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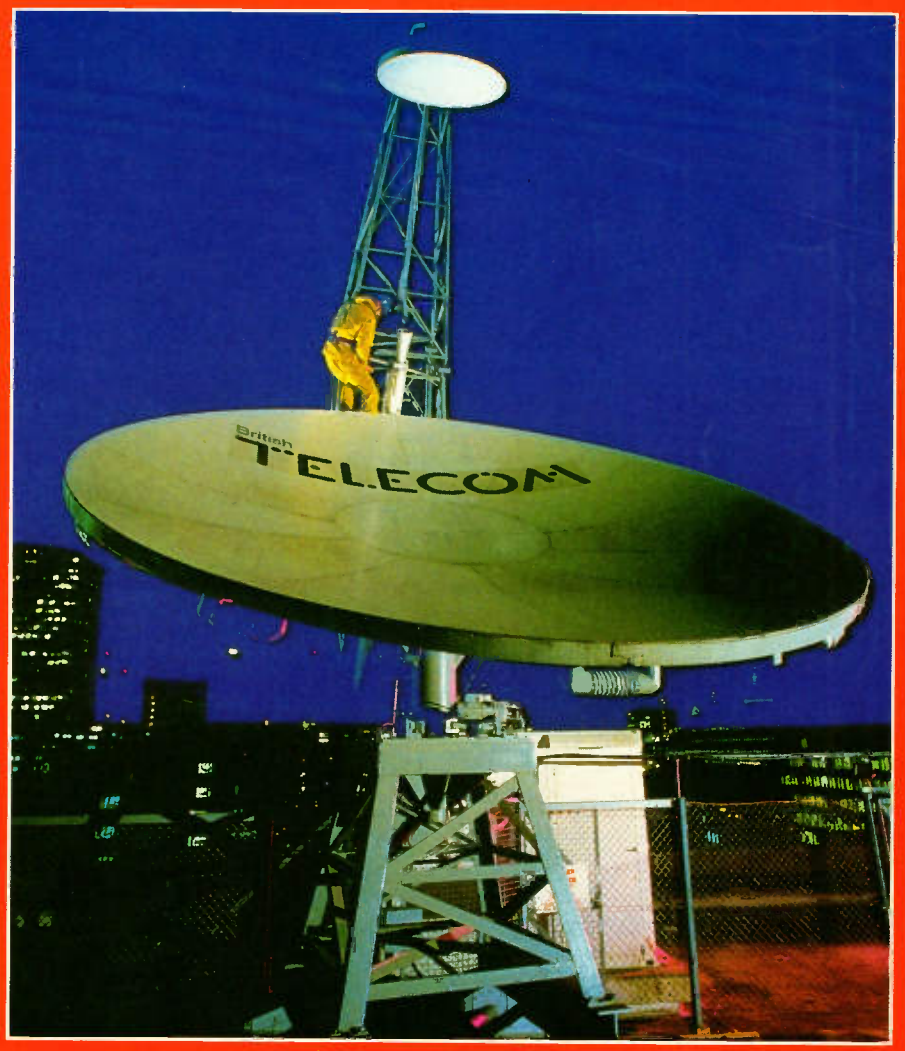

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AUTHORISED YAESU

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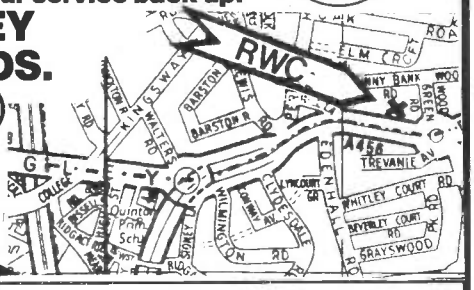
Tel: 021-421 8201/2 (24 HR ANSWERPHONE)



RWC SPECIAL OFFERS

PLEASE ASK ABOUT THE RWC CREDITCARD AVAILABLE NOW VIA LOMBARD TRICITY

RAY G4 KZH **PHIL G4 OHK**

THESE PRODUCTS ARE EXCLUSIVE TO RWC

10 Mtr MOD BOARD – Remember who did it first!

This is a complete modification board designed to fit all CB radios that incorporate the SANYO LC7137 series of sythesizer chip, the unit comprises of a small pcb with six microchips and fits almost all current legal (CB 27/81) radios, the unit is supplied with full fitting instructions and can be fitted easily by most enthusiasts, with the current upsurge in interest in this band demand has been high as this means that over 90% of current CB radios can now be used on 10mtr amateur band.

PRICE £22.50 + £1.00 post and packing
Works excellent in Cybernet, Binatone Lowe TX40G etc. * Check if your radio has the Sanyo chip fitted. We will fit unit for you **£40.00** inclusive. P&P.

KIT OF PARTS AVAILABLE **£17.50 + £1 p&p**
* Only available from RWC see R&EW March 1985 for full circuit description etc.

RAYCOM MODULAR RF AMPLIFIERS

A complete range of linear and fm amplifiers for use with both VHF and UHF hand portables and multimode portables such as the YAESU FT290R and FT790R. Power output from 15W to 45W depending on model, (eight are available). All units feature Mitsubishi or Toshiba power modules as used in the majority of mobile and base radio transceivers. Two versions are also available for business radio applications.

PRICE from £39.50 for the 15W vhf model + £2.00 post

UHF UNITS (430-440MHz)

	ORDER CODE	PRICE
25W FM/CW	U25F	£79.50
15W FM/CW/SSB/AM	U15L	£69.50
15W FM/CW	U15F	£59.50

(FULL RANGE OF POWER MODULES IN STOCK)

VHF UNITS (144-149MHz)

	ORDER CODE	PRICE
45 FM/CW	V45F	£62.30
35 FM/CW/SSB/AM	V35L	£59.50
25 FM/CW	V25F	£48.50
15 FM/CW/SSB/AM	V15L	£49.50
15 FM/CW	V15F	£39.50

A.R.M. MULTI P6 ANTENNA

This is one of the most exciting new products to be launched by RWC and is the result of many months of development by Antenna Research Manufacture based in Devon.
The antenna has been designed to meet the growing popularity in multimode portable and mobile operation and is capable of being used on both vhf and uhf in both horizontal and vertical polorization modes, both portable and mobile. The antenna has the facility of being used as both omni-directional or directional modes as well as having capability of DF function. No ground-plane or radials are required and the antenna can therefore be used in a variety of applications on frequencies between 140-450 mhz. ★ See review in March Amateur Radio.
Further details are available upon application
PRICE £41.75 complete inc post
Colinear element **£4.75**

LOWE TX40G on 10 METRES – Exclusive offer

RWC are pleased to offer this very fine radio modified on 10 metres complete with repeater shift built-in. The unit has all of the features remaining except the high/low switch now controls the offset.
This high quality Japanese made unit hs RF gain control, RIT, P.A. facility, and has a very sensitive receiver, along with >4W RF output power, and typical deviation of 4Khz.
The unit comes complete with mobile mount, and is guaranteed for six months. This unit has the RWC mod board unit fitted and represents excellent value for money as this radio still sells for £33.00 on 27mhz. Was £79.00 originally

PRICE £52.50 + £2.50 carriage (price subject to increase when existing stocks are sold) – Hurry unrepeatable offer!

RWC also stock a comprehensive range of matching linears and antennas specifically designated for 10mtr operation.

COMING VERY SOON . . .

RWC WAVEMETER,
RWC PHASING HARNESS,
RWC DUAL BAND BASE ANTENNA (VHF-UHF)

ANNOUNCING THE SUPER YAESU FT757GX

Following the release of the RWC 10mtr MOD BOARD for the SANYO LC7136/7 series of cb sythesizer chip, and its successful launch onto the UK amateur radio market, the RWC design team are now ready to announce their latest innovation.

