FEBRUARY 1989 £1.85

Amateur RADIO

For all two-way radio enthusiasts

Darkroom Secrets: A Digital Enlarger Timer

Michael Gurdus: The World at his Fingertips

A User Review: The Kenwood TH-205E and TH-215E Hand-Held Transceivers

quency will be instantly recalled ready for use.

Scan modes

The TH-215E offers a great number of scan options. Both band and memories can be scanned for 'busy' or 'vacant' frequencies with a number of options attached to each. A unique feature of this hand-held is 'scan map' which is clearly displayed on the LCD readout. This continually reminds the operator of the type of scan/search options he has chosen. All keys which are relevant to the scan and search modes have been highlighted on the keypad to help with identification.

There are three types of scan-stop modes which are selected by choosing either the 'seek', 'time' or 'carrier' keys on the keypad. Seek will search and stop on busy channels, and will remain there until the scan key is pressed again. Time will scan and stop on busy channels, but resume scanning again after approximately five seconds. Carrier will scan and stop on busy frequencies until the signal drops out, but will remain there and listen for approximately two seconds after the signal has disappeared.

Three scan modes are also available. The first of these is 'bandscan' which searches the entire band for signals. The second option is 'memory scan', which will scan the memory channels (channels without data are skipped). Any memory can be skipped by using the 'lock-out' feature, and any channel which has been locked out will flash when recalled during normal operation to remind the user that it will not be scanned. This makes it possible to scan a couple of net frequencies for activity. The last choice is a sophisticated 'programmable bandscan' which allows scanning of a large or small section of the band, the upper and lower limits are programmed in to memory channels eight and nine.

All scan and search options, although very advanced, are relatively easy to use once the keypad combination has been mastered. Kenwood have taken a lot of trouble to simplify both the programming and functions of the TH-215E.

Some people question the point of a scanning facility on a hand-held transceiver thinking it to be a pointless feature. However, being able to scan a number of frequencies is of great benefit when, for example on a Raynet exercise, a number of channels could be in use and activity is expected at any time.

Functions and features

The frequency stored in 'memory 1' can be monitored every five seconds for priority operation; this means that you can keep an eye on one specific frequency while you are monitoring another. When the channel becomes busy the 'prio' indicator on the display blinks and the rig will beep to alert you of activity on that channel.

It is also possible to rapidly tune across the band by pressing 'F' followed by one of the up/down buttons. When this is done, you can tune the entire band in a matter of seconds. The keypad can be locked to avoid accidental operation, and the transmitter can be disabled by using a couple of keystrokes.

Confirmation of microprocessor functions is provided by a series of audio beeps. Each key when pressed on the keypad makes its own unique sound which is distinctive and reassuring to the operator that the correct key has been pressed. The option may be turned off by using F followed by 'beep'. One of this system's main advantages is the different sounds from each key. The up/down keys clearly have very different sounds which can be beneficial to a blind operator.

Basic circuit details

Although the handbook does not have a circuit description, a large circuit and block diagram for each transceiver is provided. Since the RF side of both rigs is almost the same, the following basic circuit description should hold true for both sets. The block diagram for the TH-215E is shown in **Fig 1** and apart from the microprocessor functions, the block diagram for the TH-205E is almost identical.

The antenna connects to a transmit/receive switch based around D5, D6 and D7. In receive mode the signal is fed directly into the RF amplifier Q6 and Q7. L15, L16 and L17 form a variable bandpass filter which is tuned by three varicap diodes controlled by the bandshift circuit around Q11. From here the 144/145MHz signal is mixed with a frequency derived from the PLL via Q8, the resulting output of 16.3MHz forms the first IF.

A 16.3MHz filter provides selectivity, and from there Q9 amplifies the signal which is fed into a TA-7761P mixer, oscillator or detector on the IF board. The chip mixes the 16.3MHz first IF with a 16.755MHz frequency to produce the

Specifications for the TH-205E and TH-215E

General	
Frequency Range	144 to 146MHz
Mode	F3E (FM)
Operating voltage	6.3 to 15V dc (battery) 7.2 to 16V dc (dc in Jack)
Current drain	Transmit HI: Less than 1.7 amps LO: Less than 0.7 amps (with PB-1) Receive 50mA approx (no input signal) 11mA save option TH-215E 20mA save option TH-205E
Ant impedance	50 ohms
Dimensions	67mm ×173mm ×37mm ×(WHD)
Weight	520g with PB-2 and antenna
Transmitter	
RF output	HI: 5W (with PB-1) 2.5W (with PB-2) LO: 0.5W (with PB-3,4)
Modulation	Variable reactance direct shift
Frequency tolerance	Less than ±20 PPM
Frequency deviation	±5kHz
Spurious radiation	Less than −60dB
Receiver	
Circuitry	Double conversion superheterodyne
IF Frequency	1st IF 16.3MHz 2nd IF 455MHz
Sensitivity	12dB SINAD less than 0.2uV
Selectivity	More than 12KHz (−6dB) Less than 24KHz (−40dB)
Spurious response	Better than 50dB
SQL sensitivity	Less than 0.1uV
Audio output	More than 400mW into 8 ohms

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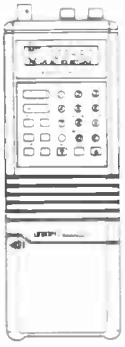

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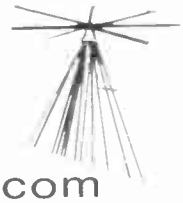

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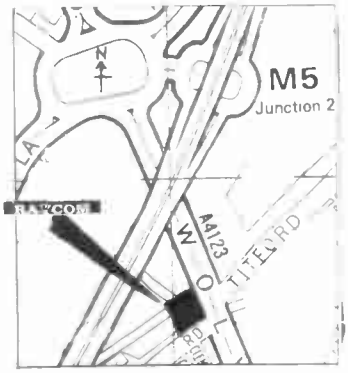

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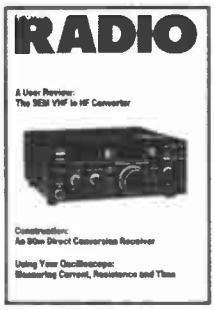

Editorial:
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Advertisement Manager:
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Advertisment Executive:
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Subscriptions:
01-684 9542

Publisher:
Peter Williams

On sale:
Last Thursday of the month preceding cover date

Next Issue:
Cover date March on sale 23 February 1989

Published by:
Amateur Radio Magazines,
Sovereign House,
Brentwood, Essex.
CM14 4SE, England
(0277) 219876

Printed: In England

ISSN: 0264-2557

News Trade Sales by:
S M Distribution,
6 Leigham Court Road,
Streatham, London.
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Tel: 01-677 8111

Cover:
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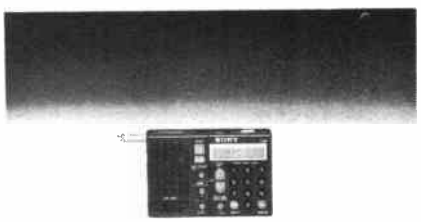
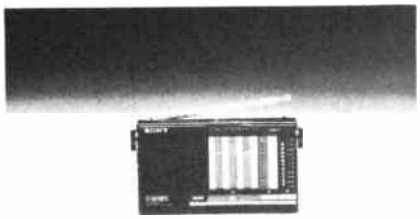


ICF SW1



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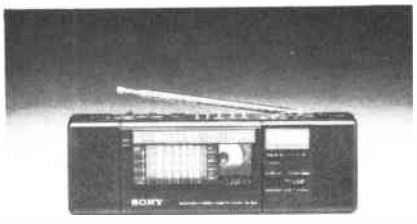


WA 8800

News and comment from Glen Ross G8MWR

From correspondence received it seems that everyone operating on the VHF bands knows that bandplans exist for most of the bands above 50MHz. Just why these plans exist and who lives where and why does not seem to be so widely known. During the winter months when little exciting activity gets reported I thought it might be useful to tabulate some of the details.

Legality

First of all it must be clearly understood that the bandplans do not exist as part of your licence. Under that you are allowed to operate using any of the permitted modes on any inband frequency you care to use. The problem is that, particularly under lift conditions, there are so many people looking for space that to mix up all the various modes on a free-for-all basis would effectively reduce the amount of space available. Consider also the operator who is interested in a particular activity, say moonbounce. It would greatly increase his chance of contacting like-minded souls if there existed an agreed frequency for such people to meet on.

The answer

This is where the bandplan comes into its own. It is simply a gentleman's agreement designating certain areas for specific uses and listing various spot frequencies as calling channels for particular modes. If we all stick to the plan then everyone has a much greater chance of success. What happens if an FM station strays into the SSB area? He uses enough space for at least ten SSB stations to work in. If he goes into the CW area he uses up enough space to hold something like 100 CW contacts. As you can imagine his presence would not be appreciated, particularly during a major opening. To be fair it must be said that FM operators are not the only people who cause problems, someone operating CW on a SSTV frequency would certainly cause irritation as well.

The plan

So where do you use a particular mode or look for your own type of activity? The table is a listing for 2 metres and the information is as up-to-date as I can provide. In the nature of things there is

2 metre bandplan

144.000	Moonbounce	
144.025	Moonbounce	
144.025	Low-end CW section	
144.050	CW calling frequency	
144.100	MS CW reference frequency	
144.150	High-end CW section	
144.150	Low-end SSB section	
144.175	Microwave talkback	
144.250	Slow Morse and GB2RS	
144.260	Raynet	
144.300	SSB calling frequency	
144.400	MS SSB reference frequency	
144.500	High-end SSB section	
144.500	Low-end all mode section	
144.500	SSTV calling frequency	
144.600	RTTY calling frequency	
144.650	Packet repeaters	
144.675	Data and packet simplex	
144.700	Fax calling frequency	
144.750	ATV call and talkback	
144.775	Raynet	
144.800	Raynet	
144.825	Raynet	
144.845	Top-end all-mode section	
144.845	Low-end beacon section	
144.835	9H3ML	Malta
144.855	LA5VHF	Norway
144.865	HB9HB	Switzerland
144.867	EA1VHF	Spain
144.902	LX0VHF	Luxembourg
144.915	GB3CTC	Cornwall
144.925	GB3VHF	Kent
144.930	OZ7IGY	Denmark
144.965	GB3LER	Shetland
144.975	GB3ANG	Angus
144.990	High-end beacon section	
145.000	Low-end RPTR inputs	
145.175	High-end RPTR inputs	
145.175	Low-end FM simplex	
145.200	Raynet	
145.225	Raynet	
145.250	Slow Morse	
145.300	RTTY	
145.500	FM calling frequency	
145.525	GB2RS news	
145.550	Rally talk-in	
145.575	High-end FM section	
145.600	Low-end RPTR output	
145.600	R0	
145.625	R1	
145.650	R2	
145.675	R3	
145.700	R4	
145.725	R5	
145.750	R6	
145.775	R7	
145.800	R8 (Continental)	
145.800	High-end RPTR output	
145.800	Low-end satellites	
146.000	High-end satellites	

PROJECT BOOK

by Martin Williams

This month we come to the final article in our short series on attenuators and how to design and build them. In the last instalment we looked at various methods of building attenuators of fixed loss for various impedances. This time we look at the design of a unit which will enable you to set any desired loss in steps of 1dB up to a maximum loss of 42dB, although this can easily be extended up to 62dB if required. The unit is intended to operate with 50 ohm lines on both the input and output sockets.

Selection

The unit consists of six switches which will allow selection of 1, 2, 3, 6, 10 and 20dB. If 60dB loss is required simply add an additional switch to give another stage of 20dB loss. The total loss is set using the individual switches. As an example, if a loss of 17dB is required select the 10, 6 and 1dB switches.

Construction

The unit should be constructed in a metal box so that the performance is not spoiled by stray radiation and the switches should be mounted in line as shown in the illustration. The switches are of the double-pole double-throw type. They should be of the slide or toggle type so as to maintain a symmetrical layout and the resistors should be mounted as shown in **Fig 1**, using the shortest convenient lead lengths.

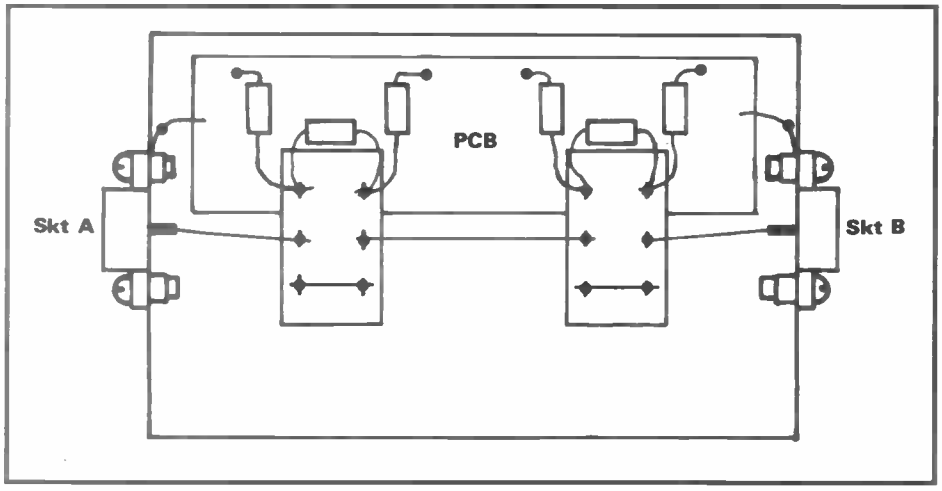


Fig 1

Earth plane

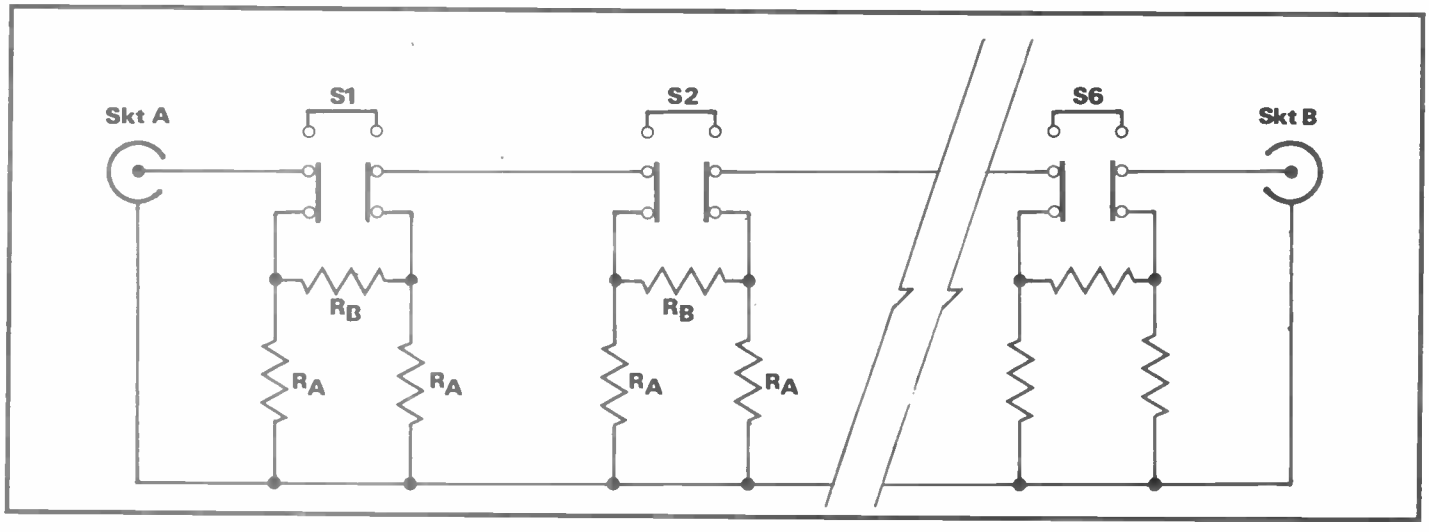
A sheet of PCB material is cut so as to be a close fit in the bottom of the box and is fixed under the switch mountings. All earth leads are connected to the ground-plane. Sockets of the desired type are fitted to the ends of the box. The earth connections from the sockets to the PCB material are made using short pieces of outer braid which have been removed from UR47 or similar coaxial cable. **Fig 2** should make the construction details clear. To conserve space it only shows two sections of the completed unit, the rest are simply cascaded in an identical manner.

	S1	S2	S3	S4	S5	S6
RA	S, 820, 56	S, 220, 220	S, 270, 22	150	S, 82, 25	S, 39, 22
RB	P, 12, 12	P, 22, 22	P, 33, 33	S, 33, 4.7	S, 56, 15	S, 220, 27

P=parallel S=series

All resistors in ohms, all ½ watt rating

Fig 2



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E. W. Hewitt Limited, Altrincham Sony Centre, 91a George Street, Altrincham, Cheshire, WA1H 1RW.

E. W. Hewitt Limited, Warrington Sony Centre, 48 The Mall, Golden Square, Warrington, Lancashire, WA1 1QE.

Peter Bamford Limited, Hull Sony Centre, 42 Paragon Street, Hull, North Humberside HU1 3ND.

Jones of Oakwood Limited, Leeds Sony Centre, 103 Vicar Lane, Leeds LS1 6PJ.

Jones of Oakwood Limited, Wakefield Sony Centre, 35 Cross Square, Wakefield, W. Yorks.

Cleartone Ltd., Manchester Sony Centre, 66/68 Bridge St., Manchester, M3 2RG.

W. M. Hewitt, 549 Ecclesall Road, Sheffield.

Lester and Nix Ltd., 11 King Street, Belper.

Williams Electrical Shops, Sheffield Sony Centre, 955 Ecclesall Road, Banner Cross, Sheffield.S11 8TY.

CBS Audio Vision Ltd., St. John's Precinct, Liverpool.

Fairbothams, 58 Lower Hillgate, Stockport.

Williams Electrical Shops, Rotherham Sony Centre, 7 Riverside Precinct, Corporation Street, Rotherham S60 1ND

Whiteleys, Deansgate, Blackpool.

Ball Bros., Bacup Road, Rossendale, Lancs.

J. G. Windows, 1-7 Central Arcade, Newcastle-upon-Tyne.

Goodrights Limited, Preston Sony Centre, 98/100 Fishergate Walk, St. Georges Centre, Preston, Lancs. PR1 2NR.

Fenhams, 119 Grainger Street, Newcastle-upon-Tyne.

Lawsons, 7 St. Anns Staith, Whitby.

Erricks of Bradford Limited, Bradford Sony Centre, 18 Rawson Square, Bradford, W. Yorks, BD1 3JP.

Hadwins, 29-33 Finkle Street, Kendle, Cumbria.

Misons, 11 Warwick Road, Carlisle, Cumbria.

Searle Audio, 229 Rawlington Street, Barron, Cumbria.

Scotland: Edinburgh Sony Centre, 386 Morningside Road, Edinburgh, Scotland EH10 5HX.

McMichael Bros., 9 Mill Street, Alloa, Clackmannanshire, Scotland SK10 1DT.

Graham Robertson, 5 Fountain Road, Bridge of Allan, Stirlingshire, Scotland SK9 4ET.

Video One, Glasgow Sony Centre, 31 Sauchiehall Street, Glasgow, Scotland G2 5HS.

Connolly Bros., Hi-Fi Limited, 31 Almondvale Centre, Livingston, Midlothian, Scotland EH54 6NB.

Connolly Bros., Hi-Fi Limited, 7 King Street, Kilmarnock, Scotland KA1 1PT.

David Steven, 1-3 Main Street, East Kilbride, Scotland.

Murray Mackie, 30 High Street, Fraserburgh, Scotland.

Martin E. Payne Limited, 38 South Methven Street, Perth, Scotland PH1 5NU.

Martin E. Payne Limited, 18 Union Street, Dundee, Scotland DD1 4BH.

C. Bruce Miller, 363 Union Street, Aberdeen, Scotland.

J. D. Brown, 28-36 Castle Street, Dundee, Scotland.

McMichael Bros. 23/27 Upper Craigs, Stirling, Scotland. FK8 2DG.

In Hi-Fi Ltd., 63 George Street, Edinburgh, Scotland.

Wales: Radiocraft Sonus Ltd., 251 Cowbridge Rd. Estate, Canton, Cardiff CF1 9TQ.

Radiocraft Sonus Ltd., 231 High Street, Swansea SA1 1NY.

Tele-Electrical Services, 9 The Brackla Street Centre, Bridgend, Mid. Glamorgan CF31 1DD.

Northern Ireland: F. Rea & Co., 24-30 Chichester Street, Belfast, Northern Ireland.

Laser Electrical Ltd., Unit 3, Abbey Trading Estate, Newton Abbey, Northern Ireland.

Audio Times, 85 Royal Avenue, Belfast, Northern Ireland.

Channel Islands: Reg Mauger (Sales) Ltd., 20 Halkett Place, St. Helier, Jersey, C.I.

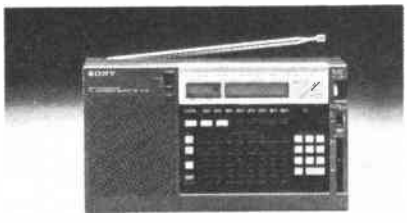
Soundtrack, 1 Church Square, St. Peter Port, Guernsey, C.I.

C. R. Regent, 49 Halkett Road, St. Helier, Jersey, C.I.

7600DA

ICF 7601L

ICF 7600DS



ICF 2001D

STRAIGHT & LEVEL

QSL CARDS TO CHINA

For those of you who have been lucky enough to have worked or heard China and are wondering about sending a QSL card, then the following list may be of use. It details callsigns, PO Box numbers and city information.

Many thanks to Hartmut DL1YDD, for providing the information. If you are going to QSL then don't forget an SAE and two International Reply Coupons to cover return postage.

Call	PO Box	City
BY1PK	6106	Beijing
BY1QH	2654	Beijing
BY1SK	2916	Beijing
BY1CJK	6206	Beijing
BY4AA	205	Shanghai
BY4AG	5304	Shanghai
BY4AOM	227	Shanghai
BY4RN	2405	Nanjing
BY4RB	413	Zhen Jiang
BY4SZ	51	Suzhou
BY4WNG	1827	Nanjing
BY5RA	730	Fuzhou
BY5RF	209	Fuzhou
BY5QA	507	Fuzhou
BY5HZ	804	Hangchow
BY5RT	707	Fuzhou
BY7KT	1285	Guangzhou
BY7HL	105	Changsha
BY8AA	607	Chengdu
BY8AC	607	Chengdu
BY9GA	12	Lanzhou (Gansu Province)
BY0AA	202	Wulumuchi (Xinjiang)

SOFTWARE TNC FOR THE SPECTRUM

Howard Benjamin recently reported in the Sinclair Amstrad Radio User Group (SARUG) newsletter on a new TNC package for the ZX Spectrum 48K micro. This will enable Spectrum users to join the growing force of packet radio users cheaply and quickly. It is believed to be the first product that implements a complete packet radio terminal on the Spectrum entirely in software.

The new system is called 'FB-AX25 Packet Radio System'. The cassette based software comes complete with a compact modem which plugs into the rear-edge connector of the computer, no modifications to the Spectrum are required. A DIN connector permits connection to the PTT, mic and loudspeaker lines of the transceiver, apart from this no other equipment is needed.

It would appear that the package is not a compromise; all the normal packet commands are available and the software includes eighty-five user selectable parameters. In receive mode the screen is split into a number of windows indicating channel number (up to six channels at one time), real-time clock and station callsign. The top two thirds of the screen are used to display incoming text and the bottom area is used as a type ahead buffer and for changing the software's parameters etc.

Future developments could include a program which will permit full colour pictures to be exchanged between Spectrums using AX25 protocol.

If you want more information regarding this interesting package contact: *Paul Newman G4INP, SARUG, 3 Red House Lane, Leiston, Suffolk IP16 4JZ. Please mark your SAE 'Packet Info'.*

NEW SOFTWARE FROM KANTRONICS

Rumours circulating from the States suggest that Kantronics are about to launch a new software rom for their range of TNCs. Version 2.85 includes many new features and these are a direct result of feedback and suggestions from users.

The latest software now includes the ability to stay connected to a distant KA-NODE when the far end station disconnects. If desired, this must be established by the end user when he builds his KA-NODE link from one node to the next or to the other end user. All this means is that you are able to establish a path to a distant city, talk to someone there and then, when that station disconnects, you remain connected to the city and are able to look around for other stations to work.

The built-in PBBS (Private Bulletin Board System) has been vastly improved, so that when somebody connects to you and you are not available to talk the new software will automatically switch the user into your private PBBS. Another improvement is that when there is mail waiting for you the STA light, if not in use by yourself, will blink to indicate this.

In addition to all these new features, the format of the PBBS has been changed so it looks like the more familiar RLI or MBL versions that you usually connect to. Each message is now listed on a separate line with SIZE, TO, FROM, DATE, TIME and SUBJECT, making each message easier to identify and read. Other standard mailbox commands are also available such as, LM (list mine), RM (read mine and KM (kill mine).

The 2.85 up-grade should be available in the UK within a matter of weeks and if you are interested in obtaining the latest version or require more information, then contact: *Kantronics, RF Data Communications Specialists. Tel: (913 842) 7745.* Alternatively, your local KAM dealer should have the up-grade shortly.

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

SHERWOOD FOREST AWARD

This award is available to all licensed radio amateurs and short wave listeners on a heard basis from 1 January 1982. A total of thirty points is required to claim the basic award. These can be obtained as follows:

– One point per station worked (heard) in Nottinghamshire.

– Two points per Mansfield ARS member station worked (heard).

– Five points for working (hearing) the Mansfield ARS stations G3GQC and G1GQC.

All permitted bands and modes may be used, however, working (hearing) the same station on a different band or mode does not count.

Log details only should be sent with a cheque or postal order for £1.50 to: Mr A Gibbins G4GNC, 52 Wheatfield Crescent, Mansfield Woodhouse, Mansfield, Nottinghamshire NG19 9HQ. Proof of contact may be requested.

A full list of current licensed members of the Mansfield ARS is available from the awards manager on receipt of an SAE.

ATARI ST FAX

WEFAX decoding software is now available for the Atari ST range of computers. Designed to be used in conjunction with the Kantronics range of TNCs, the software will allow the decoding and display of facsimile transmissions.

The program is capable of decoding all standard formats, and will work on medium or high-resolution monitors. It will automatically synchronise fax pictures on display, receive mirror images in real time and will print screens using most dot-matrix printers. Many more features are available and full information can be obtained from: *Pack-Age, Braeside, Urquhart, Crossford, Fife KY12 8QJ, Scotland. Tel: (0383) 721169* (twenty-four hours). The program is reasonably priced at £15.00 plus £1.00 p&p.

RADIO RSA

Radio RSA, the Voice of South Africa, has extended its amateur radio news coverage. 'Amateur Radio Spectrum' presented by Hans Van De Groenedaal ZS6AKV, is a programme dedicated to amateur radio and satellite communications, and can be heard in most parts of the world depending on transmission times and propagation conditions.

Schedules are in the table, reception reports are welcome and will be confirmed by a QSL card.

Reports should be send to: *Radio RSA, PO Box 4559, Johannesburg 2000, South Africa.* Try asking for some station information, books and a 1989 calendar.

Saturday	1452-1500UTC	East Africa, Middle East, Eastern Europe	21.535MHz
		South Africa	11.925MHz
		Europe, West Africa	21.590MHz
		USA, Canada	26.790MHz
Saturday	1845-1900UTC	Europe	15.365 and 17.795MHz
Sunday	0245-0253UTC	USA, Canada	9.615, 9.580 and 11.760MHz

RADIO KITS

Maplin Electronics has recently announced the introduction of a number of radio receiver kits that will be of interest to anybody who has just joined the hobby of electronics or short wave listening.

