Morgan

NEW STYLE

Radio & Electronics World

FEBRUARY 1985 99p

AUSTRALIA
HOLLAND
NEW ZEALAND
NORTH AMERICA $2.95
D71699

For all aspects of practical amateur radio

Simply the Best

LOW-PASS FILTER:
AN INEXPENSIVE HIGH-POWER UNIT

DBS:
TELEVISION BY SATELLITE

DATA FILE:
LED BAR-GRAPH & 7-SEGMENT DISPLAYS

JOYSTICK:
TOUCH-SENSITIVE DEVICE TO BUILD

AIRBORNE TV:
HISTORIC PICTURES OF 1939 EXPERIMENTS

LONGWAVES LIVE ON!
DROITWICH'S 50TH BIRTHDAY

CONTENTS

Editor
Jim Chalmers
Assistant Editor
Duncan Leslie
Advertisement Manager
Anne Brady
Publisher
Peter Williams
General Manager
Alan Golbourn

Published by
Radio & Electronics World Magazines
Sovereign House
Brentwood
Essex CM14 4SE
England
Tel: (0277) 219876
ISSN
0262-2572
Printed
In Great Britain

Newstrade sales
Seymour Press Ltd
334 Brixton Road
London SW9 7AG
Tel: 01-733 4444
Subscriptions
Tel: 01-684 3157

Audit Bureau of Circulations
Membership approved pending first audit

Safety in the shack
Some of the constructional projects featured refer to additions or modifications to equipment; please note that such alterations may prevent the item from being used in its intended role, and also that its guarantee may be invalidated.
When building any constructional project, bear in mind that sometimes high voltages are involved. Avoid even the slightest risk – safety in the shack please, at all times.

Cover Photographs
Top – First sight of new mobile aerial from ARM
Bottom – The new Motorola single chip microcomputer (p9)

SPECIAL FEATURES

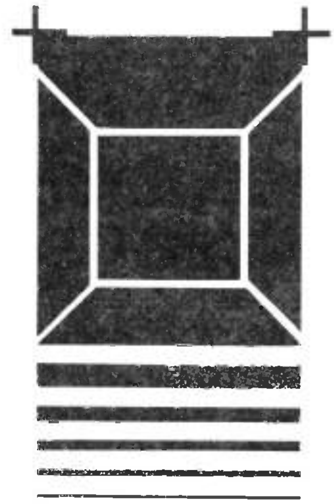
REGULARS

READER SERVICES

NEXT MONTH

☐ **Next Issue**
Cover date March 1985 on sale Thursday, 14 February

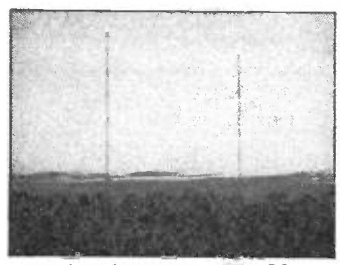
☐ **Publication Date**
Second Thursday of the month preceding cover date



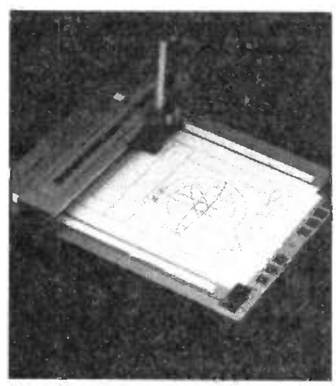
JOYSTICK

Comfort and joy – page 23

Understanding DBS – page 18



News from longwave – page 34



The plot thickens – page 8

PRODUCT NEWS

Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributors and dealers are invited to supply information on new products for inclusion in Product News.
Readers, don't forget to mention ***Radio & Electronics World*** when making enquiries

RTTY PROGRAM

Newly produced by Pearsons Computing is the G1FTU RTTY program for the 48K Spectrum.

This software allows the computer to transmit and receive RTTY with no interface or terminal unit.

The user simply connects the EAR and MIC sockets on the Spectrum to the external speaker and audio input of the transceiver.

The program features split screen operation with full type-ahead during receive and transmit, and the user has his (or her) own personalised CQ memory and eight other memories of up to 255 characters each, which may be saved on cassette.

Other features include baud rate variable between 45 and 110 baud, variable transmit tones, on-screen tuning indicator, unshift-on-space, and the capability to receive reversed 'mark' and 'space' tones.

The program also provides the user with a unique 'clarifier' facility for tuning accurately to FM RTTY tones.

Prospective buyers of the program can be assured that it will run correctly on *all* issues of the 48K Spectrum, including those fitted with microdrives, printer, joystick interfaces etc, so that you don't have to dismantle the system in order to use the program, as with some of the software on the market today.

The program costs £10 inclusive, and orders from licensed amateurs should be accompanied by a callsign for the CQ memory. Non-amateurs will be allocated a 'dummy' callsign.

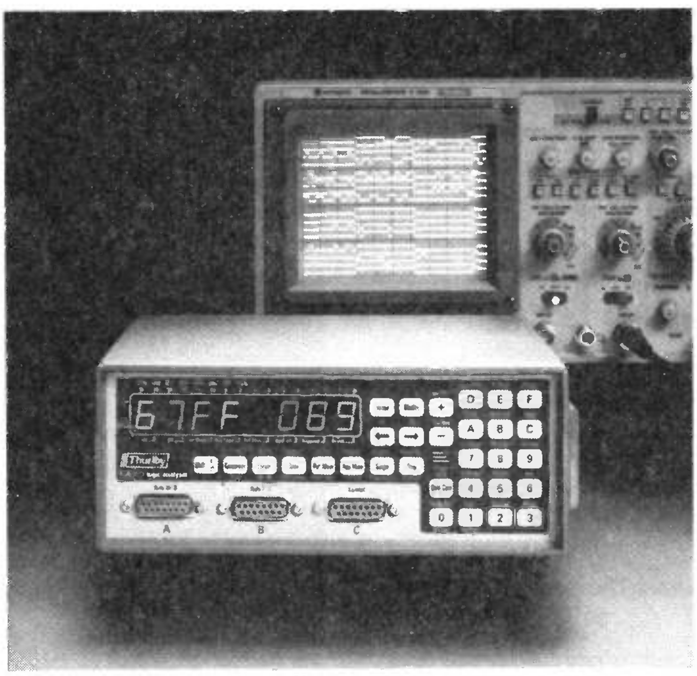
Pearsons Computing,
42 Chesterfield Road,
Barlborough,
Chesterfield,
Derbyshire.
Tel: (0246) 810652.

LOGIC ANALYSER

Thurlby Electronics have launched what they claim to be the world's first low-cost, high-performance logic analyser.

With a basic price of only £395 Thurlby believe that the LA-160 will greatly expand the market for logic analysers, since it can be allocated on a one per engineer basis, as with multimeters and oscilloscopes.

Designed and built in Britain, the LA-160 has 16 data channels (expandable to 32) and a 2000 word acquisition memory. The built-in state domain display shows the data in any of five formats: binary, octal, decimal, hex or mixed. A full sixteen channel timing domain display is also available by connecting to any conventional oscilloscope. The maximum clock rate is 10MHz for the LA-160A or 20MHz for the LA-160B.



Comprehensive trigger facilities include 20-bit trigger width, the ability to set the trigger word in any display format, selectable trigger hold-off, and a trigger arm input with selectable delay. Data can be captured synchronously or asynchronously using either the clock of the circuit under test or the internal clock, which has sixteen selectable frequencies from 1KHz to 10MHz or 20MHz.

The LA-160 is microprocessor controlled via an interactive keyboard with all the set-up information being stored in permanent memory. A non-volatile reference memory is also included. This can be loaded from the acquisition memory or the keyboard and allows reference data to be stored for comparison purposes.

Extensive software facilities include word search, block memory compare, word by word memory compare, and stop on equality or non-equality acquisition modes. A built-in RS232 interface enables the contents of the acquisition memory to be dumped to a computer.

The LA-160 weighs less than 1.8Kg (4lb) and is compact enough to fit into a tool kit or briefcase. As such it has a unique advantage over other logic analysers in portable applications.

Thurlby Electronics Ltd,
New Road,
St Ives,
Cambs PE17 4BG.
Tel: (0480) 63570.

MORSE TUTOR

PNP Communications have announced the release of a Morse tutor program for the Amstrad CPC 464 computer.

The program, which is available on cassette, takes a structured approach to the problem of gaining proficiency in the sending and receiving of Morse code.

Five modes of operation are possible:
(1) Structured tutor.
(2) Specify letters to be practiced.
(3) Select random words from internal library.
(4) Type in text to be coded.
(5) Load text from data cassette.

Over two hundred words are available in the standard internal library and they have been chosen to cover a wide range of letter combinations. Further words or text can be loaded into the program from a previously prepared data cassette. This feature is useful in setting up a dummy-run of the Morse test.

A separate program is supplied on the tutor cassette for the preparation of data tapes.

The speed range is from 4 to 24 words per minute and has been timed using the standard 'Paris' test word.

Figures are included as a separate section in the structured tutor and can be intermixed with letters in the 'text' modes. Punctuation characters may also be mixed with text and figures in the 'text' mode.

The program is available at a price of £6.90 including VAT and post and packing.

PNP Communications,
62 Lawes Avenue,
Newhaven,
East Sussex BN9 9SB.
Tel: (0273) 514465.

934MHz TRANSCEIVER

Communications specialists Commtel UK have introduced a new high quality Japanese 934MHz Personal Transceiver. Offering improved reception quality and range, 934MHz is set to revolutionise CB.

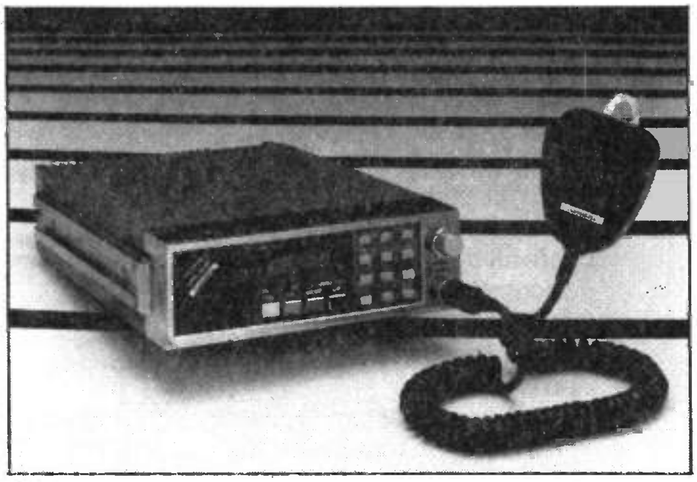
The Commtel 934 has a number of features which immediately identify the unit as a good transceiver for the serious CB enthusiast. The fully illuminated control panel is designed for easy, safe operation with a green LED display for channel numbers, and audio sound is provided by high and low sound speakers.

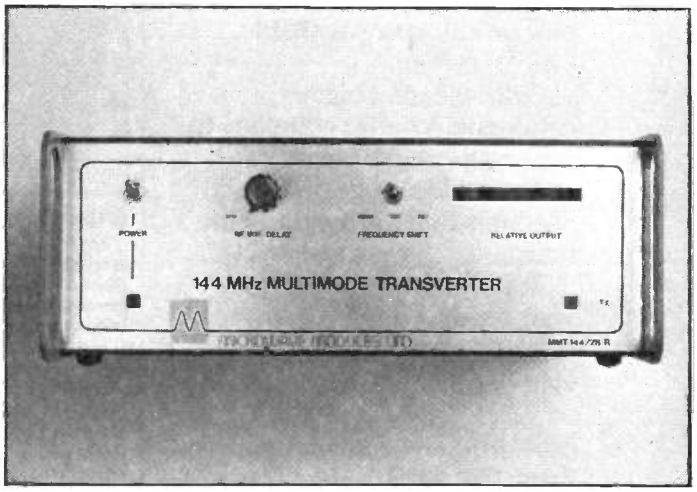
Advanced circuitry provides reverse polarity protection, and the built-in back-up power supply ensures the memory can store information for up to 1 week after the unit is disconnected from a power source.

The Commtel 934 has a multi-function high sensitivity microphone with PTT button up and down facilities. Installation and removal couldn't be simpler with the unit's easy-to-use slider mounts.

The Commtel 934 has a recommended retail price of £460.

Commtel UK, Talgold Ltd,
Fengate,
Nr Third Drove,
Peterborough.
Tel: (0733) 313444.





MULTIMODE TRANSVERTER

The MMT144/28-R is a new transverter from Microwave Modules designed to allow users of HF transceivers to achieve a first-class transceive facility on the 144MHz band.

The rugged receive section uses a GaAsFET in a noise-matched configuration feeding a high level double balanced mixer. In combination with the JFET amplifier for IF gain, this gives a good signal to noise ratio, with excellent immunity to overload and cross modulation.

There are two separate low noise oscillators, selection of which is made using a quad op-amp circuit. Simplex, repeater and reverse repeater operation are provided. Design of the unit is such that the high level injection is extremely pure and free from harmonics.

The transmit section incorporates an ALC circuit in order to produce a totally clean signal from the transverter. The 28MHz input, of ¼-300mW, is amplified after the RF Vox, ALC control and input level control circuits to an output power of 25 watts.

Indication is given on the front panel of power on, transmit, and relative output power.

Microwave Modules Ltd,
Brookfield Drive, Aintree,
Liverpool L9 7AN. Tel: (051)523 4011.

ELECTROLYTIC CAPACITORS

A new range of general purpose electrolytic capacitors is available from Iskra.

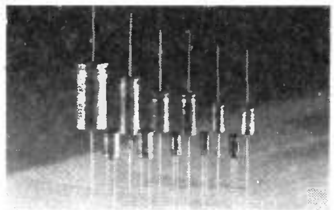
These high surge resistant devices are suitable for use in radio and TV receivers, tape recorders and acoustic equipment as well as for measuring, control and regulation equipment. They can also be used as bandpass and smoothing filters and for timing applications.

The smallest model is the long cathode radial type EEA2011 which is available in sizes from 12 to 35mm long x 5.8 to 14mm diameter, and capacitance values from 0.22 to 2200μF. The slightly larger 15 to 25mm long x 6.5 to 12mm diameter axial type EEA2071 model has a lead at each end and offers capacitance values from 1 to 1000μF, with voltage rating up to 350V.

The axial type EEA2141 is 14 to 21mm diameter x 30 to 50mm long, with a lead at each end, and offers capacitance values from 10 to 10000μF, with voltage ratings to 450V.

The EEB0071 and EEB0141 are bipolar devices, and are available with capacitance values of 4.7 to 68μF and 2.2 to 47μF respectively at 28V ac to 45V ac.

Iskra can also supply large electrolytics with values from 33 microfarads to 150,000 microfarads in voltage ratings from 6.3 volts to 450 volts. Multi-value capacitors are also available in these ranges.



Electrolytics for higher grade requirements (IEC Class 1) are also available.

Literature describing the new range is available on request from Iskra.

Iskra Ltd,
Redlands,
Coulsdon,
Surrey CR3 2HT.
Tel: (01) 668 7141.

Cirkit. Making it per

Cirkit's got the kits you need to make your copy loud and clear.

In all there are over 100 kits to choose from. Selected and designed to offer the best possible standards at the best possible price.

Delivery is fast and reliable.

We keep in touch with the manufacturers and we know what's going on. So as soon as new products are available, Cirkit has them.

Cirkit means a bigger catalogue. A better company to deal with.

And a wide range of kits and products that's growing all the time.

At Cirkit, we're tuned in to your needs.

Just send for our catalogue or visit one of our three outlets at:

200 North Service Road, Brentwood, Essex. CM14 4SG;
53 Burrfields Road, Portsmouth, Hampshire. PO3 5EB;
Park Lane, Broxbourne, Hertfordshire. EN10 7NQ.

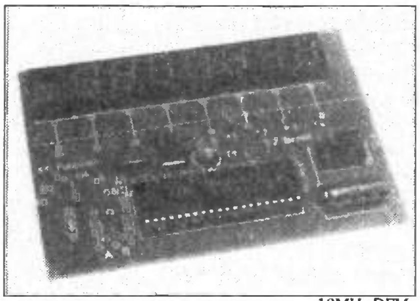
Please add 15% VAT to all advertised prices and 60p post and packing. Minimum order value £5 please. We reserve the right to vary prices in accordance with market fluctuation.

10MHz DFM

A DFM capable of operating at frequencies up to 10MHz. The kit can be configured in six different measurement modes including: frequency, period, elapsed time and unit counter. Applications can be extended using the CIRKIT prescaler and preamp.

SPECIFICATION: Input signal: 2.0V (min) TTL. Frequency range: 0 to 10MHz. Period measurement: 0.5 to 10 secs. Time measurements: up to 10 secs. Output: BCD multiplexed. Display: 8 digit 12mm LED. Supply: 6-9V DC at 100mA(nom).

41-01500 54.10



10MHz DFM

DFM PRE-AMPLIFIER

The rise time of some low frequency signals, even apparent square waves, is often too slow to give a constant readout from a DFM. The use of a pre-amp ensures that these signals are input to the DFM at the correct level and with the correct shape. This simple addition greatly increases the effectiveness of a DFM at low frequencies.

SPECIFICATION: Frequency range: 1Hz-5MHz. Sensitivity: 1Hz-3MHz:20mV, 3MHz-5MHz: 40mV. Max input voltage: 100V (220V instantaneous). Power supply: 5V 8mA. Input signal: Any. Output signal: TTL square wave.

41-01502 5.13

DFM PRESCALER

This prescaler is intended for use with the Cirkit 10MHz DFM, although it is compatible with other frequency counters. The function of the prescaler is to divide the incoming frequency by ten and to shape it into a waveform suitable for the digital input requirements of the DFM. This enables the frequency range of the DFM to be extended up to 50MHz.

SPECIFICATION: Supply voltage: 5V DC. Nominal current: 25mA. Frequency range: 10kHz-50MHz. Input sensitivity: 20mV(typical). Output: 5V TTL level. Dimensions: 80mm x 50mm.

41-01501 8.55

2m POWER AMP

A carefully designed 20W, 144MHz linear power amplifier, to boost the output of hand-held and transportable transceivers such as the TR2400 IC2E, FT208, FT290 etc. With 10dB gain to give a 20W output from a 2W input. Automatic changeover relay - switched from RF sense circuit. High power - output relay, robust construction with die-cast box, plus RX pre-amp.

SPECIFICATION: Bandwidth -3dB: 144-146MHz. Power gain: min 10dB. Output power; 1W input: 10W, 2W input: 20W. Supply voltage: 10-16V. Supply current (at 12V): <3amps-20W output. Input/Output impedance: 50Ω. Size (excluding sockets): 122 x 96 x 44mm. Pre-amp section spec as 2m Pre Amp Kit.

41-01404 32.87

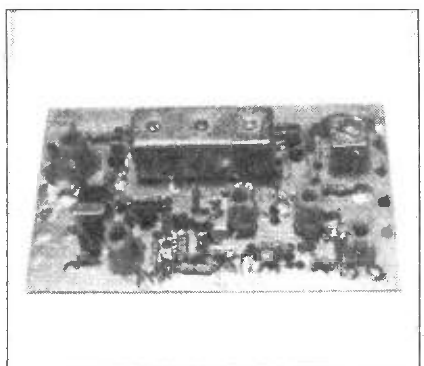
2m CONVERTER

Low noise 2m to 10m converter. This design uses low noise dual gate MOSFETs in the RF and mixer stages which, together with a TOKO pre-aligned helical filter and pre-wound coil, give a high specification and repeatable performance.

A reliable 116MHz overtone oscillator circuit is followed by a double tuned stage which gives a very clean output, this reduces spurii to a minimum. As the circuit is basically linear any mode - AM, FM or SSB - can be converted. The complete circuit is built onto a double-sided PCB.

SPECIFICATION: Noise figure: Less than 2dB. Gain: Min 22dB. 3dB Bandwidth: 144-146MHz. IF Output: 28-30MHz. Input/Output impedance: 50Ω. Supply voltage: 10-16V. Supply current (at 12V): 28mA. Size: 97 x 57 x 22mm.

41-01306 17.35



2m Converter

2m PRE-AMP

Very compact low-noise MOSFET 2m pre-amp. The overall PCB is sufficiently small to be installed inside receivers or transceivers.

SPECIFICATION: Noise figure: Better than 1.5dB. Gain: 18dB Min. Input/Output impedance: 50Ω. Size: 34 x 13 x 10mm.

KIT INCLUDES: Double-sided PCB - All resistors All capacitors - MOSFET - Coils and cans.

41-01307 3.91

To: Cirkit Holdings PLC, Park Lane, Broxbourne, Hertfordshire. EN10 7NQ.
I enclose 85p. Please send me your latest catalogue and 3 x £1 discount vouchers!
If you have any enquiries please telephone us on Hoddesdon (0992) 444111.

Name ______________________

Address ______________________

______________________ Telephone ______________________

Area of Special Interest ______________________

R&EW2

Cirkit
Bigger Stock. Better Service.

New Winter Catalogue Out Now!

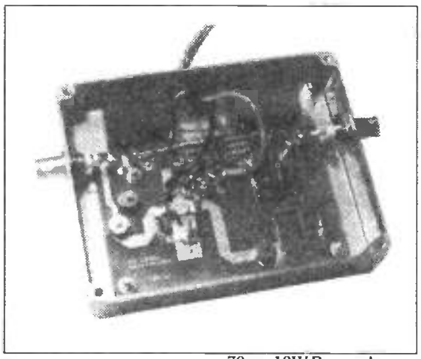
fectly loud and clear.

70cm CONVERTER

70cm to 144MHz low profile converter employing high level Schottky diode double balance mixer, pre-aligned helical filter and low noise transistors. The complete design gives a low noise figure and uses pre-aligned filters and pre-wound coils to give repeatable performance with minimum alignment.

SPECIFICATION: Bandwidth: 430-440MHz. RF Gain: 8dB min. Noise figure: <2.5dB. IF output: 144-146MHz. Supply voltage: 10V. Supply current: 30mA. Size: 97 x 57 x 15mm.

41-01405 21.50



70cm 10W Power Amp

70cm 10W POWER AMPLIFIER

The current generation of UHF handheld synthesised transceivers have almost all the facilities found in mobile/base transceivers, the only major limitation being their output power. For handheld operation 1 watt or so is adequate, but for mobile to mobile and for use wth higher power repeaters, the addition power provided by the CIRKIT amplifier increases the range considerably. This is especially noticeable, as is to be expected, at the limits of the service area.

The Cirkit 70cm Power Amp will boost the output power of hand held transceivers up to 12W. Automatic relay switching between TX and RX, is provided via the RF sense circuitry. The finished unit is mounted in a tough pre-drilled die-cast box, which provides sufficient heatsinking while providing a rugged low profile housing.

SPECIFICATION: Power gain (2W I/P): 7.2dB. Output power (13.8V) 2W input: 10W (min). Saturated power output: 14W. Supply voltage: 10-16V (13.8V nom). Input/Output impedance: 50R. Bandwidth: 430-440MHz. Supply current: 2 amps at 12W. Dimensions: 119 x 94 x 34mm.

41-01505 33.82

70cm PRE-AMPLIFIER

This high performance pre-amp offers increased receiver sensitivity and a corresponding extension of the useful communication range. The completed unit is sufficiently compact to be built into virtually any existing receiver and does not require the use of any test gear when setting up.

SPECIFICATION: 3dB bandwidth: 425-445MHz. Noise figure <2dB. Gain: 13dB (min). 1dB compression: -3dBm (0.5mW). Saturated output: -2dBm (0.7mW). Supply voltage: 8-12V (12V nom). Input/Output impedance: 50R. Dimensions 50 x 10 x 17mm.

41-01506 4.78

NOW AVAILABLE
exclusively from CIRKIT, TAU high quality ATU kits and accessories.

Full HF coverage, tunes from 1.5MHz continuously to 29.350MHz. Based on the reknowned SPC transmatch configuration, TAU innovated this composite module design with large air-spaced capacitors rated at 5kV, tested to 7kV. Roller inductor infinitely variable. Solid precision radio engineering. Heavy weight long life construction. Will tune any transmitter/aerial combination to optimum. A lifetime investment and should never need replacing. Power handling capabilities from a few milliwatts to above 3000 watts PEP. Undoubtedly the finest ATU module available today.

STU 5K ATU Kit 41-50500 130.00

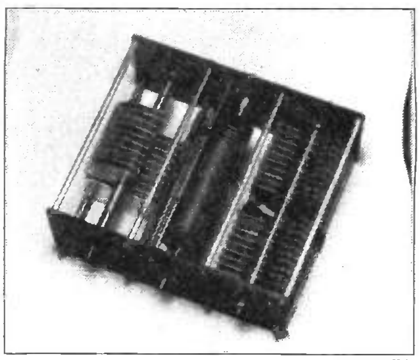
CABINET - custom-made for STU 5K ATU 41-50510 62.50

DIGITAL TURNS COUNTER
Multi-turn, vernier scale with digital indication, for use with roller coaster, with or without cabinet.
Turns counter 41-50520 27.94

BALUNS
To complete the ATU, we have the following Baluns:

Location		PEP	Ratio	Stock No.	Price
Outdoor	OB141	1kW	4:1	41-50141	27.35
Outdoor	OB111	1kW	1:1	41-50111	27.55
Indoor	IB241	200W	4:1	41-51241	17.25
Indoor	IB141	1kW	4:1	41-51141	22.35

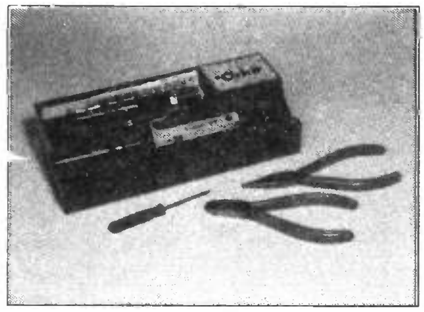
ROLLER COASTER
To complement existing equipment, covers 1-30MHz, 28uH inductance, tapered pitch for 10 and 15 meters.
Roller Coaster 41-50540 46.00



TAU ATU

AKC AERIAL KIT
Unique clip-on spacer system for open wire feeders. Patented design manufactured from an ultra-violet resistant poly-propylene the spacer can be configured to give a 75,300, 400 or 600 ohm system. Kit contains 20 spacers, 1 Tee piece and 2 Ceramic insulators.

AKC Aerial Kit 41-50530 12.70



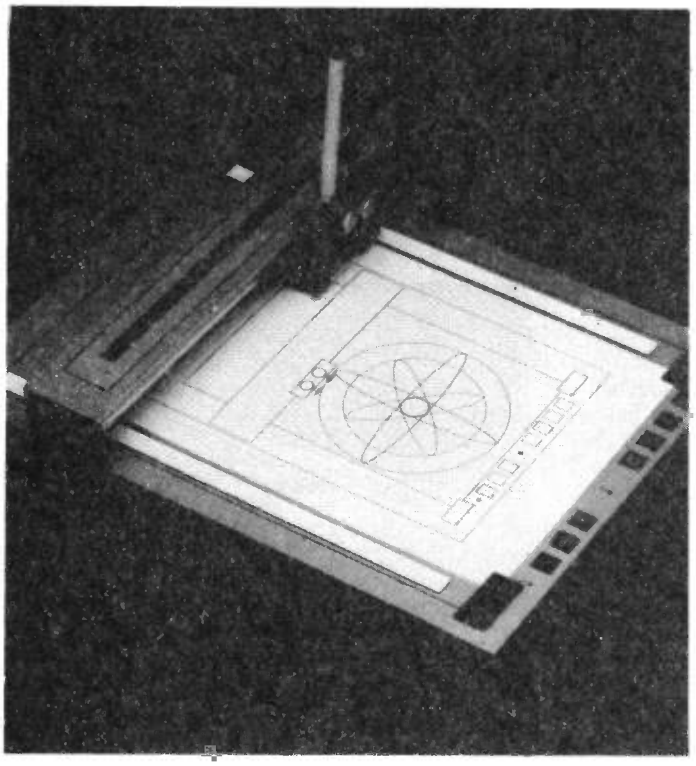
CIRKIT ELECTRONICS TOOL KIT
Contains: 15W Soldering Iron, 2 spare bits, heat shunt, solder, pliers, cutters, and screwdriver.
41-00007 15.56

Selected Lines

PB2720	80dB Piezo Buzzer	43-27201	0.55
10M15A	10.7MHz Filter	20-10152	2.10
FC177	LCD Freq. Meter	39-17700	20.00
CM161	Min LCD Clock	40-80161	8.25
8 x 0.3"	IC socket	28-00800	0.12
14 x 0.3"	IC socket	28-14000	0.13
16 x 0.3"	IC socket	28-16000	0.13
CX120P	COAX relay (PCB)	46-90120	11.96
CX520D	COAX relay (N type)	46-90520	26.98
CX540D	COAX Relay (BNC)	46-90540	26.98
HC6010	10MΩ DMM	56-06010	33.00
HC7030	0.1% Acc DMM	56-07030	43.00
Meteor	100MHz DFM	56-00100	95.00
Meteor	600MHz DFM	56-00600	121.00
Meteor	1000MHz DFM	56-01000	165.00
CS240	Antex 17W Iron	54-22300	5.20
TCP3	Weller temp cont iron	54-20007	17.63
PU3D	Weller 24V PSU for TCP3	54-20026	30.74

Books

The Radio Amateurs: Q & A Reference Manual	02-02157	5.95
Oscilloscopes: How to use them, how they work	02-21300	4.35
The World's Radio Broadcasting Stations	02-11564	7.00
The ZX Spectrum	02-00100	5.95
Electronics Pocket Book	02-21309	7.50
Practical Design of Digital Circuits	02-11831	10.45
Projects in Amateur Radio	02-21304	3.80
Active Filter Cookbook	02-21168	12.70
Beginners Guide to Amateur Radio	02-11262	4.50
CMOS Cookbook	02-21398	11.85
Design of Active Filters	02-21539	10.15
Design of Op-Amp Circuits	02-21537	9.30
Design of Phase-Locked Loop Circuits	02-21545	9.30
Design of VMOS Circuits	02-21686	10.15
Effectively Using the Oscilloscope	02-21794	9.30
Foundations for Microstrip Circuit Design	02-79447	21.00
Handbook of Electronic Tables Formulas	02-21532	11.00
TTL Cookbook	02-10358	11.00
TV Antennas and Signal Distribution Systems	02-21584	10.15



GRAPHICS PLOTTER

Linear Graphics Limited are launching a unique British developed plotter for personal computers.

Known as the Plotmaster, this flat-bed machine employs new linear motors and exclusive optical feedback technology to achieve an outstanding repeat and distance accuracy of less than 0.2mm over the whole plotting area.

Extremely compact at only 30.2 x 38.1 x 10.3cm, the Plotmaster has an effective plotting area of 19 x 27.2cm and will accept either paper or overhead transparency film up to B4 size. It is a two-pen machine with an easy-change facility that accepts virtually all types of popular pens, including roller ball, Rotring and felt tip, as well as pencils and crayons.

Pen speeds of 2.5, 7 and 15cm/sec are available, and operating keys at the side of the plotter provide manual control of pen movements including north, south, east, west, pen up/down and line/local.

Both Centronics and RS232C interfaces are available, allowing the Plotmaster to be used with almost any computer; baud rates of 110, 150, 300, 1200, 2400 and 4800 are available. Both interfaces can reside in the machine at the same time.

Special software, called 'Interceptor', can be provided for BBC computers (models A and B) and Apple II/IIe machines. This software was developed concurrently with the plotter by Linear Graphics.

Interceptor is a powerful routine that intercepts graphics commands for plotting and drawing from BASIC and routes them to the screen or plotter – as required by the user. Thus, graphics programs already written for BBC or Apple computers can be run with the Plotmaster.

The plotter can also be used as a digitiser, and digitising support software is available.

Operationally, the Plotmaster is very reliable and extremely quiet. There are only four moving parts and, due to the use of direct-drive linear motors, gears, pulleys and belts are not involved.

The plotter is competitively priced at £489 and the range of optional accessories includes six-colour pen packs, dust cover, carrying case, digitising sight and interface cables.

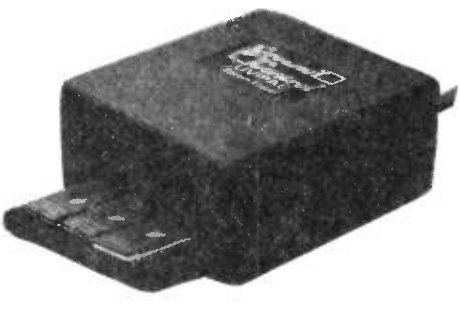
Linear Graphics Ltd,
28 Purdeys Way,
Purdey Industrial Estate,
Rochford,
Essex SS4 1NE.
Tel: (0702) 541664/5.

EPROM ERASER

Now available is an addition to the popular EPROM eraser family from Ground Control, the Uvipac (TS). Designed especially for the home microcomputer enthusiast, the Uvipac (TS) is also useful in the development lab when quick erasure of just a couple of EPROMs is required.

A special type of discharge tube is used to help achieve the very compact dimensions of the Uvipac (TS), which is housed in a 90 x 80 x 40mm plastic case. The 230 or 110 volt (±5%) mains powered unit enables up to 3 EPROMs of any size or 1 CPU with on-board EPROM to be erased in about 15 minutes.

The EPROMs are simply loaded into the conductive foam pad supplied and inserted into the unit. After the door has been closed the unit is switched on, an optical fibre indicator showing positively that the unit is in operation. When the fixed 15 minutes period has elapsed the sounder will beep; the unit is then switched off and the EPROMs removed.



The eraser can be supplied with the timer only (the Uvipac (T)) or with no timer at all (the Uvipac).

Spare tubes and conductive foam pads are available if required.

Prices start from around £20 for the Uvipac.

Ground Control,
Alfreda Avenue,
Hullbridge,
Hockley,
Essex SS5 6LT.
Tel: (0702) 230324.

PRECISION INDUCTORS

Oxley has introduced a new range of high stability, high Q precision inductors, the QLC series.

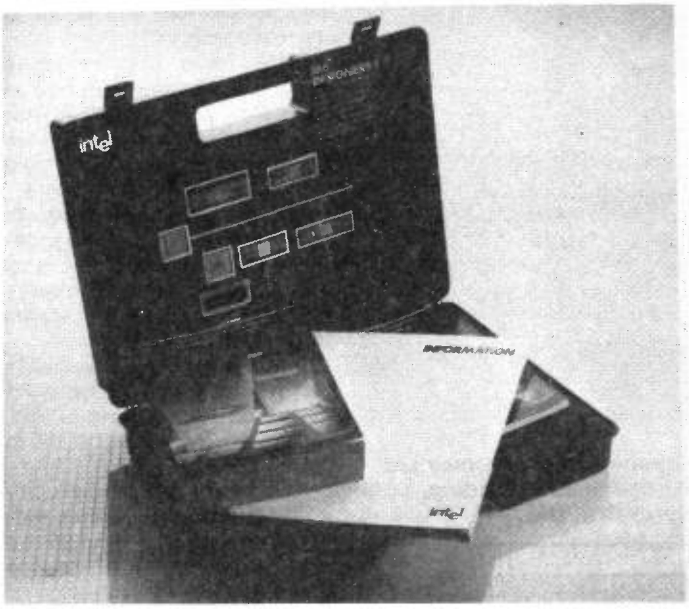
A development of the company's QL high stability metal-on-glass inductors, QLC series components are fabricated from a high purity alumina former onto which is fused a thick, high conductivity silver alloy metalisation. The terminations are silver-plated copper and are bonded using high melting point (300°C) solder to eliminate reflow of termination joints when soldering with standard 60/40 solder, and to allow ease of assembly when using wave-soldering techniques. A shoulder on the terminations allows accurate stand-off spacing from a PCB.

These inductors are used as reference standards for instrumentation, to reform clock pulses for high-speed digital communication systems, precision LC oscillators and many other tank circuit applications.

Inductance values available range from 0.045 to 1.830 microhenries with a standard tolerance of ±5%. Operating temperature range is −55°C to +125°C and temperature coefficient of inductance is ±20ppm/°C.

Oxley Developments Co Ltd,
Priory Park,
Ulverston,
Cumbria LA12 9QG.
Tel: (0229) 52621.

MICROSYSTEM DESIGNER



Now available from Rapid Recall are three Microsystem Designer kits, produced by Intel to allow serious evaluation to be carried out on a CPU and its associated peripheral devices.

The kits are related to Intel's principle CPUs (iAPX 186, iAPX 188 and iAPX 286) and each kit is contained in a smart black 380 x 280 x 100mm plastic briefcase.

Each kit includes a two-volume Microsystem Components Handbook and the appropriate CPU plus a selection of peripheral devices. Typically, the 186 kit includes the iAPX 186, DRAM controller, text co-processor, video interface controller, graphics controller, LAN co-processor and the Winchester disc controller.

Prices of the kits from Rapid are: iAPX 186 – £117.10, iAPX 188 – £117.10, and iAPX 286 – £207.50.

Rapid Recall Ltd,
Rapid House,
Denmark Street,
High Wycombe,
Bucks HP11 2ER.
Tel: (0494) 26271.

SINGLE CHIP MICRO

Motorola Microprocessor Products Division has introduced the MC68HC11A8FN microcomputer, the most highly integrated single chip MCU yet to be produced in HCMOS technology.

Providing sophisticated on-chip peripheral functions as well as low power consumption, high noise immunity, and high speed operation, the MC68HC11A8 offers the most cost effective system level solution available to date. It is fully upward object-coded compatible with the M6801 family and provides an improved instruction set that includes two programmable power saving operating modes, STOP and WAIT, as well as many new 16-bit instructions.

The fully static design of the MC68HC11A8 allows operation at frequencies down to dc, further reducing its power consumption. It is designed to run at a 2MHz bus speed across a −40 to +125°C temperature range to deliver powerful software control capacity in the harshest environments.

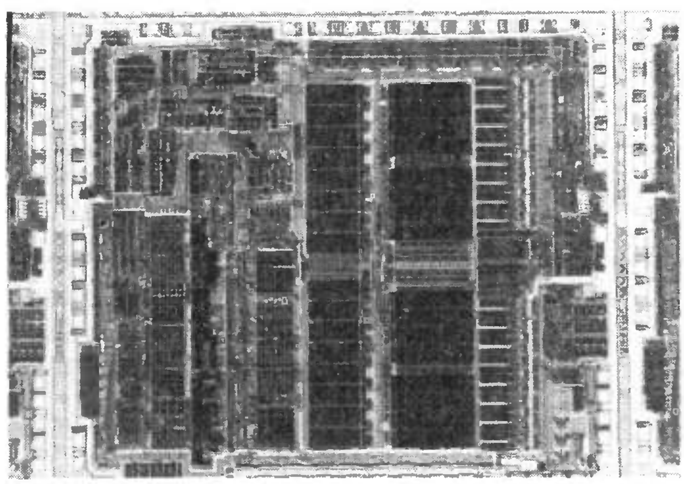
On-chip memory systems include an 8K byte ROM, 512 bytes of electrically erasable programmable ROM (EEPROM), and 256 bytes of static RAM. The inclusion of EEPROM will allow field and factory calibrations to be stored on the chip.

Sophisticated on-chip peripheral functions feature an eight-channel, 8-bit analogue-to-digital converter, an enhanced set of serial ports, timer functions, and parallel ports with full hardware capacity.

The MC68HC11A8 also provides an 8-bit pulse accumulator circuit, as well as a computer operating properly (COP) watchdog system. Since all possible opcodes or opcode sequences are not utilised, an illegal opcode detection circuit is included in this MCU.

The central processing unit (CPU) of the MC68HC11A8 is basically an extension of the MC6801 CPU. In addition to being able to execute all MC6800 and MC6801 instructions, the MC68HC11A8 uses a four-page opcode map to allow execution of 91 new opcodes.

Motorola Inc,
Microprocessor Products Division,
3501 Ed Bluestein Blvd,
Austin, Texas.



PORTABLE PRINTER

Recently made available for immediate delivery by Rapid Terminals is an enhanced version of Digital's popular plain paper printer, the portable LA12 DECwriter Correspondent.

This latest version of the 150 character per second dot matrix machine now features full bold printing capabilities in addition to its many other attributes.

Each character is printed within a 9 x 9 matrix with true descenders, and spacings can be varied between 5 and 16.5 characters per inch – the latter enabling 132 characters to be printed on 8.5 inch wide paper. Line spacing is possible between 2 and 12 lines per inch.

The LA12 has a friction feed platen which accommodates any paper up to 8.5 inches wide, including paper rolls, fanfold computer printout paper and pre-printed forms up to 14 inches long. A tractor feed option is available for use with fanfold paper, if required.

For international use, the LA12 incorporates a universal power supply and character sets for ten languages. The full 128 ASCII character set can be printed using the LA12's QWERTY standard keyboard. Also, the keyboard can be changed to numeric data entry mode using a single keystroke (an indicator shows if the numeric code is selected).

In addition to the usual EIA standard RS232C, RS423 and CCITT-V28 serial interfaces, the LA12 also incorporates an acoustic coupler, approved to work on British Telecom modems, allowing it to be connected to a host computer over standard telephone lines when being used at remote locations.

The LA12 measures only 46.5 x 14.4 x 39.4cm and weighs 9.1Kg. Two models (LA12-C and LA12-D) are available, both having the EIA serial I/O port operating at 50 to 9600 baud. The Model C also includes the acoustic coupler, allowing customers to select which communications facilities best suit them.

Rapid Terminals,
Rapid House,
Denmark Street,
High Wycombe.

PRODUCT NEWS

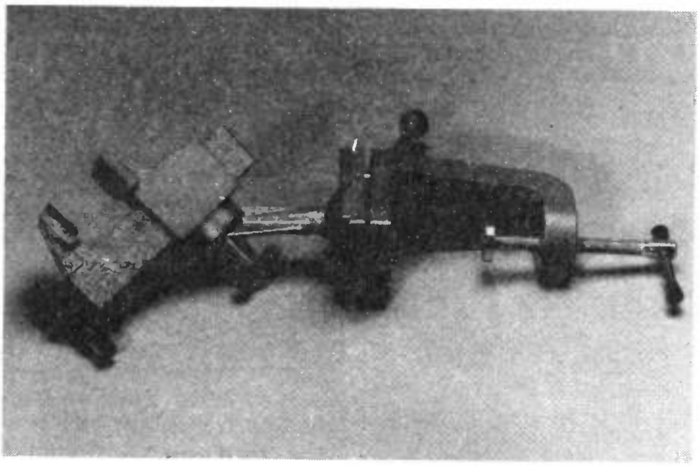
PANAVISE RANGE

The versatile Panavise range of bench-top tools and equipment has been enhanced by several recent additions, and Greenwood Electronics, the sole UK distributor, claims that it now caters for virtually any application.

The original 301 Panavise assembly comprises the 300 base which can be attached by screws to a bench-top, and the 303 vice head which slots into a universal-type joint on the base and can be twisted and tilted to any desired position before being locked in that position by hand tightening a knob.

An alternative vacuum base version (model 380) can be secured to any smooth non-porous surface.

New developments include the Model 324 electronic work centre, which has a Model 371 solder and soldering iron holder mounted on the base. An adjustable PCB rack (315) completes this unit.



Other items that can be used on all base units include the Model 337 fixture head for production fixturing, and the 336 up/down converter base to give additional dimensions of height and tilt. The Model 376 with very wide-opening jaws and the Model 366 with general purpose jaws fit all base units and offer great versatility in clamping the work piece.

Greenwood Electronics Ltd, Portman Road, Reading, Berks RG3 1NE.

CB CONVERSION

R Withers Communications will shortly be marketing a modification kit which will convert any current FM CB transceiver which uses the Sanyo LC137 IC to the amateur ten metre band.

The kit uses six chips and five wires, and will retail at approximately £23.

RWC have also released details of their 1985 range of Raycom VHF/UHF power amplifiers designed to match handheld or portable two metre or 70cm transceivers.

All units feature Mitsubishi or Toshiba RF power modules, and have RF relay changeover, switchable SSB/FM hangtime, and status indication using LEDs.

Input is factory adjustable from 100mW to 5W: the units are set up for an input of ⅓W, but other levels can be set to order.

At present the range available covers eight models with prices from £39.50, and all the amplifiers carry a twelve month guarantee.

R Withers Communications,
584 Hagley Road West,
Oldbury,
Warley,
West Midlands B68 0BS.
Tel: (021) 421 8201/2.

ELMASET INSTRUMENT CASE
No front or rear panels. 300x133x217mm deep
£10.00 ea (£1.30)

REGULATORS
LM317T Plastic T0220 variable **£1.00**
LM317 Metal **£2.20**
7812 Metal 12v 1A **£1.00**
7805/12/15/24 plastic **50p**
7905/12/15/24 plastic **50p**
CA3085 T099 Variable regulator **£1.00**
LM723 14 dil **50p**

EPROMS/MEMORIES
27128-300nS **£18.00**
2764 INTEL/FUJITSU 300ns £6.50, 250nS **£7.00**
2716, 2708, 1702 EX EQUIPMENT £2.00 .... 10/**£17.00**
2732A-4 NEW £3.50 EX EQPT **£2.50**
2114 EX EQPT 80p 4116 EX EQPT **70p**
4164-150nS £3.90 MC6810P **£1.00**

POWER TRANSISTORS
TIP141, 142, 147 £1 ea, TIP112, 125, 42B .... 2/**£1.00**
TIP35B £1.30 TIP35C **£1.50**
SE9302 100V 10A DARL SIM TIP121 .... 2/**£1.00**
2N3055 Motorola 50p .... 5/**£2.00**
2N3055 Ex eqpt tested .... 4/**£1.00**
Plastic 3055 or 2955 equiv 50p .... 100/**£30.00**
2N5302 NPN 30A 60V SIM 2N3771 .... **80p**
2N3773 NPN 25A 160V £1.80 .... 10/**£16.00**

DISPLAYS
Futaba 4 digit clock, fluorescent display FLT-02-8 also 5-LT 16 .... **£1.50**
Futaba 8 digit calculator, fluorescent display 9CT-01-3L **£1.50**
LCD Clock display 0.7" digits **£3.00**
Large Clock display 1" digits **£3.00**
7 seg 0.3" display comm cathode .... 2/**£1.00**

MISCELLANEOUS
5.25" FLOPPY DISCS DS DD BOX .... 10/**£15**
MAINS ROCKER SWITCHES 6A SPST .... 5/**£1**
4700μF 63v ITT 10A RIPPLE **£1**
1.25" Panel Fuseholders .... 5/**£1.00**
STAINLESS STEEL HINGES 14.5" BY 1" OPEN £1.00 each .... 10/**£7.00**

QUARTZ HALOGEN LAMPS
A1/216 24v 150w **£2.25**
H1 12v 55w (car spot) **£1.25**

WOUND POT CORES
With adjuster unused
RM7 LA4245 .... 3/**£1.00**
RM8 LA4344 .... 2/**£1.00**

MAINS TRANSIENT SUPPRESSORS 245v .... 3/**£1.00**
TOK KEY SWITCH 2 POLE 3 KEYS – ideal for car/home alarms £3 £100+ **£2.00**
12v 1.2w small wire ended lamps fit AUDI/VW TR7 VOLVO SAAB .... 10/**£1.00**
14v 0.75w MES lamps .... 8/**£1.00**
Heat shrink sleeving pack **£1.00**
PTFE sleeving pack asstd colours **£1.00**
250 mixed res diodes, zeners **£1.00**
Mixed electrolytic caps .... 100/**£2.00**
ITT CASS RECORD/PLAY AMP + cct **£2.00**
Stereo cassette deck **£5.00**
Stereo cass R/P head **£2.50**
Mono head £1, Erase head **50p**
Thermal cut-outs 50, 77, 85, 120°C .... ea **70p**
Thermal fuse 121°C 240v 15A .... 5/**£1.00**
Vero pins fit 0.1" Vero .... 200/**£1.00**
Double sided PCB pins .... 200/**£1.00**
TO220 Micas + bushes 10/50p .... 100/**£2.00**
TO3 Micas + bushes 10/**50p**
RELAYS 240v AC coil PCB mounting 2 pole changeover £1 3 pole c/o **£1.00**
Fig. 8 mains cassette leads .... 3/**£1.00**
KYNAR wire wrapping wire 2oz reel **£1.00**
PTFE min. screened cable .... 10m/**£1.00**
TOKIN MAINS RFI FILTER 250v 15A **£3.00**
TDK MAINS RFI FILTER 115v 15A **£1.00**
IEC CHASSIS PLUG/RFI FILTER 10A **£3.50**

Epoxy potting compound 500g **£2.00**
Mercury tilt switch small **£1.00**
Min. rotary sw. 4p c/o 1/8" shaft .... 2/**£1.00**
Thorn 9000 TV audio o/p stage .... 2/**£1.00**
10m7 CERAMIC FILTER 50p .... 100/**£20.00**
6m or 9m CERAMIC FITLER 50p .... 100/**£25.00**
240v AC FAN 4.6" SQUARE NEW **£5.50** (£1)
240/115v AC FAN 4.6" SQ. NEW **£7.00** (£1)
KLIPPON terminal block EKS 12/4
12-way 20A term block .... 3/**£1.00**
BELLING-LEE 12-way block L1469 .... 4/**£1.00**
POTENTIOMETERS short spindle
2k5 10k 2m5 Lin .... 5/**£1**
500k lin 500k log long spindle .... 4/**£1**
40KHZ ULTRASONIC TRANSDUCERS EX-EQPT. NO DATA .... PAIR/**£1.00**
STICK-ON CABINET FEET .... 24/**£1.00**
T03 TRANSISTOR COVERS .... 10/**£1.00**
TRANSISTOR MOUNTING PADS T05/T018 £3/1K DIL
REED RELAY 2 POLE N/O CONTACTS **£1.00**

RECTIFIERS
120v 35A stud **50p**
12FR400 12A 400v small stud .... 4/**£1.50**
BY127 1200V 1.2A .... 10/**£1.00**
BY254 800v 3A .... 8/**£1.00**
BY255 1300v 3A .... 6/**£1.00**
1A 800v bridge rectifier .... 4/**£1.00**
6A 100v bridge **50p**
10A 600v bridge **£1.50**
15A 100v bridge **£1.50**
25A 200v bridge £2.00 ea .... 10/**£18.00**
25A 400v bridge £2.50 .... 10/**£22.00**

SCRs
MCR72-6 400v £1 BTX95 800V 15A **£1.50**
BTX95 800v 15A **£1.50**
35A 800v stud **£2.00**
70A 500v large stud **£3.00**
MCR106 equiv. 4A 400v 40p ea .... 100/**£20.00**
2N5061 800mA 60V T092 .... 4/**£1.00**
TICV106D .8A 400v T092 3/£1 .... 100/**£15.00**
MEU21 Prog. unijunction .... 3/**£1.00**

TRIACS diacs 25p
TXAL225 8A 400V 10mA gate 2/£1.00 .... 100/**£35.00**
TXAL228 8A 400v isol. tab .... 2/**£1.00**
25A 400v ex eqpt. tested **£1.50**

CONNECTORS (EX EQPT. price per pair)
'D' 9-way £1; 15-way £1.25; 25-way **£2.00**
37-way £2; 50-way £3.50; covers 50p ea
NEW 25-way PCB SKT **£1.00**
D9 PCB PLUG 90 deg **£1.50**
0.1" double sided edge connector, 32-way ideal ZX81/SPECTRUM **£1.50**
0.1" d/sided pcb plug 24+25-way **£1.50**
2 pole sub min. connectors ideal radio control RS 466/472/488/343 5 pairs **£2.00**

IDC CONNECTORS
25-WAY 'D' PLG/SKT 37 'D' PLUG ea **£2.00**
20-WAY SOCKET (BBC USER PORT) **£1.00**
26-WAY SOCKET (BBC PRINTER) **£1.50**
34-WAY SOCKET (BBC DISC DRIVE) **£2.00**
40-WAY SOCKET **£2.00**

IDC CARD EDGE CONNECTORS D/S EX-EQPT
34-WAY (FITS DISC DRIVE PCB) **£3.00**
40-WAY (FITS CENTRONICS 739 PCB) **£3.00**
50-WAY **£3.50**

IDC RIBBON CABLE
14/16way **50p/m**
26 way **£1/m**
34way **£1.30/m**
60way **£2/m**

WIRE WOUND RESISTORS
W21 or sim 2.5W 10 OF ONE VALUE FOR **£1.00**
1R0 2R0 2R7 3R9 5R0 10R 12R 15R 18R 20R 27R 33R 36R 47R 120R 180R 200R 330R 390R 470R 560R 680R 820R 910R 1K 1K15 1K2 1K3 1K5 1K8 2K4 2K7 3K3 10K

W22 or sim 6 watt 7 OF ONE VALUE for **£1.00**
R22 1R5 9R1 10R 12R 20R 33R 51R 56R 62R 120R 180 270R 390R 560R 620R 1K 1K2 2K2 3K3 3K9 10K

W23 or sim 9 watt 6 OF ONE VALUE for **£1.00**
R22 1R0 3R0 6R8 56R 62R 100R 220R 270R 390R 680R 1K 1K8 10K
W24/ sim. 12 watt 4 OF ONE VALUE for **£1.00**
R50 2R0 10R 18R 47R 68R 75R 82R 150R 180R 200R 270R 400R 620R 820R 1K

PHOTO DEVICES
Slotted opto-switch OPCOA OPB815 .... **£1.30**
2N5777 50p .... 100/**£26.00**
TIL81 T018 Photo transistor **£1.00**
TIL38 Infra red LED 2/50p .... 100/**£16.00**
OPI2252 Opto isolator **50p**
Photo diode 50p .... 6/**£2.00**
MEL12 (Photo darlington base o/c) **50p**
RPY58A LDR 50p ORP12 LDR **85p**
LEDs RED 3mm or 5mm 12/£1 .... 100/**£6.00**
GREEN or YELLOW 3 or 5mm 10/£1 .... 100/**£6.50**
FLASHING RED 5mm 50p .... 100/**£30.00**

DIODES
1N4148 .... 100/**£1.50**
1S3740 Germanium .... 100/**£2.00**
1N4004 or SD4 1A 300v .... 100/**£3.00**
1N5401 3A 100V .... 10/**£1.00**
BA157 1A 400V Fast recovery .... 100/**£2.50**
BA159 1A 1000V Fast recovery .... 100/**£3.50**

MULTI TURN PRESETS
10R 20R 100R 200R 500R **40p**
2K 5K 22K 50K 100K 200K

IC SOCKETS
8-pin 12/£1; 14-pin 10/£1.00; 18/20-pin 7/£1; 100/£12; 1k/£80; 22/28-pin 25p; 24-pin 25p; 100/£20; 1k/£100; 40-pin 30p; 16-pin 12/£1; 100/£6

TRIMMER CAPACITORS small
GREY 1.5-6.4pF GREEN 2-22pF .... 5 for **50p**
GREY larger type 2-25pF .... 5 for **50p**

SOLID STATE RELAYS NEW 10A 250v AC
Zero voltage switching
Control voltage 8-28v DC **£2.50**
VARIAC 0 to 130v 6A new uncased **£6.00**

POLYESTER/POLYCARB CAPS
10n/15n/22n/33/47n/68n 10mm rad .... 100/**£3.00**
100N 250V radial 10mm 100/£3 .... 1000/**£25.00**
1u 250v C280 5/£1 .... 100/**£10.00**
1u5 P/carb 15mm rad .... 100/**£5.00** (£1)
2u2 160v rad 22mm .... 100/**£10.00** (£1.50)
470n 250v AC X rated rad .... 4/**£1.00**
33n 250v AC X rated rad 15mm .... 10/**£1.00**
10n 250v AC X rated rad 10mm .... 10/**£1.00**
100n 600V SPRAGUE axial 10/£1 .... 100/**£6.00**

BEAD THERMISTORS
GLASS BEAD NTC Res @ 20°c **80p**
250R 1K2 50K 220K 1M4
R53 THERMISTOR **£2.00**

BEAD TANTALUM CAPS
6u8 25V 47u 3V 68u 6V 12/£1 .... 100/**£6.00**
2u2 20V 8/£1 .... 100/**£8.00**

SMALL AXIAL CERAMIC CAPS 50V
15p 18p 22p 27p 33p 47p 68p 82p 470p 1n 10n (25V) .... 100/**£3.00**

MONOLOTHIC CERAMIC CAPS
100N 50v 100/£5 10N 50V .... 100/**£3.00**
470N 50v 100/£7 1uF 50V .... 100/**£8.00**

STEPPER MOTOR 4 PHASE 2 9v WINDINGS
£3.50 .... 10/**£30.00**

KEYTRONICS
332 LEY STREET, ILFORD, ESSEX
Shop open Mon-Sat 10am-2pm
TELEPHONE: 01-553 1863

MIN ORDER £2.50 OFFICIAL ORDERS WELCOME
UNIVERSITIES COLLEGES SCHOOLS GOVT DEPARTMENTS
P&P AS SHOWN IN BRACKETS (HEAVY ITEMS)
50p OTHERWISE (LIGHT ITEMS)

ADD 15% VAT TO TOTAL

ELECTRONIC COMPONENTS BOUGHT FOR CASH

NEWS DESK

Cellular radio

Europe's largest electronics group, Philips, announced recently that it was linking with Racal to distribute the new Vodafone cellular telephones through its UK subsidiary Pye Telecom.