This new product is aimed at the world market and is a mofication for the popular YAESU FT757GX.

After over six months of development by our design team led by G3SBI, with G8FBX and G4KZH, and successful field trials, the modification has been perfected to enable installation by the end user.

The modification serves two major purposes:

(1) To improve VFO tuning and eliminate "VCO GLITCH"
(2) To decrease tuning speed from 10khz per dial revolution to 5khz per dial revolution (selectable on the 500khz step switch).

BRIEF DESCRIPTION

The unit comprises of a small pcb designed to fit onto the existing microprocessor (Q67) and has two microchips and some small components and only eight connections, three of which are connected to three of the micro pins direct. The other five wires easily connect to existing terminals on the main pcb, and also the display board. The modification can easily be installed by experienced constructors and will be available from selected dealers who will be able to offer a fitting service.

Each mod board will be supplied complete and tested (as per the RWC 10mtr. mod board) no kits of parts will be available. Registered design pending.

PRICES

UK price is £29.50 for the built and tested pcb with complete fitting instructions and £39.50 plus carriage for a unit factory fitted and tested. User warranty will not be affected on units supplied by RWC. All prices include value added tax at the current 15%. Export enquiries are welcomed.
(Instant fitting service available, please telephone)

All the above products have been designed and built in the UK and are exclusively available from:

EXCLUSIVE: DISTRIBUTORS FOR ARM PRODUCTS & RAYCOM LTD TRADE ENQUIRIES INVITED

R WITHERS COMMUNICATIONS LTD
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Safety in the shack

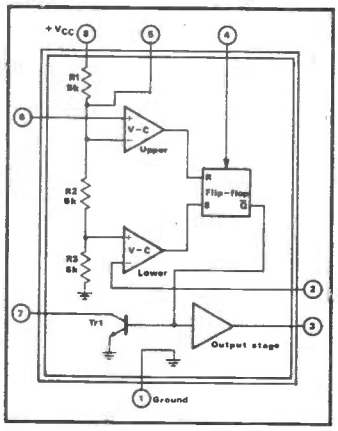
Some of the constructional projects featured refer to additions or modifications to equipment; please note that such alterations may prevent the item from being used in its intended role, and also that its guarantee may be invalidated.

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 – A satellite dish used for British Telecom's SatStream North America service
Bottom – A new tester from Steinel, the Digi-Check 3 (p4)

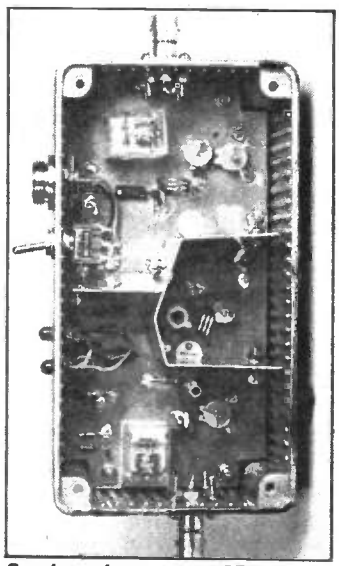
SPECIAL FEATURES

CB GB – page 8



Ubiquitous chip – page 33

REGULARS



Speak up please – page 25

READER SERVICE

Going Dutch – page 19

NEXT MONTH

☐ **Next Issue**
Cover date August 1985 on sale Thursday, 11 July

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

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

HAND-HELD TESTER

A compact, hand-held tester, the Digi-Check 3, available from Steinel (UK) Ltd, offers many of the facilities hitherto available only from sophisticated mains-powered instruments.

Small enough to fit into a pocket, the Digi-Check 3 has the benefit of an internal microprocessor that gives it a wide range of automatic features. These include automatic measurement mode selection so that the user does not have to switch the instrument between ac or dc voltage measurement, phase testing or resistance measurements. The Digi-Check 3 is able to sense which test mode is required and automatically prepare itself.

Information is displayed on a clear LCD readout to an accuracy of within ±one digit or 1.5% or reading. In addition, four audio signals are provided, giving the operator

unambiguous status indication, reading confirmation and over-range signals.

Considerable efforts have been made to ensure maximum safety under all test conditions. This is achieved using a number of approaches, based on a design that keeps the operator's attention on his (or her) hands.

The control electronics, display and two simple push-button controls are incorporated in one of the two probes, eliminating the need for the operator to look away from the probes to read the measurement.

In addition, both probes are double-insulated to IP50 standards, corresponding to DIN 40 050, with a high input resistance (660Kohms) and wide tolerance to overvoltages (up to 5000V) without damage. Normal voltage range is from 1 to 999V ac or ±999V dc, through a frequency range from 20 to 2000Hz. Resistance range in continuity test is from 0 to 500Kohms.

A wide range of other features is provided by the Digi-Check 3, including automatic switch on and off, automatic low battery voltage indication and the ability to remain stable even under the effects of large voltage pulses – up to 10KV peak, 1.2/50μS.

Steinel (UK) Ltd,
17 Reddicap Trading Estate,
Sutton Coldfield,
West Midlands B75 7BU.
Tel: (021) 378 2820.

SHORTSQUEEK

New from Global Specialties is the unique Shortsqueek tone-ohmmeter, designed, in a compact format, to provide for easy location of short circuits on printed-circuit (PC) boards. The Shortsqueek comes complete with power pack and is packaged in a sturdy carrying case.

Shortsqueek indicates by means of an audible tone whether the probe tip is being moved towards or away from the short circuit. It responds to very low values and very small changes in resistance.

The ohmmeter has a typical range of 1 to 0.01Ω and a tone shift of 1200 to 4000Hz.

Designed for a variety of PC board applications, including test, quality assurance, repair and field service operations, Shortsqueek overcomes the problems of metallic 'whiskers' between two traces, a situation where, previously, the board would have been scrapped due to the high cost of finding the problem.

Global Specialties Corporation,
Shire Hill Industrial Estate,
Saffron Walden,
Essex CB11 3AQ.
Tel: (0799) 21682.

CLAMP TESTER

The Pantec CT3206 digital clamp tester, with 3½-digit LCD and 46mm tong aperture, is currently available from Electronic and Computer Workshop Ltd.

The tester will give voltage and current surge readings, with retention of peak value, and has a hold facility. The incorporated CMOS LS1 circuit ensures 100 hours continuous operation. Accuracy is given as 1% of reading ±1 digit.

The tester will give readings in the following ranges: volts ac 0-199.9V/1000V; current ac 0-19.99 push-button depressed and 19.99-1000A automatic; resistance 0-199.9 ohms/1999 ohms.

The instrument is supplied with a carrying case, weighs 450g and its overall dimensions are 230 x 80 x 36mm.

Electronic and Computer Workshop Ltd,
171 Broomfield Rd,
Chelmsford,
Essex CM1 1RY.
Tel: (0245) 262149.

HAND-HELD MULTIMETER

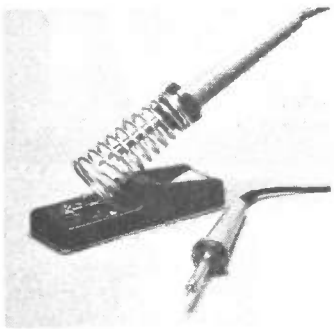
New from House of Instruments is the Soar Model 3400, a hand-held 4½-digit multimeter offering an accuracy of 0.04% and both auto and manual ranging facilities.

The Model 3400 provides measurement of dc and ac voltage and current as well as resistance, and also incorporates a diode-test facility and an audible continuity check buzzer.

Voltage ranges from 200mV to 1000V dc and 750V ac are provided, along with current ranges from 200μA to 10A. Ten resistance ranges go from 200Ω to 20MΩ.