The first is a general purpose, direct conversion short wave receiver, which is capable of resolving SSB, DSB, AM and CW transmissions. The receiver is designed to cover any single amateur band from 160 to 10 metres, and the choice of which band to cover must be made at the time of purchase. The design features reduction drive 'vernier tuning', signal strength meter, buffered RF oscillator output and on-board voltage and audio power amplifier. Also available is a pre-drilled box and chassis, plus stick-on front panel transfers to give a professional-looking finish.

A kit that may be of interest, particularly for the beginner, is a simple TRF receiver, which is contained on a single printed circuit board. The only external components are a ferrite rod aerial, speaker and battery. Maplin can also supply a simple MW/LW TRF receiver based around the ZN414 radio IC. This kit has an added audio amplifier and is able to cover both the medium and long wave bands at a flick of a switch. Again, it would make an ideal introductory kit for the beginner.

Information on any of the above and a number of other useful kits can be obtained from the new Maplin Electronics catalogue, available from W H Smith for £1.95 or directly from: *Maplin Electronic Supplies, PO Box 3, Rayleigh, Essex SS6 8LR.* Price £2.50.

COMMODORE USER GROUP

An independent Commodore user group has been launched by Simon Lewis GM4PLM, to promote the use of any Commodore computer in connection with the hobby of amateur radio. The most popular machines being used by radio hams are the C16, C64/128 and Amigas, Simon's group hopes to provide software, help and advice for all these machines.

He plans to publish a small quarterly club magazine called 'Connections'; this will include ideas, articles, electronics projects and help for any Commodore user. At the moment Simon is looking for articles for his magazine and software librarians to distribute public domain software. Being a librarian does not entail too much work, just copying discs for members and keeping your library up to date.

If you feel you can help or want to become a member of the group then please contact Simon; he has many wonderful ideas planned but needs members to get things going. One year's membership will cost £8.00 and that includes four magazines and access to all the club's facilities.

For more information contact: *Commodore Radio User Group, c/o Simon Lewis GM4PLM, 69 Irvine, Drive, North Clippens, Linwood, Paisley, Reinfrewshire PA3 3TB. Tel: (0505) 29363.*

MOBILE ACTIVITY ON HF

Israel 4X1UF, welcomes contacts with any station who has an interest in mobile HF communication. He is active from around 0600GMT and from about 1000 to 1400GMT most days and can be found around 28.500MHz if the band is open, or 21.300 and 14.250MHz.

He is quite an expert in mobile communications and at the moment he is using an Icom IC-701 and a modified 5/8 wavelength commercial VHF antenna with a switchable coil mounted beneath the car roof just under the antenna connector. At the moment Israel is working on a similar aerial system for 80m, obviously it needs a much modified coil but rumour has it the system is up and running with a fair degree of success.

If you have an interest in this type of communication then a contact with him should be most beneficial. QSL cards can be sent via the bureau or to: PO Box 3859, Haifa, Israel 31-037. If you do QSL direct then please enclose an SAE and two International Reply Coupons for a reply.

THE KENWOOD TH-205E & TH-215E REVIEW

by Steven Goodier G4KUB and John Goodier G4KUC

Kenwood's latest offerings on the hand-held scene are the TH-205E and TH-215E. Although each unit is a separate product, we felt that a joint review was the best idea because the specifications are almost identical and most of the accessories are interchangeable between each transceiver. The main differences between each rig will become apparent as we deal with them.

TH-205E general description

The Kenwood TH-205E is housed in a tough, high-impact plastic and metal case designed to withstand the knocks and blows that are often encountered in portable work. The unit measures 67mm x 173mm x 37mm (WHD) and weighs approximately 520 grams (1.15lbs) including the PB-2 Ni-Cad pack.

The first thing that strikes you about this rig is its modern and attractive appearance and the lack of a calculator-style keypad which has almost become a standard feature of today's hand-held transceivers. A simple approach to the design of this unit has placed an emphasis on ease of use which can be of benefit to portable operation.

The TH-205E is designed to operate from a wide range of voltages from as low as 7.2V up to 16V dc. This is useful as it allows operation directly from a car supply without having to use some form of voltage regulation. It is also possible to run the TH-205E from any 13.8V power-supply via the PG-2V dc cable, making the rig a useful base station transceiver.

Of course, power output is dictated by the supply voltage, and the TH-205E is capable of providing a powerful 5W of RF output when operated from an external 13.8V PSU or from the optional PB-1 12V 800mAh Ni-Cad pack. The rig is fitted with a hi/lo power switch and the output can be reduced to around 0.5W for extended battery life. Auto-battery saving circuits are built in as standard and will automatically switch the rig to a 'stand-by and listen' mode one minute after the last key has been pressed or when the squelch is closed. The saver circuit deactivates automatically when a signal is received or when a key on the transceiver is pressed. In practice this works extremely well by dropping the received current consumption from the Ni-Cad pack from around 50mA down to 20mA. Unfortunately this option cannot be switched off, but few problems should be encountered under normal operating conditions.

A view from the front

The front panel has an easily understood layout comprising very few controls and is dominated by an easy-to-read liquid crystal display (LCD) which shows the operating frequency in full. The readout can also be back-lit for night-time operation; the light is controlled by one of the push switches on the front panel and remains on for as long as the switch is depressed.

There are two buttons to the right of the display that are used for stepping the rig up and down in frequency. The tuning steps are fixed to 5kHz and cannot be changed, but rapid QSYing can be achieved by holding either key down causing the rig to move rapidly up or down the band. The operating frequency can be 'locked' by using the 'F lock' switch. Once this feature is activated other options such as scan and memory operation, etc, are disabled and the rig will be conveniently locked on to the chosen working frequency. This is a very useful feature since the rig will not accidentally change channel.

The 'offset/R' key controls the repeater operation of the TH-205E. Each time the key is pressed it will cycle from '+' to '–' and back to simplex again. The shift for UK operation is fixed to 600kHz, but you must be careful to ensure that the display shows '–' before operating. Listening to the input can be achieved by pressing the 'M' key followed by the offset/R button. For as long as this key is held down you will be able to listen to the input from the repeater 600kHz down the band. The remaining keys deal with memory operation and scanning and will be dealt with later.

A view from the top

There are only four controls on the top panel. The first is the volume control which incorporates the on/off switch, and to one side is the squelch control which can be set for the desired squelch breaking level. Turning the squelch control fully anti-clockwise activates the optional CTCSS 'tone squelch unit' (TSU-3). This enables the transceiver to listen for any one of thirty-seven possible tones which activate the receiver.

There are two push buttons just below the BNC aerial connector. The first is labelled 'tone' which selects the 1750Hz toneburst for repeater operation. Pressing it down will place the TH-205E on to transmit and will emit the continuous tone for as long as the switch is depressed. The remaining switch is the hi/lo power selector discussed earlier.

The external power-supply socket on the top panel supplies voltage from an external PSU. The Ni-Cad pack is automatically switched out when this socket is in use. An extension speaker can be plugged into the 2.5mm jack socket, and a 3.5mm socket is also provided to take an external microphone. Note that the external mic socket also carries the PTT line in the same cable and, as with most hand-helds, the rig can be put on to transmit by shorting the mic line to earth via a suitable resistor.

The only remaining socket not dealt with so far is the antenna connector which is a standard BNC fitting. The aerial supplied with the TH-205E is a standard 'stubby-duk' which measures only 13.5cm in length. Lowe Electronics supplies a range of alternative aerials (see Table 2), otherwise, an external antenna such as a collinear can be connected for base station operation.

Memory operation

The TH-205E is equipped with three easily programmed memories which can store both the operating frequency and any repeater offset. The memories are programmed by choosing the frequency of operation and repeater shift if required, then pressing the 'M' button followed by the required memory number within five seconds.

Using any one of the three buttons located underneath the LCD readout will recall the stored frequencies and will also instantly recall any further information contained within that memory. Returning to manual tuning is achieved by pressing either one of the up/down tuning buttons; this facility makes tuning straight from the recalled memory frequency most convenient. If after choosing a memory you want to return to the original operating frequency, then pressing the chosen memory number again will return you to the original dial frequency.

We found programming and recalling memories simple and easily achieved. There was no need to memorise a number of keystrokes as is sometimes necessary with other pieces of equipment. We think that novice operators would be able to use the TH-205E after only minimal instruction.

Scanning

Scanning is implemented by using the button marked 'scan'. Scanning takes place from the displayed frequency, and the rig moves quickly through the band in 5kHz steps searching out any activity. When a busy channel is found the TH-205E will stop its scan and remain there until further action is taken by the operator. It must be noted that scanning will not be resumed after the channel becomes vacant and must be reactivated

by the user.

Last but not least, the PTT switch is located on the left-hand side of the case. Just above it there is an extra switch marked 'monitor' which opens the squelch. It is intended to operate along with the additional tone squelch unit and is used to check for any channel activity before transmitting.

That concludes the basic description of the TH-205E. Before moving on to the rig's 'on air' performance, we will take a look at the TH-215E and detail its additional features.

TH-215E general description

Unlike the TH-205E, the TH-215E has a keypad to programme and control the many functions it has to offer. There is very little difference in both hand-helds' transmit and receive specifications, although the TH-215E does have more control over such things as memory operation, scanning and microprocessor control.

The TH-215E has a rugged and attractive plastic and metal case. The main part of the front panel consists of a large LCD display with the keypad situated below. The display, apart from reading the operating frequency, details many more functions and has a small bar-graph meter which indicates the received signal strength and relative power output. There are also ten displayed memory channels, as well as scan modes and auto/save functions. I found this easy-to-read display both helpful and informative, giving instant information regarding operating modes and conditions.

The TH-205E

The top panel's layout is precisely the same as that of the TH-205E, so no major description will be given. All the usual controls such as volume, squelch, hi/lo power settings and various input/output sockets can be found here. The tone-burst is fully automatic and when the tone switch is depressed, a 1750Hz tone is superimposed on to the carrier for approximately half-a-second at the start of each transmission.

Front panel controls

There are a number of useful and conveniently placed push buttons just below the LCD display. The first is used to light the LCD display during night-time operation and will remain lit for as long as this button is depressed. Next, is the 'offset/F' which activates the repeater offset shift. This was set to −600kHz but it can be reprogrammed to any odd split required by pressing the 'F' key followed by offset/F. The display will then indicate the repeater shift, which in our case was 600kHz. By using the up/down keys the offset can be shifted up or down 100kHz at a time. It is also possible to listen to the input of repeaters by using the 'reverse' button; the shift in frequency is displayed and an 'R' is shown to indicate reverse operation.

Battery-save option

The TH-215E has a switchable 'save' option which will dramatically prolong the life of the Ni-Cads. In fact, the rig's save option is a little more economical than that of the TH-205E, and reduces current consumption to approximately 11mA which is quite a saving. It is also a little more sophisticated as there are two different save options to choose from. Pressing the save button once will activate the battery-save circuit two seconds after the squelch closes. A second press activates the 'auto save mode', and the transceiver's save circuit is activated one minute after the last key operation from when the squelch closes. All auto-save functions are clearly displayed on the LCD readout.

The power-save ratio (the actual length of time the receiver section shuts down) can be changed by the user. This is done by pressing the F key followed by the save button. The display will then clear and show the power-save ratio which can be increased or decreased by using the up/down keys. There are nine power-save ratios altogether.

Keypad options

Full control of the many advanced features is selected via the front panel keypad. Many keys have two functions which are selected by first pressing the F key and then the second function within five seconds. Moving about the band is achieved by the two up/down keys, once pressed, the rig will then step in 25kHz channels making QSYing and general tuning quick and easy; tuning steps are user selectable ranging from 5, 10, 15, 20 and 25kHz. The tuning rate is set by a couple of key presses and the chosen step is indicated on the right-hand side of the display.

To enter frequencies directly from the keypad press 'enter' followed by the frequency in full; the receiver will not change frequency until all the digits have been entered. Once entered you are free to tune about the band in the usual manner by using the up/down keys.

Memory operation

Unlike the TH-205E, this rig has the advantage of ten easily programmable memories which are all available at the touch of a button. Each memory is capable of storing not only the operating frequency but also the frequency step (5 to 25kHz) and the offset frequencies for repeater operation (memory channel '0' is capable of storing odd splits). Each memory is programmed by entering the frequency you wish to store: press 'M' followed by any one of the numbers on the keypad. If the repeater shift is active then this can also be stored along with the operating frequency, making it a simple matter to store all your local repeater stations.

Retrieval is a straightforward process once the memory channels have been programmed. It involves nothing more than pressing the appropriate number on the keypad, and the memorised fre-

The TH-215E

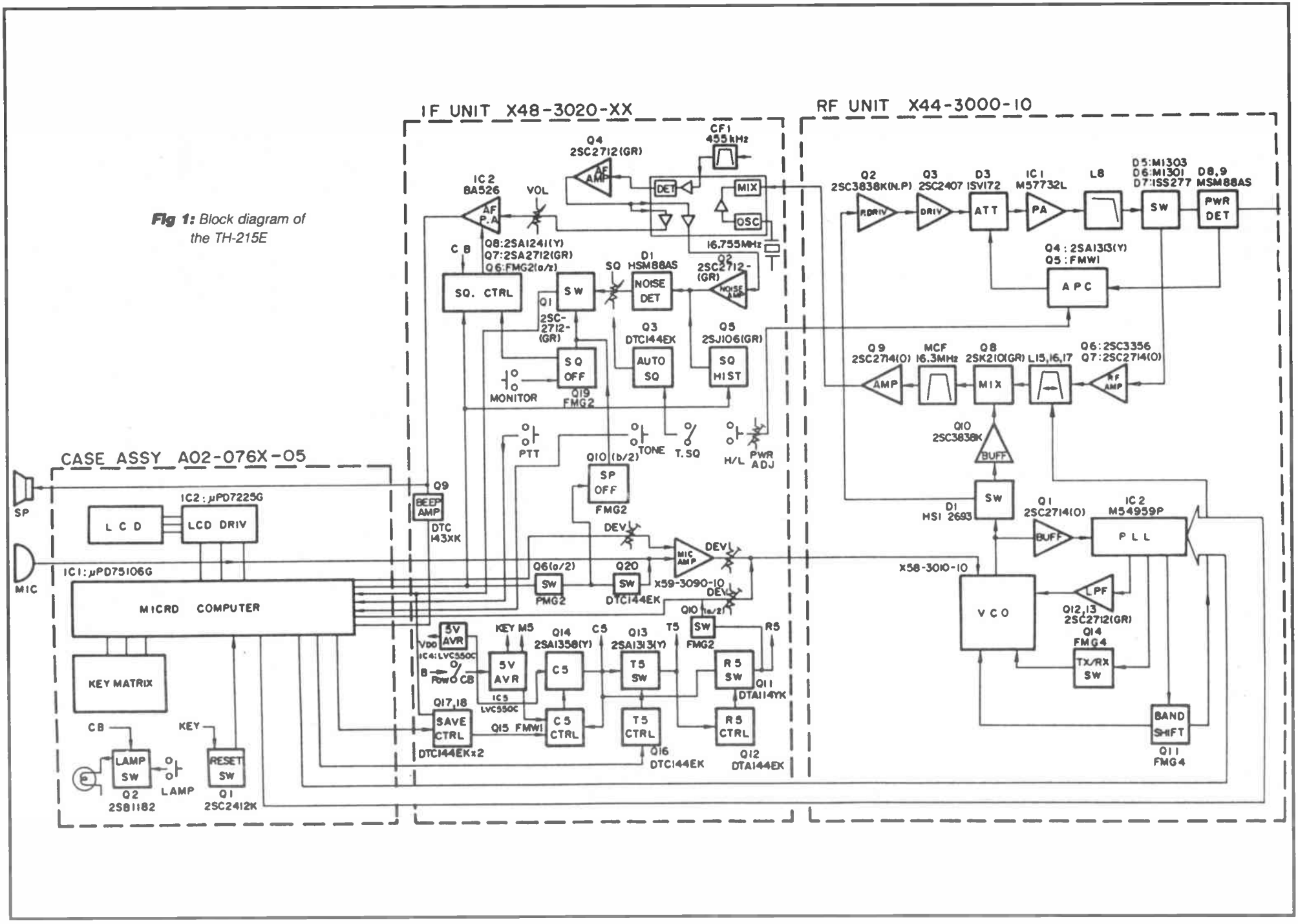


Fig 1: *Block diagram of the TH-215E*

second IF of 455kHz. Further selectivity is provided by CF1. The signal is then detected and fed to the squelch and audio amplifier circuits. The sophisticated squelch provides additional information to the rig's microprocessor which is needed for scan and battery-save operation.

On transmit, the audio from the microphone is first fed to a module mic amp unit located on the IF unit. From there the VCO is directly modulated and the resulting output is fed to the predriver transistor Q2 on the RF board. The main power amplifier is an M57732L power module and the output, which can be as high as 5W, is passed through the low pass filter L8 and on to the antenna socket via the changeover switch and power detector circuits.

Part of the output is fed back to an automatic power control circuit based around Q4 and Q5. This directly controls the attenuator D3, which is capable of varying the drive to the PA and thus protects the RF power module should the standing wave ratio be high. The hi/lo power setting is also coupled into the APC circuits.

All microprocessor functions are controlled by two multi-leg, flatpack devices (one is the main microprocessor and the other drives and controls the LCD). These are complex in operation and their functions are backed up by a long-life lithium cell. Therefore, the memories and other operational parameters are retained even when the Ni-Cads are fully discharged.

Comparing both rigs

The first thing which strikes you when using both hand-helds is the clarity of the audio that is produced by the forward facing and highly efficient speaker. Each rig is capable of delivering a maximum of 400mW of audio output which is ample for portable needs; indeed, there is more than enough audio to fill the average shack when a good quality external loudspeaker is connected.

The 25kHz steps on the TH-215E made tuning the band very quick and easy. The 5kHz tuning steps on the TH-205E slow things down a little, but rapid tuning can be achieved by holding down one of the tuning buttons.

Both receivers were very sensitive and a number of stations in the Manchester area were received with the small rubber duck aerials at our Marple QTH (ten miles south of the city centre). We stood the two rigs side-by-side and noted very few differences in sensitivity and audio quality between the two.

Programming the memories was the next step. This was a straightforward process for the TH-205E since there are only a couple of buttons to press and three memories to set up. The ten memories on the TH-215E take a little longer, but programming the rig was nonetheless quick and simple to understand. Both handbooks offer helpful tips and include examples on every aspect of each key's function.

Since these rigs are intended for portable operation we decided to test their capabilities in the field, therefore an expedition was arranged to a local high spot. Both transceivers were supplied with the PB-2 standard Ni-Cad pack which delivered 8.4V at 500mAh. This pack produced around 2.5W of RF which is more than enough for most needs. We started by listening around the bands, which clearly showed that the receive sensitivity on both rigs was more than adequate. The band appeared very lively and many distant repeaters were clearly audible. Audio quality was excellent and the memory function made tuning and listening to the band a pleasure.

A number of contacts were made, ranging from a few miles away to stations over forty to fifty miles away. Many people commented on the quality of the transmitted audio. Particular attention was paid to comments from weather stations regarding synthesiser noise, etc – none did. Next, the repeater shift was tried and accessing many repeater stations from our high spot presented no difficulties. Listening to the input with both rigs was achieved by using the 'reverse' key on the TH-215E, and the M followed by offset/R key on the TH-205E. When these keys were pressed both transceivers showed a shift in frequency of -600kHz.

Since Lowe Electronics kindly supplied two transceivers, we thought it would be a good idea to test the range from hand-held to hand-held. The test was successfully completed while working portable over difficult terrain, and contact was established up to a range of around five miles. It must be remembered that VHF coverage greatly depends on the lie of the land, and there is no doubt that a greater range could have been achieved if even one station had been located on a higher spot.

The battery's life was surprisingly long while using the PB-2 Ni-Cad pack, and the built-in battery saver circuit contributed to this. Of course, battery life depends on how often you transmit and as with all hand-helds, the Ni-Cad will soon die if you switch yourself on to 'waffle' mode. All in all, a generous amount of time is available with careful operating under normal conditions.

Ni-Cad packs

A large number of accessories are available for these hand-helds, and it is worth noting that they are incompatible with their 70cm equivalents. It would be impossible to deal with all items in great detail, so I have included a list of optional accessories from Lowe Electronics and their order code.

An AA-size empty case and no less than four Ni-Cad packs are available to power these rigs for portable use. The packs have a new locking system which aids rapid battery changing and gives maximum reliability from the pack in use. The PB-4 can supply 7.2V at 1600mAh. If you are planning to purchase a second battery then you will probably find this is the most useful in terms of output power and Ni-Cad life from a single charge.

Lowe Electronics also supplied the BT-5 empty case and the PB-4 heavy-duty pack. We filled the empty case with six AA-size cells, and both rigs ran well with a reasonably long transmit and receive cycle. It is worth considering this economical arrangement because AA-size rechargeable batteries are now relatively cheap and easily obtainable. The PB-4 provided extended battery life and is the ideal pack for all-day operation, the only disadvantage is that the PB-4 is a little large and about twice the height of the standard PB-2.

For those who wish to drive these hand-helds to their maximum output, it will be necessary to purchase the PB-1 which supplies 12V at 800mAh. When using the 12V pack, both the 2m and 70cm rigs are capable of providing a full 5W of output. This can be an added advantage when operating in a poor location.

Ni-Cad chargers

Charging these power packs is not

The BC-7 and BC-8 optional Ni-Cad chargers

difficult as Kenwood supply two optional Ni-Cad chargers. Unfortunately, the supplied wall charger will only handle the PB-2 pack and will fully charge it in around fifteen hours. Therefore, if you intend to obtain any of the additional batteries then you must also purchase one of the optional chargers.

BC-7 rapid charger

The BC-7 rapid charger has been designed to efficiently charge all of the packs in the minimum amount of time. It will take around one hour to fully charge PB-1, PB-2 and PB-3, with the higher rated PB-4 taking around seventy-five minutes to reach maximum charge. The battery slides into an opening in the top, and automatically connects to the charger circuits via connecting points behind the pack.

There is a single LED indicator on the front panel which shows green when the unit is switched on. This LED will turn red when a battery is placed in the charger, confirming that the battery has been correctly inserted and charging is taking place. When the pack is fully charged the LED will return to green, indicating that the pack has reached its full charge.

The BC-7 was used to charge both packs when the equipment first arrived. It was certainly an advantage to be able to charge two empty packs within the space of two hours. The BC-7 is very simple to use and virtually fool-proof in its operation. It is certainly worth considering if you intend to use your hand-held regularly or at short notice.

BC-8 compact charger

The BC-8 is the smaller of the two chargers and was designed to charge all types of packs, but this takes around fifteen hours because it will only charge at a nominal rate. The unit arrives in two parts, comprising the transformer, which connects to the main unit via a small power-plug, and a receptacle which holds the battery while charging takes place. Again, the pack slides into an opening in the top and charging is indicated by a small LED on the front panel.

The BC-8 is not fitted with protection circuits, so once you have finished charging it is important to switch the unit off, as overcharging for long periods could damage the Ni-Cads. Do not forget that all hand-helds come complete with the PB-2 Ni-Cad battery and BC-2 wall charger, therefore, the BC-8 would be very useful if you have a number of packs and wish to charge more than one at a time.

Handbooks

Both transceivers are supplied with basic operating manuals which also cover their 70cm and 220MHz equivalents. The TH-215E handbook has nineteen pages covering all aspects of operation and details all functions clearly, giving examples of each. The TH-205E handbook only contains eleven pages, but this is to be expected since the rig is less difficult to use. Each book also contains a list of optional accessories. A pull-out block and circuit diagram is supplied but unfortunately a circuit description is not included.

Conclusion

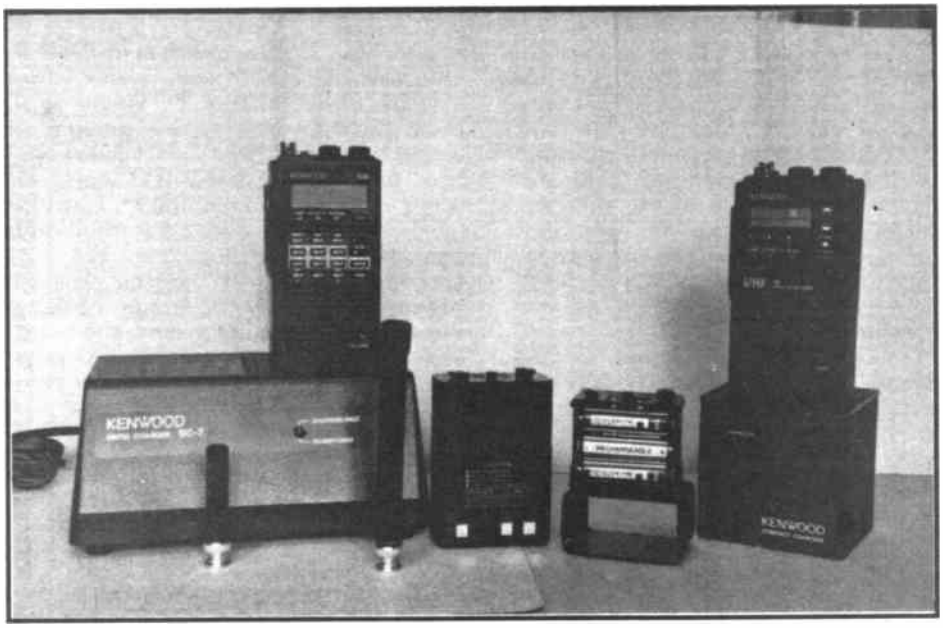
It would appear that Kenwood have produced two excellently thought-out pieces of equipment that would suit most requirements in the hand-held bracket. The TH-205E, being the cheaper of the two, most suits those operators who want an easily operated rig with memory and scanning facilities incorporated into a modern and compact unit. The TH-215E will suit those of you who want a little more sophistication built into your hand-held transceiver. Kenwood have been wise enough to keep keypad entry to a minimum of key strokes, yet still maintain easy to remember scanning and search options.

The receive and transmit specifications of each rig are identical, and there were no problems when working portable or using them as base stations. Many complementary reports were received regarding transmitted audio, and the receive quality even through the internal speaker was excellent. The LCD display on both rigs is easy to read and offers a fair amount of useful information, this being especially applicable to the TH-215E.

All in all, Kenwood have produced two fine hand-helds which should remain on the market for a long time, so we can thoroughly recommend both models. The TH-205E is priced at £215.26 and the TH-215E costs £252.13. Each rig comes complete with a PB-2 Ni-Cad pack, rubber flex antenna, wall charger and dust caps. There are also a large number of optional accessories available which are compatible with both models.

It's worth noting that 70cm equivalents of each rig are also available, these are the TH-405E and TH-415E. For more information on these and the reviewed samples contact: Lowe Electronics Ltd, Chesterfield Road, Matlock, Derbyshire DE4 5LE. Tel: (0629) 580800.

We would like to take this opportunity to thank Lowe Electronics for the loan of the sample rigs, chargers and accessories.



