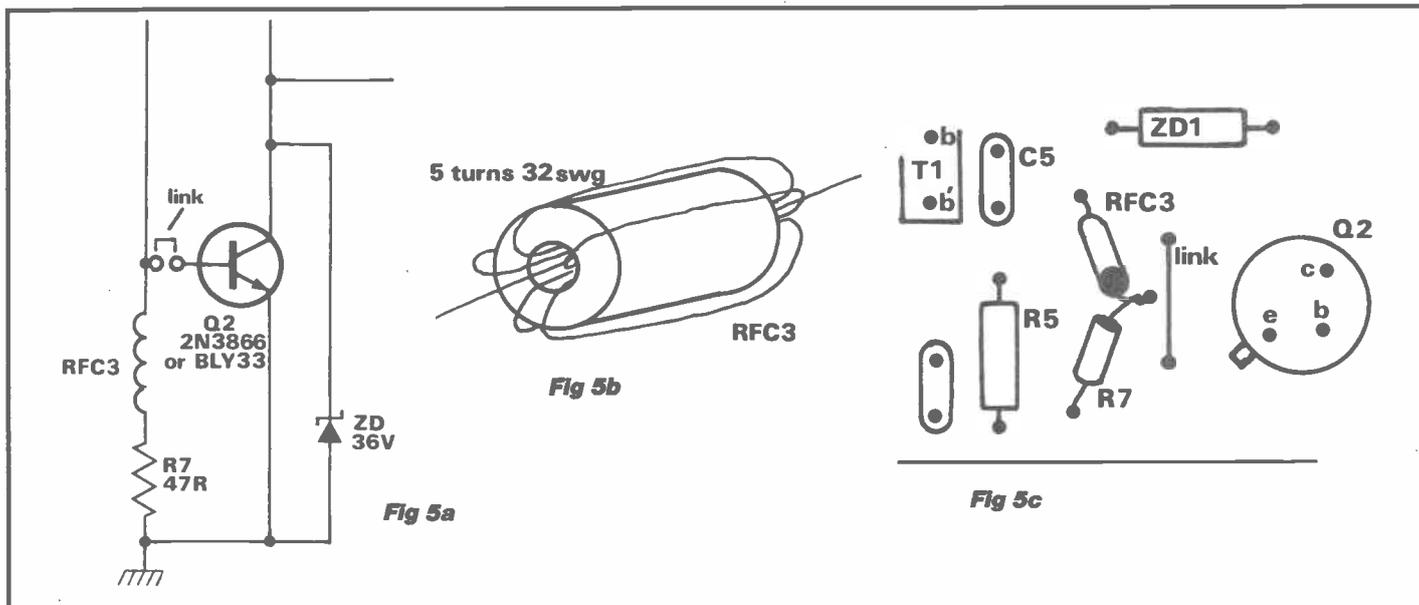


Fig 5a: (left) Circuit addition. **Fig 5b: (centre)** RFC3. **Fig 5c: (right)** Board addition

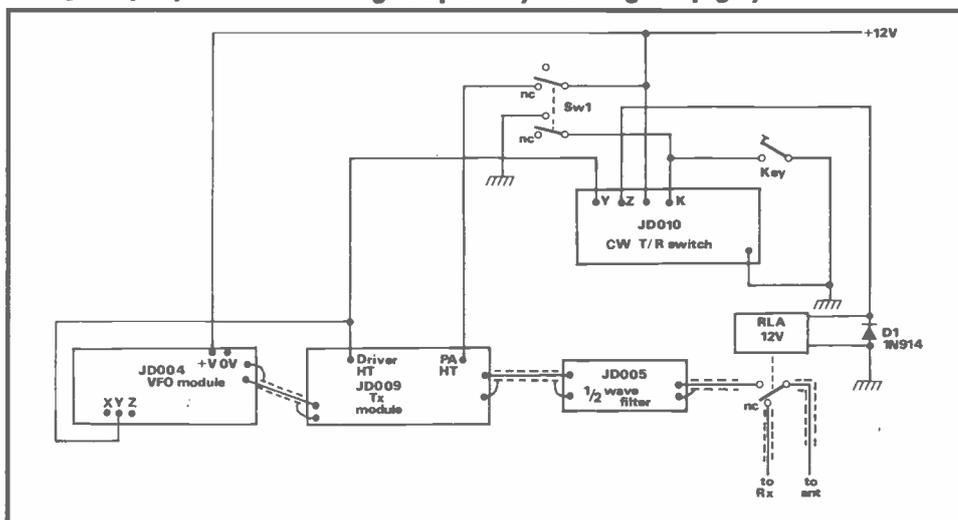


Fig 6: Final module interconnections

enables the transmitter to be netted on to the required frequency or station by listening to the VFO. The connections for this arrangement are shown in **Fig 6**.

Increasing the power output

The basic Jandek transmitter has only a modest power output, around 1W, on 80m. Although I have worked many stations on 80m with 1W to a G5RV antenna, the constructor may like to increase this power level.

A simple way to do this is to add a small Radio Frequency Choke (RFC) to the input of the PA transistor on the transmit module. This stage is operated in Class C, and increasing the RF voltage into the base will give a little more RF output. The circuit of the input to the PA stage on the transmitter module (JD009) is shown in **Fig 5a**. A small RF choke can be made by winding four or five turns of 32swg enamelled wire through a small ferrite bead, as shown in **Fig 5b**. Do take care not to scratch the enamelling off the wire on the sharp edges of the ferrite bead.

The way of adding this choke to the board is shown in **Fig 5c**. This shows the

section of the transmit module board around the input to the PA transistor (Q2). Desolder the lead of R7 at the top end and pull up the freed end of R7. One end of the RF choke can now be soldered into the vacant hole, with the other end soldered to the free end of R7. Keep the leads as short and neat as possible.

The amount of extra power output gained will depend upon the transistor used. I decided to go a stage further and replaced the 2N3866 supplied with the Jandek module with an old 'workhorse', the BLY33. Although a little dated now, these transistors are still available.

Some constructors may like to try other RF transistors, such as the CB driver stage types, in place of Q2. Using the RF choke and the BLY33, I obtained 3W of RF output power, which is a very useful QRP level to use on 80m.

Although the output level is higher, another problem has appeared. The current required by the PA transistor is now higher than the switching transistor (on the T/R module at point Y) can handle without overheating. Therefore, the PA stage cannot be keyed using point Y.

Final transmitter arrangement

The problem of the current handling capability of the T/R module could be solved by substituting a beefier transistor in place of Q3 on that module, but I decided on another approach. The alternative to keying the PA stage is to key the driver stage. One problem here may be RF leakage through the PA during the key-up condition, or even the PA stage oscillating if it is connected to the power supply without drive. But trying to key the driver with the PA stage connected to its supply all the time showed that this arrangement worked well. The final arrangement of the Jandek 80m QRP transmitter is shown in **Fig 6**.

The VFO, transmitter and filter modules are connected in line; the output going to the contacts on an antenna changeover relay. This is a 12V single-pole changeover relay (or a double-pole with only one switch bank used). The keying activates the relay from point Z on the T/R module. The Jandek transmitter's antenna and receiver input are both connected by the normally closed (NC) state of the relay contacts. A diode (1N914) is connected across the relay coil to suppress back EMF surges appearing at point Z.

The transmitter is keyed from point Y on the T/R module. The slight switch delay allows the changeover action on the antenna to occur before a signal leaves the transmitter. This transmit module is keyed at the driver stage (driver HT). The keyed voltage at point Y is also used to offset the frequency of the VFO on transmit. This is connected to the offset input point on the VFO module (also designated as Y). The frequency on transmit is therefore shifted away from the frequency of the VFO in the receive condition. As the receiver will normally be set to the same frequency as the transmitter, the VFO will not be heard during the receive periods.

The PA stage on the transmit module is powered directly from the 12V supply

BITS TO BUILD

and, like the VFO, it is on all the time. However, the supply goes to the PA via a spot switch, which is a double-pole changeover toggle switch. In the normal state, the power is switched on to the PA stage. The spot switch allows the transmitter frequency to be aligned to the receiver frequency, usually called 'netting'.

When a station is located on the receiver or a clear frequency, the transmitter can be moved to this frequency accurately by using the spot switch. When the switch is on, the key is shorted to ground and operates the T/R switch. At the same time, the spot switch removes the supply from the PA stage. The result is that the VFO and driver are operating, with the VFO on the correct transmit frequency, but there is no RF output. The signal is clearly heard in the receiver, and the VFO frequency can be adjusted by listening to the receiver. This enables the transmitter frequency to be set to a required point on the receiver without transmitting a signal. The transmitter cannot transmit a signal with the spot switch in the '1' position.

My completed transmitter was built into a case measuring 2in x 4in x 7½in (WHD). This was a junk sale find which originally housed an old 2m AM receiver. It came complete with a slow motion drive and dial. An extra hole for a potentiometer was mounted on the front

panel should I decide to use the transmitter with a direct conversion receiver board, in which case, it will be the RIT control. The transmitter could easily be built into the Minffordd Engineering A105 box.

Conclusion

On the 80m band, the little transmitter performed well. I have had several QSOs around the UK and have worked several European countries using a G5RV and 3W of RF power. It represents a simple;

effective way to try QRP on 80m.

Remember the QRP operating code: avoid calling CQ; call other stations on the band; try 'tail-ending' other QSOs; use short overs and believe that you will work stations – and you will. Oh! I almost forgot, avoid telling the other station your power output until he has given you your report, because that can be worth two to three points! The usual operating frequency for working CW QRP on 80m is around 3560kHz, perhaps I will hear you there?

Suppliers

Jandek modules

VFO	JD004	£7.75
Transmit module	JD009	£5.85
Filter	JD005	£2.65
T/ R switch	JD010	£3.25

(Add £1.00 postage)

Available From: Jandek, 6 Fellows Avenue, Kingswinford, West Midlands DY6 9ET. Tel: (0384) 288900

Equipment case

Aluminum Case Type A105 £2.35 (80p p&p)

Available From Minffordd Engineering, Sun Street, Ffestiniog, Gwynedd LL41 4NE. Tel: (0766) 762572

Alternative PA transistor

Type BLY33 £1.85 +p&p and VAT

Available From: BCD Electronic Services, Somerset House, Somerset Street, Hull HU3 3QH. Tel: (0482) 225437

NEXT MONTH

Amateur RADIO

Don't miss the October issue on sale 28 September

■ The Icom IC-725



Ken Michaelson G3RDG reviews the Icom IC-725 all band HF transceiver

**All the
Regulars:
Second-hand
World Of Data
DX Diary
Project Book
Short Wave
Listener**

SECOND-HAND

by HUGH ALLISON G3XSE

Cheap converters

Hot on the heels of last month's 'use an old PMR transceiver as a linear' idea, comes a really excellent suggestion from a reader for making a VHF (or UHF) converter out of one. Before we go any further, PMR stands for Private Mobile Radio, ie, old taxi, police, ambulance stuff.

OK, what's a converter? It's a radio frequency amplifier (RF stage), a mixer and a crystal oscillator/multiplier. What's in a PMR machine? Well, an RF stage, mixer and oscillator/multiplier, amongst other junk. Beginning to get the idea? In fact, a few moments' thought will lead you to realise what a versatile idea this is.

Suppose you have a general-coverage receiver, tuning 1 to 30MHz. You purchase a high band FM PMR box (no more than a quid, please!). Stand by for some sums. The PMR box was on, say, 170MHz, you want to tune 144MHz with your general-coverage wonderbox. Now there is a rock (crystal) in the PMR box that enabled it to tune 170MHz. Assume 10MHz IF to make the arithmetic a bit easier. Thus he must have injected 160MHz into the mixer to get 170 ($160+10=170$). You want 144 ($160-144=16$ MHz), so your receiver is going to have to tune about 16MHz to cover 2m. Incidentally, think of 146MHz in the above example, that will come up on 160-146, ie, 14MHz, so the bugger is going to tune backwards. Not ideal, but cheap!

Practicalities. A major problem seems to be finding where to connect in your receiver. In practice look around for the crystal filter (most likely marked 10.7 and lots of other stuff). This is probably driven from a coil in the collector of the mixer transistor. You can try coupling in via a few hundred pFs or so direct to the collector. Obviously a coil tuned to the 'new IF' would be better, but a capacitor is a good start.

Tuning. Well the oscillator/multiplier may not even need touching if you are going straight in and using a 'funny' IF, as above. Obviously the front end coils are going to need re-tweaking on 2m - a signal generator or a friend with a 2m rig and a load are good ideas.

Westminsters are A1 for this bodge up converter. The boards are all conveniently marked up - RF stage etc - and handbooks are available. I lashed up a very reasonable 6m converted from a low band AM Westminster to try out the idea and am quite surprised at how well it works. Luckily a crystal to give 60MHz was to hand; thus, the 10MHz IF coil in the donor Westminster was able to carry on tuning as nature intended.

Satellite TV systems

There have been several dealers

flogging off bits of TVRO (Television Receive Only) systems. The situation is such that it is possible to build up a complete system, albeit fairly basic, for fifty quid or so. There are also total working systems becoming available second-hand at quite attractive prices. As a rough guide dishes (2-4ft), set top converter and outside head seem to go at about £20.00 a lump, plus or minus a bit for condition. You've got to add on some extra dough to allow for cable, which has got to be reasonable 1GHz stuff, and some form of dish-mounting hardware.

As a quick aside, I came across two amateurs earnestly discussing the trials and tribulations of mounting a TVRO system seen for sale on a bring and buy at a rally. They seemed to think it had to go up their aerial mast. I didn't have the heart to tell them that, having travelled twenty-odd thousand miles, the extra thirty feet or so up their mast really wasn't going to make a lot of difference to signal levels.

Still talking of money, motorised systems, ie, ones that can be remotely 'steered' from one satellite to another, still command big bucks - expect to pay a ton or so for just the motor/control gubbins.

Popular confusion

Why are some systems' massive dishes akin to Goonhilly yet others are little things on the side of the house? 'Cos the big systems are watching 'distribution level' satellites, intended for cable systems, hotel chains and the like. These birds are only radiating 3 to 5 watts out, which really is bugger all, to use a technical term. To 'gather up' enough signal level you need a big dish, which has a higher gain. Astra, the satellite carrying Sky etc, radiates hundreds of watts, hence a bigger signal, hence a smaller dish is required.

Aligning the dish

I've seen grown men jumping up and down in sheer frustration at trying to align a TV dish. You have got to have both the set top converter tuned to the right channel and the aerial pointing in the right direction to start getting a picture. Just to add to the fun of it all the dish has to be correct, within a degree or so, left and right *plus* up and down. Here comes the trade secret way of aligning the dish left/right (ie, about the horizontal axis). You need a length of 2in x 1in wood, longer than the diameter of the dish, plus a compass with square sides (ie, not a round one), obtainable from camping shops. Push the wood up against the diameter of the dish, then the compass against the wood. You can now read off the direction in which the dish is pointing. How do you know where to

point it? Any satellite program listing magazine carries beam headings.

A moment's thought will give you a rough idea of how to do the same thing to align the dish in the vertical plane using a spirit level, a protractor and two lengths of 2in x 1in wood. One goes on the ground and is levelled off (using scraps of wood), as indicated on the spirit level, the other bit of wood goes across the dish diameter in the vertical plane and carries on down to the level wood on the ground. The angle of inclination is then read off where the two lengths of wood meet, using the protractor.

Rough and ready? Sure. Inaccurate? Sure. The above will get you within 5° or so, which isn't enough, but you are close and in with a chance. With the converter tuned to the right channel you should see something, then it's trial and error time with a fraction in all directions until you get the best picture. *NEVER, EVER* use a mains powered telly outside, even on a dry day, it's lethal so don't try anything clever.

Drake R2C

We were wandering around the flea market at the Elvaston Castle rally when we espied a Drake R2C, an absolutely super amateur bands only receiver, well designed and ruggedly made. Usually very expensive, £150.00 to £200.00. 'How much' we asked. When he said a fiver the world sort of swayed and everything went into slow motion. As I paid him I vaguely heard him telling me it had *never* worked, apparently it had been bought new as not working.

