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<table>
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<th>FORTOP</th>
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<td>750XX</td>
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<td>26.95</td>
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<td>725X</td>
<td>70cm TX</td>
<td>169.00</td>
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</tr>
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<td>70cm EXP</td>
<td>24cm TX</td>
<td>199.00</td>
<td>503 Mic</td>
</tr>
</tbody>
</table>

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|          |        | LW16 2m 13.4DB      |        |      |

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PMH 4/2m 4 way: UGP/2m Ground Plane 0-0DB

PMH 2/70cm 2 way: C8 70cm Colinear 6-1 DB

PMH 4/70cm 4 way: LW16 2m 13.4DB

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CHANGE IN PUBLICATION DATE
We are changing from Friday to a Thursday publication date with effect from the July, 1984, issue of R&EW. This means that the July issue will be on sale from 14th June.

We regret to inform readers that due to continually rising production costs and to enable us to maintain the high standard of content in R&EW the price of the magazine will be 90p from this issue. This is your last chance to subscribe at the old rate. See page 80.

See pages 59 and 60

COVER PICTURES
Top left: Low cost frequency standard
Top right: A Russian TV announcer
Centre left: Dual trace oscilloscope
Centre right: Digital multimeters
Bottom: Amateur TV picture

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 also taken to ensure that the contents of Radio & Electronics World are accurate, we assume no responsibility for any effect from errors or omissions.

Audit Bureau of Circulations membership approved pending first audit
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**NEW AMGIO 60-WATT AMPLIFIER**

Amgio have just released a 60-watt MOSFET amplifier and will have a 120 watt version available in the late summer. Amgio have found that there is a market for an amplifier with 5 microphone inputs and 1 auxiliary input at an inexpensive price. The microphone inputs are balanced line with XLR sockets with transformers. There is automatic override for microphone 1.

The output is 60 watts RMS into 8 ohms or 100 volt line and MOSFET's are used in the output stages. MOSFET offer excellent performance, low temperature operation and a fast slew rate. They are inherently free of crossover distortion and thermal runaway which results in this range of amplifiers being of very high quality and reliability.

The 60 watt amp was designed for installations such as churches and conference use where up to 5 microphones are required. The amplifier retails at £360 plus VAT, and is available from stock. Details from: AMGIO LTD, 26-28 Reading Road South, Fleet, Aldershot, Hants. Tel: (02514) 20567.

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**TWO NEW PRINTER MECHANISMS**

Two new printer mechanisms have been launched by Epson (UK) Ltd – the M-170 (see photo), a 40-column capacity dot matrix printer and the M-1200 thermal printer.

The M-1200 represents a major breakthrough for Epson by bringing the installed cost for thermal printer mechanisms down to a level which will appeal to the home computer marketplace. The M-1200 has a 40-column printing capacity, uses 112mm width thermal paper and offers both text and graphic mode with print speeds of 45cps and 0.41ps respectively. The unit is compact, measuring 139mm wide x 45mm deep x 23.5mm high and a wide range of applications includes intelligent instrumentation, home computers and mini and portable terminal printers. The unit will cost £23 (based on quantities of 1,000).

The new M-170 is a true 40-column capacity plain paper printer with full dot graphics capability. It is an extension of Epson's successful M-160 series offering all the same benefits of clear dot printing, low price, and compact size with the additional advantage of accepting normal paper of up to 69.5mm in width.

The M-170 prints at 0.4 lines per second and will be available for £21 (based on quantities of 1,000).
Mostek Corporation announces a new high-performance 16-bit single-chip microcomputer that can be configured either as an embedded stand-alone controller in a single-chip mode or as an intelligent peripheral controller in an expanded bus mode.

Designated the MK68200, the new component implements an architecture with an advanced 16-bit instruction set which offers high-speed execution and code space efficiency along with extensive on-chip I/O capabilities. Included in the instruction set are powerful bit-manipulation, extensive BCD arithmetic and high-speed multiply/divide operations. As an embedded stand-alone controller, this advanced NMOS device is designed for high-performance applications such as industrial controls, robotics and instrumentation.

**SOLID-STATE TV CAMERAS**

Industrial Monitoring Equipment Ltd have recently introduced a comprehensive range of solid-state cameras developed from charge-coupled devices. The development of practical cost-effective vision systems is a recent phenomenon and they are now able to offer relatively low cost video cameras for robotic vision.

The new silicon solid-state sensor technology provides many advantages including high reliability, control of lighting variation by the use of an anti-blooming device, fast image capture speeds and no image blurring when the camera is moved quickly.

The NUMEVISION concept provides the user with an entire range of modular image acquisition and processing systems. Each system is built upon a basemold depending on the CCD used. It is completed with electronic modules which are specific to precise application requirements.

For further information contact: Industrial Monitoring Equipment Limited, Penn House, Penn Place, Rickmansworth, Herts, WD3 1SN.

**ELECTROSTATIC FIELDMETER**

A new high sensitivity, auto-ranging electrostatic fieldmeter, the JCI 101, has been developed by John Chubb Instrumentation - UK Specialists in electrostatics and electrostatic instrumentation. This fieldmeter gives stable and accurate measurement of electric fields in the vicinity of 'static' charges on insulating or conducting surfaces.

The fieldmeter is designed to investigate and monitor static. Static can cause problems of material handling, attraction of dirt and shock risk to personnel in the plastics, textile, paper and packaging industries. In the microelectronics industry even low levels of static can damage sensitive semiconductor devices in manufacture and during printed circuit board assembly and handling. The high sensitivity of the instrument enables low levels of charge and low voltages to be measured remotely and without contact to the surface. Voltages as low as 100 volts can easily be observed on a person at a distance of 1 metre.

The JCI 101 fieldmeter is compact, light and easy to use for handheld investigatory studies around industrial plant and the definite, stable response with the auto-ranging liquid crystal display ensures reliable and unambiguous readings.

The front of the instrument is provided with a simple bayonet pin arrangement around the sensing aperture for easy mounting of additional units to extend the range of application of the instrument. One such unit is a guard plate to assist interpretation of measurements of charge densities on plastic webs — another is a Faraday Pall for the measurement of charge on small items.

The JCI 101 Electrostatic Fieldmeter is part of the broad range of electrostatic instruments available from John Chubb instrumentation. For further information on this and other instruments available from JCI contact: Dr J N Chubb, Unit 30, Lansdown Industrial Estate, Gloucester Road, Cheltenham. Tel: 0242-573347.
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BB8C to 25 way D Male 03-10021 4.50
25 way D Socket 10-25200 1.90
25 way D Plug 10-25100 1.30
Cover for 25 way D 10-25322 0.93
Z20 A Industrial Controller 40-49000 49.95
Z302 Industrial Controller 40-49020 49.95
ZB Basic/Debug Controller 41-00904 50.00

Nicad Batteries & Chargers
Minimum life 600 (300 PP3 size) full charge/discharge cycles. Batteries must be charged from a constant current source only. All batteries are supplied only with a residual charge and should be charged before used.

<table>
<thead>
<tr>
<th>Battery Type</th>
<th>1.2V 900mAh</th>
<th>01-22004 0.80</th>
<th>0.74</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2V 22AH</td>
<td>01-22024</td>
<td>2.35</td>
<td>1.99</td>
</tr>
<tr>
<td>1.2V 40AH</td>
<td>01-22044</td>
<td>3.05</td>
<td>2.85</td>
</tr>
<tr>
<td>PP3 8.4V 110mAh</td>
<td>01-64054</td>
<td>3.70</td>
<td>3.50</td>
</tr>
<tr>
<td>CH1/22 PP3 Charger 11mA for 16 hours</td>
<td>01-00159</td>
<td>4.30</td>
<td></td>
</tr>
<tr>
<td>CH8/RX Multi-purpose Charger</td>
<td>01-02204</td>
<td>9.40</td>
<td></td>
</tr>
</tbody>
</table>

Will recharge AA, C, D and PP3 size cells with automatic voltage selection. Will recharge following combination: 6×D, 6×AA, 6×C, 2×PP3, 2×D+2×C.

Sold in pairs: one to convert AA size to PP3 size and one to convert C to D size. Both may be used together to convert an AA to D size.

Semiconductors
Linear IC's

<table>
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<tr>
<th>Part Number</th>
<th>Description</th>
<th>Price</th>
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</thead>
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<td>LM301N</td>
<td>DIL version</td>
<td>61-03011 0.44</td>
</tr>
<tr>
<td>LM308CN</td>
<td>DIL version</td>
<td>61-03081 0.65</td>
</tr>
<tr>
<td>LM311CN</td>
<td>Popularg comparator</td>
<td>61-00011 0.46</td>
</tr>
<tr>
<td>LM324</td>
<td>Low power quad amp</td>
<td>61-03240 0.67</td>
</tr>
<tr>
<td>LM330N</td>
<td>Low power quad comparator</td>
<td>61-03390 0.96</td>
</tr>
<tr>
<td>LM346</td>
<td>Programmable quad amp</td>
<td>61-00046 3.72</td>
</tr>
<tr>
<td>LF347</td>
<td>Quad BiFET op amp</td>
<td>61-00047 1.82</td>
</tr>
<tr>
<td>LM348</td>
<td>Quad T41 type op amp</td>
<td>01-03480 1.26</td>
</tr>
<tr>
<td>LF351</td>
<td>Bi-FET op amp</td>
<td>61-03510 0.49</td>
</tr>
<tr>
<td>LF353</td>
<td>Dual version of LF351</td>
<td>61-03530 0.76</td>
</tr>
<tr>
<td>LM380N</td>
<td>IW AF power amp</td>
<td>61-00090 1.00</td>
</tr>
<tr>
<td>NE555N</td>
<td>Multi-purpose low cost timer</td>
<td>61-05550 0.45</td>
</tr>
</tbody>
</table>
for a better service.

NE556N Dual version of the 556
61-05560 0.50
uA741CN DIP low-cost op amp
61-07411 0.22
uA741CN Dual 741 op amp
61-07470 0.70
uA748N 741 with external frequency comp
61-04780 0.46
HA1388 18V PA from 14V
61-03388 2.75
TDA2002 8W into 2 ohms power amp
61-02002 1.25
ULN2083 1W max. 3-12V power amp
61-02283 1.00
MC3357 Low power NMOS IF system and detector
61-03357 2.85
ULN2853 A low current dual conversion
61-03859 2.95
LM3900 Quad norton amp
61-03900 0.60
LM3909N 8pin DIL LED Flasher
61-03909 0.68
KB4464 Radio control 4 channel encoder and RF
61-04445 1.29
KB4466 Radio control 4 channel receiver and decoder
61-04446 2.75
ICM7555 Low power CMOS version of timer
61-75550 0.98
KL038CC Versatile AF signal generator with sine/square/triangle O's
61-08038 4.50
TK11010 5 channel version of KB4445
61-10170 1.87
HA12020 Protection monitor system for amps, PSUs, TEs etc
61-12000 1.22
HA18017 83dB S/N phone preamp
61-12017 0.80
MC14112 300 band MODEM controller (Editor/US/Specs)
61-14142 6.85

Silicon Controlled Rectifiers
IBR55-100 100V 8A
S-55100 0.50
C0650 400V 4.0A
S-50016 0.70
C1220 400V 8.0A
S-50022 1.45

3mm Diameter LEDs
V178P Red
15-01780 0.15
V178P Green
15-01790 0.16
V180P Yellow
15-01800 0.18

5mm Diameter LEDs
CQZ04L Red
15-10490 0.12
CQZ04L Green
15-10720 0.15
CQZ04L Yellow
15-10740 0.15

Tri Colour LED
VS18 Orange-Green-Yellow
15-05180 0.60

Capacitors

Aluminium Electrolytics Radial PCB Mounting
10u 16V 05-14600 0.24
10u 16V 05-14600 0.28
47u 16V 05-14700 0.28
47u 16V 05-14700 0.36
47u 16V 05-14700 0.48

Tantalum Beads
Each
1uf 35V 05-10501 0.18
1uf 16V 05-10601 0.28
1uf 16V 05-10601 0.28
47uf 63V 05-14701 0.45
47uf 16V 05-14702 0.92

Monolithic Capacitors
Pack of 3
1n 04-10204 0.39
10n 04-10304 0.42
100n 04-10404 0.45

Low Voltage Disc Ceramic
Pack of 5
1n 04-10203 0.20
10n 04-10303 0.20

Polyester (C280)
Pack of 3
10n 04-10305 0.18
47n 04-47305 0.24
100n 04-10405 0.24
470n 04-47405 0.51
1uf 04-10505 0.66

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Z80AP10 2 port parallel input/output
26-18420 2.95
Z80A CTC 4 channel counter/timer
26-18430 2.90
Z8071 16bit Micro comp. and Basic
26-18461 1.75
61163 16K (2ks)8 CMOS
26-36116 6.68
Z81324 25K (4ks)8 quad
26-36132 12.00
41162 16K (1ksx16)150ns
26-24116 1.59
2764 64K (8ks)50ns
26-26764 9.50
2732 32K (4ks)50ns
26-26372 5.70

Voltage Regulators
7805 5V 1A positive
27-27852 0.40
7812 12V 1A positive
27-78122 0.40
7815 15V 1A positive
27-78152 0.40
7905 5V 1A negative
27-79052 0.49
7912 12V 1A negative
27-79122 0.49
7915 15V 1A negative
27-79152 0.49

Transistors
BC182 General purpose
58-00182 0.10
BC122 General purpose
58-00122 0.10
BC337 Plastic BC107
58-00337 0.08
BC338 Plastic BC108
58-00338 0.08
BC391 Plastic BC109
58-00391 0.08
BC307 Complement to BC237
58-00307 0.08
BC308 Complement to BC238
58-00308 0.08

Monolithic Capacitors
Pack of 3
1n 04-10204 0.39
10n 04-10304 0.42
100n 04-10404 0.45

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1n 04-10203 0.20
10n 04-10303 0.20

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Pack of 3
10n 04-10305 0.18
47n 04-47305 0.24
100n 04-10405 0.24
470n 04-47405 0.51
1uf 04-10505 0.66

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Crystal Filters 2 Pole Types
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PRODUCT NEWS

TOOLHOLDERS

Having the right tools for the job is one thing – equally important is the need to carry them in a way that is most convenient, comfortable and accessible for the user.

Jarvis Manufacturing of Eastbourne have a great many years' experience in supplying toolholders, cases, wallets, wire wrapping gun holsters, rolls and belts.

Whilst some of their products are based on a standard format, the great majority are produced – often in fairly small quantities – to meet specific requirements. The customer supplies a set of tools and consults with Jarvis on any special prerequisites, and Jarvis produce a prototype prior to manufacture.

Jarvis's capability in this field has seen their toolholders in use across a broad range of applications, including medicine, electronics, engineering, building construction office equipment servicing and electrical repairs.

For further information contact Ken Wagstaff, Jarvis Manufacturing, 116 Seaside, Eastbourne. Tel: (0323) 638624.

A/D CONVERTERS WITH SERIAL INTERFACE

Motorola Integrated Circuit Group announces availability of the MC145040/MC145041 analog-to-digital converters with serial interface. These devices are low cost, 8-bit A/D converters with serial interface ports that are compatible with SP1, Microwire and other similar interfaces.

The MC145040 offers the following features: wide operating supply voltage range of 4.0V to 6.0V for operation in NMOS as well as CMOS systems; wide operating temperature range of −55°C to +125°C; conversion rate of 16 microseconds for the standard part.

To further reduce the system cost, the MC145041 offers an on-chip oscillator that allows integration with low cost MCUs that do not output a clock signal. The inputs are TTL-compatible which can be driven with CMOS parts as well. The 20 pin DIP packages provide for 11 analog channels. These devices will also be offered in plastic quad packages. Contact your local Motorola sales office or distributor for further information.

MULTIMETERS OFFER DIGITAL PERFORMANCE AT ANALOGUE COST

Now available from Semi-concepts are the Beta man T100 and T110 handheld digital multimeters at a price that competes with analog equivalents (£49 and £59) but with the benefits of digital performance.

They feature an easy to read 3½ digit liquid crystal display with automatic polarity, decimal point and over-range indication and a maximum reading of 1999. All functions and ranges are selected by a single rotary switch and are fully protected against overloads and transients and are shielded against external fields.

The T110 can be selected to read five ranges of dc and ac voltage, six ranges of dc and ac current, six ranges of high power resistance and five ranges of low power resistance. The T110 has all these range and function selections plus an instant continuity test facility in the form of a buzzer.

The multimeters are purpose-built for heavy duty using high quality components throughout including a CMOS integrated circuit.

LOW POWER DPM WITH DIGITAL HOLD

Lascar Electronics have announced the introduction of a low-cost, low-power LCD DPM with true digital hold of displayed reading. Consuming only 1mA from a 7-15V supply, the DPM10 features auto-polarity, auto-zero, 200mV FSD, low-battery indication, 12.5mm digit height and programmable decimal points. Connection to the 0.1in board pins can be by direct solder or with a connector (supplied). The meter can be easily rescaled by the user if required to indicate different voltages, currents or other engineering units. With its good accuracy and simple connections, this meter is particularly suited to high volume applications. Supplied with a bezel, mounting clips and connector, the DPM10 is the answer to many different measurement problems.

Details from: Lascar Electronics Ltd. Module House, Whiteparish, Salisbury, Wiltshire Tel: (07948) 567.

NEW POWER MOSFET COLOUR BROCHURE

Ferranti Electronics Limited has issued a colour brochure highlighting its new generation of Power MOSFETS. Ferranti Power MOSFETS are especially suited to a wide range of switching and amplifying applications where high input impedance, high gain and fast switching speed is desired. The brochure gives fundamental MOSFET information with aid of clear colour diagrams and compares the MOSFET with existing bipolar transistors. The MOSFET structure, its mode of operation, its power handling capabilities and its advantages over bipolar transistors are noted.

Enquiries to: John Fowler & Partners Limited, Ashbourne House, 334 Wellington Road North, Stockport SK4 5DA. Tel: 061-442 6060

SOCKET TO ME MOULDED

Custom Cables International Limited, one of the first to mould 9, 15, 25, 37 'D' type connectors onto cables, now offer socket connectors moulded on round cable.
The 'Moulded Sockets' are available on 0.100in x 0.100in grid spacing and a wide range of contact quantities, 10 - 64 ways, are available. The 'Moulded Socket' connector offers many advantages over the Standard Ribbon Cable Crimped Socket Connector. These include the very low price (up to 50% less in most cases), and the fact that they are very hard-wearing, (almost an indestructable). Where frequent quick disconnect/reconnect capability is required, they will not come apart, can be used with screened cable, and are available in any length and any colour. Moulded Sockets are available from CCI along with moulded 'D' connectors and matching mating headers. Further information from: Custom Cables International Ltd, Units 2, 3 and 4, Shire Hill Industrial Estate, Saffron Walden, Essex CB11 3AQ. Tel: (0799) 25014.

LBO-308S OSCILLOSCOPE

The LBO-308S is a battery/mains portable 20MHz dual trace oscilloscope. It has a high sensitivity of 2mV per division and all triggering facilities including a special circuit to ensure positive synchronisation with composite video signals. The LBO-308S can be used with a phase and levels plus addition or subtraction of two signals. It is compact in size measuring only 120 x 235 x 320 and weighs 5Kg yet retains ruggedness to withstand the normal wear and tear of field service. A heavy duty carrying case is an available accessory. The LBO-308S is supplied complete with probes and internal rechargeable battery at a price of £59 + VAT.

Further information: Thanor Electronics Ltd, London Road, St ives, Huntingdon, Cambs PE17 4HJ. Tel: (0480) 64646.

JUNE 1984

please mention RADIO & ELECTRONICS WORLD when replying to any advertisement
For further information contact: Thandar Electronics Ltd, London Road, St Ives, Huntingdon, Cambridgeshire PE17 4HF. Telephone (0480) 64646. Telex: 32250.

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COUNTERS

TF200 BenchPortable: 8-digt Liquid Crystal Display; Frequency range 10Hz-200MHz; Resolution better than 1ppm; Sensitivity typically 10mV/mHz; Timebase accuracy 0.3ppm; Battery life 200 hours; Frequency time average period; totalize & reset; 2 ranges; 5 gate times; External clock facility; Complete with batteries.

TF400 BenchPortable: 8-digt Liquid Crystal Display; Frequency range 10Hz-40 MHz; Resolution 1Hz; Sensitivity 40mV/mHz; Timebase accuracy 0.3ppm; Battery life 80 hours; Frequency; totalize and reset; 2 gate times; Complete with batteries.

PFM200A Pocketsize 8-digit L.E.D. display; Frequency range 20Hz-200MHz; Resolution 0.1Hz; Sensitivity typically 10mV/mHz; Timebase accuracy 2ppm; Battery life 10 hours; Frequency, 2 ranges; 4 gate times.

TP600 PRESCALER Frequency range 40MHz-200MHz; Sensitivity 40mV/mHz; Powered directed by TF200 or TF400 (leads supplied).

TP1000 PRESCALER Frequency range 40MHz-1000MHz; Sensitivity 25mV/mHz; Will extend TF200 and PFM200A capability beyond 1GHz.

JUNE 1984
Venezuela
Radio Tachira, San Cristobal on 4830 at 0345, OM with station identification,YL with a promo then OM with announcements – all in Spanish. The schedule is from 0900 to 0400 and the power is 10kw.

EUROPE
Belgium
VRT (Belgische Radio en Televisie – the Flemish Authority) Brussels on 17610 at 1403, YL with a newscast in the English programme for North America and the Far East, timed from 1400 to 1445 (not on Saturday or Sunday). RTBF (Radio-Television Belge – the French community authority) Brussels on 17680 at 1025, the interval signal which is the sound of an African xylophone, this signal originally being used by Brazzaville in the Belgian Congo prior to independence, then station identification in French at the start of that language transmission for Africa and Europe, scheduled from 1030 to 1100.

Czechoslovakia
Prague on 19605 at 1434, OM with the news during an English presentation to Africa, the Far East and South Asia, timed from 1530 to 1625.

East Germany
Radio Berlin International on 7185 at 1657, OM with announcements and the station identification at the end of the English programme for Europe, scheduled from 1615 to 1700.

France
Paris on 17795 at 1604, YL with a newscast in the English programme World Service to Africa and Europe, listed from 1600 to 1700.

Greece
Athens on 17565 at 1520, YL’s with a Greek folk song during the Foreign Service ’Voice of Greece’ programme directed to North America from 1500 to 1550.

Netherlands
Hilversum on 17605 at 1518, OM with the station identification at the close of an English programme for Europe on this channel from 1330 to 1420.

Poland
Warsaw on 7270 at 0651, OM with a talk about the Polish theatre and recent productions during an English transmission for Europe, scheduled from 0630 to 0700.

Spain
Madrid on 17660 at 1410, YL with a newscast in the Spanish programmed World Service ‘Programa Mundo’ which may be heard on this frequency and in parallel on 17890 from 1400 to 1730.

Vatican State
Vatican City on 7250 at 1155, YL with a news commentary in English then OM in Spanish during the multi-lingual Italian, French, English and Spanish news and comments only programme for Europe, scheduled from 1130 to 1200 (not on Sunday).

Vatican City on 11700 at 2013, interval signal, bells then YL with the station identification at the commencement of the Portuguese programme for Africa, timed from 2015 to 2030.

ASIA
Afghanistan
Kabul on a measured 6231 at 1555, YL announces, OM with songs and local-style music in a programme of the Disciple Radio Service (2nd Programme) in Pashto/Dari, timed here from 1430 to 1630.

China
Beijing on 9290 at 1414, YL with songs and music in the Thai programme, scheduled on this channel from 1330 to 1430.

Radio Beijing on 9945 at 1420, OM with a long talk during the Vietnamese transmission, timed from 1400 to 1500.

Radio Beijing on 17605 at 0745, YL with a talk in Chinese during a Domestic Service 1 programme, on this frequency from 0100 to 1100.

India
AIR Delhi on 9950 at 1452, YL with the news in English until 1455 then the station identification and OM with a programme in vernacular.

Israel
Jerusalem on 9385 at 2100, ‘pips’ time-check then OM with station identification in a relay of the Domestic Service Network ‘B’ to Europe and North America from 0400 to 0615 and from 1745 to 2310 on this frequency, entirely in Hebrew.

Kuwait
Kuwait on 9840 at 1510, OM with recitations from the Holy Quran in a Domestic Service General Programme presentation which is on this channel from 1505 to 0015.

North Korea
Pyongyang on 6577 at 2047, OM with a talk in 7155 Rain Magazine’s series – all about internal events and all in the English programme for Europe, scheduled from 2000 to 2150.

Pakistan
Karachi on a measured 9645 at 1445, OM with announcements, OM with a song and some local orchestral backing, YL with station identification at 1447 during the Urdu transmission for the Middle East and the Persian Gulf, timed from 1330 to 1600. Karachi is listed on 9860!

Karachi on 17460 with a YL with a news commentary in the Indonesian programme, scheduled on this channel from 1000 to 1045.

Turkey
Ankara on 7154 (measured) at 2020, OM and YL alternate with a news commentary, mainly about local events and affairs, in the English programme for Europe, on this frequency from 2000 to 2100.

Yemen Arab Republic
San’a on 9780 at 2100, OM with recitations from the Holy Quran, OM with announcements and station identification in Arabic, the National Anthem and sign-off at 2106. This is a Home Service presentation entirely in Arabic and is scheduled from 0230 to 0700 on from 1000 to 2100 on this channel.