The instrument incorporates push-button range selection for easy one-hand operation, while a built-in tilt stand also allows benchtop use. It measures 90 x 175 x 38mm, weighs 300g, and is powered by a standard 9V battery.

House of Instruments,
Raynham Road,
Bishop's Stortford,
Herts CM23 5PF.



SOLDERING IRON

A general purpose 27W soldering iron, the Oryx Viking, is available from Greenwood Electronics of Reading.

Featuring a stainless steel shaft and collet and a choice of some 14 interchangeable long-life iron plated tips, the Viking can be supplied complete with a bench-top stand with steel coil receptacle. Nickel-plated tips are also available for use with the iron, making it suitable for a wide range of tasks.

The Viking is a low cost, high quality iron. Because the tip is retained by a stainless steel assembly which does not corrode under the influence of the acid fluxes commonly used in cored solder, tip changing is an easy operation. The ergonomically styled handle of the Viking features a safety ring to protect the operator's fingers from the hot shaft and offers a high degree of operator safety.

Versions are available for operation on 12V, 24V, 50V, 115V ac and 220/240V ac. The tip temperature is typically 390°C, the length is 215mm and the Viking weighs just 100 grams.

Greenwood Electronics,
Portman Road,
Reading,
Berks.
Tel: (0734) 595844.

SOLDERING STATION

Litesold have designed the new PC478/38 variable temperature miniature soldering station for use on very fine work and sensitive components, where a larger temperature controlled iron is difficult to use.

The Model 38 is one of the world's smallest soldering irons, weighing only 7 grams (less flex), and handles like a fine pen. The element shaft is only 2.4mm in diameter and the extra slim nylon handle is fitted with a screw-on finger grip. Interchangeable slip-on bits come in a range of tip sizes from 3.6mm down to 1.0mm, and are available with long-life or copper faces.

The PC478 power unit provides a steplessly variable and highly-smoothed regulated dc output (nominally 6 volts) by means of which the soldering iron temperature can be adjusted between approximately 180 and 380°C. Selected power is maintained regardless of variations of plus or minus 10% in mains supply voltage. An LED output indicator varies in brightness with power adjustment and an illuminated mains rocker switch is fitted. The unit has a 2 amp fuse.

Light Soldering
Developments Limited,
97/99 Gloucester Road,
Croydon,
Surrey CR0 2DN.
Tel: (01) 689 0574.

PCB CONNECTOR

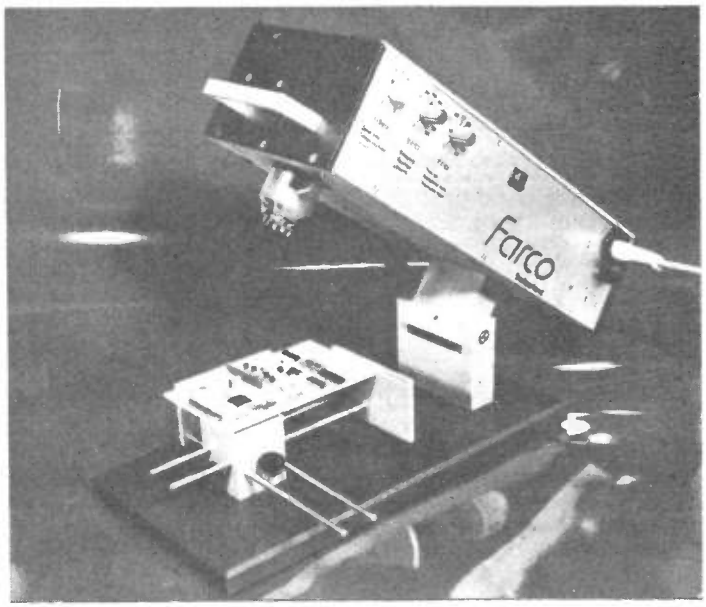
A range of compact, high current capacity 3.96mm pitch PCB connectors, the VH series, is available from Takbro.

VH series connectors can carry 7A per contact over their rated temperature range of −25°C to +85°C. They use the proven 'box-type' leaf contact which can reliably handle low voltage, low current signals as well as the larger currents from relatively high powered circuits.

These connectors are available in 2- to 10-way versions and both top and side entry units are available.

Contacts and posts are tin-plated brass; contact housings and post bases are UL94-V0 rated natural coloured nylon 66.

Takbro Ltd,
Albert Drive,
Burgess Hill,
West Sussex.
Tel: (04446) 45601.



SOLDER MACHINE

The new Farco F020 machine from Dage Intersem offers a low cost semi-automatic solution to reflow soldering surface-mounting ICs onto PCBs.

Machine-soldering of SMDs is essential because of the danger of damaging or lifting PCB pads when using manual soldering with such a fine tolerance, high pin-count device. Yet at this early stage in the market, the only machines available for the purpose are expensive highly-automated solutions, costing typically from £10,000.

The new F020 takes substrates up to 400mm square. After the PCB is positioned and the work surface clamped in place, the machine is ready for a production run. An IC is positioned on the pad and a heating element lowered over the component to reflow solder it into place.

Soldering temperature is continuously adjustable from 50 to 500°C. Users can also set dwell time (from 0.5 to 10 seconds) and a safety cut-out temperature.

The F020 offers semi-automated reflow soldering for SMD ICs at costs starting under £5,000.

Dage (GB) Ltd,
Intersem Division,
Rabans Lane,
Aylesbury,
Bucks HP19 3RG.
Tel: (0296) 33200.

SCHOTTKY RECTIFIERS

Motorola has extended its axial lead plastic Schottky rectifier line by adding six new devices with reverse voltages (V_{RRM}) ranging from 20 to 60 volts. The MBR320/30/40/50/60 are rated at 3 amps over a temperature range (T_J) of −65°C to +150°C.

The platinum and nickel construction permits an increase in temperature capability of about 25°C with only a minor increase in forward voltage drop (V_F), which still remains extremely low. The V_F for the MBR320/30/40 is 0.5 volts, and 0.6 volts for the MBR350/60 when the forward current is 1.0 amps.

This extra temperature capability, low V_F and extended voltage capability adds to overall design flexibility.

The rectifiers are suited for use in switching power supply outputs, fast switching applications, as clamp diodes and as low forward voltage drop steering diodes. Die construction features an ion implanted guard-ring for protection against high dv/dt surges.

Motorola Semiconductor
Products Inc,
PO Box 20912,
Phoenix,
Arizona 85036,
USA.

ICOM GREAT SETS...