The announcement was made in Stockholm at the plant of Ericsson Radio Systems, who will be providing the electronic switching equipment for the Vodafone network.

Ericsson's AXE 10 digital switch is already in widespread use throughout the world. As well as having been at the centre of the Nordic Mobile Telephone System (NMT) for the past two years, it is used in American systems in Buffalo, Chicago and Detroit, and in the network now nearing completion in Saudi Arabia. Ericsson also recently announced an agreement with the Canadian company NovAtel Communications to supply systems for Montreal and Toronto.

The new mobile telephone service is due to start in this country early in 1985, following trials in London during December 1984. Within 18 months of commencing operation, the network should cover 80% of the population. (*The system is described in* ***R&EW*** *November '84).*

In addition to mobile telephones for use in vehicles, equipment available during 1985 will include a transportable Vodafone for use in vehicles, on boats and in caravans, and a portable unit for carrying in a briefcase or handbag.

Electronics growth

The European electronics market is set to expand by around 7.5 per cent in real terms in 1985 compared with 1984, according to a new report from Benn Electronics Publications Ltd.

In 1985 the total West European electronics market for equipment and components will reach US $96 billion, (one US billion = one thousand

million) at constant 1983 values, compared with $89.3 billion in 1984, and is forecast to reach $114 billion in constant terms by 1988, an annual average growth rate during the period 1985-88 of 5.75 per cent in real terms.

The twelfth edition of the *Yearbook of West European Electronics Data 1985* cites a slow-down in West European economic growth beyond 1985 as the reason for the relatively low growth rates 1985-88, as Europe follows the USA into an economic downturn (on present consensus forecasts) in 1986.

The fastest growing sector will be electronic data processing (EDP), which includes computers, personal computers, word processing systems and computer peripherals.

The second largest European equipment market, for telecommunications equipment, will reach some $15.3 billion by 1988, assuming growth in the order of 6 per cent per annum over the period 1985-88.

The overall component market, including active, passive and audio components, is also projected to expand at 6 per cent per annum 1985-88. Within the component sector, integrated circuits and other microcircuits are expected to maintain a growth rate of little more than 9.5 per cent per annum in real terms for the 1985-88 period. The IC market (including hybrids) is projected to grow by almost 15.5 per cent in 1985 compared with 1984.

Other major sectors covered in the Benn European electronics yearbook include electronic office equipment control and instrumentation, communications and military equipment, medical and industrial electronic equipment, and consumer electronic equipment.

In national terms, the most surprising feature is the rise of the United Kingdom market to vie with that of West Germany in size as the largest electronics market in Europe by 1988.

However, there are strong indications that British manufacturers may not benefit from this UK market growth to the same extent as importers. An analysis of data from the new twelfth edition and previous editions of the electronics yearbook series shows that imports of electronics equipment and components have grown at a much faster rate than output in the UK over the five year period 1979-83, and reveals an alarming increase in the UK trade deficit in electronics goods compared with other European countries.

Alarmingly, the UK trade deficit in the electronics sector increased from $1 billion in 1979 representing 25 per cent of the total European electronics trade deficit, to $4.1 billion in 1983 (the latest available complete year) representing over 45 per cent of the total European trade deficit in electronics.

Additional data detailed in the twelfth edition of the yearbook include the output of vehicles and domestic appliances in Europe, forecasts of leading economic indicators such as gross domestic product, inflation, industrial output, balance of payments, unemployment to 1985 for each European country, exchange rates against the US dollar, a four language glossary and a complete explanation of the interpretation and classification of the statistics and a guide to the electronic product headings.

The twelfth edition of the Yearbook of West European Electronics Data 1985 is US $425 per copy and is available from Benn Electronics Publication Ltd, PO Box 28, Luton LU2 OBD, UK. Tel: (0582) 417438.

Low power alarms

The Department of Trade and Industry announced on 24 May that it was to review its policy on low power radio controlled intruder alarms and security alarms.

The DTI's existing policy on alarms is that they should be crystal controlled to operate in a 25KHz channel centred on a spot frequency. This has the advantage of minimising the amount of spectrum occupied and also gives some protection to other low powered telemetry users in the band.

Proposals had been made that this policy should be altered and that wideband low power alarms should be licensed to operate within the low power telemetry and tele control band at 173.200-173.350MHz. Comments were invited from any interested parties.

The DTI wished to take account of the views of all those interested and particularly all users of the band before reaching decisions.

A large number of comments were received from a range of manufacturers and users. The overwhelming majority of those who responded felt that wideband operation was not desirable and that furthermore, on the grounds of spectrum efficiency and control of interference, a good case could be made for a narrower bandwidth of 12.5KHz in the 173MHz band.

The DTI has accepted that view and work is in hand to produce new draft specifications for all low power telemetry and tele control devices. Manufacturing interests will be consulted on the production of these specifications and on the timing of their introduction, through the department's usual consultation machinery.

The consultations will also cover the possibility of reducing the channel spacing at 458MHz from 25KHz to 12.5KHz, in view of the responses to the consultation on the 173MHz band. Meanwhile no change is being made to existing licensing arrangements.

The DTI has separately announced proposals to cease the licensing of a wide range of low power devices (including telemetry and tele control) in the 173MHz band. Until views on these proposals have been considered the department will continue to license low power telemetry devices.

It should be noted that those using the band will continue to do so on a non-interference and non-protection basis (ie that no interference shall be caused to other authorised radio services and that no protection from interference is given from other services).

A bat in a cage?

No bird is held captive in this 'container' (see picture). What looks like a bird cage is in fact the screen grid of a 100KW vapour-condensation-cooled tetrode for medium and short wave radio transmitters.

The photo was taken at Siemens' electronic tubes plant in Berlin, and shows the delicate pattern of a graphite grid made from a cylindrical hollow body using a laser as a precision cutting tool.

The features are remarkably smooth and true to size when compared with sand-blasted grids. Also known as pyrographite, the material has excellent dimensional stability. In operation, the grid is loaded with as much as 24W per square cm, with temperatures just below 2000K.

European Space Agency

When Halley's Comet pays its next visit in 1986, for the first time since 1910, it will be examined at fairly close quarters (in astronomical terms) by the Giotto scientific satellite.

Giotto will take 9 months to reach the vicinity of the comet, travelling at 70Km per second.

During its flight it will maintain its stability by spinning at 15rpm.

One of the engineering problems facing the Societe Europeene de Propulsion (SEP) is the control of the on-board antenna through which the satellite will communicate its findings with the earth station, and through which instructions will be directed from earth to keep it on course.

Radar calibration problems

A radio-controlled model helicopter has helped research engineers at the Communications Division of Thorn EMI Electronics, at Wells, to solve a radar calibration problem.

The 1/7 scale helicopter was used to support a trihedral corner reflector in free space, at a constant height and range over an RSRE experimental I-band radar at the Royal Navy Frazer gunnery range at Portsmouth, Hants.

The corner reflector appeared to the radar as a ten square metre target. Accurate calibration depended on maintaining the reflector for four minutes at a height of 80m and at a range of 1Km.

This helicopter-borne reflector provided an extremely effective low-cost solution to the problem of radar 'multi-path' or spurious reflections from the ground or from water lying on the range, which had previously made calibration impossible. Another method using a sphere suspended from a kite also has disadvantages.

The model helicopter, which was constructed by Martin Sims, a research engineer at Wells, is regularly exhibited by its owner at shows in the south of England. He has acquired considerable skill in the accurate

flight positioning required for the radar trials.

Speech recognition project

Computers that recognise the human voice are to be developed in a £2 million research project headed by British Telecom's research laboratories at Martlesham Heath, near Ipswich.

The study, which will run for three years, will be undertaken in collaboration with Logica and Cambridge University.

It is being funded by the Alvey Directorate.

The aim of the project is to simplify the use of computers by non-technical people, particularly for tasks such as searching databases. Speech has long been recognised as the most natural and convenient means of communicating with computers, but at present computers can only understand simple one-word commands. Voice recognition at the man-machine interface (MMI) would enable users to give spoken commands.

To be useful to non-specialists computers must also be capable of conducting sensible conversations to clarify users' requirements and explain what they are doing.

Research in intelligent knowledge-based systems (IKBS) has shown how this level of intelligence might be built into the computer. The project team will be integrating an IKBS with Logica's 'Logos' automatic speech recogniser, and will be running several phases of user trials of a database inquiry service.

British Telecom Research Laboratories (BTRL) scientists will be providing expertise in the use of IKBS for dialogue control.

They will collaborate closely with Dr S J Young of Cambridge University in the design of the dialogue control system.

Logica will study and develop advanced techniques for automatic continuous speech recognition suitable for use in a conversational system. KBS methods will again be invoked to improve the method's capability to understand the speaker.

SKYBRIDGE

Mail order & shop:
441 PRINCES ROAD,
DARTFORD, KENT DA1 1RB Telephone: (0322) 91454

ORDERING INFORMATION: P/P 50p on orders less than £20 in value otherwise post free. All components full spec & guaranteed. Discounts available on orders over £50 – phone for details. For unlisted components phone for price.

CABLE Per metre
wire wrap ...6p
Red/white/black solid ...1/.6
11 colours ...4p
Hook-up ...7/.2
11 colours ...3p
Heavy duty ..32/.2
4 colours ...15p
Extraflex red/black ...15p
Tinned copper per 4oz reel
SWG16 ...80p
SWG18 ...85p
SWG20 ...95p
SWG22 ...95p
SWG24 ...95p
En copper per 2oz reel SWG14 ...70p
SWG16 ...80p
SWG18 ...90p
SWG20 ...90p
SWG22 ...90p
SWG24 ...105p
SWG26 ...105p
SWG28 ...105p
SWG30 ...110p
SWG33 ...110p
SWG34 ...115p
SWG36 ...125p
SWG38 ...125p
SWG40 ...150p
Figure 8 per metre 7/.25 ...13p
Coloured ribbon per foot
10 way ...20p
20 way ...40p
34 way ...80p
Mains per metre 2 core Oval 3A ...20p
Round 6A ...45p
3 core Round 3A 35p
Round 6A ...50p
Round 13A ...80p

Power
1 mm T&E ...40p
1.5 mm T&E ...45p
2.5 mm T&E ...60p
6 mm T&E ...150p
TV COAX ...40p
Screened Single round ...17p
Twin round ...20p
Figure 8 min ...20p
Figure 8 std ...30p
4 Core ...70p
Spiral wrap
1/8" ...15p
¼" ...20p
½" ...45p
Wide range of cable markers, sleeving, ties, fixings in stock-Phone for details.

CAPACITORS
Plate ceramic 1.8pF – 22nF ...8p
Disc
10pF ...10p
47pF ...15p
100pF ...15p
470pF ...15p
1000pF ...11p
2200pF ...11p
.01µF ...5p
.022µF ...5p
.047µF ...8p
.1µF ...8p
.47µF ...15p
Polystyrene
22pF ...13p
47pF ...8p
68pF ...8p
100pF ...8p
150pF ...8p
220pF ...8p
330pF ...8p
470pF ...8p
560pF ...8p
680pF ...8p
1000pF ...8p
1500pF ...8p
2200pF ...8p
3300pF ...8p
4700pF ...8p
5600pF ...10p
6800pF ...10p
.01µF ...14p
.022µF ...19p
.047µF ...25p
.1µF ...49p
Polyester
.01µF ...8p
.015µF ...8p
.022µF ...8p
.033µF ...9p
.047µF ...9p
.068µF ...9p
.1µF ...9p
.15µF ...15p
.22µF ...11p
.33µF ...16p
.47µF ...16p
.68µF ...26p
1µF ...26p
2µF ...49p
Electrolytic µF/V
1/63 ...8p
2.2/50 ...9p
4.7/63 ...9p
10/16 ...8p
10/25 ...8p
10/35 ...10p
10/63 ...13p
22/10 ...8p
22/16 ...10p
22/25 ...10p
22/35 ...11p
22/63 ...15p
47/10 ...10p
47/16 ...11p
47/25 ...13p
47/35 ...15p
47/63 ...24p
100/10 ...11p
100/16 ...13p
100/25 ...15p
100/35 ...19p
100/63 ...25p
220/16 ...15p
220/25 ...20p
220/35 ...23p
220/63 ...33p
470/16 ...23p
470/25 ...27p
470/35 ...31p
470/63 ...48p
1000/10 ...24p
1000/16 ...29p
1000/25 ...41p
1000/35 ...46p
1000/63 ...75p
2200/10 ...39p
2200/16 ...46p
2200/25 ...55p
2200/35 ...74p
3300/25 ...74p
3300/35 ...92p
4700/10 ...59p
4700/16 ...74p
4700/25 ...103p
Non-polarised
1µF ...25p
2.2µF ...25p
3.3µF ...25p
4.7µF ...25p
6.8µF ...50p
10µF ...25p
22µF ...35p
33µF ...40p
47µF ...40p
100µF ...70p
Thousands of other capacitors in stock i.e. Silvered Mica, 1% Polystyrene, Polycarbonate, Mylar, Tantalum, Trimmer, Variable etc. etc.

CRYSTALS
100k ...460p
1M ...600p
2M ...220p
3.2768M ...poa
4M ...180p
4.19304M ...320p
4.433619M ...320p
6.144M ...130p
10M ...200p
18.432M ...270p
26.54M ...200p
26.59M ...200p
26.64M ...200p
26.69M ...200p
26.74M ...200p
26.79M ...200p
26.8M ...200p
26.995M ...200p
27.045M ...200p
27.095M ...200p
27.145M ...200p
27.195M ...200p
27.245M ...200p
27.255M ...200p

CONNECTORS
Croc clips ...10p
Terminal post ...40p
1mm plug ...20p
1mm socket ...15p
2mm plug ...20p
2mm socket ...15p
3mm plug ...20p
3mm socket ...15p
4mm plug ...15p
4mm socket ...15p
Phono plug ...10p
Phono line skt ...20p
Jack plug 2.5mm ...15p
Jack plug 3.5mm ...15p
Jack skt 2.5mm ...15p
Jack skt 3.5mm ...15p
Jack skt line 2.5mm ...30p
Jack skt line 3.5mm ...25p
Jack plug ¼" mono ...20p
Jack plug ¼" stereo ...30p
Jack skt ¼" mono ...25p
Jack skt ¼" stereo ...35p
Jack skt line mono ...25p
Jack skt line stereo ...30p
COAX plug ...15p
COAX skt surf 30p
COAX skt flush 25p
COAX line skt ...45p
COAX coupler ...45p
CAR aerial plug ...15p
FM aerial plug ...20p
BNC plug ...100p
BNC round skt ...100p
BNC square skt ...100p
BNC free skt ...110p
BNC str. adapt. ...140p
BNC T adapt. 300p
VHF plug PL259 ...50p
Small reducer ...20p
Large reducer ...20p
PL259 rt.ang. ...90p
VHF round skt. 50p
VHFsquare skt 50p
Ebow adapt. ...poa
Straight adapt. 60p
VHF T adapt. 160p
Female T adapt. ...180p
XLR line plug 180p
XLR chassis skt ...330p
XLR line skt ...230p
XLR chassis plug ...160p
DIN plugs 2 pin ...10p
DIN plugs 3 pin ...15p
DIN plugs 4 pin ...35p
DIN plugs 5 pin A ...15p
DIN plug 5 pin 240° ...20p
DIN plug 5 pin 360° ...30p
DIN plug 6 pin 40p
DIN plug 7 pin 20p
DIN plug 8 pin 60p
DIN skts 2 pin ...10p
DIN skts 3 pin ...20p
DIN skts 4 pin ...15p
DIN skts 5 pin A ...15p
DIN skts 5 pin B ...20p
DIN skts 6 pin ...20p
DIN skts 7 pin ...20p
DIN line skt 2 pin ...15p
DIN line skt 5 pin ...30p
D-type plug 9 W ...80p
D-type plug 15 W ...150p
D-type plug 25 W ...150p
D-type skt 9 W ...140p
D-type skt 15 W ...200p
D-type skt 25 W ...450p
D-type rt ang. skt 9 W ...poa
D-type rt ang. skt 15 W ...poa
D-type rt ang. skt 25 W ...poa
D-type rt ang. plug 9 W ...poa
D-type rt ang. plug 15 W ...poa
D-type rt ang. plug 25 W ...poa
Covers 9 ...120p
Covers 15 ...120p
Covers 25 ...130p
Latches 9 ...30p
Latches 15 ...50p
Latches 25 ...60p
Power plug 2.1mm ...15p
Power plug 2.5mm ...15p
IEC line skt ...95p
IEC chassis plug ...90p
IEC chassis skt 90p
IEC line plug ...70p
Bulgin P429 ...50p
Bulgin P646 ...165p
Bulgin P430 ...125p
Bulgin P649 ...135p
Bulgin P650 ...110p
Bulgin P635 ...100p
Bulgin P636 ...130p
Bulgin P551 ...300p
Bulgin P552 ...100p
Bulgin SA2403 ...160p
Bulgin SA2404 95p
Bulgin SA2190 50p
Bulgin SA1862 50p
Bulgin SA2111 ...200p
Bulgin SA2019A ...150p
Bulgin SA2020 ...140p
Bulgin SA2367 ...180p
Bulgin SA2368 95p
Many other connectors, adapters & leads in stock.

OPTO
LED Std red ...10p
LED Std green 18p
LED Std yellow 15p
LED Min red ...10p
LED Min green 18p
LED Min yellow ...18p
LED clip std ...3p
LED clip min ...3p
Large range of panel lampholders, de luxe LEDs, etc.

FUSEWARE
20mm panel holder ...45p
1¼" panel holder ...59p
20mm chassis holder ...14p
1¼" chassis holder ...17p
Line holder ...14p
Fuse clips ...3p
20mm fuses 100mA, 150mA, 250mA, 500mA, 1A, 1.5A, 2A, 3A, 5A ...9p
20mm antisurge fuses 500mA, 1A, 2A ...12p
1¼" fuses 100mA, 150mA, 250mA, 500mA, 1A, 2A, 3A, 5A, 10A, 13A, 15A ...9p
1" fuses 2A, 3A, 5A, 13A ...15p

RESISTORS
½ W 5% E24 ...2p
.4W 1% E24 ...7p
1W 5% E12 ...10p
3W ww L22-1R 30p
3W ww 2R2 ...20p
7W ww ...30p
10W ww ...35p
25W ww ...170p
Ww Pots. 3W High quality ...275p
10R, 25R, 50R, 100R, 250R, 500R, 1k, 5k, 10k, 50k.

SEMICONDUCTORS
So extensive is the range of listed semiconductors Please send large S.A.E. for details.
Transistor mounts
TO3 ...10p
TO66 ...10p
DIL sockets 8 pin 9p
14 pin ...11p
16 pin ...12p
18 pin ...16p
20 pin ...17p
22 pin ...20p
24 pin ...21p
28 pin ...24p
40 pin ...35p
Range of heat sinks available – Phone for quotation.

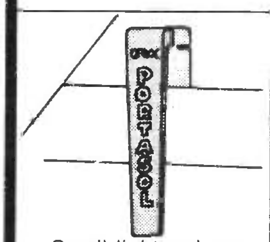
SPEAKERS
Miniature buzzer 6V or 12V ...90p
Ultrasonic ...600p transducers pair
Elliptical 5"x3" ...198p
Elliptical 6"x4" ...262p
Elliptical 7"x4" ...314p
Elliptical 7"x5" ...338p
Elliptical 8"x5" 5W ...386p
Elliptical 8"x5" 8W ...521p
Elliptical 9"x6" ...431p
Miniature 1" ...90p
Miniature 1½ ...90p
Miniature 1¾ ...90p
Miniature 2" ...90p
Miniature 2¼ ...90p
Miniature 2½" 8R 90p
Miniature 2½" 64R ...100p
Round 5" 4W 174p
Round 5" 25W ...409p
Round 5" 60W ...1587p
Round 5¼" 10W ...476p
Round 5½" 15W ...771p
Round 6" 5W 297p
Round 6" 60W ...1632p
Round 6½" 7W ...423p
Round 8" 6W 359p
Round 8" 10W ...423p
Round 8" 20W ...963p
Round 8" 60W ...1346p
Round 10" 10W ...700p
Round 10" 20W ...1113p
Round 10" 30W ...poa
Round 12" 60W ...2862p
Round 12" 100W ...4073p
Round 12" 150W ...4336p
Round 15" 150W ...7185p
Round 15" 200W ...8736p
Round 18" 200W ...£108
Motorola piezo tweeters 2" ...231p
3½" ...697p
2"x6" horn ...938p
2"x5" horn ...795p
2½" horn ...457p
3¾" ...624p
4"x10" ...1435p
Crossovers
2 way 15W ...188p
2 way 100W ...690p
3 way 25W ...193p
3 way 40W ...338p
3 way 60W ...502p
3 way 100W 1346p
4 way 80W ...628p

SWITCHES
Toggle Std SPST ...47p
Toggle Std DPDT ...62p
Toggle Min SPST ...68p
Toggle Min SPDT ...70p
Toggle Min SPDT c/off ...83p
Toggle Min DPDT ...85p
Toggle Min DPDT c/off ...117p
Toggle Min 4PDT ...209p
Toggle Min 4PDT c/off ...244p
Push to make ...20p
Push to break ...20p
Key sw spst ...259p
Rotary 1P 12W 62p
Rotary 2P 6W ...62p
Rotary 3P 4W ...62p
Rotary 4P 3W ...62p
Sude min DPDT ...22p
Sude std DPDT ...22p
DIP 4W ...105p
DIP 6W ...128p
DIP 8W ...156p
DIP 10W ...184p
Microswitch ...83p

TRANSFORMERS
6-0-6 V, 100mA ...167p
6-0-6 V, 250mA ...185p
9-0-9 V, 100mA ...167p
9-0-9 V, 250mA ...185p
12-0-12 V, 50mA ...155p
12-0-12 V, 100mA ...171p
12-0-12 V, 250mA ...188p
0-12/0-12 V, 500mA ...369p
9-0-9 V, 1A ...283p
12-0-12 V, 1A 350p
15-0-15 V, 1A 433p
20-0-20 V, 1.5A ...538p
0-12-15-20-24-30 V, 1A ...666p
6-0-6 V, 2A ...440p
9-0-9 V, 2A ...476p
12-0-12 V, 2A 538p
0-12/0-12 V, 2A ...538p
0-12-15-20-24-30 V, 2A ...900p
20-0-20 V, 2A 745p
30-0-30 V, 2A 933p
12-0-12 V, 3A 721p
0-15 V, 3A ...647p
6-0-6 V, 4A ...538p
9-0-9 V, 4A ...687p
12-0-12 V, 4A 845p
0-15 V, 6A ...949p
6-0-6 V, 8A ...980p
12-0-12 V, 8A ...1615p
Toroids: 30VA 6V ...950p
30VA 9V ...950p
30VA 12V ...950p
30VA 15V ...950p
30VA 18V ...950p
50VA 6V ...1150p
50VA 9V ...1150p
50VA 12V ...1150p
50VA 15V ...1150p
80VA 18V ...1200p
80VA 22V ...1200p
80VA 30V ...1200p
120VA 30V ...1300p
160VA 35V ...1500p
300VA 35V ...2000p
500VA 35V ...2650p
All toroids have two isolated secondaries at voltages shown

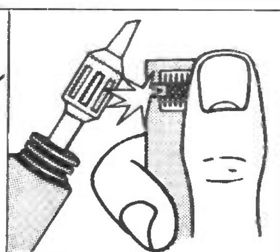
New from ORYX -PORTASOL
Portable Gas Soldering Iron

ORYX – market leaders in soldering irons and accessories introduce the revolutionary PORTASOL. This new approach to catalytic soldering iron technology is truly pocket portable (173 mm) and independent of any external energy source. PORTASOL is powered by ordinary cigarette fuel and one filling lasts for 60 minutes continuous use.



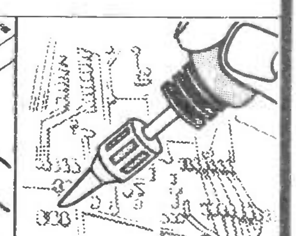
Small, light and can be carried in the top pocket.

Powered by ordinary cigarette lighter fuel.



Flint ignition system built into the cap.

Adjustable temperature equivalent to electric soldering irons 10 to 60 Watt.



Ease of soldering for engineers, hobbyists, repair men etc.

- ★ Portasol makes an ideal and handy present.
- ★ Immediately available for use anytime anywhere.
- ★ Portasol meets all safety standards.
- ★ No problem with statics.
- ★ Adjustable temperature for sensitive components.

ONLY £17·25 INCLUDING VAT, P&P

To: Greenwood Electronics, Portman Rd, Reading Berks RG3 1NE.
Please send.............(qty.) PORTASOL at £17.25. I enclose cheque/P.O./cash for £...................... or debit my Barclaycard no. ....Access no. .... Expiry date ....
NAME ....
ADDRESS ....
....
....
Please send technical leaflet. Tick   Allow 14 days for delivery.   REW1

ORDER WITH THIS COUPON TODAY

AIRBORNE TV

EXPERIMENTAL BAIRD TELEVISION TRANSMISSIONS FROM AIRCRAFT IN 1939

by RAY HERBERT

It is not often that the first detailed account of a piece of television history appears 46 years after the event. There are various reasons why the successful series of transmissions by Baird Television Limited from an aircraft in flight have remained in obscurity. For one thing, this military project was highly confidential and only a few employees were aware of the activities, and then the war years prevented any publicity. During that period the personnel involved dispersed.

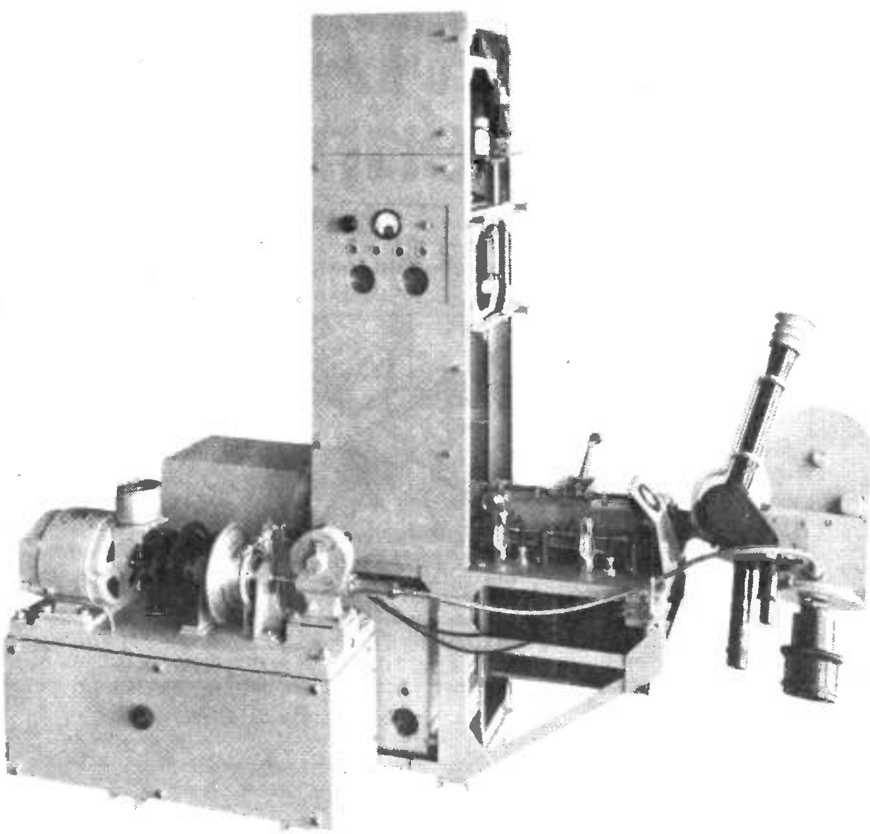
The author, who was present as a member of the Baird team throughout the series of flights, has been able to locate many of the original documents and photographs, which together with his own recollections form the basis of this article.

These historic television transmissions were not in any way isolated demonstrations to establish a first, but the result of several years development work.

Purpose

In 1937 the Baird company received a contract from the French Air Ministry to design and install a television system capable of transmitting high definition pictures (400 line) of the ground from an aircraft in flight. The main purpose of the project was to explore the use of television techniques for aerial reconnaissance. The full potential of the system, particularly the possibility of using infra-red devices, could not be exploited due to the abrupt termination of the work after the outbreak of World War II.

After initial test flights from Hendon Airport early in 1939 to establish transmission coverage, pictures of the countryside around West London were radiated regularly during July of that year, sometimes twice daily. In August the aircraft returned to its base at Villacoublay near Paris and further transmissions were made while flying over northern France.



Results were most satisfactory. At a height of 4000ft those on the ground could discern quite easily white markings on tennis courts, ripples on the water of reservoirs, and even names on buildings.

A Marcel Bloch 200 twin engine night bomber (No ED83) with a flying speed of 150mph was used to carry the equipment. The crew of five consisted of a French pilot and mechanic and three Baird engineers.

The system

Television cameras at that time were relatively crude and incapable of providing the required definition, especially in poor light. For this reason it was decided to use the Baird intermediate film process in order that the superior optical capabilities of a 16mm camera could be utilised.

This arrangement had already been in use for transmissions from the studio, and involved developing and fixing the film in 16 seconds, then passing it 'wet' through a cathode ray tube scanner for a conversion into television signals. The adaptation of this bulky equipment for use in an aircraft posed many problems in connection with size, weight, power suplies, change of air pressure and vibration.

This system had the unique advantage that at the termination of a 30 minute flight, 45000 individual pictures of the ground were available on film for detailed analysis.

Aircraft equipment

A camera fitted with two fixed focus lenses on a revolving turret scanned the ground through a hole in the fuselage floor. Pan and tilt through 30° could be accomplished, and the number of pictures a second was variable between 20 and 30.

The exposed film was processed immediately in sealed developing and fixing tanks maintained at 28°C, emerging 16-20 seconds later and then passing still wet to the scanning unit. This consisted of a vertically mounted, high intensity, 78mm tube in association with an optical system and a photo-electric multiplier. Messages and sketches written on transparent material could be placed in a holder immediately beneath the scanning tube and transmitted in the same way as the film.

An auxiliary rack adjacent to the camera position contained temperature control equipment for the processing tanks, and HF and LF timebases. The camera operator viewed the transmitted picture on a monitor screen situated in a rack which contained the modulation amplifier and pulse generator.

The vision transmitter, located in the forward gunner's position, was quite conventional, consisting of a master oscillator, frequency doubler, drive amplifier and push-pull final stage incorporating two Raytheon RK47s. This produced a power of 200 watts at 51MHz fed to a quarter-wave retractable antenna.

As a means of saving weight most of the equipment operated from a 200 volt 500Hz supply obtained from a rotary converter operating from the main aircraft batteries. A wind driven generator with a variable pitch propeller provided the 1200 volt supply for the transmitter power stages.

The weight of the entire installation amounted to 363Kg.

Receiving/recording station

A specially constructed Renault motor van with a sprung floor contained equipment for receiving and recording the pictures transmitted from the aircraft. Power was supplied by a petrol driven generator towed behind.

Two vision receivers were used (one spare), each having three RF stages, a diode detector and video amplifier. A small monitor tube could be used for setting up, the main picture being displayed on a 510mm tube, the largest then available. Due to its length, about 1 metre, it was vertically mounted and viewed via a surface-silvered mirror inclined at 45°, a technique used quite extensively for home receivers at that time.

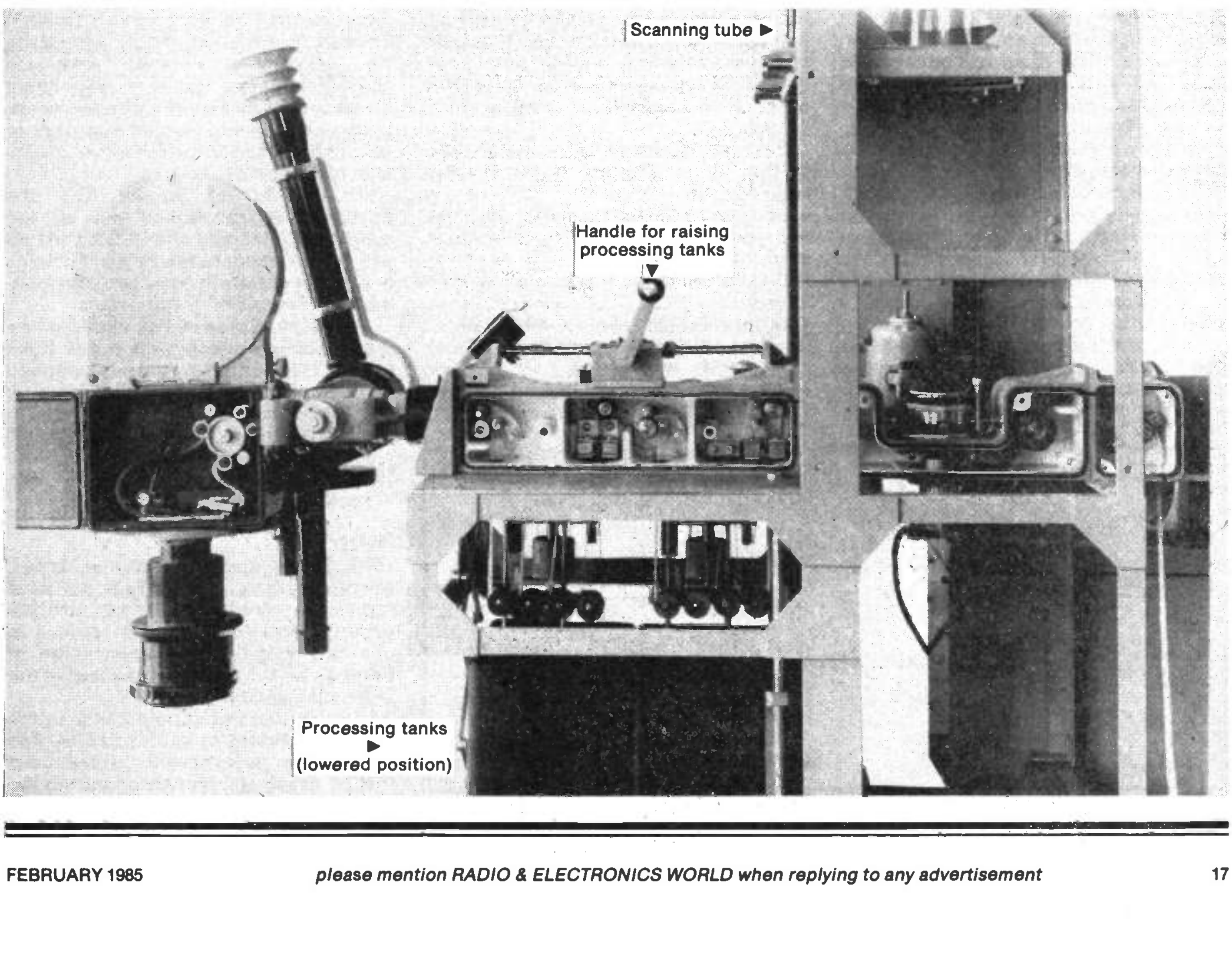
The video recording equipment enabled pictures of particular interest to be stored on 35mm film. By pressing a key the operator could choose between recording a single frame or one frame in three as a continuous series.

The arrangement employed was virtually the reversal of that used in the bomber, the same high intensity tube producing an image on the film emulsion. After exposure the film passed to a storage cassette which could then be transferred to the processing unit for developing, fixing, washing and drying.

It is known that similar projects were in progress during 1939, but due to the secret nature of the work very little information has emerged. The Baird company were probably first in getting pictures from air to ground, and were certainly the first to put out regular transmissions capable of being recorded.

After the outbreak of war the bomber moved from Villacoublay to Orleans and later Toulouse. Its ultimate fate is unknown but almost certainly it fell into the hands of the Germans.

Acknowledgements are due to BB Austin, who was in charge of the Baird design team from 1937-1940, for his help and assistance in the preparation of this article.



DIRECT BROADCASTING BY SATELLITE

by D Stewart

At present most of the Western World's satellite communication is carried by INTELSAT (International Telecommunications Satellite). If a sporting event or presidential election requires coverage, a television company will book a television channel through a telecommunications company which will then carry the signal over land by cable or microwave.

In recent years EUTELSAT (European Telecommunications Satellite) has been launched to serve the European Community, but the purpose of these satellites is primarily telecommunications and there is no direct link with the television viewer. However, in the next few years it is proposed to launch a number of satellites for various countries with the sole purpose of beaming television.

Direct Broadcasting by Satellite (DBS) for Europe was agreed in 1977 by the World Administrative Radio Conference (WARC) which allocated five channels to each country. Although the primary aim is to beam television entertainment from satellites directly to aerials on rooftops or in back gardens, other services like data access are possible.

Originally the signal power chosen was such that a good signal would be picked up by a 1 metre dish, and the signal from a neighbouring country would be of such poor quality that a viewer would not bother to watch it. However, in the years since 1977 receiver technology has improved so much that it is now possible to pick up a good signal from a neighbouring country.

Some of the problems with broadcasting from one country to another are the language barrier, and differing advertising and transmission standards. We have our own advertising standards in the UK, in Germany TV advertising is restricted, and so on with the other countries.

Transmission standards

Differing transmission standards will present a stumbling block to multinational DBS since France will use SECAM and Germany will use PAL, which are their terrestrial standards. The UK will use C-MAC, which was chosen by the European Broadcasting Union (EBU) for DBS. MAC stands for Multiplex Analogue Component and the transmission rate will be 20.25Mbit/S. The reason for choosing this rate is that it is one and a half times the sampling rate of the luminance signal in the studio.

C-MAC will be able to carry eight stereo sound channels in addition to vision. The format is 203 bits per TV line and will carry services like data, sound and access. This packet format is made up as follows: the first bit is a run-in bit, the next seven are line and frame sync, leaving 195 bits out of 203 bits. Those 195 bits give a data rate of 3Mbit/S (195 x 625 lines x 25 pictures/sec) and 3Mbit/S is capable of transmitting quite a lot of information.

Incidentally, the system is engineered so that sound fails at a signal to noise ratio that is lower than that for vision, ie sound can be carried long after the noise has corrupted the vision and made it unusable.

C-MAC will use a modulation method known as 2-4PSK (Phase Shift Keying). This is a special case of 4PSK, which requires 2 bits to describe it *(Figure 1)*. For 2-4PSK only one bit is required *(Figure 2)*, and this suits the modulators and demodulators which are either of the differential type or coherent type. The run-in bit mentioned above is required by the differential modulator.

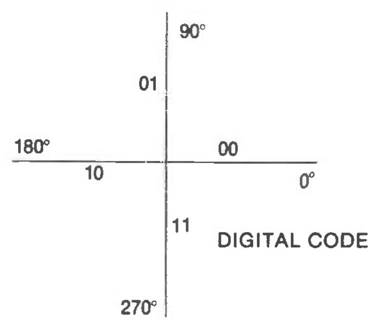


Fig 1 *4PSK*

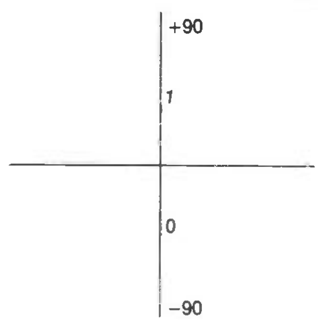


Fig 2 *2-4PSK*

DBS for Europe

Of the 5 channels per country mentioned earlier, it will be possible to operate only 3 channels simultaneously because of power restrictions on the satellite. On later versions of satellites it will be possible to operate all 5 channels simultaneously.

The table shows the approximate date for launching satellites for the various European countries and the name of each DBS operation.

Television by satellite from the UK to Europe already exists. The European Communications Satellite 1 (ECS1) was launched in June 1983 and two transponders allocated to the UK. A transponder is a receiver, frequency changer and transmitter: satellites receive signals at 14GHz and transmit at 11GHz, or receive at 6GHz and transmit at 4GHz. ECS1 operates at 14/11GHz.

One of the transponders carries a music programme for Music Box (Thorn-EMI). The other channel carries a programme called Skychannel for Satellite Television plc, and reaches an audience of half a million in Norway, Finland, Switzerland, Britain and Malta via community antenna television (CATV) systems. So in a way direct broadcasting by satellite already exists, except that such broadcasts are to groups of homes (about 50) rather than to individual homes.

On the 4th of August 1984, the European rocket Ariane put up two satellites: Telecom 1 and ECS 2. The first will have videoconferencing facilities and the second will have two transponders for Eurovision programmes.

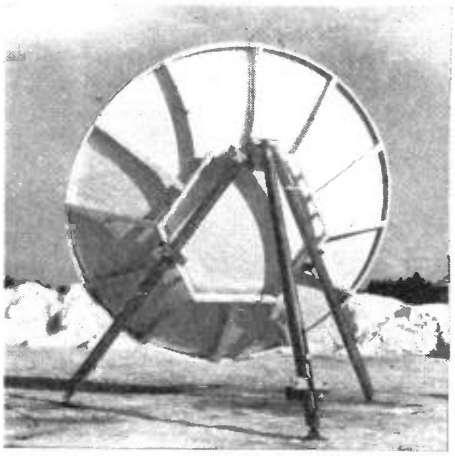
A US firm, Coronet, has appeared on the European scene with a cut price offer. It is expected to charge something like one third of the £6.5 million per year that France is asking for its channels. At present Coronet is trying to raise 10 million dollars and is negotiating with Thorn-EMI, Fagersta (Sweden) and French and German institutions.

British DBS

Marconi Space and Defence, British Aerospace and British Telecom have formed a company called UNISAT (United Satellites Ltd). It is planned to use two satellites to cover most of Europe and the eastern seaboard of the USA and Canada.

Solar panels will supply 2.3KW to the six transponders of each satellite. The power stage uses travelling wave tubes (TWTs) which will be heated during the

European DBS		
Country	**DBS name**	**Approx date**
UK	Unisat	1987
W Germany	TV-Sat	1985
France	TDF 1	1985
Italy	Olympus 1	1986
Switzerland	Tel-Sat	?
Sweden-Finland-Norway	Telex-X	1986
Luxembourg	Lux-Sat	?
Ireland	–	1987



A typical satellite receiving dish (picture courtesy of Salora (UK) Ltd)

night and whenever the sun is eclipsed. In this respect they are different from previous generations of satellites.

Figure 3 shows one kind of TWT, the helix type, which uses a spiral wire whose length is usually ten times the length of the tube, and the speed of propagation of the signal depends on the pitch of the spiral. A solenoid surrounding the glass tube produces a longitudinal field which guides the electrons along the axis of the tube. Reflections at the output would cause oscillation, and a film of graphite near the middle of the tube would provide sufficient attenuation to any backward travelling wave.

The big advantage of TWTs over other devices is the large gain together with large bandwidth, typically 40dB over 500MHz at 4GHz.

In 1982 the BBC was allocated two channels and in 1984 the IBA was also allocated two, but whereas the BBC was being charged 270 million dollars for a 7 year lease, the IBA was free to choose a cheaper, foreign satellite.

Since then, neither the BBC nor the IBA felt there was a demand for competitive services and have pooled their resources. The BBC will advance 50% of the funds and the IBA 25 to 30%. The remainder of this £400m project will be advanced by a third party. Some of the companies that have applied to be in the third party are Thorn-EMI, Granada TV Rentals, the Virgin Group and others, among them RTE, the Irish broadcasting company.

RTE together with another 26 companies has already expressed interest in starting an Irish DBS to cover most of the UK in addition to Ireland.

DBS in the USA

United Satellite Communications was the first to offer a DBS service in America and they expect to reach ten million homes. Apart from $300 for an aerial and decoding equipment, they charge $40 for five round the clock programmes. Cable companies are always in competition and in the USA there are 30 million homes linked to community antennae. They pay $25 per month for 54 channels.

The Orion Satellite Corporation has applied to the Federal authorities for permission to put up two KU-band satellites for beaming television to Europe. Banks in London and New York will finance this $230m project.

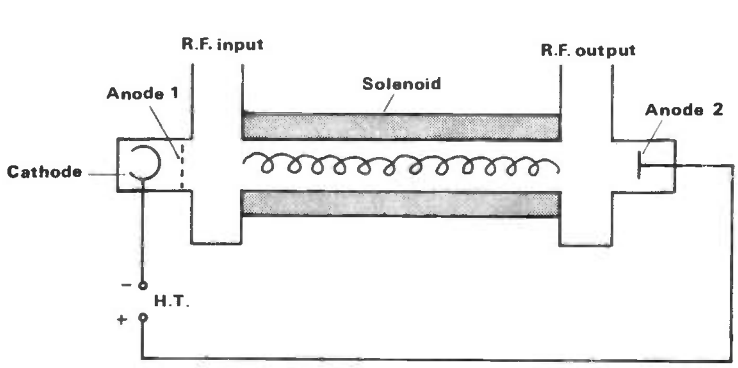


Fig 3 *The helix type of travelling wave tube*

Hughes Aircraft, the satellite manufacturer, has also applied to the Federal Communications Commission (FCC) to participate in DBS.

The DBS idea was pioneered by Communications Satellite Corporation, and its subsidiary Satellite Television Corp is building satellites.

However, all is not rosy on the DBS front with two large companies, CBS Inc and Western Union Corp, pulling out. RCA Communications has also asked the FCC if it can reduce its commitment.

Conclusions

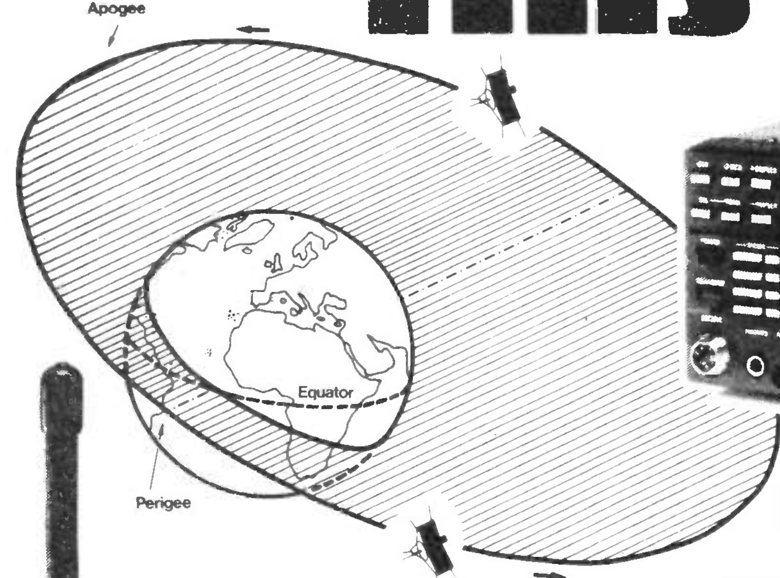
The DBS idea had an enthusiastic start but later on participants realised the cost of the operation. It needs to be funded from somewhere; one source is advertising, another is viewer rentals, but it remains to be seen how much television entertainment the ordinary citizen will accept, and quantity may be at the expense of quality. Another source of funds can be the government, because nations quite simply fear being left behind in technological facilities.

The initial rush to get off the ground has been slowed down, as we saw, to the extent where the BBC and IBA have joined forces, and apart from the UK no other European country seems to have a spare satellite in orbit (or even on the ground).

The DBS idea is an excellent one for large land masses like the USA or remote areas like Western Australia, particularly since DBS is capable of more than just entertainment (data access is also available).

But DBS beyond a nation's boundaries has the difficulties we explored earlier: language barriers, advertising standards and technical standards. Besides these, another problem that has not been resolved is the question of cable companies versus DBS companies. Are these in competition or are they complementary? Unless countries resolve issues like this, the future of DBS will remain confused.

ICOM IS OUT OF THIS WORLD.



IC-271 & 471

ICOM can introduce you to a whole new world via the world communications satellite OSCAR. Did you know that you can Tx to OSCAR on the 430-440MHz IC-471 and Rx on the 2m. IC-271.

By making simple modifications, you can track the VFO's of the Rx and Tx either normally or reverse. This is unique to these ICOM rigs and therefore very useful for OSCAR 10 communications. Digital A.F.C. can also be provided for UOSAT etc. This will give automatic tracking of the receiver with digital readout of the doppler shift.

The easy modifications needed to give you this unique communications opportunity are published in the December '84 issue of OSCAR NEWS. Back issues of OSCAR NEWS can be obtained from AMSAT (UK), LONDON, E12 5EQ.

BUT, ON THE OTHER HAND...

IC-02E
IC-04E, (70cm).

The new direct entry microprocessor controlled IC-02E is a 2 meter handheld jam packed with excellent features.

Some of these features include: scanning, 10 memories, duplex offset storage in memory and odd offsets also stored in memory. Internal Lithium battery backup and repeater tone are of course included. Keyboard entry is made through the 16 button pad allowing easy access to frequencies, duplex, memories, memory scan and priority.

The IC-02E has an LCD readout indicating frequency, memory channel, signal strength, transmitter output and scanning functions. New HS-10 Headset, with earphone and boom microphone, which operates with either of the following:- HS 10-SB Switch box with pre-amplifier giving biased toggle on, off and continuous transmit. HS 10-SA Voice operated switch box, with pre-amplifier, mic gain, vox gain and delay. The IC-2E and 4E continue to be available.

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Than

ICOM PRICES ARE DOWN TO EARTH.

(Please contact us or your local Icom dealer for current prices)

IC-751

The IC-751 could be called the flagship of the ICOM range as it features 32 memory channels, full HF receive capability, digital speech synthesizer, computer control and power-supply options. The 751 is fully compatible with ICOM auto units such as the AT-500 and IC-2KL. The IC-751 now has a remote push-button frequency selector pad

Standard features include: a speech processor, switchable choice of J-FET pre-amp or 20dB pin diode attenuator and two VFO's, marker, 4 variable tuning rates, pass band tuning, notch, variable noise blanker, monitor switch, direct feed mixer in the front end, full break-in on CW and AMTOR compatibility.

The first IF is 70.045 MHz. Any XIT and RIT adjustment is shown on the display. The transmitter features high reliability 2SC2904 transistors in a low IMD (-32dB@100W) full 100% duty cycle. For more detailed information on this excellent set, please get in touch with us.

IC-290D/290E

290D is the state of the art 2 meter mobile, it has 5 memories and VFO's to store your favourite repeaters and a priority channel to check your most important frequency automatically. Programmable offsets are included for odd repeater splits, tuning is 5KHz or 1KHz.

The squelch on SSB silently scans for signals, while 2 VFO's with equalising capability mark your signal frequency with the touch of a button. Other features include: RIT, 1KHz or 100Hz tuning/CW sidetone, AGC slow or fast in SSB and CW,Noise blanker to suppress pulse type noises on SSB/CW.

You can scan the whole band between VFO's/scan memories and VFO's. Adjustable scan rate 144 to 146 MHz, remote tuning with optional IC-HM1 microphone. Digital frequency display, Hi/Low power switch. Optional Nicad battery system allows retention of memory.

Special Offer as from 15th January '84 IC-290D reduced to £469 and the IC-290E to £399. Also 70cm version IC-490E, £529. Take advantage of this money saving offer.

Agent: Gordon G3LEQ, or telephone Knutsford (0565) 4040. Please telephone first, anytime between 0900 – 2200 hrs.
Gordon also sells Yaesu products.

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

Please note that we now have a new retail branch at 95, Mortimer Street, Herne Bay, Kent. tel:69464. Give it a visit, BCNU.

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet

Thanet Electronics
Dept RW,143 Reculver Road, Herne Bay, Kent.
Tel:(0227) 63859/63850

All diodes at 10p or less in this list 20 of one type £1.00

OA 47	8p
OA 90	8p
IN 60	5p
IN 541	5p
IN 914	3p
IN 2069a	10p
IN 2070	10p
IN 4001	3p
IN 4002	3p
IN 4003	4p
IN 4004	4p
IN 4005	4p
IN 4006	4p
IN 4007	5p
IN 4148 x 40	£1
IN 4448 x 40	£1
IN 4742	10p
IN 4722	10p
IN 4751	10p
IN 5235	10p
IN 5254	10p
IN 5349	10p
IN 5392	10p
IN 5393	10p
IN 5928B	10p
1AV 30	10p
IM 72Z55	10p
IR 106a	20p
IR 3051	10p
IS 164	10p
IS 921	10p
IS 3011a	10p
IS 3072a	10p
IS 5024a	50p
IS 5030	50p
ITT 210	10p
ITT 921	10p
ITT 923	10p
ITT 1075	10p
ITT 2001	10p
ITT 2002	10p
ITT 4150	10p
ZE 1.5	10p
ZF 3	10p
ZF 3.3	10p
ZF 4.3	10p
ZF 10	10p
ZF 11	10p
ZF 12	10p
ZF 15	10p
ZF 33	10p
ZF 43	10p
ZF 47	10p
ZF 82	10p
ZPD 3.9	10p
ZPD 4.7	10p
ZPD 5.6	10p
ZPD 10	10p
ZPD 47	10p
ZPY 8v2	10p
ZPY 12	10p
ZPY 16	10p
ZPY 24	10p
ZPY 43	10p
ZPY 47	10p
ZPY 56	10p
ZTE 2	10p
ZTK 22	10p
ZTK 33	10p
ZTK 33a	10p
ZW 13	12p
ZW 27	10p
ZW 4.3	10p
ZW 310	10p
ZX 68	30p
ZY 47	10p
ZY 72	10p
AA 113	10p
AA 119	8p
AA 144	10p
BA 102c	10p
BA 157	8p
BA 159	8p
BA 173	8p
BA 182	8p
BA 201	8p
BA 202	8p
BA 243	8p
BA 248	8p
BA 316	5p
BA 318	5p
BAV 10	10p
BAV 21	10p
BAW 21	10p
BB 103	10p
BB 105A x 12	£1
BB 105B x 12	£1
BB 105G x 12	£1
BB 121a	10p
BRC 83c13	10p
BZX 46c22	15p
BZX 61 9.1	8p
BZX 61c110	8p
BZX 61c20	10p
BZX 61c30	10p
BZX 61c220	10p
BZX 70c6v2	8p
BZX 70c12	20p
BZX 70c33	8p
BZX 79c3v9, 4v7, 5vl, 5v6, 6v2, 6v8, 7v5, 11, 12, 30, 47	10p each
BZX 83c4v3, 5v6, 8v2, 12, 13, 24, 27, 33	10p each
BZX 84c6v8 x 10	30p each
BZX 85c8v2	10p
BZX 88c0v7, 3v9, 4v3, 6v2, 8v2.12	10p each
1A/1600V	10p
CV 8617	10p

Min 12 volt Relays	75p
Y 716	10p
Y 729	30p
Y 730	10p
Y 827: 6A/1KV	20p
Y 860	30p
Y 933	5p
Y 969	50p
Y 997	30p
R 1038	40p
R 1039	40p
R 2009	80p
R 2010b	£1
R 2029	50p
R 2210	60p
R 2257	50p
R 2265	60p
R 2305	50p
R 2306	50p
R 2322/2323	pair 80p
R 2323	15p
R 2396	50p
R 2461	60p
R 2030	50p
R 2443=BD124	40p
R 2737	40p
R 2738=TIP41	30p
R 2775=TIP41c	40p
R 3129=TIP47	40p
S 2008b	80p
BU 105/04	80p
BU 108	£1
BU 124	50p
BU 126	80p
BU 180a	65p
BU 204	70p
BU 205	£1
BU 206	£1
BU 207	£1
BU 208	80p
BU 208 on heat sink	70p
BU 208A	£1.10
BU 208D	90p
BU 222	£1
BU 326	£1
BU 407	80p
BU 426V	60p
BU 500	£1.10
BU 508A	£2
BU 526	75p
BU 807	£1
BUX 84	50p
BUW 84	30p
BUY 71	£1
TIC 106a	30p
TIC 116m	40p
TIC 116n/Y 1003	35p
TIC 126N	40p
TIC 206m	30p
TIC 225S	40p
TIC 226E	40p
TIC 226m	30p
TIC 236m	30p
TICV 106D (T092 case 2A/400V)	10p
TIP 29	20p
TIP 30	35p
TIP 30A	35p
TIP 30B	40p
TIP 30C	45p
TIP 31	30p
TIP 31A/RCA 16334	35p
TIP 32	25p
TIP 33B	50p
TIP 33C	70p
TIP 34A	50p
TIP 34B	60p
TIP 34C	70p
TIP 35B	50p
TIP 35C	70p
TIP 35D	80p
TIP 36	50p
TIP 36C	70p
TIP 41B	40p
TIP 41D	70p
TIP 42/BRC 6109	30p
TIP 48	40p
TIP 49	30p
TIP 57	30p
TIP 100	30p
TIP 102	30p
TIP 112	30p
TIP 115	50p
Tip 117	50p
TIP 120	35p
TIP 125	35p
TIP 130	30p
TIP 131	25p
TIP 136	30p
TIP 140	50p
TIP 147	50p
TIP 640	50p
TIP 2955	35p
T 6032	30p
T 6036	40p
T 6040	40p
T 6047	40p
T 6049	40p
T 6051	40p
T 6052	40p
T 9004	40p
T 9005	40p
ZTX 102c	10p
ZTX 107	10p
ZTX 108c	10p
ZTX 109k	5p
ZTX 213	5p
ZTX 341	10p
ZTX 342	10p

SPECIAL OFFER CVC 21
Chassis complete £35
Computer Transformer 20v/2.25A, 20v/1.5A, 17.5A, 19/5A, 28/05A £3

ZTX 384	10p
ZTX 451	10p
ZTX 550	10p
MJ 2253	60p
MJE 3040	60p
MJE 2209	10p
SP 8385	50p

Voltage Regulators

-5V/UA78PO5SC	30p
-5V/LM79MO5CP	25p
-8V/79M08c	30p
+6V/78M06c	30p
-10v/78LA10	20p
LM 337	30p
LM 342/18	30p
LM 340T 5.0	50p
-12V/MC 7912	20p
-12V/LM 340T12	50p
-15V/78M15	15p
-18V/MC78M18	20p
-24V/78M24	30p
MC 7724cp	40p
MC 7824	40p
TIS 90	10p
TIS 91	20p
TIS 92	20p
TIS 93	20p

CB Radio transistor
16119 2A/40v.50Meg
5 for £1.