A variety of optional accessories

Operational Accessories for the TH-205E and TH-215E

PB-1	12V dc 800mAh Ni-Cad pack (charge with BC-7 and 8)
PB-2	8.4V dc 500mAh Ni-Cad pack (charge supplied)
PB-3	7.2V dc 800mAh Ni-Cad pack (charge with BC-7 and 8)
PB-4	7.2V dc 1600mAh Ni-Cad pack (charge with BC-7 and 8)
BT-5	AA-size battery case
BC-7	Rapid Ni-Cad charger for PB-1,2,3 and 4
BC-8	Compact charger for PB-1,2,3 and 4
BC-2	Wall charger for PB-2 Ni-Cad pack
PG-2V	Dc cable for base station operation
RA-2	Rubber-flexible antenna
RA-3	Telescopic whip antenna
RA-8B	Stubby helical antenna
SMC-30	Speaker microphone
MB-4	Mobile mount
BH-5	Swivel belt mount
SC-12	Soft carrying case to fit PB-2 and 3 Ni-Cads
SC-13	Soft carrying case to fit PB-1 and 4 Ni-Cads
LH-4	Deluxe leather case

Note: All accessories will fit both the TH-205E, TH-215E and their 70cm equivalents

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3A/146J	7.50
3A/147J	7.50
3A167M	10.00
3A3A	3.95
3A4	1.10
3A5	4.50
3AT2	3.35
3B22	25.00
3B24	12.00
3B26	24.00
3B28	16.00
3BZ6	1.50
3C45	39.50
3CX3000A7	650.00
3CY5	1.50
3D21A	29.50
3E22	49.50
3E29	39.50
3EJ7	1.95
3H	0.40
3J 170E	1450.00
3L	0.40
3Q4	2.50
4-65A	75.00

4-250A	85.00
4-400A	87.50
[illegible]	425.00
4B32	38.00
4B/551B	128.00
4BQ7A	1.75
4BZ6	1.95
4C28	25.00
4C35	145.00
4CX125C Eimac	150.00
4CX250B	45.00
4CX250BM	65.00
4CX250K	115.00
4C250R	125.00
4CX350A	100.00
4CX350F	95.00
4CX1000A	425.00
4CX1500B	470.00
4CX5000A	1000.00
4D21/4-125A	65.00
4D32	126.00
4GS7	2.25
4GV7	2.25
4JC6A	2.95
4KT6	1.50
4X150A	35.00
4X500A	350.00
5A/102D	9.50
5A152M	9.00
5A163K	10.00
5A170K	6.25
5A-180M	9.00
5A-206K	10.00
5AM8	2.15
5AN8	1.20
5B-110M	10.00
5B-254M	14.50
5B-255M	19.50
5B-256M	15.00
5B-257M	15.00
5B-258M	14.50
5C22	125.00
5CL8A	2.50
5J180E	1980.00
5LJ8	2.95
5R4GB	5.50
5R4GY	4.95
5TA	5.95
5T8A	1.95
5U4G	4.50
5U4GB	4.50
5V4G	2.50
5X4	4.95
5Y3GT	1.95
5Z3	4.50
5Z4GT	2.50
6/30L2	0.70
6A203K	9.00
6A7	4.95
6A8	1.50
6AB7	4.50
6AC7WA	2.00
6AG5	2.50
6AG7	1.95
6AH6	3.50
6AJ4	3.50
6AJ7	2.00
6AK5	1.95
6AK6	2.50
6AL5	0.85
6AM4	3.25
6AM5	6.00
6AM6	1.95
6AN5	4.50
6AN8A	4.50
6AQ5	1.75
6AQ8	1.00
6AR5	5.95
6AS5	1.50
6AS6	2.50
6AS7G	4.50
6AT6	1.95
6AT8	1.75
6AU4GT	2.00
6AU5GT	4.50
6AU6	0.95
6AV6	1.95
6AW8A	3.50
6AX4GT	1.95
6AY3B	1.95
6AZ8	4.50
6B8G	1.50
6B10	1.95
6BA6	1.50
6BA7	4.50
6BA8A	3.50
6BC8	0.85
6BE6	1.50
6BG6G	3.00
6BH6	1.95
6BH8	1.50
6BJ6	1.50
6BK4	6.50
6BL6	85.00
6BL8	1.15
6BM6	115.00
6BN6	1.85
6BN8	3.95
6BQ5	0.95
6BQ7A	1.50
6BR7	4.95
6BS7	5.50
6BW6	5.35
6BW7	1.50
6BZ6	2.50
6BZ7	2.95
6C4	1.50
6C5	1.95
6C6	3.50
6C8G	1.50
6C9	4.95
6CA4	4.95

6CA7	3.50
6CB5	3.95
6CB6	1.95
6CD6GA	4.50
6CF6	1.95
6CG7	4.50
6CH6	6.95
6CL6	3.25
6CL8A	1.50
6CM7	2.95
6CS6	0.75
6CS7	0.95
6CW4	6.00
6CX8	2.50
6DC6	2.35
6DJ8	1.00
6DK6	1.50
6DQ5	6.50
6DQ6B	2.50
6DT6A	1.50
6DW4B	3.50
6E5	3.95
6EA7	2.50
6EA8	2.50
6EB8	1.75
6EJ7	0.85
6EM5	2.50
6EM7	2.50
6EV8	1.75
6EV7	2.95
6EW6	1.50
6F1	2.00
6F5	5.50
6F6G	2.50
6F7	6.50
6F13	3.00
6F14	1.00
6F17	2.75
6F23	0.80
6F24	1.25
6F25	1.25
6F28	1.25
6F32	1.25
6F33	12.50
6FH5	6.50
6FH8	5.95
6FL2	4.50
6FQ7	4.50
6GE5	3.95
6GH8A	2.50
6GK6	3.95
6GJ7	0.85
6GM6	2.85
6GS7	2.15
6GV8	0.95
6GW8	2.50
6GY5	4.95
6GY6	2.50
6H1	6.50
6H6	2.50
6H6GT	1.95
6HB7	1.95
6HF8	2.50
6HM5	2.50
6HQ5	3.50
6HS6	4.95
6HS8	2.95
6HZ6	3.50
6J4	2.15
6JAWA	3.15
6J5GT	2.50
6J6	2.00
6J7	4.15
6J7G	4.15
6JB6A	7.95
6JE6C	7.50
6JM6	7.50
6JU8A	2.50
6JS6C	8.50
6K7G	2.00
6K8G	3.00
6KD6	8.95
6KG6A	6.95
6KM8	2.50
6L1	2.50
6L6GC	2.95
GL6GC USA	6.50
6L6GT	2.95
6L6WGC	5.50
6L7	3.50
6L15	3.15
6L19	3.95
6LJ8	2.50
6LD20	1.15
6LF6	7.50
6LQ6	7.50
6P28	2.00
6Q7GT	1.50
6R7	3.15
6RHH8	10.00
6S4A	1.50
6SA7	1.35
6SC7	1.50
6SH7	1.35
6SJ7GT	1.20
6SK7	1.35
6SL7GT	1.95
6SN7GT	1.95
6SQ7GT	1.50
6SS7	1.95
6T8	1.50
6U6GT	3.50
6U7G	3.50
6U8A	1.50
6V6G	1.25
6V6GT	1.95
6W4GT	1.95
6Y6G	3.95
6X2N	1.00
6X4	1.50
6X5GT	1.00
6X5GTY	1.00
6X8A	2.25
7A6	4.50
7AU7	1.50
7B6	3.50
7B7	2.50
7D8	4.50
7J7	8.50
7K7	7.50
7L	1.50
7Q7	4.50

7Y4	2.50
8B8	2.50
8B10	2.50
8BQ5	1.95
8CW5	1.50
8EB8	1.50
8FQ7	1.97
10D2	1.25
10DE7	2.50
10DX8	2.50
10EB8	1.95
10EW7	2.95
10F1	0.75
10GK6	1.95
10P14	2.50
11E3	55.00
11R3	6.50
12A6	3.95
12AD6	1.50
12AE6	5.50
12AH7GT	4.95
12AL5	1.00
12AT6	1.25
12AT7	1.15
12AT7WA	2.50
12AU6	1.50
12AU7	0.85
12AV6	1.95
12AV7	2.50
12AX4GTB	1.50
12AX7	0.95
12AX7WA	2.50
12AX7S	7.95
12AY7	3.95
12B4A	4.50
12BA6	2.50
12BE6	1.95
12BH7A	3.50
12BL6	1.75
12BR3	1.95
12BY7A	3.50
12C8	2.50
12CA5	1.95
12CX6	1.20
12DQ6B	3.50
12DW4A	3.50
12DZ6	3.95
12E1	16.50
12E14	35.00
12FX5	1.95
12GN7	3.95
12HG7	3.95
12J5GT	3.95
12J7GT	3.50
12JZ6	2.95
12K7GT	1.50
12K8Y	1.95
12KU7	1.95
12PE13A	83.00
12S7GT	1.50
12SA7GT	1.95
12SG7	4.75
12SK7	1.95
12SJ7	1.50
12SN7GT	1.85
12SW7	3.50
12SY7	4.50
12X4	1.95
13D7	3.20
13D9	3.20
13DE7	2.50
13DR7	2.95
13E1	145.00
13EM7	3.50
14B6	4.50
14R7	3.50
15E	5.50
16AQ3	1.95
16GY5	2.95
16H	0.40
16L	0.40
17A8	3.50
17AX4GTA	1.95
17BE3	2.50
17DW4A	2.95
17EW8	0.95
17JZ8	4.50
18D3	6.00
18GB5	3.50
19AQ5	3.50
19AU4GT	2.50
19BG6	3.50
19G3	19.50
19G6	9.00
19H4	35.00
19H5	33.50
20CV	6.50
20D1	0.70
20LF6	7.95
20L1	0.95
20P1	0.55
20P4	1.95
20P5	1.15
21JZ6	4.95
21KQ6	4.95
21LU8	3.75
24B1	39.50
24B9	39.50
25BQ6	1.75
25DQ6B	2.95
25L6GT	1.75
29C1	16.50
29KQ6	6.50
30C15	0.50
30C17	0.40
30C18	1.49
30FL2	1.35
30FL12	0.95
30FL13	1.10
30FL14	1.29
30L1	0.45
30L15	0.00
30L17	0.80
30P4MR	1.00
30P12	1.00
30P18	0.80
30P19	1.00
30PL1	2.50
30PL13	0.50
30PL14	1.75
31JS6C	5.50
33A/158M	19.50

35A3	3.95
35A5	4.50
35C5	4.50
35L6GT	2.00
35Z3	1.95
35Z5GT	3.50
38HE7	6.95
40KD6	6.50
42	6.95
47	6.00
50A5	1.50
50B5	1.95
50C5	0.95
50CD6G	1.95
50EH5	1.50
50JY6	2.95
53KU	4.50
75B1	3.50
75C1	4.50
80	4.50
83	6.50
83A1	7.50
85A1	6.50
85A2	2.95
90AV	17.50
90C1	3.50
90CG	17.50
90CV	17.50
91AG	9.00
92AG	19.50
92AV	16.50
95A1	6.50
100E1	10.00
108C1	2.50
150B2	6.50
150C1K	9.00
150C2	2.50
150C4	2.50
185BT	1.50
211	33.50
230D	15.00
231D	15.00
250TH	150.00
307	5.00
328A	15.00
404A-10	0.95
425A5	6.00
436A	35.00
572B	65.00
705A	12.50
708A	6.00
713A	25.00
723A/B	75.00
724A	275.00
725A	275.00
726A	75.00
7027A	7.50
801A	16.00
802	25.00
803	14.95
805	59.00
807	5.50
808	5.95
810	65.00
811	15.00
812A	35.00
813	27.50
813 Philips	35.00
829B	14.50
833A	95.00
843	7.50
866A	6.50
872A	20.00
873	50.00
954	1.00
955	1.00
958A	1.00
1299A	0.50
1626	3.00
1768	95.00
1849	315.00
1927	25.00
2040	25.00
2050	6.95
2050W	6.95
4004A	11.50
4212E	250.00
4212H	250.00
4313C	4.00
4328D	9.00
4471	35.00
4687A	9.50
5544	79.50
5636	5.50
5642	9.50
5651	2.50
5654	1.95
5670	3.25
5672	4.50
5675	26.00
5678	7.50
5687	4.50
5696	4.50
5702	3.50

5704	3.50
5718	6.15
5725	2.50
5726	2.50
5727	2.50
5749	2.50
5750	1.85
5751	2.95
5763	6.50
5814A	3.25
5823	6.50
5829WA	6.50
5840	3.50
5842	11.00
5863	95.00
5886	13.95
5894	39.50
5899	4.50
5963	1.75
5965	2.15
6005	1.85
6021	3.95
6057	3.75
6058	3.95
6059	3.75
6060	2.25
6062	4.50
6063	2.00
6064	3.25
6067	7.00
6072	6.95
6080	6.50
6080WA	6.50
6132	10.50
6136	2.50
6146B	9.50
6146W	12.50
6155	72.00
6156	72.00
6157	2.50
6158	3.20
6189	4.50
6201	6.45
6205	6.95
6211	2.50
6267	4.50
6299	250.00
6350	3.50
6360	4.50
6386	14.50
6442	75.00
6443	7.00
6463	7.50
6550 RCA	15.00
6550 GE	10.95
6688	6.50
6761	12.50
6870	11.50
6883B	9.95
6973	7.95
7025	2.50
7025S	6.95
7027A	6.50
7032	2.00
7036	4.95
7044	6.95
7054	3.95
7059	2.50
7119	9.00
7167	3.95
7189	6.50
7193	7.50
7199	7.50
7247	4.95
7475	6.00
7486	155.00
7527	85.00
7551	6.50
7558	6.45
7581A	9.95
7586	15.00
7587	16.50
7591A	6.95
7609	47.00
7698	75.00
7699	25.00
7788	25.00
7815	89.50
7868	7.50
7895	17.50
7963	7.95
8005	95.00
8020	45.00
8136	2.15
8156	7.95
8417	[illegible]
8844	25.00
8874	218.00
8950	10.50
9001	1.50
18042	10.50
18045	10.00
18046	11.50

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DX DIARY

News for HF operators compiled by Don Field G3XTT

The bands were buzzing again during December and, as I had anticipated, 10m was full of activity for the ARRL Contest. I worked forty-five of the mainland states in some very limited operating, and the only one I failed to hear was Wyoming, always a rare one.

FO5LZ was quite active in early December from the Marquesas Islands, before returning to France for the holiday period. The Marquesas are part of French Polynesia but, under the revised DXCC rules, could well end up counting as a new one, though this is by no means certain. FO5LZ was workable every afternoon on 20m, but via long path which fooled quite a number of folk (including me). There will be another opportunity to work the Marquesas Islands in early March when W1XX, N1CIX and WB6GFJ will operate as FO0FB. This effort is mainly aimed at the ARRL Contest, but I'm sure they will look for other parts of the world outside the contest period.

Too late for inclusion in last month's column was news that the group who had planned to operate in early 1989 from Kingman Reef, Palmyra and elsewhere, would actually go to Mellish Reef and Willis Island instead, starting around 7 January. I hope you caught this one. Certainly I still needed Mellish Reef, and imagine I'm not the only one. Steve VP8BUB is still on South Georgia, and has promised to be active between April and October. If you need this one it is probably worth dropping a line to Hazel G4YLO who handles the QSLs and may well be able to help with times and frequencies. Also from that neck of the woods, EA4YW should be in the South Shetland Islands by now, signing EA0BAE. He will be there until about mid-April.

Tom 9Q5NW is likely to make one more foray at TN4NW early this year, although I have no dates. Tom takes a portable PC with him for logging and gets very cross with anyone who makes a duplicate QSO (which he can check instantly using the computer). TU4BR/5U7, who has done much to keep Niger on the air of late, is reported to be due to pack up soon. It is notable that much of the activity from the rarer countries in Africa these days seems to involve Americans such as these two and Dave J52US who is another who has been extremely active on all bands and modes. Many work in the various US embassies and are on tours of duty of two years, so it's well worth catching them while you can because at other times many of these countries can be very rare indeed.

DX News Sheet reports that ZD8AE went QRT late last year due to TVI problems. An irate neighbour put a fish-hook through his feeder. And I thought it could only happen in suburbia!

The Hungarian operation from Vietnam wrapped up at the end of November after making a staggering number of QSOs. My guess is that they must have comfortably achieved their target of 100,000. Full marks to all the operators who did an absolutely splendid job. Unfortunately they were unable to make the planned side trip to Cambodia.

VK0NE was due to leave Macquarie Island in December but his place should have been taken by no less than three amateurs, VK0GC, VK0AK and VK0DS. VK0GC has been very active previously from Macquarie (I recall him being worked in the UK on both 40 and 80m), so this one should become fairly easy to work over the next year or so. VK0AK is reported to be especially keen on CW. FT4ZE should now be operational from Amsterdam Island, having replaced Dany FT5ZB. Look for him mainly on CW.

After a long period of inactivity and lots of rumours of possible operations, it finally looks as though we may see some activity from Mariana Island. ZS6PT expects to be active as ZS8MI for fourteen months, beginning in April. Definitely one to look out for. ZS5E will handle the QSLing.

DXCC notes

During December the DX Advisory Committee of the ARRL rejected the proposal to bring Okino-Torishima back on to the Countries List, but has recommended that Rotuma Island should count. However, the DX Awards Committee, which was due to meet in January, had to ratify these recommendations before they could be implemented.

The W6AM story

Newly-licensed DXers may not have heard of the late Don Wallace W6AM, though he was well-known to the DX world for many years. A recent article in the American **QST** magazine by Jan N6AW gave some interesting background to the W6AM story. Don, who became a Silent Key in May 1985, had been an enthusiastic amateur from the early days of the hobby as well as being professionally employed as a naval radio officer. However, it was in 1945 that he bought the 120 acres of land on the Palos Verdes peninsula of California where he was to establish the antenna farm which was to make him famous in the DXing world. Don installed sixteen rhombic antennas, the longest being 1550 feet! All this involved sixty-one telephone poles, each 80ft high, as supports, another ninety feeder poles, each 25ft high, and some fifty-two miles of feedline!

This antenna hardware kept Don at the top of the DX standings and, even after he sold ninety-five acres in 1962, he was still able to maintain an antenna set-up which was second to none. Apparently the land he sold was used for housing development and, in time, some eleven amateurs would live and set up their antennas in the area which had previously been enclosed by the biggest of the rhombics.

W6AM was renowned for his CW copying ability, for which he won a number of cups. Over the years he made some 500,000 QSOs, and received 100,000 QSLs!

N6AW had the task of dismantling the W6AM station, but only after following Don's wish that the station should be kept on the air for a year after his death. N6AW remarks on what a joy it was to operate the monster station. In just three weeks 100 countries were worked on 80m, and fifty JAs were worked on top band in a night. All in all, quite a story. I don't suppose there will be many who can follow in W6AM's footsteps, but he was certainly an inspiration to the rest of us to put out the best signal we can with the resources available.

QSLs for awards

DX News Sheet has recently been carrying a debate about whether QSL cards should still be required for awards purposes or whether the 'honour system', as used by the New Zealand national society for their awards programme, should apply. This system assumes that DXers are essentially honest, and therefore calls only for a certified log extract. The argument for the honour system is that QSLing can be costly, time-consuming and, in any case, is itself open to abuse by those DX stations who are prepared to 'sell' cards or who simply don't check their logs to see whether a contact really took place.

Doing without a QSL requirement for awards would take much strain from the bureau system, and might encourage some DX stations back on the air who currently fear to make any contacts

because they know they will be besieged by QSL cards. The discussion recognises that many DXers will still want to collect QSLs for their own sake, but the suggestion is that this should be kept quite distinct from awards collecting.

The other side of the equation is that, for the truly competitive awards like DXCC or IOTA, there is no doubt that there is a handful who try and cheat their way to the top of the pile (it happens in contesting as well) and the QSL requirement goes some way to limiting the scope for cheating. Also, as I have said in these pages before, sometimes it is possible to think in the heat of the moment and the QRM surrounding a DXpedition that you have had a satisfactory QSO with a DX station, when in fact you are not in his log. Mind you, having just received blank ZK1 and EL cards in a batch of samples from a company which prints QSL cards, I can see that the unscrupulous can get their hands on rare cards if they want to, even without making a contact.

To be fair, getting QSLs out of DXpeditions is usually no problem. It is the amateur in a remote spot who simply wants to be able to work folk around the world in order to keep in touch, who often gets to the point of desperation with demands for QSLs.

Similarly, the cost of collecting cards for a major award can be high (though a lot less than the cost of a new rig). No doubt the debate will continue, though as I said earlier, I suspect that many readers enjoy QSLs for their own sake, as mementoes of interesting times on the air. I should be pleased to receive any comments you may have.

Perhaps one of the real irritations is the way that more DX stations are demanding 'payment' for QSLs or laying down rules about how to QSL. One manager, for example, asks for only one card per envelope, at least a dollar per card, the call to be written in bold letters on the envelope, etc, etc. As each manager seems to have his own foibles, those of us who are chasing cards have to be telepathic to know what to do for the best! Common sense used to be enough. In other words, if you want a card direct, enclose enough by way of IRCs or whatever to cover the postage, enclose an SAE to save the manager the chore of writing one out and ensure that all the details on your QSL are correct to save the manager or DX station having to hunt through his log to verify the contact.

Awards

After that little dissertation it may seem rather perverse to go on to talking about an award which requires QSL cards, but that is the way the world of awards tends to be right now. I talk in these pages of new awards from remote parts of the world, but I thought it was time to remind you of some of those available nearer home.

One which is particularly popular is the IARU Region 1 Award, for confirmed contacts with amateurs in those countries whose national societies are members of IARU Region 1. The list has grown over the years and the table shows those countries which currently qualify. There are three classes of the award: class 3 for confirmed contacts with twenty countries, class 2 for thirty-five, and class 1 for all eligible countries. The award is administered in the UK by the RSGB Awards Manager, GW4BKG, and there is a charge of £3.00.

The award can be endorsed for a single mode (eg 'all CW) and there is also a '28MHz only' variant. However, whereas for the main award contacts can have been made at any time since 15 November 1945, for the 28MHz award contacts must have taken place after 1 July 1983. Although not all the countries concerned are active at present, all have been on in recent years and are likely to continue to be reasonably easy to work for the foreseeable future.

Contests

As I promised last month here are some further details of the ARRL contests. The CW event is on 18/19 February and the SSB event on 4/5 March. Each runs for the full forty-eight hours. The categories include single-operator single-band, single-operator multi-band, single-transmitter multi-op, two transmitter multi-op and unlimited multi-op. There is also a single-operator all-band QRP category (5 watts output or less). US and Canadian stations send signal report plus state or province (multipliers are mainland states – not Hawaii or Alaska – plus District of Columbia, VE1-8, VO and VY1, fifty-nine in all), while we send signal report plus a three digit number indicating approximate transmitter output power. Score three points for each complete contact.

A range of plaques and certificates will be awarded to winners in the various categories. Logs should be sent on official forms postmarked not later than 5 April to ARRL HQ. I can help with a photocopy of the rules, cover sheet and log sheet.

Also during February there is the CQWW 160 SSB contest from 2200GMT on the 24th until 1600GMT on the 26th. The YU-DX Contest is on 4/5 February (twenty-four hours starting at 2100GMT on Saturday), the Dutch PACC Contest takes place the following weekend (from 1400GMT on Saturday until 1700 on Sunday), and the French SSB Contest is on 25/26 February (thirty-six hours from 0600GMT on Saturday). Looking ahead, pencil in 18/19 March for the Bermuda Contest (the UK winner gets a free holiday in Bermuda) and the following weekend for the CQ WPX SSB Contest.

Finally, congratulations to Roger GW4OFQ who becomes the first GW to be awarded the 5-band Worked All Zones award. This is a particularly remarkable achievement because Roger has always had to make do with very modest antennas.

COUNTRIES FOR IARU REGION 1 AWARDS

Country	Prefix	Country	Prefix
Algeria	7X	Lebanon	OD
Andorra	C3	Lesotho	7P
Austria	OE	Liberia	EL
Bahrain	A9	Liechtenstein	HB0
Belgium	ON	Luxembourg	LX
Botswana	A2	Malta	9H
Bulgaria	LZ	Mauritius	3B
Cyprus	5B	Monaco	3A
Czechoslovakia	OK	Morocco	CN
Denmark	OZ	Netherlands	PA
Djibouti	J2	Nigeria	5N
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Gambia	C5	San Marino	T7
German Dem Rep	Y	Senegal	6W
German Fed Rep	DL	Sierra Leone	9L
Ghana	9G	South Africa	ZS
Gibraltar	ZB	Spain	EA
Greece	SV	Swaziland	3DA0
Hungary	HA	Sweden	SM
Iceland	TF	Switzerland	HB9
Ireland	EI	Syria	YK
Israel	4X	Turkey	TA
Italy	I	United Kingdom	G
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A DIGITAL ENLARGER TIMER

by David J Silvester

The main difficulty with photographic enlarging while working in a darkroom is switching on and off the enlarger lamp using the same clock which is used for developing the film. The level of 'safe-light' allowed for colour photography is extremely low, thus manual control of the enlarger becomes almost impossible. In these circumstances it must be simple to operate the timer. A small amount of light will need to be given out by the timer from the display and the illuminated push button, although the levels can be kept very low and will not affect the unexposed paper. With any timer there must be a way to set the time when the output is active (the 'exposure' state) as well as a separate unlimited time state (the 'set-up/focus' mode). There is a third state which I have called the 'static' state for when the timer is awaiting further instructions. A bank of two thumb-wheel switches provides the necessary time information for the unit, and a low intensity green LED display shows the remaining time.

Considerable thought went into deciding if the timer should count up from zero to the exposure time or from the exposure time down to zero. After experimenting with both ways, I found it easier to carry out test exposures using the down counter. This method of counting uses a parallel load up/down counter which is held permanently in the down counting mode. The parallel load counter has a secondary advantage because when altering the thumb-wheel switches in the static state, the display immediately shows the set time without needing to refer to the switches and without the enlarger's lamp coming on. With this in mind, the design's specification is as follows:

1. The exposure time of 1 to 99 seconds is selected by a digi-switch.
2. Mains-driven timer with 50/60Hz selection.
3. The counting control is set to 10Hz to reduce maximum error to 10% at one second.
4. Low intensity display of time.
5. The illuminated push-switch extinguishes during exposure.
6. Short push-on switch for exposure.
7. Long push-on switch for set-up.
8. Display blanking during set-up shows when this mode is in use.

The timer only operates at a slow speed and the highest frequency is 50Hz (CMOS-type logic chips were chosen). There was no attempt to micro-miniaturise the PCB which uses a full Eurocard size without cutting. The effect of miniaturisation in the darkroom would make the unit more difficult to use.