IC-735, The Complete HF Radio

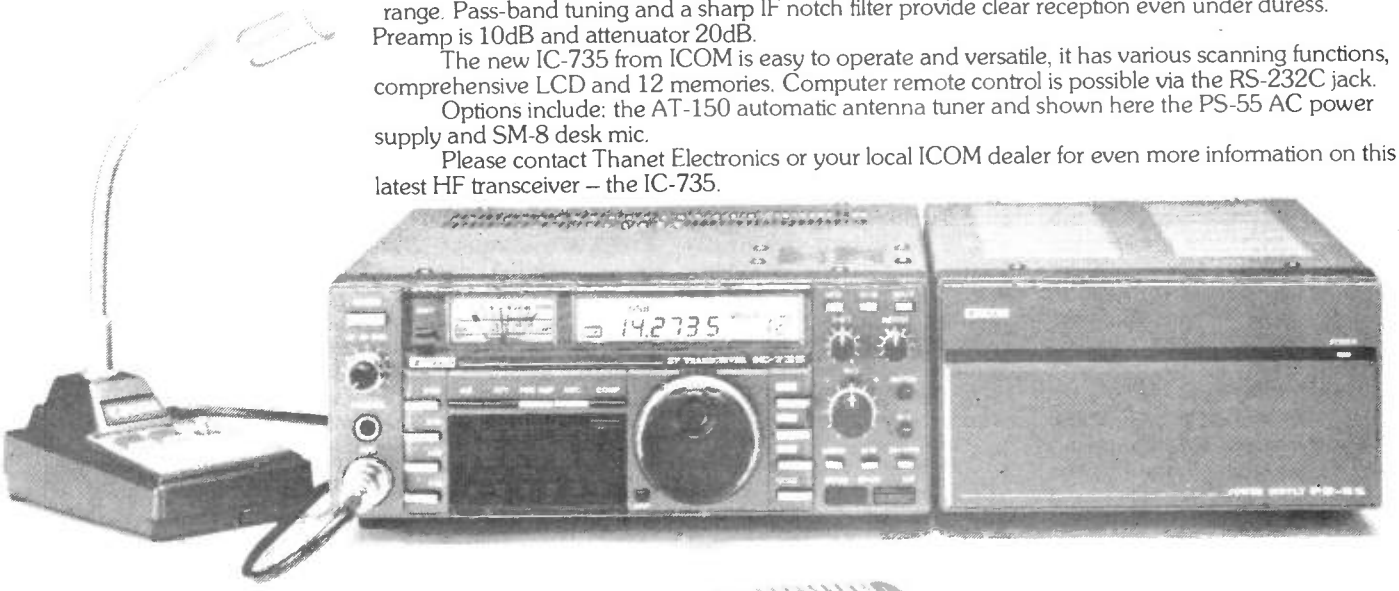
This new HF transceiver from ICOM is compact enough to make mobile or portable use a possibility. The IC-735 covers all Amateur frequencies from 1.8MHz to 30MHz including the three new bands 10, 18 and 24MHz. Modes include SSB, CW, AM and FM. all circuits are solid-state and output is approximately 100 watts.

Tuning ranges from 100kHz to 30MHz, made continuous by using a high-side IF and a CPU control system. RTTY operation is also possible. Dynamic range is 105dB with a 70.451 MHz first IF circuit. The direct feed mixer rejects spurious response and gives higher sensitivity and wider dynamic range. Pass-band tuning and a sharp IF notch filter provide clear reception even under duress. Preamp is 10dB and attenuator 20dB.

The new IC-735 from ICOM is easy to operate and versatile, it has various scanning functions, comprehensive LCD and 12 memories. Computer remote control is possible via the RS-232C jack.

Options include: the AT-150 automatic antenna tuner and shown here the PS-55 AC power supply and SM-8 desk mic.

Please contact Thanet Electronics or your local ICOM dealer for even more information on this latest HF transceiver – the IC-735.



IC-3200E

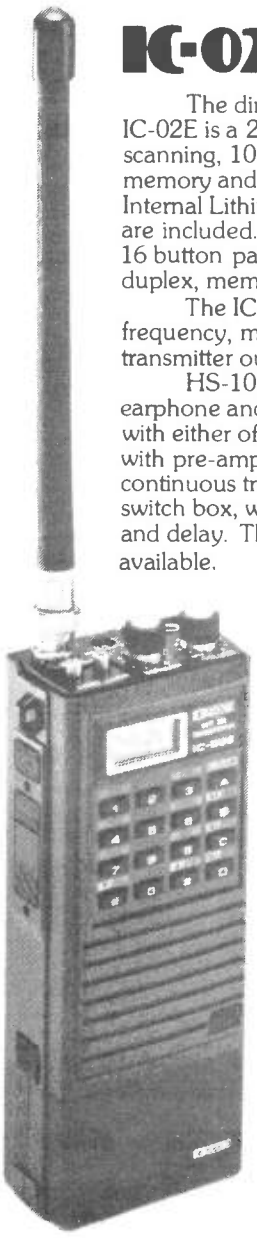
A new exciting set is the ICOM IC-3200E FM Dual-band transceiver (144-430/440 MHz). This is the smallest transceiver available.

The IC-3200E employs a function key for low-priority operations to simplify the front panel. LCD display is easy to read in bright places, showing frequency, VFO A/B, memory channel duplex mode and S/RF meter information.

Other features include a 10 channel memory able to store operating frequencies, Simplex or Duplex A memory lock-out function allows the memory scan to skip programmed channels when not required. The IC-3200E has a built-in duplexer and can operate on one antenna for both VHF and UHF. Options include: IC-PS45 DC. power supply, HS-15 mobile mic, SM6 and SM8 desk mics. SP-10 external speaker and UT-23 speech synthesizer A great future is predicted for the IC-3200E.

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Tha

ICOM GREAT VALUE



IC-02E, IC-04E

The direct entry microprocessor controlled IC-02E is a 2 meter handheld, 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 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.

HS-10 Headset also available, 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.

Authorised Icom dealers in the UK

Alexian Electronics Ltd. Edinburgh, 031-554 2591.
Alyntronics, Newcastle, 0632-761002.
Amateur Radio Exchange, London (Ealing), 01-992 5765.
Amcomm, London (S. Harrow), 01-422 9585.
Arrow Electronics Ltd., Chelmsford Essex, 0245-381673/26.
Beamrite, Cardiff, 0222-486884.
Booth Holding (Bath) Ltd., Bristol, 02217-2402.
Bredhurst Electronics Ltd., W. Sussex, 0444-400786.
Dressler (UK) Ltd., London (S. Harrow), 01-558 0854.
D.W. Electronics, Widnes Cheshire, 051-420 2559.
Hobbytronics, Knutsford Cheshire, 0565-4040. Until 10pm daily.
Photo Acoustics Ltd., Buckinghamshire, 0908-610625.
Radcomm Electronics, Co Cork, Ireland, 01035321-632725.
Radio Shack Ltd., London NW6, 01-624 7174.
Scotcomms, Edinburgh, 031-657 2430.
Tyrone Amateur Electronics, Co. Tyrone, N. Ireland, 0662-2043.
Reg Ward & Co. Ltd., S.W. England, 0297-34918.
Waters & Stanton Electronics, Hockley Essex, 0702-206835.

Listed here are authorised dealers who can demonstrate ICOM equipment all year round. This list covers most areas of the U.K., but if you have difficulty finding a dealer near you, contact Thanet Electronics and we will be able to help you.

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 have a retail branch at 95, Mortimer Street, Herne Bay, Kent. Tel: 369464. Give it a visit, BCNU.

Cue Dee Antennas Special Offer!

CUE DEE antennas are designed to last for decades – the best possible aluminium alloy for this purpose is used (SIS 4212-06).

The booms are made of 28mm tubing with 1.5mm wall, with colour marks clearly indicating where to fit the elements. By using tubular boom, and a synthetic guy wire on the long yagis, the windload is reduced by a factor 0.66 compared to using square shaped material for boom and guying.

The driver element is made of 12mm tubing and features a PTFE (Teflon) insulated gamma match which is pre-tuned at the factory and made for 50 ohm feeder with a PL 259 type connector. No further adjustments or power consuming balun needed. This matching system ensures a clean radiation pattern and transfers the power without losses.

The parasitic elements are made of 6mm solid rod and mounted to the boom with the aid of a CUE DEE element washer, boom to element part and a screw. This, together with our intelligible assembly manual, makes an extremely easy and solid assembly which assures the long life of a CUE DEE antenna.

2 metre Yagis.
4144A – 4 element, 8dBd gain £19.00.
10144 – 10 element, 11.4dBd gain £37.00.
15144 – 15 element, 14dBd gain £49.00.
Order now while stocks last.

ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet Electronics

Dept RW,143 Reculver Road, Herne Bay, Kent. Tel: (0227) 363859

MOBILE RADIO

Uniace Telecommunications Ltd have announced their new Uniace 400 personal mobile transceiver for the 934MHz leisure band.

All British made using state-of-the-art design and surface-mounted component techniques, the transceiver performance equals or exceeds the basic DTI specifications. Using microprocessor control and an integrated VCO, the frequency stability is ensured by the use of a TCXO for the reference oscillator giving a tolerance of ± 1ppm over a temperature range of 0°-60°C.

The Rx is a dual conversion superhet with IFs at 21.4MHz and 100KHz. Selectivity is ensured by the use of Gigafil pre-tuned cavity filters as well as the more conventional crystal filtering. Double-balanced Shottky diode mixers are used for frequency mixing. A bipolar transistor preamp in the Rx front end gives low noise and good sensitivity, at about 0.5μV for 20dB quieting, matching any other 934MHz equipment on the British market. The squelch control is signal-to-noise operated, which has been found to be most efficient on this band, and as well as the conventional variable control an auto position has been provided.

On the transmit side a Vogad takes care of the audio, providing automatic speech processing. Filtering by Gigafils in the Tx line makes for a nice clean and tight RF signal to the hybrid PA module, which gives a full 8 watts transmitted power.

Finally, at the present time, the Uniace 400 is supplied tuned to the 20 channels as allocated by the DTI, but provision has been made for easy conversion to 40 channels as and when these are available.

The standard controls are volume on/off switch, squelch with auto position, tone control switch and hi-lo band switch, which is provided for future use when the 40 channels become legalised. There is an Rx signal strength meter, a transmit indicator LED and the usual LED channel number display. The supply voltage should be 13.4 volts at 3 amps and the antenna socket is a low loss BNC type for ease of mobile installation.

The Uniace 400 is available for £355 including VAT.

Uniace Telecommunications,
Unit 8,
Conway Road Industrial Estate,
Llandudno Junction,
Gwynedd, North Wales.
Tel: (0492) 613232.

'CUSTOM' ENCLOSURE

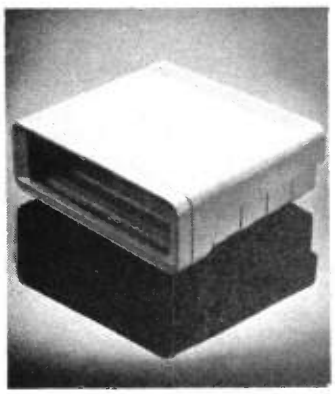
In the past, if the electronics designer needed a small quantity of low cost enclosures he purchased off-the-shelf injection moulded or sheet metal boxes. Now Beechcraft Ltd of Midsomer Norton, near Bath, have unveiled the Exten System; a new enclosure system that combines good looks with practicality, features innovative construction and offers the option to completely customise the fascia area at very low cost.

This is done by utilising the expanded PU foam process, which does not require the expensive tooling of injection moulding yet is rigid, light and very strong.

By simply substituting part of the mould, Beechcraft are able to produce quantities as small as 25 of these 'custom' enclosures for a tooling charge as low as a few hundred pounds.

The Exten is available in four sizes, the largest being able to accept a 19 inch subrack assembly, and has a wide range of options including vertical or angled fascias, extra venting, RFI screening, dozens of standard colours and a carrying handle/stand.

Beechcraft Ltd,
Westfield Industrial Estate,
Midsomer Norton,
Bath BA3 4BS.
Tel: (0761) 416642.



IC SOCKETS

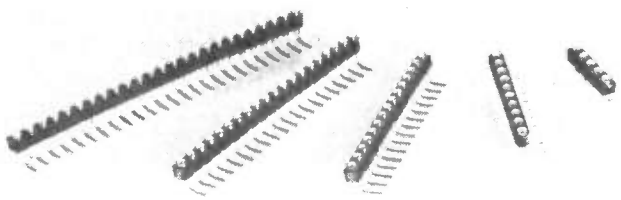
Aries Electronics (Europe) has introduced its Vertisocket range of IC sockets, designed to allow single row devices to be mounted at right angles to the PC board. Available with 2 to 25 positions, the 0517 Vertisockets feature collet style sockets with gold contacts and tin- or gold-plated shells on 0.100 inch centres.

The single-in-line sockets are end-to-end stackable on 0.100 inch centres and they are moulded so that they can be broken down to any number of pins from 25 downwards without damage.

Aries can supply the 0517 Vertisockets either to full 25 position length or to any desired number of positions.

The body of the single row Vertisockets is made from glass-filled thermoplastic.

Aries Electronics (Europe),
Alfred House,
127 Oatlands Drive,
Weybridge, Surrey KT13 9LB.
Tel: (0932) 57377.



BIG CATS

With the market for loudspeakers rapidly expanding, Maplin Electronic Supplies have introduced a range of eleven high quality, high performance, high power loudspeakers which the company hopes will establish new standards in professional audio equipment. The Maplin 'Big Cat' range is UK designed and built to meet the most demanding European standards.

The Big Cat loudspeakers combine high power capability, electrical strength and professional quality of sound with a low cost price factor. Major features of the range include: a virtually indestructible, high temperature voice coil reinforced with glass-fibre; 100% heat overload tolerance; advanced technology magnet system; rigid cast alloy chassis; linen or plastiflex elastomer surrounds; 5in to 18in, 50W to 300W.

Details are featured in the *Maplin 1985 Buyer's Guide to Electronic Components.*

Maplin Electronic Supplies,
PO Box 3, Rayleigh,
Essex SS6 8LR.

MICROWAVE ATTENUATORS

A comprehensive range of microwave continuously-variable attenuators, covering frequency ranges from dc to 500MHz and up to 18GHz, is offered by Anglia Microwaves Ltd.

Manufactured by ARRA Inc, the range includes miniature, lockable, direct reading models for panel-mounting applications and motorised models. Versions with negligible phase shift can be supplied, together with high power types able to handle up to 500W CW or 10KW peak.

The most popular attenuators include a wide choice of direct-reading attenuator types with attenuations of up to 120dB. These feature a non-contact attenuation variation method, which has the benefit of not altering the calibration with usage. These, designed primarily for panel mounting, can be orientated in any position while still giving easily-read dial calibration.

The entire family features low insertion loss, typically 0.5dB from the miniature models, low VSWR and a proven rugged, high reliability construction.

Anglia Microwaves Ltd,
Radford Business Centre,
Radford Way, Billericay,
Essex CM12 0BZ.
Tel: (02774) 59855.

NEW BBC MICRO

The 'B+', the latest newcomer to the acclaimed BBC Microcomputer range, has been announced by Acorn Computers.

With a full 64K of RAM memory, plus 32K ROM expandable to 192K, and a built-in enhanced disc drive interface, the B+ offers significant increases in both power and performance over the standard Model B, for a price of £499 including VAT.

The first public showing of the BBC B+ was at the BBC Micro and Electron User Show at the New Horticultural Hall, London during May. Full stocks of the B+ are now ready for shipment to distributors and dealers.

The main circuit board, the heart of the BBC Micro, has been completely redesigned for the B+, and Acorn are confident that it is more reliable than before.

Additional features of the BBC B+ include six repositioned ROM sockets, making them very much more accessible to users installing software chips. Extra ROM space is also freed by a single chip machine operating system/BBC BASIC, and for maximum reliability virtually all components except language ROMs have been soldered, not plugged into sockets.

However, the B+ is fully compatible with the BBC B and shares all its features, including BBC BASIC, Econet upgradeability, expandability through Tube (R) and 1MHz ports, serial and centronics interfaces for printers, cassette and joystick interfaces, TV, colour and B/W monitor outputs, and a full 73 key professional keyboard.