U 19885	40p
U 3832	15p
U 3845	15p
MR 508	10p
MR 501	10p
MR 502	10p
BCW 71R	30p
BYF 1202	10p
BYF 1204	10p
BYF 3126	40p
BYF 3214	40p
BYX 10	6p
BYX 36/600	35p
BYX 38/300	25p
BYX 55/350	10p
BYX 55/600 (Bead)	10p
BYX 71/350	20p
BYX 71/600	50p
BYX 72/300	20p
BYV 95B	10p
BVY 95C	12p
BYV 96D	10p
BYZ 106	10p
BPW 41	15p
BYW 56 2A/1000v G11	8p
BZY 93c75	50p
BZV 15/18	30p
BZV 15/30	30p
BZW 70c6v2	10p
BZX 79 3v	10p
Bush thyristor RCA 76122	£1
ITT computer bookset 2020	£2
G8 20 turn 100K pot	35p
Transformer 240v/20v-500Ma	75p
Viewdata torroidals	£6
CVC 20 tube base	£2
Mitsumi tape motor	75p
Sankyo tape motor	75p
Swiss made 250rpm/240V motor very small	75p
Mono scan coil 110 small neck	£1.50
Infra red led LD57CA	15p
Mono scan coil	£3
G8 transductor	£1
AT 4041/41 transductor	£1
2K5 Lin pot with 40mm spindle	20p
1982 Hitachi Ae isolator	50p
Mullard FM decoder 1401	£1
Philips service pack, flat films, 57 condensers 56nf-2 2uf	£2
VHF 3 Transistor rotary tuner DX-TV	£1
15K-20 turn pots	20p
Thorn panel 6x100 pot - changeover switch (Irish)	50p
Battery converter TA 75 for colour TV 12/24v Thorn 3787	£6
Thorn 3500 2A cut out	75p

Stereo GEC amp 20 watt - pre-amp with 4 pots - mains power unit with circuit £6

SPECIAL OFFER
Decca-TTT etc.
FEO4/250AC/4
Mains filters
(grey type) x 4
£1

BRIDGES

SKB 2/08 L5A	30p
KBL 005	30p
KBL 02	30p
KBP 04	30p
W02	15p
W004	15p
W005	20p
GEC remote panel Main transformer 3/ic SAA 1025/SN 74141/TBA 231	£6
AT 2076/55 GEC split diode transformer	£10
AT 2048/11 LOPT Mullard	£2.50

PHILIPS DIY HOME SECURITY ALARMS KITS
Send for details. Prices **£54 to £112**

10 Mixed TV & radio speakers **£5 - £2 post**

8Ω 4in speakers	£1
4700/10v x 10	50p
68/16 x 10	50p
150/16 x 10	50p
47/25 x 10	50p
220/25 x 10	50p
1/250 x 10	50p
8000/30v	50p
470/40v x 10	£1
22/100v x 10	£1
100/350v	70p
400/350v	70p
47/500v	25p
1/600v	25p
022/1kv	10p

Philips stereo magnetic cartridge Philips, GP412, GP406 & GP 412-2 at **£6.00**
Philips GP422.4CH (£40 cost) **£6**
Philips car radio speaker kit 12W speaker & tweeter in cases pair **£10.00**
Stereo Dynamic Cartridge

12 Volt Aerial Changer over Relays £1

GEC Hitachi
V/Cap tuner, after 1979 Series £13
6 Push Button Unit for GEC 2100 Series Replacement for Touch Button Unit £12

Mullard
Broadband
RF power modules
BLW 60C **£6.00**
12.5 V 175 MC-S 45w
VHF.BGY33 **£15**
UHF.BGY22E
£5 PT4236C
£5 PT9783
£5 PT8706C

Various Tools and Accessories

Philips	£1.00
Freeze	£1.00
Foam Cleaner	£1.00
Contact Cleaner	£1.00
G11 Neon Switch	£1.00
GPO 5 way plug	25p
12v screwdriver tester with lead - croclip	25p
Mains timer 13 amp - up to 2 hours: easy to use, plugs into socket	£3.00
Sellotape PVC Electric Insulation 25mm x 20M	50p 50mm x 20M 70p
Telescopic aerials (radio)	£1.00
UHF Radio Aerial	80p
Xcelite pliers	£3.90
Xcelite snips	£5.00
Xcelite cutters	£3.90
GKN Supascrew kits	£2.50
VU meter	45p
Pull up large aerial	75p
'V' TV aerial	£1.00
Soldering iron 6v/23w	£2.50
Weller solder iron 15 watt/25 watt	£5.00
Portable TV aerial	75p
Phillips snips	£2
2 way baby alarm/intercom with long leads	£5
Phillips universal battery tester/charger, fuse/bulb tester	To Clear £4
Volt/ohm test meters 1000 ohm/volt	£5
Eisenmann NICAD CHARGER 5.5V/150 ma	£2
12V Nicad pack 'AA'	£2.50
Hitachi TP 007 Battery pack 7.2v/1.6A	£7
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V	80p
'AA' /1.25V Nicad	£1
'C' Nicad	£2
'D' Nicad	£3
Duracell PP3	80p
Duracell C	50p
70ML Silicone Sealer (clear)	£1
3/4in x 1/2in microphone/speaker	50p
Continental 2 pin plug with 5 1/2ft mains lead (black & blue)	5 for £1
7in Ferrite rod with LW/MW coils	50p
Xcekute 5in bent nose plier	£3.50
De-solder pump - 2 nozzels	£5.20
Plastic box for i.c.s with anti-static pad 6in x 3in x 1/2in	75p
Can of handy oil mobil	40p
Flat Red LED	12p
500gm 60/40 solder reel	£7
Clearweld glue pack	30p
Dual v/u meter -20 - - 10db	£1
15 service manuals Thorn 3504 & 3448, etc	£2.50
3 x C90 Cassettes	70p
Can Freezer	£1.75
K30 thermistor 232266296009	75p
Screwdriver kit 6 different types small in box	£6.00

75R/25 Watt	25p
18R/11 Watt	25p
120R/17 Watt	20p
Front End Music Center VHF/MW/LW x 13in x 3 1/2in	£3
Output Stage for music center	£5
SONY 1400KV Chroma Panel	£6
SONY 1400KV Tuner unit	£3.50
SONY 1400KV Touch button unit	£3.50
Texas Viewdata Decoder VDP 12/80 Issue 3 with all IC's	£10.00

Quantity Reductions

BY204/4	25 for £1.00
BY206	25 for £1.00
BD132/238	20 for £2
W005 bridge	20 for £2
G11 touch button red	6 for £1
BY210/600	25 for £1.00
BY298 3 amp/fast/R	20 for £1.50
BD239	20 for £2.00
MR856	25 for £1.50
BU126	10 for £6.00
BU205	10 for £8.00
BU105	10 for £6.00
2SC2122A	10 for £8.00
BF458	10 for £1.00
BD136	10 for £1.25
BF224	20 for £1.40
OA90	40 for £1.00
BYX10	100 for £4.00
KT3 multicaps	10 for £7.50
50 High voltage ceramic condensers	£1.50
Mixed Mounting Kit for Power Transistors	50p
300 Condensers	£1.50
300 Resistors	£1.50
150 Electrolytics	£2.00
15 Bulbs	40p

SENDZ COMPONENTS
63 Bishopsteignton, Shoeburyness, Essex SS3 8AF
SAME DAY SERVICE
All items subject to availability. No Accounts: No Credit Cards. Postal Order/Cheque with order Add 15% VAT, then £1 Postage. Add Postage for overseas
Callers: To shop at 212 London Rd, Southend. Tel: 0702-332992
Open 9-1/2.30-6. GVMT - school orders accepted on official headings add 10% handling charge.

Video lamps	20 for £5, 200 for £25
Antistatic Discloth	8 for £1
100 Diodes	£1.50
100 Fuses	£2.00
100 W/W Res	£1.50
BF 199	20 for £1
BC 547	100 for £4
10 x 20 Turn 100k pots, Rank	£2
Thorn 9 volt power supply regulated	£3.00
BF 470	20 for £2
Metal BD 124	10 for £8
20 Slider Knobs	70p
6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye	£1.00

Mixed Packs

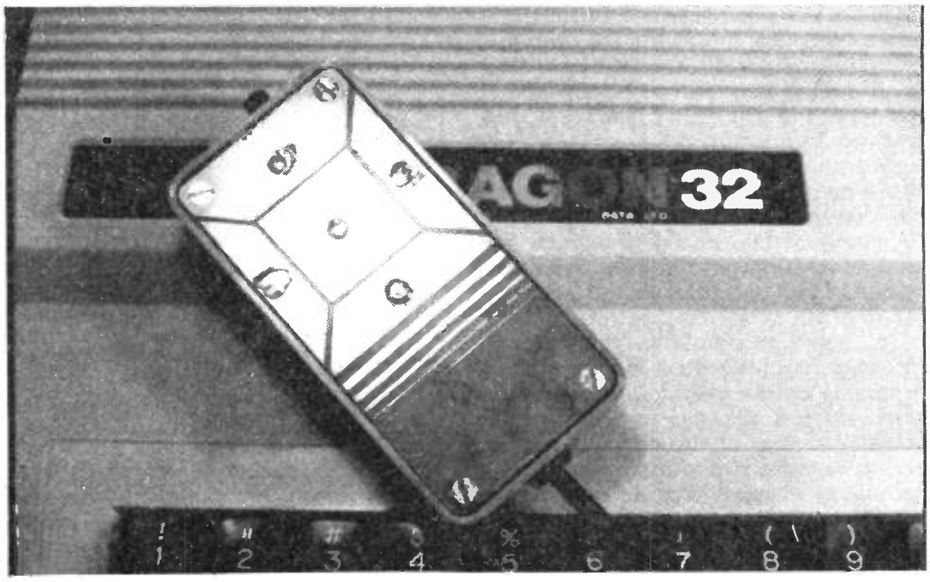
TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits	£1.00
50 Mixed AC series Transistor	£4.50
15 Panel mount rocker switch 250V/10A	£1.50
25 Panel Mount Bulbs & Neons 10A	£1.50
10A	£1.50
Mixed ribbon cables	£1.00
25 LED red/yellow/green	£1.50
20I/C Holders	£1.20
20 Large LED Red	£1.00
20 Small LED Red	£1.00
10x20 Turn 100K Pots	£1.00
100 Transistor	£2.50
20 Convergence Pots	80p
100 Sticks	£1.00
10 Thermistors	80p
20 Slider Pots	£1.00
30 Presets	50p
15 VDR - thermistors, degaussing HT, etc	£1.00
40 glass reed switch	£1
10 press to make switch	70p
40 Pots	£1.50
10 Gun Switches	50p
5 Tube Bases	£1.00
1,000 Diodes, Condensers, Resistors on Bandolier	£3.00
Lucky Dip 600 gram	£1.00
Jungle Bag 5Kg	£5.00
20 Knobs	£1.00
40 Pots, 1/4in + 6mm spindles for audio TV	£3
20mm Fuse Holders Chassis Mount	10 for £1
IN4001/6 100 mixed	£2.50

TOUCH-SENSITIVE JOYSTICK

PETER ROUSE

This joystick contains no moving parts, and features 8-direction control with automatic self-centering. It is more robust and cheaper to construct than a conventional device, and yet with practice is faster than most when it comes to *zapping* Klingons.

The heart of the system is an IC that costs only a few pence, and a single PCB is used for both the circuitry and touch pads. Although the circuit shown is designed specifically for the Dragon 32 and 64 computers, the principle of operation can be applied to virtually any computer. In fact, the circuitry can be adapted for almost any form of touch switch that may be required and is far more reliable than many previously published circuits.



Joyless sticks

With the exception of some up-market, up-price joysticks, many conventional types do seem to have many shortcomings, which can include sloppy movement, weakness at the hands of over enthusiastic young starship commanders, erratic performance due to dirt on potentiometer tracks, and stiffness and lack of movement on self-centering types. My own frustrations came to a head when I discovered that the expensive, futuristically styled *'Zapblaster Sooperstick'* that I had spent a fortune on contained two of the cheapest and nastiest looking potentiometers I had ever seen, and a 'fire' switch that I doubt any manufacturer would ever admit to making.

It was at this point that I pondered on the absurdity of the whole situation. Inside my computer lurked some of the most sophisticated electronic circuitry available on the consumer market, and yet here I was trying to control it with a little stick attached to two bits of bronze that were rubbing up and down a bit of carbon. After wiping the tears from my eyes and stifling the laughter, I pondered on how to find a more sophisticated substitute, and it hardly needed a genius to realise that the answer lay in touch sensitive switching.

Touching thoughts

There are several ways of achieving touch switching. The first, often seen on such equipment as modern hi-fi units, is in fact not *true* touch switching, but consists of two or more conventional switch contacts mounted behind a membrane. Owners of equipment such as the Sinclair ZX-81 computer will be familiar with this type of switch, as it is used on the machine's keyboard. Although it can be effectively used in some applications, it presents difficulty for a home construction project, if only because of the very precise engineering that would be necessary.

The second and probably most common type of touch switch usually relies on the human finger conducting a small amount of current onto the input of a CMOS gate circuit (the principle of operation is demonstrated when you touch the live input of an amplifier: the ever-present mains field is coupled via the body into the amplification chain and hum is heard through the loudspeaker).The extremely high impedance of CMOS circuits make them ideal for this kind of operation, but the drawback comes in removing the 50Hz ripple and a lot of other electrical noise. The usual practice is to use capacitors for filtering, and then squaring circuits to clean up any remaining spikes.

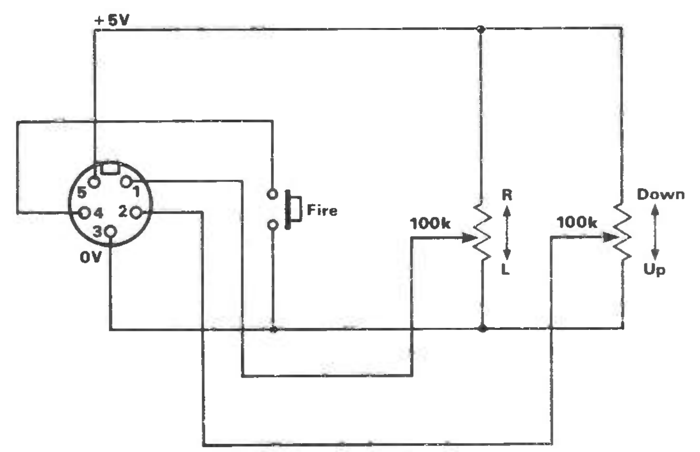


Fig 1 *Joystick connections for Dragon 32/64*

Snags

The snag is not only that a lot of circuitry is needed, but also that when contact is removed the filter capacitors take quite a while to discharge the minute currents involved. This hang time may only be a fraction of a second but, where a computer game is concerned, that could be the difference between rescuing the damsel in distress or getting crushed to death by one of King Kong's barrels.

I mention all this because the circuit about to be described does not suffer any noticeable hang time and only one IC is used to switch four lines. This makes the circuit suitable for almost any touch switch requirement.

Joystick principles

Before discussing the actual finished circuit, it is a good idea to look briefly at how a computer interprets the output of a joystick. *Figure 1* shows the system used on the Dragon computers and is typical of the principle often employed. The two potentiometers are mounted at right angles to each other and manoeuvered by the joystick through a gimbal. Each potentiometer is connected to the 5V supply at one end of the track and chassis ground at the other, and so operates as a potential divider with 2.5V at the wiper when it is centred.

On some computers, the Dragon included, sophisticated machine code programs can be used to measure even small voltage changes as the wiper is moved one way or the other. However, almost without exception, most arcade games rely solely on sensing three voltage states only; 2.5V for centre, above 2.5V (logic high) and below 2.5V (logic low). The latter are used to sense left/right or up/down depending on the configuration the particular computer uses. By sensing the output from both potentiometers, the computer can easily determine appropriate diagonal movements as well.

Figure 2 shows a push-switch equivalent of the potentiometer arrangement,

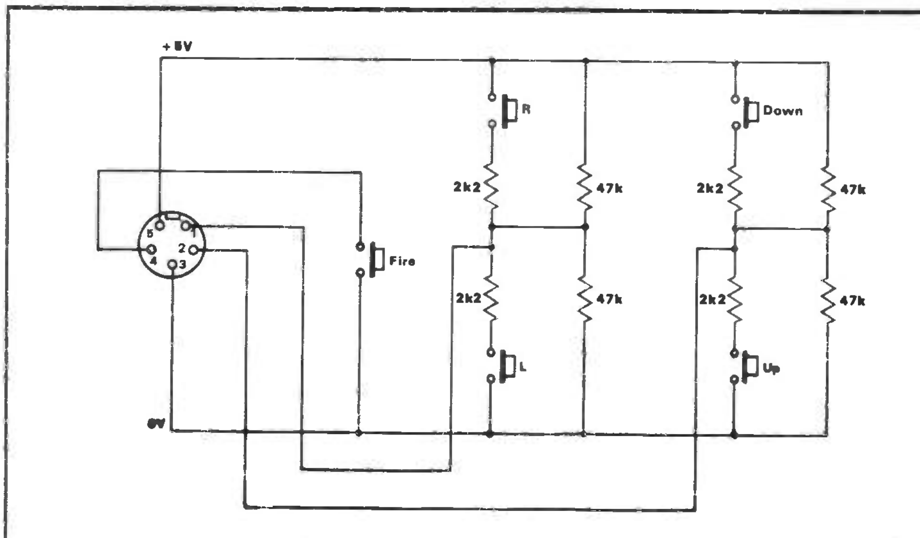
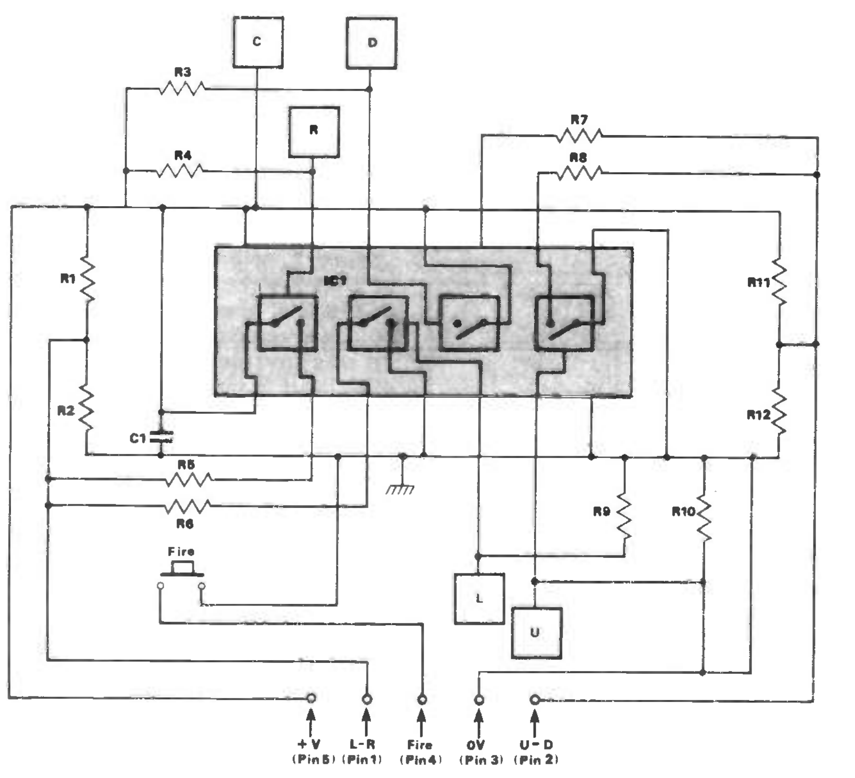


Fig 2 *Equivalent 'electronic' circuit*

with the 47K resistors forming the 1:1 divider when no switch is pressed. Pushing a switch sends the control voltage high or low through the appropriate 2K2 resistor. It should be noted that the 2K2 value chosen is merely a token value to ensure that there is enough of a swing high or low without a short circuit occurring if two switches are pushed simultaneously.

This latter arrangement is a hard-wire equivalent of the electronic circuit that has been adopted for the touch control.



The circuit diagram

The working circuit

The circuit is centred around a quad bilateral gate type CD4066. This consists of four solid-state, single-pole, single-throw switches, each with its own control line. Taking the control 'high' closes the switch whilst taking control 'low' opens it. The device was never really intended for this kind of application and control pins are not as sensitive as those on many conventional CMOS gates. However, even a minute current conducted by a finger or thumb between the supply line and control will trigger the switch, and so this comparative lack of sensitivity is used to advantage. It means a positive, physical touch must be made across two closely spaced contacts.

The touch plates are arranged in such a way that the thumb or finger normally rests on the centre +V pad, but when moved in the required direction simultaneously touches the chosen control pad (or pads for diagonal movement). When a control pad is not touched, the control gate is held low through the

COMPONENTS LIST

Resistors (all ¼W)

R1, 2, 11, 12	47K
R3, 4, 9, 10	10M
R5, 6, 7, 8	2K2

Capacitors

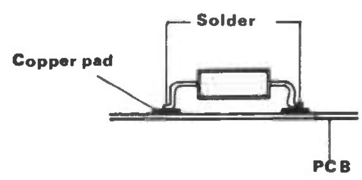
C1	10n ceramic disc

Semiconductors

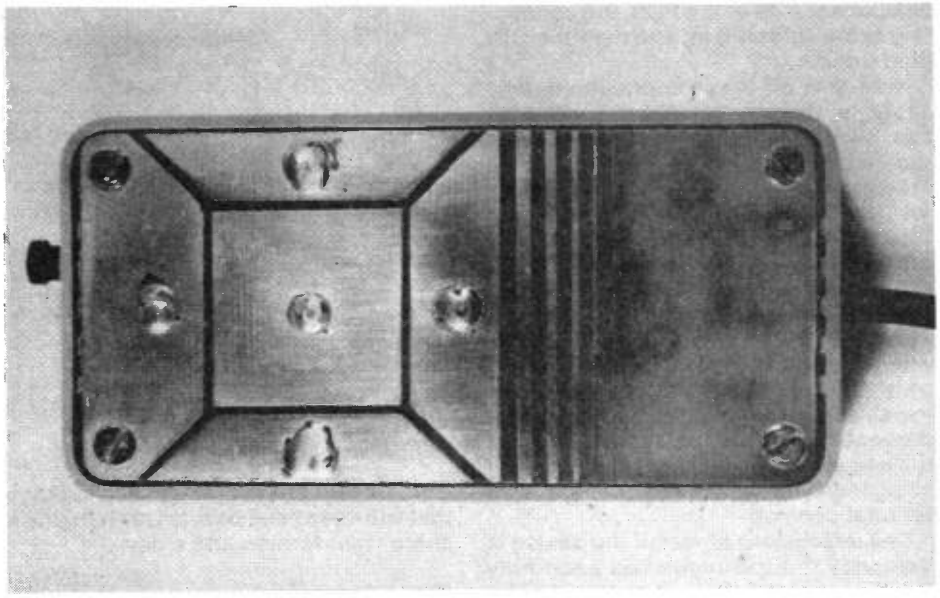
IC1	CD4066

Miscellaneous

Bimbox 2002
5-core cable
SP push-switch
5-pin, 270 degrees DIN plug
PCB
etc



Component mounting



10Mohm resistor. Resistors 1,2,11, and 12 form the potential dividers, whilst resistors 5,6,7,8 prevent accidental shorting of supply to ground.

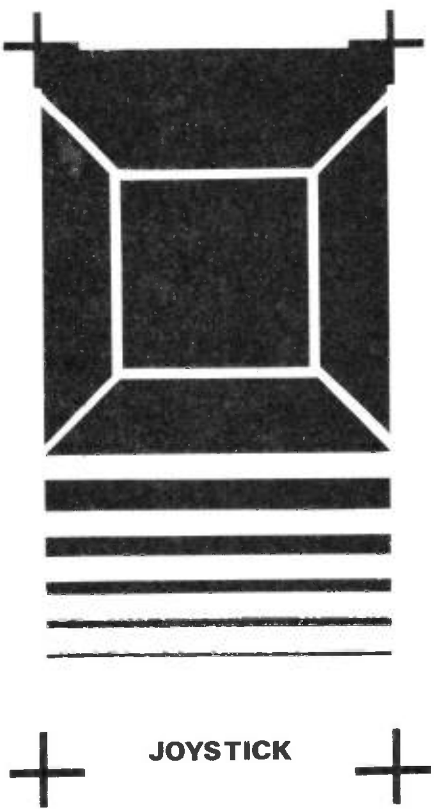
Looking at the finished circuit, it should be easy to see how it relates to *Figure 2*. Touch switching has not been used for the fire button, not just because it would involve an extra IC, but also because in practice it does not work very well. It was included on two prototypes but later abandoned because it never quite felt right, and family and friends commented that it was awkward having to hold your trigger finger away from the contact when not firing.

Construction

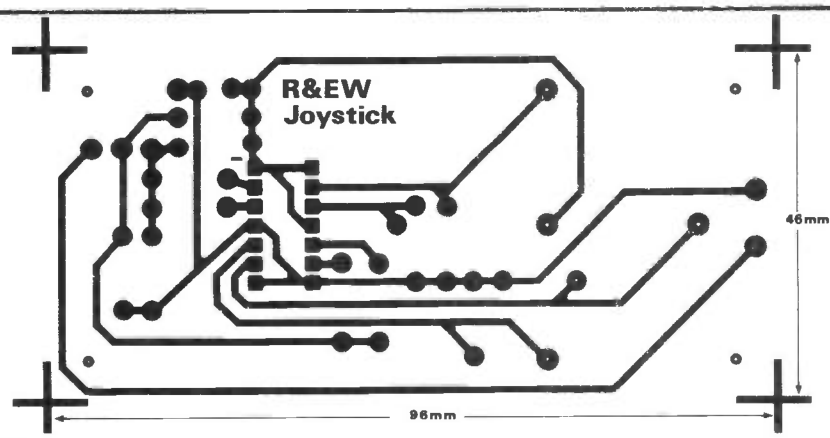
The PCB performs two functions: it forms the touch panel-cum-lid on one side, and circuit mounting on the other. The method of mounting the components may seem a little odd to some constructors, but will be familiar to anyone who has built RF power amplifiers. The components are not mounted through the board, but are instead soldered directly onto their pads.

Five connections must be made through the board from the PCB tracks on the underside to the touch panels on top. In order that large solder blobs and wire ends should not obstruct movement across the panels, these connections should be made with very fine wire (a single strand from some coax braid is ideal) and the minimum of solder.

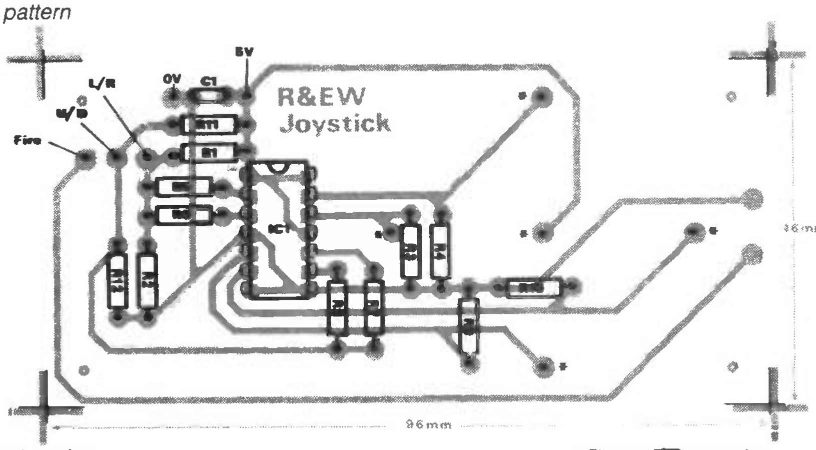
The lid of the case is discarded and holes are drilled for the cable and fire switch. The latter is best offset slightly, to favour either left or right hand use as shown in the photographs. The switch is then connected to its two pads on the



Lower PCB layout



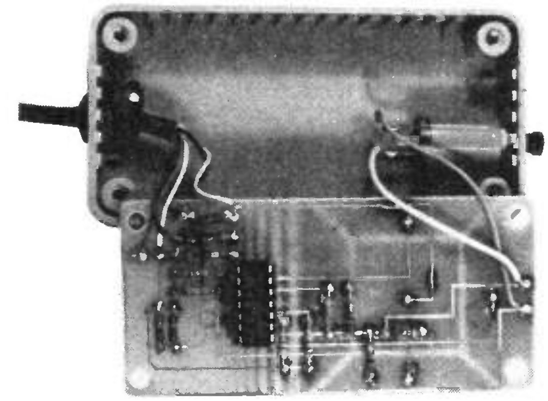
PCB Foil pattern



Component ovelay

component side of the PCB, the connecting cable soldered in, and then the DIN plug fitted.

Note that all these connections only apply to Dragon computers, although tips on using the joystick with other makes are provided at the end of the article.



Touch and go

The ideal way to use the joystick is single-handed with movement controlled by the thumb. At first it will seem a little strange, but cast your mind back to when you first took on the *Space Invaders* and the awful scores you used to get. With practice it can outshoot most conventional joysticks and is ideal for the less active . . . the slight movement of a finger and thumb are *all* that is required for total control.

One interesting aspect of the device is that once the technique has been fully mastered, you don't even need to hold it in front of you. Because the thumb is only moving in relation to the hand it is just as easy to use the unit with your arm dangling down the side of your easy chair, or even behind your back.

The only thing you will need to watch is that the surface of the touch panels should be kept reasonably clean. Buttery little fingers can create surface leakage that will keep your warp drives hanging a sharp right forever and a day.

Other computers

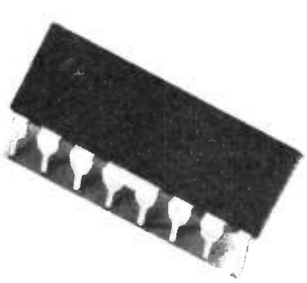
As has already been mentioned, many computer joysticks work on the same principle as the Dragon's. However, we regret that it is impossible for us to provide specific details of how to connect any particular make to the circuit presented here. The principles involved are very simple and it should not be difficult to modify the circuit to suit other machines.

The basic switching principles involved can also be applied to computers such as those in the Atari range which use a sequence of on/off switches rather than voltage division through potentiometers.

If the manufacturer has not supplied connection data in the computer's handbook, it should not be too difficult to open up an existing joystick and trace the connections with a multimeter.

THE HORSESHOE NAIL SYNDROME

Brian Dale



For want of a nail the shoe was lost,
For want of a shoe the horse was lost,
For want of a horse the knight was lost,
For want of a knight the battle was lost,
For losing the battle the war was lost,
For losing the war the country was lost,
All for the want of a horseshoe nail.

Last June, the maiden launch of the space shuttle *'Discovery'* was delayed following the failure of an on-board IBM computer. Investigation of the fault revealed that a corrosion problem within the 'core driver' had caused the failure.

At the same time, a Pentagon spokesman revealed that it had been discovered that a large number of integrated circuits manufactured by the Taiwan factory of Texas Instruments had not received their full quota of checks before being incorporated into equipment.

Suspect

Whilst the lack of adequate inspection does not mean that the integrated circuits are necessarily faulty, these must nevertheless be considered 'suspect' and subjected to further testing before reliance can be placed upon them. Such inspection may well, at first sight, appear possible within normal maintenance schedules but for two facts: firstly, it is almost impossible to check every aspect of performance of a highly complex IC such as a microprocessor or a 64K RAM within its normal working environment, and secondly, the magnitude of the problem. It is estimated that for IBM defence products alone, 15 million circuits of nearly five thousand different types are suspect.

Doubtless, with the assistance of United States industry and the efficiency of their military maintenance organisation, this problem will have been solved long before you read this article, but the fact that such a circumstance *could* arise caused me to start thinking of my home equipment, both homebuilt and commercial, most of which contains a fair proportion of integrated circuits.

The development of the integrated circuit has been a boon to manufacturer and customer alike, for it has made possible economic incorporation of highly complex circuits in moderately-priced equipment. Coupled with this, the vast requirements of the military and commercial markets has made possible a phenomenal rate of development in which equipment is virtually obsolescent by the time it reaches the retailer's shelves, and each succeeding technology is outdated within four to five years.

Nowhere is this more evident than in the production of integrated circuits. Taking RAMs alone, only a few years ago 1K capacity was normal and 4K the exception. Today 64K RAMs are readily available and 128K and 256K units are in the late stages of development, if not already in production.

On a recent TV programme, an eminent University Professor in the field of computing forecast that within fifty years the capacity of a single RAM will be sufficient to contain the whole of the world's annual written output. Similar strides are being made in the development of almost all other types of integrated circuit.

With such development rates, it is obvious that long production runs of any one type of IC would be impossible. To investigate this further I telephoned a number of the major IC manufacturers. *The replies I received astounded me.*

In essence they were that, with a few notable exceptions such as the Plessey SL series and TTL, only *one* production run of any IC is made – and this is terminated as soon as the demand reduces. This period could be anything from one to, at the most, six years.

Normally, about a year before production is terminated, major customers such as manufacturers and large maintenance organisations are informed, and advised to order *ALL TIME* spares.

Once a production line has closed it is almost impossible to reopen, for in re-equipping for the next technological development, much of the previously used equipment will be outdated and necessarily discarded.

If a more modern version of an IC is considered, it would have to use the more modern technology and, in consequence, would exhibit different characteristics to its predecessor. Under such circumstances it is unlikely that it would be a 'plug-in' replacement, and circuit *redesign* would be necessary.

Bath tub

The serviceability of any equipment follows a 'bath tub' curve. When the equipment is new, there is a settling-in period during which unfamiliarity with the equipment and minor design faults cause the fault rate to be quite high, but this rapidly diminishes and the equipment soon settles down for a relatively trouble-free service life.

After a few years, however, faults of age appear. Perhaps, for example, a capacitor leaks, ceasing to block a voltage, which in turn blows an IC, etc. Such minor faults are usually readily detected, but rectification costs time and money. Unfortunately, due to lack of demand during the service life, production of the required IC has probably ceased.

Contrary to popular belief, in the commercial field operators look for a service life of ten to fifteen years, for *any* less would cause the accountants to question the viability of the use of such equipment. Compare this with the duration of production of the ICs used and it will be seen that for the majority of the equipment life, the maintenance engineer will be relying on the diminishing stocks of spares remaining on his, and the wholesalers', shelves. As these stocks fall so prices will rise, with a consequent reflection on maintenance costs.

No replacement

Even more serious is the situation where no replacement IC is obtainable, and the equipment operator is faced with either a redesign of the equipment board by himself or the manufacturer's 'Post Design Services' department, or with the replacement of equipment which, but for the lack of an IC which originally probably cost less than a pound, would otherwise have given several more years service.

Responsible commercial equipment manufacturers consider this a major problem and, in consequence, now tend to carry far greater stocks of replacement ICs than would have been considered necessary a few years ago.

Within the domestic market, the introduction of integrated circuits has lowered the production costs of domestic radio and hi-fi equipment to the point that once outside the initial guarantee period, for all but the most expensive items, the owner is quite happy to be told that the equipment is 'uneconomic to repair' and thus purchase a replacement.

In extension of this, I have been informed by a reliable source that one manufacturer of home electronic organs, whose price range extends from a few hundred to several thousand pounds, in order to further a policy of planned obsolescence destroys all spare parts five years after each model ceases production.

Unfortunately, the amateur radio market seems to fall between these extremes. Although the equipment is expensive, it is marketed with the same enthusiasm as in the ordinary domestic market, with each major manufacturer introducing several new models each year.

Base station equipment, either HF or VHF, today costs two to four times as much as a domestic TV receiver. In consequence, I would suggest that, despite many pieces having a somewhat robust life-style, being taken on holidays and being bounced up rough mountain tracks to field-day sites, this price difference should also reflect a proportionate difference in *life.*

Unserviceable

For many amateurs, especially those who take up the hobby in retirement, the acquisition of an 'all-singing, all-dancing' rig is a 'once-in-a-lifetime' purchase. *The possibility that it may be rendered unserviceable and valueless after a few years for want of a single IC which is no longer available must present a considerable worry.*

I am sure that the many highly reputable equipment dealers throughout the country will invariably do their best to assist in such circumstances, but they too have to live, and it would be totally uneconomic for them to provide PDS services for any but the most popular equipment.

Not interested

In contrast, and I would be delighted to be proved wrong, I cannot imagine that the major manufacturers of the Orient would be remotely interested in providing PDS for equipment which has ceased production and is, from their point of view, 'outdated'.

What, therefore, is the answer to this dilemma? I regret that I cannot find one.

To a commercial equipment operator I would suggest building up a massive stock of spare ICs and semiconductors when they are cheap and plentiful, for they will economically extend the life of equipment and, when no longer required, will doubtless fetch a good price on the market.

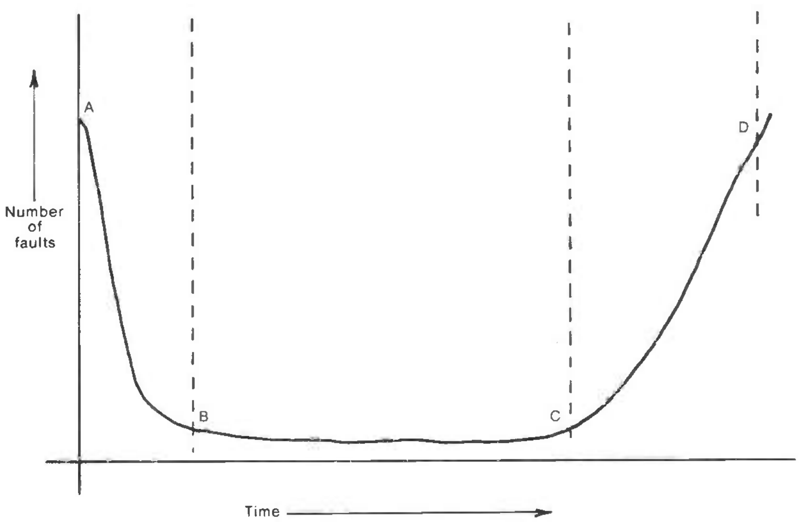
To the amateur, however, this technique is not possible for it is unlikely that he (or she) will have more than one set of equipment of each type. Reliance must therefore be placed on the dealers.

The dealers are also in a cleft stick for, although they will invariably do their best, economics will inevitably dictate their spares holdings.

All is not perhaps as black as this article may indicate, for modern equipment is extremely reliable and the chances are that the *majority* will give a long trouble-free life. The research for this article was made with commercial operators who frequently run their equipment 24 hours per day, year in year out. In consequence their equipment will suffer accordingly.

Caveat emptor

Nevertheless, the IC supply problem exists and I feel that prospective purchasers should be aware of the situation before investing their savings in equipment.



The 'bathtub' serviceability curve. A high initial fault rate at A rapidly subsides due to familiarity with the equipment. From B to C few faults arise and there is little demand for spares. After C faults of age manifest and it is a commercial decision at which point the equipment is replaced.

★ ★ NI-CAD BARGAINS ★ ★

Re-chargeable Nickel-cadmium batteries in stock. Ex-equipment but very little used condition. DEAC 1000DK Button Stacks 6 cells – 7.2V. Size 2¼ x 2" diam. Capacity 1AH. **£4** inc. VAT (p&p 25p). DEAC 600DKZ Button stacks 3 cells – 3.6V. Size 1¼ x 1¼" diam. Capacity. 0.6AH. **£1.80** inc. (p&p 20p).

Also available – PCB's from which these batteries have been removed containing Transformer, Diode rectifiers, smoothing capacitors, DPDT Relay, fuses etc., easily adapted to charge either of the above stacks. ONLY **£1.80 each inc. VAT** (p&p 75p).

★★ STEPPER MOTORS ★★

Brand new stock of 'ASTROSYN' Type 20PM-A055 stepper motors. 28V DC. 24 steps per rev. 15 oz-in torque @ 100PPS. Body length 2½", diameter 2", shaft ¼" diam × 4¼" spirally threaded. Weight 16oz. Price each £11.50 (p&p 50p). Connections supplied. INC. VAT.

★ ★ STEPPER MOTORS ★ ★

In stock — used, but excellent condition, 4-phase steppers. 50 steps/rev motor with (removable) gearbox giving a 300:1 reduction. 6V DC operated. Complete with a driver board requiring just a single 6V rail and pulse input. Motor measures 1" × 2" diameter, gearbox ⅞" × 2⅞" output shaft 3/16". Sold complete with connections, CCT diagram of motor, CCT details of half-stepping etc. All for just **£8 inc. VAT** (p&p 50p).

OPTICAL ISOLATORS

SPERRY UNIVAC M4000 opto-isolator units providing 2KV of insulation between Modems and Terminals. 25 way 'D' connectors (RS232C Interface) in and out. Measures 9×5×7". Complete with handbook .... £16.50 inc vat & pp.

BECKMAN TURNS COUNTER DIALS

Miniature type (22mm diam). Counting up to 15 turn "Helipots". Brand new with mounting instructions. Only **£2.50** each. Inc VAT & pp

TELEVISION SERVICE KIT

We have managed to obtain a stock of Labgear T.V Service equipment affording vast savings on new price. All items are sold in full working condition and guaranteed.

LABGEAR COLOURMATCH CM6004PG. UHF TV Pattern generators. Grey scale, variable level cross-hatch & dot patterns. £35. inc

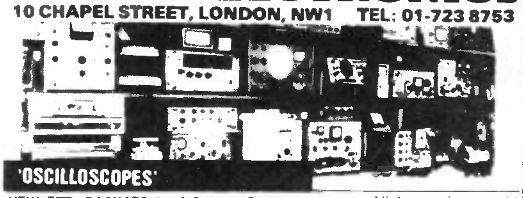
LABGEAR COLOURMATCH CM6010RG Gated Rainbow colour pattern generators Cross-Hatch/dot & gated rainbow (RGB) colour bar patterns.. £65 inc.

UNAOHM EO684 PAL Colour-bar & pattern gen. £275+
KORTING 82512 PAL/NTSC Colour &patterngen £275+

Mail Order customers please add £2.50 postage ea item

RALFE ELECTRONICS

10 CHAPEL STREET, LONDON, NW1 TEL: 01-723 8753



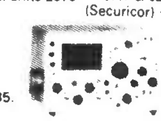
'OSCILLOSCOPES'

HEWLETT—PACKARD 141A Storage Oscilloscope.
HEWLETT—PACKARD 1707A dual trace 75MHz £750
TEKTRONIX 454A dual trace 150MHz sweep delay £950
TEKTRONIX 453 dual trace 50 MHz sweep delay £600
TELEQUIPMENT S61 — see display below
TELEQUIPMENT D67 dual trace 25MHz sweep delay £350
TELEQUIPMENT D75 dual trace 50 MHz sweep delay £450
TELEQUIPMENT D63 c/w dual-trace & differential units £375

All these units are sold in full operational condition and calibrated to spec. All prices are subject to additional VAT & carriage (Securicor) + £10

★★ TEST EQUIPMENT ★★

SONY/TEKTRONIX 335 SCOPE ½ list price.
REGUVOLT 2KVA CVT's Sine wave 230V, AC £100.
MARCONI TF868 LCR Bridge
MARCONI TF2604 Electronic Multi-Meter
MARCONI TF893A Audio Power Meters **£85.**
MARCONI TF2502 RF Power Meters DC-1GHz. 10w fsd **£350.**
MARCONI TF2701 In-Situ Universal Component Bridge **£250.**
ROHDE & SCHWARZ 'SDR' AM Signal Generator 0.3-1GHz.
TEKTRONIX 2901 Time-mark Generator.
ROHOE & SCHWARZ Resonance Frequency Meter 470MHz-2.5GHz.
ROHDE & SCHWARZ Polyscop SWOB II.
BRUEL & KJAER Heterodyne Voltmeter 0.5-240MHz.
AIRMEC Display Oscilloscope 279, 4-trace, 14x10" CRT **£195.**
RIKADENKI 3-channel Chart Recorder, Model B-341.



TELEQUIPMENT S61 SCOPES

A bulk purchase of these quality oscilloscopes enables us to offer them for sale for just £100 +vat. Specification as follows. Bandwidth DC-5MHz Sensitivity 5mV/div Sweep speeds from 500ms/div to 1us. 8×10cm CRT. External X & Z-mod inputs. £115 inc vat & inc handbook Zerox.(Carriage £10)

POWER CUTS ???

We all hope not, but be prepared in case. We have a stock of Transistorised Flourescent light inverters for emergency use. These are top quality units in polyprop transluscent cases with black base. 12V Battery input 8W tube (supplied) output. Circuitry has solid state change over to charge Ni-cad cells when mains supply is on (batts not supplied). Size 12x4x5". Buy now before its too late! £22 ea inc VAT & P&P. Also available 12VDC-Mains 50Hz inverters from 100W.

★ SWEEPERS ★

TELONIC 2003 System 800-1500MHz **£325**
TELONIC SM2000 with 500-900MHz plug-in **£175**
KNIGHT KG-687 3-220MHz. **£150**

★ TEKTRONIX ★
FILE MANAGER SYSTEM MODEL
4907 Option 31 (Third disc drive).
4051 Graphic System compatible
GPIB (IEEE 488-1975) compatible.

PLEASE NOTE. All the pre-owned equipment shown has been carefully tested in our workshop and reconditioned where necessary. It is sold in first-class operational condition and most items carry a three months' guarantee. For our mail order customers we have a money-back scheme. Repairs and servicing to all equipment at very reasonable rates. PLEASE ADD 15% VAT TO ALL PRICES. EQUIPMENT WANTED. PLEASE WRITE OR PHONE.

★ COMPUTER PERIPHERALS ★

1.6MB 8" FLOPPY DISC DRIVES – New Stock

After our recent sell-out of the DRE7100 FDDs, we are pleased to offer another bargain package as follows: BRAND NEW American 'MFE Corp' model M-700 **DOUBLE-SIDED** 8" Disc Drives. Massive storage capability up to 1.6MBytes. Full IBM compatability. External power requirements are ±5V at 1.2A and +24V at 1.1A. Full spares/back-up available U.K. (Elcomatic's). Current list is over £315.

** NOW LOWEST PRICE EVER **£160** – INCLUDING MANUAL INC CARRIAGE & INC VAT **

8" SHUGART type SA800

Floppy disk drives. We are pleased to say that we have these in stock now after our sellout a few months ago. Used but excellent condition single-sided drives to 800KB. Few only at the same price £90 inc VAT & carriage & Zerox of user handbook. Also to those too late for our last stock of 19MByte Winchesters – we now have some coming in ca. £125, please call.

★ SWITCHING POWER SUPPLIES ★

The following DC power supplies are available now from stock in limited quantities. All fully tested and guaranteed

5V @ 10 Amps **£18**	12V16A(110V In) **£20**
5V @ 20 Amps **£20**	5V @ 40 Amps **£30**
5V @ 60 Amps **£40**	19V @ 30 Amps **£40**
+15V, −12V & +5V @ 11A, 4A and 40A **£50**	

ALL PRICES NOW INCLUDE VAT. CARRIAGE + £2 EACH.

★ CENTRIFUGAL BLOWERS ★

'TORIN' Type U62B1. 230V Cap'Start (supplied), very powerful (200W. 3,000rpm) centrifugal fans for large rack cooling or enclosure extraction applications. Overall dimensions 20x12 cms, outlet 6x4 cms. BRAND NEW Surplus stock. **£15 each inc.** VAT, pp £1.50. ALSO SEE LEFT HAND COLUMN

ROTRON INSTRUMENT COOLING FANS

Supplied in fully tested excellent condition, as follows:
115V. 4½×4½×1½" **£5.** 230V same size £5.50. 115V 3×3×1½" **£4.** 230V 3" size, brand new **£6.** Also small quantity 115V 4½" size, brand new **£6.** Postage each + 50p please.

WW10

REPAIR THAT OLD BLACK & WHITE TV with the aid of the best seller "TV FAULT FINDING"

Over 100 illustrations, including 60 photographs of a television screen after the appropriate faults have been deliberately introduced.

Comprehensive Fault Finding Guide cross-referenced to methods of fault rectification described at greater length in the text.

5th Edition
Edited by J R Davies
132 pages

(more than 200,000 copies sold)

Price **ONLY £1.50** (inc p&p)

Available only from:

DATA PUBLICATIONS
45 Yeading Avenue, Rayners Lane, Harrow, Middx HA2 9RL

TAU

Designed and manufactured in Gt. Britain

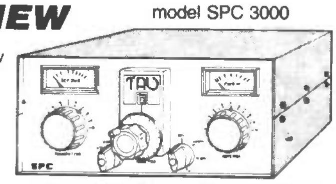
TAU SYSTEMS LTD
51 GREENHEY PLACE
EAST GILLIBRANDS
SKELMERSDALE WN8 9SA
ENGLAND Phone: 0695 24662

INTRODUCING *the REAL* ATU

FULL COVERAGE, TUNES 1·5 CONTINUOUS TO 29·350 Mcs

NEW model SPC 3000

Special Features
1 Renowned "SPC" transmatch circuit
2 TAU innovative composite design®
3 Large spaced Capacitors rated 5kV, tested to 7kV
4 Roller Coaster Inductor infinitely variable
5 Balun built in, 1Kw, 4 to 1 impedance ratio
6 Transmitter switch, thro ATU or direct to antenna
7 Five position antenna switch to 5 input/outputs
8 Twin Meter automatic readout of SWR & Power
9 unsurpassable transmission strength and clarity
10 Solid, traditional precision radio engineering
11 Heavyweight, long-life construction
12 Superb ultra-compact cabinet design with tilt feet
13 Superlative finish and looks — compatible with all rigs
14 Will tune any Transmitter/Aerial combination to optimum
15 Lifetime Investment — will never need replacing



cabinet dimensions, wide 313mm, high 147mm, deep 380mm
unpacked weight 9.7 kilos of solid quality engineering

£349.95 including UK VAT ex works, carriage extra

UNDOUBTEOLY THE FINEST ATU AVAILABLE — NOBODY MATCHES UPTO US! TAU SYSTEMS LTD

RTTY and CW TRANSCEIVE with NO TERMINAL UNIT

This fantastic program interfaces direct with your rig, slashing the cost of previous systems. Split screen, type ahead, all the usual features and more. Tape and kit for the very simple interface, including PCB and User Port connector, for only £20.00. Ready-made interfaces available. For CBM64, BBC-B, and VIC20 (+ at least 8k). CW-only version for SPECTRUM £10.

And four superb programs for CBM64, VIC20, BBC-B, SPECTRUM

LOCATOR QTH or Maidenhead locator or lat/long. Distance, headings, contest points, converts between locator and lat/long. Tape £6.

LOGBOOK Date, band, mode, call and remarks. Superfast callsign search. Easy, fast updating of files. Screen/printer output. VIC20 needs at least 8k expansion. Tape £6.

MORSE TUTOR Britain's best. Learn fast in easy stages from absolute beginner to over 40 wpm. Join the hundreds who have succeeded with this program. Tape and full learning guide £6. **For ZX81-16k also.**

RAE MATHS All the practice and testing you need. Tape and comprehensive reference sheet sheet detailing all you need to know £8. VIC20 needs expansion (any). **For ZX81-16k also.** Don't let maths make you fail. PASS with this program.

All programs are very easy to use and come with full instructions.
Prices include p&p 1st Class by return. Add £1 per tape if outside UK or Ireland.

technical software (REW)
Fron, Upper Llandwrog, Caernarfon, Gwynedd LL54 7RF
Tel. 0286 881886

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

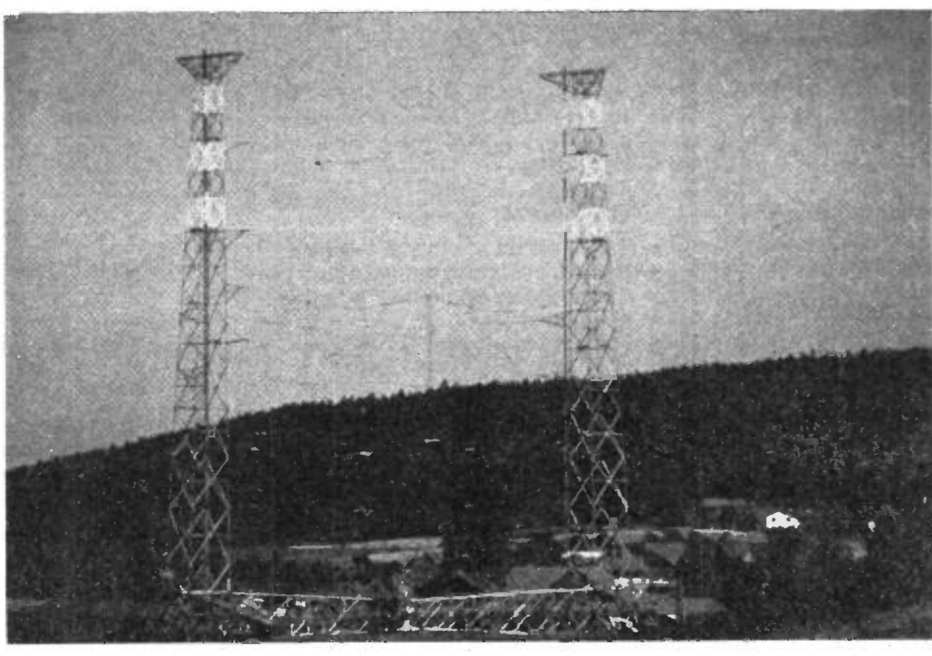
As we have said before in these notes, by far the best way of getting into amateur radio is via short wave listening. You'll get to know the characteristics of the radio frequencies, and you may even get sufficiently hooked to want to be able to read the Morse code signals you hear. If that happens, when you do progress to becoming a radio amateur, you'll have mastered what many folk find is the most difficult part of getting a full transmitting licence.

Many SW broadcast stations also have most interesting and instructive amateur radio programmes, from which a lot can be learned which is helpful in extending your knowledge of amateur radio matters.

SBC

One of these stations is Swiss Radio International. As I write this, the postman has just delivered the latest programme sheet for this station and I see that their short wave programme is entitled *'Swiss Shortwave Merry-Go-Round'*. It is radiated in their transmissions on the second and fourth Saturdays of each month on numerous frequencies. Reception in Europe and adjacent areas can be heard on 3.985, 6.165 and 9.535MHz between 0600 and 2245GMT.

There are transmissions in English every day at 0900, 1100, 1315, 1530, 1815, 2145, 0145, 0430 and first thing in the morning at 0700GMT. Each transmission lasts 30 minutes. Full details can be obtained by writing for the programme guide to: *The Swiss Broadcasting Corporation, CH-3000 Berne, 15 Switzerland.*



Those older readers who remember the days of the early bright emitter valves will be interested in some experiments recently carried out by the European Space Agency, in which tests were made to see if the emission of metal from hot filaments in vacuum devices could be prevented when these devices were run in zero gravity conditions.