Next day it was out-on-the-bench time. In the box were numerous spares - a full set of valves, all coils, several boards etc - and it was obvious that nigh on everything within the set had been changed for genuine new replacement parts. The assorted paperwork contained bills for all the bits at a total of roughly what a new receiver would have cost. There was also correspondence going back ten years between various parties on the subject of repairing it. The circuit diagram was well thumbled to the point of disintegration, this was going to be some battle.

Tentatively I brought him up on a Variac. With the set wired for 240V he was gently brought up to 120 then all the rails were checked - all read roughly half what they should have been, so full mains was applied and there was no smoke. A finger on the volume control produced hum so we had audio, but a volt of RF up the aerial hole produced no action.

How does the set work? Basically it's a triple conversion superhet thingy. Incoming signals are amplified (at signal frequency), converted down to a tunable IF of 5MHz, then 455, then 50kHz, a

fearsome brute indeed. The volt of RF was left up the aerial and a 'scope up the grid of the first mixer showed the preselector coils had been twiddled a great deal, but twenty minutes later he was properly aligned.

The next stage (first mixer) was up and running, but the tunable IF seemed wrong. A counter showed the tunable local oscillator way out, another ace tweaker no doubt, but it was soon reset. The 455kHz IF was mistuned, and the switchable (sideband select) third mix oscillator was also out.

Now we had several volts of signal into the grid of the 50kHz IF stage, but nothing on the anode. Time to check the dc volts round the valve. Anode lots, grid 2 lots, grid 1 nothing, cathode lots and lots! This was definitely not right, up to 10V or so maybe, but 100 plus? The cathode tag of the valve socket had never been used, likewise the adjacent earth tag. Joining the two brought forth lots of action, in fact an excellent receiver all round.

The reason for the 50kHz last IF is so that LC filtering at this IF is possible. In use this filter is truly excellent on CW and makes the receiver a joy to listen to.

Uncontrollable brilliance

A fault I've come across on many modern 'scopes, and by modern I mean mostly transistor, made within the last fifteen years or so, is one of uncontrollable brightness. The brilliance pot on the front panel does nothing and, like as not, there is no flyback blanking either. The cure is often simple, there is a diode between the cathode and grid of the tube and I'll bet it has gone a short.

The diode is normally mounted on the tube base itself, often with a high value resistor of 1 to 10Ω across it. To check, you want the 'scope off, give it a minute or two for the voltages to subside, then simply check it for ohms, forwards and backwards. For most 'scopes the replacement doesn't have to be anything special, a 1N4148 seems to be all right.

'Blick'

I seem to have missed out on these fine transceivers until now. They are small (car radio sized), solid state and use modern components. I bought one for 50p, not working, at the Spalding rally –

sometimes I throw my money away! To be honest, I was extremely impressed with what I found. The receiver is excellent, a decent 10.7MHz filter plus a good front end seem to equal 20dB quieting for the microvolt. The transmitter is conventional up to the driver stage, then a Motorola power module does the action up to a generous 20W or so. Sure, crystal controlled, but at this sort of price who is complaining? Incidentally, although sold as not working, it did!

As is the way of these things, a few weeks later at the Newbury car boot sale (excellent do, loads of bargains) I'm gleefully extolling the virtues of the rig to some acquaintances, when they say they know all about them. One story goes that they were British made, in Wales, by a now defunct manufacturer.

All present said they had only seen high band FM versions and agreed that they are excellent on 2m. In comes another vehicle to the sellers' area, the impromptu meeting is called off and we adjourn to see what is up for sale by the newcomer. There is a whole trayful of Blinks, again sold as not working, mine for a fiver the lot – irresistible.

There seem to be three variants available on the surplus market at the moment: a single channel, a multi channel (6) and a multi channel plus leads dangling out the bottom for some kind of tone calling system. Of the twelve I bought most of the faults were broken coils/cores and snapped ribbon cables. The rigs are obviously reliable, but people have buggered them up with careless handling.

Scopex RM4D 10A

These 'scopes are appearing all over the place, mainly ex-educational establishments. They are randomly priced, from £5.00 for a non-worker, £45.00 to £125.00 for a worker – guess which ones I bought?

The 'scopes are all transistor, 'dual' trace (chopped or alternate, it's not a dual gun tube) and are sold as 10MHz bandwidth. All the examples I have come across are well over 10MHz, 3dB down at about 23MHz seems typical, and have excellent triggering being well able to trigger on 35MHz traces. It's got to be said that the trace is a bit dim on the top timebase speeds with the multiplier in

use, but that's the only gripe. Incidentally, don't buy one as a 20MHz 'scope on my say so, you're buying a 10MHz unit and anything else is a bonus.

Faults, I'm really going to let the cat out of the bag here. Whole heaps of them came my way, dirt cheap, sold with duff tubes. Why duff? Well, all the appropriate voltages were present and correct on the tube base, yet no heaters and thus no trace.

What was actually the matter with them? A white growth on the tube pins, totally isolating them from their sockets. A quick rub round with Scotchbrite and all was well. Seems a common fault, I've come across it in examples bought from numerous sources. Remember, 'scope tubes are dangerous (they implode) and must be treated with care – if you ain't sure, don't touch.

Some of the 'scopes had other faults, I've not seen a circuit of them yet, but the layout is fairly obvious and fault finding is easy. Most failures seem to be duff transistors – following the signal through, watching where it stops then changing the transistor seems to be the best approach.

Old duff video recorders

You know the type of kid. Dead bright, cute and streetwise – obviously going to be successful in his chosen career in a few years time. Why was one of these youths busy filling up his dad's car with duff videos at the Newbury car boot sale? When I asked, he told me the reason. Anything up to £2.00 he would buy, and he stripped them down for the components. Apparently he had a thriving business repairing CB sets but didn't wish to pay full price for components. Several videos contain power transistors well able to give 10W plus at 27MHz. For £2.00 a video, if he used one power transistor he had got his money's worth, all other useful components were free. Sometimes he made one working video up out of two or three duff ones, then he was really quids in.

Incidentally, the Newbury car boot sale was great. Loads of tempting old rubbish, all at reasonable prices. If you are wise to 'Old Warden' this is a mini version. Probably only a hundred or so cars, but quality junk none the less. It's certainly well worth a visit.

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MEASURING SMALL CURRENTS AND VOLTAGES

by Samuel Dick

Small currents and voltages appear throughout electronics. Nowadays, a few microamps can power many kilobytes of memory or carry information deep within a CPU chip, and receiver sensitivities are measured in microvolts. But small voltages and currents are just as important in electronics. Most transducers produce relatively small amounts of power and, since these form the interface between electronics and the real world, knowing how to handle this power correctly may often be critical to the success of a project.

How can we measure them?

Measuring small quantities of currents and voltages is never easy. Analogue multimeters used to place such a burden on the circuit under test that some small voltages could not be measured without significant error. Today, this problem has been eased by using digital multimeters which have a much higher input impedance of up to 10M Ω , or more. This means that sources with impedances of 1M Ω can be measured with 91% accuracy, and many circuits with lower impedances need suffer no significant error at all.

For home projects, the humble op-amp has many applications. Op-amps with MOSFET inputs have a very high impedance and are suitable for coupling to low power sources. The reason why MOSFET op-amps are particularly useful is that the gate of the input FET is insulated, and is only capable of passing a very small leakage current through the metal oxide (the 'MO' in MOSFET) which is in the pico-amp region. The same is true of CMOS logic chips. With these, a small capacitor, when charged up to the positive supply voltage, will keep a gate high for some minutes before its charge is dissipated (see Fig 1).

One very important factor is to ensure that, if you want to extract the maximum power out from a source, the impedance of the source equals that of the equipment measuring it. This is quite easily proved, either by empirical calculations or calculus.

What are the problems involved?

As well as being produced by transducers, small EMFs are also generated by many other effects. Some form the basis of transducers but if the effect is not the one in which you are interested, then they can be a problem.

The first example occurs when dissimilar metals are joined together. One practical application of the thermoelectric effect is the thermocouple. Here two junctions are used, with one being maintained at a known temperature, while the other performs the desired measurement. If both were at the same

temperature then the currents generated would cancel out (see Fig 2), but using a temperature difference allows a small current voltage to be generated. If a copper-gold or copper-silver junction is used, around 300nV per $^{\circ}\text{C}$ will be generated. This will increase to 400mV per $^{\circ}\text{C}$ for copper-silicon, while copper-copper oxide junctions give 1mV per $^{\circ}\text{C}$.

These voltages are useful if you want to make a thermocouple, but can ruin sensitive measurements if such junctions happen accidentally. To avoid unwanted thermal EMFs, metal-metal junctions should always be between identical metals where possible. Soldering introduces other metals but cold-welds (produced by crimping) offer a

solution, since many connections can be made symmetrical, ensuring that all parts of equipment are kept at roughly the same temperature thereby minimising any EMFs present. So, if, say, a copper-iron junction cannot be avoided then putting in an iron-copper junction elsewhere may help, provided both are at similar temperatures.

We are all familiar with the electric generator – a coil of wire moved in a magnetic field will have an EMF induced in it. But even very weak fields such as transformers, magnetic actuators, or even the earth, may induce EMFs. The movement in the conductor does not need to be large – a lead which is not firmly attached may pick up noise from

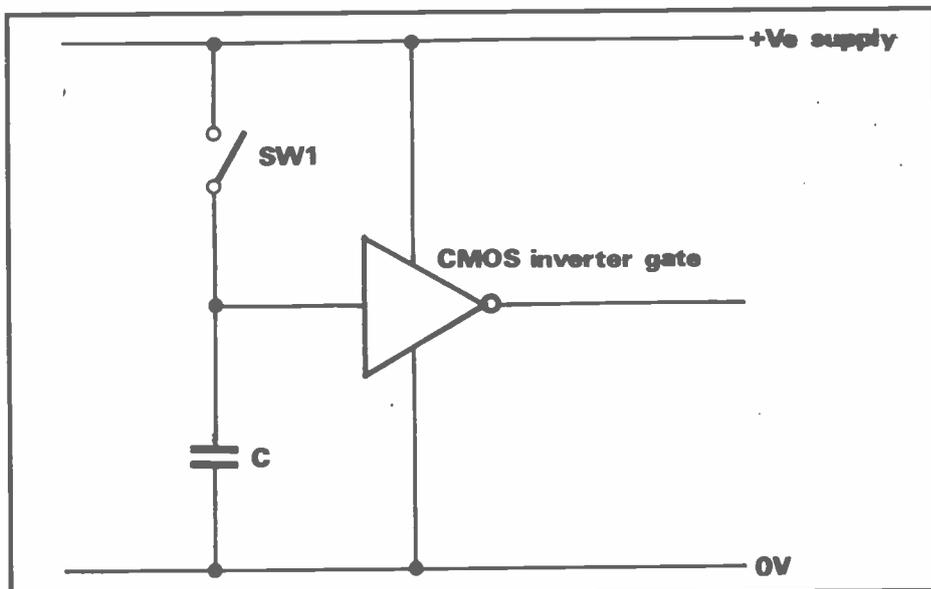
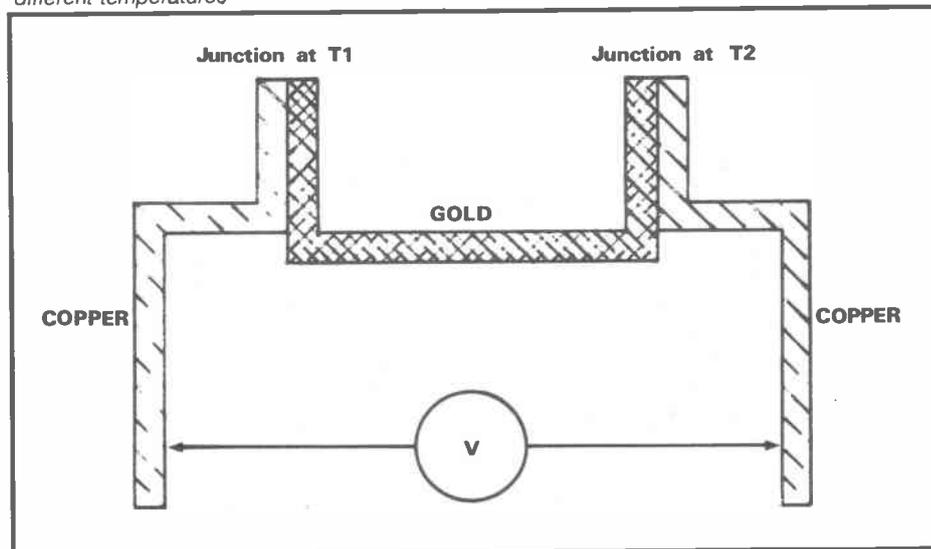


Fig 1: Charging 'C' by momentarily closing SW1 keeps the output low for several minutes

Fig 2: Thermocouple effect: two dissimilar metals are bonded into two junctions which are held at different temperatures



MEASURING SMALL CURRENTS AND VOLTAGES

induced EMFs. Since the EMF generated is proportional to the area of the loop made by the circuit, keeping connectors close together (so minimising loops) is essential.

Of course, exposed wires in the radio shack are very prone to picking up RF voltages from the transmitter, or even local oscillators in receivers. If this is a problem, by ensuring that good earthing is used throughout the shack, with ferrite beads and feed-through capacitors being used where possible, should help to reduce stray and unwanted signals (see Fig 3).

Thermal and magnetic effects are rather obvious compared with the next three effects.

Triboelectric effects generate EMFs inside cables, even in coaxial cables, which are normally assumed to keep noise at bay. If such cables are bent or twisted in use, friction between the conductor and the insulating material of the cable generates an EMF. In a poorly designed cable currents of around 50nA can be generated, which is easily enough to upset very delicate systems. Even equipment which you think is not particularly sensitive may pick up noise and unwanted signals (at very low level) from many sources. Thus, obscure sources of noise start to be important!

The piezoelectric effect is used in microphones, record player cartridges, and ultrasonic transducers, and when

certain materials (quartz, ceramics and some plastics) are subjected to stress, voltages appear across opposing surfaces. While a very small amount of power is available, the voltage can be quite high. A serious use of such high voltages is in battery-less gas lighters! When their handle is squeezed, a crystal is compressed and, on release, generates sufficient voltage to produce a good spark. Occasionally piezoelectric materials find their way into equipment, perhaps as insulating bushes or PCB supports. If they are in contact with, say, tracks on a PCB then, if the equipment is bent or twisted, a voltage may be injected into the nearby circuitry.

The last effect imitates a battery. Often, during the manufacture of assemblies, some flux or other mildly corrosive material is left on PCBs. In time this absorbs moisture from the atmosphere, and where it comes in contact with the copper tracks the effect will generate an EMF which can reach up to a few microvolts, although in typical cases, an order of magnitude reduction might be expected.

Guarding

Once a 'pure' signal has been obtained, it is all too easy for the signal to leak away to ground over high resistance conduction paths on, say, a PCB. The use of guard tracks helps this (see Fig 4). A guard track is a track on a PCB which

runs very close and on both sides of the track carrying the signal. The guard track is typically connected to the output of the first buffer amplifier, which has the weak signal as its input. This means that the area of the PCB surrounding the signal track has roughly the same voltage as the signal. So, by Ohm's law, little leakage current flows because the voltage drop from the signal track to its surroundings is negligible.

Noise

Yet another hazard of trying to measure low voltages and currents is noise. This can come in the form of interference from nearby equipment, although this can be reduced by good shielding and grounding. However, there is also irreducible noise, given to us by nature.

The random motion of electrons in a conductor causes an unequal number to be thrown against opposite sides. This creates a random voltage across the sides of the material. In resistors, this voltage is called the Johnson noise and is given by:

$$V^2 = 4kTR\Delta f$$

Where 'k' is Boltzmann's constant, 'T' is the temperature, 'R' is the resistor's value, and ' Δf ' is the bandwidth used for the measurement. Therefore, a wide-band amplifier connected to the resistor is going to produce a noisier output compared to a narrowband amplifier. As a guide to the magnitude of this noise voltage, a 10k Ω resistor will have 5 μ V of Johnson noise over the dc to 40kHz frequency range.

