

DECEMBER 1987 £1.40

AUSTRALIA
HOLLAND
NEW ZEALAND
NORTH AMERICA \$2.95
D71699

Radio & Electronics

The communications and electronics magazine

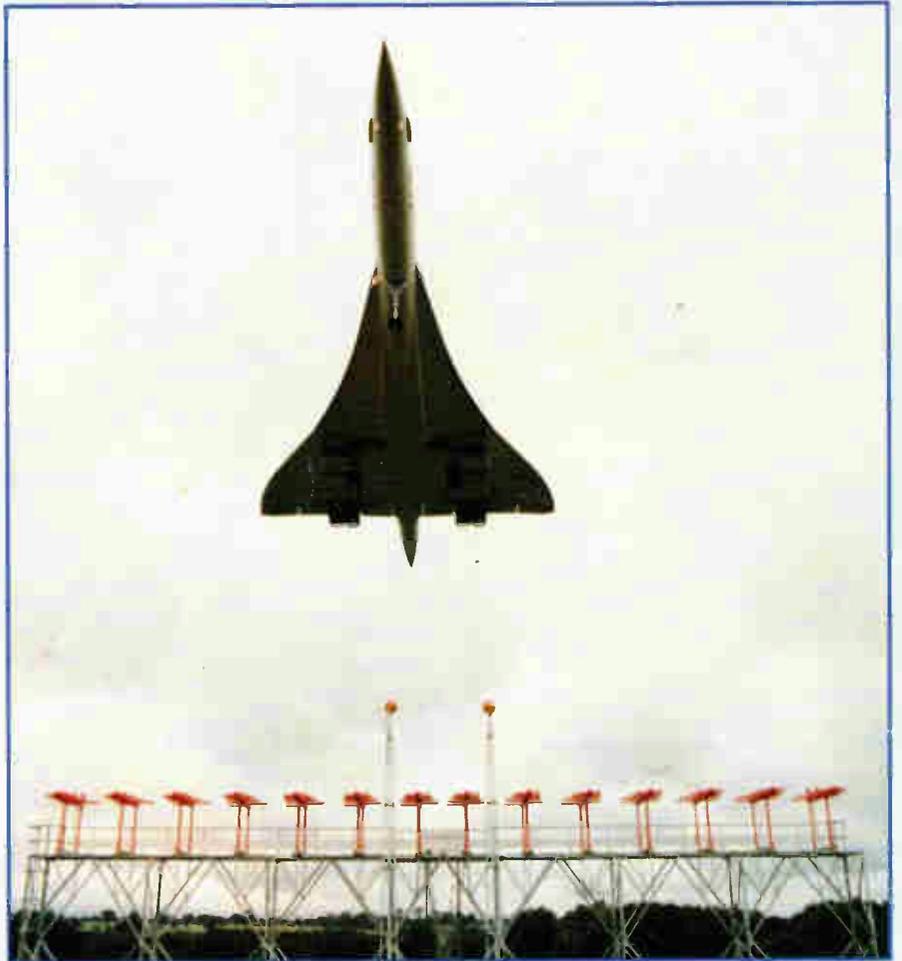
World

**UP IN THE AIR:
APPROACH AND
LANDING SYSTEMS**

**UNILAB REVIEW 2:
UOSAT GROUND
STATION PACKAGE**

**BUDGET RX:
A SHORT WAVE
RX FOR £15**

**DC RECEIVERS:
CHEAPER THAN
THE SUPERHET!**



**UNDERSTANDING
TELEVISION**

CONTENTS

Editor

Anita Ley

Editorial Assistant

Lisbeth Stedman

Advertisement Manager

Marian Vidler

Publisher

Peter Williams

Published by

Radio & Electronics World
Magazines

Sovereign House

Brentwood

Essex CM14 4SE

England

Tel: (0277) 219876

ISSN

0262-2572

Printed

In Great Britain

Newstrade sales

S M Distribution

16/18 Trinity Gardens

London SW9 8DX.

Tel: 01-274 8611

Subscriptions

Tel: 01-760 0409

© Copyright 1987
Radio & Electronics World Magazines

Safety in the shack

Some of the constructional projects featured refer to additions or modifications to equipment; please note that such alterations may prevent the item from being used in its intended role, and also that its guarantee may be invalidated.

When building any constructional project, bear in mind that sometimes high voltages are involved. Avoid even the slightest risk - safety in the shack please, at all times.

Whilst every care is taken when accepting advertisements we cannot accept responsibility for unsatisfactory transactions. We will, however, thoroughly investigate any complaints.

The views expressed by contributors are not necessarily those of the publishers.

Every care is taken to ensure that the contents of this magazine are accurate, we assume no responsibility for any effect from errors or omissions.

Cover Photographs

Top - Aviation Electronics
(p28)

Bottom - Pattern Generator
from Thurlby Electronics (p6)

SPECIAL FEATURES

22 Unilab Schools Satellite Project

Alan Pickard presents the UoSAT ground station package

28 Aviation Electronics

Brian Kendal continues his occasional series with a look at approach and landing systems

34 Data File

Ray Marston looks at a further selection of Phase Locked Loop IC circuits

37 Poor Man's Receiver

Sir Douglas Hall builds a receiver for under £15

42 Direct Conversion Receivers

Using ICs in DC receivers for the MW band is discussed by M Slifkin and G Abbott

49 How Hams Made Records

David Lazell recalls the antics of the professionals and the amateurs in the early stages of voice recording

52 Understanding Television

Norman Ash discusses the origination of a fascinating aspect of communications as a hobby

REGULARS

4 Product News

12 News Desk

15 Amateur Radio World

17 ATV on the Air

18 Network 934

40 Medium Wave DXing

47 Latest Literature

55 Dx-TV Reception Reports

59 QSO

60 Short Wave News

62 Free Classified Ads

READER SERVICES

39 Subscription Order Form

41 Amateur Radio Subscription Order Form

46 Back Issues Order Form

51 Newsagents Order Form

63 Free Classified Ad Form

66 Advertisers Index

66 Advertising Rates and Information

NEXT MONTH

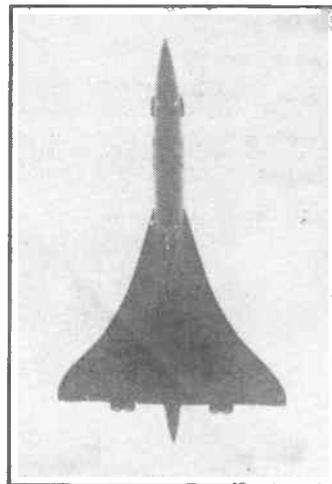
16 What's in store for you

Next Issue

Cover Date January 1988, on sale Thursday
10 December

Publication Date

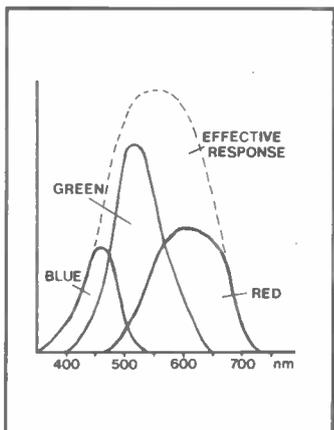
Second Thursday of the month preceding cover date



Flying high - pg 28



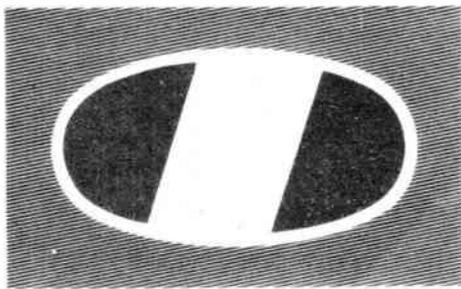
On Air - pg 49



Magic box - pg 52



Printed matter - pg 47



ICOM

Communications



IC-575, 28/50Mhz Dual band multimode base station.

The ICOM IC-575 base station was developed to meet the demand for advanced communications for the recently acquired 6m band. Similar in appearance to the IC 275 475 2m and 70cm base stations, the beauty of this new transceiver from ICOM is that it gives you the best of both worlds: 6 & 10m in one compact unit. The IC 575 covers 28-30Mhz and 50-54Mhz. Operating modes are SSB, CW, AM & FM. Power output is 10 watts (AM 4 watts) with a front panel control to reduce output for QRP operations. A pass band tuning circuit narrows the I F passband width, eliminating signal in the passband. A built-in notch filter eliminates beat signals with sharp attenuation characteristics.

Some PLL systems have difficulty meeting the lockup time demands placed on them by new data communications. This is why ICOM developed the DDS (Direct Digital Synthesizer) method. With a lockup time of just 5msec, the DDS method allows the IC-575 to handle data communications such as packet or AMTOR. 99 programmable memories can store frequency, mode, offset frequency and direction. A total of four scanning functions for easy access to a wide range of frequencies: memory scan, programmed scan, selected mode memory scan and lock out scan. The IC 575 has an internal A C power supply, but can also be used on 13.8v DC for mobile or portable operation.

Optional accessories available are the UT36 voice synthesizer, the IC FL83 CW narrow filter, SM7 external loudspeaker, HP2 communication headphones and SM8 SM10 desk microphones. Other transceivers available in this range are: IC 275E 2m multimode 25w, IC 275H 2m multimode 100w, IC 475E 70cm multimode 25w, IC 475H 70cm multimode 75w.



You can get what you want just by picking up the telephone. Our mail order department offers you free same day despatch whenever possible, instant credit, interest free H.P. Barclaycard and Access facility, 24 hour answerphone service.

Datapost



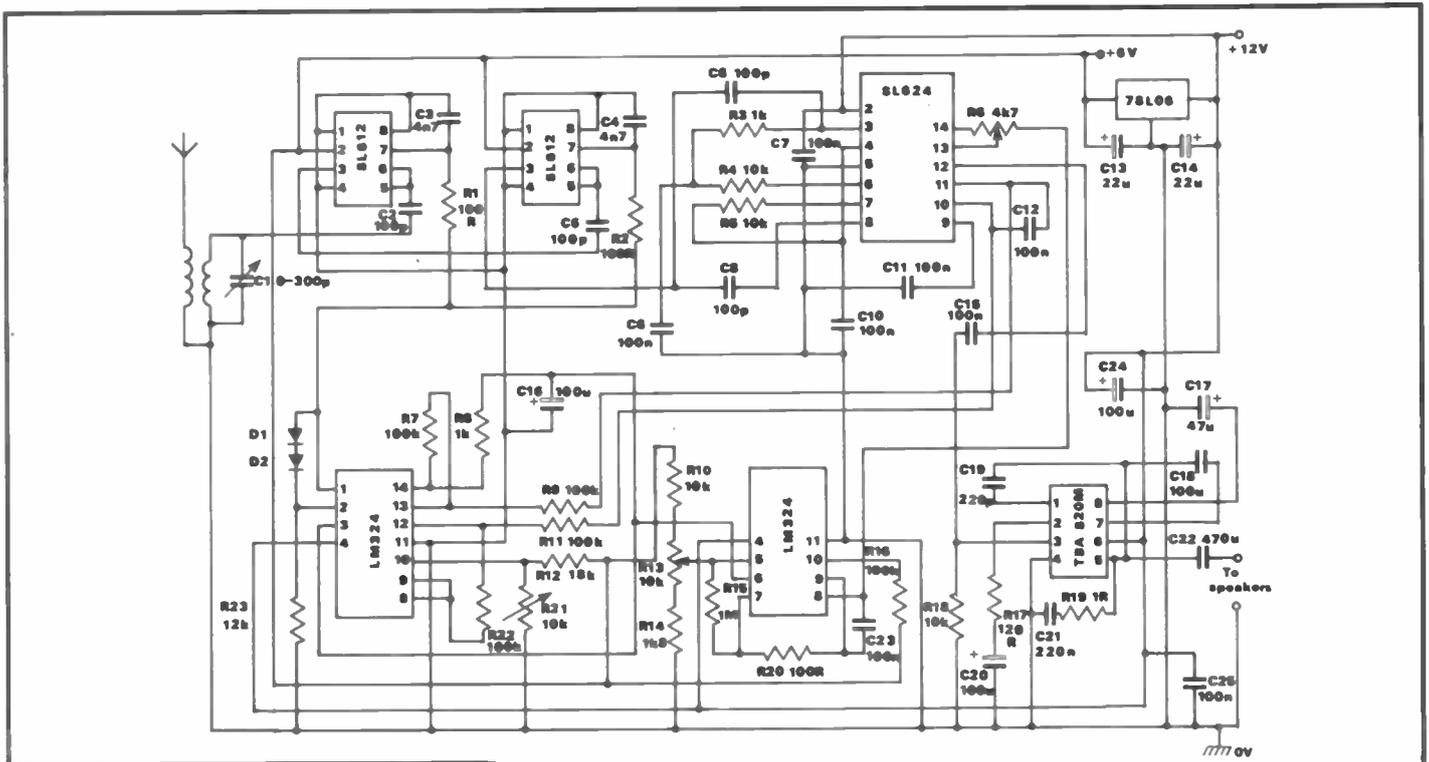


Fig 3 Homodyne receiver

frequency leaving behind the audio. One other advantage of the DC receiver is that it does not require inductors or transformers, usually the more expensive and heavy components in radio receivers.

There are two distinct versions of the DC receiver, the homodyne and the synchrodyne. The homodyne uses the incoming signal itself to supply the mixing or demodulating frequency and therefore requires some form of RF selectivity for tuning purposes. The synchrodyne uses a separate local oscillator which is tunable, but then one requires that this has the right phase relationship with the incoming signal so as to avoid phase distortion. In addition, the local oscillator must have exactly the same frequency as the incoming signal. Any difference will result in a superheterodyne whistle or beat frequency.

The drawbacks of DC receivers which have been previously constructed appear to be the following: the use of discrete components has led to both high cost and complexity; when tuning the synchrodyne, a beat note is heard between stations which can be rather irritating; by using no RF stages for the synchrodyne all the gain has been at AF which has led to severe problems with microphonics and mains hum. In our designs we have attempted successfully to overcome all these problems, with both the homodyne and the synchrodyne, and by using cheap ICs have reduced both the cost and component count.

For those unfamiliar with IC circuits a few notes may prove useful. It is frequently necessary to decouple the

$Q = 200$ over range
550kHz to 1600kHz.
Coupling coefficient =
 $k = 0.75$.
Step down ratio = 16:1
Tuning capacitance:
190pF - 550kHz, 20pF - 1500kHz

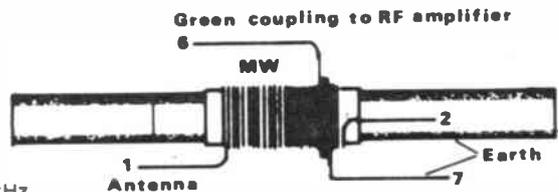


Fig 4 Ferrite rod antenna

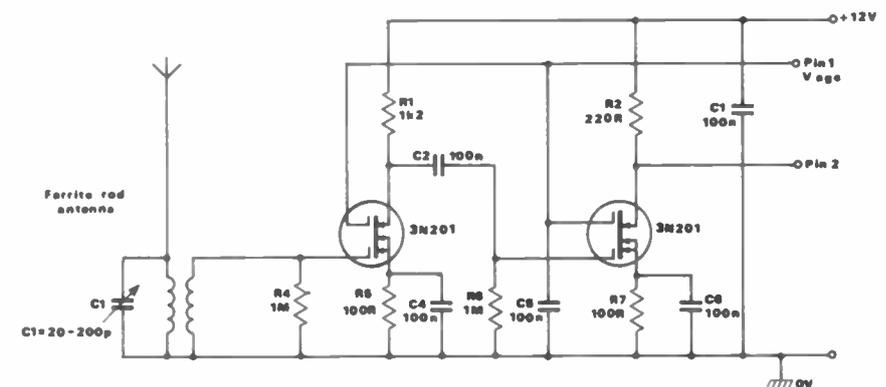


Fig 5a Radio frequency stage of simplified homodyne

power supply to earth using disc ceramic capacitors at the IC power supply pin in order to remove noise. Many of these ICs require a very specific range of input voltages to operate correctly. These, of course, are to be found in the manufacturers' data sheets. It is strongly recommended that, even when copying a ready designed circuit, the data sheets should be obtained so that one knows which adjustments to make for optimum

performance.

Figures 1 and 2 show the schematic plan of our homodyne and synchrodyne.

Figure 3 shows the circuit diagram of the homodyne. It works as follows. The signal is received on a ferrite rod aerial and tuning is carried out by a simple air-spaced variable condenser, and is then passed through an IC RF stage. The signal is split and one half is passed through a limiting amplifier to strip off

device. The circuit diagram is shown in Figure 6. From Figure 2 it can be seen that the local oscillator is obtained from a phase locked loop Signetics NE564. For the synchrodyne application the frequency of the VCO must have sufficient range to tune over the whole of the medium wave band. The NE564 turned out to be very suitable for this application, although somewhat poorly documented. This enables a simple solution to the problem of obtaining a local oscillator which can be phase locked to the incoming signal, all integrated into a small inexpensive packet.

The PLL operation is shown in Figure 7, and can be briefly explained as follows. With no signal input to the system the error voltage $V_e(t)$ coming out of the phase detector is zero and the voltage controlled oscillator (VCO) operates at a set frequency, known as its free-running frequency. If an input signal $V_s(t)$ is applied, the phase comparator compares the phase and frequency of the input with the VCO frequency and generates an error voltage $V_e(t)$ related to the phase and frequency differences between the two signals. This error voltage is then filtered and amplified and applied to the control terminal of the VCO. The control voltage $V_d(t)$ forces the VCO frequency to vary in a direction such as to reduce the frequency difference between the input signal and the VCO. If the input frequency is sufficiently close to the VCO frequency, ie, within the capture range, the feedback nature of the PLL causes the VCO to lock or synchronise with the incoming signal. The capture range is determined by the value of the low pass filter, ie, by C5 and C6.

There is also a lock range slightly larger than the capture range over which the PLL will hold the station once locked in. The lock range is determined by the current flowing into pin 2 of the PLL, ie, by the values of R1 and R2. Once in lock, the VCO frequency is identical to the input signal but exactly 90 degrees out of phase. This 90 degree difference can be overcome by adding a separate 90 degree phase shifter in the circuit.

This 90 degree phase shift is accomplished by the use of a D-type flip-flop 74HC74 and exclusive OR gate 74HC76, introduced into the feedback loop of the PLL. The 74HC04 device shown in Figure 5 is added to compensate for the time delay in passing through the 74HC74. It should be noted that in this circuit the VCO requires to be at twice the signal frequency, as the effect of the 74HC74 is to act as a divide-by-two.

There are many alternative forms of phase shifters which can be used but this appears to be the simplest. The demodulating signal is taken from between the 74HC86 and the 74HC74.

In this circuit we have used a different and much cheaper mixer to the

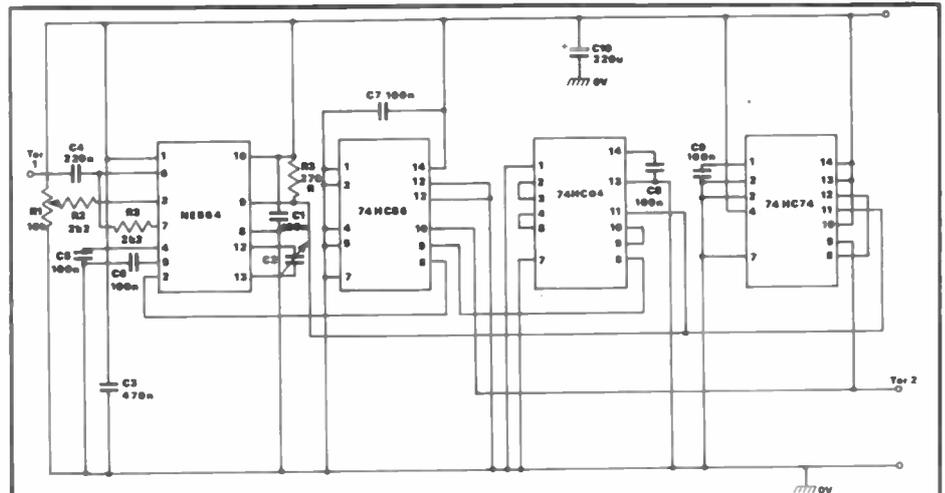


Fig 6c Demodulating signal stage

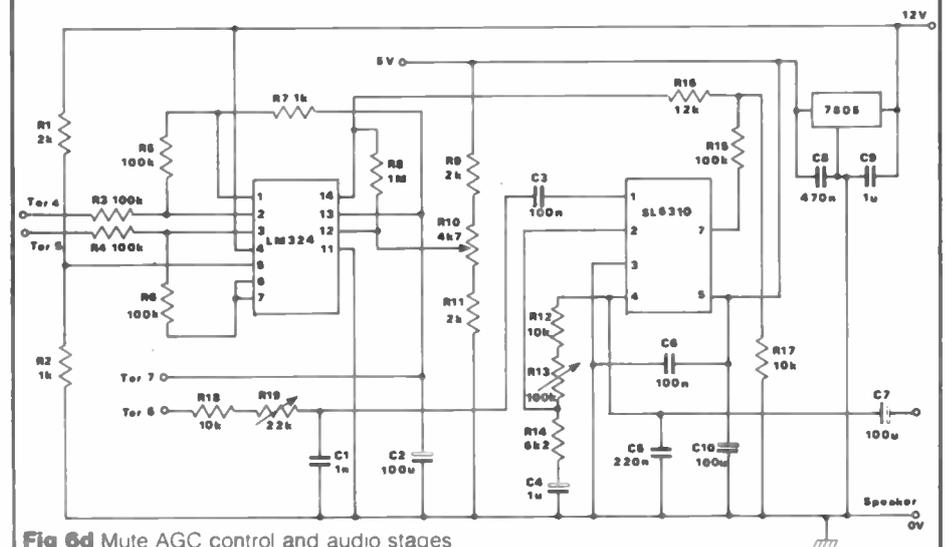


Fig 6d Mute AGC control and audio stages

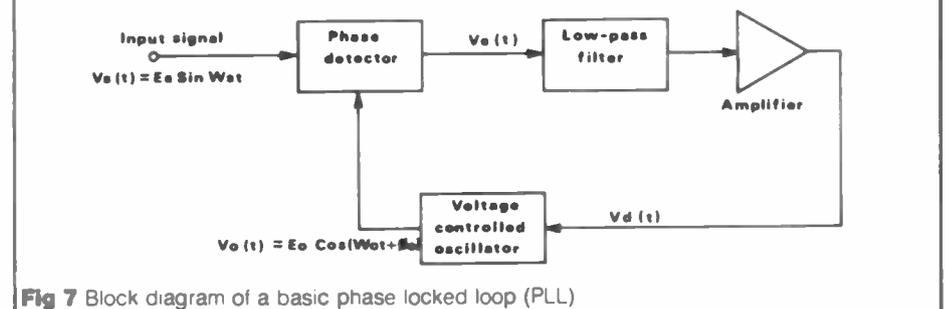


Fig 7 Block diagram of a basic phase locked loop (PLL)

homodyne since we do not require the limiting amplifier. The MC1496 integrated double balanced modulator/demodulator was used as shown in Figure 6. The low pass filter for this device is provided by resistors R7 and R8 and capacitors C4 and C5. These give a high frequency cut-off of circa 18kHz, but can be adjusted to choice or even made variable.

The tuning arrangement for the synchrodyne is very different from that of the homodyne. Although the PLL provides a very easy and cheap solution to the provision of a local oscillator, it introduces a complication in that the tuning of the capacitor for the VCO

follows a very different relationship from the tuning of the ferrite rod aerial capacitor. One cannot, therefore, use a ganged capacitor to tune both simultaneously.

We considered that the use of two separate tuning capacitors would not be acceptable. It might be possible to devise some kind of mechanical arrangement to enable the two tuning capacitors to be ganged, but it was beyond our capability. Instead, we have opted for using a broadband two stage RF amplifier using two 3N201 dual gate MosFETs with a wire antenna. A two metre wire antenna has a capacitance of 15pF and an impedance of 22kohms at

DC RECEIVERS

500kHz. The RF stage is shown in Figure 6. However, this stage showed some instability which was cured by putting it in a screened box. The use of dual gate MosFETs enables AGC to be applied from the product detector via the op amp LM324, pin 13.

In this circuit we have used the Plessey SL6310 switchable audio amplifier, which is directly driven from the mute control, the op amp LM324 (pin 14) which monitors the PLL and observes when it is locked onto a signal. When locked the PLL gives a signal across pins 6 and 12. The muting level is set by R10 which can be a variable or preset pot. Volume control is provided by the potentiometer R13.

As this circuit requires both 12V and 5V, an on-board 5V regulator 7805 is provided.

This circuit has been constructed on a matrix board and hard-wired. The RF stage was mounted in a screened box.

On test the synchrodyne proved to be superior to the homodyne and much superior to the superhet. The tuning characteristics are very different from those of a superhet, because of the lock-in properties of the PLL. One must tune slowly and the stations suddenly appear, like tuning an FM receiver with AFC.

One property of the PLL is that if there are two signals within the lock-range, then it will lock onto the stronger signal, even if only very slightly stronger, completely suppressing the weaker signal. This contributes to its excellent audio quality, particularly at night when the continental stations cause interference on superhet receivers. However, if one is interested in DX listening, then it would be an advantage to make the capture and lock ranges variable in order to tune in the weaker signals if they lie closer in frequency to stronger signals than the original capture range. This might lead to some cutting of the AF high frequencies. In addition, it should be noted that a narrow capture range has the disadvantage that the PLL can be more easily thrown out of lock by a noise pulse.

The cost of the synchrodyne was about £15.

It is clear that the DC synchrodyne offers a real alternative to the usual superhet, particularly as most of the complex circuits required can be realised with cheap ICs. There is undoubtedly room for further experimentation. As the NE564 PLL can operate up to 50MHz then it should be possible to extend this receiver to work

in the short wave region and, of course, in the other direction into the long wave region.

If the problem of ganging the tuning capacitors could be solved then one could use a ferrite rod antenna for the longer wavelengths up to about 1.6MHz, together with a simpler RF stage. There has recently appeared on the market the NE568 integrated PLL which will operate up to 150MHz; this may well enable a synchrodyne to be built covering the whole of the short wave band. No doubt as more sophisticated ICs come onto the market, an even better and cheaper circuit could be devised. Although the homodyne also has some advantages over the superhet, in view of the superiority of the synchrodyne, this would appear to be the preferred circuit.

References

- Pat Hawker, 'Synchronous Detection', *Wireless World*, September 1972.
- J W Herbert, 'The Homodyne Receiver', *Wireless World*, September 1973.
- J Lindsey Hood, 'Synchrodyne AM Receiver', *Electronics and Wireless World*, January 1986.
- D G Tucker, 'The History of the Homodyne and the Synchrodyne', *J Brit, IRE*, April 1954.

RADIO & ELECTRONICS WORLD BACK ISSUES

TO: Back Issues Department • Radio & Electronics World • Sovereign House • Brentwood • Essex • CM14 4SE

NAME

ADDRESS

.....

..... POSTCODE

PLEASE SUPPLY: (state month and year of issue/s required) NOTE: Jan & Feb '82, Dec '83, Mar and Aug '86 are not available

..... at £1.40 each

PAYMENT ENCLOSED: £ -

Cheques should be made payable to Radio & Electronics World. Overseas payment by International Money Order or credit card

CREDIT CARD PAYMENT:

.....

EXPIRY DATE /

SIGNATURE

.....
C P I

Carbon Film resistors 1/4W 5% E24 series 0.51R to 10MΩ.....	1p
100 off per value - 75p, even hundreds per value totalling 1000	£7.00
Metal Film resistors 1/4W 10R to 1MΩ 5% E12 series - 2p, 1% E24 series	3p
Mixed metal/carbon film resistors 1/2W E24 series 1R to 10MΩ	1 1/2p
1 watt mixed metal/Carbon Film 5% E12 series 4R7 to 10 Megohms	5p
Linear Carbon pre-sets 100mW and 1/4W 100R to 4M7 E6 series	7p
Miniature polyester capacitors 250V working for vertical mounting	
.01, .015, .022, .033, .047, .068-4p, 0.1-5p, 0.15, 0.22-6p, 0.33, 0.47-8p	
Mylar (polyester) capacitors 100V working E12 series vertical mounting	
1000p to 8200p - 3p, .01 to .068 - 4p, 0.1 - 5p, 0.12, 0.15, 0.22-6p, 0.47/50V-8p	
Subminiature ceramic plate capacitors 100V wkg vertical mountings, E12 series	
2% 1.8 pf to 47 pf - 3p, 2% 56 pf to 330 pf - 4p, 10% 390p - 4700p	4p
Disc/plate ceramics 50V E12 series 1P0 to 1000P, E6 Series 1500P to 47000P	2p
Polyethylene capacitors 63V working E12 series long axial wires	
10 pf to 820 pf - 3p, 1000 pf to 10,000 pf - 4p, 12,000 pf	5p
741 Op Amp - 20p, 555 Timer	22p
cmos 4001 - 20p, 4011 - 22p, 4017	40p
ALUMINIUM ELECTROLYTICS (Mfda/Volts)	
1/50, 2.2/50, 4.7/50, 10/25, 10/50	5p
22/16, 22/25, 22/50, 47/16, 47/25, 47/50	6p
100/16, 100/25 7p; 100/50 12p; 100/100	14p
220/16 8p; 220/25, 220/50 10p; 470/16, 470/25	11p
1000/25 25p; 1000/35, 2200/25 35p; 4700/25	70p
Submin, tantalum bead electrolytics (Mfda/Volts)	
0.1/35, 0.22/35, 0.47/35, 1.0/35, 3.3/16, 4.7/16	14p
2.2/35, 4.7/25, 4.7/35, 6.8/16 15p; 10/16, 22/6	20p
33/10, 47/6, 22/16 30p; 47/10 35p; 47/16 60p; 47/35	80p
DIODES (p/wamps)	
75/25mA 1N4148 2p, 800/1A 1N4006 6p, 400/3A 1N5404 14p, 115/15mA OA91	6p
100/1A 1N4002 4p, 1000/1A 1N4007 7p, 60/1.5A S1M1 5p, 100/1A bridge	25p
400/1A 1N4004 5p, 1250/1A BY127 10p, 30/45mA OA91 6p, 30/15A OA47	8p
Zener diodes E24 series 3V3 to 33V 400 mW - 8p, 1 watt	12p
Battery snaps for PP3 - 6p for PP3	12p
L.E.D.'s 3mm, & 5m.m. Red, Green, Yellow-10p, Grommets 3mm - 1 1/2p, 5mm	2p
Red, flashing L.E.D.'s require 5V supply only	30p
Mains indicator neons with 220K resistor	10p
20mm fuses 100mA to 5A Q/blow 5p, A/surge 8p, Holders pc or chassis	5p
High speed pc drills 0.8, 1.0, 1.3, 1.5, 2.0mm - 25p, Machines 12V dc	£6.50
HELPING HANDS 6 ball joints and 2 croc clips to hold awkward jobs	£4.50
AA/HP7 Nicad rechargeable cells 80p each, Universal charger unit	£6.50
Glass reed switches with single pole make contacts - 8p, Magnets	12p
TRANSISTORS	
BC547/8/9-8p, BC557/8/9-8p, BC182L/4L-10p, BC183,183L-10p, BC212,212L-10p,	
BC337,337L-12p, BC727/737-12p, BD135/6/7/8/9-25p, BCY70-15p, BFY50,52-20p,	
BFX88-15p,2N3055-50p, TIP32,32-30p, TIP41,42-40p, BU208A-£1.20, BF195,197-12p	
All prices are inclusive of VAT. Postage 20p (free over £5). Lists Free.	

THE CR SUPPLY CO
127 Chesterfield Rd, Sheffield S8 0RN
Return posting

Latest Literature

DICTIONARY OF ELECTRONICS

by S W Amos

First published in 1981, the second edition of this handy dictionary has been thoroughly revised, with 300 new definitions and 200 existing ones being reworded or expanded. Most of the changes were adopted to keep pace with digital techniques, semiconductor devices, computers and microprocessors.

Unlike the standards published by the BSI and IEC, which are written by and for experts, such previous knowledge is not assumed in this dictionary.

Some entries are short essays, with explanatory diagrams, and subjects are listed under the initial of the first word (for instance, 'low pass filter' is listed under 'L', not 'F'). Cross references within the explanation are included in bold italics to aid greater understanding.

A useful appendix of abbreviations and acronyms can be referred to as a guide if the term is only known in its shortened form - another example of the thoughtful presentation which makes this book instantly indispensable.

Ideal for engineers, technicians, students or interested amateurs, this is a reference book par excellence, with TV, radio and computing terms all being included as well as the more basic definitions.

Butterworth Scientific Ltd,
£25. ISBN 0-408-02750-9.

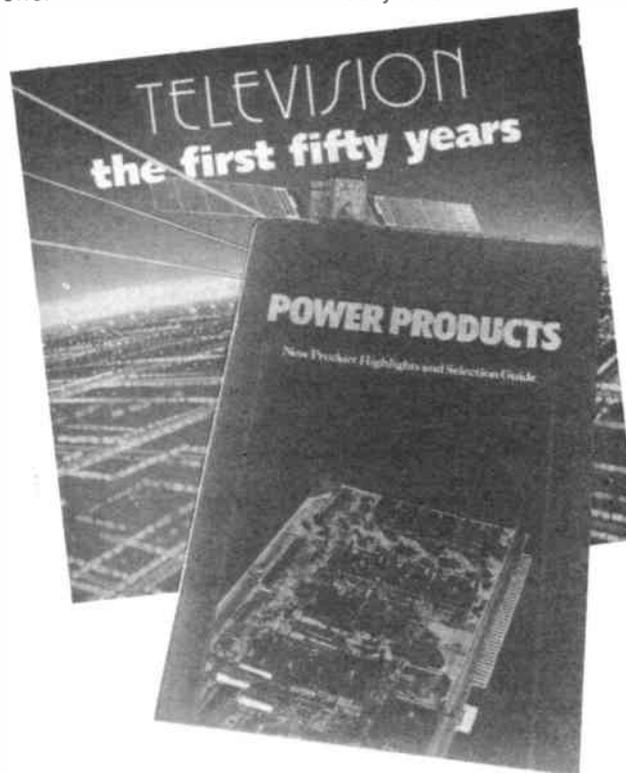
TELEVISION - THE FIRST FIFTY YEARS

K Geddes and G Bussey
Produced by Philips Electronics, this celebratory booklet takes a nostalgic trip down the road to Alexandra Palace and the clash between Baird and EMI/Marconi. The illustrations include all of the landmarks of these years with period photographs, diagrams and representations of the earliest images to appear on

these primitive sets.

The booklet then looks at developments up to the present day, especially Philips' latest ventures in the field of video recording and satellite TV.

Despite the not too subtle advertising, this 36 page booklet is interesting and entertaining reading, and worth a look for the pictures alone.



Philips Electronics, ISBN 0-948-48905-7.

INDUSTRIAL CONTROL HANDBOOK

by E A Parr

Shyly hiding under this awesome title are definitions and diagrams of various devices and circuits of interest to radio and electronics enthusiasts. Included are devices like bandpass filters, low pass and notch filters, dc amplifiers, op-amp specifications and much more, all intended ultimately to explain the ways in which the multitude of electronic and mechanical devices encountered in the industrial environment function.

Intended for use in the workplace as a practical guide, volume 2 of this three volume set gives a comprehensive treatment of the subjects covered, venturing into the realms of mechanical and production engineering as well as the field of general electronics-related devices.

Fortunately, due to its lack of theoretical bias, the book is easy to follow and

understand, with diagrams and pictures illustrating the various industrial devices and their applications. As the book points out, a well trained staff is the best investment a company can make, so this book could well prove to be a worthwhile investment.

Blackwell Scientific Publications, £45. ISBN 0-632-01835-6.

Texas Instruments

An illustrated 40 page catalogue entitled 'Power Products', by Texas Instruments, is available free from Online Distribution.

It is a guide to the full TI range of power semiconductors. This spans

applications as diverse as electronic ballasts for fluorescent lighting and 'TISP' transient surge protectors for telecommunications circuits.

Highlighted are two key features of TI's range of power transistors; darlington and thyristors. There are product selector guides and a cross reference chart.

Also included are applications notes and package dimension outlines.

Online Distribution Ltd,
Melbourne House,
Kingsway,
Bedford MK42 9AZ.
Tel: (0234) 217915.

Hero Electronics

Hero Electronics has produced a brochure showing the complete range of Hosiden LCD displays.

Hosiden is a leading Japanese manufacturer of LCD and electro-mechanical products. LCD technologies include Twisted Nematic (TN), Super Twist (STN), Thin Film Transistor (TFT) and silk screen print.

In the brochure, the complete range of Hosiden character and graphics modules is shown. Features of the displays are modules with backlights and super twist modules with silver and blue types, as well as the more common display with a yellow background.

Hero Electronics Ltd,
Dunstable Street,
Amphill,
Bedfordshire MK45 2JS.
Tel: (0525) 405015.

Online

Available free on request from Online Distribution is a new 44 page catalogue of Mitel telecommunications products.

It offers a range of analogue and digital devices, with features based on Mitel's years of experience in private switching systems and associated products.

Armed with the new catalogue, customers can select a device, order it by phone and have it

LATEST LITERATURE

24 hours.

Online Distribution offers a specialist service in electronic component distribution by providing a broad product range covering semiconductors, passives, electromechanical products and cables and connectors from a small, select group of market-leading manufacturers.

*Online Distribution Ltd,
Melbourne House,
Kingsway,
Bedford MK42 9AZ.
Tel: (0234) 272733.*

Greenweld

Greenweld have just brought out their latest electronics component and equipment catalogue.

Contained within its 88 pages are many widely varying types of electronics-related goods, from books to breadboards and burglar alarms, Morse keys to ICs and multimeters to tweeters. . .

Also included is a bargain list of surplus electronics components which are generally unavailable elsewhere, and various 'star

buys' - offering excellent value for money. The catalogue costs just £1 including postage and the first thousand customers will receive a free continuity tester.

*Greenweld,
443K Millbrook Road,
Southampton SO1 0HX.
Tel: (0703) 772501.*

Microkit Ltd		0536 744664																																																																																																																																																																																																																																																																					
		24hr 7 days/week																																																																																																																																																																																																																																																																					
<table border="1"> <tr> <td>74TTL</td> <td>158</td> <td>40</td> <td>55</td> <td>NE555</td> <td>18</td> <td>TL082</td> <td>45</td> </tr> <tr> <td>LS MC</td> <td>161</td> <td>55</td> <td>65</td> <td>TL074</td> <td>90</td> <td>TL084</td> <td>45</td> </tr> <tr> <td>00</td> <td>20</td> <td>25</td> <td>163</td> <td>55</td> <td>55</td> <td>ULN2004</td> <td>70</td> </tr> <tr> <td>02</td> <td>20</td> <td>25</td> <td>164</td> <td>55</td> <td>55</td> <td></td> <td></td> </tr> <tr> <td>04</td> <td>20</td> <td>25</td> <td>165</td> <td>80</td> <td>75</td> <td></td> <td></td> </tr> <tr> <td>08</td> <td>20</td> <td>25</td> <td>165</td> <td>80</td> <td>75</td> <td></td> <td></td> </tr> <tr> <td>10</td> <td>20</td> <td>25</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>11</td> <td>20</td> <td>25</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>14</td> <td>20</td> <td>25</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>20</td> <td>20</td> <td>25</td> <td>WD2797</td> <td>19.00</td> <td></td> <td></td> <td></td> </tr> <tr> <td>21</td> <td>20</td> <td>25</td> <td>WD1797</td> <td>19.00</td> <td></td> <td></td> <td></td> </tr> <tr> <td>27</td> <td>20</td> <td>25</td> <td>WD3216</td> <td>14.28</td> <td></td> <td></td> <td></td> </tr> <tr> <td>42</td> <td>49</td> <td></td> <td>7812</td> <td>30</td> <td></td> <td></td> <td></td> </tr> <tr> <td>51</td> <td>20</td> <td>25</td> <td>78M12</td> <td>30</td> <td></td> <td></td> <td></td> </tr> <tr> <td>74</td> <td>20</td> <td>30</td> <td>75154</td> <td>90</td> <td></td> <td></td> <td></td> </tr> <tr> <td>85</td> <td>50</td> <td></td> <td>ADC0808</td> <td>9.90</td> <td></td> <td></td> <td></td> </tr> <tr> <td>86</td> <td>20</td> <td>49</td> <td>LM311</td> <td>40</td> <td></td> <td></td> <td></td> </tr> <tr> <td>123</td> <td>80</td> <td>55</td> <td>LM324</td> <td>40</td> <td></td> <td></td> <td></td> </tr> <tr> <td>132</td> <td>40</td> <td>49</td> <td>LM337</td> <td>1.20</td> <td></td> <td></td> <td></td> </tr> <tr> <td>138</td> <td>40</td> <td>49</td> <td>LM348</td> <td>55</td> <td></td> <td></td> <td></td> </tr> <tr> <td>139</td> <td>40</td> <td>49</td> <td>LM358</td> <td>45</td> <td></td> <td></td> <td></td> </tr> <tr> <td>153</td> <td>45</td> <td>50</td> <td>LM3900</td> <td>40</td> <td></td> <td></td> <td></td> </tr> <tr> <td>157</td> <td>40</td> <td>55</td> <td>OP07CP</td> <td>65</td> <td></td> <td></td> <td></td> </tr> </table>	74TTL	158	40	55	NE555	18	TL082	45	LS MC	161	55	65	TL074	90	TL084	45	00	20	25	163	55	55	ULN2004	70	02	20	25	164	55	55			04	20	25	165	80	75			08	20	25	165	80	75			10	20	25						11	20	25						14	20	25						20	20	25	WD2797	19.00				21	20	25	WD1797	19.00				27	20	25	WD3216	14.28				42	49		7812	30				51	20	25	78M12	30				74	20	30	75154	90				85	50		ADC0808	9.90				86	20	49	LM311	40				123	80	55	LM324	40				132	40	49	LM337	1.20				138	40	49	LM348	55				139	40	49	LM358	45				153	45	50	LM3900	40				157	40	55	OP07CP	65				<p>SAVE OVER 40% ON OUR EX EQUIPMENT MEMORIES AND EPROMS</p> <p>1000s of delighted customers</p> <p>QUARANTEED UV BRASSED AND TESTED</p> <table border="1"> <tr> <td>4118</td> <td>16K x 8</td> <td>£0.75</td> </tr> <tr> <td>2716</td> <td>2K x 8</td> <td>£1.50</td> </tr> <tr> <td>2732</td> <td>4K x 8</td> <td>£1.50</td> </tr> <tr> <td>2784</td> <td>8K x 8</td> <td>£1.20</td> </tr> <tr> <td>27128</td> <td>16K x 8</td> <td>£2.50</td> </tr> </table> <p>EPROMS</p> <table border="1"> <tr> <td>2716</td> <td>2K x 8</td> <td>£2.70</td> </tr> <tr> <td>2732</td> <td>4K x 8</td> <td>£2.65</td> </tr> <tr> <td>2784</td> <td>8K x 8</td> <td>£2.45</td> </tr> <tr> <td>27128A</td> <td>16K x 8</td> <td>£3.70</td> </tr> <tr> <td>27256</td> <td>32K x 8</td> <td>£3.75</td> </tr> <tr> <td>27512</td> <td>512K x 8</td> <td>£9.70</td> </tr> </table> <p>DRAM BY NIMOS</p> <table border="1"> <tr> <td>4164</td> <td>64K x 1</td> <td>£0.98</td> </tr> <tr> <td>41256</td> <td>256K x 1</td> <td>£2.38</td> </tr> <tr> <td>4418</td> <td>16K x 1</td> <td>£3.30</td> </tr> <tr> <td>41464</td> <td>64K x 1</td> <td>£3.30</td> </tr> </table> <p>DRAM BY CMOS</p> <table border="1"> <tr> <td>2114LP</td> <td>1K x 4</td> <td>£1.50</td> </tr> <tr> <td>2128LP</td> <td>2K x 8</td> <td>£2.50</td> </tr> </table> <p>DRAM BY CMOS</p> <table border="1"> <tr> <td>6118LP</td> <td>2K x 8</td> <td>£1.40</td> </tr> <tr> <td>6264LP</td> <td>8K x 8</td> <td>£2.40</td> </tr> <tr> <td>62256LP</td> <td>32K x 8</td> <td>£14.50</td> </tr> </table> <p>EPROM BY NIMOS</p> <table border="1"> <tr> <td>2716</td> <td>2K x 8</td> <td>£2.70</td> </tr> <tr> <td>2732</td> <td>4K x 8</td> <td>£2.65</td> </tr> <tr> <td>2784</td> <td>8K x 8</td> <td>£2.45</td> </tr> <tr> <td>27128A</td> <td>16K x 8</td> <td>£3.70</td> </tr> <tr> <td>27256</td> <td>32K x 8</td> <td>£3.75</td> </tr> <tr> <td>27512</td> <td>512K x 8</td> <td>£9.70</td> </tr> </table>	4118	16K x 8	£0.75	2716	2K x 8	£1.50	2732	4K x 8	£1.50	2784	8K x 8	£1.20	27128	16K x 8	£2.50	2716	2K x 8	£2.70	2732	4K x 8	£2.65	2784	8K x 8	£2.45	27128A	16K x 8	£3.70	27256	32K x 8	£3.75	27512	512K x 8	£9.70	4164	64K x 1	£0.98	41256	256K x 1	£2.38	4418	16K x 1	£3.30	41464	64K x 1	£3.30	2114LP	1K x 4	£1.50	2128LP	2K x 8	£2.50	6118LP	2K x 8	£1.40	6264LP	8K x 8	£2.40	62256LP	32K x 8	£14.50	2716	2K x 8	£2.70	2732	4K x 8	£2.65	2784	8K x 8	£2.45	27128A	16K x 8	£3.70	27256	32K x 8	£3.75	27512	512K x 8	£9.70
74TTL	158	40	55	NE555	18	TL082	45																																																																																																																																																																																																																																																																
LS MC	161	55	65	TL074	90	TL084	45																																																																																																																																																																																																																																																																
00	20	25	163	55	55	ULN2004	70																																																																																																																																																																																																																																																																
02	20	25	164	55	55																																																																																																																																																																																																																																																																		
04	20	25	165	80	75																																																																																																																																																																																																																																																																		
08	20	25	165	80	75																																																																																																																																																																																																																																																																		
10	20	25																																																																																																																																																																																																																																																																					
11	20	25																																																																																																																																																																																																																																																																					
14	20	25																																																																																																																																																																																																																																																																					
20	20	25	WD2797	19.00																																																																																																																																																																																																																																																																			
21	20	25	WD1797	19.00																																																																																																																																																																																																																																																																			
27	20	25	WD3216	14.28																																																																																																																																																																																																																																																																			
42	49		7812	30																																																																																																																																																																																																																																																																			
51	20	25	78M12	30																																																																																																																																																																																																																																																																			
74	20	30	75154	90																																																																																																																																																																																																																																																																			
85	50		ADC0808	9.90																																																																																																																																																																																																																																																																			
86	20	49	LM311	40																																																																																																																																																																																																																																																																			
123	80	55	LM324	40																																																																																																																																																																																																																																																																			
132	40	49	LM337	1.20																																																																																																																																																																																																																																																																			
138	40	49	LM348	55																																																																																																																																																																																																																																																																			
139	40	49	LM358	45																																																																																																																																																																																																																																																																			
153	45	50	LM3900	40																																																																																																																																																																																																																																																																			
157	40	55	OP07CP	65																																																																																																																																																																																																																																																																			
4118	16K x 8	£0.75																																																																																																																																																																																																																																																																					
2716	2K x 8	£1.50																																																																																																																																																																																																																																																																					
2732	4K x 8	£1.50																																																																																																																																																																																																																																																																					
2784	8K x 8	£1.20																																																																																																																																																																																																																																																																					
27128	16K x 8	£2.50																																																																																																																																																																																																																																																																					
2716	2K x 8	£2.70																																																																																																																																																																																																																																																																					
2732	4K x 8	£2.65																																																																																																																																																																																																																																																																					
2784	8K x 8	£2.45																																																																																																																																																																																																																																																																					
27128A	16K x 8	£3.70																																																																																																																																																																																																																																																																					
27256	32K x 8	£3.75																																																																																																																																																																																																																																																																					
27512	512K x 8	£9.70																																																																																																																																																																																																																																																																					
4164	64K x 1	£0.98																																																																																																																																																																																																																																																																					
41256	256K x 1	£2.38																																																																																																																																																																																																																																																																					
4418	16K x 1	£3.30																																																																																																																																																																																																																																																																					
41464	64K x 1	£3.30																																																																																																																																																																																																																																																																					
2114LP	1K x 4	£1.50																																																																																																																																																																																																																																																																					
2128LP	2K x 8	£2.50																																																																																																																																																																																																																																																																					
6118LP	2K x 8	£1.40																																																																																																																																																																																																																																																																					
6264LP	8K x 8	£2.40																																																																																																																																																																																																																																																																					
62256LP	32K x 8	£14.50																																																																																																																																																																																																																																																																					
2716	2K x 8	£2.70																																																																																																																																																																																																																																																																					
2732	4K x 8	£2.65																																																																																																																																																																																																																																																																					
2784	8K x 8	£2.45																																																																																																																																																																																																																																																																					
27128A	16K x 8	£3.70																																																																																																																																																																																																																																																																					
27256	32K x 8	£3.75																																																																																																																																																																																																																																																																					
27512	512K x 8	£9.70																																																																																																																																																																																																																																																																					
<p>ADD VAT 18% ORDERS UNDER £25 ADD £1 P&P OVER £25 POSTAGE FREE ORDERS DISPATCHED SAME DAY BEFORE 3.30PM DEPT (RES) 18 KOLDERMEADOW AV, CORBY, NORTHANTS NN16 9AJ</p>																																																																																																																																																																																																																																																																							

New ASTRID + New

Access UoSAT OSCAR 9 & 11 Scientific Satellites with your BBC B upwards or Spectrum 48K upwards computers. (Others via RS232 serial port). A **complete** Satellite Receiving System including all cables, aerial, display software etc. All for only £156+VAT, direct from the **designers**.

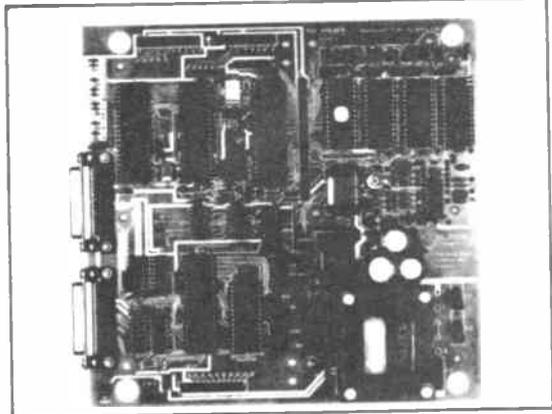
Send for full details to:

SRW Communications Ltd
ASTRID House, The Green
Swinton, MALTON, N Yorks YO17 0SN
or Telephone Malton (0653) 697513

The Archer Z80 SBC

The SDS ARCHER - The Z80 based single board computer chosen by professionals and OEM users.

- ★ Top quality board with 4 parallel and 2 serial ports, counter-timers, power-fail interrupt, watchdog timer, EPROM & battery backed RAM.
- ★ **OPTIONS:** on board power supply, smart case, ROMable BASIC, Debug Monitor, wide range of I/O & memory extension cards.



The Bowman 68000 SBC

The SDS BOWMAN - The 68000 based single board computer for advanced high speed applications.

- ★ Extended double Eurocard with 2 parallel & 2 serial ports, battery backed CMOS RAM, EPROM, 2 counter-timers, watchdog timer, powerfail interrupt, & an optional zero wait state half megabyte D-RAM.
- ★ Extended width versions with on board power supply and case.



Sherwood Data Systems Ltd

Sherwood House, The Avenue, Farnham Common, Slough SL2 3JX. Tel. 02814-5067

TOP HF



IC-761, HF Transceiver with general coverage receiver

The new ICOM IC-761 H.F. Transceiver has many features making it probably the best top of the line Amateur transceiver available today. This all mode transceiver features an internal aerial tuning unit and A.C. power supply. The A.T.U. boasts a 3 second band selection and tune up with a VSWR matching of less than 1.3:1. For the serious operator the 100kHz-30MHz general coverage receiver and 105dB dynamic range make it ideal for DX chasing. Frequency selection is by the main VFO or via the front panel direct access keypad.