In the early vacuum radio valves the glass envelope, which was quite clear when the valve was new, soon became covered with a metallic deposit, and the heated filament ultimately disintegrated.

The space shuttle launched on 5 October last carried a European Space Agency 'Get Away Special' payload, known as HALEX for Halogen Lamp Experiment. Halogen lamps are used as heat sources for the optical radiation furnaces now under development for material science research in space. Their main advantage is the low power consumption in comparison with conventional heating elements in furnaces.

However, there is still some uncertainty as to whether the performance of Halogen lamps will remain constant during extended periods in the microgravity environment of space.

Halogen lamps are most effective heat sources mainly because they are long lasting and very stable at high temperatures. This is due to the so-called 'Halogen cycle', a chemical process which prevents evaporated tungsten from the filament from depositing on the lamp casing and blackening it.

During the cycle, the molecules of Halogen gas in the bulb react chemically with the evaporated tungsten and draw it back to the filament, where the reverse chemical reaction occurs and the tungsten re-deposits.

In the microgravity environment of space, however, there is no gravity-induced convection, which is the main power behind the Halogen cycle; there is only diffusion. The HALEX experiment is intended to determine to what extent the absence of convection reduces the effects of the Halogen cycle.

UoSAT OSCAR-9 birthday mission

UoSAT-9 was launched by NASA at 1127GMT on 6 October 1981 from the Vandenberg Air Force Base in California, into a 554Km sun-synchronous polar earth orbit, on a Delta 2130 launch vehicle.

A resumé of its activities was issued from the University of Surrey to mark this anniversary. A great deal has happened since that launch day, both on the spacecraft and on the ground. UO-9 took a little while to 'tame' – the difficult command links caused the commissioning phase to stretch out longer than anticipated, and gave rise to the well-remembered months of 'steady tone' while the University of Surrey and the SRI fought to regain use of the spacecraft.

Those five months were put to good use upgrading the ground station, and following the successful recovery of the spacecraft great strides were made with the activation of the on-board experiments, and particularly navigation and attitude control. The complex and difficult de-spin and attitude manoeuvres culminated in temporary gravity-gradient stabilisation. However, the magnetometer cables on the boom became tangled during deployment and the boom had to be retracted. The spacecraft was then spin stabilised and the remaining experiments activated.

A weekly schedule of daily experiments has been executed for the last two years, including a weekly news bulletin service; CCD image data; radiation experiment data; and computer generated telemetry, Digitalker and whole-orbit telemetry surveys. The bulletin service has been especially successful for keeping the user community in close contact with spacecraft operations, as well as providing information on future mission proposals and more general space news.

The spacecraft has not exhibited any measurable degradation since the failure of the secondary computer memory devices in the summer of 1982, and the rate of decay of the orbit has been much less pronounced than was anticipated, giving rise to an extended orbital lifetime of perhaps another two years.

Meteorological spacecraft news

A good publication for those with an interest in weather satellites has become established over the past year. *'The Journal of the Environmental Satellite Amateur Users Group'* is published by R J Alvarez WO4MRJ, and details are available from: *2512 Arch Street, Tampa, Florida 33607, USA*.

The journal appears quarterly. The last issue had 22 pages and included station construction details, WX satellite status reports, meteorological studies, data receiving tips, a Soviet WX satellite report and UoSAT status reports.

Licence schedule

Following discussions between the RSGB and the DTI, a new schedule to the amateur radio transmitting licence has been formulated. It has been produced in a single format to cover both Class A and Class B licences.

Class A licensees can transmit on any amateur band, but must have passed the Morse code test. Class B licences permit transmission on the 2 metre band and above, without knowledge of the Morse code.

The schedule has been clarified and indicates the frequencies, the maximum power and the class of transmission authorised.

Sunspots

From time to time, statements are made about how to look for sunspots – though there are not many to be seen these days. Such a comment was made in a recent amateur radio feature in one of the SW broadcasts such as that referred to in the first paragraphs of this article.

It cannot be said too often that *no way* does one look directly at the sun through dark glass, optical filters, metal films on glass and certainly not through a telescope or binoculars, with or without a solar filter. Even the latter have been known to fracture due to heat from the sun's rays being concentrated on them. If this happens, you stand a very good chance of damaging your eyes sufficiently to cause blindness, and reports continue to appear in the press of this happening.

The only way to observe sunspots is to make use of a solar screen on a telescope, which is usually available as an accessory. The telescope need not be a very large one – the writer uses a 2½ inch diameter instrument, and this has proved very suitable for regular routine sunspot recording.

Band Plan changes

Some expansion of the 3.5, 21 and 28MHz phone bands has recently been authorised by the FCC in the United States. Phone privileges for US radio amateurs are now as follows:

Extra Class: 3.750-4.000, 21.200-21.450 and 28.300-29.700MHz.

Advanced Class: 3.775-4.000, 21.225-21.450 and 28.300-29.700MHz.

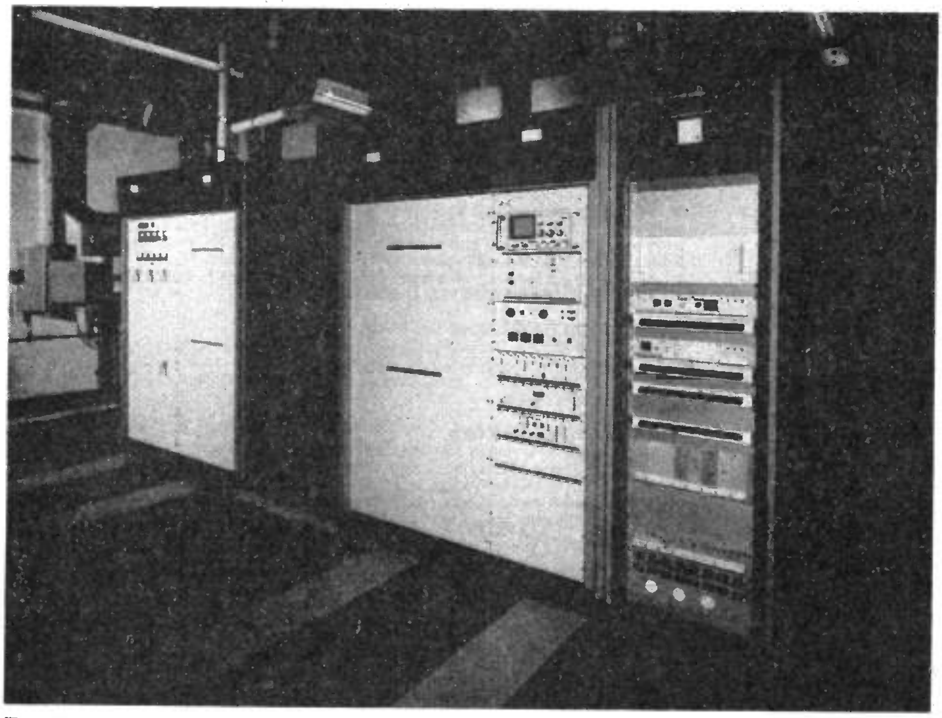
General Class: 3.850-4.000, 21.300-21.450 and 28.300-29.700MHz.

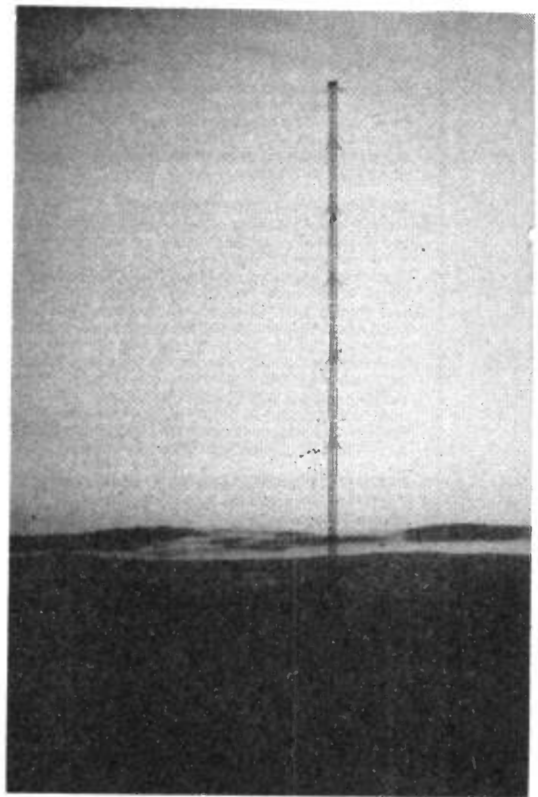
At the recent IARU Region 1 conference it was agreed that the section of the 3.5MHz band 'reserved' for DX working should be extended to cover 3775 to 3800KHz. If respected, this will give those interested in working DX on 80 metres a better chance of doing so.

As a rough guide, the most favourable time for working DX on this band is from (say) two hours after sunset to two hours before sunrise.

LONG WAVES LIVE ON!

NIGEL CAWTHORNE G3TXF





The Droitwich antennae & (left) the new Marconi transmitters

In the European and North African region, the long wave broadcast band is in the frequency range 150-285KHz. By international agreement, the 135KHz of bandwidth available is split into 15 channels each 9KHz wide.

In the UK, the most well-known long wave broadcast station is the BBC's station on 200KHz. The main 200KHz transmitter is sited at Droitwich, but there are also two other less well-known transmitters in the UK on the same frequency. Both are in Scotland. The 50KW transmitters at Burghead on the Moray Firth and at Westerglen in Stirling operate in synchronism with the Droitwich transmissions. The 200KHz channel (or the '1500 metres long wave') carries the BBC's Radio Four programme.

The BBC's main 200KHz transmitters at Droitwich operate with a power of 400KW into an 180m high antenna. The transmitters currently in operation have been in service for many years and are about to be replaced by a pair of new Marconi 250KW transmitters, which will feed 500KW into the antenna.

Happy birthday

Droitwich recently celebrated its fiftieth birthday. The station first went on the air on 6 September 1934, and the original Marconi transmitter was rated at 150KW. Its 400KW successor was also a Marconi transmitter. The new (2x250KW) transmitters currently being installed are therefore only the third set of transmitters to be installed at Droitwich for the 200KHz service in fifty years.

Antennae

Long wave broadcasting presents the broadcast engineer with several unique problems, many of which centre around the constraints caused by the antenna.

At a frequency of 200KHz, the corresponding wavelength is 1500 metres. A 'simple' half-wave dipole would need to be 750 metres in length, with 375 metres of wire in each arm! Even to be just a quarter-wave above ground, such a dipole would have to be on masts at least 375 metres high. Such a 'simple' dipole would need masts at least as high as the Eiffel Tower to be effective!

In practice, long wave broadcasters usually use single element antennae which are a combination of vertically and horizontally polarised components. *Figure 1* shows in outline the present arrangement at Droitwich, as well as the outline of the larger antenna that will soon be used to replace it.

The present antenna consists of a 'T' supported between two 180m masts. The top section of the 'T' is currently 90m long, and the 180m vertical section joins it in the centre. The size of the top section of the antenna is to be increased to 172m.

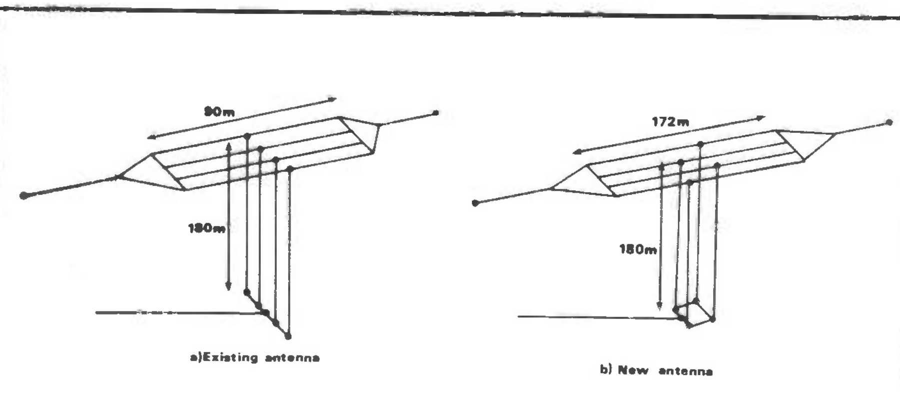
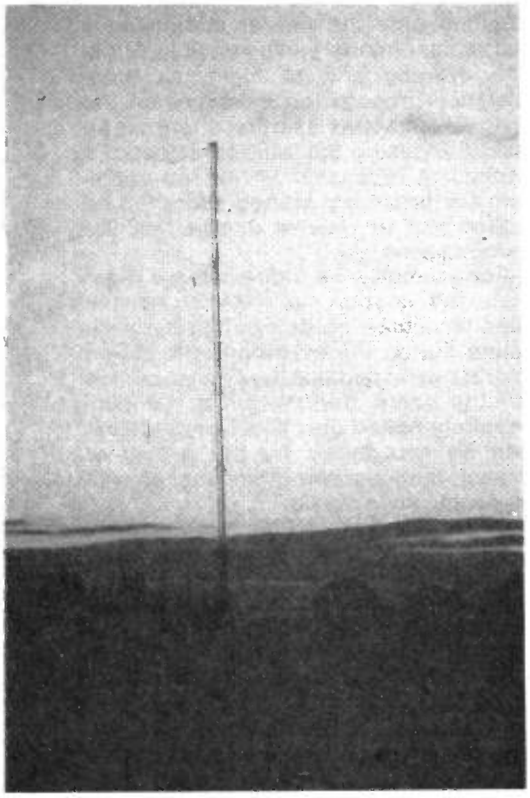


***Fig 1** Before and after, with new dimensions and method of feeding*



Even though such antennae are very large physically they are electrically very 'short'. It is because they are electrically so short that they present a challenge both to the transmitter designer who has to design a transmitter to match into the antenna, and to the antenna designer who has to maximise the efficiency of the antenna system.

Bandwidth

The electrical shortness of the antennae and the relative bandwidth of the modulation at these low frequencies are major design constraints for long wave broadcast transmitters. Added to these constraints, there is also the requirement for high transmitter power levels. The table lists the long wave broadcast stations currently operating in Europe and North Africa. All the stations are

EBU channel	Frequency KHz	Station	Power KW
1	155	Donebach, W Germany	500
	155	Tromso, Norway	50
	155	Brasov, Rumania	1,200
2	164	Allouis, France	2,000
3	173	Kalinigrad, USSR	1,000 S
	173	Nador, Morocco	1,200
★	178	Oranienburg, DDR	750
4	182	Ankara, Turkey	1,200
★	185	Saarlouis, W Germany	2,000
5	191	Caltanissetta, Italy	50
	191	Motala, Sweden	300
6	200	Warsaw, Poland	200
	200	Droitwich, BBC, UK	400 S
	200	Etimesgut, Turkey	200
	200	Leningrad, USSR	150 S
7	209	Munich, W Germany	500
	209	Azilal, Morocco	800
	209	Kiev, USSR	500
	209	Reykjavik, Iceland	500 S
8	218	Monte Carlo	1,400
	218	Oslo, Norway	200
9	227	Warsaw, Poland	2,000
10	236	Luxembourg	2,000
	236	Leningrad, USSR	2,000 S
11	245	Kalundborg, Denmark	150
12	254	Lahti, Finland	1,500
	254	Tipaza, Algeria	1,500
13	263	Burg, DDR	200
	263	Moscow, USSR	2,000
14	272	Czechoslovakia	1,500
15	281	Minsk, USSR	500

★: not conforming with 9KHz channel spacing
S: synchronised with other transmitters in the same country

using high transmitter powers.

To appreciate the bandwidth problem of long wave broadcasting, it is useful to make a direct comparison with amateur band transmissions.

A typical amateur installation might have a half-wave dipole for 40m, which is about 66ft long. The 40m amateur band is 100KHz wide (ie 7.0-7.1MHz). A full-size 40m dipole cut for 7050KHz will work satisfactorily at both ends of the band. The SWR might start to get a little high at each end of the band, but the dipole will be usable. The bandwidth cover (100KHz) represents about 1.4 per cent of the centre frequency (100/7050 x 100%).

Compare this with the situation in the long wave broadcast band!

Assume that the carrier frequency of the long wave broadcaster is 200KHz. For an AM transmission, the sidebands on either side of the transmitter will spread out about 4KHz. The total bandwidth required will therefore be about 8KHz. This is 4% (8/200 x 100%) of the centre carrier bandwidth.

Taking this back to the 40m amateur band analogy, the equivalent bandwidth requirement (for the modulation alone) would be from 6900KHz to 7200KHz! (see *Figure 2*).

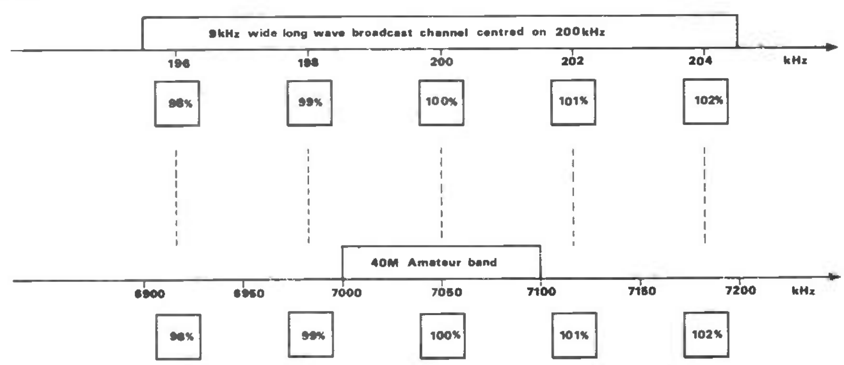


Fig 2 *A comparison of 200KHz LW and 40m bands*

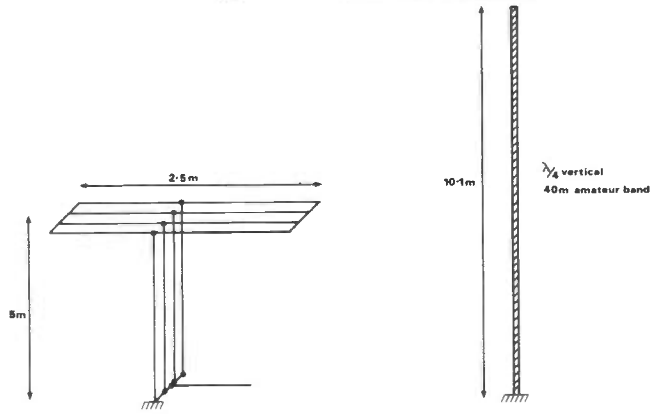


Fig 3 *The Droitwich antenna (left) scaled down to the 40m band*

The bandwidth constraints of operating in the long wave broadcast band are such that the modulation bandwidth around the carrier due to the sidebands alone presents a matching problem to both the transmitter designer and the antenna designer.

High-Q antennae

Because the antennae used for long wave broadcasting are electrically so 'short', they are narrow in bandwidth. To appreciate how short they are, it again might be useful to return to our 40m amateur band analogy.

If we reduce the dimensions of the existing BBC antenna at Droitwich (180m vertical section with 90m horizontal top section, in a 'T' format) in proportion to frequency from 200KHz to 7050KHz, we end up with a 'T' antenna as shown in *Figure 3*. The vertical section would be only 5m high and the top section about 2.5m wide.

This is a somewhat smaller antenna than you would normally expect to be using on 40m!

In the same way that you would expect such an antenna to have a high 'Q' on 40m, its equivalent at 200KHz also has a high 'Q'.

By scaling both the modulation sidebands and the antenna dimensions from the 1500m (200KHz) BBC long wave installation to a typical 40 metre amateur band installation, it is possible to appreciate some of the problems facing the long wave broadcast system designer.

The modernisation of the BBC's Droitwich installation includes both replacing the existing transmitters with new purpose-designed Marconi transmitters and increasing the size of the antenna top-section.

An interesting complication of this project is the fact that one of the masts supporting the LW antenna is itself a vertical radiator for the BBC's 150KW transmitter on 693KHz, which carries Radio Two programming at Droitwich.

It is quite likely that the interaction between the LW antenna and the MW vertical radiator will require some slight retuning of the vertical radiator's matching system after the LW top-section has been changed over.

On many long wave channels there is more than one station operating; careful planning ensures that mutual interference problems are kept to a minimum.

The present allocation of frequencies and powers in both the long wave and medium wave broadcast bands stems from the Regional Administrative Conference held in Geneva in 1975 and which started to come into effect in 1978.

Geneva Conference

The preamble to the agreement drawn up at Geneva by over 150 countries started along the lines:

> 'With the object of facilitating relations, mutual understanding and co-operation in the field of LF/MF broadcasting, with a view to improving the use of the frequency bands allocated to the broadcasting service in order to ensure satisfactory reception of the broadcasting service for all countries, recognising that all countries large and small have equal rights and that the needs of all countries and in particular the needs of the developing countries shall be fulfilled as far as possible in the implementation of this Agreement. . .'

The Geneva Plan was dealing in the main with the problems of a medium wave band which had previously been discussed at the Copenhagen Conference held in 1948 in the shadows of WW2. The allocation of frequencies at the Copenhagen Conference had not been done on a neutral nor particularly fair basis. The Geneva Conference sought to redress this imbalance as well as tidy up what had in the meantime become very crowded broadcast bands.

The long wave broadcast channels with their requirement for high powers and large antenna systems were not so sought after as the medium wave channels. In comparison the medium wave, which runs from 525KHz to 1605KHz, contains 120 channels (each 9KHz wide), whereas the long wave has only 15 channels.

High-powered LW stations are separated geographically, and during the daytime only the nearer station on a particular channel will be audible, but in the evening and at night, as long-distance propagation increases on the long waves, stations further afield can be heard. By using the 'nulling' effect of a broadcast receiver's ferrite rod aerial, one LW broadcast station can often be nulled out to receive another on the same channel.

For example, the high-powered Algerian LW station at Tipaza on the Mediterranean coast can regularly be heard during the evening in the UK on 254KHz, provided that the Finnish station on the same frequency can be successfully nulled out. The Tipaza station can be recognised by the Arabic or French language programming, as well as Arabic style music.

Under the Geneva Plan many new LW transmitter locations and powers were agreed. However, many of the allocations which were then agreed have not yet been implemented.

As an example, there is an allocation for a 1000KW LW broadcast station at El Golea in the centre of Algeria, to operate on a frequency of 200KHz. Similarly Tunis has an allocation for 1200KW at 281KHz. Funds may not always be readily available for the construction of such major broadcast stations.

As funds do become available within the various broadcasting organisations, these and other long wave allocations may eventually be taken up. However, the capital investment required to install a high-powered long wave broadcast station is large. High-powered transmitters and large antennae cost huge sums to purchase and install. The masts and transmitters may require a lot of civil engineering work to erect transmitter buildings and to put in mast foundations.

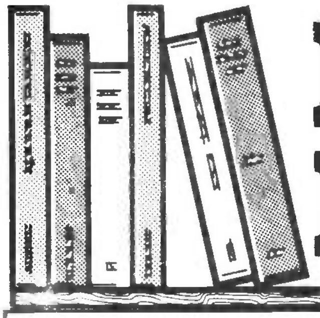
As well as the capital costs of such installations, there are the running costs to be considered too.

The running costs are also high because of the large amounts of energy required to run powerful long wave transmitters. Even modern high-efficiency long wave transmitters such as the pair of Marconi 250KW units going into Droitwich, with system efficiencies of around 70%, still require over 700KW of electricity to run them.

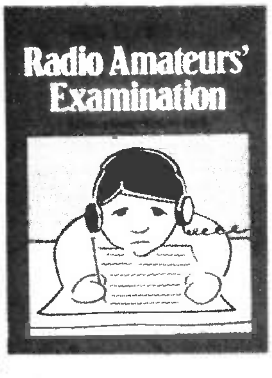
Broadcasting authorities may well have priorities for their funds other than the installation of long wave broadcast stations. It is therefore possible that some of the LW 'allocations' made at Geneva may never actually be taken up, even though they were hard fought for at the time of negotiating the plan!

References

1 *'10th International Broadcasting Convention'* IEE Conference Publication No 240.
2 *EBU Technical Review No 206,* August 1984.



RSGB BOOKS



How to Pass the Radio Amateurs Examination

Edited by G L Benbow G3HB

This newly published book is a guide to would-be amateurs intending to sit the Radio Amateur' Examination. It is intended to compliment the Radio Amateurs' Examination Manual, giving facts about the examination and how to cope with multiple-choice type questions. There is a comprehensive series of test papers, included in the book. All the questions have been devised by members of the Education Committee of the RSGB and are set in a similar style to those encountered in the RAE. Chapter titles: What is a multiple-choice examination?; Tackling the multiple-choice RAE; Mathematics for the RAE; Preparing for the RAE; Sample multiple-choice examination papers.

91 pages, paperback 246 by 184mm price **£3.42**

Locator Map of Europe

The new international (Maidenhead) locator system comes into use on January 1 1985. This new map published by the RSGB shows locator squares for Europe at a glance, with an inset world-wide locator map showing the main locator squares for the rest of the world. The instructions for its use are printed in 17 European languages including English. *Size 625 by 900mm* Price **£1.95**

There is also a desk version of the map printed on card Price **70p**

Other RSGB Publications

A guide to Amateur Radio (*19th edn*) **£3.91**
Amateur Radio Awards (*2nd edn*) **£3.68**
Amateur Radio Call Book (*1984 edn*) **£7.14**
HF Antennas for All Locations **£7.35**
Microwave Newsletter Technical Collection **£6.83**
Morse Code for Radio Amateurs **£1.64**
Radio Amateurs' Examination Manual **£3.84**
Radio Communication Handbook (*paperback*) **£11.79**
Teleprinter Handbook (*2nd edn*) **£12.72**
Television Interference Manual **£2.31**
World at their Fingertips **£7.75**
VHF/UHF Manual (*4th edn*) **£10.58**
Meteor Scatter Data **£3.51**

Logbooks

Amateur Radio Logbook **£2.77**
Mobile Logbook **£1.23**
Receiving Station Logbook **£2.87**

Maps

Great Circle DX Map **£2.43**
World Prefix Map in full colour (*wall*) **£2.53**

Other Publications

Active Filter Cookbook (*Sams*) **£12.71**
All About Cubical Quad Antennas (*RPI*) **£5.83**
Amateur Single Sideband (*Ham Radio*) **£5.46**
Antenna Anthology (*ARRL*) **£6.00**
ARRL Antenna Book (*Hardback for p/b price while stocks last*) **£8.78**
ARRL Electronics Data Book **£4.47**
Beam Antenna Handbook (*RPI*) **£6.83**
Better Short Wave Reception (*RPI*) **£6.83**
Care and Feeding of Power Grid Tubes (*Varian*) **£6.99**
CMOS Cookbook (*Sams*) **£13.07**
Complete Shortwave Listener's Handbook (*Tab*) **£12.21**
FM and Repeaters for the Radio Amateur (*ARRL*) **£4.30**
G-QRF Club Circuit Handbook **£4.52**
Guide to Oscar Operating (*AMSAT-UK*) **£1.78**
Hints and Kinks for the Radio Amateur (*ARRL*) **£4.47**
How to Troubleshoot and Repair A R Equipment **£10.47**
IC Op-amp Cookbook (*Sams*) **£11.76**
International VHF FM Guide **£2.45**
Newcomer's Guide to Simplex and Repeaters on 2M **£1.24**
Radio Frequency Interference (*ARRL*) **£4.18**
Satellite Experimenters Handbook (*ARRL*) **£10.11**
Satellite Tracking Software for the Radio Amateur (*AMAST-UK*) **£4.47**
Secrets of Ham Radio DXing (*Tab*) **£7.92**
Semiconductor Data Book (*Newnes*) **£7.97**
Shortwave Propagation Handbook (*Cowan*) **£7.79**
Simple Low Cost Wire Antennas (*RPI*) **£6.83**
Solid State Design for the Radio Amateur (*ARRL*) **£7.87**
Television for Amateurs (*BATC*) **£2.23**
UHF-Compendium Parts 1&2 .... **£14.93**
Understanding Amateur Radio (*ARRL*) **£4.73**
VHF Propagation Handbook (*Nampa*) **£3.75**
Weekend Projects for the Radio Amateur (*ARRL*) **£4.95**
World Atlas (*RACI*) **£3.35**
World Radio TV Handbook 1984 .... **£12.25**

Membership of the Radio Society of Great Britain is open to all Radio Amateur and Listeners. For details of subscription and the benefits of membership, please contact the Membership services Department. All items in this advertisement include post and packing. Members of the Society are entitled to discounts on these prices. Personal callers may obtain goods minus postage and packing charges.

RSGB Publications

Lambola House, Cranborne Road,
Potters Bar, Herts EN6 3JW
Telephone: (0707) 59015

NEW THIS MONTH

IEC FILTER PLUG

Made by Rendar, integrated chassis mounted plug with mains filter rated 2A. Like RS 238-514. Only **£3.00**

7-SEG LEDS

MAN8910 0.8" red seven segment LED's common anode. **£1.25**, 10 for **£10**

DIL SOCKETS

Gold plated low profile at unbeatable prices:

14DIL **£7/100**
16DIL **£8/100**
24DIL **£12/100**
40DIL **£20/100**

VOLTAGE REG SCOOP

7924UC 1A 24V **40p**
uA317UC ½A variable **50p**
78MGU1C variable **65p**

'TORUS'

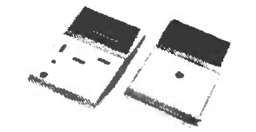
Computer controlled Robot built around the gearbox described below. Complete kit of parts inc PCB, program listings for BBC (other micros soon) £44.85 20W ribbon cable (min 3m recommended — 5m better) £1.30/m SAE for illustrated leaflet.

MOTORISED GEARBOX

These units are as used in a computerised tank, and offer the experimenter in robotics the opportunity to buy the electro-mechanical parts required in building remote controlled vehicles. The unit has 2 x 3V motors, linked by a magnetic clutch, thus enabling turning of the vehicle, and a gearbox contained within the black ABS housing, reducing the final drive speed to approx 50rpm. Data is supplied with the unit showing various options on driving the motors. Two new types of wheels can be supplied (the aluminium discs and smaller plastic wheels are now sold out). Type A has 7 spokes with a round black tyre and is 100mm dia. Type B is a solid heavy duty weel 107mm dia with a flat rigid tyre 17mm wide.

PRICES.

Gearbox with data sheets: **£5.95** ea
Wheel Type A: **£0.70** ea
Wheel Type B: **£0.90** ea



These digital multimeter cases are moulded in high impact black plastic and are offered at an extremely attractive price to clear stocks.

DP2010 — 110x80x20mm, this too has cut-outs for range switches and terminals with a smart aluminium fascia marked with ranges etc. Batter accessible by removeable cover on back **75p.**

DP100 — Same size as above, but this was for use as a digital thermometer, so theres only a single 9mm ø hole in the front panel **75p.**

Z917 PSU Panel 320x190mm with MJ802 (30A 100V 200W) on large heatsink. 7 smaller heatsinks contain: 2x7805; 7812; 7905; 2xMJE2955; 2SA473. Also 555, 3x4A bridge rects, large smoothing caps, multiway plugs and sockets etc. Ex-equip working order. Only £8.50.

DIP BOARD

Fibreglass DIP board 158x165mm double sided with 58w 0.1" edge connector gold plated. Vero. **£3.50.**

20 WAY RIBBON CABLE

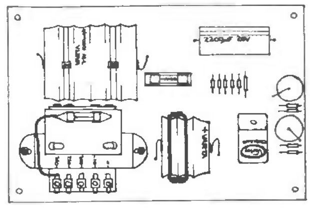
Twisted and flat computer grade for lower crosstalk. Reformed into flat sections every 21" for IDC connectors. Only 70p/21" or £25 per 100ft reel.

1984/5 CATALOGUE

84 page A4 size — Bigger Brighter, Better — more components than ever before! With each copy there's discount vouchers. Bargain List. Wholesale Discount List. Bulk Buyers List. Order Form and Reply Paid Envelope.

All for just **£1.00!!**

Winter Supplement due out November — Send large SAE for your free copy.



NI-CAD CHARGER PANEL

177 x 114mm PCB with one massive Varta Deac 57 x 50mm Ø rated 7.2V 1000mAH and another smaller Deac 32 x 35mm Ø rated 3.6V 600mA. The price of these Ni-Cad stacks new is over £20. Also on the panel is a mains input charger transformer with two separate secondaries wired via bride rectifiers, smoothing capacitors and a relay to the output tags. The panel weighs 1kgm. All this for just **£6.00.**

GREENWELD
— The Pack People!

K524 OPTO PACK – a variety of single point and seven segment LEDS (incl. dual types) of various colours and sizes, opto isolators, numicators, multi digit gas discharge displays, photo transistors, infra red emitters and receivers. 25 assorted £3.95 100 £14.95 250 £35

K528 ELECTROLYTIC PACK – All ready cropped for PCB mounting, this pack offers excellent value for money. Good range of values and voltages from 0.47μF to 1000μ, 6v to 100v. 100 £3.95 250 £8.95 1000 £32

K531 PRECISION RESISTOR PACK – High quality, close tolerance R's with an extremely varied selection of values mostly ¼ and ½w tolerances from 0.1% to 2% – ideal for meters, test gear etc. 250 £3 1000 £10

K532 RELAYS – wide selection of styles voltages and contacts. 4V – 240V, AC/DC, SP to 4PCO 20 for £6 100 £25

K525 PRESET PACK – Big, Big variety of types and sizes – submin, min and std, MP, slider, multiturn and cermets are all included. Wide range of values from 20R to 5M. 100 assorted £6.75 250 £12 95 1000 £48

PCB MOUNTING NI-CADS

Much sought after 4.8V 150mA batts with PCB mntg tags on 25mm pitch. Batt size 25 x 16ø. Ideal for paralleling. 99p ea; 10 + 85p; 25 + 70p; 100 + 60p

FIBRE OPTICS

Scoop purchase of single and twin cable. For use with visible light or infra-red. Core 1mm dia, overall 2.25mm dia. Single 50p/m; 20m coil £6.30. Twin 90p/m; 20m coil £11.00

MINIATURE RELAYS

PCB mounting. DPCO size 20x15x15mm. Available in 3.9 or 12V. £1 each

1W AMPLIFIER

Z914 Audio amp panel 95x65mm with TBA820 chip. Gives 1W output with 9V supply. Switch and vol control. Just connect batt and speaker. Full details supplied. Only £1.50 10 for £12; 25 for £25; 100 for £75.

Z915 Stereo version of above 115x65mm featuring 2 x TBA820M and dual vol control. £3.50 10 for £30; 25 for £65; 100 £200

AM TUNER PANEL

Z916 For use with mono amp above. Neat panel 60x45mm. Only £1.50; 10 for £12.

NI-CAD CHARGER SCOOP!!

Ever-Ready model CH4, this charger will take up to 4 AA, c or D cells plus 2 PP3 if required. Smart two tone grey case 212x97x60mm. Only £7.95.

STEREO AMP PANEL

Z908 Panel 147 x 38mm with 2 x TDA 1004 6W audio amp IC's not *soldered in!* so they can easily be removed. Also 1000/16. 1000/10 x 2. 470/16 elecs, ceramic discs. R's also choke (All easily removed) Only **£3.00** (IC's cost £4 ea) Circuit Supplied.

SEAT BELT ALARM

Originally for sale at £8.95, these well made units 70x50x25mm provide both audible and visual alarms. Uses 2 IC's, PB2720 transducer, etc. Available ready built, with circuit and instructions for just **£3.95.** Also available as a kit, PCB + all components, box, wire, etc, together with instructions. Only **£2.95.**

GREENWELD

Min Access order value £5 No min CWO value. Official orders from shcools etc. welcome — min invoice charge £10.

Our shop has enormous stocks of components and is open from 9-5.30 Mon-Sat. Come and see us!!

443K Millbrook Road
Southampton SO1 0HX
Tel: (0703) 772501/783740
All prices include VAT; just add 60p P&P

DATA FILE . . .

More opto-electronics from Ray Marston

In the last two editions of *Data File* we have given a basic introduction to the general subject of opto-electronics, and have taken detailed looks at LED principles and at practical LED 'flasher', 'chaser', and U237-based 'bar-graph' display circuits.

In the present edition of 'The File' we continue the 'display' theme by taking a detailed look at practical LM3914-series LED 'dot-' and 'bar-graph' display circuits, and conclude by taking a brief look at a variety of types of 7-segment display system.

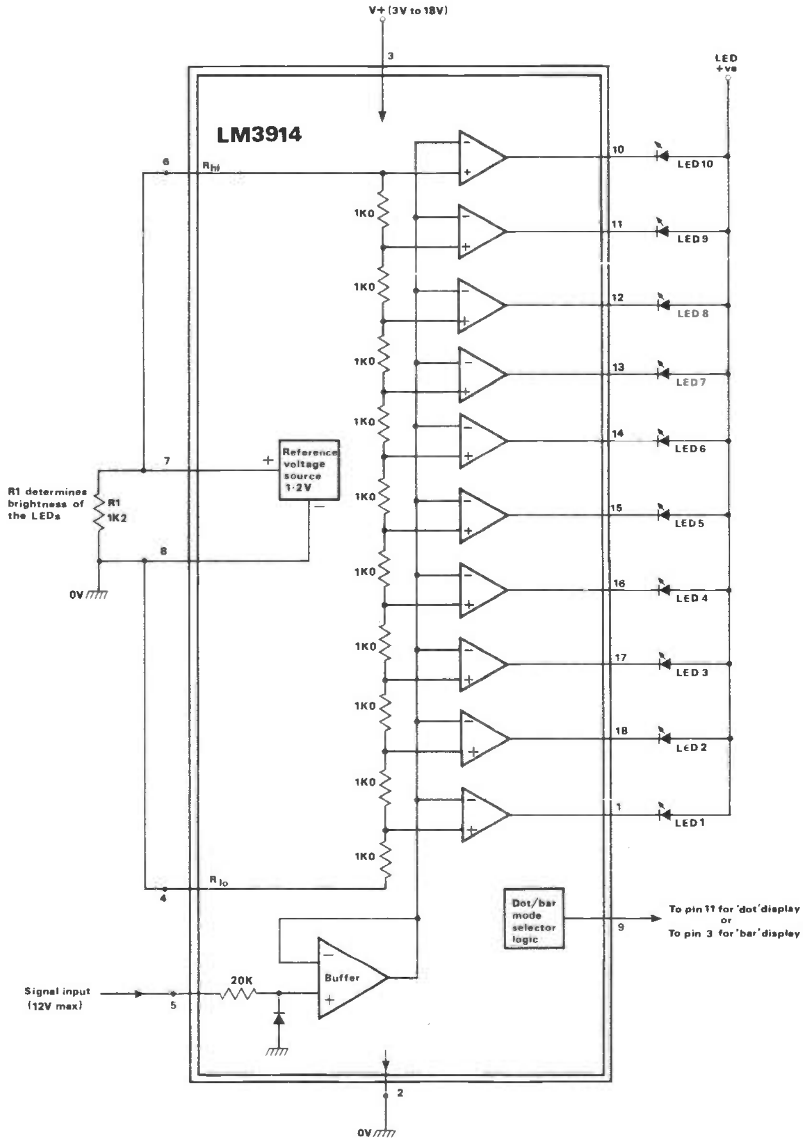


Fig 1 *Internal circuit of the LM3914*

LM3914-series basics

The LM3914 family of dot-/bar-graph driver ICs are manufactured by National Semiconductors. They are fairly complex but highly versatile devices, housed in 18-pin DIL packages and each capable of directly driving up to 10 LEDs in either the 'dot' or the 'bar' mode.

The family comprises three devices, these being the LM3914, the LM3915, and the LM3916. These ICs use the same basic internal circuitry (see *Figure 1*), but differ in the style of 'scaling' of the LED-driving output circuitry, as shown in *Figure 2*.

Thus the LM3914 is a linearly-scaled unit, specifically intended for use in LED 'voltmeter' applications in which the number of illuminated LEDs gives a direct indication of the value of input volts.

The LM3915, on the other hand, has a log-scaled output designed to span 0 to −27dB in ten −3dB steps, and is specifically designed for use in 'power meter' applications etc. Finally, the LM3916 has a semi-log scale, and is specifically designed for use in 'VU meter' applications.

All three devices of the LM3914 family use the same basic internal circuitry, and *Figure 1* shows the specific internal circuit of the linear-scaled LM3914, together with the connections for making it act as a simple 10-LED 0 to 1.2V meter.

The IC contains ten voltage comparators, each with its non-inverting terminal taken to a specific tap on a 'floating' precision multi-stage potential divider, and with all inverting terminals wired in parallel and taken to input pin 5 via a unity-gain buffer amplifier.

The output of each comparator is externally available, and can sink up to 30mA; the sink currents are internally limited, and can be externally pre-set via a single resistor (R1).

The IC also contains a 'floating' 1.2 volts reference source between pins 7 and 8. In *Figure 1* the reference is shown externally connected to the internal (pins 4 and 6) potential divider. Note that pins 8 and 4 are shown grounded, so in this case the bottom of the divider is at zero volts and the top is at 1.2 volts.

In addition the IC contains a logic network that can be externally set to give either a 'dot' or a 'bar' display from the outputs of the ten comparators. Operation of the IC is as follows:

Assume that the IC logic is set for bar mode operation, and that the 1.2 volt reference is applied across the internal 10-stage divider as shown. Thus 0.12V is applied to the inverting or reference input of the lower comparator, 0.24V to the next, 0.36V to the next, and so on. If a slowly rising input voltage is now applied to pin 5 of the IC, the following sequence of actions takes place:

When the input voltage is zero, the outputs of all ten comparators are disabled and all LEDs are off. When the input voltage reaches the 0.12V reference value of the first comparator, its output conducts and turns LED1 on. When the input reaches the 0.24V reference value of the second comparator, its output also conducts and turns on LED2, so at this stage LEDs 1 and 2 are both on.

As the input voltage is further increased, progressively more and more comparators and LEDs are turned on until eventually, when the input rises to 1.2 volts, the last comparator and LED10 turn on. At this point all ten LEDs are illuminated.

A similar kind of action is obtained when the LM3914 logic is set for dot mode operation, except that only one LED is on at any given time. At zero volts no LEDs are on, and at above 1.2 volts only LED10 is on.

LED No	LM3914	LM3915		LM3916		
	Typical threshold-point value, at 10V fsd					
	V	V	dB	V	dB	VU
1	1.00	.447	−27	.708	−23	−20
2	2.00	.631	−24	2.239	−13	−10
3	3.00	.891	−21	3.162	−10	−7
4	4.00	1.259	−18	3.981	−8	−5
5	5.00	1.778	−15	5.012	−6	−3
6	6.00	2.512	−12	6.310	−4	−1
7	7.00	3.548	−9	7.079	−3	0
8	8.00	5.012	−6	7.943	−2	+1
9	9.00	7.079	−3	8.913	−1	+2
10	10.00	10.00	0	10.00	0	+3

Fig 2 *Threshold-point values of the LM3914/15/16 ICs*

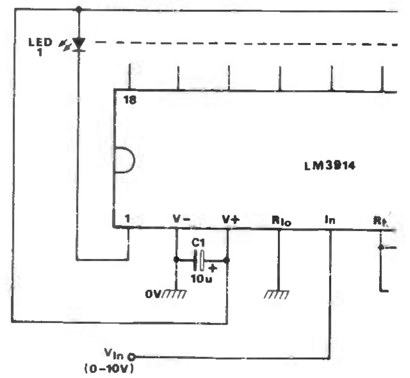


Fig 5 *Alternative variable range*

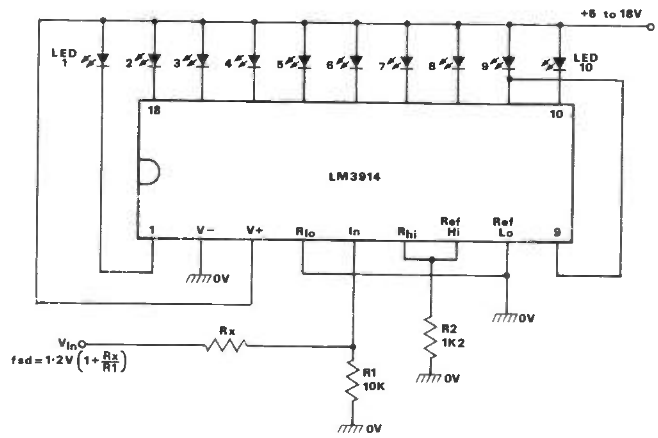


Fig 3 *1.2V-1000V fsd dot mode voltmeter*

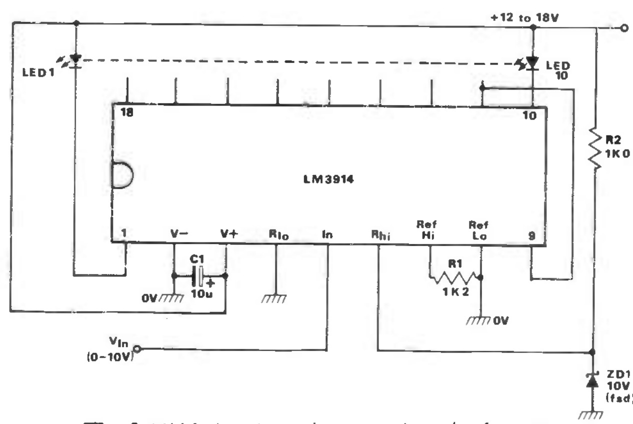


Fig 4 *10V fsd meter using an external reference*

Some finer details

In *Figure 1*, R1 is shown connected between pins 7 and 8 (the output of the 1.2V reference), and determines the 'on' currents of the LEDs. The 'on' current of each LED is roughly ten times the output current of the 1.2V source, which can supply up to 3mA and thus enables LED currents of up to 30mA to be set via R1.

If, for example, a total resistance of 1K2 (equal to the paralleled values of R1 and the 10K of the IC's internal potential divider) is placed across pins 7 and 8, the 1.2V source will pass 1mA and each LED will pass 10mA in the 'on' mode.

Note from the above that the IC can pass total currents up to 300mA when used in the bar mode with all ten LEDs on. The IC has a maximum power rating of only 660mW, so there is a danger of exceeding this rating when the IC is used in the bar mode.

In practice, the IC can be powered from dc supplies in the range 3 to 25 volts, and the LEDs can use the same supply as the IC or can be independently powered; this latter option can be used to keep the power dissipation of the IC at minimal level.

The internal 10-stage potential divider of the IC is floating, with both ends externally available for maximum versatility, and can be powered from either the internal reference or from an external source or sources.

If, for example, the top of the chain is connected to a 10 volt source, the IC will function as a 0 – 10V meter if the low end of the chain is grounded, or as a 'restricted-range' 5 – 10V meter if the low end of the chain is connected to a 5 volt source.

Constraint

The only constraint on using the divider is that its voltage must not be greater than 2 volts less than the IC's supply voltage (which is limited to 25V maximum). The input (pin 5) to the IC is fully protected against overload voltages up to plus or minus 35V.

The IC's internal voltage reference produces a nominal output of 1.28V (limits are 1.2V to 1.32V), but can be externally 'programmed' to produce effective reference values up to 12 volts (we'll show how later).

The IC can be made to give a dot mode display by wiring pin 9 to pin 11, or a bar display by wiring pin 9 to positive-supply pin 3.

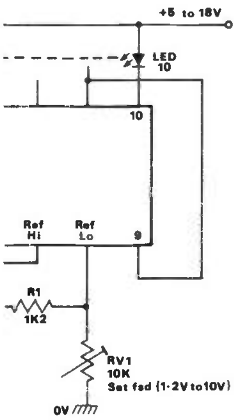
Finally, it should be noted that the major difference between the three members of the LM3914 family of ICs lies in the values of resistance used in the internal 10-stage potential divider.

In the LM3914, all resistors in the chain have equal values, and thus produce a linear display of ten equal steps. In the LM3915 the resistors are logarithmically weighted, and thus produce a log display that spans 30dB in ten 3dB steps. In the LM3916, the resistors are weighted in a semi-log fashion and produce a display that is specifically suited to VU meter applications.

Let's now move on and look at some practical applications of this series of devices, paying particular attention to the linear LM3914 IC.

Dot mode voltmeters

Figures 3 to *7* show various ways of using the LM3914 IC to make 10-LED dot



: dot mode voltmeter

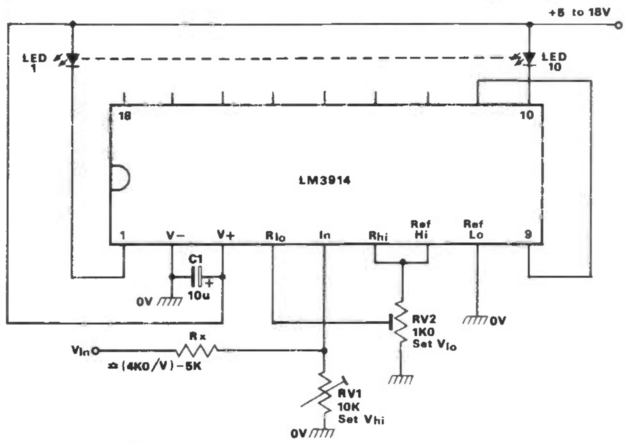


Fig 6 *Expanded scale dot mode voltmeter*

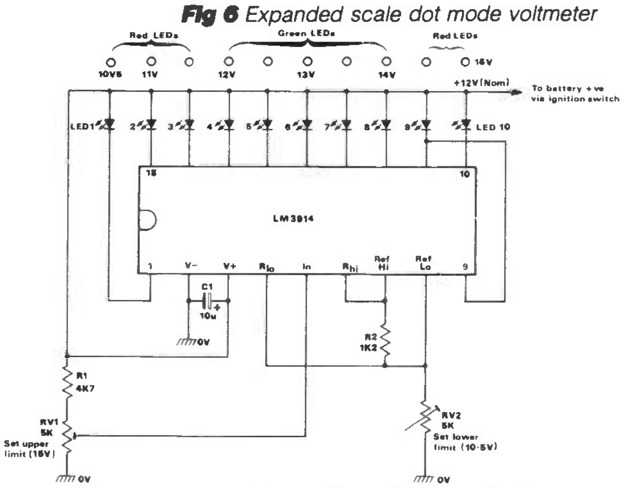


Fig 7 *Expanded scale dot mode car voltmeter*

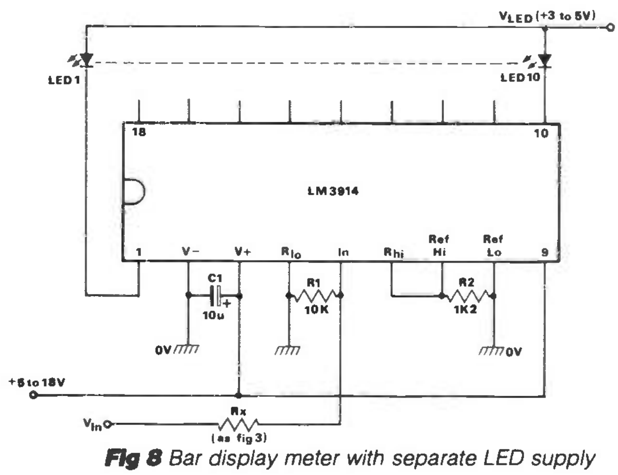


Fig 8 *Bar display meter with separate LED supply*

mode voltmeters. Note in all of these circuits that pin 9 is wired to pin 11 to give dot mode operation, and that a 10μF capacitor is wired directly between pins 2 and 3 to enhance circuit stability.

Figure 3 shows the connections for making a variable-range (1.2V to 1000V fsd) voltmeter. The low ends of the internal reference and divider are grounded and their top ends are joined together, so the meter has a basic full-scale sensitivity of 1.2V, but variable ranging is provided by the Rx-R1 potential divider at the input of the circuit.

Thus, when Rx is zero the fsd is 1.2V, but when Rx is 90K the fsd is 12 volts. Resistor R2 is wired across the internal reference and sets the 'on' currents of the LEDs at about 10mA.

Figure 4 shows how to make a fixed-range 0 – 10V meter, using an external 10 volt Zener (connected to the top of the internal divider) to provide a reference voltage. The supply voltage to this circuit must be at least two volts greater than the Zener reference voltage.

Figure 5 shows how the internal reference of the IC can be made to effectively provide a variable voltage, enabling the meter fsd value to be set anywhere in the range 1.2V to 10V.

In this case the 1mA current (determined by R1) of the floating 1.2V internal reference flows to ground via RV1, and the resulting RV1 voltage raises the reference pins (7 and 8) above zero. If, for example, RV1 is set to 2K4, pin 8 will be at 2.4V and pin 7 at 3.6V. RV1 thus enables the pin 7 voltage (connected to the top of the internal divider) to be varied from 1.2 volts to about 10 volts, and thus sets the fsd value of the meter within these values.

Figure 6 shows the connections for making an expanded-scale meter which, for example, reads voltages in the range 10 to 15 volts. RV2 sets the LED current at about 12mA, but also enables a reference value in the range 0 – 1.2V to be set on the low (pin 4) end of the internal divider.

Thus if RV2 is set to apply 0.8V to pin 4, the basic meter will read voltages in the range 0.8 to 1.2 volts only. By fitting potential divider Rx-RV1 to the input of the circuit, this range can be 'amplified' to (say) 10 – 15V, or whatever range is desired.

Finally, *Figure 7* shows an expanded-scale dot mode voltmeter that is specifically designed to indicate the value of a car's battery (12 volts nominal).

In this case R2-RV1 are effectively set to give a basic range of 2.4 to 3.6 volts, but the input to the circuit is derived from the positive supply rail via the R1-RV1 potential divider, and the indicated volts reading thus corresponds to a pre-set multiple of the basic range value.

As shown in the diagram, red and green LEDs can be used in the display, arranged so that green LEDs illuminate when the voltage is in the 'safe' range of 12 to 14 volts.

To calibrate the above circuit, first set the supply to 15 volts and adjust RV1 so that LED10 just turns on. Reduce the supply to 10 volts and adjust RV2 so that LED1 just turns on. Re-check the settings of RV1 and RV2. The calibration is then complete and the unit can be installed in the car by taking the '0' volt lead to the chassis and the '+12V' lead to the car's battery via the ignition switch.

Bar mode voltmeters

The dot mode circuits of *Figures 3* to *7* can be made to give bar mode operation simply by connecting pin 9 to pin 3, rather than to pin 11. When using the bar mode, however, it must be remembered that the IC's power rating must not be exceeded by allowing excessive output-terminal voltages to be developed when all ten LEDs are on.

LEDs 'drop' roughly 2 volts when they are conducting, so one way around this problem is to power the LEDs from their own low voltage (3 to 5V) supply as shown in *Figure 8*.