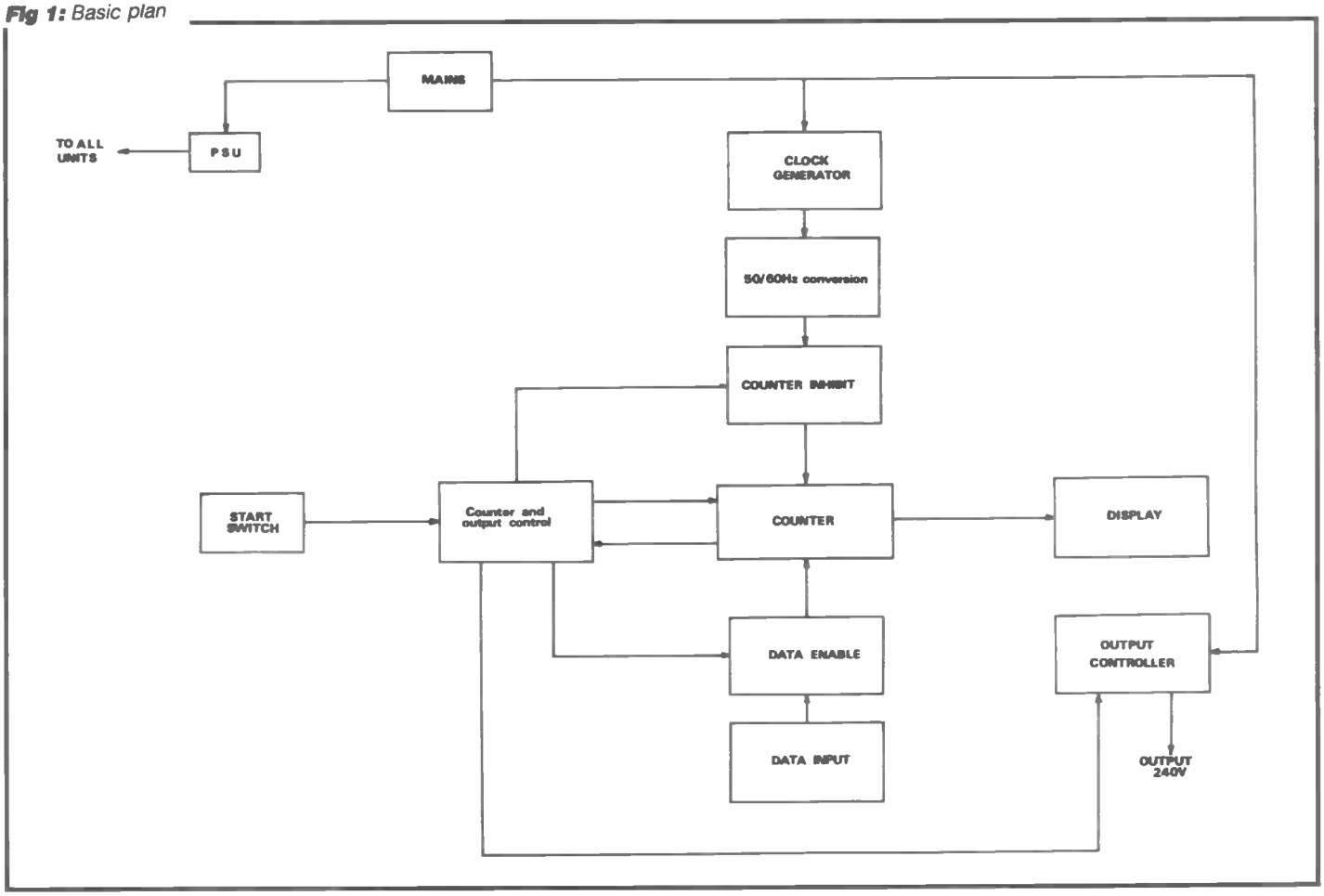
How it works

The instrument can be divided into a number of simple units (see **Fig 1**), which when they come together form the complicated system of the timer. The most important parts are the connnections between the units.

The display

The display comprises two seven-segment common cathode LEDs driven from the display driver chips IC3 and IC4 shown in **Fig 2**. These driver chips do not contain any current-limiting resistors so these are provided by IC1 and IC2 which, rather than semiconductor devices, are dual in-line resistor packs with seven 4K7 ohm resistors which are electrically separated from each other across the pack. There is no reason why a total of

Fig 1: *Basic plan*



A DIGITAL ENLARGER TIMER

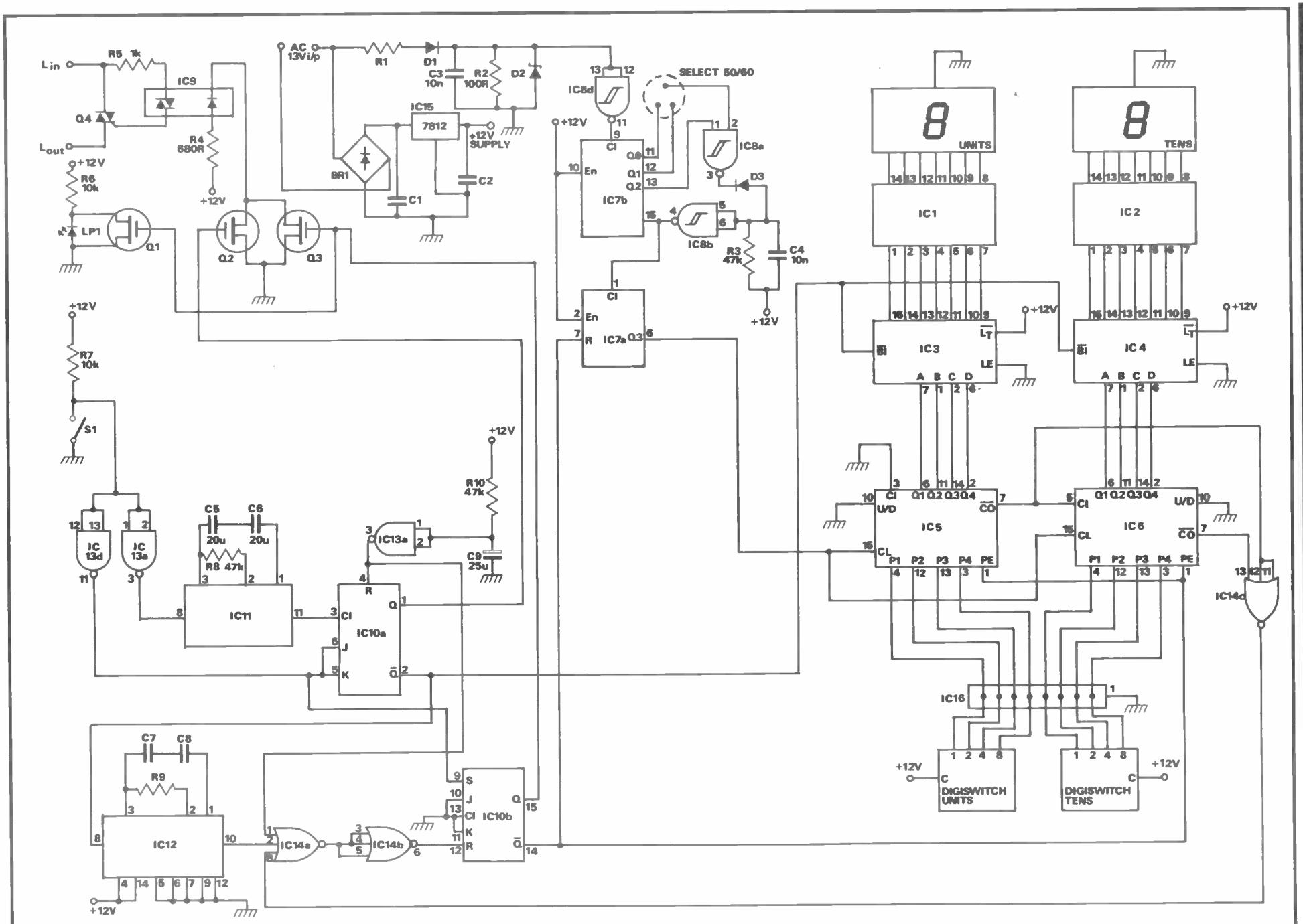


Fig 2

fourteen separate resistors cannot be used in the display, but the neatness of the IC-style resistor pack and the ease with which the resistor value can be changed if these packs are inserted into IC sockets has much to recommend it.

The value of resistance is substantially higher than normal for an LED display, but since the timer is used in the darkroom we need to reduce the LED intensity substantially to prevent glare. In normal room lighting the display should hardly be visible at all. Green LEDs were chosen because the eye is more responsive to green (red LEDs can be used if required).

Although resistors of 4K7 ohms have been recommended, this is better suited to black and white enlarging with its higher levels of darkroom safe lighting. When the timer will be used almost exclusively for colour enlarging, then resistor packs with values of 22K ohms or above can be substituted to further reduce the intensity. IC3 and IC4 contain the BCD to seven-segment decoding (their lamp test and latch enable inputs which are not normally used), but the blanking input (the display goes off when the input is made low) is used by the control circuit to show when the unit is in the set-up/focus mode. More of this when we reach the control section.

The counter

The counter consists of two sections. The up counter of IC7a and IC7b produces switched 1Hz pulses from the incoming mains frequency of 50 or 60Hz which is then used by the down counter section of IC5 and IC6. A clipped sine-wave at mains frequency from the clock generator enters IC8d where the 'Schmitt' trigger-gate produces a square-wave with short transition times from the rough square-wave. This enters the first stage of the BCD up counter IC7b. The first stage operates as a divide by five or divide by six counter, depending on the position of the selector plug. The counter is continuously enabled and normally counts from 0 to 9 (binary 0000 to 1001) before resetting.

For the 50Hz mains input we can arrange that when the counter reaches 5 (binary 0101) the gates of IC8a and IC8b are activated and send a pulse into the reset pin of the counter which immediately resets to zero. Note that there is a specified pulse width which the counter must receive if it is to reset correctly, and that the pulse from IC8a may be extremely short and unable to reset IC7b. To avoid this problem when the counter reaches five, the output pin of IC8a goes low, a current flows through the diode, the input to IC8b goes low and the output goes high, resetting the counter and clocking the second stage counter IC7a. Now capacitor C4 (having one side connected to logic high) will very rapidly charge through the diode while the output of IC8a is low. As IC7b resets, the output of IC8a goes high but the capacitor C4 attempts to maintain the input to IC8b low. With IC8a's output high the diode D3 is reverse biased and the input to IC8b increases in voltage when the capacitor C4 discharges through R3 (note that one side of the capacitor and the resistor R3 are to +12V, not ground). The output of IC8b remains high until the discharge of the capacitor allows the Schmitt gate to trip. Although the extra pulse-width gained only amounts to 0.5mS, this is sufficient to ensure that both sections of IC7 receive a sufficiently long pulse to reset correctly, and that IC7a receives a stable clocking signal at 10Hz. IC7a is a simple divide by ten counter where the reset pin is used to hold the counter at zero until the timing facility is in use. Stopping the counter at this stage rather than at the 1Hz pulses, reduces the timing error at short exposure times.

The down counter consists of two BCD asynchronous parallel load up/down counters with the 'direction select' fixed in the down count mode. The clocking is synchronous, ie, both gates are clocked together and carry in and carry out signals (both active low) and control the counter. When the counter reaches zero both carry-outs will be low. At this point the gate IC14c has both inputs low with the output going high. IC14c is a three input NOR gate with two inputs tied together, but with active low inputs the NOR gate acts as a negative logic NAND gate. In a normal NAND gate, only when *all* inputs are high, ie, active, will the output become low and active. With active low carry-out signals, the output will only become high when the counter reaches zero. This signal is sent to the control logic to show that the counting and therefore the exposure, has finished. The parallel load data to the counter comes from a pair of BCD digi-switches with the common terminal tied to logic high and a resistor pack with its common terminal to low. These resistors are in a special single in-line pack with eight resistors and a commoned terminal. Single resistors can be substituted but in this case they will have all of their free ends pointing away from the board, and a separate link-wire will be needed for the earth terminal.

Set the counter chips IC5 and IC6 using the digi-switches to receive a BCD active high signal. This is forced into the counter when the preset enable signal is high. This occurs when IC7a is forced into a permanent reset. Any changes in the preset input are immediately sent to the output in the static state and hence to the display. This system allows the digi-switches to be altered at will during the static state and the display to react immediately, thereby allowing a new time to be set without looking at the switches. The counting time cannot be altered by the user in the exposure state as the preset enable is reactivated until the timer reaches zero.

The control system

The enlarger timer requires two discrete modes of operation: an exposure and a focus/set-up mode. The static state occurs at the end of either the exposure or set-up modes. In the exposure mode, pressing the push button will initiate the timing sequence and turn on the enlarger's lamp via the LED in the opto-isolator IC9. In the focus mode the opto-isolator must be activated, although setting a time limit is unnecessary.

With our own limitation of a single push button for selecting the exposure of focus modes, we need to use the time that the button is pushed in order to define the required function. The flip-flops in IC10 are the main items used to differentiate between the two functions. Although IC10a and IC10b are both similar devices the IC10a chip is used as a true JK flip-flop, while with the IC10b the JK facility is disabled and the device is used as an RS flip-flop. When the enlarger timer is switched on, C10 and R10 (through gates IC13a, IC14a and IC14b) force reset signals into both flip-flops forcing the Q outputs to zero and their complement Q bar to one. This forces the timer into the static state. The Q bar on IC10a holds the blanking input to the display high in the unblanked mode. The Q bar on IC10b forces the preset enables of IC5 and IC6 high, latching-in the data on the digi-switches which is then immediately displayed on the LEDs. In addition, the high from the Q bar of IC10b also holds IC7a in a reset and keeps the counter at zero. The lows on the two Q outputs prevent all of the power MOSFETS of Q1 to Q3 from conducting (the diode in the opto-isolator IC9 and the enlarger lamp will be off), and since the lamp in the push switch S1 is not shorted to ground via Q1 the lamp will be on. The timer remains in this static state until the push switch S1 is pressed. If the value on the digi-switches is altered the new value will automatically be transferred to the counter and on to the display.

On pressing the switch S1, the output from the two buffers IC13a and IC13d both go high and force the output of IC11 (a monostable multivibrator) low for a period determined by the values of R8, C5 and C6. Both multivibrators are edge-triggered devices and trigger only on the rising edge of a transition and not from a falling edge or a steady state signal. The set input of IC10b also goes high at the same time, consequently, its outputs change state, ie, Q goes high and the Q bar goes low. The high on Q of IC10b conducts Q3, and the opto-isolator operates illuminating the lamp in the enlarger. The transistor Q1 also goes into conduction, shorting out the lamp in the push switch and turning it off during the exposure time. The low on IC10b's Q bar releases the preset enable on both the down counter chips and the reset on the divide by ten counter IC7a. If we release the push switch quickly when IC11 times out, the state of IC10a does not change. The timer will now remain in this state while the down counter reduces to zero. At zero count both carry-outs are low and IC14c becomes

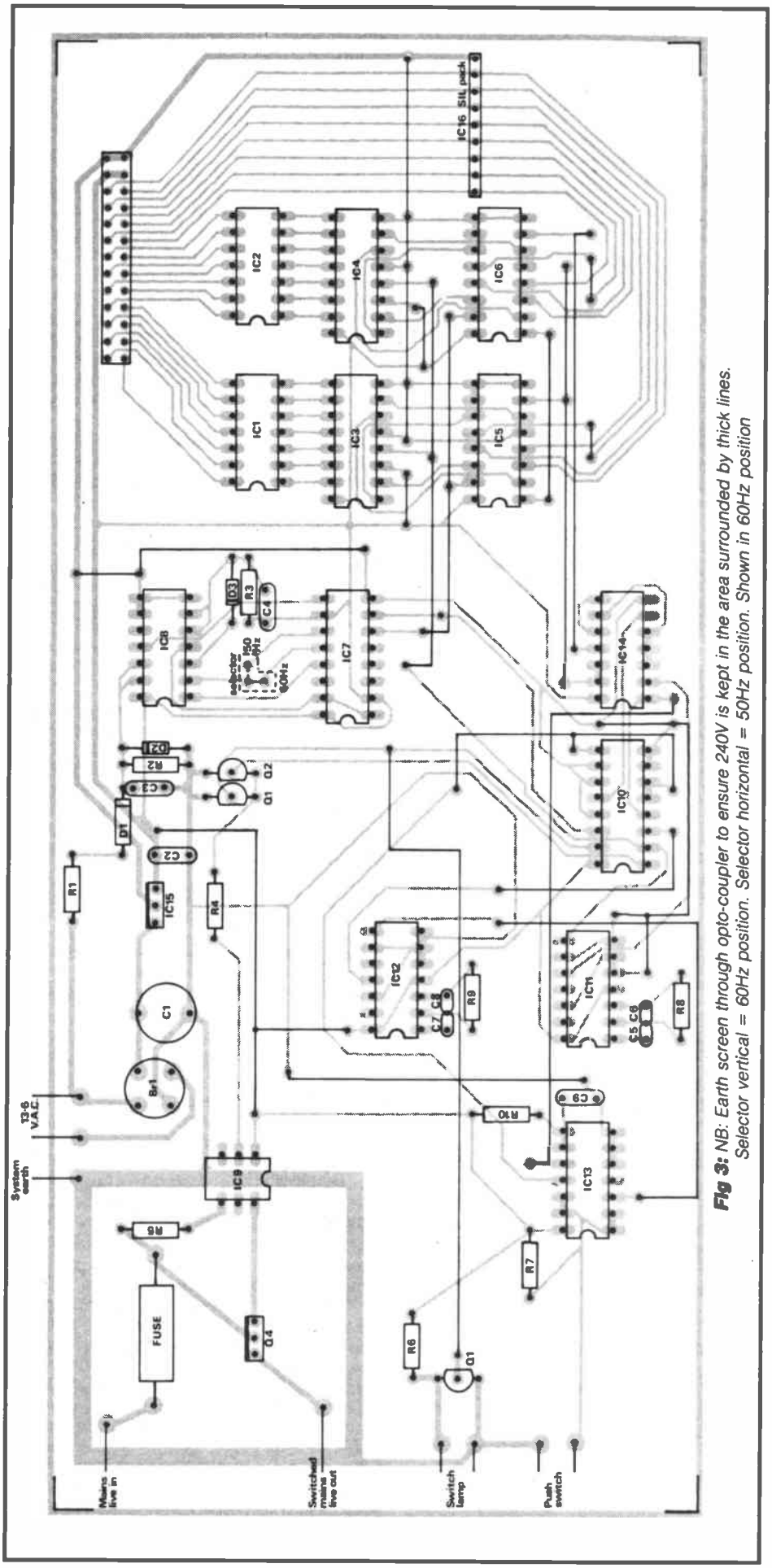


Fig 3: NB: Earth screen through opto-coupler to ensure 240V is kept in the area surrounded by thick lines. Selector vertical = 60Hz position. Selector horizontal = 50Hz position. Shown in 60Hz position

active. This activates the gates IC14a and IC14b, resetting the RS flip-flop IC10b and returning the counter to the rest state.

It is possibly easier to explain some of the operation of a JK flip-flop as contained in IC10 before looking at the circuit itself. The outputs can only be changed by influence of the J and K inputs when the clock input is on its positive-going transition. Here, the J and K inputs are tied together presenting only two possibilities. With the J and K inputs low and with the passage of a positive-going edge there will be no change in the outputs, but with both inputs high the positive edge causes the outputs to change state. The positive edge occurs when the monostable IC11 times out at around 0.5 seconds after pushing the control switch. With a short push the J and K inputs will return to low before the edge and the state of IC10a will not change. The counter will be in the expose mode. If, however, the button is held down until IC11 times out then the J and K inputs will still be high and the state of IC10a will change. Q2 conducts with this change of state, forcing the enlarger lamp on regardless of the state of IC10b, ie, whether Q3 is in conduction or not. The low on the Q bar output of IC10a enables the blanking of the display chips and turns off the display indicating which focus/set-up mode is in use. A second long push on the control switch changes the state of IC10a, turns off the lamp and re-enables the display. In addition, the rising edge on the Q bar of IC10a sets IC12 timing which, in turn, resets IC10b no matter what its previous state. Even if IC10b is in the timing mode and the switch lamp is off, the timer will immediately go to the rest state.

The power supply and clock generator

The power circuits comprise the Triac and driver, the 12V power-supply and the 50/60Hz generator. When the LED in the opto-isolator is illuminated the opto-Triac in the isolator's output conducts, hauling the gate into conduction at any mains input fractionally above or below zero volts via the 1K0 resistor, consequently, the power Triac Q4 fires. The power dissipation in the resistor R5 is very low due to the fast turn-on of the power Triac, therefore only a 0.25W resistor needs to be used.

A 13.6V transformer supplies a simple bridge, capacitor and 7812C regulator dc power-supply, so little needs to be said about this part. At mains frequency the signal derives from the same transformer supply. On positive ac inputs, when the input exceeds +12.6V the zener D2 conducts in reverse mode with D1 in normal forward mode, while R1 acts as a current limit.

On an ac input cycle the voltage at the input to IC8d rises to approximately 12V and then remains constant. The capacitor C3 acts as a smoothing device for noisy mains environments but is often left out. On negative parts of the ac input D1 is reverse biased, and R2 ensures that

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the inputs to IC8d do not go below ground potential. The clipped sine-wave passes through the Schmitt buffer gate IC8d for squaring and then to the counting circuits.

The power Triac may be any one of a vast range of types; hence, the only requirement for its selection is that it should pass the current needed by the enlarger, including any turn-on surges. The lamp in the control switch LP1 can be an LED or filament lamp but the value of R7 for the filament lamp needs to be altered from the given value to obtain a suitable dull glow from the control switch when used in the darkroom. The resistor packs IC1 and IC2 are plugged into IC sockets in the prototype and it would be a good idea to retain these since it is easier to change the intensity of the LED display to suit the constructor's requirements. The values of 4K7 to 10K are subjective so the constructor may wish to amend the value to suit his individual needs.

IDC pin connections

1	F LED units	14	E LED tens
2	G LED units	15	digi-switch 10
3	A LED units	16	digi-switch 20
4	B LED units	17	digi-switch 40
5	C LED units	18	digi-switch 80
6	D LED units	19	digi-switch 1
7	E LED units	20	digi-switch 2
8	F LED tens	21	digi-switch 4
9	G LED tens	22	digi-switch 8
10	A LED tens	23	+5V to digi-switch
11	B LED tens	24	+5V to digi-switch
12	C LED tens	25	ground to LED common
13	D LED tens	26	ground to LED common

Table 1

Display connections

1	A segment	8	D segment
2	F segment	9	LH decimal point not used
3	common cathode	10	C segment
4	no pin	11	G segment
5	no pin	12	no pin
6	RH decimal point not used	13	B segment
7	E segment	14	common cathode

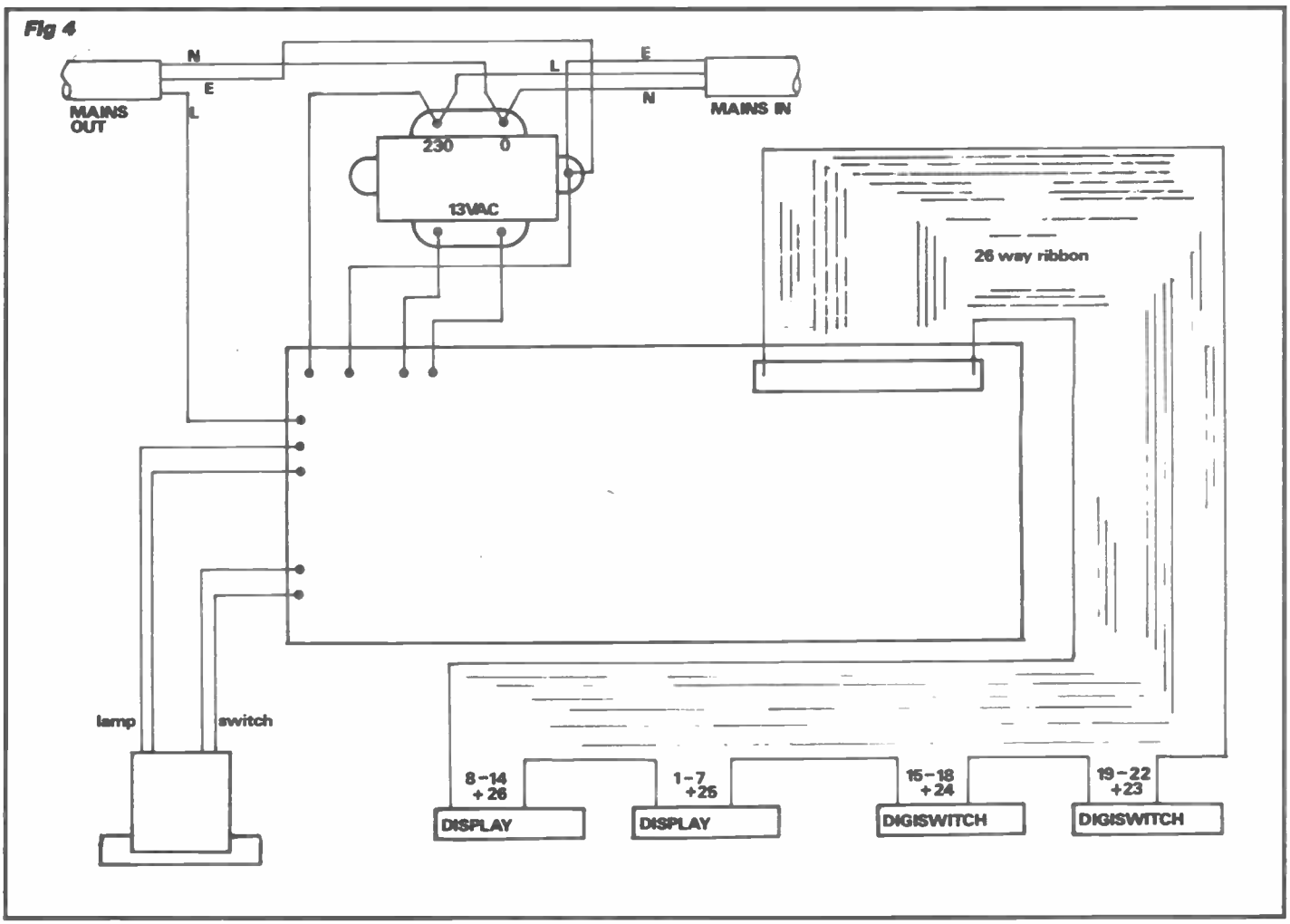
Table 2

Construction

The inputs are connected by a 26 way IDC plug and socket for the connections to the display and the digi-switches. Sixteen of the wires from the plug are used on the display, and in the prototype they were hard-wired to the IC socket-type pins on the Bulgin LED display bezel. The smallest bezel available is four displays wide, and two of the 16 pin sockets from the unit are removed leaving the centre two.

Table 1 gives the pin connections on the IDC plug. Looking at the PCB with the

Fig 4



plug in the upper right-hand corner, pin 1 is the bottom left pin, pin 2 is directly above it and pin 3 is to the right of pin 1 on the bottom row. Using the IDC socket and the locating notch on the plug near IC2, will ensure that the ribbon cable from the plug will be correctly numbered if the stripe is on the side closest to pin 1.

Table 2 gives the pin connections on the seven segment LED display which is the same as a DIL IC pin layout, except that some of the pins are missing. The displays plug into the bezel but as this consists of 16 pin sockets, only the upper 14 pins are used.

There are few difficulties in constructing the main PCB, although the main track side shows a number of tracks passing between the pins of some of the ICs without making contact. Soldering these closely spaced tracks may cause some difficulties, especially near the IDC socket. A small 1mm tipped soldering iron is ideal for this purpose. IC sockets are recommended for all of the ICs to prevent static damage to the chips and, in the case of the resistor packs IC1 and IC2, they allow changes in the resistor value to alter the display intensity without the necessity of unsoldering. An 8 pin DIL socket was used for IC9, and the 6 pin opto-isolator with the terminals for the normal pins 4 and 5 were removed.

Fig 3 shows the components' layout on the PCB. To find the smaller components fit the items in the decreasing order number of pins. The IDC socket is fitted first followed by all of the IC sockets, but do not fit the ICs at this stage. Solder all of the small components on to the PCB and fit the 50/60Hz selector jumper in the position that suits the local mains frequency. Once the soldering has been completed, carry out the following tests before applying power to the board. Using a multimeter on a low ohms range, check that each pin in the plug is isolated from its neighbours and that there are no solder bridges between the IC pins, especially between the pins and the track which passes between them. Having checked for and removed any errors attach the wires to the transformer (see **Fig 4**). Turn the power on and check that the power-supply delivers 12V between pins 7 and 14, or pins 8 and 16 of the IC sockets. Turn the power off and insert IC7 and IC8 only, turn the power on again and use a logic probe to check that pins 11 and 4 of IC8 have signals on them. If all is satisfactory turn off again and insert the remaining ICs and the cable from the IDC plug to the display and digi-switches. All of the ICs fit with pin 1 to the bottom left except for IC9, the opto-isolator, which points downwards.