And for when reception is difficult, pass band tuning, I.F. shift, notch filter, noise blanker, pre-amp and attenuator should enable you to copy even those weak DX stations whether amateur or broadcast.

The C.W. operator will appreciate the electronic keyer, 500Hz filter and full break in (40wpm) other filter options are available. The IC-CR64 high stability crystal is standard as is the CI-V communications interface for computer control. Twin VFO's and split mode for cross band contacts the IC-761 features program scanning, memory scan and mode select scan and the 32 memories can store frequency and mode.

The transceivers operating system is held permanently in ROM and is not dependant upon the lithium battery. The cell is used for memory back up only. A new style meter gives P.O., A.L.C.; IC, VC, COMP and SWR readings. Optional accessories include the IC-SP20 external loudspeaker with audio filter selections, FL101 250Hz CW filter, FL102 6kHz A.M. filter and the EX 310 voice synthesizer. The SM8 & SM10 desk microphones are also suitable for this equipment.

Telephone us free-of-charge on:

HELPLINE 0800-521145.

Mon-Fri 09.00-17.00 and 14.00-17.00

This is strictly a helpline for obtaining information about or order on ICOM equipment. We regret this service cannot be used by dealers or for repair enquiries and parts orders. Thank you

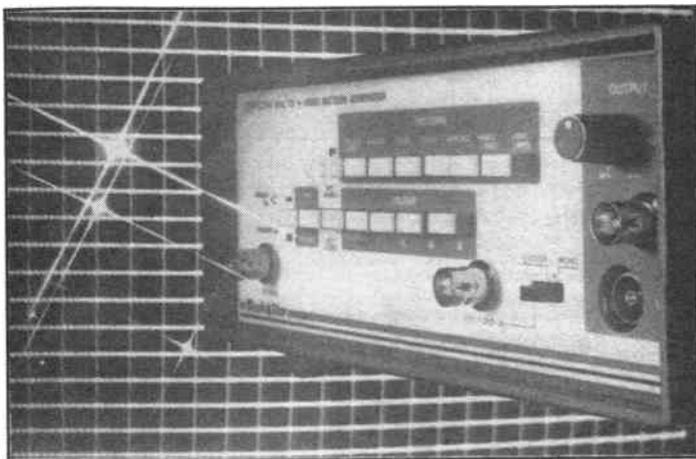


ICOM (UK) LIMITED
Dept REW, Sea Street,
Herne Bay, Kent CT6 8LD.
Tel: 0227 363859.

PRODUCT NEWS

Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributors and dealers are invited to supply information on new products for inclusion in Product News.

Readers, don't forget to mention **Radio & Electronics World** when making enquiries



PATTERN GENERATOR

Available ex-stock from Thurlby Electronics is the Orion low cost TV/video colour pattern generator. It can be used with the majority of PAL TV systems and also provides highly versatile RGB outputs for use with video monitors.

The unit is compatible with PAL B, D, G, H, I and K systems. Video test signals include colour purity patterns, RGB, 100% white, grey scale, cross hatch, vertical and horizontal lines, dots and 1MHz vertical lines. These enable testing of static and dynamic convergence, video amplifier linearity, colour purity, general colour performance and focus.

A switchable sound carrier adjustable to 5.5, 6.0 or 6.5MHz is available. Internal modulation (FM or AM) is achieved

with a 1kHz sine wave.

External modulation via a DIN socket also allows the testing of television sound systems.

Also included are a separate video input to modulate camera signals and fully-variable RF and video output levels which facilitate AGC testing.

The Orion pattern generator is a high performance, low cost instrument with applications in manufacture, test and servicing of televisions and computer and video monitors. The Orion pattern generator costs £199 plus VAT.

*Thurlby Electronics Ltd,
New Road,
St Ives,
Huntingdon,
Cambs EE17 4BG.
Tel: (0480) 635700.*

DUAL-TRACE SCOPE

Offering an excellent price/performance ratio, the new Crotech model 3133 25MHz dual trace oscilloscope is offered at £319.

A useful facility is a variable 10:1 hold-off for the timebase to facilitate reliable triggering on aperiodic and complex waveforms. The timebase range is from 40ns/div to 0.2s/div and maximum vertical sensitivity of 2mV/div. The 5 inch flat-faced CRT has a 10 x 8 division graticule which has effective 0 and 100% markings

to simplify rise time measurements.

The 3133 has a rise time of 14ns and can be operated in X-Y modes, and has add/subtract channel options.

Triggering is reliable up to 40MHz and there is an active TV trigger circuit. Z modulation is also provided.

*Crotech Instruments Ltd,
2 Stephenson Road,
St Ives,
Huntingdon,
Cambridgeshire PE17 4WJ.
Tel: (0480) 301818.*

MULTI SCOPE

Incorporating a unique switchable 1kHz/1MHz squarewave generator, plus a built-in component tester which even allows in-circuit testing of semiconductors, the Hameg HM605 oscilloscope now available from STC Instrument Services is a true multi-function unit.

The 60MHz instrument is designed for high performance applications in laboratory, production and service areas and features a maximum input sensitivity of 1mV/div, a delay line to enable viewing of the trigger edge, an overscan feature, and vertical-mode, alternate,

line and single sweep triggering facilities with a variable hold-off time capability.

For TV frame and line displays, variable hold-off RF and LF filters at any sweep speed can be used. Sweep ranges from 5ns/div to 2.5s/div provide optimum resolution for both fast and slow signals, whilst a variable sweep delay facility allows detailed signal analysis by offering up to x1000 expansion of waveforms.

*STC Instrument Services,
Dewar House,
Central Road,
Harlow,
Essex CM20 2TA.*

LISTEN AND TALK

The world's first hand-held menu-driven line monitor with full facilities for measuring the quality of communications lines is announced by David Bisset Ltd. The audio test set and line monitor, model ATS-2, provides 'listen and talk' facilities, can dial up a circuit, monitor the signal (or the noise) and accurately measure the characteristics of a line. It can test a data link to Hong Kong, a customer's leased line or a selection of dial-up lines.

Intended for checking, trouble-shooting or installing any equipment connected to the PSTN (Public Service Telephone Network), the ATS-2 may be used on 2-wire or 4-wire circuits and on a wide range of equipments for voice or data, namely: modems, data networks, videotex, PABXs and digital exchanges, dealer boards, facsimile and telephones.

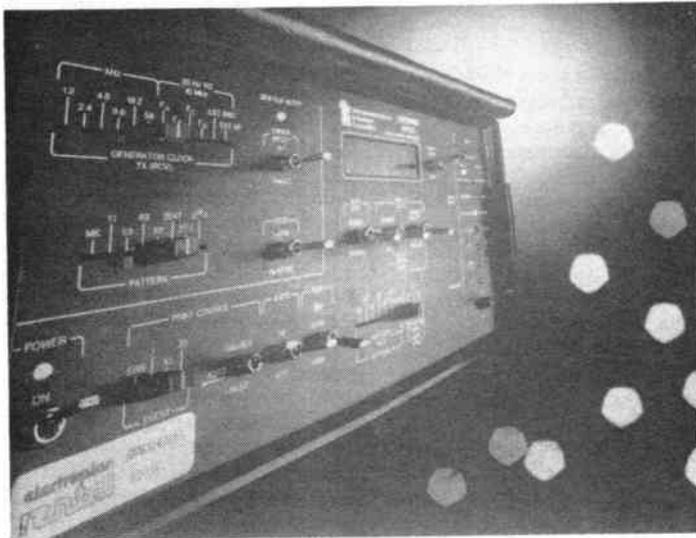
ATS-2 is battery-operated and comprises a telephone handset, a signal generator and high accuracy measuring set. It can listen to a modem or a noisy line and measure signal levels +10 to -65dBm, frequencies 20Hz to 10kHz, background noise, impulse noise, signal to noise ratio and line quality using P/AR (peak-to-average ratio) rat-

ing. A two-line LCD displays menus, modes and measurements.

Among its many facilities are terminated or bridging measurements, auto-dial with storage for ten 16-digit numbers, DTMF (tone) or Strowger-type dialling, exchange hold, built-in speaker and microphone.

*David Bisset Ltd,
65 High Street,
Redbourn,
Herts AL3 7LW.
Tel: (058285) 2637.*





FIREBERD

The Fireberd 1500A data error analyser is now available for hire from Electroplon Rental.

The instrument performs fundamental bit and block error measurements for testing the quality of data communications networks and is ideal for initial installation and periodic performance checks, hardware development and testing and troubleshooting. Standard RS232

and optional IEEE488 interfaces allow for remote or unattended testing, with printout if required, for isolation of elusive communication faults. The 1500A's portability makes it a suitable instrument for site work.

The microprocessor-based 1500A measures bit error rate, bit errors, block errors, blocks, error-free seconds, errored seconds, seconds of testing and elapsed time. The instrument can be operated

at data rates between 10b/s and 13Mb/s in full duplex or simplex modes, with good interfacing flexibility. A range of fifteen interface options includes RS232, V.35, MIL-188C and MIL-114, RS449, DS-1, WECO 303, Lab and G.703.

The 1500A generates eight data patterns: all marks, 1:1 and 1:3 and five pseudorandom patterns of 63, 511, 2047, $2^{15} - 1$ and $2^{20} - 1$ bits. Errors can be inserted singly or at a constant 1×10^{-3} rate. Audio indication of errors, sync losses and completion of bit error rate measurement is available.

Standard internal clock frequencies are 1.2, 2.4, 4.8, 9.6, 19.2 and 56kHz, and four optional clock frequencies can be user-specified between 50Hz and 13MHz. An external clock can be accepted.

The instrument is available on short term hire or at reduced longer term rates.

*Electroplon Rental,
PO Box 19,
Orchard Road
Royston,
Herts SG8 5HH.
Tel: (0763) 47251.*

ex-stock from Thurlby Electronics, who offer full technical and service support.

A unique phase control method and choke input filter ensure excellent regulation, low input current and low ripple and noise at a high efficiency level. Smooth, high accuracy voltage setting is achieved using a 10-turn potentiometer.

To compensate for voltage drops due to lead resistance between the power supply and load a remote sensing function is available.

Output voltage and current can be controlled by an external voltage or resistance, enabling remote control of the power supply.

Both voltage and current limits may be preset and checked during operation with voltage and current limited operation being indicated by an LED display.

Other features include overvoltage protection, an output on/off switch and excellent temperature characteristics and transient response. Series and parallel connection of the units may be made with master-slave operation.

Prices of the PD series start from £495 plus VAT.

*Thurlby Electronics Ltd,
New Road,
St Ives,
Huntingdon,
Cambs EE17 4BG.
Tel: (0480) 63570.*

COMBINED SKILLS

Accurate signal distortion measurement down to 0.3% FSD over a wide bandwidth from 30Hz to 300kHz, together with voltage level measurement down to -60dBm, can be performed with the Crotech type 2017 auto tune distortion analyser and level meter.

The distortion analyser makes use of an auto tuning sharp rejection filter stage which eliminates the fundamental from an input signal and measures the remainder, presenting the results as the signal distortion. Using the input attenuator, signals from 300mV to 300V can be accepted.

Measurement accuracy of the second harmonic is better than -2dB for a fundamental range from 30Hz to 100kHz and better than -3dB from 100kHz to 300kHz. With a careful design, the residual distortion of the instrument is less than 0.05%. Automatic nulling accuracy is better than 2dB of manual null.

The level meter section of

the type 2017 allows measurement of signal voltages from 1mV to 300V in twelve ranges, equivalent to +50dBm to -60dBm in 10dB steps. Measurement may be performed on signals from 30Hz to 3MHz (± 1 dB) for input ranges of 1mV to 3V and from 30Hz to 100kHz ($\pm 0.5\%$) for inputs of 10V to 300V.

The meter displays the level to an accuracy of $\pm 5\%$. Residual noise is below $200\mu\text{V}$ rms and there is a BNC output of the level signal giving approximately 150mV full scale into an open circuit.

The type 2017 is designed for rack or desk-top operation and, with the type 2016 low distortion signal generator and type 2018 power meter, forms a complete rack-mounting audio test system. RRP for the type 2017 is £599.00.

*Crotech Instruments Ltd,
2 Stephenson Road,
St Ives,
Huntingdon,
Cambs PE17 4WJ.
Tel: (0480) 301818.*

LAB PSU

The Trio-Kenwood PD range of bench/laboratory power supplies features models in combinations of voltages up to 110V and currents up to 30A. They are available





ILLUSTRATOR

Following the popularity of the Digimouse and to complement this equipment, Nidd Valley have now released a new graphic software package, *Illustrator*.

This versatile graphics development program produces high resolution print-outs in a choice of 4 sizes and 2 densities in crisp monochrome, with no loss of detail and no distortion. This very powerful print option is designed to allow illustrations to be incorporated with word processor text.

Certain *Illustrator* functions are allocated to the function keys, as this provides greater flexibility and efficiency when using the mouse. For example, shapes can be moved around the screen with the mouse whilst their size is being altered with the function keys.

Drawing functions and utilities are selected from 8 pull-down and 4 pop-up windows.

The software includes an extensive library of designs, plus the facility for users to create their own icons, patterns and brush styles. Designs can be edited using the 'zoom' and 'pixel editor', then saved and reloaded later.

Drawing options include 'lines', 'multilines', 'ray', 'circle', 'ellipse', 'sector', 'curve', 'polygons'. These can all be rubber banded or enlarged/reduced. Shapes can be drawn inverse or filled, text can be entered in a choice of 2 styles and 3 sizes, plus there is a facility to produce custom-designed fonts.

Illustrator is disc based – there are no ROMs to fit. The

program was written for the Nidd Valley mouse but will support any BBC compatible mouse.

Available now for the B/B+ at £49.90 complete with a Digimouse, *Illustrator* can also be supplied as software only at £19.90. Prices include VAT and postage.

Nidd Valley Micro Products,
4AA9 Thorp Arch Trading Est,
Wetherby,
West Yorkshire,
England LS23 7BJ.
Tel: (0937) 844661.

FLOPPY DISC DRIVES

The SMD480M is the latest 3.5 inch micro floppy disc drive announced by Epson.

The one inch (25.4mm) high slim SMD480M is plug compatible with most IBM 5.25 inch drives and has a 1.0MB capacity, 80 tracks per surface and a transfer rate of 25K bits per second.

The SMD480M is available also in an industry standard half-height 5.25 inch bezel and mounting frame (model SMD489M) for IBM PC and IBM clone users to install direct with no case or wiring changes. This further allows media interchange with the new IBM PS/2 machines.

Models interfacing with the IBM PC/AT and PC/XT are available – models SMD480M-007 and SMD480M-004 respectively.

The drive's 20mm diameter permanent magnet type stepper motor, together with a unique rack and pinion head positioning mechanism developed in the watch division of Seiko Epson, achieves high track position repeat-

KWIKKALK

Methodia Design of Norway have just released *KwikKalk*, the latest software in their Technical Series.

This very comprehensive program is designed to take the hard work out of radio calculations. You just enter the circuit values you already have and it instantly provides the component value that you need.

The current value of all components is held in the program so that you don't have to keep entering them every time when performing a series of related calculations.

The program is menu-driven, very easy to use and contains useful explanations and hints for its operation. It is the perfect addition to every constructor's shack and also comes in handy when preparing for the Radio Amateurs Exam.

There are versions for Spectrum, CMB64 and BBC-B/Master computers at £12 on tape or £14 on CBM or BBC disc or Spectrum microdrive cartridge. BBC disc users should state if they want 40 or 80 tracks.

Technical Software,
Fron,
Upper Llandwrog,
Caernarfon LL54 7RF.
Tel: (0286) 881886.

MONOCHROME MONITOR

Following the recent introduction of a 7 inch monochrome monitor, Hero Electronics has further extended its range with the addition of a 15 inch monochrome display. The 15 inch monitor is mains driven and accepts a variation in supply from 90V to 264V ac.

The CRT has a 110° deflection angle and a P31 phosphor. A feature of the monitor is its low power consumption which is 0.5 amp at 120V ac. The resolution of the monitor is typically 1300 lines with a 25MHz bandwidth. Priced at £108 in 10 off quantities, the monitor is outstanding value for a high performance mains driven display.

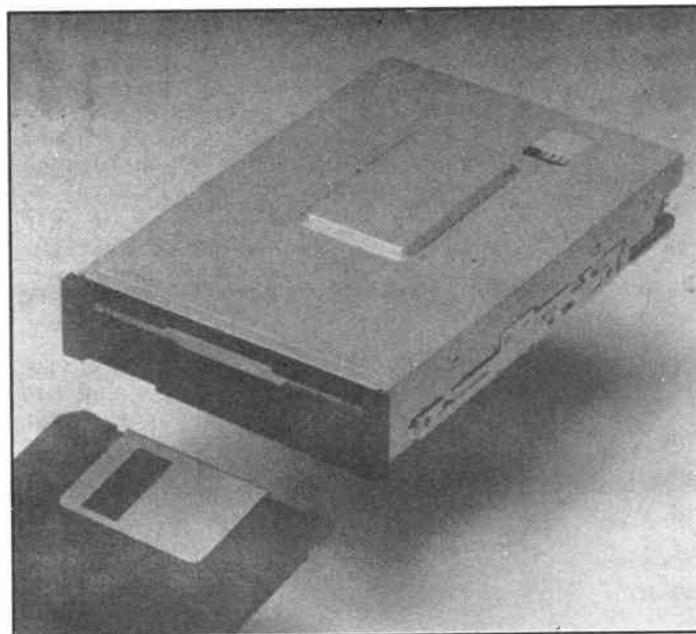
Hero Electronics Ltd,
Dunstable Street,
Amphill,
Beds MK45 2JS.
Tel: (0525) 405015.

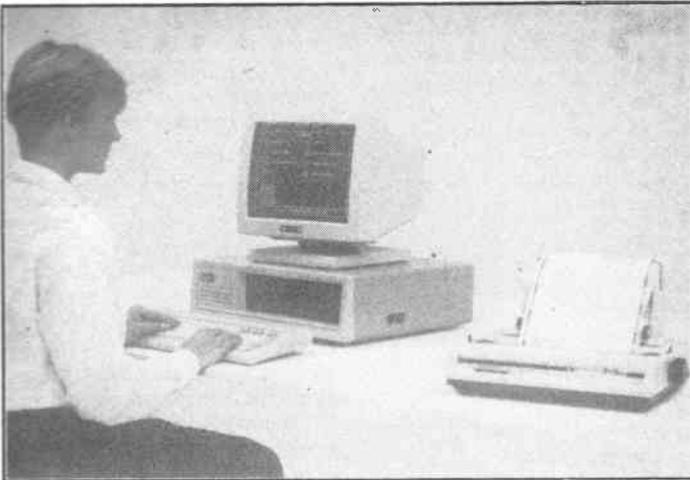
ability with lower peak currents and enhances speed and reliability.

A single 5 volt power supply reduces circuit complexity and a low 1.8 watt (typical) power consumption reduces power supply costs and con-

sumption.

Epson (UK) Ltd,
Dorland House,
388 High Road,
Wembley,
Middlesex HA9 6UH.
Tel: 01-902 8892.





PcTEX

Equipment which enables personal computers to be used as telex terminals is being offered by the Swedish company ITD-Wernor.

Called PcTex, it consists of a printer with built-in telex functions and software for the IBM PC and compatibles.

Personal computers equipped with PcTex gain increased efficiency and productivity by adding the telex function to existing applications.

The computer's word pro-

cessing program is used to create and edit telex messages, which are then transferred to the PcTex system for automatic transmission.

Incoming telex messages can be received and printed out regardless of whether the computer is connected or not. The PcTex program stored in the computer is only used for transmitting.

Several messages can be placed in a queue for transmission. Abbreviated numbers and telex address numbers can be assembled into

IBM INTERFACE

Now available from Wasec, the Advantech AD50488 provides a fully functional IEEE488 interface for the IBM personal computer series. Constructed on a 3/4 size card, it is suitable for the IBM PC/XT/AT computers and all compatible models. All of the IEEE488 commands are supported, making the AD50488/PC combination an ideal hardware platform for GPIB instrumentation systems.

IBM Basic, Basica, compiled Basic, Microsoft C, Microsoft Fortran, Microsoft Pascal and Turbo Pascal languages are supported. The device driver is embodied in onboard firmware requiring no extra disc-based software and enabling immediate use of the system after power on. 2Kbytes of onboard RAM provide workspace without placing additional demands on the computer memory. The powerful command set coupled with a simple initialisation procedure makes prog-

ramming very straightforward. The familiar standard IEEE488 command mnemonics are supported.

Data can be transferred at speeds of 67Kbytes/sec under program controlled I/O or at 300Kbytes/sec via one of three DMA channels. This ensures fast and efficient data transfers in GPIB systems which generate large amounts of data, eg spectrum analysers, DSOs. An optional real-time clock offers precision timing functions for measurement and control. Ranging from milliseconds to months, a programmable timeout feature prevents system hang-ups caused by inactive devices.

With a basic price of £200 each, AD50488 is supplied complete with a comprehensive user's manual and one year warranty.

Wasec,
PO Box 161,
Wallington,
Surrey SM6 8BA.
Tel: 01-668 5400.

groups, so that the same message can be sent automatically to all receivers within the same group. The system can also send telex messages to telefax subscribers.

The PcTex program is menu-driven and controlled via function keys. The system is approved by Swedish Telecom for connection to the telex network.

ITD-Wernor AB,
Birgitta Roos,
Box 1050,
S-171 21 Solna,
Sweden.
Tel: +46-8 734 02 10.

TEMPERATURE KIT

ETI recently announced the introduction of a general purpose temperature kit.

This kit can take accurate temperature measurements of almost anything, anywhere within the factory and laboratory areas. Each kit contains a Thermo 3 digital thermometer - range -50°C to 750°C - and two temperature probes, a needle/penetration probe and a surface probe.

When not in use the probes and the instrument fit neatly into a purpose made carrying case, which ensures that both the instrument and probes are kept in perfect condition.

Utilising different probes, most temperature measurements can be handled by the one instrument. For instance, when used in conjunction with the penetration probe it can be used for piercing into the centre of plastic mouldings, for testing hot and cold liquids in various utensils. The surface probe is more suitable for checking surface

temperatures inside ovens, bearings and hot plates, etc.

Each kit costs £82.25 excluding VAT.

ETI,
PO Box 81,
Worthing,
West Sussex BN13 3PW.
Tel: (0903) 202151.

DELAY TIMERS

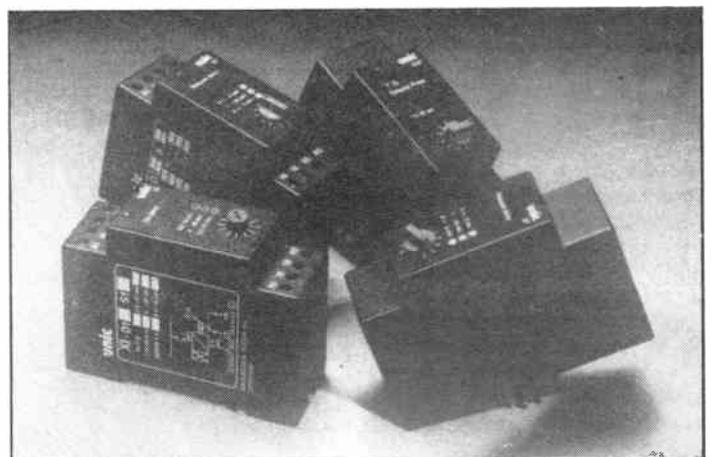
New from Highland Electronics is the X series of timers, offering a comprehensive range of delay functions including 'on' delay, release delay without auxiliary voltage, and star/delta start with delayed impulse.

The three models in the new series are the Type XI (on delay), Type XF (release delay) and Type XIW (star/delta start). The units are designed for simplicity of operation, with a front-panel knob being the only control, and they can be mounted directly on a DIN rail or in an 11-pole plug-in base.

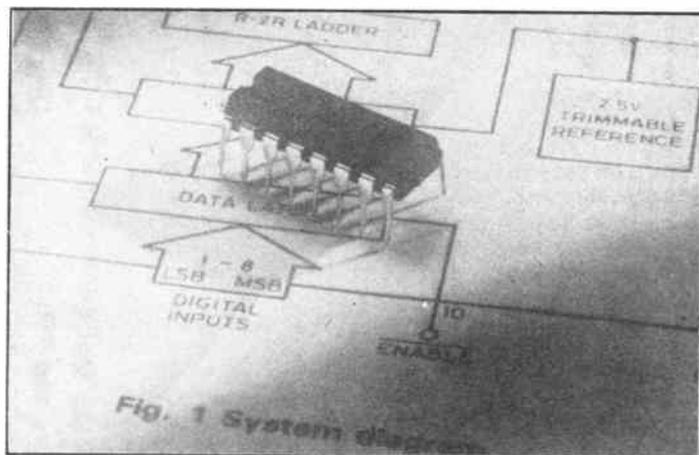
The X series is available for operation at voltages of 24V ac/dc, 110-120V ac, 220-240V ac, or 380V ac. Timing ranges are 0.5-10 sec, 4-80 sec or 0.5-10 min for the XI; 0.1-3 sec, 1-30 sec or 0.1-3 min for the XF; and 1.5-60 sec delay and 75ms pulse for the XIW.

Repeatability is within 0.5%, temperature drift is 0.15% per °C maximum, and setting accuracy is +10%. Front-panel LEDs indicate when the output relay is energised.

Highland Electronics Ltd,
Albert Drive,
Burgess Hill,
West Sussex RH15 9TN.
Tel: (04446) 45021.



PRODUCT NEWS



D-A CONVERTER

Now available from RR Electronics is the ZN438 D-A converter by Ferranti.

The ZN438 is a monolithic 8-bit device with input latches to make updating from a data bus easier and a buffer amplifier to give a low analogue output impedance. The ZN438 also contains a trimmable 2.5V reference which is internally connected to the R-2R ladder switches and to Vref

out.

The ZN438 also features 1.25 μ s settling time to ± 0.5 LSB; a microprocessor, TTL and 5V CMOS compatible; guaranteed monotonic over full operating temperature range.

*RR Electronics Ltd,
St Martin's Way,
Cambridge Road,
Bedford MK42 0LF.
Tel: (0234) 47211.*

HARTING CONNECTORS

Now available from RR Electronics is the Harting range of Min D connectors for industrial control systems, electronic office machines and telecommunications equipment.

The Harting Min D meets the dimensional requirements of Mil-C-24 308 and is available with 9, 15, 25, 37 and 50 contacts.

A metal collar gives electric shielding, mechanical protection and polarisation.

Harting Min D connectors

are available in solder cup and solder pin terminals, optionally screened and tin plated. There is an RS232 version of the solder cup connector; the solder pin-type is also available with right angled terminals.

*RR Electronics Ltd,
St Martin's Way,
Cambridge Road,
Bedford MK42 0LF.
Tel: (0234) 47211.*

SYMBOL LEDs

Available from Hero Electronics is a wide range of symbol LEDs at lower cost. Designated the TLS Series from Telefunken, there are square, round, rectangular and triangular types. The LEDs are available in four colours, red, green, yellow and orange, and in sizes and styles ranging from 1.2mm round to 5x5mm square. The range encompasses over 80 different variations of symbols and sizes.

An example of the pricing is the TLSR 5200 (5mm round) which costs £5.30 per 100pcs. These LEDs have even luminance over the emitting sur-

face with a wide viewing angle (100°) and they are matched for luminous intensity and colour. The LEDs are ideal for flush mounting and legend indicators, especially in high density applications where a uniform output is required.

*Hero Electronics Ltd,
Dunstable Street,
Amphill,
Bedfordshire MK45 2JS.
Tel: (0525) 405015.*

RFI FILTERS

Corcom's F2810 and F3297 RFI (radio frequency interference) filters are designed for 3-phase/4-wire star configurations, where they provide filtering in each of the three lines plus the neutral line.

The filters are equally suited to use on standard 3-phase delta configurations.

The devices provide both common mode and differential mode suppression from 150kHz to 30MHz, and are effective for both balanced and unbalanced 3-phase loads. They are made to IEC380 specifications and are



also UL recognised.

Maximum current rating is 10A for the F2810 and 30A for the F3297, and rated voltages are 440V phase-to-phase and 250V phase-to-neutral.

*Corcom UK,
8 Westgarth Place,
College Milton North,
East Kilbride,
Scotland G74 5NT.*

MINI TRANSFORMERS

The OB (on board) range of miniature transformers available from Avel now conform to the requirements of seven exacting specifications, VDE-0551, IEC-742, SEV-1003, UL-506, CSA-C 22.2, BS415 and CEE-15.

The load ratings range from 0.8VA to 30VA, with the 0.8VA being claimed to be the world's thinnest transformer at only 10.5mm (0.413in) high. The flat height profile enables the 0.8VA version to be mounted where there is 0.5in board spacing, the 2VA version where the board spacing is 0.75in, the 4, 6, 10 and 14VA with 1.0in spacing and the 18, 24 and 30VA types with 1.5in, which makes this range ideal for direct mounting on close spaced PCBs.

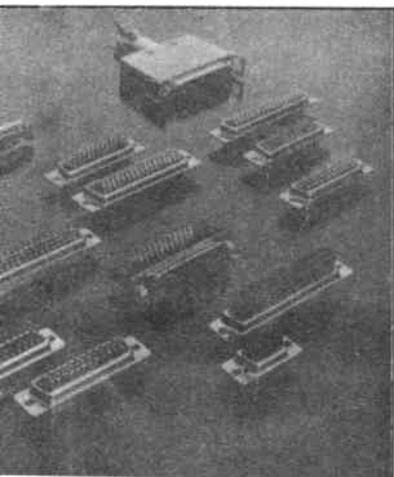
The other dimensions are 44 x 53mm for the 2, 4 and 6VA types and 68 x 57mm for the 0.8, 10, 14, 18, 24 and 30VA types. This low height profile and general small size enables a power supply to be an integral part of a particular

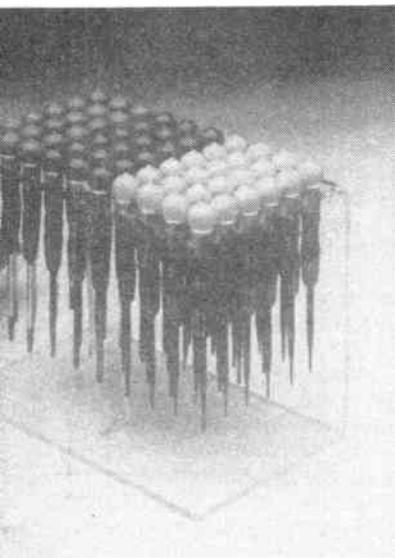
board or section of a circuit, rather than drawing power from a central PSU.

Dual primary windings can be connected in parallel for 120V ac and in series for 240V ac nominal operation at either 50 or 60Hz. Seven dual secondary windings can be provided which give 5, 6, 9, 12, 15, 18 and 24V rms when parallel connected and 10, 12, 18, 24, 30 and 48V rms when series connected. The secondaries can also be connected as series independent if the applied potential between them does not exceed 500V dc. The secondary voltage tolerance is within 5% at nominal input and full load.

The regulation is typically 30% and each transformer is capable of operation with a temperature rise of between 30 and 40°C up to the Class E 120°C maximum operating temperature.

*Avel-Lindberg Ltd,
South Ockendon,
Essex RM15 5TD.
Tel: (0708) 85344.*





LITTLE THINGS

As an extension to its ranges of screwdrivers for the electronic and radio/TV industries, CeKa Works has introduced a new selection of small 'Micro' screwdrivers for the most delicate tasks.

With self centering 'button'

heads and ribbed turning grooves moulded into the handles, the 'drivers measure just 85mm from button to tip and are available in versions to suit slotted, recessed or 'Torx' screws: each type is clearly identified by button colour (slotted - yellow; recessed - red; Torx - blue) and sizes are printed onto the handles.

Tip sizes of the four slotted drivers range from the minute 0.8mm to 1.8mm, the recessed tools are sizes 000,00 and 0, whilst 'Torx' drivers are in four sizes from 06 to 09.

For the stockist trade, there is also a choice of attractive acrylic display stands holding different selections of screwdrivers; also a handy clip-top pack of the four slotted and three recessed sizes.

CeKa Works Ltd,
Pwllheli,
Gwynedd,
North Wales LL53 5LH.
Tel: (0758) 612254.

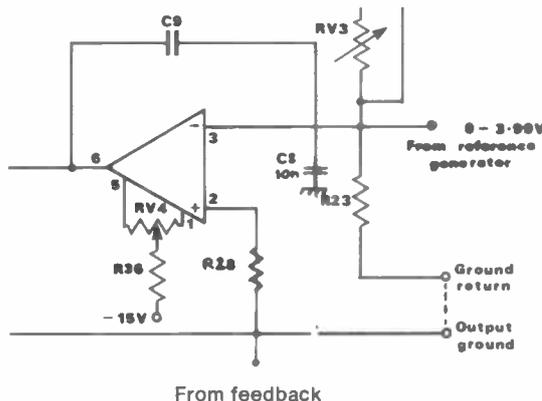
ERRATA

In David Silvester's article 'A Laboratory Power Supply' in the September issue of *Radio and Electronics World*, several errors have been discovered.

In *Figure 2* the IC inverting and non-inverting inputs have been reversed, although the text is correct.

In *Figures 5 and 6* the variable resistors are listed as RV1 to RV4 while the component list says Vr1 to Vr4.

None of the resistor values are missing. R34 is on the line starting R16, R35 on the line starting R7, R36 on the line starting R19, R37 on the line starting R10. In *Figure 6* there is a mistake in the diagram in the area of the IC. The corrections are below:



RADIO AND RTTY BOOKS – WITH FREQUENCY LISTS



All new articles . . . completely revised listings . . .
400 pages for 1988.

PASSPORT TO WORLD BAND RADIO

New Larger 1988 Edition in Stock

Everything you need to explore and enjoy the exciting realms of shortwave radio. The first part, *How to Tune in the World* looks at a few countries and subjects available. Part two, *1988 Buyer's Guide to World Band Radio*, reports 'hand-on' and laboratory tests of the latest models and comparative ratings of just about every major portable or tabletop receiver. Finally, *Worldscan* runs through all the frequencies of the world band spectrum and shows who's broadcasting from where, at what times, and in which languages.

Price £14.95 plus £1 postage in UK.
Overseas £6 airmail or £2 sea mail worldwide, Europe and Eire.

GUIDE TO UTILITY STATIONS 1987

★ Lists 14,817 Frequencies ★ 4,593 RTTY Stations
★ 1,759 New Frequencies ★ 2,931 Callsigns

Tune into the world's Utility Stations, such as airlines, commercial shipping, military Met with the 1987 Edition of *Guide To Utility Stations*. A massive 14,817 frequencies from 0.30 MHz including RTTY, CW, SSB, AMTOR, FAX, SITOP, VFT, etc giving full details of each station. That's not all! There are chapters on Q-codes, Z-codes, SIMPO reporting, Met stations, 3 maps, and much more. All stations have been monitored making this book (485 pages) the most comprehensive and accurate.

Price £19.95 plus £1.65 postage and packing in UK
Overseas £2.45 by sea or £7.25 airmail worldwide.

AERONAUTICAL RADIO HANDBOOK

★ Over 8,500 Frequencies Listed ★

Listen into aircraft long distance communication around the world. *Aeronautical Radio Handbook* shows you where you will find the HF frequencies for trans Atlantic flights, Sydney Volmet, Moscow Airport, and thousands more. This largest known aeronautical frequency list also includes many illustrations, maps and background information which will open up the aviation bands for you.

Price £16.25 plus 75p postage in UK
Overseas £3 airmail or £1 sea mail worldwide, Europe and Eire.



We have a Very Comprehensive Range of Books for the Shortwave Listener Covering Many Subjects and Listing Thousands of Frequencies.

NEW BOOKS

LISTENER'S HANDBOOK Everything you always wanted to know about receivers, antennas, the spectrum, accessories, etc.
Price £9.25 plus 75p postage and packing.

GUIDE TO FACSIMILE STATIONS by J Klingenfuss. A very comprehensive guide on the subject listing frequencies.
Price £12.25 plus 75p post and packing.

UNO, DOS CUATRO A fascinating guide to numbers stations.
Price £9.75 plus 75p post and packing.

AIR BAND RADIO New edition showing how to eavesdrop on aircraft and ground control.
Price £5.99 plus 75p post and packing.

AIR TRAFFIC CONTROL by D Adair. A detailed insight on how the air traffic control works.
Price £6.99 plus 75p post and packing.

LISTENER'S LOGSHEETS Ideal for SWL's, scanner listeners and DXers. Enough for over 1,000 entries.
Price £1.95 plus 45p post and packing.

BETTER RADIO/TV RECEPTION A new comprehensive book on getting the best from your SW receiver and TV, plus how to pick up more stations.
Price £9.95 plus 70p postage and packing.

MARITIME RADIO HANDBOOK Tune into the world's shipping. Gives hundreds of stations between 4 and 26 MHz, and lists the regular transmissions of coastal stations giving times, callsigns, mode, etc.
Price £13.75 plus 65p postage and packing.

RADIO HACKERS CODE BOOK How to decode those coded transmission.
Price £6.95 plus 65p postage and packing.

Other titles include:
Worldwide Weather Broadcasts, GCHQ, Air & Metro Code Manual, Service of QSL'ing, Utility Address Book and more.

Ask for our New Free Catalogue giving details of all books and prices

INTERBOOKS



RE11 Stanley
Perth, PH1 4QQ Scotland
Tel: Stanley (0738) 828575 (24hrs)
Almondbank (073883) 708



NEWS DESK

Royal visit

His Majesty King Hussein of Jordan made a private visit lasting over two hours to the headquarters of Racal Electronics plc at Western Road, Bracknell, on September 14th.

King Hussein viewed the company's range of electronics and communications equipment, including many new developments, on view at the Racal Group Presentation Centre.

At the end of his visit the King – a keen amateur radio enthusiast – was presented with the latest high technology Racal 3701 communications receiver by his host, Sir Ernest Harrison, chairman and chief executive of the Racal Electronics Group. The 3701 high frequency receiver is one of a new range of advanced equipment designed for use in a wide variety of applications.

Over the past few years

Racal has supplied a considerable amount of high frequency communications and tactical radio equipment now being used in Jordan.

LW frequency changes

The BBC is to change the frequency of Radio 4 long wave (low frequency) transmitters to 198kHz on 1st February 1988. The transmitters, which are located at Droitwich, Westerglen and Burghhead, are being moved from 200kHz (1500m) to 198kHz (1515m) as a result of the World Administrative Radio Conference (WARC) in 1979, which required all long wave stations to operate on a frequency spacing of 9kHz. Most receivers will need to be slightly retuned as a result of the change, although digital tuners will need to be reprogrammed.

The long wave transmitters, which carry the Radio 4 (UK) programme, operate as

frequency standards, being locked to rubidium drive sources.

For reception advice on the long wave transmitters, listeners may contact the Engineering Information Department, Broadcasting House, London W1A 1AA. Tel: 01-927 5040.

Wales Technology Centre

The opening of Britain's first regional technology centre, to be based at the Welsh Development Agency, Cardiff, designed to bring industry and the skills of the education sector closer together, was announced in September. Six other centres will open around the UK in the coming months.

An initial £100,000 is being used to set up the project. The money comes from the Pickup programme, which is jointly funded by the Manpower Services Commission and the Welsh Office Education Department, and the Department of Trade and Industry is also backing the venture. Dr Glyn O'Thomas has been appointed co-ordinator.

The centre will be managed by WINtech, the technology arm of the Welsh Development Agency, which exists to

assist the growth of all kinds of technology related companies in Wales and helps with new product acquisition and development, use of new production techniques, market analysis, training requirements and the improvement of industry's links with academia.

Training centre

NEC Electronics has just opened a new training centre at Milton Keynes. This has been set up to provide specialist training on advanced semiconductor products for equipment design engineers.

Currently, NEC are putting the finishing touches to a series of eight 2 and 3-way courses covering product subjects appropriate to the latest applications of semiconductors. The topics include courses on single chip microcontrollers, high performance single chip microcomputers, 16-bit microprocessors and peripherals, DSP and speech processing, 32-bit microprocessors, magnetic media controllers, graphics controllers and communications controllers.

All courses are produced to provide equipment designers with a thorough basic grounding in the product. Each topic follows a similar pattern of an introduction and overview, followed by a detailed description of the features of the devices and how to use them. Applications and hands-on sessions, including programming where appropriate, are major parts of each course.

£650,000 for polytechnic

The Department of Trade and Industry has announced that Hatfield Polytechnic is to receive over £650,000 in two separate projects.

The funding is to be provided to set up an 'awareness and training' centre at Hatfield for Advanced Manufacturing in Electronics and to support activities by Cimtech, the polytechnic's National Centre for Information Media and Technology.

Mr John Butcher, Parliamentary Under-Secretary of state for Industry, selected Hatfield as one of six polytechnics to receive

King Hussein of Jordan discusses communications with Sir Ernest Harrison, chairman of Racal Electronics



£150,000 to set up electronics centres. He earmarked Birmingham and North Staffs polytechnics to work jointly and others to receive money are Huddersfield, Polytechnic of Wales, Sunderland, Plymouth and Liverpool. Other centres will be created at Highbury College of Technology; University of Hull; Queens, Belfast; Napier and Strathclyde.

The regional network of Advanced Manufacturing in electronics (AMIE) centres are being established as part of the Government's programme to encourage industry to benefit from the latest AMIE techniques.

Six centres were initially to be funded, but because of strong demand it was decided to set up 12 over two years. The funding going to each will cover 50 per cent of costs over the initial two-year period, says the DTI.

Cimtech is to receive around half a million pounds in an initiative in which the centre will lend its expertise to the development and application of document imaging systems. A similar sum goes to the National Computing Centre at Manchester who will co-operate with Cimtech in the initiative.

The joint Cimtech/NCC project will establish a British 'centre of expertise' known as DISC (Document Imaging Systems Centre), which will be the focal point from which any interested party can obtain authoritative and impartial advice on all aspects of document imaging systems.

It will also set up a small number of 'demonstrator' sites, where working systems can be evaluated and put on show to potential users.

Cimtech will concentrate on the technologies, notably optical discs, and on large scale systems. NCC will deal with office automation issues, including relationships between document imaging systems and existing data processing and office automation systems.

The centre of expertise will be established at the two physical locations, Cimtech in Hatfield and NCC in Manchester.

The need for the initiative is

prompted by the estimate that around 95 per cent of information in offices is held solely on paper. Developments are now at a stage where consideration can be given to using new technologies which can store and retrieve such information and ultimately incorporate it into corporate databases.

Tulips and Amstrad jams

The Tenth Personal Computer World Show – thirty per cent bigger than last year – was the best attended so far, with large crowds queuing to enter on the first day.

The exhibition was tailored for the business and trade interests, although the presence of many top software houses lent a noisy carnival atmosphere to the serious business at hand. Even Mattel, the toy manufacturers, were represented, showing a state-of-the-art laser game.

Many visiting executives were seen testing the latest arcade entertainment before investigating the multitude of products from the UK, US, Europe and the Far East.

Tulip Computers tiptoed into the running this year, exhibiting their complete range of micros with small footprints – as you might guess, they are based in Holland, but will be opening an office in Crawley soon.

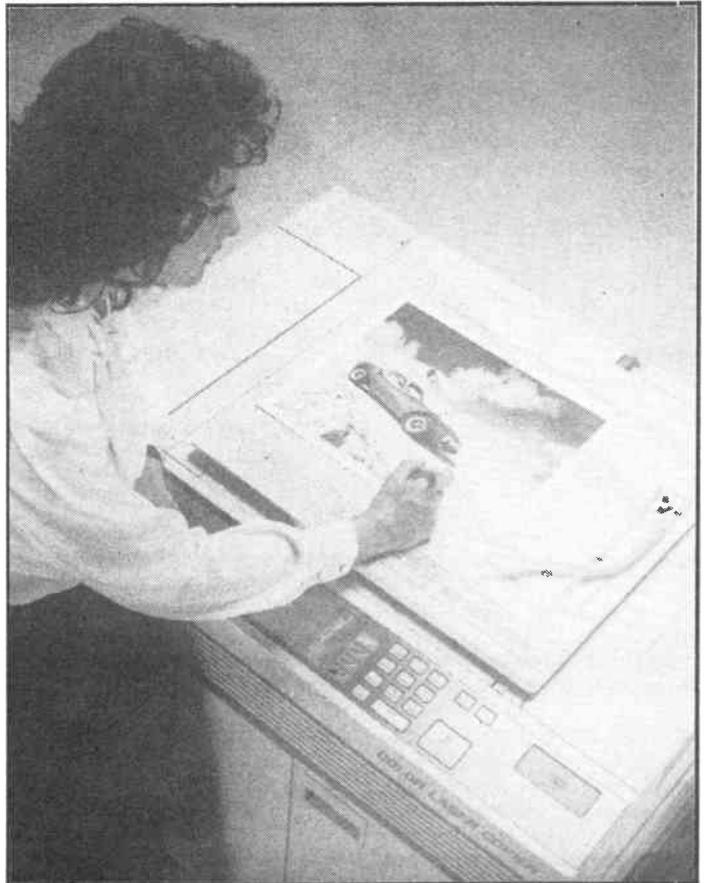
Amstrad launched the PCW9512 at the show, a word processor with a daisywheel printer of letter quality. Their prominent stand also contained their latest range of PCs, printers and software packages.

With Commodore and Atari camping themselves in convenient 'villages' – with clusters of related or service companies – the show offered a wide variety of PC related wares and services.

Desktop publishing was strongly represented at various stands, with Mirrorsoft, Letraset, Agfa and AST all promoting DTP products. All in all, a fascinating and most enjoyable experience.

Colour laser copier

Canon has introduced a 'revolutionary' colour laser copier, the world's first plain paper digital machine capable of high-quality full colour reproduction with a wide



The new simple to use Canon Laser copier

range of editing, formatting and colour creation/conversion features.

In creative applications, it is more a design tool than a copier, while for normal business use, it offers companies and organisations a variety of benefits and full colour copying for an economic price of £17,000.

The new machine benefits from Canon's expertise in laser printing technology and full colour reproduction.

Zorland C

The best selling Zorland C compiler is now available to universities and colleges of further education under the National Educational Software Scheme.

On payment of £1,000 Zorland will grant an educational site licence allowing unlimited use of the Zorland C compiler, full source code and library software. Zorland will also supply 50 sets of documentation with additional copies available at the cost price of £4.50.

Licences have already been purchased by Trent Poly-

technic and the University of Liverpool. John Haggins, managing director of Zorland C now and in the future. To do this we are trying to make it as easy as possible for educational establishments to select Zorland C for their courses'.

Zorland's educational site licence scheme was formulated with the help of Barry Barker, the National Educational Software Co-ordinator, who is based at Leicester Polytechnic. Harold Wise, head of computer services at the polytechnic, commented: 'There are tremendous advantages for institutions in purchasing software in this way. At Leicester we have 800 micros and you only have to do the arithmetic to understand the financial benefits, but it also helps us to expose students to the full range of software. It all depends on the responsiveness of the suppliers, and British companies like Zorland are much better at this than the Americans for instance.'



Solartron's 1201 Spectrum analyser using Violet software

Artificial Intelligence

Solartron Instruments is co-operating with Intelligent Applications Limited to initiate a significant step forward in measurement technology. The purpose of the joint venture is to directly couple artificial intelligence to measuring instruments to eliminate the requirement for costly and time-consuming expert intervention in many practical applications.

In the longer term the joint venture is addressing many applications where electronic instrumentation is used in conjunction with machinery, such as machine health monitoring and process control, with particular reference to preventive maintenance. Now becoming widely recognised as the most cost-effective method of ensuring trouble free running of machinery, preventive maintenance employs instrumentation to measure a range of parameters at regular intervals to predict the possibility of breakdown. The costs and inconvenience of catastrophic breakdowns and unnecessary speculative overhaul are therefore eliminated.

The first fruit of the new venture is VIOLET (Vibration Order List Expert), given its first airing in June at KBS 87. VIOLET is an IBM PC-compatible, menu-based software

package which is used with Solartron's 1201 spectrum analyser.

The 1201 produces a trace of vibration magnitude against speed of revolution which has clearly-defined peaks relating to the performance of various components in the machine. The information generated by the instrument previously required expert analysis, and an element of guesswork, to determine which components were faulty and the appropriate course of action.

Now the information from the 1201 can be input to VIOLET, which compares performance with an order sheet stored on disc and identifies out-of-spec and new vibrations.

The operator is given an opportunity to input relevant details such as increased noise levels. The system then indicates the most likely sources of trouble, and even produces trend information to show accurately when breakdown is likely to occur. Maintenance can therefore be scheduled and parts procured to minimise downtime.

Potential applications include maintenance of turbines, jet and diesel engines, rolling stock in mills, conveyors, trains, etc. Each application requires initial expert input, which can be supplied either by IA or the

user, to establish the rules. Thereafter operation, either online or using data pre-recorded on the 1201's disc storage system, is straightforward and can be carried out by relatively inexperienced personnel.

The Information Age

Plans were announced recently for the development of a national educational showplace and visitor attraction in Berkshire for the computer, communications and other advanced technology industries.

As envisaged, it will be one of the largest and most comprehensive facilities of its kind open to the general public, presenting the history, state of the art and future potential of the broad spectrum of information technology, and its application. Its intention will be to 'make technology come to life'.

The announcement was also a call to arms for companies involved with information technology whose moral and financial support will ultimately determine the success of the project.

Marconi secures NATO deal

The Secure Radio Division of Marconi Defence Systems (MDS) based in Portsmouth has won a contract valued in excess of £5m for the provision to NATO of a very low frequency (VLF) naval communications system.

The contract, placed by the British Ministry of Defence on behalf of NATO, was won in the face of severe international competition.

Secure Radio Division is well established in military communications for all three services, and has been involved in data processing for many years. The contract represents a significant expansion into the area of naval communications for Marconi.

The new system will automate current laborious manual processing techniques, provide greatly increased capacity and improve the flexibility of NATO submarine communications.

This will be achieved by the use of sophisticated computer processing combined with

specially developed automatic switching techniques and the latest advanced radio methods. All software will be prepared using the new NATO standard computer language, ADA.

When completed, the project will provide an advanced VLF system covering the NATO operating areas and offering modern, reliable and secure communications to NATO submarine forces.

Europe goes cellular

Racal Vodaphone and Telecom Securicor Cellular Radio are among the 13 cellular operators to have signed the Memorandum of Understanding on implementing a pan-European digital cellular service by 1991. The signing took place in Copenhagen on September 7th.

The Memorandum of Understanding commits the operators to a detailed timetable for the procurement of the new networks and the opening of a public service.

In welcoming the news, John Butcher, Parliamentary Under Secretary of State for Industry, expressed his pleasure that so many operators had already signed; only four countries were expected to do so by this date.

Racal Vodaphone and Telecom Securicor Cellular Radio, the operators of the two existing successful UK cellular radio networks, will also be the two UK operators of pan-European digital cellular telecommunications networks, and will offer competitive services.

Customers on their present networks will continue to enjoy a service with their present equipment but this will be limited to the United Kingdom.

As from 1991 new digital mobile equipment is expected to become available which will enable UK subscribers to not only enjoy a high quality public mobile radio service in the UK but also to be able to gain access to any other European country participating in the pan-European service.

Both vehicle sets and hand portables will be catered for in the pan-European digital system.

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

The successful launch of the European Space Agency's Ariane 19 rocket on 15th September had considerable significance for the Amateur Radio Satellite Service. After eighteen months of failures by the Western satellite launchers, the launch confirmed the ESA as being the world's top commercial satellite launch agency. The European Space Agency numbers thirteen member states - Austria, Belgium, Denmark, France, the Federal Republic of Germany, Ireland, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom. Finland is an associate member and Canada is linked to the agency by a co-operation agreement.

Ariane 19 launched two communication satellites, ECS-4 and AUSSAT K-3, the latter for Australian telecommunication satellite services. They were successfully launched into orbits which were practically identical to the intended orbits. Such very high injection orbit accuracy minimises the number of corrections necessary and thus saves the on-board propellant, hence prolonging the lifetime of the satellites.