An alternative solution is to power the IC and the LEDs from the same supply, but to wire a current-limiting resistor in

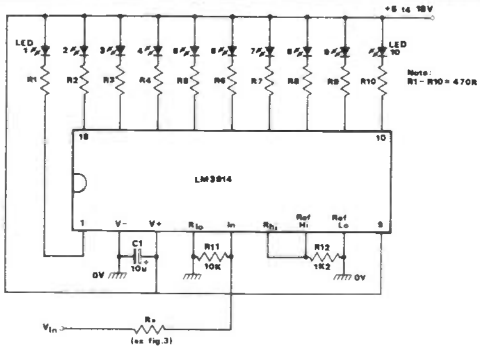


Fig 9 *Bar display meter with common supply*

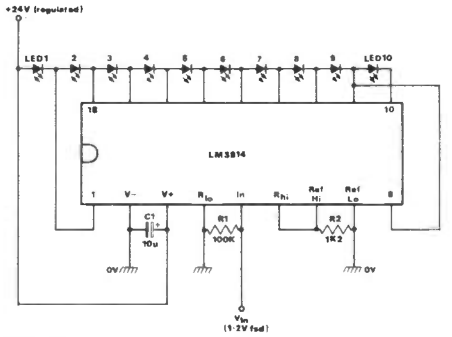


Fig 10 *Bar display with minimal consumption*

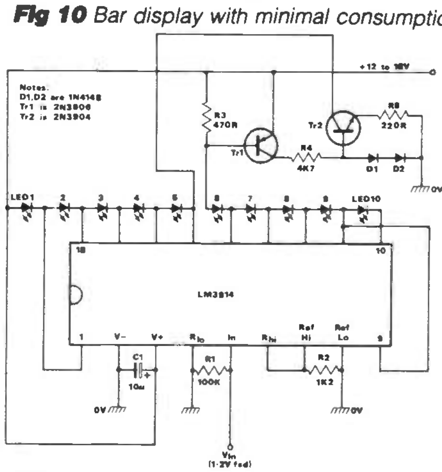


Fig 11 *Modification for unregulated supplies*

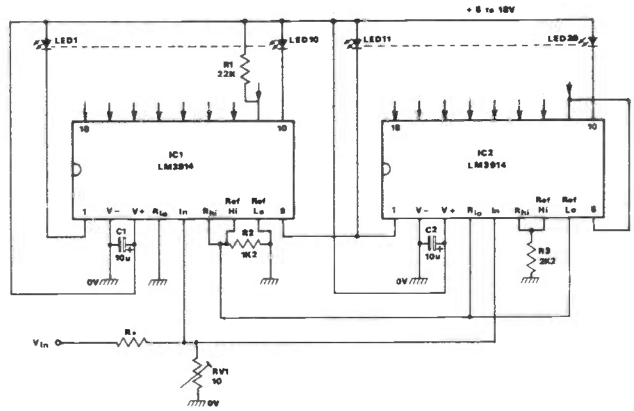


Fig 12 *Dot mode 20-LED voltmeter*

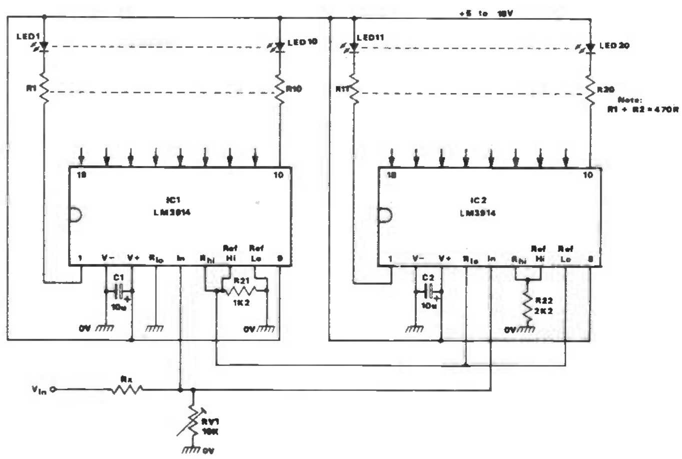


Fig 13 *Bar mode 20-LED voltmeter*

series with each LED as shown in *Figure 9,* so that the IC's output terminals saturate when the LEDs are on.

Figure 10 shows another way of obtaining a bar display without excessive power dissipation. Here the LEDs are all wired in series, but with each one connected to an individual output of the IC, and the IC is wired for dot mode operation.

Thus when LED5 (for example) is driven on it draws its current via LEDs 1 to 4, so all five LEDs are on. In this case, however, the total LED current is equal to that of a single LED, so power dissipation is quite low.

The LED supply to this circuit must be greater than the sum of all LED voltage drops when all LEDs are on, but must be within the voltage limits of the IC; a regulated 24V supply is thus needed.

Figure 11 shows a modification of the above circuit which enables it to be powered from an unregulated supply within the 12 to 18 volt range. In this case the LEDs are split into two chains, and the transistors are used to switch the lower (LEDs 1 to 5) chain on when the upper chain is active; the maximum total LED current is equal to twice the current of a single LED.

20-LED voltmeters

Figure 12 shows how two LM3914s can be interconnected to make a 20-LED dot mode voltmeter. Here the input terminals of the two ICs are wired in parallel, but IC1 is configured so that it reads 0 to 1.2 volts, and IC2 is configured so that it reads 1.2 to 2.4 volts.

In the latter case, the low end of the IC2 potential divider is coupled to the 1.2V reference of IC1, and the top end of the divider is taken to the top of the 1.2V reference of IC2, which is raised 1.2V above that of IC1.

The *Figure 12* circuit is wired for dot mode operation. Note in this case that pin 9 of IC1 is wired to pin 1 of IC2, and pin 9 of IC2 is wired to pin 11 of IC2. Also note that a 22K resistor is wired in parallel with LED9 of IC1.

Figure 13 shows the connections for making a 20-LED bar mode voltmeter. The connections are similar to those of *Figure 12,* except that pin 9 is taken to pin 3 of each IC, and a 470R current-limiting resistor is wired in series with each LED to reduce the power dissipation of the ICs.

To conclude this look at LM3914 circuits, *Figure 14* shows a simple frequency-to-voltage converter circuit that can be used to convert either of the *Figure 12* or *13* circuits into 20-LED tachometers or rpm meters. This converter should be interposed between the vehicle's contact-breaker points and the input pin of the 'voltmeter' circuit.

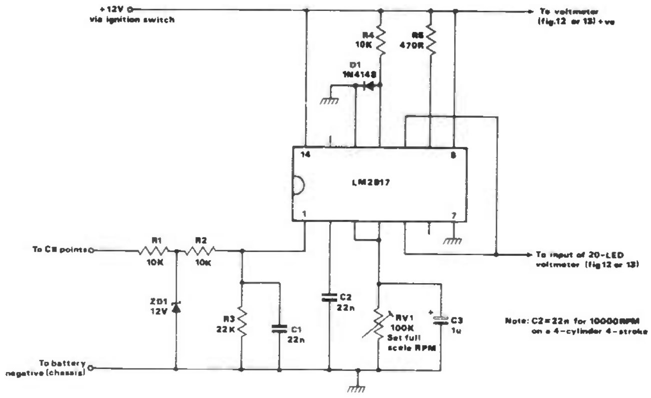


Fig 14 *Car tacho conversion circuit*

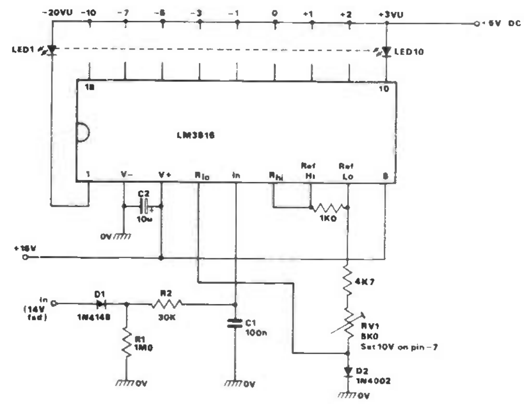


Fig 16 *Simple VU meter*

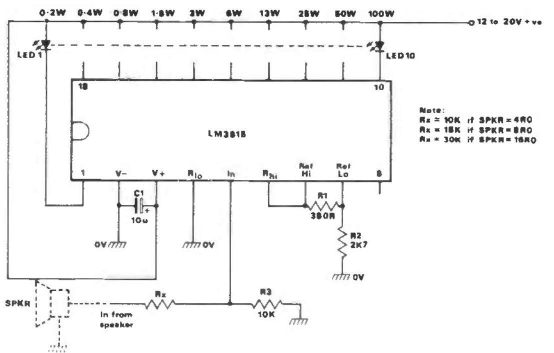


Fig 15 *Simple audio power meter*

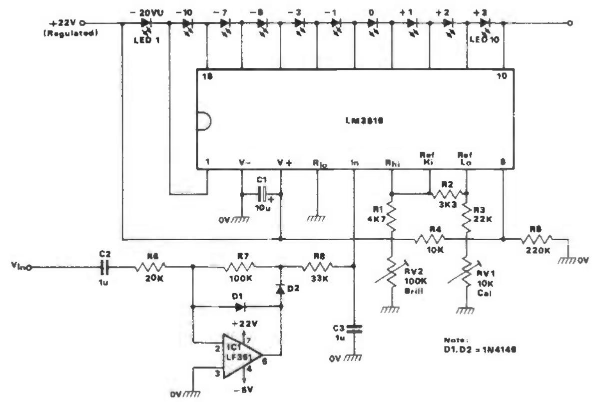


Fig 17 *Precision VU meter with low current drain*

In *Figure 14,* the C2 value of 22nF is the optimum value for a full-scale range of 10000rpm on a 4-cylinder 4-stroke engine. For substantially lower full-scale rpm values, the value of C2 may have to be increased. The value may have to be reduced on vehicles with 6 or more cylinders.

LM3915/LM3916 circuits

The LM3915 'log' and LM3916 'semi-log' ICs operate in the same basic way as the LM3914, and can in fact be directly substituted in most of the circuits shown in *Figures 3* to *13*.

However, in most practical applications these ICs are used to give a 'meter' indication of the value of an ac input signal, and the simplest way of achieving such a display is to connect the ac signal directly to the pin 5 input terminal of the IC. The IC responds only to the positive half of such input signals, and the number of illuminated LEDs is thus proportional to the instantaneous peak value of the input signal.

In such circuits, the IC should be operated in the dot mode and set to give about 30mA of LED drive current. *Figure 15* shows a practical example of such a circuit.

The *Figure 15* circuit is that of a simple LM3915-based audio power meter. Pin 9 is left open-circuit to ensure dot mode operation, and R1 has a value of 390R to give an LED current of about 30mA. The meter gives audio power indication over the range 200mW to 100W.

A more sophisticated way of using these ICs to show the value of an ac input signal is to use a half-wave converter to change the ac signal into dc, which is then fed to the input of the IC. *Figures 16* and *17* show practical LM3916-based 'VU meter' circuits of this type.

In *Figure 16* the input signal is converted to dc via the simple D1-R1-R2-C1 network.

Note in this case that rectifier D2 is used to compensate for the forward voltage drop of D1. Also note that this particular circuit operates in the bar mode, and uses separate supplies for the IC and the LED display.

Precision

Finally, to complete this look at the LM3914 range of devices, *Figure 17* shows how the LM3916 can be used as a precision VU meter by using a precision half-wave rectifier (IC1) to give ac/dc conversion.

Note in this circuit that the LEDs are wired in series and IC2 is wired in the dot mode, to give a low-consumption bar display of the type shown in *Figure 10.* To set up the circuit, simply adjust RV1 to set 10V on pin 7: RV2 can then be used as a 'brightness' control.

7-segment displays

A very common requirement in modern electronic circuitry is that of displaying alpha-numeric characters. Digital watches, pocket calculators, and digital multimeters and frequency meters are all examples of devices that make use of such displays.

The best known type of alpha-numeric display is the so-called '7-segment' display, which comprises seven independently accessible photo-electric 'segments' (such as LEDs or liquid crystals) arranged in the form shown in *Figure 18.*

The segments are conventionally notated from 'a' to 'g' in the manner shown in the diagram, and it is possible to make them display any numeral from '0' to '9' or any alphabetic character from 'A' to 'F' (in a mixture of upper and lower case letters) by activating these segments in various combinations, as shown in the 'truth table' of *Figure 19.*

Practical 7-segment display devices must be provided with at least eight external connection terminals. Seven of these terminals give access to the individual photo-electric elements, and the eighth terminal provides the essential 'common' connection to all elements.

If the display is of the LED type, the seven individual LEDs may be arranged in the form shown in *Figure 20,* in which all LED anodes are connected to the 'common' terminal, or they may be arranged as in *Figure 21,* in which all LED cathodes are connected to the 'common' terminal.

In the former case the device is known as a 'common-anode 7-segment display'; in the latter case the device is known as a 'common-cathode 7-segment display'.

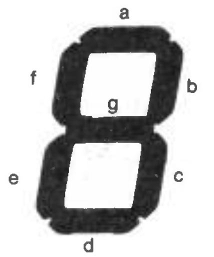


Fig 18 *Standard 7-segment display*

SEGMENTS (√ = ON) a	b	c	d	e	f	g	DISPLAY	SEGMENTS (√ = ON) a	b	c	d	e	f	g	DISPLAY
√	√	√	√	√	√		0	√	√	√	√	√	√	√	8
	√	√					1	√	√	√			√	√	9
√	√		√	√		√	2	√	√	√		√	√	√	A
√	√	√	√			√	3			√	√	√	√	√	b
	√	√			√	√	4	√			√	√	√		C
√		√	√		√	√	5		√	√	√	√		√	d
√		√	√	√	√	√	6	√			√	√	√	√	E
√	√	√					7	√				√	√	√	F

Fig 19 *Truth table for 7-segment display*

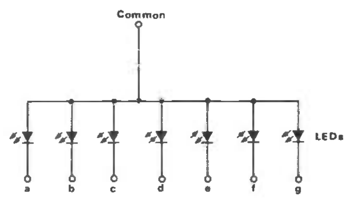


Fig 20 *'Common anode' display*

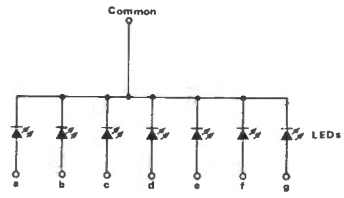


Fig 21 *'Common cathode' display*

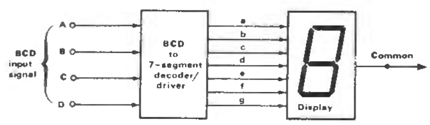


Fig 22 *Connections for a decoder/driver IC*

BCD SIGNAL D	C	B	A	DISPLAY	BCD SIGNAL D	C	B	A	DISPLAY
0	0	0	0	0	0	1	0	1	5
0	0	0	1	1	0	1	1	0	6
0	0	1	0	2	0	1	1	1	7
0	0	1	1	3	1	0	0	0	8
0	1	0	0	4	1	0	0	1	9

Fig 23 *Truth table for decoder/driver*

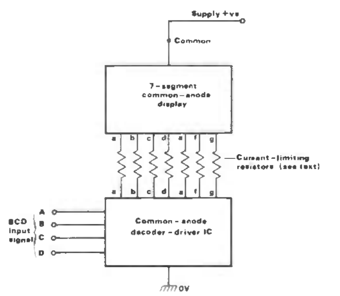


Fig 24 *Driving a common anode display*

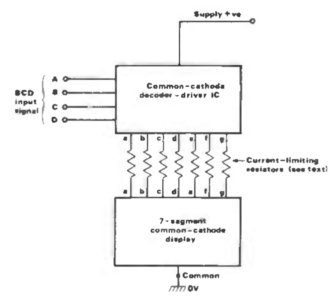


Fig 25 *Driving a common cathode display*

7-segment display/drivers

In most practical applications, 7-segment displays are used to give a visual indication of the output states of digital ICs such as decade counters and latches etc.

These outputs are usually in a 4-bit BCD (binary coded decimal) form, and are thus not suitable for directly driving a 7-segment display. Consequently, special ICs are available to convert the BCD signal into a form suitable for driving these displays.

These ICs are generally known as 'BCD to 7-segment decoder/drivers', and are connected between the BCD signals and the display in the basic manner shown in *Figure 22.*

The table of *Figure 23* shows the relationship between the BCD signals and the displayed 7-segment numerals.

In practice, BCD to 7-segment decoder/driver ICs are usually available in a dedicated form that is suitable for driving only a special class of display unit, eg common anode LED, common cathode LED, or liquid-crystal display (LCD). *Figures 24* to *26* show the methods of interconnecting each of these IC and display types.

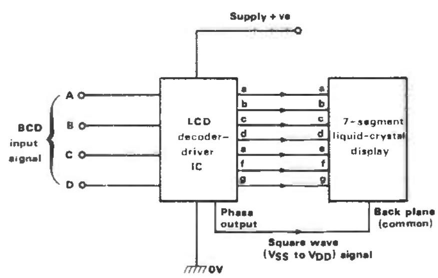


Fig 26 *Driving a liquid crystal display*

Note in the case of the LED circuits *(Figures 24* and *25)* that if the IC outputs are unprotected (as in the case of most TTL ICs), a current-limiting resistor must be wired in series with each display segment. Most CMOS ICs have internally current-limited outputs, and do not require the use of these external resistors.

Finally, note in the case of the *Figure 26* LCD-driving circuit that the 'common' or 'backplane' (BP) terminal of the display must be driven with a symmetrical square wave signal, derived from the 'phase' output terminal of the IC.

In next month's edition of *'Data File'* we'll show some practical BCD to 7-segment decoder/driver ICs, and take a look at multiplexing techniques. We'll also look at a range of light-sensitive circuits such as switches and oscillators etc.

EAST CORNWALL COMPONENTS

TRANSISTORS · DIODES

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC126	0.35	BC108	0.10	BC302	0.32	BD244A	0.65	BF258	0.30	BT101/300	1.15	BYX36/150	0.22	TIP32	0.40
AC127	0.30	A B or C	0.12	BC303	0.32	BD375	0.32	BF259	0.32	BT101/500	1.25	BYX36/600	0.28	TIP32C	0.60
AC128	0.30	BC113	0.14	BC307	0.10	BD410	0.76	BF262	0.30	BT102/300	1.35	BYX48/300	0.72	TIP33A	0.63
AC128K	0.34	BC114	0.12	BC308A	0.10	BD434	0.68	BF263	0.30	BT102/500	1.65	BYX49/300	0.47	TIP34A	0.72
AC132	0.55	BC115	0.12	BC323	0.99	BD436	0.68	BF270	0.30	BT106	1.50	BYX55/350	0.29	TIP41C	0.46
AC141	0.26	BC116	0.15	BC327	0.14	BD437	0.76	BF271	0.26	BT108	1.30	BYX55/600	0.33	TIP42A	0.52
AC141	0.26	BC117	0.22	BC328	0.14	BD438	0.75	BF273	0.18	BT109	1.18	BYX71/600	1.18	TIP47	0.60
AC141K	0.40	BC118	0.17	BC337	0.12	BD439	0.68	BF274	0.32	BT116	1.25	BYZ12	0.42	TIP110	0.88
AC142	0.26	BC119	0.30	BC338	0.12	BD507	0.48	BF323	0.92	BT119	3.52	C106D	0.80	TIP2955	0.60
AC142K	0.45	BC125	0.12	BC350	0.14	BD508	0.53	BF336	0.25	BT120	3.60	E1222	0.40	TIP3055	0.60
AC151	0.45	BC140	0.28	BC440	0.30	BD509	0.54	BF337	0.25	BT121	3.02	E5024	0.30	TIS43	0.32
AC152	0.45	BC141	0.42	BC441	0.32	BD510	0.48	BF338	0.26	BT138/600	1.30	GET872	0.48	TIS88	0.40
AC176	0.26	BC142	0.30	BC461	0.32	BD517	0.56	BF355	0.42	BT151/560R	0.90	ITT44	0.04	TIS90	0.25
AC176K	0.46	BC143	0.30	BC547	0.12	BD520	0.66	BF363	0.82	BT151/300R	1.16	ITT2002	0.11	TIS91	0.28
AC187	0.42	BC147	0.08	BC548	0.12	BD699	1.25	BF367	0.24	BTY79/400R	2.80	ME0402	0.20	ZTX108	0.12
AC187K	0.48	A or B	0.10	BC549	0.12	BD707	0.88	BF371	0.27	BU100A	2.30	ME0404/2	0.24	ZTX109	0.12
AC188	0.44	BC148	0.08	BC550	0.18	BDX18	2.35	BF422	0.38	BU104	2.00	MEU21	0.60	ZTX212	0.28
AC188K	0.50	A or B	0.09	BC550C	0.18	BDX32	2.10	BF450	0.38	BU105	1.20	MJ400	1.25	IN4001	0.05
ACY40	0.88	BC149	0.09	BC557	0.12	BF115	0.32	BF457	0.33	BU105/02	1.56	MJ2955	0.90	IN4003	0.05
AD142	1.10	BC157	0.10	BC558	0.12	BF117	0.54	BF458	0.36	BU108	1.80	MJ3000	1.98	IN4004	0.06
AD143	1.10	BC158	0.10	BCX34	0.27	BF119	0.82	BF459	0.44	BU124	1.75	MJE240	0.60	IN4006	0.07
AD149	0.96	BC159	0.10	BCY70	0.15	BF120	0.38	BFR39	0.22	BU126	1.25	MJE340	0.54	IN4007	0.07
AD161	0.42	BC160	0.30	BCY71	0.17	BF123	0.40	BFR40	0.22	BU133	1.80	MJE370	0.88	IN4148	0.05
AD162	0.42	BC161	0.30	BCY72	0.18	BF125	0.42	BFR41	0.22	BU204	1.35	MJE520	0.48	IN5400	0.12
AD161/AD162	0.96	BC168B	0.12	BCZ10	1.68	BF127	0.38	BFR51	0.30	BU205	1.30	MJE2955	0.99	IN5402	0.15
AF106	0.48	BC169C	0.10	BCZ11	1.45	BF152	0.16	BFR61	0.32	BU206	1.70	MJE3055	0.70	IN5405	.16
AF114	2.10	BC170	0.14	BD124P	0.80	BF154	0.23	BFR62	0.28	BU208	1.55	MPSLO1	0.28	IN5406	0.18
AF115	2.10	BC170B	0.10	BC130Y	0.68	BF157	0.40	BFR88	0.34	BU208A	1.63	OA47	0.10	IN5408	0.20
AF116	2.10	BC171	0.10	BD131	0.34	BF158	0.22	BFR90	1.72	BU208/02	2.05	OA90	0.08	IS920	0.08
AF117	2.10	BC171	0.10	BD132	0.34	BF159	0.24	BFT41	0.38	BU326S	1.75	OA91	0.09	2N697	0.55
AF118	0.85	A or B	0.08	BD131/BD132	0.95	BFR160	0.23	BFT43	0.36	BU407	1.65	OA95	0.18	2N706A	0.33
AF121	0.62	BC172	0.08	BD135	0.32	BF167	0.30	BFW10	0.79	BU407D	1.80	OA200	0.06	2N2904	0.28
AF124	0.48	A or B	0.20	BD136	0.36	BF173	0.25	BFW44	0.76	BUX80	3.70	OA202	0.15	2N2906	0.24
AF125	0.46	BC177	0.20	BD137	0.36	BF177	0.42	BFX29	0.28	BUY20	1.75	OC25	2.10	2N2926G	0.10
AF127	0.48	BC178A	0.22	BD138	0.38	BF178	0.30	BFX30	0.30	BUY69A	2.60	OC26	1.70	2N3053	0.22
AF139	0.68	BC182	0.08	BD139	0.38	BF179	0.32	BFX80	3.56	BUY69B	1.96	OC28	1.50	2N3054	0.56
AF178	0.68	A B or C	0.09	BD140	0.38	BF180	0.35	BFX84	0.24	DBY101	0.48	OC29	2.47	2N3055	0.45
AF239	0.68	BC182L	0.09	BD144	160	BF181	0.35	BFZ85	0.25	BY118	1.10	OC35	1.75	2N3702	0.10
AF279S	0.72	A B or C	0.09	BD145	1.82	BF182	0.32	BFX86	0.26	BY122	0.68	OC36	1.75	2N3704	0.10
AL100	2.50	BC183	0.09	BD150A	0.51	BF183	0.32	BFX87	0.26	BY126	0.12	OC42	0.72	2N3708	0.10
AL102	5.90	A B or C	0.10	BD159	0.65	BF184	0.32	BFX89	0.65	BY127	0.10	OC42K	1.40	2N3772	1.90
AL113	2.20	BC183L	0.06	BD160	1.65	BF185	0.32	BFY50	0.21	BY133	0.15	OC44	0.72	2N3773	2.70
ASY80	1.75	A B or C	0.12	BD165	0.45	BF194	0.08	BFY51	0.21	BY135	0.25	OC45	0.58	2N3904	0.16
AU110	1.40	BC184	0.10	BD175	0.60	BF195	0.10	BFY52	0.21	BY164	44	OC71	0.50	2N3906	0.15
AY102	4.32	A B or C	0.10	BD182	1.00	BF196	0.10	BFY57	0.40	BY179	0.66	OC72	0.52	2N5294	0.46
BA102	0.34	BC207	0.15	BD183	1.10	BF197	0.10	BFY90	0.90	BY182	0.87	OC81	0.68	2N6107	0.71
BA110	0.67	BC208	0.15	BD184	1.20	BF198	0.14	BFY90S	1.34	BY184	0.40	OC200	2.45	2N6126	0.68
BA121	0.40	BC212	0.09	BD201	0.72	BF199	0.15	BR100	0.20	BY187	0.72	OC202	2.20	2SB337	1.60
BA129	0.38	A B or C	0.10	BD202	0.87	BF200	0.48	BR101	0.44	BY189	4.75	ORP12	0.85	2SC1172Y	2.90
BA148	0.15	BC212L	0.08	BD204	0.80	BF222	0.48	BR103	0.58	BY198	0.44	R2008B	1.50	2SC1173Y	0.82
BA154	0.08	A B or C	0.10	BD222	0.80	BF224	0.20	BRC443	1.75	BY199	0.47	R2010B	1.52	2SC1302	1.40
BA155	0.10	BC213	0.09	BD225	0.86	BF224J	0.15	BRY39	0.38	BY206	0.24	SHG1.5	0.40	40251	0.95
BA156	0.08	A or B	0.10	BD232	0.45	BF240	0.20	BRY56	0.42	BY207	0.24	TAG1/100	1.40	40361	0.58
BA157	0.28	BC213L	0.10	BD233	0.60	BF241	0.25	BRY61	0.66	BY210/400	0.25	TAG3/400	1.78	40362	0.60
BA164	0.14	A or B	0.10	BD234	0.62	BF244	0.26	BSS17	0.56	BY210/600	0.26	TIC44	0.40	40411	3.72
BB104B	0.52	BC237	0.11	BD235	0.63	BF244A	0.28	BSS27	0.92	BY210/800	0.30	TIC45	0.45	40530	0.80
BB105B	0.30	BC236	0.12	BD236	0.63	BF244C	0.24	BSX19	0.34	BY223	1.20	TIC46	0.48	40673	0.80
BB105G	0.48	BC239	0.14	BD237	0.66	BF245A	0.26	BSX20	0.34	BY227	0.26	TIC47	0.70	40964	1.54
BB110B	0.42	BC251	0.12	BD238	0.56	BF254	0.15	BSX59	0.62	BY229	0.30	TIC106A	0.70	2SJ 50	5.20
BC107	0.10	A B or C	0.14	BD241	0.60	BF256	0.40	BSX76	0.29	BY238	0.68	TIP30A	0.46	3SK88	0.66
A or B	0.12	BC301	0.30	BD243A	0.80	BF257	0.32	BT100A/02	0.94	BYX10	0.24	TIP31C	0.54	3SK135	5.20

VOLTAGE REGULATORS

Type	Price (£)
78L05	0.30
78L08	0.30
78L12	0.30
78L15n	0.30
78M05	0.50
78M08	0.50
78M12	0.50
78M15	0.50
78M24	0.50
7805	0.55
7808	0.56
7812	0.55
7815	0.55
7818	0.55
7824	0.55
7905	0.65
7912	0.65
7915	0.65
7918	0.65
7924	0.65
CA3085	0.96
723C	0.36
LM317K	3.50
LM317T	0.90

CONVERGENCE POTENTIOMETERS

5, 7, 10, 15, 10, 50, 100, 200, 500R **38p each**

SPECIAL OFFER

30, 120, 270, 470, all at 20p each

CAPACITORS

Metallised Paper

2n2F 1500V DC	**60p**
2n2F 600V AC	**24p**
3n6F 1700V DC	**60p**
4n7F 1500V DC	**60p**
10nF 1000V DC	**22p**
10nF 500V AC	**80p**
15nF 300V AC	**30p**
22nF 300V AC	**32p**
100nF 1000V DC	**46p**
470nF 1000V DC	**85p**

HV Disc Ceramic (†)

1kV 1.5nF	**18p**
3kV 1.5nF	**20p**
8kV 10, 47, 56, 82, 100, 120, 150, 180, 200, 220pF	**30p**
270, 300pF	**39p**

VALVES

Type	Price (£)
DY802	0.88
DY86/87	0.75
ECC81	0.85
ECC82	0.65
ECC83	0.75
ECC84	0.65
ECC85	0.90
ECC88	0.95
ECF80	0.90
ECH81	0.75
ECH84	0.75
ECL82	0.75
ECL86	0.98
EF80	0.65
EF86	1.65
EF183	0.75
EF184	0.75
EH90	0.54
EL34	2.50
EL84	0.59
EL509	5.50
EM87	2.55
EY86/87	0.67
EY500A	1.65
PCC84	0.50
PCC85	0.65
PCC89	0.74
PCC189	0.85
PCF80	0.75
PCF86	1.25
PCF200	1.55
PCF801	1.45
PCF802	0.85
PCF806	1.20
PCL82	0.90
PCL83	2.50
PCL84	0.90
PCL86	0.58
PCL805/85	1.35
PD500	3.75
PFL200	1.35
PL33	1.50
PL36	1.45
PL81	0.85
PL82	0.75
PL83	0.65
PL84	0.75
PL95	2.00
PL504	1.20
PL508	2.40
PL509/519	7.50
PY88	1.80
PY500A	2.40
U26	1.90
UCH81	0.30
UCL82	1.70
6J5GT	1.75
6SJ7	2.20
30FL12	1.60
6JB6A	4.00

NEW 1985 CATALOGUE NOW AVAILABLE — Many prices reduced — range increased — 123 pages — fully illustrated. Price 65p, per copy (free upon request with orders over £5) — includes 30p. Credit Note, special offer sheets, order form and pre-paid envelope. **SEND NOW FOR YOUR COPY.**

ZENER DIODES

400mW Plastic 3V-75V **8p each 10/75p**
1.3W Plastic 3V-200V **15p each 10/£1.40**
1.5W Flange 4.7-47V **£1.26 each**
2.5W Plastic 75-75V **87p each**
20W Stud 75-75v **£1.31 each**

INTEGRATED CIRCUITS (£) EACH

Type	£	Type	£
AN240P	3.42	SN76530P	1.40
AN214Q	3.88	SN76533N	1.60
AN715Q	2.90	SN76650N	1.05
CA3065	1.75	SN76660N	0.75
CA4031P	2.88	SN76666N	0.80
CA4102	3.30	STK015	6.60
CA4250	3.60	TA7108P	3.20
CA4400	2.96	TA7120P	2.20
CA4422	3.07	TA7129AP	3.66
LC7120	5.33	TA7130P	1.66
LC7130	5.26	TA7172	1.80
LC7137	5.15	TA7193	5.50
LM380N	0.80	TA7172P	1.80
LM1303N	2.52	TA7176	2.50
HA1151P	3.12	TA7202P	4.18
MC1307P	1.86	TA7204P	1.86
MC1310P	1.86	TA7205AP	1.50
MC1312P	2.26	TA7208P	3.25
MC1327P	1.75	TA7210P	.50
MC1330P	0.83	TA7222P	2.12
MC13449P	1.86	TA7223P	3.68
MC1350P	1.20	TA7227P	5.60
MC1351P	2.60	TA7310P	1.80
MC1352P	1.50	TA7609P	4.28
MC1357P	.88	TA7611AP	2.88
MC1358P	1.30	TAA263	2.48
MC1496L	1.15	TAA310A	2.68
ML231B	2.10	TAA550	0.60
ML232B	2.10	TAA570	1.99
ML237B	2.30	TAA611A12	3.50
NE555	0.60	TAA611B12	2.85
C-mos 555	0.88	TAA630S	3.90
NE556	0.80	TAA661B	1.70
SAA1024	5.35	TAA700	2.80
SAA1025	8.40	TAA840	3.38
SAS560A	2.60	TAD100	2.80
SAS560S	1.86	FM FILTER	1.20
SAS570S	1.86	TBA120A	1.00
SAS580	2.86	AS,S,SA,SB	1.30
SAS590	2.82	Q,T,U,UQ	1.32
SC9503P	1.10	TBA120B	1.30
SL432A	4.00	TBA231	1.45
SL901B	5.20	TBA281	2.66
SL917B	6.25	TBA395	1.20
SL1327Q	1.10	TBA480Q	1.60
SN76003N	2.44	TBA400	2.30
SN76013N	1.90	TBA510	2.60
SN76023ND	2.90	TBA510Q	2.60
SN76033N	2.45	TBA520/Q	1.60
SN76110N	1.12	TBA530/Q	1.30
SN76115N	2.00	TBA540/Q	1.40
SN76131N	1.65	TBA550/Q	1.52
SN76226DN	1.80	TBA560C	1.70
SN76227N	1.10	TBA560CQ	1.60

Type	£	Type	£
TBA570	1.50	UPC1156H	4.20
TBA641BX1	4.60	UPC1158H	0.76
TBA651	2.80	UPC1163H	0.98
TBA673	2.40	UPC1181H	1.60
TBA700	2.85	UPC1185H2	3.75
TBA750	2.80	UPC1212C	1.30
TBA800	1.60	UPC1230H	3.90
TBA810P	1.10	UPC1350C	4.25
TBA810S	1.20	UPC1367C	3.40
TBA820	1.60	UPC1378H	4.40
TBA890	3.88	UPC2002H	2.80
TBA920/Q	3.00		
TBA950/2A	3.05		
TBA970	4.05		
TBA990	1.88		
TCA160C	3.90		
TCA270S	4.00		
TCA270SA	4.02		
TCA800	3.10		
TCA940	1.90		
TDA440	3.80		
TDA1002	1.90		
TDA1003A	5.50		
TDA1004A	2.90		
TDA1006A	2.40		
TDA1035S	4.50		
TDA1044	4.30		
TDA1170S	3.00		
DA1190	3.50		
TDA1200	2.98		
TDA1270Q	3.70		
TDA1327A	1.66		
TDA1352A/B	1.56		
TDA1412	1.20		
TDA2002	2.80		
TDA2020	4.60		
TDA2030	2.78		
TDA2140	5.90		
TDA2521	4.10		
TDA2523	3.50		
TDA2530	2.70		
TDA2540	3.80		
TDA2541	3.80		
TDA2560	3.60		
TDA2571A	2.50		
TDA2581	3.20		
TDA2590	3.20		
TDA2591	2.98		
TDA2593	2.98		
TDA2610	3.20		
TDA2611A	1.94		
TDA2640	2.90		
TDA2680	3.40		
TDA2690	3.50		
TDA3950/A/B	2.60		
UPC554C	1.32		
UPC557H	0.90		
UPC566H	2.95		
UPC575C2	3.20		
UPC1018C	1.10		
UPC1025H	2.90		
UPC1032H	0.90		

BRIDGES

1½A 50V	0.27
100V	0.28
200V	0.32
400V	0.40
600V	0.50
800V	0.58
3A 100V	0.52
200V	0.55
400V	0.61
600V	0.57
800V	0.60
6A 100V	0.66
200V	0.68
400V	0.74
600V	0.80
800V	0.86
10A 50V	2.20
100V	2.24
200V	2.35
400V	2.50
600V	3.50
25A 50V	2.05
100V	2.25
200V	2.40
400V	3.20
600V	3.95

SERVICE AIDS

ALL SERVISOL PRODUCTS

Switch Cleaner	0.88
Circuit Freezer	0.96
Foam Cleanser	0.84
Aero Klene	0.78
Silicone Grease (Aerosol)	1.00
Antistat Spray	0.82
Plastic Seal	0.88
Excel Polish	0.75
Fire Extin 640g	2.80
Video Head Cleaner	0.88
Silicone Grease (ICI) 75g tube	1.00
Solda Mop (Std)	0.72
Solda Mop (L/Gauge)	0.72

Additional P&P on above 30p

RESISTORS — CARBON FILM 5%

¼W 1RO to 10M (E12 Range)	**2p each. 15p/10. 75p/100**
½W 2R2 to 10M (E24 Range)	**2p each. 15p/10. 75p/100**
1W 10R to 2M2 (E12 Range)	**7p each. 65p/10. 5.00/100**
2W 10R to 2M2 (E6 Range)	**8p each. 70p/10. 5.00/100**

RESISTOR KITS — each value individually packed

¼W pack 10 each value E12—10R to 1M 610 pieces	5.00
¼W pack 5 each value E12—10R to 1M 305 pieces	3.00
½W pack 10 each value E12—2R2 to 2M2 730 pieces	5.00
½W pack 5 each value E12—2R2 to 1M 365 pieces	3.50
1W pack 5 each value E12—2R2 to 1M 353 pieces	15.00
2W pack 5 each value E6—10R to 2M2 317 pieces	18.00

RESISTORS — WIREWOUND Generally 5%

2-5W 0-22 to 270R Available in preferred values	0.20
4W 1Ro to 10K. Available in preferred values	0.21
7W 0.47R to 22K. Available in preferred values	0.25
11W 1R0 to 22K. Available in preferred values	0.29
17W 1R0 to 22K. Available in preferred values	0.37

FUSES

1¼in Quick Blow 100 150 250mA £1.30 1 1.25 1.5 2.5 3 10 15A **55p 1¼in Time Delay** 100mA **£3.50** 150mA **£2.25** 250 300 500 600 750 850mA **£1.84** 1 1.25 1.5 1.6 2A **£1.84** 2.5A 3.15 3.5A **£2.82 20mm Quick Blow** 100 125 160 200 250 315 400 500 600 800mA 1 1.25 1.5 2 2.5 3.5 4.5 6.3A **40p 20mm Time Delay** 100 125 150 200mA **£1.80** 750 300 400 500 600 800mA **£1.00** 1 1.25 1.5 2 2.5 3 3A **85p 1in Mains** 2 3 5 7 10 13A **85p**

Manufacturers please note – we can offer very competitive production quantities of 20mm Quick Blow & Time Delay range – apply for quotation

NI-CAD

Universal Ni-Cad charger, charges PP3, AA, C.D
Price **£6.00**

RECHARGEABLE BATTERIES

AA	0.85	ea-	10/7.50 ea
HP11	1.75		ea-4/6.80 ea
HP2	2.05		ea-4/7.80 ea
PP3	3.80		ea-4/14.80 ea

Fuseholders

20mm Panel Mounting	0.28
20mm Chassis Mounting	0.06
1¼in Panel Mounting	0.35
1¼in Chassis Mounting	0.342
Carline 1¼in Mounting	0.10

Terminal Blocks

2 amp 12 way	0.19
5 amp 12 way	0.20
15amp 12 way	0.48
32amp 12 way	0.92

PLUGS & SOCKETS

Metal Co-ax Plug	0.15
Plastic Co-ax Plug	0.14
Single Junction Socket	0.80
Plastic Phono	0.10
F M Plugs	0.20
PL259	0.38
Reducer	0.15
2.5mm Plug Meta	0.15
2.5mm Plug Metal	0.15
2.5mm Chassis Socket	0.10
3.5mm Chassis Socket	0.10
2 pin ¼in Mono Chassis Socket	0.14
4 pin ¼in Mono Chassis Socket	0.20
6 pin ¼in Mono Chassis Socket	0.30
4mm Banana Plug	0.15
4mm Banana Socket	0.15
PP3 Battery Connectors	0.08
PP9 Battery Connectors	0.15

Soldering Section

XS25 Watt Iron Kit/complete with stand & plug attached	7.20
CS 18 Watt as above	7.00
ANTEX 15W IRON	5.00
ANTEX 18W IRON	5.00
ANTEX 25W IRON	5.20
ANTEX ELEMENTS	2.00
ANTEX BITS	0.95
ANTEX STANDS	1.90
SOLDERSUCKER	4.60
500gm SOLDER	6.80
SOLDA MOP	0.70
ANTEX SOLDERING STATION complete with Iron – 30W or 40W	49.95
Spare nozzles for Soldersucker	0.45

POTENTIOMETERS

Carbon Track, Rotary 0.25W Log & Lin values. All ¼in Spindle, 20m body dia, Shaft 2' long.

4K7–2M2 Single Gang Log	.32	10/3.00
1K –2M2 Single Gang Lin	.32	10/3.00
5K –2M2 Single Gang DP Switch Log	.75	10/7.00
5K –2M2 Double Gang Log & Lin	.86	10/8.25

MINI 'D' CONNECTORS

		9way	15way	25way	37way
PLUGS	Solder				
	Lug	.52	.65	.88	1.45
	R. Angle	.89	1.34	1.98	3.48
SOCKETS	Solder	.78	.98	1.33	2.48
	Lug	1.18	1.78	2.70	4.15
COVERS	R. Angle	.95	.95	.98	1.00

Type	£	Type	£	Type	£
4000	0.24	4042	0.60	4097	2.65
4001	0.24	4043	0.42	4098	0.80
4002	0.25	4044	0.50	4099	1.05
4007	0.25	4046	0.60	4161	0.96
4011	0.24	4049	0.38	4162	0.96
4012	0.24	4050	0.36	4163	0.96
4013	0.56	4051	0.70	4174	0.96
4014	0.60	4052	0.60	4175	1.00
4015	0.60	4053	0.60	4194	0.99
4016	0.40	4066	0.45	4501	0.38
4017	0.60	4067	2.45	4502	0.38
4018	0.60	4068	0.24	4503	0.40
4020	0.85	4069	0.24	4507	0.48
4021	0.58	4070	0.25	4508	1.30
4022	0.96	4071	0.24	4510	0.55
4023	0.35	4072	0.25	4511	0.55
4024	0.60	4073	0.25	4512	0.55
4025	0.24	4075	0.25	4514	1.15
4027	0.45	4076	0.68	4515	1.15
4028	0.48	4077	0.25	4516	0.55
4029	0.75	4078	0.25	4517	2.70
4030	0.35	4081	0.25	4518	0.48
4031	1.30	4082	0.25	4520	0.53
4033	1.25	4085	0.58	4521	1.15
4034	1.48	4086	0.58	4522	1.25
4035	0.70	4089	1.25	4526	0.60
4036A	2.75	4093	0.37	4527	0.65
4038	0.75	4094	0.96	4528	0.68
4039A	2.80	4095	0.95	4531	1.30
4040	0.60	4096	0.99	4532	0.66
				4536	2.85
				4538	0.80
				4539	0.90
				4541	0.90
				4543	1.25
				4549	4.00
				4553	2.45
				4554	1.92
				4555	0.35
				4556	0.55
				4557	2.50
				4558	1.20
				4559	3.25
				4560	1.80

IC SOCKETS

Dil to Dil

8	pin	0.08	0.70/10
14	pin	0.10	0.95/10
16	pin	0.11	1.00/10
18	pin	0.14	1.60/10
22	pin	0.21	1.95/10
24	pin	0.25	2.25/10
28	pin	0.30	2.75/10
40	pin	0.34	3.10/10

TELEPHONE SPECIAL

BT App Tel Plug & 4-core Lead	1.25
BT App Secondary Socket	1.95
BT App Master Socket	2.85
BT App Plug only	0.58
BT 4-core Cable 15pm 100m	12.00

B.T.Telephones now available.

MICRO

2764-250n/s	5.80
Z80A-CPU	3.70
Z80A-CTC	3.30
Z80-ADNA	9.00
Z80-AP10	3.40
Z80-AS10/0	8.75
Z80-AS10/2	8.99

Send now for our free 8 page special offer list - free with our catalogue

EAST CORNWALL COMPONENTS
DEPT REW 2 119 HIGH STREET
WEM
SHROPSHIRE SY4 5TT TEL: 0939 32689
Telex: 35565

VISA

ORDERING: All components are brand new and to full specification. Please add 50p postage/packing (unless otherwise specified) to all orders and then add 15% VAT to the total. Either send cheque/cash/postal order or send/telephone your Access or Visa number. Official orders from schools, universaties, colleges etc most welcome.
Send now for our latest catalogue, 65p per copy (includes 30p credit/pre paid envelopes, current special offers and lots lots more).
New retail 1000 sq ft shop now open. Mon-Fri 9am-5pm, Sat 9am-12pm.

PHONE
0474 813225
3 LINES

P.M. COMPONENTS LTD

DEPT REW SELECTRON HOUSE, WROTHAM ROAD
MEOPHAM GREEN, MEOPHAM, KENT DA13 0QY

TELEX
966371
PM COMP

INTEGRATED CIRCUITS

AN124	2.50
AN214Q	2.50
AN239	2.50
AN240P	2.80
AN264	2.50
AN612	2.15
AN362L	2.50
AN7140	3.50
AN7145	3.50
AN7145M	3.95
AN7150	2.95
BA521	3.35
CA1352E	1.75
CA3086	0.46
CA3123E	1.95
CA3140T	1.15
ETT6016	2.50
HA1339A	2.95
HA1366W	2.75
HA1377	3.50
HA1156W	1.50
HA1551	2.95
LA1230	1.15
LA4102	2.95
LA4140	2.95
LA4031P	1.95
LA4140	2.95
LA4461	3.95
LA4250	2.95
LA4420	1.95
LA4430	2.50
LA4400	4.15
LA4422	2.50
LA4461	3.95
LC7120	3.25
LC7130	3.50
LLC7131	5.50
LC7137	5.50
LM1011	3.15
LM324N	0.45
LM380N	0.95
LM383T	2.95
M51513L	2.30
M5155L	2.95
M51521L	1.50
MB3712	2.00
MB3756	2.50
MC1307P	1.00
MC1310P	1.95
MC1327	0.95
MC1327Q	0.95
MC1330P	1.10
MC1349P	1.20
MC1350P	0.95
MC1351P	1.50
MC1357	2.35
MC1358	1.58
MC1495	3.00
MC1496	1.25
MC145106P	7.95
MC1723	0.50
MC3357	2.75
MC3401L	2.50
ML231B	1.75
ML232B	2.50
MSM5807	8.75
PLL02A	5.75
SAA500A	3.50
SAA1025	7.25
SAA5010	6.35
SAS560S	1.75
SAS570S	1.75
SAS580	2.85
SA/SB/T/U	1.00
SL901B	4.65
SL917B	6.65
SL1310	1.80
SL1327	1.10
SL1327Q	1.10
SN76003N	1.95
SN76013N	1.95
SN76023N	2.75
SN76033N	1.95
SN76110N	0.89
SN76115N	1.25
SN76131N	1.30
SN76226DN	2.95
SN76227N	1.05
SN76533N	1.65
SN76544N	2.65
SN76570N	1.00
SN76650N	1.15
SN76660N	0.90
STK014	7.95
STK015	5.95
STK043	9.50
STK415	7.95
STK433	5.95
STK435	7.95
STK437	7.95
STK439	7.95
STK461	11.50
TA7061AP	1.50
TA7108P	1.50
TA7120P	1.65
TA7129P	2.50
TA7130P	1.50
TA7137P	1.00
TA7146	3.95
TA7176AP	2.95
TA7193P	3.95
TA7203	2.95
TA7204P	2.15
TA7205AP	1.15
TA7222AP	1.80
TA7227P	4.25
TA7310P	1.80
TA7313AP	2.95
TA7314P	2.95
TA7137P	1.00
TA7314P	2.95
TA7321P	2.25
TA7609P	3.95
TA7611AP	2.95
TAA550	0.25
TAA570	1.95
TAA661B	1.20
TAA700	1.70
TBA120AS/B/-C	1.00
TBA231	1.25
TBA395	1.50
TBA396	0.75
TBA440N	2.55
TBA480Q	1.25
TBA510	2.50
TBA510Q	2.50
TBA520	1.10
TBA520Q	1.10
TBA530	1.10
TBA530Q	1.10
TBA540	1.25
TBA540Q	1.35
TBA550Q	1.95
TBA560C	1.45
TBA560Q	1.45
TBA570	1.00
TBA641A12	2.50
TBA651R	2.50
TBA720A	2.45
TBA750Q	2.65
TBA800	0.89
TBA810AS	1.65
TBA810P	1.65
TBA820M	0.75
TBA820Q	1.45
TBA890	2.50
TBA920	1.65
TBA950/2X	2.35
TBA970	2.95
TBA990	1.49
TBA990Q	1.49
TCA270	1.10
TCA270SQ	1.10
TCA650	2.50
TCA800	2.95
TCA830S	1.95
TCA900	2.50
TCA940	1.65
TDA440	2.20
TDA1001	1.95
TDA1002A	1.95
TDA1003A	3.95
TDA1004A	3.25
TDA1006A	2.50
TDA1010	2.15
TDA1035	2.50
TDA1037	1.95
TDA1044	2.15
TDA1170	1.95
TDA1190	2.15
TDA1270Q	3.95
TDA1327	1.70
TDA2002	1.95
TDA2003	2.95
TDA2010	1.95
TDA2020	2.95
TDA2030	2.80
TDA2140	3.95
TDA2151	1.95
TDA2160	2.50
TDA2190	2.95
TDA2521	3.25
TDA2522	1.95
TDA2523	2.95
TDA2524	1.95
TDA2530	1.95
TDA2532	1.95
TDA2540	1.95
TDA2541	2.15
TDA2560	2.15
TDA2571	2.95
TDA2581	2.25
TDA2582	2.95
TDA2593	2.95
TDA2600	6.50
TDA2610	2.50
TDA2611A	1.95
TDA2640	3.50
TDA2680A	2.75
TDA2690	2.45
TDA3310	2.95
TDA4600	2.50
TDA9503	3.15
TDA3560	3.95
TEA1009	1.35
UPC566H	2.95
UPC575C2	2.75
UPC1025H	1.95
UPC1028H	1.95
UPC1032H	1.50
UPC1156H	2.75
UPC1158H	0.75
UPC1167C2	1.15
UPC1181H	1.25
UPC1182H	2.95
UPC1185H	3.95
UPC1191V	1.50
UPC1350C	2.95
UPC1353C	2.45
UPC1365C	3.95
UPC2002H	1.95
555	0.35
556	0.42
723	0.50
741	0.35
747	0.50
748	0.35
7808	0.60
7805	0.65
7815	0.65

NEW BRANDED CATHODE RAY TUBES

A1865/20	65.00
AW36.11	26.00
CME822W	19.00
CME822GH	25.00
CME1428GH	45.00
CME1428W	39.00
CME1523GA	39.00
CME1523W	39.00
CME1431GH	39.00
CME1431W	39.00
CME2022GH	45.00
CME2024W	45.00
CME2325W	45.00
CME3126GH	45.00
CME3128GH	45.00
CME3128W	45.00
CME3132GH	45.00
CME3155W	45.00
CRE1400	25.00
CV429	69.00
CV1450	35.00
CV1526	19.00
CV2185	15.00
CV2191	19.00
CV2193	15.00
CV2326	65.00
CV5119	65.00
CV5320	65.00
CVX389	55.00
D9-110GH	39.50
D9-120	45.00
D10-210GH	45.00
D10-210GH68B	65.00
D10-210GH72	65.00
D10-230GH	35.00
D10-230GM	35.00
D10/293GY/90	55.00
D13-27GH	49.50
D13-30GH	49.50
D13-33GM	49.00
D13-47GH/26	55.00
D13-47GH/34	55.00
D13-47GH	65.00
D13-51GL/26	65.00
D13-51GM/26	55.00
D13-450GH/01	65.00
D13-471GH/26	55.00
D13-550GH	65.00
D13-600GM	59.00
D13-610GH	59.00
D13-610GM	59.00
D13-611GH	59.00
D13-611GM	69.00
D13-630GH	59.00
D14-120GH08	65.00
D14-150GH	75.00
D14-150GM	75.00
D14-172GH/84	59.00
D14-172GR	65.00
D14-172GV	55.00
D14-173GH	55.00
D14-173GM	53.00
D14-173GR	65.00
D14-181GH/62	65.00
D14-181GH/98	55.00
D14-181GJ	65.00
D14-181GM	53.00
D14-181GM50	59.00
D14-182GH	59.00
D14-182GM/98	65.00
D14-200BE	59.00
D14-200GA/50	65.00
D14-210GH	75.00
D14-270GH/50	75.00
D14-310W	110.00
D14-320GH	65.00
D14-320GH/82	65.00
D14-340GH/KM	45.00
D14-340KA	45.00
D16-100GH	65.00
D16-100GH/85	69.00
D16-100GH/67	65.00
D16-100GH67A	75.00
D16-100GH/79	69.00
D16-100GH79A	75.00
D16-100GH97	65.00
D16-100GH/70	59.00
D16-160GH	65.00
D21-10GH	65.00
D21-10GJ	69.00
D21-10LD	69.00
DB7.36	35.00
DB7.36	55.00
DG7.5	55.00
DG7.32	45.00
DH3.91	65.00
DH7.91	45.00
DP7.5	35.00
DP7.6	35.00
DN13.78	35.00
F15-101LC	49.00
F16-101GM	55.00
F16-101LD	65.00
F21-130GR	65.00
F21-130LC	55.00
F21-131GR	79.00
F31-10GM	65.00
F31-10GR	65.00
F31-10LC	65.00
F31-10LD	65.00
F31-12LC	65.00
F31-12LD	65.00
F31-13GR	65.00
F31-13LD	65.00
F31-13LG	65.00
F41-123LC	160.00
F41-141LG	160.00
F41-142LC	165.00
M7-120W	19.00
M14-100GM	45.00
M14-100KA	65.00
M14.100LC	45.00
M17-151GVR	175.00
M17-151GR	175.00
M19-100GY	65.00
M19-101GR	65.00
M19-103W	55.00
M23-110GH	55.00
M23-111W	65.00
M23-111GH	65.00
M23-111LD	65.00
M23-112GM	55.00
M23-112GV	55.00
M23-112GW	65.00
M23-112KA	65.00
M23-112LD	65.00
M23-112W	65.00
M24-120GM	59.00
M24-120GR	59.00
M24-120LC	59.00
M24-120WAR	59.00
M24-121GH	65.00
M24-121LC	59.00
M24-121WA	59.00
M28-11LA	49.00
M28-12GH	55.00
M28-12LC	55.00
M28-13LC	49.00
M28-13LG	49.00
M28-13GR	49.00
M28-13WA	49.00
M28-131GR	55.00
M28-132GM	55.00
M28-133GH	55.00
M31-100GH	65.00
M31-101GH	55.00
M31-182GR	55.00
M31-182GV	53.00
M31-183W	65.00
M31-184W	65.00
M31-184GH	65.00
M31-184P31	65.00
M31-185GH/VR	69.00
M31-186W	69.00
M31-190GH	65.00
M31-190GR	65.00
M31-190LA	65.00
M31-190W	59.00
M31-191GH	59.00
M31-191GR	59.00
M31-191GV	55.00
M31-191W	59.00
M31-192W	59.00
M31-195GH	59.00
M31-210GH	59.00
M31-220W	59.00
M31-270GY	65.00
M31-271P31	65.00
M31-271GW	65.00
M31-271W	65.00
M36-12W	76.00
M36-141LA	75.00
M36-141LG	75.00
M36-141W	75.00
M36-170LG	75.00
M38-103GR	65.00
M38-113GH	65.00
M38-120W	65.00
M38-120WA	65.00
M38-121GR	65.00
M38-121GHR	65.00
M38-121LA	65.00
M36-121WA	65.00
M36-122GW	65.00
M38-140LA	65.00
M38-141LA	65.00
M38-142GR	65.00
M38-142LA	65.00
M38-340P31	55.00
M38-341GR	55.00
M38-341P31	55.00
M38-344P39	55.00
M40-120W	59.00
M43-12GM/01	65.00
M43-12LG/01	65.00
M44-120LC	65.00
M44-120GR	65.00
M47-25GR/22	65.00
M50-120GH	65.00
M50-120GR	65.00
M50-120GV	65.00
M50-120LC	65.00
M61-120LC	76.00
M61-120W	76.00
M61-120W	75.00
S6AR	45.00
SE42BP31AL	65.00
SE42BP31	65.00
SE52AP31AL	65.00
SE5Fp31	55.00
T937	55.00
T948N	55.00
T948H	65.00
V3191	59.00
V4150LC	55.00
V4254B	55.00
V4274GH	65.00
V4283W	65.00
V5002LD	65.00
V5004GR	59.00
V5004LD	59.00
V6001GH	59.00
V6006GH	65.00
V6007DP31	59.00
V6007GW	65.00
V6008GH	59.00
V6008W	65.00
V6034WA	59.00
V604CLA	59.00
V6048F	65.00
V6048J	49.00
V6052GH	65.00
V6052GR	65.00
V6064BLA	65.00
V6064BP31	55.00
V6064CLA	65.00
V6069GH	65.00
V6070P31	49.00
V7016A	65.00
V7030	59.00
V7031GH	59.00
V7031/67A	59.00
V7035A	49.00
V7037GH	45.00
V8004GR	65.00
V8006GH	65.00
V8010A	65.00
2BP1	9.00
3BP1	13.50
4EP1	30.00
3H/OBM	55.00
3WP1	18.50
5BP1	9.00
5BHP1	30.00
5BHP1FF	30.00
5BHP31	30.00
5CP1	10.00
6EP7/S	39.00
13BP1	13.50
13BP4	17.50
17DWP4	25.00
32J/1085	69.00
88D/88B/89D/89L	15.00
1273	39.00
1564	39.00
1844	45.00
55451GM	75.00
9442E1	80.00
95447GM	75.00
95449	75.00
7709631	79.50