EE PX’s
Translated from DXers shorthand into English, this heading becomes English Programmes – a list of which has been sent to the writer by W M Rigby of Morecambe, Lancs. All are correct at the time of writing and are listed here in GMT order. 0900 to 1030 9535 Bern, Switzerland; 1015 to 1045 17775, 21655, 21695 Dubai, United Arab Emirates; 1100 to 1200 21535, 25790 Johannes- burg, South Africa; 1300 to 1500 9585, 15220, 25790 Johannes- burg; 1630 7065 Tirana, Albania; 1630 5930, 7345 Prague, Czechoslovakia; 1800 10400, 15010 Hanoi, Vietnam; 1930 7065, 9480 Tirana; 1900 10400, 15010 Hanoi; 2000 7155 (but see above) Ankara, Turkey; 2030 7065 Tirana; 2030 10400, 15010 Hanoi; 2115 to 2245 9805 Cairo, Egypt; 2200 to 2300 9560 Ankara and 2200 7065, 9480 Tirana. Note that transmission times are not shown, the transmissions are of 30 minutes duration.

Our thanks are due to WMR for his efforts on our behalf.

CLANDESTINE
The almost endless search for clandestine transmitters continues unabated and so does the interest displayed by many DXers. In one notable SWL publication a special section is devoted to them almost every month and also deals additionally with the pirate pop stations never mentioned in these articles. Clandestine stations are political and claim to represent an opposition to the governments with which they are at variance. ‘I shall be dealing with the clandestine stations more fully at a later date but for the moment I bring to your attention one of the latest loggings.

Voice of the PLA
Voice of the PLA (People's Liberation Army) on 9627.6 (measured) at 1115, orchestral version of the International followed by OM with station identification in Chinese ‘(Jiefangjun Zhi Sheng)’ and sign-off. The transmissions are irregular, the subsequent three days listening sessions drawing a blank. An alternative frequency is that of 7524.6 but no joy there either.

NOW LOC THIS
Radio Nacional de Sao Tome and Principe on 14807 at 1837. OM’s with a discussion in Portuguese. This one has been back on its original frequency on the short waves for some months now after a prolonged absence. The Home Service entirely in Portuguese operates from 0530 to 2300 (Saturday until 2400) with a power of 10KW. The full identification is ‘Aqui Sao Tome transmite Radio Nacional de Republica Democratica de Sao Tome e Principe’.

NOW HEAR THIS
Radio Station 4VEH Cap Haitien, Haiti on 4930 at 2302, OM with announcements and a talk in French. This is another transmitter absent for some time from the short waves, seemingly abandoning its 9770 and 11833 channels. The schedule is reportedly from 1100 to 1500 and from 1900 to 0400. Listen then on 4930 around 2300.

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JUNE 1984
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LM317 Metal............. £2.00
7812 Metal.............. £1.00
LDO303 Metal 12V 0.337 15V 80p £1.00
7805/12/15/24 plastic 40p
7905/12/15/24 plastic 50p
CA3865 TO99........... £5.00
JL304 or TO3 50p
EPROMS/MEMORIES
2764 300ns........... £7.00
2732A-1 21624 v 150w
21624 Ex epqt........ £2.50
2716 Ex epqt........ £2.00 10/ £17
2614 Ex epqt AMD.... £8.00 10/£65
MC6810P................ £1.05 10/£3.50
POWER TRANSISTORS
2N3055 Motorola....... 50p/£2.00
2N3055 Ex epqt tested.... £5.00
MJE3055................. £5.00
MJE2955 equiv........ 50p
DISPLAYS
Futaba 4 digit clock fluorescent display 597-02-6........ £1.60
Futaba 8 digit calculator display 420-01-3........ £1.60
LCD Clock display 0.7" digits................ £3.00
Large LCD display 1" digits.................... £3.00
7 seg 0.3" display combi........ 50p
MISCELLANEOUS
QUARTZ HALOGEN LAMPS
A1 21624v 150w........ £2.25
H1 12v 55w (car spot)........ £1.25
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with adjusted unused
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(id. no. 203).................... £2.00
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fit AUIV/W TR7 VOLVO.... 10/£1.00
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TO3 Micas + bushes...... 10/50p
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Varly 24v dc 4p o relay... £0.80
fig 8 mains cassette leads... £3.01
KYMAR wire wrapping wire 2oz reel... £1.00
PTFE mini screened cable... 10m/£1.00
TO220 Micas + bush FLTER 250v 15A 10/50p
DK MAINS RFI FILTER 115v 15A... £1.00
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Min rotary sw 4p o 1/8" shaft... £2/£1.00
Mini toggle switch 2x15A 10m7 CERAMIC FILTER 50p.... 100/£2.00
6m CERAMIC FILTER........ £5.00

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JUNE 1984
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101
The general interests of some of our readers are shown below. If you have similar interests why not establish a point of contact at the time and on the band indicated.

If you wish to be included in this scheme, would you please complete and return the form below and send to: Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE.

**MOST IMPORTANT** — include a telephone number — if you have a particularly interesting contact so that we can contact you for details for publication.

**G4LNA:**
Usually available Mondays to Fridays between 0630 and 0715 and before 1200 during weekends on 1.8, 3.5, 7.10 and 14MHz. Uses CW mainly but sometimes phone on RNARS nets nr 2069. Equipment includes Redifon marine TCVR with H/B synthiser and his special interest is Homebrew. Most interesting contact was QSO and CARU from the Magnus oil platform.

**5B4NA:**
Usually available daily except Mondays and Tuesdays between 1330 and 1630 GMT on 10, 15 and 20 metres. Uses phone and CW. Equipment includes FT902 DM and his special interests are DX stations and contacts with USA stations. Most interesting contact to date was QSO-A3J with 5W1DZ in Apia (Western Samoa) on 21243.

**G4VFG:**
Usually available between 2200 and 2400 Monday to Friday on 80m and at various times during the weekends on 10 metres and 2 metres SSB. Uses mostly phone but occasionally CW. Equipment includes Yaesu FT77, Edystone EC10 RCVR, Trio 2300 FM 2m, Belcom liner ZS8B. His special interests are QRP portable work on VHF, construction and simple antennae. Most interesting contact was VP8ALD on S Orkney on 28MHz.

**G4NNJ:**
Usually available daily on 20, 40 and 80 metres. Uses CW only.

Equipment includes Homebrew QRP on 80m and Heath HW7 40/20/15. His special interests include rag-chew around the UK on 80m.

**G6NAE:**
Usually available daily after 1800 on 144MHz. Phone only at present. Equipment includes IC290H, IC2E, Belcom Liner 2, R1000, Vic 20 with MPTU-1 terminal unit (RTTY). His special interests are /P operation, RTTY, amateur satellites and FSTV (receive only).

**G3VMR:**
Usually available Sundays on 2m, CH14 (145/35) and 10m (28.4). Nets 1100 (social), 1930 (data). Uses phone, FM preferred. Equipment includes Multi 2000 & Atlas 210. Special interests are high speed data and news bulletins using CQIT tones at 500 and 1200 baud, text and programs.

**G1FIM:**
Usually available daily between 0800 and 2000 on 160 through 10 metres (local chats on 2m). Uses RTTY and AMTOR. Equipment includes FT1012D, VIC-20, AMTOR AMT-1, 5 band vertical antenna. His special interests are RTTY and AMTOR mainly 20m. Auto-mode available on 14075 MHz daily. Most interesting contact was FP8 in 1960s. 10Watts CW on 7MHz.

**G1ESG:**
Usually available on Wednesdays, Fridays and Sundays between 0830 and 2100 on 144 MHz. Uses phone, F3E and sometimes J3E. Equipment includes Icom IC2E and FT290R. His special interest is DX. Most interesting contact was Lebanon during lift, RST (5-0-3).

**G3ZNZ:**
Usually available most days on 144 and 432MHz. Uses J3E and FM mainly horizontal. Equipment includes FT221R Mutex Board, FT780R and 19ELE ‘Cushcraft’ Boomer. Special interests are radio computing with Dragon 32, diplomas especially DLD1000 on VHF and PA1000 2 metres VHF. Most interesting contact made to date was QSO with King Hussein (JY1) and his then wife Princess Muna (JY2). Both confirmed. Last QSO to complete ‘WAB’ gold (13) and ‘Mary Rose’.

**G3NRW:**
Usually available on Sundays between 0900 and 1300 on 2 4 and 20 metres. Equipment includes FT200, MM transverters, Nascom for RTTY and AMTOR. He is editor of ‘Datacom’ and of the BARTG quarterly magazine. His special interests are RTTY, AMTOR, Packet radio, computers, QRP (50W on 20m) and transmitting RTTY news on 2m on Sundays at 1030.

**G3YLr:**
Usually available most days on 3.5MHz through 30MHz and 144-146MHz. Uses mainly phone. Equipment includes HF bands, Ten Tec Argosy II, 144-Trio 2300 and 40w amp. Special interests are RNARS, AMSAT, G-QRP, mobile, Technical interest: antenna transmission lines, methods of matching. Has upwards of 1000 QSL cards and has had one interesting QSO with Jan Mayen Island and another with St Kilda.

**G1DCD:**
Usually available daily between 1800 and 0100 on 2 metres. Uses phone and RTTY. Equipment includes KDK FM 2630, Belcom LS102 and MM transverter. Special interests are AMTOR, satellite work and European DX.

Most interesting contact was made with F6BY (France).

**G6XOYX:**
Usually available early evenings on most days on 2m, 23cm and above. Uses phone, RTTY with computer. Equipment includes, Trio TR1010 SSB TXcvr, H/brew linear, H/brew FM Synth Rig, 9ELE, Tonna, 24 ELE Quad (23cms) and his special interests include VHF/UHF DX, Meteor scatter microwave propagation, homebrew equipment and computer-aided communication. Most interesting contact to date was made with Karl OK1KH/P. Czech 2m SSB.

**G3FC:**
Usually available most days during the afternoons of the winter months and in the mornings and early evenings during the summer. He uses CW only and the bands preferred are 80, 40, 20, 15 and 10 metres. Equipment includes homebrew QRP, med pwr, QRO and his special interests are homebrew gear, U/W awards, DARQ (DIG) awards and experimental ‘small garden’ antennae. His most interesting contact made to date was with a Japanese Maritime Mobile.

**G6YD:**
Usually available late evenings on Thursdays and at weekends on 2m. Uses phone. Equipment includes FT290R + Mickey Mouse 10W linear and FT1012 (listening only). He is club secretary of the 308 Amateur Radio Club and his special interest is computer link-up to Ham radio. Most interesting contact to date was Vic Elliot (VE1OH) Nova Scotia lighthouse keeper.

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JUNE 1984
### POINTS OF CONTACT

**G2VF:**
Usually available most afternoons and evenings on 40, 15, 20 and 10m (CW only). Equipment includes Heathkit HX1681 and DX100 transmitters, HF loop antenna. Special interests include loop antennas for HF bands, RSGB QSL awards. Bureau Sub Manager.

Had an interesting contact with OR4VN during the Antarctic expedition of 1964/65.

**G3AKG:**
Usually available Monday to Friday: 08.00-09.00, 09.30-10.30, 15.00-17.00 on 10, 15 and 80 metres. Uses CW and SSB.

Equipment includes FT101E (modified), Standard C6500 and Datong downconverter. Special interests are various nets, 80m, KSG, BTI, RNARS and ROOTA.

**G4ARS:**
Usually available daily from 16.00 on 70, 144, 432, 1296 and 5760 MHz. Uses SSB, CW, FSTV, RTTY. Has various equipment and his special interests include EME on 144/432 MHz, MS on 144 (432), Auroral, Sporadic-E and DX Tropo. Most interesting contacts made to date: 564AZ on 70 MHz, LA6HL/TF Iceland, three QSO's on 144 MHz.

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### POINT OF CONTACT

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Type of Licence
A          B

Bands usually preferred

Operating days
M T W T F S S

Times

Equipment

Phone/CW

Special interests eg DX,AMSAT etc

Most interesting contact made to date

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We are pleased to accept Points of Contact not on our order form

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### CORRECTIONS AND MODS

Whilst every effort is made to minimise errors in diagrams we will correct these as they come to our knowledge and we also appreciate the co-operation of our readers in notifying these.

We occasionally receive suggested modifications from readers who have constructed projects form Radio & Electronics World and we will publish those that would interest other readers.

For example, it may be possible to extend the use of a particular item by minor circuit changes or re-arrangement only. If this can be done for minimal cost and the idea has been proved in practice, others may benefit from the information.

Write to Corrections and Mods, Radio & Electronics World, Sovereign House, Brentwood, Essex, CM14 4SE

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**HF LINEAR AMPLIFIER (APRIL 1984 ISSUE):**

We are advised that Mr. G R Jessup, G6JP, originated this article and regret that Mr. Jessup was not included in the acknowledgements.

**SX-200N RELATIVE S-METER (MAY 1984 ISSUE):**

We regret that we omitted the Parts List for this project. It is as follows:-

- **Parts list**
  - IC1 - LM3915
  - R1 - 220K, 1/4W
  - R2 - 1K, 1/4W
  - VR1 - 1K pre-set
  - C1 - 270pF ceramic
  - C2 - 0.01uF ceramic
  - C3 - 10uF 25Vwkg

- D1, D2 - IN 4148 or similar
- LED1-10 - 3mm green
- Connecting wire, PCBs, adhesive pads

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FOR SALE

- Yaesu FT101E Mk3, CW/Filter, 12 volt converter, RF Processor, Fan plus spare valves & holdings FM RX/tx conversion (not fitted) £275. Hirschmann RCM 1000, 2 way, 12 volt 100w square aluminium boom section £90, 400w inc. extended boom £10. lot QRTSY Tel: 01-651-0633 (Croydon).
- FRG7 Yaesu comm, receiver, excellent condition. Also 2 metres £130.00 for both. Tel: Yateley 0252 875810.
- Popular 54, 1256 assembled but unused, £25. J- Beam processor £102, assembled but unused. £10. Refect 934 MHz short coil in 2m, pole, unused £5. High quality power splitter (not power combiner) £100. Heliak N connection £10. Masthead antenna changeover switch, with remote control. Ideal VHF/UHF, £400. 2m, 19 rear, vertical £150. For sale were £25. Free to good home. £25, 4 power amplifier PSU. With fault and diagram. £1. Buyers collect or pay carriage please. Andy Emerson, G8PTH, 71 Fulsway, Northampton, NN2 8PH Tel: 0604 644130.

- ATV Program for the 48K spectrum as reviewed in N E 53 RAWE with 96 features including testcards, maps, large printing, ORA calculator and much much more. The price which includes a 13" TV set, remote control. 12.50 inc.P&P from R. Stephens, Tootill, Milton, High Salvington, Worthing, Sussex. For list of other programs send £5.
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- Trio TR 2500 hand-held 2FM Rig, excellent reports, as new, must sell to go to 70cms, just £200.00. Stuart Law '16, Tapton House Road, Sheffield, S10 3BY. Tel: 0742 652898. 5.30 - 6.30 pm.
- Two Uniaxce 200 CB sets £75 the pair. Also Dunt-M6010P enlarger all sizes up to 6x6 incl. with two lenses, glass plates, engravings, carriages and 40cm enlarging frame. Make me sensible offer around £200. Cadocc, Arlington Terrace, Aldershot, GU11 3JF. Tel: 0734 852552.
- Yaesu FT202DM HF transceiver, mint condition, complete with Y0148 desk microphone, hi-mic allows remote control, pair of spare batteries (brand new). Brand new GSRV antenna never used, instruction manual. £625 the lot, all letters answered, sorry no phone. Consider computer plus John McCurrie, 20 Thornhill Road, Ayr, Scotland, KA8 OLT.
- Marconi Sig Gen 801B/3/D/SD, looks like new. RF 1.5 to 400MHz in 5 bands very good working order with three manuals, its own GaBi handbook, parts manuals, service manual. Also with new set of valves. The valves alone cost £100. It must all be collected. Tel: 0826 257101. Good condition for £50. First buyer pays by post at cost of his own time arranged. Peter Tel: Ipswich 0473 855825 anytime.

- Bearcat 220 scanner receiver mains/12V synthetised, 30MHz, £35.00, 24/12V £65.00, 115/240 £135.00 GBRHU Tel: Newhall 6205/27. £150.
- Old mags, PW, Swad, Rocom etc. ideal for study, for RAE. Kenwood TS130 very little use so offers. £80, swap, handled or written in. Phil. £50. Very nice Portable VHF multiband RX £35. Log books £2 each, only a few left. Split charge relay new £15. Martin part £19. Do not ask. £35.00.
- Printer LX180-L high speed matrix 180 charac- ters second ASCII code with parallel interface continuous paper feed. Good working order complete with cables completes with lotted £60. Flippy disks 8 x twin measures 8.5x12x1cm, unused but complete with 19in rack mount cards, cables etc. £50. Tefen 210 working £10. £200.00.
- Test equipment £60 D3 dual-beam scope, dual-timebase, 50MHz £2250.00. (cost new circa £2500). HP 141B dual-beam, 20MHz scope with plotter £5000. £7500. (100v), £9500.00. £10000.00.

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Zeta 70 linear AM/FM SSB 70W AM/Ppye Radio Telephones in working order, easily.
Trio R100 receiver, hardly used, mint condition.
Trio KA2000A stereo, amplifier, KW Viceroy plus one VHF base and one chimney.

Expensive ads

Trio R100 receiver, hardly used, mint condition.

Ex-RF WfW WOPS, If trained at Blackpool and Compton Bassett and operated in Western desert.

Jukebox, £10,000.

Rfo 5T receiver with mains PSU and complete set of nine general coverage coils 50 K-30 ML.

Clearance sale 1070 Channel VHF Marine band Rx/Tx (as new) for any system capable of Tx/Rx on MF and HF bands. Petty Officer M Brownlee, 7 Croft Terrace, Botcherby, Carlisle, CA1 2SN. Tel: 46552.

Some 5M open reel tape spools, ancient ships' records or DE gear, chart echo sounder, equipment, transducers, hydrophones, undersea recordings, 5030 ohm Hi-Fi mono headphones, Woodhouse, Treneweth Portpathan, St Austell, Cornwall, PL26 6AV.

SSM Europa 4m transverter G6LKF QTH/R for Tel Darek, Southend 553841.

Exchange FDK 70EX Multi: TRx/Rx 1 Watt to 25 watt FM. Good condition no mode. + 4 eiltron.

RS66000 4x100W plus speakers and 4 gang speaker switch.

Science of Cambridge MK-14 computer, any condition. M J Gundy, PO Box 89 Belize City, Belize, Central America.

Small Short Wave Marine Amateur Receiver such as Coder 12B or similar. Have Edystone model 670 not working, with complete set of new valves in fair condition. Also have Simulcaptor and Linear L4A amplifier. Would exchange for similar SW receiver such as Coder 12B or similar type.

While the circuit diagram would be very useful, Andy Cunningham, 32 Datchet Road, Cannington, Yeovil, Somerset.

Information required for a British Physical laboratory meter TVM 1063. Any postage, printing etc will be paid for. Tel: Wisbech 70649.

FREe CLASSIFIED ADS

NOW WANTED

EX-RAF forage cap with badge. Also letters from ex-RAF WWII WOPS, if trained at Blackpool and Compton Bassett and operated in Western desert.

m H Eye test 0900 09 42 33

Wreath of Carnation, Swann, Saffron Walden, Essex.

I have a Staker TX4 DFX multimode CB transceiver.

Also in fair condition.

I have a Staker TX4 DFX multimode CB transceiver.

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I have a Staker TX4 DFX multimode CB transceiver.

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I have a Staker TX4 DFX multimode CB transceiver.
WANTED

-**Racal RA63 SSB adaptor. Add-on frequency control unit for small Ham transceivers. Model V101. Alimentation: Tel: Milton Keynes 0908 314905 before 2pm.

- FRG7 or similar. Must be good condition, preferably Herts Bucks area. Please phone with details to G41XY St Albans. Tel: 39908.

- Circuit diagram and/or workshop manual for GEC communications receiver type BRT 4002. Good Price paid or will pay for loan of same. Martin, 4 Church Lane, Timberland, Lincoln, LN4 3LE. Tel: 581292.

- German WW2 radio and radar equipment by collector. Parts, technical bulletins etc also wanted. Will collect or pay freight. Ragnar Oddvar, Vejdammen S, DK2870 Nolte, Denmark. Tel: 02 851875 (evenings).

- Realistic Pro 2002 so channel scanner or Gemscan 70 or similar GRHU Tel: 0273-516001 (Newhaven).

- Rigonda 6in television sets – working or not. Viewfinder/monitor and service manual for Sony CV2100 monochrome television camera. Andie Wilkes, G4NTV, 34 Tideswell Road, Great Barr, Birmingham B42 2DT Tel: 021 525 5445 (office hours only).

- Exchange Realistic Professional 2001 Scanner, Brand new, Program with memories, covers a II VHF, UHF, Bands for HF Rig. Tel: BI4N3 39333.

- Free standing Tilt over telescopic triangular tower, any height considered. Must be hot dip galvanised and preferably with electric winch. GSX3N QTHR. Tel: 051 722 3644.

- WS68 and Radioset No 8, No 1, for definite museum in Scandinavia. Will pick up. Also incomplete set of interesting Canadian WW2S also wanted. Can exchange from the same era or cash in return. Will collect in UK. R Ottersted, Veddammen S, DK2687 Holte, Denmark. DK 2840 Holte.

- Wireless equipment radio valves, wireless books, mags, trade literature 1920 to 1930, also early valve Hi-Fi (Leak, Williamam, Quad 1, Lowther etc) and Clandestine 'Spy Set' radios/military communications equipment. Anything interesting with valves in it considered.

- Tel: 794 0823

- Circuit and calibration data for BPL component comparator C2457/3 to loan or purchase. Also manual and or circuit for cessor FM signal generator type 1004A, or 1003A. Also circuit for advance millivoltmeter 77B. H. L. Earnshaw, 58 Prices Lane, Reigate, Surrey. RH2 9AY Tel: 0307 305480.

- Heathkit HW7 or HW8 or Mizuho HF QRP transceiver, working or not. Full details and price. Tel: Newbury 40750.

- Good condition XZ1 for under £45 with books and games and instructions. Master Toby Wood, 37 Pilgrims Way, Harleston, Norfolk. Tel: RS3456.

- CW, RTTY decoder, also 10m to 2m transvr. Tel: 054 27 1272.

- Yaesu YG2C1 digital freq. display for FT212, G8YQT, QTHR. Tel: 0227 606675.

- R406M Redfox Marine Comms RX. Sailed with these for over 21 years. Prices? I have GCT's. Morris Tel: 0644 710 741.


- Empty 5-inch tape reels. H G Woodhouse, Trenoweth, Porthpean, St Austell, Cornwall, PL26 6AN.

- I would like to get in touch with people in UK to trade VIC 20 books, tapes, discs, etc. Write to: Mike Neville, 182 Eagle Road, Letherbridge, Alberta, Canada, T1H 4G6.

- Drone desk mic, type 7097, 7077 etc. Price QTH. Pete Bennett, (G3YDU). Tel: Nunasteon 349461.

- FT 77 or similar, Cash or PX FT 290 + accessories. G1E NL, Tel: 06532 2545.

- Oscilloscope tube, new or secondhand, type E 225. Taylor price paid. T. Watkin, T. 68 Ashwood Road, Nuneaton, Warwickshire CV10 9AY.

- CCT diagram or any information on ARDE scope type 58 and type 63A, can photocopy. £10.00 offered, also Harman, Solartron scope 5701D with units CX 1441 and CX 1443, L.R.K. Gregory, The Well House, The Downs, Henne Bay, CT6 6JP. Tel: 022737 4744.

- "Senior Citizen" enthusiast wants Lindsey Hood cassette recorder (Series 2) by Hart Electronics. Complete working or un-built kit, with FTL 10 deck. Even part kit considered, but must have deck with it. Not too expensive. Please could exchange with camera. Ken Evans, Sheford Cottage, Melbury Abbas, Shaftesbury, Dorset. Tel: Shaftesbury 3515.

- Racal RA63 SSB adaptor, HRO and coils + P/P. Milton Keynes, 0908-314905 (after 3pm).

- Trio R200 and Trio VHF converter in first class condition. Tel: Wroxham (06063) 3392.

- Help! Has anybody any idea who may have hidden in his shack a VFO 30G or any VFO that will adapt to fit the Kenwood Trio TR-7200. If you do and it's for sale please contact Terry, G1YHF at 25 Duke Street, Fitzwilliam, Pontefract, WF9 5AQ.

- Manuals or circuit for Heathkit oscilloscope 0-12U and electronic switch S3U. Also Philips Scopo PM 3021. Buy or borrow. Write G G Tannent, 7 The Martings, Cranleigh Gardens, South Norwood, London, SE25 4JS.

- Benkson portable radio model 999. This radio has fourteen transistors and covers five wave bands and is powered by batteries only. Frank T. Plan, 218 Dickson Avenue, Dundee, Scotland. DD2 4DD. Tel: Dundee 645325.

- AM CB and plans for all band AM TX. Thomas Williams, 51 Alamein Drive, Winsford, Cheshire. CW7 1DG.