After turning the unit on, the display should illuminate with the same value set on the digi-switches and alter instantaneously when the switches are changed. Checking the tens and units numerals will show any faults in the soldering or solder bridges. Finally, test the unit in both modes to see if your efforts have been successful.

Components list

Resistors
All 0.25W unless stated

IC1, 2	7 isolated resistor pack 4K7, Dale type: MDP1403-472G
IC14	8 commoned resistor pack 100k, Beckman L91-100k
R1, 6, 7	10k (see text for value of R6 if using filament lamp)
R2	100k
R3, 8, 9, 10	47k
R4	680R
R5	1K0

Capacitors

C1	1000μF 25V electrolytic
C2	0.1μF ceramic
C3	0.01μF ceramic (optional item)
C4	10pF ceramic
C5, 6	10μF Tantalum bead
C7, 8, 9	22μF Tantalum bead

Semiconductors

IC3, 4	4511 CMOS
IC5, 6	4510 CMOS
IC7	4518 CMOS
IC8, 13	4093 CMOS
IC9	MOC3020 opto-isolator
IC10	4027 CMOS
IC11, 12	4047 CMOS
IC14	4025 CMOS
IC15	7812C regulator (78L12 is not recommended due to current needed)
Q1, 2, 3	VN10KM
Q4	TIP226D
Br1	W005
D1, 3	1N4148
D2	12V zener 400mW
LP1	LED or filament lamp for switch S1

Display LEDs are red or green as required

Miscellaneous

26 way IDC socket and plug plus 1m 26 way ribbon cable
Display bezel Bulgin for four LEDs
Two BCD encoded digi-switches with end fittings
Illuminated push switch
13.6V 0.5A filament transformer
Case
Grommets
Outlet socket
Connecting wire

The metal bashing part consists of cutting holes in the front panel for the display bezel, the digi-switches and the push button. The rear panel will need to be drilled for the input and output cables and their grommets. Mounting screws for the PCB and the transformer need to be fitted into the case's bottom, and one of these screws has to carry the earth terminal to ensure that the case is securely tied to ground. After final construction, re-test with a lamp before connecting to the enlarger, and ensure that the fuse on the printed circuit board is small enough in value to give protection against a fault occurring, you should find that a 2 amp slow-blow fuse is adequate.

ICOM

VHF/UHF FM Handhelds

If you want a handheld with exceptional features, quality built to last, and a wide variety of interchangeable accessories, take a look at the ICOM range of FM transceivers.

All ICOM Amateur handhelds are supplied with a flexible antenna, rechargeable nicad battery pack and an AC wall charger.

IC-2E 2 Metre Thumbwheel Handheld

This popular transceiver from ICOM is still available after eight years of production. If you're looking for a straightforward but effective handheld the IC-2E takes some beating. Frequency selection is by means of thumbwheel switches (with 5KHz up switch), with simplex and repeater operation possible. Power output is 1.5 watts or LOW 150 milliwatts (2.5 watts possible with BP5A battery pack).

MICRO 2E/4E

These micro sized 2 metre and 70 centimetre handhelds give the performance and reliability you expect from ICOM. Measuring only 148 x 50 x 30 the micro fits in your pocket as easily as a cassette tape. The micro features up/down tuning switches for quick frequency changing, 10 programmable memories, LCD readout and 1.5 watts output (2.5 watts possible with BP24 battery pack).

IC-02E/04E Keypad Handheld

These direct frequency entry handhelds utilise a 16 button keypad allowing easy access to frequencies, memories and scan functions. Ten memories store frequency and offset, a front panel LCD readout indicates frequency, signal strength and transmitter output. Power output is 2.5 watts or LOW 0.5 watt. (5 watt is possible with the BP7 battery pack or external 13.8v D.C.)

IC-2GE/4GE

The 'G' series of handhelds fulfills the most important criteria for a handheld transceiver, it is small, rugged and easy to operate. The 20 memory channels can store simplex and repeater frequencies and with the several scan functions there is no need to manually search for activity. The 3 watt output and power saver circuit ensures low battery drain. (7 watts is possible with the BP7 battery pack or external 13.8v D.C.)*

IC-12E 23 Centimetres

Similar in style to the 02E/04E this 1296MHz handheld utilizes ICOM's experience in GHz technology, gained by the excellent IC-1271E base station. With the growing number of repeaters on 23cm the IC-12E makes it an ideal band for rag chew contacts. Power output is 1 watt from the standard BP3 battery.

IC-32E Dual Bander

This exciting new handheld offers 2 metres and 70 centimetres in one compact unit. Tough and splash resistant it offers many features including crossband duplex operation, 20 dual band memories and power saver circuit. The IC-32E utilises most existing ICOM accessories, ideal if you are upgrading from an existing ICOM handheld.

Also available for ICOM handhelds are a large range of optional extras including rechargeable nicad battery packs, dry cell battery cases, desk chargers, headset and boom microphones, leatherette cases and mobile mounting brackets. New products just released:- HM46 miniature speaker/microphone and HS51 lightweight headset/microphone complete with PTT and Vox unit.

Icom (UK) Ltd.
Dept AR , Sea Street, Herne Bay, Kent CT6 8LD. Tel: 0227 363859. 24 Hour.

Count on us!

Into '89 with Icom

IC-751A HF All-Band Transceiver

- **Amateur Bands 160m - 10m.**
- **General Coverage Receiver.**
- **105db Dynamic Range.**
- **100W Output (40w A.M.)**
- **32 Memories.**
- **Electronic Keyer.**
- **CW Semi/Full Break-in.**
- **HM36 Microphone.**

The ICOM IC-751A was created for the ham operator who demands high performance whether entering contests, chasing DX or just simply enjoying the shortwave bands. It is an all mode solid state transceiver with a host of features designed for the crowded HF bands of today.

Additional features include passband tuning, 9MHz notch filter, adjustable AGC, noise blanker, RIT and XIT. A receiver pre-amp and attentuator provides additional control when required. The FL32 9MHz/500Hz CW filter is fitted as standard with CW sidetone on Rx and TX modes. On SSB the new FL80 2.4Khz high shape factor filter is fitted.

The transmitter is rated for full 100% duty cycle with a high performance compressor for better audio clarity. With 32 memory channels and twin VFO's, scanning of frequency and memories is possible from the transceiver or the HM36 microphone supplied.

The IC-751A is supplied for 12v operation but can be used with either internal or external A.C. power supply. It is fully compatible with ICOM auto units such as the IC-2KL linear amplifier and the AT500/100 antenna tuners.

Options available:- PS35 internal AC power supply, PS15 external AC power supply, EX310 voice synthesizer, SM8 and SM10 desk microphones and SP3 external loudspeaker.

Helpline: Telephone us free-of-charge on 0800 521145, Mon-Fri 09.00-13.00 and 14.00-17.30. This service is strictly for obtaining information about or ordering Icom equipment. We regret this cannot be used by dealers or for repair enquiries and parts orders, thank you.
Datapost: Despatch on same day whenever possible.
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SECOND-HAND

by HUGH ALLISON G3XSE

Codar AT5

A few months ago there appeared in this learned tome an article on the AT5 by G2BZQ (October 1988). In it he mentioned that this 160/80m transmitter has a bit of a reputation for drift, though he had not experienced it.

Over the years I have played with dozens of these fine little rigs and a couple have had either drift or no VFO. In all cases a new VFO valve (an EF80) cured the problem.

G2BZQ makes no mention of prices in his article. A dead 'un is about a fiver. A 'nude' one (no PSUs or other accessories) but working, about £15.00. One with a PSU of some sort, mains or mobile, add a fiver. Full house, an AT5, both PSUs, mobile and base station control boxes plus the matching mobile transistor receiver, £35.00. In my defence I saw a full house package not sell at Derby for £45.00.

On the subject of dead AT5s, some years ago I mentioned the 'medium wave' modifications and, having bought one in this state for a fiver at the Shuttleworth do, it obviously bears repeating.

Many years ago, about the time of the birth of Radio One, there were dozens of illegal pirate radio stations transmitting on the medium wave. Being quite cheap, the AT5 was a natural to form the basis of the transmitter, either used as is (but modified) or via a PA of some sort for greater coverage. The modification simply consisted of 500pf capacitors (or thereabouts) across all the tuned stages – VFO, buffer and PA coil.

Obviously, quite a few of these stations got raided and the equipment confiscated. This later turned up at auctions, etc. I suppose some people grew tired of their illegal activities and are now flogging their equipment. If your recently bought AT5 seems to work but isn't transmitting on top band, then it's a reasonable bet it's running between 1 and 1.5MHz. To restore, remove the added capacitors. G2BZQ's article had a circuit which should help you.

Labgear Topbander E5051

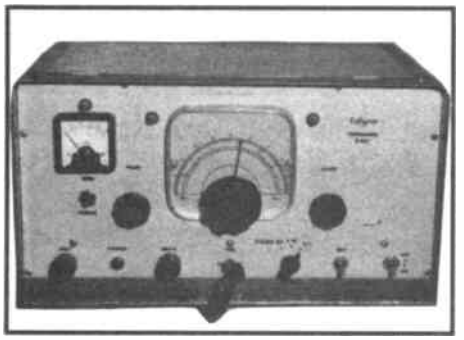
Substantial. Like enormous. Like fourteen inches long by about ten high. AM and CW only, and, talking of onlys, only 10 watts out as well.

Now the good news: reliable and stable. Really disgustingly dirty, rusty examples that I've bought for a quid have worked first go. One other plus: you can double in the PA to go on 80m.

It must be the size of the thing that contributes to the reliability, there is plenty of room for the heat to harmlessly dissipate. Everywhere you look inside the case there is just empty space! So if you want to add mods to it, there is room for them.

The power supply is built in and more than adequate. There is no mains hum on the signal and CW reports are T9 every time.

Price-wise, well, upwards from a quid. A clean worker £15.00 to £20.00, £25.00 is too much even for one with mike, key and handbook. You are going to need some room to keep it too! Really, you are buying an enormous equivalent of the AT5 with built-in mains PSU.



Labgear Topbander E5051

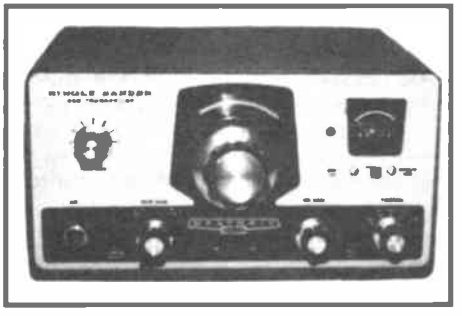
Heathkit Single Banders

You don't have to be a Mensa member to work out that a single bander is only going to do you one HF amateur band. What is not so obvious is that the whole of that band is not going to be covered. The 20m variant doesn't do the CW end, for example, though a tweak round the VFO and an audio oscillator up the mike socket can soon cure that, albeit with no tuning calibration.

The pretty box you see in the picture doesn't show the external power supply. Mains and mobile supplies were available, though many examples sold at rallies often come with a home-brew, rather than home-made supply. The thing is valves throughout so mobile consumption is amps, even on receive.

The receiver isn't bad, a couple of microvolts on the 20m variant gives 10dB sig noise, and there is no doubt the transmitter does its stuff too. The only reservation against whole-hearted recommendation is the PA valves. These seem to have a very short lifespan, even if run correctly and even if run gently. They are also very expensive.

Heathkit Singie Bander



One weird thing about the design is the calibrator. The transceivers came with an octal socket into which one could plug the optional calibrator, this being a standard unit and used in, for example, the RA1. In the single banders this socket is quite high up on the chassis, so that, with the option installed, the top of the valve on the calibrator module ends up ⅛in from the top of the case. If I now tell you that the feet on the bottom of the wraparound case (ie all one piece) are held on by nuts and bolts, so that you have to lift the chassis up 3/16in to clear them, you will soon work out why I break so many valves in the calibrators. Solution? Glue the feet on!

Prices. Well, the power supply requirements are not too difficult to meet for home use, so a non-power supplied 'bare unit' at £30.00 would be reasonable. £40.00 to £45.00 is about right for a box plus one PSU mobile bracket, mike and handbook. £50.00 absolute tops for one with base and mobile PSUs.

This rig is recommended for someone who is limited to a single band aerial and wants HF SSB, or someone a bit short of cash!

Tatsuko TR2100M

The scenario is that our hero of the story gets his licence, goes on 2 FM, after a while discovers 2m SSB and/or gets the urge to learn Morse. If he doesn't have much money then this rig could admirably fit the bill.

The TR2100M is a very unusual machine. It contains enough pencell batteries to raise 12 volts, and powered from these it will chuck out about 1 or 2 watts, which is ideal for a portable machine.

However, if 12 volts is obtained from an external source, be it a car battery or mains power supply, then 10 watts becomes available. The set is now well powered for fixed or mobile use. Brilliant.

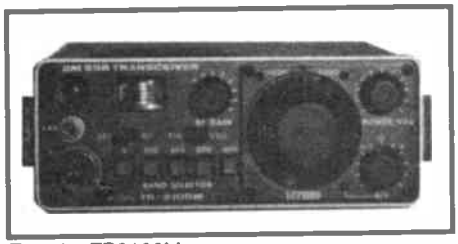
The machine is continuously tuneable, but the tuning is via VXO, ie a crystal is pulled. Unlike the Liner 2 the VXO goes over 200kHz so there is a row of five push-buttons to cover 144 to 145MHz. Sets came as standard with 0-200 and 200-400kHz fitted, ie they cover 144 to 144.4. This does cover most of the CW and SSB action. There is no reason why a crystal cannot be fitted to enable coverage from, say, 145.8 to 146, should satellite working be of interest. The VXO is very stable and well-mannered, with no tendency to stop running.

One 'funny' is that the dial lights go out after twenty seconds of use. This is a battery saving device and is perfectly normal.

Prices. For your £50.00 don't expect more than a basic machine without Ni-

Cads and extra tuning chunks, but you should be able to obtain one. A real beaut with all the extras will be around £70.00 to £80.00. Price new, by the way, wobbled between £100.00 and £130.00, depending on the importer and state of the pound.

Given a straight choice between a decent Liner 2 and a well used (but working) 2100M, take the latter.



Totsuko TR2100M

Heathkit HW17A

Don't. Can I be much stronger than that? I'm trying to save your wallet from pain. AM is the only mode. We have valves, thus horrendous current consumption if mobile. We have a free running local oscillator, thus drift. The power supply is external (mains or 12 volts). The transceiver is big enough, the power supply just adds insult to injury. Sensitivity? Appalling: 10uVish, for 15dB sig noise. Yes, sure, in its day it was the bee's knees, but nowadays, no. You have been warned.

Heathkit HW17A

Beltek W5400

I'm very sentimentally attached to these rigs; the first transceiver I ever had stolen from my van was one of these. In those days the Beltek was worth money, nowadays I use one in the van for precisely the opposite reason, it ain't worth much and, consequently, it doesn't matter if it is stolen. Unfortunately, the styling does make the thing look a bit CBish, which probably encourages theft.

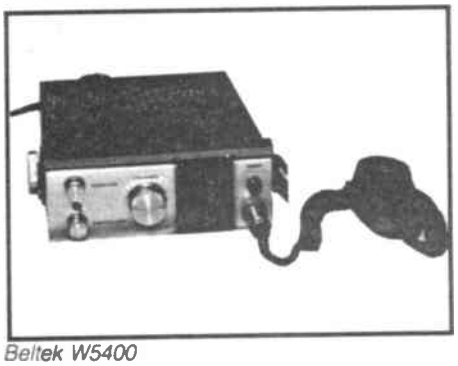
I really do like these transceivers but I am going to say a couple of things against them in a moment, so first a word in their favour. They are cheap. A good 'un, with twelve pairs of useful rocks (we are crystal controlled here), mike, mobile bracket and fitted toneburst, £45.00 tops. I've seen working scruffs go for £20.00 or thereabouts.

On the subject of useful channels, beware. These machines are so old they are likely to have real dogs fitted; useful stuff like the original Japanese calling channel of 144.48.

Two naughties. The audio output chip is weird, 2N3055 sized and lots of legs. Very prone to popping if abused. Leave the set alone and, probably, you'll have no aggro. Over volts it, or, best of all, run it into half a dozen other speakers in parallel, and it's a goner. The bad news gets worse, you stand more chance of getting Mrs T to vote Labour than getting a replacement. The cure is to stuff in an LM380 or similar.

The other trouble is the IF filter. Would you believe 25kHz plus? Two channel reception on one crystal! Fortunately the action is on 455kHz so an ex-CB set filter, which will be the wrong style, can go in, or the correct shaped one can often be found in junk bins at rallies for very little money.

The transmitter gives a reliable 10 watts or so, often a watt or two less, and is switchable to a low power of around the watt.



Beltek W5400

The receiver isn't brilliant, it blocks a bit and everything will go quiet if a strong signal transmits near you. It isn't wonderful on sensitivity either, a couple of microvolts for 15dB quietening seems typical. A present-day preamp can help a bit, though the blocking may get worse.

Honest, I don't want to turn you off this box. Call it adequate. Ideal as a second set, or a dedicated natter box for strong signal work. You would be disappointed if you live in a 'scratchy' area, but they are cheap and moderately reliable.

The 'Scooper'

Official name MR1000A. Receiver only. Super little 'top pocket' sized set, a bit bigger than your average fag packet. Most came resplendent with Ni-Cads fitted (half pencell size, four-off) and a charger. There's a whole day's continuous squarking out of one charge, and the batteries seem to last forever; I've repaired dozens and never a duff cell.

Talking of faults, 90% come in not working on one channel. There are thin, multi-strand, insulated wires from the crystal sockets. These are often punctured by excess lead lengths of components on the foil side of the PCB, nearly always where the two side covers join the top, which is about half an inch down. Be careful to dress these leads when refitting covers, normally only after fitting a new crystal. To cure? Well, a bit of tape over the puncture will suffice. The wires don't get broken, merely short through to the component wire.

These are crystal controlled. The rocks are standard and freely available.

The 'Scooper'

One other fault. The earphone, if used (there is an internal speaker) can double as an aerial. The earphone has its audio feed supplied via chokes, and a capacitor goes 'twixt choke and aerial socket. The choke leadout seems to sheer off at the earphone socket for some reason, perhaps due to minute movement every time the earphone plug goes in. No sweat to cure, simply resolder the stump of the choke back on to the socket. This fault is well worth looking for if there is no audio.

Performance. About the microvolt for 20dB quietening, give or take a bit. Perfectly adequate for making distracting noises in your ear at a rally, or for having on the bench running from its own little rod aerial (which should be supplied). It should pull in the local repeater round the house, provided you are in its service area. It works a treat.

Price. Well, say £15.00 for one with everything and a couple of useful channels, complete with charger, aerial, earphone etc; £20.00 tops for one with a full set of rocks; £10.00 if working but 'nude'.

In next month's edition of 'Second-hand' Hugh Allison considers the pros and cons of the Daiwa Search 9, the Yaesu FT2, Lowe 2m and Dymar receivers and looks at what you can expect to pay for them second-hand

50MHz

by Ken Ellis G5KW

Major opening to North and Central America

In my column last month, I said that I hoped to report this month on the first transatlantic QSOs of cycle 22 by F2. Hence the openings during November and December to Aruba, Canada, Turks and Caicos, Equador and the USA (fully reported in 'From the mailbag') came as no surprise. It confirms the general consensus of opinion that the peak of cycle 22 will be one of the best on record. There have not been any reports of TEP openings from the UK to South Africa recently but the spring equinox period (March-April) should bring a repetition of the DX openings that we were favoured with last autumn. Preparations are already being made in SA as Hal Lunds reports.

50MHz TEP path

The following report on the 50MHz TEP path during cycle 22 comes from F M Smith 'Smithy' G8KG.

'The end of August marked a transition from the exciting days of summer Sporadic E to the equally exciting but different regime of F layer propagation (in which I include TEP) where the behaviour of the 50MHz band is an extension of that of the higher HF bands. For most UK amateurs this was the first F layer season on 50MHz, the band having become available near the time of the solar minimum. Those with HF experience knew that, broadly speaking, the maximum usable frequencies on all paths increased as the solar cycle approached its peak but many were unsure as to what to expect. The events on the band since the last few days of August have provided some early experience and were certainly exciting and to some extent unexpected. They were, however, aspects of a solar-driven and seasonal improvement in F layer propagation and were broadly in line with known ionospheric behaviour.

'There are two generally used indexes of solar activity as it relates to HF and low VHF propagation: the sunspot number and the 2800MHz solar flux. Both are measured daily but are also reported as monthly averages and as "smoothed" (values which are effectively 12 month running averages). Neither of these indexes is an exact measure of the solar emissions which govern F layer propagation but they do, in a general way, indicate what can be expected – though a high index can sometimes accompany poor conditions!

'The two indexes are loosely related, tending to move together but with the trend in solar flux often lagging by one solar rotation. In the following the sunspot numbers quoted are those actually measured and reported, not the so-called "effective sunspot numbers" broadcast by Radio Australia which are only notional values derived from the solar flux measurements and can differ from actual numbers by as much as 50% either way.

'In June 1988 the monthly sunspot number topped 100 for the first time in the current cycle (average 2,800 flux 140) and the values for July to October were: 112.6, 111.2, 120.8 and 124.4 (monthly solar flux 150, 155, 152 and 170sfu). These are not very different from those at the *peak* of cycle 17 in 1937! It is perhaps not generally known that up to the middle of 1988 the solar indexes for cycle 22 have been consistently higher than for any previously recorded cycle at the same age. Also, even in October, there was little to choose between the relative position of the present cycle and that of cycle 19 on its way to the mighty peak of 1957/58 in which the highest monthly sunspot number was 253.8 (highest monthly solar flux 286sfu).

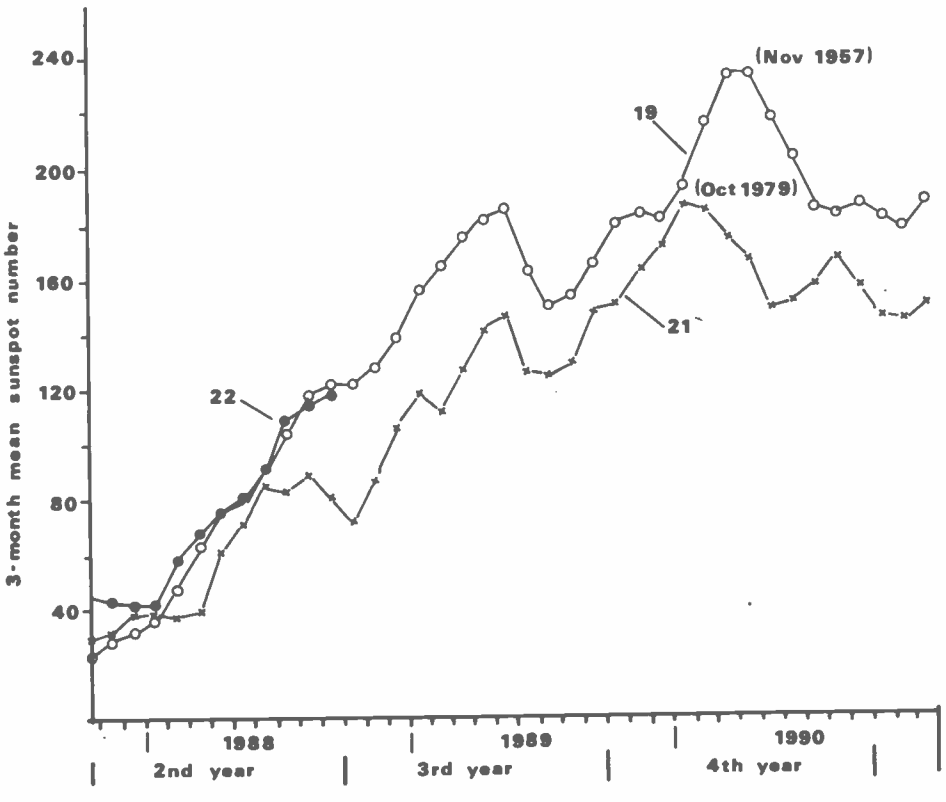
Forecasting the peak of cycle 22

'It is generally accepted that there is as yet no way of predicting the size of a future solar peak with certainty but both SIDC Brussels and NDGC Boulder are currently forecasting a probable peak smoothed monthly number in the range 175-190 in the third quarter of 1989 or early in 1990, and a similar value is predicted by a new and relatively untried method. This would make it the second highest peak on record and individual monthly numbers could be in the 200s (monthly solar flux approaching 250sfu and daily values above 300sfu).

'Returning to the events of August to October, our starting point is a monthly mean sunspot number in the 110-120 range and from this there are well-established procedures for predicting the likely maximum usable frequency (MUF) over an F layer path at a given time. A few general points will help an understanding of such propagation on the 50MHz band. Firstly, for UK stations there is nearly always a gradient of increasing ionisation in a generally southerly direction so that stations in the south will always see a higher MUF and this is even more the case for stations in, say, France, Portugal and Malta. There will therefore be some times when F2 paths from the south will fall short of UK stations unless Es over the last 2,000km provide a link.

'Secondly, when an F2 path is just open, the length of a single hop is frequently in the range of 5,000-6,000km

Fig 1: *Progress of solar cycle 22 compared with cycles 19 and 20*



rather than the conventional 4,000km at lower frequencies, presumably because 50MHz waves penetrate the ionosphere more deeply and are refracted more gradually than those of lower frequency. Nevertheless, higher ionisation leads to shorter hops and at the peak of cycle 21 the skip occasionally shortened to around 2,000km.

'Thirdly, the highest MUFs are to be found in two great belts, one on each side of the magnetic equator, which move westward around the globe with the sun.

'Finally, published predictions of F layer MUFs are necessarily based on predicted sunspot numbers and with a fast-rising cycle may prove pessimistic. They are also usually based on a maximum single hop of 4,000km and therefore underestimate the 50MHz possibilities.

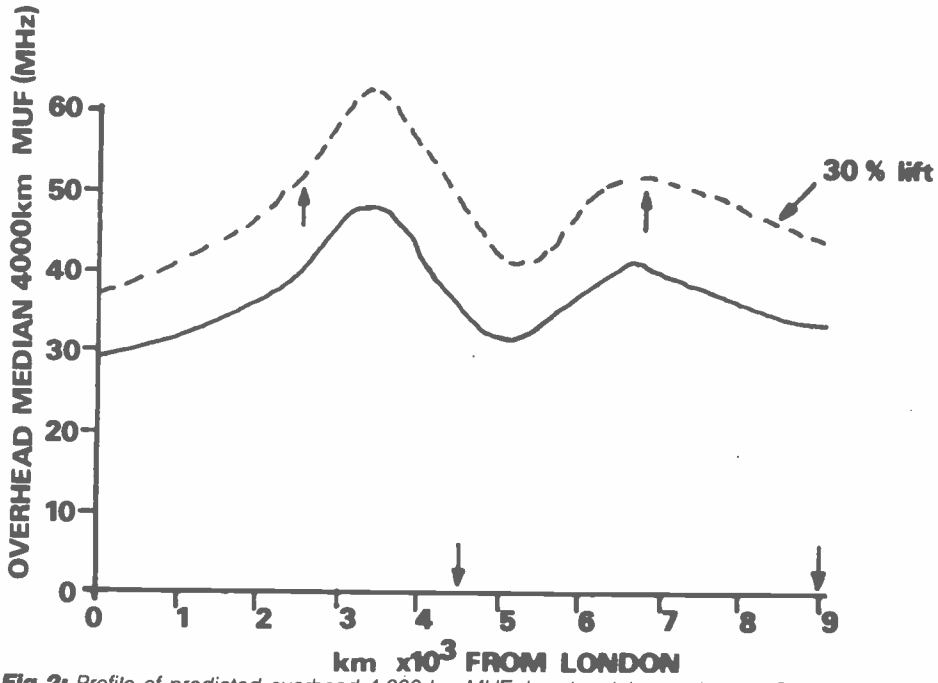


Fig 2: *Profile of predicted overhead 4,000 km MUF, London-Johannesburg 1 October 1600hrs R=120*

Actual conditions

'Because of its high occupancy the 28MHz band provides a very good field for comparing "actual" conditions with predictions. Starting in the last few days of August 1988 and for much of September and October it was evident that the highest frequencies open to many parts of the world were anything from 20 to 30% or more above the median MUFs (ie those likely to be reached or exceeded on half the days in the month) predicted for a monthly sunspot number (R) of 110-120. Part of the reason for this must have been that the daily numbers were sometimes in the 150-190 range and, perhaps more important, the average over several days reached as high as 160.