Acorn Computers Ltd,
Fulbourne Road,
Cherry Hinton,
Cambridge CB1 4JN.

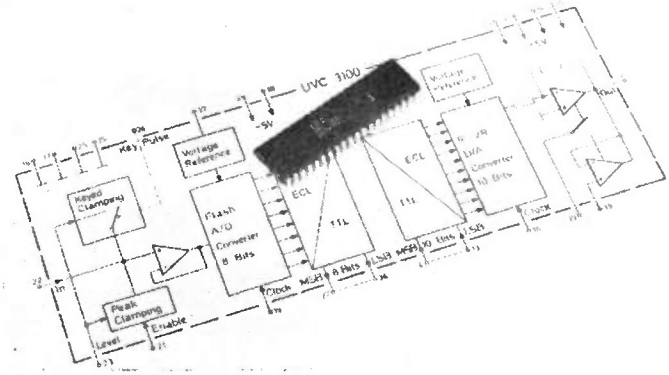
DISC DRIVE

What is believed to be the cheapest disc drive for the BBC Micro user is now available from RCS Computer Services. It is the Olivetti disc drive and it is being offered at £60 + VAT (£69 including VAT, plus £3.50 post and packaging). A 5¼ inch, 100K, 40 track, single-sided drive, it comes complete with a utility disc, handbook and all the cables required to plug into a BBC Model B + D.

For users without a disc interface on their micro, RCS is offering a special package price of £168.50 including VAT (plus £7.00 postage and packaging). This upgrades the machine to full Acorn specification and includes the Olivetti disc drive.

The offer is available while stocks last. RCS Computer Services is the central repair agent for Acorn.

RCS Computer Services,
Leeway Data Products Ltd,
Enterprise House,
Central Way,
North Feltham
Trading Estate, Middlesex.



A/D & D/A CONVERTER

The new UVC 3100 from ITT Semiconductors can reduce chip count in applications requiring high-speed A/D and D/A conversion.

The chip combines an 8-bit flash A/D converter with a 10-bit D/A converter, together with various auxiliary circuits, for frequencies up to and including the video range.

The A/D converter offers 8-bit resolution. Differential non-linearity is ½LSB, absolute non-linearity is specified at 1%.

The complementary 10-bit D/A converter is also a high-speed part and is capable of operation at clock rates to 25MHz. Differential non-linearity is ½LSB, absolute non-linearity is 1%.

To minimise chip count and increase versatility the device also incorporates a number of support circuits. An impedance converter is provided for example, upstream of the ADC, to decouple the input against the high input capacitance of the ADC.

The UVC 3100 has TTL-compatible I/O and requires a ±5V supply. Typical applications include TV signal decoding in cable and satellite converters.

ITT Semiconductors,
145-147 Ewell Road,
Surbiton,
Surrey KT6 6AW.
Tel: (01) 390 6578.

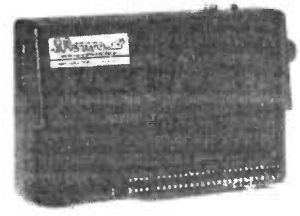
PACESETTERS

Nidd Valley Micro Products have introduced two new games peripherals, including a special joystick interface for the Spectrum incorporating their slow motion facility (patent pending).

Pacesetters give the computer user full control over program and screen speed at the turn of a knob, from normal down to freeze, and like the original Slomo. unit (which is still available) give a new dimension to games playing.

The Programmable Pacesetter enables all games to be played with joystick and with full Slomo control. The joystick movement keys for each game are easily programmed into the interface memory, keeping a permanent record. The Spectrum Pacesetter responds to all Kempston software using IN(31) with full Slomo control.

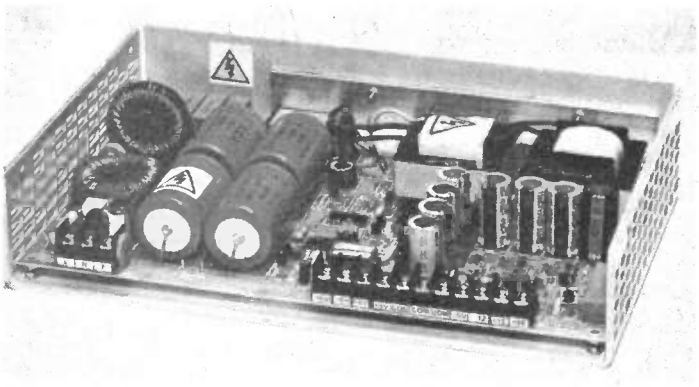
Both Pacesetters have an on/off button and LED indicator to enable the user to see



when slow motion mode is operating, so preventing software corruption whilst loading or saving from tape or microdrive. Both interfaces are compatible with all popular joysticks, including the Quickshot II.

These are high quality British products, reasonably priced at £14.95 for the Spectrum Pacesetter and £24.95 for the Programmable Pacesetter, including VAT and postage.

Nidd Valley Micro
Products Ltd,
Stepping Stones House,
Thistle Hill,
Knaresborough,
North Yorkshire.



POWER SUPPLY

A new high performance 350W switched mode supply, which permits high peak currents to be drawn from all outputs, is now available exclusively in the UK from Powerline Electronics Ltd.

Manufactured for Powerline and designated the F350, this new compact power supply unit provides outputs of 5V at 50A, +12V at 8A, −12V at 5A, +24V at 5A and −5V at 5A. Total peak power output is 450W yet the chassis is of comparable dimensions to those of competitive models providing only 300W total peak power.

Power failure indication is provided as standard and the F350 is designed in accordance with the safety requirements of IEC380 and IEC435, VDE0804, VDE0806, BS5850, TG2 and TG26.

Powerline Electronics Ltd, 5 Nimrod Way, Elgar Road, Reading, Berks RG2 0EB. Tel: (0734) 868567.

MULTI-OUTPUT PSU

Weir Electronics Limited has introduced the first of a new series of high-efficiency multiple-output switched-mode power supply units, designed as economic dc energising sources in a variety of OEM applications.

Identified as the Weir HSS100, the new model is a five output unit rated at 100 watts with convection cooling or 150 watts with forced air cooling. A feature of the HSS design is the short rise and fall time of the switching waveform, giving operating efficiency better than 80% at all but the lowest power output levels, with a high standard of reliability enhanced by the light loading of the switching circuits.

In the unit's standard form the voltages and maximum currents of its five output rails are, respective: 1/+5.1V 12A, 2/+12V 5A, 3/−12V 2A, 4/−5V 1A and 5/+24V 2A. These output voltages allow a single HSS100 to power a complete microcomputer system, including disk drives, displays etc as well as the processor itself and its memory cards. Variants on the standard unit are available, giving alternative output voltages.

All outputs are voltage regulated to compensate for line-voltage and load changes, with full regulation on outputs 2, 4 and 5 to give virtual independence from effects of loading on other output rails. Performance features include overvoltage protection in the form of a latch circuit on output 1, and a power-fail signal which provides a logic transition from '1' to '0' to indicate that the input voltage is no longer sufficient to maintain output levels within specification for more than a further 5 milliseconds.

Weir Electronics Ltd, Durban Road, Bognor Regis, Sussex P022 9RW. Tel: (0243) 865991.