Similarly, if a current is flowing along a wire, then not exactly the same number of electrons pass a given point during consecutive seconds. There is a fluctuation, rather like the number of cars passing under a motorway bridge, and the mean square of this is:

$$(I_m)^2 = 2eI\Delta f$$

where 'e' is the charge on the electron, 'I' is the current flowing, and ' I_m ' is the RMS variation on top of the 'steady' current 'I'. This type of variation, which is due to the particle nature of current, is called 'shot noise'. It is unlikely that shot noise will trouble you, unless you wish to measure exceedingly small currents in the pico-amp region.

Both these sources of noise cannot be reduced, although Johnson noise can be reduced by making 'T' zero (ie, operating circuits at absolute zero). But this is not very practical!

The trick to reduce both Johnson and shot-noise sources is to take advantage of the ' Δf ' term in both equations. If you keep the bandwidth of the circuitry to a minimum (while still retaining the features you require, of course), then this will cut down the amount of noise which gets into the system. Note that in the case of shot noise in currents, a smaller current will have a larger percentage of noise, so higher currents can keep noise down. With Johnson noise, the implications of the equation are that low value resistors will generate less noise than their high valued counterparts.

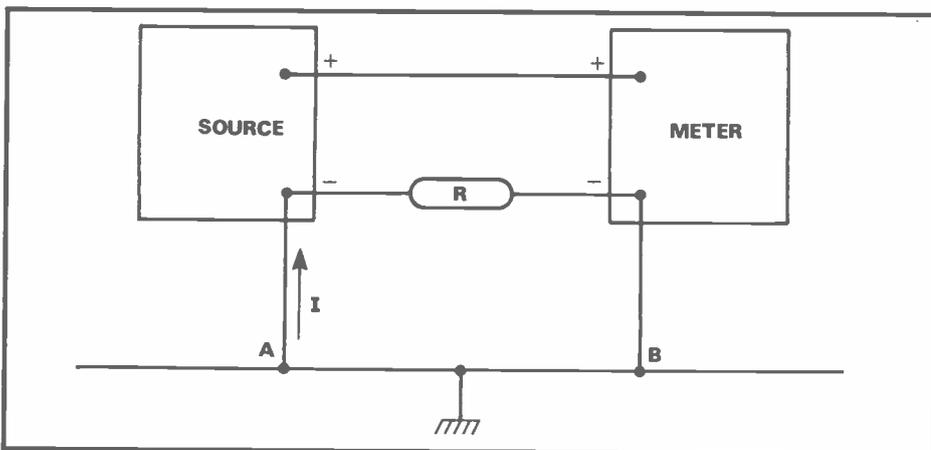
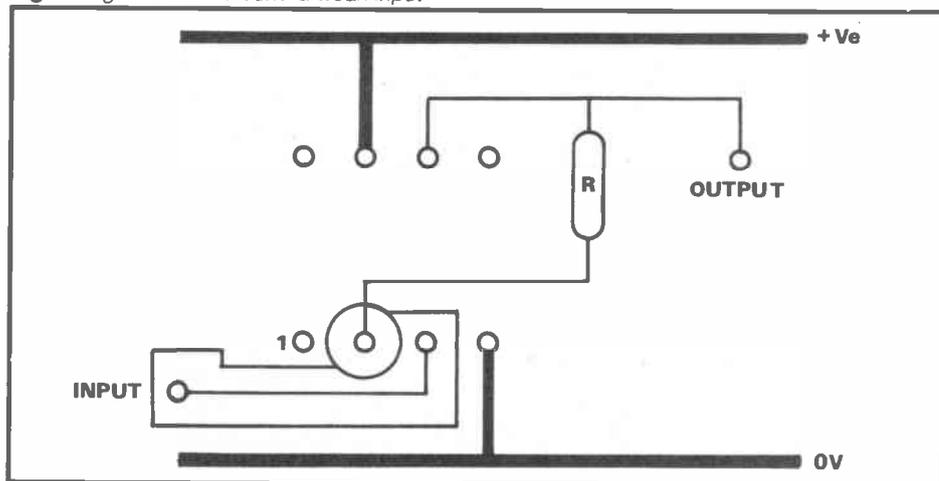


Fig 3: Measuring ground loops

Fig 4: A guard track around a weak input



The World of D | A | T | A BY DON FIELD G3XTT

The highlight of July was my operation, with friends from the Cambridge University Wireless Society, from the Flannan Islands (as GB0FLA) and St Kilda (as GB0SK). I hope many of you managed to work us. Having suffered force eight gales and the pleasure of ferrying equipment ashore in an open dinghy, I began to get a taste of what serious DXpeditioners have to go through. Comments from callers such as, 'Can't you activate some of the other islands in the group while you are at it?' didn't go down too well when it was blowing a gale for much of the time. And the other islands, which we could see from where we were, had no landing stage – just a sheer rock-face covered in slime and seaweed!

Those of you who attend the RSGB's HF Convention on 1 October at the Belfry Hotel, near Oxford, will get more of a flavour of DXpeditioning. F6EXV will talk about the operations from the Marquesas and Austral Islands, and there is the possibility of some other, equally intrepid, DXpeditioners on hand as well. Slides of some recent IOTA operations will be shown on the Saturday evening for the benefit of those staying overnight.

WARC bands

Good news as you probably now know. The DTI had a last minute change of heart regarding 18 and 24MHz, and has agreed to extend to them the same power, antenna and mode privileges that we enjoy on the other HF bands. This took effect from 1 July, and since then I have noted a relatively high level of UK activity. For my own part, some brief forays on to 18MHz, using just a vertical antenna, have produced contacts with most continents. You really don't need a beam or high power to succeed, at least for the moment. Listening to 18MHz while writing this, I have heard HZ1AB, J52US and FM5CW in just the last few minutes. Japanese stations have also been coming through at good strength in the evenings.

Forthcoming DX

The big news is that the LA-DX Group, who put Peter First Island on the air in early 1987, is hoping to make a similar success of Bouvet Island, with a planned starting date of 24 December. The cost

will be in the region of a staggering \$200,000, and fund-raising efforts have already begun. G4DYO of DX News Sheet is running a 'DXCC Speed Challenge' in aid of Club Bouvet, and we can expect other similar ventures. In the initial press release about Bouvet there is talk of strong, frightening gusts of wind, 'impossible' landing conditions and worst case ocean-wave heights up to 30ft, making landing and especially departure very difficult. Seals, weighing up to five tons, guard the shore, while the smell of the penguin colony is disgusting. The operators will likely have to carry from one to two tons of fuel and equipment up to half a mile from the landing site. No fresh water is available on the island. If you want to find Bouvet Island on a map, look well to the south of South Africa, though to the north of Antarctica.

Now to sunnier climes. OH1RY is planning yet another tour of the Pacific, this time with OH2BAZ, OH2VB and OH2BGD (who plans some RTTY operation). The dates are 19 October until 23 November. They hope to sign YJ0RY from Vanuatu, 3D2VV from Fiji and 3D2RY from Conway Reef (3-13 November).

The rumour mill has it that EI4GV, who is actually Belgian, and others will operate from Mount Athos from 2-9 September, and from Albania from 9-16 September. Now wouldn't that be nice!

K5MK/5 may operate from 20-22 October from Dernieres Island. This one ought to qualify for an IOTA reference once activated. Check on or near 28600, 21250, 21260 and 14260kHz. Ron Wright ZL1AMO, may appear from the North Cook Islands between late September and early November. I have no more information on this one.

Prefixes

Moroccan amateurs were allowed to use the CN60 prefix from 9-15 July to celebrate, if I recall correctly, the King's sixtieth birthday. Some of the US trust territories in the Pacific have recently been allocated new prefixes by the ITU. It is anticipated that KC6 stations will soon appear with call signs in the V63AA to V63ZZ series and KX6 stations, with call signs in the V73AA to V73ZZ series.

Some of the recent USSR prefixes have been confusing, to say the least. Back in May there was a number of

stations using prefixes EM, EO, ER, EU, EV and EW. They were all to do with victory in WWII and were allocated as follows:

EM – Stations located in former capitals of guerilla activity;

EO – Stations in cities that were awarded medals for their contribution towards victory;

ER – ER3A, ER3W etc, were located in Moscow;

EU – Stations in the capitals of the fifteen Soviet republics;

EV – Stations in the capitals of Soviet autonomous republics;

EW – Stations located in 'hero' cities.

How do you identify the DXCC country of these and other special USSR call signs? The first or only letter of the suffix identifies the second letter of the standard USSR prefix. The digit is meaningless, except for stations located in Asiatic Russia, like EO0AAK and EO9ACS. For oblast collectors, in call signs with two or three letters in the suffix, the second letter of the suffix usually indicates the station's oblast. For example, EM0COG would be in Byelorussia (UC) in the oblast normally associated with UC20.

Liberian amateurs used the 6Z prefix during July to celebrate the 142nd anniversary of independence. If you worked five of these stations you qualify for an award. Send a certified log extract (signed by your national awards manager or two licensed amateurs) to: LRAA Awards Manager, PO Box 10-0987, 1000 Monrovia 10, Liberia. The fee is \$5.00 or ten IRCs. No QSLs are required for the award, but if you want QSLs for any of the special stations, then apply to: R Wynhoff K5HUT, 12915 Memorial Drive, Houston, Texas 77079, USA.

Awards

ZD8MAC kindly sent me details of a number of new awards. The South Atlantic award is available for working at least one station on each of the South Atlantic dependencies, ie, Ascension, St Helena and the Falklands. The Ascension Island award is for working at least three stations on Ascension Island. The Air Bridge award is for working one station in the British Isles, one on Ascension and one in the Falklands. To apply for any of these: list the relevant log entries, certify that the QSOs have

taken place, and send twenty IRCs, \$10.00 or five pounds sterling to: Awards Manager, PO Box 2, Ascension Island, South Atlantic.

As well as the special award mentioned earlier, the Liberian Radio Amateur Association has a wide-ranging awards program. These include:

– Worked All Liberia Award. For contacts with stations in the nine counties of Liberia since 1 April 1964. The contacts must cover at least three different bands.
– Work Fifty Countries Award. Worked stations in at least fifty countries since 1 April 1964.

– Work 100 Countries Award. As above, but 100 countries.

– Six Counties Award. Worked six Liberian counties, with the contacts covering at least two bands.

– West African Countries Award. Worked eight West African states plus at least five Liberian stations, using at least two different bands since 1 January 1962.

– Work ECOWAS Countries Award. Worked stations in at least twelve member countries of the Economic Community of West African States (consisting of Benin, Burkina Faso, Cape Verde, Gambia, Ghana, Guinea, Guinea Bissau, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo), one of which must be Liberia, on at least three bands since 28 May 1975.

The charge for each award is \$5.00 or ten IRCs, and the application method and address is as given earlier. The log extract should include the callsign of the station worked as well as the date, time, band, mode and signal reports.

Contests

The major contests to look out for during September are the Worked All Europe SSB Contest on 9-10th (see last month), the Scandinavian Activity Contests (CW on 16-17th and SSB on 23-24th), and the CQWW RTTY Contest on 23-24th.

Looking further ahead, the IRSA Contest Championships, sponsored by **American Radiosporting Magazine**, take place on 1 October (CW leg) and 7 October (SSB leg). The VK/ZL SSB and Ibero-American SSB contests are on 7-8 October, and the RSGB 21/28MHz Phone Contest is on the 8th. The VK/ZL CW Contest is on 14-15th and the RSGB

21MHz CW is on the 15th. Jamboree on the Air is on 21-22 October (how about offering to help your local scout group with this one?). And then the big one of the year, the CQWW Phone Contest, takes place on 28-29 October. Next month I will give some operating tips for this one, as well as a list of some of the DXpedition operations which will be active for the contest. Just to start you off, I hope to join other members of the Chiltern DX Club in a major multi-single effort from Jersey as GJ6UW, with some CW and WARC band operation before and after the contest.

While on the topic of contests, I was fascinated recently to read the results of a survey, conducted by the **US National Contest Journal**, of those who take part in contests and what equipment they use.

According to the survey (of US contesters), the typical HF contest enthusiast is forty-three years of age, degree educated (89% of respondents to the survey had a university degree, 20% also had a higher degree), with a family income of \$60,000. He has been licensed for twenty-seven years, having first obtained his licence when sixteen years old, much prefers CW to SSB operation, and regards the CQWW contests as far and away his favourites – well ahead of WPX, ARRL DX etc. He uses two towers, owns two transceivers, and works an average of 6,600 contest QSOs a year. He enjoys contests mainly for their competitive nature; and his competitive instincts are likely to extend to other sports, such as Baseball or Softball. Interestingly, he shares the popular view that contests can be antisocial and that there are too many of them, but regards the major contesting events as something special, deserving of lots of effort and enthusiasm.

At first sight these results may seem surprising, but I think that if such a survey was conducted in the UK, the results would be similar. We may need to make do with more modest stations, mainly due to space limitations (the biggest stations in the US were those in the midwest where space is more readily available), but the majority of serious UK contesters have been at the game for many years, and are professional people who work hard and play hard.

A dream antenna

Another article in **National Contest Journal** caught my eye, and is also related to serious contesting. Jeff Briggs K1ZM, wrote about his experiences operating from NP4A using Pedro's new full-sized, three-element, 80m beam up to 160ft! Jeff operated with this monster antenna in last year's CQWW CW Contest, going for a new single band world record on 80m, and ended up working 2,256 stations in thirty-one zones and 103 countries. Over 1,500 of the contacts were with Europe and Japan. As far as I am aware this is the first time DXCC has been worked in a contest weekend on 80m, though it is a frequent occurrence on the higher bands. Jeff found it hard-going in the early hours of the contest, simply because of the vast number of European stations calling him at any one time. However, he found the front-to-side ratio of about 25dB invaluable in keeping the US signals to a minimum, allowing him to press on with working three point QSOs. Apparently an article on the construction of this antenna is due to appear in **CQ Magazine**, though somehow I doubt that there will be many imitators!

Preparing for autumn

That wraps it up for another month, except for a final piece of advice. Do ensure that all your antenna work is done before the autumn winds and rains set in. If all the predictions are to be believed, we could well see some of the best propagation for years during the next few months, and it would be a shame to miss out. If you are pushed for space, why not try a quad or yagi just for 10m? They don't take up too much space and need not be more than about 30ft high, and 10m should yield some of the best DX of the lot. My guess is that anyone working exclusively on 10m in the October CQWW Contest could well expect to be able to work up to 150 countries in the one weekend, but you will need to put out a reasonably competitive signal to achieve that score.

As always, if you have any news or views, or would like further information on awards or contests, then drop me a line via the editorial office or direct to: 105 Shiplake Bottom, Peppard, Henley-on-Thames, Oxon RG9 5HJ.

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THE PYE M2000 RADIOPHONE CONVERSION FOR THE 2m BAND

by Bernard Nock G4BXD

The M2000 is a 25W, fifty-five channel (25kHz spacing), VHF radio telephone which operates at around 165MHz. The onboard microcomputer controls the frequency selection and all the Tx/Rx switching in the phone system.

Conversion

This 2m band conversion involves removing the PCB with the micro and the PCB housing the tone circuitry, and provides a means of manual channel selection. You will need a small 12W soldering iron to carry out the work inside the black box, but this only requires a basic knowledge of soldering skills.

The basic layout of the M2000 in **Fig 1** shows the PCB edge connector, the micro PCB and the tone PCB. After removing the retaining screws, these PCBs can be removed and discarded.

Two new xtals need to be fitted to tune the synthesiser oscillator and mixer on to the right frequency and to give Tx/Rx on the same channel. One xtal is a standard 10.7MHz and should present no problem, but the other will depend upon the coverage required (I used a 40.650MHz xtal to give a coverage of 144.400-145.975MHz. This xtal will need to be ordered). **Fig 2** shows both xtals and their positions. The formula for the 40MHz xtal is given as:

$$(f_{RX} + 18.2)/4$$

The manual channel-change is in the form of a binary bit pattern and replaces the digital signal coming out of the micro PCB. Six bits are required to obtain full coverage on 2m. Fortunately, there are

six spare lines in the control box cable once the control box is modified. There are a few component changes required in the radio, mainly replacing several capacitors to lower the oscillators. No additional caps are needed on the Tx or Rx tuned circuits. **Fig 3** shows which capacitors require alteration.