ELECTRO-OPTICAL

95025	25.00
9558B	25.00
9677M	22.00
P4231BAM	19.00
XP1002	29.00
XP1117M	24.00
XP2040	35.00

SEMICONDUCTORS

AAY12	0.25
AC126	0.45
AC127	0.20
AC128	0.28
AC128K	0.32
AC141	0.25
AC141K	0.34
AC142K	0.30
AC176	0.22
AC176K	0.31
AC187	0.25
AC187K	0.28
AC188	0.25
AC188K	0.37
AD142	0.79
AD143	0.82
AD149	0.70
AD161	0.39
AD162	0.39
AD161/2	0.90
AF106	0.50
AF114	1.95
AF121	0.60
AF124	0.65
AF125	0.35
AF126	0.32
AF127	0.65
AF139	0.40
AF150	0.60
AF178	1.95
AF239	0.42
AU106	4.50
AU107	3.50
AU110	2.00
AY102	2.95
BC107A	0.11
BC107B	0.11
BC108	0.10
BC108A	0.11
BC108B	0.12
BC109	0.10
BC109B	0.12
BC109C	0.12
BC114	0.11
BC116A	0.15
BC117	0.19
BC119	0.24
BC125	0.25
BC139	0.20
BC140	0.31
BC141	0.25
BC142	0.21
BC143	0.24
BC147	0.09
BC147B	0.09
BC148A	0.09
BC148B	0.09
BC149	0.09
BC153	0.30
BC157	0.12
BC158	0.09
BC159	0.09
BC160	0.28
BC161	0.28
BC170B	0.15
BC171	0.09
BC171A	0.10
BC171B	0.10
BC172	0.10
BC172B	0.10
BC172C	0.10
BC171B	0.10
BC174	0.09
BC174A	0.09
BC177	0.15
BC178	0.15
BC182	0.10
BC182LB	0.10
BC183	0.10
BC183L	0.09
BC184LB	0.09
BC204	0.10
BC207B	0.13
BC208B	0.13
BC212	0.09
BC212L	0.09
BC212LA	0.09
BC213	0.09
BC213L	0.09
BC214	0.09
BC214C	0.09
BC214L	0.09
BC237B	0.09
BC238	0.09
BC239	0.12
BC251A	0.12
BC252A	0.15
BC258	0.25
BC258A	0.39
BC284	0.30
BC300	0.30
BC301	0.30
BC303	0.26
BC307B	0.09
BC327	0.10
BC328	0.10
BC337	0.10
BC338	0.09
BC347A	0.13
BC461	0.35
BC478	0.20
BC527	0.20
BC547	0.10
BC548	0.10
BC549A	0.08
BC550	0.14
BC557	0.08
BC557B	0.08
BC558	0.10
BC639/10	0.30
BCY33A	1.60
BD115	0.30
BD116	0.50
BD124P	0.59
BD131	0.42
BD132	0.42
BD133	0.40
BD135	0.30
BD136	0.30
BD137	0.32
BD138	0.30
BD139	0.32
BD140	0.30
BD144	1.10
BD150C	0.29
BD159	0.65
BD160	1.50
BD166	0.55
BD179	0.72
BD182	0.70
BD201	0.83
BD202	0.65
BD203	0.78
BD204	0.70
BD222	0.46
BD223	0.59
BD225	0.46
BD232	0.35
BD233	0.35
BD234	0.35
BD236	0.49
BD237	0.40
BD238	0.40
BD242	0.65
BD246	0.75
BD376	0.32
BD410	0.65
BD434	0.65
BD437	0.75
BD438	0.75
BD520	0.65
BD538	0.65
BD597	0.95
BD701	1.25
BD702	1.25
BD707	0.90
BDX32	1.50
BDY57	1.65
BF115	0.35
BF119	0.65
BF127	0.39
BF154	0.20
BF158	0.22
BF160	0.27
BF167	0.27
BF173	0.22
BF177	0.38
BF178	0.26
BF179	0.34
BF180	0.29
BF181	0.29
BF182	0.29
BF183	0.29
BF184	0.28
BF185	0.28
BF194	0.11
BF195	0.11
BF196	0.11
BF197	0.11
BF198	0.16
BF199	0.14
BF200	0.40
BF241	0.15
BF245	0.30
BF257	0.28
BF258	0.28
BF259	0.28
BF271	0.26
BF273	0.18
BF336	0.34
BF337	0.29
BF338	0.32
BF355	0.37
BF362	0.38
BF363	0.65
BF371	0.25
BF394	0.19
BF422	0.32
BF423	0.25
BF457	0.32
BF458	0.36
BF487	0.66
BF595	0.23
BF597	0.25
BFR39	0.23
BFR40	0.23
BFR41	0.28
BFR81	0.25
BFR88	0.30
BFR90	1.50
BFR91	1.75
BFT42	0.35
BFT43	0.35
BFW61	0.60
BFW92	0.85
BFX29	0.30
BFX84	0.26
BFX85	0.32
BFX86	0.30
BFX88	0.25
BFY50	0.21
BFY51	0.21
BFY52	0.25
BFY90	0.77
BLY48	1.75
BR100	0.26
BR101	0.40
BR103	0.55
BR303	0.95
BRC4443	1.15
BT100A/02	0.85
BT106	1.49
BT116	1.20
BT119	3.15
BT120	1.65
BU105	1.95
BU108	1.69
BU124	1.25
BU125	1.25
BU126	1.60
BU204	1.55
BU205	1.30
BU208	1.39
BU208A	1.52
BU208D	1.95
BU326	1.20
BU326S	1.50
BU407	1.24
BU500	2.25
BU526	1.90
BU807	2.25
BUY20	2.15
BUY69B	1.70
MJ3000	1.98
MJE340	0.40
MJE350	
MJE520	0.48
MJE2955	
MPSA13	0.29
MPSA92	0.30
MRF237	3.45
MRF450A	12.50
MRF453	17.50
MRF454	23.50
MRF455	17.50
MRF475	2.50
MRF477	10.00
OC16W	1.95
OC23	1.50
OC29	2.25
OC36	2.25
OC42	0.75
OC44	0.75
OC45	0.55
OC70	0.45
OC71	0.55
OC75	0.95
OC81	0.55
OC18W	2.50
R2008B	1.45
R2010B	1.45
R2322	0.58
R2323	0.66
R2540	2.48
RCA16334	0.90
RCA16335	0.80
S2060D	0.95
SKE5F	1.45
TIP29	0.40
TIP29C	0.42
TIP30C	0.43
TIP31C	0.55
TIP32C	0.42
TIP33B	0.95
TIP34B	0.95
TIP41A	0.45
TIP41C	0.45
TIP42C	0.47
TIP47	0.65
TIP120	0.60
TIP125	0.65
TIP142	1.75
TIP146	2.75
TIP161	2.95
TIP2955	0.80
TIP3055	0.65
TIS91	0.20
TV106/2	1.50
ZRF0112	16.50
2N1100	6.50
2N1711	0.30
2N2110	4.50
2N2219	0.28
2N2905	0.40
2N3053	0.40
2N3054	0.59
2N3055	0.52
2N3702	0.12
2N3703	0.12
2N3704	0.12
2N3705	0.12
2N3706	0.12
2N3708	0.12
2N3733	9.50
2N3773	2.75
2N3792	1.35
2N4280	3.50
2N4427	1.95
2N4444	1.15
2N5294	0.42
2N5296	0.48
2N5298	0.60
2N5496	0.95
2SA329	0.95
2SA715	0.60
2SC495	0.80
2SC496	0.80
2SC931D	0.95
2SC1096	0.80
2SC1106	2.50
2SC1172Y	2.20
2SC1173	1.15
2SC1306	1.00
2SC1307	1.50
2SC1364	0.50
2SC1449	0.50
2SC1678	1.25
2SC1909	1.45
2SC1945	2.65
2SC1953	0.95
2SC1957	0.80
2SC1969	1.95
2SC2028	1.15
2SC2029	1.95
2SC2078	1.45
2SC2091	0.85
2SC2098	2.50
2SC2166	1.95
2SC2314	0.80
2SC2371	0.35
2SC931D	0.95
1SD234	0.50
2SD325E	1.65
3N211	1.95
3SK45	0.95
3SK88	0.65

DIODES

AA119	0.08
BA115	0.13
BA145	0.16
BA148	0.17
BA154	0.06
BA156	0.15
BA157	0.30
BAX13	0.04
BAX16	0.06
BB105B	0.30
BT151	0.79
BY126	0.10
BY127	0.11
BY133	0.15
BY184	0.45
BY176	1.20
BY179	0.63
BY182	0.55
BY184	0.35
BY199	0.40
BY206	0.14
BY208-800	0.33
BY210-800	0.33
BY223	0.90
BY298-400	0.22
BY299-800	0.22
BYX10	0.20
BYX36-150R	0.20
BYX38-600R	0.60
BYX55-600	0.30
BYX71-600	1.10
BZX61	0.15
BZY88	0.10
BZY95C30	0.35
CS4B	4.50
CS10B	8.45
OA47	0.09
OA90	0.05
OA91	0.06
OA95	0.06
OA202	0.10
1N21DR	6.00
1N23B	5.00
1N23C	6.00
1N23ER	6.00
1N23WE	5.00
IN4001	0.04
IN4003	0.04
IN4004	0.05
IN4005	0.05
IN4007	0.06
IN4148	0.02
IN4448	0.10
IN5401	0.12
IN5402	0.14
IN5403	0.12
IN5406	0.13
IN5407	0.16
IN5408	0.16
ITT44	0.04
ITT923	0.15
ITT2002	0.10

BASES

B5D	5.50
B7G	0.15
B7G SKTD	0.28
B8G	0.70
B8H	0.70
B9A	0.25
B9ASKTD	0.40
B9G	0.75
B10B	0.20
B13B	0.60
B14A	3.00
12 Pin CRT	0.95
Nuvistor	2.95
Octal	0.35
SK610	35.00
UX5	1.75
UX7	1.75
Valve Can	0.30
8 Pin Dil	0.14
14 Pin Dil	0.15
16 Pin Dil	0.15
18 Pin Dil	0.16

WIREWOUND RESISTORS

4 Watt 5R6-10K	0.20
7 Watt R47-22K	0.20
11 Watt 1R5-15K	0.25
17 Watt 1R-15K	0.30

ZENER DIODES

BZX61 0.15

6V2 7V5 8V2 9V1 10V 11V 12V 13V 15V 16V 18V 20V 22V 24V 27V 30V 33V 36V 39V 47V 51V 56V 68V 75V

BZY88 0.07

2V7 3V 3V3 3V6 3V9 4V3 4V7 5V1 5V6 6V2 6V8 7V5 6V2 9V1 10V 11V 12V 13V 15V 18V 20V 24V 27V 30V

THERMISTORS

VA1040	0.23
VA1056S	0.23
VA1104	0.70
VAT8650	0.46
VA1097	0.25

BATTERIES

7V Power Mike batteries TR175 £2.25 ea other prices on request

LINE OUTPUT TRANSFORMERS

DECCA 100	7.95
DECCA 1700 MONO	9.95
DECCA 1730	6.95
DECCA 2230	8.25
GEC 2040	6.95
GRUNDIG 1500	15.45
GRUNDIG 5010-6010 2222, 5011-6011	13.45
ITT CVC20	8.20
ITT CVC30	8.25
PHILIPS G8	6.50
PHILIPS G9	8.95
PHILIPS G11	13.39
PYE 725	10.95
RBM T20A	12.40
TANDBERGE 90	11.15
TELEFUNKEN 711A	11.15
THORN 1590	9.50
THORN 8000	9.20
THORN 9000	9.95
THORN 9800	22.40
THORN MAINS TRANSFORMER 3000/3500	9.70

SOLDERING EQUIPMENT

25W Antex Iron	4.50
Weller Instant Heat Gun	11.30
240V Weller Marsman	4.74
1/2 Kilo Solder 60/40	6.95

EHT MULTIPLIERS

ITT CVC20	6.35
ITT CVC30	6.35
PHILIPS G8 550	6.96
RANK T20A	6.91
THORN 3000/3500	7.57
THORN 8500	6.50
THORN 9000	8.00
UNIVERSAL TRIPLER	5.45

REPLACEMENT ELECTROLYTIC CAPACITORS

DECCA 30 (400-400/350V)	2.85
DECCA 80/100 (400/350V)	2.99
DECCA 1700 (200-200-400-350V)	3.55
GEC 2110 (600/300V)	2.25
ITT CVC20 (220/400V)	1.20
PHILIPS G8 (600/300V)	2.25
PHILIPS G9 (2200/63V)	1.19
PHILIPS G11 (470/250V)	2.35

POTENTIOMETERS

STANDARD VERTICAL POTS	0.12
MIN. VERTICAL POTS	0.12
STANDARD HORIZONTAL POTS	0.12
MIN. HORIZONTAL POTS	0.12
CONVERGENCE PRE-SETS	0.30
SLIDERS LOG	0.48
SLIDER LINEAR	0.48

SPARES & AIDS

FOAM CLEANSER	0.79
FREEZE IT	0.82
SOLDA MOP	0.64
SWITCH CLEANER	0.79
WD40	1.25
PUSH PUSH MAINS SWITCH (DECCA, GEC, RANK, THORN ETC)	1.02
PYE IF GAIN MODULE	6.99
ANODE CAP (27KV)	0.69

PUSH BUTTON UNITS

DECCA, ITT, CVC20 6 WAY	7.95
ITT CVC5 7 WAY	10.19
PHILIPS G8 (550) 6 WAY	14.49

VARICAP TUNERS

ELC1043/05 MULLARD	8.65
ELC1043/06 MULLARD	8.65
U321	8.25
U322	8.25

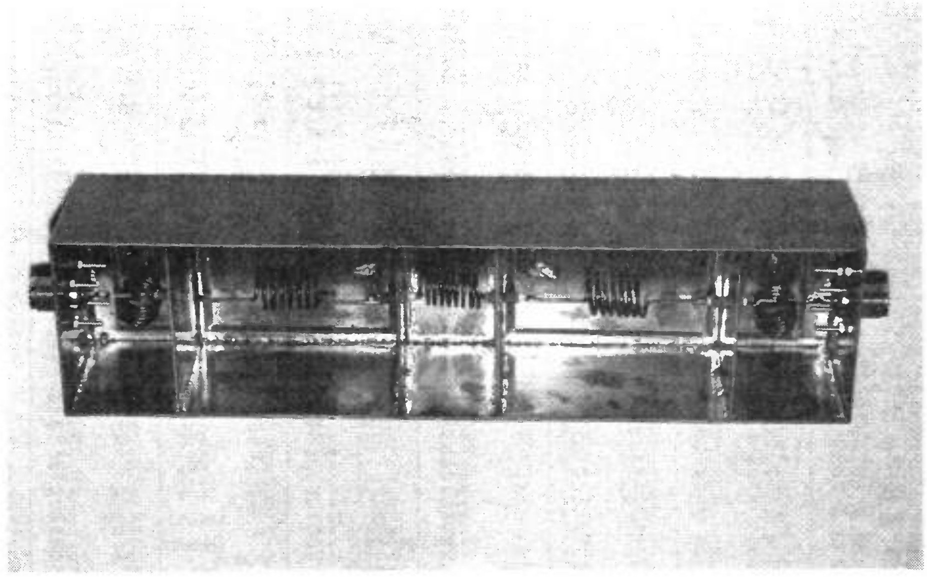
20MM ANTI SURGE FUSES

100MA-800MA	15p each
1A-5AMP	12p each

20MM QUICK BLOW FUSES

100MA	5p each
200MA-5AMP	5p each

LOW-PASS FILTER



Construct this low-cost high power unit designed and built by Duncan Walters G4DFV

The radiation of unwanted harmonics contained within the output spectra from amateur radio transmitters is undesirable in the extreme; the problems range from the potential hazard of interference to other services, to the important fact that it constitutes an offence under the terms of the amateur licence.

Very thoughtful design with circuits, layouts and on-board filtering as well as stringent test limits are employed in modern manufacturing techniques associated with radio transmitting equipment. However thorough these precautions are, in practice total elimination of these frequencies is impossible; but such steps that are taken *are* necessary to ensure that the final radiated signals contain only the minimum levels of unwanted frequencies, keeping them well below the levels of the output so as to be insignificant for all practical purposes.

Where home construction is used, however, unless exceptional care is taken over such areas the levels of unwanted frequencies finding their way through to the output may be of much higher orders than desired. This is especially true if great attention has not been paid to such likely areas as supply rail de-couplings, correct termination of impedance-dependent devices, inter-stage bandpass filtering and couplings, output filtering in oscillators and mixers, phase locked loop frequency synthesisers, and any other suspect circuitry which is apt to generate more than the desired frequencies.

Output filtering should be fitted as standard, especially if the design of the power amplifier is of the wideband type featured in modern circuit design manuals. Any stages dealing with medium to high levels of signal should be operated well within the limits of the devices employed. Such circuits as buffer amplifiers, high level mixers, drivers and power amplifiers should be operated well within the specifications of the devices used and *not* pushed beyond working limits or overdriven; minimum drive levels consistent with required output, to keep such devices within their operating limits, greatly reduce the probability of the generation of harmonics and spurii.

Still present

Having said all this, unwanted signals may still be present at high enough levels to cause problems since they are being radiated from the antenna system, whether the gear is commercial or homebrew, well designed or not. Incorrect resonance of part or all of the antenna system can generate harmonics or other odd frequencies, or exaggerate a normally lower level signal to such an extent that it becomes troublesome. In these cases normal procedures of finding a cure can prove fruitless, so alternative approaches have to be sought.

Getting back to the production of harmonics within the equipment, many non-linear elements such as semiconductor junctions can, under certain conditions, generate unwanted harmonics. One area where they are subjected to the right kind of excitation is as diodes in the circuit of the SWR meter, a common enough measuring instrument in amateur stations.

Using an ATU (antenna tuning unit) in conjunction with antenna systems does afford some frequency-selectivity and reduction in unwanted radiation, but if the output is coupled directly to the antenna, any SWR meter-generated harmonics *will* be radiated.

Output filtering

Various methods are available by which the attenuation of undesirable radiations is acheived by inserting a filter of one form or another between the transmitter output and the antenna system, or between the SWR meter and the antenna system. If the latter method is adopted, it has the merit that it will attenuate any signals generated by the diodes in the SWR meter as well as any emanating from the transmitter.

An ideal type of filter to use would be one which allowed only the frequency required to be radiated through, and which attenuated all others. This would be perfect but for one problem: if it was decided to alter the output frequency of the transmitter at any time, then at once it would become necessary to change the filter in order to allow the new frequency to pass. This would prove an awkward and tiresome task each time a new frequency was selected.

Filters using this general idea are utilised, but are usually tailored to exhibit wider bandwidths, each type being entirely stylised for a particular application. These types of filters are known as bandpass filters, for, as the name implies, they pass only their designated band of frequencies whilst attenuating all others.

Low-pass filters

The use of bandpass filters has much to commend it, and they are fine in situations where transmitters are destined to be operated on one band only. If multi-band operation is desired, the awkward situation arises where it becomes necessary to change filters with each change of band.

To overcome this annoying problem, and to fill the gap between having a filter as previously described or not having one at all, a type designed to pass all the transmitter frequencies but attenuate all higher frequencies would be a more realistic approach. It would attenuate those unwanted radiations whose frequencies fell within the most domestically monitored bands, namely the VHF radio broadcast band (88 to 108MHz) and the UHF television band (470 to 854MHz), as well as the VHF and UHF amateur bands and all other frequencies in this part of the spectrum. This type is known as the low-pass filter.

If the HF amateur station is capable of being operated on all bands from 160 to 10 metres, then it would be useful to have a filter to attenuate all frequencies above 30MHz. Filters of this type are available commercially, and vary greatly in performance, power handling capacity and price. Some of the cheaper commercial models available are designed for quite low power, such as the CB low-pass filter models. These are alright if QRP is the main hobby.

The more robust, higher power handling models are usually much more expensive, however. So the prospective filter purchaser is faced with two alternatives; a) to obtain a cheap model and run the risk of damage to the transmitter if it breaks down through its inability to withstand the power level being used, or b) to fork out some tens of pounds on a more suitable but far more expensive type.

Home-brew

The only other possibility is to home-brew a filter. The thought of trying to obtain the hard to come by values of high voltage working capacitors required for a design capable of enduring full power input might deter some people. However, with a straightforward, no-nonsense, practical filter design and sufficient details for construction, an effective working filter can be produced which is capable of performance and power handling comparable to expensive models, but at a mere fraction of the cost, and with no worries about the high voltage capacitance.

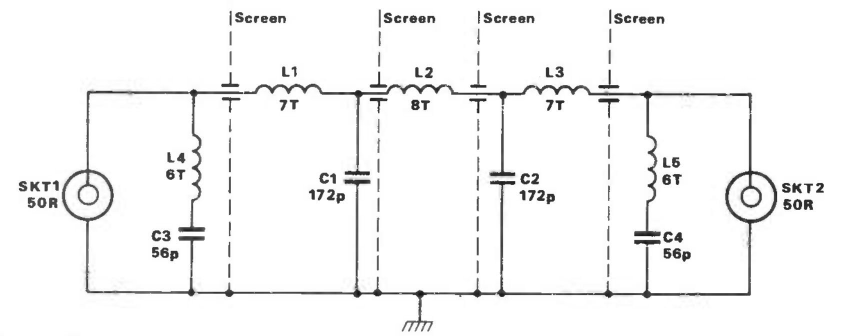


Fig 1a Circuit diagram

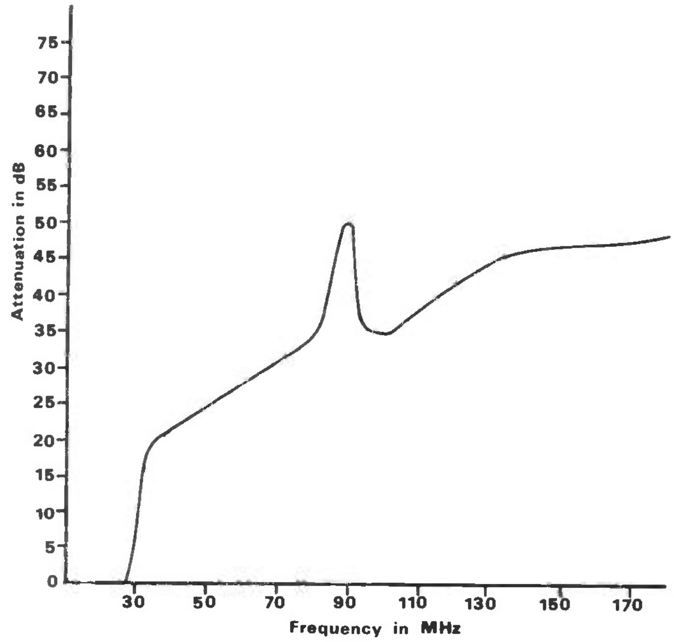


Fig 1b Attenuation/frequency graph

The filter

A matching impedance of 50 ohms has been chosen as it appears to be possibly one of the most commonly used in transceiver designs in recent years.

To overcome the difficulty in obtaining the necessary high voltage capacitors required in the design of a low-pass filter which is to withstand not just the normal levels of power during minimum reflected VSWR situations, but also the likelihood of excessive voltages in instances of mismatch, this design puts the normally undesirable capacitance effects of double-sided printed circuit board to good use. All four capacitors in the filter circuit are made using this technique.

Printed circuit board is usually available in quite useful 'offcut' sizes suitable for the home constructor, which are sold fairly cheaply on the component stalls at radio rallies, but of course it can be obtained from dealers. It comes in a variety of thicknesses and board materials, the two commonest being glass fibre reinforced polyester resin and synthetic resin bonded paper (SRBP).

Glass fibre board is used in this design due to its superior mechanical strength and better electrical insulation properties. The only critical factors involved are the thickness of the material and the surface area of the capacitor plates. The thickness of the board used for the capacitor plate panel in the prototype filter was 1.5mm, inclusive of the two copper foils. This had a capacitance of approximately 3.72pF per square cm (24pF per square inch).

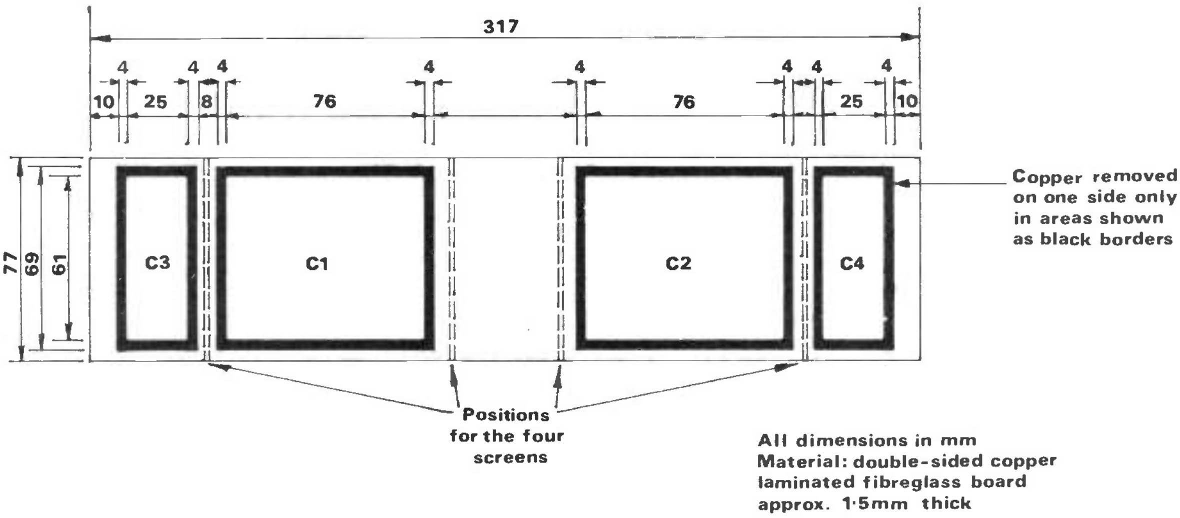


Fig 2 *Details of capacitor plate panel*

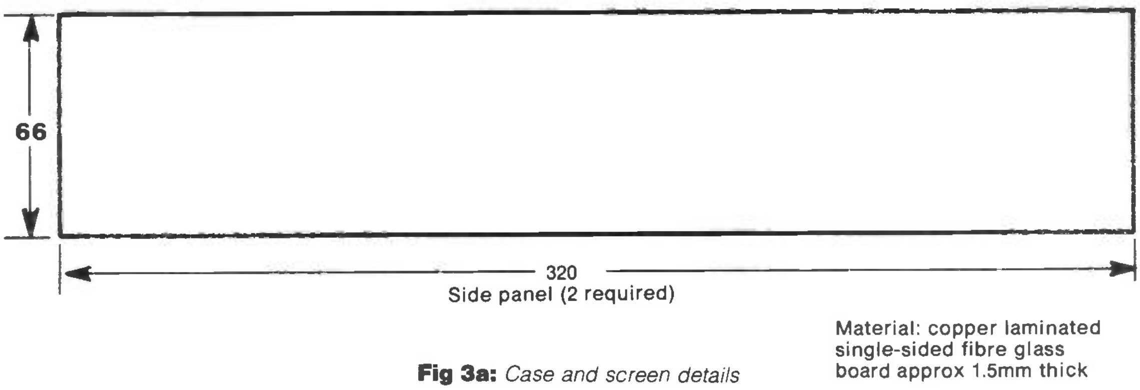
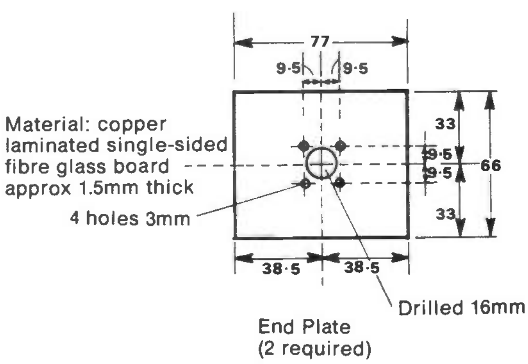


Fig 3a: *Case and screen details*



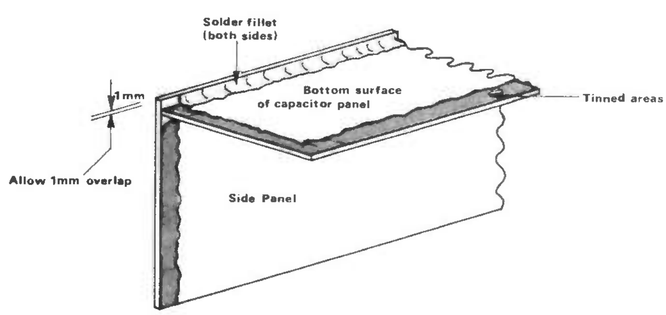
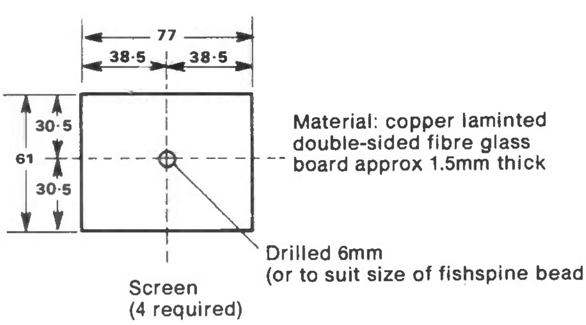


Fig 3b: *Joining side and capacitor panels*



Capacitors

With reference to *Figure 2*, it can be seen that four plates are required on one side only of a piece of the double-sided board measuring 317 by 77mm. The reverse side is left untouched. This forms the 'earthy' side of the four-capacitor common plate.

After the blank board has been cut to the size specified, mark out the border areas carefully, ensuring correct dimensions. Double check the dimensions, then using a sharp scribing instrument score the lines deeper into the copper surface. Note that all the borders need to be 4mm wide.

Now the copper foil must be removed from the borders to isolate the capacitor plates. Using a very sharp utility knife (a 'Stanley' knife is ideal) with a straight blade, carefully cut along the previously scored lines several times until a tell-tale white powdery substance begins to show through the cuts. This is the surface of the glass fibre 'dielectric' being scored by the knife blade, and signifies that the copper has been breached. Special attention should be paid in the corners of the borders where the lines meet. Ensure that the copper is well cut through at these points.

Using the point of the blade, carefully lift up one corner of the foil and slowly peel back. Once a small strip has been lifted pull slowly with the finger and thumb until it has all been peeled away. If the foil tears at any time simply reinsert the blade underneath and start again.

Once all the borders have been removed in this way, the board should be well cleaned on both sides using a mixture of scouring powder and water until the copper is polished clean. The board should then be thoroughly dried and set aside.

The case of the prototype filter was made using four pieces of single-sided circuit board, but only because the material was to hand. There is no reason why the case and the four internal screens could not be fabricated from tinplate. Aluminium is not recommended as it is necessary to be able to solder to the case material without difficulty. *Figure 3a* gives the details of the component parts for the case and screens.

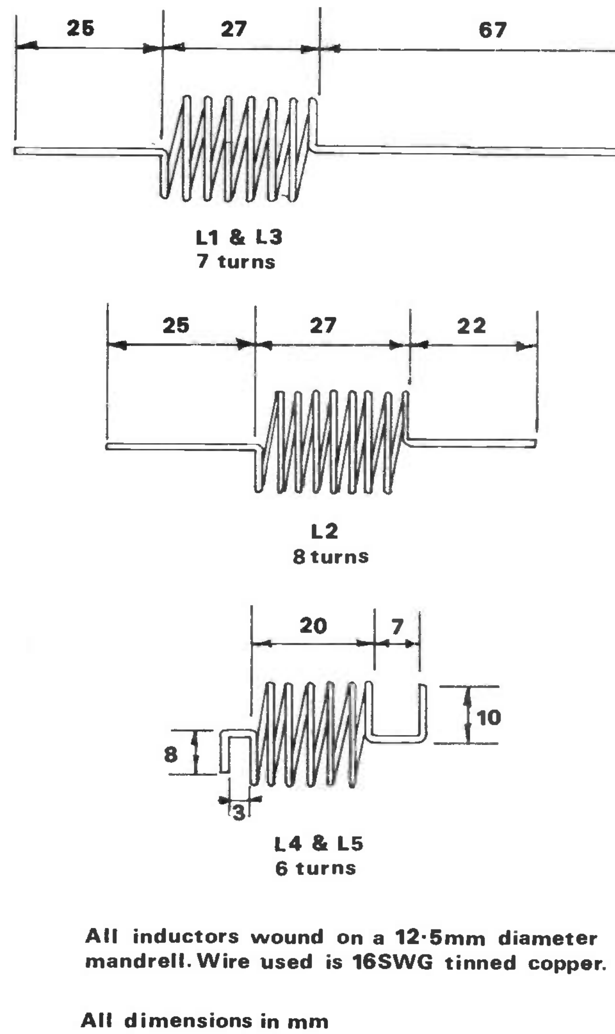


Fig 4 *Inductor winding details*

Tinning

Once all the parts have been made they must undergo a similar cleaning operation to the capacitor panel, using water and scouring powder once more followed by thorough drying.

A medium to high power soldering iron is required for the next part of the procedure. One of 25 watts or more should be suitable, a chisel shaped bit being preferable to a pointed pencil shaped bit.

Each section of the case, the four screens and the capacitor panel must now be tinned to give a 5mm wide border around the perimeter of each piece. Both sides of the double-sided capacitor panel must be treated in this way. The areas where the screens will later be joined to the capacitor panel top surface and the side panels must also be tinned accordingly.

The technique of joining up the sections is easily explained. Using the capacitor panel as the bottom of the case, the side panels and the end panels are fitted around it. The screens are then slotted into the case in their appointed places.

Wherever a copper surface meets another at right angles, a soldered 'fillet' joint must be made.

Although it sounds easy, one or two snags can be overcome by assembling the case in the proper order. The best way to construct the case is itemised below:

(a) Join one side panel to the capacitor panel so that both copper foils on the capacitor panel are joined to the side panel (*Figure 3b*). Ensure that they join at right angles.
(b) Repeat the procedure with the other side panel.
(c) Join the two end plates to the ends of the capacitor panel in a similar way.
(d) Close up the corner seams and solder.
(e) Slide the two outermost screens into position and solder all three areas on both sides (the two remaining screens will be fitted later).

The two SO-239 sockets can now be fitted into the holes in the end plates.

Coil construction

Full details of the inductors L1 to L4 are given in *Figure 4*, so it is only necessary to mention here that the critical points are to ensure correct size wire, number of turns, length and diameter of the coils. Any diversion from the dimensions given will result in variation from the desired performance.

Final construction

After all four inductors have been produced and checked for correct size etc, they can be assembled into the filter as explained below:

(a) Select L2 (the centre inductor) and the two remaining screen sections. Four of the fish-spine beads and two short lengths of sleeving are also required. Fix one of the screens into position and solder. Slide two fish-spine beads onto each of the leads of L2 and then slide the two pieces of sleeving over the beads. Feed one end of L2 through the central hole in the recently fitted screen. Slide the other screen into position, locating the free end of L2 through the hole in the centre, and solder the screen into place. L2 should be held in position by the two screens.

(b) Taking L1 or L3 (it does not matter which), slide two fish-spine beads over the longest lead. Slide a piece of sleeving over the beads. Insert the coil lead through the central hole in one of the outermost screens, ensuring the beads and sleeving stay located in the hole, and locate the end of this lead into the open-ended central tag of the SO-239 socket. Solder the lead into the socket at this point. Leave the other end loose for the time being. Repeat the procedure with the other inductor, L1 or L3.

(c) Take either L4 or L5, and position it so that the largest 'U' bent lead is facing downwards. Locate this coil in one of the end compartments of the case above its corresponding capacitor plate, C4 or C3. Position the coil so that the lower lead touches the capacitor plate and solder them together. The other lead should touch the lead running horizontally to the SO-239 socket. Solder and join these leads at this point. Repeat the procedure with the other coil.

(d) Taking two pieces of the 16swg tinned copper wire, solder these to the C1 and C2 capacitor plates a short distance away from the innermost screens (as shown in *Figure 5*). Cut the leads long enough to join up with the leads from L2. At these points join all three wires at both sides.

(e) Remove any loose pieces of wire, and ensure that the fish-spine beads and sleeving are still in place in all the holes of the screens. Check all soldered joints are sound and not 'dry'. Construction is now complete.

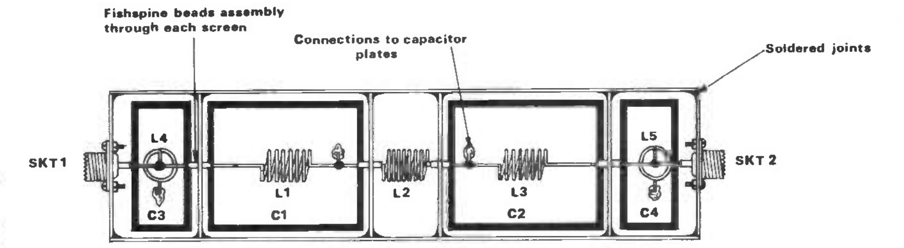


***Fig 5** Inside view of the completed filter*

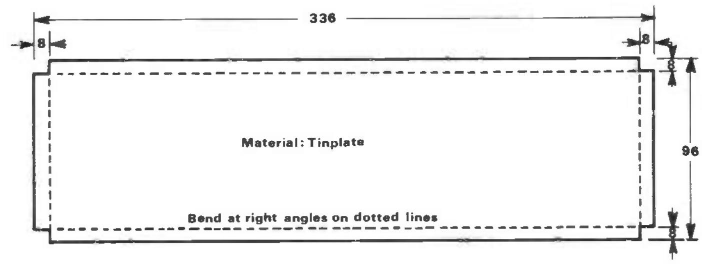


***Fig 6** Details of a suitable lid*

COMPONENTS LIST

Inductors

L1, L3	7 turns, winding length 27mm, 12.5mm dia with leads 67mm and 25mm, 16swg tinned copper wire.
L4, L5	6 turns, winding length 20mm, 12.5mm dia with leads 17mm and 11mm, 16swg tinned copper wire (leads to be formed as in *Figure 4*).
L2	8 turns, winding length 27mm, 12.5mm dia with leads 22mm and 25mm, 16swg tinned copper wire.

Capacitors

C1, C2 172pF formed by a capacitor plate 76mm x 61mm on capacitor panel.
C3, C4 56pF formed by a capacitor plate 25mm x 61mm on capacitor panel.

Capacitor plate material – one piece of double-sided glass fibre copper laminate board of 317mm x 77mm. Critical overall thickness must be 1.5mm ± 0.05mm.

Miscellaneous

Skt 1, 2 SO-239 type sockets, chassis mounting 4-hole fixing.

8 off	6BA x ½in cheese-head screws plus washers and nuts.
8 off	ceramic 'fish-spine' beads or other similar insulated feedthrough material (fish-spine beads are used for supporting high power wirewound resistor off the surface of PC boards). *Holes in centre of beads must be large enough for the 16swg wire.*
4 off	pieces of sleeving, approximately 10mm long, to slide-fit over the fish-spine beads.

Sufficient single-sided glass fibre copper laminate board for the two side panels and two end plates, thickness not critical. Sufficient double-sided material for the 4 internal screens, thickness not critical (alternatively, tinplate can be utilised for these panels, plates and screens). Suitable size tinplate for lid.

A suitable lid can be fabricated from tinplate. An 8mm lip should be formed around the edges to hold it in place on top of the filter (see *Figure 6* for details).

Conclusion

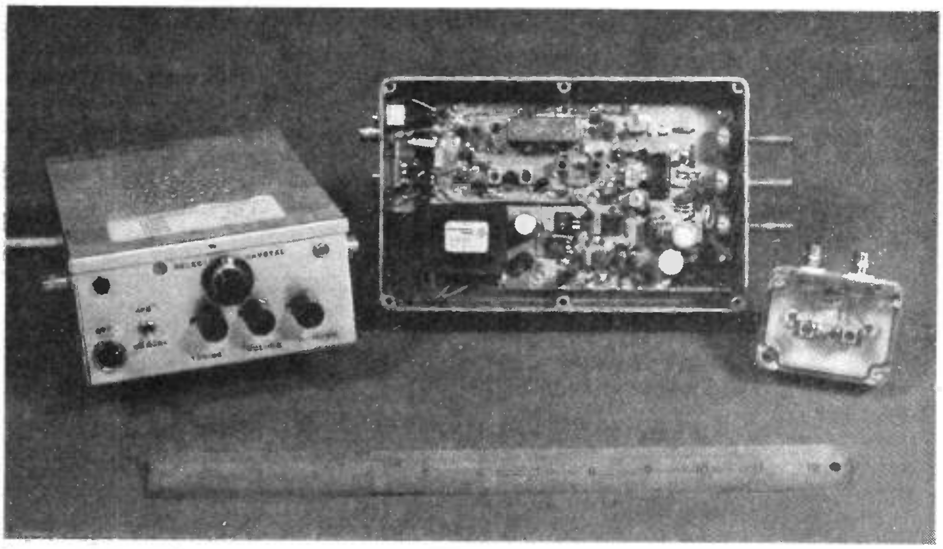
After checking through the filter with a multimeter (set to a high ohms range) for any short circuits or leakage between the centre conductor of one socket and ground, check the filter from the other socket in the same manner. If no reading is obtained during either test, then all is OK.

Switching to a lower range, check between the two centre conductors of the socket. This should show a virtual short, which is the correct reading.

All that needs to be done now is to connect the filter into a 50ohms impedance line between the SWR meter and antenna or between the SWR meter and ATU, and provided it has been built correctly it should function. If the fish-spine beads tend to be too loose and move along the leads, a small blob of solder will keep them in place.

RUSSIAN ☆ SATELLITES

A guide to the reception and decoding of VHF signals from the USSR's navigation satellites: PART TWO: The complete receive system explained



by P Daly, D Bell, M Leybourne
Department of Electrical and Electronic Engineering
University of Leeds
and
P A Pitts
University Television Service
University of Leeds

4. RECEIVE CHAIN HARDWARE

4.1 Radio-frequency to baseband

As described in the introduction, present satellite navigation systems transmit at both 150 and 400MHz, although the Soviet satellites only modulate the lower-frequency carrier.

The receive chain was specifically designed to handle transmissions at or around 150MHz, providing decoded outputs and the capability to carry out measurements on receive signal characteristics.

The reader is referred to *Figure 2* for a block diagram of the VHF receiving equipment, with input at 150MHz and approximate level -95dBm, and output at baseband consisting of the three tones at maximum level 0.7V.

The front-end uses two dual-gate MosFETs (type 3SK88), the first acting as a low-noise moderate-gain pre-amplifier and the second as the first mixer stage with output at 10.7MHz.

Filtering at radio frequency is accomplished immediately prior to the first mixer stage, using a triple-chamber helical filter originally designed for the amateur band at 144MHz but modified to a new centre frequency of 150MHz.

The first local oscillator is crystal-controlled and followed by two tripling stages before mixing. Since the intermediate frequency (IF) is 10.7MHz, the crystal frequency is close to 15.5MHz.

Owing to the fact that the Cosmos navigation satellites transmit at several VHF frequencies around 150MHz, provision has to be made in the receiver either for multi-channel operation by means of dedicated crystals at each nominal frequency, or for automatic frequency control (AFC) covering the entire band of transmission frequencies.

Although AFC is available, the degree of control at one frequency is only sufficient to cover the maximum Doppler frequency swing of around 6KHz.

Coverage of the entire range of frequencies, which is 120KHz, can be achieved with single crystal control if the frequency can be pulled down by means of an external series inductor. This form of control, of course, is manual and must be set immediately prior to reception.

Another alternative is to limit reception to the satellites with identification numbers 11-14, which all transmit at the same nominal frequency of 150MHz.

The first IF signal at centre frequency of 10.7MHz is filtered through a ceramic bandpass filter of bandwidth 15KHz.

A second mixing stage, also crystal-controlled, follows with output at 455KHz, limited to 12KHz bandwidth by means of a ceramic filter.

Finally the second amplification stage is followed by AM detection.

Three outputs are provided:

(1) an AFC output to the voltage-controlled first oscillator;

(2) an audio frequency output for further amplification and loudspeaker monitoring;

(3) a levelled output for further signal processing in the synchronisa-

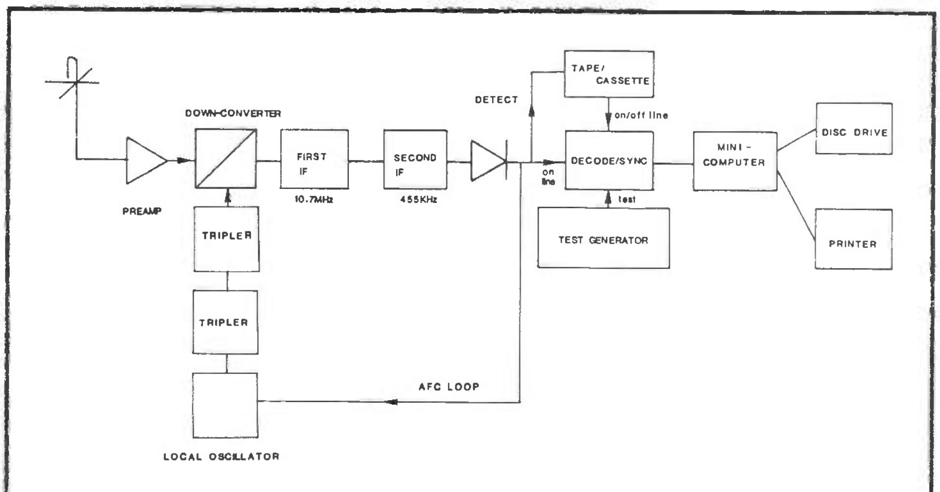


Fig 2 *Block diagram of Cosmos satellite signal receiver system*

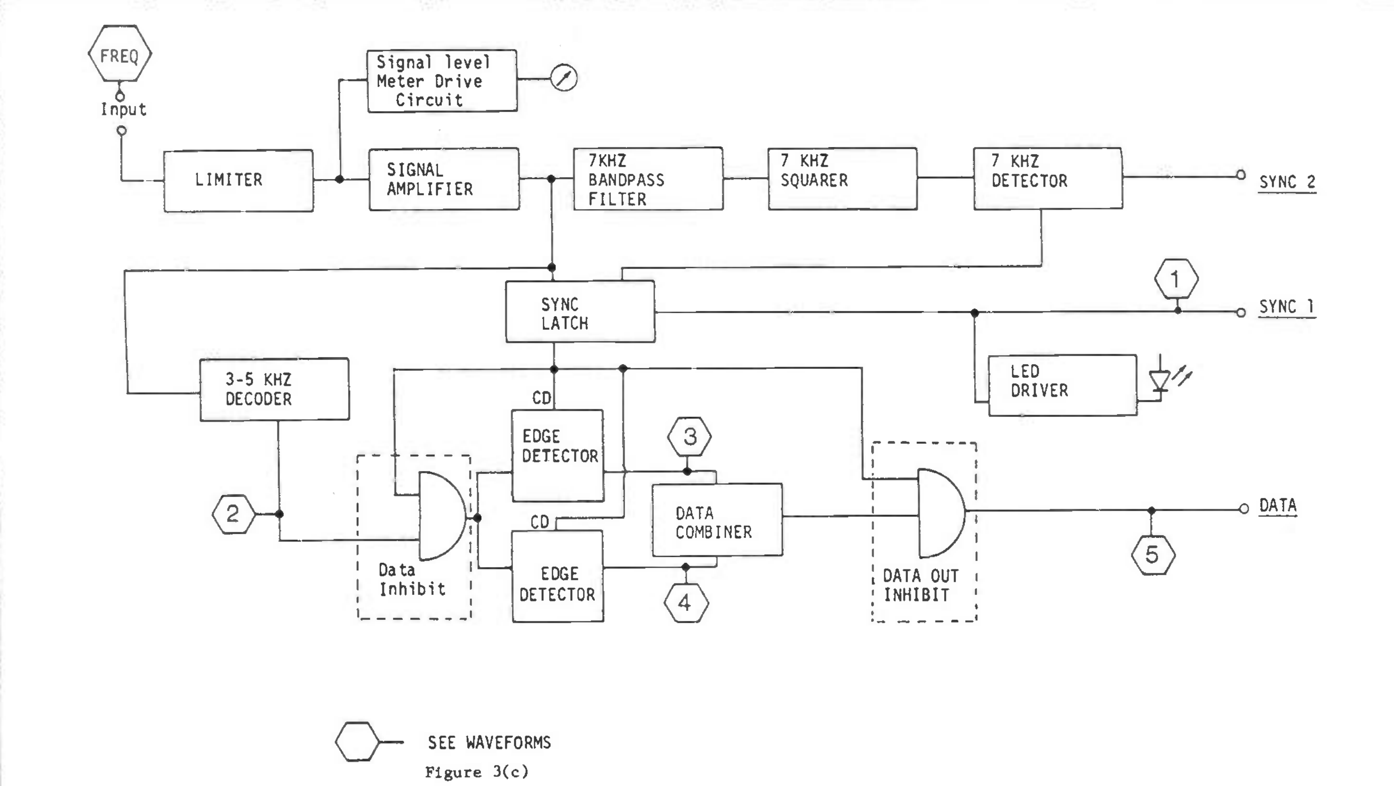


Fig 3a *Block diagram of synchronisation/decoder unit*

tion/decoder unit.

The overall performance of the receiver produces a noise figure of around 1.5dB.

4.2 Synchronisation/decoder unit

The essential function of the synchronisation/decoder unit is to condition the input signal so as to provide an isolated synchronisation tone every second, and a data line with differentially decoded binary information.

The following brief description of the circuit implementation to produce the necessary outputs refers to *Figures 3(a), (b)* and *(c)*.

These show, respectively, a block diagram *(a)* and circuit diagram *(b)* of the signal conditioner, and a typical waveform display *(c)* at critical points in the receive chain – numbered 1-5.

The input from the receiver or tape recorder consists of one of three tones at 3, 5 or 7KHz within a signal bandwidth of 15KHz.

With reference to *Figure 3*, the signal is fed to a limiter formed by IC1, whose role is to compensate for signal level fluctuations.

The output level, which at this stage is only 600mV, is increased using an amplifier (IC2) whose voltage gain is variable between 5.5 and 15.5.

The signal path splits at this stage, one path leading to the synchronisation decoder and the other to the data decoder.

4.2.1 Synchronisation unit

The signal from the amplifier leads to a bandpass filter (IC3,4) centred at 7KHz so as to remove the data tones, allowing the sync pulses to appear at the input of a levelling amplifier (IC5) whose role is to re-invert the signal at a fixed output reference level.

A squaring operation follows (IC6), with a diode-resistor combination unit designed to prevent false triggering on noise impulses.

The HEX inverter (IC7a) produces a sharply-defined triggering edge in the 7KHz waveform, from which any remaining fast spikes have been removed in the low-pass input RC filter.

At this stage the squarewave at 7KHz is used to trigger a monostable timing device (IC8a) and to provide the clock input to a D-type flip-flop (IC9a).

If the triggering pulses at the B input to the monostable arrive at a rate faster than its reset time, the monostable will remain permanently on, with the result that the output Q will also remain high. Since the input frequency is 7KHz and the monostable will reset after an interval corresponding to a period at 6KHz, this condition is met.

In addition to the high output from the monostable, both the D and clock lines on the D-type flip-flop also remain high.

On the removal of the tone at 7KHz the monostable resets to zero, thus setting the CLR line and Q output of the flip-flop to zero. This output will remain off until the arrival of an input to the monostable at a frequency exceeding 6KHz.

In consequence, an output pulse is produced (sync 2) at TTL levels lasting as long as the 7KHz input pulse.

The sync latch (IC10a,b) provides an inverted sync output (sync 1) and, in conjunction with a clamped version of the input, a drive to an LED for visual indication of synchronisation.

The second sync output (waveform 1, *Figure 3)* is also used to provide a data inhibit to the data decoder as long as the sync pulse lasts.

4.2.2 Data decoding

Returning to the point where the signal path divides, the data line is fed via a diode limiter to a HEX inverter (IC7b) which clamps the signal to TTL levels.

A second inverter (IC7c) is followed by the data decoder circuit formed by a monostable (IC8b) and D-type flip-flop (IC9b), which function exactly as in the sync unit except that the monostable timing is set to 4KHz rather than 6KHz.

The reason for this change is, of course, to differentiate between the two data tones at 3 and 5KHz. The output of this circuit will, as a result, consist of a '1' when the input frequency is above 4KHz and a '0' when below 4KHz.

For a typical data sequence as shown in *Figure 3(c)*, the output of the monostable (waveform 2) is 'on' or 'off' depending on the presence of pulses at 5 or 3KHz.