- Manual for Lafayette receiver HE60 or photo. Will pay. Ray White, 38 Boxted Avenue, Clacton on Sea, Essex.


- Yaesu FRG 7700 or Trio R200. Have to swap Ham international Jumbo Hopebase CB including Portel stand like new with graphic equaliser, compressor, etc. as new. A. Campbell, 24 Elizabeth Rd, Seaton, Devon. EX12 2DS. Tel: Seaton 3123.

- Urgently required, circuit diagram or any information for Metro model U127S AC/12V/DC. B/W 12in portable TV, make unknown. Denning, 46 Court Road, Staines, Windsor, BSI5 2GQ. Tel: Windsor 675000.

- RTTY and SSTV programs for the CB64 wanted on cassette, exchange possible with other programs. D C Cabasier, 25 Rive Epoigny, 94120 Fontenay-sous-Bois. France.

- Circuit information on how to convert Harvard 410T. Forty Channel 2MHz handheld NBFM transceiver to work on 29.6MHz amateur band. Anthony Stokes G3ZH, Shenfield Crescent, Brentwood, Essex, CM15 8BW. Tel: 0277 221465.

- Exchange FT078R 70cm Portable TX/RX. NC-9C charger plus Datong D70 Morse Tutor.

---

**FREE CLASSIFIED ADS**

We are pleased to be able to offer readers this free Classified Ad Service to enable you to sell unwanted equipment or advertise for your wants.

Simply complete the order form overhaul, although we will accept ads not on our order form. Feel free to use an extra sheet of paper. If there is not enough space on the order form.

Send to: **Radio & Electronics World** Small Ads, Sovereign House, Brentwood, Essex CM14 4SE.

**DEADLINE**

Send your ads in, as ads will be inserted in the first available issue on a first come first served basis.

**CONDITIONS**

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Classification:
For Sale ........................................... □ Wanted ...........................................

USE BLOCK CAPITALS (One word per box)
To avoid mistakes please write clearly and punctuate your ad

Name/Address
Postcode/Telephone

USE SEPARATE SHEET FOR MORE WORDS

Ensure that you have included your name and address, and/or telephone number

CONDITIONS: Your ad will be published in the first available issue. We will not accept trade advertisements. We reserve the right to exclude any advertisement.

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BASEMENT OFFICE, 5, DAVID PLACE, ST HELEIN, JERSEY, C.I.

‘MORSE MODULE’
Ready to use tone practice Osc. Works with all Keys.
Price £5.50 + P&P 50p.

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PRIVATE OR TRADE ENQUIRIES WELCOME
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RADIO & ELECTRONICS WORLD

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We accept Access and Barclaycard/Visa
All prices include VAT and P & P

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453a, Becontree Ave
Dagenham
Essex, RM8 3UL

JUNE 1984
please mention RADIO & ELECTRONICS WORLD when replying to any advertisement
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 Booth Holdings Bath
 6 Golf Club Lane
  Saltford, Bristol
  Tel: 0227 2149

KEN

 Thanet Electronics

 IPO (ICOM)
  P.O. Mortimer St, Herne Bay
  Tel: 0227 6646

The content of this document includes advertisements and classifieds for various electronic items for sale, such as transistors, capacitors, and other components. There are also details about prices, quantities, and contact information for various suppliers and advertisers. The document also includes instructions for setting up a radio or electronic equipment, with diagrams and step-by-step guides. The text is written in a technical and professional tone, with a focus on providing detailed information for readers interested in electronic engineering or DIY projects.

The advertisements include items such as surplus equipment, wireless equipment, and electronic components. The prices range from £2.50 to £75.00, and the items are available in various quantities. The suppliers provide details about the items they are selling, including descriptions, specifications, and contact information.

The text is written in a clear and concise manner, with a focus on providing the necessary information for readers to make informed decisions about purchasing electronic components or equipment. The document is well-organized, with a logical flow of information that makes it easy for readers to navigate and find the information they need.

Overall, the document is a useful resource for anyone interested in electronic engineering or DIY projects, providing detailed information about the products available and how to purchase them. The technical language used makes it clear that the content is intended for readers with some knowledge of electronics or engineering, but anyone with a basic understanding of the subject could also benefit from the information provided.
TIGER LY9 70 Cms Antenna

New from Ant Products, a superb addition to the range of renowned antennas, the Tiger LY9 for 70 cms. A lightweight antenna with a heavy weight signal. Offering a high 11 db gain on a 58 inch boom length. Great for vertical or horizontal mounting. Supplied in matched pairs for the ultimate Oscar station complete with all hardware for mounting with elevation control. Precisely adjustable for angle in order to get the best performance. Also including matching unit for circular polarisation. Right or left hand can be chosen with equal efficiency. Last but not least our famous two year guarantee and full back up service.

Write now for full details enclosing SAE plus 25p in stamps

Ant Products, All Saints Industrial Estate
Bagnall Lane, Pontefract, West Yorkshire
Tel: 0977 700949

CATALOGUE OF ALLSORTS
Electrical, Electronic, Audio.
Send 40p and SAE to:
CABLECE
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Milton Keynes MK12 6AQ. Dept REW

FOR A PROFESSIONAL FINISH
Use Strip-fix Plastic PANEL SIGNS

Set 3 — White wording
Set 4 — Black wording
Over 1,000 words and symbols, covering more than 300 terms, in each set of 6 sheets.

Set 5 — Dials
6 sheets containing one large and two medium scales, large horizontal tuning scale, frequencies, 12 control panels.

Easy to fix. Stapled in booklet form to hang above workbench
Only £1.50 per set, all 3 sets for only £3.00 inc VAT & postage

Available only from:
DATA PUBLICATIONS
45 Yeading Avenue, Rayners Lane, Harrow, Middx HA2 9RL
autoranging AF voltmeter, SINAD/distortion meter and RF power meter (100W).

For preselection, up to 8 signal frequencies can be programmed through the front panel keyboard. Frequency stepping is possible with an adjustable channel spacing. All parameters measured can be read in both digital and analogue forms through LEDs and 4 large-size panel meters.

Automatic measurement control, such as automatic frequency setting of the modulation meter and signal generator with selectable duplex distance on incoming transmitter signals, push button operation and bidirectional protected RF input/output socket allow rapid and accurate measurements to be made on transceivers, duplex and relays systems. The compact, light-weight and rugged test set is suitable for both use in the field and the laboratory. No mains operation or battery powered.

Further details on the Model FMPM-30 can be obtained from: The Sales Department, Systron-Donner Limited, St Marys Road, Sydenham Industrial Estate, Leamington Spa, Warwickshire, Tel: (0926) 35411.

THE PANASONIC RE-B600LBE PORTABLE COMMUNICATIONS RECEIVER

Panasonic have introduced the RF-B600LBE, a PLL synthesized FM/LW/MW/SW portable communications receiver with a micro-computer multi-tuning system. This model is designed to give accurate, stable reception. This new mains or battery operated portable radio has a highly developed technological construction, although operating procedures are straightforward.

The RF-B600LBE incorporates 5 advanced tuning systems, and a fluorescent digital display will show the frequencies that are being tuned - in 1KHz steps for SW/LW and MW bands and in 0.005MHz for the FM band. Additional features include: a product demodulator for clearer SSB and CW; an automatic noise limiting system to reduce unwanted interference; an AM/RC gain control to permit adjustment of signals that are too strong and cause distortion; and a widthband selector switch designed to prevent cross interference and provide cleaner sounds in AM broadcasts.

Elegantly styled in a silver and grey finish, the RF-B600LBE has a recommended retail price of £444.50 and is available complete with instruction manual through Panasonic's authorized dealer network.

JUNE 1984

WOULD YOU BELIEVE IT?

Sansui Electronics (UK) are launching a whole new range of in-car hi-fi products that aim to offer the same levels of sound reproduction in your car as you have become accustomed to in your home. Sansui have achieved this goal by concentrating on the technical specifications of the product range, eg their RX 700/710 models have a THD (Total Harmonic Distortion) of .05% which is even less than their own highly acclaimed AU-DD2 domestic amplifier, and something you'll really appreciate when you turn the volume up.

This concern with sound quality, has not, however, caused Sansui to ignore those convenient features that allow you to keep your eyes on the road, whilst operating your system. The RX 700/710 has auto reverse and there is automatic music program search, to help you easily locate tracks on a cassette. There are also 30 pre-sets on the tuner section, which again is highly specified with a frequency response of 30-15 kHz - as good as the majority of domestic tuners.

The range starts at just over £200, with the flag-ship model, the CX 910L costing around £340, for which you get Dolby B & C, bass, treble, loud, quartz PLL synthesized tuning, automatic station seek and a choice of green or orange panel illumination as well as a host of other features.

The power output of the models ranges from 12 watts per channel to 20 watts, with the additional option of two power amplifiers for those who want up to 55 watts per channel.

Also available will be a wide selection of 2-way and 3-way speakers.
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ADVISING RATES & INFORMATION

Radio & Electronics World

ADVERTISING RATES & INFORMATION
ABC membership approved pending first audit Jan-Dec 1984

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CONDITIONS & INFORMATION

SERIES RATES

Series rates also apply when larger or additional space to that initially booked is taken. If 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 but contract. This will automatically be inserted if no further copy is received. Display Ad and Small Ad: series rate contracts are not interchangeable. If series rate contract is cancelled the advertiser will be liable to pay the unearned series discount already taken.

C.OP.

Except for County Guide's copy may be charged monthly. No additional charges for type-setting or illustrations (except for colour separations) for illustrations additional to send photograph or artwork. Colour Ad rates do not include the cost of separations.

Printed - web-offset.

PAID ADS

All single insertion ads accepted for a prepayment are submitted on a first come, first served basis. Each insertion is payable in full before publication. Accounts will be credited for series rate contracts subject to satisfactory references. Accounts are strictly net and must be settled by publication date.

FOR FURTHER INFORMATION CONTACT

Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4EE

JUNE 1984

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Why is it that in a little over a year muTek’s SLNA 145sb preamplifier for the FT290 has been a hit on such a big scale?

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<th>Price</th>
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<tbody>
<tr>
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<td>10A current meter</td>
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Plessey Radar restore original television

The first flickering, eye-straining pictures which heralded the birth of the television era and a social and entertainment revolution have been made to live again by engineers and apprentices with Plessey Radar at Cowes, IOW. They have combined their talents, and their patience, to restore an early 1930's television – an antique, mechanical 'goggle box' which fascinated affluent grandchildren.

The original Baird set, costing £18 in the days when steam radio ruled, has been loaned to the National Wireless Museum at Arreton Manor, IOW, after being discovered under a pile of rotting firewood in an Essex cottage where it had lain forgotten for half a century. Only six televisions have survived and all are believed to be priceless.

To operate the television a household had also to own two radio sets to watch pictures described as 'barely discernible' which were broadcast for two hours each evening on the medium wave. One wireless provided the picture, the other the accompanying sound.

The television operated on 30 lines but, with the aid of a scan converter, it is hoped that it may eventually be adapted to show today's 625 line pictures.

Two technician apprentices Mark Holloway and Nick Warry helped to restore the television. Nick said: 'I had seen photographs of one before in magazines which I read, but I didn't think I would ever work on the real thing. We had to decide how best to reproduce a new disc and we worked from photographs of a drawing made at Cowes. Fortunately, the television was complete and no bits were missing but it was extremely tarnished and needed a great deal of cleaning up. The scan converter involved a great deal of design work but we thought that it would be possible'.

Mr Ian Moth, a principal electro-optics engineer with Plessey Radar and also a radio amateur, advised the apprentices on the rebuild. He said: 'Our principal problem was the large aluminium disc which had been buckled and torn. We couldn't restore it, so we had to copy it. It was through the whirling disc that the television scanned the picture. Behind it was a light and a family of three or four, huddled together, viewed by looking through a magnifying glass incorporating two lenses which gave good distortion properties. The effect could be compared to looking at a slide viewer.'

US may adopt European TV system

A new colour TV system that may be selected to improve the technical quality of American television is based on the European PAL colour television system. The proposed system is one of a number being studied following an American decision to look at ways of improving the technical quality of their TV system. If adopted, new sets for the system would be needed, though manufacturers would be able to use many of the existing components and sub-assemblies.

The new system, called AmPAL, is not identical to PAL but improves on it by removing its 'eight-field sequence' – jargon for PAL's major drawback. American viewers are at a disadvantage as a result of being first with colour television back in the 1950s. The NTSC system, named after National TV Standards Committee, (or alternatively, 'Never The Same Colour!'), has long been criticised for its sensitivity to what engineers call 'phase errors' in the transmission path and which frequently results in poor colour rendition.

If the Americans change their TV system to AmPAL it could have benefits for the British consumer. Japan would be under pressure to change from NTSC and production of single-system sets would be expected to reduce the price of imported sets.

New repeater group

A recent meeting was held to form a new repeater group for GB3NN (RB2), located 3Km south of Wells Next The Sea, Norfolk. Site approval and a franchise have been received and licensing procedures are in progress with the DTI.

It is hoped to have the repeater operational at its new site by June/July '84. The repeater is a Pye 460 UHF unit converted to 70cm repeater use, the aerials are 4 stacked J-poles for Rx and 4 stacked dipoles for Tx, the site is 77m AGL, with aerials at 25m high, giving an ERP of 12 watts.

Donations from any prospective users of GB3NN would be gratefully accepted by the keeper: Bill Tuck G6KZP, 'Whalebone Cottage', Wells Next The Sea, Norfolk NR23 1EN, or the treasurer: Malcolm Amis G4VDC, 'ArcanteII', 5 Waveney Close, Wells Next The Sea, Norfolk NR23 1HU.

Digital storage oscilloscopes

A new in-depth application note written by Chris Crook of Gould Design & Test Systems Division gives an authoritative review of digital storage oscilloscopes and their applications. The application note compares digital storage oscilloscopes with other classes of waveform-storage instruments, and also discusses the effects of resolution and sampling on waveform capture.

Specific applications discussed in the new publication include the simultaneous display of reference trace and updated trace for easy testing of electronic circuits; automatic plotting of spikes on power supply lines to analyse the causes of data corruption in computer circuits; automatic recording of alarm conditions using the variable set-point facilities on a DSO; automatic recording of bursts
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of pulses or transients into separate stores to overcome start-up delays: automatic copying of the displayed waveform into a computer for analysis by average, Fourier analysis, or integration to find, for example, the energy content of the waveform; and automatic copying of the displayed waveform onto a pen recorder.

Application Note and further information from Gould Design & Test Systems Division, Ildford, Essex IG6 3UE.

New computer school in London

A new London Computer and Electronics School is due to open in Hammersmith. Apart from management and financial support from The BOC Group, it will receive backing from The Manpower Services Commission and grants from The Department of Trade and Industry and the London Borough of Hammersmith and Fulham. Of the £1 million cost, over half will come from The BOC Group.

Prospective students for the six month and one year courses must be at least 19 years of age, unemployed, and will need to show evidence of having been out of full time education for the past two years. They will also need to succeed at an aptitude test and an interview. The courses begin in June and initially, the number of students will be limited to 120. During the course, students will receive a wage in the region of £40 per week, according to personal circumstances.

The School aims to meet two urgent needs. First, people can be provided with access to a new career with good long-term prospects and second, employers can be provided with people who are productive from day one. The demand for such people has been demonstrated by a survey which revealed that a shortage of several thousand suitably trained people in the computer and electronics field exists in the London area.

The success of the School will be measured by how many of its students are placed in jobs at the end of the course. As the programme has been designed to meet the criteria for producing qualified graduates for industry, it is hoped to achieve a high placement rate. Indeed, there is a built-in incentive in the arrangement with the BOC to achieve a high placement performance whereby its financial contribution is reduced for each graduate not placed in a job related to the skills for which he or she has been trained.

Oversewing the establishment of the London School, is Mr Marty Hanfling, President of BOC’s Educational Services Division. He says: 'We see this first couple of years as very much a pilot scheme. It’s the first time a school of this type has been set up in the UK and, in conjunction with our partners in the venture, we shall be monitoring its progress closely'.

The address of the London Computer and Electronics School is Glenthorne House, Hammersmith Grove, London W6, and the office will be open to receive applications from Saturday 7th April.

Satellite study to keep solar panels in place

Marconi Space & Defence Systems Ltd has been commissioned by the 11-nation European Space Agency (ESA) to study ways of improving the pointing accuracy of large spacecraft. The study will focus on the particular problems presented by large, flexible solar panels with a view to the eventual application of this research to very large telecommunications spacecraft.

Large satellites with high output powers (up to several kilowatts) need to be manoeuvred with a high degree of accuracy to ensure that their communications antennae are correctly orientated with respect to the Earth: even a tenth of a degree error in a satellite communications beam at a distance of 20,000 miles could mean a serious loss of data at the ground station. Pointing accuracy is, of course, even more vital for satellites with very narrow beams.

The Space Division of MSDS, located at Portsmouth, has already embarked on an ambitious programme aimed at improving the control thruster jets (and their propellants) which react to, and correct the natural drift of satellites in orbit. Earlier improvements in thruster jet control have already led to a phenomenal increase in pointing accuracy for small, power-limited craft where the solar-collecting panels are fixed to the body of the satellite. However, large, power-hungry craft with their extended solar panel structures present a particular problem: such structures tend to bend under the impulse generated by the control thrusters. This unwanted flexing introduces further movement of the spacecraft, probably necessitating additional correction by the thrusters and ultimately leading to further disorientation of the satellite. This could negate any improvements in thruster control and result in depletion of propellant reserve.

The operational life of the craft would, therefore, be seriously affected.

The new study takes a mathematical approach to the problem by applying Sturm’s algebraic theorem, first proposed in 1836, to calculate a correctly timed sequence of thruster commands. Those commands, delivered by a Marconi attitude control microprocessor, could correct the pointing of the satellite and bring the solar collectors and other flexible parts of the satellite to a state of zero vibration at the same instant. This process can be repeated automatically, to correct natural drift or the effects of deliberate commands from the ground to alter the position of a spacecraft in the sky.

The study also addresses methods of determining the vibration pattern of flexible satellite structures from a single sensor, typically a gyroscope, attached to the spacecraft. By duplicating these Sturm-based techniques, satellite pointing accuracies should soon improve from the 0.15° currently achieved, to better than 0.05°.

Walmore Electronics

Walmore Electronics Ltd, the Covent Garden based communications specialists, have been appointed sole UK agent by E-H International Inc. This Oakland, California based manufacturer of automatic test equipment claims to produce ‘the cleanest pulses in the world’. To substantiate their claim, E-H International produce a range of programmable and benchtop pulse generators with frequencies from 0.6Hz to 250MHz and pulsewidths from less than 1ns to 1s.

To complement the pulse generators, a full range of waveform analysers is available and to facilitate the switching of pulses, a line of programmable coaxial switches is available. Additionally, PCB mounted reed switches are available.

Leisure Zone Ltd

Leisure Zone Ltd, home consumer electronics and electronic games importers, are now in liquidation. The company began trading in March 1982 and had lost some £50,000 by June 1983. It has now gone into voluntary liquidation: the likely total estimated deficiency as regards unsecured creditors is £32,361.

For further information please contact Clive Hicks on 01-499 1649.

JUNE 1984

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**Videoconference Service**

A digital videoconference service between London and New York will start shortly. The new service will be set up jointly by British Telecom International (BTI) and AT&T Communications. Initially, it will operate between British Telecom's studios in London and other cities in Britain, and AT&T's studios in New York and 13 other American cities. The digital videoconferencing service to the USA follows the inauguration of a similar service earlier this year to Toronto, Canada *(R&E News, April)*.

The service will use a high-speed digital link between international exchanges in London and New York, providing full motion video and audio communications. A British Telecom-developed video coder/decoder (Codec) codes and compresses the signals that make up the television picture, transmitting only changes in picture content from one frame to the next. This reduces the bandwidth required to 2Mbit/s or possibly less.

British Telecom is planning to provide terminals and codecs for private use on purchase or rental terms through its VideoStream domestic videoconferencing service scheduled for launch after Easter. These video terminals will incorporate television cameras, monitors, microphones and loudspeakers, enabling users to set up conferences from rooms in their own premises.

The announcement was made at the International Teleconference Symposium which is being run under the auspices of BTI in conjunction with Comsat (USA), KDD (Japan), OTC (Australia) and Teleglobe (Canada).

Intelsat, which has 106 member countries, owns and operates a global satellite network supplying two-thirds of the world's international telecommunications services. Britain is Intelsat's second largest shareholder.

**R&EW Zilog competition**

Following a series of articles describing Zilog's Z8000 microprocessor, *Radio and Electronics World* and Zilog UK ran a competition whose prize was donated by Arcom Control Systems Ltd. Entrants had to answer some fifty questions and describe a suitable application for their prize.

Mike Quee, Zilog UK's European Marketing Manager, had the great pleasure of presenting the Z8000 CPU VME board to lucky winner Dave Wells.

Mr. Wells is attending the Cranfield Institute of Technology in Cranfield, Bedfordshire where he is taking a PhD in Ecological Physics studying bird migration using an X-Band Radar System. He is planning to use the board in his experiments.

**Learn from Maplin**

Maplin Electronics are set to become a major supplier of training products and services. As the sole UK distributor of the newly expanded Heathkit Educational Systems, Maplin can supply a fully comprehensive range of training and educational products, support services and courses.

Having appeared on TV, radio and the press, Maplin's highly user-friendly robot 'Hero' has become the best known and best selling training robot. Also receiving considerable interest are the Heathkit microprocessor courses, which range from basic instruction to build yourself a micro' level with kits supplied by Maplin.

Maplin, the major UK suppliers of electronic components and a leading distributor of hobby computer products, are similarly expanding their range of 'Practical Projects'. These provide users with a kit covering such projects as special interfaces for many of the popular range of home micros, home security devices, car and radio enhancements. The company have decided to produce and publish on a monthly basis 'Maplin's Top Twenty Kits'. At the top of the list are the 75W Mosfet Amp Module; Modems; The ZH81 I/O Port and a car burglar alarm.

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**LOW COST COMPUTER CAD FOR ELECTRONICS**

Number One Systems, the Cambridgeshire based electronics design consultants, announce the launch of a Sinclair Spectrum version of their DC/AC line circuit analysis program for micro-computers.

The program was written originally for the BBC-B and Newbrain computers and has proved to be extremely popular with universities and industrial R & D establishments both at home and abroad.

The version for the Spectrum is in response to many requests, particularly from undergraduate students and school science teachers, and brings professional electronics CAD facilities within the reach of all. Circuitry to up to 16 nodes and 60 components can be analysed for input impedance, output impedance and gain.

Resistors, capacitors, inductors, transformers, op-amps and FETs can be simulated by the program, and the AC performance of circuits containing any combination of these components fully evaluated over a wide frequency range without the need for laborious breadboarding and bench testing.

Once a circuit has been entered into the computer it can be stored on tape for further analysis at a later date.

Modifications can be made to the component values and circuit configuration during a simulation thus enabling the designer to assess quickly the circuit's sensitivity to component tolerances, stray capacitances, temperature effects etc.

The program is ideally suited for frequency response analysis of filter circuits, audio amplifiers, wideband amplifiers, tuned RF amplifiers, linear integrated circuits etc, and has now been in use for over two years.

The version for the Sinclair Spectrum is supplied on cassette and is fully documented.

For further information contact Adrian Espin or Martin Morris at Number One Systems on (0480) 61778

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MICROPROCESSOR-CONTROLLED DOT MATRIX PRINTER WITH RS232 INTERFACE

An inexpensive way to extend the home computer facility by adding a hard copy printer. Graham Moore, G4DML, explains how he did just that.

Many people with home computers do not own a printer of any sort. Certainly they do seem rather costly for what they are, mainly because electromechanics are much more expensive to produce than the pure electronics found in micros.

The following article explains a simple method of constructing an RS232 ASCII printer utilising one of the many cheap dot matrix plain paper printer mechanisms that are available today. The mechanism used in the printer described is a Roxburgh DP822 7-needle 21-column unit that was picked up from the scrap heap with a burnt-out needle solenoid. After rewinding the solenoid no other problems were experienced and the design was embarked upon.

Print mechanism
The DP822 unit, as in most others of similar type, is a unidirectional printer. The needle head is driven by a spiral grooved shaft, the return spiral being 50% shorter than the print spiral. When the motor is turned-on the head begins to move and a 'start print' signal is generated by a reed switch closing. This switch remains closed for the complete print cycle and is used to define the start of printing and to keep the motor running.

A pulse generator incorporated in the printer gives a timing signal which defines the positions for print-head needle firing. This provides a pulse approximately every 1.7 milliseconds and it is imperative that the needles are accurately synchronised to these pulses in order to ensure exact registering of the printed characters (see Figure 1).

Paper feeding is performed by energising the paper feed solenoid while the motor is running. The solenoid must be energised for approximately 30 milliseconds to ensure correct operation of the mechanism chosen; this will, however, vary if other mechanisms are used.

Printing a character is performed by seven solenoids which drive needles that impact the ribbon against the paper. The operation is carried out five times in succession with a varying pattern until the character matrix is built up. Being energised for only 750 microseconds, the solenoids are therefore of very low impedance; a peak current of 2.5A is drawn by each needle and it is essential that the 12v PSU can supply adequate current for these periods.