'The 4,000km TEP path from London to Johannesburg showing a 30% "lift" is shown in **Fig 2.** The effect of this lift in MUFs of upwards of 30% was to be seen in various 50MHz openings of which some typical ones are briefly discussed.

UK to ZS6 and ZS3 (late Aug to Oct)

'The distances of around 9,000km are just about right for two-hop F2 paths on 50MHz given a high enough MUF at the two reflection points. The two late August openings were at a time of high solar activity and considerable lift on 28MHz but may well have needed help from Es. The main openings were in late September and October. Between 1200 and 1800hrs at this time of the year there is a steep gradient of increasing MUF along the path to South Africa as far south as 20N and a similar rising gradient at the far end. The predicted median F2 MUF for R=120 is only about 40MHz, but on both 27 September and 9 October the solar indexes were well above the monthly averages for seven days and the MUF lifts on 28MHz were around 30% which is quite enough to account for the 50MHz openings. **Fig 2** shows the profile of "overhead" median 4,000km MUF8 predicted for the London/Johannesburg path in late September/early October with R=120. The dotted line shows the effect of a 30% lift. It is only required that the overhead value should be 50MHz or higher at the two reflection points.

G to LU (8 September)

'The distance of around 11,000km could have been covered on 50MHz by two hops of 5,500km or by two shorter hops with the help of Es at the UK end, the latter looking more likely. The lift above the predicted median MUF would need to have been a little over 30%. 28MHz was open to all continents on that day and the lift was certainly approaching the 30% mark and could have been higher, particularly in the evening. Much the same considerations apply to the CT to LU contacts later in the month, this path being easier because it is somewhat shorter and CT is nearer to the high MUF belt.

9H to JA long path (8 and 9 October)

'In the first half of October the world-wide distribution of MUFs late in the day is ideal for a long path between southern Europe and Japan. Both Malta and Tokyo are at 36N and the whole 30,000km path lies in relatively low latitudes on either side of the geomagnetic equator. For R=120 the limiting MUF is at the Malta end (much earlier than this and the JA end has not opened) and the predicted median value is about 39MHz. Over the rest of the path it is in the 40s so, once again, a lift of 30% above the median is sufficient and this was the same weekend that saw good G-ZS openings. It should be noted that on these two days while Boulder reported magnetic A indexes of only 7 and 16 (measured in Virginia), Wingst in Germany reported values of 100 and 40 respectively, a highly active magnetic field which may have contributed to the lift needed for these openings.

'Without wishing to be pessimistic it must be said that the long path from the UK to JA is a much more difficult proposition, lying between 70N and 70S and following a significantly different route.

'From mid-October onwards the distribution of high F2 MUFs tends to favour east-west paths but these require a higher level of mean solar activity to reach the 50MHz mark. During late October and early November there were pointers to the presence of high MUFs. One such is the appearance of extremely strong signals from OH2TEN in the morning and early afternoon – not Es but the F2 skip shortening to less than 2,000km which means that the 4,000km MUF at the mid-point is above 40MHz. When DL0IGI does the same, look out for Caribbean and/or North American openings. Also the Soviet TV transmissions on 49.740/60kHz have been quite strong on

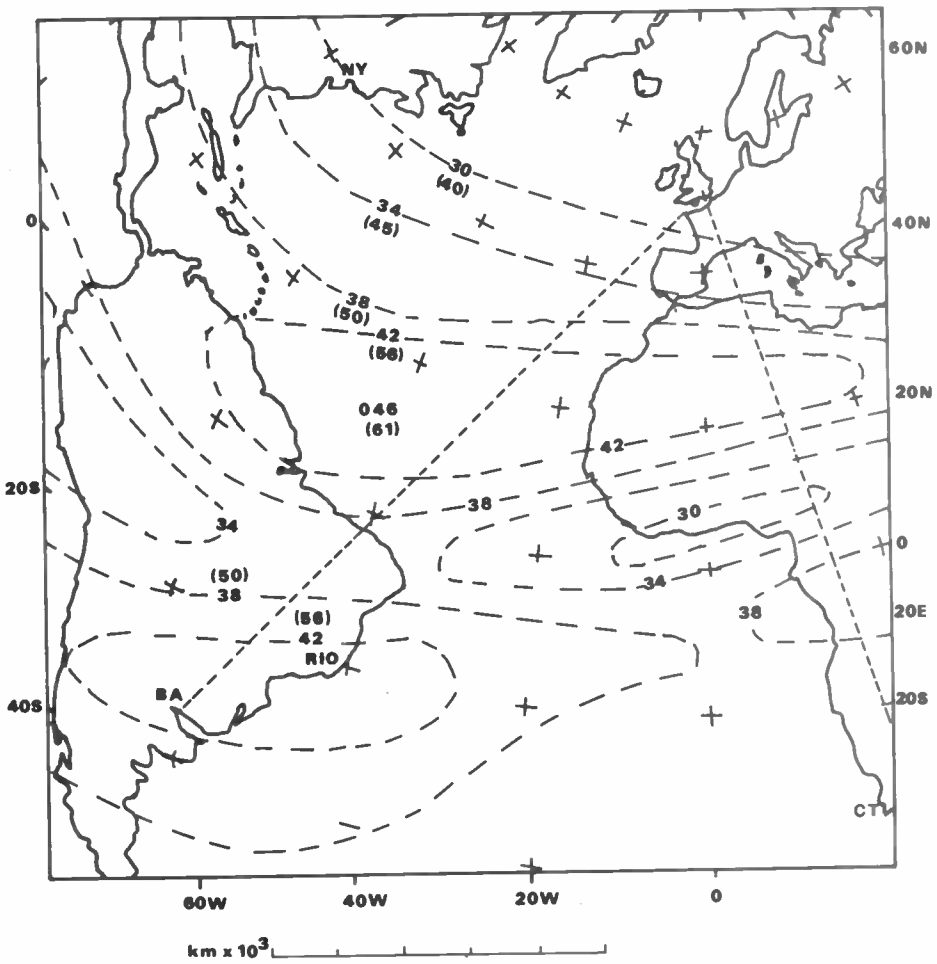


Fig 3: *Predicted median 4,000km MUF contours for September 1800 hrs, R=110. 33% lift values in brackets*

some mornings and on 31 October video sub-carriers extended well above 50MHz with Russian walkie-talkies and commercial harmonics up to at least 50.5MHz – all indications being that this was F2 not Es propagation. It is interesting to note that the first transatlantic openings were in February 1979 which coincided with the minor peak of 145 in the sunspot curve at two years and eight months. We *could* reach this level by February 1989 if not before, but we must wait and see!'

From the mailbag

The following report for October and November has been sent in by David Butler G4ASR IO81MX.

'Saturday 8 October 1430hrs, QSOs with ZS3E, ZS6XJ, ZS3AT, ZS6PW, ZS6BMS, ZS6AXP, ZS6ANZ and ZS6LW. Wednesday 30 November 1258-1522hrs, CT0WW, 9H1SIX, HC2FG, K1JRW, VP5D, VE1YK, P43AS, K1JRW. Heard W9OEH, PA0XMA, PA0HIP, GW4LXO, GI8YDZ and many Gs (reads like a good day on the HF bands!). Opening closed at 1530hrs, followed by aurora to GB3RMK and GI8YDZ until 1630hrs. A Sporadic E opening started at 1830hrs to Malta on 120°. QSOs with 9H1SIX, 9H1EL and 9H1CG.'

Ted Collins G4UPS of Hemyock, Devon, sends a six-page report of activity over the period. Due to pressure on space this month, I regret I can only include some of the main features.

'6 November. Opening started with FY7THF beacon audible at 1312hrs, heard CT stations by "backscatter" at 1354hrs. Heard HC2PG working W stations at 1400hrs. All W stations faded out on 28MHz at 1411hrs. Heard VP5D on 50.110.58. At 1425hrs, VE1YX 58. At 1431hrs, OK3CM giving VP5D a report via 28.885. At 1447hrs 6 metre QSO with VE1YX 59+ each way. At 1449hrs heard K1JRW with big UK pile-up. At 1457hrs, heard P43AS 55 SSB working pile-up of W stations.

'At least G4IJE and G4ASR worked both HC2FG and VP5D. VP5D had extensive coverage with G stations, working from GJ and GU up to G2ASR in York. QSL information for VP5D is via W3HNK. P43AS is via Box 2380, San Nicolas, Aruba. Bearing in mind the W/VE stations were all peaking from 240°, and taking into account the poor conditions on 28MHz, I think the opening to HC2FG was TEP-enhanced by a large Sporadic E cloud midway, and the openings "across the pond" were double-hop Es. It was certainly a very strange opening with many UK stations picking up new countries. Costas SV1DH states that from 1 January 1989 more 6 metre permits will be issued. Jan OH1AA is soak-testing a beacon for Grand Cayman Island. His callsign is ZF2KZ on 50.016.5.

'On 2 November TK5BF was worked on 6m by several Gs. It later transpired that Corsica is a no-go area as far as 6 metres is concerned. OH2BYW tells me that on 31 October he heard JA4NBM on 6m between 1135 and 1211hrs at good strength. It was later revealed that JA4NBM was in fact beaming towards FT5ZB at that time. During a recent QSO with Ahmed Zaidan HZ1HZ in Mecca who hopes to be on 6m soon, I learned that the US club station at the Dahran air-base has permission to operate on 6m. Wayne V31AB in a QSO on 28.885 told me that he is in Belize for at least twenty years and is active on 6m from 27 November. Mike ZD8MB worked into CT crossband between 1615 and 1715hrs, to EA4CGN and several F stations including FC1BUU in grid LN94! Oh for a smidgen of Sporadic E during his TEP openings (it will come one day Ted, as those of us know who worked you many times whilst you were ZD8TC).

'UK mutterings behind the scene indicate that talks are in progress concerning power limits in the UK on 6m. Certainly it is hoped that an increase in power limits will be announced in the not too distant future. I overheard VE3EVM saying that he was going to VP2M in December and would be taking 6m gear with him.'

Mike G3SED of Portsmouth reports that a large scale opening occurred here on 30 November. The solar flux was 140 and at midday the A index rose to 30. Less than an hour later there was a large scale F2 opening with huge backscatter signals. All stations were beamed towards the mid/south Atlantic. In the UK the optimum bearing was around 240 degrees with the following worked or heard. At 1350 HC2FG heard: GB3SIX S9 beam at 240 degrees, FY7THF S9, VP5D S9+, VE1YX worked S9, K1JRW 5/5, WA5HNK EL29 square heard at S3, P43AS worked only by G4JCC, 9H1EL, 9H1BT, and at 1945 final contact with 9H1EL as the band faded out. An exciting day, here's to the next.

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SHORT WAVE LISTENER

TREVOR MORGAN GW4OXB

Scouts Jamboree on the Air

It's nice to be able to start with a pleasant task. As regular readers will be aware, the Scouts have their annual Jamboree on the Air in October, and I present an award to listeners who send in logs of the Scout stations they hear. The small entry fee is donated to MENCAP.

The 1988 entry was not as big as was hoped, especially from Scout stations, but our regular listeners sent in some nice logs and a clear winner emerged. So, to the results.

The clear winner this year was Hedley Falkinder of Kirby Misperton with 418 points. Joint second place was shared between Joan Slater of Matlock and Eric Franks of Paignton with 306 points. Philip Davies of Market Drayton was third with 253 points. Runners-up were Clifford Tooke (152 points), Bill Holt (120 points), Darrell Jacobs (ninety-six points), Stan Taylor (ninety points), Alan Houchen (ninety points), Cliff Queeley (eighty points), Heinz Tank (sixty-eight points), David Glow (sixty-seven points), Torfaen Scouts (sixty-six points), 3rd Wingerworth Scouts (fifty-four points), Elmer Liddicoat (fifty-one points), John Jenkins (forty-three points) and the 3rd Wingerworth Scouts VHF team (twenty-nine points).

Comments received included: 'Pity all the Scout stations didn't announce their troop details' (a common complaint, especially regarding overseas stations), '. . .a very enjoyable contest- . . .good way to introduce the youngsters to the hobby', '. . .really good Jamboree this year', 'looked in vain for GB2WFF. . .where were you?'

Well, I was there and logged by most entrants. Conditions were not so good on 80m where there was a lot of noise, but the higher bands were in good condition and paths were found to work JAs on 15m and Ws on 10m. I only worked sixty-five stations over the weekend due to work commitments on both days. QSL cards were sent out on the Monday.

Congratulations to all those who took part. Certificates have been sent to all entrants and Hedley, Joan, Eric and Phil have trophies to decorate their shacks.

The total sum received for the MENCAP fund this year was £15.20 which included a bit extra from Joan, who sponsored herself for contacts made. Thank you. Many thanks for your support – see you next year!

Continental series

While on the subject of awards, the claims for the 'Continental' series have been coming in thick and fast, many listeners claiming for individual bands and modes. This series, part of the International Listeners Association Awards Scheme, is an ideal introduction to awards as they are not too difficult to obtain. They are free to ILA members but other listeners can submit claims with a handling fee of 50p.

Details are simple. All you have to do is log 100 stations in one continent. They can be either broadcast stations or amateur and can be logged on mixed or single bands and, in the case of amateur stations, single or mixed modes.

Award hunters

Heading this month's claims is Harry Yeldham of Burnham on Crouch, with claims for the South American award and a European on 10m only. But special congratulations are due for his claim for the Gold Prefix Award for 1000 different prefixes logged! There are some very nice ones among the list including 3V1, 3W8, 4N9, 5V7, 6W7, 7P8, 9X5, A92, CJ9, DW2, FV8, HK7, J73, NW200, PW8, S4, SX1, VX8 and XQ3. Harry's station consists of the FRG8800 and RA17 with a couple of end-fed wires. Being on a farm obviously helps, and a 274ft end-fed can pick up a lot of signals!

John Wainwright G6PBW of Chesterfield claimed for the North American and USSR awards. John also uses end-feds with a seventy footer at only 15ft and a 50ft sloper. His FRG7 is the original non-digital version but he finds it simple to use and an excellent performer.

Nice to see Barrie Musselwhite of Warminster back in the lists, with a claim for the North American award. Barrie has been trying out a more modest aerial for loft use and it's been working fine. Although intended for 10m, it receives well on all bands.

Last of the claims this month comes from Luciano Marquardt of Hereford who sends in his Silver Prefix Award claim for 500 prefixes all neatly laid out in a book. Worthy of mention are A71, CY0, S01, HL9, JT1, V3, VP9 and XX9. Equipment in this case was very modest, comprising a DX302 and a half-wave dipole. Well done, Luciano!

On the bands

The bands have been in the 'funny' period for the past month or so, with nothing really certain. The 20m band has been all but closed around 2100 and there have been very high noise levels on 80 and 40m. VO1FB was copied at S9+40dB on 40m while the Europeans were in the noise. Top band has been very good at times with lots of Stateside with VE1ZZ leading the way but, strangely, few Europeans to be heard.

Unusual prefixes

There's been a nice crop of unusual prefixes around including 3W8DX (Vietnam); R8BUO (celebrating forty-five years since the liberation of Kiel); P40V (QSL to AI6V) who, apparently, set a new record for the multi-multi section of the CQWW/SSB contest; SN70KRA (commemorating seventy years of Polish independence); ZS88AOO; a string of JYs for JY1's birthday and S01A (as if S0RASD wasn't strange enough).

Our thanks to Mike Ribton for his excellent report, as usual!

Equipment for airband monitoring

Last month we had a brief look at airband monitoring. The airband listener is very well catered for by manufacturers but it is as well to try out a couple of receivers before you buy one as even some quite expensive receivers are not as good as you might expect. Also you may find that some 'scanning' receivers do not have the airband included. Remember, the VHF frequencies lie between 118 and 136MHz.

As you may know, VHF signals operate on a 'line of sight' basis. So, for ideal reception, there should be clear airspace between your receiver and your intended target. If you happen to live in a heavily built-up area or in very hilly country, you will probably find reception restricted to aircraft flying at a high level. The ideal, of course, is to be on a hill or high building and hand-held receivers help a lot. Very open, flat areas such as some parts of Essex can provide very good reception too.

As with all VHF reception, signals can be affected by weather conditions and it is useful to note when 'lift' conditions are about. A good guide is your television as these conditions also often affect television signals to such an extent that European programmes can be seen superimposed on your usual ones. More frequently, faint diagonal shadows can be seen on the screen over the picture. During these conditions it will often be possible to hear aircraft or even control towers on the Continent.

What about aerials? The simple groundplane aerial or dipole is quite adequate but good quality discone aerials are not terribly expensive (under £30.00) and do give excellent results, but all aerials should be put up in the clear – away from buildings. Use good quality coaxial

feeder and you should have no problems.

Air traffic control

There are three designated areas of control. Airport control deals with the immediate vicinity of the airport and controls landing, take-off and ground movement. These operations are controlled from the visual control room, the glass-topped building that we're all familiar with. Approach control covers aircraft within the area of the airport. Aircraft are guided towards or away from the airport in preparation for landing or after take-off. Also, aircraft passing within its boundaries are given guidance to make sure there is no conflict with aircraft landing or taking off. Area control provides a service to aircraft using the airways or flying in the special rules area. Most of the passenger and freight craft in UK airspace are under the surveillance of area control.

The airways

These are 'corridors' of airspace, ten nautical miles wide connecting terminal areas or crossing the UK to connect other airways' systems. They are all in straight lines between reporting points. These are classified as either low level or high level, the division being at 24,500 feet. Aircraft wishing to join an airway must obtain clearance from air traffic control either before departure or during flight if outside controlled airspace. The special rules area refers to all airspace between 24,500 and 66,000 feet. Aircraft operating at these levels are obliged to receive a mandatory air traffic service and are not required to remain within the confines of upper airspace.

Uncontrolled 'free' airspace covers all airspace outside the control areas, consisting of lower airspace which extends to 8000 feet and middle airspace which extends to 24,500 feet. This area is used by light aircraft and some scheduled flights. Aircraft are on a 'see and be seen' rule or, in inclement weather, on instrument flying rule. Aircraft may use the flight information service which gives weather, traffic and airport conditions and liaises with area control to join or cross airways.

Well, that gives you a very basic outline of the air traffic control system. Obviously it is a lot more involved and Graham Duke's book **Air Traffic Control** (Ian Allan Press) gives you a fuller picture.

As with amateur radio, abbreviations are commonly in use during communication and the phonetic alphabet is used for clarification. Messages are classified into six priorities.

1. Distress messages; prefixed 'MAYDAY'.
2. Urgent messages; prefixed 'PAN'.
3. Direction finding.
4. Flight safety including air traffic control messages and position reports.
5. Meteorological messages.
6. Flight regularity of 'company messages'.

There are a large number of code-words used during communications which refer to navigational or aviation terminology. It will take a while to get used to the terms used.

There is a lot of enjoyment to be gained from this side of the listening hobby and, indeed, there are many airband listeners who concentrate entirely on these bands, having no interest at all in other parts of the hobby. Rather like the railway enthusiast who knows railway traffic movements back to front, the keen airband enthusiast can probably tell you about every flight that enters his area. Like all things, you get out of the hobby what you are prepared to put in! However, remember, if you are interested in airband monitoring, be sensible about it and on no account make a nuisance of yourself.

Project Year

At the NEC in Birmingham last year, the RSGB introduced 'Project Year' which was intended to encourage young people into amateur radio. As regular readers know, I have, through this column, been encouraging newcomers to the hobby through the International Listeners Association. We've been fully supported by ***Amateur Radio*** from the start and from a nucleus of less than a dozen listeners, the Association is now over 500 strong. Many of the members are connected with youth organisations, such as the Scouts and have done their bit to encourage youngsters into the hobby.

However, it seems from the mail I receive that it's not the youngsters that are taking up the hobby, but the mature person who, having seen his/her children start their own families, now has time for leisure pursuits. Amateur radio is not a cheap hobby. With more sophisticated equipment coming on to the market every day and more computerisation coming into the hobby, it's no wonder that the youngsters are not joining us.

In the old days radio was a mystery area. It was new and exciting. There was very little in the way of amateur equipment but ex-government shops could sell you a receiver pretty cheaply to get you started. After the war there were plenty of ex-signallers from the forces who had lived 'dots and dashes' and come to love them.

What have we to offer now? Almost every home has a radio, television and, possibly, a computer. The children have grown up in an electronics and space age environment so there is no mystery left.

We will get newcomers showing an interest, but I think the majority will be from the older generation.

At an exhibition recently, I chatted to a group of youngsters from a local school. Of over a dozen, only seven had a serious hobby. Three in athletics, two in stamp collecting, one in cycling and one in model-making. Oh yes, eight of the group had computers. . .for games!

The listeners are not so much affected by the changes in government policy as the demand for commercial airspace increases, but the licensed amateur is certainly going to feel the pinch.

So, what can we do to keep the hobby not just alive but growing? Should we adopt the method used by some American schools and use amateur radio as part of physics lessons or another part of the curriculum? What do *you* think?

MICHAEL GURDUS
THE WORLD AT HIS FINGERTIPS

by Thomas King

In 1974 following a coup in Cyprus the state radio of this tiny Mediterranean country announced that President Makarios was dead. In reality, the political and religious leader of the then war-torn island had only fled the capital of Nicosia making his way to Paphos, a small village in the southern part of Cyprus. From a small transmitter there he broadcast a message in exile.

That transmission was monitored and the tape replayed over Israel Radio. Other rebroadcasts followed from other short wave and medium wave outlets. They were listened to by American and British agencies. Swiftly acting on the Makarios appeal they organised a rescue and assisted with his eventual return as the lawfully elected head of government. The man who monitored that initial plea was Michael Gurdus.

War in the Gulf

When the Iran and Iraq war began, radio transmissions from Syria and Libya co-ordinating early shipments of weapons to Iran were monitored. Following the announcement to the world community that such activities were under way, Iraq severed diplomatic relations with Iran. The man who monitored those broadcasts was Michael Gurdus.

As a TWA jet was flying over Greece it was hijacked. The man who first monitored the terrorist activity in progress was Michael Gurdus.

While it's impossible for Michael Gurdus to always be at the right place at the right time, his ability to tune into the world and then interpret the broadcasts is not only uncanny it's highly impressive and very professional. And so it should be because it's his job as the experienced 'ears and eyes' of a highly respected and unique communications monitoring service specialising in the Middle East.

In simple terms this Tel Aviv-based DXer listens to radios – lots of them – and watches several colour monitors for about sixteen hours a day, seven days a week. He has equipment to scan the bands from medium wave through short wave to the UHF spectrum. In addition, he has access to a sky full of satellites and the facilities to record everything.

Guided by a stack of confidential frequency lists and a small library of specialised communications-oriented magazines and books, some equipment is squelched on fixed frequencies such as 14.418MHz the Kuwait News Agency, and 9.117.7 a popular frequency for aircraft flying over the Persian Gulf. More often than not, however, the sporadic transmissions are purely routine. But when something out of the ordinary occurs, the communications room in the Gurdus home is crowded with the constant ringing of bells as Michael gets telephone calls from all over the world when something is happening in the Middle East.

This has been the case for a number of major events, all of which have made world headlines. He was particularly busy providing information and insight during the Makarios escapade, the early days of Iran versus Iraq, the TWA caper as well as the American bombing of Libya, the Israel/Lebanon War and the 1980 attempt by the American Air Force to free the hostages in Iran. While all these events are still vivid in his mind the most 'shivering' episode of his career was in 1984 when he heard the screams of passengers on the ill-fated hijacked Kuwaiti plane.

A massive number of telephone calls and a large amount of monitoring time these days is devoted to the conflict in Michael's own country of Israel. Not only does he monitor the broadcasts of Israel Radio but he listens to and watches the events from neighbouring Arab nations.

Michael's university training in Middle East political science, his fluency in Hebrew, Arabic, Polish, Russian, French, English and some German coupled with his passion for communications means that he is invaluable to Israel Radio and TV as an authorative news source. The world-known DXer, who began his professional monitoring career in 1979 and who was influenced by his father, a chief correspondent for the French News Agency, is also considered invaluable to an American television network.

NBC TV values his ability to listen to and understand the Middle East so highly that a telephone 'hot line' was established in 1985. All he needs to reach the American television giant is to pick up the 'red phone'. There's never a busy signal and there are no telephone numbers to remember! The company has also provided facilities for direct satellite transmission to New York.

Satellite communication

At present there are more than twenty different satellites providing viewable signals to Israel. On the eastern footprint of the ECS-1, the European satellite, there's the BBC link between Washington and London. London's ITN uses ECS-1's Bright Star Transponder in the evenings to transmit information to New Zealand. Other ECS-1 transponders relay German and Turkish television signals. There are five Russian satellites with portions of their footprints over Israel as well as two Intelsats which serve, among other nations, the communication needs of Gabon and Niger.

One of Michael's favourite sources of information and entertainment comes from an Intelsat transponder used by the US Forces Armed Television Service. Because of interest in Johnny Carson and football, Michael is able to keep in touch with these contributions from the USA even if it means video taping them for playback the next day.

Aladdin's cave

To monitor the world around him, Michael is fortunate in having a wider choice of communications equipment available than can be found in the majority of shops selling such items. Included in the cornucopia of electronic gadgets are four satellite receivers (manufactured by Drake, Anderson and Tracker Systems); a Sony world zone portable short wave receiver; a Collins 51S1 receiver; a Panasonic RF-2900 receiver; a VHF/UHF tuner; a reel-to-reel tape recorder next to a Seiko world time clock; controls for the two roof-top rotators; two R-2000 receivers from Kenwood; recorders from Sony, Toshiba and Sharp; a Yaesu FRG-9600 VHF/UHF receiver capable of monitoring amateur repeaters in the area; a Kenwood R-5000 receiver; a Drake R7 receiver; a 5in NTSC Sharp colour monitor and another one from JVC; a Yaesu FRG-7000 receiver next to an older FRG-7; a BARCO professional colour monitor from Belgium; a Brother printer; a telereader; a 21in BARCO monitor; an AKAI "9 Standard' VCR; a Sony TV and a National video.

With such an assortment of equipment it's quite understandable that a wide variety of antenna accessories is needed. The roof top of Michael's house is filled with an amazing assortment of 'signal grabbers'. Apart from a 5 metre dish for the 'C' band and a 3 metre dish for the 'KU' band satellites (both of which are portable), Michael has installed beams for the 7, 13 and 21MHz bands, dipoles for 8, 11, 15 and 26MHz, a long wire for the medium wave bands, a loop antenna, an FM beam and a VHF/UHF beam primarily for aircraft transmissions.