If you are unlucky enough not to have the back-plate housing the voltage regulators and connectors but, simply, the black box ending in the two D way connectors, then a bit of work will be required. **Fig 4** shows what is on the back-plate, but all you basically need to provide is the 5V regulated supply and a

few connectors with which to hang the aerial, LS and power input, etc.

In service, the handset came in through the back-plate, but this can be fed down the control box cable with a bit of rewiring, and the LS can still be taken from the back.

After fitting both xtals and replacing the three capacitors, you can start on the control box. Remove the front-plate and discard the contents of the box. Then cut a piece of copper-clad board to size, fit it in place of the front panel and secure the board with four bolts.

The actual configuration of the control box is up to the individual, but the best

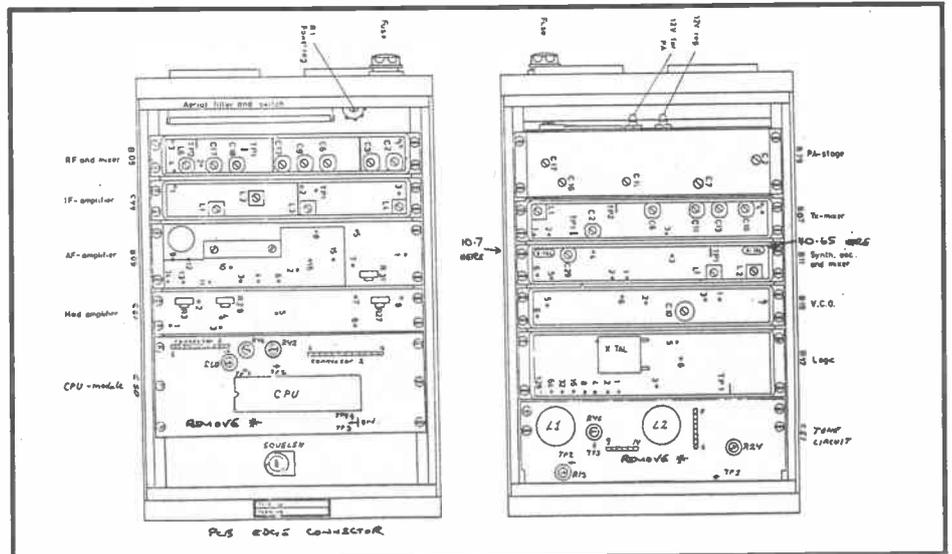
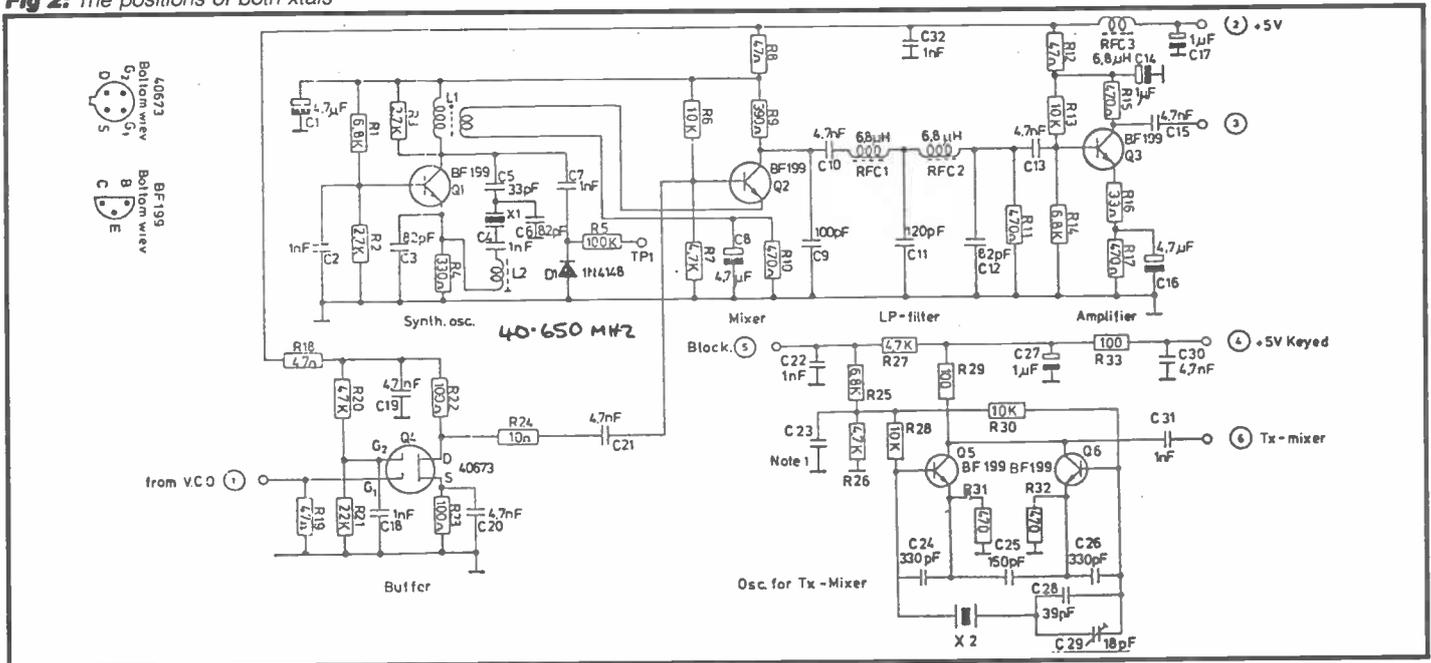


Fig 1: The basic layout

Fig 2: The positions of both xtals



THE PYE M2000 RADIOPHONE CONVERSION FOR THE 2M BAND

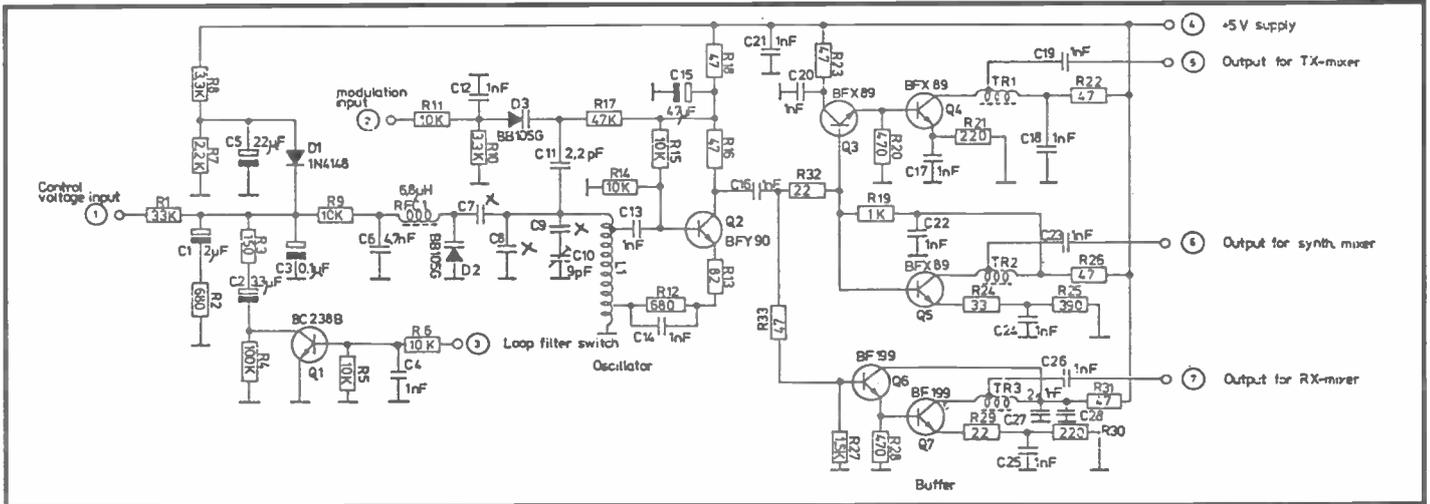


Fig 3: Schematic diagram showing which capacitors measure alteration

Bit	32	16	8	4	2	1
144.400	0	0	0	0	0	0
145.975	1	1	1	1	1	1

Table 1

Bit	32	16	8	4	2	1
145.600 Rx RO	1	1	0	0	0	0
145.000 Tx RO	0	1	1	0	0	0

Table 2

solution is to keep it as simple as possible. The circuit of the original box is shown in Fig 5, and Fig 6 shows an alternative. Fortunately, enough lines can be obtained to supply the six channel select lines: PTT, volume, squelch, on/off lamp, Tx lamp, mic and ground.

Fig 5: Print connector plug for the mother board and circuit of the original box

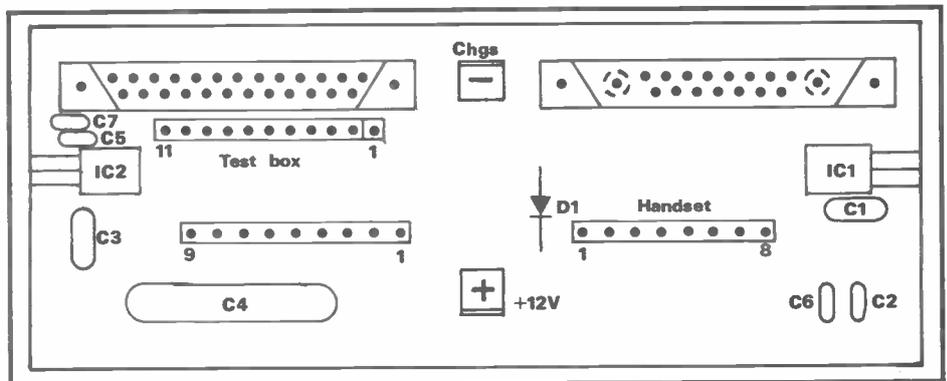


Fig 4: Rear view of the back-plate

The digital code for selecting the frequency is shown in Table 1.

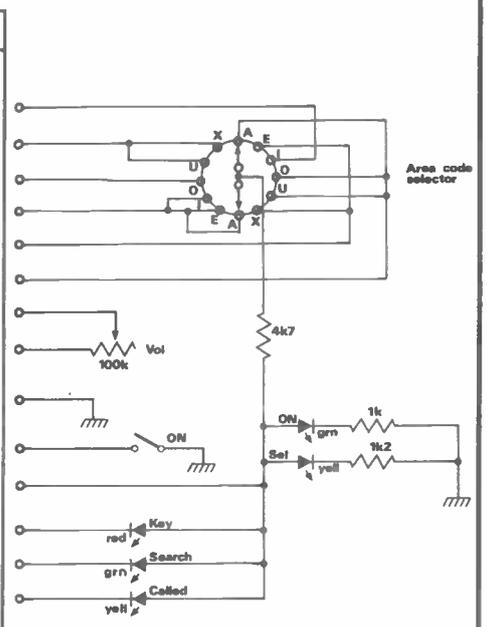
This code requires certain alterations when a repeater shift is needed. The

example in Table 2 shows why.

Bits 32 and 8 need to be reversed on Tx by using a relay which only operates when a shift is needed. A complicated

PRINT CONNECTOR PLUG FOR MOTHER BOARD C53A FRONT SECTION NR 206-OV2F

Function	Colour	No	No	Colour	Function	Function	Colour
Ground	white/blue	A	1		Area code I	Area code I	red/black
On/Off	grey	B	2		Area code U-X	Area code U-X	red/white
Area code U-X	red/white	C	3		Area code O	Area code O	red/green
Area code O	red/green	D	4		Area code I-E-I	Area code I-E-I	blue/black
Area code I	red/black	E	5		Area code E-X	Area code E-X	blue/white
Area code F-X	blue/white	F	6	N	Area code A-O-U	Area code A-O-U	blue/green
Area code A-O-U	blue/green	H	7	O	+5V supply	+5V supply	violet
Area code A-E-I	blue/black	J	8	T	Volume	Volume	brown
+5V supply	violet	K	9	U	Ground	Ground	white
Volume	brown	L	10	S	On/Off	On/Off	grey
+12V for lamps	light green dark green	N	11	E	+12V for lamps	+12V for lamps	light green dark green
Key lamp	pink	R	12	D	Key lamp	Key lamp	pink
Search lamp	red	S	13		Search lamp	Search lamp	red
Called lamp	yellow	U	14		Called lamp	Called lamp	yellow
Ground	black	V	15				
			16				
			17				
			18				



THE PYE M2000 RADIOPHONE CONVERSION FOR THE 2m BAND

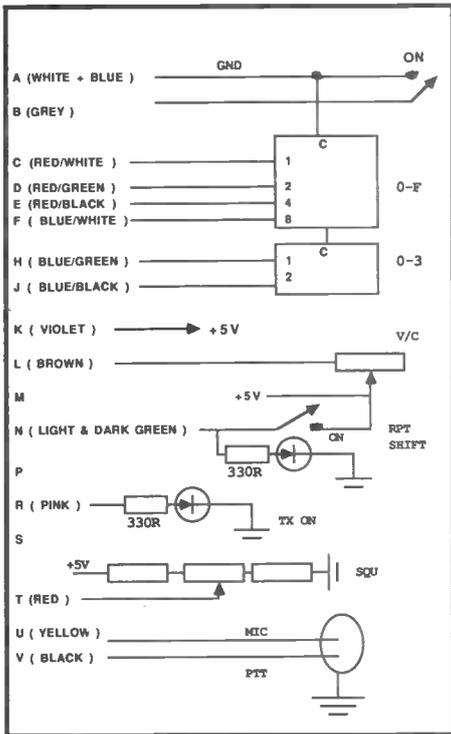


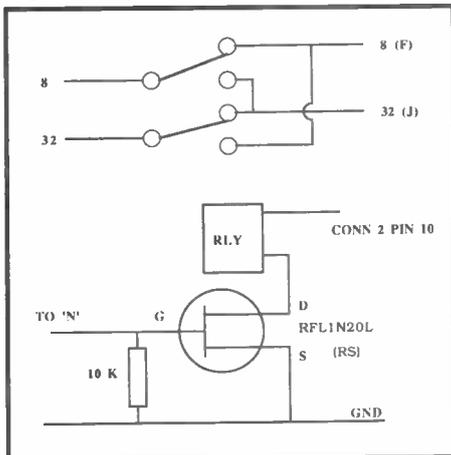
Fig 6: Alternative circuit (see Fig 5)

CCT could be used which automatically gives RPT shift when the code falls on an RPT channel, but the easier option of manual switching should be used (Fig 7 shows the wiring). Originally, the relay was wired so that the switch on the control box supplied the volts and the other end of the relay was wired to the PTT line, but this upset the PTT switching too much, so an alternative CCT was devised.

One of the pins on connector 1 goes +12V on Tx. The switch in the control box now feeds 5V to the gate of a FET which has the relay coil in the drain; this gives no problems at all. Again, a complicated CCT could be devised to obtain a more realistic display of the actual frequency in use, but two hex thumb-wheel counters, each giving a 4 bit binary pattern, should be used; the code representing the channel soon becomes familiar with use (see Table 3).

In the main box the two transistors and their associated caps and resistors are

Fig 7: Repeater shift CCT



Channel	Code
145.500	2C
145.525	2D
145.600	30
145.700	34
ETC	

Table 3

located near the front of the box on the micro side; these being the driver CCT for the searching and called lamps in the old control box. Connections 'U' and 'T' on the edge strip (see Fig 8) can now be removed; this gives a few copper pads to hang other wires on. The end pin on the edge connector goes to ground. This track is cut because pin 5 is used for the PTT line.

The multipin plug that used to feed the code signals to the tone PCB can now be used to get the 6 bit channel select across to the synthesiser (see Fig 8) by using the old connector 2 on the micro PCB. On the PCB C61 (mod amp), remove the capacitor connected to pin 5 and link a wire from pin 5 to pin 1; this gets the new mic connection from the edge strip.

Tuning

Having changed the xtals, inserted the new capacitors and completed the new control box, the final task is to tune the set for use on the 2m band.

Synthesiser: Connect high res dc VM to TP1 on B11. Tune L1 for approx 3V. Coil L2 is for frequency adjustment.

PLL: Dc VM to TP1 on B17. Oscilloscope (1V/DIV) to TP1 on B17. Adjust the

VCO trimmer for 'lock'. Lock is a stable 25kHz which 'ripples' as the dc volts increase while adjusting the trimmer (adjust for 3V). Set channel select to the highest and lowest setting and ensure that the lock remains.