Design
Because of the complexity of the control functions required it seemed obvious to use a processor of some kind, the Z8681 being the one chosen (Figure 2). The processor, IC1, is one of the latest additions to the Z8600 range and is ideally suited to control applications, with its three I/O ports, 256 bytes of internal RAM and an internal UART. The Z8681 has no internal ROM, allowing an external 2716 EPROM to be used for program storage. A 74LS373 latch is used to demultiplex the address/data bus, and the processor design is completed with the 4049 inverter, IC4a. In order to interface the Z8 UART with the 'outside world' an RS232 to 5V logic converter, TR1, is included so that the printer can be driven by most micros.

To enable the Z8 to interface with the motor and solenoids on the printer mechanism, the circuits incorporating IC7 and IC6a respectively were constructed. As can be seen from Figure 2 they consist mainly of Darlington current drivers to power the low impedance electromechanics on the printer.

So that the Z8 can interpret the 'start print' signal and the timing pulses, both of these must be amplified and converted to ITL. This is done by IC4c in the case of the start signal, and by TR2-IC4d for the timing pulse. Both circuits generate 5V square pulses that can readily be input to the processor.

The power supply, as previously mentioned, must be capable of supplying quite large currents for relatively short periods of time. This can be accomplished by constructing a supply with a high-value output smoothing capacitor, large enough to supply the 750μs pulse to the print solenoids without overloading the rest of the circuits.

The power supply circuit Figure 3 shows a PSU capable of supplying about

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**Fig 1** Needle solenoid timing and control waveforms

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In order to print a character a matrix must be made up of 5 binary words that are output consecutively to the print needle solenoids. As can be seen from the table of ASCII characters the codes start at 20 Hex and end at 7F Hex, those below 20 being reserved for control codes. Therefore, if we subtract 20 Hex from the ASCII code we obtain values between 0 and 5F Hex. The resulting value is multiplied by five and the result used to address a look-up table which contains the 5 bytes to output.

As can be seen from the table, a carry will be generated by the higher of the codes and this must be taken into account before addressing the ROM look-up table.

The resulting pattern is thus (for the figure 8): \( \text{8} = 38 \text{ H (ASCII code)} \)

\[ \text{38 H - 20 H} = 18 \text{ H, } 18 \text{ H} \times 5 = 78 \text{ H hex} \]

Thus the look-up table pointer for 8 is located at 78 bytes from the start.

### Table 1

<table>
<thead>
<tr>
<th>Address</th>
<th>Word</th>
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<tr>
<td>78 Hex</td>
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<tr>
<td>79</td>
<td>01001001</td>
</tr>
<tr>
<td>7A</td>
<td>01001001</td>
</tr>
<tr>
<td>7B</td>
<td>01001001</td>
</tr>
<tr>
<td>7C</td>
<td>00110110</td>
</tr>
</tbody>
</table>

The resulting bit pattern is that of a figure 8 lying on its side. Note that the high order bit of the word is always 0 as we only need to drive seven needles, these being connected to the low order data lines.

#### Construction

The complete printer interface was constructed on Veroboard to allow for the numerous modifications that one usually has to make on a project of this kind. It was also felt to be impracticable to publish a PCB layout as most of the dot matrix mechanisms have differing drive requirements; however, a good idea of the circuitry required should be obtained by studying the circuit diagram.

Most of the devices used are non-critical and any device with similar specifications can be used, remembering that the EPROM must be at least a 450ns device if the processor is to be used at 7.4MHz on normal timing. Ensure that the 12V and 5V rails are as isolated as possible, i.e. by taking all the 0V lines back to a very low impedance point; otherwise some problems may be experienced with transients when the print needles are energised.

#### Testing

Switch on and confirm that the solenoids are not operated. The motor may run during the processor reset cycle: this

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**JUNE 1984**

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**Resistors** (all 1/4W, 5%)
- R1 to R8, R10, R19, R27 to R33: 4.7kΩ
- R9: 100kΩ
- R11, R12, R18: 10kΩ
- R13, R34 to R40: 470Ω
- R14: 1.8kΩ
- R15, R20 to R26: 1kΩ
- R16: 120kΩ
- R17: 22kΩ

**Capacitors**
- C1: 47μF, 16V
- C2, C3: 22pF
- C4: 10nF
- C5: 100nF

**Semiconductors**
- TR1, TR2: BC183
- TR3, TR7 to TR13: BFY51
- TR4, TR14 to TR20: BD705
- TR5, TR6: BD135
- IC1: Zilog Z8681
- IC2: 74LS373
- IC3: 2716
- IC4: 4049
- IC5, IC6: 74LS07
- IC7: 74LS06
- D1, D2: 1N916
- D3 to D9: 1N4001

**Others**
- S1 to S4: SPST DIL switches
- S5: SPST momentary switch
- XL1: 7.3728 MHz crystal

**Power Supply**

**Capacitors**
- C1: 15000μF 16V
- C2: 4700μF 12V
- C3, C4: 10nF ceramic
- C5: 1000μF 12V

**Others**
- BR1, BR2: Bridge rectifier 2A
- S1: 1-pole mains switch
- X1: 7805 regulator
- T1: Transformer 240V AC
  - 9V secondaries

---

**Fig 4** Flowline of main polling routine
DOT MATRIX PRINTER

is normal due to the Z8's architecture. Confirm that there is a clock on Z8 pins 2 and 3 at 7.373MHz; note that it is this clock that also determines the baud rate (being set by the switches on port O). Confirm that the current drawn is less than 400mA from the 5V rail and less than 10mA from the 12V rail.

If the ASCII input is now pulled high the printer should operate — but print garbage. The reason for this is that the Z8 is looking for a start bit which it sees when the input goes high, although the character it reads in will be all '1's, which is invalid. If the testing so far is satisfactory then proceed as in the next paragraph.

Operation

On switch-on ensure that all the print needles are not energised — otherwise they may overheat and burn out. Ensure that the correct baud rate is selected, as follows:

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Input a 'CR' (Carriage Return) from an ASCII keyboard and ensure that the printer performs a linefeed and paperfeed and that the head positions itself at the beginning of the next line. Now input 22 characters and ensure that nothing happens until the last one is input, at which point the complete line should be printed and a 'CR' 'LF' (Line Feed) performed. Note that the print head is now positioned one position in from the edge of the paper when the next line is printed to indicate a continuation line. This does not happen if a 'CR' is received.

In the software described no facility is included for printing lower-case letters. However, this facility just involves adding them to the look-up table should they be required.

A sample print-out is shown below

```
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
```

A flowline diagram of the main polling routine is shown in Figure 4.

Conclusion

Although this project was initiated as a software exercise on the Z8 it has proved to be an immensely useful method of obtaining hard copy at very low cost. Further, the Z8 part of the printer can also be used for alternative applications when a printer is not required — the one in the Author's establishment being used as a darkroom computer.

Hopefully, the Z8 will find many other useful applications in the control environment, the application just described being a very simple one. GoOdPPrintTimGi!

---

JUNE 1984

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FRG7700 RX

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IC751 AF TX
IC745 HF TX
IC730 HF TX
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IC25E 2M H/H
IC20E 2M H/H
IC40E 70CM H/H
IC70R RX
IC417 RX

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This circuit is intended to provide a plug-in module that can replace a 2532 EPROM during the design stages of a ROM/EPROM. As the unit runs from the READ/WRITE line of the computer, correction of errors or re-programming is much faster and easier than with EPROMs.

The circuit
The unit, shown schematically in Figure 1, consists of a simple inverter (TR1) and two static RAMs (IC1,2). Address lines A0 to A16 and Data Bus lines D0 to D7 are common to both IC's. Address line A17 is used to switch between the two static RAMs, with the aid of the output enable (OE) and the inverter TR1.

Resistors R1-R3 hold the chip unselected and in the READ mode. This allows the unit to be unplugged without losing the data within. When powered down or removed from the computer, battery B1 provides power for data retention through D2. In addition, diode D1 provides a DC block when the computer is powered down. This is to prevent excessive load being taken from the battery by the rest of the circuit.

Battery life will be several days with a fully charged battery. The battery itself is charged through D1 and R4 all the time that the unit is in circuit. The approximate charge time is typically between 1 and 2 hours.

Construction and testing
Construction is fairly simple, but requires some dexterity. The board has to be small to fit in the space allowed by the average computer. Vero-board can be used but a PCB will give a neater result. Connect the headers on the solder side of the board, taking care to get the spacing between them correct.

Examine the board for short circuits and poor solder joints before plugging it in.

Once you are happy with the module, plug it into a 2532 EPROM socket on your computer. Connect the flying lead to the READ/WRITE line of the expansion bus connector.

The unit should now function as a 4K block of RAM at the address of the EPROM socket. Write a data pattern to the unit and read it back to check for READ/WRITE errors. Then turn the power to the computer off for a couple of minutes, then back on. The data written into the unit should still be present with no errors. This test will fail if the back-up battery has not been charged beforehand. Once programmed, the unit may be removed from the computer without loss of data.
FT203R YAESSU'S NEW COMPACT 2M HANDLE

The ultra compactness of the FT203R is due mainly to Yaessu's chip component circuit board assembly, the chip components being installed automatically by robots. The 203's features include thumbwheel frequency selection, built in S/P0 meter, 2.5W RF/IF at 10.8V, (3.5W O/P with FN84), Vox activated switching is possible when used in conjunction with YM-2. Accessories supplied include FB83, FTE-2 tone unit, CSC6 case and YH-1A4A antenna.

FT203R 2.5W transceiver £169.95 inc
FB83 Case for 6A4A cells £8.50 inc
FN84 12V Ni-cad pack £38.40 inc
CSC6 Tone unit (when FN84 is used) £59.50 inc
YM-2 Headset/Mic £13.90 inc
MH-122B Speaker Mic £16.95 inc
SMC8 9AA Charger (13A style) £8.05 inc
MMB21 Mobile mounting bracket £7.85 inc

FT726R MULTIMODE UHF, VHF, HF

FT726R (2) Transceiver c/w 2m £739.00 inc
21/24/28 6m module £200.00 inc
50/72 6m module £185.00 inc
430/726 70cm module £250.00 inc
SAT726 Full duplex module £95.00 inc
XF455MC 600Hz CW filter £39.85 inc

FM TRANSCEIVERS FOR MOBILE

FT230R 2m Transceiver 25w £259.00 inc
FT2730R 70cm Transceiver 10w £229.00 inc
FT2720R Transceiver 70cm 25w £209.00 inc
FT2720RU Transceiver 70cm 10w £199.00 inc

HANDHELD FOR 2m or 70cm

FT208R & FT708R

FT208R 2m Handheld 2.5W £199.00 inc
FT708R 70cm Handheld 1W £209.00 inc
SMC6-9AA (13A style) Hand charger £6.05 inc
NC7 Base charger £32.95 inc
NC8 Base quick charger + PSU £54.05 inc
PA3 Heavy duty case £25.30 inc
NC8C Slow charger £6.50 inc
FN82 Battery Pack £21.45 inc
FRA2 Battery pack sleeve £3.45 inc
FLC5 Heavy duty case £25.30 inc
MMB10 Mobile bracket £8.05 inc

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The next venture in amateur radio

In this article RJ Redding describes the reasons for radio amateur interest in high speed data transmission and explains the techniques that are involved.

One of the finest aspects and most absorbing interests of amateur radio, is the pioneering of new techniques. The terms of the transmitting licence puts this beyond dispute, and it has been a continuous process since the earliest days.

Scientists knew about radio waves for decades, before the cat’s whisker and home made coils of the hobbyist led to the growth of broadcasting.

Commercial pressures on the known wavelengths pushed amateurs into shorter and shorter ones, with the opening of the higher frequency bands and the pioneering of techniques such as single side band and the narrow band FM, to meet each restriction as it was encountered.

Once a public service is well established, as is the case now with sound and vision broadcasting, the opportunities for original experimentation become slim. However, new components and techniques open up fresh possibilities, and possibly this is now the case in the transmission of high speed data, because of the ubiquitous microprocessor.

Although the home computer is viewed with mixed feelings by radio amateurs, it is undoubtedly here to stay, and there is a communication problem. Continually buying programs on tape cassettes has disadvantages, and there are currently two novel alternatives. One is ‘Micronet’, which makes use of Prestel to download programs, and the other is ‘Basicode’, which has recently been broadcast by ‘The Chip Shop’ on Radio 4 with considerable impact.

These are concerned with computer programs which apply mainly to games. There is a much bigger and wider use for the same technology, namely INFORMATION EXCHANGE and also there is a need to operate in plain English text without the restrictions inherent in any program language.

Data transmission

Amateurs are well used to ‘data transmission’ even if they call it CW, RTTY, or Amtor. In all cases, the information is contained in a binary signal which has two states, or to put it more plainly, either it is there or not there. This is, perhaps, an exaggeration, for Morse is really three-state, but again the speed of transmission is limited because we need time to distinguish between the dots and dashes.

On the other hand, if we use electronic logic for translation, the limitation becomes the speed with which the data can be input and the rate at which it can be printed out. For mechanical teleprinters this sets the speed at 45 or 55 baud, or at the most 110 baud.

If, however, we go on to the microprocessor and electronic storage, we can prepare text in a memory and then proceed to dump it into a communication channel to be received into another memory and subsequently printed out when required. The limitation is now a matter of communication, and determined by the channel quality and the available bandwidth.

Table 1 indicates the order of speed capability of a telephone line or a speech radio channel. The transmission speed is measured in ‘baud’, which may be loosely translated as ‘bits per second’. It is perhaps more realistic to compare in terms of characters transmitted per second, because the number of bits varies from code to code.

RTTY tends to use a five bit code, whereas ASCII variously uses six, seven or eight with various ‘protocols’ and hence the apparent discrepancy between baud number and character rate.

To show what this means in practice, a

<table>
<thead>
<tr>
<th>TABLE 1: Capability of a Radio Channel</th>
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<tbody>
<tr>
<td>Information</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>Music (Stereo)</td>
</tr>
<tr>
<td>Broadcast (AM)</td>
</tr>
<tr>
<td>Mobile Speech</td>
</tr>
<tr>
<td>FSK Data</td>
</tr>
<tr>
<td>CW (Morse)</td>
</tr>
</tbody>
</table>

JUNE 1984
ten minute news bulletin of the type transmitted by RSGB would take 80 minutes to transmit by Morse, 10 minutes by RTTY, 3 minutes at 300 baud ASCII, and less than one minute at 1200 baud ASCII.

Speed and storage
One may argue that we cannot follow the sense much faster than speech, so what is the point of sending it any faster? The new and significant import is storage. We can compile a message or information at leisure, establish a link and at the appropriate moment, quickly dump it into the memory of another machine, from whence it can be utilised when required.

One does not have to listen or read through the entire bulletin to find an item; one can use the computer to search or scan whether there is anything on a particular topic of interest.

The next stage is, of course, to arrange to receive the news bulletin automatically – via a time switch and see if the latest is available, in case any of the information is required. Thus we always have the latest information, for example, about satellite predictions and band conditions.

Such facilities are the essence of commercial electronic mail and networking, in that one can send a message at an appropriate time to be collected and used or responded to when convenient. Anyone who has participated in the ‘telephone tango’ in attempting to fix a date with a number of individuals, will appreciate the value of such a system, which is, of course, extendable in all sorts of directions.

At the moment these techniques are mainly used on the telephone network, and are highly developed in the USA. The reason is probably because local calls in many areas are free, whereas the use of networks, even amateur club ones in the UK, can prove very expensive and this is where the radio amateur can use his abilities to his own advantage.

I believe we can take the apparatus and techniques which are used on telephone lines and use them to great advantage on amateur radio communication channels. The problems in some ways are simpler, because we are conditioned to simplex working as opposed to the duplex (both ways at once) operation, which is the norm in telephony.

To make the best use of this, I feel that we need to look very carefully at present day telephone practice and see how much we can leave out and how we can simplify the remainder to make it suitable for amateur radio use.

Let us first look at what has already been done with data to see how we may benefit from telephony-type practice.

Current practice in data transmission
Data transmission uses a ‘modem’ which is a shortened form of MODulator/DEModulator in which a tone is shifted, i.e. frequency-shift keyed (FSK) by a small amount to indicate binary ‘ones’ or ‘zeros’. Unfortunately, the various users have adopted different tones and degrees of shift as well as different speeds, and Table 2 approximates the spread of these.

This is far from absolute, because the American telephone systems differ from the rest of the world and the various cassette recording styles for home computers bear some similarity, but the number of different ‘standards’ nearly matches the number of machines.

Standards
It is hardly worth arguing the pros and cons for a further standard because of the versatility of electronics. It is possible to make one chip which will work on a large number of the ‘standards’, just as it is possible to write a computer program which will turn any dialogue of Basic into any other.

An ambitious project in a home computer club was well advanced in such a universal translation program when it was found highly desirable to play back a program on the same recorder on which it was made, to avoid the dissimilarity of individual magnetic heads. Perhaps the success and popularity of Basicode, as broadcast by Radio 4, is that point is automatically satisfied in the philosophy.

Sending programs over the air
On many occasions amateurs have transmitted programs to one another, but invariably this has been from one machine to another of exactly the same type. Thus there is little doubt about the feasibility of such transmission, even at comparatively high speeds like 1500 baud used on the Dragon.

However, I think there is great advantage in adapting strictly the tones and format of the standard used universally on telephone lines, namely the CCITT and using plain ASCII for the text. The reason for this is that anyone with data equipment for a telephone line or a Prestel system can, with a little

<table>
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<th>TABLE 2: FSK Tones Used by Various Systems</th>
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<tbody>
<tr>
<td><strong>System</strong></td>
</tr>
<tr>
<td>RTTY &amp; AMTOR</td>
</tr>
<tr>
<td>DUPLEX MODEM V21</td>
</tr>
<tr>
<td>DUPLEX MODEM</td>
</tr>
<tr>
<td>BELL-US</td>
</tr>
<tr>
<td>V23 MODEM</td>
</tr>
<tr>
<td>BELL-US</td>
</tr>
<tr>
<td>(Optional)</td>
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</tbody>
</table>

In suggesting this, I am in no way meaning to cast aspersions on existing RTTY and AMTOR practice, merely attempting to extend it. Indeed, many people who go for the high speed data will include the lower speed types because of their unique specialities. RTTY is an easy and cheap way of getting going with data and receiving commercial traffic, and AMTOR is a DX-form of it which has been well publicised recently. (March 1984 R&EW.)

It is supreme in what it was designed for, eg high accuracy, highly reliable transmission of message into the Telex-on-Radio (TOR) system which, because of its mechanical nature, is fairly slow.

In its amateur form, AMTOR, it requires an answering transmitter for each character and though the system has been developed into ‘forward error correction’ by doubling each transmission, it is hardly suitable for widespread broadcasting on channels that are available for news bulletins etc. It is limited to 110 baud, which is about one tenth of the speed at which a dot-matrix printer of computer practice can operate.

Tests
Again, this is a proposal on tests over a few months and open to modification in the light of experience. There will be mismatches and incompatibilities; for instance, most computers have some sort of interface, and one needs to unravel the mysteries of RS 232 or RS 423, although luckily most of it seems quite irrelevant for radio purposes.
THE TRIO-KENWOOD ‘TS-430S’ TRANSCEIVER

A comprehensive review of one of the latest ‘TS’ series of transceivers
by Anthony Stokes, G3ZRH

The TS-430S is a general coverage MW-SW transceiver introduced in the UK market during 1983 and performance of the set is substantially better than that of many earlier models.

The receiver has continuous coverage from 150kHz to 30MHz, and the transmitter operates on all of the amateur bands, although it can be made general coverage for non-amateur requirements.

The set is comparable with the Yaesu FT757 and Icom 751, although the latter is rather more expensive and does have some superior features. Weighing in at only 6.5kg it contains no valves in the PA or driver stages, and therefore requires only a single supply of 13V at 20amps. The voltage (in the range 12-16V) is not critical regarding performance. It is thus much more portable than similar valve transceivers. The block diagram is shown opposite.

Capabilities
As well as CW/SSB/AM, FM may be received across the frequency spectrum. The sharpness of the selectivity in the AM position is such that 'slope detection' of narrow band FM (NBFM) signals does not work well, and therefore the optional FM board is required for satisfactory FM working.

Even the addition of the YK88A AM filter does not appreciably help the demodulating signals in the 27MHz citizens band, although it may be possible to zero-boat the carrier in the receiver SSB position.

The frequency stability of this receiver is so good that one can listen to AM music broadcasts for long periods on either USB or LSB.

Although the main tuning is in 100Hz or 10Hz steps – by microphone control if desired – there is also a receiver independent tuning control for obtaining final precision. As well as two independent VFO circuits there are eight 'memory' channels that may be preset independently to any frequency and mode, sequentially scanned if so desired. Another scanning facility enables the receiver to scan continuously between two preset frequencies until a signal is received that is strong enough to break through the squelch if this is set; this is particularly useful on ten metres where, for example, 29.52-29.69MHz may be continuously scanned until the squelch lifts and shows when an NBFM station is present. The transceiver has split frequency capability and can even transmit and receive in different modes. This is useful on, say, top band where the transmitter might be on AM, but the receiver on SSB.

Performance
The selectivity of the receiver is very good, helped by the tunable IF shift control and the IF notch filter. This is ably demonstrated, for example, on long wave DX reception or on 75 metres where amateur stations must be separated from non-amateur signals. With the YK-88CN 270Hz filter it is pleasant to enjoy a major improvement on 7 or 14MHz CW in the separation of stations without the 'ringing' effect of older AF filters. Although the sharpness of the IF filters in the Icom 751 is appreciably better, the author is well satisfied with the TS-430S selectivity characteristics. Only the FM detector circuit could profitably be improved upon. The quoted -6dB bandwidth of 15KHz is really too broad for working on 29 or 27MHz where channel separation is typically 10KHz but this complaint applies to all the current generation of general coverage Japanese transceivers. The sensitivity is good, and the addition of an external preamplifier only improved the overall S/N ratio by around 3dB, although the 'S' meter responded better to weaker signals.

Whilst the RF attenuator switch is both simple and effective (if seldom needed), it is regrettable that the noise blanker is relatively ineffective. It does prove fairly effective against RFI, but little else, unlike the Yaesu and Icom noise blankers which are effective against a wide variety of QRM. It is hoped that the manufacturers might improve on this in future models.

The transmitter PA is well designed, and whilst the output circuit is fixed at about 500mA impedance, a standing wave ratio detector circuit ensures that power input to the PA is steadily reduced in response to a rise in SWR. Additionally there is a fan which switches on when the PA heatsink becomes warm and if there is excessive heat generated the transmitter switches itself off until safe operating conditions are resumed.

There appears to be adequate sensitivity in the microphone preamplifier and audio processor circuits, and the Vox or Morse key adjustable delay transmit-receive switching is fast enough, even for contest operation. Rear panel connections are provided for VHF transverter, linear amplifier, external speaker, Morse key etc. The output from the external speaker socket may conveniently be taken to the input of an RTTY decoder, so that headphones need not be unplugged from the front panel when operating in the 'teleprinter' mode.

Conclusions
Being only 10.6 x 10.1 x 3.8 inches the set provides a performance equal to or much better than many older sets of substantially greater dimensions. The maximum legally permitted CW power of 100W output is readily obtained on all bands 3.5-29MHz, but on AM it is recommended that 30W is not exceeded if modulation characteristics are to remain good, and on FM the driver AGC is set to obtain a 40W output. On SSB, more than 250W PEP input is possible.

The receiver is relatively immune to signal breakthrough but some weak spurious responses are occasionally perceptible, but scarcely at a level to cause any bother, and certainly far below those of many current-production, transistorised, general coverage receivers. In addition to the main tuning knob there are push switches for changing the frequency in 1MHz steps, or in larger steps from one amateur band to another and the frequency is displayed to the nearest 10 or 100Hz.

The set can be thoroughly recommended where one does not wish to incur a larger outlay such as that required for an Icom 751 and is, on the whole, good value for money.
There are 20, 30 and 40 litre designs using the famous Peerless Polypropylene bass units (newly released to the DIY market), a 7 litre mini speaker and two designs specifically intended for use with digital systems. The Wilsom Audio Total kits include all cabinet components, accurately machined from MDF board drive units, crossover kits, wadding, grille fabric, terminals, nuts, bolts, etc. Full details are in the Peerless Manual for Loudspeaker Constructors which is available F.O.C. (send 12" x 9" SAE).

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<th>Pre Amplifier</th>
<th>POWER REQUIREMENTS</th>
<th>RF * VOX</th>
<th>PRICE INC VAT</th>
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<td>30W</td>
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<td>MML144/100-S L S</td>
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<td>MML144/100-S S</td>
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<td></td>
<td>13.8V ~ 12A</td>
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<td>3, 10 or 25W</td>
<td>300W</td>
<td></td>
<td>13.8V ~ 14A</td>
<td>13.8V ~ 14A</td>
<td></td>
<td>£245 (p&amp;p £4.50)</td>
</tr>
</tbody>
</table>

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JUNE 1984
During spring and early summer last year, a group of other radio amateurs and myself, in the Norwich area, carried out data transmission experiments using ZX Spectrum computers and 2m VHF FM transceivers on a frequency of 144.7625 MHz.

The interface between the computer and the transceiver is a fairly simple matter. One has been designed and built by Paul G4VLS (ex G6LUN), a member of the group, who supplied several to other members.