This success should allow the V-21 launch to take place early in the New Year. The Amsat Phase 3-C satellite is due to be launched on V-21. The delay in its launch had one good effect: it provided time to prepare a new integrated housekeeping unit (IHU). This is a computer which controls the overall spacecraft operations under software control. The delay gave time to provide it with more 'radiation resistance' than there was on Oscar 10. This lack of adequate radiation resistance is thought to have been the cause of the IHU failure on Oscar 10. In addition, special tungsten 'appliques' were donated by Ross Forbes WB6GFJ for the new IHU and supporting circuit structures. These tungsten appliques are even more resistant to radiation than the tantalum covers used on Oscar 10 and on the Phase 3-A satellites.

Now that Oscar Phase 3-C is within sight of launching, the design of Oscar Phase 4 is beginning to make the headlines. Jan King W3GEY, Amsat-NA's Engineering Vice-President, who is overseeing the design of Phase 4, has recently given some indication of the way the design is progressing. It is to be a

geo-stationary satellite, as opposed to the orbital satellites previously launched. A team of twenty professional engineers and scientists are engaged on the project and numerous innovations which have never before been used on spacecraft are being investigated. One of the most interesting of these is the fluid momentum control, a unique momentum control system pioneered by Lou McFadin W5DID, an engineer with NASA. This system would eliminate the gyro wheel required by three axis stabilised spacecraft. The gyro or 'momentum wheel' is very expensive and since it has moving parts, it has a high risk of failure. It will pump a ferro-magnetic fluid around the spacecraft for momentum transfer and control. The pumping action would be magnetically powered, thus eliminating the need for a mechanical pump.

Unlike previous Oscars, Phase 4 will not spin or tumble but will be stabilised in three axes. To maintain this stability, occasional 'nudges' will be applied to the satellite. These nudges will come from minute jets on the spacecraft and a new type of propellant fluid is proposed for this purpose. As the fluid is expendable, the overall lifetime of the spacecraft is limited by the quantity of fluid which can be carried and a new highly efficient fluid is being investigated.

Much improved transponder electronics are being designed by Dr Karl Meinzer DJ4ZC of Amsat-DL. HELAPS technology is to be used, HELAPS standing for High Efficiency Linear Amplification by Parametric Synthesis. This technology has been patented by Dr Meinzer, as it is considered to be a very profitable system for producing vastly improved efficiency in linear amplifiers.

James Miller G3RUH is investigating the use of digital signal processing techniques, designed to automatically null select uplink passband frequencies when the uplink signal exceeds the desired strength. This would provide a means of putting a stop to the 'alligators' who persistently use excessive uplink power in their transponder transmissions.

Meanwhile a new Phase 3-D concept is under consideration which it is expected will be carried out under the supervision of Amsat-DL, with co-operation from

other Amsat organisations world-wide. It is to be much larger and more powerful than previous Oscars, with a transponder with an output of 250 watts pep. The uplink will be on 145MHz and 1269MHz and the downlink in the 435MHz band. It should be accessible by simple, low-powered amateur stations world-wide.

It is hoped to launch it early in 1988 into a Molnija type orbit, with visibility in the northern hemisphere of fifteen hours a day and in the southern hemisphere more than five hours a day. Its life expectancy is expected to be about eight years.

UoSAT operations

UoSAT-2 has a special schedule for educational establishments on Wednesdays. This was suspended during the summer vacation, but is running again now. The University of Surrey spacecraft team is anxious to receive reports on this programme and asks that those who listen to it should report on its reception and value. These should be sent to: UoSAT Mission Control Centre, University of Surrey, Guildford, Surrey GU2 5XH.

UoSAT-1 appears to have a 'stronger' downlink signal than UoSAT-2 at times, on similar passes. The reason for this was recently explained in the UoSAT Mission Control Centre Bulletin, No 105. Firstly, UoSAT-2's transmitter yields between 220mW at eclipse and 480mW in sunlight of RF output, dependent on battery voltage. The power taken by the VHF transmitter decreases as the battery voltage decreases to avoid excessive discharge. UoSAT-1 generally yields around 475mW and is rarely in eclipse at the time of writing. Secondly, UoSAT-2 is at 698km altitude whereas UoSAT-1 is at 478km altitude when overhead, so UoSAT-1 is some 3.2dB 'closer'. Consequently, dependent on the ground station antennas used, UoSAT-1 can be up to 6dB stronger than UoSAT-2 under certain circumstances.

Amateur radio licence revision

The RSGB recently published its proposals for a revision of the Amateur Radio Licence in *Radio Communication*, under the title *21st Century Licence*.

For many years there has been a feeling that a complete revision of the

amateur licence was long overdue. The schedule fiasco of 1982 was the trigger for a thorough overhaul of the schedule to the amateur licence, which was finally achieved some time ago, but ever since then the RSGB has wanted to get on with the rest of the job. Following recent careful consultation of the matter in depth, things have now reached the proposals stage.

The society feels that in order to increase interest in amateur radio they should be able to do more than just offer new recruits the basic requirements to enable them to communicate by radio.

However, as in most such interests it is necessary to maintain a balance. It is essential to ensure that radio amateurs have a sound basic knowledge of radio frequency techniques and operating aspects of radio communications. This means that encouragement must be given to simple, low power CW operation as well as to the high technology aspects of the hobby.

The RSGB is concerned that the experimental side of amateur radio is often hindered by present day licence conditions and the long, tedious time-scales involved when new ideas are put forward to the licencing authorities for approval. Future licences must be less

restrictive and more flexible.

So far the proposals towards these ends include such items as making the licence more logical and easier to understand; incorporating all the effects of past licence variations and interpretations into a main licence; bringing the licence into line with modern operating procedure; wording the licence in more general terms in order to provide sufficient flexibility for amateurs to carry out experimental work, thus making contributions to industry and the scientific world at large; producing a licence which caters for as many types of activity as possible, ie, Class A, Class B, maritime, message handling, and Raynet.

A big task, but it may come about sooner than we think. There are indications that the DTI would like this licence review to be completed within a matter of months – not years!

50MHz band for FM users

The RSGB's VHF Committee has decided to recommend a section of the 50MHz band for FM users. The FM channels will be 51.410 to 51.590MHz with 51.510MHz as the calling frequency. The standard peak deviation of 5kHz will apply. The committee hopes that this will

encourage FM operation in the centre top half of this band.

The ghost of RS1

The Russian amateur radio satellite RS1, which was launched on October 26th 1978, continues to be reported from time to time, sending '5015' in CW on 29.400MHz. The latest report comes from Toshi JR3FRF, who was listening for RS10/11. The transponder and telemetry ceased to function due to battery failure some years ago, but the transmitter still appears to be functioning when the solar panels become illuminated by the sun. These provide sufficient energy for RS1 to be heard sending these spurious telemetry signals (*from UoSAT Bulletin*).

ISWL 80 metre net

One of the most popular nets on the air must be the International Short Wave League's phone net on 3685kHz \pm QRM on Saturday mornings at 0930hrs GMT, SSB. The writer has so far worked around twenty-five different stations on this net. The net controller is Dick Rugg G2BRR, who manages to control the net with great diplomacy! Details of membership can be obtained from Jim May G1GWG, ISWL HQ, 10 Clyde Crescent, Wharton, Winsford, Cheshire CW7 3LA. 

NEXT ISSUE

Radio & Electronics

The communications and electronics magazine **World**

RTTY TERMINAL FOR THE AMSTRAD

A complete RTTY interface/terminal for use with the Amstrad CPC464/664/6128 range of computers

THE ST900 – FIFTY YEARS ON

The last of those well-known receivers designed by Mr John Scott-Taggart

PLUS ALL THE USUAL FEATURES!

On sale 10 December

To be sure of your copy, why not take out a subscription?

ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

Are the times changing? Slow-scan news is starting to come in regularly (thank you) but seventy centimetres has dropped off alarmingly! Anyway, sit back and enjoy three months' activity reports...

Microwave matters

My main area of interest at present is 3cm, says Bob Platts G8OZP. Equipment at present is a 30 inch dish with DIY cassegrain feed and homebrew LNB and Rx. Tx is an 8mW Gunn diode. On the 16th August the equipment was set up in the car park on Clent Hill, 10km south of Dudley. Much to the fascination of visitors, P4-5 pictures were received from Dave G8NND 83km away on Merryton Low, north Staffs. The path is marginal line-of-sight.

Later Dave moved to another location at a similar distance, but 500ft lower, not line-of-sight and with two obstructions. Again P4-5 signals were received from Dave and after a transmission of ¾ hour duration, Dave managed to take a P0.5 from me. Funny stuff this 3cm... All transmissions were on 10.250GHz FM with 3MHz deviation. If any other members are looking for 3cm contacts, I am in the callbook. I shall also be active during the International and Autumn Vision contests.

Eric GW8LJJ wishes he could have stayed longer at Crick, but had to get back to south Glamorganshire. He congratulates Viv from Bristol for her enthusiasm. On Monday, the day after the convention, she was on top of a Welsh mountain working /P on 24cm.

I was travelling back to south Wales from Rugby that day, and during my trip I called in from time to time to enquire how she was doing in the contest. She was doing very well, eight contacts on 24cm at last count. Well done, Viv - Contest Manager award her the prize! But Viv, why choose a Welsh mountain? Give us GWs a chance!

I hope to join Viv and everyone else on 24cm in the next contest (international), as I have the homebrew receiver working and, after a struggle, the transmitter oscillator is also in operation. The Tx is Peter Johnson's design - sorry, redesign. I etched the new-design PCB and mounted all components. Upon switching on, the oscillator did not start. I realised that I had no ground-plane! A piece of tinfoil was glued to the back of the PCB and pins were soldered through... still no oscillation! A 2pF2 capacitor, soldered between base and emitter of the BFR91 oscillator transistor, soon brought it to life.

'Feeding video into the unit gave good depth of modulation (deviation). I am

now working on the PA stages, so hopefully GW8OOJ/P will be on 24cm. I am also contemplating 10GHz. I look forward to working quite a few of you in the contest and Viv - stay in Bristol!

Foreign reports

In Belgium, ON9CAA and ON1WW are proposing an ATV repeater near Opplabbeek. It would have input on 24cm and output on 70. An application is with the RTT administration and we'll relay more news when we have it.

From Albany (New Zealand) our regular correspondent advises that the Wellington VHF group favours four AM 24cm channels, to be used as extenders (translators) to their primary repeater (callsign ZL2WA) on 443.25MHz in, 614.25MHz out. ATV operators in Auckland and Christchurch, on the other hand, favour two FM TV channels instead and Ian ZL1TOQ and Ralph ZL1TBG have both built equipment from BATC designs.

The Hawkes Bay VHF group has established a new ATV repeater. Vision is on 443.25 in, 614.25 out and sound is on 448.75 in, 619.75 out. Power output (AM) is 5 watts, with a 15dB gain corner reflector located at Temata Peak, 300 metres above sea level. The repeater normally works as a beacon, radiating a test pattern and QSL information. A speech synthesizer on the sound channel says '614.25MHz' followed by a series of tones and then repeats the sequence. Fascinating!

News from Oxford...

Jeff G8PX flies the flag for Oxford with a detailed report (I wish I received more like this!). He congratulates the BATC committee for its organisation of the Crick rally; he enjoyed it very much and thinks it one of the finest in the rally calendar. On 70cm activity has fallen off a bit, but we have one newcomer who lives at Wantage, about 12 miles south of Oxford.

He is G3CU and he took up ATV after seeing some of the local group's pictures. He has built the BATC converter and low-power transmitter, which is boosted to 20 watts with a MM linear. Despite the hills, P2 to P3 pictures have been swapped with G8PX. An improved aerial and masthead pre-amp at G3CU should give improved results.

G6ZSI lost his aerials in the gale (they are still on the ground) and G6YTW also had damage. New aerials are promised soon. G0CAD has moved to Wallingford and has been testing out his new aerials on ATV.

Moving up to 24cm, G8SIN and G6MSQ were seen to buy the Solent 1 watt

transmitter from the Worthing Group stand and G6MSQ also purchased a Bristol FM Group aerial during the Crick rally. Further news is eagerly awaited by G6ZHC, who is looking for a local to start, as it's a bit lonely on 24cm in the Oxford area.

Jeff himself started to build some hardware for a Spectrum-based SSTV system two years ago but never finished it as he became hooked on fast-scan TV. After getting inspired at Crick, he finished off the hardware and it is now working on tape only. He also has a software-only system, from Crick. As soon as he has got it working he hopes to start a local net on 144.4MHz with other Spectrum users.

G8PX is also building the G8CGK pattern generator from the *Slow Scan Companion* and remarks on the excellent value for money of the BATC's PCBs. Namechecks for the above are G0CAD Dave, G6ZSI Eddy, G6ZHC Barry, G3CU Bert, G6YTW Tony, G8SIN Dermot and G6MSQ Chris. Thanks for the news, Jeff.

From Greece...

D Valaris SV1UY from Byron (which I assume is a suburb of Athens) reports that SSTV activity has been quite good throughout the summer months, despite holidays and other engagements. He worked LX1DA, ZP5CCG, VO1BL, 5B4CV, OK3ZAS, ZS6BDT, 11HJP, JA8PPE, C3ISD, G14FZD and, of course, Dick G4RRX and Robert G4TUK. Also DL1HBN, SP4KM and many other stations around Europe. 'It seems', he says, 'that SSTV will never die as some people say because there are many people who like it very much.'

'Here in Greece some new SSTV stations are showing up and I must mention SV1AFN, SV1UG, SV1EF and SV1VV who use Commodore and Spectrum programs. The only other person with camera facilities, apart from myself, is SV1OJ. I forgot to mention SV1PC, who was active last year with a home made phosphor monitor and a flying spot scanner, but abandoned the scanner because it was too big for his shack.'

'He wants to start SSTV activity again very soon. As for myself, I hope to be QRV on 70cm ATV very soon; I have already built a simple 100mW exciter from *The Best of CQ-TV*. The aerial will be a 15 element yagi with a small amplifier to raise the power output to about 1 watt.'

He continues: 'I would also like to mention the SSTV plague of 20 metres. It is an IS0 station (callsign supplied) who is interfering with everyone talking on 14230kHz, including SSTVers talking about SSTV and exchanging pictures. He never listens carefully and has nearly

ATV ON THE AIR

spoiled many nice DX QSOs in SSTV, including my own. I have heard that many people have written letters to him and to the IARU. In the last few days I have not seen him QRMing, but saw another SSTVer from Sardinia doing the same thing. Maybe he is his successor, HI.

'If anybody knows about the PCB for the Robot 400, any photographs, photocopies or the address where these can be obtained, please let me know. I will cover all costs for copying and postage. Write to me at 24 Grigoriou E Str, GR-162 31 Byron, Athens, Greece. Thanks.'

... and from Sweden

Helmer Lindquist SM6CCD replied to a letter I sent to him on behalf of EATWG inviting Swedish ATVerS to appoint a representative to the European ATV Working Group. Helmer sends us his support and mentions that they have no more than perhaps 10 to 12 people interested in ATV in Sweden and there is thus no ATV manager for SM. All the same, Helmer is prepared to act as intermediary.

Slow-scan activity

Sandy Pimlott G8IDE writes from St Budeaux (Plymouth) with some snaps he has taken from the screen. He uses a home-brewed SSTV monitor and has recently much improved the camera using plastic drainpipe and plant-pots. Some of his best reception has been on 14.230MHz (20 metres).

From Treverva near Falmouth a letter comes from Roland G4UKL, who pays tribute to Richard G3WW. 'Richard was the doyen of slow-scanners and will long be remembered for his patience, unfailing kindness and courtesy. He was always reminding us to follow our colour transmissions with 'just a couple of frames of 8-second black and white, for

those not fortunate enough to receive colour'. The strain of selling his house and moving, never an easy thing to do at his age, put him off the air for quite a time and must have worried him.

'The contest referred to by G2BMI was in fact organised by IVCA and was won by the same HA1ZH mentioned by Jim. Not surprising, considering he was on the air day and night for seven days - we wondered when he slept! There will be another marathon contest early in 1988 and I will send details to CQ-TV. The contest is almost 100 percent SSTV orientated, with very few ATV entries.'

Roland also tells us of the International Visual Communication Association, an informal association of amateur radio enthusiasts with a high interest in all forms of visual communication. Roland is UK correspondent and won a trophy in the contest.

Member interaction

'There are members', he says, 'in every country where visual communication is allowed. It is located at 99 Oenoke Lane, New Canaan, Conn 06840, USA. The object of the association is the enjoyment of our hobby by the interaction amongst members and amateurs in general, accomplished by nets, contests, newsletters, dissemination of technical information and just plain fun.'

'An annual donation of \$10 is asked (\$100 buys a life membership) to cover the cost of printing, postage and trophies. Members on low incomes or having a hard time donate what they can afford. Through ICVA, he continues, it will eventually - and hopefully - be possible to net all continents with better sited stations relaying transmissions. An interchange of pictures with, say, India and the Pacific will be possible via a relay in Switzerland.'

'The international spread is well illustrated in the list of successful contest participants. I have, on several occasions, enjoyed a two-way colour picture exchange with stations in the Los Angeles area, via a Florida station... as we say, all good fun and in keeping with the experimental clause in the licence.'

'Just for information, my station in south-west Cornwall consists of a Trio TS940S (modified by Lowe), a Yaesu FT102 as backup, a TL922 linear and a three element tri-band beam. I also have a Robot 1200C, modified to store four high resolution colour pictures and with SC1 compatibility (courtesy of G3OQD), to BBC Master computer with Philips high-res colour monitors.'

'Pictures can be transmitted from camera, domestic TV, computer graphics or from disc and tape library, with immediate switching between sources. The Robot is almost entirely controlled by the computer. It will, for example, instruct the Robot to transmit any number of frames (sequentially, from memory) at any speed, in either Robot or SC1 format. The same program will also, if requested, send the VIS line twice to ensure sync setting.'

'Fast-scan ATV is a dead duck in this area of Cornwall; there is too much granite to soak up the RF and consequently no interest, as far as I am aware. The scene with SSTV is better; there are now four stations with colour capability and a dozen more with black and white, using Spectrums and DRAE'.

Signoff

That's it for this time: does anyone want to redress the balance on 70cm? Let's have plenty more reports in time for the next issue, please and send them to me, care of the editor at Sovereign House - thanks!

My appeals for more feedback from you out there in 934-land seem to have borne fruit at last and, as a result, I have had some useful letters to stimulate thoughts.

Don't forget that the current misty weather can also mean lifts; the abnormally warm weather we are having as I write these words is a good sign. Look out for a calm day followed by rapid cooling down in the evening. Heavy dew on cars outside and fog are further indications that conditions may get lively in the evening. Unusual patterning or continental interference (with requests to please not adjust your set) are the clincher. When a tropospheric opening or 'lift' occurs, DX stations come in like locals and you may well find yourself glued to the rig trying to work stations 100, 150 or 200 miles away. Spring and autumn are traditionally the best time for openings, giving enhanced propagation, but they can also occur on hot days in

NETWORK

934

Andy Emmerson G9BUP

mid-summer and during bright spells in mid-winter.

Further propagation

Someone who is no stranger to long distance propagation is Mike Devereux, the Nevada Communications man. He issues a special certificate for 934MHz contacts made to his headquarters station Tango Charlie 01 in Portsmouth,

and so far around 90 of these certificates have been issued for contacts in excess of 100 miles. You too can obtain one by working TC01; Mike and the crew monitor the band from 0930-1730 Monday to Saturday and for selected periods on Sundays.

Mike is particularly interested in studying propagation at 934MHz and has just completed lengthy trials over a 170km path to compare the effects of vertical and horizontal polarisation at these distances. Many people have been waiting for some definitive findings on this subject, and here are the results.

Using just a simple 12 element loop yagi, with 8 watts at the antenna and an ultra low noise preamplifier, Mike has been able to maintain contacts over this path via troposcatter. Many comparisons were made between vertical polarisation (normal on 934MHz) and horizontal during a period of some six months, and the following was found:



U.K. 569
Mick Miller, P.O. BOX 94
SITTINGBOURNE, KENT.
ME9 7LZ ENGLAND.

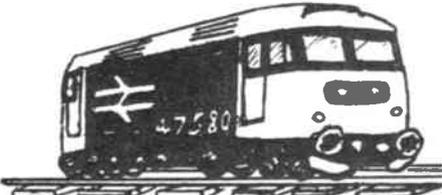
STATION	DATE	TIME	FREQ

MODE	RST	QRM	
		QRN	
		QSB	

MY QTH

TRX

ANT



QSL card from Mick Miller UK569 of Eastwood in Essex

■ Horizontal polarisation gave less fading on the path with approximately 2dB longer peak signals.

■ With vertical polarisation, fading was much deeper and on many occasions the signal would disappear into the noise level for 30 per cent or more of the time.

'It must be stated', says Mike, 'that these differences are on 'beyond the horizon' contacts. On a 'line of sight' path they could detect no difference in signal levels when working either vertical to vertical or horizontal to horizontal beams. Obviously, when one antenna is horizontal and the other vertical, rejection of up to 25dB was obtained'.

This is fascinating stuff for me, and I am sure that readers who also have a serious interest in the band will be grateful to Mike for sharing his findings. It also illustrates what I have always thought, that on normal local contacts there is nothing to be gained by changing to horizontal polarisation, as this will make it much more difficult for mobiles (who are restricted to vertical antennas) to keep in touch. The only exception would be in districts where cellular radio breakthrough makes horizontal working essential, but I have heard no problems of this kind lately.

Frequency feedback

Last time we discussed the DTI's proposed new technical specifications for the 934MHz band, which had been made in view of the intention to establish a common European specification for 933-935MHz personal radio apparatus. You will recall that Mr Maxwell of the DTI had explained that the choice lay between an analogue Swiss-style system or a brand new digital one.

The existing specification, MPT1321, it was explained, had come to the end of its useful life and would be withdrawn, probably in 1989, before the new norms are introduced (which is expected to take place in 1990). Existing equipment and frequencies would remain in use until at least 1990, when the radio spectrum was being reviewed, and every

effort would be made to ensure that the new specs would take account of existing users and avoid potential interference.

John UK152, from Chasetown, rang me to say that he feels this statement is ambiguous, and gives no long term security to users of our band. He questions the reason for cancelling the MPT1321 specification and says that withdrawing the right to import Tx's is the same as taking away the band.

Good question, and in truth no one knows the answer, but there are several points to be noted. For a start, there is still plenty of time to import more sets and, indeed, there are a goodly number in the country already, setting aside all those already in use on the air. Inevitably, demand for sets of this kind would decline once the new system (whatever it turns out to be) was announced, and it would be clearly unrealistic for dealers to sell 'old-style' sets to customers who wanted to use the new personal radio system.

Guessing the future

What is totally unclear at this stage is how long the present kind of 934MHz operation will hang on, how long it is permitted and how long there are users still keen on the system. What is also unclear is whether PARS, the government's preferred digital short range radio system, ever comes into being and what progress the analogue system used in Switzerland and now Holland makes. My own guess is that PARS will never happen and that a hard core of 934 users will keep the flag flying!

On the same subject, Mike Devereux, Britain's largest importer and supplier of 934MHz equipment, is quietly confident. 'I have had several meetings with the DTI', he says, 'and they have assured me that the department has no intention of taking away the 934MHz band. They intend to introduce a short range radio service in the early 1990s and this service will have to take account of the existing 934MHz CB radio users.'

'I understand that a new specification will be introduced for equipment in the 933-935MHz sub-band, probably in several years time. Because of its introduction, the current specification will be withdrawn. The effect of this withdrawal will be that we may not import any further radios to the old specification; however, we may continue to sell all of our existing stocks of Delta 1 934MHz transceivers. Prospective purchasers will be able to use these radios for the life of the sets (which will be quite considerable). For our part, we are carrying large stocks of spare parts and will be in a position to maintain and service Delta 1 transceivers for many years to come. I expect the existing use of the 934MHz band to continue for many years, together with my company's commitment to that band.' That spells it out!

I am still waiting for information from the Netherlands to see what particular kind of 934MHz system will be established there - at least I have identified the right government department and we just await their reply! John UK152 has been sounding out opinion on an automatic personal radio system in the Midlands, where he has been taking some PRS sets lent by Jim Finch to rallies and club meets. Assuming that PRS has its own set of channels on 933MHz, quite a few people say that they would buy these (dual system) sets. They like the privacy of PRS and the idea of using the same radio for personal conversations and for open channel nets.

A welcome letter has arrived from Mick Miller UK569 in Eastwood, Essex who says, 'I enjoy your efforts in *Network 934*. It's a pleasure to read about 934 activities without having to buy a CB mag!'

'I have been on the band now for almost three years and am actively involved with the Essex area group of the 934 Club UK. We have recently had our annual mobile rally at Brentwood. The Southend and District amateur radio society came along and gave us a demo with HF, two metres and Packet radio, which all went down very well with those who attended. It was nice to see so many amateur stations there who were taking a keen interest in the 934 stations operating.'

'The station this end is a Delta 1, PA-7 collinear and 12 element loop yagi. Operating conditions here are very good, with quite a few amateur stations using the band and all stations with a high degree of operating procedure. To any stations who have thought about 32cm, all I can say is come and join the gentlemen's band - you won't regret it!'

Thanks for a great letter Mick - 934MHz and amateur radio co-exist well together and I am pleased to hear of the excellent co-operation in your neck of the woods. Let's have some more letters, photos and QSL cards now - no need for false modesty!

VISA
PHONE
0474 60521

P.M. COMPONENTS LTD

SELECTION HOUSE, SPRINGHEAD ENTERPRISE PARK, SPRINGHEAD ROAD, GRAVESEND, KENT DA11 8HD

TELEX
966371
TOS PM

INTEGRATED CIRCUITS

AN103	2.80	LA4300	2.50	AL12970	1.10	TA7609P	3.80	TCA760	2.50	UJA4050	2.00
AN143	2.50	LA4461	3.25	SN7474	1.80	TA7811AP	2.90	TCA800	2.50	UDA4600	2.80
AN214	2.50	LC7120	3.80	SN7429	0.85	TA7829	2.50	TCA800	0.95	UDA9503	3.15
AN214Q	2.50	LC7130	3.80	SN76023N	3.90	TAA310A	3.80	TCA8305	1.95	TEA1099	1.35
AN236	1.00	LC7131	3.80	SN78110N	0.80	TAA320A	3.50	TCA900	2.50	UPC410C	3.50
AN239	2.80	LC7137	3.50	SN78155N	1.25	TAA350A	1.95	TCA940	1.85	UPC566H	2.05
AN240P	2.80	LM322K	4.95	SN78131N	1.90	TAA550B	1.95	TDA440	2.20	BA156	0.18
AN247	2.50	LM324N	4.80	SN7622DN	4.80	TAA570	1.95	TDA1000	2.95	UPC575C2	2.75
AN260	2.95	LM360N	1.90	SN7622DN	2.95	TAA621	3.95	TDA1003A	3.95	UPC10001H	1.95
AN282	1.95	LM3808N	3.80	SN76227N	1.05	TAA6320S	2.90	TDA1008A	2.90	UPC1020H	1.95
AN284	2.50	LM383T	2.95	SN76228N	2.95	TAA661B	1.95	TD1010A	2.50	UPC1024H	2.95
AN291	3.50	LM390N	3.80	SN78533N	1.95	TAA700	1.70	TD10105	2.15	UPC1025H	1.95
AN301	2.95	SA1011	3.15	SN76550N	1.15	TAA930	3.95	TD10105	2.15	UPC1025H	1.95
AN303	3.50	MS155L	2.95	SN76560N	0.80	TBA120AS/B/C	1.00	TD10105	2.15	UPC1025H	1.95
AN313	2.95	MS1513L	2.30	STK011	7.95	STK011	7.95	TD10105	2.15	UPC1025H	1.95
AN315	2.25	MS1521L	1.80	STK014	7.95	SAVSB/TJU	1.95	TD10105	2.15	UPC1025H	1.95
AN316	2.95	MB3705	1.50	STK015	8.00	TBA231	1.30	TD10105	2.15	UPC1025H	1.95
AN331	3.00	MB3712	2.00	STK018	7.95	TBA398	1.95	TD10105	2.15	UPC1025H	1.95
AN342	2.95	MC1357	2.95	STK025	11.95	TBA398	0.75	TD10105	2.15	UPC1025H	1.95
AN382L	2.50	MC1307P	2.00	STK032	7.95	TBA440N	2.95	TD10105	2.15	UPC1025H	1.95
AN612	2.15	MC1310P	1.95	STK078	11.95	TBA480Q	1.25	TD10105	2.15	UPC1025H	1.95
AN6382	3.95	MC1327	1.70	STK085	8.00	TBA510	2.50	TD10105	2.15	UPC1025H	1.95
AN7140	3.50	MC1327Q	0.95	STK415	7.95	TBA510Q	2.50	TD10105	2.15	UPC1025H	1.95
AN7145	3.50	MC1349P	1.75	STK433	8.00	TBA520	1.10	TD10105	2.15	UPC1025H	1.95
AN7159M	3.95	MC1357	2.95	STK435	8.00	TBA520Q	1.10	TD10105	2.15	UPC1025H	1.95
AN7150	2.95	MC1350P	1.75	STK437	7.95	TBA530Q	1.10	TD10105	2.15	UPC1025H	1.95
AN7151	2.50	MC1351P	1.75	STK439	7.95	TBA530Q	1.10	TD10105	2.15	UPC1025H	1.95
BA521	3.35	MC1358	1.95	STK461	11.95	TBA540	1.25	TD10105	2.15	UPC1025H	1.95
CA1352E	1.75	MC1495	3.00	STK463	11.95	TBA540Q	1.25	TD10105	2.15	UPC1025H	1.95
CA308	0.45	MC1496	3.00	STK463	11.95	TBA550Q	1.95	TD10105	2.15	UPC1025H	1.95
CA123E	1.95	MC1723	0.75	STK0029	7.95	TBA580Q	1.45	TD10105	2.15	UPC1025H	1.95
CA3131EM	3.50	MC3357	2.75	TA7061AP	1.90	TBA570	1.00	TD10105	2.15	UPC1025H	1.95
CA3140s	2.50	MC1406P	2.95	TA7072	2.85	TBA651R	2.50	TD10105	2.15	UPC1025H	1.95
CA3140T	1.15	MC14518PC	2.95	TA7073	3.00	TBA673	1.95	TD10105	2.15	UPC1025H	1.95
ETT6018	2.50	MC14518PC	2.95	TA7073	3.00	TBA720A	2.45	TD10105	2.15	UPC1025H	1.95
HA1137M	1.95	MC14518PC	2.95	TA7108P	1.95	TBA750	1.95	TD10105	2.15	UPC1025H	1.95
HA1159W	1.50	MC14518PC	2.95	TA7120P	2.50	TBA750Q	2.85	TD10105	2.15	UPC1025H	1.95
HA1306	1.50	MC14518PC	2.95	TA7130P	1.95	TBA800	0.80	TD10105	2.15	UPC1025H	1.95
HA1322	1.95	MC14518PC	2.95	TA7137P	1.00	TBA810AS	1.95	TD10105	2.15	UPC1025H	1.95
HA1339A	2.95	MC14518PC	2.95	TA7146P	1.50	TA810P	0.85	TD10105	2.15	UPC1025H	1.95
HA1369W	2.75	MC14518PC	2.95	TA7146P	1.50	TBA810P	0.85	TD10105	2.15	UPC1025H	1.95
HA1377	3.50	MC14518PC	2.95	TA7146P	1.50	TBA820M	0.95	TD10105	2.15	UPC1025H	1.95
HA1406	1.95	MC14518PC	2.95	TA7146P	1.50	TBA820Q	1.45	TD10105	2.15	UPC1025H	1.95
HA1551	2.95	MC14518PC	2.95	TA7146P	1.50	TBA890	2.50	TD10105	2.15	UPC1025H	1.95
LA1201	0.85	MC14518PC	2.95	TA7146P	1.50	TBA920	1.85	TD10105	2.15	UPC1025H	1.95
LA1230	1.95	MC14518PC	2.95	TA7146P	1.50	TBA920	1.85	TD10105	2.15	UPC1025H	1.95
LA3201	0.85	MC14518PC	2.95	TA7146P	1.50	TBA990	3.35	TD10105	2.15	UPC1025H	1.95
LA4101	0.85	MC14518PC	2.95	TA7146P	1.50	TBA990	3.35	TD10105	2.15	UPC1025H	1.95
LA4102	2.95	MC14518PC	2.95	TA7146P	1.50	TBA990	3.35	TD10105	2.15	UPC1025H	1.95
LA4140	2.95	MC14518PC	2.95	TA7146P	1.50	TBA990	3.35	TD10105	2.15	UPC1025H	1.95
LA4031P	1.95	MC14518PC	2.95	TA7146P	1.50	TBA990	3.35	TD10105	2.15	UPC1025H	1.95
LA4400	3.50	MC14518PC	2.95	TA7146P	1.50	TBA990	3.35	TD10105	2.15	UPC1025H	1.95
LA4420	3.50	MC14518PC	2.95	TA7146P	1.50	TBA990	3.35	TD10105	2.15	UPC1025H	1.95
LA4422	2.50	MC14518PC	2.95	TA7146P	1.50	TBA990	3.35	TD10105	2.15	UPC1025H	1.95

DIODES

AA119	0.08										
BA115	0.13										
BA145	0.16										
BA148	0.17										
BA154	0.08										
BA156	0.18										
BA157	0.30										
BA244	0.75										
BA301	0.75										
BA302	0.85										
BA313	0.75										
BA317	0.95										
BA328	2.95										
BA521	1.75										
BAV21	0.30										
BAW62	0.18										
BAK13	0.04										
BAK16	0.12										
BB1205B	0.30										
BT151	0.70										
BY126	0.10										
BY127	0.11										
BY133	0.15										
BY164	0.48										
BY178	1.20										
BY182	0.68										
BY184	0.38										
BY189	0.40										
BY206	0.14										
BY206-800	0.33										
BY210-800	0.33										
BY223	0.90										
BY298-400	0.25										
BYX90	0.22										
BYX110	0.20										
BYX25-600	1.25										

PUSH BUTTON UNITS

Decca/ITT	6way	7.95	C81(a)ie	6way	14.90
Decca	4way	7.95	ITT	7way	10.50
Hitachi	4way	11.95	Neons	7way	12.50
Pye	6way	10.35	Rank	4way	10.50
GEC213	6way	9.95	Rank	6way	10.50
GEC210	6way	10.50	Luxor	6way	11.00
GEC	6way	10.50			

FUSES

2mm Q/B	0.06 each				
100 MA	200 MA	250 MA	500 MA	1	
AMP	1.25 AMP	1.5 AMP	1.6 AMP	1	
2 AMP	2.5 AMP	3.15 AMP	4 AMP	1	
Special offer: 100 per type	4.90				
20mm A/B	0.15 each				
100 MA	150 MA	160 MA	250 MA	1	
500 MA	800 MA	1.25 AMP	1.6 AMP	1	
AMP	2 AMP	3.15 AMP	5 AMP	1	
Special offer: 100 per type	11.90				
1.25 inch Q/B	0.06 each				
250 MA	500 MA	750 MA	1 AMP	1	
AMP	2 AMP	3 AMP	7 AMP	1	
AMP	Special offer: 100 per type	4.00			
1.25 inch A/B	0.15 each				</

UNILAB SCHOOLS SATELLITE PROJECT

Alan Pickard presents the

UOSAT GROUND STATION PACKAGE

This review concerns the UoSAT receiving and decoding system from Unilab. For details of the weather satellite system see Part 1 of the review article in the October issue of *Radio and Electronics World*. This system is intended for use with the BBC B, B+ or Master 128 micros. A monitor (colour if possible), printer (Epson FX80 type preferably), disc drive and cassette recorder are required.

The UoSAT series

The UoSAT-1 satellite (also known as OSCAR 9) is the result of the work of the Department of Electronic and Electrical Engineering at the University of Surrey in Guildford. The alternative acronym OSCAR stands for Orbital Satellite Carrying Amateur Radio, indicating that one of the functions of the spacecraft is to allow amateur radio operators to transmit and receive signals to and from each other via space.

The altitude of UoSAT-1 is 554km (344

miles) and its polar orbit is 95 minutes. Telemetry information is transmitted on 145.825MHz. The 'other' satellite is UoSAT-2, or OSCAR 11. This orbits at 700km altitude with a polar orbit time of 98 minutes.

Both UoSATs transmit telemetry information relating to experimental data collected by onboard instruments, eg near-earth electromagnetic fields, solar and geomagnetic disturbances, etc. In addition to this, information concerning the spacecraft's onboard electronics, state of solar cells, etc is provided.

Further details can be found in the *UoSAT Spacecraft Data Booklet* (Unilab cat no 990.124). This consists of 40 A4 pages of very detailed descriptions of hardware, technical specifications, block diagrams of spacecraft, sub-units, etc.

Unilab system outline

The UoSAT ground station package is

detailed as follows: UoSAT receiver, with leads; UoSAT data demodulator, with lead; UoSAT receiver antenna, with phasing harness; UoSAT RF preamplifier; coaxial cable, 10 metres with connectors; SAT-PACK 1 orbital prediction software (40T disc, manual); SAT-PACK 2 and 3 telemetry and graphics software (3 x 40T discs, sample tape, manual).

In addition, the package includes Surrey University data display software (2 x 40T discs, manual); Surrey University data display booklet and the Schools Satellite Project Master Manual.

Apart from the BBC Micro system (detailed later), everything required for a fully operational ground station is provided. *Figure 1* shows the basic set-up for the complete receiving, decoding and displaying system.

Ground station package

Before looking at the system components in detail and then describing its operation fully, it is worth mentioning that the system reviewed was carefully and thoroughly packed and presented no difficulty in assembly of the aerial or in getting the various items to function correctly.

The documentation and full range of software is quite substantial and consists of three packages with a total of six discs, 1 cassette and 3 software manuals. In addition, there is the Master Manual (detailing UoSAT and NOAA systems) and the UoSAT booklet, which is very informative. Compared to the Unilab

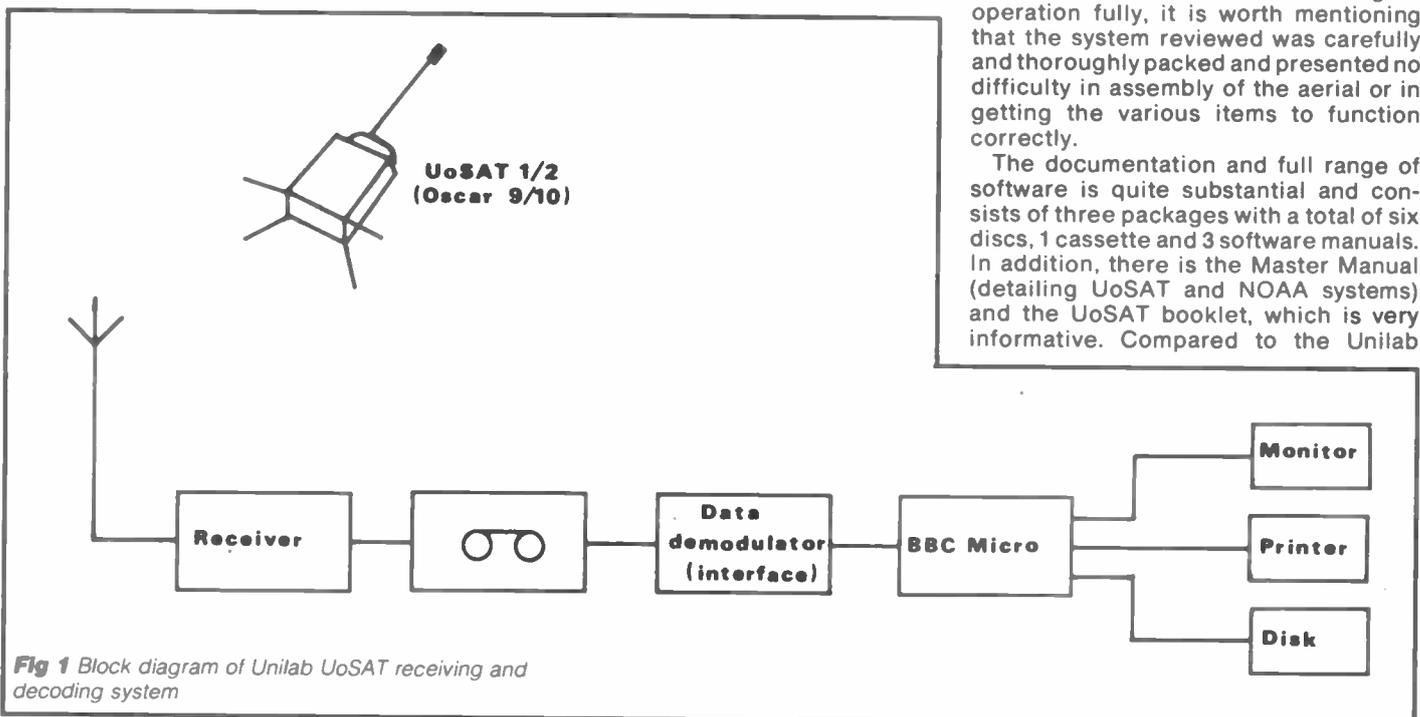


Fig 1 Block diagram of Unilab UoSAT receiving and decoding system

weather system the software is more substantial, as it plays a very large part in dealing with the received data. In some ways, the raw data received is of very little value without all of the software. It is possible to decode data manually or even to write your own decoding programs, but this would be rather tedious and very time consuming. The software and its facilities represent a major part of the system.

Hardware

■ **Aerial:** The aerial is a 5 element, left-hand, circularly polarised crossed Yagi, consisting of one pair of crossed dipoles, one pair of crossed reflectors and three pairs of crossed deflectors. This aerial is rather large and would require substantial support, particularly if roof-mounted.

Although it is highly directional due to the number of director elements, it can be used satisfactorily in a fixed position. An optional RF amplifier can be used to improve signal to noise ratio and provide error-free text. This is simply inserted between the aerial and co-ax feeder.

Full instructions are given on assembly and installation, including the connection of the phasing harness. All that is required is a small screwdriver and an adjustable spanner for mounting the aerial onto a mast.

My installation consisted of the aerial clamped to a broom handle, which was then gripped in a Black and Decker Workmate in the centre of the lawn (this method was also used for the weather receiver aerial, see Part 1). This arrangement worked ok, but was pushing the strength of the (wooden) mast to its limits!

Ten metres of co-ax cable terminated by BNC plus at the receiver end and N-type at the aerial end are provided.

■ **Receiver:** The receiver unit is in the form of a flat, orange-topped steel case, measuring about 24cm x 13cm x 4cm. It is clearly labelled for connection of aerial (BNC socket), power supply (banana sockets) and a 75 ohm type 'aerial' socket for connection to a tape recorder (MIC) input.

A 4mm jack socket enables connection to the REMote socket of a portable cassette recorder. Aerial and cassette leads are included.

As the unit is intended for school lab use, a bench power supply is assumed to be easily available. Another reason for this is that the 16-18V ac or dc supply input can be achieved using lamp batteries, enabling the receiver to be operated outside without the constraints of mains supplies. Presumably, an optional mains unit would increase the cost of the unit and also make it slightly heavier. Current requirements are typically 150mA.

The receiver unit includes an audio amplifier and speaker which enables the monitoring of the satellite signal during (attended) recordings, or just when listening to a pass. This audio output is

AMSAT-UK CALENDAR.

AMSAT OSCAR-9

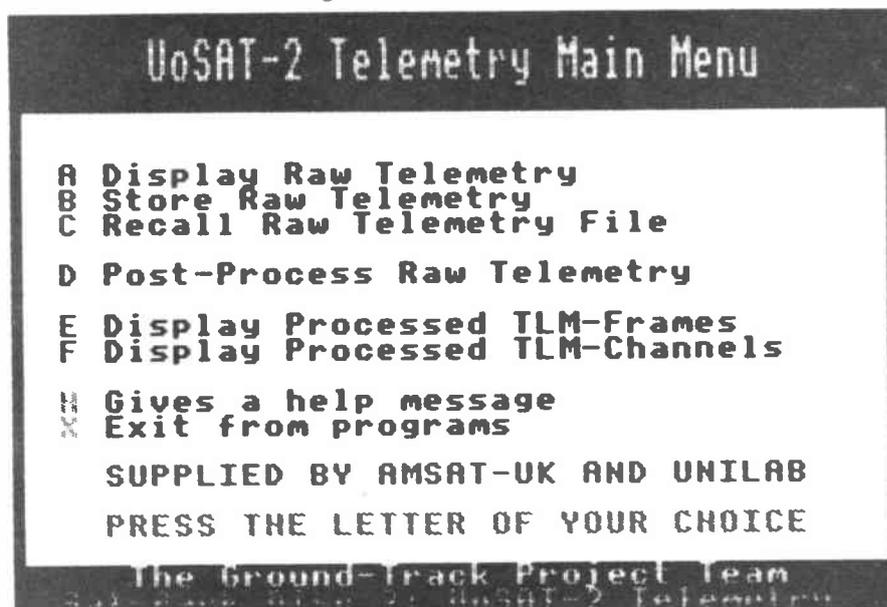
MAY - JUNE 1987

This Calendar gives the predicted EQX for only those Orbits, that will at sometime during the pass be in range of somewhere in the UK.

OSCAR9	08-05-87	OSCAR9	09-05-87	OSCAR9	10-05-87	OSCAR9	11-05-87
04:25:26	147 >	03:58:37	141 >	05:06:00	157 >	04:39:11	151 >
05:59:39	171 >	05:32:50	164 >	06:40:13	181 <	06:13:23	174 >
07:33:52	194 <	07:07:02	188 <	08:14:26	205 <	07:47:36	198 <
09:08:05	218 <	08:41:15	211 <	09:48:38	228 <	09:21:49	221 <
15:24:55	312 <	10:15:28	235 <	16:05:29	322 <	15:38:39	316 <
16:59:08	336 <	14:58:06	305 <	17:39:42	346 <	17:12:52	339 <
18:33:21	359 <	16:32:19	329 <	19:13:54	9 >	18:47:05	3 >
20:07:34	23 >	18:06:31	353 <			20:21:17	26 >
		19:40:44	16 >				
OSCAR9	12-05-87	OSCAR9	13-05-87	OSCAR9	14-05-87	OSCAR9	15-05-87
04:12:21	144 >	05:19:43	161 >	04:52:53	154 >	04:26:03	147 >
05:46:33	167 >	06:53:56	184 <	06:27:06	178 >	06:00:15	171 >
07:20:46	191 <	08:28:09	208 <	08:01:18	201 <	07:34:28	194 <
08:54:59	215 <	10:02:21	231 <	09:35:31	225 <	09:08:41	218 <
15:11:49	309 <	16:19:12	326 <	15:52:22	319 <	15:25:31	312 <
16:46:02	332 <	17:53:25	349 <	17:26:34	342 <	16:59:44	336 <
18:20:15	356 <	19:27:37	13 >	19:00:47	6 >	18:33:57	359 <
19:54:27	19 >			20:35:00	29 >	20:08:09	23 >
OSCAR9	16-05-87	OSCAR9	17-05-87	OSCAR9	18-05-87	OSCAR9	19-05-87
03:59:12	140 >	05:06:34	157 >	04:39:44	150 >	04:12:53	144 >
05:33:25	164 >	06:40:47	181 <	06:13:56	174 >	05:47:05	167 >
07:07:38	188 <	08:15:00	204 <	07:48:09	198 <	07:21:18	191 <
08:41:50	211 <	09:49:12	228 <	09:22:21	221 <	08:55:30	214 <
10:16:03	235 <	16:06:03	322 <	15:39:12	315 <	15:12:21	309 <
14:58:41	305 <	17:40:15	346 <	17:13:24	339 <	16:46:33	332 <
16:32:53	329 <	19:14:28	9 >	18:47:37	2 >	18:20:46	356 <
18:07:06	352 <			20:21:50	26 >	19:54:59	19 >
19:41:19	16 >						

Fig 2 Orbital prediction calendar extract

Fig 3 SAT-PACK screen menu



also 'tapped off' and outputted to the tape recorder.

In addition to the volume control, a squelch control can be used to adjust the signal level which will activate the receiver and also turn on the recorder. A Doppler monitor output is provided for those interested in observing carrier frequency changes as the satellite progresses past the ground station.

After connecting up the receiver to the aerial and tape recorder, the squelch is set to the point where it just turns off the recorder remotely. The unit is then left to record the next pass or passes; but remember first to depress the record keys and switch on the external power supply!

Unless you are in attendance, or have information available about pass

UoSAT GROUND STATION PACKAGE

```
*****
Sat-Pack: UoSAT-2 RAW TELEMETRY FILE DISPLAY
Reading from file: R.TEST-2
*****
```

```
;UOSAT-2          8510270104147
00503601499502671203352704052305039F06025107052008047B09037D
10306411332212000313064014128E15440416181F175120184739195386
20378E21184E22660023000124000625000726097A27557228515B295248
30512531040632286D33577534000735268A36320437430338476E39504B
40767241120642642643066744167045000146000247494A48506F494768
50579E51102752680953686E54658A55000056000357500758494459507E
60826A615BE7621F4E63330564440265170566586B67700668000E69000F
;UOSAT-2          8510270104133
00505001478A02673003349D04052305039F06025107052008047B09037D
10295F11332212000313063714129F15440416181F175157184863195397
20443121184E22660023000124000625000726097A27556328512C295248
30513431040632286D33579B34000735265736317037430338476E39504B
40766341120642642643063244166145000146000247494A48506F494779
50563551102752676053682A54653155000056000357499658494459507E
60826A615BE7621F4E6333056444026517056647ED67700668000E69000F
```

Fig 4 Raw data display

UoSAT-2 SATELLITE TELEMETRY

Source file: 'P.TEST-1'

```
FRAME No.      : 8510270104128      (1)
Mission time   : 27/10/85   10:41:28
AOS date/time  : 27/10/85   10:39 hrs.
```

```
Analogue Data Channels: 00-59
00 <506>      Solar array current -Y      19.0000      mA.
01 <468>      Nav mag X axis              1.4980      uT.
02 <673>      Nav mag Z axis              33.1979      uT.
03 <348>      Nav mag Y axis             -16.5564      uT.
04 <052>      Sun sensor no.1            <          >
05 <039>      Sun sensor no.2            <          >
06 <025>      Sun sensor no.3            <          >
07 <052>      Sun sensor no.4            <          >
08 <047>      Sun sensor no.5            <          >
09 <037>      Sun sensor no.6            <          >
```

Fig 5 Processed telemetry data sample

times (more on this later), the unit can be left on overnight or, more usefully, during the day.

Before embarking on the recording and then processing of received signals, it is good strategy to familiarise yourself with the system using the program disc (SAT-PACK 2/3) and sample tape. This is clearly explained in the Master Manual and also the software booklet accompanying the disc.

Note: Receiving satellite signals does not require the operation of the computer system, unless it is required to receive and monitor live passes. However, this is not very practical due to the RF interference generated by the computer itself.

I will return to the use of software and the processing of received data after looking at the next part of the hardware, namely the data demodulator (interface) unit.

■ **Data demodulator (interface):** The data demodulator unit is another flat box which matches the receiver in size and appearance. It has a mains PSU, co-ax input from cassette (EAR) output and a

switch to select UoSAT-1 (OSCAR 9) or UoSAT-2 (OSCAR 11). Output from the demodulator is via multi-way cable to the BBC RS423 input.

Operating the system

The Unilab Master Manual provides full instructions on how to drive the system, including information on using software and menu, but more detail is included in the individual software manuals. Very simply, the receiver automatically outputs audio tones on to cassette tape. Once recorded, these tones need to be loaded into the BBC Micro via the interface unit (data demodulator).

Raw data from tape can be examined either by using UoSAT data display disc 2 (option 3, 1200 baud), which provides screen display only, or by using SAT-PACK 2 (option 4), which creates raw data files for printing.

At this stage, use of the 'INPUT POLARITY' and 'SIGNAL INVERT' switches can be made and a meaningful data stream produced. This crude 'guessing' method is necessary unless you

have definite information on particular passes, ie which satellite is transmitting and whether data is inverted or not.

General familiarity will also enable the user to deal with several passes situated 'serially' on the same cassette tape, including noisy sections around auto switch on and switch off. The limitations of the raw data received and displayed will soon be realised, although it is useful and of educational value to be able to see the 'unformatted' telemetry as it arrives at the aerial.