Rx mix: Dc VM to TP2 on B08. Tune C17 and C18 for maximum. Connect the signal generator to the aerial socket. Dc VM to pin 4 on C49. Tune the following trimmers and coils on B08: C2, C3, C6, C9, C10 and L6. Tune L1 on C49 to maximum. Decrease the signal generator output to help get the CCTS right on peak. If a signal generator is not available, then use a local repeater. Finally, fine-tune L6 (B08) and L1 (C49).

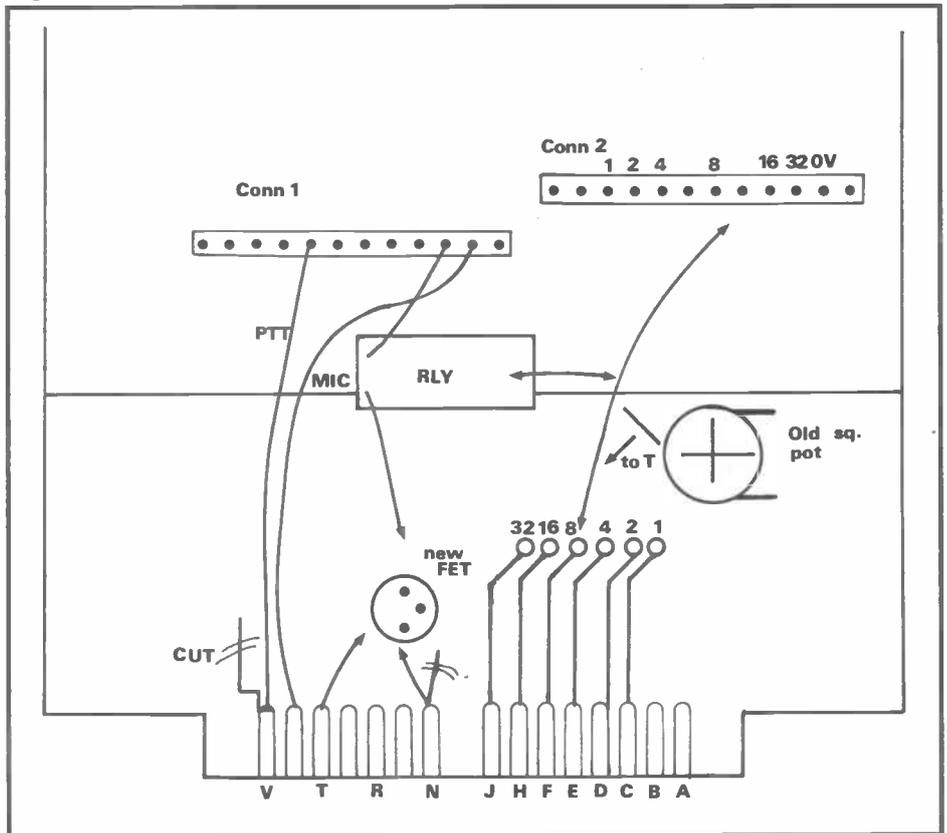
Tx mix and amp (B07): Dc VM to TP1 (B07) and tune L1 for maximum. Set caps C2, 6, 11, 13 and 18 to maximum. Dc VM to can of transistor 2 (the middle one) and tune C2 and C6 for maximum. Use an RF probe on the output coax link, tune C11, C13 and C18 and readjust C2 and C6 for maximum output (150mW).

Tx PA: Turn pot R1 (B57) counter-clockwise. Use an SWR bridge into a dummy load on the aerial socket. Tune all PA trimmers to maximum output, with a final tweek on C18 (B07). Adjust the pot R1 to set the output power level.

Frequency: If the xtal is set correctly, the set should be on the 25kHz step channels. Frequency adjustment for the Rx is via coil L2 on B11. Set the Tx frequency using C29 on B11.

The set will now receive and transmit on 2m. The 25W Tx/Rx has a quoted sensitivity of 0.4mV for 20dB sinad, and the RF and mixer transistors can be replaced with more active devices later.

Fig 8: Directing the 6 bit channel select across to the synthesiser





Tony Smith G4FAI takes his bimonthly look at the world of dots and dashes

No-code entry in USA?

A *Morsum Magnificat* reader in South Africa runs an amateur Morse class. After reading the debate about the future of Morse in recent British and American magazines and seeing the results of readership surveys, he tells me his students are convinced the test will be abolished shortly in both countries. They think that other countries will follow suit and they are wondering whether it's worth continuing with their classes.

There have certainly been a lot of words generated on the subject but at the present time it's all wishful thinking based on a misunderstanding! The heated debate in the USA relates to various proposals that there should be a 'no-code entry' into amateur radio for operation on certain frequencies *above 30MHz*; something we have had in Britain for years! In *CQ* magazine, June 1989, Ed Judge W5TOO reports on the conclusions of an ARRL Committee specially set up to study the issues and make recommendations to the ARRL board of directors.

The Committee recommended that the present USA Technician class be renamed 'Technician Plus' and that a new code-free 'Technician' licence be created with all operating privileges above 30MHz, including 50MHz but excepting 2m, where only digital operation between 144.9 and 145.1MHz would be allowed. Upgrading to the new Technician Plus grade would be effected by passing a Morse test of 5wpm giving access to the 80, 40, 15, and 10m bands, exactly as with the present Technician grade.

Using virtually the same argument as the RSGB, the ARRL thinks that under future pressure the greatest strength of amateur radio will be in numbers. W5TOO comments that bright, young people 'computer literate, technically adept, and creative' are willing to prove their competence in areas of regulations and technical knowledge but are unwilling to submit to what they view as a non-

relevant, out-moded and unreasonable requirement – the Morse code.

During the Committee proceedings, Dave Sumner K1ZZ, Executive Vice-President of ARRL, advised that the League estimated a growth rate in new licensees – with a no-code licence – of 12%, provided they worked hard at recruiting. But it was agreed there would not be the flood of new people some seem to fear. ARRL will now decide if it wishes to petition the FCC for an amendment to the amateur regulations to permit code-free entry as recommended by the Committee.

By contrast . . .

Undoubtedly national societies everywhere are attempting to do what they think is best for amateur radio, but it is interesting to compare their different approaches.

On the basis of the American argument, the fact that the UK already has a code-free licence for frequencies of 50MHz and above should surely mean that we are already successfully recruiting our fair share of 'computer literate, technically adept and creative bright young people'. Yet the RSGB in its own efforts to bring these same elusive folk into amateur radio is proposing a new novice licence to include a 5wpm Morse test, which in the States is thought to keep them away!

While their concern on behalf of amateur radio is to be applauded, one sometimes wonders if the societies are on the wrong track. I was particularly struck by the comment of an industry spokesman at the Miami Hamfest, reported by W5TOO, 'If you stood at the entrance to the World's Fair and handed out blank Extra Class tickets, maybe one-hundredth of one percent would ever be used'. W5TOO also commented, 'We all love amateur radio . . . But the sad fact is, in the eyes of a public accustomed to supersonic jet travel and intercontinental long-distance calls, amateur radio has lost its magic.'

It seems more than likely that the major

effect of abandoning the Morse test completely would be inside amateur radio, resulting in greater use of the HF bands by existing amateurs, rather than the attraction of more newcomers to the hobby. Whatever the eventual result, however, the Morse test is unlikely to be dropped as a qualification for amateur operation up to 30MHz until it is no longer a requirement under the international radio regulations.

FCC licence revision

The FCC has just approved a full-scale revision of their regulations relating to the Amateur Service, effective from 1 September 1989. This retains the Morse test in accordance with international regulations, although their interpretation of the test requirement is different from ours. The FCC says that while the international rules require amateur operators to prove they are able to send correctly by hand and to receive correctly by ear texts in the Morse code, their policy is that a telegraphy receiving test is adequate proof of both sending and receiving ability, although volunteer examiners do have the option of administering a sending test in any particular examination if they wish.

The rules

The test involves receiving all the letters of the alphabet, numerals 0-9, full stop, comma, question mark, oblique and the prosigns AR, BT and SK. The test must last at least five minutes and contain each required telegraphy character at least once. Five letters count as one word while numerals, punctuation marks and prosigns are counted as two letters. Tests are administered at different speeds according to the amateur licence class applied for. Novice and Technician Class need a minimum of 5wpm; General and Advanced Class, 13wpm; and Extra Class 20wpm. Acknowledgements to W5YI REPORT for this item.

FISTS straight key week

The above event takes place from 0001hrs on 3 September to 2359hrs on 9 September 1989. It is intended to encourage not only the use of the straight key but also to foster activity in CW.

This is *not* a contest. All stations are welcome to join in and FISTS members will be invited to submit nominations for the 'Best Fist of the Week'. In sympathy with EUCW rules, *any* station (whether a member or not) receiving two or more nominations will receive a certificate with the club's compliments.

All FISTS members worked during this period will qualify towards the FISTS Century Award (send an SAE for details) and the club call (G0IPX or G0IPX/M) will be active.

The suggested frequencies to try are: 3.550/3.559, 7.027/7.0295 and 0.55 on HF bands. FISTS members will also be active on the WARC bands.

All enquiries about the FISTS Morse Club should be sent to: George Longden G3ZQS, 119 Cemetery Road, Darwen, Lancs BB3 2LZ.

SHORT WAVE LISTENER

TREVOR MORGAN GW40XB

Phew! That's about the first word that comes to mind! As the man said, 'It ain't half hot, mum!' However, some of you have been brave enough to venture into the shack and get some listening done, particularly our awards' chasers.

Awards

With two claims in for Gold this month, it's a fight as to who's first in line, so it's out with the old coin again. So, winning the toss is our old mate Darrell Jacobs, of Mortimer, who has claimed his *second* Gold Award for 1,000 prefixes logged, this time on 15m only! It's taken him three years to compile the list.

Among the expected usuals are such niceties as the following: OE5JTK/YK (Syria), TG/W2JGR (Guatemala), V3JRS (Belize), HH7GE (Haiti), ZA6AL (Albania, logged in 1986), TX0A (French Guiana), 5U7/TU4BR (Niger), 9V1WP (Singapore), FT8TWP (Crozet Island), HN7C (Syria) and VS6, A4X, A6X, 6CB, T50, 3DO, HS0, WP6, H44 and HB9SB/MM at 9°5'N, 47°46'W! Darrell now uses an Apple III computer, so he may go off on a different tack... who knows?

Our other Gold winner is Terry Lincoln, of Weymouth, who also claims one for 15m (this band is really showing some excellent stuff lately). Terry had some good loggings too with: A47, BV4, CE7, CX6, HL0, JW5, KX4, TR8, TZ0, VQ9, VS6, XQ2, 3B8, 6TB, 6W6 and 8Q7. Very nice effort, Terry.

Our next claim is from Brian Biddle, of Leicester. Brian uses an FT-707 which has a good receiver section, and he claims the North America Continental award with: W7ABX, KL7BJ, VE8RCS, 8P6OV, J37AH, J6LB, KP2A/KP5, J7DSL and I88AQ, among others. It's a respectable start to the hunt, so well done, Brian.

Peter Cain, of Newcastle, claimed the Broadcast Monitor award for 100 stations logged. Nothing exotic here,

but some nice loggings nevertheless (frequencies are in brackets). They include: Ibra Radio (7110), Radio Damascus (9950), VO Ethiopia (9560), Radio for Peace (13660), KUSW, Utah (15225), Radio Bangladesh (11510), Radio Veritas (15465), Voz del Cid (6305), KFBS, Saipan (12025) and Radio Globo (11805).

Pete uses the R1000 which has a good reputation, but it's amazing what can be heard on the simplest receivers with just a little patience.

The idea behind offering these awards is to encourage owners of even basic radio receivers to really listen to the different bands. The technique of slowly moving the tuning control instead of whipping between Radio 1 and Capital Radio is easily mastered, and you will be surprised by what can be heard on those 'foreign' broadcasts.

My first receiver

The first receiver I ever had was an Ultra 'all band' radio which was powered by accumulators (we still had gas lighting in those days!). The aerial was a 'Woolworth's wonder' wire: a length of stranded copper wire that was sold as a radio aerial at that emporium. My father and I had some fun with that set until the valves started to fail, and when we got real electricity (240V dc!). We upgraded then to a radiogram which wasn't as much fun, but dad loved Caruso so that was the end of 'DXing' for a while.

By the time real receivers were available in the late forties to early fifties, I was suffering from puberty and all that entailed. So it wasn't until the early sixties when I was able to afford a Perdio portable that I rekindled my interest in world broadcast reception.

What a difference nowadays! Not only is there a surplus of equipment available, but most of us can actually afford to buy it! However, it is not necessary

to spend heaps of money to enjoy exploring the world of radio. Even some of the older receivers are capable of giving good results.

Successful listening

When you are interested in listening, it doesn't pay to get too bogged down in technicalities. Many of the lads who claim major awards, not only ours but national or international ones, owe their success, not to technical superiority, but by simply knowing what their equipment is capable of and how to get the best from it. This knowledge comes from pure 'hands on' experience of where to look and at what time for that rare station. There's nothing to beat it, and the more time you spend just listening and logging the better. You'll soon realise that certain frequencies are better at certain times and that certain atmospheric conditions are a sign of good DX propagation. Aerials are also a study in themselves, and it's only by using different configurations of wire aerials and comparing them that you'll find out what is best for your locality.

From the mailbag

Derby and District ARS have released the results of their Third Annual 144/146MHz contest. There was only one participant in the SWL section, D Gilbert, of Surrey, who scored a respectable 288 points.

Winner of the full-power section was G0FEH/P, with G1EUU/P and GW4VVX/P as runners-up. The low power (30W maximum) winner was G4RLF/P with G7APD/P and G4ARI in the chase. This contest, held in March, is always well-supported, but the listeners' section could do with a boost, lads!

The British Amateur Radio Teledata Group has had a couple of retirements from the committee. The new membership secretary is Ann Reynolds G6ZTF. The components/software depart-

ment is now in the charge of Ted Hatch G3ISD, and publications are handled by Peter Adams G6LZB (they do a nice range of beginners' guides, too).

The 91st Leicester Scouts ARC is promoting the GB Award in November using their callsign, GB4GBA. The award is available to listeners and licensed amateurs having 100 confirmed contacts with UK special event stations, and endorsement stickers are available up to 500. Full details are available from G4SJJ or myself.

The Ormskirk and District ARC will be on the air from 9-10 September with G4SNX from the National Vintage Tractor and Engine Club Rally in Bickerstaff. Mike Marsden BR85477 will be there to greet any listeners who pop in.

Some readers may remember me mentioning the Great Circle Short Wave Society of Virginia, USA, a couple of years ago. The President, Dr Harold Cones, and I created a 'sisterhip' between the GCS and the International Listeners Association, which was started through this column four years ago.

On 15 September, my wife and I will be joining Harold and the gang at the ARRL Convention at Virginia Beach. Among other things planned, I will be operating 20m portable, so I would be very pleased to receive any reports on signals heard from there.

The dates to listen in are from 14-19 September (from Virginia and Ohio) and from 21st to 24th (from Florida). I will be operating SSB around 14.200 to 14.250 and CW around 14.045 to 14.075. The times should be around 2300BST and I'll be signing with GW40XB/W4. I'll try to do something special in the way of QSL cards!

Well that's about it for this month, so have a successful month of listening.

Any band reports, news or comments to: 1 Jersey Street, Hafod, Swansea SA1 2HF.

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News and comment from Glen Ross G8MWR

Several letters have come my way recently containing complaints about the spreading of SSB signals. The problem lies in the fact that people believe the manufacturer's blurb, which tells you that the device you have just bought from them is a 100W, or whatever watt linear. Now the fact that the gubbins will produce 100W is not denied, but doing so in a 'linear' manner is very much in doubt.

Definition

Let us recap on what a linear should do. For this purpose we will assume that it has a power gain of ten times and is rated at 100W maximum output. The output should follow the input drive power exactly, or in a linear fashion, hence the name. So, 1W in gives 10W out and 5W in gives 50W out, but as the drive power is increased beyond this sort of level you find that the increase in output does not follow the increase in drive: you have run up against a phenomenon known as compression.