However, to get started, a simple interface can be made by connecting the extension loudspeaker socket to the earphone socket on the computer for 'receive' and connecting a spare transceiver microphone socket to the microphone socket on the computer for 'transmit'. An additional pair of leads is connected to an on/off switch to key the transmitter.

The internal loudspeaker connections of most transceivers are disconnected when an extension loudspeaker is plugged in, thus an indication that the station is going to transmit data and this will alert receiving stations to connect their transceivers.

**Performance**

The group started with limited programming knowledge, and during our data transmission periods, we were all able to pass on hints, tips, information and ideas to assist each other in learning 'Basic'. We started by transmitting simple programs from magazines or books and progressing to longer programs and 'Screen$' pictures. In general we had a fair amount of success, varying from 95% to 55% throughout the group, depending on factors that we previously agreed. These were listed during our many discussion sessions after each 'data transmission' period and are as follows:-

1. Transmit/receive frequency alignment of the different transceivers in the group.
2. Correct deviation at the 'transmitting' station.
3. The quality of recovered audio at the 'receive' station, eg freedom from distortion and noise.
4. Extent of multipath reception and general man-made interference between the stations in the group.
5. Duration of the data transmission.
6. Power output of the 'transmitting' station.

It might come as a surprise to readers that 'Power output' is number 6, however the group found that received data transmission at a signal strength of about 51, could be successfully received, provided that the first five items on our list were maintained within close limits.

With regard to number 5 of the list, the group found that whilst short programs could usually be transmitted, the longer programs, which contain 'Screen$' and machine code segments, quite often failed. This was due to one or more factors on the 'list' and some members found this discouraging at first. We were all fairly pleased with the results after successive attempts.

**The program**

Our experiences will enable others to understand some of the problems concerning data transmission and I have produced a program that is of professional quality and easy to use for any data transmission application, whether it is for amateur or private mobile radio use.

My first objective was to determine what the program should be able to achieve, keeping it easy to use, reliable and well presented. Then I planned the
SOFTWARE PROGRAM FOR THE ZX SPECTRUM

ASCII Data Listing.

40 CLEAR 28999
42 FOR i=29001 TO 29824
44 READ a: POKE i,a: NEXT i
45 STOP

50 DATA 22,9,0,49,46,32,80,114,101,112,97,114,101,32,109,101,115,15,97,103,101,13,13,50,46,32,68,105,105,115,112,108,97,121,32,39,117,114,
114,101,110,116,32,109,101,115,115,97,103,101,13,13,51,46,32,68,105,
115,115,121,13,32,13,13,52,46,32,83,97,118,101,32,109

115,115,121,13,32,13,13,52,46,32,83,97,118,101,32,109

56 DATA 65,71,69,32,84,79,32,84,65,69,22,21,21,11,69,83,83,78,65,71,69,32,22,21,1,80,82,69,83,83,32,69,78,84,69,82,32,84,79,32,82,69,84,85,
82,78,82,84,79,32,77,69,78,85,32,12,1,10,69,78,84,69,82,32,77,69,83,
83,65,71,69,32,22,1,5,68,73,83,80,76,65,69,32,83,84,79,82,69,84,32,78,

60 DATA 65,71,69,32,84,79,32,84,65,69,22,21,21,11,69,83,83,78,65,71,69,32,22,21,1,80,82,69,83,83,32,69,78,84,69,82,32,84,79,32,82,69,84,85,
82,78,82,84,79,32,77,69,78,85,32,12,1,10,69,78,84,69,82,32,77,69,83,
83,65,71,69,32,22,1,5,68,73,83,80,76,65,69,32,83,84,79,82,69,84,32,78,
77,89,83,83,65,71,69,32,22,3,4,70,79,76,76,97,87,32,84,72,69,83,69,32,
73,78,83,84,82,85

58 DATA 65,71,69,32,84,79,32,84,65,69,22,21,21,11,69,83,83,78,65,71,69,32,22,21,1,80,82,69,83,83,32,69,78,84,69,82,32,84,79,32,82,69,84,85,
82,78,82,84,79,32,77,69,78,85,32,12,1,10,69,78,84,69,82,32,77,69,83,
83,65,71,69,32,22,1,5,68,73,83,80,76,65,69,32,83,84,79,82,69,84,32,78,
77,89,83,83,65,71,69,32,22,3,4,70,79,76,76,97,87,32,84,72,69,83,69,32,
73,78,83,84,82,85

81 CLEAR 15073
83 CLEAR 17968

*** NOTE: WHEN ALL DATA ENTERED AND PROGRAM RUN WITHOUT ERROR - DELETE LINES 42 TO 68 ***

displays and layouts of the parts of the program. My first version was written in Basic, but although this was adequate, I was not satisfied with the operating speed, so I decided to write the program in machine code. The input statement was retained in Basic.

The program is written in three parts and should be entered in the following order:

1. ASCII Data Listing: The very long data list contains all the screen printed items and control characters from ASCII code in a decimal format. The listing is essential for the correct display operation of the program and will need to be entered very carefully.

2. Machine Code Listing: This listing is the brain of the program and includes the Hex code, Mnemonics and, as necessary, decimal coding. This Listing is not relocatable and should be assembled with any good assembler. I used UV 4BK from ACS, which I find very good.

3. Basic Program Listing: This short Basic Listing is for inputting your information and interfacing the machine code routines.

Message preparation.
The program has been written for either a 16K or 48K Spectrum in the same memory locations. It is Menu driven and, apart from a few notes to help the reader understand how to use it, should be self-explanatory. This is the Menu:

1. Prepare Message
2. Display Current Message
3. Display Stored Message
4. Save Message to Tape
5. Transmit
6. Receive

To prepare a message select (1) and print out the first line of your message, followed by 'Enter' and continue until the last line is on the display, then press 'Enter' by itself. After a short delay the screen will clear and the menu will return.

To save message to tape, select (4) and when you have the tape ready press 'Enter' and your message will be written onto tape without a header.

To transmit, select (5) and follow instructions given. It is interesting to note that a complete 'screen' of informa-
SOFTWARE PROGRAM FOR ZX SPECTRUM

Machine Code Listings

<table>
<thead>
<tr>
<th>Org 2925;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
</tr>
<tr>
<td>Main</td>
</tr>
<tr>
<td>End</td>
</tr>
<tr>
<td>Menu</td>
</tr>
<tr>
<td>Choice</td>
</tr>
<tr>
<td>Display</td>
</tr>
<tr>
<td>Prepare</td>
</tr>
<tr>
<td>Load</td>
</tr>
<tr>
<td>Save</td>
</tr>
<tr>
<td>Transmit</td>
</tr>
<tr>
<td>Receive</td>
</tr>
<tr>
<td>Write</td>
</tr>
<tr>
<td>Read</td>
</tr>
<tr>
<td>Loop</td>
</tr>
</tbody>
</table>

In conclusion

It is hoped that this article and program Pwill be of interest to many readers of R & E W and that it will encourage more amateurs to experiment with 'data transmission'. Any reader who has any difficulty in entering the program, can obtain a copy on tape from me at the following address:- Mike Collins, 5 Stafford Ave, Costessey, Norwich, Norfolk NR5 0OF, or telephone 0603 666260 during working hours.

Acknowledgements

I would like to express gratitude to the members of the group, G4VRX (ex G6JOO) Dave, G4VLS (ex G6LUN) Paul, G4OLP Richard, G4GIE John and G4MRN Mich who took part in the experiments and provided the results which promoted the idea of this program.

I would also like to thank Dr I Logan whose books were used to teach myself Machine Code. Mr P Lyons (National Field Manager of Aircall PLC) and G6PAM Derek who both persuaded me to prepare the article for publication.

June 1984

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It is now eighteen months or more since the ‘new bands’ became available for amateur use. The 10MHz allocation of 10100-10150 KHz became available on 1st January 1982, whilst allocations in the 18 MHz and 24 MHz – 18068-18168 KHz and 24890-24990 KHz – became available on 1st October 1982.

Activity on these bands has been increasing quite noticeably in recent months, particularly on 10MHz where some amateur station activity can be found at most times. Activity on 18MHz can best be described as ‘sparse’, whilst on 24MHz very little in the way of reports of activity has been seen.

Writing about these new allocations, Richard Baldwin in the IARU news feature in the January 1984 issue of QST, reminds readers of how close to failure the request for these frequency allocations came, when they were discussed at the World Administrative Radio Conference in Geneva in 1979. Not all countries at this Conference were in agreement with the proposals, by any means. However, the day was won, and these allocations went through. It was agreed that these bands, ‘will remain allocated to the fixed and land mobile service until amateur primary status is achieved, not later than 1st July 1989.’

In view of the limited width of ‘new’ bands and in order not to cause interference to the primary user by others it was agreed that fairly severe restrictions should be applied, particularly on 10MHz. Because of the anticipated popularity of this band, vis-a-vis the other two, use was to be restricted to CW and RTTY. Contests would not be sponsored on these bands nor would contacts be credited for awards.

Do these voluntary, mutually agreed restrictions please everyone, asks Richard Baldwin? No, naturally they do not! There is considerable pressure being brought to permit SSB and the crediting of DX contacts for the DXCC award.

But, says Richard, ‘sometime in the near future another General World Administrative Radio Conference will occur and the ITU will be taking another look at the allocation table. One of IARU’s goals will then be to try and get expanded privileges for 10MHz. We will be in a better position to achieve these if we have done nothing to violate the terms under which we now occupy these bands, ie, we remember we are there on a secondary basis and that we do not cause interference to primary users’.

The 10MHz beacon at Norden, Germany, on 10144KHz is still functioning well, and is a good indicator of conditions on this band. It is installed at NORDEICH RADIO, one of the German Coastal stations. Its callsign is DK0WCY – see these notes for October 1983.

‘New look’ newsletter
The British Amateur Radio Teleprinter Group has just up-dated its Newsletter. It has a new name ‘Datacom’, and a new look. As their editor, Ian Wade, G3NRW, says, ‘The new name was chosen because we felt that a professionally printed magazine with more than 100 pages was hardly a newsletter any more and we also needed a name which would roll off the tongue more easily and would tell the world that BARTG is about data communications. Hence the name ‘Datacom’. Ian goes on to say: ‘Data communica-


AMATEUR RADIO WORLD

Simulating the imagination of many computer communications in many different forms, Packet Radio and developments like digital repeaters stimulating the imagination of many BARTG members.

The first issue of Datacom is a truly fine effort, and does great credit to Ian Wade as its editor. It is to be published quarterly, and should attract many more members to BARTG.

UOSAT 2

Can you imagine the disappointment which must have fallen upon the UOSAT 2 team? After a mammoth effort to build the satellite, the team met a launch date opportunity, a faultless launch and two orbits in which perfect, strong, telemetry signals were received, they suddenly ceased on the third orbit. UOSAT was over the Pacific Ocean at the time and no obvious reason for the failure has become apparent. Since then, 'deathsly silence'! There have been some reports that signals have been heard, but so far no telemetry has been recorded and the cause of the trouble cannot therefore be determined.

It looks as though another effort, similar to that needed to get UOSAT 1 off the ground, and its launches will be needed to 'bring the bird back to life.' All we can do at the moment, is to wish Martin and his team success and to express to them our sympathy in their dilemma.

Dr Martin Sweeting spent several days at the end of March at Jedrell Bank Radio Telescope using the 85 foot antenna to see if signals from UOSAT 2 could be picked up. The 85 foot antenna with a cross-dipole feed on 145 MHz was used both within a narrow 2.5 KHz bandwidth and with a wider bandwidth of +100 KHz.

The receiver and the antenna was first checked out using UOSAT 1 and with radio noise from the sun and the star Cassiopeia. With these test sources, everything worked well. The UOSAT signal peaked to +75dB above the minimum discernable signal level and provided the best UOSAT telemetry data the team had ever heard! So if UOSAT 2 was still radiating even the weakest of beacon signals, it should have been audible. OSCAR 10 was also tracked and signals from 42,000 km right out at apogee from the 145.810MHz beacon were 55dB above noise.

UOSAT 2 was tracked on evening and morning passes but nothing could be detected that could be reliably ascribed to UOSAT 2. So it looks as though it's 'back to the drawing board,' to try to come up with something else to explain UOSAT 2's demise!

Top of the class

Norfolk radio amateur Martyn Jordan was recently presented with a bronze medal for having the highest marks in the country in the City and Guilds Radio Amateurs examination. He lives at Edgefield, Lyng. Aged 34, Mr Jordan is a Norwich fireman. He chose down to the hard work of his tutor at the Fenstanton Adult Education Centre, Mr Roger Rayner. He first became interested in radio during his schooldays at the Alderman Jex School, Norwich, which has a shortwave radio receiver. His call is G4VAO. He is a member of the Firefighters Net, an international radio club for firemen. Eight thousand students passed the test.

Chinese Amateur Radio Society

Amateur Radio is once again active in China. The Chinese Radio Sports Association has recently applied for membership of IARU.

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* Full instructions, parts list, circuit etc.

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This kit is being included in the May issue of 'Shortwave Magazine' by G3RW. The article says a lot more than we can in this space. Suffice to say these are very good designs and experienced constructors.

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* 12 Volt operation
* Output into an 8 ohm 'speaker' or 'phones'.
* Only one adjustment to make to align the module.
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* Balanced FET mixer, FET VFO.

The unit only requires a couple of 50pF tuning capacitors by way of external components to function perfectly.

K1 C13-95, assembled PCB module (aligned) £18-90

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K1 C18-90, assembled PCB module £22-90.

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PA2/30 K1 £22-90, assembled PCB module £26-90.

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K1 £9-90, assembled PCB module £11-90. (includes a switched bias output on TX and provision for a TX indicator).

XM1 CRYSTAL CONTROLLED FREQUENCY MARKER

A really useful piece of test equipment, besides helping you meet Amateur licence frequency measurement requirements. Out kit has a built in voltage stabiliser to maintain accuracy 12 Volt operation, onboard voltage regulator.

The XM1 provides marker outputs at 1MHz, 100kHz, 25kHz and 10kHz, these are usable up to 70cm, unlike some CMOS designs. The XM1 has a pulsed ident facility for distinguishing markers from off-air signals on crowded bands. This facility is very useful, and much preferable to tone modulated markers, whose bandwidth becomes larger as frequency increases. If you are going to invest in a piece of test equipment, it pays to go for a good quality design, this XM1 provides.

K1 £15-90, assembled PCB module £19-90.

ST2 CW SIDE-TONE UNIT or PRACTICE OSCILLATOR

The ST2 provides a nice sounding sinewave note, either from your key or from the output of your TX by RF sensing. This design should not be confused with cheap and nasty squarewave circuits so common in horrible sounding practice units. A side-tone, or a practice oscillator should sound like a good off-air signal received on a quality set. Output is up to approx. 1W at 800kHz, a volume control is included.

K1 £5-20, assembled PCB module £9-50.

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Introduction
Each channel of a modern stereo 'hi-fi' audio system can be represented by a number of inter-connected blocks, as indicated in Figure 1. Here, input signals from either a radio tuner, a tape (cassette) deck, or a phono pre-amplifier are selected via SW1 and then fed to the input of a power amplifier stage via a tone-control system and a volume control. In practice, the tone control system may include refinements such as 'scratch' and 'rumble' filters, etc.

Typically, the tone-control system needs to be driven by input signals with mean amplitudes of tens or hundreds of millivolts. Signals of suitable amplitude are usually available directly from the output of a tape or tuner unit, but not directly from the output of a magnetic phono pick-up. In the latter case, therefore, the phono signal must be passed to the tone-control input via a suitable pre-amplifier stage, as indicated in the diagram.

Several manufacturers produce dedicated ICs specifically intended for use in audio pre-amplifier and tone-control applications. These devices are designed to give excellent power-supply ripple rejection, low signal distortion a wide bandwidth, and a very low noise figure.

Among the best-known of such devices are the LM381/LM382/LM387 range of dual audio pre-amplifier ICs, available from National Semiconductors.

LM381/LM382/LM387 ICs
National Semiconductors produce a range of five low-noise dual pre-amp ICs, these being the LM381 and LM381A, the LM382, and the LM387 and LM387A: the 'A' suffix devices are simply premium versions of their type, with superior low-noise figures. Figures 2 to 4 show the outlines of each of these ICs, together with the actual circuit of one of the identical pair of amplifiers housed in

Figure 1 Block diagram of one channel of a 'hi-fi' system

Figure 2 Circuit of the LM381/LM381A dual low-noise preamplifier

Figure 3 Circuit of the LM382 dual low-noise preamplifier
in each package, and Figure 5 gives a summary of their performances.

All five of these ICs are designed to operate from single-ended power supplies. They all use the same BASIC amplifier circuitry, but differ in minor internal details and in their pin-outs. They incorporate internal compensation and comprehensive power supply decoupler, regulator circuitry, and can give large output voltage swings and a wide power bandwidth. The various ICs differ in the following respects.

The LM381 and LM381A have provision for externally optimising their noise figures and for adding external compensation (for narrow-band or low-gain applications). These ICs are normally used in the differential input configuration, but can be used in the 'single ended' input mode in ultra-low-noise applications.

The LM382 has no provision for adding external compensation or for operation in the single-ended input configuration, but has a built-in resistor matrix that enables the user to select a variety of closed-loop gain options and frequency-response characteristics.

Finally, the LM387 and LM387A are 'utility' versions of the LM381/LM381A, with only the input and output terminals of each amplifier externally accessible, and with no provision for external frequency compensation or single-ended input operation.

**LM381/LM381A basics**

It has already been stated that the National Semiconductors range of five preamp ICs all use the same basic internal circuitry, but differ in minor details.

The operation of the entire range of devices can thus be understood by taking a close look at the circuitry of the LM381/LM381A shown in Figure 2. This circuit in fact comprises four major sections, these being a 1st-stage amplifier (Q1-Q2), a 2nd stage amplifier (Q3 to Q6), an output stage (Q7 to Q10), and a biasing network (Q11 to Q15). Figure 6 shows a simplified 'equivalent' circuit of a complete pre-amplifier, showing its four major sections.

The Q1-Q2 1st-stage input amplifier of the IC is powered via the internal biasing network, and has a biasing potential of 1.2V permanently applied to Q1 base via a 250k series resistor. This 1st-stage can be operated as either a differential or a single-ended amplifier (a differential stage generates 41% more noise than a single-ended stage).

When used in the differential mode, the Q1-Q2 amplifier must be 'balanced' by feeding 1.2V to Q2 base via an external biasing network connected as shown. When used in the ultra-low-noise single-ended mode, Q2 must be turned off by grounding its base, and Q1 must be 'balanced' by feeding 0.6V to Q2 emitter via the external biasing network. This 1st-stage amplifier gives a voltage gain of x80 when used in the differential mode, or x160 in the single-ended mode.

<table>
<thead>
<tr>
<th>V Supply</th>
<th>LM381</th>
<th>LM381A</th>
<th>LM382</th>
<th>LM387</th>
<th>LM387A</th>
</tr>
</thead>
<tbody>
<tr>
<td>9V - 40V</td>
<td>10mA</td>
<td>10mA</td>
<td>10mA</td>
<td>10mA</td>
<td>10mA</td>
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<td>Equivalent noise input Typ</td>
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<td>Figure, μV RMS Max</td>
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<td>1.2</td>
<td>0.9</td>
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</table>

**Fig 5.** Performance characteristics of the five dual pre-amplifier ICs.
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The 2nd-stage amplifier comprises common emitter stage Q5 (with constant-current load Q6), which is driven from the output of Q1 via Darlington emitter follower Q3-Q4. This 2nd-stage amplifier gives an overall voltage gain of about 2000, and is internally compensated via C1 to give unity gain at 15MHz. This compensation provides stability at closed-loop gains of x10 or greater. At lower gains, an external capacitor can be wired in parallel with C1 to provide suitable compensation.

The output stage of the amplifier comprises Darlington emitter follower Q8-Q9, which is provided with an active current sink via Q7. Transistor Q10 provides short-circuit protection by limiting the output current to 12mA.

The biasing network of the amplifier is designed to give a very high supply-signal rejection ratio (120dB), and consists essentially of very-high-impedance constant-current generator Q11-Q12-Q13, which is used to generate a ripple-free reference voltage across ZD2. This reference voltage is then used to power the first two stages of the amplifier via Q14 and Q15, and to provide internal biasing to Q1 base.

**Differential operation**

The LM381 or LM381A IC can be operated in either the differential-input or the single-ended-input modes. Differential-input operation is suitable for use in all general-purpose applications in which a 'good' low-noise performance is required. Single-ended-input operation is recommended for use only in applications where an ultra-low-noise performance is needed.

To use a LM381 or LM381A pre-amp in the differential-input mode, the IC must first be biased so that its output takes up a positive quiescent value that is independent of variations in supply voltage, and this can be achieved by connecting potential-divider R1-R2 between the output and the non-inverting input of the IC as shown in Figure 6, thus forming a dc negative-feedback loop. The inverting input terminal of the IC (Q1 base, in Figure 7) is internally biased at roughly 1V2 above zero: consequently, when R1 and R2 are connected as shown in Figure 7, dc negative feedback causes the non-inverting input terminal to take up a value equal to that of the inverting terminal (1V2). The amplifier output therefore attains a dc value of 1V2 x (R1+R2)/R2, and can be set at any desired value by suitable choice of R1/R2 ratio. In practice, R2 should have a value less than 250K.

The Figure 7 circuit can be made to act as a non-inverting ac-amplifier by simply ac-coupling the input signal to the non-inverting input terminal of the amplifier. In this configuration the circuit has an input impedance of about 250K: input signals must be limited to 300 mV rms maximum, to avoid excessive distortion.

The dc voltage gain of the above
The noise generation of 01 varies with thus causing the emitter and collector above their normal values of about 15uA. In practice, however, it can be shown that the noise generation of 01 varies with collector current density, and is mini-

Suitable dc-biasing can be obtained by connecting potential divider R1-R2 as shown, so that roughly 600mV is developed across R2 when the IC output is at the desired dc-voltage level. Thus, if a quiescent output of +12V is needed, R1 and R2 must give a dc-voltage gain of x20. R2 can, if desired, be shunted by R3-C1, to give an ac-voltage gain that is greater than the dc value.

Note in the above biasing circuit that R2 is in fact wired in parallel with the internal 10K emitter resistor of Q1, and thus causes the emitter and collector 'current density levels' of Q1 to increase above their normal values of about 15uA. In practice, however, it can be shown that the noise generation of Q1 varies with collector current density, and is mini-

**Figure 11** Low-distortion (<05) x10 inverting amplifier

**Figure 12** 4-input unity-gain audio mixer

**Figure 13** LM381A with external components for single-ended varied-current-density operation

**Figure 14** Ultra-low-noise x1000 pre-amplifier

**Figure 15** Ultra-low-noise magnetic phono pre-amp with RIAA equalisation
mum at a density of about 170μA. Consequently, the circuit generates minimum noise when R2 has a value of about 1kΩ. To prevent Q1 collector from saturating at this current level, the internal 200kΩ collector resistor of Q1 must be by-passed and the major part of the current provided via external load resistors R4-R5, which are decoupled via C2.

The Figure 13 'single-ended' circuit is intended for use as a non-inverting amplifier only, and has a typical input impedance of about 10kΩ. Ideally, input signals to the circuit should have source impedances below 2kΩ, and all resistors should be low-noise metal-film types. Figures 14 and 15 show a pair of practical versions of the ultra-low-noise circuit. Figure 14 is a x1000 amplifier, and Figure 15 is a magnetic-phono' pre-amplifier with RIAA equalisation. In both cases, RV1 is used to set the dc output voltage at half-supply value. In Figure 14, C3 is used to limit the upper 3dB point of the frequency curve to 10kHz.

**LM382 circuits**

The internal circuitry of each half of the LM382 is identical to that of the LM381, except that the addition of a 5-resistor matrix and the elimination of certain terminals means that this IC cannot be used in the 'single-ended' input mode and has no facility for external compensation, but the addition of the resistor matrix means that bias- and filter-network design can be greatly simplified. It should be noted that this matrix is specifically intended for use in applications in which the IC is powered from a 12V supply.

Figures 16 to 19 show various ways of using the LM382 with a 12V supply. Figure 16 shows how to use the IC as a non-inverting amplifier with an ac-gain of 40, 55 or 80dB. Figure 17 shows the circuit of an inverting amplifier with a gain of 40dB, and Figure 18 shows a unity-gain inverting amplifier. Finally, Figure 19 shows a phono' pre-amp with RIAA equalisation.

**LM387 circuits**

The internal circuitry of each half of the LM387/387A is identical to that of the LM381, except for the elimination of certain terminal connections. The elimination of these terminals means that the IC can only be used in the 'differential' input mode, without external compensation. The IC is, nevertheless, quite versatile, and Figures 20 to 26 show some practical applications of the LM387 (or LM387A) IC.

Figure 20 shows how to connect the IC as a non-inverting amplifier with an ac-gain of 52dB. The dc-gain (and thus the quiescent output voltage) is determined by R1 and R2, and the ac-gain is determined by R1 and R3. Figure 21 shows how to modify the circuit for use as a phone pre-amp with RIAA equalisation, and Figure 22 shows how to modify it for use as a NAB tape playback amplifier.