TRANSISTORS

BC107/8/9	– 12p	BC184L	– 10p	BFY50,51,52	– 20p
BC147/8/9	– 10p	BC212,212L	– 10p	BFX88	– 15p
BC157/8/9	– 10p	BC327,337,337L	– 12p	BSX19	– 12p
BC547/8/9	– 8p	BD135,136	– 25p	BSX20	– 15p
BC557/8/9	– 8p	BD137,138,139	– 25p	2N2926	– 7p
BC182L	– 10p	BF195,7	– 12p	2N3055	– 50p
BC183	– 10p	BCY70	– 15p	TIP31A,32A	– 30p

SUBMINIATURE TANTALUM ELECTROLYTICS, (MFDS/VOLTS)
0.1/35,0.22/35,0.47/35,1.0/35,3.3/16,4.7/16.....14p
2.2/35,4.7/25,10/6 – 15P 4.7/35,6.8/16.....16p
10/16,10/25,22/6 – 20P,15/25,22/16,33/10.....30p
ELECTROLYTIC CAPACITORS. (Mfds/Volts)
1/25, 1/50, 2.2/25, 2.2/50, 4.7/25, 4.7/50, 10/16, 10/25, 10/50.....5p
22/16, 22/25, 22/50, 47/16, 47/25, 47/50, 33/10 – 6p. 100/16, 100/25.....7p
100/50 – 12p, 100/100 – 14p. 220/16 – 8p. 220/25, 220/50.....10p
470/16, 470/25 – 11p. 470/35 – 12p. 470/40 – 15p. 1000/16.....15p
1000/35 – 22p. 1000/40 – 35p. 2200/10 – 8p. 2200/25.....35p
Carbon Film resistors ¼W 5% E24 series 0.51R to 10MO.....1p
100 off per value – 75p, even hundreds per value totalling 1000.....£7.00
Metal Film resistors ¼W 1OR to 1MO 5% E12 series – 2p, 1% E24 series.....3p
Mixed metal/carbon film resistors ½W E12 series 1RO to 10Mo.....1½p
Mixed metal/carbon film resistors 1 watt E12 series 1ORO to 1OMO.....5p
Miniature polyester capacitors 250V working for vertical mounting
01, 015, 022, 033, 047, 068 4p. 015, 022 6p. 0.33 & 0.47.....8p
Mylar (polyester) capacitors 100V working E12 series vertical mounting
1000p to 8200p – 3p.01 to 068 mfd – 4p. 0.1 5p. 0.12 & 0.15.....6p
Plate or disc ceramic 50V E6 series 1.0 pf. to 47,000 pf.....2p

Subminiature ceramic plate capacitors 100V wkg vertical mounting. E12 series.
2% 1.8 pf to 47 pf – 3p. 2% 56 pf to 330 pf – 4p. 10% 390p – 4700p.....4p
Polystyrene capacitors 63V working E12 series long axial wires
10 pf to 820 pf – 3p. 1000 pf to 10,000 pf – 4p. 12,000 pf.....5p
Light dependant resistors NORP12.....65p

DIODES (p.i.v./amps)
75/25mA 1N4148 2p. 800/1A 1N4006 6p. 400/3A 1N5404 14p. 115/15mA OA91.....6p
100/1A 1N4002 4p. 1000/1A 1N4007 7p. 60/1. 5A S1M1 5p. 100/1A bridge.....25p
400/1A 1N4004 5p. 1250/1A BY127 10p. 30/45mA OA90 6p. 30/15A OA47.....8p
Zener diodes E24 series 3V3 to 33V 400 mW – 8p. 1 watt.....12p
L.E.D's 3 & 5mm Red 10. Green, Yellow 12p. Grommets 3mm – 2p, 5mm.....2p
20mm fuses 100m A to 5A. Q/blow 5p. A surge 6p. Holders pc or chassis.....5p
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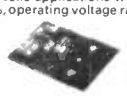

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AL 5070 (AL120) - Top class 50W 8ohm module with self-contained heat sink and built-in protection circuitry, produces really 1st class sound with a distortion level at an incredible .02%.

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AL 12580 (AL250) - A rugged top of the range module providing output powers of up to 125W into 4ohms which employs 4 heavy duty output transistors to ensure a stable and reliable performance. Currently used in disco units, public address systems, juke boxes and even domestic Hi-Fi.

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PA 207 - A quality stereo pre-amplifier and tone control unit suitable for driving any of the above amplifiers. Operates from a supply rail of 40-70V.

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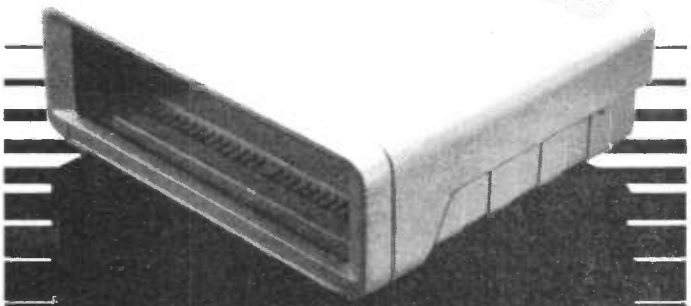
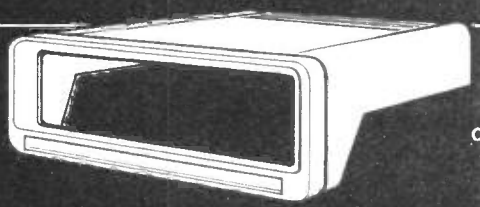
EXTEN



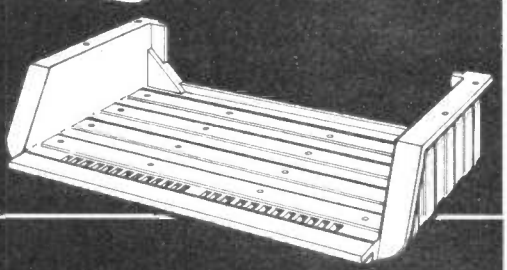
The not so Standard Enclosure

Today's sophisticated end-user demands electronics equipment that is not only technologically advanced but, more than ever, is well packaged.
Beechcraft announce the Exten, a new off-the-shelf enclosure which offers the versatility you need plus the striking looks your customers demand.
The Exten is light but tough, moulded in rigid PU foam, in four sizes up to 19" sub-rack size, with two bezel options and easy access to front and rear.



Simple two part construction

Extensive coverage of inserts



But the real beauty of the Exten is that the whole bezel area can be customised to your own design, quickly and very cheaply.
Send for details.

beechcraft

Beechcraft Limited, Westfield Industrial Estate, Midsomer Norton, Bath, Avon BA3 4BS. Telephone: (0761) 416642. Telex: 44627.

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NEWS DESK

A matter of FAX

Instant transmission of foreign language text and artwork is now possible via IPMC Translation's new electronic facsimile (FAX) service.

The international translations company believes that it is the first organisation in its industry to provide this facility, and that it is critical for clients to see and approve the work they have commissioned laid out as it will be printed, something which telex cannot do. FAX gives the complete picture on line and reduces communications downtime.

In future, IPMC's London-based multi-lingual staff will be able to liaise with their clients by FAX, telex or computer in over 33 European, Far and Middle Eastern languages.

Further information is available from: *IPMC Ltd, 25 Marloes Road, London W8 6LG.*

Prestel for Singapore

Singapore has chosen British Telecom's Prestel system in a £15 million deal with Marconi to develop the world's most advanced combined viewdata and teletext service.

The contract was announced on 13 May, on the eve of the Asia Telecom exhibition. It is the biggest ever for an exported viewdata system.

Singapore Telecoms' unique Teleview service will use both telephone links and television signals. The high capacity of television will enable the service to carry high definition pictures, graphics and characters from the Chinese language in picture form.

Teleview is due to start public service to more than 1,000 customers in March 1987. It will have advanced facilities such as electronic messaging, two-way telex, Photo Videotex and terminals in public buildings linked to the Singapore telephone network's directory enquiry centres.