Nasties

This has the same effect as overdriving an audio amplifier; when this runs into compression the peaks of the wave are clipped and you hear the result as distortion. The same thing happens in our linear, and the resulting distortion is heard as splattering noises up and down the band.

Much investigative work on this was done a couple of years ago by G3OSS, and his figures for various commercial amplifiers were published in several reviews for this magazine. His general conclusion was that transistorised amplifiers maintained linearity *only* when driven to around 70% of rated power, push them much beyond that and you are in trouble. All the preceding remarks only apply to SSB. If you are working FM then the non-linearity is of no consequence.

Rough guide

Having established the electronic cause of the problem, we now need to

look into why so many linears get overdriven. As the problem with the linear was believing the paperwork, the majority of overdriving is caused by believing the SWR meter. In most cases, the operator sets the SWR meter to read forward power and then runs the linear up on FM to see what he can squeeze out of it. He then goes to SSB and talks it up to the same meter reading. Here he makes his big mistake. He forgets that the meter needle suffers from inertia and that there is no way it can respond fast enough to follow the speech peaks. While the meter needle is on its way up the speech peak is falling again, and the best the meter can do is to average it all out.

Practical

What does all this mean in practice? If you get 100W out on FM, then you should only talk up the power so that you get a reading of around 30W on speech peaks. You will still get 100W output on peaks, the meter just can't read it fast enough. Fortunately some of the latest SWR meters can measure PEP output, and if you are lucky enough to have one of these, then simply drive the rig for full output from the linear.

The mole report

One of the major events in the VHF man's diary has been the RSGB exhibition at the NEC, because this is where he has the opportunity to examine all the latest gadgets and new equipment. This year the RSGB decided not to run the show, and many people assumed that this signalled the death of the event. Our friendly mole tells me that this is not the case, and that the RSGB will return to the NEC next year. The dates for your diary are probably 21-22 April. If you want more information contact G3MVV, who is QTHR.

More news from the mole is that the RSGB has sent the proposals for the new entry level licence to the DTI and that they have bowed to public opinion and dropped the Student name; henceforth, it will be known by the name everyone

else would have used from the start, Novice. Full details of the proposals are not known as yet, but the mole is working on it.

Abusive

During the last couple of months there has been a lot of talk about repeater abuse and just whose responsibility it is to clear up the problem. The DTI took the matter in-hand a few days ago when they closed down GB3SL, the south London repeater, for a period of twenty-eight days to allow a cooling off period. Anyone who listens to the London repeaters will know the abuse and foul language to be heard make most other repeaters' problems appear insignificant by comparison. The snag is that all the hassle will start up again just as soon as the repeater comes back on air. It is not the repeater that needs closing down but the people who cause the problem. Shutting down GB3SL simply means that all the good guys suffer the inconvenience of being unable to use the system, whilst the people who caused the problem will simply move on to another repeater. Effective monitoring by the RIS is now a thing of the past, and far too many operators actually play into the hands of troublemakers by responding to them. This gives troublemakers the satisfaction of knowing that they are causing problems. The far better solution is to completely ignore them and let them assume that their efforts are in vain.

50MHz report

This is the band where the VHF man can get into the serious long-distance stuff. I shall be carrying detailed monthly reports of the best activity. Not on a 'who worked where and what' basis, but as a general synopsis of the better days' activities each month.

On 19 July the ZB2VHF beacon was being received before 0800hrs and was still audible as late as 2300hrs. During the morning CT4KQ and T77C were worked on the south coast with signals up to 599. By early afternoon, many French stations were being worked as far north as the Midlands. Other stations heard or worked were: 9H5EE, 9H5O and 9H5FL – all from Malta. Around 1600hrs SV1OE was heard calling QRZ W for some considerable time, but there is no report of an actual contact. At about 1630hrs 9H1FL and 9H5E were working into Finland, and SV1OE contacted G3JVL. Shortly afterwards, various Greek stations were heard on the band. At 1735hrs ZS3JO was calling CQ and reporting reception of GB3RMK. Mid-evening saw several Spanish stations contacting England and Holland.

On the 21st the band opened around 1130hrs when the ZB2VHF and 9H1SIX beacons were audible. At 1200hrs T77C was heard working G stations and was still there at 1300hrs. At about the same time 9H5EE was heard contacting G and PA stations. Between 1400 and 1730hrs many Finnish stations were on the band, and at 1700hrs ZS3JO was heard contacting many OH stations and also had contacts into Scotland. From around

1930hrs there were many French and Dutch stations working into England, and the ZB2VHF, CT0WW and 9H1SIX beacons were all very strong. From around 2100 to 2145hrs ZD8MB was putting a good signal into G and GW. There are also reports of many OH stations contacting ZS3E during the day.

Even better

The following days showed even better results. On the 22nd the band opened at 0700hrs with strong signals from Norway and Finland, and a little later the 5B4CY beacon was S7 in southern England. Right up until 1300hrs there were many OH stations getting into England, and at 1020hrs ZB2VHF was peaking at S9+. By 1330hrs GM4GPP in Shetland and GM0EWX were coming into the south with signals up to 59. Conditions were good to the south with G4UPS reporting reception of ZS3VHF, which was heard by various people from 1415 to 1735hrs. At 1720hrs ZR6A was in contact with G4AHN and shortly afterwards, 9H1GB was getting into Finland. CR8LN was heard calling CQ at 1750hrs, but there are no reports of anyone working him. Mid-evening saw huge signals from Finland getting into G land, and at 2230hrs PA0HIP was heard calling K1TOL. A little later W8IGY and various W5 stations were heard by G4IHN.

On the 23rd the band conditions were rather poor until about 1600hrs, when ZS6WB was heard working G3JVL. The

ZS3VHF beacon was running at S9 and ZS6CE was also putting in a good signal. At 1700hrs French stations were heard calling the USA and W4DR was contacting stations on the south coast. During the next hour K2MUB, K1HTV/3 and KA1GD were also worked. By 1800hrs the good conditions had moved around to the south, with good signals coming in from South America. Among calls reported were: LU6DLB, LU2EIO, CX8BE and CX4HS, who finally faded into the noise at about 2030hrs.

Dishes

Many people run equipment on the bands above 1GHz from their home location, and it looks as though a planning problem may be looming on the horizon. On most of the higher bands, the most common aerial system is usually a 3-4ft diameter dish. With the arrival of satellite TV many councils are giving blanket permission for dish installations in an effort to avoid a great number of planning applications. The problem is that most councils are limiting the size of the dish to about 30in, stating that the dish must not be mounted in a location where it can be seen from the front of the house. What happens if your neighbour objects to your amateur radio dish, which you have installed at the top of the tower well clear of all obstructions, hence in open view, and tries to get it included in the new planning regulations? At the moment the outline planning conditions

in some areas do not specifically mention television dishes, so it could be that a more general view might be held, to our disadvantage, particularly in those 'amenity sensitive' areas of the United Kingdom.

Spacing

The RSGB VHF committee is deliberating a move to 12.5kHz spacing on 2m and is asking for your help in the matter. If you are a member you will find a questionnaire on page nine of the July issue of **RadCom**. Several questions are asked, including this gem, 'What is the average density of 144MHz amateurs in your area?' I advise you to reply that most are as thick as two short planks! A quick note including how active you are and your views on moving to narrow spacing would be very much appreciated by G3ZVW.

Close-down

Time to throw the big switch again. Thanks to Ken Ellis for keeping the 50MHz pages alive for so long. I shall be attempting to give the band fairly substantial coverage in future issues and to this end, I would ask all 50MHz operators to let me have their news so that we can continue to give good coverage to this excellent band. If you do not send it, I cannot use it. All news and comment to me at: 81 Ringwood Highway, Coventry, or contact G8MWR @ GB7NUN.

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2	A	4	7.01	1	2	6.19	1.98	1	A	2	10.25	2.20	
3	M	6	12.08	2	A	4	10.01	2.20	2	M	4	13.17	2.53
4	P	8	12.87	3	M	6	11.60	2.42	3	P	6	19.05	2.64
6	S	12	15.82	4	P	8	13.84	2.53	4	S	8	21.72	2.75
8		16	18.59	5	S	10	16.62	2.74	5		10	27.46	3.19
10		20	25.02	6		12	19.41	2.91	6		12	31.32	3.41
15		30	31.10	8		16	25.74	3.02	8		16	44.04	4.12
20		40	44.40	10		20	29.94	3.24	10		20	51.28	4.40
30		60	63.75	12		24	33.42	3.45	12		24	59.09	5.22
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ONE MEGABYTE UPGRADE FOR THE ATARI 520STFM COMPUTER

by Steven Goodier G4KUB and John Goodier G4KUC

The Atari 520STFM and Atari 1040 range of computers is becoming very popular with both radio amateurs and home computer enthusiasts. The Atari 520STFM uses the very powerful Motorola 16/32 bit 68000 CPU, which runs at 8MHz; the same chips as used in the Apple Macintosh. It comes complete with a built-in 3.5in disc drive and power supply unit and displays superb graphics with up to 512 colours on screen. It will also drive the Atari SM-125 high resolution monochrome monitor.

Menus

The Atari ST range also makes extensive use of GEM (Graphics, Environment, Manager) and WIMP (Windows, Icons, Mouse, Pull-down menus), which replaces the old operating system commands such as those found on the IBM, CPM and BBC micros, making the machine very easy to use. Once you are familiar with using the menus and mouse, then very sophisticated and powerful software can be run with great ease and with only occasionally having to refer to the handbook.

The main difference between the 520STFM and the 1040 is the size of the memory and disc drive. The 520STFM comes complete with 512k of RAM and a single-sided disc drive, whilst the 1040 is fitted with 1 megabyte of memory and a double-sided disc drive. The 520STFM is also fitted with a UHF output for driving a television set. One of the most popular modifications to the 520STFM is to increase the size of the RAM to 1 megabyte.

512k RAM upgrade

This modification is only intended for the Atari 520STFM, which already has additional places on the PCB to take extra RAM chips. The Atari 520STFM requires sixteen additional RAM chips, sixteen decoupling capacitors and three 68R resistors (may not be needed on some models) to increase its memory capacity to that of the 1040, ie 1 megabyte. Before starting this modification, be sure in your own mind that you have the necessary skills and patience to complete the work successfully. If you have little or no soldering experience, then have someone else do the work for you. Not only do you need to be skilled with a soldering iron, but you also need a good-quality 'solder sucker' and a few simple tools.

The recommended memory chips are

type 41256-15, the same type already fitted into the machine. My memory chips consisted of four 41256-15, four 41256-12 and eight 4256-15. The 4256-15 is equivalent to the 41256-15, and I have had no problems with my extra memory. The last number on the chips denotes the memory access time, eg types 41256-15 and 41256-12 equal 150ns and 120ns respectively. It is not recommended that chips with a slower access time of 150ns are used. You will also need sixteen 0.1 μ F decoupling capacitors and I strongly recommend that you use good-quality turned pin IC holders, as opposed to soldering the memory chips directly to the board. Turned pin IC holders offer minimal resistance and the contacts are funnel-shaped with gold-plated contact springs. They also offer protection against capillary action, plus they have four jaws to grip the IC leg.

The modification

Step 1. Lay the computer face down and remove all the self-taped screws which hold the case together. Do not remove the three screws holding the disc drive in place. Turn the computer

over and remove the top cover. This will reveal the metal-shielded case, disc drive, power supply and keyboard.

Step 2. Remove the keyboard by unplugging the connector located on the main PCB. Next remove the disc drive. To do this you will have to remove a small metal screen at the back of the drive; this will reveal the drive's power supply and edge connector. The drive is held in place by three long screws located underneath the computer. Remove these and pull the drive forward; this will make the job of disconnecting the power supply and edge connector a lot easier. Take care when pulling the edge connectors away from the disc drive.

Step 3. Next remove the metal screen over the power supply unit to reveal the supply board. Remove all the screws holding the main PCB to the bottom of the case (on my 520 there were five in all). Three screws are located on the front of the board and the remaining two are used to hold the power supply unit in place. Before you can proceed you will have to remove the power supply board. This is done by first removing the supply and edge connector on the front of the

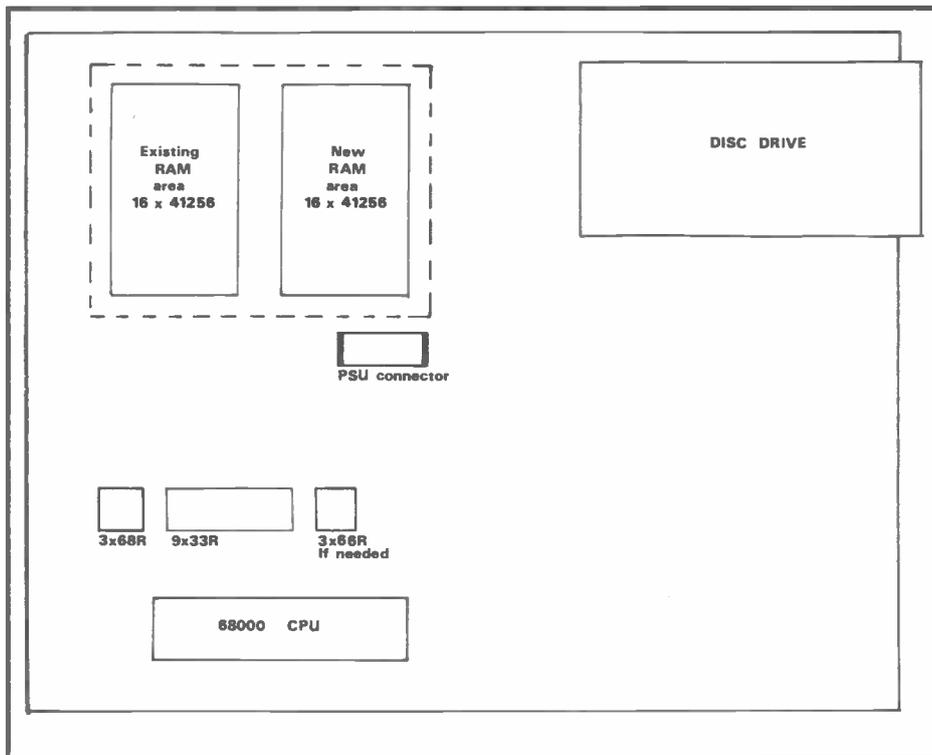


Fig 1: Layout of the Atari 520STFM. The dotted area is the power supply unit which sits over the RAM area when fitted

ONE MEGABYTE UPGRADE FOR THE ATARI 520STFM COMPUTER

PSU board, then pulling and lifting the board up and away. You will have to play about a little before the board frees itself, but there should not be too many problems. Once it has been removed, you will have a clear view of where the new RAM chips are going to fit (see Fig 1). If your board is anything like mine, then all the holes intended for the new memory chips will be flooded with solder. Remember, all these holes need careful desoldering, so a fair degree of patience and skill is required.

Step 4. The next job is to remove the large metal screen that surrounds the main PCB, which is held in place by several 'lugs' at various points around the side of the case. Once these have been located and bent straight, remove the top of the screen to reveal the component side of the Atari 520STFM. You should now be able to lift the PCB away from the bottom of the case. Once you have done this, remove the other half of the screening plate from underneath the PCB. Always remember to handle the PCB with great care.

Step 5. This stage of the modification is perhaps the most difficult. Take a good look at the PCB and locate the sixteen places which will take the new memory chips, also find the positions of the sixteen decoupling capacitors and the three resistors marked R71, R72 and R73 (see Fig 1 for the general layout). It is possible that R71, R72 and R73 may already be fitted to some models, in which case, you will have one less soldering job to do. Unless you are very lucky, all of these holes will now need desoldering. The best tool for this is a solder sucker, which will suck away the solder and leave the holes clear. If the solder pad becomes too hot there is a danger of it lifting and coming away from the board, so if any of the holes don't clear first time, leave it and go on to the next. I would advise you to try and desolder the board from both the top and bottom sides, this will help to avoid lifting of the PCB pads.

Step 6. Once you have successfully desoldered the IC, capacitors and resistor pads, clean the board with a paint brush to clear any loose solder.