Figures 23 to 26 show various ways of...
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In this article we've looked at various circuits based on the LM381/LM382/LM387 range of ICs. These ICs are, however, high-gain, wide-band devices, and in practice, some care must consequently be taken in the construction of these circuits if they are to work correctly. The two most-frequently encountered problems are those of RF-instability, and RF 'pick-up'.

The RF-instability problem is usually caused by inadequate high-frequency power supply decoupling: note that in all pre-amp circuits the power supply to the IC must be RF-decoupled by wiring a 100n ceramic or 1n0 tantalum capacitor directly across the power supply pins of the IC.

The RF 'pick-up' problem manifests itself in the pick-up and demodulation of AM broadcast signals. This problem can usually be eliminated by wiring a 10uH RF choke in series with the IC input terminal, and perhaps by also decoupling the input terminal (or terminals) with a low-value capacitor, as shown in Figure 27.

Usage hints

Figure 22 LM387 tape playback amplifier (NAB)

Figure 23 LM387 active tone-control circuit

Figure 24 Rumble filter

Figure 25 Scratch filter

Figure 26 Speech (300Hz – 3 KHz) filter

Figure 27 RF pick-up elimination circuitry

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<td>MC2</td>
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NOTES FROM THE PAST

Comments on the world of radio
originally written 25 years ago

This veteran can recall the days in the early 1920’s, when mains electricity was not widely available when it did arrive it was by means of rather unsightly wooden poles and overhead wires.

Another Old Timer, ET, has written: ‘Since last year I have retired down here in remote North Cornwall where we are still without electricity supply. It’s almost like the good old days, except that modern dry batteries are reasonably reliable and present-day valves are economical in their current demands.’

Ninety-five per cent of the real Old Timers will well remember being without mains. They were still a great rarity in private houses at the conclusion of World War 1 – and for a good few years after.

We had only bright emitters taking 4 or 6 volts at not less than one amp apiece, and you can guess what they did to the clumsy and crude accumulators of that period. It was not the chief worry that they lasted only one evening or so between charging.

Few and far

The worst problem was hauling them to the nearest charging station, and these were few and far between.

Some of the more enterprising motor garages had a ‘Charging Board’, and it made a real hole in my limited pocket-money – which I found equally as hurtful as having to haul the darn things backwards and forwards.

Radio enthusiasts were easily identifiable by the acid burns on their jackets and, indeed, when one went to visit friends one invariably looked around to see how many more holes had been burned in their living-room carpet. Distracted housewives spent much time and ingenuity searching out matching rugs, etc, to cover the gaping scars.

For myself, I had to haul my batteries nearly a mile to get them recharged and, although still only a schoolboy, the waste of time and energy irked me sorely. The avoidance of tiresome jobs always stimulates my imagination, so I invented what was many years later to re-appear as the wheeled shopping-stick. This consisted of a stout walking cane, two 6in pram wheels and a box platform designed to keep the battery upright when held at the transit angle. Perhaps in those more leisurely days most groceries, etc, were delivered. Anyway, nobody copied my ‘invention’ for shopping purposes.

However, twenty-five years later, when I came back from World War II and everyone had to fetch and carry, I found half the housewives in the country busily tripping each other up with their wheeled shopping-sticks.

Down our way

Eventually the electric mains came right to the end of the road in the select South London suburb in which we then lived, a real off, too, 200 volts AC. Adjacent districts which had been wired some years earlier were of supposedly ‘safe’ voltages of 35 or 50 volts DC or some other queer figure. I was so excited that I shot round to the Electric Company’s office without even asking my parent’s permission. Yes, they would bring it to our front door for a mere £35, after which we would have to get an approved contractor to wire the house. I used all my schoolboy eloquence on Dad and Mum to take advantage of this modern blessing. I even argued that we should not wait for the neighbours to have it first. Let the Jones’s keep up with us! Whether that argument carried any weight I don’t know, but at last Dad decided to have it laid on to the ground floor only, ‘to start with’.

While no one had yet seriously considered mains-operated sets I had long since dreamed of battery charging; and to my joy, in addition to having it installed on the ground floor, we also had a lightning point put in our rather large cellar. There were, of course, no metal rectifiers available at that time and as the mains were AC, I got busy collecting jam jars, chemicals and bits of metal to try my hand at chemical charging. I couldn’t find out much about it, and it seemed that nobody else knew much either, but such minor considerations did not deter me. I had everything two or three days later in readiness, and the big moment to switch on arrived. No explosions – just a few gentle bubbles, and off I went to school.

Now, I had never known Mother to go in that cellar before, but for some extraordinary reason she decided to go down there that very morning. She was horror-stricken at the sight of my jam jars bubbling away merrily. Indeed, according to her version they were boiling and seething like a witch’s cauldron, and she was convinced the house would be going sky-high at any moment.

She rushed off the fetch Dad, and by the time she got there she also claimed she saw sparks dancing up and down the wires. So convincing was her story that apparently he dared not go too near it, and finally contented himself with switching off at the mains.

Of course, there was a terrible row and I was forbidden to carry out any more experiments with chemical charging, hence I have had less experience of this than any other branch of old-time radio activity. I might add that I spent several more years trundling my wheeled stick backwards and forwards an extremely humilitating experience for a bright, proud youth whose family actually had their own electricity supply right to the house!

Two-way traffic

It is curious how slowly wrong ideas die. Years ago there was a belief that crystal sets gave a ‘purer’ tone than valve sets. I suppose it was the association of ideas. A crystal set must obviously be crystal clear! There are still many people who believe that the two aerial sockets at the back of their TV receivers are one for the picture and the other for the sound. To one such believer who I met this week I remarked it was amazing that the signals knew which hole to go in! At first he agreed that it was quite as remarkable as TV itself, but after a little reflection he said he thought it was probable that something inside the set ‘draws’ the respective signals into the appropriate holes. Which only goes to show that you can think of an explanation for anything if you ponder on it long enough. However, it is better to get to the truth of the matter and the radio amateur is well served in this by membership of the Radio Society of Great Britain (RSGB).

RSGB

The following short comment on support for the Radio Society of Great Britain is as apt today as when it was written twenty-five years ago. This is essentially a democratic body and is, in its major principles, truly representative of a world-wide movement. It has much good service to the hobby both at home and in Europe to its credit. The youthful amateur to-day has a lot to thank it for, and he should do everything in his power to strengthen its position. The Society represents his sheet-anchor in the maintenance of national goodwill, and may yet be his sole safeguard against possible future curtailment of his privileges by an autocratic officialdom.
MC1648 (SL1648)
Voltage Controlled Oscillator

The term 'VCO' is in fact a small misnomer, since the MC1648 is only the active part of the circuit - the tank coil and the tuning varactor are outside, and can be user-designed to operate anywhere in the range from virtually DC to 150MHz.

Why this instead of a familiar one transistor oscillator? The answer is simple - the tank circuit is essentially a two-terminal circuit, with the minimum of circuit strays, enabling the maximum possible tuning range to be achieved.

Q6 and Q7 form a positive feedback pair like many now found in one-chip AM radio ICs, with AGC in a feedback loop to provide a stable output level and obtain maximum frequency response. Q4 isolates the oscillator pair from the loading effects of the output driver stage and to feed the AGC stage formed around Q5.

The device is primarily aimed at the synthesiser designer - the circuit illustrated here shows the MV1401 - although these days the TOKO KV series offer better value for money and a wider choice of applications and frequency ranges.

The MC1648 is also well suited to applications in instrumentation - particularly as a result of the AGC and buffered output, and the simplicity of single point range switching. The low noise characteristics also score when the output of the device is mixed with a crystal oscillator in wide ranging mixer generator applications.

Circuit schematic used for collector output operation

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<tr>
<td>60-100</td>
<td>MV2106</td>
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NOTE: Any frequency deviation caused by the signal generator and MC1648 power supply should be determined and minimized prior to testing.

Noise deviation test circuit and waveform
TRANSFER CHARACTERISTICS IN THE VOLTAGE CONTROLLED MODE USING EXTERNAL VARACTOR DIODE AND COIL. TA = 25°C

**Graphs:**

- **Top Left:** Input frequency (MHz) vs. input voltage (V) for L: Micro Metal Toroidal Core #T44-10, 4 turns of No. 22 copper wire.
- **Top Right:** Diagram of a circuit with components: VCC = +5 Vdc, VEE = Gnd, 0.1 µF, 1 kΩ.
- **Bottom Left:** Input frequency (MHz) vs. input voltage (V) for L: Micro Metal Toroidal Core #T44-10, 4 turns of No. 22 copper wire.
- **Bottom Right:** Diagram of a circuit with components: VCC = +5 Vdc, VEE = Gnd, 0.1 µF.

**Notes:**

- The 1200 ohm resistor and the scope termination impedance constitute a 25:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

---

**Circuit Details:**

- **Component Values:**
  - 5 µF
  - 1 kΩ
  - 0.1 µF
  - 0.1 V

---

**Additional Information:**

- Micro Metal Toroidal Core #T44-10, 4 turns of No. 22 copper wire.
- Micro Metal Toroidal Core #T30-22, 5 turns of No. 20 copper wire.
ICOM's IC-745 is the all-in-one transceiver featuring an HF all band SSB, CW, RTTY, AM (receive only) ham transceiver, plus a general coverage receiver. Options for FM transceive and an internal power supply make the IC-745 the complete transceiver in an all-in-one package.

The receiver section features a 100kHz to 30MHz general coverage receiver, this allows access to all HF bands plus all the frequencies in between. The IC-745 has an adjustable AGC circuit and DFM (Direct Feed Mixer) giving a wide dynamic range of 103dB with an intercept point at +18dBm. Exceptionally clean reception is achieved with a low noise P.L.Circuit and a 70MHz first IF.

The IC-745’s features include IF shift, 16 programmable memories with lithium battery back-up, passband tuning, a noise blanker both wide and narrow, threshold level control, notch filter, receive audio tone control and an all mode squelch. Also available is a front and switchable receiver preamp providing 12dB gain. P.I.T has a ±1KHz range.
The IC-471E is the most advanced 430 MHz transceiver available today. It covers the spectrum from 430-440MHz with FM, SSB, or CW using the most advanced turquoise, LCD display and keyboard. The IC-471E is suitable for simplex, repeater operation, moonbounce or satellite work, and has features found on no other transceiver.

Some standard features include 32 tunable memories, a high visibility fluorescent display, RIT readout, scanning, 12V DC or AC operation with optional power supply.

The UHF receiver section of the IC-471E features a screen front end and mixer, a 70.4515 MHz first IF, low noise PLL locked to 10Hz and an AGC circuit. Sensitivity is less than 0.3uV for 12dB S/N with the optional GaAs FET preamp which adds another 15dB.

The transmitter section provides 25 watts of power in FM, SSB and CW. This can be varied in all modes from 1 to 25 watts. The design of the IC-471E is based on an entirely new CPU chip that is easy to operate and offers the maximum number of functions available. A lithium battery memory backup is featured maintaining the set's memory for up to 7 years. An internal computer interface option is available as well as the IC-PS25 internal switching AC power supply.

The IC-471E has a speech synthesizer that announces the displayed frequency, ideal for blind operators, is an option extra along with the SM6 desk microphone and 22 channel memory extension with scan facilities.

As you can see from this brief description the IC-471E, (and its 2 meter brother the IC-271E) are very versatile sets indeed. More detailed literature can easily be obtained from Thanet Electronics Limited.
All issues from October 1981 onwards are still available, with the exceptions of January 1982 and February 1982. All orders must be pre-paid, the cost of each issue being £1.00 inclusive of postage and packing. A contents index spanning the issues from October 1981 to September 1983 is available on receipt of a stamped addressed envelope. To ensure that you don’t miss any future issues, we suggest that you place a regular order with your newagent or complete the subscription form found in this issue.
James Dick reviews and describes the many advantages provided by this versatile instrument

Now that the computer is firmly established in the home, numerous manufacturers are producing a new species, referred to as ‘portable computers’. They come in all shapes and sizes—some with built-in cassette, printer, and disc. The marketing philosophy is simple: the professional businessman has come to expect a computer in the office, so, when he travels, he should be able to take one along. In the midst of this boom, it seems strange that any company should be troubled to produce a new handheld calculator. After all, with so much computing power even in home systems, a calculator might be expected to be less than what is wanted. However, Hewlett-Packard (makers of exceedingly nice calculators) have decided to do just that.

The new 41

Following the HP41C, and the 41CV, the HP41CX is the newest family member. Weighing in at a mere 7 ounces and fitting into the back pocket of the author’s jeans, it is a true pocket machine—ideal for the busy engineer or executive who needs to wander around acquiring and analysing data.

With over 200 functions (including the usual trigonometric, base-conversion, statistical...) the 41CX is well suited to the task. Indeed, the operating system is a staggering 24 kilobytes. Programming is simplicity itself—like most programmable calculators, the user just types in the keystrokes as if the problem was being solved manually. The CX’s memory will swallow up to 3000 program steps. There are extensive program editing facilities as well as a filing system which enables the user to create files of programs, data, or ASCII text.

Most of this is common place these days—so what is so special about the 41CX? The clue lies in Hewlett-Packard’s description of the 41CX as a low cost portable system controller. The calculator (if that is a fair description) is really the heart of an expandable system. A magnetic card reader allows storage and retrieval of programs or data, a thermal printer can provide a permanent record of results, and an optical wand will ingest bar-code.

On examining the rear of the 41CX, the user will spy four hatches that may be removed to plug in the peripherals mentioned above—and a whole family of incredible interface modules. Incredible because the 41C series can now talk system-speak in dialects of RS232C, IEEE488, Video signals, or HP-IL.

The HP-IL interface allows the 41C series to control up to 30 peripherals in a loop which chains all the devices together. Information, in frames of 11 bits, is passed round the loop and returns to the 41C for verification; transfer rates of 50Kbaud can be achieved. Using the 41CX, the built-in clock can selectively wake up some of the loop peripherals, perform a measurement at a set time, and then put the whole loop to sleep again; over 30 time functions (such as day-of-the-week and number-of-days-between-two-dates) are available.

If the vast number of instruments with IEEE488 and RS232 protocols is considered, it is clear that Hewlett-Packard have produced a winner. There is even an HP-IL interface kit for design engineers and hobbyists to link up their custom made hardware to the loop.

At home

The impressive parade of technology described above is all very well for the commercial purchaser—but what of the hobbyist? There is no danger of a beginner being left out in the cold. An excellent set of documentation is supplied. Pre-written software modules are available for antenna design—including calculation of beam patterns for aerial arrays, shortwave transmission path calculations, and RF path loss. So the 41CX will feel at home in the shack—but even away from the radio room, other software packs do general electrical calculations. Plug in an 'Electrical
Engineering' module, and the 41CX will help you design active filters, optimise class A amplifiers, or calculate transmission line impedances.

Once you have constructed an interface kit, the rig can no doubt be linked-in along with a monitor. Indeed, without any add-ons, the vast memory space for programs allows the DX-er access to useful information – a short program will calculate beam headings and estimated best frequency for a contact with known longitude and latitude. The satellite user may program in the orbital elements to obtain altitude and azimuth for VHF/UHF aerial pointing.

At just over £200 for the basic unit, the 41CX represents good value-for-money as a pocket computer. Although the add-on units and modules are not cheap, the end product is hard to match for ease of use, flexibility, and sheer professionalism.

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Ten years ago most amateur circuits were constructed on one of two types of insulated boarding.

The first, a plain synthetic resin bonded paper (SRBP) board with holes drilled at 0.1 inch intervals was used by making circuit connections in tinned copper wire on the reverse side of the board to the components. This method of construction is illustrated in the photograph.

The second method used 0.1 or 0.15 inch veroboard with straight printed lines in copper foil on the reverse side of the board, the components being soldered to the printed wires as in normal printed circuit board (PCB) construction. The veroboard method is still used for small projects but for most work, printed circuit boards reign supreme.

Types of boards

Many advertisers offer PCBs made for articles published in the electronic magazines, but how does the designer of a new circuit turn his idea into a working project?

The printed circuit board, as supplied, consists of an insulating sheet of SRBP or glass fibre with a thin copper foil bonded onto one side. Double-sided boards are also available and these are used in radio frequency projects, one side of the board being used as a ground plane. For more complex projects that would involve a large number of link wires on a single sided board, a double-sided PCB with both sides having printed wires can be produced, but we will return to this later.

Circuit drawing

The next step is to draw the circuit using actual component shapes and, when ICs are needed, photocopies from the suppliers' catalogues can be cut up and used. Small pieces of paper showing ICs, transistors and other components can be stuck to a larger sheet and wiring added in another colour.

An alternative method is to stick the photocopies to one piece of paper and cover with a sheet of drafting film on which the wiring can be drawn in pencil. It is very easy to correct the pencil lines on the drafting film as it is less prone to damage when rubbing out lines. Note that the drawing is of the circuit looking onto the component side of the board. If a number of wires need to cross over each other, the drawing may be altered by rotating the components and redrawing the wires. In some cases it will be impossible to remove all the crossovers but the aim is to reduce them to the smallest number possible. Figure 2 shows such a 'rough' viewing looking down onto the component side of the board.

The next part of the procedure depends upon the method the designer decides to use for actual circuit production. All PCB production requires that a protective material (etch resist) is placed over the copper foil that will form the final circuit thus allowing the etching solution (normally ferric chloride) to

Caution

Toxic and corrosive chemicals are necessarily used in the processes described in this article. Ensure that an adequate degree of ventilation is available, do not inhale the vapours or smoke during processing and do not splash the liquids. Keep the chemicals away from the eyes and AWAY FROM CHILDREN. Wash the hands thoroughly after using these chemicals.

Figure 1 The 9V power supply
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remove the unwanted foil. The etch resist must then be removed, prior to drilling the board and soldering the circuit together. There are a number of alternative ways of applying the etch resistant material to the board. The large-scale rough drawing is used to show the wiring diagram from the foil side of the board by viewing from the wrong side against a bright light. The drafting film method makes this a simpler proposition.

**Etching processes**

Observe the cautions stated under the heading of this article when carrying out the following procedures. When using a system in which the etch resist is applied directly to the board, the reverse view of the rough drawing is used and this is copied using correctly sized spots and lines for the components required. The PCB must be cleaned thoroughly before use and Vim or Jif household cleaners are suitable if used sparingly.

Although there are a number of ways of applying the resist, (etch resistant ink pens, etch resistant transfers or in emergency, sellotape), the masking of the copper is rather difficult since the foil carries no guide as to the correct location for the wires. The constructor must also take extreme care when working with etch resistant transfers or inks as errors are difficult to correct and the remainder of the copper foil must be kept free of fingerprints, which will interfere with the etching process. A 1mm wide strip of foil is capable of carrying over 1 amp, but for all high power applications, the width of the foil carrying heavy currents should be increased substantially.

**More complicated boards**

The method described so far is satisfactory for simple circuits of up to four ICs but what happens when we need 10 ICs and, say, 30 other components on the PCB? The simplest method now becomes the more professional photo-etching process. The illustrations of Figure 3 show the process in full and this method does not require a darkroom or even a UV exposure box to work satisfactorily. It should be noted however that a UV box does ensure a constant source of light and provides reliable results.

The most difficult part of this method is the drawing of the negative shown in Figure 3c, but even this is substantially easier than drawing the circuit onto the copper foil directly and the negative can be used to make many identical boards if required. The negative may be drawn on either clear acetate film (as used in overhead projectors) or translucent drafting film. When using drafting film the negative is drawn with the view shown from the component side of the board, Figure 4a, and the surface which is drawn on is placed against the photosensitive layer before exposure.

The translucent sheet can prevent a
clear outline being formed if it comes between the drawing and the photoresist layer, and I would recommend adopting the same method even when using acetate film. When the negative is being drawn, a sheet of 0.1 inch graph paper should be placed below the acetate film to act as a reference. Transfers covering the pin layouts of a vast range of components, as well as plain circles for resistors etc, are easily available and these can be placed on the acetate sheet with great speed and accuracy, due to the 0.1 inch grid of graph paper. This is because most components have lead outs set at 0.1 inch intervals or multiples thereof.

The wiring between transfers can be put on in either of two ways, using black tape or by direct drawing with a 1mm hollow point drafting pen and indian ink. I have used Rotaring pens and TT ink which, like the drafting film and acetate sheet, are available from office equipment suppliers. Special ink rubbers which remove the ink without marking the acetate film are also available.

Figure 4 shows the negative drawn from Figure 2, using these transfers, and is on a 1:1 scale with the final PCB.

Double sided boards for RF use, when the second side of the PCB is left as a plane copper foil, can be treated as a single sided board when drawing the negative. The lines connecting the components will be substantially larger than with low frequency designs and the remaining copper on the board will be left as an earthed copper screen except for thin etched lines around the live connections. After drawing the outlines of the enlarged areas, matt black model enamel can be used to fill in. Double sided boards with both sides having printed wires will need locating holes drilled into the PCB and on the two negatives to allow accurate alignment during exposure.

Photosensitive boards
Photosensitive boards may be purchased ready-made or an uncoated board may be sprayed with photosensitive lacquer. Coating of the board should be carried out in the following way.

Having cleaned the board sufficiently to make the copper layer water 'wettable', it is dried thoroughly with a clean cloth or paper tissues. The board is then sprayed with photosensitive lacquer in a darkened corner of the room and allowed to dry for about ten minutes. It is most important that the board is kept dust-free. When the board is dry, it can be baked at 70°C for 20 minutes or left at room temperature for a further 24 hours prior to exposure. The photoresist is exposed through the negative, about 10 minutes is needed with a UV light box having two 8 watt lamps, although sunlight can be used for exposure but the results vary considerably.

After exposure, the board is developed in a dilute solution of sodium hydroxide (caustic soda). About 6-7 grams (1 tablespoon full) per litre seems to be best. This will leave a coloured resist over the foil that will form the final circuit. It is best to check that there are no scratches in the photoresist layer which would cut one of the required connections. Faults can be corrected using an etch resistant ink pen. Etching in ferric chloride is carried out next and is much faster if one uses a warm to hot ferric chloride solution, and a neat way of achieving this is to use a hot water bath. Always etch in a non-metallic container, for example, an old 1 gallon ice-cream tub made of thick plastic, or if using a water bath a suitable glass dish. After washing excess etchant off the board, the photoresist is removed with an organic solvent, such as acetone which seems to work best. The board can now be drilled with a 1mm bit and, with RF double sided boards which were etched on one side only, the copper foil around the component holes can be cut back with a ½ inch drill to prevent the components shorting to earth.

Sodium hydroxide and acetone should be available from a chemists shop although you may have to order them. Ferric chloride and other suitable etchants are sold by many electronic component suppliers, either in anhydrous (powdered) form, or as an already made up concentrated solution.

Please note
These chemicals can do some extremely unpleasant things to your skin and eyes. Use rubber gloves at all times, wash all equipment very thoroughly when finished and keep separate from household utensils. The author normally wears glasses and would always advise that eye protection be worn when working with chemicals.

Figure 4a Component side view

Figure 4b Copper foil side view

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This book is for beginners as well as those already familiar with this popular database package. It not only provides new users with all they need to know to get this complex software package working as a comprehensive information processing system, but also sets out more sophisticated methods and introduces ways of exercising greater control and getting even more value from the databases that have been created. In addition, the book shows in detail how to write programs in the language which is supplied as part of the dBase II package.

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The author, M de Pace, has been using computers for nineteen years, and specialises in applying technology to the needs of the modern business or office environment. He is a member of the British Computer Society, Institute of Management Consultants, and Institute of Data Processing Managers.

Granada Publishing Ltd, 8 Grafton Street, London W1X 3LA. Tel: 01 493 7070.

RADIO WAVES
UNDERSTANDING RADIO WAVES by Peter Bubb (Price £6.95).

This book takes the reader through, at a general level, a wide variety of aspects of radio waves, from first principles through communications receivers and aerial systems to such diverse topics as navigation, model control and microwave cooking.

The book is very clearly written and supported throughout by clear, informative diagrams and also has a selection of very interesting and topical photographs. There are eighteen chapters, each of approximately half a dozen pages, so one does not get bogged down in theory. This might, however, leave a more technical reader wanting to know more and it might be a little frustrating to find that the chapter finishes just as you are getting your teeth into the subject concerned! However, for those who simply want a good, up-to-date, sound introduction to a fascinating subject, this book can be thoroughly recommended.

Lutterworth Press, Farnham Road, Guildford, Surrey.

GUIDE TO RADIO
BEGINNER’S GUIDE TO RADIO (Ninth edition).

This new edition continues the work of its predecessors, which have given many readers a sound basic knowledge of radio principles and practice. The author, Gordon King, has again updated the text to keep up with the changes in radio technology. The book takes you in logical steps from the theory of electricity and magnetism to the sound you hear from the loudspeaker. It describes the nature of the radio signal, what is involved in transmitting and receiving it (including stereo broadcasting) and what kinds of equipment are needed. Then it examines the components of a receiver, and how they are built up into circuits that will do the various jobs required.

This edition includes a new chapter on Citizen’s Band radio and information on CB aerials. Other sections have been re-written to help those readers studying for the Radio Amateurs’ Examination (RAE).

Written in a non-technical, highly readable style, with a minimum of mathematics, this guide provides the newcomer to radio with an enjoyable introduction to the subject. It will open the door to further reading and to greater skill in handling radio equipment, whether for work or leisure.