Software

The significance of the data processing software can now be demonstrated by using the UoSAT data display software for both UoSAT-1 and UoSAT-2. This produces whole orbit data (WOD), including graphs of chosen parameters. Also, real-time telemetry data is displayed, for the monitoring of analogue measurements and digital status points.

SAT-PACK 2 and 3 for UoSAT-2 produces data in the form of graphs and tables.

Some sample results

Figure 2 is an extract from the orbital prediction calendar which is supplied to members of AMSAT-UK (see references). In this case data is for OSCAR 9 (UoSAT-1).

Figure 3 is an example of the menus encountered when using SAT-PACK disc 2.

Figure 4 shows raw data for UoSAT-2.

Figure 5 is an example of part of a printout of raw telemetry data which has been processed into tabular form.

Figure 6 is a full telemetry printout (60 channels).

Figure 7 is an alternative numeric data display.

Technical details

L.EQX is the latitude position at which the UoSAT craft crosses the 0° longitude equator in an approximately S>N direction. Satellite crossings are usually stated as being between 0-360°W, although maps use 0-180°W (clockwise) and 0-180°E (anti-clockwise). Pass time (horizon to horizon) is 10-15 mins, with usually no more than 10 minutes of 'useful' data.

Interpretation

Practice and familiarisation: The altitude of UoSAT-1 is 554km; UoSAT-2 is 700km. The orbit time of UoSAT-1 is 95 mins; UoSAT-2 is 98 mins. The RF carrier frequency of UoSAT-1 is 145.825MHz; UoSAT-2 is 145.825MHz.

Conclusions

The Unilab system is very easy to use, being well organised and fully documented. I found that the system worked first time, with no problems, apart from basic familiarisation. This system provides a fairly cheap and reliable means of capturing data from

the two UoSAT craft currently in orbit. It is fully supported by some fairly comprehensive and sophisticated software.

Anyone who is interested in satellite activities, as well as scientific measurements made in space, can have access to a reasonably sophisticated satellite system in terms of hardware (space, computer and radio) and a suite of software, which enables some very detailed data processing and display. The Unilab system enables the bringing together of physics, space engineering, digital and analogue electronics, including microprocessor systems and telecommunications. It also provides an insight into the operation of commercial communications satellites.

A great deal of support in terms of organisations, literature and hardware is available and the associated knowledge and experience continues to expand.

Acknowledgements

I would like to thank Unilab Ltd for the loan of this system for review, in particular Mr David Duff and Mr Alan Hammond.

References

Unilab Ltd,
Clarendon Road,
Blackburn,
Lancs BB1 9TA.
Tel: (0254) 57643.

AMSAT-UK,
94 Herongate Road,
Wanstead Park,
London E12 5EQ.

Dr M Sweeting, Director,
UoSAT Spacecraft Engineering
Research Unit,
Dept of Electronic and Electrical
Engineering,
University of Surrey,
Guildford,
Surrey GU2 5XH.
Tel: (0483) 571281.

Mr J Fenner,
Scarborough Sixth Form College,
N Yorks.

Prices

Combined NOAA and UoSAT systems, £423; UoSAT system, £225; UoSAT receiver, £77.22; UoSAT data demodulator, £38.51.

If you missed Alan Pickard's review of the Unilab weather satellite system which appeared in the October issue, back issues are available for £1.40 each. Phone (0277) 219876 or send a cheque to us at the address on page 3

Source file: 'P.UOSAT11'

FRAME No. : 8705310194127 (6)
Mission time : 31/05/87 19:41:27
AOS date/time : 01/06/87 00:00 hrs.

Analogue Data Channels: 00-59				
00	<100>	Solar array current -Y	790.4000	mA.
01	<070>	Nav ma9 X axis	-57.6050	uT.
02	<742>	Nav ma9 Z axis	43.7066	uT.
03	<000>	Nav ma9 Y axis	-69.0000	uT.
04	<000>	Sun sensor no.1	< >	
05	<338>	Sun sensor no.2	< >	
06	<211>	Sun sensor no.3	< >	
07	<461>	Sun sensor no.4	< >	
08	<474>	Sun sensor no.5	< >	
09	<322>	Sun sensor no.6	< >	
10	<140>	Solar array current +Y	714.4000	mA.
11	<250>	Nav ma9 (wing) temp	23.1884	C.
12	<000>	Horizon sensor	< >	
13	<000>	Spare (tbd)	< >	
14	<026>	DCE RAMUNIT current	-6.6269	mA.
15	<064>	DCE CPU current	-61.5300	mA.
16	<695>	DCE GMEM current	273.1905	mA.
17	<470>	Facet temp +X	2.0000	C.
18	<452>	Facet temp +Y	3.6000	C.
19	<613>	Facet temp +Z	-26.6000	C.
20	<170>	Solar array current -X	657.4000	mA.
21	<000>	+10V line current	77.6000	mA.
22	<675>	PCM voltage +10V	10.1250	V.
23	<000>	P/W logic current (+5V)	1.1200	mA.
24	<000>	P/W Geiger current (+14V)	1.8900	mA.
25	<418>	P/W Elec sP.curr (+10V)	40.1300	mA.
26	<417>	P/W Elec sP.curr (-10V)	36.7810	mA.
27	<289>	Facet temp -X	38.2000	C.
28	<400>	Facet temp -Y	0.0000	C.
29	<458>	Facet temp -Z	4.4000	C.
30	<290>	Solar array current +X	429.4000	mA.
31	<060>	-10V line current	28.0000	mA.
32	<665>	PCM voltage -10V	23.9400	V.
33	<240>	1002 comp curr (+10V)	50.4000	mA.
34	<011>	Digitalker current (+5V)	1.4300	mA.
35	<342>	145MHz beacon Power O/P	500.0000	mA.
36	<385>	145MHz beacon current	34.7000	mA.
37	<395>	145MHz beacon temp	17.0000	C.
38	<408>	Command decoder temp (+V)	-1.6000	C.
39	522	Telemetry temp (+X)	-8.4000	C.
40	<090>	Solar array voltage (+30V)	-42.6000	V.
41	<100>	+5V line current	174.6000	mA.
42	<726>	PCM voltage +5V	6.0984	V.
43	<175>	DSR current (+5V)	36.7500	mA.
44	<042>	Command RX current	38.6400	mA.
45	<000>	435MHz beacon Power O/P	-200.0000	mA.
46	<004>	435MHz beacon current	1.7600	mA.
47	<461>	435MHz beacon temp	3.8000	C.
48	<503>	P/W temp (-X)	-4.6000	C.
49	<495>	BCR temp (-Y)	-3.0000	C.
50	<030>	Battery charge-disch9 curr	-3010.4000	mA.
51	<100>	+14V line current	500.0000	mA.
52	<277>	Battery voltage (+14V)	5.8170	V.
53	<052>	Battery cell volts (MUX)		
54	<169>	Telemetry current (+10V)	3.3600	mA.
55	<302>	2.4GHz beacon Power O/P	258.1333	mA.
56	<013>	2.4GHz beacon current	5.8500	mA.
57	<478>	Battery temp	0.4000	C.
58	<477>	2.4GHz beacon temp	0.6000	C.
59	<488>	CCD imager temp	-1.6000	C.

Fig 6 Full telemetry display for 60 channels

UoSAT-2 NUMERIC TELEMETRY

Source file 'P.UOSAT11'

FRAME No. : 00000000A300 (1)
Mission time : 00/00/00 00:00:00
AOS date/time : 01/06/87 00:00 hrs.

Channels 00-69 telemetry

00	100	01	070	02	742	03	000	04	000	05	338	06	---	07	461	08	474	09	314
10	140	11	250	12	000	13	000	14	026	15	162	16	642	17	488	18	452	19	---
20	170	21	000	22	675	23	000	24	009	25	418	26	433	27	275	28	400	29	465
30	290	31	060	32	655	33	242	34	011	35	342	36	385	37	395	38	488	39	519
40	090	41	180	42	726	43	172	44	042	45	000	46	004	47	461	48	504	49	495
50	000	51	100	52	277	53	863	54	168	55	305	56	013	57	478	58	477	59	488
60	---	61	---	62	---	63	---	64	---	65	---	66	---	67	---	68	---	69	---

FRAME No. : 8705310194108 (2)
Mission time : 31/05/87 19:41:08
AOS date/time : 01/06/87 00:00 hrs.

Channels 00-69 telemetry

00	100	01	070	02	742	03	000	04	000	05	338	06	211	07	461	08	474	09	314
10	140	11	250	12	000	13	000	14	026	15	162	16	642	17	488	18	452	19	612
20	170	21	000	22	675	23	000	24	009	25	418	26	433	27	275	28	400	29	465
30	290	31	060	32	655	33	242	34	011	35	342	36	385	37	395	38	488	39	519
40	090	41	180	42	726	43	---	44	042	45	000	46	004	47	461	48	504	49	495
50	---	51	100	52	277	53	863	54	168	55	305	56	613	57	478	58	477	59	488
60	---	61	---	62	---	63	---	64	---	65	---	66	---	67	---	68	---	69	---

Fig 7 Alternative numeric data display

COMPUTER WAREHOUSE

1000's OF BARGAINS FOR CALLERS

THE "ALLADINS" CAVE OF COMPUTER AND ELECTRONIC EQUIPMENT

HOT LINE DATA BASE

DISTEL

The ORIGINAL FREE OF CHARGE dial up data base. Buy, browse or place YOUR OWN AD for goods or services to sell. 1000's of stock items, spares and one off bargains. Updated daily. ON LINE NOW. CCITT, 8 bit word, no parity. For 300 baud modems call 01-679 1888. For 1200-75 baud modems call 01-679 6183

FREE Your monitor from its computer!! For only £29.95 it becomes a SUPERB HIGH QUALITY - COLOUR - TV SET

The fabulous TELEBOX an INVALUABLE MUST for the owner of ANY video monitor with a composite input, colour or monochrome. Made by a major UK Co. as a TOP QUALITY, stand alone UHF tuner and costing OVER £75 to manufacture, this opportunity to give your monitor a DUAL FUNCTION must not be missed! The TELEBOX consists of a compact, stylish two tone charcoal moulded case, containing ALL electronics tuner, power supply etc to simply plug in and convert your previously dedicated computer monitor into a HIGH QUALITY COLOUR TV SET, giving a real benefit to ALL the family! Don't worry if your monitor doesn't have sound - THE TELEBOX even has an integral 4 watt audio amplifier for driving an external speaker, PLUS an auxiliary output for superb quality television sound via your headphones or HI FI system etc. Other features include: Compact dimensions of only 15.75" w x 7.5" d x 3.5" h latest technology, BRITISH manufacture, fully tuneable 7 channel push button tuner, Auto AGC circuit, SAW filter, LED status indicator, fully isolated 240v AC power supply for total safety. Mains ON-OFF switch etc. Many other uses.

LIMITED QUANTITY - DON'T MISS THIS OFFER!!!

ONLY £29.95 OR £24.95 if purchased with ANY of our video monitors. Supplied BRAND NEW with full instructions and 2 YEAR warranty. Post and packing £3.50 *When used with colour crt.

COLOUR & MONOCHROME MONITOR SPECIALS

'SYSTEM ALPHA' 14 COLOUR MULTI INPUT MONITOR

Made by the famous REDIFFUSION Co. for their own professional computer system this monitor has all the features to suit your immediate and future requirements. Two video inputs, RGB and PAL Composite Video, allow direct connection to BBC/IBM and most other makes of micro computers or VCR's, including our very own TELEBOX. An internal speaker and audio amp may be connected to computer or VCR for superior sound quality. Many other features: PIL tube. Matching BBC case colour. Major controls on front panel. Separate Contrast and Brightness - even in RGB mode. Separate Colour and audio controls for Composite Video input. BNC plug for composite input. 15 way D'plug for RGB input, modular construction etc.

This Must Be ONE OF THE YEAR'S BEST BUYS. PC USER

Supplied BRAND NEW and BOXED, complete with DATA and 90 day guarantee. ONLY £149.00 as above OR IBM PC Version £165.00 15 Day 'D' sct £1.00 BNC sct 75p BNC interface cable £5.50

DECCA 80 16 COLOUR monitor, RGB input. Little or hardly used manufacturer's surplus enables us to offer this special converted DECCA RGB Colour Video TV Monitor at a super low price of only £99.00, a price for a colour monitor as yet unheard of! Our own interface, safety modification and special 16" high definition PIL tube, coupled with the DECCA 80 series TV chassis give 80 column definition and quality found only on monitors costing 3 TIMES OUR PRICE. The quality for the price has to be seen to be believed! Supplied complete and ready to plug direct to a BBC MICRO computer or any other system with a TTL RGB output. Other features are: internal speaker, modular construction, auto degaussing circuit, attractive TEAK CASE, compact dimensions only 52cm W x 34" H x 24" D. 90 day guarantee. Although used, units are supplied in EXCELLENT condition. ONLY £99.00 + Carriage

DECCA 80, 16 COLOUR monitor, Composite video input. Same as above model but fitted with Composite Video input and audio amp for COMPUTER, VCR or AUDIO VISUAL use. ONLY £99.00 + Carr

REDIFFUSION MARK 3, 20 COLOUR monitor. Fitted with standard 75 ohm composite video input and sound amp. This large screen colour display is ideal for SCHOOLS, SHOPS, DISCOS, CLUBS and other AUDIO VISUAL applications. Supplied in AS NEW or little used condition ONLY £145.00 + Carr

BUDGET RANGE EX EQUIPMENT MONOCHROME video monitors. All units are fully cased and set for 240v standard working with composite video inputs. Units are pre tested and set up for up to 80 column use. Even when MINOR screen burns exist - normal data displays are unaffected. 30 day guarantee.

12 KGM 320-1 B/W bandwidth input, will display up to 132 x 25 lines. £32.95
12 GREEN SCREEN version of KGM 320-1. Only £39.95
9 KGM 324 GREEN SCREEN fully cased very compact unit. Only £49.00

Carriage and insurance on all monitors £10.00

DC POWER SUPPLY SPECIALS

GOULD OF443 enclosed compact switch mode supply with DC regulated outputs of +5v @ 5.5a +12v @ 0.5a -12v @ 0.1a and -23v @ 0.02a Dim 18 x 11 x 6 cm 110 or 240v input BRAND NEW only £16.95

GOULD G6-40A 5v 40 amp switch mode supply NEW £130.00
AC-DC Linear PSU for DISK drive and SYSTEM applications. Constructed on a rugged ALLOY chassis to continuously supply fully regulated DC outputs of +5v @ 3 amps -5v @ 0.6 amps and +24v @ 5 amps. Short circuit and overvoltage protected 100 or 240v AC input. Dim 28 x 12.5 x 7 cm NEW £49.94

Carriage on all PSU's £3.00

KEYBOARDS

Manufacturer's BRAND NEW surplus DEC L434 Un-coded keyboard with 67 quality gold plated switches on X-Y matrix - ideal micro conversions etc. £24.95

AMKEY MPNK-114 Superb word processor chassis keyboard on single PCB with 116 keys. Many features such as On board Micro, Single 5v rail, full ASCII coded character set with 31 function keys, numeric keypad, cursor pad and 9600 baud SERIAL TTL ASCII OUTPUT! Less than half price

Only £69.00 with data. Carriage on Keyboards £3.50



DON'T MISS THE CPM Deal OF THE CENTURY

The FABULOUS CPM TATUNG PC2000 Professional Business System

A cancelled export order and months of negotiation enables us to offer this professional PC, CPM system, recently on sale at OVER £1400, at a SCOOP price just over the cost of the two internal disk drives! Or less than the price of a dumb terminal!!

Not a toy the BIG BROTHER of the EINSTEIN computer, the DUAL PROCESSOR PC2000 comprises a modern stylish three piece system with ALL the necessities for the SMALL BUSINESS, INDUSTRIAL, EDUCATIONAL or HOBBYIST USER. Used with the THOUSANDS of proven tested and available CPM software packages such as WORDSTAR, FAST, DBASE2 etc. the PC2000 specification at our prices. CANNOT BE BEATEN!

Double sided 40/80 track disk drives (1Mb per drive) PSU, 4K of memory mapped screen RAM, disk controller, RS232, CENTRONICS and system expansion ports, and if that's not enough a ready to plug into STANDARD 8" DRIVE port for up to FOUR 8" disk drives, either in double density or IBM format. The ultra slim 92 key, detachable keyboard features 32 user definable keys, numeric keypad and text editing keys, even its own integral microprocessor which allows the main 280A to devote ALL its time to USER programs, eliminating 'lost character' problems found on other machines. The attractive, detachable 12" monitor combines a green, anti-glare etched screen, with full swivel and tilt movement for maximum user comfort. Supplied BRAND NEW with CPM 2.2, user manuals and full 90 day guarantee! Full data sheet and info on request.

PC2000 System with CPM Etc COST OVER £1400

PC2000 Business System with CPM and Ready to Run FAST Sales and Purchase Ledger supports up to 9000 Accounts, VAT etc COST OVER £1700

PC2000 Wordprocessor System with CPM and TEC FP25 daisywheel printer

NOW only £399

NOW only £499 Carriage & Insurance £12.00

NOW only £799

MODEMS

Join the communications revolution with our super range of DATA MODEMS, prices and specifications to suit all applications and budgets. BRAND NEW State of the art products.

DACOM DSI2123 Multi standard 300-300, 1200-75 Auto answer etc £268.00
DACOM DSI2123AQ Auto dial, smart modem with multi standard AUTO SPEED detect, and data buffer with flow control etc. £365.00
DACOM DSI2123GT THE CREAM of the intelligent modems auto dial auto call index, buffer etc etc. £498.00
Steebeck SB1212 V22 1200 baud FULL DUPLEX sync or async, optional auto dial £465.00
TRANSDATA 307A Acoustic coupler 300 baud full duplex, originate only, RS232 interface. £349.00

Ex BRITISH TELECOM full spec, CCITT ruggedised bargain offers. SOLD TESTED with data. Will work on any MICRO or system with RS232 interface

MODEM 13A 300 baud unit, only 2" high fits under phone. CALL mode only £45.00
MODEM 20-1, 75-1200 baud Compact unit for use as subscriber end to PRESTEL, TELECOM GOLD, MICROWET etc. £39.95 + pp £6.50

MODEM 20-2 1200-75 baud Same as 20-1 but for computer end £65.00 + pp £6.50
DATEL 2412, Made by SE Labs for BT this two part unit is for synchronous data links at 1200 or 2400 baud using 2780/3780 protocol etc. Many features include 2 or 4 wire working, self test, auto answer etc. COST OVER £800. Our price ONLY £199 + pp £8.00

DATEL 4800, RACAL MPS4800 baud modem, EX BT good working order ONLY £295.00 + pp £8.00

SPECIAL OFFER
MODEM TG2393, EX BT up to 1200 baud, full duplex 4 wire or half duplex over 2 wire line. ONLY £85.00 PER PAIR + pp £10.00

For more information contact our Sales Office. **MATRIX PRINTERS**

SPECIAL BULK PURCHASE of these compact high speed matrix printers. Built in Japan for the Hazeltine Corporation this unit features quality construction giving 100cps bidirectional full pin addressable graphics 6 type fonts up to 95 single sheet or tractor paper handling, RS232 and CENTRONICS parallel interface. Many other features. BRAND NEW and BOXED COST £420. Our price ONLY £199.00

RECHARGEABLE BATTERIES

Dry Fit MAINTENANCE FREE by Sonnenschein & Yuasa
A300 07191315 12v 3Ah NEW £13.95
A300 07191312 6v 3Ah NEW £9.95
A300 07191202 6-0-6v 1.8Ah TESTED Ex Equip £5.99

VDU TERMINALS

Standard VDU data entry terminals at give away prices!!

QUME QVT108, Current product state of the art terminal with detachable keyboard, 12 green screen, 2 page RAM, TVI 925 Hazeltine ADM5A emulations, software setup 25 x 80 Clock, Swivel and tilt base. Printer port. Function keys etc. BRAND NEW and BOXED AT ALMOST HALF PRICE ONLY £425.00

AJ510 - EX RENTAL, 280 controlled 15 green screen 24 x 80 display graphics, cursor addressing, printer port etc. Very good condition TESTED complete with manual only £225.00

ADDS 520 - Dumb terminal used 12 b/w screen RS232 interface and printer port. TESTED. ONLY £125.00. Carriage on terminals £10.00

100's of other terminals in stock. CALL for more details

SURPLUS SPECIALS ON PRESTEL - VIEWDATA - TELEX

PLESSEY VUTEL, ultra compact unit, slightly larger than a telephone features A STANDARD DTMF TELEPHONE (tone dial) with 5" CRT monitor and integral modem etc for direct connection to PRESTEL, VIEWDATA etc. Designed to sell to the EXECUTIVE at over £600! Our price BRAND NEW AND BOXED at only £99.00

DECCAFAX VP1 complete Professional PRESTEL system in slimline desk top unit containing Modem, Numeric keypad, CPU PSU etc. Connects direct to standard RGB colour monitor. Many other features include Printer output, Full keyboard input, Cassette port etc. BRAND NEW with DATA A FRACTION OF COST only £55.00

ALPHATANTEL, Very compact unit with integral FULL ALPHA NUMERIC keyboard. Just add a domestic TV receiver and you have a superb PRESTEL system and via PRESTEL the cheapest TELEX service to be found! Many features: CENTRONICS Printer output, Memory dialling etc. Supplied complete with data and DIY mod for RGB or Composite video outputs AS NEW only £125.00

Post and packing on all PRESTEL units £8.50

EX-STOCK INTEGRATED CIRCUITS

4164 200 ns D RAMS 9 for £11 4116 ns £1.50 2112 £10.00 2114 £2.50 2102 £2.00 8116 £2.50 EPROMS 2716 £4.50 2732 £3.00 2764 £4.95 27128 £5.50 6800 £2.50 6821 £1.68A09 £8 68B09 £10 80B5A £5.50 80B8 £15 80B8 £8 NEC765 £8 WD2793 £28 8202A £22 8251 £7 8748 £15 Z80A DART £6.50 Z80A CPU £2.00 Thousands of ICs EX STOCK send SAE for list

DISK DRIVES

Japanese 5 1/4" half height, 80 track double sided disk drives by TEAC CANON TOSHIBA etc. Sold as NEW with 90 day guarantee. ONLY £85.00 DEC F8-503 Double sided HH 40 TRK NEW £75.00 SUGART SA400 SS FH 35 TRK £55.00 SIEMENS FDD100 SS FH 40 TRK £65.00 carriage on 5 1/4" drives £5.50 BRAND NEW metal 5 1/4" DISK CASES with internal PSU.

DSK1 for 2, HH or 1 FH drive £29.95 + pp £4.00
DSK2 2 for 1 HH drive £22.95 + pp £3.50
DSK3 3 As DSK1 LESS PSU £12.95 + pp £2.50
DSK4 As DSK2 LESS PSU £10.95 + pp £2.00

8" IBM format TESTED EX EQUIPMENT.
SHUGART 800/801 SS £175.00 + pp £8.50
SHUGART 851 DS £250.00 + pp £8.50
TWIN SHUGART 851* a2 Mb total capacity in smart case, complete with PSU etc. £595.00

MITSUBISHI M2894-83 B DS 1 Mb equiv to SHUGART SABSOR, BRAND NEW at £275.00 + pp £8.50
DYSAN 8" Alignment disk £29.00 + pp £1.00
Various disk drive PSU's Ex Stock SEE PSU section.

HARD DISK DRIVES

DRE/DIABLO Series 30 2.5 Mb front load £525.00
Exchangeable version £295.00, ME3029 PSU £95.00
DIABLO 44/DRE4000A, B 5+5 Mb for £750.00
CDC HAWK 5+5 Mb £795.00, CDC 9762 80 Mb RM03 etc. £2500.00

PERTEC D3422 5+5 Mb £495.00
RODIME 5 1/4" Winchester ex-stock from £150 CALL
Clearance items - Sold as seen - no guarantee

ICL 2314 BRAND NEW 14 Mb Removable pack hard disk drive, cost over £2000 with data. ONLY £999.00
BASF 6172 B 23Mb Winchester £199.00

Unless stated all drives are refurbished with 90 day guarantee. Many other drives and spares in stock - call sales office for details.

All prices quoted are for UK Mainland, paid cash with order in Pounds Sterling PLUS VAT. Minimum order value £2.00. Minimum Credit Card order £10.00. Minimum BONA FIDE account orders from Government Depts, Schools, Universities and established companies £20.00. Where post and packing not indicated please ADD £1.00 + VAT. Warehouse open Mon-Fri 9.30-5.30 Sat 10.30-5.30. We reserve the right to change prices and specifications without notice. Trade, Bulk and Export

32 Biggin Way, Upper Norwood, London SE19 3XF
Telephone 01-679 4414 Telex 894502 Data 01-679 1888

ERS — PRINTERS — PRINTERS — PRINTERS

SUPER DEAL? NO - SUPER STEAL THE FABULOUS 25 CPS "TEC STARWRITER"

Made to the very highest spec the TEC STARWRITER FP1500-25 features a very heavy duty die cast chassis and DIABLO type print mechanism giving superb registration and print quality. Micro-processor electronics offer full DIABLO/QUEM command compatibility and full control via CPM WORDSTAR ETC. Many other features include bi-directional printing, switchable 10 or 12 pitch, full width 381mm paper handling with up to 163 characters per line, friction feed rollers for single sheet or continuous paper, internal buffer, standard RS232 serial interface with handshake. Supplied absolutely BRAND NEW with 90 day guarantee and FREE daisy wheel and dust cover. Order NOW or contact sales office for more information. Optional extras RS232 data cable £10.00 Tech manual £7.50. Tractor Feed £140.00 Spare daisy wheel £3.50 Carriage & Ins (UK Mainland) £10.00



SUMMER OFFER ONLY £399.99!!

DIY PRINTER MECH

Brand New surplus of this professional printer chassis gives an outstanding opportunity for the Student, Hobbyist or Robotics constructor to build a printer - plotter - digitiser etc, entirely to their own specification. The printer mechanism is supplied ready built, aligned and pre tested but WITHOUT electronics. Many features include all metal chassis, phosphor bronze bearings, 132 character optical shaft position encoder, NINE needle head, 2 x two phase 12V stepper motors for carriage and paper control, 9.5" Paper platen etc. etc. Even a manufacturer's print sample to show the unit's capabilities!! Overall dimensions 40 cm x 12 cm x 21 cm.

Sold BRAND NEW at a FRACTION of cost ONLY £49.50 + pp £4.50

TELETYPE ASR33 DATA I/O TERMINALS

Industry standard, combined ASCII 110 baud printer, keyboard and 8 hole paper tape punch and reader. Standard RS232 serial interface. Ideal as cheap hard copy unit or tape prep. for CNC and NC machines. TESTED and in good condition. Only £235.00 floor stand £10.00. Carr & Ins. £15.00.

EX NEWS SERVICE PRINTERS

Compact ultra reliable quality built unit made by the USA EXTEL Corporation. Often seen in major Hotels printing up to the minute News and Financial information, the unit operates on 5 UNIT BAUDOT CODE from a Current loop, RS232 or TTL serial interface. May be connected to your micro as a low cost printer or via a simple interface and filter to any communications receiver to enable printing of worldwide NEWS, TELEX and RTTY services.

Supplied TESTED in second hand condition complete with DATA, 50 and 75 baud xtals and large paper roll.

TYPE AE11	50 Column	ONLY £49.95
Spare paper roll for AE11		£4.50
TYPE AF11R 72 Col	+ Ribbon	£65.00
TYPE AH11R 80 Col	ASCII/BAUDOT	£185.00
	Carriage and Insurance	£7.50

GE TERMIPRINTER



A massive purchase of these desk top printer terminals enables us to offer you these quality 30 or 120 cps printers at a SUPER LOW PRICE against their original cost of over £1000. Unit comprises of full QWERTY electronic keyboard and printer mech with print face similar to correspondence quality typewriter. Variable forms tractor unit enables full width - up to 13.5" 120 column paper, upper - lower case, standard RS232 serial interface, internal vertical and horizontal tab settings, standard ribbon, adjustable baud rates, quiet operation plus many other features. Supplied complete with manual. Guaranteed working GE30 £130.00. GE1200 120 cps £175.00. Untested GE30 £65.00. Optional floor stand £12.50 Carr & Ins £10.00

SEMICONDUCTOR 'GRAB BAGS'

Mixed Semis amazing value contents include transistors digital, linear, IC's, triacs, diodes bridge recs. etc etc. All devices guaranteed brand new full spec with manufacturer's markings, fully guaranteed.

50+ £2.95 100+ £5.15
TTL 74 Series A gigantic purchase of an "across the board" range of 74 TTL series IC's enables us to offer 100+ mixed "mostly TTL" grab bags at a price which two or three chips in the bag would normally cost to buy. Fully guaranteed all IC's full spec. 100+ £8.90, 200+ £12.30, 300+ £19.50

CENTRONICS 710 PRINTERS

Ex RENTAL Heavy duty full width carriage printer up to 132 columns on 17" fan fold sprocket fed paper. 60 cps print speed with standard RS232 or 20 mA loop interface. Supplied in TESTED used condition with data. ONLY £85.00 carriage and insurance £10.00.

MAINS FILTERS

CURE those unnerving hang ups and data glitches caused by mains interference with professional quality filters. S05A matchbox size up to 1000 watt 240 V Load ONLY £5.95. L12127 compact completely cased unit with 3 pin fitted socket up to 750 watts ONLY £9.99.

EPROM COPIERS

The amazing SOFTY 2 The "Complete Toolkit" for copying, writing, modifying and listing EPROMS of the 2515, 2716, 2532, 2732 range. Many other functions include integral keyboard, cassette interface, serial and parallel i/o UHF modulator ZIF socket etc. ONLY £195.00 + pp £2.50
"GANG OF EIGHT" intelligent 280 controlled 8 gang programmer for ALL single 5v rail EPROMS up to 27128. Will copy 8 27128 in ONLY 3 MINUTES. Internal LCD display and checking routines for IDIOT PROOF operation. Only £395.00 + pp £3.00
"GANG OF EIGHT PLUS" Same spec as above but with additional RS232 serial interface for down line loading data from computer etc. ONLY £445.00 + pp £3.00
Data sheets on request

20,000 FEET OF ELECTRONIC AND COMPUTER GOODIES

ENGLAND'S LARGEST SURPLUS STORE - SEEING IS BELIEVING!!

DEC CORNER

PDP 1140 System comprising of CPU, 124k memory & MMU 15 line RS232 interface.
RP02 40 MB hard disk drive
TU10 9 track 800 BPI Mag tape drive, dual track system VT52 VDU, etc etc Tested and running £3,750.00
BA11-MB 35 Box, PSU, LTC £395.00
DH11-AD 16 x RS232 DMA interface £1,900.00
DLV11-J4 x EIA interface £350.00
DLV11-E Serial Modem support £190.00
DUP11 Synch Serial data i/o £850.00
DQ200 Dialog - multi RK controller £495.00
DZ11-B 8 line RS232 mux board £650.00
KDF11-B M8189 PDP 1123 PLUS £1,100.00
LA30 Printer and Keyboard £80.00
LA36 Decwriter EIA or 20 mA loop £270.00
MS11-JP Unibus 32kb Ram £80.00
MS11-LB Unibus 128kb Ram £450.00
MS11-LD Unibus 256kb Ram £850.00
PDP11/05 Cpu Ram, i/o etc £450.00
PDP11/40 Cpu, 124k MMU £1,850.00
RT11 ver 3B documentation kit £70.00
RK05-J 2.5 Mb disk drives £650.00
KL8 JA PDP 8 async i/o £175.00
M18E PDP 8 Bootstrap option £75.00
VT50 VDU and Keyboard - 20 mA £175.00
VT52 VDU and RS232 interface £250.00

Give your VT100 a Birthday!!
Brand New VT100 Keyboards only £85.00

1000's of EX STOCK spares for DEC PDP8, PDP8A, PDP11 systems & peripherals. Call for details. All types of Computer equipment and spares wanted for PROMPT CASH PAYMENT

MAG TAPE DRIVES

Many EX STOCK computer tape drives and spares by PERTEC, CIPHER, WANGO, DIGIDATA, KENNEDY etc. Special offer this month on DEI Cartridge tape drives ONLY £450.00 each.

CALL FOR DETAILS

COMPUTER/SYSTEM CABINET & PSU

All in one quality computer cabinet with integral switched mode PSU, mains filtering, and twin fan cooling. Originally made for the famous DEC PDP8 computer system costing thousands of pounds. Made to run 24 hours per day the psu is fully screened and will deliver a massive +5v DC at 17 amps, +15v DC at 1 amp and -15v DC at 5 amps. The complete unit is fully enclosed with removable top lid, filtering, trip switch, power and run leds mounted on ali front panel, rear cable entries, etc. etc. Units are in good but used condition - supplied for 240v operation complete with full circuit and tech. man. Give your system that professional finish for only £49.95 + carr. 19" wide 16" deep 10.5" high Useable area 16" w 10.5" h 11.5" d

Also available less psu, with fans etc. Internal dim. 19" w, 16" d, 10.5" h. £19.95. Carriage £8.75

66% DISCOUNT ON ELECTRONIC COMPONENTS EQUIPMENT

Due to our massive bulk purchasing programme, which enables us to bring you the best possible bargains, we have thousands of IC's, Transistors, Relays, Caps, PCB's, Sub-assemblies, Switches etc etc surplus to OUR requirements. Because we don't have sufficient stocks of any one item to include in our ads we are packing all these items into the BARGAIN OF A LIFETIME. Thousands of components at giveaway prices. Guaranteed to be worth at least 3 times what you pay. Unbeatable value and perhaps one of the most consistently useful items you will ever buy!! Sold by weight

2.5kts £5.25 + pp £1.25
10kts £11.25 + pp £2.25

5 kts £8.90 + £1.80
20kts £19.50 + pp £4.75

1000's of other EX STOCK items including POWER SUPPLIES, RACKS, RELAYS, TRANSFORMERS, TEST EQUIPMENT, CABLE, CONNECTORS, HARDWARE, MODEMS, TELEPHONES, VARIACS, VDU'S, PRINTERS, POWER SUPPLIES, OPTICS, KEYBOARDS etc. etc. Give us a call for your spare part requirements. Stock changes almost daily.

Don't forget, ALL TYPES and QUANTITIES of electronic surplus purchased for CASH



APPROACH AND LANDING SYSTEMS

By Brian Kendal G3GDU

AVIATION ELECTRONICS

Part three

On approaching his destination, the pilot is faced with the problem of leaving his cruising altitude, aligning with the runway and adjusting his descent rate so that his aircraft will make gentle contact with the runway at a speed which will allow the braking systems to stop the aircraft before reaching the other end of the runway.

In conditions of unlimited visibility this does not cause undue difficulty. However, particularly in temperate climates, this situation rarely exists for, as we are all aware, it is not unusual for the cloudbase to be at only a few hundred feet or even at ground level.

Unfortunately, in such circumstances, due to fuel limitations, the pilot can only wait a limited time before he must make an approach and some assistance from the ground is therefore necessary.

Over the years many different approach aids have been used, one of the more common being a Terminal VOR (TVOR) or NDB (see the September issue, p28) located on the airfield. Using this system, the aircraft approaches the airfield at a specified height (usually 3000ft above airfield level) and on a reciprocal bearing to the runway which he intends to use.

As he passes over the radio aid, he commences descent at a specified rate (usually 500ft per minute) which he maintains for three minutes, by which

time he is at 1500ft. He then levels the aircraft and executes a carefully regulated turn to reverse direction, realigns with the runway and recommences descent for two minutes.

He should now be aligned with the runway at a point five hundred feet above and one minute's flying time from it, from where he can make a visual approach. If conditions are such that this is still not possible, he will abort the approach and divert to an alternative airfield.

The use of such relatively simple procedures are today limited to minor airports or where good conditions are the rule rather than the exception, as in the tropics.

An unusual combination is used at the airport at Carlisle, where directional information is derived from an NDB and distance-to-run on the approach is given by a co-located DME (Distance Measuring Equipment).

At international airports, NDB or TVOR approaches are unacceptable both on the grounds of accuracy and the time factor. Here, the Instrument Landing System (ILS) has been in use for many years.

This system has, in general, proved both reliable and accurate. However, it has some limitations, such as needing fixed approach paths, and in mountainous terrain signal reflections may make it difficult, if not impossible, to provide sufficiently accurate guidance. This has resulted in the development of the Microwave Landing System (MLS) which, by the turn of the century, will be replacing ILS on all but a few airports.

Instrument landing system

ILS was developed from the American wartime SCS-51 landing system, although it has now been refined to a degree which I doubt the original design team ever thought possible.

The principle of operation is that the guidance signal is modulated by 90 and 150Hz, the modulation depth of each varying with the relative position of the receiver, but with the levels being equal on the designated approach path.

The azimuth guidance is provided by a transmission in the 108 to 112MHz band and the vertical guidance signal is at about 330MHz. In addition, two marker beacons are provided on a frequency of 75MHz, at distances of about one and four miles from the runway threshold to give a distance indication. Horizontal polarisation is used throughout.

Many airfields have also installed Distance Measuring Equipment (DME),

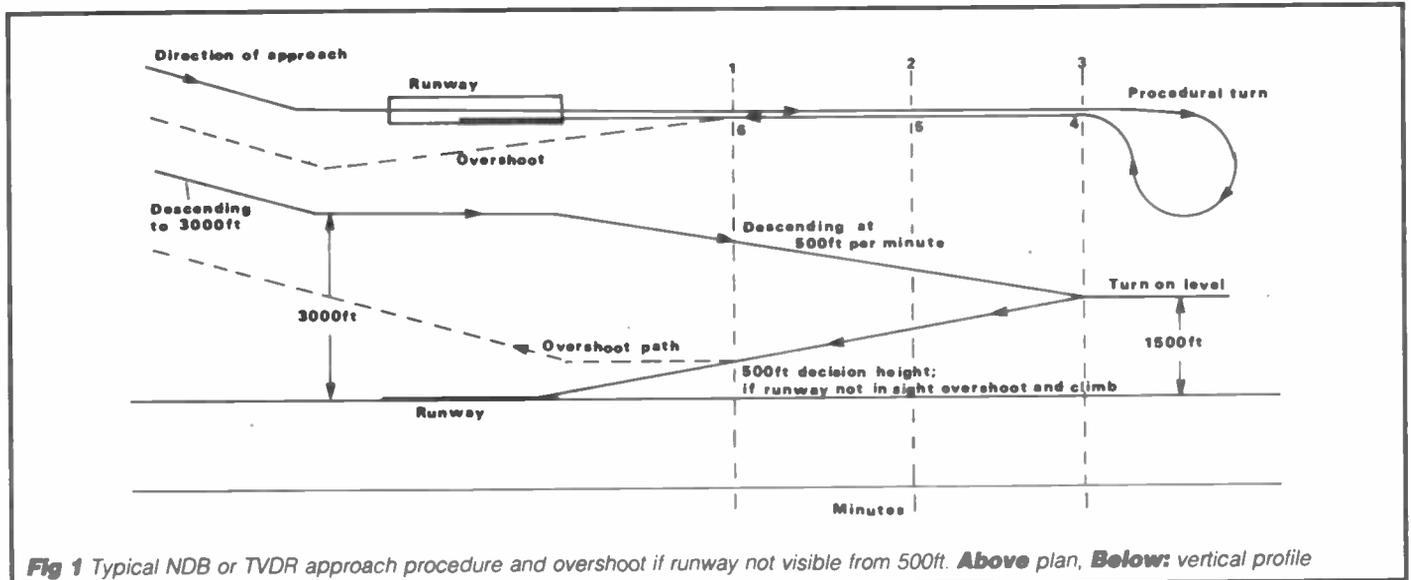
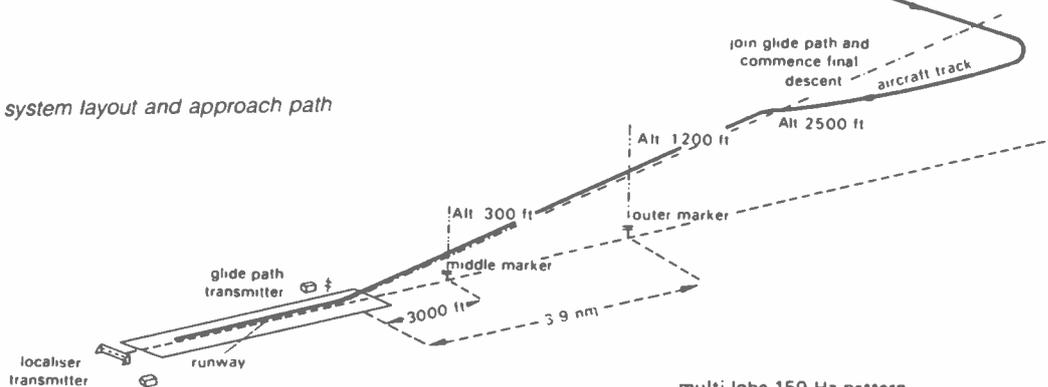


Fig 1 Typical NDB or TVOR approach procedure and overshoot if runway not visible from 500ft. Above plan, Below: vertical profile

Fig 2 ILS – system layout and approach path



to give a continuous distance-to-run readout.

Azimuth guidance

Azimuth guidance is provided by the localiser transmitter, which is located at the upwind end of the runway. This is required to radiate a signal modulated by 90 and 150Hz tones in which the former predominates to the left hand (to the aircraft) of the approach path and the latter to the right. On the course line, the modulation depth of each tone should be equal and on either side of this line the difference in depth of modulation (ddm) should be proportional to the angular displacement. At 2 degrees off course the ddm must be 15.5%, this corresponding to full scale deflection of the aircraft's ILS indicator. Outside this, the ddm should be in excess of 15.5%.

In order to achieve this radiation pattern, the aerial array has to be fed with two separate signals. The first, known as CSB (Combined Carrier and Sideband), comprises a normal A3 transmission, the carrier being modulated equally by 90 and 150Hz signals. The second is the residue from the carrier of the modulated signal after the carrier has been balanced out (ie. DSB). This is known as the SBO (Sidebands Only) output.

The localiser aerial array consists of a number (usually between 12 and 24) of dipole or yagi aeriels backed by a reflector mounted in line with, and at right angles to, the centre line of the runway. Each aerial is fed with both CSB and SBO signals in varying phase and proportion such that, by the consequent combination of component signals, a narrow beam of the required characteristic is radiated.

In addition to navigational information, the facility callsign is radiated in international Morse code at regular intervals for station identification.

Vertical guidance

Vertical guidance is achieved by the Glide Slope transmitter. This is located adjacent to the touchdown point of the runway.

Again the directional guidance is obtained from the comparison to two tones, but this time the 90Hz modulation

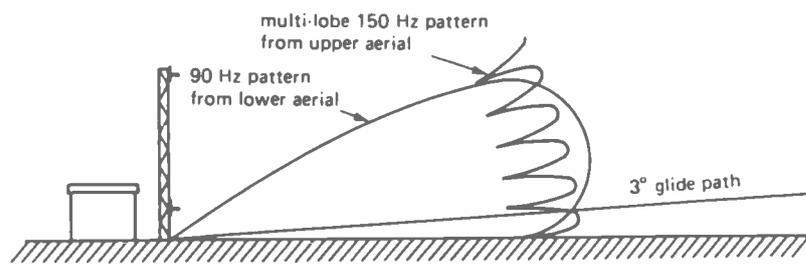


Fig 3 Principle of equi-signal guide path

predominates above the glide path and 150Hz below.

There are several methods of producing this radiation pattern, all working on similar principles. However, the easiest to understand is probably the system known as the 'equi-signal', which is now all but obsolete. In this system, two aeriels mounted on a single mast are used. The lower of these is at a height of approximately 1.5 wavelengths and radiates a carrier modulated by 90Hz. The upper aerial is at a height of about seven wavelengths and radiates a carrier modulated by 150Hz.

Consider first the lower aerial. Due to its height above ground, it will radiate three lobes in the vertical radiation pattern, the lowest of which will be at an angle of about 10 degrees to the horizontal.

Similarly, due to its height, the upper aerial will radiate fourteen lobes, of which the lowest will be at a more acute angle to the ground than the lowest from the lower aerial.

At the intersection of these two lobes the condition for ILS glide path guidance will occur, ie a straight line path where the 90 and 150Hz modulation depths are equal with the 90Hz modulation predominating above the desired approach line. This condition recurs at a much higher angle causing what is known as a 'false glide path', but this is easily recognised by the pilot because of the high descent rate necessary.

As said previously, the equi-signal system is rarely used today; nevertheless, all the more modern systems use a similar principle of generating the course information from the interaction of the radiation patterns from two or more aeriels at different heights.

The glide path is normally set to an angle of 3 degrees to the horizontal, but this may be varied to some degree to meet local conditions. Minor day to day adjustment of the glide slope angle may be achieved by varying the relative power levels fed to the two aeriels.

Two extreme cases of this are at Plymouth Airport and the new London STOLport, where Racal Avionics have installed a system giving a descent angle of 7.5 degrees for use by Brymon Airways' de Havilland Dash-7 STOL aircraft.

Aircraft equipment

The aircraft equipment consists essentially of three separate receivers to receive the marker, localiser and glide path signals.

The marker receiver is low sensitivity equipment tuned to 75MHz, the output of which is fed to both the aircraft intercommunication system and to an indicator lamp on the instrument panel.

The localiser and glide path receivers are conventional superhet equipment with ganged frequency selectors. This is possible as the localiser and glide path frequencies are 'paired'.

After detection within each receiver, the demodulated signal is split into three, the first part of which is fed to the aircraft intercommunication system to allow aural verification of the identification of the facility.

The second path feeds filters on 90 and 150Hz in order to compare the relative level of the incoming tones, after which the output of the comparator is used to drive either a cross pointer meter or the aircraft flight director.

The third path summates the tone levels to determine whether sufficient signal is present for reliable guidance. If

APPROACH AND LANDING SYSTEMS



The glide-slope aerial at Plymouth Airport. These are unique in that the approach angle may be switched to either 3 or 7½° (photo: Racal)

so, warning 'flag' indicators on the ILS indicator are removed from sight.

Alternatively, the output of the ILS receivers may also be coupled to the aircraft flight director system to facilitate automatic approaches. In these circumstances it is usual to operate two or three equipments simultaneously, the outputs of which are compared, and the flight director takes instructions when the two outputs are in agreement (in the

case of a duplicated system) or in a 2:1 majority in a triplicated system.

ILS accuracy

ILS is categorised in accordance with the accuracy of the particular installation. The categories are:

- Category 1. Operation down to 60m decision height with a Runway Visual Range (RVR) in excess of 800m.
- Category 2. Operation down to 30m

decision height with an RVR of 400m.
Category 3a. Operation with no height limitation with an RVR of 200m.

Category 3b. No height limitation and RVR of 45m. Guidance along runway.

Category 3c. No height or visibility limitation. Guidance along runway and to parking bay.

If the requirement for visibility seems high, it must be remembered that in the final stages of the approach, the aircraft is still probably travelling at speeds in excess of 150mph.

Most international airports have at least Category 2 installations, but in Europe the major airports are almost all Category 3a. As yet none has reached Category 3c.

Microwave landing system

The ILS system was originally standardised in 1949 and has proved both accurate and reliable. However, some fifteen years ago it became evident that it was necessary to consider an eventual replacement and by 1978 proposals had been made by Britain (Doppler MLS), Germany (DME based landing system) and USA/Australia (Time Referenced Scanning Beam).

The All Weather Operations Panel of the International Civil Aviation Organisation considered these proposals and recommended that the Time Referenced Scanning Beam system should be adopted as the future international standard.

The Time Referenced Scanning Beam

The basic principle of the azimuth element of the Time Referenced Scanning Beam is that a narrow fan-shaped beam is swept from left to right (To-scan, as seen by the aircraft) and then from right to left (Fro-scan). By measuring the time interval between successive scans, the aircraft receiver can determine its bearing from the ground facility.

In a similar fashion the elevation is derived by measuring the time interval between an upward and a downward scan. Range information is provided by a suitably located DME.

Both azimuth and elevation guidance information are transmitted on the same frequency, being separated by a time division multiplex system.

Each angle function scan consists of four elements:

1. The preamble which consists of a five unit synchronising code, a further code of five information bits and a parity bit.
2. A series of pulses for left/right guidance and Out of Coverage indication.
3. The To and Fro angle scan.
4. A pair of pulses for system test which may be used by receivers or as an end to end check in receiver test mode.

The angle functions radiated within the TRSB format are: azimuth; elevation; missed approach azimuth; flare and 360 degree azimuth.

The signal format allows for 13.5 scans

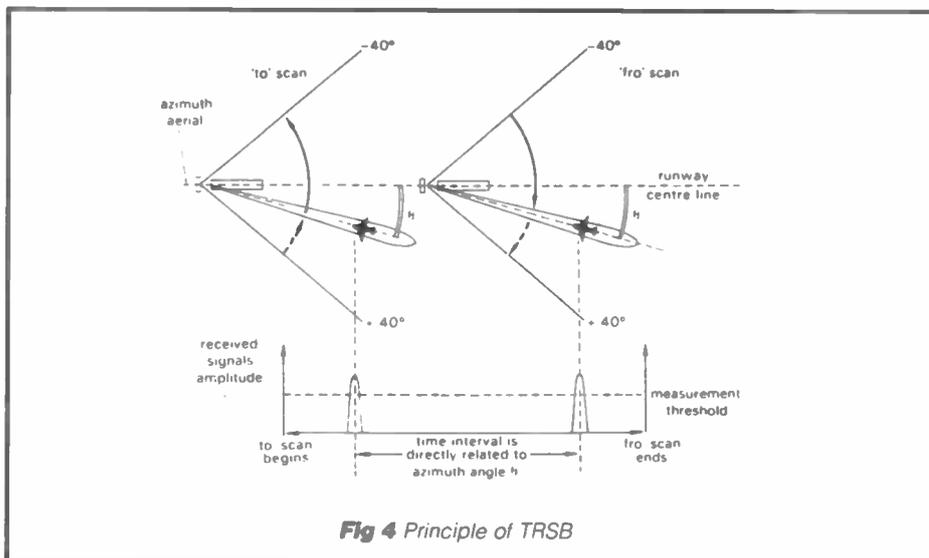


Fig 4 Principle of TRSB

per second in azimuth and 40.5 scans per second in elevation.

The equipment operates on frequencies between 5031MHz and 5090.7MHz.

The advantages of MLS

Although the ILS system has proved effective and reliable over many years, nevertheless, it has several serious disadvantages which are addressed by the new system.

With ILS only a single approach path was possible, this being normally set for conventional aircraft.

No suitable guidance was available for high descent angle STOL aircraft or helicopters.

As will be realised from the system description, MLS only provides positional information. The approach path on MLS is therefore only limited by the processing power within the receiver. In most MLS receivers, the pilot will make a selection of the desired approach angle which may be varied to suit the prevailing circumstances.

As an example of this, the author recently experienced a 3 degree conventional approach followed by a 6 degree glide path with 5 degree azimuth offset on consecutive runway approaches, the only necessary action on the part of the pilot being to select a different glide slope and azimuth settings on the equipment control unit.

A further development, which is not yet available, is that the software in the receiver will allow the flight crew to select a curved approach path which will have obvious environmental advantages in noise sensitive locations.

One of the most serious disadvantages of ILS is that, due to the frequencies used, it is very difficult to obtain a narrow beam for the azimuth guidance and, due to the system of operation, impossible in the vertical guidance element.

Due to these wide beam widths, signals from the edge of the beams are frequently reflected from surrounding high ground, buildings, etc, back towards the centre line where they combine with the beam and give false course information in the form of a bend in the indicated course. By careful location and selection of the transmitting equipment, this effect may be minimised, but there still remain some airports where it is impossible to install ILS.

With MLS, due to the very high frequencies involved, it is possible to generate extremely narrow beams, which consequently overcome much of this problem. In extreme cases the angle of the To-Fro scan can be reduced so that the radiated beam does not impinge on the reflecting object, thus maintaining the integrity of the transmitted information.