Step 7. Solder into place the turned pin IC sockets. Make sure all of the connections are good and allow plenty of solder to flow on to the joint. You will find that the solder will flow down the leg of the IC holder, making a joint on both sides of the board. Check all of the joints for solder bridges etc, and solder the sixteen decoupling capacitors and resistors into place, if not already fitted. These can be fitted anyway round but, again, check all of the joints and make sure you don't have any solder bridges.

Caution

At this stage I checked to see if the computer was still working by temporarily fitting the disc drive and power supply unit on to the bare PCB. This is *not* advised unless you really know what you are doing, because the power supply

carries 240V mains and some of the components are *live*. Always remember that mains voltage can *kill*. If you are in any doubt, then temporarily fit your computer back together and test it that way. Connect a monitor to the computer and place the system's disc into the drive and switch it on. If all is well the drive should read the ACC files etc, and after a couple of seconds the normal Atari desktop should appear.

Problem

At this point I encountered a problem. At switch on the disc drive spun for about half a second then stopped, and my SM-125 monitor remained blank. When I connected a colour monitor to the computer, all it displayed was a screen full of colours. I knew that this had to be a memory fault, so I set about trying to find the problem. I started by checking all of the solder joints and made sure that there were no solder bridges etc, but the disc drive still would not work. Then I checked the connections between all of the memory chips using an audible continuity bleeper. Most of the pins on the memory chips were connected together, so putting one probe on one leg of the first chip and the other probe on the same leg of the last IC socket produced a 'beep' from the meter.

Eventually, I discovered that the fault was due to a track on one of the IC pads which must have broken while clearing the holes of solder. The crack was invisible to the naked eye and could only be checked with a continuity checker. Once the track had been bridged with a piece of wire, the computer fired up without any problems.

Plugging in the RAM

After you have fitted the IC sockets, capacitors and resistors and checked that your computer is still working, it is just a simple matter of plugging in the new RAM chips. Be careful when plugging in the chips, since it is easy to apply too much pressure and bend the pins. Also remember to plug in the RAM chips the correct way round. If everything is working as it should and the modification has gone to plan, you will now have a computer with 1 megabyte of memory.

Extra resistors

The upgrade notes failed to mention anything about fitting an extra three resistors, so when I plugged in the extra RAM and tried the computer it would not work! The SM-125 monitor was either blank or showed a multitude of colours on my TV set. As soon as I unplugged all of the extra RAM chips, the machine worked without any problems. I then plugged in one chip and I got the same fault. I was sure the computer was not reading the new RAM, but why? I went through all the connections again with my continuity checker, but they all seemed to be fine. I then traced a couple of pins from the RAM already fitted to the Atari which went to three resistors just below the RAM area. After checking the same pins from the new RAM area, I found that these went to three vacant places intended for resistors R71, R72 and R73. As soon as these resistors were fitted, the computer worked without any problems and reported that I had a full 1 megabyte of RAM.

All that is required now is to assemble and test the machine. You should have no problems putting together the micro, but take care when reconnecting the power supply and disc drive edge connectors. I found the hardest part was reassembling the screening box and putting the lid back on. If you do not have a memory tester then load a program, such as a word processor or a RAM disc, to determine the amount of free RAM available. Using 1st Word Plus with the spell checker loaded, I had over 620k available for text.

Conclusion

The Atari 520STFM with its standard 512k is a very powerful computer, but the additional half megabyte of memory makes the machine much more flexible. With the recent introduction of new programs such as 'Calligrapher', which really needs a full megabyte to run effectively, an upgrade for some people is a priority.

If you are considering upgrading your Atari, then you have to decide whether to attempt the modification yourself or to let a dealer fit the extra chips. Whatever your decision, I am sure you will find the extra memory useful in the future.

Components List

16	41256-15 or 4256-15 RAM chips
16	16 pin turned pin IC holders
16	0.1 μ F miniature capacitors
3	68R resistors

Maplin FJ65V
Maplin YR758

Component notes

The memory chips are available from many sources, and it is worth looking through the Atari user magazines to see what is available in the way of upgrades. If you purchase an upgrade kit, you will have a second set of notes to refer to as well as this article.

The chips are available from Maplin Electronic Supplies Ltd, PO Box 3, Rayleigh, Essex SS6 8LR, priced at £12.95 each (order code QY74R), or from STC Electronic Services, Edinburgh Way, Harlow, Essex CM20 2DF, priced at £10.13 each (stock number 10894C).

THE POCOM PRM 1200 PACKET DECODER

by Ken Michaelson GR3DG



The PRM 1200 is a packet radio decoder for the short wave listener which accepts and decodes all packet transmissions, with the addition only of the normal receiver (SSB for HF and FM for VHF) and a monitor with composite input; no computer or driver program is required. The unit is manufactured by the well-known firm of Poly-Electronic, in Bassersdorf, Switzerland.

Description

The unit consists of the PCB packet decoder and the video PCB, which provides a composite signal for connection to a monitor or television receiver. The decoder PCB contains ten ICs and a number of discrete components. There is one 40 pin LSI chip which, I assume, acts as a dedicated microprocessor and is possibly a Z80. Three of the remaining chips are 28 pin versions.

The PRM 1200 uses the AM7910 modem chip and has a 6264 16k CMOS RAM associated with the software EPROM. The software chip is labelled with the version number and identification number ('A'), which have to be quoted when obtaining extra software. The 1 amp 250V fuse fitted to the board can be replaced by removing the video board situated above it. The board measures approximately 175mm deep x 100mm wide. The technical specification is shown in the Table.

The 'On/Off' switch soldered on to the front end of the main PCB works in the continental fashion, ie, up for on. There is also an 8-way DIP switch, of which only four ways are used. The four switches control the operation of the unit and will be commented on later. The effective tuning display consists of a twelve-segment red LED bar array, and is also soldered on to the main PCB.

At the rear of the case, there are three sockets arranged in a roughly triangular shape. Two of these are PHONO sockets: the top socket is for the video out and the lower one is for the signal in. The third socket is the usual 2.1mm power socket which accepts 10 to 13V dc. The rig's current consumption is about 600mA.

The video board (fitted above the main board) is connected to the main PCB by a 10-way ribbon cable with plugs at either end. There are eight ICs on this board, one of which is a 40 pin LSI type 8516. The two other main ICs are 28 pin versions: a 6116 8k RAM and a 2764 8k EPROM, into which the necessary software has been soldered. The other ICs are of the straightforward '74' series.

The three main ICs are all in sockets, as are the four main ICs on the main board below, and can be replaced in the event of trouble or change of software.

The PRM 1200 is housed in a plastic case measuring 140 x 45mm x 190mm (WHD), and is separated by unscrewing four screws from the underside.

Operation

To operate the PRM 1200 is simplicity itself. On switch on a cursor moves across the screen building up the opening display: POCOM PRM 1200 PACKET RADIO MONITOR SYSTEM, followed by the version number and the manufacturer's name. This is surrounded by a box and looks most effective. The positioning of the switches are displayed at the bottom of the screen, eg, 1200 BAUD - NRZI ON - FILTER OFF > NO ERRORS IN SELF TEST <. Underneath this message, POCOM PACKET RADIO is shown in reverse video. The messages are displayed immediately under the self-test information, where a flashing cursor shows the start of a line.

The unit decodes either 1200 baud or 300 baud signals (1200 baud for VHF or 300 baud for HF), and it is merely a question of deciding which baud rate you want to receive and then moving switch 2 either ON or OFF (ON for 300 and OFF for 1200). It is also possible to decode speeds of 600 or 2400 bauds using combinations of switches 1 and 2 (600 bauds: switch 1 ON, switch 2 OFF, and 2400 bauds: both switches 1 and 2 ON).

In order to receive packet radio using the AX-25 protocol (NRZI) switch 3 has to remain on, but using switch 4, the filter switch, gives an alternative of packets received. With the switch OFF all packets ('U', 'S' and 'I' frames) are decoded, but with the filter ON only the 'I' frames are monitored. This applies to all four speeds. Whenever a change in the switching arrangement is carried out, it is necessary to do a reset. This operation sounds very complicated, but merely involves switching the unit off and then on again to reinitialise! The manufacturers state that the unit *must* be switched off whenever the switches are altered.

Conclusion

The unit worked well on the HF bands, particularly on 14MHz, where a number of interesting packet stations were copied, including VEs and Ws.

As an additional facet for the short wave listener to follow transmissions on the various bands, the PRM 1200 is worthy of serious consideration.

The PRM 1200 costs £258.00, plus £2.50 for postage, packing and insurance. The price is inclusive of VAT. My thanks to Dewsbury Electronics, 176 Lower High Street, Stourbridge, West Midlands, tel: (0384) 390063 or 371228, for the loan of the PMR 1200 for this review.

Technical Specification

Codes of operation	Amateur packet radio to AX.25 standard at 300, 600, 1200 and 2400 bauds Commercial data transmissions to CCITT V23 Commercial data transmissions to Bell 202 at 600 and 1200 bauds Press services at 200 bauds/eight-channels
LF sensitivity	50mV with limiter stage for variable signal input LF input via phono-socket on rear panel
Video processing	Integrated video board with twenty-four lines of eighty characters each Standard ASCII character set to US and German standards with upper and lower case letters Character matrix 7x9 for high resolution Composite video signal output 75 ohms 1.0 V/pp to connect a normal commercial video monitor with a bandwidth of 15MHz or more
LF demodulator	High-quality special modem chip (AM7910) with steep-edged filter selection which is processor controlled
Data output	Serial interface at 9600 bauds Data format: ASCII code, eight-bit, no parity, one stop bit
Self-test	Built-in self-diagnostics to check all the important functions

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MUSINGS OF AN OLD TIMER

I was in the local emporium the other day waiting my turn to be served behind a customer who had only received his transmitting licence a few days previously.

He had obviously sought the advice of the assistant who insisted that the most suitable and, in fact, the only appropriate equipment for him was a 2m FM transceiver and an omnidirectional aerial.

On my journey home, I thought about this advice and it somehow jarred in my mind. Admittedly, the 2m FM band cannot be bettered for mobile operation and local chats, but does it really provide the newcomer with anything more than a SUPER-CB channel with better signal to noise ratios and, thanks to the repeater network, somewhat improved range?

What it patently does not provide is any more than the most minuscule insight into the many fascinating facets of amateur radio.

Channelised FM operation, either on 2m or 70cm, has nothing in common with any other band or mode. A period of monitoring the calling channel in the south-east of England will reveal that possibly as high as 90% of calls are made

to a specific station, whilst the vast majority of CQ calls remain unanswered.

As a measure of this, I recently conducted a simple experiment in which I called CQ on the calling channel ten times each night for a week. From those seventy calls only two QSOs resulted, despite the fact that my signal was of substantial strength over an area of nearly five thousand square miles.

Under similar circumstances, who would blame our newcomer if he quickly became disillusioned and changed his allegiance to 'tiddlywinks'!

Even when he makes a few friends on the band and his QSOs become more frequent, interest can very easily wane, for there is very little challenge in working local and semi-local stations.

Perhaps better advice would have been for our new colleague to have purchased a multimode and a small beam. Had finance been a problem, a look along the 'used equipment' shelves would have probably revealed either an old multimode or separate equipment for both FM and an SSB operation at a similar cost.

With the availability of even 2W of SSB and a small beam, home-made if neces-

sary, long-distance operation becomes possible.

This does not mean that our new colleague should immediately join the ranks of the square hunters and DX fiends, but it does make possible - even in only the slightest of lifts - contacts up to a hundred or more miles away, and to experience the type of operation which is normal on all but the channelised VHF bands. Furthermore, in the fullness of time, the addition of a relatively inexpensive transverter permits operation on 50MHz where, at appropriate times during the sunspot cycle, intercontinental working is possible.

So to those wise people who stand behind the counters of the amateur radio emporia up and down the country, I say, 'Think carefully when you recommend equipment to a new operator. Think not only of such factors as cost, reliability and your profit margin, but also whether the equipment will nurture an abiding interest in amateur radio. For if it does, over succeeding years that newly licensed amateur will return to your counter again and again.'

Footnote

The pseudonym 'Old Timer' conceals the identity of an amateur who has spent over forty years on the amateur bands. In that time he has constructed and operated equipment on every amateur band from 160m to 23cm. He is as keen today as the very first time he used a soldering iron.

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BUILD A POWER AMPLIFIER FOR 2m HAND-HELDS

by Harold Goble G4FDQ

Having acquired a Trio 2200GX as the only means of working on 2m, it soon became obvious that a bit more power was needed to transmit from my home QTH using a 1/2 collinear to stations further afield.

The receiver on the 2200GX range of transceivers is geared to work with at least 10W on transmit and as a preamp was not really necessary, a simple FM power amplifier was called for.

Outputs

The outputs of the 2200GX are approximately 800mW and 2.5W. The PA transistor I used was the SD1143, which will run with an input of just over 1W of FM and give about 15 to 18W out, depending on the actual drive applied to it. The 800mW gives a fair output, but the transistor severely overruns if the rig is accidentally switched to 2.5W. Therefore, a 100 ohm carbon resistor must be included in the input to the PA to drop the power to about 1.25W when the rig is on full power (see Fig 1).

The RF switching can be done by using an RF sensing circuit which operates a relay through a switching transistor. This gives the advantage of two power settings with the amplifier in circuit.

For hand-helds with only 1W output, the 100 ohm resistor can be omitted and the front end tuned to 50 ohms. As very few components are required, build the PCBs by cutting out the lands on which the components are mounted and stick them in place with super-glue on to double-sided, copper clad board. For those who prefer to make a conventional PCB by etching, the same layout would apply.

Construction details

This project requires a minimum of tools and very little test equipment and can be built 'on the kitchen table', wife permitting!

As already mentioned, the PCBs are made using the same techniques as for

Assembling the amp board

Before commencing the soldering work, place the power transistor in position and mark the places on the lands to show the outline of the connections. These areas can then be left clear of components until the transistor is finally soldered in place. Position the heatsink on to the back of the PCB and drill a hole in it to take the

fixing stud on the back of the transistor. Temporarily bolt the PCB to the heatsink using the transistor to hold them together. Mark the outline of the heat-sink finned area on a piece of paper. Cut out the outline and use this as a template to mark the hole in the bottom of the box. The box can then be cut in readiness for the final assembly later. Remove the transistor and put it aside for soldering in

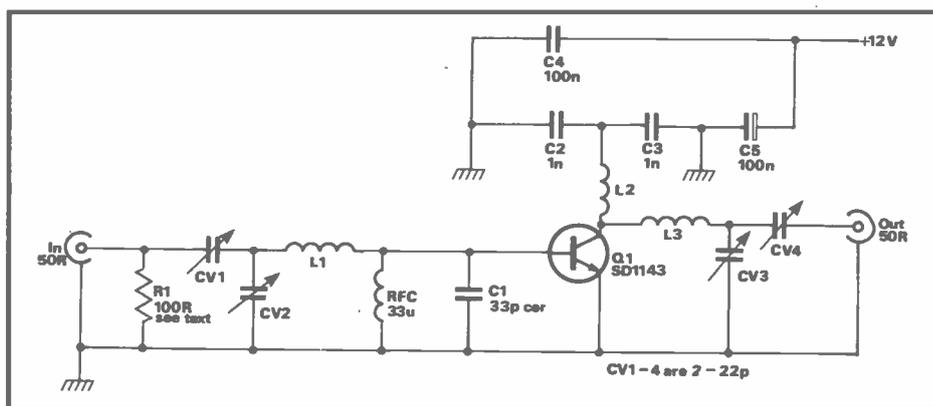


Fig 1: Amplifier circuit

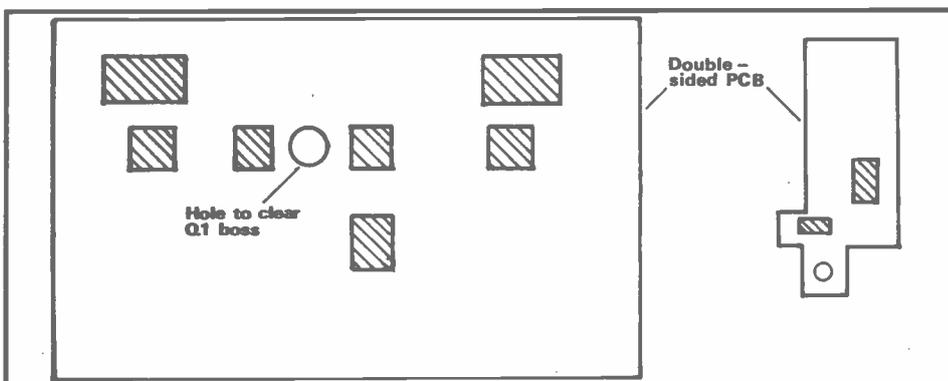


Fig 2: Shaded areas are cut to size and fixed with Superglue

Fig 3a: Component layout



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BUILD A POWER AMPLIFIER FOR 2m HAND-HELDS