Powerline Electronics have announced their new 1984 catalogue of power supplies, dc/dc converters and power instrumentation. Comprising over 100 pages this new catalogue describes ranges of linear supplies, switched mode supplies from 30 to 1500 watts output, dc to dc converters, laboratory units, high voltage supplies, constant voltage transformers and power supply test equipment.

Powerline Electronics Ltd, 5 Nimrod Way, Elgar Road, Reading RG2 OEB. Tel: (0734) 688967.

NEW PROJECTS
30 SOLDERLESS BREADBOARD PROJECTS – BOOK 2 (price £2.25).

Written and produced in a similar style to Book 1, this volume contains thirty new projects based on CMOS logic ICs, that can easily be built upon ‘Verobloc’ breadboard, the projects in Book 1 all being designed around linear devices.

Wherever possible the components used are common to several projects, hence with only a small number of reasonably inexpensively components it is possible to build, in turn, every project shown.

Each project is presented with a brief circuit description, circuit diagram, component layout diagram and components list.

Also included, if necessary, are any special notes on constructing the designs as permanent units.

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REPAIRS
Introduction

Let us start with wires and broken lines of communication. There is an old saw that it is not the telephone but the connections between them that go wrong. How often has a serviceman been called out, merely to find a wire loose or a plug half out?

Flexible cables eventually break, often near one end, and hence it is wise to have a 'strain-relief' moulding, as shown in Figure 1. Wires are occasionally cut through by doors or by sharp edges on cabinets, but this form of carelessness should be obvious and therefore more easily avoided.

More subtle are the problems with interconnections that gradually go 'soft' or become intermittent. A good sprung contact, if possible with some wiping action to cut through oxide layers, is advisable. Connector blocks should have leaves or captive bushes under their screws (Figure 2), so that wires are not severed. It is often forgotten, however, that the metals tin and lead suffer from 'creep', and so wires should not be solder-tinned prior to securing under any form of screw terminal: with time, the pressure becomes relieved, the connection worsens, and IR heating speeds up the decline.

Moisture and corrosion

Turning now to the insidious faults caused by moisture and corrosion. Where dissimilar metals are in contact, and some damp is present, an electrical cell is formed.

In relays, even where contact materials are consistent, a corrosive atmosphere can fuse closed contacts together, or encourage the growth of 'fur' that keeps open contacts forever open (Figure 3.) Gasket-sealed connectors are effective only if it is certain that moisture will not be trapped on the inside, eg during mating.

If high voltages are present the problems are worse, and tracking lengths on insulators must be improved, eg with 'sheds' or re-entrant sections (Figure 4).

Leak proof

Batteries are a frequent source of trouble, and leak-proof types are most desirable. Fine wires from relay and transformer windings can corrode and break at their terminations. More surprising is the brittle fracture that can occur at the spot-welded ends of potentiometer wires, despite being dry.
**Deliberate**

Some connections, of course are deliberately breakable; a fuse is intended to blow on overload, but remember that it will also eventually break if run near its limit for a long time. In some cases, thermally or magnetically tripped circuit-breakers are preferable.

Even with 'solid state' devices, ie. semiconductors, a built-in fuse exists (the bonding wire), but it is not easily repairable!

With rugged devices such as diodes and thyristors, protection against excessive current can be provided by a separate fuse, but if transistors are to be made safe from second breakdown (Figure 5), fast electronic protection is needed.

There is much to be said in favour of simplicity of design. With a little extra thought, a piece of equipment may sometimes be simplified, for example with wiring harnesses lessened and interconnections generally reduced. This may mean having most of the back-wiring on a printed-circuit mother-board (See Figure 6). The fewer the hand-routed and hand-soldered joints the better, resulting in a simpler, more reliable and lower-cost product.

With modern flow-soldering machinery, the dry joint should be a thing of the past. Unfortunately, some components must of necessity be testable or field-replaceable, and here sockets of some kind are desirable. However, beware the 'dicky' socket, that merely adds to cost and unreliability. It is worth paying a little extra for dual-in-line sockets that have good lead-ins and contacts for the IC's pins.

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**Figure 5** Safe operating area

**Figure 6** Loom or motherboard
Mechanical considerations

Often, purely mechanical considerations are important. For example, in a multiway connector, how good is the locking arrangement, and will it hold the weight of a heavy cable? (See Figure 7). Also, are contacts accessible or replaceable without special tools? Do shells and clamps cut into the wires? There is a trend now to insulation-displacement connectors, where sharp tines cut through the insulation and bite into the conductors. They typically take lightweight ribbon cables. Clamping arrangements and mechanical robustness are worth investigation, especially if connection is to be made outside (rather than merely within) some equipment.

Fault-finding tips

Only a supreme optimist would expect equipment never to go wrong. Nowadays, with products incorporating microprocessors and memory devices, specialised test-gear is often required for fault finding. However, it can be extremely difficult to trace intermittent faults, and poor contacts that show up only now and then.

The traditional method is to bang the equipment. Dry joints or cracks in tracks on printed circuit boards can often be located by flexing and tapping the board. Other useful dodges are to apply heat with a blower, or maybe squirt selected areas with a freezer-aerosol. Devices prone to breakdown may be found by raising the supply voltage, and vulnerable ICs by aiming some form of spark-generator (eg a gas-lighter) at them; unfortunately, these are destructive tests.

Case-histories

Now here are some case histories. A certain make of popular home computer was found to give much trouble in loading programs from the cassette player. Signal levels and various other electronic parameters were checked, but in fact the problem was traced to the miniature jack-plugs provided, which were a very loose fit. Curiously, there is no such thing as a 'standard' 3.5mm jack-plug or socket, and hard plating or irregular insulators and mouldings do not help. In another, somewhat different, instance, a problem arose with connectors of the soft, moulded-on variety: the three-pin plug (Figure 8) which connected a twin electric blanket to two thermostatic controllers could (with sufficient force) be reversed in the socket, with the result that one partner's heater was controlled by the other's knob, and vice-versa. The result was a classic case of positive feedback, where one person froze and the other boiled.

In another case involving jack-plugs, the quarter-inch variety were used on a large piece of studio equipment for cables linking various units; on one occasion, a somewhat short technician, who needed to reach the top chassis, was observed climbing up these cross links as if on a rope-ladder!

As so often is the case, best results are obtained with a blend of expertise and common sense, but few systems are foolproof. The trouble with fools is that they are so damnably ingenious.
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A LOW COST FREQUENCY STANDARD
by Brian Adkinson

A straightforward project utilising an unmodified television receiver to generate the reference pulse.

This frequency-standard provides an accurate and stable signal source which may be used to calibrate a low cost frequency counter. With suitable division of the output accurate frequencies of 10KHz, 1KHz, 100Hz etc may also be obtained to calibrate, say, an oscilloscope timebase and, no doubt, other uses can be found for the unit.

Many frequency-standard designs are based on the principle of using a very accurate off-air carrier such as the BBC 200KHz long wave transmission from Droitwich. The carrier is used to phase lock an internal oscillator, often running at 10MHz, and thereby produces a reference output at a much higher multiple of the input carrier frequency but with the same basic accuracy.

Many electronics engineers and hobbists probably have only occasional need for a frequency-standard and the purchase of a commercially-made unit is not justified. A fair commitment in time and effort is needed to construct a reference of the type outlined. The reasons for this are due, in part, to the need to build a suitably sensitive receiver 'front end' for reception of the off-air signal, so that reception in any chosen location will be reliable. Also the inevitable modulation of the carrier (Radio 4) must be well filtered out to prevent phase jitter from entering the PLL system. These two factors add considerably to the complexity of the design and, bearing these points in mind, a far simpler approach was decided upon, whilst still retaining the basic PLL principle of operation.

This project is cheap and easy to build, utilises standard 'off the shelf' parts and requires no setting up or alignment. The trade off for this simplicity is a maximum output frequency of 1MHz instead of 10MHz (because of a CMOS PLL IC with a maximum VCO operating frequency of 1.5MHz), and the need for a domestic television receiver (colour or monochrome) to provide the reference signal. No direct connection or modification to the TV is necessary.

The frequency source
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Figure 2 The circuit diagram
emitter junction of an NPN transistor. The timing of the flyback pulse is initiated by the line synchronising pulse which is transmitted with the vertical sync pulses and video information.

The line sync pulse occurs during the transmitted line period of 64µs which is very accurately controlled and this, together with the vertical sync pulse, provides the master timing for the complete 625 line transmission system.

Circuit description

A block diagram of the frequency – standard is shown in Figure 1. This illustrates the connections between the three main parts of the circuit, namely input conditioning and signal detect circuitry, the PLL system output buffer and power supply.

Input conditioning

Referring to the circuit diagram Figure 2, flyback pulses are coupled to the input socket SK1 via a 'pick-up' lead. C1 together with the input impedance of T1 form a simple high pass filter to reduce the effect of 50Hz vertical pulses from the TV receiver. T1 is unbiased and will turn on when a pulse with an amplitude greater than 0.6V is present. This further reduces pickup of unwanted low-level signals. IC1a, an inverting Schmitt trigger, ensures a clean logic switching input for the SIG pin of IC2 (pin 14).

D1, D2, R4 and C3 rectify and filter the incoming signal and via Schmitt inverter IC1b, drive the SIGNAL LED (D4) to give clear indication of an incoming pulse train. As there is no 'power on' indication, except when an input signal is present, R4 and C3 also serve the purpose of momentarily taking IC1b input high during power up of the unit and SIGNAL LED D4, therefore, pulses momentarily at switch on, but if an input signal is present D4 will remain on. D3 protects the input of IC1b from the negative voltage present at the 'earthly' end of C3 after switch off.

Signal inhibit

The output of IC1b (pin 4) is also taken, via R6, to the VCO inhibit pin of IC2 (pin 5). In the absence of an incoming signal IC1b output is high and the VCO inhibited, hence preventing spurious output from the unit.

Phase lock loop system

The heart of the PLL system is IC2 (Figure 3), a low power CMOS device incorporating a choice of two phase comparators, a linear voltage controlled oscillator and a 5.2V zener diode. (Not used in this application). The VCO free running frequency is determined by the values of R8, R9 and C5 which, with the values specified, will be approximately 850kHz. Phase comparator II (pin 13) was used in this design because with the PLL in a locked condition, a clear indication of phase lock (namely a logic high), is present at the PHASE PULSES output (pin 1).

This output via IC1c lights the lock LED (D5) and thus gives reassurance that the loop is locked. At phase lock, using comparator II, there is a 0° phase shift between the SIG IN (pin 14) and COMP IN (pin 3).

Early experiments with phase compara-
tor 1 (pin 2) proved that, whilst providing better noise immunity than phase comparator II, misleading 'lock' indications were evident, due to the mode of operation of comparator I. Here, in a locked condition, the phase angle between SIG and COMP can be between 0° and 180°, depending upon the initial free running frequency of the VCO. Due to the phase shift, this type of locked condition is difficult to detect.

C6 and R10 form the low pass or loop filter for control of the VCO and a long time constant was chosen for two reasons. Firstly, as previously stated, phase comp II has relatively poor noise immunity (due to edge triggering of the SIG and COMP signals) and secondly, although the incoming 15,625Hz is a very accurate frequency, there is a degree of phase jitter present. This has presented no serious problems in the design and is believed to be caused by slight modulation of the line scanning circuitry by the vertical timebase. There is a phase jitter of less than 0.05Hz as measured at the 1MHz output when using the component values chosen for the filter. The phase lock loop is completed by IC3, a 7-stage binary counter. Output 0° (pin 4) is used here to give 2° division.

The VCO output (pin 4 IC2) of 1MHz is applied to the clock pulse input of IC3 (cp pin 1) which then divides it back down to 15.625Hz to provide the COMP input to IC2. T2 buffers the 1MHz output from IC2 and gives a 6V peak-to-peak output at low impedance on SK2 and IC4 is a 12V regulator which ensures reliable operation of IC2 at the required operating frequency.
Construction
The unit may be housed in any available case, metal or plastic, of suitable dimensions. Input and output sockets can be selected to suit individual requirements. Component layout is not critical, but use of printed circuit rather than strip board is advised. A mains power supply is not essential if only occasional use is envisaged. Two alkaline PP3 batteries in series, will provide power for periods long enough to allow periodical calibration of test equipment.

If a mains or external DC supply is used, the maximum dissipation of IC4 must not be exceeded, therefore, the input should lie within the range of 15 to 25 volts.

Initial testing
No setting up is required but, in the event of non operation, the following information may be helpful. With an input signal supplied from a TV receiver or signal generator, D4 will confirm operation of the complete input circuit. Should a fault be suspected in the PLL section, the VCO can be allowed to free run as an aid to diagnosis by earthing pin 5 of IC2 (VCO inhibit). The free running frequency is not critical and may lie within the range 700KHz to 950KHz.

Current drain with no input signal is approximately 3mA and, with loop lock, approximately 35mA. Investigate large deviations from these figures.

Operation
Virtually any TV receiver will generate a suitably strong field to trigger the reference. The author has found a single unscreened piece of wire, preferably not more than 1.5 metres in length, to be adequate although if problems are encountered with a particular TV receiver, a ‘capacitor pickup plate’ may be required. This can take the form of a 10 x 10cm piece of copper clad PCB or similar, with the pickup lead soldered to it.

The pickup lead or plate should be taped to the cabinet of the TV after first determining the area of strongest field strength. Reasonably noise-free reception is required.

When a suitable signal is received the SIGNAL LED should light, followed shortly by the LOCK LED. Observe the LOCK LED carefully as any flicker or dimming, indicates the input signal is noisy and, therefore, not allowing stable lockup of the PLL. Reposition the pickup lead until a stable lock is obtained, before using the standard.

Fire performance
The prototype unit has been extensively used with many receivers and over a long period of time. During this period it has operated reliably, the the author has been well satisfied with its performance.

PARTS LISTS

<table>
<thead>
<tr>
<th>Resistors</th>
<th>Capacitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1, 4</td>
<td>C1</td>
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<tr>
<td>R2</td>
<td>C2</td>
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<tr>
<td>R3, 5, 7</td>
<td>C3</td>
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<tr>
<td>R6</td>
<td>C4</td>
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<td>R8, 9</td>
<td>C5</td>
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<td>R10</td>
<td>C6</td>
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<td>C7, 8</td>
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<tr>
<td>R12, 13</td>
<td>C9</td>
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All electrolytes 25V dc wkg

Semiconductors

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<tr>
<th>IC1</th>
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<tr>
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<td>IN4148</td>
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<td>D4, 5</td>
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<tr>
<td>T1209</td>
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Misc

Case, Sockets/Switch etc

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<th>M A S H A L L S</th>
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**Mullard Broad Band RF Power Modules**

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Price (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHF9Y33, UHF92Y64</td>
<td>£15.00</td>
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### T.S. Tubes

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<tr>
<th>Component</th>
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<tbody>
<tr>
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### Integrated Circuits

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### Thermistors

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Club secretaries and organisers are requested to send information of forthcoming events as early as possible
to *Radio & Electronics World*, Dates for your Diary, Sovereign House, Brentwood, Essex CM14 4SE

<table>
<thead>
<tr>
<th>Date</th>
<th>Function</th>
<th>Location</th>
<th>Contact</th>
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<tbody>
<tr>
<td>13 May</td>
<td>First Sunday DF Contests</td>
<td>Wirral and District AR Club</td>
<td>G Scott G8TRY</td>
</tr>
<tr>
<td>15 May</td>
<td>Operating evening using club call signs GARQT &amp; G6TBH on HF &amp; VHF</td>
<td>Biggin Hill AR Club</td>
<td>I Mitchell G4NSD</td>
</tr>
<tr>
<td>16 May</td>
<td>Foxhunt briefing</td>
<td>S Bristol AR Club</td>
<td>G8X1H/G40PQ</td>
</tr>
<tr>
<td>18 May</td>
<td>AGM, Amateur Satellites-talk by G3AAJ at Downs</td>
<td>S Manchester Radio Club</td>
<td>GSFVA, G3UHF G8MR</td>
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<td></td>
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<td>Kent Repeater Group S Sutton &amp; Cheam Radio Society</td>
<td>M W Stoneham G4RVV G3HSK</td>
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<tr>
<td>21 May</td>
<td>Model Engineering - Michael Kingston</td>
<td>Leighton Linslade Radio Club</td>
<td>P Brazier G6JFN</td>
</tr>
<tr>
<td>23 May</td>
<td>2 Metre SSB Night Equipment Demonstration by Gordon Adams, G3LEQ, Talk on Slow Scan TV</td>
<td>The Home Counties Amateur Television Club Farnborough and District Radio Society Fareham &amp; District AR Club</td>
<td>G62TX/G62TY G Scott G8TRY</td>
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<td>Dunstable Downs Radio Club S Manchester Radio Club</td>
<td>P W Andrews G6MNJ</td>
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<td>B Davey G41T6</td>
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<tr>
<td>25 May</td>
<td>Oscar 10 by G3VZV, Talk by winners of Homebrew contest</td>
<td>Leighton Linslade Radio Club</td>
<td>P Brazier G6JFN</td>
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<tr>
<td>27 May</td>
<td>Plymouth Rally</td>
<td>Devonport Secondary School Park Ave, Devonport, Plymouth</td>
<td>Peter G8WAX G Scott G8TRY</td>
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<tr>
<td>30 May</td>
<td>ATV Night, DF Practice, from Hesswall lay-by</td>
<td>S Bristol AR Club Wirral and District AR Club</td>
<td>G3UHF G8MR</td>
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<tr>
<td>1 June</td>
<td>Modifications to the Club’s FT221 by G4MYB</td>
<td>S Manchester Radio Club</td>
<td>L Smith GAVNK</td>
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<td>2-3 June</td>
<td>HF National Field Day</td>
<td>Leighton Linslade Radio Club</td>
<td>P Brazier G6JFN</td>
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<tr>
<td>3 June</td>
<td>70 MHz CW contest, 6 hours section</td>
<td>Wirral and District AR Club</td>
<td>G Scott G8TRY</td>
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<tr>
<td>4 June</td>
<td>Quiz; round two</td>
<td>Leighton Linslade Radio Club</td>
<td>P Brazier G6JFN</td>
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<td>6 June</td>
<td>Lecture: Radio Interference Service</td>
<td>S Bristol AR Club</td>
<td>Len G4RZY</td>
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<td>8 June</td>
<td>Summer Barbecue at Old Warden Club quiz</td>
<td>Dunstable Downs Radio Club S Manchester Radio Club</td>
<td>P Seaford G8XTW G3UHF G8MR</td>
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JUNE 1984
### DATES FOR YOUR DIARY

<table>
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<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>10 June</td>
<td>Contest-425 MHz Trophy</td>
<td>Wirral and District AR Club</td>
<td>G Scott G8TRY</td>
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<tr>
<td></td>
<td>Contest-432 Trophy</td>
<td>Leighton Linslade Radio Club</td>
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SOLDERING SECTION

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JUNE 1984
Radio Frequency Bridge

Although simple in design and easy to construct, an RF bridge has many uses. It can measure unknown values of impedance, inductance, and capacitance. The circuit consists of a Wheatstone bridge (Figure 2a), but instead of a battery as a source of current a two-transistor multivibrator is used, and the conventional moving coil balance meter is replaced by a radio receiver (Figure 2b). The multivibrator operates at an audio frequency, but the square wave output contains many harmonics which can be detected by a radio receiver up to 30MHz and beyond.

The multivibrator acts as an RF signal generator, but unlike conventional generators it produces all its outputs at the same time. It is this combination of broadband signal generator and selective receiver that makes the bridge such a versatile measuring instrument.

Construction

The building of the bridge should present no problems, and it can be built in an evening. A small metal box is an ideal housing. The shaft of the variable potentiometer RV (Figure 2) should be fitted with a pointer and sufficient room left around the knob to mark a scale. The connection to the receiver should be by a short length of screened lead. Because the receiver earth is then connected to terminal B (see Figure 2b), no other part of the circuit should be electrically connected to the box.

Calibration

To calibrate the scale, the bridge is connected to a radio receiver which is tuned to any frequency between 500 KHz and 2 MHz. The receiver should have an intermediate frequency (IF) with a pass-band of at least 3 KHz, and it should preferably have an S-meter. If the IF is too narrow, the individual harmonics of the multivibrator will be detected, and balancing the bridge will be difficult. (This is the ideal application for an old receiver with an IF as wide as a barn door).

When the bridge is connected to the Rx (Figure 1) and switched on a tone should be heard, and the S-meter should read. As the tuning is altered the tone should remain at a constant sound level. Tuning should have no effect. If the tone rises and falls as the tuning is moved the receiver selectivity is sufficient to distinguish between the individual harmonics of the multivibrator. At this point, either use a wider IF, or double the value of the capacitors C1 and C2 in Figure 3. Changing these capacitors will lower the frequency, bring the harmonics closer in frequency and make

---

Figure 1 The RF bridge and associated receiver

Figure 2a Conventional Wheatstone bridge

Figure 2b The RF bridge

RJ Harry describes an invaluable piece of equipment that can be built in just one night

---

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Front loading deck with full solenoid control of all functions including optional read in fast wind modes. 1/2 volt operation and 2-6K memory counter and Half IC Motion Sensor Standard motor interface and operation to heads. £38.00 plus VAT. Technical specification included.

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The Leader range of high performance oscilloscopes are designed to suit most requirements, offering comprehensive specification and long term reliability, yet remaining low cost.

The LBO series includes a battery portable with 20MHz bandwidth, two lost cost 15MHz and 20MHz models and 35MHz, 50MHz and 100MHz laboratory performance models with or without delayed sweep.

LBO-514A is a dual trace, 15MHz bandwidth, 1mV sensitivity oscilloscope. £169.91
LBO-522 is a dual trace, 20MHz bandwidth, 500uV sensitivity oscilloscope, featuring Xf, variable hold off plus full TV triggering.

LBO-523 is a dual trace, 35MHz oscilloscope offering similar features to the LBO-522 plus internal graticule dome-mesh tube with 7KV acceleration (pda)
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LBO-518 is a 50MHz quad channel oscilloscope with eight trace capabilities, offering comprehensive triggering and timebase facilities.
LBO-308S is a battery/mains dual trace 20MHz small compact oscilloscope offering all the features normally found in a bench scope.
operation easier. However the harmonic
energy at higher frequencies may be less
and the highest working frequency may
be reduced.

A selection of close tolerance resis-
tors should be connected across the
‘unknown’ terminals and the bridge
balanced by adjusting RV for a null (ie, a
dip) in S meter reading, then the value
should be marked on the scale.

At this stage the frequency range and
balance can be assessed with a resistor
connected, null the bridge at 1MHz. The
null should be sharp. Repeat at 10MHz,
the null may be less precise. As the
frequency is increased the null will
become less deep, and may be at a
slightly different position. The output of
the multivibrator will also fall with
increasing frequency, so that the S meter
no longer reads. The null can still be
detected by ear, and the bridge used at
frequencies where the S meter reading is
insufficient. The highest usable fre-
quency depends on several factors, one
being the receiver sensitivity. The bridge
is now ready for a variety of tasks.

Inductance

If the receiver is tuned to 159KHz the
scale can be read directly in micro-
henries. That is, 10 ohms may be read
as 10uH, 47 ohms as 47uH, and so on.

If the receiver is tuned to 1.59MHz the
range of inductance is altered so that 10
ohms equals 1uH, and 47 ohms equals
4.7uH, and so on in proportion.

This simple relationship is achieved by
a little mathematical juggling of the
formula \( X_L = \frac{2\pi fL}{\Omega} \) (Symbols have the
usual values).

Capacitance

This is harder to measure than induct-
ance, and the easiest solution is to mark
additional scales for the capacitance
ranges required. Initial calibration
should be done with a selection of close
tolerance capacitors.

Using the formula: \( X_C = \frac{1}{2\pi fC} \) gives
the reactance (in ohms) where \( f = \) frequency
in Hz, \( C = \) capacitance in Farads.

At 1.59 MHz a capacitor of 100pF has a
reactance of 1000 ohms, and another of
10,000pF (0.01 uF) has a reactance of 10
ohms. Other frequencies will give other
ranges of capacitance.

Tuned circuits

The resonant frequency of a parallel
tuned circuit can be found by connect-
it to the bridge and setting RV to a high
value and adjusting the receiver
frequency until a dip in the S meter is
found.

Baluns and RF transformers

The effective frequency response of
aerial baluns and RF transformers can be
easily checked with the bridge.

For a balun, the balanced connections
should be terminated in the correct
impedance, say 50 ohms. For a balun with
a 1:1 turns ratio, the 50 ohms should be
reflected to the unbalanced terminals
which should be connected to the
bridge. As the receiver is tuned over the
designed frequency range of the balun
the null should remain substantially in
the same position but a fall in efficiency
of the balun will show as a fall in
impedance reading.

Inaccuracy of the bridge at higher
frequencies can be checked by measur-
ing the 50 ohm resistor on its own.
Whatever variations in value the bridge
indicates with the resistor alone should
be the same as those when the balun is
interposed between the bridge and
resistor.

A balun or transformer with a turns
ratio other than unity will behave in a
different way. Impedance is propor-
tional to the square of the turns ratio, so a 2:1
turns ratio will reflect an impedance of
200 ohms (50 x 4) into the primary when
the secondary is connected to a 50 ohm
resistor.