An example of this is at Pemberton Airport, near the Whistler ski resort in the Rocky Mountains in Canada. Here the airfield is at an elevation of 700ft and the approach path is at an angle of 7.5

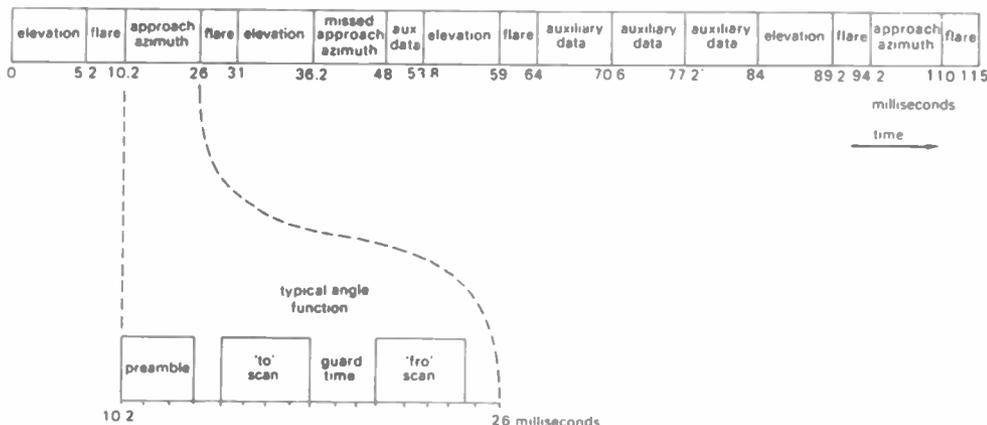


Fig 5 TRSB time division multiplex format

degrees through a narrow gap between 7000ft mountains. Prior to the installation of MLS, the airfield was closed whenever cloud was present, but now it can remain open in all but the worst conditions.

Implementation

Very much in its infancy, MLS is only operational in a few difficult sites in Canada and the USA. However, there is one operational installation in the United Kingdom at Yeovil and an experimental installation is on extended trial at London Airport.

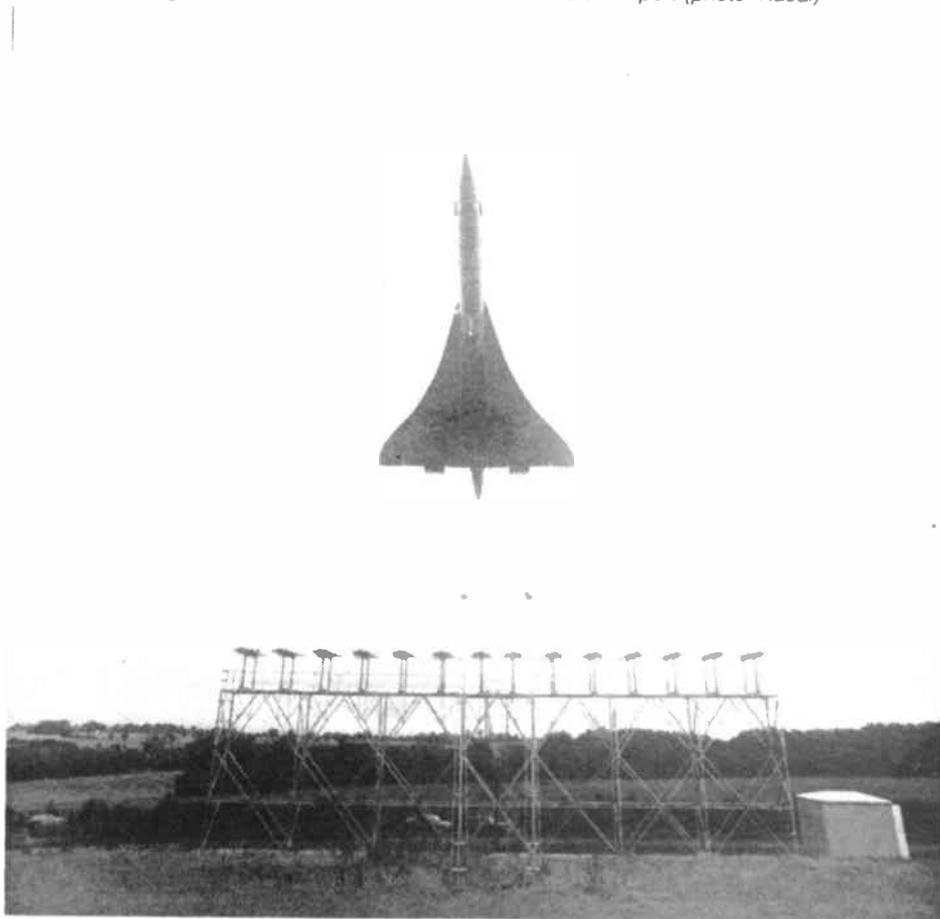
Until the year 1995 there is no requirement to install MLS at airports,

but from that date the system will have equal status to ILS.

Navigational facilities are extremely expensive to install and are expected to remain in service for fifteen to twenty years. As a consequence, the changeover to MLS will take a considerable period but, by the early years of the 21st century, the transformation should be complete and ILS but a memory.

In this and previous articles I have described the R/T, short range navigation and approach and landing systems. In my next I will be describing the types of primary radar used in air traffic control systems.

Concord passing over the Racal ILS azimuth aerials at Luton Airport (photo Racal)



ELMASET INSTRUMENT CASE

300x133x217mm deep £10.00 ea (£2.20)

REGULATORS

LM317T Plastic TO220 variable £1
LM317 Metal £2.20
7812 Metal 12v 1A £1.00
7805/12/15/24 plastic 50p 100 + 27p
7905/12/15/24 plastic 50p 100 + 27p
CA3085 T099 Variable regulator £1
LM338 5A variable £5

COMPUTER ICS

27128 250n⁵ NEW £3.30
68008 Processor Ex-Equip £5
27256-30 ex-eqpt £3.00
2764-30 USED £2
2716-45 USED £2 100+£1.50
1702 EPROM ex equip £5.00
2732-45 USED £2 100+£1.50
2114 EX EQPT 60p 4116 EX EQPT 70p
6264LP15 8K static ram £2.80
6116-3 (TC5517AP) £1.50
4416 RAM £3.50

SURFACE MOUNTED TRANSISTORS

BCW30 BCW31 BCW72 NTAV70 1s2836 min 50/type 100/£2.50

POWER TRANSISTORS

POWER FET IRF9531 2/£1
2N3055H RCA House numbered 5/£2
2SC1520 sim BF259 3/£1 100/£22
TIP141, 142/146, 1E1 ea, TIP112, 125, 42B 2/£1
TIP35B £1, 30 TIP35C £1.50
SE9302 100V 10A DARL SIM TIP121 2/£1
2N3055 Ex eqpt tested 4/£1
Plastic 3055 or 2955 equiv 50p 100/£35
2N3773 NPN 25A 160V £1.80 10/£16

QUARTZ HALOGEN LAMPS

A1/216 24v 150w £2.25
H1 12v 55w (car spot) £1.50

MISCELLANEOUS

To - 220 Heat Slnk sim RS 403-162 10/2.50
D.I.L. Switches 10 Way £1 8 Way 80p. 4/5/6 Way 50p
180 Volt 1 watt ZENERS ALSO 12V 20/£1
Miniature co-axial cable RG316U £0.50/metre
Olivetti logos calculator keyboard (27) key plus 12 Digit
fluorescent display on driver board (ie calculator less case,
transformer and printer) £1.30
Plastic Equipment case 9x6x1.25" with front and rear
panels containing PCB with eprom 2764 -30 and ICS 7417
LS30 LS32 LS74 LS367 LM311 7805 Reg. 9 way D plug, push
button switch, din socket £1.90
VNIOLM 60V 1/2 5ohm TO-92 mosfet 4/£1. 100/£20
MIN GLASS NEONS 10/£1
RELAY 5v 2 pole changeover looks like RS 355-741 marked
STC 47WB05T 2/£1
OMRON RELAY 3.6volt coil 2p c/o contacts marked
G4D-287P-BT2 2/£1
MINIATURE CO-AX FREE PLUG RS 456-071 2/£1
MINIATURE CO-AX FREE SKT RS 456-273 2/£1.50
STRAIN GAUGES 40 ohm Foil type polyester backed balco
grid alloy £1.50 ea 10+ £1
DIL REED RELAY 2 POLE n/o CONTACTS £1
Zettler 24v 2p c/o relay 30x20x12mm sim. RS 348-649
..... £1.50 100+ £1
ELECTRET MICROPHONE INSERT £0.90
Linear Hall effect IC Micro Switch no 613 SS4 sim RS
304-267 £2.50 100+ £1.50
Hall Effect IC UGS3040 + MAGNET £1.00
OSCILLOSCOPE PROBE SWITCHED X1X10 £10
CHEAP PHONO PLUGS 100/£2 1000/£18
1 pole 12 way rotary switch 4/£1
AUDIO ICS LM380 LM386 £1 ea
555 Timer 5/£1 741 Op AMP 5/£1
COAX PLUGS nice ones 4/£1
4 x 4 MEMBRANE KEYBOARD £1.50
15,000uF 40V SPRAGUE 36D £2.50 (£1.25)
INDUCTOR 20uH 1.5A 5/£1
NEW BT PLUG + LEAD £1.50

1.25" PANEL FUSEHOLDERS 5/£1
CHROMED HINGES 14.5 x 1" OPEN £1 ea
TOK KEY SWITCH 2 POLE 3 KEYS ideal for car/home
alarms £3
12v 1.2W small wire ended 1 amps fit AUDI VW TR7 SAAB
VOLVO 10/£1
12V MES LAMPS 10/£1
STEREO CASSETTE HEAD £2
MONO CASS. HEAD £1 ERASE HEAD 50p
THERMAL CUT OUTS 50 77 85 120C £1 ea
THERMAL FUSE 121C 240V 15A 5/£1
TRANSISTOR MOUNTING PADS TO-5/TO-18 £3/1000
TO-3 TRANSISTOR COVERS 10/£1
STICK ON CABINET FEET 30/£1
PCB PINS FIT 0.1" VERO 200/£1
TO-220 micas + bushes 10/50p 100/£2
TO-3 micas + bushes 20/£1
Kynar wire wrapping wire 2oz £1
PTFE min screen cable 10m/£1
Large heat shrink sleeving pack £2
CERAMIC FILTERS 6M/9M/10.7M 50p 100/£20
TOKIN MAINS RFI FILTER 250v 15A £3
IEC chassis plug rfi filter 10A £3
Potentiometers short spindles values 2k5 10k 25k 1M 2M5
new value 5/£1
500k lin 500k log 4/£1
40Khz ULTRASONIC TRANSDUCERS EX-EQPT NO
DATA £1/pr
PLESSEY INVERTER TRANSFORMER 11.5-0-11.5V to
240v 200VA £8 (£3)
Large Qty Available 240 to 115v step down transformers
1kVA £13 carr £3

DIODES & RECTIFIERS

1N4148 100/£1.50
1N4004/SD4 1A 300V 100/£3
1N5401 3A 100V 10/£1
BA158 1A 400V fast recovery 100/£3
BA159 1A 1000V fast recovery 100/£4
120v 35A stud 65p
12FLO 12A 200V small stud 4/£1.50 100/£25
BY127 1200V 1.2A 10/£1
BY254 800v 3A 8/£1
BY255 1300v 3A 6/£1
6A 100V Similar MR751 4/£1
VM88 800mA 100VDIL b/REC 5/£1
1A 800v bridge rectifier 4/£1
4A 100V bridge 3/£1
6A 100v bridge 50p
8A 200V Bridge 2/£1.25
10A 200v bridge £1.50
25A 200v bridge £2 ea 10/£18
25A 400v bridge £2.50 10/£22

SCRs

2P4M equiv C106D 3/£1 100/£20
MCR71-6 10A 600V SCR £1
35A 600v stud £2
TICV106D. 8A 400V SCR 3/£1 100/£15
MEU21 Prog. unijunction 3/£1

TRIACS

NEC Triac ACO8F 600V TO 220 5/£2 100/£30
NEC Triac 150L Tab TO220 6A 400V 2/£1
ACOV8FGM 800mA 400V TO92 TRAC 3/£1
Diacs 4/£1
TXAL225 8A 400V 5mA gate 2/£1 100/£35
TRAL 2230D 30A 400V isolated stud £4 each

CONNECTORS

Centronics 36way IDC plug £4 10+ £3.50
Centronics 36way IDC skt £4
Centronics 36way plug (solder type) £40
USED Centronics 36W plug & socket £3
'D' 9-way £1; 15-way £1.50; 25-way £2
37-way £2; 50-way £3.50; covers 50p ea

WIRE WOUND RESISTORS

W21 or Sim 2.5W 10 of one value £1
R10 0R15 0R22 2R0 4R7 5R0 5R6 8R2 10R 12R 15R 18R 20R
22R 27R 33R 36R 47R 56R 62R 91R 100R 120R 180R 330R
430R 470R 560R 680R 820R 910R 1K15 1K2 1K5 1K8 2K4 2K7
3K3 3K0 5K0 10K R05 (50 milliohm) 1% 3W 4 for £1
W22 or Sim 6W 7 of one value £1
R47 R62 1R0 1R5 1R8 3R3 6R8 9R1 10R 12R 20R 24R 27R 33R
51R 56R 62R 68R 100R 120R 180R 220R 270R 390R 560R

620R 910R 1K0 1K2 1K5 1K8 2K7 3K3 3K9 4K7 8K2 10K 15K
16K 20K
W23 or Sim 9W 6 of one value £1
R22 R47 1R0 1R1 15R 56R 62R 68R 100R 120R 180R 220R 300R
390R 680R 1K0 1K5 5K1 10K
W24 or Sim 12W 4 of one value £1
R50 1R0 2R0 6R8 9R1 10R 18R 22R 27R 56R 68R 75R 82R 100R
150R 180R 200R 220R 270R 400R 620R 6K8 8K2 1K0 10K 15K

PHOTO DEVICES

Slotted opto-switch OPCOA OPB815 £1.30
2N5777 50p only
TIL81 T018 Photo transistor £1
TIL38 Infra red LED 5/£1
OPI252 Opto Isolator 50p
Photo diode 50p 6/£2
MEL12 (Photo darlington base n/c) 50p
RPY58A LDR 50p ORP12 LDR 70p
LEDs RED 3mm or 5mm 12/£1 100/£6
GREEN or YELLOW 3 or 5mm 10/£1 100/£6.50
FLASHING RED OR GREEN LED 5mm 50p 100/£35

SUB MIN PRESETS HORIZONTAL

1K 4K7 10K 22K 47K 1M 10M 15/£1 100/£5

MULTI TURN PRESETS

10R 20R 100R 200R 250R 500R 50p
1K 5K 10K 22K 50K 100K 200K 2K2 2K5 47K 500K 2M2

IC SOCKETS

6-pin 15/£1 8-pin 12/£1; 14-pin 10/£1.00; 18/20-pin 7/£1;
22/24/28 pin 4/£1 40 pin 30p

TRIMMER CAPACITORS 5/50p

Grey 1.5 to 6.5pF Grey larger type 2 to 25pF purple
Transistors 2N4427

Feed Thru Ceramic Caps 1000pF 10/£1

SOLID STATE RELAYS NEW 10A 250v AC

Zero voltage switching
Control voltage 8-28v DC £2.50
40A 250V AC Solid State relays £18

POLYESTER/POLYCARB CAPS

1n/3n/5n/6n/2/10n 1% 63v 10mm 100/£6
10n/15n/22n/33/47n/68n 10mm rad 100/£3.50
1uF 250V Mullard/Siemens AX 10/£1 100/£8
100N 250V radial 10mm 100/£3
2u2 160v rad 22mm 100/£10
33n/47n 250v AC X rated rad 15mm 10/£1.00
1u 600V Mixed dielectric 50p ea

BEAD THERMISTORS

GLASS BEAD NTC Res @ 20°C 80p
250R 1K2 50K 220K 1M4

BEAD TANTALUM CAPS

8 25V 47u 3V 12/£1 100/£6
2u2 20V 8/£1 100/£8

MONOLITHIC CERAMIC CAPS

10n 50V 2.5mm 100/£4.50
100n 50v 2.5mm or 5mm 100/£6
100N 50V axial Shortleads 100/£30
10N 50V 100/£4 1000/£35

STEPPER MOTOR 4 PHASE 2 9v WINDINGS

£3.50 10/£30

KEYTRONICS

MAIL ORDER ONLY

P.o. Box 634

Bishops Stortford, Herts, CM23 2RX

TELEPHONE: 0279 505543

ELECTRONIC COMPONENTS BOUGHT FOR CASH

MIN CASH ORDER £3.00 OFFICIAL ORDERS WELCOME
UNIVERSITIES COLLEGES SCHOOLS GOVT DEPARTMENTS
MIN. ACCOUNT ORDER £10.00

P&P AS SHOWN IN BRACKETS (HEAVY ITEMS)
65p OTHERWISE (LIGHT ITEMS)

ADD 15% VAT TO TOTAL



Ray Marston looks at a further selection of Phase Locked Loop (PLL) IC circuits

In last month's edition of *Data File* we explained the basic operating principles of Phase Locked Loop systems, and then went on to take a detailed look at the 4046B CMOS PLL IC. We concluded by looking at a variety of practical ways of using the VCO (voltage controlled oscillator) section of this IC. In the present edition of *The File* we look at a further selection of practical applications of the 4046B IC.

Sound-effects generators

The VCO section of the 4046B IC is exceptionally versatile. Its operating frequency can be scanned over a very wide range via a control voltage applied to pin 9, and its output can be gated on and off via a voltage applied to pin 5. These characteristics make the IC suitable for use in a variety of special sound-effect generator applications, and *Figures 1 to 6* show a selection of practical circuits of this type.

The circuit in *Figure 1* acts as a conventional siren-sound generator; it produces a tone that rises slowly from zero to a maximum value when SW1 is closed, or falls slowly from maximum to zero when SW1 is opened. This action is caused by the C1 voltage that is applied to voltage-control pin 9, and which rises exponentially via R1 when SW1 is closed, or falls exponentially via R2 when SW1 is opened. Note that R3 ensures that the operating frequency falls to zero when the pin 9 voltage is zero. The VCO output is ac-coupled to the speaker via C4 and Q1.

Figure 2 shows how the above circuit can be modified to give a quick-start action in which the frequency rapidly switches to maximum value when SW1 is closed (as C1 charges rapidly to half-supply volts via R1-R2 and D1), but decays slowly to zero when SW1 is

opened (as C1 discharges exponentially via R3).

Figure 3 shows how the circuit can be further modified so that it generates a phasor sound of the *Star Trek* kind when push button switch PB1 is closed. In this case the 4011B IC is wired as an astable multivibrator that is gated via PB1 and produces a chain of 4mS pulses at intervals of 70mS.

Each pulse rapidly charges C2 via R3-D2, to produce a high tone that then decays fairly slowly as C2 discharges via R5, only to be repeated again on the arrival of the next pulse.

A different type of sound generator circuit is shown in *Figure 4*. This design can be used to generate either a pulsed tone or a warble tone signal (depending on the SW1 setting) when PB1 is closed.

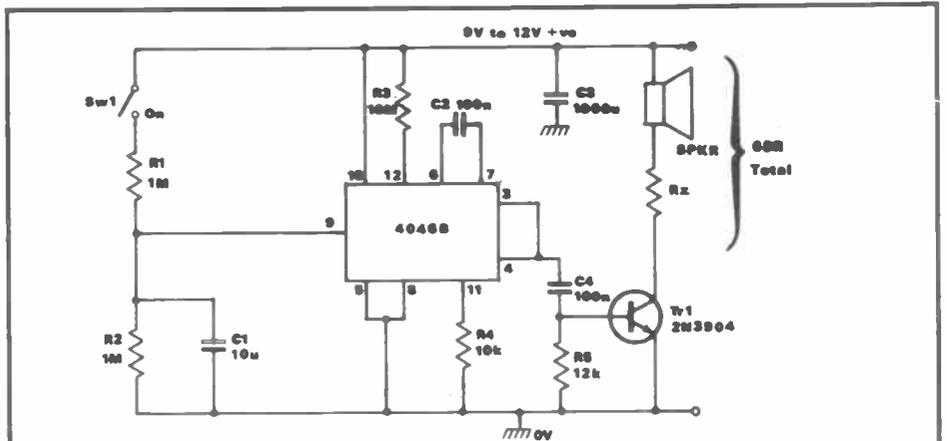


Fig 1 Electronic siren circuit

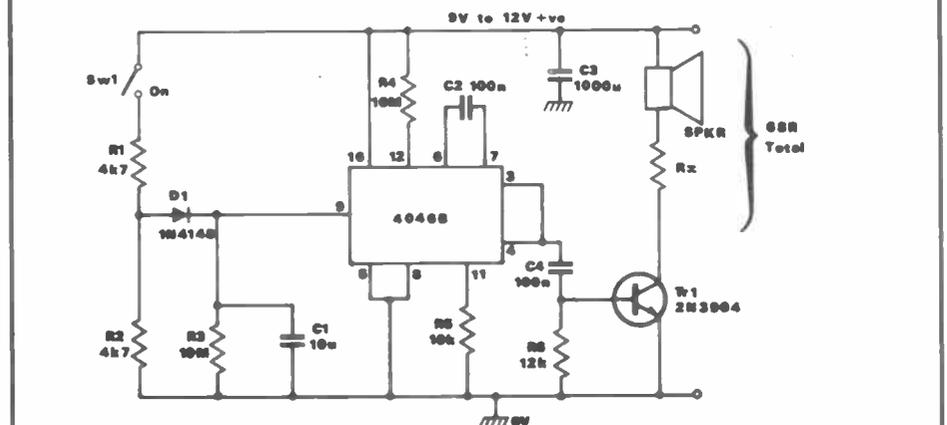


Fig 2 Quick-start siren circuit

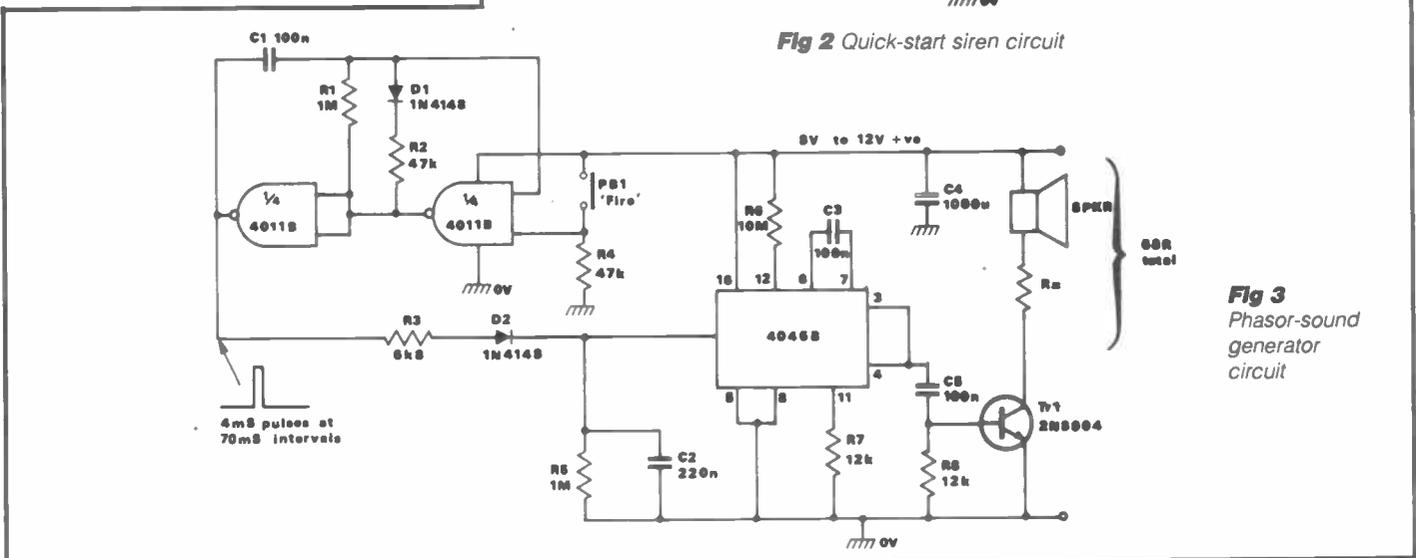


Fig 3 Phasor-sound generator circuit

DATA FILE

Here, PB1 is used to simultaneously enable pin 5 of the 4046B and to gate on the 4001B astable multivibrator, which then applies a rectangular (alternately fully-high and fully-low) waveform to pin

9. In the pulsed mode, the VCO generates zero frequency when pin 9 is low. In the warble mode it generates a tone that is 20% down on the high tone when pin 9 is low.

Figure 5 shows the circuit of a special-effects run down clock/sound generator of the type used in electronic dice and roulette games. The circuit action is such that a fast-spinning clicking sound is generated when PB1 is pressed, and the clicking rate slowly decreases (runs down) to zero when PB1 is released. The circuit operates as follows.

When PB1 is pressed, C1 rapidly charges to a high voltage via D2. Simultaneously, Q1 is biased on via D3-R4 and connects R6 between pin 11 and ground, thus making the VCO operate at tens of kHz and thus effectively generate an unpredictable (random) number of clock pulses. When PB1 is released, Q1 turns off and VCO timing is governed by R7. Simultaneously, C1 rapidly discharges to half-supply volts via R1-R2-D1, causing the VCO to operate at about 100Hz. C1 then slowly discharges via R3, and the VCO frequency slowly decays to zero over a period of about 15 seconds.

The output of the Figure 5 circuit can be used to directly clock most types of counter, and can be direct-coupled (via R9) to crystal or ceramic transducers to produce low-level run-down sounds. Note that the circuit's output may settle in either the logic 0 or logic 1 state when the run-down is complete, so the output should not be dc-coupled to power amplifier stages, etc.

Figure 6 shows how the above circuit can be modified to ensure that the output always settles in the logic-0 state on completion of the run-down, thus making it safe to direct-couple the output to power amplifier stages, etc. Here the 3140 op-amp is wired as a voltage comparator and is used to automatically turn the VCO off and drive its output low (via pin 5) when the pin 9 voltage falls below a reference value of roughly 2 volts (set on pin 3 of the op-amp).

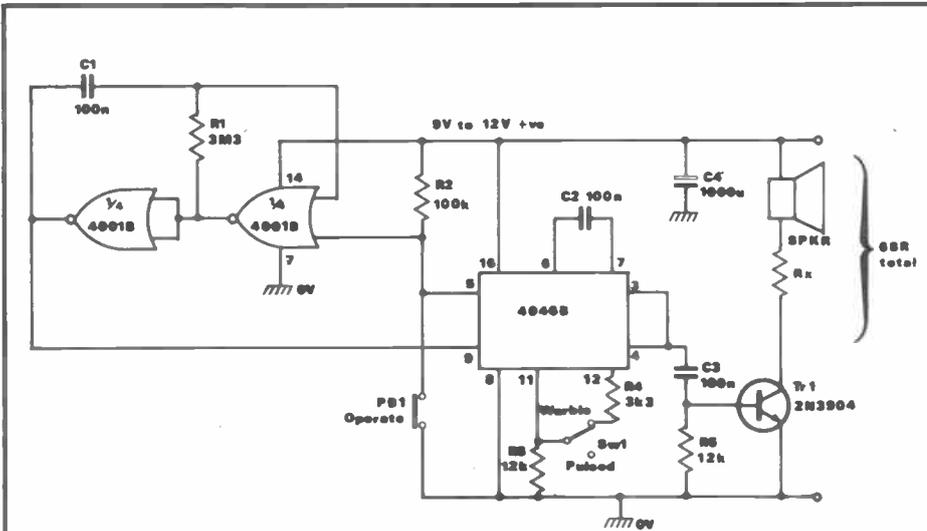


Fig 4 Combined pulsed-tone/warble-tone alarm generator

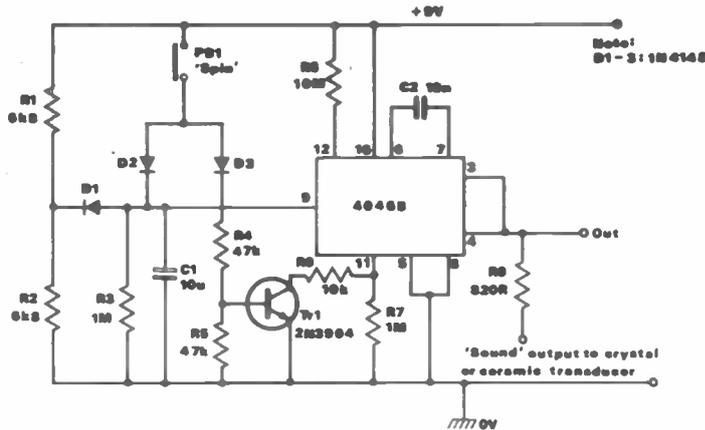


Fig 5 'Run down' deck/sound generator circuit

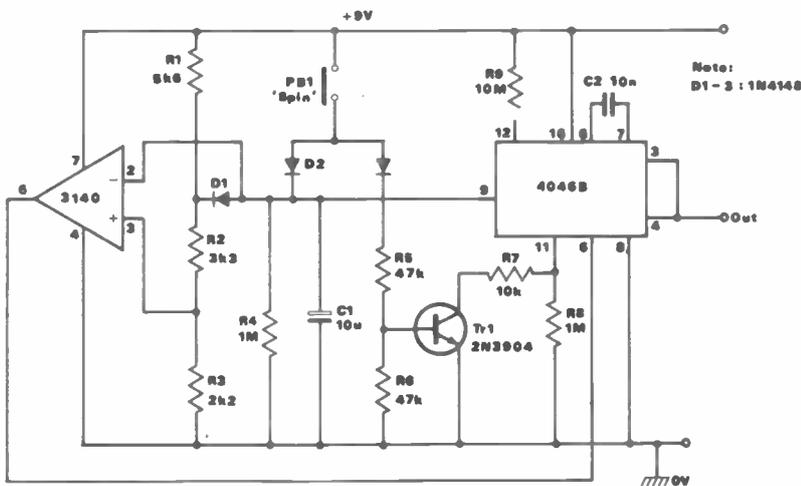


Fig 6 Modified version of the run-down generator

Special VCO circuits

The versatility of the VCO section of the 4046B makes it suitable for use in a variety of special-purpose waveform generator applications, and Figures 7 to 9 show a brief selection of such circuits.

The Figure 7 circuit is that of a simple FSK or frequency shift keyed square wave generator. With the particular component values shown, this circuit generates a tone frequency of 2.4kHz when a logic-1 signal is applied to pin 9, or a 1.2kHz tone when a logic-0 signal is applied to the same point. Note that the high tone is determined by the C1-R2 values, and the low tone by the C1 and R2+R3 values, and that alternative tone frequencies can readily be obtained by altering these component values.

The Figure 8 circuit is that of a 220kHz FM waveform generator. Here the internal Zener (pin 15) of the 4046B is used to provide a stable supply to the 3140 op-amp, which is wired as a $\times 20$ inverting ac amplifier but has a quiescent bias of

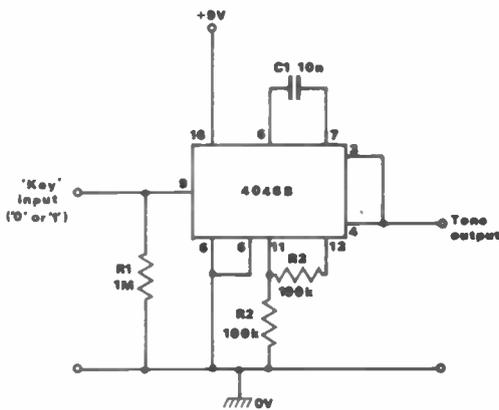


Fig 7 FSK generator. Logic 0=1.2kHz, Logic 1=2.4kHz.

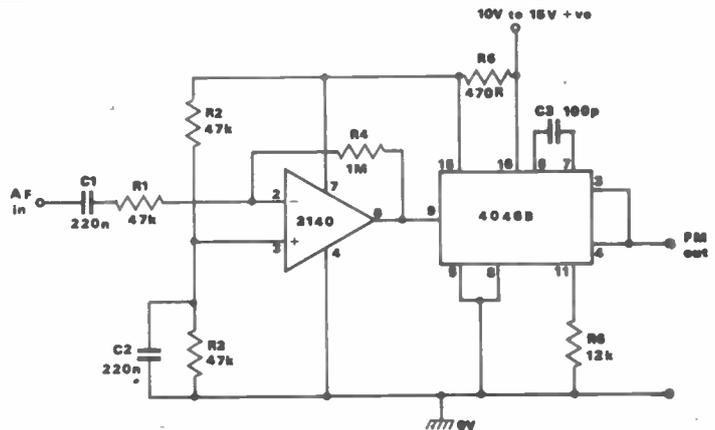


Fig 8 220kHz FM generator

about 2.6 volts applied to its non-inverting (pin-3) input via R2-R3, so that the output (pin 6) of the op-amp comprises a mean 2.6 volt potential that is amplitude modulated with an amplified ($\times 20$) version of the AF input signal. This output is applied to the voltage control input terminal (pin 9) of the 4046B's VCO, which has its C3-R6 component values chosen so that it generates a mean output carrier frequency of 220kHz, which is frequency modulated via the original AF input signal.

Finally, Figure 9 shows how the 4046B VCO can be used as a wide-range universal square-wave 'clock' generator that spans the nominal range 0.5kHz to 500kHz in three switch-selected bands. This simple but very useful piece of test gear provides a 2-phase output and can be used in either the free-running or the gated modes.

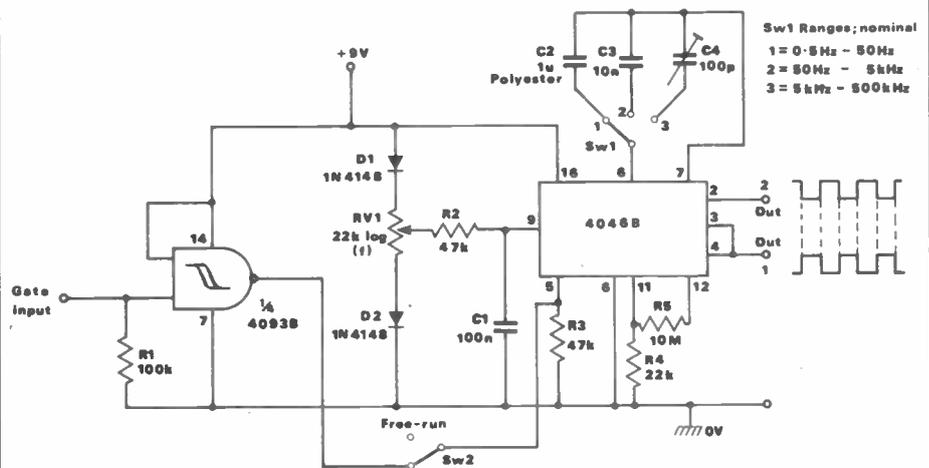


Fig 9 'Universal' clock/square wave generator

PLL circuits

The 4046B is a PLL device. The basic operating principles of the basic phase-locked loop (PLL) circuit were fully explained last month, so in this concluding section of this edition of *Data File* we'll look at some practical ways of using the 4046B in useful PLL applications.

Figure 10 shows the 4046B used as a wide-range signal tracker, which will capture and track any input signal within the approximate frequency range 100Hz to 100kHz, provided that the input signal (to pin 14) switches fully between the 0 and 1 logic levels. Note that this circuit (and all others shown in this section) makes use of wide-range phase-comparator 2, and it can thus lock to any signal within the 'span' range of the VCO. Filter R2-R3-C2 is used as a sample-and-hold network in this operating mode, and its component values simply determine the settling and tracking times of signal capture. The VCO operating frequency is determined by R1-C1 and the pin 9 voltage. The VCO 'span' range (and thus the capture and tracking range of the circuit) ranges from the VCO frequency

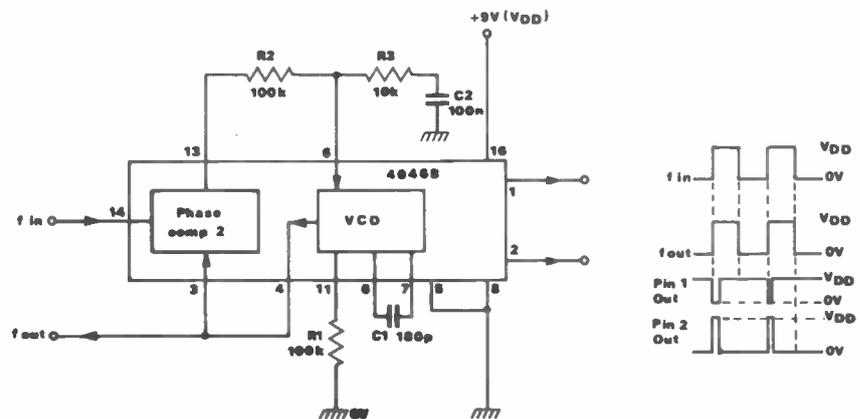


Fig 10 Wide range PLL signal tracker, showing waveforms obtained when the loop is locked

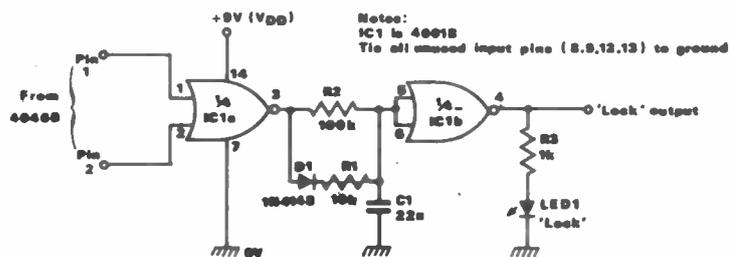


Fig 11 PLL 'lock' detector/indicator

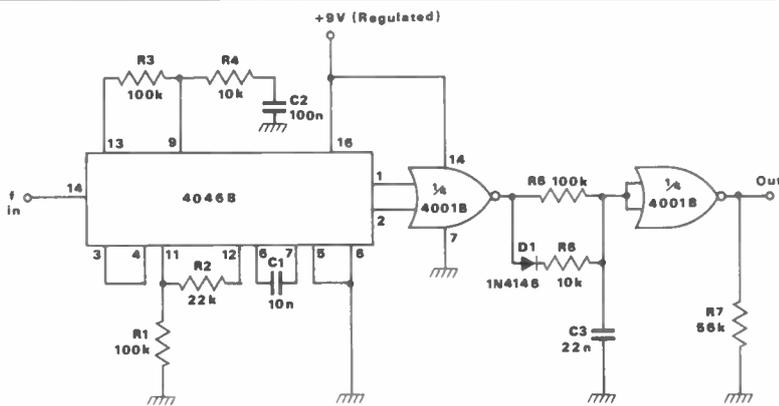


Fig 12 Precision narrow-band (1.8kHz-2.2kHz tone switch)

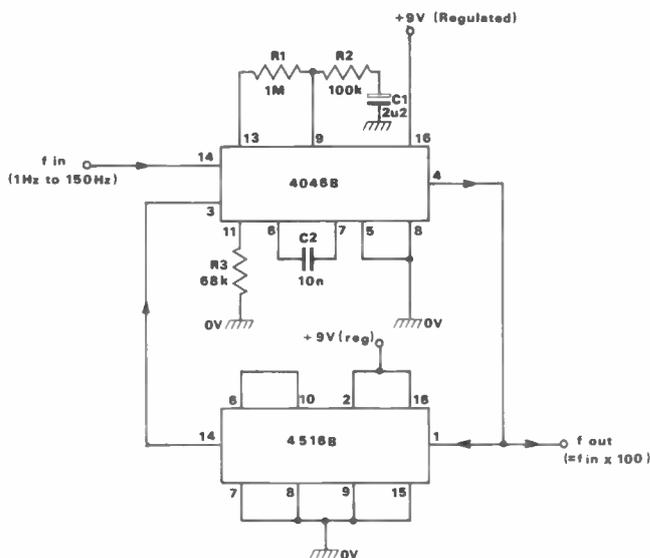


Fig 13 A low frequency $\times 100$ multiplier/pre-scaler

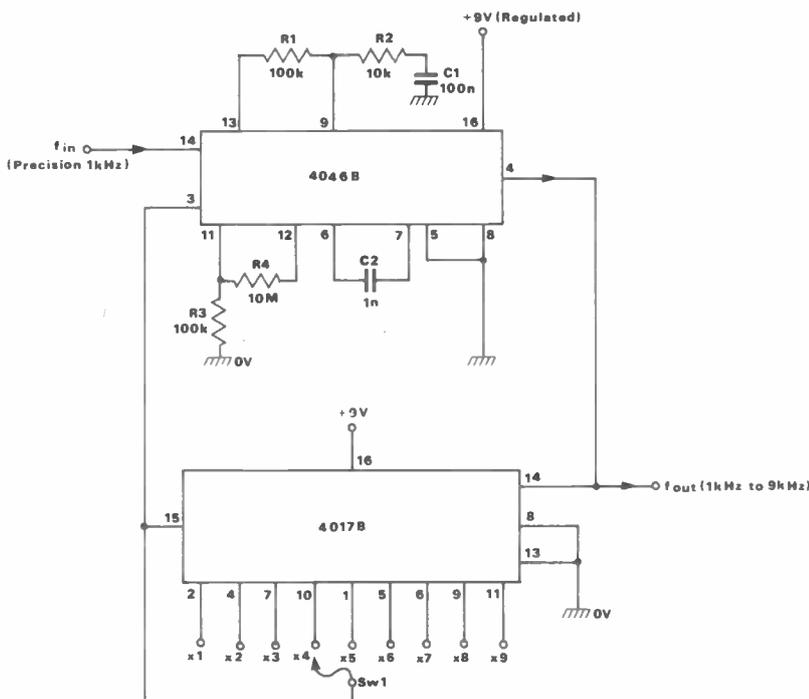


Fig 14 Simple 1kHz-9kHz frequency synthesizer

value obtained with pin 9 at zero volts to that obtained with pin 9 at VDD volts.

Figure 11 shows a simple but very useful lock detector/indicator circuit that can be used in conjunction with the above PLL circuit. In the PLL the output of each phase comparator comprises a series of pulses with widths proportional to the difference between its two input signals. The output of phase comparator 1 is normally low, and that of phase comparator 2 is normally high, except for these pulses. When the PLL circuit is locked (see Figure 10), the two outputs are almost perfect mirror images of each other; when the loop is not locked, the signals are greatly different.

In the Figure 11 lock detector/indicator circuit the above facts are put to use via the 2-input NOR gate IC1a, which is driven from the outputs of the two comparators. The circuit action is such that if the loop is locked, the IC1a output remains permanently low, thus driving the IC1b output high and illuminating LED 1. If the loop is not locked, however, the IC1a output comprises a series of positive-going pulses that rapidly charge C1 via D1-R1, thereby forcing IC1b output low and holding LED 1 fully off.

Narrow band tone switch

Figure 12 shows how a PLL circuit can be combined with a lock indicator to make a precision narrow-band tone switch. Here the VCO's maximum frequency is determined by R1-C1 and the minimum frequency by (R1+R2)-C1. With the component values shown, the frequency is variable from about 1.8kHz to 2.2kHz, and the circuit can thus only lock to input signals within this frequency range. The output of the circuit is normally low, but switches high in the presence of a suitable input signal.

Finally, Figures 13 and 14 show a couple of practical frequency multiplier circuits. The Figure 13 design acts as a $\times 100$ frequency multiplier/pre-scaler that can be used to change 1Hz to 150Hz input signals into 150Hz to 15kHz output signals that can easily be read on a standard frequency counter. The 4518B IC used in this circuit actually contains a pair of decade counters, and in Figure 13 these are cascaded to make a divide-by-100 counter.

The Figure 14 circuit acts as a simple frequency synthesizer. It is fed with a precision (crystal derived) 1kHz input signal, and provides an output that is a whole-number multiple (in the range $\times 1$ to $\times 9$) of this signal. The 4017B is used as a programmable divide-by-n counter in this application. The single 4017B can easily be replaced by a string of programmable decade counters, to make a wide-range (10Hz to 1MHz) synthesizer.

In next month's edition of *Data File* we will continue the PLL theme by looking at the NE565 and NE567 types of IC. 

POOR MAN'S

RECEIVER

Build a Short Wave receiver for £15

by Sir Douglas Hall

The design described in this article can be built for about £15. It is the result of recent experimental work carried out with the object of producing a very simple short wave receiver which will receive stations from all over the world, including CW and SSB signals, with few components and minimum cost.

Obviously, it will not give the same results as a sophisticated receiver costing, perhaps, twenty times as much, but its efficiency will probably surprise many who build it. Ordinary 8 ohm stereo phones are used, connected in parallel by the wiring for 4 ohm mono function, and the cheaper phones are better for

this purpose as they are usually much more sensitive than the more expensive hi-fi types.

As the current drawn from the battery is just under 1mA, the running costs are extremely small, and a PP3 battery will give hundreds of hours of service unless the receiver is put away for long periods without use. The frequency band covered is continuous from about 16MHz to about 1.35MHz. Speaking in terms of wave length, this means that the 19, 22, 25, 31, 41, 49, 60 and 75 metre broadcast bands are covered, plus the high frequency end of the medium wave band. This can be useful; Radio Devon is well

received at the author's home in Devon. In addition, the 20, 40, 80 and 160 metre amateur bands are catered for. No coil changing is involved.

If Figure 1 is examined it will be seen that the signal is applied to the emitter of Tr1, which acts as a common base RF amplifier, the output being applied by C6 to the base of Tr2. This second transistor is connected in my Spontaflex configuration, a circuit which was introduced by me in this magazine's predecessor (*Radio Constructor*) in varying forms to suit medium and long waves, short waves and VHF FM signals respectively. It will be seen that Tr2 acts as an emitter

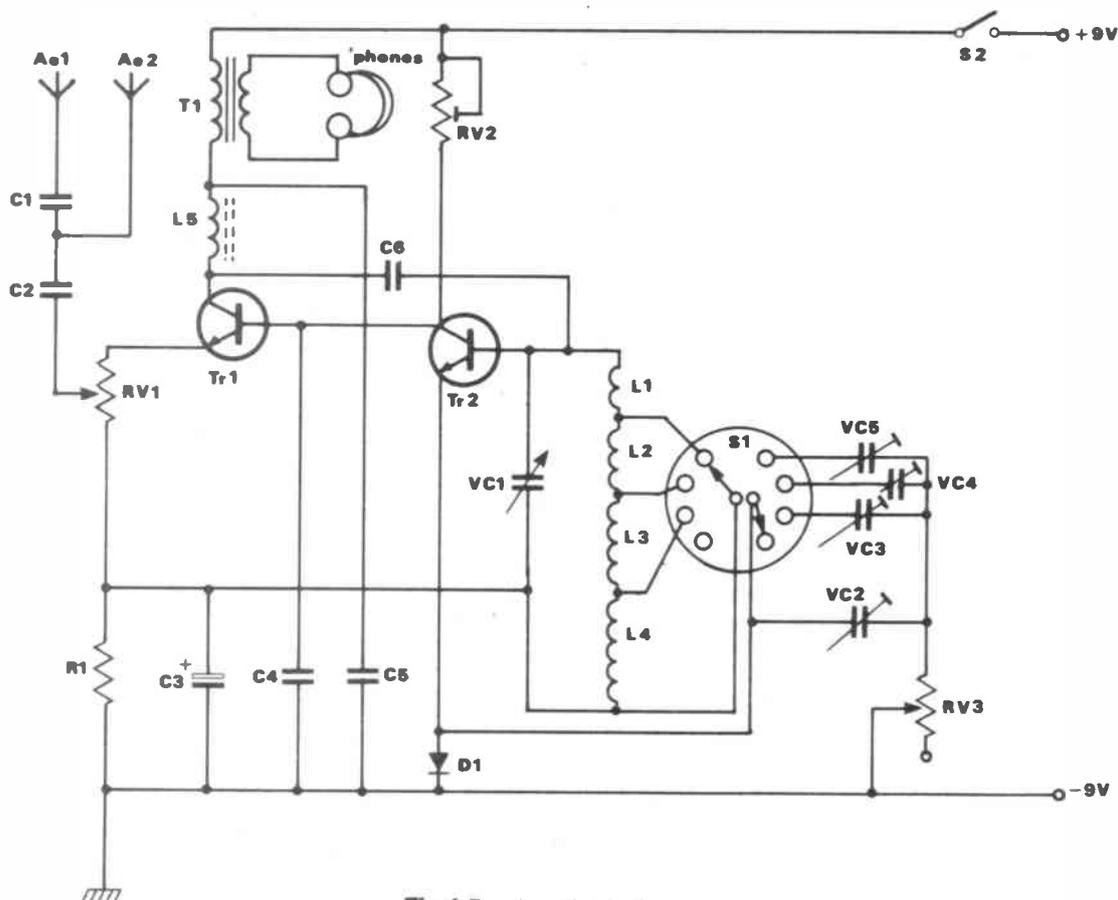


Fig 1 Receiver circuit diagram

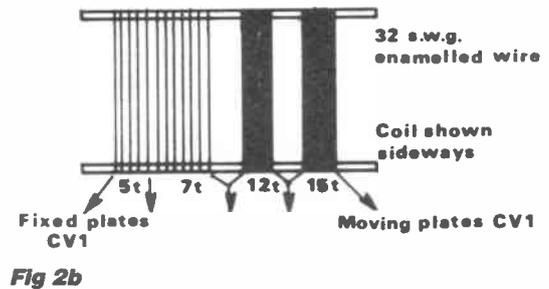
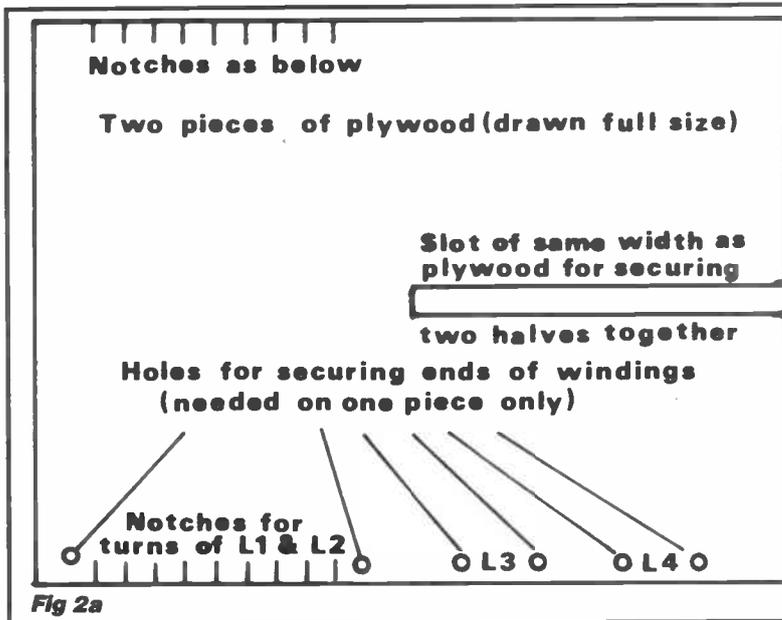


Fig 2b

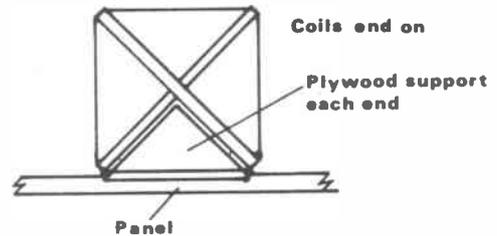


Fig 2c

foilower at RF, detection takes place at D1 and the AF signal is then automatically applied back to the transistor now acting as a common base amplifier. This circuit is unique in that both the incoming RF signal and the outgoing AF signal are at high impedance – an arrangement which is not possible with any of the orthodox methods of connecting a single bipolar transistor.

At first sight it might appear that Tr2's output load, VR2, would be heavily damped by the low input impedance of Tr1, but as this impedance varies in inverse proportion to the current passed, and in direct proportion to the amplification factor, circumstances favour a fairly high input impedance. This is further assisted by the negative feedback provided by VR1 which is not bypassed at AF. In the result, and with the high impedance output load provided by T1, the overall amplification given by Tr1 is very high.

It has already been stated that the input impedance of Tr2 at RF is high; hence, a single coil without a tapping can be used as RF input load. This removes the voltage drop normally experienced as a result of the step down in impedance required for a common base or common emitter amplifier, and compensates to some degree for the fact that Tr2 does not provide voltage amplification at RF except through reaction. Also, by using the Colpitts method for obtaining reaction, a separate coil for this purpose is avoided and this makes the design of the coil very simple. Reaction results from the capacitance tap effect of one or other of the four trimmer capacitors in conjunction with the internal capacitances of Tr2, the exact amount of feedback being controlled by VR3.