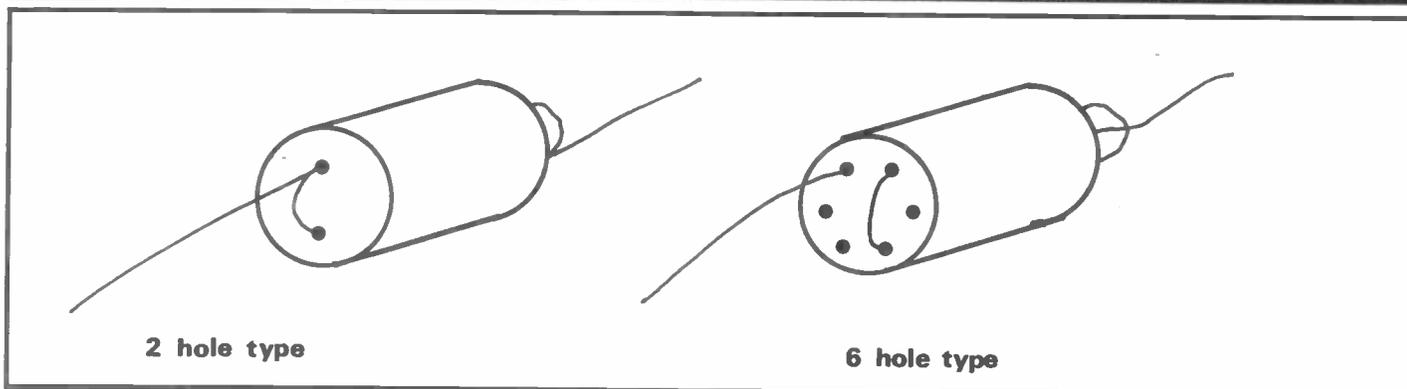


Fig 3b: RFC wound components

Components List

Component

Double-sided, copper clad board
 Transistor SD1143¹
 Transistor BC108
 Capacitors (all at 30V working)
 4 10mm diameter variable Mylar film or ceramic (shown as 2-25pF)
 2 1n disc ceramic
 1 1 μ F tubular (small)
 1 100fd electrolytic PCB mounting
 1 33pF minimum disc ceramic
 1 100 ohm 2W resistor
 1 six-hole ferrite core
 2 SO239 chassis-mounting sockets
 26swg enamelled copper wire
 20swg tinned copper wire
 14swg silver-coated wire
 4Ba and 6Ba, fixing nuts and bolts
 5 4Ba solder tags

Supplier

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Relay assembly

Relay two-pole changeover 12V coil
 1 1.8pF minimum tubular ceramic capacitor
 1 2.2n tubular ceramic

Diodes

2 4148
 1 4013

Heatsink (4in x 2.4in)

Maplin 4.5°C/W FLAIU
 Radiospares 401-497
 4in x 2½in

Aluminium box (6in x 4in x 2in)
 1 small rubber grommet
 Wire for 12V input leads
 50 Ω coax for internal connections

place as the last part. This avoids subjecting the transistor to unnecessary heat while working on the other components. Now solder in the other components, as shown in **Figs 3a** and **3b**.

Check the PCB with an ohmmeter for short circuits to earth around the lands. Then fix the transistor in place through the PCB and the heatsink, applying a little heatsink compound where the boss meets the heatsink. Solder the transistor in place.

RF switching relay

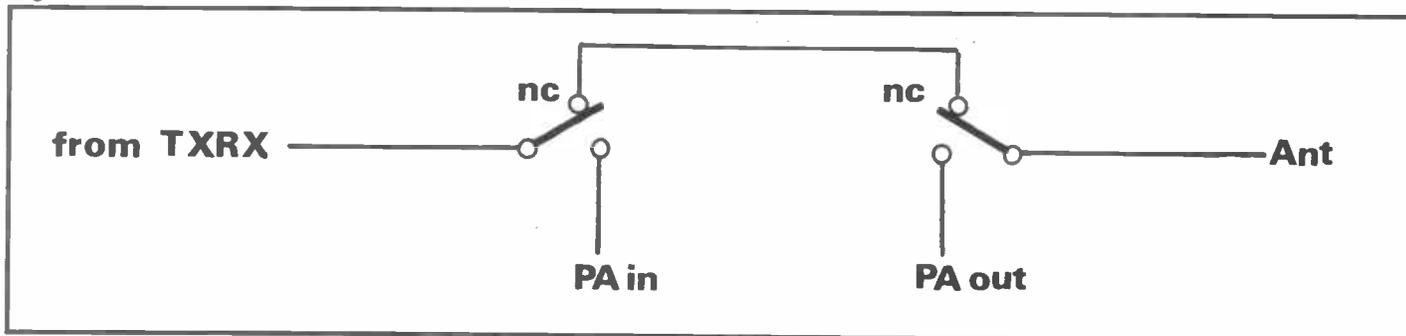
The relay is a double-pole changeover with a 12V coil. Should you encounter any difficulty obtaining one, a four-pole relay can be used by omitting two of the switches. In any case, check that the contact layout is the same as in **Fig 3a**. If not, wire your relay as shown in **Fig 4a**.

Mount the PCB using the single fixing shown, then wire up and fit the components, as shown in **Fig 3a**. At this point, the **Fig 3a** assembly can be checked to ensure that the switching works properly. To operate the relay, fit the power leads as shown in **Fig 4b**, ie, + to the relay coil and - to the PCB (earth). Place a temporary link between the collector and negative line and check that the circuit is operating correctly to the output leads with an ohmmeter, ie, Tx/Rx is through to 'Ant' (de-energised) and the PA board input, and that Ant is to the PA board output (relay energised).

The box

The aluminium box, available from most component stockists, should measure 6in x 4in x 2in (WHD). It is best to consider the bottom of the box as eventually being the top, leaving the removable lid as the base.

Fig 4a: Wiring diagram for the relay



BUILD A POWER AMPLIFIER FOR 2m HAND-HELDS

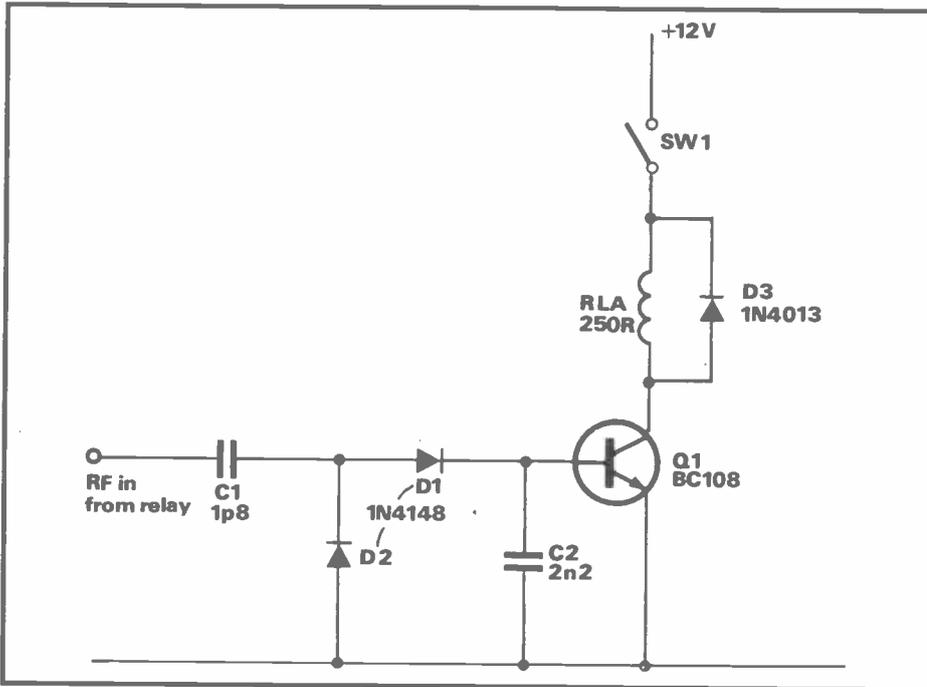
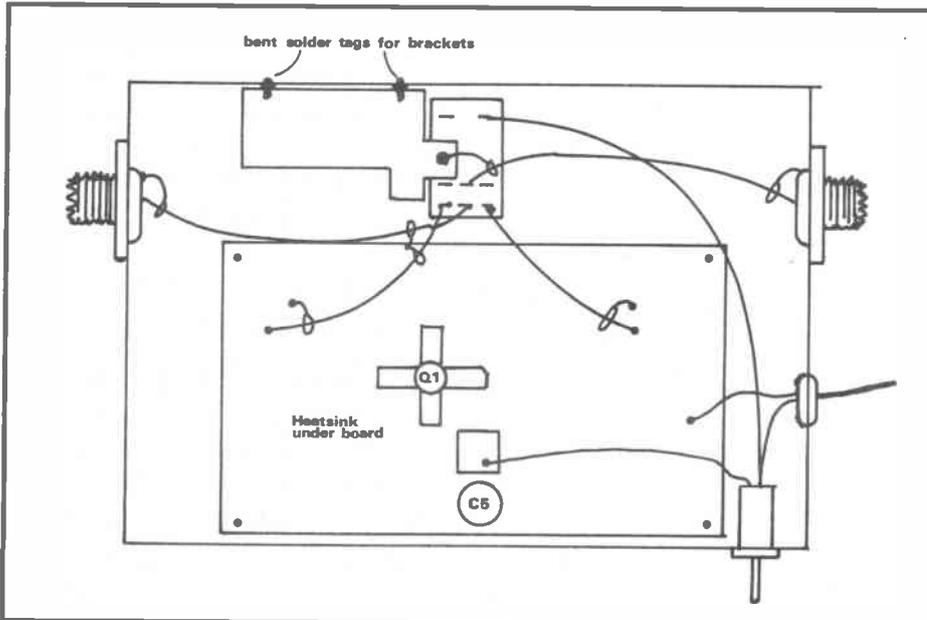


Fig 4b: Fitting the power leads to the RF relay

Fig 5: Suggested layout for the relay board



The input and output sockets used are of the chassis-mounting type (SO239), and one of these should be fitted to each end of the box at a point 3in from the front and 1in from the bottom. Use a solder tag to fit the coax braiding to the box; fit another tag to each end under the socket fitting screws. Then position the PA board lengthwise along the box with its edge nearest to the 100mfd cap, close to the front (see Fig 5).

The cooling fins of the heatsink pass through the bottom, and then the assembly is bolted in position. A single-pole switch should be fitted to the front of the box on the right to switch the positive supply to the relay.

The relay board is then fitted as in Fig 5, this makes the coax leads to the board and sockets as short as possible. The board is fixed by soldering two 4BA solder tags to the side of the small board; these should be bent upwards at right angles to enable the assembly to be fixed through the side of the box. After the remaining wiring in the box is completed, the PA is ready for testing.

Testing

Once the multi-range test meter has been connected, set it to the 5 amp range in the positive lead to monitor the current taken by the PA. The SWR/power meter fitted to the output goes into the dummy load. If the transceiver has a low power position, this should first be fed to the input.

With the supply on and the Tx/Rx transmitting, check for current (the ammeter will indicate collector current plus relay coil current) and movement on the power meter. If there is power showing, peak the output trimmers for maximum output on the meter, then the input ones. Continue to adjust the trimmers alternately until maximum output is indicated on both meters. Switch the Tx/Rx to 2.5W and continue to peak the trimmers for maximum. If the relay does not hold in to start with, earth the collector of the BC108 for the initial low power adjustments and remove the link as soon as the relay holds on its own. Finally, check the rig on the air through the antenna with the SWR bridge circuit.

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ADVERTISERS INDEX

Air Supply	23	Lake Electronics.....	35
Brian J Reed.....	13	Marlec Engineering Co Ltd.....	33
J Bull	51	Nevada Communications	19
Candy Club.....	44	No 1 Systems	10
Cirkit.....	13	Poole Logic.....	35
Cobonic Ltd.....	18	Radio & Telecommunications	
SRW Communications.....	29	Correspondence School	29
P M Components.....	4,5	Ralfe Electronics.....	25
Display Electronics	22	Raycom	2
R N Electronics.....	18	Samsons (Electronics)	39
GCHQ	33	Thames Marionics.....	35
Heatherlite Products	21	Waters & Stanton.....	52
ICOM	26,27	Western Electronics.....	19
ICS International	23		



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- BD7 4 In flex switches with neon on/off lights, saves leaving things switched on.
- BD9 2 6V 1A mains transformers upright mounting with fixing clamps.
- BD11 1 6 1/2in speaker cabinet ideal for extensions, takes our speaker. Ref BD137.
- BD13 12 30 watt reed switches, it's surprising what you can make with these—burglar alarms, secret switches, relay, etc., etc.
- BD22 2 25 watt loudspeaker two unit crossovers.
- BD29 1 B.O.A.C. stereo unit is wonderful breakdown value.
- BD30 2 Nicad constant current chargers adapt to charge almost any nicad battery.
- BD32 2 Humidity switches, as the air becomes damper the membrane stretches and operates a microswitch.
- BD42 5 13A rocker switch three tags so on/off, or change over with centre off.
- BD45 1 24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day, original cost £40 each.
- BD49 10 Neon valves, with series resistor, these make good night lights.
- BD56 1 Mini uniselector, one use is for an electric jigsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole.
- BD59 2 Flat solenoids—you could make your multi-tester read AC amps with this.
- BD67 1 Suck or blow operated pressure switch, or it can be operated by any low pressure variation such as water level in water tanks.
- BD91 1 Mains operated motors with gearbox. Final speed 16 rpm, 2 watt rated.
- BD103A 1 6V 750mA power supply, nicely cased with mains input and 6V output leads.
- BD120 2 Stripper boards, each contains a 400V 2A bridge rectifier and 14 other diodes and rectifiers as well as dozens of condensers, etc.
- BD122 10m Twin screened flex with white pvc cover.
- BD128 10 Very fine drills for pcb boards etc. Normal cost about 80p each.
- BD132 2 Plastic boxes approx 3in cube with square hole through top so ideal for interrupted beam switch.
- BD134 10 Motors for model aeroplanes, spin to start so needs no switch.
- BD139 6 Microphone inserts—magnetic 400 ohm also act as speakers.
- BD148 4 Reed relay kits, you get 16 reed switches and 4 coil sets with notes on making c/o relays and other gadgets.
- BD149 6 Safety cover for 13A sockets—prevent those inquisitive little fingers getting nasty shocks.
- BD180 6 Neon indicators in panel mounting holders with lens.
- BD193 6 5 amp 3 pin flush mounting sockets make a low cost disco panel.
- BD196 1 in flex simmerstat—keeps your soldering iron etc. always at the ready.
- BD199 1 Mains solenoid, very powerful, has 1in pull or could push if modified.
- BD201 8 Keyboard switches—made for computers but have many other applications.
- BD210 4 Transistors type 2N3055, probably the most useful power transistor.
- BD211 1 Electric clock, mains operated, put this in a box and you need never be late.
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- BD252 1 Panostat, controls output of boiling ring from simmer up boil.
- BD259 50 Leads with push-on 1/4in tags—a must for hook-ups—mains connections etc.
- BD263 2 Oblong push switches for bell or chimes, these can mains up to 5 amps so could be foot switch if fitted into pattress.
- BD268 1 Mini 1 watt amp for record player. Will also change speed of record player motor.
- BD283 3 Mild steel boxes approx 3in x 3in x 1in deep—standard electrical.
- BD293 50 Mixed silicon diodes.
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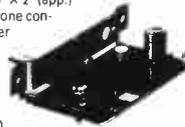
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