The highest antenna is located some 36 metres above the peaceful, tree shaded street in downtown Tel Aviv. This artifical 'mountain' of solid steel towers and masts, coupled with the area's slightly elevated position not far from the sea, provides for enhanced reception. It's not a place entirely free from noise, Michael noted, but it is just about ideal when the conveniences of a major city are considered.

A typical Michael Gurdus day begins at 9 to 9.30am. With only a few short breaks in between he continuously monitors the enormous medium wave, short wave and VHF/UHF spectrum until about 1am each day. A night out is a rarity and a holiday nowadays is unknown. Before becoming so involved in the world of professional listening, he used to make the odd holiday trip here or there. But he got fed up travelling. As Michael said, 'a few days is a long time to be away. And besides that, where would I go? The whole world is here'!

USING YOUR OSCILLOSCOPE

PART THREE

This month Joe Pritchard looks at measuring time and frequency

Initially, the procedure for measuring periodic signals is similar to that required for dc measurements, except that you may wish to select the ac input position to get rid of any dc component of the signal under test. Set the Y amplifier gain to a level where the entire waveform can be seen on the screen.

The 'scope's timebase should be set as required. Details of this will be given in your 'scope manual. However, there are a couple of points to look out for:

1. Adjust the timebase to no more than a couple of cycles on the screen at once should you want to examine the signal in detail. Start at a timebase which is considerably longer than the duration of the signals.
2. When taking measurements from the screen do ensure that the timebase control is in the 'calibration' position.
3. Use the 'X-shift' control to move the displayed signal from side-to-side to make measurements easier (see **Fig 1**).
4. When estimating the periodic time of a signal it is usually easier to measure the time between 'zero crossings' (**Fig 1**) than from anywhere else. Do make sure, though, that you only measure between points on the waveform that are a full cycle apart if the waveform is periodic.

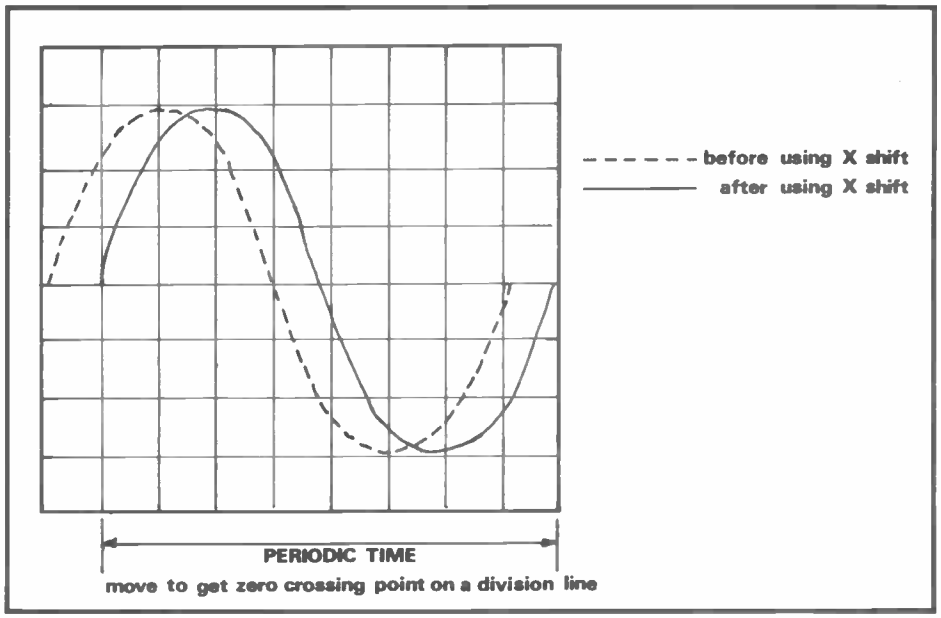


Fig 1

For a periodic signal such as a sine-wave (see **Fig 2**) the frequency can be estimated using the formula f=1/P where P is the periodic time for the signal.

The periodic time is measured by counting the number of large and small horizontal divisions between two similar parts of the waveform, and multiplying this by the 'time/division' setting of the timebase controls. Suppose we have counted two large and seven small divisions with a timebase of 1mS/division. This will give a periodic time of 2.7mS and a frequency of 1/(2.7E−3) = 370Hz.

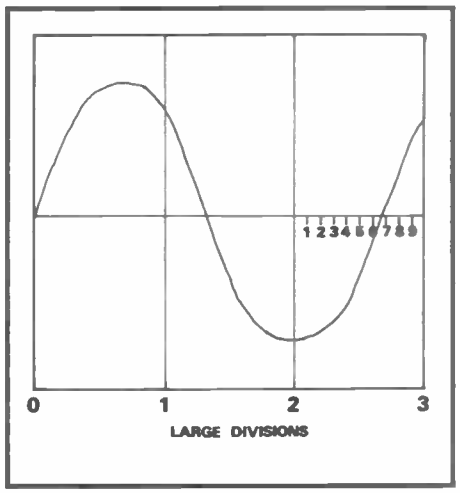


Fig 2

When estimating frequency, take into account the limitations imposed on you by your equipment. At the low frequency end of the scale the limitation will be due to the persistence of the screen phosphor; slowly changing signals may not leave a trace on the screen long enough for you to measure. At the high frequency end the limitations are due to the 'scope's bandwidth and the timebase settings which are currently available on the 'scope. Many 'scopes have a 'divide by 5' setting on the timebase controls that extend the timebase to shorter times, eg, a trace time of 5uS will be shortened to 1uS when this facility is in use. However, do not rely on it too much as the accuracy begins to suffer when very short duration trace times are being used.

Estimation of very low frequencies can be carried out even if the persistence of the screen phosphor does not allow a full waveform to be displayed long enough for you to take measurements. To do this, we use the trigger level and ± triggering capabilities of the 'scope. Set the 'scope with as low a timebase as you can achieve. Now select '+' triggering (this is often a push button, but details will be found in your 'scope's manual). Select the manual trigger level and turn it to its least sensitive position. The trace should now disappear. Connect the input signal and adjust the level control until a periodic flick of the trace across the screen can be seen. The start of the trace is now locked to the level of the input signal rising through the level set by the 'scope's controls. If we had selected '−' triggering, the trace would start when the signal level had decreased through the preset level (see **Fig 3**).

The time between each trace being visible on the screen is known as the periodic time of the signal, and will probably need measuring with a stop-watch – there's still a role for low-tech in the amateur's shack! Note, however, that measurements made like this will be of a low accuracy.

These methods are equally applicable for measuring times, and a 'one shot' type circuit can be timed by properly using the trigger level control, ie, setting the ± trigger facility to suit the circuit being measured. In fact, in these cases the 'scope's external trigger facility can often be used to advantage. Here, the trace across the screen is started on receiving a trigger pulse generated by an external circuit. This allows a pulse, for example, to trigger a monostable circuit and start the 'scope trace simultaneously. The output of the monostable circuit can then be monitored by using the 'scope in the usual fashion. The distance across the screen between the start of the trace and the pulse output from the monostable is the delay introduced by the monostable. **Fig 4** shows how this sort of measurement can be carried out. Not all 'scopes have an external trigger socket, but it can be most useful where present.

Lissajous figures

When I was at school, I was fascinated by Lissajous figures on oscilloscopes but rarely had to estimate frequency while using them. Even now I'm more likely to reach for my dip meter or frequency counter, although it is possible to

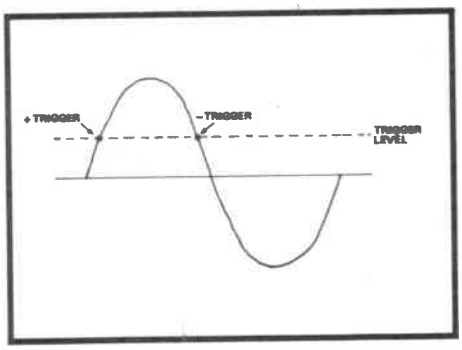


Fig 3

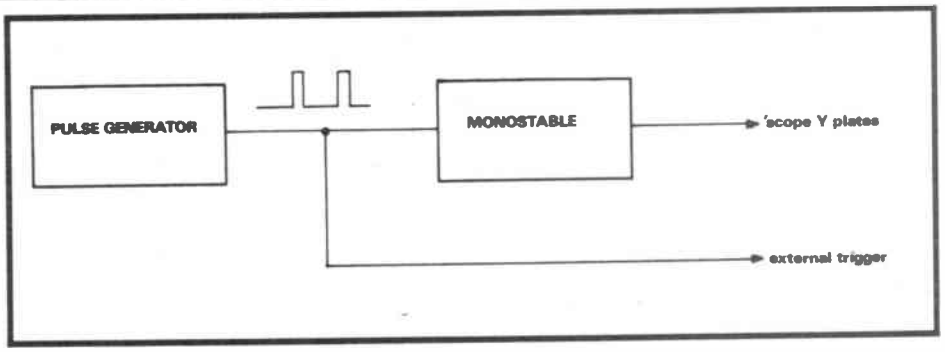


Fig 4

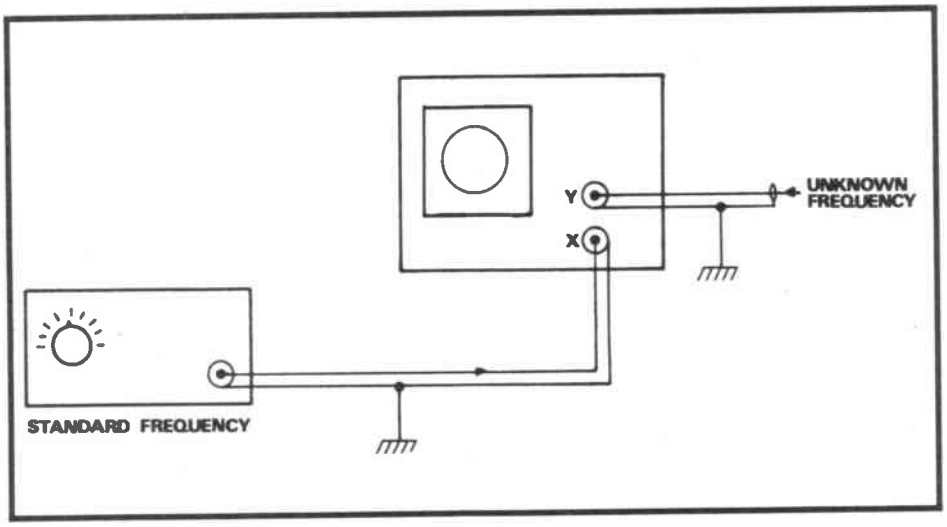


Fig 5

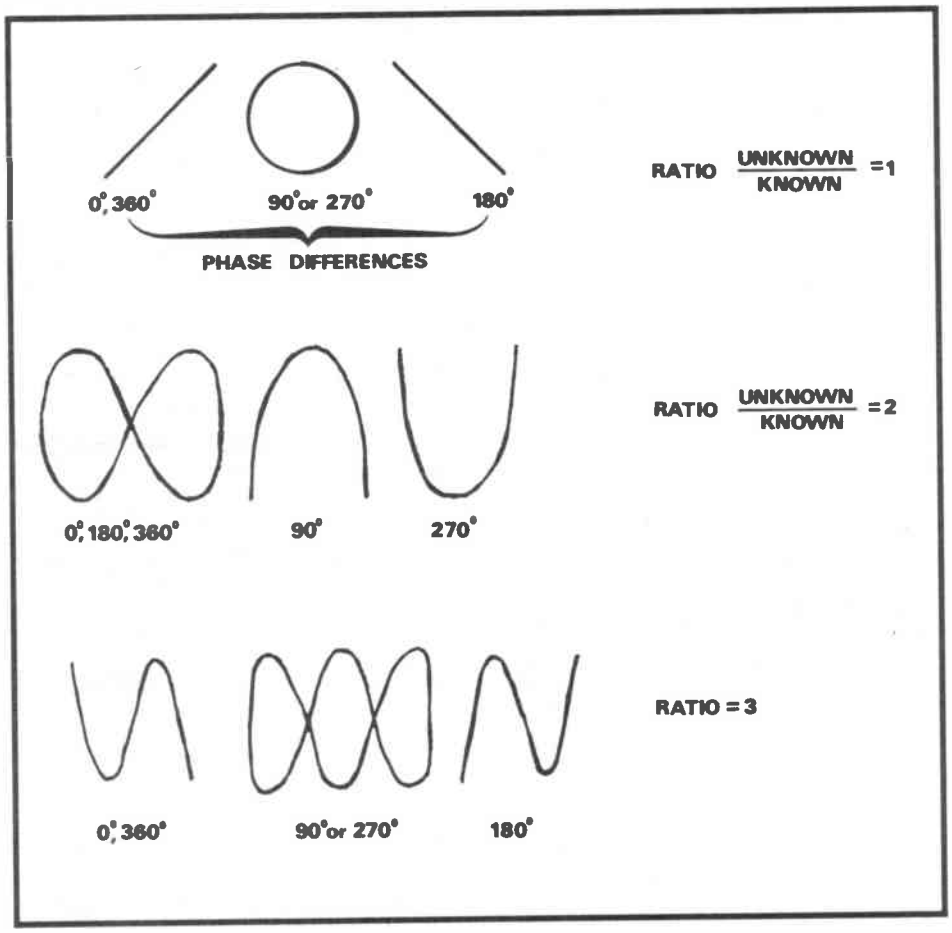


Fig 6

approximately estimate frequency using this technique. Quite simply, it works by comparing an unknown signal with a signal of known frequency, which is usually produced by a signal generator appropriate to the frequency concerned. The technique is best suited to sinusoidal signals and a practical set up is shown in **Fig 5**. The main reason for using this technique of frequency estimation is that you can apply a signal to the X axis of the 'scope display as well as to the 'Y' axis. The X axis signal thus replaces the internal timebase of the 'scope. A pattern will be displayed on the 'scope, depending on the relative frequencies of the two signals *and* phase relationships. Some examples of these patterns can be seen in **Fig 6**, and many standard laboratory manuals for electronics and physics will show other displays. The relationship between the two frequencies is illustrated in **Fig 8**. Some general points to consider when using Lissajous figures are as follows:

1. The X frequency can be a standard or fixed frequency and thus Y frequencies are calculated as a ratio of the X frequency. However, having a variable X frequency allows you to try and get a 1:1 pattern, which is easier to recognise than some of the higher level Lissajous figures.

2. The amplitudes of the X and Y signals should be as close to each other as possible. You may have to attentuate one signal (usually the known signal) or amplify the unknown signal, depending on their relative signal levels. If you do not do this the results may not be too good, but you can use the 'scope's X and Y gain controls to good effect.

3. As you can see from **Fig 6**, phase is important; indeed, you can use this technique to measure phase-change in circuits (see **Fig 7**). Here, the 1:1 Lissajous figures are used because the frequency is the same, and the orientation of the figure will indicate the phase-change applied by the circuit. However, the corollary of this is that the phase-shift applied to the two signals by the horizontal and vertical amplifiers of the oscilloscope must be similar, otherwise an 'artificial' phase-shift will be recorded by the 'scope due to its own internal circuitry.

By having the capability of measuring time and frequency on an oscilloscope, we can also estimate the value of

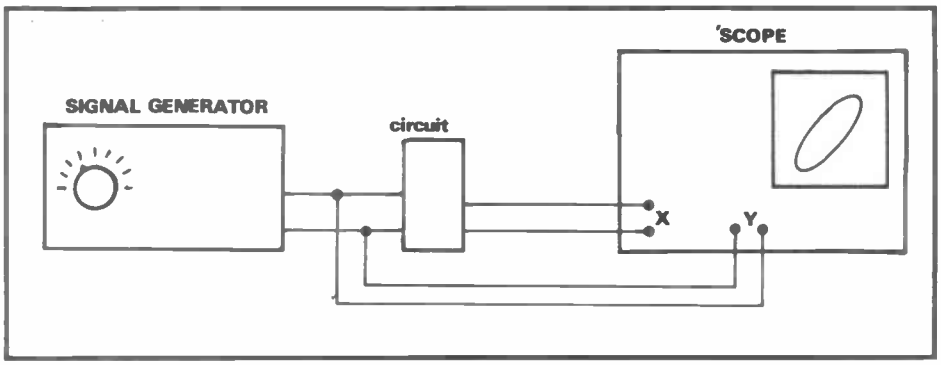


Fig 7

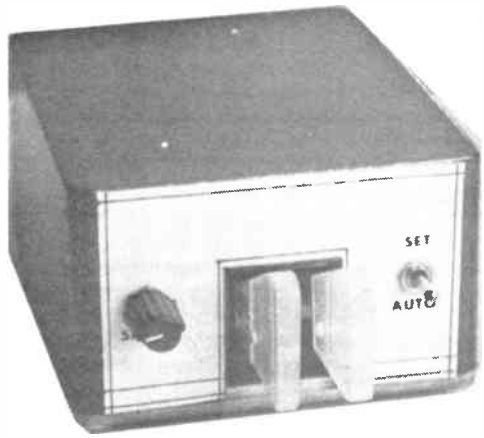
components that can be placed in a circuit and made to oscillate. If we know the values of the other frequency determining components in the circuits, we can determine the frequency of oscillation from the display and estimate the value of the unknown. Not highly accurate, but good enough for many applications.

Diagnosing circuit problems

Next month I will consider how we can use the 'scope to diagnose circuit problems by examining the waveforms at different stages in amateur radio circuits.

BITS TO BUILD

AN IAMBIC KEYER BOARD



I have always admired those men of science who were not only masters of the scientific knowledge of their day, but also had a sound classical background. When they produced new inventions or processes they were able to go back to their classical education and give them generic names. Radio is derived from Latin, television from Greek and so on. Oh . . . those 'Mickey Mouse' words that come out of computer science!

Iambic keying is popular with CW operators. Now, there is a word with solid Greek roots. Oddly enough, the Greek for 'root' means 'to assail'. Thankfully it does not mean assail the other station with speedy and incoherent Morse. Although listening to some CW operators using automatic Morse keys it might have that meaning. In fact, it refers to a poetic metrical system which uses two syllables, the first short and the second long. The 'assail' comes from the fact that this poetic device was first used in Greek satire. Enough of the second-rate classics! What does iambic keying mean in Morse code generation?

Most radio amateurs are familiar with paddle keys; these are Morse keys with a sideways rather than a conventional up and down action. The crudest form is the 'Sideswiper' in which the Morse characters are made manually by moving a side-action arm to and fro on to side contacts. I once sent bad Morse using a hacksaw blade and a couple of heavy relay contacts mounted on pillars either side of the blade. The more familiar version is the semi-automatic 'bug key'. With these keys the dashes are made manually on one set of contacts (the push to the left) and a vibrating arm striking another contact makes the dots (the push to the right). The speed of dot generation is controlled by a sliding weight on the vibrating arm. Such semi-automatic Morse keys are as old as the century and probably the most common examples are the Vibroplex keys – beautiful things which are still available.

From the beginning of the 1960s electronic keys (elbugs) became more popular, and most paddle keys these days are designed to drive electronic circuitry to generate both the dots (dits) and the dashes (dahs). The earliest examples used single paddle keys which gave dashes on the left motion and dots on the right motion. The more recent versions are dual paddles designed to drive iambic mode electronic keyers. They are also called 'squeeze' keys because the operator can generate the dahs and dits by squeezing the paddles rather than pushing them from side-to-side. These can be used for true iambic keying.

An iambic keyer is operated by squeezing the twin paddles so that the circuitry generates alternating dahs and dits: the long and the short of the iambic mode. What are the advantages? Such a key reduces the number of manual actions required to generate Morse characters. Pat Hawker G3VA has calculated that it requires eighty-two contact actions to send the complete alphabet on a straight (up and down) key. The semi-automatic key requires sixty-six actions and the single paddle elbug requires fifty-three, but an iambic keyer only needs forty-five. An experienced iambic operator can perform squeeze combinations which produce reduced manipulation characters or combinations of characters. The most common procedure signals are AR, CT and VA which can be made with a single squeeze and CQ which can be made with two squeezes. If you do not know how this works, ask an experienced CW operator who uses iambic keying to show you. I would advise anyone moving from straight to automatic, or single paddle to iambic keying, to have a lot of practice before using their new skill on the air.

There are several types of commercial paddle key available on the amateur market, and some operators make their own paddles. The paddle drives an electronic keyer circuit of which there are several types available. Most recent circuits are designed for iambic keying, although they can be used with a single paddle as a conventional elbug. Many operators use a squeeze paddle with single paddle movements to generate the dahs and dits, but this is a wasteful use of the technology.

An iambic keyer circuit

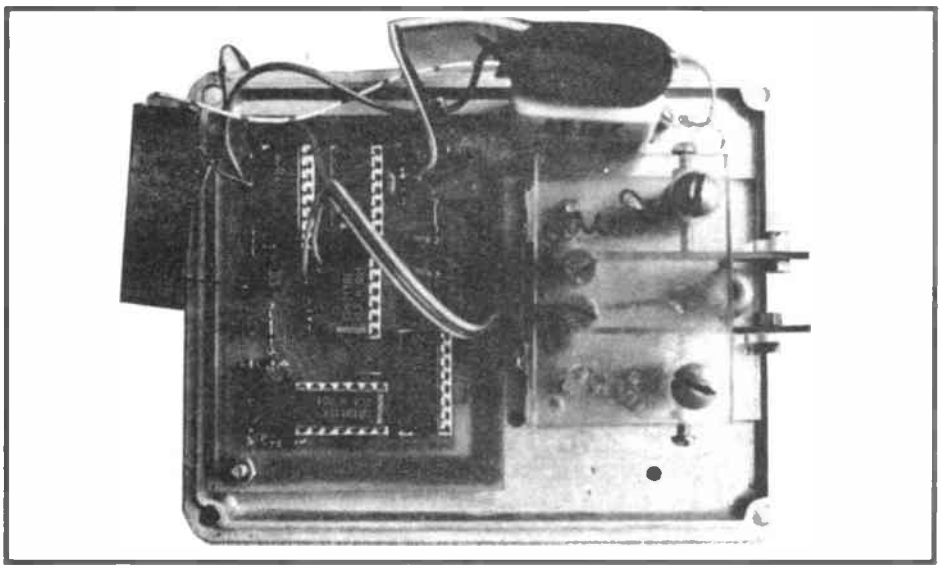
The circuit for an iambic keyer shown in **Fig 1** uses CMOS logic integrated circuits. In this circuit IC1 (A and B) form the dash memory and IC1 (C and D) form the dot memory. These are reset by IC3 A and IC3 D. IC2 forms the dash, IC5 gives the iambic operation and IC4 is the gate. The speed of the Morse is controlled by R7. Two pairs of transistors, Q1, 2, 3 and 4, act as solid-state switches to give positive or negative output keying. These can also drive a relay if contact keying is required.

The circuit includes self-completing characters, eg, the contact is touched to make a dash but not held on the contact long enough for the dash to be completed; the dash will still complete itself and be the correct length in relation to the length of a dot at the same speed. With this facility it would be possible to have made another dot before the dash had been completed by the self-complete facility, so this dot could be missed out. The circuit also includes a memory which inserts that dot even if it has been 'passed by' in the speed of operator action.

The layout of the circuit board is shown in **Fig 2.** This layout is used in the Kanga Products kit for this keyer circuit. When making the connections to the board, remember that the correct position for the dashes (dahs) is to the left and for the dots (dits) to the right. Right-handed people make dots with their thumb and dashes with their index finger. Some left-handed people reverse this convention. The keyer circuit is powered by a 9V PP3 battery. In practice, an on/off switch is not required because the stand-by current (when not keying) is less than a micro-amp.

Keyer kit

I built this keyer circuit from the kit supplied by Kanga Products. The kit comes complete with a tinned and drilled fibreglass printed circuit board and all the required components. R7 is even supplied as a preset control to mount on the board. Most constructors will probably wish to replace this preset control with a suitable potentiometer of the same value to provide a front panel speed control. Although the kit was very simple to build I must strike a slightly cautious note. The layout is compact and some of the connection lines etched on the board are fine. A fine soldering iron is required, and solder must be quickly applied and not be allowed to form any bridges over adjacent connection lines on the board. Inexperienced constructors must be careful or seek help when soldering the board. The layout drawing is easy to follow but care must be exercised with the integrated circuits (ICs). They are CMOS devices and can be damaged by static charges due to



careless handling – avoid mauling the pins! The ICs must also be connected the right way around on the board, as should the transistors and the two diodes, D1 and D2.

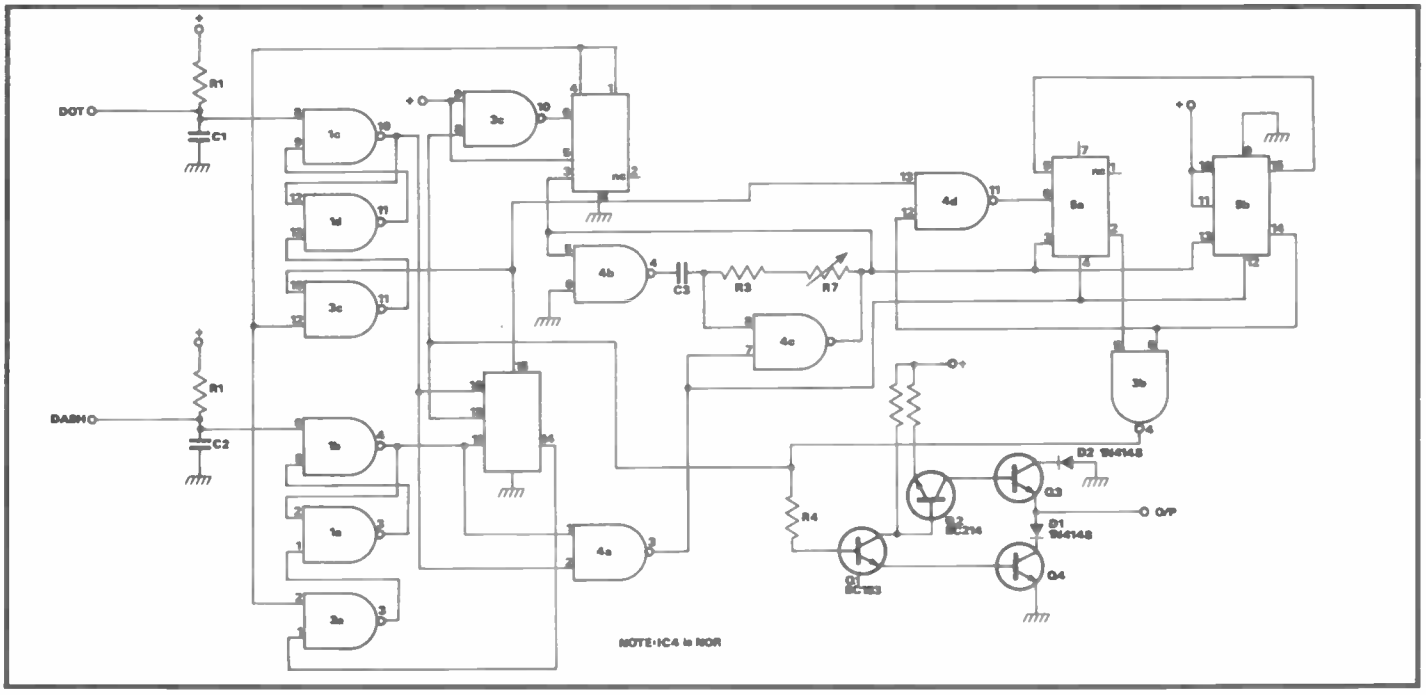
Once the board has been completed and carefully checked over against the circuit and layout drawings as well as inspected for solder bridges, it can be tested. Connecting the supply with a multimeter, on the lowest current range, in series should draw less than 1 micro-amp. After this test, reconnect the supply with a miniature 12V bulb between the positive supply terminal and the output terminal. Joining the negative supply terminal to the dot terminal using a fly lead or a crocodile cliplead should make the lamp flash. Connecting the dash terminal to the negative terminal will cause the lamp to flash more slowly. If both dot and dash terminals are connected to the negative terminal, the lamp will flash alternately short and long: the iambic action.