It is convenient to have two separate aerial terminals, one for connection of a long external aerial through the small resulting capacitance of C1 and C2 in series, the other for use of a short indoor aerial (which may be a few feet of wire up to a picture rail) through the larger capacitor C2 only. The prototype has a telescopic aerial built in and connected

to Ae2, but this is not essential and is not included in the £15 estimate. Although an earth terminal is shown, it has been found in practice that unless a very short aerial is used results are better from an overall sensitivity/selectivity point of view without an earth. Experiment is called for here, to suit local circumstances, and it may be found that the values of C1 and C2 can sometimes be changed with advantage.

The heart of this receiver is the coil unit, which is made as shown in Figure 2. Figure 2a is drawn full scale and a tracing may be made of it and used as a template. It is a good plan to varnish the former before the coil is wound on it to prevent any absorption of moisture in damp conditions.

Setting up the receiver is very simple. Adjust VR2 for maximum resistance. Attach an aerial, selecting the terminal in accordance with the remarks made earlier. Turn S1 to the position shown in Figure 1. VC2 is then adjusted so that reaction can be controlled satisfactorily by VR3 for any setting of VC1 combined with any setting of VR1. S1 is then turned so that L2 is brought into circuit, and VC3 is adjusted for satisfactory performance. The procedure is then carried out for the other two settings of S1 in exactly the same way. If satisfactory reaction proves impossible on any band, reduce the resistance presented by VR2. Problems are unlikely, but the highest frequency band is the one likely to produce any that may occur.

If you wish to receive CW or SSB, VR3 is adjusted so that the receiver is oscillating gently, a slight hiss giving the indication. No disturbance will be caused to others because of the buffer effect of Tr1. For AM signals the reaction setting should be just short of the oscillation point for maximum sensitivity and selectivity, VR1 being used to reduce the input if this is necessary with powerful signals. There should be no backlash, the receiver sliding gently in and out of oscillation as VR3 is adjusted. The presence of backlash indicates a faulty component or a wiring fault.

The transistor type chosen has been selected after very thorough experimentation. Constructors should not buy 'equivalents' which may not work well in this design. The 2N3707s only cost 4p each at Brian Reed's (161 St John's Hill, Clapham Junction, London SW11 1TQ. Tel: 01-223 5016).

It is assumed that anyone who makes this receiver will have had some construction experience, or will have help available from someone who has. So detailed layout instructions are not

PARTS LIST

Resistors

R1	1.2kohms, ¼W carbon
VR1	220 or 250 ohms pot
VR2	47kohms preset
VR3	470 or 500 ohms pot

Capacitors

C1	10pF ceramic or silver mica
C2	100pF ceramic or silver mica
C3	100µF 6V radial elect
C4	1.5kpF ceramic
C5	1.5kpF ceramic
C6	10pF ceramic or silver mica
VC1	100pF air-spaced
VC2	50pF trimmer
VC3	50pF trimmer
VC4	50pF trimmer
VC5	50pF trimmer

Inductors

L1	4.7MH choke, Siemens
L2-5	See text
T1	'Small pentode' op transformer

Semiconductors

Tr1	2N3707
Tr2	2N3707
D1	OA81 or OA91

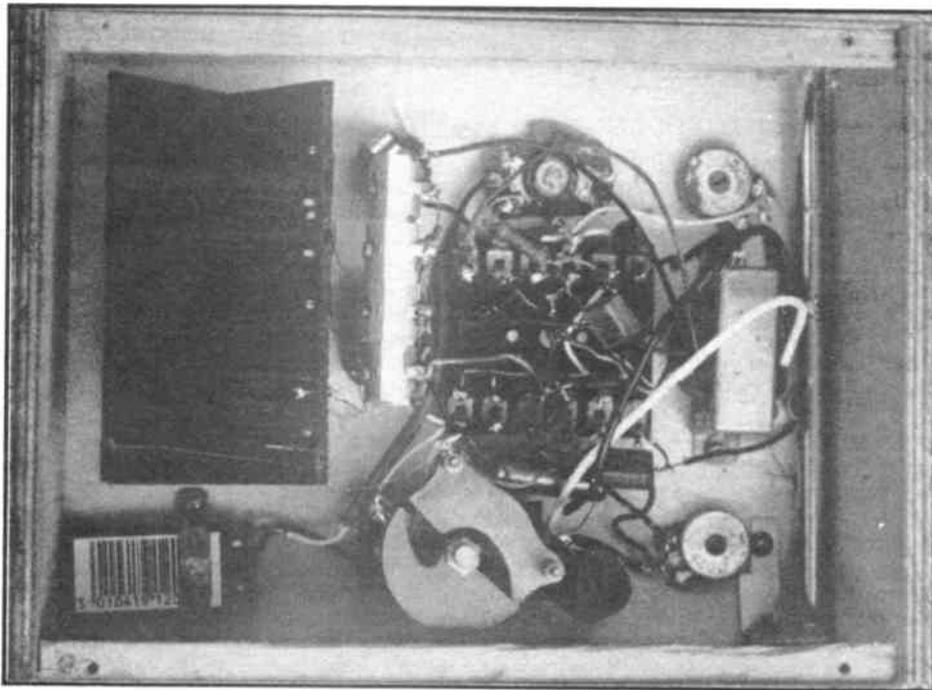
Switches

S1	2 pole 4 way
S2	slide switch

Miscellaneous

9 way group board
Reduction drive
4 knobs
1 stereo phone jack
3 sockets for A and E
Plywood, screws, panel pins, etc

Poor Man's Receiver



Many people have their favourite suppliers of components, but it might be mentioned that if the following shopping list is used the total cost of components, including VAT, postage and packing, will come to under £14 at the time of writing. The suggested shopping list is T1 from Radio Components Specialists, 337 Whitehouse Road, West Croydon, Surrey; VC1, the reduction drive, the one fixed resistor, L1, 2oz of wire and the stereo phone jack from Electrovalue, 28 St Jude's Road, Englefield Green, Egham, Surrey TW20 0HB; and all other components, including the four trimmers in the form of a five trimmer unit, one of which can be cut off, from Brian Reed, address as above.

About £1 remains out of the £15 to cover the cost of a little plywood for the coil unit and case, plus a few wood screws and panel pins. It is noteworthy that nearly half the cost is taken up by VC1 and its reduction drive, and if these are in the spares box, or obtainable from a surplus dealer, the cost will be drastically reduced. Phones are not included. I use Ross Electronics type RE220. An amplifier can be used, connected across the primary of T1 with an isolating capacitor if necessary. If the amplifier is mains operated, an earth will automatically be connected to the receiver and the remarks made earlier will apply. 

provided, but it may be of interest to know that the prototype is built with all the components mounted on a plywood panel measuring 23cm by 18cm, which is itself over a plywood box 7½cm deep. The box should not be made of metal or

be metal lined, and it is convenient to operate the receiver in such a way that the coil is standing vertically. If the unit is horizontal it will act as a frame aerial and pick up powerful signals direct in a way which cannot be controlled by VR1.

THE COMMUNICATIONS AND ELECTRONICS MAGAZINE



- Regular well-informed columns on various aspects of amateur communication
- Up-to-date news on the latest technology
- Simple and useful constructional projects, plus clear explanations of the theory behind them
- Delivery to your door by publication date each month
- Inflation proof – price guaranteed for 12 months

On sale NOW at your newsagent and at equipment dealers

RADIO & ELECTRONICS WORLD SUBSCRIPTION ORDER FORM

To: Subscription Department • Radio & Electronics World • 1 Clarendon Road • Croydon • Surrey • CR0 3SJ
Tel: 01-760 0409

PLEASE SUPPLY: (tick box) for 12 issues, all rates include P & P

Inland	World-Surface	Europe-Air	World-Air
£16.80..... <input type="checkbox"/>	£18.70..... <input type="checkbox"/>	£22.45..... <input type="checkbox"/>	£29.40..... <input type="checkbox"/>

NAME.....

PAYMENT ENCLOSED:

£ —

Cheques should be made payable to Radio & Electronics World Overseas payment by International Money Order, or credit card

ADDRESS.....

CREDIT CARD PAYMENT **EXPIRY**

.....

..... Postcode.....

Signature.....

MEDIUM WAVE

DXING

by Steve Whitt



This month I'll be taking a look at some of the mystery signals that lurk between the more usual broadcasting stations. But firstly, to get the ball rolling this month I have a feature on how to successfully identify the stations you hear.

The identification question

If you tune in to your local radio station it soon reveals its identity through a number of clues: its strength, frequency, programme style and most importantly its on air ID (callsign, jingle, etc), which is easily heard since there is no interference. We now need to ask what happens when you are trying to decipher a weak, fading signal from a distant station that may well be using an unfamiliar language. The fundamental question is, at what point is a station identified and how should a station that is not fully identified be described?

The process of identifying stations should be viewed as a broad spectrum of probability. At one end is the completely unidentified station, an example of which is the open or blank carrier with no modulation – although you may have quite a good idea about its identity, such a signal really is unidentified. At the

other end of the spectrum is the positively (100% probability) identified station (eg '... the powerful missionary outreach station, the Atlantic Beacon, 50000 watts at 15-70, broadcasting from the beautiful Turks and Caicos Islands in the West Indies...' leaves little doubt about this station's identity!).

Many DX stations fall somewhere between these two extremes; for example, you may hear only part of a callsign, perhaps in a poorly understood language, maybe in the midst of heavy interference or jamming. Or perhaps no identification is heard, but certain characteristics of the signal or programme content point in the direction of one particular station. Generally speaking, the longer one listens to a station, on one date or over many days, the more clues there are to help achieve successful identification.

The factors which contribute to the identification of a station are almost without limit. Among them are time of reception, frequency, quality of signal and programming style. The latter is usually one of the most important clues, since valuable information can be gleaned from the languages used and music played, as well as from advertising,

weather reports, time checks and so on. It should be appreciated that one's ability to identify a station depends mostly on the ability to interpret what is being heard. And, rather like a detective investigating a crime, it takes experience as a DXer to reach a correct conclusion based upon limited clues.

Even the most experienced DXer will not be able to identify everything heard, so there needs to be some way of indicating how certain (or uncertain) a particular identification is. Hence the following shorthand expressions have developed as a solution to this problem:

a) *Identified*: Implies that the listener is 100% certain of a station's identity since a full announcement by the station was clearly heard.

b) *Presumed*: When a station is listed as presumed it means that the listener has had sufficient clues to the station's identity to be almost (90-99% probability) certain of its true identity. All that is missing is a formal ID announcement.

c) *Tentative*: This term usually describes a situation where the listener is fairly certain that a particular station is being heard – indeed that the probability is substantially greater than 50%, typically from 75%-90%. It is important, however, to note that a tentative logging is not just a pure guess, since there still have to be a number of clues.

d) *Unidentified*: Anything short of tentative is called 'unidentified' and the DXer should resist the temptation to classify loggings as tentative if there is insufficient evidence. When there is any doubt about a logging, it is wise to err on the side of caution and list it as unidentified; however, you may feel that it is worth indicating which station you think it might have been if you have an idea.

English In Europe

Although there are 34 countries in Europe, most with their own language or dialect, it is possible to find broadcasts in English from many of them – indeed, at least 24 countries are active in this area. Some transmissions are high-powered affairs aimed at listeners here in the UK, whilst others are local stations with programmes geared towards the tourist or expatriate population. Stations in the latter category that may well be of interest to the DXer since they are not always easy to hear outside the station's normal coverage area. Table 1 includes examples of both styles of broadcast and should be of interest both to the DXer and the traveller who wants to keep in touch with news and developments.

Utilities

If you tune around the MW band carefully you may hear signals that sound like intermittent bleeping and perhaps will not pay much attention to them. On the other hand, depending on where you live, you might find such signals a painful source of interference to normal reception. The majority of these signals are radio beacons for aircraft – think of them as a radio equivalent of a lighthouse guiding a ship. World-wide, most navigational beacons (marine and aeronautical) are to be found on fre-

Table 1

Station	Frequency	Time	Comments
Gibraltar R Gibraltar	1458kHz	0545-2300	0.5/2kW
Germany (FRG) American Forces Network	873, 1107 and 1143kHz	24hrs	
Malta R Mediterranean	1557kHz	2230-2330	
Poland R Polonia	1503kHz 738, 1206kHz 1206, 1503kHz	1830-1855 2230-2300 2305-2355 2305-2355	multilingual multilingual
Sweden R Sweden Int	1179kHz	1600-1630 2100-2130 2300-2330	
The times given are all UTC and are effective during this winter season			

quencies between 280 and 490kHz, ie between the LW and MW broadcast bands. There are, however, a number of exceptions to the rule and over 100 beacons actually operate on the MW band. The vast majority are found in the USSR but a few are located in the UK. Try finding the beacons in *Table 2*.

All these stations (except those on 518kHz) are aeronautical non-directional beacons (NDB) which transmit a continuous carrier, audio modulated with their callsign in Morse code. The operational range in nautical miles is shown in nautical miles (nm), over which a pilot will be able to use the signal for accurate navigation. The DXer, on the other hand, will be able to hear these signals over much greater distance – especially at night. The three stations listed on 518kHz are part of a world-wide network known as NAVTEX, a system designed to transmit navigational and meteorological warnings and other urgent messages to shipping. These messages are carried by a network made up of many stations, all operating on one frequency but using synchronised time windows to avoid mutual interference. The UK stations have a 15 minute time slot starting at the allocated times shown in the table above. A radio teletype system known as NBDPT SITOR-B is employed, which will sound like warbling audio tones on an ordinary radio; but if you have a home computer and an interest in experimenting, it might be

Frequency	Call, station, location and time (UTC)
518kHz	GCC Cullercoats R (0048, 0448, 0848, 1248, 1648, 2048) GLD Land's End R (0018, 0418, 0818, 1218, 1618, 2018) GPK Portpatrick R (0130, 0530, 0930, 1330, 1730, 2130)
545	LIC Lichfield (50nm), 24hrs, 52.44.47N, 01.43.03W
580	BN Bacton Helicopter Terminal, Norfolk
669.5	BTN Barton (25nm), 24hrs, 53.27.31N, 02.27.22W
669.5	STN Stornoway (60nm), 24hrs, 58.17.12N, 06.20.35W
734	WCO Westcott (30nm), 24hrs, 51.51.09N, 00.57.38W
850	CFD Cranfield (15nm), Mon-Fri 0800-2000 in summer, Mon, Wed, Sun 0900-1800 Winter, 52.07.45N, 00.33.20W

Table 2

possible to link it to your receiver to decode these messages!

Normally, the clocks in Continental Europe run one hour ahead of those in Britain and Ireland, but because the two areas make their changes from summer to winter time on different dates there is a period during which no time difference exists. During the summer the continent is 2 hours ahead of GMT while we are just one hour ahead, and in winter both areas are one hour earlier. Since European Summer Time ends on the last Sunday of September and British Summer Time ends four weeks later there is nearly a whole month of unusual timings.

In general, it will be observed during this transition period that European stations sign on in the morning at roughly the same time as UK stations, rather than an hour earlier which is more usual. The keen DXer will realise that because there will be less interference between

0300 and 0500hrs UTC than is normally the case, some good DX opportunities may become available. To illustrate this point, Radio Luxembourg is a good example of a station whose hours of operation usually prevent the reception of DX for more than a short period. This station, on 1440kHz, is so powerful that it blocks any possible transatlantic DX on the same frequency, but each night it leaves the air for a period between the end of the English programmes and the start of the German morning programme, resulting in a short DX window. The peculiarities of the clock changes ensure that this window expands to 1½-2 hours duration in October – normally only ½-1 hour is available. Using this technique to monitor 1440kHz whilst Luxembourg was off, I was recently able to hear American station WRRO in Warren, Ohio and WWGT Westbrooke, Maine.

THE PERFECT COMPLEMENT TO RADIO & ELECTRONICS WORLD



With regular features like:

- ☆ **DX DIARY:** Don Field G3XTT with all the news of rare DX, contests and DXpeditions
- ☆ **G3OSS TESTS:** Angus McKenzie – the fairest, most comprehensive reviews available anywhere

MORE NEWS, MORE FEATURES, MORE FUN, MORE STYLE

Make sure of your copy by placing a regular order at your newsagents or by taking out a post free, inflation proof subscription, with early delivery to your door each month

AMATEUR RADIO SUBSCRIPTION ORDER FORM

To: Subscription Department • Amateur Radio •
1 Clarendon Road • Croydon •
Surrey • CR0 3SJ Tel: 01-760 0409

PLEASE SUPPLY: (tick box) for 12 issues, all rates include P & P

Inland £17.40 World Surface £19.30 Europe-Air £23.05 World-Air £28.10

NAME.....
ADDRESS.....
.....
..... Postcode.....

PAYMENT ENCLOSED: £ Cheques should be made payable to Amateur Radio. Overseas payment by International Money Order, or by credit card

CREDIT CARD PAYMENT Card expiry date

.....
Signature

DIRECT CONVERSION RECEIVERS FOR THE MW BAND USING ICs

By M Slifkin D.Sc G8HES and G Abbott B.Sc

Although the superheterodyne receiver is almost the only form of receiver currently in use there are other types of receivers, some of which, like the direct conversion receiver, might offer advantages of both economy and performance over the superhet. The idea of the direct conversion receiver was put forward in the 1940s by Tucker. However, although several designs have been built over the years they have all suffered from various defects. Interest in the DC receiver has been kept alive mainly by radio amateurs and many designs, always for SSB and CW single band

receivers, have appeared in the amateur radio literature in recent years.

Recently, a design appeared in *Electronics and Wireless World* for an AM direct conversion receiver for the medium wave band. However, this is a very complex design and very expensive, of the order of £75. We have built two different forms of the DC receiver using mainly commonly available ICs to give receivers with a low component count, low cost and performance equal or superior to that of a commercial superhet.

Before describing the receivers it is

worth saying a little about both the superhet and the DC receivers. The superhet was introduced many decades ago to overcome the many defects of the tuned radio frequency receiver, which included variable selectivity and sensitivity with tuning. The superhet overcomes these problems by mixing the incoming signal with a local oscillator so that the difference frequency produced by the mixing process comes to some predetermined intermediate frequency, usually 465kHz for the medium and short waves.

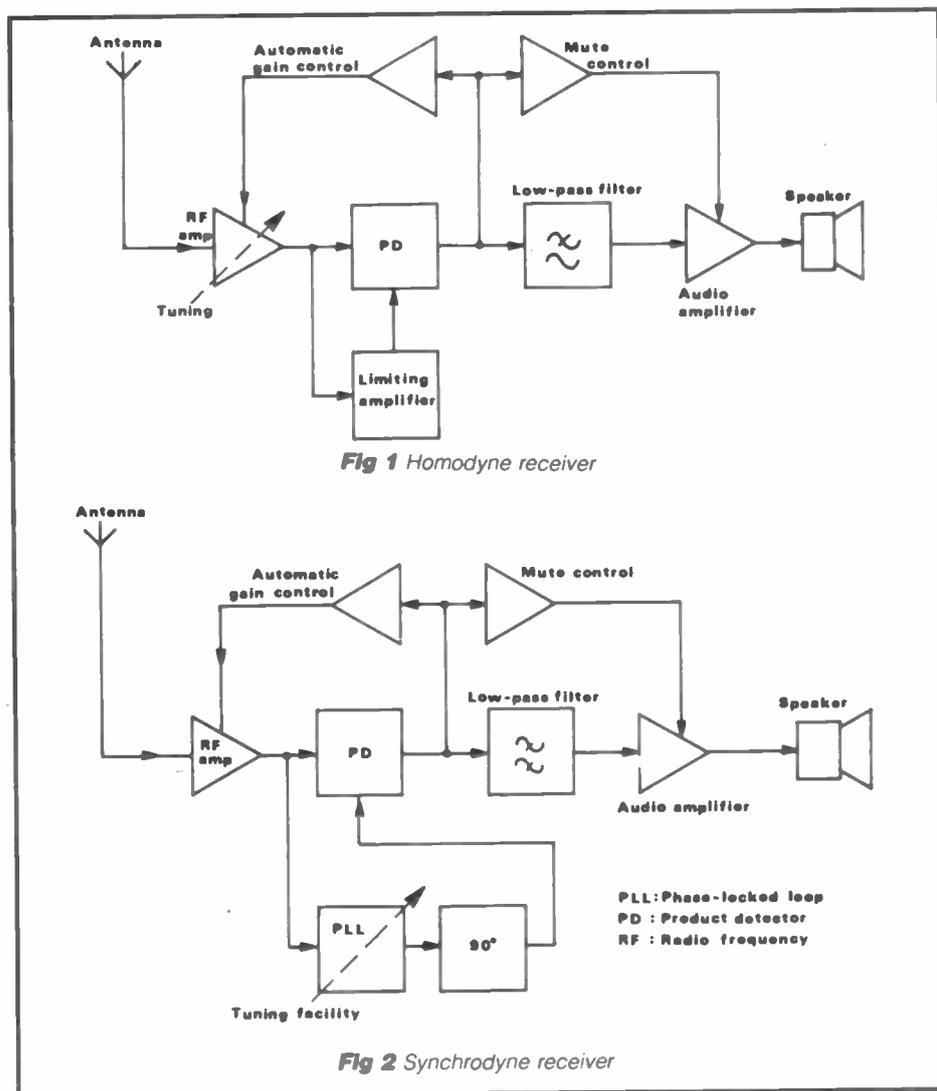
Nearly all the selection and gain is carried out at this IF so that the superhet has reasonably constant selectivity and sensitivity over the whole of its frequency range. However, the superhet itself has problems, apart from being complex and hence relatively expensive. The major ones are those of image response and spurious. The direct conversion receiver was designed to combine the best features of the superhet without its attendant problems of spurious and image response.

How it works

It works as follows. The incoming signal is mixed with a signal of the same frequency, so that the difference term is zero and hence the audio is taken directly from the mixer. There will be terms consisting of higher frequencies arising from the mixing process, but these can be removed by a simple low pass filter consisting of a resistor and capacitor. The selectivity of the receiver is determined by this post mixer low pass filter and can be varied by the operator at will if desired.

Furthermore, this form of extracting the audio signal from the carrier is far superior to the usual diode detector as it is a very linear process. Diode detectors work well on strong signals which are not heavily modulated but give distorted outputs on weak signals or strongly modulated signals. Those familiar with this mixing technique will recognise that this is product detection, which is far superior to that of diode detection but usually only available in very expensive receivers for the commercial user.

Another way of viewing the DC receiver is that it demodulates the incoming signal, unlike the superhet which detects it, ie it removes the carrier



During the 1930s, the radio journals were eager to encourage home recording. David Lazell says 'they didn't know the half of it'.

Home recording was alive and well in the 1930s – but on disc, not wire or plastic tape (then unheard of in Britain). As the original application of sound recording to movies was on disc and not tape, this is hardly surprising. Indeed, amateur recording was seen as a possible business aid, appropriate enough as the original concept by Valdemar Poulsen in 1907 was for a telephone answering machine.

As technical engineer for the Copenhagen Telephone Company, Poulsen had good, workable ideas. His patent applied to a spooled, steel tape which used magnetic impulses to store and relay messages. But, as a young man,



Permarec consists of a thin metal disc coated on both sides with a soft plastic substance which cuts like wax.

'When the sound is recorded on this, the disc is baked for about three hours, and is then permanent. When hardened, it can be played some hundreds of times with steel needles'. In addition to standard 10in and .12in sizes, playing back at 78rpm, a special version came as a 16in record playing at 33 $\frac{1}{3}$ rpm.

Giving a playing time of some 16 $\frac{1}{2}$ minutes, these large-diameter discs were originally designed for movies using sound-on-disc, and played from the middle out to the rim in an attempt to minimise the effect of needle wear.

The Permarec system used a straight-line tracking device, which pulled the recording arm across the record.

'The recording arm,' explained Mr

HOW HAMS MADE RECORDS

he failed to stimulate the confidence of financial backers, and whilst Poulsen had ideas for a tape that could be used time and time again, he became a visionary rather than a commercial product designer.

A model of his 'telegraphone' was presented to the Science Museum in 1907, but his ideas were followed up, not by the British, but by the nation's commercial rivals in Germany.

Tape development

So it was that in 1929, a German scientist named Pflueger worked on the development of a plastic base recording tape, using ferric powder in a dry adhesive base – the essential technology on which video is based.

There was little secret about this work until well into the 1930s, when its political possibilities were recognised. It is true that the BBC in the 1930s had primitive recording equipment, yet no-one in Britain seemed to recognise the significance of the work in Germany.

Even British Intelligence seems to have been fooled by the work in Nazi Germany. It was assumed that Hitler's broadcasts were made 'live' because of the signal quality, and that his location was thus easily traced. Only at the war's end did the Allies discover the advances in tape recording technology – these being enthusiastically taken to the USA for rapid commercial development.

Whilst the Germans developed plastic tape recording in the 1930s, the British were seemingly uninterested in the subject, even though primitive recording experiments on radio brought favourable viewer comment.

In the more than slightly wireless-crazy 1930s, an audio tape recorder industry could have had the kind of rapid take-off enjoyed by imported video

David Lazell recalls the antics of the professionals and the amateurs in the early stages of voice recording

recorders in the years after 1978. But nobody seemed interested in the commercial application of scientific principles long discussed in the academic press – a familiar enough problem in Britain.

Throughout the 1930s, the hobby radio press encouraged DIY home recording. Mr P R Leslie MA, wrote some good instructional features for the *Chronicle Wireless Annual*, published by *The Manchester Evening Chronicle*. The *Annual* by the way, was a very substantial paperback, crammed with articles and advertisements, with much to interest the short waver and legendary value for a bob (5p)!

Aluminium discs were the original medium, but were easily damaged, soon wore out and gave poor play-back quality. They had to be played with fibre needles which needed to be replaced with every playing. Electric motors applied to gramophones – or record players, as we would call them – gave a necessary consistent speed, and amplified signal enhanced the possibilities.

By 1935, progress in television and home recording caused considerable comment. Mr Leslie reported that a new type of recording disc was available, 'as easily cut as the aluminium disc, yet as permanent and robust as the commercial moulded record, yet with the same standard reproduction, and capable of being played with steel needles...the

Leslie, 'is simply a gramophone pick-up and carrier arm with a special cutting needle. The action, however, is the opposite of that in ordinary gramophone reproduction. Instead of the needle being moved to and fro with respect to the electromagnets of the pick-up in the record groove, and thereby setting up alternating currents, the alternating currents representing the sound are fed to the electro-magnets, and so set up movements of the needle, which cuts the groove accordingly'.

He considered the Permarec disc 'equal, at least, to the less expensive commercial records'. Obviously not up to the Decca black and gold or HMV bright red labels.

A Blackpool company offered a competing system, the Recloid, in the same disc sizes but where the black coating of the record is already hard, and is softened temporarily for recording by smearing it with a special softening preparation.

Another system, the Cairmor, used aluminium discs which had to be sent to the manufacturer for processing, ie being used as master copies for pressing an ordinary shellac disc. The Kingston-Wearite system used a 6in aluminium disc, deemed to be suitable for domestic entertainment.

Mr Leslie commented on the unusual tracking system, 'A subsidiary needle is fitted to an outrigger arm which runs in a blank groove around and concentric with the aluminium disc. This method cuts a good spiral but restricts the size of the record'.

Advertising was understandably enthusiastic: 'The Permarec System is as used in the professional studios because the records are soft when recorded, and afterwards hardened. The Permarec System has taken the music world by

HOW HAMS MADE RECORDS

Yours for only 4 gns deposit at CURRYS!



PHILIPS RECORDERGRAM

Here is a really remarkable and neat recorder for only 39 gns. One hour play-

Made in Holland

This advertisement from 1957 illustrates the pricing of reel-to-reel tape recorders in guineas. As well as the AG8107, better known as the Recordergram, Philips marketed the two speed AG8106

39 gns OR FROM **4 GNS DEPOSIT**

★ including microphone and reel of tape.

Please send me further details of the Philips Recordergram and also the address of my nearest Currys branch, so that I may inspect the Recordergram without obligation.

Post this coupon to: CURRYS LTD., Head Office

270 BRANCHES TH

A TAPE RECORDER IN FLEET STREET



THE RADIOGRAM KID REMEMBERS THE OLD SPOOLS

David Lazell's booklet written on his experiences in tape recording journalism

storm because the results are positively first class and in fact have been accepted by critics and writers,' declared the sales promotion from Musikon Ltd, of 19 Lisle Street, London.

By 1937, the *Chronicle Wireless Annual* was giving more coverage to short wave—and to television. Few readers could have appreciated the brief time left before both pursuits were to be abruptly abandoned in the face of war.

However, the 1937 issue saw *Home Recording* featured once more, as Mr H G Westcott of the Permeko Company of Leicester reported on new developments. Permeko designs offered a drive unit separate from the recording console. There were obvious improvements on the domestic disc recording systems marketed earlier in the 1930s. The cutter moved across the disc, from outside rim to the centre.

'The speed with which the cutter

moves across the disc determines the number of grooves which will be cut,' wrote Mr Westcott, 'and the number per unit length is taken as a convenient form of classification. For general purposes, 95 grooves to the inch is satisfactory and is practically equivalent to a standard wax disc'.

Playing life of the new discs was equal to any commercial disc, with a cellulose coating on an aluminium blank. This technology of the later 1930s was still in use in the early 1950s—and this writer used such a record for his 21st birthday message to posterity in May 1952 (though posterity took no notice)!

Disc recording

The 1937 feature was optimistic. Using a piezo crystal microphone, one could make a family scrap-book in sound. 'Cellulose-type disc recording is now being used almost universally in our

leading film studios,' declared Mr Westcott. 'High class music dealers throughout the country are installing disc recording apparatus for the use of their clients'.

An early 1950s feature film with Norman Wisdom, *Trouble in Store* (released on video in March 1983 by Rank Video), shows how in-store cellulose recording was 'sold' along with the sheet music.

Radio hams were among the most interested experimenters, though usually inclined to get it working for the rest of the family rather than for specialists' hobby use. A lot had happened in five years. Mr M W White's article *Practical Home Recording* in the 1932 *Chronicle Wireless Annual* referred to 'aluminium blanks' (which usually cost sixpence) which provided only two minutes playing time.

A Paul Robeson bellow?

Mr White must have been something of a recording pioneer, referring to his first attempts at home recording seven years earlier, ie in the mid 1920s. Shades of Edison!

'I bought a few aluminium discs and put one on the gramophone. You were expected to speak, or sing, into the horn and so impress sound, via the sound box onto the disc. Three of us did a mighty Paul Robeson bellow into the horn, and as the necessity for fibre needles was not then recognised, when we played it back, we got a thin squeak of unintelligible words recognisable by the rhythm more than anything else as Swanee River'.

He added (perhaps reflecting family opinion), 'That stopped the experiments until last year, when some real recording outfits began to come onto the market, and my conviction that there was a big future in making records at home received its first encouragement'.

Outfits could be bought for upwards of £2, perhaps from £3 if you owned a mains electrical gramophone. In addition to the systems later noted by Mr Leslie, the 1932 feature included reference to *The Mivoice Speakeasie*—presumably for boot leggers, recalling the inevitable connotations of the 'speak-easy'.

There seems little doubt that radio hams and other serious enthusiasts would have taken up the cellulose coated disc for wide use, had war not come in 1939. For one thing, the medium would have provided 'evidence' for those DX tall tales much loved by the amateur fraternity, then as now.

The one surprising aspect in all the excitement was the BBC's lack of initiative to promote the technology for home consumption. However, the BBC had other problems by 1937, including the highly successful poaching of their listening audience by the new commercial stations.

Incidentally, in the 1950s, Radio Lux-

HOW HAMS MADE RECORDS

embourg was to promote a talent spotting contest in which entrants sent in spools of recording tape containing their *piece de resistance!*

The Blattnerphone

The broadcasting bureaucracy of the 1930s seemed relatively uninterested in the possibilities of home recordings. But then, they might have argued, you cannot be good at everything. Perhaps they foresaw the piracy problem. A rather interesting recording device, situated in room LH2, in what were called 'the bowels of Broadcasting House', nevertheless caught the public's imagination. Called the Blattnerphone, it looked more like a folding bicycle than any contemporary radio electronics.

It used wire for recording – or to be more precise, a form of steel tape. But as spools were almost two feet in diameter, and weighed around eleven pounds, portability was hardly up to today's standards. The official name for the gadget was the Blattner-Stille Recorder, but it was known to BBC listeners as the Blattnerphone.

Its keepers seemed to have high hopes of it, as the BBC was inundated with wise suggestions as to the recording of diverse shows. The BBC used portable gramophone record (not tape) recording apparatus. Problems in this direction abounded, and some high, tall stories were told by engineers.

Like that of Victor Smythe, who produced the Northern Notions radio programme from Manchester. Having assigned a junior engineer to do an early morning show with the north-west coast fishermen at Morecambe, Mr Smythe was awakened very early one morning and told he had to go himself, *straight-away!* It seems that no-one in the BBC studios at Piccadilly, Manchester, had told the producer about the tides.

Nor were performers especially enthralled by the prospect of being 'blattnered', the word used by a well-known playwright of the period, C

Whitaker Wilson. He commented, after a terrible experience with the BBC's Blattnerphone, 'You may be under the impression that you have a pleasing speaking voice. Don't you believe it. Your voice is *awful*. It doesn't sound a scrap like you thought it did. If you don't believe me, you know what you can do. You can be blattnered and sit and listen to yourself' (*Radio Pictorial*, 8th January 1937).

Had the invitation been given on the air, there seems little doubt that listener response would have been impressive enough. Mr Whitaker Wilson added that he had told a colleague about his awful experience with the Blattnerphone. His friend, gaunt and anxious, responded that he had suffered an even worse experience, having seen himself on movie film at a cinema.

The BBC's recording van was perhaps the most evident aspect of the potential for broadcasting – but the vulnerability of the records (noted in the hobby radio journals) posed a constant problem.

Radio Pictorial referred to an accident which occurred as Victor Smythe, an enthusiast for recording, was returning to the BBC studios in Piccadilly, Manchester one day in 1937: 'He was particularly pleased with one batch of records, which he had heard played back in the recording van, and was rushing them to Manchester. The precious discs were in the back of Victor's car, and he forgot all about them when he met some old friends, whom he offered a lift. Somebody sat on the records! As they say in the best comic strips, 'Ker-runch!'

Domestic recorders

The Germans developed plastic tape recording during the war, but whilst Grundig was the first to market domestic tape recorders in Europe, the Japanese developed the potential world market. In the process, they established an electronics industry which in turn established a leadership role in manufacture of

sophisticated short wave equipment.

Two mass merchandise products created the base for the Japanese consumer electronics industry – the transistor radio, and the tape recorder. Indeed, the latter created the Sony identity in Japan.

According to Nick Lyons in *The Sony Vision* (published in New York, 1976), a Sony executive saw a tape recorder for the first time whilst at the NHK Studios in Tokyo. Built to the German specification, the machine was in use by a US Army major.

Agreements with Philips ensured full use of the new compact cassette, developed by Philips in the early 1960s, with Sony's own automatic recording level system.

It could be said that tape recording and the transistor radio in the 1950s prepared the way for short wave product development in the 1960s – and after.

Japanese success in video products is also linked to this initiative, of course. The last British approach to the subject was a gadget, marketed in the late 1950s, which converted an electrically driven record-player into a tape recorder. As far as I know, the BBC stuck with the Blattnerphone.

Hams had a lot of good ideas thrust at them in the 1930s, and it would be interesting to discover how many attempted to construct their own television sets, as proposed by the hobby radio press. Significantly, the early articles on home recording enthused on the opportunities of recording favourite radio programmes, etc.

All breaches of copyright, but none of us were lawyers with soldering irons that long ago.

Note: The writer of this article has written a booklet on his experiences in tape recording journalism. *A Tape Recorder in Fleet Street*, is available at £1 from David Lazell, 29 West Leake Road, East Leake, Loughborough, Leics LE12 6LJ.

SURPLUS/REDUNDANT STOCKS ELECTRONIC COMPONENTS

We offer cash for your surplus components including integrated circuits, transistors, memories, microprocessors, I/C sockets, connectors, caps etc. Top prices paid, collection no problem. Please contact us today with your lists by , fax, telex, telephone or letter to:

MARLOW MARKETING

ELECTRONIC COMPONENT SURPLUS DEALERS
151A Milton Road, Gravesend, Kent, DA12 2RG, England
Fax: 0474-327-960 Telex: 940-16512 (NWWO G),
Tele: 0474-320062

ALSO. COMPLETE FACTORY CLEARANCES UNDERTAKEN

NEWSAGENT ORDER FORM

**Radio &
Electronics**
THE COMMUNICATIONS & COMPUTER EQUIPMENT WORLD

To (name of newsagent)

Please order a copy of **Radio & Electronics World** for me every month

NAME

ADDRESS

Newstrade distributors: Seymour, 334 Brixton Road, London SW9 7AG. Tel 01-733 4444

UNDERSTANDING TELEVISION

Norman Ash introduces a fascinating aspect of the communications hobby

There seems to be a wide interest within amateur radio circles in amateur television (ATV). Many potential enthusiasts have little or no knowledge of the technology involved in making television work. This article introduces a fascinating subject, which should encourage more people to take up this aspect of the hobby.

In the days of its inception modern digital technology was not available and television has developed as an analogue system. This means that the electronic signal produced closely relates to the visual information it contains.

The visual image is created when the eye receives electromagnetic waves similar to radio waves, except that these are at higher frequencies, between

about 400nm to 700nm in wavelength. The average eye responds increasingly towards the centre of this visual spectrum and the response falls off towards each side (Figure 1).

It is the effect of these different frequencies upon the eye that creates the sensation of colour. Red has the longest wavelength, blue the shortest and the eye is most responsive to green, which is between them.

Primary colours

These are the three primary colours used to create the spectrum of colours used in television. By mixing a proportionate amount of red, green and blue an acceptable colour spectrum can be created. White is produced by 'balancing' these colours in specific proportion (ie, 59% green, 30% red and 11% blue). 'White balancing' adjusts the exact proportion of red to blue and is used to 'line up' a colour television camera to differing lighting conditions.

System overview

The television camera converts the light it receives through its lens into an electronic signal of a standard form. Regrettably, several standards exist throughout the world. This video 'line' signal can then be fed through various equipment. If this chain is completed by

the end use, for example of a videotape recorder (VTR) or a television set, it is known as closed circuit television (CCTV), but if this link is broken and a radio transmitter and receiver is inserted, the basic system of broadcast and amateur television is created (Figure 2).

This results in two distinct electronic television signals, the video 'line' and the 'radio frequency' or RF signal. On some television equipment both types of signal can be used.

RF signal

Television equipment can often be found which will work with an RF signal within the UK's broadcast band of frequencies, in the UHF part of the radio spectrum. Sockets are often marked as the 'aerial' connection.

The conversion from line signal to RF is said to be 'modulated' and would normally involve 'carrying' the line signal upon the selected RF signal frequency. This modulation is achieved either by the carrier frequency following the amplitude of the line signal (amplitude modulation, AM) or by varying its exact frequency slightly according to this amplitude (frequency modulation, FM). See Figure 3.

The video line signal itself can contain all the required information to regener-

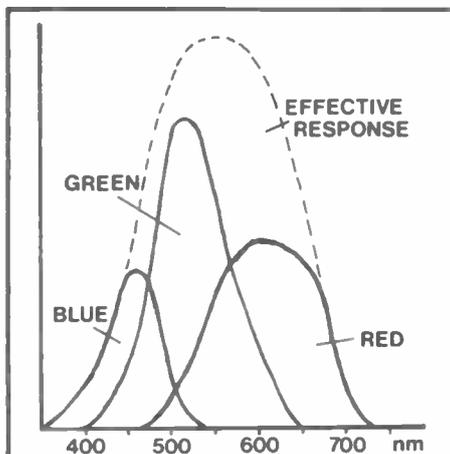


Fig 1 Sensitivity of the eye's red, green and blue receptors

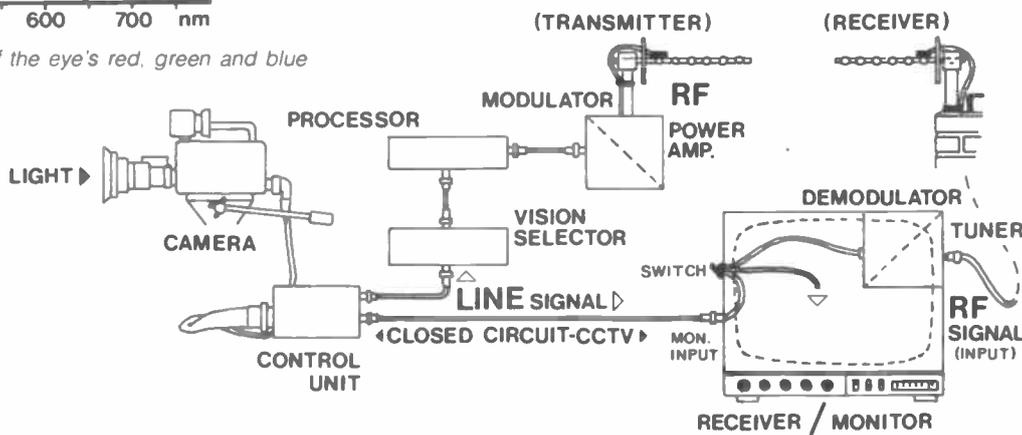


Fig 2 Overview of a television system

ate the original image. This type of line signal is referred to as a 'composite' signal. This is because the signal not only contains the visual image, but also the instructions for placing the elements of this image in the correct place on the screen. This is the 'synchronising' information (syncs).

Consider the monochrome system. Figure 4 illustrates that the brightness of a point in the picture can be represented by a positive voltage, above the zero reference level. This 'grey scale' from black (0 volts) to white (+0.7 volts) is limited in a standard signal, so that television equipment is not overdriven. A 70% proportion of the composite signal is normally used for this, the remaining 30% being negative going synchronising pulses (-0.3 volts). This standard composite video signal is normally set to a volt in overall amplitude.

Definition and scanning

The television image is divided into vertical and horizontal information (Figure 5) in the aspect ratio of 4 units wide by 3 deep. The definition in the vertical plane is fixed by the method used to create the electronic signal.

A television camera will scan across a small section of the vertical image at a time, in the horizontal plane. Its height fixes the maximum vertical definition. This creates a line of information, the signal variation corresponding to the image that the camera is scanning. This horizontal definition varies according to the quality of the equipment concerned. Blocks of vertical lines (monochrome) are used in a range of coarse to fine gradations, to determine and set up this horizontal definition. These can be seen on most broadcast test cards that are transmitted.

The limit to the television system being able to display a difference within one area of picture is known as an 'element' and television pictures can either be described as able to 'define' so many 'picture elements' (pixels) or able to resolve a grid of vertical lines of a given frequency.

Synchronisation

Once one line of information has been scanned, the electronics involved are said to 'flyback' ready to scan across once more. However, by the time this has occurred a small gap has been created between the new line and the old (due to the comparatively slow pulling down of the scan as it occurs from top to bottom of the picture).

The solution is that on alternate scans (from top to bottom) lines are arranged to 'interlace' with the previous scan. It therefore takes two full scans of this 'field' of view to create one complete television picture.

In the UK the rate at which scanning takes place has been chosen for its availability for reference purposes. The public electricity supply alternates at a

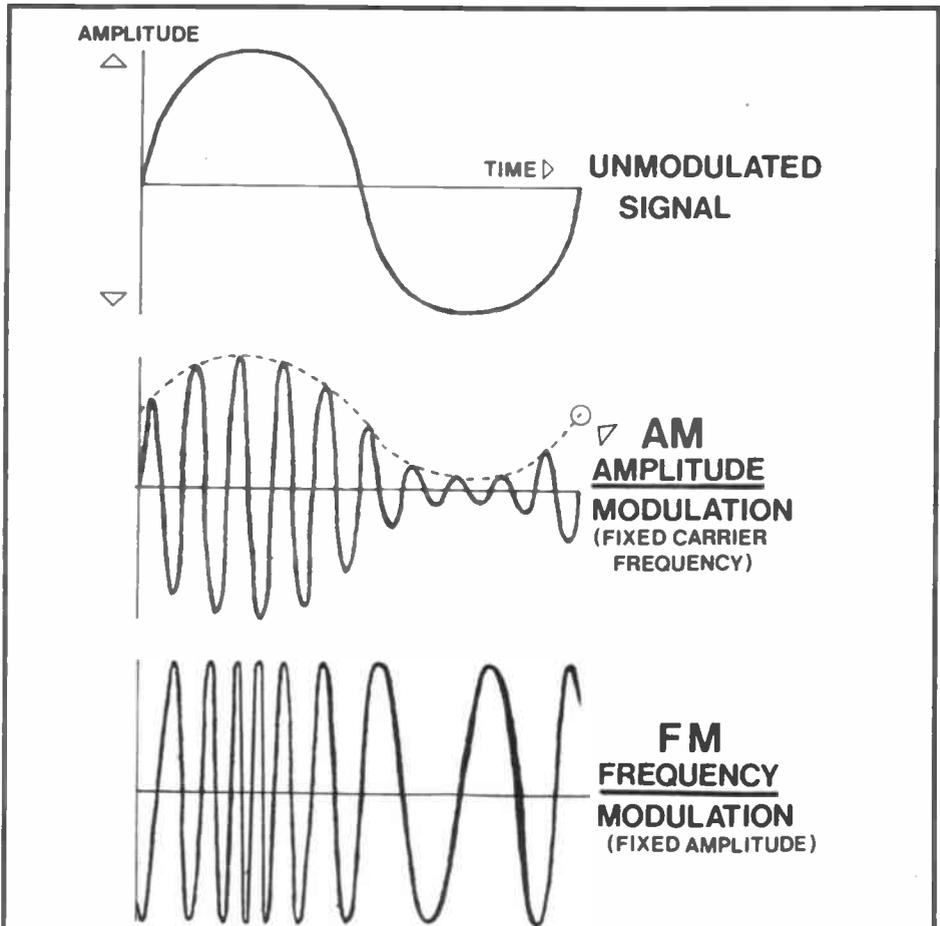


Fig 3 The principles of modulation

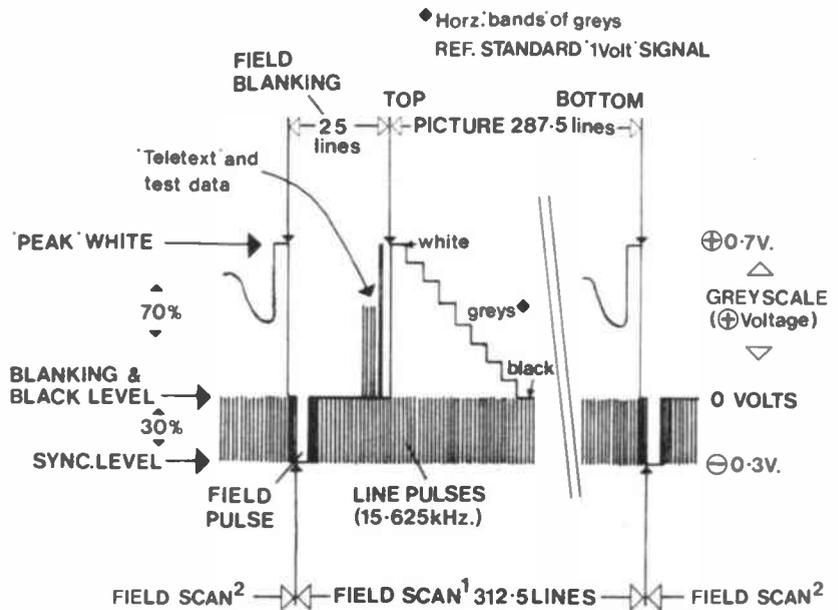


Fig 4 The 'field' waveform (simplified)

frequency of 50Hz (cycles per second) and from this two complete scans occur every 25th of a second. This results in the moving television image being updated 25 times each second. This is more than adequate to convince the viewer of continuous movement.

The number of lines used in the UK is quoted as 625, but this includes a period (twice each complete picture) when the scanning lines return to the top of the picture. These 50 lines are 'blanked' out to prevent them being seen as they zigzag their way up the screen. A number

UNDERSTANDING TELEVISION

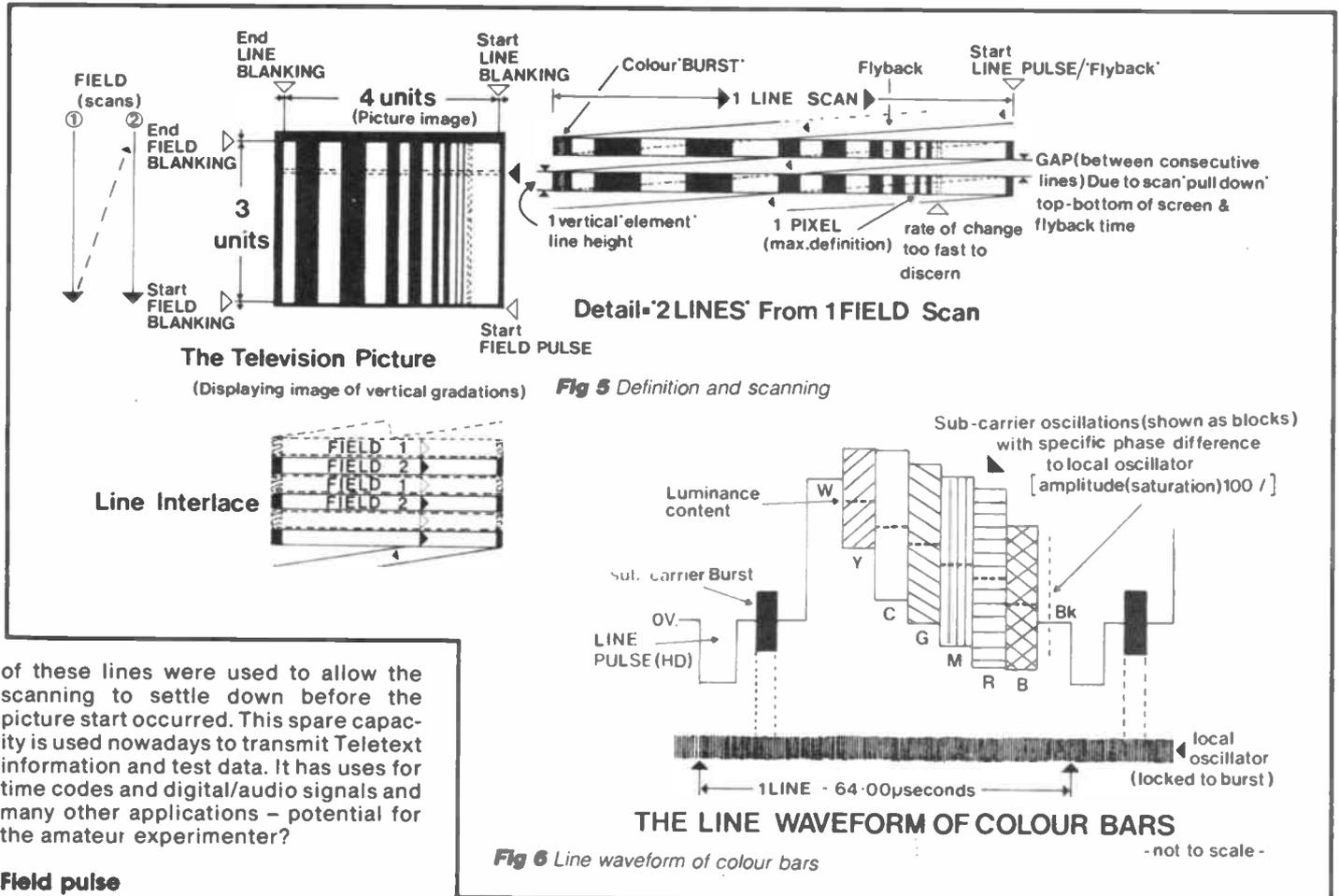


Fig 5 Definition and scanning

Fig 6 Line waveform of colour bars

of these lines were used to allow the scanning to settle down before the picture start occurred. This spare capacity is used nowadays to transmit Teletext information and test data. It has uses for time codes and digital/audio signals and many other applications - potential for the amateur experimenter?