Conclusion

Sufficient has been said to illustrate
the use of this simple instrument. Any
work in electronics or radio requires test
equipment, and I can think of no other aid
to a workshop that can so quickly pay
back the time spent in construction and
 calibration. Every radio shack should
have one.
This modification, compensates the varying brightness levels of displayed colours from a BBC micro when used with the RGB interface for the TX-90 (described in R&EW, January 84 issue).

The interface was built so that the Ferguson 37140 colour television could be used as a colour monitor for the BBC microcomputer. The television's controls were set up for the usual viewing conditions of a dark background and light text or graphics. Some programs create a display with a light background (eg yellow) and dark text (eg blue). This caused the displayed brightness to fall, but it can be compensated for by increasing the brightness control. Rather than adjusting the controls every time the display changes, a solution to the problem was sought and resulted in the following modification to the interface circuit.

Procedure
Looking at the circuit of the interface (R&EW, Jan 84 issue, Page 47), the Red, Green & Blue signals are ac coupled into the transistor amplifiers by 10 uF capacitors C1, C2 & C3. Converting the amplifiers to dc coupling throughout will remove the problem. The conversion is much easier to perform than might be expected:

a) Remove C1, C2 & C3.
b) Remove R1, R10 & R18.
c) Remove R2, R11 & R19.

d) For each channel, connect the input signal to the slider of the preset potentiometer RV1, 2 or 3.
e) For each channel, connect the top of the preset potentiometer to the base of the input transistor TR1, 3 or 5.

Figure 1 shows the circuit diagram of the now dc coupled input stage. RV1, RV2 & RV3 are adjusted in a similar manner as described in the original article.
Time seems to fly; it's time to run down the activity report once more. So here it is: as ever, we start on 70cm and go progressively higher, finally returning to the lower frequencies for a bit of slow-scan.

We seem to have been well served with openings during the past winter season, and reading the Benelux DX Club magazine (kindly passed on by Arthur Milliken) I see that our signals have been making it over to the Netherlands.

Noted in despatches, so to speak, are:

- G3DFL, G4NPS, G4RNA, G4SRF, G8CIT, G8LES, G8SKO, G8VBS, G6LIC, G6YLG (29.9.83 & 26.10.83 at Beemster);
- G4NPS (23.10.83 in Texel);
- G3DFL, G4PSK, G6YLG, G6VBS (26.10.83 in Bergum);
- G4RNA & G6AVB (27.10.83 at Driebergen);
- G4RKP and GU8FBO (4.12.83 in Rotterdam).

Gordon Hunter GM3ULP is prompted to write from Motherwell to tell us about the large ATV net which operates every Monday. His setup is a MM transmitter and 48 element Multibeam at 35 feet in a less than perfect location. Licensed first in 1969 as GM6ADR/T, he used to work GM6AE/T across the Clyde. Nowadays, his most regular contact is Norrie GM4BVU, also 'just across the Clyde.' Gordon is also QRV on slow-scan, but finds little activity; how about some skeds?

In downtown Newport Pagnell, Jon G4MDU and Andy G6LTZ recently gave an impressive talk and demonstration of ATV to members of the Milton Keynes radio club. Not content with the usual talk and slide show, the pair went on to mount a live outside broadcast from the pub across the road! A portable camera and backpack transmitter/aerial combination made this all possible, and the results made the audience extremely aware of the possibilities of ATV. We can confidently expect an increase of ATV activity in the district as a result!

The aforementioned openings which favoured 70cm gave equal or better possibilities on 24cm. On the 29th December, Rod G8VBC saw P5 pictures from F3LP on 24cm. Given that Rod is located near Derby and F3LP is in Le Havre (nearly 400 km), this is most encouraging. Rod was unable to get through on 2 metres, no doubt because lower bands were not so favoured.

From Southamton, Allan G8CMQ writes about 24cm activity in the Solent area. Two stations are on the air, himself and Sid G4JOU, with Mike G8LES in the role of visiting advisor and source of encouragement. Sid built the first Tx &D oscillator on 429 MHz, home-made 70cm PA with 3-5W into a homebrew tripler and Tonna 21 element 1296 yagi. Operating frequency is 1265 MHz FM. Allan made the first Rx from an Ambit 23cm converter (modified), a TV tuner and BATC IF board. With a double 15 slot antenna, results were P5 over 2.5 miles.

P5 every time

Mike suggested mods to the converter, retaining just the oscillator chain and results shot to P5. Further mods and a GaAsFet front end mean P5 every time now, and P3 even when Sid runs 10W from the BATC free-running oscillator.

Sid has a W&D FM IF which works well, fed by the BATC converter but is plagued by UHF broadcast breakthrough. Allan's TX is now up to 10W input to the tripler. Allan is off the air but hopes for even better results from his new QTH.

Even over non line-of-sight paths they have been surprised with the capability of the 24cm band; best DX was over 25 miles when Allan took the Rx to Nick G8MCQ's place, giving P4 despite a long cable run and no preamp. Activity is expected to increase and Allan's new QTH has a clear takeoff for at least 10 miles in all directions. So point your beams towards ZK04G!

A letter from Cyril James G3VVB bemoans the price of varactor diodes, saying that Mullard quoted £36 each for BXY36s. I must say I am glad I bought a Microwave Modules unit while they were still available, if you are not the happy possessor of one of these, look out for...
One of several 32 seconds frame black and white pictures transmitted by slow-scan TV using a Wraase (German) converter. Date was 13 February 1984 and frequency 14230 KHz, sent by Peter I3XQW. Richard Thrilow G3WW received the signals and recorded them on audio cassette before printing them with his Seikosha GP-250X computer printer.

them at bring and buy stalls or the Wood & Douglas substitute may well be available by the time you read this. Cyril does a very nice line in cavities, dish feeds and filters for 23 and 13cm (see photo) and if you have any special requirements, you could do worse than write to him QTHR. I bought one of his 23/24cm interdigital filters and it is a work of art.

Slow-scan news

This time we seem to have more SSTV letters – is there a slow-scan revival perhaps? Dick G3LUI from Hullbridge in Essex, counts at least 16 stations in the two metre net he organises on Wednesday evenings. Stations from London, Cambridge, Kent and Essex take part, and the old problem of shifting beam headings (and non-SSTV QRM) has been overcome by splitting into two or more QSOs and QSYing HF of the calling frequency.

Two stations, G3WW and G4GZN, are producing good quality colour with the new SC1 scan converter from Wraase. Roddy G3CDK has perfected his instant colour SSTV playback of commercial TV transmissions, while Dick has found it extremely bad luck to replace all the fixing screws on any piece of shack equipment!

Another regular correspondent, Richard G3WW tells of a two way SSTV contact with 16GK1 on 26th February. Frequency was 14227.4 KHz, with 5-9-5 signals; Richard received six pictures on his SC1 converter which were displayed on a normal Sony TV set. Richard has now added a GP-250X dot-matrix printer to his setup, enabling him to produce permanent pictures on paper; a sample was enclosed with his letter.

Exotic contacts

A lot of Richard’s contacts have call signs which look distinctly exotic to me, such as SN8HEM (listen on 14230+5 at 17.45-18.00 GMT) and ZL2AUJ on 14229.7. G4NJI has a ‘print out’ board for the SC1 and with G4DYB can be found almost nightly on 144.5 FM or 144.23 SSB around 21.00 GMT. Apparently an FM voice net congregate on the SSTV calling frequency and refuse to move because their licences don’t mention 144.5 as the SSTV calling frequency. Such crassness beggars belief; my response would be to run QRO (whoosh, over the top!) but that is not ‘the ham spirit’ either. I suppose the simplest idea is to have a pre-arranged fallback frequency and hope you don’t upset some other special-mode users!

Our final SSTV letter is from John Hibbert G3YCV in Ramsgate. He too, is a member of the Essex net on Wednesdays, and has lately made contacts to South Africa, North & South America and Europe. He has replaced his Pye Lynx camera and got colour filters, so can now produce smart colour pictures.

John and a colleague have also devised a colour caption generator program for the Dragon computer, producing four lines of eight characters to the page. The computer’s video output is fed to the SC-160 scan converter’s camera input. If anyone else is interested they can send a SAE to John QTHR or to Aphros Software, Hawley Square, Margate, Kent. John also gave a talk to the Thanet club recently; the demo went well and seemed to impress those present, especially the way you can get colour pictures from a black and white camera! Look out for more SSTVers in Kent...

Finally, a plea from Bob Valder G4RRU in Peacehaven, Sussex. He has built the ‘RadCom’ SSTV receive converter and BATC character generator and is looking for ideas for a fast-to-slow scan converter. He will be pleased to hear from others in his area, so that he can try out the receive converter.

More news

So there we are: once again you have sent plenty of letters, and I apologise if I had to abbreviate your news just a little. I always enjoy reading your letters and printing your news, even if I don’t get a chance to reply to each letter. Let me have more news for next time and send it to me at Brentwood, care of the Editor. Many thanks in advance.
In retrospect, February wasn’t anything to shout about as far as DX-TV was concerned compared with previous months. The Sporadic-E activity which continued throughout the winter appeared to fizzle out at the beginning of the month. Most days produced evidence of meteor-scatter activity which helped fill an otherwise empty log. A tropospheric opening appeared during the period between the 12th and 16th giving Scandinavian Band III and UHF reception on the 12th and the usual West German and Dutch transmitters for the remaining time.

A short-lived but intriguing Sporadic-E (SpE) opening occurred on February 5th during the late morning. Signals were observed on channels E2 and E4 consisting of programme material coming from south-east Europe. Tuning around the band produced colour bars between channels IA and E3. The pattern was finally swamped by RAI (Italy) programmes on channel IA. It is suspected that the colour bars originated from Nord Center Television, one of Italy’s private stations situated close to Udine in the north-east of the country. This station is frequently received during the summer months when there are intense SpE openings. We haven’t as yet seen them on programmes. Colour bars or similar electronic displays are often radiated by NCT for lengthy periods even during the early evening.

Eastern European signals were seen on R2 at 1136 GMT via SpE but they soon faded away. The highlight was the sighting of a test card not unlike the very old USA ‘Bull’s Eye’ type via meteor-shower for just a second or so on channel E4. It was probably only a technical programme from a European service!

**DX-TV Log for February**

The following meagre log reflects the conditions during the month under review. But don’t forget, as you read this the 1984 Sporadic-E season should be opening up.

1/2/84:

- CST (Czechoslovakia) on channels R1 and R2 with the ‘RS-KH’ EZO electronic test card; ORF (Austria) on E2a radiating the Philips PM5544 test card plus the monochrome Telefunken T05 test card; DDR: F (East Germany) E4 on electronic test pattern; TVE (Spain) E3 on test card prior to programmes.

5/2/84:

- Unidentified programmes via SpE during the late morning from south-east Europe; unidentified signal on channel R2; RAI (Italy) on IA; Colour-bar pattern probably from NCT Italy on a frequency between IA and E3; USA-type test card on E4 via meteor-shower propagation (MS).

6/2/84:

- TSS (Russia) R1 transmitting the old 0249 monoscopic test card via SpE; co-channel reception of programme on R2 at times.
- DR (Denmark) E3 on PM5544; CST R1 on EZO test card floating with TSS and co-channel programme; TSS R2 via SpE with programmes.

7/2/84:

- TSS R1 on ‘BPEMR’ News programme; MTV-1 (Hungary) R1 with the multi-burst pattern; CST R2 on EZO test card; unidentified programme via SpE on E4.

8/2/84:

- DDR: F E4 on test card; CST R1 with the ‘RS-KH’ test card.

10/2/84:

- CST R2 on test card.

12/2/84:

- NOS (Netherlands) 1st network clock caption with programmes during the early evening on E4 from the Lopik transmitter via improved tropics.

13/2/84:

- NOS-1 E4 on ‘PTT-NED.1’ PM5544 test card; SR (Sweden) on E10 from the 60kW outlet at Naessjo and E11 from Kisa (30kW); DR (Denmark) E5 and E10 with skiing followed by closedown sequence and ‘DR DANMARK’ PM5544; SR-2 channel E30 and SR-1 on E9 seen late evening on programmes from the Goeteburg outlet; NRK (Norway) E10 from Skien and E11 from Halden on programmes followed by the closedown sequence at 2215 with a clock caption and programme schedule for TV and radio.

14/2/84:

- NOS-1 E4 and E6 on ‘PTT-NED.1’ PM5544 plus NOS-2 with ‘PTT-NED.2’ test card on channel E45. NOS-1 was seen later on E5 with programmes; RTBF 1 (Belgian French-language network) on E8 from Wavre with the PM5544 following closedown; West Germany E9 and E11 from Westdeutscher Fernsehen (WDR) 1st Network with identification caption and programmes. All reception via improved tropospheric conditions.

16/2/84:

- TSS R1 on clock caption and BPEMR News programme during a short SpE opening between 1759 and 1805.

20/2/84:

- CST R2 on ‘RS-KH’ test card.

21/2/84:

- TVP (Poland) R1 on PM5544 with a dark background; CST R1 and R2 on EZO pattern.

22/2/84:

- NRK E3 with the identification ‘NORGE GAMLEM’ on the PM5544 from Gamlemsveten.

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**Pic 1** Telefunken T05 monoscopic test card radiated by ORF FS2 in Austria

**Pic 2** Russian News programme relayed in East Germany for the Soviet Army stationed around Berlin

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Experienced French DX'er Pierre Godou (Rennes) has supplied details of his DX-TV set-up. His aerials are shown in Picture 4 and comprise separate wideband Band III and UHF arrays both with masthead amplifiers. For Band I coverage two Fuba multi-element arrays are used. One is cut to channel E4, the other is cut to channel E2. Both are equipped with masthead amplifiers. The system is atop a lattice mast and is fully rotatable. A dual-standard (French 819 lines/CCIR 625 lines) Sony 112UM monochrome portable receiver is used which covers the CCIR system B channels. For FM radio DX a Sony CRF 290 receiver is employed which provides 84-108MHz coverage. Pierre's receivers are shown in Picture 5.

Alan Jardin has written from Kuwait informing us of possible Italian TV reception towards the end of the last Sporadic-E season. He has also received several Middle East TV services such as those operating in Bahrain and Dubai in Band I. Alan hopes to receive the ARAMCO TV service from Dhahran in Saudi Arabia but it may be very difficult. Dhahran uses channel E3 with only a few kilowatts effective radiated power (ERP) and it is too close for normal SpE reception. At the same time the transmitter seems too low-power for reliable tropospheric DX, Alan has now become interested in satellite TV. Only the Emir (or King) has a satellite dish, so far, and when our correspondent made enquiries about obtaining a system, the local suppliers were very suspicious!

A few Swedish delicacies were sampled during the tropics by Kevin Jackson in Leeds. On the night of the 12th, Sveriges Radio 2nd network programmes were coming in on channel E39. Kevin suggests that this may have been the 2.2kW outlet at Kungshamn on the west coast, just north of Goeteborg at a distance of some 937Km. There are two alternative outlets but at greater distances. These are Oernskoeldsvik with 400kW (120km north-east of Sundsvall) and Sylsabeaek on 10kW situated north of Karlstad.

The 13th showed an improvement for Kevin with SR-1 on E9 (from Goeteborg) and E11 (possibly from Kisa with 30kW) together with SR-2 on channel E30 (Goeteborg) and E37 (from Vasteras on the east coast at 1265Km). The latter two signals were almost snow-free on test card and programmes. Danmarks Radio (Denmark) were also seen during the afternoon from both the E5 Aalborg 50kW and E10 Vestjylland 60kW transmitters. A few French (TDF) transmitters in Brittany were noted but the only West German signals to arrive at Kevin's location were from Harz West on E10 and Kiel on E35.

Gosta van der Linden (Netherlands) appears to have received the low-power (10kW) Belgian UHF transmitter located in the Brussels area on channel E25. The outlet, which radiates BRT TV2 programmes, is situated atop a tall building. Gosta has advised that following the collapse of the Wavre transmitter in Belgium, one of his most frequent signals on channel E28 has disappeared from his log. However he can receive RTBF TELE 2 programmes from a channel E49 outlet operating near Brussels. During the recent improved tropospheric conditions, Gosta noted a variety of British UHF stations and he even caught a glimpse of the famous BBC 2 Colour Test Card 'F'.

**Service Information**

**Eire:**

Radio Teletís Eireann are to close the low-power channel C relay in Dublin.

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**Contact Information**

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since UHF coverage of RTE-1 in the area is considered to be adequate.

The RTE-2 network is to be radiated from the Kippure main transmitter on channel J (223.23MHz vision) on full power by mid-1984. It should be noted that channel I is often omitted from charts and listings and is usually incorrectly quoted as being channel J. Channel H is 207.25MHz, channel I is 215.25MHz and channel J is 223.25MHz. These frequencies correspond to vision carriers.

**Spain:**

Television Española appears to have altered their test transmissions. The GTE electronic test card, normally radiated for about 15 minutes prior to programme commencement, has been seen at various times of the day. Perhaps the familiar electronic bar patterns which carry transmitter location information has been discontinued – for at least the moment. We will keep a look out towards the south over the next few weeks.

**Belgium:**

According to the latest EBU station list the Brussels transmitter radiating TELE2 programmes on channel E45 has increased its ERP from 500W to 1KW.

**France:**

France Régions 3 are radiating a special colour test pattern during the afternoon. It consists of vertical bars with superimposed Antiope (French teletext service) information.

**Syria:**

The EBU now lists the SRT transmitters from Abou Kamal and Nabi-Saleh, both operating on channel E3, with ERP's of only 400W and not 400KW! Hassake on E4 is listed as 95W rather than 35KW.

**Denmark:**

The regional programme from Danmarks Radio known as ‘TV SYD’ is radiated on Sundays between 1300 and 1400 local time with repeats on Mondays from 0830 to 0930 and 1545 until 1645. The outlet at Senderjylland operates on channel E7 with 60KW ERP.

**West Germany:**

Programmes from Norddeutscher Rundfunk (NDR) are broadcast on channel E28 from Neumunster with 200KW. The ERP should now increase to 500KW. The Molin/Tarkau transmitter is in service on channel E53 with an ERP of 20KW. Transmissions are also radiated from a 100W relay at Lauenburg on E46. The FuBK test card includes the identification ‘SH’.

WDR-1 has started broadcasting from a 100KW outlet at Bonn on channel E43. The FuBK test card carries the identification ‘WDR 1 BO 43’.

Service Information this month was kindly supplied by Andy Webster (Wigan), Gusta van der Linden (Rotterdam, Netherlands) and the European Broadcasting Union (Belgium).

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**HAVE YOU THOUGHT OF BECOMING AN AUTHOR?**

We are always interested in receiving articles to be considered for publication and are particularly keen to hear from anyone who has something to say related to the amateur radio field. As mentioned before, projects for fellow readers to build are most welcome.

You don’t need to be an expert writer. If you can get your ideas down on paper, preferably typed, with drawings that we can follow and photographs where relevant, we will sort out the style, grammar, spelling etc.

If you have an idea for an article, or have designed and built a project that you think others would be interested in, but still have doubts about becoming an author, why not write (giving brief details and your telephone number) or telephone the editorial dept... and of course you will be paid for your effort.
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Pye Pocketkite Nightfall for PFI/TX/RX. New boxed £15. £10. Whish aerial Ex-Gov. 4ft collapsible £1.00.

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JUNE 1984
Keeping the promise made in the December 1983 issue, here are some Latin American stations to be heard on the short wave band (3200 to 3400).

There is a station, Radio Riberao Preto in Brazil, on 3205 that has been logged here many times and which is on the air from 0600 to 0400 with a power of 1kW. If conditions are good for LA reception and the channel is relatively QRM free, then this one is a good 'marker' or indicator for other South American transmissions on this band.

Slightly higher up the band there is HCJB Quito in Ecuador on 3220 where it is scheduled from 0900 to 1300 and from 2130 to 0200 in Quecha – the local Indian language – and from 0200 to 0500 in Spanish, the power being 10kW.

Regularly reported in the short wave listener press is the Brazilian Lins Radio Clube, Lins on 3225 which operates in Portuguese and is on the air from 0730 to 0400 at 1kW. Sometimes the dominant transmission to be heard on this channel is the Venezuelan Radio Occidente in Tovar, on the air from 1000 to 0400 at 1kW (Saturday and Sunday until 0300) in Spanish.

The Ecuadorian La Voz del Triunfo, Santo de los Colordos may be heard on 3252 but reportedly varies from 3252 to 3253 on occasions, identifying as 'La Voz del Tigre'. It is on the air from 1000 to 0400 with a power of 1kW.

In Calcuta, Ecuador is located La Voz del Rio Carriyal operating on 3260 at 2kW from 1300 to 0330 (Saturday until 0400) and on Sunday from 1200 to 0300, identifying as 'Radio Carriyal'. If, however, you would like to try for some real super DX, why not tune to 3292 where operates the Peruvian La Voz de Oxapampa located in Pasco and tuned on the air from 1100 to 0330 at 1kW. Recently moved from 3260, where it was rarely reported probably due to co-channel QRM, it should now be in the clear – we hope.

On 3275 there is a mix of two Brazilians and one Venezuelan, the latter being Radio Mara, Maracaibo working from 1000 to 0400 at 1kW and the most often reported channel occupant, the Brazilians being Bauru Radio Clube (0730 to 0400 at 1kW) and Radio Difusora, Caceres scheduled from 0900 to 0330 at 1kW. The latter mentioned is not very often featured in the SW press. Quite recently brought to notice is the Ecuadorian La Voz del Napo located in Tena and radiating programmes in both Spanish and Quecha from 2200 to 0230 with a power of 1kW on 3280. Quite recently a new occupant has appeared on this channel in the guise of Radio Chaco, Yacuiba in Bolivia, both the power and the schedule being unknown.

On nearby 3284 may be found the Peruvian Radio Esmeralda in Huanta, on the air from 2100 to 0300 at 1kW. Just alongside, on 3285, you will find the often logged Radio Belize, Belmopan in Belize working to the schedule 1100 (Sunday from 1200) to 0510 at 1kW, always assuming of course that your listening session has coincided with a period of good conditions for reception of this area of the world.

Another DX gem for UK listeners would be the reception of the 0.36kW La Voz del Rio Tarqui in Cuenca, Ecuador, scheduled from 1000 to 0500. It is currently reported by USA DXers as operating on 3286, a move from the previously occupied 3285 channel, but it has also been heard on 3669 so take your choice.

On 3290 there is the Peruvian Radio Tayabamba in La Libertad province with the schedule 1100 to 0315, power unknown; and Radio Panamerica with a 1kW signal from 2300 to 0300 operating from Quero in Ecuador. A few kHz up the dial to 3300 where, sometimes, one can log Radio Cultural in Guatemala City, Guatemala, now working from 2245 to 0830 with a power of 10kW and being regularly mentioned in reports from DXers. The Bolivian Radio San Miguel located in Riberara occupies the 3310 channel from 1000 to a variable closing time around 0300. The power is 1kW and logged here in the UK several times a year.

In the above schedules I have included only that part applicable to possible reception here in the UK and omitted those times which prohibit any chance of success. The review continues next month.

**AROUND THE DIAL**

This information is provided to assist those interested to tune around their dials to the frequencies, and at the times stated, hopefully to log the stations we have listed here.

**AFRICA**

**Egypt**

Cairo on 15155 at 1529, an interval signal of local-style music then OM (old oam = male announcer) with station identification and recitations from the Holy Qur'an at the commencement of the Afghan programme directed to East and Central Africa from 1530 to 1630.

Cairo on 17690 at 1433, OM with recitations from the Holy Qur'an during the Hindi transmission times from 1430 to 1530.

**Libya**

Tripoli on 15415 at 1100, OM with station identification in Arabic, drums, Arabic-type music then OM with songs in a relay of the Domestic Service on this channel from 1100 to 1745, thereafter radiating programmes as 'Voice of the Greater Arab Homeland'.

**Morocco**

Tanger on 17595 at 1435, OM's with songs in a vernacular, local-style music in a relay of the Home Service to the Middle East, West Africa, Europe, South Morocco and Mauritania, scheduled from 1100 to 0100 on this frequency.

**Zambia**

Lusaka on 4910 at 2017, OM's with a discussion in a vernacular – they use seven of them plus English in their broadcasts – but this channel is the Home Service entirely in vernaculars on the air from 0350 to 0530 and from 1530 to 2105 (Friday and Saturday until 2205). The power is 50kW.

**THE AMERICAS**

**Columbia**

Emisora Nuevo Mundo, Bogota on 4755 at 0654, OM with a programme of recorded local pop songs and music then OM with promos complete with echo-effect. The language is Spanish and this one is operating irregularly on a 24-hour basis, the power being 1kW.

Ondas del Meta, Villavicencio on 4885 at 0656, OM with a ballad in Spanish complete with local-style orchestral backing. OM with the station identification as 'Ondas del Meta, La Voz del Llano, Villavicencio, Colombia' and frequencies, 1kW.

**Costa Rica**

Emisora Radio Reloj, San Jose on 4832 at 0553, OM announcer then pop songs and music in typical local style. This one is on the air around-the-clock and has a power of 1kW.

**Guatemala**

La Voz de Nahuala, Nahuala on 3360 at 0223, OM with announcements in Spanish, YL (young lady – female announcer or artiste) with a local folksong. LV de Nahuala operates from 2130 to 0230 at 1kW. The channel is a difficult one owing to the surrounding commercial QRM (man-made interference).