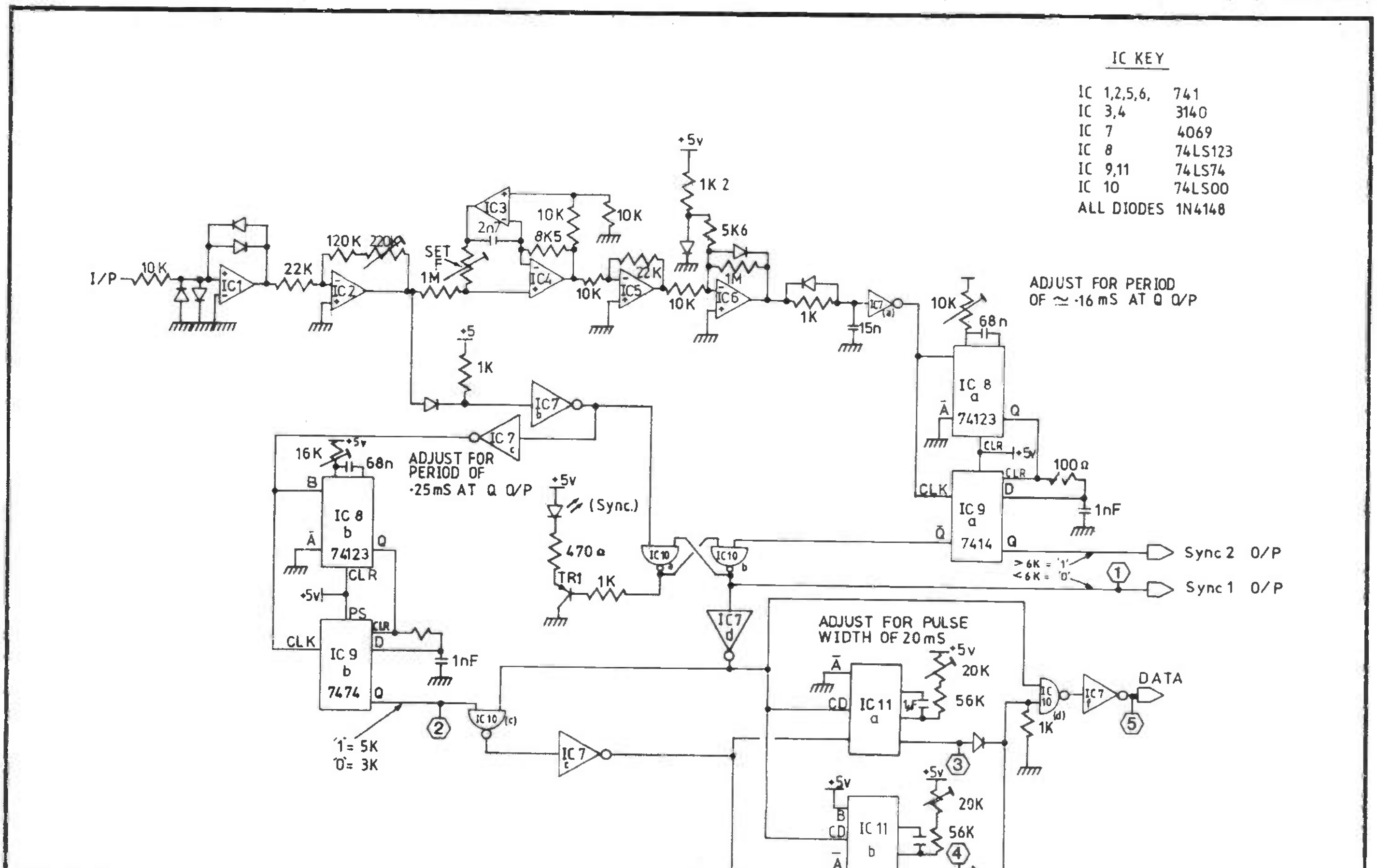


Fig 3b Circuit diagram of synchronisation/decoder unit

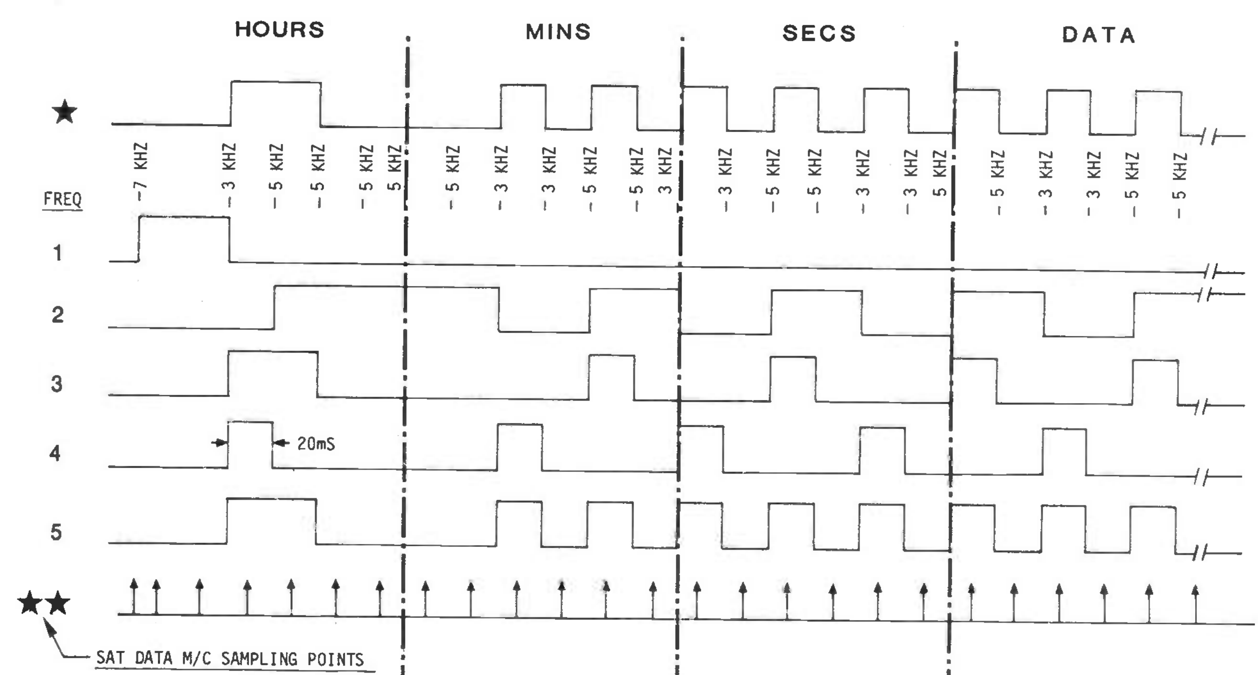
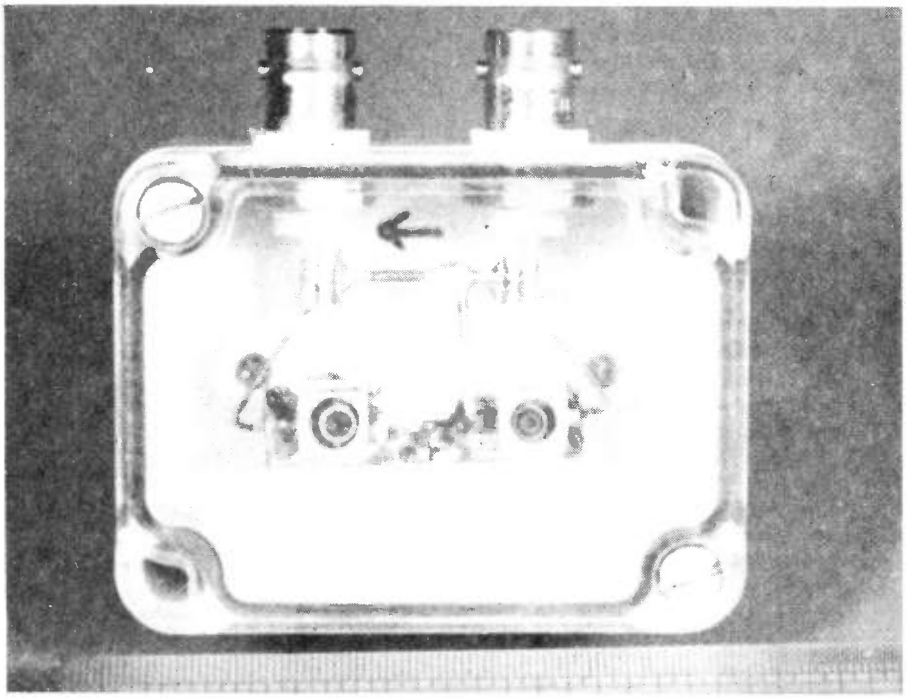
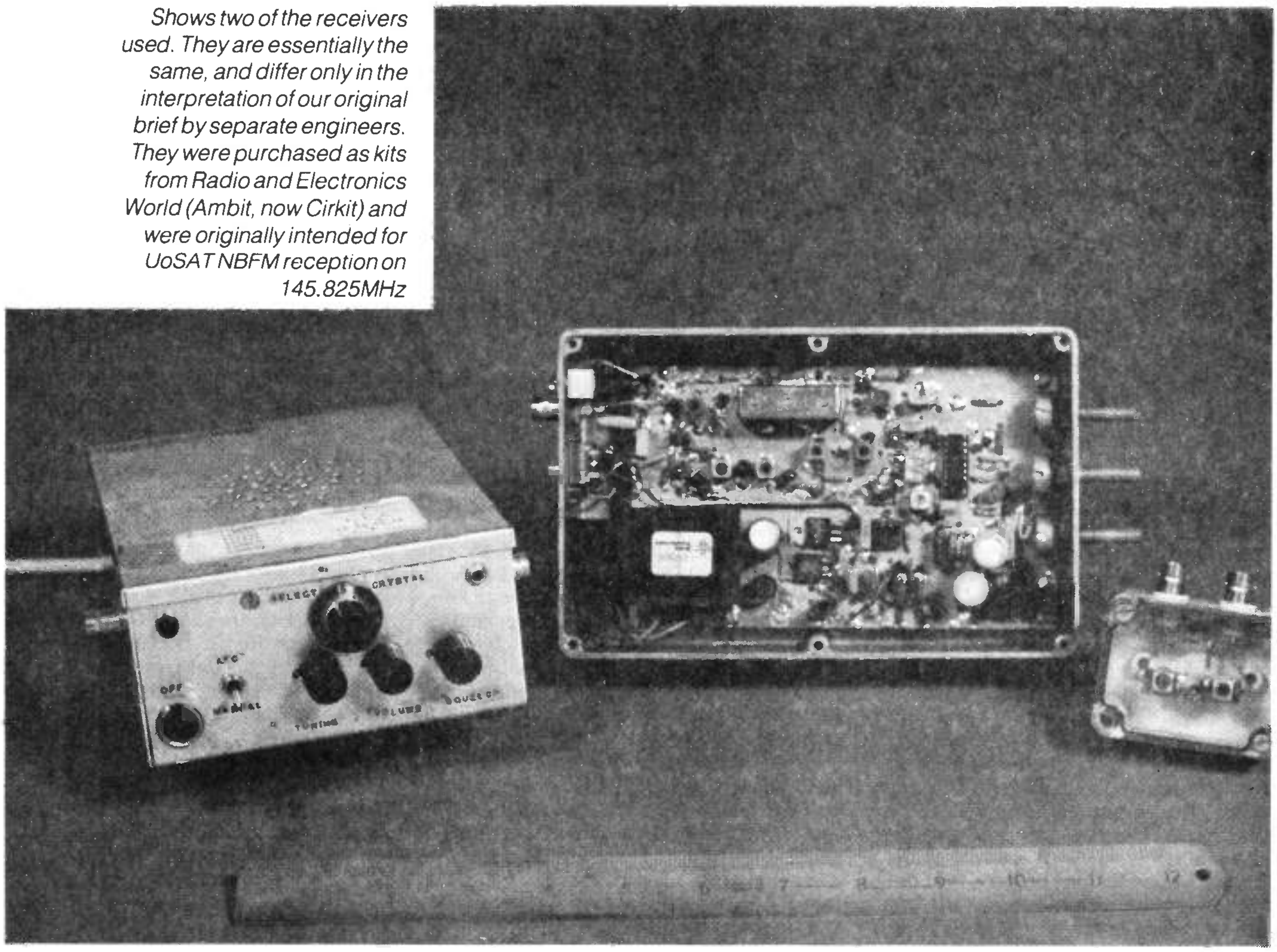


Fig 3c Typical waveforms at critical points

Shows the 150MHz antenna pre-amp in its weatherproof enclosure. It provides 20dB gain, and is placed about 6ft from the crossed dipoles so as to prevent 'howl round'. Its 10mA of dc supply current is fed via the centre conductor of the co-ax cable and a couple of RF chokes from the receiver



Shows two of the receivers used. They are essentially the same, and differ only in the interpretation of our original brief by separate engineers. They were purchased as kits from Radio and Electronics World (Ambit, now Cirkit) and were originally intended for UoSAT NBFM reception on 145.825MHz



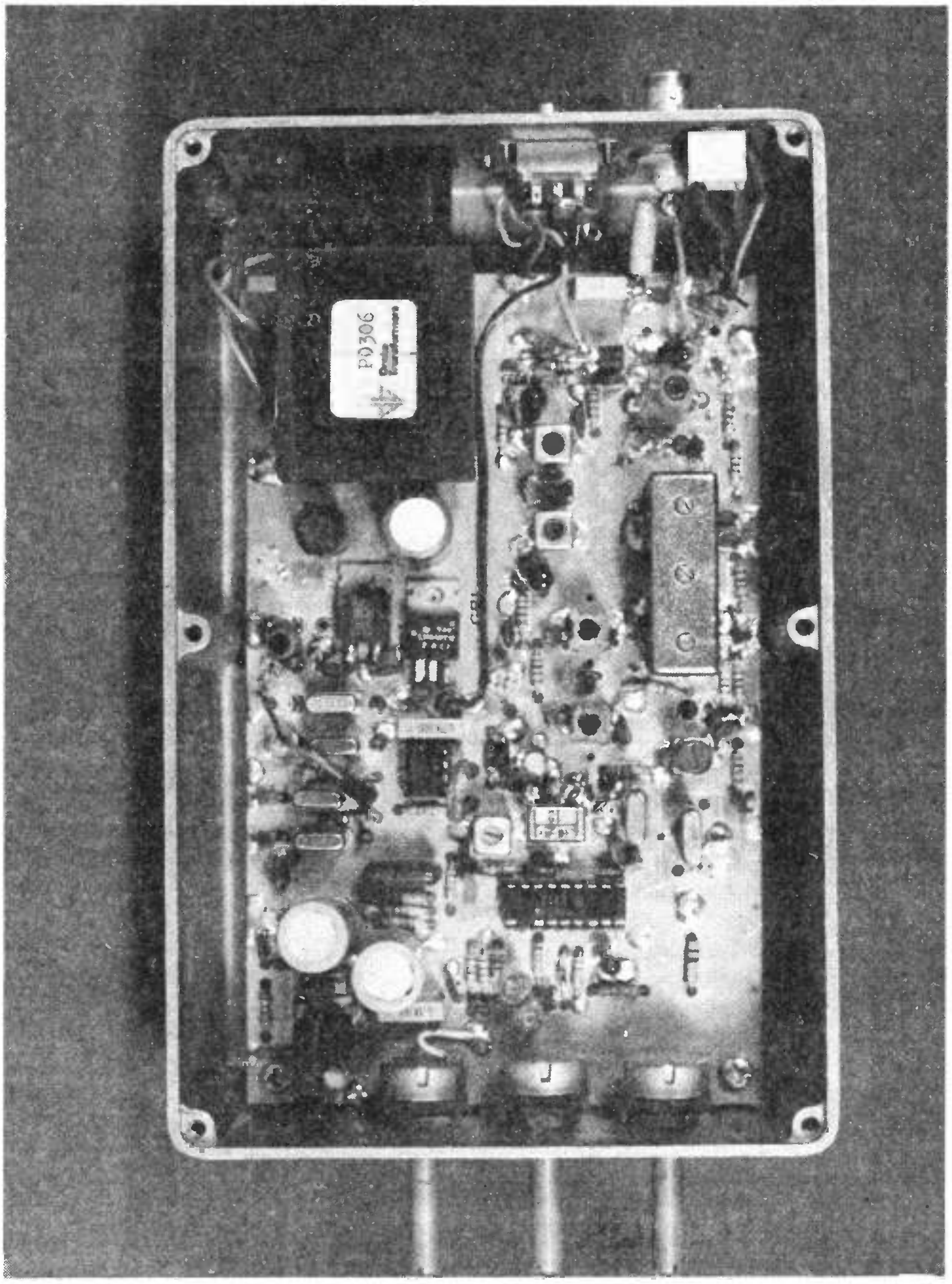
Shows one receiver in close-up. The BNC connector at top right is the antenna input.

The modifications to the original receiver are as follows:-

Dc from the 12V regulator is routed via the central wire, through a switch and on to the decoupled end of the choke. The triple chamber helical filter has been dismantled and one and a half turns removed from the free end of each helix. This is not as difficult as it sounds and offers an ideal opportunity to see just how the adjustment screws work. After re-assembly tune the filter to 150MHz using a progressively weaker signal. It will be found that the input and output helixes have a more marked resonant peak than the centre one.

This particular receiver has an additional regulator (5V) for a LCD frequency counter that plugs into the DIN socket, near the slide switch. The counter reads crystal frequency which when multiplied by nine and added to the first IF (of 10.7MHz) gives signal frequency.

The original Ambit receiver had provision for six crystals, four of which can be seen near the wire to the left, which is 'patched' to the appropriate crystal. The two at the bottom have series connected varicap diodes for AFC operation. The crystal at the top has a series inductor between it and earth which can 'tune' the whole 'CICADA' band, ie 149.910MHz to 150.030MHz.



The data inhibit line from the sync decoder (mentioned in the previous section) prevents data decoding by blocking (NAND gates 10a,b) both input to and output from the decoder.

In the absence of the sync pulse, the data output is allowed to proceed to a signal edge-detector circuit formed by the dual monostable circuit (IC11a,b).

The pulse width of both monostables is set to the duration of a single data bit (20mS). The monostables are set to detect positive and negative edges (one for each).

It is important to note that the first data bit following the termination of the sync pulse is forced to be a '1' owing to the action of the cleardown (CD) input to the monostables. Since the coding is differential, it is important to fix the first bit so that the differences between this bit and following bits can successfully reproduce the data stream.

The two monostable outputs are shown in *Figure 3(c)* as waveforms 3 and 4, and the effect of initial bit setting and edge detection is clear.

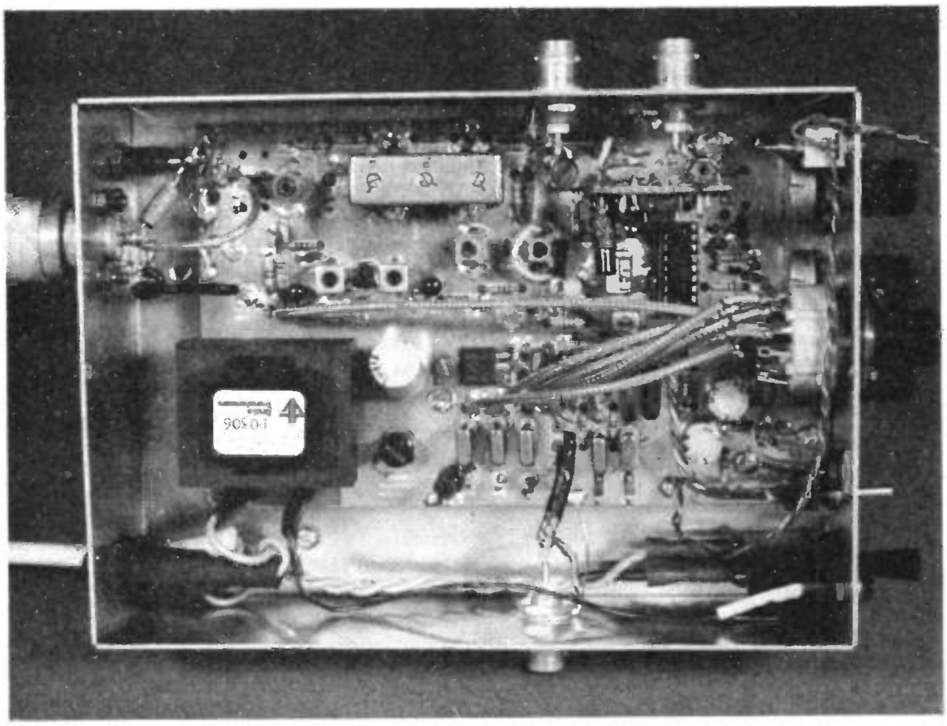
The final stage in this data detection unit results in the two monostable outputs being wire OR'ed together and fed to the computer interface only when the data inhibit is removed. The data is inverted (IC7f) to provide the TTL data input to the computer (see waveform 5 in the figure).

To enable the reader to more easily comprehend the data logging process, the data sampling pulse sequence is also shown in the figure.

Essentially, the detection of the leading edge of the sync pulse is followed by sampling at the centre of the sync/data pulses. In other words, sync pulse detection is followed by a waiting interval of 10mS and then by 49 samples at 20mS intervals.

The final 10mS in the word is used as a delay before receiving the next word.

NEXT MONTH:
The computer operations are outlined, with a note on orbit prediction



Shows the other receiver – notice the loop around the final multiplier for an external frequency counter. The adjacent BNC connector carries buffered 10.7MHz output for alternative demodulation.

This receiver has 5 crystal positions and one VFO input. Notice the 6 position selector switch and associated wiring.

Shows the control panel where the operator can select either AFC or manual tune for any crystal position. Note the reminder sellotaped to the set-top of the 'CICADA' group transmit frequencies.

I hope these pictures will help you visualise the reception side of the hardware. It was my intention to include some of the 'decoder' and PET computer but my colleague has borrowed them. Of particular interest is an off-screen picture that demonstrates the fallibility of the Russian navigation system – it shows satellite ID7's output (received late April 1984) displaying the same positional co-ordinates it has been transmitting since June 1983; it should be updated each Wednesday. Clearly it has gone wrong, like a record struck in a groove and they are unable to switch it off!

LATEST LITERATURE

Clubs, manufacturers, publishers and agents are invited to send details of new books; catalogues, data sheets, etc for inclusion on this page

STEP-BY-STEP KEYBOARDING ON THE PERSONAL COMPUTER

By Steven Radlauer.

This recently published book is intended to give a solid grounding in keyboarding techniques on a computer, with the aim of increasing a user's speed and efficiency with his machine.

Instruction in typing skills and computer operations is followed by exercises to strengthen the newly acquired ability. The subjects covered include word processing techniques, preparation of business correspondence, editing and proof-reading a text etc. There is also a special 'word processing workbook' section.

As well as purely keyboard skills, the book contains an introduction to the words and symbols of BASIC.

Barron's, London, £5.95

AN INTRODUCTION TO Z80 MACHINE CODE

By R A & J W Penfold.

The Z80 (or the faster Z80A) microprocessor forms the heart of many home computers currently available, including the ZX81, the Spectrum, and the new Amstrad CPC464 and Tatung Einstein. Direct programming of this chip, rather than programming with a high level language, allows much faster running of operations.

This increased running speed is the only advantage of machine code programming, however, and for many applications is not worth the extra effort involved, since such programs are harder and take longer to write.

Where machine code programming is deemed necessary a book such as this is invaluable (indeed, vital).

The book begins with an introduction to microprocessors, and assumes no previous knowledge of these devices or of machine code. Assembly language is covered briefly, clearing up the confusion between this and machine code, and compiled languages (as against interpreted languages such as BASIC) are mentioned.

There is a chapter containing example programs, which includes machine-specific listings for some popular home computers (including the ZX81 and Spectrum), and the final chapter is a brief outline of input/output commands for controlling peripheral devices.

This 136 page book provides a clear and easily understood introduction to Z80 machine code, and as such should prove useful to anyone who has a need for the increased speed available when programming this microprocessor directly.

Bernard Babani (Publishing) Ltd, £2.25

HOW TO PASS THE RADIO AMATEURS' EXAM

Edited by George Benbow G3HB.

This large paperback is the first edition of an RSGB handbook aimed at the would-be amateur.

The major part of the book is taken up with nine sample multiple-choice examination papers, grouped together in chapter 5. The previous four chapters give brief outlines and instructions for passing the exam.

The first chapter describes the actual format of the exam, since many people are unfamiliar with the multiple-choice style. This chapter also describes the marking procedure, and compares its suitability with the earlier written exam.

The second chapter deals with the proper approach to a multiple-choice exam with regard to both learning beforehand and actually answering the questions, and gives some very good (and not often seen) advice.

The third chapter covers mathematics for the exam, and considering its brevity covers this subject reasonably well. This book is not, of course, intended as the sole reference text for passing the exam!

Chapter four gives details of where to find RAE courses, and outlines the exam requirements.

This is basically just a book of practice papers with a few important guidelines added (the first four chapters cover only fourteen pages). It is also unsurprising that all the books in the list of recommended reading are RSGB publications!

RSGB Publications, £3.42

MICRO INTERFACING CIRCUITS – BOOK 2

By R A Penfold.

Micro Interfacing Circuits Book 1 covered getting signals into and out of a microcomputer. This follow-up volume concerns 'real-time' interfacing, and treats the subject from a more practical than theoretical viewpoint.

The book is divided into three chapters, which cover audio interfacing, light and temperature, and power control circuits.

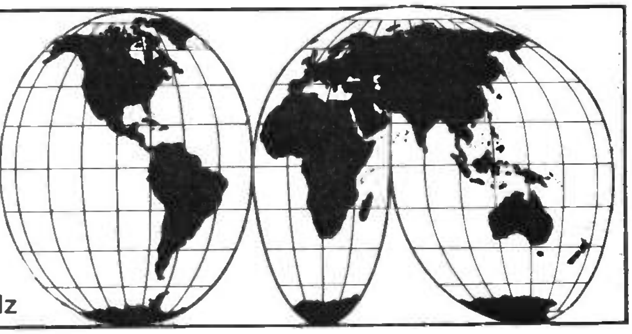
The subjects covered include speech synthesis, D/A converters, and audio switching in the first chapter; LED displays, counter and sensor circuits (including a light pen), and temperature sensing and switching in the second chapter; and unipolar, bipolar and pulsed controllers in the third chapter.

All chapters include practical circuits, with a full description of each, and IC pin-out diagrams are also included. The book is not aimed at beginners, but for many of the circuits an expert knowledge of electronics is not required.

This is very obviously a practical book, for whilst each circuit is described in depth, the coverage of background theory is noticeably sketchy. A more complete description might be appreciated by some, but this said the book certainly succeeds in its intention of providing the knowledgeable enthusiast with some practical applications.

Bernard Babani (Publishing) Ltd, £2.25

SHORT WAVE NEWS FOR DX LISTENERS



By Frank A Baldwin

All times in GMT, **bold** figures indicate the frequency in KHz

Now that the season for reception here in the UK of signals from some of the Indonesian stations is in full swing, some information about these will be of interest to many readers of these columns. Although I have written about this subject in past issues, receipt of a letter from a reader requesting such information now prompts me to bring this matter to the fore.

The broadcasting system in Indonesia is a complex one, and the total number of stations is impossible to estimate. Apart from the inevitable pirate transmitters, there are four types of station in operation, these being: (1) Radio Republik Indonesia (RRI), (2) Radio Pemerintah Daerah Tingat Dua (RPDTD), (3) Forces Radio stations, and (4) private stations (amateurs).

RRI

The stations that interest most of us here in the UK are those in the government owned network of Radio Republik Indonesia (RRI), it being symptomatic of Indonesian and other DXing that the nearer one is located to the country the more types one will succeed in logging. In general RRI transmitters are more often reported in the SWL press of the UK and northern Europe than the remainder of Indonesian-based stations.

RRI Jakarta with the Programa Nasional is the main station of the network, its main function being to provide programmes of national interest and feeding material to the networks of both local and regional transmitters. A fact that can greatly assist UK DXers in identifying these stations is that they must directly relay newscasts from Jakarta, and therefore all Indonesian transmitters included in the network feature these at 2300, 0000, 0500, 0600, 0700, 1200, 1300 and 1500. The latter time is that which concerns us in the UK, as this is the transmission most likely to come through to us here in northern Europe.

The various networks are as follows:

Nusantara 1 (Network satu) caters for Sumatra, the main transmitter being at Medan. The network structure comprises stations based at Banda Aceh, Bengkulu, Bukittinggi, Jambi, Padang, Pangkalpinang, Palembang, Pekanbaru, Sibolga, Tanjung Karang and Tanjung Pinang.

Nusantara 2 (Network dua) with a coverage of Bali, Java and Lombok-Sumbawa has a main station at Yogyakarta feeding those based at Bandung, Bogor, Denpassar, Jember, Kupang, Madium, Malang, Mataram, Semerang, Singaraja, Surabaya, Surakarta and at Sumenep.

Nusantara 3 (Network tiga) has its main station at Banjarmasin and covers Kalimantan (Borneo) from transmitters at Palankaraya, Polianak and at Samarinda.

Nusantara 4 (Network empat) radiates to Sulawesi (Celebes) and Timor from its master station at Ujung Pandang to the remainder at Dili, Gorontalo, Kendari, Menado and at Palu.

Nusantara 5 (Network lima) covers Irian Jaya (West Irian) and Maluku (Moluccas) with the major station at Jayapura being linked with those sited at Ambon, Biak, Fak-Fak, Manokwari, Merauke, Nabire, Serui, Sorong and Ternate.

Radio Pemerintah Daerah Tingat Dua (RPDT2) stations are those of the various regional governments, each with its own capital and province or special district. Generally speaking these stations are difficult to log here in the UK, but for the information of those interested, and to make this guide as complete as possible, these capitals with their attendant special districts and provinces are listed here.

Capital at Ambon, Propinsi Maluku (Province Moluccas); Banda Aceh, Daerah Istimewa (Special District) Aceh in Sumatra; Bandung, Propinsi Jawa (Java) Barat; Banjarmasin, Propinsi Kalimantan (Borneo) Selatan; Bengkulu, Propinsi Bengkulu in Java; Denpassar, Propinsi Bali; Jakarta, Daerah Khusus-Jakarta Raya in Java; Jambi, Propinsi Jambi in Sumatra; Jayapura, Propinsi Irian Jaya; Kupang, Propinsi Nusa Tenggara Timur (Timor); Mataram, Propinsi Nusa Tenggarah Barat in Lumbok-Sumbawa; Medan, Propinsi Sumatera Utara in Sumatra; Menado, Propinsi Sulawesi (Celebes) Utara; Padang, Propinsi Sumatera Barat; Palangkaraya, Propinsi Kalimantan Tengah in Borneo.

Forces Radio stations are low powered and only very occasionally heard outside the South East Asian area, although I did once log Angatan Udara some years ago when it was transmitting around the 11MHz mark.

Private stations are licensed by the government and are situated in main towns and cities.

Rarely heard outside of the country, they are commercial enterprises and as such are said to largely feature western pop music.

AROUND THE DIAL

Make yourself comfortable, switch on the receiver, adjust the dial or the digits to the frequencies at the times listed here and you may log some of the following.

AFRICA

Benin

Cotonou on **4870** at 0510, fast rhythmic music in the typical local style, YL with songs in vernacular. This was a transmission in the Home Service which features programmes in French and local vernaculars. The schedule is from 0400 (Saturday from 0545, Sunday from 0600) to 0800 (Saturday until 1100, Sunday until 2300) and from 1300 to 2300. There is an English newscast from 2000 to 2015 and the power is 30KW.

Botswana

Radio Botswana, Gaborone on **4848** at 0352, interval signal which consists of the sound of cows lowing and the tinkling of cow bells. At 0359 a choral rendition of the national anthem, OM with the station identification in Setswana, announcements followed by the hymn *'O God Our Help in Ages Past'*.

Burundi

La Voix de la Revolution, Bujumbura on **3300** at 1935, OM with a talk in vernacular, heard with some difficulty under some near co-channel utility QRM. Well, at least the time is more reasonable for most readers!

This is the Home Service 1, which uses French and vernaculars from 0300 to 0700 (Sunday until 1000) and from 1600 to 2100, this latter part of the schedule including an English session from 1645 to 1700. The power is 25KW but the frequency can vary up to **3306** on occasions.

Ghana

GBC Accra on **3366** at 0534, YL with announcements in English then a choir with some hymns. This was a programme of GBC2 which is entirely in English from 0500 to 0900 and from 1600 to 2305 with a power of 10KW.

Liberia

LBS Monrovia on **3255** at 0528, OM with a programme review in English which apparently included some relays of the BBC in London. The Liberia Broadcasting System operates on this channel from 0458 (Sunday from 0558) to 0700 and from 1830 to 2400 with a power of 25KW.

Malawi
MBC (Malawi Broadcasting Corporation) Blantyre on **3380** at 0605, OM and YL with a newscast, presumably in Chichewa.
This one is scheduled on the air from 0255 to 0530 (from April to September until 1110) and from 1745 (from April to September from 1300) until 2210.
An International Service in English and Chichewa is timed from 1600 to 1800. The power is 100KW.

Namibia
SWABC (South West Africa Broadcasting Corporation) Windhoek on **3270** at 0209, a programme of dance music records which included the ever popular '*La Cucaracha*'.
This programme was also logged in parallel on **3295**, this being the All Night Service.
The schedule is from 1615 to 2200 and from 0358 to 0515 in local vernaculars on **3270**. The All Night Service is timed from 2200 to 0358, the power being 100KW.

Niger
ORTN (Office de Radiodiffusion Television du Niger) Niamey on **3260** at 0530, the national anthem, a few bars of music rendered on a local style flute then OM with the station identification in French followed by recitations from the Holy Quran.
Niamey is on the air from 0530 to 0700 (Sunday until 0900) and from 1700 (Saturday and Sunday from 1630) to 2200 (Saturday until 2300). This was a transmission in the Home Service 1, the power being 4KW.

Nigeria
FRCN (Federal Radio Corporation of Nigeria) Lagos on **3326** at 2117, OMs with a discussion in a vernacular in the Channel 1 service, this being timed on the air from 0430 to 1000 and from 1700 to 2310 with a power of 50KW and in parallel in **4990**.

South Africa
SABC Johannesburg on **3320** at 0348, YL and OM with a discussion about sport in South Africa. This English language schedule is on the air from 0300 to 0426, but according to the published schedule is seasonal from May to September inclusive (although this logging proves that to be incorrect).
SABC on this frequency also operates in Portuguese from 1900 through to 1056 with a power of 250KW.

Swaziland
TWR (Trans-World Radio) Mpangela on **3240** at 0325, OM with announcements, OM with a song in vernacular then some organ music. This vernacular service operates from 0300 to 0345 daily with a transmitter power of 25KW.

THE AMERICAS

Brazil
Radio Globo, Rio de Janeiro on **11805** at 2006, OM with a most excited commentary on a local futebol (football) match which included a goal. If you have never heard an LA commentator frenziedly announcing a goal then you have a treat in store – the loudly shouted word *'goal'* is extended for at least thirty seconds and ends in a cacophony of gabbled words describing the momentous event!

Ecuador
Radio Iris, Esmeraldas on **3380** at 0335, YL with a song in Spanish, OM with some promos, all mixed with the sound of African drums from the co-channel Blantyre transmitter in Malawi. Radio Iris operates from 1000 through to 0400 (Sunday until 0200) with a power of 10KW. The frequency however is likely to vary to **3381** at times.
Radio Zaracay, Santo Domingo on **3395** at 0331, OM with some announcements in Spanish then some local folk music. The schedule is from 1000 to 1400 and from 2000 to 0500 (Sunday until 0400). The power is 25KW.
HCJB Quito on **17790** at 1958, OM presenting an English programme directed to Europe from 1900 to 2000. Station identification and time check at 2000.

Netherlands Antilles
Bonaire on **17605** at 2003, OM with a song then OM with announcements during a Dutch transmission intended for Central and North West Africa and Europe, timed from 1930 to 2025.

Peru
Radio Los Andes, Huamachuco on **5030** at 0411, OM with announcements in Spanish, OM with a ballad then more announcements including some local addresses. R Los Andes is on the air from 0900 to 0400 but operates a 24 hour schedule on Sunday. The power is 5KW.

ASIA

Afghanistan
Radio Afghanistan on **4740** at 1521, YL with announcements then OM with songs complete with local style music. This is the Home Service 1 in Pushto/Dari and is on the air from 0125 to 0200 and from 0330 to 1930.

China
CPBS Beijing on **3360** at 1742, OM with announcements and then some Chinese classical music. This is the Taiwan Service in Chinese and Hakka which is transmitted from 2050 to 0102, from 0815 to 1045 and from 1200 to 1802.

India
AIR (All India Radio) Gauhati on **3235** at 1531, YL with a newscast in English. The schedule is from 1230 to 1700 with the news in English at 1530. The power is 10KW.
AIR Kurseong on **3355** at 1556, YL with a talk in English about Indian financial affairs. This Indian regional station is scheduled from 1130 to 1740 with a power of 20KW.

EUROPE

Finland
Helsinki on **15265** at 0935, YL with an interesting talk all about the current musical scene in Finland and this during an English transmission for Australia, Europe and the Far East timed from 0900 to 1030 on Sunday only.

Greece
Athens on **11645** at 1937, YL with a newscast during the French programme for Europe scheduled from 1930 to 1940 (news only).

Netherlands
Hilversum on **9895** at 0552, OM and YL with an English transmission for the Caribbean and North America timed from 0530 to 0625. It was all about Dutch radio dramas and how the sound effects are produced.

Portugal
Lisbon on **11740** at 2040, OM with news of local events during an English presentation to Europe, timed from 2030 to 2100 daily.

SOUTH EAST ASIA

Indonesia
RRI (Radio Republik Indonesia) Bengkulu on **3265** at 1534, OM with a talk in Indonesian. Bengkulu in Sumatra is on the air from 2230 to 0200, from 0500 to 0800 and from 0930 to 1600 with a power of 10KW.
RRI Padang on **4003** at 1544, OM with songs in Indonesian with a backing of some local pipe music. Padang, also in Sumatra, operates from 2300 to 0100 and from 0945 to 1615 with a power of 10KW.

Singapore
BBC relay, Kranji on **3915** at 1552 with a World Service programme in English all about church music and choirs. The World Service in English on this channel is timed from 1500 to 1745 and the power is 100KW.

CLANDESTINE

Voice of the Liberation of Iran on **15554** at 1728, YL with a harangue in Persian with many mentions of Khomeyni. The schedule is from 1630 to 1830 and may also be heard on the parallel frequency of **9027**.

NOW LOG THIS

Radio Norte, Montero, Bolivia on a measured **4938.5** at 0015, OM with the station identification then OM with a talk in Spanish with several mentions of Bolivia. R Norte is on the air from 1000 to 1230, from 1600 to 1730 and from 2200 to 0230 with a power of 1.5KW.

NOW HEAR THIS

Radio Tropical, Montero on **4935** at 0020, OM with a talk in Spanish, OM with a folk song. This Peruvian is scheduled from 1000 to 0400 with a power of 1KW. ■

DX-TV

RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

An upsurge in Sporadic-E activity produced intense openings on many days during October. Some of the openings were lengthy and signal strengths were as high as those experienced during the main summer season. A few unusual signals were noted too.

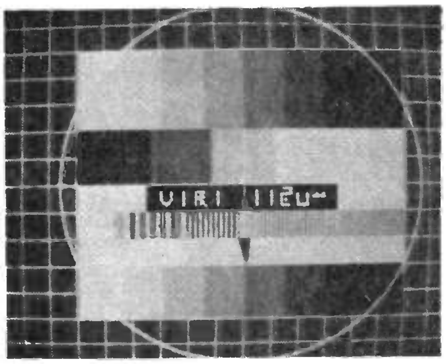
Very strong tropospheric reception from France reached many parts of southern and central England between October 12th and 15th. Weaker trops from Eire and West Germany were also in evidence at times. A watch was kept on the lower Band I channels (E2 and R1) just in case any F2 activity occurred during the month, but nothing was seen.

Sporadic-E activity

The key dates when Sporadic-E (SpE) activity of any significance occurred were October 14th, 15th, 17th, 22nd and 24th. Fortunately the 14th fell on a Sunday, thus allowing many enthusiasts to note reception from the south-east.

Here in Derby the opening was in progress upon switch-on at 1342GMT and signals from Italy (RAI) on channels IA and IB were resolved. The IA reception was accompanied by heavy patterning – in fact most of Band I was affected. A check with an audio monitor revealed that the band was crowded with Italian private radio links.

What was at first thought to have been an OIRT FM band opening from Eastern Europe between 64MHz and 72MHz also turned out to be Italian radio links. In fact, they embraced the 49MHz to 70MHz spectrum. The ubiquitous 49MHz cordless telephones were very much in evidence with foreign dialling tones and Italian babble!



FuBK test card radiated by VIRI in Iran

An opening lasted for much of the day on the 22nd. CST (Czechoslovakia) were noted during the morning with Spanish (TVE) channel E2, E3 and E4 signals dominating the band in the afternoon. The TVE-2 outlet on channel E2 is still in operation despite rumours about it facing the axe! The second network was noted radiating colour bars, whilst the first chain transmitted programmes.

October trops

Reports of tropospheric reception from the 12th to the 15th indicate that the Canal Plus service from France appeared at high levels on at least three Band III channels, with the best quality signals arriving on the 15th. There is still some confusion over the channel numbering system to be adopted in this band, although it is widely understood that the French channel slightly HF of E5 is known as Ch5.

This particular outlet (received over a wide area of southern and eastern England) has been noted radiating Canal Plus previews. On the 15th pictures were very strong and we were able to assess the effects of scrambling techniques used by TDF for some of the programmes. The idea is to persuade potential viewers into purchasing a decoding unit in order to help finance the new service.

The transmissions noted here in Derby exhibited line displacement, and consequently everything had a fine ragged edge. Whilst it wasn't impossible to watch the programmes, it wasn't exactly an enjoyable experience!

One of the other outlets undergoing tests was located on channel 7 (between E7 and E8). At present a variety of unusual test patterns are radiated. A circular type was noted during the opening, but later in the evening it was replaced by a blockboard pattern.

A colour bar pattern with text was seen on Ch10 (approximately E11). It's been on the air for about a year and has been noted during other openings.

DX log for the month

The following reception log details transmissions noted by the authors in Derby during October:

1/10/84: CST on channel R1 with their 'RS-KH' test card. It was later seen on R2; TVE E2 during the later afternoon with the colour GTE test card.

5/10/84: CST R2 on the 'RS-KH' test pattern.

6/10/84: Switzerland (SRG-1) E2 from the Bantiger transmitter near Bern carrying the '+PTT SRG1' FuBK test card.

7/10/84: ORF (Austria) on E2a with the 'ORF FS1' PM5544 test pattern.

8/10/84: TVE E2, E4 with 'tve' GTE test card; TVP (Poland) R1 with their PM5544 test card, which has a darker background; CST R1 on EZO test card; ARD (West Germany) E2 and E4 with 'ARD/ZDF' identification caption; weak trops from NOS-1 on E4 (from Lopik in the Netherlands) radiating the PM5544; TDF (France) on channel F5 with Canal Plus programmes.

10/10/84: CST R1 on 'RS-KH' test pattern; unidentified signals on channel R1.

11/10/84: DR (Denmark) E3 on PM5544; TVP R1 on test card; CST R1 with the EZO test card and FuBK pattern prior to station opening with 'CST 01' identification caption; ORF E2a showing their monochrome Telefunken TO5 test card.

13/10/84: Tropospherics during the morning consisting of TDF on E39 (from Dunkirk) with 'CENEX-BCH' PM5544 minus the central vertical bar; NOS-1 E4 with 'PTT-NED1' PM5544; BRT (Flemish language network in Belgium) on E10 from Wavre with 'BRT TV1' PM5544; trops during the early evening included ARD on channels E9 and E11 (from Westdeutsches Fernsehen) with a round or two of boxing.

14/10/84: Unidentified religious service on channels E3 and E4; RAI (Italy) on IA and IB with programmes during the early afternoon. Many Italian private stations were heard between 49 and 70MHz; RTE-2 (Eire) on channels G and I with programmes; RTE-1 were seen radiating progs on channel H; small SpE opening at 2025GMT on R1 with unidentified signals.

15/10/84: TVE-1 on E2 and E4 with the test card and progs; TVE-2 E2 on test card; CST R1 on EZO test pattern; Switzerland E2 with the FuBK test card carrying '+PTT SRG1' identification; trops including NOS-1 on E4, BRT E10, RTBF (French language service in Belgium) on E11 from Anlier, ARD on E9 from Langenberg, TDF on F5 with Canal Plus previews and the 'RESEAU 4' PM5544 test card. TDF were also noted radiating a colour bar pattern with a text display.

17/10/84: TVE E3 and E4 on 'tve tve1' GTE test card via SpE; late afternoon opening on R1 with announcer and unidentified slow fade-out; OIRT FM band activity noted.

18/10/84: CST R1 using the 'CST 01' FuBK test card.

22/10/84: ARD E4 (NDR – Norddeutscher Rundfunk) with an electronic test card received via meteor shower (MS) at 0840GMT; CST R1 on EZO test card; TVE E2, E3 and E4 with the GTE pattern. During the early evening TVE-1 radiated a bullfight, while on TVE-2 colour bars

were noted on channel E2. All reception via Sporadic-E.
23/10/84: CST R1; TVP R1 on PM5544 test card.
24/10/84: CST R1 and R2; TVE E2 and E3 using GTE test card. TVE also on E3 with a bar pattern and 'AITANA 3' identification; TVP R1 and R2 on test card.
26/10/84: TVE on channel E3 radiating the GTE colour test card.
28/10/84: ORF on E2a with their 'ORF FS1' PM5544 test card.

Reception reports

Our recent article entitled *'Sporadic-E Propagation'* (***R&EW***, August '84) generated some interest, and Mike Wilkinson of Workington in Cumbria decided to take the plunge and join the ranks of TV DXers. Armed with a Grundig 6400 colour receiver (featuring multi-band and remote control facilities) purchased from his 'local' branch of Dixons some 50 miles away, his DX receiving station was established on October 5th. A loft mounted 2-element (dipole and reflector) Band I aerial was installed.

The opening on the 14th gave him Italy on channel IA with a news programme showing the Pope. The following day Mike was rewarded with the Spanish 'tve' test card on channels E2 and E3 from 1349GMT. A late evening opening between 2100 and 2200GMT produced Icelandic reception on E3. The 'RUV ISLAND' PM5544 test card was being radiated. On E2 a football match was seen but there were no clues as to its origin.

Excellent conditions were present on the 22nd when a film from the *'Carry On'* series was noted on channel E3 between 1130 and 1145. Over on E2 a film starring Peter Ustinov was occasionally resolved in colour. A 'ZDF' station identification was noted in the right-hand corner which confirmed reception from West Germany.

It is interesting to note that during the morning period West Germany's 1st network (ARD) combines with the 2nd network (ZDF), hence the 'ZDF' identification appearing in Band I.

Mike has also experienced meteor shower activity. At 1150 on channel IA the Italian test card with 'RAI 1' identification flashed up for all of two seconds. During the same activity Switzerland was logged on the FuBK test card with the inscription '+PTT SRG1'.

Bob Brooks of South Wirral has been busy with early morning DX again. His catches during the first few days of October included Switzerland E2, Sweden E2, Czechoslovakia R1 and R2 and Austria on channel E2a.

It is interesting to note that Bob's reception consists mainly of test cards, so if anyone is struggling with identifying TV stations we suggest DXing a little earlier in the day! The best times for test card reception seem to be before 0830 and around lunchtime, since most services devote the morning transmission period to schools television.

Andrew Webster (Billinge near Wigan) did well on the 22nd when there was an all-day opening. The Czechoslovakian EZO-type test card (see ***R&EW*** April 1983) was present on R1 for most of the morning. In the afternoon it was the turn of Spain to make an appearance.

Andrew reports that whilst watching an opening from Yugoslavia on E3 the programme was suddenly interrupted and replaced by the FuBK test card with 'JRT ZGRB 1' identification. This seemed very unusual since this particular test pattern is normally only seen on E4 from the Zagreb studios.

All was revealed however when the test card was replaced by the PM5544 carrying the inscription 'RTV LJUBLJANA'. Apparently there had been a break in the programme, which had indeed originated from Zagreb but was being received by Andrew from the Ljubljana network. Consequently the FuBK test card was radiated until the engineers in Ljubljana realised that there had been a fault and switched in their own Philips test card.

Zimbabwe?

Tony Cater (Wigan) sent reception details covering September which arrived a little too late for the last column. Of importance was a possible sighting of the Zimbabwe PM5534 test card from the south-east at the beginning of the month on channel E2.

Harold Brodribb (St Leonards-on-Sea) noted clear reception of RTBF Belgium radiating the PM5544 test card with 'LEGLISE CANAL 11' at the top. On channel E8 a West German station was noted carrying forthcoming programme schedules and an ARD1 logo. Later in the day between 1630 and 1800 Radio Telefis Eireann (RTE) was resolved. RTE-1 was present on channel D with a news programme, while on channel G RTE-2 were screening an item on an invasion of Ireland.

Good quality French Band III signals were resolved by Harold. There was also an E4 signal which was subject to rapid fading. It is thought to have come from the Lopik transmitter in the Netherlands. Harold studies the weather charts during tropospheric openings and regularly checks the barometer. As pressure dropped after the 15th, so did the amount of DX – in fact it vanished!

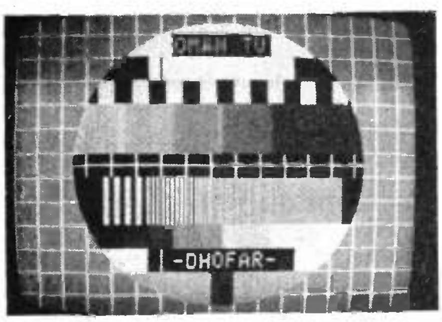
Harold lives in an exposed location so he uses indoor aerials for TV DXing. A Plustron multiband receiver and an elderly Bush TV125 dual-standard set are in operation. The latter set has been modified to accept an output from an external varicap tuner. The dual-standard characteristics of the vision detector circuit mean that positive or negative video can easily be selected.

Nord Center Television

In St Neots (Cambs) John Bray saw a caption consisting of the letters 'NCT' on a grey background during an opening to Italy on October 14th. This was identified as originating from the private Italian station of 'Nord Center Television' operating from Udine in the north-east.

This particular station has been lacking somewhat this year, whereas at other times it has been fairly common. Its operating frequency seems to change from season to season. It has been noted on channels IA and E3 as well as on a frequency somewhere between the two!

John uses the Luxor SX9 series colour receiver for DX-TV. One problem which he has now overcome is the auto switch-off facility. The receiver is designed to switch itself off approximately 5 minutes after the station has closed down, ie in the absence of a signal. As far as the DXer is concerned this is a problem because the set cannot be left running on a vacant channel for more than 5 minutes.



PM5544 electronic test card used by Oman TV
Photo courtesy of J Stoodley

Identification caption broadcast by Oman TV
Photo courtesy of J Stoodley

Clock caption transmitted in Abu Dhabi
Photo courtesy of J Stoodley

John contacted Luxor for assistance. To defeat the timed switch-off facility the output from pin 9 of the TDA2594 on the sync module is removed. This is easily done by disconnecting RS16(1K0) on the module. The circuit is shown in *Figure 1*. A switch has been added to select the defeat mode when required.

Please note that when modifications of this type are undertaken it must be stressed that the manufacturer's guarantee may be invalidated. It should also be ensured that modifications such as the fitting of external switches, etc are not carried out on receivers which have a 'live' or so-called 'half-mains' potential chassis. Fatal accidents occur only once!

John points out that versions of the SX9 with a remote control handset already have the defeat facility when 'channel 19' is selected.

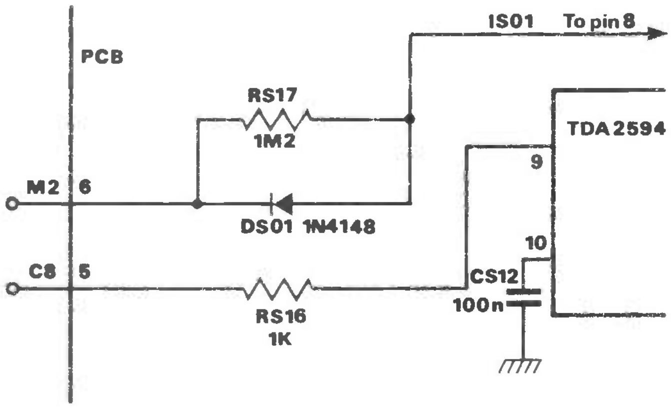


Fig 1 *The relevant part of the sync module circuit diagram*

Mysteries solved

In a recent column we mentioned that Clive Athowe and Ray Davies (both of East Anglia) had seen the Belgian 'BRT TV1' PM5544 on channel E39. Gösta van der Linden (Rotterdam, Netherlands) has solved the mystery. The transmitter Clive and Ray noted is located in West Germany at Bensberg to the east of Cologne. It radiates Belgian programmes for the Belgian armed forces on channel E39 with an ERP of 600W.

Gösta also suggests that the mystery Norwegian test card with 'BJERKREIM' identification received on channel E35 could be a new outlet, although this isn't shown in the NRK 1984 listings. An alternative explanation is that the Ølmedal channel E35 800W relay now takes its feed from Bjerkreim rather than Stord.

Another mystery which has cropped up once or twice during recent trop openings is reception of 'Noorder Koggen' on channel E34. Gösta has advised that this is a pirate TV transmitter operating at Midwoud in the province of Noord-Holland in the Netherlands.

Our thanks to Gösta for helping to clear up these mysteries.

New French channels

We recently received a letter from Alan Duchatel of the French DX club called 'AFATELD' (Association Française d'Amateurs de Télévision à Longue Distance). Channel and frequency allocation details were included for the Canal Plus service. These are as follows:

Band I

Ch2 49.25MHz(s) 55.75MHz(v)
Ch3 54.00MHz(s) 60.50MHz(v)
Ch4 57.25MHz(s) 63.75MHz(v)

Band III

Ch5 176MHz(v) 182.50MHz(s)
Ch6 184MHz(v) 190.50MHz(s)
Ch7 192MHz(v) 198.50MHz(s)
Ch8 200MHz(v) 206.50MHz(s)
Ch9 208MHz(v) 214.50MHz(s)
Ch10 216MHz(v) 222.50MHz(s)

Alan is the editor of the DX-TV section of the AFATELD magazine, which is published in French.

Further details are available from his home at: Place de Mons, Cénac 33360 Latresne, France.

Service Information

Tunisia: A new transmitter has opened on UHF at Bou Kornine. It radiates programmes on channel 26 with an ERP of 44KW.

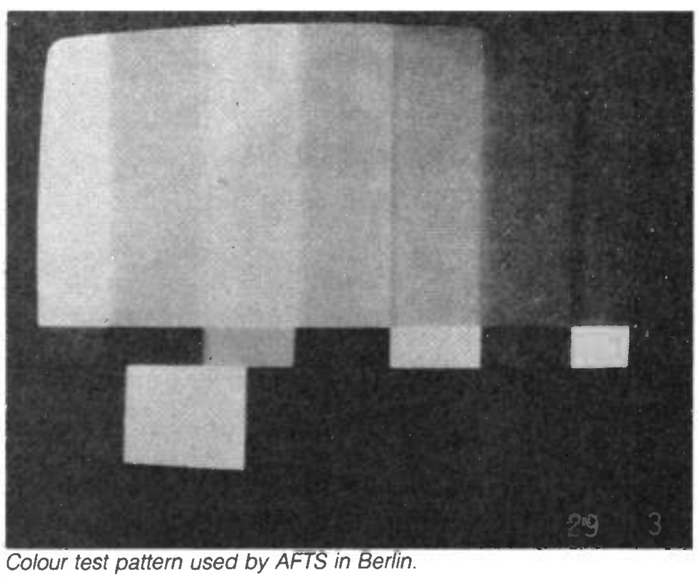
Albania: According to reports from France, the Albanian TV service (RTS) has been seen on channel E4 as well as channels IC and R4 during the 1984 Sporadic-E season.

Denmark: Danmarks Radio (DR) now radiates the PM5544 test card with a digital clock insert (ie the PM5534).

Jordan: The PM5544 test card transmitted by JTV on channel E3 occasionally includes the transmitter identification 'SUWAILEH'.

Service information this month was kindly supplied by Gösta van der Linden (Netherlands).

News programme from Sender Freies Berlin (SFB-3), West Germany



Colour test pattern used by AFTS in Berlin.

ATV ON THE AIR

Presented by Andy Emmerson G8PTH

In previous months I have enthused over the Sony HVS-2000P, which as you will remember is a sophisticated camera switcher and effects generator. At the current close out price of £29.95 it must be the bargain of the year for videots. I bought one recently and the more I use it the more I find I like about it.

Ninety-two transistors

The P on the end of the type number indicates PAL; there are NTSC and SECAM versions as well, though we don't see them in this country.

Knowing the complexity of producing a SECAM colour signal I'd love to know how they do it, and to this end I did try to order the service manual for the HVS-2000S. Unfortunately I was sent the PAL version book, but even this is a useful document and at around £3 or £4 it is worth ordering from Sony's spare parts place at Bath Road, Slough. From it you will learn for instance that the unit contains 92 transistors and 13 integrated circuits, the latter being mainly simple CMOS logic types.

The book also contains all the theory of the mixer's operation and, as is Sony's fashion, is well written and illustrated. In fact if the other home video manufacturers issued service manuals like Sony's we would all be grateful. If you have any intention to modify or repair your unit in future you would be well advised to get hold of a copy.

Of course, to use the unit itself you don't have to have Sony cameras or even a colour camera, though in the latter case you will lose the colourising facility.

I have never bothered with colour cameras on ATV myself, mainly because I cannot afford them! But I maintain that a good monochrome camera gives far clearer pictures (many good surveillance designs have 400 or 500 lines picture definition) and anyway colour is a bit naughty on 70cm. Which is not to say I don't put out colour bars now and again, but...

The first change I made to my unit was to fabricate a couple of adaptors for the two video input sockets. You could of course drill the case for BNC connectors, but I chose not to risk drilling in the wrong place, so I made a couple of adaptor cables.

You will need two Hirose (pronounced *hiroshi* apparently) K-type plugs and two BNC line sockets. The K-types can be bought loose in better video stores (and *Hi-Fi Care Retail Ltd* in London's Tottenham Court Road) for £4.95. You can also order them by mail from *Comprehensive Video* of Raynes Park and, I believe, from Sony.

The centre conductor of the coaxial cable goes to pin 1 and the screen to pin 2; obviously any old grot bootlace co-ax will do, the more flexible the better. Having made these adaptor cables you can now connect any video source via BNC plugs.

Although the colouriser gives you a choice of colours it does not offer white, which I think is best for captions. No problem, though: just turn the rotary control *between* two click stops.

If you want to experiment with video feedback try looping the monitor output (set to input) back into the monochrome camera input. Try various settings of the key level control.

This month's exotic pictures recieved by John Cowie GM6KJD

Effects

Another great effect is to display the primary signal on a monitor and point your monochrome camera at the screen. By adjusting the key level and colourising the resultant mono camera signal you can get vivid swirling effects and multiple images which will really take your breath away.

The key level will enable you to control the degree of feedback, and it helps if you tilt the b/w camera: in other words do not hold it horizontal but inclined at 45 degrees to the horizontal. You can now make animated captions even from a still card ... I could fill up a whole article on this technique!

Remember that your two cameras must be synchronous, ie genlocked.

You can achieve this in several ways. If you like, both cameras can be synchronised to a central SPG (the most professional way). Alternatively one (the master, colour source) can be free running (either camera or VCR) and then only the slave, monochrome camera need be genlockable. You can use Sony's own (expensive and often virtually unobtainable) HVM-100 or another camera which locks up to composite video (ie the main source taken out of the monitor socket and looped through a picture monitor).

Another handy bonus with the HVS-2000 is that it acts as a proc-amp (processing amplifier). Not everybody has normalised 1.0 volt signals – many cameras and test generators put out 1.4V, or you may have an old homebrew crosshatch generator which can barely reach 0.8V. This often causes problems 'downstream', such as the transmitter needs readjustment each time you change vision source, or a callsign generator won't lock up unless it sees exactly 0.3V of sync. Anyway this Sony unit sorts all this out and produces a clean 1.0V output. And now we'd better change the subject.

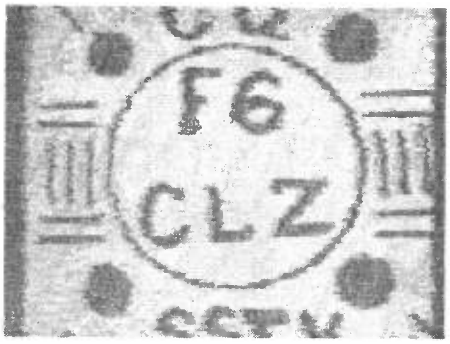
Repeater news

TV repeater news now. Word is that Glenfield Video (GB3GV) is to move to somewhere high up like Bardon Hill or Markfield – I wonder if they'll change the callsign to match!