Field pulse

During this 'blanking' period a pulse occurs which triggers this return of scan to the top of the screen. It is called the 'field pulse' (being two fields of scan to each complete picture). It may also be called 'vertical drive' (VD).

Figure 4 shows how the complete composite signal might look. Notice how the synchronising information is arranged as a negative going series of pulses and the picture information itself is positive going.

Line pulse

The line scanning works in similar fashion, the horizontal drive (HD) pulse occurring during the line scan blanking period. Compare Figures 4, 5 and 6.

Bandwidth

The speed at which an image is scanned and the definition (the rate of ability to change along a line scan) determines the frequency required. Being an analogue signal, a whole range of frequencies is likely to be involved up to this maximum. The image in Figure 5 illustrates this (the larger the gradation, the less the number of changes per second).

The required radio frequency bandwidth is very valuable. Broadcast television uses an 8MHz block of frequencies for each channel they transmit. The four UK channels would not even fit into the whole of the high frequency (HF)

band! But television is used by amateurs on HF. Slow-scan television (SSTV), as its name suggests, considerably reduces the rate of scan. For a broadcast rate of 15.625kHz, a slow-scan rate of 16.6Hz might be used. The resultant bandwidth requirement then reduces to a mere 2.5kHz or less - the width of a narrow speech channel. Sound is often sent separately for amateur transmissions.

Chroma information has an additional demand upon bandwidth. Normal scan speed colour information requires about 1.3MHz, but is 'encoded' within the main RF carrier signal. This 'subcarrier' is therefore within the overall bandwidth, but at the expense of monochrome definition. For a normal UK signal (a broadcast bandwidth of 5.5MHz is catered for) this 'subcarrier' is placed within the top 1.3MHz (centred at around 4.4MHz).

Colour detection

The waveform in Figure 4 is only seen one part at a time. As each line is about to be scanned, a burst of this colour subcarrier (4.4MHz) is transmitted (during the line blanking period) as a reference. The phase relationship of this frequency, during the line scan, to signal information (centred on 4.4MHz) dictates the hue of the colour displayed. The amplitude of this frequency dictates the intensity of the colour (Figure 6).

The UK system inverts this phase relationship on alternate lines (to cancel our errors) and is called phase alternating line (PAL). The system is compatible with monochrome; without the burst the chroma is not switched on and the red, green and blue channels give a grey scale response.

Other signal formats

Those of you with computers will recognise these RGB signals as an alternative to the composite signal described earlier. Better quality is achieved through not needing to decode the colour information and the limitations of subcarrier use.

These three primary colours, being fixed in proportion to obtain white, only require two colours to be transmitted (normally red and blue). The third proportion of colour information is found by the difference. This colour difference signal and a 'luminance' signal is used in higher grade television.

Future potential

The potential is there for a great deal of amateur experimentation with the advent of computer graphics, disc filing of television pictures, digital stereo audio, satellite communication, tubeless cameras and screens. Fully digital television may well narrow the gap between amateur and professional.

DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

Looking back through the August logs, it appears that the sporadic-E season was clearly on the decline with fewer sustained openings. However, unusual signals, usually known as exotics, continued to appear and this tended to compensate for the reduced activity.

Around the middle of the month a small tropospheric lift produced French and Belgian signals in some areas, but the best was yet to come. Anticyclonic weather conditions at the end of the month created an eye opener for the DXer, with many rare catches from stations deep into West Germany and even Czechoslovakia.

Sporadic-E rundown

August 1st was a memorable day, when at least three Arabic Band I stations were received in the UK shortly after 1330BST. At 1342, Kevin Jackson of Leeds logged Jordan using the PM5534 test pattern with 'JTV SUWELIEH' identification. However, this was not the case at the home of Ray Davies in Happisburgh on the Norfolk coast. Something more

exciting was on the screen. A hurried phone call from Ray explained that a PM5534 was 'belting in' on channel E3, with the identification 'ORTAS DAMAS' confirming reception of Syria. A check on this channel at Derby revealed nothing but snow, although shortly after 1400BST a programme was noticed, just above noise level, with large Arabic subtitling across the centre of the picture. There is every chance that this was the other Band I transmitter in Syria, at Hassake, and that programmes had commenced.

Another instance of Arabic DX occurred a fortnight later on August 16th at 1146 on channel E3, when Kevin noticed a discussion programme in progress between two men each wearing a fez. According to his dictionary, the country where a fez is worn is Egypt and this has prompted us to question whether the reception did in fact originate there. There has been no official Band I transmitter using this channel (E3) for many years, but earlier in the season a reception report from a DXer living in

Malta suggests that this channel is indeed used. We wonder if this could explain the mystery Arabic FuBK test pattern seen twice on this channel?

Here at Derby on the 5th, a very weak programme remained on channel E4 from a southerly direction after the Spanish TVE-1 network had closed down. Portugal was still around on E3 but the programmes seemed to be different. Unfortunately, the weak signal did not last long enough to form any definite conclusions about its origin.

At 1311 on August 6th, a strange looking FuBK test pattern made a brief appearance on channel E2. There was a black rectangle present at the end of the frequency gratings on the right-hand side. Reception was via meteor shower and there were no clues as to its origin.

On the 7th, Simon Hamer of New Radnor in Powys saw Iceland on channels E3, E4 and E2. There was no mistaking the latter channel because the PM5544 test card with 'RUV ISLAND' was on air at the time. This is the second report of an E2 sighting this season, but

PHOTO FILE ● PHOTO FILE ● PHOTO

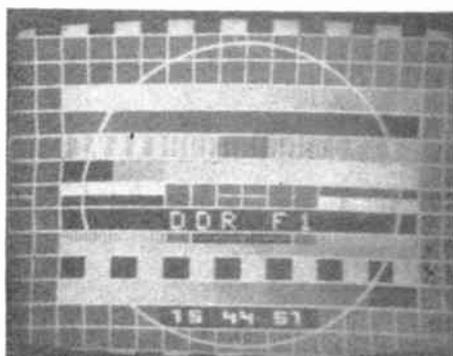


Fig 1 East German test card received via enhanced tropospherics



Fig 2 Identification caption used by DDRF.1 (East Germany)



Fig 3 Swedish PM5534 test card - note new identification at the top!



Fig 4 Clock caption from Swedish Schools television

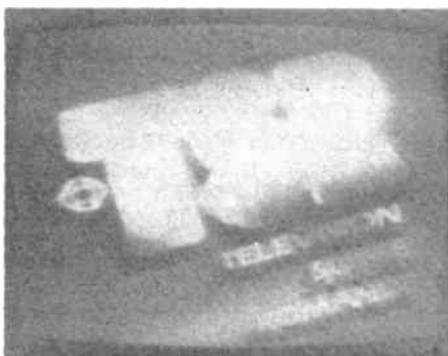


Fig 5 Identification caption radiated by Swiss French language service, TSR



Fig 6 News programme broadcast by the Swiss Italian language service, TSI

DX-TV RECEPTION REPORTS

no official outlet seems to exist. A 20W relay was listed until the early seventies.

An early morning opening on the 8th produced the Greek test pattern at 0858 in the Leeds area. Unfortunately, this is one signal which has avoided the Derby area this year!

New Italian channel

A new unofficial Band I channel has been created by the Italian private TV operators. It lies just below channel E2 and has a vision frequency of 47.685MHz, according to Mark Dent of Leeds who has confirmed it using a scanner. It is only recently that the Italian private stations have decided to use channels other than the traditional Italian exclusive ones, namely IA and IB. Mark suggests that the reason for using such an offset frequency is to avoid clashing with the official E2 sound carrier with the channel IA vision carrier frequency at 53.75MHz.

Reception has occurred at least twice on this channel, once towards the end of July and again on August 15th. The first sighting consisted of advertisements, the presentation of which was similar to that of 'Telemarket' whose broadcasts have frequently appeared on E2 this season. The reception on the 15th consisted of a programme with the lettering 'TVA' in the lower left-hand corner of the screen. At times a second transmission was present floating with TVA. Broadcasts from TVA originally took place on channel E3 and later moved to IA during the season. It is not clear at this stage whether TVA have abandoned IA in favour of the new allocation.

Tropospheric upsurge

Thanks to the weatherman (or did an anticyclone have something to do with it?), intense trop DX was present over the August bank holiday. The 31st seemed the best day, with long haul stations present for much of the day. While searching through the many West German transmissions present in Band III, Mark Dent of Leeds noted the Czechoslovakian Plzen channel R10 outlet. Here at Derby, while tuning around the top end of Band III for East Germany on channel E12, the Czechoslovakian R12 station at Usti-Nad-Labem was resolved, albeit weakly, for only a few minutes.

This would have probably gone undetected if it wasn't for the use of the new D-100 converter with sound monitoring. Hearing the characteristic vision buzz of the Czechoslovakian 'RS-KH' test pattern prompted a search for the picture! High-level Band III signals from the East German transmitters at Inselberg on channel E5 and Brocken on E6 were in evidence for most of the day with SECAM colour.

A couple of interesting trop signals arrived in Band I on the 31st. The West

German Kreuzberg channel E3, which radiates Bayerischer Rundfunk programmes, was present during the morning, but the most interesting catch was the East German Cottbus transmitter on E4 at 1712. The same programme, consisting of pop music, was being monitored on channel E6 at the time. Kevin Jackson noted the Bayerischer Rundfunk broadcasts on E3 and E4. Kevin comments in a letter: 'The trop at the moment is rather good. I've been receiving signals all day from DFF Inselberg and Brocken at very high levels, along with some SWF (West German) outlets. It's rather uncommon to have signals from the 900km range in all day, especially at these levels. I've even had good quality stereo from AFN Frankfurt on 98.7MHz. I have never heard that one before and to find it in stereo was quite a shock!'

The new Dutch 3rd network test transmissions have had quite an airing recently with channel E30, allocated to Lopik, giving good results in colour. This will certainly be a daily signal in many UK locations, although during trop openings it will play havoc when attempting to receive West German and Swiss DX on this channel.

Poor Perseids

No, we're not taking pity on the cat. We are referring to the meteor showers (MS) during August, which usually peak around the period 10th-12th. The Perseids are traditionally very active, producing MS pings well into the Band III spectrum. Unfortunately, the Perseids during the past few years have produced very little DX, or to be more exact, there have been very few reports. Despite extra vigilance in Band III, Mark Dent comments that this year there was virtually nothing doing apart from a Norwegian test card on E7 on the 12th and the Polish test card from the Lodz 100kW outlet on R7 on the 17th. The latter was seen by chance as Mark was tuning through the band.

DX-TV log for August

This month we are featuring part of Kevin Jackson's DX-TV log for August. Reception consists of programmes unless otherwise indicated.

1/8/87: TSS (Russia) on channel R1 at 0953; NRK (Norway) E2 radiating the 'NORGE STEIGEN' PM5534 test pattern at 1126; RAI (Italy) IA and IB at 1128; TVP (Poland) R1 with the 'TVP' clock at 1243; JRT (Yugoslavia) E4 with programmes from the Zagreb studios at 1253; TVP R2 at 1253; TVR (Rumania) R2 at 1254; TVE-1 (Spain) E2 at 1255; JRT E3 programmes from Beograd at 1302; JTV (Jordan) E3 with the 'JTV SUWELEIH' PM5534 at 1342; MTV (Hungary) R1 showing a multiburst test pattern at 1350 going on to the 'MTV-1 BUDAPEST' PM5544 at 1358; TVE-1 E4 at 1645; TVR R2 announcer at 1723; MTV R2

at 1734; TSS R2 clock at 1759.

2/8/87: TVE-1 E3 at 0830; TVE-1 E2 and E4 at 0904; RTP (Portugal) E3 showing the low frequency test pattern at 0940, switching to the 'RTP LISB 1' FuBK at 0948; RAI IA and IB at 1636; JRT E4 at 1811.

4/8/87: TVE-2 E2 with vertical bars pattern at 1557; TVE-1 E3 and E4 at 1620; RTP E2 at 2042.

5/8/87: MTV R1 teletext pages at 1748; ORF (Austria) E2a at 1753; JRT E4 at 1757; RTU (Radio-Tele-Uno, Italy) IA 'TELE UNO' caption followed by programme schedule at 1800; ARD-1 (West Germany) E2 at 1814; JRT E3 at 1820; RAI IA at 1835; SRG (Switzerland) E2 and E3 at 1844; RAI IB at 1845; TVR R2 at 1912.

7/8/87: RTP E3 on 'RTP-PORTO' FuBK test pattern at 0935; TVE-1 E4 at 0937; TSS R2 at 1745; TDF Canal Plus (France) L2 at 1858; TVP R1 and R2 with 'dt' news caption at 1901.

8/8/87: RAI IA 'RAI-1' PM5544 at 0717; MTV R1 and R2 multiburst test pattern at 0724; TVE-1 E2 GTE test card with 'tve tve 1' identification at 0727; JRT E4 at 0738; JRT E3 at 0741 with Beograd programmes; TVE-1 E3 GTE test card at 0741; EPT (Greece) E3 on 'EPT' PM5534 at 0858; RAI IA PM5544 at 0904 (2 signals present).

12/8/87: NRK E4 showing the 'NORGE HADSEL' PM5534 at 1441.

15/8/87: TDF tf1 L42; TDF Antenne 2 L39; RTBF-1 (Belgium) E8; BRT-1 E10. All signals via trop. DX via sporadic-E (SpE): RAI IA and IB at 1121; ORF E2a on PM5544 at 1123; TVA (Italian private station) on new channel (see 'sporadic-E rundown') at 1210 with co-channel private station; JRT E3 Beograd clock at 1830; ARD-1 E2 at 1844; RAI IA at 1900; JRT E4 at 1901; TVR R2 at 1921; TVE-1 E3 at 2122.

16/8/87: TDF tf1 L42; TDF Antenne 2 L34 and L39; TDF FR3 L40; RTBF-1 (Belgium) E8; BRT-1 E43; NOS-2 E27 - all via enhanced trop conditions. Via SpE: TVE-1 E2, E3 and E4 at 0907; unidentified Arabic signal on E3 at 1146 floating with JRT; RAI IA at 1230; TSS R2 at 1347; RTP E3 at 1352.

22/8/87: RTP E3 at 1746; TVE-2 E2 at 1754; TVE-1 E4 at 1754; RAI IA at 1848; TVE-1 E3 at 1908 - all SpE; BRT-1 E43 and BRT-2 E46 via lightning scatter.

25/8/87: TVE-1 E2 at 1324; TVE-2 vertical bars test pattern at 1324; RAI IA and IB at 1326 and 1628; JRT E3 and E4 at 1645.

26/8/87: RAI IB at 1835.

29/8/87: TDF tf1 L39 and L42; TDF Antenne 2 L34, L39 and L43; TDF FR-3 L42; Canal Plus L5, L7 and L8; La Cinq L34; BRT-1 E43; NOS-1 E6; RTBF-1 E8; West Germany: NDR-1 E40, NDR-3 E43; TSI (Switzerland) E34 (La Dôle transmitter); SVT-1 (Sweden) E8 - all trop.

Service information

East Germany: A TSS-1 (Russia) relay is now operational on channel E2 at Nohra.

Denmark: 'TV SYD' is continuing to broadcast, but as a private company rather than being part of the state owned

DX-TV RECEPTION REPORTS

service, 'Danmarks Radio' (DR).

The service radiates from the Rangstrup outlet on channel E7 and associated relay stations between 1915 and 1930 local time. TV SYD will later become part of the proposed TV-2 service but, until then, the private station will continue to use DR's outlets.

The new UHF channel for the DR service from Copenhagen will be E31 from April 1st 1988. This is the channel used by DR for experimental UHF transmissions from Gladsaxe in 1970.

The TV-2 channel for the Copenhagen area will be E53. This service is due to open on October 1st 1988 and the following transmitters will be used:

- Fyn, ch E22
- Copenhagen, ch E53
- Bornholm, ch E56
- Sydsjælland, ch E50
- Sydvestjylland, ch E33
- Aalborg, ch E35
- Vendsyssel, ch E37
- Aarhus, ch E26
- Sonderjylland, ch E27
- Vestjylland, ch E40
- Viborg, ch E54
- Lolland (V), ch E28
- Kalundborg, ch E48
- Svendborg, ch E32
- Vejle, ch E30.

West Germany: 'RIAS-tv' is expected to start transmitting via an outlet in Berlin during 1988, possibly on channel E25 with an ERP of up to 250kW, but this has not yet been confirmed. At present, channel E25 is used as a temporary 'tropo-link' between West Berlin and the transmitter at Hühbeck which is located in the Federal Republic. Incidentally, 'RIAS' is an abbreviation for 'Radio In American Sector'.

It has been decided that Hamburg is to have two channels set aside for private TV services. The most likely channels to be allocated are E36 and E48, both with an ERP of approximately 10kW.

The private TV service now operating in München/Ismaning uses channel E59 with an ERP of 1kW. The station is known as 'MGK' or 'Kanal 4'.

The TV services operated by SAT-1 and RTL+ are likely to have the lion's share of spare UHF channels. The SAT-1 outlets at Mainz (channel E36 with 300W ERP) and Koblenz (E57 with 110W ERP) have been in service since December 1986. During next October, SAT-1 will spread to West Berlin and share the RIAS-tv channel E25 outlet.

The table shows the latest SAT-1 transmitters which are expected to come into service.

Sweden: The Swedish PTT occasionally transmits scrambled signals via SVT transmitters when they are not being used for programmes. The decoder system is the same as that used by the French 'Canal Plus' service.

The required transmitters are switched on from the PTT control centre at Stockholm. Under Swedish law, the PTT cannot transmit programmes which may be received by the general public. This is overcome by using the scrambling techniques.

Usually only test signals are radiated, such as colour bars and the PM5534 test card, although they have shown educational programmes.

France: Canal Plus have started to broadcast live unscrambled CBS news programmes from America between 0600 and 0630GMT.

The sixth TV service is now called 'Metropole 6'. The following M-6 transmitters were recently opened: Lille Lambersart on channel E53 with 1kW ERP and Dunkerque-Ville on channel E62.

This month's service information was kindly supplied by Michael Summers Larsen (Odense, Denmark), Roger Bunney (Romsey, UK), Gösta van der Linden (Rotterdam, Netherlands) and the Benelux DX Club (Netherlands). 

OSCILLOSCOPES	
TELEQUIPMENT D83. Dual Trace 50MHz Delay Sweep Large Tube.....	£360
TELEQUIPMENT D61 Dual Trace 10MHz with manual.....	£180
S.E. LABS SM111 Dual Trace 10MHz Solid State Portable AC or External DC operation 8 x 10cm display with manual.....	£160
TELEQUIPMENT D43. Dual Trace 15MHz with manual.....	£100
TELEQUIPMENT S54A. Single Trace 10MHz Solid State with manual.....	£90
GOULD/ADVANCE OS255 Dual Trace 15MHz with manual.....	£225
ADVANCE OS250TV Dual Trace 10MHz with manual.....	£180
HAMEG 207 Single Trace 8MHz with manual.....	£90
MULTIMETERS	
AVO complete with batteries & leads..... from	£45
Leather cases available.....	£10
AVO 8 MKV complete with batteries, leads & case	£90
AVO TEST SET No 1 (Military version of AVO 8) complete with batteries, leads & carrying case	£95
TEST LEADS suitable for AVOMETERS. Red & black with 2 Croc-Clips & 2 Prods (P&P £2)	£5
AVO Model 73. Pocket Multimeter (Analogue) 30 ranges. Complete with batteries & leads.....	£18
AVO 72 - similar to above but no AC current range. With batteries & leads.....	£10
ANALOGUE POCKET MULTIMETERS. Philips/Taylor etc. With batteries & leads..... from	£10
COMMUNICATION RECEIVERS	
Recal RA17L 500KHz-30MHz. With manual.....	only £140 each
Eddystone 730/4 480KHz-30MHz With manual.....	only £110 each
ISOLATING TRANSFORMER	
240V Out-500VA £18 (P&P £5). 100VA £8 (P&P £2)	
24V Out-500VA £8 (P&P £5). 200VA £4 (P&P £4)	
AVO TRANSISTOR TESTER TT169	
Handheld GO/NGO for In-situ Testing. Complete with Batteries, Leads & instructions (P&P £3)	£18 ea
	NOW ONLY £12
STEPPING MOTORS	
Type 1. 200 Steps per rev 4 Phase (5 wire) 12/24V. Torque 25oz inch (will run on 5V with reduced torque).....	£18 ea
Type 2. 6/12 Steps per rev. 3 Phase 12/24V (will work on 5V).....	£2 ea
5 off.....	£7.50
Type 3. NORTH AMERICAN PHILIPS 24 Steps per rev 4 wire SV 3 amps 0-250rpm 0-200 PPS.....	£6 ea
Used equipment - with 30 days guarantee. Manuals supplied if possible.	
This is a VERY SMALL SAMPLE OF STOCK. SAE or Telephone for Lists. Please check availability before ordering. CARRIAGE all units £16. VAT to be added to Total of Goods & Carriage. Callers welcome 9am to 5.30pm Mon-Fri (until 8pm Thurs)	
STEWART OF READING	
110 WYKEHAM ROAD, READING, BERKS RG6 1PL	
Telephone: 0734 68041	

Type 4. 200 Steps per rev. 120V (3 wire) Torque 25oz inch.....	£4 ea
Type 7. WARNER 24 Steps per rev. 3 Phase (6 wire). 26V. Holding Torque 45oz inch.....	£5 ea
SPECIAL OFFERS	
COSSOR OSCILLOSCOPE CDU150. Dual Trace 35MHz. Delay Sweep. Solid State. Portable 8x10cm Display. With manual.....	NOW ONLY £180 each
Optional Front Protection Cover containing 12 Probes & Viewing Hood.....	£12
SOLARTRON OSCILLOSCOPE CD1400. Dual Beam 15MHz. With manual.....	ONLY £85 each
AVO VALVE TESTER CT160. Suitcase style. 22 bases (P&P £7).....	ONLY £28 each
MARCONI AM/FM Sig Gen TF1069 10-470MHz £280	
MARCONI AM/FM Sig Gen TF905 range from.....	£150
FARNELL SINE/SQUARE type LFM2 1Hz-1MHz Compact.....	£80
ADVANCE SG28 AM 150KHz-220MHz.....	£45
Many other Generators available - Please enquire	
B-K Precision CRT Restorer/Analyser Model 467. Supplied with 2 bases and manual (P&P £7).....	ONLY £125 each
LABGEAR Colour Bar Generator KG1. 8 Test patterns (P&P £4).....	ONLY £40 each
QUERLY Keyboard (as in Lynx Micro). Push to make. Cased (P&P £3).....	£5 each
SWITCHED MODE PSU -7-12V 0.25A. 5V 15A. 24V 1.4A.....	£20 each P&P £3
Other Switched Mode PSU available. Please enquire DATRON 3000 PROM COPIER (copies up to 10) (P&P £7).....	£180 ea
NEW EQUIPMENT	
HAMEG OSCILLOSCOPE 605. Dual Trace 60MHz. Delay Sweep. Component tester.....	£583
HAMEG OSCILLOSCOPE 203.6. Dual Trace 20MHz. Component tester with 2 probes.....	£314
All Other Models Available	
BLACK STAR FREQUENCY COUNTERS (P&P £4)	
Meter 100-100MHz.....	£99
Meter 600-600MHz.....	£126
Meter 1000-1GHz.....	£175
BLACK STAR JUPITOR 500 FUNCTION GENERATOR	
Sine/Square/Triangle. 0.1Hz 500KHz (P&P £4).....	£110
Black Star Orion Pal TV/Video Colour Pattern Generator.....	£199
HUNG CHANG OMM 7030 3 1/2 digit. Handheld 28 ranges including 10 amp AC/OC 0.1%. Complete with Battery & Leads (P&P £4).....	£39.99
As above DMM 6010 0.25%.....	£33.50
OSCILLOSCOPE PROBES Switched x 1, x 10 (P&P £2).....	£11

Fresh stocks again secured at this SPECIAL PRICE



£39.95

NEW AUTOMATIC ANTENNA ROTATOR - Aerial Techniques introduce their new automatic, economical rotator system for improvement of radio and television reception. Ideal for DXing and domestic use (pull in alternative out of area ITV regions), the full mount rotator accommodates ALL types of TV & FM aerial, large or small, having 192 lbs/in of motor torque. The system consists of two major components, the automatic control box and the rotor head unit, the vertical carrying capability of the latter is 45kg. The additional Support Bearing may be used for heavier load applications (up to three aerial arrays may be employed, depending on size). The attractively styled Control Console features continuous indication of beam/aerial heading, telling you the aerials position at all times. Bracket for Rotator support mast up to 52mm (2" approx) in diameter, stub/rotation mast is up to 40mm (1 1/2" approx) in diameter.

COLOROTOR Automatic Antenna Rotator and Control Console (uses 3 core cable)..... **£39.95**

SUPPORT BEARING for heavier load applications..... **£13.95**

YOKO Multisystem VHF/UHF 5" screen Television. System B/G (5.5MHz sound) AND System L FRENCH standard (6.5MHz sound). Ideal for TV-DXing and Sporadic-E monitoring, covers Band 1, 3 & UHF; 3-way power, 12v DC (lead supplied), Dry batteries & Mains operation. (SAE leaflet)..... **£89.95**

(Carriage & Insurance on above TV £4.95)

'A TV-DXers Handbook' completely new and revised edition by Roger Bunney, a must for ALL DX enthusiasts..... **£5.95**

We are the specialist aerial company for all installations - domestic, fringe, distribution and DX. Try our comprehensive and illustrated Catalogue at 75p full of all the latest equipment, please include SAE with any other enquiries.

All prices inclusive of VAT & Carriage. Delivery normally 7-10 days. ACCESS & VISA Mail and Telephone orders welcome.



AERIAL TECHNIQUES (RE)

11, Kent Road, Parkstone,
Poole, Dorset, BH12 2EH. Tel: 0202 738232.



SHURE 450 MICROPHONES



For CB, PA and Ham Radio
The **BEST** for only

£39.95

PLUS £2.00 p+p
outside UK extra
Normally sold for £69.95

Also available hi-band VHF
mobile antenna's only

£9.95

PLUS £1.50 p+p
outside UK extra
Normally sold for £18.00

Cheques please allow 7 days for clearing
Postal orders same day dispatch

STEFAN'S RADIO LTD
78, MARKET ST CHURCH
ACCRINGTON BB5 0DN. LANCs

Prices below normal trade. Some 1/10 quantity rate. Send 18p SAE or label for free catalogue. (OVERSEAS 2 REPLY COUPONS)

Millions of components: thousands of different lines

Rechargeable Nickel Cadmium batteries (ex unused equipment) AA(HP7) 1.25 volt 500 mA..... Set of four £2
ITT Mercury Wetted relay 20-60 VDC Coil. SPCo, 2A..... 79p. 10-£5
LED illuminates Red, Green or Yellow depending upon polarity/current. 5 x 2½mm Face

.....25p or 100 for £23 or 1000 for £200
10,000 Resistors. ½ to 2 watt. 1Ω to 22meg. ½% to 10% NOT a jumbled mass, but ready sorted into values

..... £25 collected £29 Mail Order
5mm Red Flashing LED..... 25p or 10 for £2.25

Watch/Calculator/Lighter etc Mercury Batteries Made by Ray-O-VAC 10 mixed popular sizes £1.50, 50 for £5.00
IN4004 or IN4006 Diodes..... 300 for £6.50

KBS005/01/02 3 amp 50 V/100 V/200 V/bridge rectifiers, 35p/36p/40p. 10 off £3.20/£3.40/£3.70. 100 off £30/£31/£34

Plessey SL403 3 Watt amp. From Bankrupt source, hence sold as untested..... 4 for 60p or 10 for £1.20p

5mm LED, clear, lighting hyperbright (600mcd), red up to 200 times brighter (gives beam of light) 25p, 100/£20, 1000/£150

Mullard 5mm LED, 40 red, 30 green, 30 yellow = 100 mixed £7
'HARVI' Hardware packs (nuts-bolts-screws-self tappers, etc) marked 35p retail, 100 mixed packs for £11.

Modern silver/black/aluminium, etc knobs 50 mixed, £6 (sent as 10 sets of 4 + 5 sets of 2 - 15 different type/sizes).

SEND PAYMENT PLUS 18p SAE

Postal orders/cash - prompt dispatch.

Cheques require 9 days from banking to clear.

Crossed postal orders and cheques - add 20p handling due to Bank's increasing 'commission' on business accounts.

Cheques drawn on Barclay's Bank not accepted.

Prices you would not believe before inflation!

BRIAN J REED

TRADE COMPONENTS, ESTABLISHED 30 YEARS
161 ST JOHNS HILL, CLAPHAM JUNCTION
LONDON SW11 1TQ.

Open 11am till 6.30pm Tues to Sat. Telephone 01-223 5016

R N ELECTRONICS

Professionally designed equipment for Amateurs

6 METRE Linear TRANSVERTER



Allows any popular 2 Metre Transceiver (up to 3W) to be used on 6 Metres any mode (ssb, FM, CW, Packet etc.)

Low harmonic output

DC or RF switching

Low noise BF981 front end

Boxed versions supplied with either PL259 or BNC plug to 2 metre transceiver

- 25W pep o/p complete boxed transverter **£172** +4.00 p&p
- 2W pep o/p complete boxed transverter **£135** +4.00 p&p
- 2W pep o/p assembled and tested P.C.B. **£105** +2.00 p&p
- 25W pep o/p add on P.C.B. **£47** +2.00 p&p

25W PA for use with FT690 etc. with 2-3W drive including switching and low pass filter **£82** +4.00 p&p

ALL PRICES INCLUDE VAT

37 Long Ridings Ave Hutton Brentwood Essex CM13 1EE. Tel: 0277 214406



STATE OF THE ART SPECTRUM SOFTWARE

G1FTU SSTV TX/RX

8, 16, 24, 32, 48 and 96 second SSTV. Colour text and graphics transmit. Brightness and contrast controls. Frame stores for saving and printing. 9 text memories. Good RX performance on HF and VHF. £12 on cassette, £14 on microdrive or Opus disc.

G1FTU RTTY TX/RX

The classic RTTY program, still going strong. Split screen, type ahead operation 45-110 baud amateur and commercial reception. Reverse tones, unshift-on-space, tuning indicator, etc, etc...

£10 on cassette, £12 on microdrive or Opus disc.

G1FTU CW TX/RX

The ultimate morse transceiver program. Split screen, type ahead, software filters, QSO review, print, re-send. Variable speed and tone. INCLUDES A BUILT-IN LAMBIC KEYS.

This program has it all. £10 on cassette, £12 on microdrive or Opus disc.

STOP PRESS! Dedicated Spectrum PACKET RADIO SYSTEM coming soon! Spectrum AX25 TNC with built-in software at half normal price.

Write or phone for full details. Return of post despatch on all orders. (Please include your callsign with the order).

PEARSONS COMPUTING
42 Chesterfield Road, Barlborough
Chesterfield, Derbyshire S43 4TT
Tel: 0246 810652

On these pages we present details of interesting contacts from clubs and individuals. We would be happy to receive any similar items from readers

Peas, pies and presents

Christmas is a-coming, and Sheffield Amateur Radio Club is getting in the mood with a pea and pie supper on December 14th – exiled Northerners everywhere will breathe a sigh of nostalgia.

After the big event, should you feel that the purple and green socks which Aunt Maud gave you are not quite your thing, the club is holding a Chrissie prezzie swapshop on December 28th. Who knows, perhaps you could gain the transceiver of your dreams? That is, if you can find a purple and green sock maniac...

The club meets every Monday at 8pm in the Firth Park Pavilion, Sheffield. Tuition for Morse code and the RAE takes place between 7pm and 8pm. Details of forthcoming events can be obtained from Alan G8ZNG on (0742) 395287.

Party time

Bath and District ARC is holding its Christmas party on December 9th. It is rumoured that the reason for the early date is because the party actually continues until the 25th...

When the club is not full of the Christmas spirit it meets at the Englishcombe Inn, Englishcombe Lane, Bath at 8pm on Wednesdays. Club contact is H Welchman G6E1Y, who can be contacted on Bath 28010 daytimes, or Bath 318128 evenings.

I sple

Rugby Amateur Transmitting Society, not to mince words, is going to celebrate the festive season with a mince pie evening. This will take place on December 22nd, thoughtfully giving members time to get their appetites back for Christmas dinner.

Talking of Christmas dinners, the club is holding theirs on December 15th. A good month for any club member who is fond of their food!

The society meets every Tuesday at 7.30pm at the Cricket Pavilion outside Rugby Radio Station and for more details about the contents of meetings – or mince pies – please contact Kevin Marriott G8TWH on (0788) 77986.

Social service

Farnborough and District Radio Society would like to wish one and all a happy Christmas, and although there is no meeting on the 23rd, a Christmas social evening will be held on December 9th.

The club normally meets at 7.30pm at the Railway Enthusiasts Club, Hawley Lane, Farnborough, and information about forthcoming events can be obtained from the club secretary, Tim, on Camberley 29231.

Baluns and beads

No, not party baluns! Fareham and District Amateur Radio Club is hosting a serious talk (we think) entitled 'Bobbins, Baluns and Beads', to be given by G3CCB on 2nd December. This should be interesting!

The club carries indefatigably on towards Christmas with a talk on December 16th on taking the Morse test, by G3TZL.

Fareham and District ARC meet every Wednesday at 7.30pm, with a Morse class from 6.30pm, at Portchester Community Centre, Westlands Grove, Portchester, Hants. The club secretary G3CCB can be contacted on Fareham 288139.

Heavenly peace

A quiet month is in store for Chelmsford Amateur Radio Society, whose only listed event for the month is a talk on packet radio on December 1st. Perhaps the Christmas celebrations are going to start early in Chelmsford?

When the club is not gathering its strength for the festive season it meets at 7.30pm on Tuesdays at the Marconi College in Arbour Lane, Chelmsford.

Bury AGM

Bury Radio Society is holding its AGM on December 8th. Normal club meetings are held every Tuesday at the Mosses Centre, Cecil Street, Bury. Information about events can be obtained from M L Jamil G1VQE, the club's publicity officer.

Closed for Christmas

Christmas drinks will be on offer for Felixstowe and Dis-

trict Amateur Radio Society on December 14th at the Grosvenor Hotel, Felixstowe.

The connection between the above and the next announcement is not clear, but the club will be closed on December 28th. It is hoped that it will not take members that long to recover...

All club lecture meetings take place at 8pm in the Scout Hut, Bath Road, Felixstowe, and details can be obtained from Paul Whiting G4YQC on (0473) 642595.

Un-DXpected

We were surprised to receive a colourful QSL card from Baghdad in Iraq. The Y1BGD Club likes to keep in touch, it seems, and members have been about on 80, 40, 20, 15 and 10m most days at about 0500 to 1100 or 1700GMT. They would be interested to hear from anyone who picked up their special call on November 1st, Y10BZF, from a special event station at the Baghdad International Fair.

The club's PO Box number is 5864, Baghdad, Iraq, for anyone who wishes to contact it. The club hopes to open up more contacts between the UK and the Middle East – this sounds full of eastern promise.

Hi, SANDRA

Sudbury and District Radio Amateurs have been showing their lovely faces recently, and as they are only a few months old (as a club – we expect that the members are a little older) they are extremely pleased by their attendance figures and want everyone to keep on coming! They must be more than just a pretty face...

The club meets on the first Tuesday of the month at the Saracen's Head, Newton Green, Sudbury and details of events can be obtained from G1GPD on (0787) 77004.

Remember your social

Underground, overground... wherever they may be, Wimbledon and District Amateur Radio Society members know that their social evening is to be held on December 11th.

Normally meetings are held on the second and last Fridays of each month, but as Christmas coincides with the second meeting it will not be held this month.

The club meets in St Andrews Church Hall, Herbert Road, Wimbledon SW19, and enquiries should be directed to the hon secretary, George Cripps G3DWW, on 01-540 2180.

Not the BBC

Dunstable Downs Radio Club invites members to come on over to having a party on December 18th, but the festivities are getting under way earlier in the month with a Christmas TV show via GB3TV.

There will not be a meeting on the 25th, of course, but normally the club meets every Friday at 8pm at Chews House, 77 High Street South, Dunstable, Bedfordshire. Details can be obtained from the secretary, Tony G0COQ, on (0582) 508259.

Changing BARS

Banbury Amateur Radio Society has been undergoing various changes lately, and now meets at two week intervals at 'The Mill', Spice Ball Park, on Wednesdays from 7.30pm. All amateurs and SWLs are welcome.

On December 2nd, Neil Taylor G4HLX will be talking about satellite communications, followed by half an hour of questions and answers on the RSGB at the present time. There will be no meeting on December 30th. To find out more, call Bryan G11IO QTHR or on Banbury 51774.

SHORT WAVE NEWS

FOR DX LISTENERS

By Frank A Baldwin

All times in UTC, **bold** figures indicate the frequency in kHz

Continuing with our update of Indian regional transmitters currently operating on the Tropical Bands, those on the 60 metre band (**4750** to **5050**) frequencies are now reviewed.

For those readers who were unfortunate in not being able to obtain a copy of the previous issue of *Radio & Electronics World*, the most favourable time for UK based listeners to hear some of the Indian regionals is from around 1515 to 1730 and again from 0025 onward.

For those comparatively new to DXing, station identification of these transmitters is simplified by the fact that news bulletins in the English language are featured in their schedules.

Start here

Tune to **4800** at 1530, at which frequency and time you may hear the news in English from AIR (All India Radio) Hyderabad. This station is heard here regularly throughout the season (September to March) for reception of Indian regionals and quite often around 0025 at other periods in the year. The schedule is from 0025 to 0215 and from 1200 to 1740 in Hindi and English, the latter being newscasts timed at 0035, 1230, 1530 and at 1730 in the South Regional Service. The power is 10kW.

The city of Hyderabad itself is the capital of Andhra Pradesh State and an administrative, commercial and transportation centre. Formerly an Indian State, Hyderabad is also the name given to a region formed by amalgamation of the states of Andhra Pradesh, Maharashtra and Mysore.

AIR Calcutta is on **4820** with a power of 10kW, programming in Indian vernaculars and Bengali in the East Regional Service with one newscast in English. Unlike the signals from Hyderabad, those from Calcutta are not frequently heard here in the UK. It transmits from 0025 to

0210 and from 1230 to 1730 with a power of 10kW, the English news bulletin being timed at 0035.

The city of Calcutta, on the banks of the Hooghly River, is the capital of West Bengal, being the chief port of Eastern India and founded by us British in 1690. Calcutta is famed in history for the notorious 'Black Hole'. After the city was captured by the Nawab of Bengal in 1756, most of the remaining garrison were suffocated by being cramped overnight in a very small cell. Calcutta was retaken by Clive of India in 1757.

AIR Bombay operates on **4840** from 0025 to 0215 in vernaculars and Hindi and from 1230 to 1740 in vernaculars, Hindi and English (Saturday from 1200 to 1230 in vernaculars and Hindi). English newscasts are at 0035, 1430 and at 1730. The power is 10kW, being often heard and reported by UK DXers. Bombay radiates the West Regional Service.

Again for those who missed the previous issue, Indian vernaculars are Assamese, Kannada, Malayalam, Marathi, Oriya, Punjabi and Telegu. The city of Bombay is a major port and industrial centre on the Arabian Sea coast and was formerly the capital of Bombay province but is now the capital of Maharashtra State. Bombay was the headquarters of the East India Company from 1668 to 1858.

Rarely reported, and at one time thought to be inactive, is AIR Kohima on **4850** carrying Indian language broadcasts in the East Regional Service from 0025 to 0215, from 0230 to 0400 and from 1000 to 1300. There is an English news bulletin at 0035. Kohima was the scene of a fierce battle against Japanese forces during World War II.

New Delhi

The regional programming AIR Delhi on **4860** at 20kW is scheduled in Hindi and Eng-

lish from 0030 to 0040, from 0215 to 0250 in vernaculars, Hindi and English, from 0300 to 0350 in vernaculars, Urdu, Hindi and English, from 1230 to 1315 in Hindi, from 1345 to 1435 in vernaculars, Gujarati and English, from 1445 to 1600 in English, Urdu and Hindi and from 1730 to 1740 in English and Hindi. News bulletins in English are timed from 0035, 0230, 1430, 1530 and at 1730.

AIR New Delhi also carries the Foreign Service in Nepali on **4860** with a power of 20kW from 0130 to 0215.

More regionals

AIR Lucknow is currently on **4880** at 10kW, radiating from 0230 to 0400 in Hindi and English, the latter being a newscast at 0230. It is rarely heard far from signal source.

Yet another rare occurrence for UK DXers is the reception of signals from AIR Kurseong. At 20kW, it operates from 0125 to 0400 in vernaculars and has the English news bulletin at 0230. The frequency is **4895**.

A tune to **4920** may result in the reception of signals from AIR Madras. It is on the air in vernaculars and English in the South Regional Service from 0025 to 0215 and from 1200 to 1740 in English; Hindi and Tamil. The news bulletins in English are at 0035, 1230, 1530 and at 1730. According to a recent report, AIR Gauhati is now operating on **4940** from 0200 to 0400.

On **4960**, AIR New Delhi programmes in Punjabi and English from 0245 to 0400 and in Hindi and English from 1030 to 1215 with a power of 10kW. The English bulletin is timed at 0230.

The seldom heard AIR Aizawl carrying the East Regional Service is on **5050** from 0025 to 0200 in Assamese and Hindi and from 1230 to 1630 in Assamese, Hindi and English (Saturday from 1630 to 1740 in Assamese and Hindi). The English bulletin is at 1430 and 1530. The power is 10kW.

AFRICA

Gabon

Africa Number 1, Moyabi on **4890** at 0424 carrying a relay of RFI (Radio France International). A newscast of world events in English was followed by the station identification in both English and French at 0430.

The Moyabi Relay can also be heard on **21700** from 1500 to 1600, when relaying the Tokyo, Japan programme in English for Europe. On the occasion now reported, it was featuring a talk about the aromatic trees of Nippon.

Mozambique

Radio Mozambique, Emissao Nacional, Maputo on **3210** at 1910, an English language lesson which included such phrases as 'How much is a first class ticket to London?' The power is 100kW and the evening schedule is from 1500 to 2215 but transmissions would appear to be irregular. Radio Mozambique has also been heard in parallel on **4865.8** at 1851 when in Portuguese, the power on this channel being 25kW and the evening schedule 1500 to 2205. Both are frequently heard by UK DXers.

Nigeria

Lagos on **15120** at 0641 when a news bulletin of both local and world events followed by the station identification, both in English, were logged. The French broadcast followed at 0645.

South Africa

SABC (South African Broadcasting Corporation) Johannesburg on **3955** at 2138 with a Radio Orion programme of songs and music with announcements in Afrikaans. The schedule of Radio Orion on this frequency is from 1930 to 0300, the power being 100kW.

Tanzania

Dar-es-Salaam on **5050** at 1856, OM with talk was followed by some local wind instrument music accompa-

nied by African drums then a time-check at 1900 and the news. This 10kW transmitter carries the National Service in Swahili from 0300 to 0700 and the Commercial Service, also in Swahili, from 1300 to 2015.

Uganda

Kampala on **5026.4** at 1902, OM with a newscast in English mainly composed of local affairs – very interesting, concern about local water supplies being expressed. The National Programme in English, French, Swahili and local vernaculars is on the air from 0300 (Saturday and Sunday from 0345) to 0600 and from 1300 (Saturday and Sunday from 1400) to 2100. The power is 20kW. Kampala has also been heard in parallel on **4976**, which channel carries the Home Service in vernaculars and English to the same schedule as above. The power is 50kW.

SOUTH AMERICA

Bolivia

Radio Nueva America, La Paz on **4795** at 0401, OM with the station identification in Spanish and then the sign-off without the Hymno Nacional (National Anthem). This 1kW transmitter radiates in Spanish from 2200 (variable) to around 0400 in addition to a morning schedule not receivable here in the UK.

Brazil

Radio Anhanguera, Goiania on **4915** at 0432, OM with the station identification and promotions in Portuguese. This 20kW transmitter is on the air around the clock and is regularly reported by European and UK listeners.

Colombia

Radio Super, Medellin on **4780** at 0348 when a programme of folkloric songs and music typical of the locality was enjoyed. Radio Super works to a 24-hour schedule in Spanish, the power being 2kW.

Equador

Radio Cuenca Independiente, Cuenca on **4800.6** at 0405, featuring a programme of folk songs and music. Operating in Spanish, this 5kW transmitter is scheduled

from 1000 through to 0700 and occasionally around the clock. Radio Cuenca Independiente is the correct station title, that formerly reported (Radio Popular de Cuenca) being incorrect. According to a recent report, the station owner stated that he wished to emphasise independence from any other local or national influences.

Venezuela

Radio Nacional, Caracas on **5020** at 0408, OM with the station identification in Spanish, the National Anthem and then off the air. At 30kW, this Venezuelan station is scheduled in Spanish from 1000 through to 0400.

ASIA

China

Chinese stations on the low frequencies can now be heard here in the UK, as we are now in the season for Asian reception. Try for the following.

Yunnan PBS (Peoples Broadcasting Station), Kunming on **2310** at 2202, YL with a talk in a local dialect then into a programme of local music and songs. Rarely reported by UK based DXers, this station transmits the Home Service 3 in Dehong Jai and Jingpo from 2225 to 0030 and from 1025 to 1630. The power is 15kW.

Yunnan PBS has also been logged on **2460** at 2155. The Home Service 1 on this channel is aired from 2150 to 0100, from 0255 to 0600 and from 0855 to 1540, the power being 15kW.

Xinjiang PBS, Urumqi on **2560** at 2347 with the Home Service in Uigher, also being heard in parallel on **4735**. The schedule on both channels is from 2300 to 0200, 0330 to 0730 and from 1030 to 1700. The power is 15kW.

Perhaps one of the most interesting Chinese stations to listen for at this time of the year is CPBS Beijing operating on **5075**. It has been heard on several occasions around 2140, during which an English language lesson has been featured. These consist of a few sentences in Chinese followed by a translation in English. Then follows an English talk, usually about facets of English life. On one

notable recent occasion such a talk was followed by a rendition of the song 'He's Got the Whole World in His Hands' in English, a five pips time-check at 2200 and then into Chinese.

India

Delhi on **9910** at 2057, local songs and music followed by the station identification and a newscast in the English presentation to Europe, timed daily from 2000 to 2230.

Iraq

Baghdad on **11840** at 1841 with songs and music during the Arabic programme for West Africa, timed from 1800 to 2400 and also heard in parallel on **11740**.

Baghdad has also been logged on **11950** at 1847 with local songs and music in the Arabic transmission for Western Europe, scheduled from 1800 to 2300.

SOUTH-EAST ASIA

North Korea

Pyongyang on **9977** at 1404 when radiating a talk in the Korean programme for South-East Asia, timed from 1400 to 1450.

Laos

Vientiane on **15420** at 1119, YL with a talk in French followed by a song in Lao then OM with the station identification and schedule announcements in French, the Lao National Anthem and off at 1129. I should add, however, that this is a USSR relay and not direct reception. It is interesting none the less.

PACIFIC

Australia

Shepparton on **11910** at 0615, an interview with an English visitor to Australia. This English presentation to South Africa is scheduled from 0600 to 0700 daily.

Shepparton has also been logged on **15240** at 0638 when carrying the English programme to the South Pacific, which is timed from 2100 to 0730.

Marianas

KYOI Saipan on **11900** at 1329, USA made pop record programme in the English transmission to East Asia,

scheduled from 0800 to 1700. This one is in the clear after Bucharest, Romania signs off channel at 1327.

Philippines

FEBC (Far East Broadcasting Company), Manila on **11850** at 0850, YL with a newscast in the English programme for Central Asia, scheduled from 0830 to 0900. The signal was wiped out when Moscow signed on channel at 0859.

CLANDESTINE

Voice of the Mojahed (Mojahedin-e Khalq) on **4452** at 2014, YL with a talk in Farsi (Persian), the transmission being subjected to jamming. Probably located in Iraq, the transmissions are aimed at resistance cells located within Iran. The station identification is Inja Seda-ye Mojahed Ast or sometimes Seda-ye Mojahedin Khalq-e Irana.

Voice of Unity on **15685** at 1610, OM with a harangue in, presumably, Pushto/Dari. Subjected to the almost inevitable jamming, identified as BR in Morse, it signed off at 1612. The location is unknown but is probably Pakistan.

NOW HEAR THESE

Southern Sound, Umtata, Transkei on **3927.3** at 1917, announcements followed by a USA recorded religious talk, all in English. This 20kW transmitter currently operates from 1700 to 0400 and features newscasts in English on the hour from 1700 to 2000 inclusive.

Radio Continente, Peru on **8930.9** at 0023, OM with a talk in Spanish, the station identification at 0030 followed by more talk with many trilled Rs, beloved by Latin American audiences, until 0100 then into a programme of local music and songs. 

Watch out
for more
DX news
next month

FREE CLASSIFIED ADS

FREE CLASSIFIED ADS CAN WORK FOR YOU

We are pleased to be able to offer readers the opportunity to sell your unwanted equipment or advertise your 'wants'.

Send to: **Radio & Electronics World**, Sovereign House, Brentwood, Essex CM14 4SE.

DEADLINE AND CONDITIONS

Simply complete the order form at the end of these ads, feel free to use an extra sheet of paper if there is not enough space on the order form. We will accept ads not on our order form.

Advertisements will be inserted in the first available issue on a first come first served basis. We reserve the right to edit and exclude any ad. Trade advertisements are not accepted.