Additions

I fitted my keyer board into a diecast aluminium box 3½x4½x2in high but any suitable box can be used and it need not be a metal one. I also used a home-made squeeze paddle which was a shortened version of a paddle made some years ago by G3PDL. It is more usual to have the electronics inside the box and the paddle outside, connected by three

PART	QTY	VALUE
R1, 2, 3	3	100k
R4	1	10k
R5, 6	2	4k7
R7	1	470k lin preset
C1, 2	2	1NF (0.001 or 102)
C3	1	100NF (0.1 or 104)
D1, 2	2	1N4148
TR1	1	BC214
TR2	1	BC183
TR3, 4	2	BCX33
IC1, 3	2	4001
IC2, 5	2	4027
IC4	1	4001
14 way sockets	3	
16 way sockets	2	

Fig 1: *The iambic keyer. The table shows the values for Fig 1*



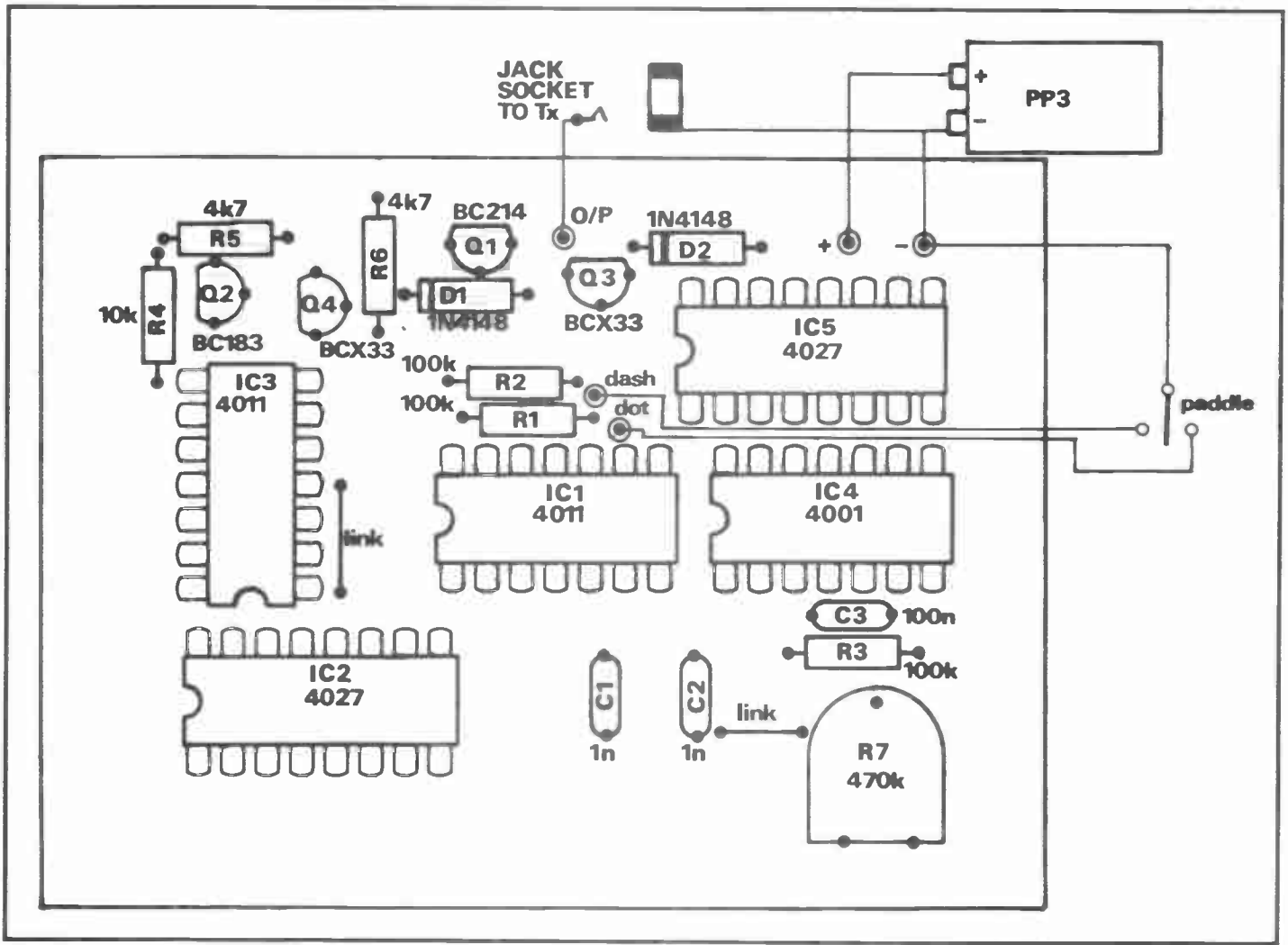


Fig 2: *Layout of the iambic keyer*

wires to a plug and socket arrangement at the box. Some constructors use stereo jack plugs and sockets for this purpose.

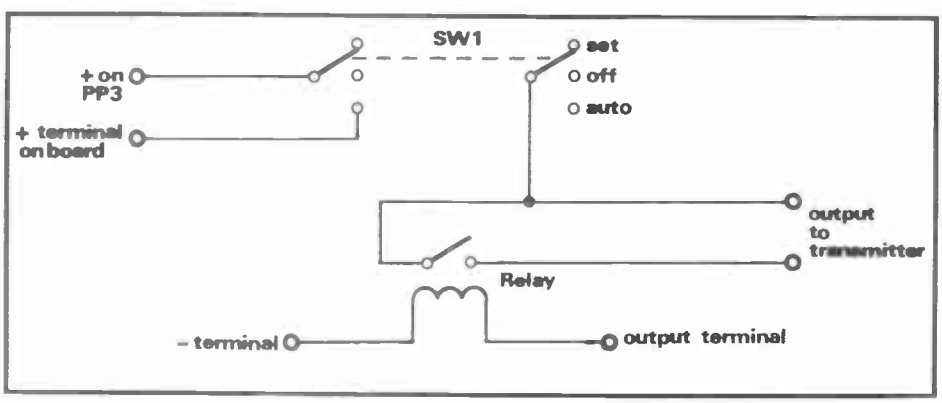
I also added a couple of extras to the circuit which are shown in **Fig 3.** Although an on/off switch is not really necessary, I decided to add one so that I could include it with a 'set' (or 'tune') switch. This is a switch which has a 'key hold down' position for tuning the transmitter. In effect, it shorts out the output leads which go to the transmitter key socket. For this purpose I used a miniature toggle switch. It is a double-pole, double-throw, centre-off switch. In the centre position the keyer is switched off, but when the switch is thrown upwards the output is shorted for tuning purposes (set). When the switch is thrown downwards the keyer circuit supply is switched on ('auto').

I also added relay switched keying which in my view is preferable, since the mechanical switching action provided by the relay can be used to key any kind of transmitter circuit. Sometimes I will key simple low-power transmitter boards into the supply-line, and this requires a key switching action which is isolated from ground (**Fig 3** shows how to add the relay). The circuit repeats the action of the bulb used for testing the board. Surplus items for both the switch and the relay have been used, but commercial items which are included in the component listings are equally suitable.

I like this keyer board as it is compact, inexpensive and performs very well. It would be useful for portable and casual operating away from the main station and would make an excellent main station keyer.

Fig 3: *Circuit additions. The table shows the values for fig 3*

SW1	= Double-pole, Double-throw Centre Off, Miniature Toggle Switch. (Maplin FH05F would serve)
RLY	= Reed Relay 700 ohm coil. (Maplin FX50E would serve)



Sources

The Iambic Keyer Kit is available from: Kanga Products, 3 Limes Road, Folkestone, Kent. It costs £12.45 plus 85p p&p.

sure to be a group of people I have left out. If there is then please contact me so that the list can be updated. Remember though that local club nets do not qualify for a nationally reserved frequency!

You will also notice the large number of frequencies allocated to Raynet (five spot frequencies plus repeater facilities at 145.800). It seem unreasonable to tie up so much space except in emergencies and I feel that it makes sense to make use of these frequencies for normal purposes *except* when asked to move to make way for emergency traffic when you should do so **at once**. Except in emergency conditions Raynet is simply another amateur radio interest and must learn to live with the rest of us. I now expect a deluge of letters from Raynet members, of which I am one.

The frequencies allocated to GB2RS, slow Morse and rally talk-in are only used on an occasional basis and can therefore be used for normal working unless they are required for the designated purposes.

Close down

Next month we will look at some of the other bandplans which, perhaps to our advantage, are not nearly so complex as the 2m one. I am still fighting the packet radio system and you can leave messages on the GB7NUN-2 board at Nuneaton. Other ways to contact me are via Prestel (once described as 500,000 answers waiting for a question) using 203616941 or direct by snailmail to 81 Ringwood Highway, Coventry CV2 2GT.

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■Hamgear: super ATU and preamp, £25.00. Atlas 210-100W HF transceiver, exchange for 2m rig. Geoff. Tel: (0484) 645923

■Trio TS530SP 10m-160m tcvr, mint condition, £625.00 ono. Tel: (0287) 38103 after 6pm Mon to Fri, anytime weekends, buyer collects

■Icom IC-211E, plus ICRM3 and UC1332 UP converter, 1-33MHz, £425.00. Trio TR8400 70cm with PS10 base unit, £200.00. Both with manuals. Dave G6PJE, Tel: (0945) 880693

■Icom R71E communication Rx, as new, excellent instruction manual, FM unit fitted, £615.00 ono. Tel: (0926) 54556, 6-8pm

■Back numbers of Amateur Radio for sale. Volumes 2 and 3, 1983, March to November. 1984 January, March to August, October to December inclusive. 1985 February to December. 1986 January, February and April. 1987 April to August and 1988 December to March. Buyer collects or pays postage, offers. Tel: 01-476 0332

■Sony PRO80, as new, £250.00. Tel: 01-228 4835

■Ten-tec Argosy 2 HF transceiver, 80 to 10m, SSB/CW, complete with mains PSU, mic, manual, boxed, as new, offers. Tel: (0273) 517933

■SEM Europa, C, VHF transverter and matching Europa power-supply, type CPS 10. Also Butternut HF6V, offers or WHY? Tel: (0266) 45527

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■11m crystals, suitable for Yaesu FT-101E, 3 crystals in all, £10.00. Write to: Leighton Smart, 33 Nant Gwyn Trelewis, Mid-Glamorgan CF46 6DB

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■AVO valve characteristic meter mk3/4. Selector switch for all valve circuits – no cards required. Very good condition, complete with data manual and working instructions, £55.00. Tel: (0483) 36953

■Collector's item: HMV stereogram, model 2310, teak finish, radio tuner, cord broken, otherwise excellent. Offers. Tel: (0992) 586475

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■RCA AR88D general coverage receiver, 0.54-32MHz in 6 bands, mint condition, complete with original speaker cabinet, copies of manual and circuit diagrams, collector's item, £80.00. Tel: 051-336 4239 evenings

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BD2 5 13A spurs provide a fused outlet to a ring main where devices such as a clock must not be switched off.
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BD22 2 25 watt loudspeaker two unit crossovers.
BD29 1 B.D.A.C. stereo unit is wonderful 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.
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BD45 1 24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day. original cost £40 each.
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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.
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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.
BD221 5 12V alarms, make a noise about as loud as a car horn. Slightly soiled but OK.
BD242 2 6in x 4in speakers, 4 ohm made from Radiomobile so very good quality.
BD252 1 Panostat, controls output of boiling ring from simmer up boil.
BD259 50 Leads with push-on ¼in 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.
BD305 1 Tubular dynamic mic with optional table rest.

VERY POWERFUL 12 VOLT MOTORS—⅓rd HORSEPOWER. Made to drive the Sinclair C5 electric car but adaptable to power a go-kart, a mower, a rail car, model railway, etc. Brand new. Price £15.00 plus £2.00 postage. Our ref. 158.

WHITE CEILING SWITCH 5 amp 2 way surface mounting with cord and tassle. Made by the famous Crabtree Company. Price £1 each. Our ref BD528.

13A SWITCH SOCKETS Top quality made by Crabtree, fitted in metal box with cutouts so ideal for garage, workshop, cellar, etc. Price £2 each. Our ref 2P37.

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There is a total of over 400 packs in our Baker's Dozen range and you become entitled to a free gift with each dozen packs.
A classified list of these packs and our latest "News Letter" will be enclosed with your goods, and you will automatically receive our next news letter.

THREE CAMERAS All by famous makers, Kodak, etc. One disc and two different instant cameras. All in first class condition, believed to be in perfect working order but sold as untested. You can have them for £10 the three, including VAT, which must be a bargain—if only for the lenses, flash gear, etc. Our ref 10P58.

ATARI 65XE COMPUTER At 64K this is most powerful and suitable for home and business. Brand new, complete with PSU, TV lead, owner's manual and six games. Can be yours for only £45 plus £3 insured delivery.

DATA RECORDERS ACORN for Acorn Electron, etc., reference number ALF03, with TV lead, manual and PSU. Brand new. Price £10 plus £1.50 post. Order ref 10P44.

ATARI XC12 for all their home computers. With leads and handbook. Brand new. Price £10 plus £2 post. Order ref 10P53.

JOYSTICK FOR ATARI OR COMMODORE for all Atari and Commodore 64 and Vic20. New. Price £5. Order ref 5P126.

EXTRA SPECIAL OFFER We will supply the Atari 65XE, data recorder XC12, joystick and six games for £57.50 plus £4 insured delivery.

SUB-MIN TOGGLE SWITCH Body size 8mm x 4mm x 7mm **SBDT** with chrome dolly fixing nuts. 4 for £1. Order Ref. BD649.

VENNER TIME SWITCH. Mains operated with 20 amp switch, one on and off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only £2.95 without case, metal case—£2.95, adaptor kit to convert this into a normal 24hr. time switch but with the added advantage of up to 12 on/offs per 24hrs. This makes an ideal controller for the immersion heater. Price of the adaptor kit is £2.30.

SOUND TO LIGHT UNIT. Complete kit of parts for a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two-tone metal case and has controls for each channel, and a master on/off. The audio input and output are by ¼in. sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitate ease of connecting lamps. Special price is £14.95 in kit form.

MINI MONO AMP on pcb, size 4in x 2in approximately. Fitted with volume control and place for a tone control should you require it. The amplifier has three transistors and we estimate output to be 3w. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of £1. Our ref BD495.

RE-CHARGEABLE NICADS 'D' SIZE
These are tagged for easy joining together but tags, being spot welded, are easy to remove. Virtually unused, tested and guaranteed. £2.00 ref 2P141 or 6 wired together for £10.00 ref 10P47.

LEAD LAMP Normal hand-grip type plastic holder, with glass cover to protect the lamp and further protection in the form of a wire guard with a hook for hanging. Ideal as loft light or for car repairs, etc. Takes 60w lamp. Has good length flex. Price £4. Our ref 4P31.

2.5kw TANGENTIAL BLOW HEATER has an approximate width of 3in. (plus motor), elements made up of two 1.2kw sections so with switch available you can have 2.5kw, 1.2kw or cold blow. Over-heat cutout eliminates fire risk should fan stop or air flow be impeded. Fan blades are metal. Price £5 plus £2.50 post. Our ref 5P62. Switch 50p.

ALBA TWIN CASSETTE RECORDER AND PLAYER WITH STEREO RADIO This is a mains/battery portable made to sell, we understand, at about £50 but the ones we have are line rejects. They are brand new still in the manufacturers' boxes but have a slight defect associated with the cassette section. The radio and amplifier section, both mono and stereo, is perfectly OK. If you are handy at mending things then this should be for you. Price £20 or two for £38 plus £3 insured post, either package. Our ref 20P7 or 2 x 20P7.

LASER TUBE

Made by Philips Electrical. New and unused. This is helium-neon and has a typical power rating of 1.6mW. It emits random polarised light and is completely safe provided you do not look directly into the beam when eye damage could result. DON'T MISS THIS SPECIAL BARGAIN! Price £29.95 plus £3 insured delivery.
POWER SUPPLY FOR PHILIPS LASER available in kit form, Price £15 plus £2 postage,

PAPST AXIAL FAN—MANUFACTURERS REF NO. TYP4580N. This is mains operated. 15 watt rating and in a metal frame with metal blades so OK in high temperatures. Body size approx. 4¾" square x 1⅝" thick. £6.00 each, plus £1.00 postage. Our ref 6P6.

VERY POWERFUL MAGNETS Although only less than 1" long and not much thicker than a pencil these are very difficult to pull apart. Could be used to operate embedded reed switches, etc. Price 50p each, 2 for £1.00. Ref BO642.

ORGAN MASTER is a three octave musical keyboard. It is beautifully made, has gold plated contacts and is complete with ribbon cable and edge connector. Brand new, only £12 plus £3 postage. Order ref. 12P5.

MUSIC FROM YOUR SPECTRUM 128 We offer the Organ Master three octave keyboard, complete with leads and the interface which plugs into your 128. You can then compose, play, record, store, etc., your own music. Price £19 plus £3 special packing and postage. Order ref. 19P1.

20A DOUBLE POLE RELAY WITH 12V COIL complete with mounting brackets, made by the Japanese Omron Company. Price £2 each. Our Ref. 2P173A.

TORROIDAL MAINS TRANSFORMER with twin outputs. 6.3V 2A and 12V 600mA, so ideal for FOO power supply. Price £5. Our Ref. 5P122.

QUICK FIX MAINS CONNECTOR A must for your workshop. Saves putting on plugs as you just push the wires under the spring clips. Automatically off when lid is up. Price £7.50. Our Ref. 7P5/1.

BT HANDSET with curly lead terminating with flat BT plug. Colour cream. Price £5. Our Ref. 5P123.

RUBBER FEET Stick on. Ideal for small instruments and cabinets. Pack of 56 for £1. Our ref BD603

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Brighton (0273) 734648 or 203500

POPULAR ITEMS
Some of the many items described in our current list which you will receive if you request it

3½in FDD CHINON 80 track 500k. Shugart compatible interface. Standard connections, interchangeable with most other 3½in and 5¼in drives. Brand new. £28.50 plus £3 insured post.

CASE NOW AVAILABLE FOR THE CHINON F353 This is the 80 track, single sided one which we have been selling at £28.50. The case is sheet metal, finished in hammer-beige with ample ventilation and rubber feet. Overall size 4¼in x 7in x 1½in approx. Designed to take the ribbon cable and 3 core power lead. Price £8. Our ref 8P21.

3in FDD HITACHI HFD305SXA Shugart compatible interface. 500k on 3in disc. Recommended for many Amstrads but interchangeable with most drives. £29.50 plus £3 insured post.

FDD CASE AND POWER SUPPLY KIT for the 3in or 3½in. £11.00. Ref 11P2 for the Chinon, 11P3 for the Hitachi.

9in MONITOR made for ICL, uses Phillips black and white tube. Brand new and complete but uncased. £16.00 plus £5.00 post.

ACORN COMPUTER DATA RECORDER REF ALF03 Made for the Electron or BBC computers but suitable for most others. Complete with mains adaptor, leads and handbook. £10.00. Ref 10P44.

POWERFUL IONISER Uses mains transformer. Generates approx. 10 times more ions than the normal diode/cap ladder circuits. Complete kit £11.50 plus £3.00 post.

FREE POWER! Can be yours if you use our solar cells—sturdily made modules with new system bubble magnifiers to concentrate the light and so eliminate the need for actual sunshine—they work just as well in bright light. Voltage input is .45—you join in series to get desired voltage—and in parallel for more amps. **Module A** gives 100mA, Price £1, Our ref. BO631. **Module C** gives 400mA. Price £2, Our ref. 2P199. **Module D** gives 700mA, Price £3, Our ref. 3P42.

SOLAR POWERED NI-CAD CHARGER 4 Ni-Cad batteries **AA (HP7)** charged in eight hours or two in only 4 hours. It is a complete, boxed ready to use unit. Price £6. Our ref. 6P3.

50V 20A TRANSFORMER 'C' Core construction so quite easy to adapt for other outputs—tapped mains input. Only £25 but very heavy so please add £5 if not collecting. Order Ref. 25P4.

SWITCH AC LOADS WITH YOUR COMPUTER This is easy and reliable if you use our solid state relay. This has no moving parts, has high input resistance and acts as a noise barrier and provides 4kW isolation between logic terminals. The turn-on voltage is not critical, anything between 3 and 30V, internal resistance is about 1K ohm. AC loads up to 10A can be switched. Price is £2 each. Ref. 2P183.

METAL PROJECT BOX Ideal size for battery charger, power supply, etc.; sprayed grey, size 8in x 4½in x 4in high, ends are louvred for ventilation other sides are flat and undrilled. Price £2. Order ref. 2P191.

BIG SMOOTHING CAPACITOR. Sprague powerlytic 39,000uF at 50V. £3. Our ref. 3P41.

4-CORE FLEX CABLE. Cores separately insulated and grey PVC covered overall. Each copper core size 7/0.2mm. Ideal for long telephone runs or similar applications even at mains voltage. 20 metres £2. Our ref.2P196 or 100 metres coil £8. Order ref. 8P19.

6-CORE FLEX CABLE. Description same as the 4-core above. Price 15 metres for £2. Our ref. 2P197 or 100 metres £9. Our ref. 9P1.

TWIN GANG TUNING CAPACITOR. Each section is 0005μf with trimmers and good length ¼in spindle. £1 each. our ref BD630.

13A PLUGS Pins sleeved for extra safety, parcel of 5 for £2. Order ref. 2P185.

13A ADAPTERS Takes 2 13A plugs, packet of 3 for £2. Order ref. 2P187.

20V-0-20V Mains transformers 2½ amp (100 watt) loading, tapped primary. 200-245 upright mountings £4. Order ref. 4P24.

BURGLAR ALARM BELL—6" gong OK for outside use if protected from rain. 12V battery operated. Price £8. Ref. 8P2.

VERY RELIABLE CAPACITOR 4.7μf 400v not electrolytic so not polarised, potted in ali can, size 1¾ x ¾ x 1½in high, with axial leads. A top grade capacitor made for high class instrument work. Ideal for PCB mounting. 2 for £1. Our ref BD667.

USEFUL MAINS TRANSFORMER Upright mounting, normal tapped primary, has two secondaries. One gives 20v at 1.5 amps if used alone, or the other gives 10V at 3 amps if used alone. Join the two in series for 30v at 1 amp. Price £2. Our ref 2P214.

CAPACITOR BARGAIN—axial ended, 4700μF at 25V. Jap made, normally 50p each, you get 4 for £1. Our ref. 613.

SINGLE SCREENED FLEX 7.02 copper conductors, pvc insulated then with copper screen, finally outer insulation. In fact quite normal screened flex. 10m for £1. Our ref BD668. Ditto, but solid conductor. 10m for £1. our ref BD668a.

M.E.S. BULB HOLDERS Circular base batten type fitting. 4 for £1. Our ref BD127a.

SPRING LOADED TEST PRODS—Heavy duty, made by the famous Bulgin company, very good quality. Price 4 for £1. Ref. BO597.

ASTEC P.S.U.—Switch mode type. Input set for +230V. Output 3.5 amps at +5V, 1.5 amps at +12V, and 3 amps at +5V. Should be OK for floppy disc drives. Regular price £30. Our price only £10. Ref. 10T34. Brand new and unused.

APPLIANCE THERMOSTATS—Spindle adjust type suitable for convector heaters or similar. Price 2 for £1. Ref. BO582.

3-CORE FLEX BARGAIN No. 1—Core size 5mm so ideal for long extension leads carrying up to 5 amps or short leads up to 10 amps. 15mm for £2. ref. 2P189.

3-CORE FLEX BARGAIN No. 2—Core size 1.25mm so suitable for long extension leads carrying up to 13 amps, or short leads up to 25A. 10m for £2. Ref. 2P190.

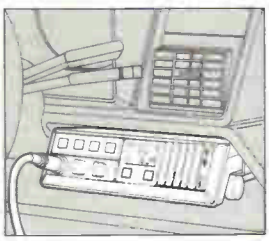
ALPHA-NUMERIC KEYBOARD—This keyboard has 73 keys giving trouble free life and no contact bounce. The keys are arranged in two groups, the main area is a QWERTY array and on the right is a 15 key number pad, board size is approx. 13" x 4"—brand new but offered at only a fraction of its cost, namely £3, plus £1 post. Ref. 3P27.

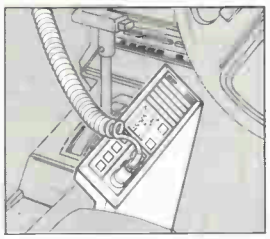
WIRE BARGAIN—500 metres 0.7mm solid copper tinned and p.v.c. covered. Only £3 plus £1 post. Ref. 3P31—that's well under 1p per metre, and this wire is ideal for push on connections.

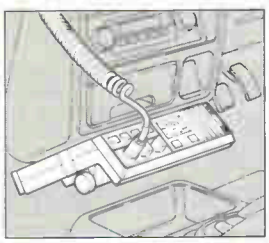
INTERRUPTED BEAM KIT—This kit enables you to make a switch that will trigger when a steady beam of infra-red or ordinary light is broken. Main components—relay, photo transistor, resistors and caps, etc. Circuit diagram but no case. Price £2. Ref. 2P15.

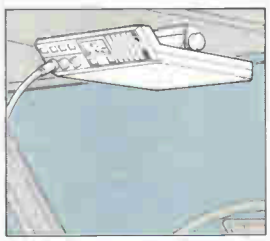
1/8th HORSEPOWER 12 VOLT MOTOR Made by Smiths, the body length of this is approximately 3in, the diameter 3in and the spindle 5/16th of an inch diameter. It has a centre flange for fixing or can be fixed from the end by means of 2 nuts. A very powerful little motor which revs at 3,000rpm. We have a large quantity of them so if you have any projects in mind then you could rely on supplies for at least two years. Price £6. Our ref 6p1, discount for quantities of 10 or more.

The new AMR1000/S
It checks out from every angle


Under dash mounted (side)


Central console mounted


Under dash (central)


Roof mounted

Whichever way you look at it, the Navico AMR1000/S sets new standards in 2m mobile transceivers.

The angled, reversible control panel, together with a range of inexpensive optional mounting brackets enables installation in any vehicle, whether under or on top of the dash, either side of a central console or even from the roof.

This means the display will always face you giving total access to the controls which are spaced to allow simple, safe, mobile operation. The front mounted loudspeaker will also face you, projecting the sound toward you and not at your feet or into the dashboard.

Combine this with the most sensitive and selective receiver, an audio response tailored for today's busy band and the unique, fully automatic repeater/simplex operating facilities and you have a truly remarkable mobile radio.

There is also a choice of models to suit your exact needs. In the words of Chris Lorek of HRT about the Navico AMR1000/S "Not only does it out-perform its competition on technical grounds but it offers many very useful operating features not found on other rigs, and sells at what appears to be a very competitive price".

Check it out for yourself, prices start at just £247.25 (incl. VAT). For more details and to arrange a personal demonstration clip the coupon today.

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