Seriously, this will be really good news if it comes off, as the repeater is in a bit of a dip and has a job to cover all of Leicester. This is also thought to be a function of the Alford Slot antenna, which seems to produce a parallel beam which suits some people but goes straight over the heads of others (or straight into buildings and hills instead of rising over them). As a result only well sited stations can get into GB3GV at present.

The proposed sites, on the other hand, are nice and high, overlooking Charnwood Forest and much of the East Midlands (Markfield is the site of GB3CF, LES and LEX). Timescale is not yet determined, and may be quite a few months while the repeater is 'souped up' a bit. All we need now is a change to FM operation and we'll all be happy!

Another repeater which may be on the move is GB3VR, currently close to Worthing. The idea is to shift it up to Race Hill, Brighton (where they hold the Sussex Mobile Rally each year, and known to be a superb site). A dual Alford Slot system will beam coastwise in each direction and also across to France. The Sussex mob regularly work France on TV, so perhaps Brighton will be France's first TV repeater too!



I hear that the London TV repeater is more than just a notion. Some of the lads at ITN are involved and the site selected is Kent House, the London Weekend TV tower on the South Bank (also site of GB3LW).

There are the professional users of the location to be considered (it is a 2GHz remote link pick-up point), but at least the paperwork has been applied for.

Goop on a reel

How do you seal up your connectors when you install an outside aerial? Bitter experience tells me that whatever you think is satisfactory is not, so it is worth taking a lot of care over this little task.

The first point to note is that N-types are the only sort of connector which can be considered waterproof, and even then you need to tape them up to avoid corrosion.

BNC and UHF patterns, even if tightly wrapped in tape, cannot be considered satisfactory. Somehow or other dampness seems to condense inside the connectors, and this is of course deadly to transmitters if it leads to a dead short (pretty obvious), or worse, a high VSWR which you don't notice for a while.

I have always used self-amalgamating tape from Radiospares; this gives a good workmanlike seal, but it is a pig's job to undo after it has set. If you are on the roof or up a mast in a gale, trying to snip away at this rubbery mess is a real pain.

A product which has been available for a few years in the United States is a mouldable rubber 'putty', which you press round the connector and cable end. It is alleged not to harden, crack or deteriorate, and you can peel it away easily later. It does not harm connectors or coaxial cable, and it has had quite good reviews in *'73'* magazine. By chance I noticed that my local Tandy store now carries it, and I pass this on to you in case you want to try it out. The part number is 278-1645 and the price is £2.29 for 60 x 0.5in of this goop.

QSO

On these pages we present details of interesting contacts from clubs and individuals. We would be happy to receive any similar items from readers

AMTOR/RTTY for the blind

Phillip Stanley G6TLI and some of his associates have been busy with some interesting experiments in London recently:

Over the past few weeks, myself and two other radio amateurs (G4VWW – Steve, G6YYZ – Terry) have decided to pursue a project in which a whole new world can be opened up for blind operators in the use of RTTY/AMTOR.

The reason for this idea was mainly due to our friend Steve (G4VWW-IK3CSU) who visits us once or twice a year from Italy.

During his visits he has taken tremendous interest in the use of RTTY/AMTOR, but there was only one problem: he could not operate the system unless there was either myself or my brother in attendance.

At long last we have managed to overcome this, so we decided to let other operators in the same position as Steve share the benefits of our work.

The idea was to look at speech synthesis, which basically works on the same lines as a printer (but without the paper!) and also is compatible with most computers, ie uses an RS232C serial or Centronics parallel interface.

There are quite a number of units available, but after some careful consideration we decided to go for one which was designed and made by Braid Systems Ltd which perfectly suited our requirements, its various options available being sent by a series of control codes (ie letter or word mode, high or low pitch settings, volume and speed).

There were one or two problems to be overcome, since the speech synthesiser from Braid Systems had only an RS232C serial port. My particular computer, although having provision for both, only sends data to a printer via the Centronics port. Consequently it would not allow us to run AMTOR at the same time, because the AMTOR modem also had only RS232C.

Rather than wait for the optional Centronics port to be fitted, which meant that we would have to wait another few weeks, we decided to overcome this problem by connecting the AMTOR unit and the Braid synthesiser together.

This was done by using the RS232C input to our computer from the AMTOR unit in parallel with the data output of the AMTOR to the synthesiser.

All control codes to the AMTOR unit and the synthesiser are sent by the computer from the RS232C data-out port. This meant putting the AMTOR unit into transmit mode and then sending the various control codes to give us the functions available (pitch, words or letters). The data was then confirmed via echo back to the synthesiser.

I must add that it does depend on the particular computer being used. The computer that we are using is the Tono 9000E communications terminal.

Some computers have different provisions. The Apple 2, for instance, can use TTL levels to drive the AMTOR unit and RS232C to send the data to the Braid synthesiser. The same also goes for the Commodore 64. Obviously it does vary from one computer to another.

Incidentally, the Braid synthesiser works on 150 to 9600 baud, which is programmable by changing the DIL switches located on the back panel. At any speed less than that required the unit states that there is a 'frame in error'.

After a series of CQ calls on 80 metres, our first contact was made with G3RSP Alan, located in Harlow, Essex.

We had said to him 'we are trying out a new printer, so would you be kind enough to send carriage return/line feed after approximately 30 characters'. This allowed the unit to come back with the data sent more quickly (the synthesiser responds to sending data after each carriage return sent).

This he kindly did, and he was intrigued as to what the printer was, so we explained to him what we were up to.

Alan then said he would very much like to hear it. This was certainly no problem because he was within easy reach of London, so we decided to work crossband betwen 80m and 70cm. He then sent a series of text, ie 'The quick brown fox...' etc, and this was re-transmitted as he was typing. He stated that he was quite surprised at the clarity of the synthesiser, and wished us success in perfecting our experiments.

A few days later, after making sure that all the connections were OK and everything was in perfect working order, Steve decided to make a few contacts on his own while we were out at work. When I came home he said he had been having 'a whale of a time' and had made contacts on 20m into Spain, Italy and Austria.

So now we have decided to write and let you know the outcome of our very successful experiments.

We are now making ourselves available to whoever wishes to see a demonstration either here at my station or within easy reach of London.

I must add that we are only doing this as a hobby, and also to help those operators in the same situation as our very good friend Steve to have a further outlet into a different aspect of amateur radio. We know that there are a number of operators who would dearly love to work AMTOR/RTTY without having to have somebody else in attendance to read the VDU or printout.

We have some literature arriving shortly with regard to the Braid synthesiser for those that are interested. All they need is the computer (and obviously the choice is very wide).

I would also like to say thanks to all those people who helped us in the setting up of this experiment: G8PUU – Bob (BBC), G6YYZ – Terry, Braid Systems Ltd, G3RSP – Alan (for the initial experiment) and especially to G4VWW/IK3VSU Steve for giving us something to do in the first place!

Exhibition blues

We recently heard from a very unhappy reader who travelled to London from Wales for the *'Your Computer'* Christmas Fair at Olympia, listed in December's *Dates for your Diary*, only to find that it had been cancelled.

It is some time since we were notified of this event by the organisers, and it is unfortunate that they did not inform us of its cancellation. However, even if they *had* done so deadlines are such that this might well have been too late for publication before the scheduled date.

We therefore feel it incumbent upon us to advise readers to check with the organisers that such events have not been postponed or cancelled, since the cost of a telephone call can save a great deal of disappointment.

Our sympathy lies with any readers who have suffered similarly. Let us hope that reporting this incident helps prevent more such instances in the future.

Class B Morse

Mr John Butcher MP, Parliamentary Under Secretary of State for Industry, announced on 7 December that as a result of discussions between the Department of Trade and Industry and the Radio Society of Great Britain, holders of the Amateur Radio Licence (B) who wish to use Morse code in their radio contacts may do so for an experimental period of one year.

The experiment will start on 1 April 1985 and last until 31 March 1986. Any Class B licensees interested in participating in the experiment should request a letter of variation to their licence to permit them to transmit Morse code from their station address.

Requests should be sent to: *The Secretary, Radio Society of Great Britain, Alma House, Cranborne Road, Potters Bar, Herts EN6 3JW.* Applicants should enclose two first class stamps to cover costs and postage.

There is no selection process. All applicants who hold a current amateur radio licence (B) will receive a letter of variation and a copy of a leaflet called *'Guidelines for Class B Licensees using Morse'.*

It is hoped that the experiment will encourage Class B licensees to practise the sending and receiving of Morse in preparation for the amateur Morse test, as well as helping them to see its advantages as a mode of transmission.

'Professional amateurs'

An interesting proposal has come in from Martyn Thompson G1KIA concerning mobile operation:

'I personally spend a good deal of my time on the road, and encounter a large number of amateurs who are, like myself, HGV drivers or otherwise employed in service or sales related fields.

'The idea of forming some kind of association was not, I must admit, wholly my own. It started some weeks ago when in QSO with a small group of mainly HGV drivers through the Motherwell repeater GB3CS. Another station suggested that we form our own club for 'Truckers', not a term I relish, but it started the seed of an idea.

'A few weeks later when in QSO through the Barnsley repeater GB3NA, again with a group of mostly HGV drivers, the idea of a giant repeater for HGVs was joked about. I promptly passed on the idea of our own association.

'The idea was received with an enthusiasm I did not expect, the only change to the original idea being the inclusion of 'all' professional drivers, ie anyone who spends his, or her, working hours at the wheel.

'The outcome of this discussion is this letter, in order to feel the ground as it were. Although it is not intended to be too formal in structure any ideas etc from any amateurs interested in such an association would be most welcome.

'Initially write c/o
PO Box 122,
Earls Barton,
Northampton,
NN6 0DE.
(Please enclose sae)

'Lastly I would like to thank some of the stations involved in the various discussions on this subject over the air: G6VYC John, G1EPP Peter, G1EAN Alf, G4XQV Terry, G6LLM Keith, GM1FHF Archie, with apologies to any I forgot.'

For your information...

There are some interesting talks on the projected programme for the Radio Society of Harrow. These include a *'History of Outside Broadcast TV'* on 18 January, given by Bill Sutton G3FWI, and *' Use and abuse of VHF'* on 1 February, given by Angus McKenzie G3OSS.

As many readers will be aware, Angus McKenzie writes for our sister publication *Amateur Radio.*

The Radio Society of Harrow meets every Friday evening at: *The Harrow Arts Centre, High Road, Harrow Weald (opposite 'The Alma' public house),* with talk-in on GB3HR (RB14).

Details can be obtained from Dave G8XBZ.

Feline fun

We recently received the October edition of *CATS Whispers,* the newsletter of the Coulsdon Amateur Transmitting Society, which contains an amusing fox's-eye view of a 2m Fox Hunt. They seem to have a sense of humour in Coulsdon: as well as a good cartoon inside, the cover bears a drawing of a rather interesting cat, *à la Tom & Jerry* (but why pirate costume?). We were also amused to note that the club callsign is G4FUR.

Anyone who wants to join the fun can find club meetings at St Swithin's Church Hall, Gravelands Road, Purley, Surrey, on the second Monday and last Thursday of the month at 8pm. REW

NOTES FROM THE PAST

Some interesting comments from the 1950's...

My favourite set for use on the amateur bands was built in 1939 and is still used more or less daily. It holds its own with contemporary communications receivers despite its age, and the only attention it has received since it was first finished was when it was rejuvenated by changing to more modern type valves.

Oddly enough, it still has the original electrolytics – the good old wet type, and they have never leaked! I checked them recently and they seem to be well up to lots of good service yet.

The coil assembly for this receiver, five switched wavebands up to 650 metres consisting of 20 separate formers, took me nearly three months of my spare moments to get to my complete satisfaction. I have often thought since how much quicker (and more compact) it would have been if I had only decided to make those otherwise unobtainable coil boxes. It would also have obviated a tangle of switching and the inevitable losses in the HF bands.

When I first built it the still new and wonderful 6K8 was all the rage, but I finally decided on a separate oscillator. This arrangement is to be preferred, but I should hardly dare use one in a design for readers. They don't seem to like the idea of 'wasting' that extra 0.3 amp heater current when they can see nothing for it.

Occasionally visitors raise their eye brows at it, and I apologetically murmur something about improved performance on ten. They just sniff and tell me they use a converter. I don't need to, and most 10 metre converters use a separate oscillator anyway.

In the wee small hours

According to no less an authority than the Minister of Fuel and Power, four million people switched on lights and radio in the wee small hours of the morning to listen to a broadcast of a prize-fight.

The cynical can ponder on the silly mass hysteria which seems so easily worked up by a few headlines in the sensational press, and on the emptyheadedness of those who take no part in serious hobbies.

It is not, however, for the benefit of either of these classes of readers that I mention it. It is for those who might wish to cut it out and keep for a future defence when the XYL casts doubt on their sanity on the occasions when they stay up late o' nights because the prospect of working (or logging) a new country seems promising.

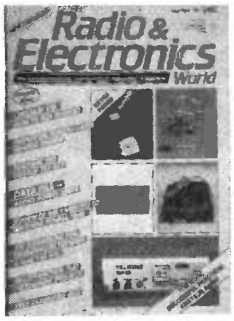
Radio & Electronics World

For all aspects of practical amateur radio

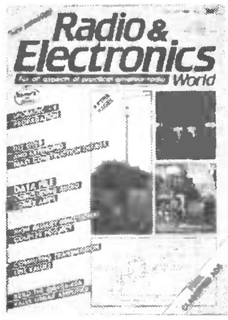
BACK ISSUE SERVICE

All issues from October 1981 onwards are still available, with the exceptions of January and February 1982, and December 1983. 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 newsagent or complete the subscription order form found in this issue.

JUNE 1984
Projects – Microprocessor Controlled Dot Matrix Printer; One Nights Work – Replacement Plug-in Module for 2532 EPROM; A low-cost Frequency Standard; Radio Frequency Bridge; Modifying the RGB Interface for the Ferguson TX90.
Features – High Speed Data Transmission; Trio-Kenwood TS-430S Transceiver; ZX Spectrum Data Transmission Program; Data File – National Semiconductors LM Range of Dual Audio-Preamplifier ICs; Data Brief – MC 1648 (SL 1648) Voltage Controlled Oscillator; HP41CX Calculator Review



JULY 1984
Projects — VLF converter, a unit for the very low frequency; Teleprinter Terminal Interface; Multifunction Test Instrument, a versatile piece of test equipment; Building the Fortop TVT-437; Improving Indoor Aerials, getting better reception without an aerial amplifier; Logic Probe for CMOS and TTL's.
Features; Amplicon Digital Panel Printer; Oscar 10; Yaesu FC102 Review; Data File — audio power amplifiers; Images of the World, a new publication review.

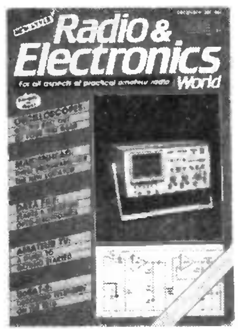


AUGUST 1984
Projects – High Quality Directional Coupler, a coupler for frequencies above 432 MHz; QQV06-40A Linear amplifier, a 100 watt valve linear amplifier; 40ft Tilt-over and extending mast, a home construction project; One night's work, adapting a portable typewriter; BBC Micro volume control; TV and Video interface.
Features – Twenty Questions; Sporadic-E propagation; Data File – Audio amplifiers; BBC Micro Morse tutor; Improving Resistors; Data Communication; Computing Transmission Lines

SEPTEMBER 1984
Projects – Low Power Transmitter, an 80m CW design; AM RAD, an experimental signal generator; Spectrum Analyser, further update on this project; Five Station Scanner, an add on unit for the 720 channel airband receiver.
Features – Computing Inductances, a program for winding coils; Data File, a look at alarm systems; Satellite Update, more information about weather satellites; Noise, a look at this electronic phenomenon; Distance and Bearing Program, an aid for station location; Super-Transmatch, a review of Tau Systems ATU kit.

OCTOBER 1984
Projects — Base Mic, construct this processor controlled accessory; One night's work, build an indoor UHF TV aerial.
Features — Modems, the link between computers and radio; Non-linear elements, a look at multipliers; Data File, continuing the look at alarm systems; SSTV for the BBC Micro, getting started in this mode; Testing! Testing! how to use your test gear: multimeters.

NOVEMBER 1984
Features – cellular mobile radio; computing attenuators for calculating resistance values; small aerials, coping with problems of space; 27-29MHz conversions; Data File, concluding the series on security systems; FETs – a beginner's guide; Non-Linear elements, log and anti-log; QSO, interesting contacts from clubs and individuals; ATV on the air, with a look at a range of aerials for the average pocket.



DECEMBER 1984
Features — Cable TV goes on the air; Simple speech processor, a simple device to increase a stations 'talk power', Uosat-2 telemetry, decoding satellite signals using this BBC Micro program, Tatung Einstein review; Testing! Testing! oscilloscopes; ATV — getting started; Data File, LED circuits and opto electronic principles; Morse test, self study course; Computing Maidenhead, three programs relating to the Universal (Maidenhead) Locator; QSO, club and event news; ATV on the Air, with news from the air waves.

JANUARY 1985
Features — Canal Plus, Europe's first VHF/UHF pay-TV service; Phased Vertical Arrays, a computer program for the design and modelling of antenna systems; Russian Satellites, the first part of a series looking at the equipment used to decode signals from the navigation satellites; RF small signal amplifiers, some of the obstacles encountered when constructing radio frequency devices; Principles of Z80 Morse Decoding; Data File, a look at LED sequencer and analogue-value indicator circuits.

RADIO & ELECTRONICS WORLD BACK ISSUE ORDER FORM

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

NAME:...

ADDRESS:...

....

....

....POST CODE..............................

PLEASE SUPPLY: (state month and year of issue/s required) [NOTE: January & February 1982, and December 1983 issues not available]

....

....

.... at £1.00 each

PAYMENT ENCLOSED: £ —

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

CREDIT CARD PAYMENT: ☐ ☐

SIGNATURE...

C P I

NEXT ISSUE

Radio & Electronics World
For all aspects of practical amateur radio

COMPUTING – TRACKING

Brian Kendal and Jeff Howell present a program to calculate inductance and capacitance values for tuned circuits

ELECTRONIC LOCK

Stay secure with this cheap and versatile project from A P Dean

DATA FILE

Continuing the opto-electronics theme, Ray Marston covers decoder/driver ICs and multiplexing techniques as well as some light sensitive circuits

CB CONVERSIONS

Bill Sparks and Colin Horrabin with a project based on their novel technique outlined last November.

RUSSIAN SATELLITES

The third part of this series describes the computing of the received data

PLUS all the usual features!
New products ● News ● Reception reports . . .
DON'T MISS the March issue – on sale **14th February**

To be sure of your copy of *Radio & Electronics World*, complete the newsagents order form in this issue or take out a subscription

FREE CLASSIFIED ADS

FREE CLASSIFIED ADS CAN WORK FOR YOU
We are pleased to be able to offer readers the opportunity to sell your unwanted equipment or advertise your 'wants'.

Simply complete the order form at the end of these ads, feel free to use an extra sheet of paper if there is not enough space on the order form. We will accept ads not on our order form.

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

DEADLINE AND CONDITIONS
Advertisements will be inserted in the first available issue on a first come first served basis. We reserve the right to edit and exclude any ad. Trade advertisements are not accepted.

FOR SALE

■ FT1012D mic fan FM 9 Bands FC902 ATU FTV901R 2m Fitted only £610, no offers, prefer not to split. G4UYI Bob Tel: (0946) 810205 after 5pm.

■ Daiwa Search 9 used as base with power pack. Fitted with eleven crystals £25. Weale, 1 Candy Croft, Great Bookham, Surrey KT23 4BZ. Tel: Bookham 56741.

■ Yaesu FT707 three months old, never used for Tx only Rx. This is a real bargain £400 OVNO. Jen SX1000 synth cost over £350 new want £85. Tel: (0283) 33526 after 6pm.

■ Memopak 16K for ZX81 £7. CD1014/2 DB scope sweep needs slight attention good condition £20. Amtron field strength meter 24 – 32MHz £10. Hella universal 12V hazard warning lights conversion £10. Tel: Hythe (Kent) 68854.

■ DX100U CW/AM Tx 160 – 10m self contained 100W output £65. Superstar 360FM AM, FM, LSB, USB, CW. Ideal for conversion to ten metres, with info, £85. Ten metre portable Icom 1050 with nicads and flexi-aerial £35. Send SAE for clear out list. McCarthy, 31 Philip Road, Ipswich, Suffolk IP2 8BQ. Tel: (0473) 215047.

■ Clearing out, large quantity of semiconductors, diodes, transistors for sale, bags 50 £5.00 P & P 50p. Six 2N5942 VHF power £5.00 each, three 2N5070 VHF power transistors £3.00 each, one PF1 Rx UHF £4.00 P & P 80p, small quantity of IC linear digital etc bags 20 £4.00 each. All components are unused. One box 49 xtals assorted freq's types used £10.00. C Cooper. Tel: (0705) 386254.

■ Yaesu FT902DM transceiver plus matching transverter FTV902, as new condition, £685. Tel: (31) 54264 Great Bookham, Surrey.

■ Sony CRF320 dual conversion receiver, first class condition with service manual and instructions USB/LSB/CW/AM/SW/FM/LW/MW, built in timer, recorder and lots more features cost £850 will accept £395 ono. Could meet half way to and from QTH. Freq read out SW 1.6-30MHz also will consider P/X on HF equipment or VHF scanner SX400, AR2001, Tel: (Evening) Bournemouth 824890.

■ Power amps for 2 metre transmitters. 16W PA strip 2N6080 + 2N6082, 23dB gain, 52% efficient, 13.8Vdc at 2.25A £10. 16W PA module diecast case + full heatsink 2N6080 + 2N5590, 15.5dB gain 64% efficient, 13.8Vdc at 1.8A, £11. Please add £1.50 postage for each unit. Tel: (0473) 54405 (evening) or write 103 Foxhall Road, Ipswich, G8KDL (Steve).

■ Datong Morse Tutor, £35. R1155A unmodified, some details, needs PSU £20. Tel: (01) 994 836.

■ Oscilloscopes, signal generators and other electronic equipment for sale. Telequipment S51E SB scope £30, D43 DB, £70, Solartron CD1400 DB, £100, plusnsome spare plug-inf for CD1400 (details on applicatcon). Tektronix 180A time mark generator (to 50MHz), £40, Tektronix 107 suarewave generator (1MHz) £20, advance AF signal generators H1 £30, J2, £35, SG67 (to 1MHz) £15, Heathkit AW1V audio wattmeter, £20. David Russell, 9 South Beach Road, Ardrossan, Ayrshire KA22 8AX. Tel: (0294) 64144.

■ Radio and television servicing books from 1968 – 1977, 9 books for sale, £30. Burgess, 49 Theodore Rd, Scunthorpe DN15 8HB.

■ Realistic PRO2008 VHF-UHF scanner. 68-88MHz, 144-174MHz and 410-512MHz coverage. Receive everything from your local 70cms or 2m repeater to British Telecom's mobile telephone service. Memory back-up, channel lock-out and scan delay are just some of the features of this electronic eavesdropper. As new – no mods. Cost £115 new, yours for only £65 or offer. Creed 54 Teleprinter-complete with: Internal paper tape puncher, 6S/6 paper tape reader, J-Bell alarm, numerous rolls of printer paper and paper tape plus new spare ink ribbon. All in good working order and operational on 45 or 50 Baud. Sale due to completion of computer based RTTY system, £25 or offer. Will swap for FRG7 or other HF Rx with cash adjustment. Prefer buyer collects but can deliver in Northern area within reason. S Jenkinson G6HBZ, QTHr or Tel: Keighley (0535) 52511 Ext 315 during working hours.

■ Eddystone 740, 840C, 888A, Hammerlund military rack receiver, needs PSU Hallicrafters SX62 receiver, various other receivers, some needing work. Heathkit DX100U CW/SSB transmitter. Many 1930s broadcast receivers in wood, bakelite. Please write or telephone: John Baker, 13 Burrard Road, London NW6 1AB. Tel: (01) 794 0823.

■ Lots of old service sheets and manuals for amateur radio, vintage wireless, test equipment, audio, TV, video etc. Copies available, LSAE with 'wants' and I'll try and help. Maurice Small, 8 Cherry Tree Road, Chinnor, Oxon OX9 4QY.

■ 48K Spectrum, 2 months old, leads, manuals, PSU, plus £70 worth of software, and Currah Speech Unit £90. Collectors item R1155B immaculate, unmodified, handbook for all models, PSU/test unit with pre-amp and speaker built in £65, OVNO. Ferranti valve interstage transformer, Air Ministry variable voltage PSU 1-15V approx, requires meter, in TU5B case, offers invited. Buyers collect or carriage extra. Borthwick, 92 Linglie Road, Selkirk, Borders Region, Scotland.

■ Jumbo Ham International 26.065 27855 £125. Astatic Silver Eagle £75. Astatic Tear Drop £10. Astatic Mobile King £10. Realistic TR1001 FM hand set, rechargeable nicad charger, hand mike, flexible antenna, carry case, £65. Sigma 4 £30. Yaesu FT707 FC707 FV707DM headphones mobile mount, base mic MD1B8 YM35 G Whip ext speaker £650. 60ft telescopic tower £275. Tel: Ingrebourne (04023) 45470 or Basildon (0268) 284550.

■ Heath S/H audio signal generator 10Hz/100KHz £14. Wolsey VHF/UHF professional high gain distributor aerial amplifier with two aux -40dB monitor sockets £25. Manor supplies colour cross hatch test generator £25. Zx Spectrum 32K RAM pack by Cheetah as new only £15 cost £40. Vega Radio World Reception as new MW/LW/6SW £10. Wein stereo FM-MW tuner amp with 8 track player as new £15 only. Mr Mabrouk, 21 Redington House, Rodney Street, London N1 9QQ. Tel: (01) 226 5676 day, (01) 278 4806 evening.

■ Colt 320 DX multi-mode £25. Ham International multi-mode two £25. Harry Moss audioline £15. RA17 Racal Rx £150. Sharp MZ80A £200. Lynx 96K new £100. DNT 40FM on 10 metres with USA repeater shift £30. ICOM 1050 part modded to 10 metres £25. Mike G4UPD (QTHr) 82 Seaforth Road, Leeds LS9. Tel: (0532) 491366.

■ Books and mags. Radio, TV electronics and broadcasting, about 90 books from 1794 to present day prices from 75p to £95. Write for list. Steve (G8KDL), 103 Foxhall Road, Ipswich (SAE please).

■ FT7B HF mobile Tx 120W input 80-10m, YC7B extension frequency display £350 ono. HF 3-30MHz 12V solid-state linear amplifier 0.5-10W input 200W, 1100W/50W output £120 ono. 10m FM Tx Grandstand Gemini Factory converted with 150W/60W linear £50 ono. 10m 3 ele Yagi £20 ono. Astronomical telescope 60mm objective lens. With tripod and accessories £80 ono. Creed 75B teleprinter adjusted for 45.5 baud amateur use £25 ono. Wanted: FT101ZD FM 432/144MHz transverter. Consider part exchange for any of above items. Tel: Gerard, Rossendale (0706) 218694 after 5pm.

■ AVO model 8 MKII £50. Newnes Radio TV servicing books vols 1 to 5, 1955-56, 1961-62, 1962-63, 1964-65, 1965-66, 1966-67, 1967-68, 1968-69, 1969-70, offers. DATA X'sistor book, 1974, offers. K Muir, 26 Admirals Walk, Littlehampton, West Sussex BN17 6RH. Tel: L'Ton 723067.

■ TR9000 10W multimode, as new, full working order, little used, original packing, mobile mount, £270. G6GVV Tel: Hatfield Broad Oak (027970) 427.

■ Trio TS510 working £85. Racal RA17, RA66, RA63, MA168, all okay, good condition £220. Handbooks, leads ext. Audio terminal unit Redifon £15. Creed 7B free. CU89 terminal unit £15. Will exchange all above for modern Racal Rx WHY lots of old valves 150 for £15. Tel: Leeds 677101.

■ Multimode II AM FM, SSB, 120 channels with lead, mic, manual in box £70. Please write to: Mr M Richards, c/o 'Les Yard' Aughton, Collingbourne, Kingston, Nr Marlborough, Wilts.

■ Eddystone 940. High quality general coverage communications receiver. 480KHz to 30MHz in 5 bands. Controls: RF gain, IF gain, BFO, crystal phasing, AF gain, AGC, noise limiter, selectivity (three band-widths). Excellent mechanical construction and very high quality analogue dial read out. Physically is in perfect condition and recently re-aligned. Only £100. Brand new spare valves £6. Tel: Steve G8KDL on (0473) 54405 (evening) or write 103 Foxhall Road, Ipswich IP3 8JZ.

■ Ultra Cub 2 metre handheld transceiver, five channels. Xtals for R7, S20, S22, S23. 0.5W RF output 0.8μV sensitivity. Uses 12V Nicads. Full circuits and data available. Four free Nicads included. Only £45. Tel: Steve G8KDL (0473) 54405 evenings or write 103 Foxhall Road, Ipswich IP3 8JZ.

■ Monitors. Green Screen. 23MHz. Made by Motorola. Separate video signal input, horizontal sync input. Vertical sync input. 12 inch screen. One with case, one for spares. Circuit diagram £50 the two. Tel: Keith (0543) 376366 (West Mid's).

■ Standard 8900 2 mtr TCVR FM 10W Five memories. Scanning Mic repeater shift. Exchange for FRG7700 or FT200 WHY. Keith G40CH (0543) 376366 (West Mids).

■ AVO valve tester model CT160 with leads, manual. Perfect working order £30 inc post. First cheque secures, others returned. Valve data manuals 7 different volumes covering many thousands of types £1.50 each or £10 complete set. Some manuals on old wireless sets, receivers. SAE with 'wants' and I'll try and help. Lots of surplus ICs SAE list, Mr Maurice Small, 8 Cherry Tree Road, Chinnor, Oxon OX9 4QY.

■ Eproms Ex projects 2516, 2716, 2732, 2764, all erased and tested. Tel: (0843) 33398 after 6pm.

■ Sharps MZ80A computer mint condition, bargain at the price, no offers, £295. MM4001 RTTY interface and RCA printer. Never used for transmitting. Mint condition £180 or nearest offer. These items will not be sold before appearing in Amateur Radio. Buyer collects or extra for post and package etc Tel: Johnny Gainsborough (0427) 5266 anytime.

■ Claude Lyons ac auto voltage stabiliser, BTR-5 240V model, 5 amp, used once only, offers or swap WHY Phone Truro 75858 between 6-7pm.

■ Yaesu FT102 C/W narrow SSB filter, mic, SP102, manuals etc, in original boxes, immaculate condx, £550. Racal RA17 Rx 0.5 to 30MHz C/W manual, recently overhauled £140. Heathkit 2KW transmatch C/W balun & manual. £70. SSM Europa 10m to 2m transverter £25. Including spare PA's. Computer modem suits BBC £20. Wilson WE800 144 to 148MHz synthesised FM 10W/1W mobile/portable C/W manuals etc, £120. Can deliver within 100 miles. Butterfield G4AAQ, Pontefract. Tel: (0977) 791071.

■ Realistic TRC2001 40 Chan FM rig, almost new, unused £25 ONO. Colley, 13 Ferry Road, Wawne, Hull HU7 5XU. Tel: 822276.

■ Tandy TRS80 pocket computer with interface and printer and connectors for cassette, complete manuals, eight tapes. For games, finance, electronics. Has single line LCD display, bargain £40. Colley, 13 Ferry Road, Wawne, Hull HU7 5XU. Tel: 822276.

■ Panasonic 3100 general coverage Rx with FM broadcast bands, SSB, CW, RTTY, 2 filters, modified for use with MW loop as well as usual external ant. 1 year old in first class condition, list price £219 sell for £115 ono plus postage. Mr R W Hall, 23 Whitehouse Court, Ushaw Moor, Durham, DH7 7NH.

■ Microwave Modules 70cm to 10m receive down converter and 2m to 70cm Tripler. Both old models, £14 each incl UK postage. 'Everyday Electronics' November 1972 to July 1977, £20 the lot incl. UK postage. Will separate at 75p each. 'Practical Electronics' August 1970 to July 1982, few missing £40 the lot, or 75p each incl UK postage. SAE with all enquiries. Colin Redwood G6MXL, 45A Lulworth Avenue, Hamworth, Poole, Dorset BH15 4DH.

WANTED

■ Reasonable price paid for N-model Pye Bantam or SR9 on 144-146 2 metre, can collect or pay carriage. Tel: Pete anytime on (0602) 326618.

■ Can anyone please help? Wanted urgently: wiring circuit diagram for Siemen's 2000 16mm projector. Not amplifier circuit. Would copy if drawing could be loaned etc. Would appreciate information on place of manufacture if known in Germany, or British agent. Mr J P Hupfield, 47 Leeward Road, West Worthing, Sussex. Tel: (0903) 66329.

■ Wireless set No 11 and transmitter T1083, £50. Each offered in restorable condition. Warner, 45 Eastry Close, Ashford, Kent TN23 2RS. Tel: (0233) 36185.

■ Urgently required, 2-30MHz 100H element for Bird thruline type 43 wattmetre. Good price paid or would exchange 100MHz to 250MHz 10watt element. W G Cooper, (G4PIY) 'Totara", Birch Slatt, West End, Woking, Surrey GU249NR. Tel: Brookwood 2251 (evenings).

■ Manual for Eddystone receiver Model 940 coverage 0-30. Tel: Rainham (Essex) 02348.

■ Scope probes for CX1441 and modern S/S colour TV test equip, EHT meter, Normende EG3872 generator with handbook. Tel: Hythe (Kent) 68854.

■ Has anyone a copy of the users manual for the Trio R600 that I can have to buy, loan or copy? Reasonable expenses met. Pye, 98 Hall Place, 7 Edgware Road, London W21NG: Tel: 01 723 3847.

■ FDK multi VFO11. Contact G1JYF Tollgate, Callington, Cornwall. Tel: Liskeard 83291.

■ Ham multimode II circuit diagram will pay reasonable price. Also any mods available. Please tel: Martin (890) 4829.

■ Dead VHF/UHF amateur rigs. Cash. Please write with details. A Jefford, 78 Churchill Road, Exmouth, Devon EX8 4DT.

■ Racal SSB adaptor, RA63 or RA98. See also my for sale ad. Tel: Milton Keynes (0908) 314095.

■ Service manual with circuit diagram for Telequipment D52AR. Schofield, 26 Birkenshaw Lane, Birkenshaw, Bradford BD11 2HA.

■ Yaesu FT101B or KW2000 A or B, any condition, preferably working order, or any similar HF rig. Reasonable offers please write to: John Cavanagh, 190 Liverpool Road, Huyton, Liverpool, Merseyside L36 1RJ.

■ PGMs for RTTY and other that can fit on MC-10 (Tandy) or Alice (France) with 20K RAM. Any letter about the MC-10 will be very welcome, and I will exchange PGM if desired. Thank you and super 73. CUL. Guy Houie, 61 Jean de Lafond, Bouchervile, Quebec, Canada, J4B 2B6. Tel: (514) 655 9905.

■ Info: researcher compiling data-base on communications receivers wants to buy/borrow/copy handbooks or data sheets on all commercial, ex-military, and amateur HF receivers of any age. Contact Steve G8KDL, Tel: (0473) 54405 evenings or write 103 Foxhall Road, Ipswich.

■ Service information and circuit details of Telequipment. Scope type D31. Greenfield, 20 Church Meadow, Lilleshall, Shropshire, TF10 9HD. Tel: (0952) 604302.

■ Circuits for Minimate car radio. VEF transistor Russian and BCC CT53 sig gen. Valve audio gen, good cond etc. Also info on Vortexion CBL recorder. Alan Judge, 106 Bicknor Road, Maidstone ME159PD. Tel: (0622) 50709.

■ Engineer into HF solid-state linear design required to help me further my ideas on 500W PEP + mobile unit, fee or expenses to be agreed, any interested parties please write in first instance to G4ZOW, 3 Ryecroft Close, Hemel Hempstead, Herts.

■ Still looking for 6 pin connectors for WS10, singles, doubles, any length, any condition. Also Pye aerial plugs and sockets for above. Somebody must have some, please help, your price paid. Also handbook or photo copy for KW160 Top Band Tx. Tel: Pete G4IQZ (0235) 34037 evenings, daytime (0235) 45047 Oxon.

■ Control head and patch lead for hi band Vanguard 6CH wanted. Also 16mm films, mag or optical sound. G8BSK, 290 Priory Road, St Denys, Southampton, SO2 1LS.

■ Any service sheets or manuals for Amerex mono TV model ACT 22m, 3m Wallensak 4766 stereo cassette deck, ITT Star radio telephone 'Starphone' type M5. Will pay costs. Many other wants. Write SAE for list. Mr Maurice Small, 8 Cherry Tree Road, Chinnor, Oxon OX9 4QY.

■ FRG7700 wanted in exchange for Standard 8900 144-146MHz EM Tx-Rx 10W 5mem with scanning mic plus 7/8 whip and gutter mount. Keith G40CH (0543) 376366 (West Mids).

FREE CLASSIFIED AD ORDER FORM

Send to: Radio & Electronics World Classified Ads·Sovereign House · Brentwood · Essex · CM14 4SE

Classification: (tick appropriate box) If you want to insert ads under more than one classification use separate sheets for second and subsequent ads

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.

RE0285

NEW IMPROVED **Radio & Electronics World** — For all aspects of practical amateur radio

SMALL ADS

MORSE TUTOR

£4.00 on cassette. **£8.50** on microdrive for Sinclaire Spectrum. Also available for the QL at **£8.50.** 4 to 19 words per minute, variable spacing, variable groups of random letters, numbers or mixed; Random sentences, own message, single characters and variable pitch. Feedback on screen, printer, or speech (Currah Microspeech 48K only) and repeat facility, 16K and 48K versions on one cassette 48K only on microdrive.

WD SOFTWARE
Hilltop, St. Mary, Jersey, C.Islands
Telephone (0534) 81392

AMTOR for the DRAGON 32/64

Now you can run AMTOR directly on the DRAGON without expensive external hardware.

Program + Timer/interface module to add to your own TU £55.25
RECEIVE ONLY version £36.25
MF2 SWL Terminal unit. 170/425/850 Hz. Switched shift. + Morse capability £32.00

For full details send 2x17p stamps
ACCESS & VISA accepted
Please add VAT at the current rate to all prices

PNP COMMUNICATIONS (REW)
62 Lawes Avenue, Newhaven
East Sussex BN9 9SB. Tel: (0273) 514465

CHESHIRE

Glenbond (Videotel) Ltd
25, Stamford Street,Altrincham,Cheshire, WA14 1EX
Tel: 061 941 3057 **Telex: 666387**
Standard 2m and 70cm – Jaybeam – Ant Antennae Antiference – Weltz – Sinclair computer spares
Colin G1 1ZD Gavin G1 1ZL
Your radio sold on commission basis

NOTTS

R.A.S.(NOTTINGHAM)
P Owen G8UUS
3 FARNDON GREEN; WOLLATON PARK
NOTTINGHAM: TEL: 0602 280267
Open: Tues-Fri 10-5.30 Sat 9-5
YAESU: FDK: ICOM: TONNA
HALBAR: WELZ: ANTENNAS & OWN GW5 H.F

COUNTY GUIDES

FROM ONLY £13.16 PER MONTH

Take advantage of this simple, economical and rewarding method of advertising by filling in the form below.

KENT

Thanet Electronics ICOM
95 Mortimer St, Herne Bay
Tel: 02273-69464
Open: Mon, Tues, Wed 9-5
Thurs 9-1, Fri, Sat 9-5.30
All mail order & service enquiries to head office, 143 Reculver Rd, Tel: 02273-63859

XXX ADULT VIDEO CLUB

For the genuine adult films. Available only from ourselves. Ring

0924-471811 (24hrs)

For the intimate details or write
ADULT VIDEO CLUB
P.O. Box 12, Batley, W. Yorks.

LIVERPOOL

PROGRESSIVE RADIO ELECTRONICS SPECIALISTS
47 Whitechapel Liverpool 051 236 5489
89 Dale St Liverpool 051 236 0154
93 Dale St Liverpool 051 236 0982
Open Tues-Sat 9.30-5.30
FOR ALL YOUR ELECTRONIC NEEDS.

Radio & Electronics World COUNTY GUIDE

Ensure that radio & electronics enthusiasts in your area know where to find you

Ad sizes
20mm x 59mm = single County Guide
40mm x 59mm = double County Guide

Total prepayment rates	Ad space	3 issues	6 issues	12 issues
	single	£47.00	£88.00	£158.00
	double	£94.00	£176.00	£316.00

LONDON

BONEX LTD
RF component specialists Toko coil & Inductors
102 Churchfield Road
London W3 6DH
Tel: 01 992 7748

RADIO & ELECTRONICS WORLD COUNTY GUIDE ORDER FORM

TO: Radio & Electronics World · Sovereign House · Brentwood · Essex · CM14 4SE · England · (0277) 219876

print your copy here ....

....

....

....

....

NUMBER OF INSERTIONS REQUIRED

Single County Guide 3 .... £47.00 ☐ 6 .... £88.00 ☐ 12 .... £158.00 ☐
Double County Guide 3 .... £94.00 ☐ 6 .... £176.00 ☐ 12 .... £316.00 ☐

PAYMENT ENCLOSED £ —

Cheques should be made payable to Radio & Electronics World. Overseas payments by International Money Order

Conditions — Payment must be sent with order form. No copy changes allowed. Ads accepted subject to our standard conditions, available on request.

Registered No 2307662 (England)

C P I

NORFOLK

Eastern Communications
31 Cattle Market Street
NORWICH
(0603) 667189
MAIL ORDER
MON-FRI 9.00-6.00
SAT 9.30-5.00
ICOM
ACCESS/BARCLAYCARD

Complete full-size sets, any published service sheets £2.50 + large SAE – except CTV's/Music Centres from £3.50 + large SAE. Manuals from 1930 to latest. Quotations, free 50p magazine, price lists, unique technical publications, for large SAE. Comprehensive TV or Radio courses now only £9.50 each

TISREW
76 Church Street, Larkhall, Lanarkshire ML9 IHE
Phone: 0698 883334

RTTY SOFTWARE

CBM64, VIC20, ATOM, DRAGON 32/64, TANDY COLOR COMPUTER
Advanced machine code programs with split-screen type-ahead operation, any baud rate, saveable memories etc.

AMTOR

Superb full-feature system for Dragon 32/64 & Tandy at one third the cost of current alternatives.

MORSE DECODER & SENDER
MORSE TUTOR: BASICODE KIT

Available for Dragon 32/64. Large SAE for software/hardware details.

Grosvenor Software (REW)
22 Grosvenor Road, Seaford, Sussex
Tel: (0323) 893378

G W MORSE KEYS
4 Owen Close, Rhyl, Clwyd
Wales LL18 2LQ

THE GW MORSE KEY
A joy to use and to look at, this key is made from solid brass polished and mounted on a slate base, here in GW land (not JA) Mounting the key on slate stops all movement of the key when in use. £34.50 pp £2.00 ea.

24 HR LCD CLOCK
Clear ½" high lcd readout repeat alarm clock, battery powered (2 AA pencells). No R/F problems known. Complete with batteries £9.50 pp £0.50 ea.

GWHIP PRODUCTS
The full range of Gwhips always in stock for quick and prompt delivery or collection.

****
NEW — NEW BASE STATION ANTENNA FROM — NEW
NEW — GWHIP PRODUCTS — NEW
NEW — AVAILABLE SOON — NEW
****

For full information and price list please send SAE

BRASS CALL PLATE
Your callsign engraved on a brass plate for fixing to the GW morse key or any of your radio equipment. £1.00 only.

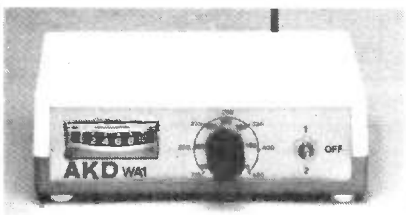
NO POST & PACKING CHARGE FOR ORDERS OVER £50.00

Amtron Electronic Kits and instrument cabinets. Over 70 kits in our range plus special offer on obsolete kits. Send SAE for catalogue.

Amtron UK Ltd
7 Hughenden Road, Hastings East Sussex TN34 3TG

AKD Armstrong Kirkwood Developments
10, Willow Green, Grahame Park Estate, London, NW9.
Tel: 01-205 4704

VHF/UHF ABSORPTION WAVEMETER
Covers 120-450 MHz. Extremely sensitive. Low-profile. Requires PP3 battery £24.95



HIGH PERFORMANCE RF FILTERS
SLIMLINE, ATTRACTIVE APPEARANCE
Used by British Telecom, Thorn-EMI, ITT, Telefusion, Granada etc.

Standard range terminated in Belling Lee plug/socket (75ohms) – others to order
Model TNF2 Tuned Notch Filters (Braid & Inner) for 2, 10, 15, 20 Metres & CB (state which) £7.50
The TNF2 range have a very low insertion loss and very high rejection over the band for which they are supplied. They are the best possible answer for aerial borne interference from a single known frequency or frequency band.
Model RBF1-70cms Notch Filter (inner only) £6.32
Model BB1 Braid Breaker £6.32
Also available, 3 High Pass models and a "Radar Blip" filter for VCRs. Please send A4 or C4 stamped addressed envelope for filters data sheet and price list.
All items are manufactured by AKD in UK and carry a two year guarantee plus 14 day money back promise (no reason required).
Items usually despatched within two days from receipt of order. Prices include VAT, postage & packing.
(Prop.) J.W. ARMSTRONG
ALSO AVAILABLE FROM MOST LEADING AMATEUR RADIO DEALERS

★ SERVICE MANUALS ★

For **ALL** Amateur Radio, Vintage Wireless, Audio, Television, Video, Test Equipment etc. etc.
Thousands stocked. LSAE enquiries and quote **by return** plus **FREE** catalogue.

MAURITRON TECHNICAL SERVICES
Dept REW, 8 Cherrytree Rd, Chinnor, Oxon, OX9 4QY

Learn to make your own Printed Circuit Boards
EXPERIMENTER'S PRINTED CIRCUIT KIT

Laminate Boards, Chemicals, Instruction Book, also, Plans & Circuits for 50 Interesting Projects you can build with own parts and transistors £2.50 p&p 50p.
Protect your premises with an efficient BURGULAR ALARM, PHOTOELECTRIC KIT £5.50 p&p 50p. INVISIBLE BEAM OPTICAL KIT £4.50 p&p 50p. Send SAE for details of all Kits & Circuits and FREE 5 transistors & 5 diodes.

EXPERIMENTAL ELECTRONICS 335, Battersea Pk Rd
London SW11. Tel: 01 720 2683

RADIO & RTTY BOOKS

CONFIDENTIAL FREQUENCIES LIST New 6th Eddition listing thousands of Aero, CW coastal etc. Stations worldwide £11.90 + 80p p&p.
WORLD PRESS SERVICES FREQUENCIES News RTTY Servies listing by frequencies, GmT & Country plus more £6.20 + 60p p&p.
CLANDESTINE CONFIDENTIAL New guide to rebel shortwave stations £6.20 + 60p p&p.
GUIDE TO RTTY FREQUENCIES 4500 stations listed worldwide £8.85 + 60p p&p
RTTY TODAY beginners guide to RTTY decoding on home computers, etc. £6.20 + 60p p&p
2 or more books p&p free

INTERPRODUCT LIMITED
Dept RE3, Stanley, Perth PH1 4QQ Tel: 073882-575

NEXT ISSUE ON SALE 14 FEBRUARY

TECHNICAL INFO SERVICES (REW)
76 Church St — Larkhall — Lanarks

FULL SIZE SERVICE SHEETS
Any radio, audio £2.50 + l.s.a.e.
CTVs/MusC £3.50 + l.s.a.e. complete set

Worlds largest collection service manuals 30's — date from £4.50-£35 each.

Comprehensive TV Repair Course
Complete Radio Service & Repair Course
ONLY £9.50 EACH

Repair data/circuits almost any named TV/Video for £10.50

Sae brings any quotation
FREE 50p mag, inc. service sheet!
Pricelists unique elect. publications

FOR FAST QUOTES
RING 0698 883334

Used Equipment Centre

Buying or selling? Contact the Used Equipment Centre for the best deal. 25 years of amateur radio experience, friendly advice, full no quibble guarantee on all equipment. Heard about our exchange plan, buy & try? Why not contact me, David Cole G3RCQ Hornchurch 55733, evenings/weekends or send SAE for full details & current list of equipment. G3RCQ 65, Cecil Avenue, Hornchurch, Essex. Urgent daytime enquiries 01-594-3495.

MORSE READING PROGS

Work on clean signals, without hardware interface. ZX81 1K UNEXPANDED MEMORY. Translated code, with word and line spaces for easy reading. Automatic scroll action, **£7.00 Incl.**
SPECTRUM 16-48K. Scroll action with 10 page scrolling memory, instantly accessible page by page **£8.00** inc. All types variable speeds. Feed signal direct into EAR socket.

Pinehurst Data Studios, 69 Pinehurst Park, West Moors Wimborne, Dorset BH22 OBP

Radio & Electronics World
For all aspects of practical amateur radio

SMALL ADS

This method of advertising is available in multiples of a single column centimetres — (minimum 2cms). Copy can be changed every month.

RATES
per single column centimetre:
1 insertion £9.65, 3 — £9.15, 6 — £8.65, 12 — £7.75.

RADIO & ELECTRONICS WORLD SMALL AD ORDER FORM

TO: **Radio & Electronics World · Sovereign House Brentwood · Essex CM14 4SE · England · (0277) 219876**

PLEASE RESERVE ....centimetres by..............columns

FOR A PERIOD OF 1 issue........☐ 3 issues........☐ 6 issues.......☐ 12 issues........☐

COPY enclosed........☐ to follow........☐

PAYMENT ENCLOSED:........ £ —

Cheques should be made payable to Radio & Electronics World. Overseas payments by International Money Order

CHARGE TO MY ACCOUNT........☐

COMPANY ....

ADDRESS ....

SIGNATURE .... TELEPHONE..........................

....

	C	P	I							

ADVERTISERS INDEX

Radio & Electronics World
For all aspects of practical amateur radio

ADVERTISING RATES & INFORMATION

ABC membership approved pending first audit Jan-Dec 1984

DISPLAY AD RATES

depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
			series rates for consecutive insertions		
61 x 90	⅛page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	¼ page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	½ page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

COLOUR AD RATES

depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
		colour rates exclude cost of separations	series rates for consecutive insertions		
128 x 186 or 263 x 90	½ page	£420.00	£395.00	£375.00	£335.00
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00

SPECIAL POSITIONS

Covers: Outside back cover 20% extra, inside covers 10% extra
Bleed: 10% extra [Bleed area = 307 x 220]
Facing Matter: 15% extra

DEADLINES

*Dates affected by public holidays

issue	colour & mono proof ad	mono no proof and small ad	mono artwork	on sale thurs
Mar 85	17 Jan 85	23 Jan 85	25 Jan 85	14 Feb 85
Apr 85	14 Feb 85	20 Feb 85	22 Feb 85	11 Mar 85
May 85	7 Mar 85	13 Mar 85	15 Mar 85	11 Apr 85
Jun 85	11 Apr 85	17 Apr 85	19 Apr 85	9 May 85

CONDITIONS & INFORMATION

SERIES RATES
Series rates also apply when larger or additional space to that initially booked is taken.
An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.
Previous copy will automatically be repeated if no further copy is received.
A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.
Display Ad and Small Ad series rate contracts are not interchangeable.

If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

COPY
Except for County Guides copy may be changed monthly.

No additional charges for typesetting or illustrations (except for colour separations).

For illustrations just send photograph or artwork.

Colour Ad rates do not include the cost of separations.

Printed — web-offset.

PAYMENT
All single insertion ads are accepted on a pre-payment basis only, unless an account is held.
Accounts will be opened for series rate advertisers subject to satisfactory credit references.
Accounts are strictly net and must be settled by publication date.

FOR FURTHER INFORMATION CONTACT
Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE.
(0277) 219876

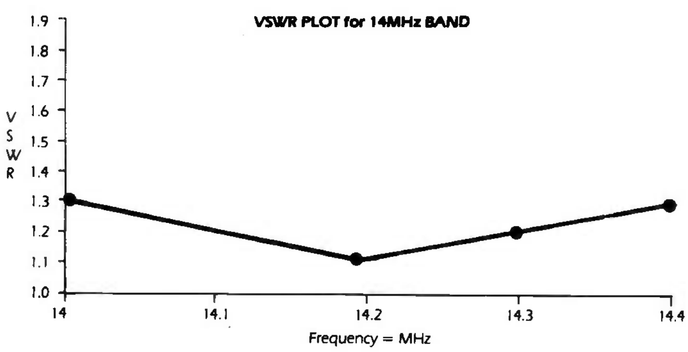
Overseas payments by International Money Order.
Commission to approved advertising agencies is 10%.

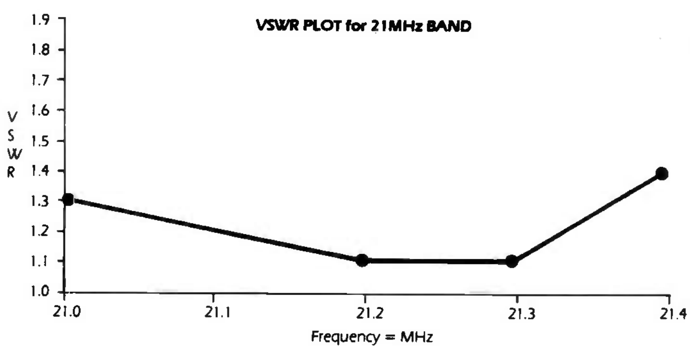
CONDITIONS
10% discount if advertising in both Radio & Electronics World and Amateur Radio. A voucher copy will be sent to Display and Colour advertisers only.
Ads accepted subject to our standard conditions, available on request.

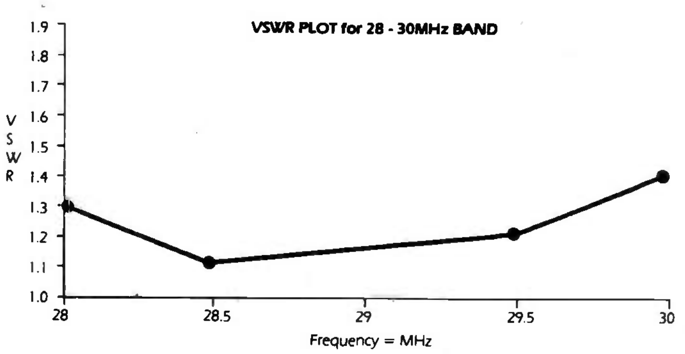
A New Approach to HF Antennae Design

Compare these performance figures of Hightech Antennae's **MBFr80** with the best 3 element antennae available today.

	Typical Spec. for 3 element Tri Band Beam	**Hightech Antennae's Spec for MBFr80**
	No. of Elements — 3	2 Parasitic + 1 Absorber Element
Front to Back Ratio	25dBd	43dBd
Forward gain	6dBd min.	Better than 4.5dBd
VSWR at Resonance	1.5 : 1	1.1 : 1
Max. Power Input	1kW (100% duty cycle)	2kW (100% duty cycle) 5kW peak
Input Impedance	50 ohm	50 ohm
Boom Length	4.2m	4m
Max. Element Length	8.2m	4.6m
Max. Wind Survival	75mph	100mph
Net Weight	16.3kg	8kg
Wind Load	80mph = 47kg	100mph = 23kg







The front to back ratio advantage from Hightech Antennae's **MBFr80** is 18dBd better than other antennae available today. Remember this is a 3 S-unit noise reduction in unwanted directions over and above other antennae.

6dBd = 1 S-unit

Massive front to back ratio. This is more important than forward gain on today's crowded amateur bands.

Flat VSWR across all HF bands.

No need for the purchase of ATU's for those with solid state PA's.

No need for the purchase of baluns.

A complete break with the coil and capacitor trap arrangement with, of course, its associated losses, restricted bandwidth etc.

Expandability: Extra parasitic element (director)
Extra absorber element for even greater front to back ratio.

With the conversion kits available, a 3 element, 3 band beam with an enormous front to back ratio will become the standard for others to follow.

H I G H T E C H

Antennae (Scotland) Ltd

To: HTA (Scotland) Ltd., 24 Gremista Ind. Est., Lerwick, Shetland Is. ZE2 0PX

Please Supply ....**MBFr80** Antenna(e)

@ **£189.95** incl. VAT & P & P

Name (please print) ....

Address (please print) ....

.... Postcode ....

REW5

I enclose a cheque/PO payable to HTA (Scotland) Ltd value £ ....

or debit my Access Card No. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Cardholder Signature ....

Credit Card Hotline 0595 - 5949 Please allow 28 days for delivery. Offer valid UK only