FOR SALE

■ Microwave Modules MMK1691/137.50 weather satellite converter, £40. MMG1691 weather satellite GaAsFET preamp, £30. Also, six foot aluminium dish aerial on stand, £50. ARE AB3000 air band radio (PLL), £30. Nine inch black and white monitor, composite video, £20. All items as new. Tel: Bassingham 231, after 6pm

■ Printer, for use with Dragon, BBC, Oric with interface cable. Uses plain till roll paper, £15 + pp. Tel: (0582) 581229

■ R1155 original, no mods, £40. Mullard high speed valve tester perfect, complete with 900 test cards, £75. Rohde & Schwarz Rx, 10kHz-32MHz, super set but large, £60. D43 scope, vgc, £50. TF1331 scope, far from well, tube OK, with manual, £12. CT52 scope with manual, vgc, £25. TF144G sig gen, vgc, accurate, £30. ADM patt test Rx 150kHz-30MHz, similar design to Eddystone 840, works very well, £35. CR100, vgc, £35. Tel: Burnham on Sea (0278) 784205

■ Concord II Ham International AM, FM, SSB, LSB, CW, suitable to convert to 2 metres. Offers. Also ATU, £15. Tel: (0283) 221870

■ FT980 all mode HF transceiver, 0-30MHz, inc SP980 speaker, FIF232 interface, as new, £980. Tel: (0480) 53775 after 5pm

■ Kenwood R1000 communications receiver, 0-30MHz, upper and lower sideband switches, Morse switch, narrow and wide filters, digital LED readout. Perfect condition. Ideal for the short wave listener, can be connected to RTTY readers, etc, only £290. Tel: (0746) 761996 or (0746) 2097 (Shropshire)

■ To be cleared: 6800 development system with EPROM programmer and Flex, £400. Cossor oscilloscope, £250. Zicon 701 logic analyser (new), £1000. Parallel dot matrix printers (Centronics 739, Canon A1200, and Epson MX-100 type III), Sanyo monochrome monitors, £25. Light box, £20. Drawing board, £20. Many components and electronics and computing books. Vidhya Thillai, 74 Forlease Road, Maidenhead, Berks SL6 1SD. Tel: (0628) 36121

■ Mains transformer for AR88D, also spare valves. E Hastings, The Battle, Pound Lane, Gillingham, Dorset SP8 4NP. Tel: (07476) 2024

■ Brand new and boxed power supply, 5V 20A, 12V 4A, 15V 4A, etc, £25. Hundreds of valves, state requirements. 2764 IC, £1.50. Alinco ELH 730G UHF linear amplifier, £50. Crystals, £1 each. Audio sport EC44 mike on stand, £15. Jaybeam x 5 Yagi with phasing harness, £20. Hi-mould side swipper key, £10. Brand new QV06-40A, £10. 240V snail type blower, £5. Roy Reynolds G31DW, 6 Church Way, Stratton, Swindon SN3 4NF. Tel: (0793) 822055

■ Toshiba XRJ9 compact disc player, as new, with £120 worth of discs, all cost £300, accept £200. Would exchange for an HF Rx ie R1000, R2000, FRG7700 or similar, must be in gwo. Write to P Jones, 76 Pengwern, Llangollen, Clwyd, N Wales LL20 8AS

■ Trio R-2000 general coverage Rx, boxed, as new condition. Covers 150kHz to 30MHz all modes. £350 ono. Tel: Flitwick (Beds) 715238, after 6pm

■ Racial receiver mod, S820 99, S8015 97 + sideband converter + frequency synth + aerial tuner, leads and manuals, offers. Tel: (091) 2530775

■ Sailor radio receiver, model R105, capable of receiving SSB, SW, LW, MW, NW with spaces for 20 crystals. Tel: (08063) 288

■ Yamaha VSS-100 digital sampler keyboard with tape, handbook, original packing, NiCads. Pristine condition. Sell or swap for best HF Rx offered. Historians, collectors, one Marconi V24 valve. Also major British makers' catalogue of military radio circa 1920(?), must be rare, unique. Genuine offers considered. F N Howard GW3DEX, 7 John Lewis

Street, Hakin, Milford Haven, Dyfed SA73 3HT

■ Eddystone 770U/2 receiver, covers freq 160MHz-500MHz in AM, FM. Ideal for military, air bands, UHF. VGC, £85.00. I will arrange transport to you! Some new valves in and recently checked over. Has six overlapping bands. Very heavy ant. Compact and nice looking. Mr George Jacob, 23 Waterloo Gardens, Penylan, Cardiff CF2 5AA. Tel: (0222) 487299, evenings

■ AVO valve tester plus manual and circuit diagram, £50 ono. Telequipment oscilloscope type S51B with manual, £70 ono. Tel: Hornchurch (04024) 40138

■ Ferrograph recorder test set II, cost new £705, has built-in signal generator and standard 3.15kHz oscillator. Also has meters for measuring distortion and wow and flutter plus a sensitive millivoltmeter. Includes manual, excellent condition, ideal for hi-fi buff, etc, £275. Tel: Andy on (0252) 22193 (Aldershot)

■ Murphy A40 console (1938), requires some repair. Was most advanced radio of its time. Tel: Dudley 57907

■ Enthusiasts clearout: large parcels of components, equipment, circuit boards, etc. Super assortment in each parcel. Sold by weight. 1kg = £5, 2kg = £7, 3kg = £9, 5kg = £12, 10kg = £20, 20kg = £35. All post free. You will be delighted. If you reply quickly and specify the sort of stuff you want I will do my best to fulfil your requirements. Enclose cheque/PO with order. Mr Bailey, 1435 Pershore Road, Stirchley, Birmingham B30 2JL

■ Yaesu FRG8800 Rx, £300. SPC300 ATU, £90 ono. FRT7700 ATU, £20. Sky Coupler ATU, £20. 12V PSU, £10. VHF omnimatch, £10. Telereader 670E, £100. SP102 speaker with filters fitted, £60. Buyer inspects and collects. Roger Digby. Tel: Bradford 670329

■ FDK multi 112 metre FM transceiver, c/w mobile bracket, ½ whip and gutter mount. Owner's handbook. 10W/1W output. Repeater channels R0/R7 and inputs simplex 19/23. Auto scanning, £110. G3RDG QTHR. Tel: 01-455 8831

■ Solartron CD1400 oscilloscope, £50. A large number of *Practical Wireless*, *Electronic* and *TV* magazines. Tel: 01-747 1635

■ For sale or exchange: Daiwa CNW419 ATU as new for small sig gen, HRO Rx coils, p/p, spkr, etc. Sig gen must be OK and not large and heavy ex WD. Want £175 or near offer for ATU. Trio MC60A desk mike, as new, £55. Airmec p/s mod 776, 0-750V dc at 250mA + 6.3V dc, £40. Exchanges, etc. Tel: Milton Keynes (0908) 313507

■ Yaesu FRG9600 Mkl 60-905MHz c/w Revcone omnidirectional antenna + PSU, £350 ono. Tel: (0202) 576485

■ Set of service manuals, pre 1939, for HMV domestic radio receivers. Offers phone Working 30624 most evenings

■ Advance OS3000 DB scope, £60. Manual for OS4000, £5. FM, AM, sig gen, Marconi TF995A 1.5 to 220MHz, £40. Icom IC21 plus VFO, £60. GEC microscope, very old, £10. Solartron digital multi-meter NiCads, mains, £20. Taylor 65A RF sig gen, £5. Wayne Kerr LCR bridge B424, £38. Scope amp, HP1801A 50MHz, £25. Weir multi-reg 731 pwr supply 0-15V 2A, 0-30V 1A, £25. Variac 0-240V 2A, £10. Clarke G8CZH, tel: 01-859 1852

■ Surplus to requirements used components, taken from working circuit boards. Pots, relays, switches, heatsinks, cable connectors, electro caps, wirewound resistors, etc. Large box only £4 plus £1.50 post and packing. Also radio alarm clocks, 10 only, digital display, each has slight fault hence price, £2.50 each plus 75p post and packing. Cheques or postal orders to Mr M Day, 39 Vainord Lane, Saint Peter Port, Guernsey, Channel Islands

■ Liner 22m SSB transceiver. Good condition, £70

ono. Two 8m DSDD disc drives, bargain at £100 ono. Robert, tel: (0203) 317360 after 6pm

■ Complete amateur radio station 757 transceiver, 757 automatic antenna tuner, 757 heavy duty power supply, Mossely three element tri bander beam, co-ax, switch boxes, 10 metre vertical antenna, wire antenna, £950. G4ZNB. Tel: Rochdale 524602, evenings/weekends only

■ Sony TC377 stereo reel to reel tape recorder, three speeds, three heads. Very good condition, £95. Large number 7 inch spool tapes also available. Tel: 01-907 3512

■ QRT shack clearance. Yaesu FP757HD heavy duty power supply, £165. Yaesu FC757AT automatic ATU, £250, both items hardly used, mint and boxed. Realistic (Tandy) PRO32 hand-held 200ch programmable scanner with too many features to mention - mint, boxed and guaranteed, £210. Hitachi video camera power supply with leads, £15. Transistor tester, £5. Scarab hardware and software for Spectrum as follows: communication board for RTTY/CW Rx/Tx, £13; terminal unit for RTTY/CW, £25; hardware and software for Rx SSTV, £9; Software for RTTY/CW Tx/Rx, £5; 'multiface 1' (the ultimate copier) with video o/p and joystick interface, £7; Boris Diplomat chess computer, £15; MM 2 metre converter, £7; antenna switch, £5; antenna rotator and cable, £15; audio generator, £2; GDO (solid-state), £15; dummy load, £2; many spares and radio mags. Gordon Jackson, 109 Culver Grove, Stanmore, Middlesex HA7 2NG. Tel: 01-907 2253

■ Trio TS811E 70cm multimode base rig. ALC processor, DCS 'all singing all dancing', £1,099 to buy today, asking £750 or offer, or part exchange against FT790R and/or FT690R Mk 1 with cash difference. Also have MM MTV435 70cm ATV Tx with pre-amp, £145 or offers. Chris Barker, 52 Spode Street, Stoke-on-Trent, Staffs ST4 4DY. Tel: (0782) 46570 any time after 10am

■ Yaesu FR400 DX Rx, 10 to 160m with FM, provision for 6m and 2m. New full set of valves fitted, also spare set, excellent condition. Bargain at £95 ovo. Tel: (0604) 34078 evenings until 12.30

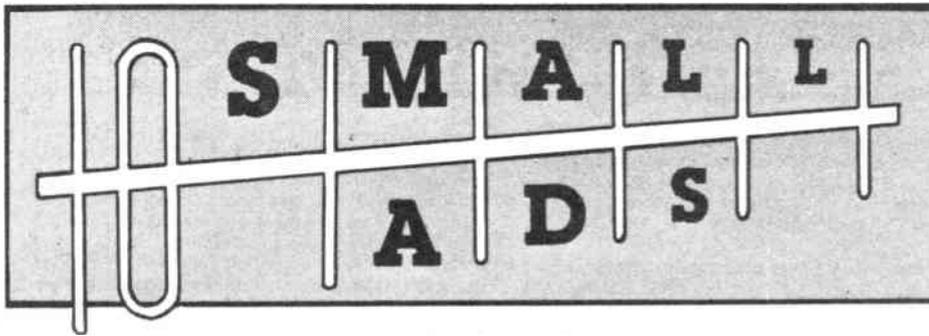
■ QV06-40 valve, £5; 2x QV03-20 valves and bases, £2; 4CX 250B and UHF base, £20; 25 watt VHF Hi Band PMR amp with manual, £25; 40 channel CB, mint/boxed, £20; antenna combiner/splitter, £2; BATC designed video call sign generator, built and tested, £15; Wood & Douglas FM TV demod module, 53MHz in, video out, TVRO, £30; Pye PF70, xtalled on RB0 and SU8, includes 2 NiCads and charger, £65; Sunpak Autozoom 5000 pro flash gun, amazing power, £50; 135mm lens in Pentax 42mm screw and K mount adaptor, £20; Pentax ME autowinder, £20; flashgun bracket, £4; flashgun extension lead, £1. Tel: (0604) 766913 any time

■ Security clock (patrolman's type), suitable for private security firm or industrial security company. Price to include extra tapes and ribbons, £85. Peter, tel: Chesterfield 454815

■ Icom IC120 23cm FM inc yagi, £250. Hitachi GP4D colour video camera, £50. MML432/50 linear, £95. Marine scanner, £45. Signal R357 hand-held airband, £25. CTE767 10m linear, £30. JVC GRC1 camcorder inc tapes, £350. Jim G4XRU, tel: (0903) 690415

■ One large box of new/used components, PCBs, chassis, etc. Weight over 30lb, only £25 post paid. One ex-hospital heart-rate monitor unit with orange CRT screen, meter, loudspeaker - working but no mains lead, only £25 post free. One parcel of 500 new resistors, capacitors, etc, £5 post free. Approx 1,000 new boxed valves. Send SAE for quote on requirements. Tel: (021) 472 3688

■ Howes CTU25 ATU, maximum 25W, 1.8-30MHz, aluminium case, £12. Cambridge antenna noise bridge, 2-1000Ω, 150kHz-150MHz, £13.50. Oldham



JAPANESE Ic's (PART OF OUR RANGE)

AN7178 £2.95, BA5408 £2.20, HA1377 £2.20, HA1392 £2.50, HA1394 £2.95, HA1397 £2.75, HA1398 £2.75, HA13001 £2.95, LA4460 £1.80, LA4481 £1.80, LA4507 £4.25, LC7137 £2.75, M51517 £2.80, MB3705 £1.80, MB3712 £1.80, MB3722 £3.50, MB3730 £2.50, MB3731 £3.50, STK461 £7.50, STK463 £8.40, TA7205AP £1.00, TA7222AP £1.30, TA7240 £2.95, TA7241 £2.95, TA7270 £2.75, TA7271 £2.75, TA7274 £2.95, TA7280 £3.50, TA7281 £2.95, TA7292 £2.95, TA7283 £2.95, TA7288 £2.95, TA7611 £3.20, UPC575 £1.00, UPC1158 £2.95, UPC1181 £1.10, UPC1182 £1.10, UPC1185 £2.50, UPC1188 £2.75, UPC1230 £2.50, UPC1263 £2.50, UP1277 £2.75, UPC1278 £2.75, UPC1365 £3.80, UPC1394 £1.95, A00 60p POST AND PACKING AND THEN ADD 15% VAT TO TOTAL
T POWELL 16 PADDINGTON GREEN LONDON W2 1LG
 OPEN MON-FRI 10AM-5PM, SAT 9AM-12 NOON.
 TELEPHONE: 01 723 8246
 ACCESS/VISA. TELEPHONE ORDERS ACCEPTED OVER £5.00

WORKSHOP SERVICE MANUALS

ANY MUSIC AUDIO, MONO TV - £4.50
 ANY COLOUR TV, AMATEUR RADIO - £9.50
 ANY VIDEO RECORDER, TEST - £19.50
 STATE MAKE/MODEL/TYPE. PLUS 50p post.
 LSAE ENQUIRIES OTHERS PLUS FREE REVIEW.
MAURITRON (REW), 8 CHERRY TREE ROAD, CHINNOR, OXFORDSHIRE OX9 4QY.

RF DEVICES AT ROCK BOTTOM PRICES!

Nobody beats us!

Over 30,000 RF devices at low prices
REPLACEMENT RF TRANSISTORS
 MRF454 HF/SSB 80W £24.50
 MFR450 HF/SSB 50W £11.60
 MRF238 VHF/FM 25W £12.80
 MRF475 HF/SSB 20W £3.25
 2SC1969 HF/SSB 18W £2.75
 2SC2043/1307 HF 16W £2.00
 2SC1947 VHF 3.5W £7.60
 2SC1946A VHF 32W £15.30
 BLW 60R HF/VHF 50W (Special) £7.50

REPLACEMENT RF POWER MODULES

M57704/SAU3 UHF 15W £39.20
 M57712/37 SAV7 VHF/FM 25W £39.50
 M57713/SAV8 VHF/SSB 15W £39.00
M57718/SAU4 UHF/SSB 15W £49.50
 M57719 VHF/PMR 15W £31.20
 M57727 VHF/SSB 38W £47.50
 M57749/SAU11 934/FM 7W £39.20

Send £1.00 p&p. SAE for full list
 All prices inc. VAT
 Many Ic's and other types in stock
 Equivalent for most devices available

RAYCOM LTD
 DEPT AR 584 HAGLEY RD WEST
 QUINTON BIRMINGHAM
 B68 0BS
 021 421 8201-3
 (24hr answer phone)

THE SCIENTIFIC WIRE COMPANY
 811 Forest Road, London E17. Telephone 01-831 1888

ENAMELLED COPPER WIRE			
SWG	1lb	8oz	4oz
8 to 34	3.63	2.09	1.10
35 to 39	3.82	2.31	1.27
40 to 43	6.00	3.20	2.25
44 to 47	8.67	5.80	3.49
48	15.96	9.58	6.38
SILVER PLATED COPPER WIRE			
14 to 30	9.09	5.20	2.93
TINNED COPPER WIRE			
14 to 30	3.97	2.41	1.39
Fluxcore Solder			
	5.90	3.25	1.82

Please add 15% VAT. Orders under £2 add 20p.
 SAE for list of copper and resistance wire.
 Dealer enquiries welcome.

CATALOGUE No24

Bigger and better than ever before. 64 pages crammed with thousands of exciting bargains. Electronic components, power supplies, motors, fastenings, ballraces, tools, surplus mechanical miscellanea, plastics, PTFE and many more all at bargain prices.

SEND 75p

J A CREW & CO
 Spinney Lane, Aspley Guise
 Milton Keynes MK17 8JT

G4 DXX
Video Electronics
 For Icom, Dray, Wells, DAIWA, Datong. N934 MHz equipment, logbooks, rotators, cable, etc.
 OPEN 9-5pm, Closed Wednesdays
 141 Lancaster Road, Morecombe, Lancashire LA4 5QJ
 Phone: (0524) 418873

JAYCEE ELECTRONICS LTD
 JOHN GM30PW
 20 Woodside Way, Glenrothes, Fife KY7 5DP
 Tel: 0592 756962
 Open: Tues-Sat 9-5
 Quality secondhand equipment in stock. Full range of TRIO goodies. Jaybeam - Microwave Modules - LAR.

AGRIMOTORS
 MERTON CB AND RADIO CENTRE
 MERTON GARAGE AND POST OFFICE, MERTON.
 Nr OAKHAMPTON, DEVON EX20 3DZ
 OPEN 6 DAYS 9-6 LUNCH 1-2pm
 EARLY CLOSING THURSDAY 1.00pm
 (SUNDAYS BY APPOINTMENT)
 SPECIALIST IN 934 MHz
 SUPPLIERS OF ALL 27MHz AND 934 MHz EQUIPMENT
 AMATEUR ACCESSORIES CATERED FOR
 08053 200

BEAM VIDEO
 Throughout the house on Channel 36.
 Price £10.50 + P&P 50p. Phone for leaflet:
Electronic Mailorder A
 62 Bridge Street, Ramsgate
 Lincs BLO 9AG
 Tel: 070682-3036 (24hrs)

Radio & Electronics
The communications and electronics magazine World

This method of advertising is available in multiples of a single column centimetres — (minimum 2cms). Copy can be changed every month.

RATES
 per single column centimetre:
 1 insertion £9.65, 3 — £9.15, 6 — £8.65, 12 — £7.75.

SMALL ADS

RADIO & ELECTRONICS WORLD SMALL AD ORDER FORM

TO: Radio & Electronics World · Sovereign House
 Brentwood · Essex CM14 4SE · England · (0277) 219876

PLEASE RESERVE.....centimetres by.....columns

FOR A PERIOD OF 1 issue..... 3 issues..... 6 issues..... 12 issues.....

COPY enclosed..... to follow.....

PAYMENT ENCLOSED:..... £ —

CHEQUES SHOULD BE MADE PAYABLE TO
 Radio & Electronics World Overseas
 payments by International Money Order
 Credit Card
 CREDIT CARD
 EXPIRY DATE

CHARGE TO MY ACCOUNT.....

COMPANY

ADDRESS

SIGNATURE TELEPHONE.....

C P I

**VALUABLE
SPACE FOR
SALE!**

Telephone
the advertising
department on:
0277 219876
for details

TURN YOUR SURPLUS

IC's TRANSISTORS etc, into cash, immediate
settlement. We also welcome the opportunity
to quote for complete factory clearance.

CONTACT:

COLES-HARDING & CO
103 South Brink, Wisbech, Cambs
TEL: 0945 584188
Est Over 10 years

PSSS....

**ALL THE SUPER
BARGAINS ARE
ON THE
INSIDE-FRONT
COVER OF THIS
MAGAZINE!!**



ETESON ELECTRONICS

15B Lower Green,
Poulton-le-Fyde, Blackpool
Tel: (0253) 885107

Open: 9.30am - 12.30, 1.30 - 5.30. Closed Wed & Sun.
Electronic Component Specialists.

A wide range of electronic components, IC's, capacitors,
transistors, resistors, plugs and sockets etc.

HEATHKIT U.K.

Spares and service centre.
Cedar Electronics, Unit 12, Station
Drive, Bredon, Tewkesbury,
Glos. Tel. 0684 73127

Selectronic

The UK's leading suppliers of
934MHz personal radio equipment

203 High Street
Canvey Island, Essex,
Tel: 0268 691481
(Open Mon-Sat 9-5.30)

Amateur radio equipment also in stock

**NEXT ISSUE
ON SALE
10th DEC
1987**

**PROFESSIONAL
ELECTRONICS TECHNICIANS**

Short re-training courses (3 week)
VCR SERVICING
MSC GRANT AID PAYABLE TO EMPLOYERS (ATS GRANT
50% OF FEES). UNEMPLOYED MAY BE ELIGIBLE FOR
FULL JTS GRANT AID

HIGH PRACTICAL CONTENT ON ALL COURSES
BTEC ONC AWARDS
NEXT COURSES COMMENCE 4th JANUARY 1988
TELEVISION AND VIDEO. COMPUTER TECHNOLOGY.
TELECOMS. PROGRAMING

The LONDON ELECTRONICS COLLEGE Dept REW
Brompton Institute
Penywern Road, London SW5 9SU
Tel: 01-373 8721 PRESTEL*2115495

VALVES WANTED

Especially large audio types
PX4, PX25, PP3/250, KT66, KT88 complete collections or shop
clearance etc welcome

AMAZING BARGAIN PACKS

20lbs of transistors, resistors, potentiometers, electrolytics, etc.
etc Amazing value - a few items would cost £10, but we haven't
time to sort out Grocery box 11" cube, crammed to the brim, 20lbs
£10 + VAT 50lbs £20 + VAT Delivered.

PLEASE STATE PRICE REQUIRED, CASH WAITING.

MARTIN BILLINGTON
39 Highlands Rd, Horsham, West Sussex RH13 5LS
Tel: 0403 884088

COLOUR DISPLAY TUBES

New 14" and 19" colour CRT's
with scan coils. Several hundred
obsolete stock for disposal.
Trade enquiries welcome.

Contact: Department REW

Telephone: 0684 299444

Please mention
Radio & Electronics World
when replying
to any
advertisements

MOTOROLA MONITORS.

7", 9", 12" & 15" TTL/COMPOSITE
*15/230V AC SOME WITH 12V DC, 15V DC, 24V DC
OR 70V DC OPTIONS. GREEN OR BLACK AND WHITE.
OVER 300 MODELS PLUS TUBES AND SPARES
AVAILABLE FROM STOCK. ALL REPAIRS
UNDERTAKEN.

WOODVILLE LTD
0923 721004

**COUNTY
GUIDE**

RATES
BOXES ad sizes
20mm x 59mm single
40mm x 59mm double

Total prepayment rates	Ad space single double	3 issues £47.00 £94.00	6 issues £88.00 £176.00	12 issues £158.00 £316.00
------------------------------	------------------------------	------------------------------	-------------------------------	---------------------------------

RADIO & ELECTRONICS WORLD COUNTY GUIDE ORDER FORM

TO: Radio & Electronics World · Sovereign House · Brentwood · Essex
CM14 4SE · England · (0277) 219876

print your copy here

NUMBER OF INSERTIONS REQUIRED

Single County Guide 3 £47.00... 6 £88.00... 12 £158.00...
Double County Guide 3 £94.00... 6 £176.00... 12 £316.00...

PAYMENT ENCLOSED

£ —

Cheques should be made payable to Radio and
Electronics World. Overseas payments by Internati-
onal Money Order

Conditions — Payment must be sent with order form. No copy changes allowed Ads accepted subject to our
standard conditions, available on request

Registered No 2307667 (England)

C P I | | | | |

ADVERTISERS INDEX

Aerial Techniques	57	Marlow	51
J Bull	67	Microkit	48
SRW Communications	48	Pearsons Computing	58
P M Components	20,21	Brian Reed	58
Display Electronics	26,27	Sherwood Data	48
RN Electronics	58	Specialist Semi-Conductors	68
ICOM	4,5	Stefans Radio	58
Interbooks	11	Stewart of Reading	57
Keytronics	32	C R Supply	46
		R Withers	2

Radio & Electronics
The communications and electronics magazine **World**

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES		series rates for consecutive insertions			
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
61 x 90	1/8 page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	1/4 page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	1/2 page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

COLOUR AD RATES		colour rates exclude cost of separations	series rates for consecutive insertions		
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
128 x 186 or 263 x 90	1/2 page	£420.00	£395.00	£375.00	£335.00
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00

SPECIAL POSITIONS	Covers:	Outside back cover 20% extra, inside covers 10% extra
	Bleed:	10% extra [Bleed area = 307 x 220]
	Facing Matter:	15% extra

DEADLINES		*Dates affected by public holidays			
issue	colour & mono proof ad	mono no proof and small ad	mono artwork	on sale thurs	
Jan 88	12 Nov 87	18 Nov 87	20 Nov 87	10 Dec 87	
Feb 88	10 Dec 87	16 Dec 87	18 Dec 87	14 Jan 88	
Mar 88	14 Jan 88	20 Jan 88	22 Jan 88	11 Feb 88	
Apr 88	11 Feb 88	17 Feb 88	19 Feb 88	10 Mar 88	

CONDITIONS & INFORMATION		
<p>SERIES RATES Series rates also apply when larger or additional space to that initially booked is taken. An ad of at least the minimum space must appear in consecutive issues to qualify for series rates. Previous copy will automatically be repeated if no further copy is received. A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received. Display Ad and Small Ad series rate contracts are not interchangeable.</p>	<p>If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken. COPY Except for County Guides copy may be changed monthly. No additional charges for typesetting or illustrations (except for colour separations). For illustrations just send photograph or artwork. Colour Ad rates do not include the cost of separations.</p>	<p>Printed — web-offset. PAYMENT Above rates exclude VAT. All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers subject to satisfactory credit references. Accounts are strictly net and must be settled by publication date. FOR FURTHER INFORMATION CONTACT Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE. (0277) 219876</p>



£1 BAKERS DOZEN PACKS

Price per pack is £1.00. * Order 12 you may choose another free. Items marked (sh) are not new but guaranteed ok.

- 1-5 13 amp ring main junction boxes
- 2-5 13 amp ring main spur boxes
- 5-3 flush electrical switches
- 7-4in flex line switches with neons
- 8-2 80 watt brass cased elements
- 9-2 mains transformers with 6V 1A secondaries
- 10-2 mains transformers with 12V ½ A secondaries
- 11-1 extension speaker cabinet for 6½" speaker
- 12-5 octal bases for relays or valves
- 13-12 glass reed switches
- 14-4 OCP 70 photo transistors
- 16-4 tape heads, 2 record, 2 erase
- 17-1 ultrasonic transmitter and 1 ditto receiver
- 18-2 15000 mfd computer grade electrolytics
- 19-2 light dependent resistors
- 20-5 different micro switches
- 21-2 mains interference suppressors
- 22-2 25 watt crossover units 2 way
- 23-1 40 watt 3 way crossover unit
- 28-1 6 digit counter mains voltage
- 30-2 Nicad battery chargers
- 31-1 key switch with key
- 32-2 humidity switches
- 34-96 x 1 metre lengths colour-coded connecting wires
- 36-2 air spaced 2 gang tuning condensers
- 37-2 solid dielectric 2 gang tuning condensers
- 38-10 compression trimmers
- 41-6 Rocker Switches 10 amp mains SPST
- 43-5 Rocker Switches 10 amp SPDT Centre Off
- 44-4 Rocker Switches 10 amp DPDT
- 45-1 24 hour time switch mains operated (s.h.)
- 46-1 6 hour clock timeswitch
- 48-2 6V operated reed switch relays
- 49-10 neon valves - make good night lights
- 50-2 x 12V DC or 24V AC, 4 CO relays
- 51-1 x 12V 2C 0 very sensitive relay
- 52-1 12V 4C relay
- 55-1 locking mechanism with 2 keys
- 56- Miniature Uniselectors with circuit for electric jigsaw
- 57-5 Dolls' House switches
- 60-5 ferrite rods 4" x 5/16" diameter aerials
- 61-4 ferrite slab aerials with L & M wave coils
- 62-4 200 ohm earpieces
- 63-1 Mullard thyristor trigger module
- 64-10 assorted knobs ¼ spindles
- 65-5 different thermostats, mainly bi metal
- 66- Magnetic brake - stops rotation instantly
- 67- Low pressure 3 level switch
- 69-2 25 watt pots 8 ohm
- 70-2 25 watt pots 1000 ohm
- 71-4 wire wound pots - 18, 33, 50 and 100 ohm
- 73-4 3 watt wire wound pots 50 ohm
- 77-1 time reminder adjustable 1-60 mins
- 78-5.5 amp stud rectifiers 400V
- 85-1 mains shaded pole motor ¼" stack - ¼ shaft
- 86-25" ali fan blades fit ¼" shaft
- 87-23" plastic fan blades fit ¼" shaft
- 88- Mains motor suitable for above blades
- 89-1 mains motor with gearbox 1 rev per 24 hours
- 91-2 mains motors with gearbox 16 rpm
- 93-4 11 pin moulded bases for relays
- 94-5 B7G valve bases
- 95-4 skirted B9A valve bases
- 96-1 thermostat for fridge
- 98-1 motorised stud switch (s.h.)
- 101-1 12½ hours delay switch
- 103-1 6V mains power supply unit
- 104-1 14½V mains power supply unit
- 105-1 15 pin flex plug and panel socket
- 107-1 15" speaker size radio cabinet with handle
- 109-10 ¼" spindle type volume controls
- 110-10 slider type volume controls
- 112-1 heating pad 200 watts mains
- 114-1 1W amplifier Mullard 1172
- 115-1 Wall mounting thermostat 24V
- 118-1 Teak effect extension 5" speaker cabinet
- 120-2 p.c.b. with 2 amp full wave and 17 other recs
- 122-10 mtrs twin screened flex white p.v.c. outer
- 132-2 plastic boxes with windows, ideal for interrupted beam switch etc
- 155-3 varicap push button tuners with knobs
- 188-1 plastic box, sloping metal front, 16 x 96mm, average depth 45mm
- 241-1 car door speaker (very flat) 6½" 15 ohm made for Radiomobile
- 243-2 speakers 6" x 4" 15 ohm 5 watt made for Radiomobile
- 266-2 mains transformer 9V ½ A secondary split primary so OK also for 115V
- 267-1 mains transformers 15V 1A secondary p.c.b. mounting
- 330-2 6V 0.6V mains transformer .3a p.c.b. mounting
- 350-40 double pole leaf switches
- 365-1 7uf 660V 50hz metal cased condenser
- 453-2 2¼in 60 ohm loudspeakers
- 454-2 2¼in 8 ohm loudspeakers
- 463-1 mains operated relay with 2 sets c/o contacts
- 464-2 packets resin filler/sealer with cures
- 465-35A round 3 pin plugs will fit item 193
- 466-4 7 segment l.e.d. displays
- 470-4 pc boards for stripping, lots of valuable parts
- 480-4 13A double pole magnetic trip, saves repairing fuses
- 498-4 1000uf 25V axial electrolytic capacitors
- 504-1 Audax PM 8" speaker 15 ohm 5 watt rating
- 515-100 4BA 1½" cheesehead plated screws and 100 4BA nuts
- 541-1 pair stereo tape head as in cassette recorder/players
- 546-1 bridge rectifier 600V international rectifier ref 3SB100
- 548-2 battery operated relays (3-6v) each with 5A c/o contacts 2 pairs
- 553-2 lithium 3V batteries (everlasting shelf life)

TELEPHONE BITS

- Master socket (has surge arrester - ringing condenser etc) and takes B.T. plug.....£3.95
- Extension socket.....£2.95
- Dual adaptors (2 from one socket).....£3.95
- Cord terminating with B.T. plug 3 metres.....£1
- Kit for converting old entry terminal box to new B.T. master socket, complete with 4 core cable, cable clips and 2 B.T. extension sockets.....£11.50
- 100 mtrs 4 core telephone cable.....£8.50

COMPACT FLOPPY DISC DRIVE EME-101

The EME-101 drives a 3" disc of the new standard which despite its small size provides a capacity of 500k per disc, which is equivalent to the 3½" and 5¼" discs. We supply the Operators Manual and other information showing how to use this with popular computers: BBC, Spectrum, Amstrad etc. All at a special snip price of £27.50 including post and VAT. Data available separately £2, refundable if you purchase the drive.

MULLARD UNILEX AMPLIFIERS

We are probably the only firm in the country with these now in stock. Although only four watts per channel, these give superb reproduction. We now offer the 4 Mullard modules - i.e. Mains power unit (EP9002) Pre amp module (EP9001) and two amplifier modules (EP9000) all for £6.00 plus £2 postage. For prices of modules bought separately see TWO POUNDERS.

CAR STARTER/CHARGER KIT

Flat Battery? Don't worry you will start your car in a few minutes with this unit - 250 watt transformer 20 amp rectifiers case and all parts with data and case £17.50 post £2.

THIS MONTH'S SNIP

is a 2½kW tangential heater, metal box to contain it and 3 level switch to control it. Special price £7.50 post paid.



VENNER TIME SWITCH

Mains operated with 20 amp switch, one on and one 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/off per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is £2.30

Ex-Electricity Board. Guaranteed 12 months.

12 volt MOTORS BY SMITHS

Made for use in cars, etc. these are very powerful and easily reversible.

Size 3½" long by 3" dia. They have a good length of ¼ spindle - 1.10 hp £3.45 1.8 hp £5.75, 1.6 hp £7.50



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 ¼" 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.

9" MONITOR

Ideal to work with computer or video camera uses Philips black and white tube ref M24 306W. (which tube is implosion and X-Ray radiation protected. VDU is brand new and has a time base and EHT circuitry. Requires only a 16V dc supply to set it going. It's made up in a lacquered metal framework but has open sides so should be cased. The VDU comes complete with circuit diagram and has been line tested and has our six months guarantee. Offered at a lot less than some firms are asking for the tube alone, only £16 plus £3 post.

LIGHT BOX

This when completed measures approximately 15" x 14". The light source is the Philips fluorescent 'W' tube. Above the light a sheet of fibreglass and through this should be sufficient light to enable you to follow the circuit on fibreglass PCBs. Price for the complete kit, that is the box, choke, starter, tube and switch, and fibreglass is £5 plus £2 post, order ref 5P69.

TANGENTIAL HEATERS

We again have very good stocks of these quiet running instant heat units. They require only a simple case, or could easily be fitted into the bottom of a kitchen unit or book case etc. At present we have stocks of 1.2kw, 2kw, 2.5kw, and 3kw. Prices are £5 each for the first 3, and £6.95 for the 3k. Add post £1.50 per heater if not collecting.

CONTROL SWITCH enabling full heat, half heat or cold blow, with connection diagram. 50p for 2kw, 75p for 3kw.

FANS & BLOWERS

5" £5 + £1.25 post, 6" £6 + £1.50 post 4" x 4" Muffin equipment cooling fan 115V £2.00 4" x 4" Muffin equipment cooling fan 230/240V £5.00 9" Extractor or blower 115V supplied with 230 to 115V adaptor £9.50 + £2 post. All above are ex computers but guaranteed 12 months. 10" x 3" Tangential Blower. New. Very quiet - supplied with 230 to 115V adaptor on use two in series to give long blow £2.00 + £1.50 post or £4.00 + £2.00 post for two

TELEPHONE LEAD

3 mtrs long terminating one end with new BT, flat plug and the other end with 4 correctly coloured coded wires to fit to phone or appliance. Replaces the lead on old phone making it suitable for new BT socket. Price £1 ref BD552 or 3 for £2 ref 2P164.

POWERFUL IONISER

Generates approx. 10 times more IONS than the ETI and similar circuits. Will refresh your home, office, shop, work room etc. Makes you feel better and work harder - a complete mains operated kit. case included. £9.50 + £2 P&P.

J & N BULL ELECTRICAL

Dept. R.E., 250 PORTLAND ROAD, HOVE, BRIGHTON, SUSSEX BN3 5QT
MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access & B/card orders accepted. Brighton (0273) 734648 or 203500.

NEW ITEMS

Some of the many described in our current list which you will receive with your parcel

£2 POUNDERS*

- 2P120 - 1 combined clockwork switch and thermostat for boiler control
- 2P122 - 1 30a rotary switch, surface mounting with pointer knob
- 2P123 - 1 25a rotary switch, surface mounting, cover engraved, high, medium low and off
- 2P124 - 1 28kv 001 mfd block condenser
- 2P127 - 1 30a bridge rectifier assembly on heat sinks
- 2P129 - 1 10rpm motor 115V so supplied with adaptor for 230V
- 2P131 - 1 Crozet rotary switch, fits the Crozet gear box
- 2P132 - 1 ceiling heat-stat for fire warning or protection
- 2P133 - 1 Circuit breaker 20a, Crabtree ref C50
- 2P134 - 1 19V 500mA psu, plugs into 13a socket
- 2P135 - 1 10m 10 conductor intercom cable
- 2P136 - 1 12½ kw element made for tangential blowers
- 2P137 - 1 Thermo couple, stainless steel tipped for measuring internal heat
- 2P138 - 1 Mains transformer 20V-0-20V 1A upright mounting
- 2P141 - 1 rechargeable battery D size (4 AH) solder tag ended
- 2P142 - 10m 4 pair intercom cable White PVC outer
- 2P144 - 1 mains operated relay with 4 x 8a c/o contacts
- 2P145 - 1 10,000 of 70V dc smoothing capacitor
- 2P146 - 17,800 of 150V dc smoothing capacitor
- 2P148 - 1 Technical information on 3 FOD refundable if you buy fdd
- 2P149 - 5 diff battery operated model motors
- 2P150 - 1 PSU chassis with all components for 24V 2A dc unwired
- 2P151 - 1 Metal box 14½" x 14" x 4" with lid add £2.00 post
- 2P152 - 1 Motor start capacitor 50uf 250V
- 2P153 - 1 Two station intercom unused but line reject
- 2P154a - 1 Nicad charger - plug into 13a socket 5.2V 7UA output
- 2P154b - 1 Nicad charger - plug into 13a socket 6V 9VA output
- 2P155 - 1 Mains transformer giving 16, 17, 18 & 20V 60W
- 2P158 - 1 Oven thermostat with temp calibrated knob
- 2P159 - 1 19V 500mA cased with mains lead and output lead
- 2P160 - 1 13a plug adaptor fused takes 3 - 3a plugs
- 2P161 - 16" diagonal slide cutters
- 2P162 - 1 Stereo Matrix PCB mounting deemphasis K35
- 2P163 - 1 AC Working capacitor 12uf 660V AC or 1500V dc
- 2P164 - 3 Phone leads 3 mtrs long take one end B T plug other end

£3 POUNDERS*

- 3P7 - 1 DC voltage, doubler or halver for 12V to 24V 12 to 6V 24 to 12V
- 3P8 - 1 24hr time switch Sangamo, new condition Guaranteed 1 year
- 3P9 - 12V 500mA psu plugs in 13a socket regulated
- 3P10 - 1 Mains transformer 50V 2A with 6 3 pin light winding, upright mounting, fully shrouded plus £1 post
- 3P13 - 1 Noise filter to fit in mains lead of appliance up to 25a
- 3P15 - 1 waterproof case will take 150 watt transformer
- 3P16 - 1 signal box, 3a mps on face plate of metal box size 5½" x 3½"
- 3P17 - 1 choke and starter to work B fluorescent tube at 125W
- 3P18 - 1 22V 3a mains transformer with bridge rect fitted on top panel
- 3P20 - 1 0.5a ammeter 3½" ac dc ex equipment
- 3P21 - 1 power factor correction condenser 36uf 350ac
- 3P22 - 1 200va - auto transformer 230 to 115V toroidal encapsulated £1.50 post
- 3P23 - 1 36V-0-36V tapped 20V-0-20V 100va
- 3P24 - 13 floppy disc for Amstrad etc
- 3P25 - 17 Electricians pliers

£4 POUNDERS*

- 4P12 - 50m low loss co ax 75ohm - £1 post
- 4P13 - 3 Horstmann time and set switches 15amp
- 4P14 - 1 150w mains transformer core 43V 3.5A secondary
- 4P15 - 1 powerful motor 2" stack fitted with gearbox final speed 60rpm mains operated, could operate door opener etc
- 4P17 - 1 Uniselectors 3 pole 25W, 50V coil standard size
- 4P18 - 1 Volt meter with digital display (DIGIVISOR)
- 4P19 - 1 12V dc motor will fit to gearbox 4P20
- 4P20 - 1 Gear train giving speed reduction

£5 POUNDERS*

- 5P86 - 1 Transformer upright mounting 230/240V primary 2 x 100 1a secondary
- 5P88 - 1 Transformer in waterproof metal box 24V 5A add £2 post
- 5P89 - 14 bank heating element each 2kw ideal convactor heater
- 5P90 - 1 18" long tangential blower with motor at one end
- 5P91 - 1 14" blower, motor in middle
- 5P92 - 10m Audio co ax double screened 75ohm super low loss for TV
- 5P93 - 16 Alarm bell 24V dc or ac
- 5P94 - 1 Current transformer 14V out with 1a dc input
- 5P95 - 1 Vintage photo call
- 5P97 - 1 Impedance matching transformer 0.4-5-8-160 ohm 100 add £1.50 post
- 5P98a - 1 0.90a ammeter for mounting outside control panel
- 5P98b - 1 0.180a ammeter for mounting outside control panel
- 5P99 - 1 Mains operated blower centrifugal output size app 5" x 1½"
- 5P100 - 1 Mains splitter 45a switch 3 - 15a fused circuits
- 5P101 - 1 Model motor 1 rpm from 6V reversible

£7 POUNDERS*

- 7P1 - 1 Instant heat solder gun - mains with renewable tip and job light

£8 POUNDERS*

- 8P1 - 1 Charger transformer 10a upright mounting 230/240 primary 16v 10a secondary
- 8P2 - 1 6" underdome alarm bell suitable for a fire alarm or burglar alarm mains operated.
- 8P3 - 1 heat sink big powerful so ideal for power transmitter
- 8P5 - 1 ½ hp motor 900 rpm capacitor run
- 8P6 - 1 24hr time switch - 2 on off 16a c/o contacts 3" x 3" x 1½"
- 8P7 - 1 Silent sentinel invisible ray kit
- 8P8 - 1 Papst fan 3½" x 3½" x 1½" 230V metal bodied

£10 POUNDERS*

- 10P13 - 1 reversible motor with gearbox 104 rpm Parvalux
- 10P14 - 1 100a time switch 1 on/off per 24hr extra triggers £1 per pair
- 10P15 - 1 Max demand meter 230 ac mains
- 10P16 - 1 powerful air mover 2 small type blowers with motor in middle
- 10P18 - 1 mains operated klaxon
- 10P19 - 1 12V alarm bell really loud, mains operated, in iron case - £5 post
- 10P22 - 1 sensitive volt meter relay
- 10P23 - 1 fruit machine heart 3 fruit wheels each stepper motor operated add £3 post
- 10P24 - 1 big panel meter face size 4" x 2½" 200uA movement scaled 1-10
- 10P26 - 1 "Secretary" phone auto-dialer complete untested sold as such
- 10P29 - 1 12V engine cooling fan
- 10P30 - 1 instrument psu on pcb has 4 outputs. 12V / 5V 6A / 12V .5A / 5A
- 10P31 - 1 7 day time switch 16a c/o contacts sep switches for each day
- 10P32 - 1 68 rpm 1/6 hp motor reversible

£15 POUNDERS*

- 15P1 - 1 kit for 115V hi fi amp
- 15P2 - 1 kit for psu to supply one or two 15P1 amps
- 15P3 - 1 time switch battery or mains operated - 18a c/o contacts, 7 day programmable has 36hr reserve

£25 POUNDERS*

- 25P1 - 1 1500 PSI hydraulic pump 24V dc motor, made for operating aircraft undercarriage etc

LIGHT CHASER KIT motor driven switch bank with connection diagram, used in connection with 4 sets of xmas lights makes a very eye catching display for home, shop or disco, only £5 ref 5P56.

BIO-FEEDBACK ACCESSORIES

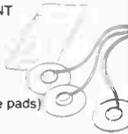
A METER MOVEMENT which can be built into your bio-feedback monitor to make it a completely self-contained instrument. Don't worry if you've already drilled the terminal holes - the meter will cover them up!



SENSITIVE METER MOVEMENT ONLY £1.90 + VAT

SPARE ELECTRODES AND GEL

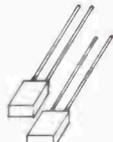
5 sets of electrodes (10 electrode pads) and a sachet of conductive gel, all for £2.90 + VAT



LEDs

RECTANGULAR LEDs

Green rectangular LEDs for bar-graph displays
50 for £3.50 + VAT
500 for £25 + VAT



100 for £6 + VAT
1000 for £45 + VAT

DIGITAL AND AUDIO EQUIPMENT LEDs

Assorted 3mm LEDs: red, green, yellow and orange. 25 of each (100 LEDs) for £6.80 + VAT



BIO-FEEDBACK

FEATURED IN ETI
DECEMBER 1986

A complete parts set for the ETI bio-feedback monitor including meter. Originally offered from limited stocks at £14.55 (without meter), this sensitive GSR monitor has proved so popular that we have decided to make it a permanent feature of our catalogue



The complete parts set includes case, PGB, all components, leads, electrodes, gel, meter and full instructions

BIO-FEEDBACK PARTS SET ONLY
£11.50 + VAT

HI-FI POWER METER

FEATURED IN ETI
MAY 1987

Measure the output power of your hi-fi with the ETI power meter. The meters can be back-lit for effect - the scale and 'power' legend will glow green to contrast with the red pointer. Two switched ranges give readings of 0-10W and 0-100W

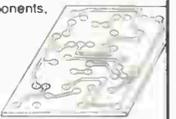


The parts set consists of meter movement, PCB, all components, range switch and full

MONO POWER METER PARTS SET £3.90 + VAT

STEREO POWER METER PARTS SET £7.20 + VAT

SUITABLE CASE £7.50 + VAT



TACHOMETER AND DWELL METER

FEATURED IN ETI
JANUARY 1987

SPECIAL OFFER



Last few to clear at only £9.50 + VAT! (Previously offered at £16.40.) The complete parts set includes case, printed circuit board, all components, plug, socket, switches, test leads and clips, meter and full instructions

TACHOMETER AND DWELL METER PARTS SET ONLY £9.50 + VAT

Offer applies only until stocks are exhausted.

MATCHBOX AMPLIFIER

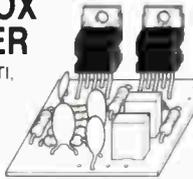
FEATURED IN ETI,
APRIL 1986

No ordinary amplifiers these. When our first customers took an interest, it was for the diminutive size (both modules will fit in a matchbox!), the total disregard for power supplies and speaker impedances, and the impressive power output from these little amplifiers. When they re-ordered, it was for the sound quality.

Two amplifier modules were described, both based on the powerful L165V IC. The single IC version will deliver over 20 Watts with a suitable speaker and power supply. The bridge version can provide up to 50W. Although the specified supply voltage and speaker impedance must be used to achieve maximum power, both modules are quite happy to work from any voltage between 12V and 32V, and will accommodate any type of speaker. The bridge version is ideal for giving a boost to car Hi-Fi systems, driving two 4 Ohm speakers in parallel on each channel for best effect.

Both designer-approved parts sets consist of a roller trimmed printed circuit board and all components. The L165V ICs are also available individually, with a free mini data sheet giving specifications and suggested circuits.

SINGLE IC MATCHBOX AMPLIFIER SET (20W into 8 Ohms) £6.50 + VAT
BRIDGE AMPLIFIER SET (50W into 8 Ohms) £8.90 + VAT
L165V IC with data £3.90 + VAT



KNIGHT RAIDER

FEATURED IN ETI, JULY 1987

The ultimate in lighting effects for your Lamborghini, Maserati, BMW (or any other car, for that matter). Picture this: eight powerful lights in line along the front and eight along the rear. You flick a switch on the dashboard control box and a point of light moves lazily from left to right leaving a comet's tail behind it. Flip the switch again and the point of light becomes a bar, bouncing backwards and forwards along the row. Press again and try one of the other six patterns. An LED display on the control box let's you see what the main lights are doing.

The Knight Raider can be fitted to any car (it makes an excellent go light) or with low powered bulbs it can turn any child's pedal car or bicycle into a spectacular TV-age toy!

The control box parts set consists of case, switches, LEDs, PCB components, hardware and instructions. The sequence board includes PCB ICs, power FETs, components, hardware and instructions.

KNIGHT RAIDER CONTROL BOX ONLY £6.90 + VAT!
KNIGHT RAIDER SEQUENCE BOARD ONLY £11.90 + VAT!

BRAIN WAVE MONITOR

FEATURED IN ETI,
AUGUST 1987

ALPHA: HOW TO SUCCEED WITHOUT REALLY TRYING

This was the title of a recent OED television program which showed how life can be dramatically improved with aid of alpha training. Alisdair McBeth overcame his shyness with girls, others became more confident, improved their sporting abilities, learned to cope with stress and all without really trying!

Alpha monitors are not new, but good ones are hard to find. To detect a few uV of brain waves in the midst of noise that is tens of thousands of times as great is not easy! The ETI Alpha Monitor is probably the most powerful and effective design to be found outside an EEG laboratory. The sensitive circuit locks on to the all important alpha rhythm and helps you to strengthen and control it. Quickly. Then you put it to work for you, strengthening your confidence and abilities day by day.

Our approved parts set consists of EEG electrodes and headband, case, two PCBs, screening box, top quality PMI amplifiers, all components and full instructions (including training exercises). Assembly time is about five to six hours.

ALPHA MONITOR PARTS SET ONLY £29.90 + VAT!



Complete Parts Sets for ETI Projects

MAINS CONDITIONER

FEATURED IN ETI,
SEPTEMBER 1986

It is astonishing how many people buy or build top-flight hi-fi equipment, and then connect it to a noisy, spiky mains supply. Rather like buying a Ferrari and trying to run it on paraffin, you might think. Expecting crystal clear sound, the poor music enthusiast ends up with a muddy, confused mush, and feels that he has somehow been cheated. 'Is this hi-fi? My music centre sounded just as good!

The domestic mains supply is riddled with RF interference, noise, transient spikes, and goodness knows what else. Computers crash, radios pop and crackle, tape recordings are spoiled and hi-fi sounds 'not quite right'. Why put up with it when the solution is so simple? The ETI mains conditioner is the lowest cost upgrade you will ever buy, and probably the most effective!

Our approved parts set consists of PCB, all components, toroid*, enamelled wire, fixing ties, fast response VDR* and full instructions.

ETI MAINS CONDITIONER PARTS SET ONLY £4.60! + VAT

*Note: the toroid and VDR supplied are superior to the types specified in the article.



CREDIT CARD CASINO

FEATURED IN ETI,
MARCH 1987

This wicked little pocket gambling machine measures only 3" x 2" x 1/2". It will play all kinds of casino games, including:

- Roulette
- Craps
- Pontoon

Our approved parts set comes complete with case, self-adhesive fascia, trimmed and drilled printed circuit board, all components, hardware, full instructions and three different games to play!

CASINO PARTS SET ONLY £5.90! + VAT



Five extra games FREE with every order!

MAINS CONTROLLER

FEATURED IN ETI,
JANUARY 1987

Have you ever wondered what people do with all those computer interfaces? Put your computer in control, say the ads. The Spectrabeeb has eight TTL outputs. What on earth can you control with a TTL output? A torch bulb?

The ETI Mains Controller is a logic to mains interface which allows you to control loads of up to 500W from your computer or logic circuits. An opto coupler gives isolation of at least 2,500V, so the controller can be connected to experimental circuits, computers and control projects in complete safety. Follow your computer's interface with a mains controller and you're really in business with automatic control!

The mains controller connects directly to most TTL families without external components and can be driven by CMOS with the addition of a transistor and two resistors (supplied).

Your mains controller parts set contains: high quality roller trimmed PCB, MOC3021 opto-coupler, power triac with heatsink, mounting hardware and heatsink compound, all components, including snubber components for switching inductive loads, transistor and resistors for CMOS interface full instructions.

MAINS CONTROLLER PARTS SET £6.20 + VAT!



POWERFUL AIR IONISER

FEATURED IN ETI,
JULY 1986

Ions have been described as 'vitamins of the air' by the health magazines and have been credited with everything from curing hay fever and asthma to improving concentration and putting an end to insomnia. Although some of the claims may be exaggerated, there is no doubt that ionised air is a much cleaner and purer, and seems much more invigorating than dead air.

The DIRECT ION ioniser caused a great deal of excitement when it appeared as a construction project in ETI. At last, an ioniser that was comparable with (better than?) commercial products, was readily available to build and use! Apart from the serious experiments, we have some of the suggested experiments we have suggested.

We can supply a matched set of parts, fully approved by the designer, to build this unique project. The set includes a roller trimmed printed circuit board, 66 components, case, mains lead, and everything you need for the tester. According to one customer, 'I received about a third of the price of the individual parts. How much more can we say?'

Instructions are included.
DIRECT ION PARTS SET £9.50 + VAT



PROJECT BOX

PROJECT CASE WITH PP3 BATTERY COMPARTMENT

ONLY £2.60! + VAT



LM2917 EXPERIMENTER SET

Consists of LM2917 IC, special printed circuit board and detailed instructions with data and circuits for eight different projects to build. Can be used to experiment with the circuits in the 'Next Great Little IC' feature (ETI, December 1986)

LM2917 Experimenter Set £5.80 + VAT

RUGGED PLASTIC CASE

Suitable for mains conditioner and mains controller

ONLY £1.65 + VAT



SPECIAL OFFER

Our best selling mains conditioner now available with an elegant white case.

WHITE IONISER PARTS SET ONLY £9.80! + VAT

Prices shown are exclusive of VAT, so please add 15% to the order total. UK postage is 60p on any order. Carriage and insurance for overseas orders £1.50. Please allow up to 14 days for delivery.

Specialist
ETI PROJECTS LTD

LIMITED

FOUNDERS HOUSE
NEEDWOOD,
MOORSOUTH
GWENT