The system is designed to operate on both telephone links and standard 625-line television transmissions. Customers will receive signals on their terminals via the television link, using the telephone to send out their instructions and response frames. The service will also operate on telephone links alone in both directions in the event of interruptions to the television signal.

RS232C Replacement

Following R J Redding's article *An RS232C Replacement*, published in the May 1985 issue of ***R&EW***, Mr P W Tomlinson of Avondale Workshops, Bristol, has written to inform us of his company's views on the new BSI interfacing proposals:

'The concept of a three wire serial data interface is not new – many visual display units (VDUs) provide this method of working, albeit with RS232C electrical parameters. The connector and cable concept of S5/8 is, however, novel in its application to data transmission and is welcomed.

'Unfortunately, the electrical part of the specification as currently published is incorrect, given that the intention of the authors is to define an interface specification which will guarantee that equipment using 74HCMOS components as line drivers and receivers will talk to all other equipment designed to the specification, and will do so reliably and safely.

'We have been in correspondence with the CCTA (Central Computer and Telecommunications Agency) and now have a response from one of the authors of the CCTA documents agreeing that the electrical specification is incorrect. We would therefore discourage anyone from making use of the specification as currently published, although the line driver and receiver circuitry in the CCTA documents (using 74HC14s) is basically OK.

'We have made initial proposals for reworking the electrical part of the specification, as we believe that it can be made watertight.'

A copy of a document containing these proposals can be obtained by sending an SAE to: *Avondale Workshops, Woodland Way, Kingswood, Bristol BS15 1QH.*

CableVision

GEC McMichael has won a contract worth about £14M from Clyde CableVision Ltd to supply and install the electronic equipment for a cable TV system.

Clyde CableVision is the Glasgow-based cable television consortium which in 1983 successfully applied to the government for licences to own and operate a multi-channel cable system.

Clyde's system will be of switched-star configuration which qualifies CableVision for a 23 year licence. A key component is the new GEC switch jointly developed by GEC and Delta Kabel for the UK market which will be produced at Slough. This system initially provides 27 television channels, 9 radio channels and a range of interactive switches from security to personal computing.

GEC McMichael, who will establish a project office in Glasgow, plan to install the first units in mid-1985 for start-up in October 1985. The complete installation will take about four years.

The Clyde CableVision franchise area includes Glasgow's main business and financial centre, its principal hotels and both its universities. Some 114,000 households and 14,000 business premises will have access to the services.

SEI cores

Ferrite cores from Salford Electrical Instruments, one of the founder companies in the GEC group, are key components in electrical and electronic systems. Within transformers and inductors they are used in cars and trucks, new-style car aerials, telecommunications and switching devices, home and office telephones, computers, washing machines and domestic TVs, and a variety of industrial applications. In turn, a key component in the SEI range of cores is Bayferrox iron oxide from Bayer, which comprises nearly 70 per cent of the initial powder mixes for the soft ferrites.

Bayer's Bayferrox is said to have very good chemical purity levels, high reactivity and bulk density. This uniformity and consistency is vital in a production sequence involving some 30 individual operations.

Bayferrox 1352 comprises two-thirds or more of the oxides blended by SEI for soft ferrite production. Mixes are of iron/manganese/zinc and iron/nickel/zinc. Batches are pressed out daily into a variety of soft ferrite shapes ready for sintering.

Further information is available from: *Bayer UK Ltd, Bayer House, Strawberry Hill, Newbury, Berkshire RG13 1JA.*

Black Box Cable Shop

With the new Cable Shop service launched in Black Box's *1985 Data Communication Catalogue*, savings of up to seventy per cent on some manufacturers' prices can be achieved.

The Cable Shop has the stated aim of providing a 24 hour delivery on the widest selection of top quality cables at the most competitive prices of any supplier in the UK.

Cable Shop in Reading stocks miles of cable and hundreds of connectors compatible with all the major computer manufacturers, including IBM, HP, DEC, Wang, Texas Instruments and Data General. Each cable is tailor-made to customers' specific requirements.

Orders may be placed by telephone, telex, facsimile or by posting the Cable Shop card in the Black Box catalogue. In case of queries, Cable Shop has experienced technical staff who can help customers sort out their cabling needs.

Black Box have also announced a data link scrambler known as the Crypton, aimed at securing the dial-up mini and micro system from illicit access. Black Box is confident that this hardwired device will prove impenetrable to any unauthorised users, even those who know the system passwords.

Hardwired into the data link in pairs with one unit situated on the computer side and the other at the terminal end, the device works like an electronic lock, each pair with its own unique code. Only the user who has an identically wired scrambler can receive intelligible data when dialling into the computer.

New distributors

Ant Products, manufacturers of the Silver 70 and Tiger range of amateur radio antennas have appointed three major product distributors in the north-west.

In the Greater Manchester and Cheshire areas, Glenbond (Videotel) Limited, 25 Stamford Street, Altrincham, Cheshire WA14 1EX. In the South Yorkshire area, Alan Hooker, 42 Netherhall Road, Doncaster and in North Humberside, Hessle Communications, 4 Boothferry Road, Hessle, Hull.

These three dealers all carry substantial stocks of Tiger antennas including the new two metre colinear antenna. A catalogue containing detailed information of the Ant Products Tiger and Silver 70 range of antennas can be obtained by sending 50p to cover postage to: *Ant Products, All Saints Industrial Estate, Baghill Lane, Pontefract, West Yorkshire WF8 2HA. Tel: (0977) 700949.*

Components shop

Martelec Ltd have announced the opening of a new electronic components shop at 43 Queen's Road, Farnborough in Hampshire.

Catering for the needs of both the hobbyist and the local electronics industry, the shop carries a broad range of components and tools. A twenty-four hour ordering service is offered for more unusual items and the company is happy to accept mail orders (a catalogue will be available in the near future).

In co-operation with a printed circuit manufacturer on the premises, Martelec also offer a PCB service for magazine projects as well as readers' own designs.

Further information can be obtained by writing to the address above or telephoning (0252) 515666.

New directory

ERA Technology is currently compiling a directory of all the essential components required in the design and development of optical sensors based on optical and opto-electronic techniques. The directory will contain comprehensive company and product details, and a major feature will be product tables giving the key technical parameters for both components and materials.

ERA expects the directory to become a prime data source for all those involved in the design and development of optical sensors in industry. The first edition, published in mid-1985, will cover products available for users in the United Kingdom. Later editions will be extended to include Europe, the USA and Japan.

ERA has already mailed a large number of suppliers in this field, but companies with products which they feel should be included in the directory are invited to send data sheets/application notes and catalogues to: *Edward Lecznar, Information Services Department, ERA Technology Ltd, Cleeve Road, Leatherhead, Surrey KT22 7SA. Tel: (0372) 374151, ext 461. FAX no: (0372) 374496.*

Light fantastic

One of the most exciting technological innovations in recent years has been the development of optical fibre cables for a variety of applications of world-wide interest. In telecommunications, for example, optical fibre cables are replacing trunk coaxial cables and are gradually taking over from junction cables and, in some cases, wideband local networks, which are suitable for TV distribution and various data and interactive services. They also have computer applications and are particularly valuable for military purposes, due to their freedom from interference.

In optical telecommunications systems the electrical signal is converted to an optical signal by means of an electro-optical transmitter such as a laser or light-emitting diode (LED). Having then been transmitted via an optical fibre cable to a terminal point, the optical signal is converted back to an electrical signal by an optical receiver such as a photodiode. A major advantage is that signals can be transmitted over long distances before amplification or regeneration becomes necessary. Data, telephony and television may be transmitted using modulation by analogue or digital methods.

The importance of this evolving medium is borne out by the publication of a new British Standard, BS 6558 *Optical fibres and cables, Part 1: General requirements,* which is related to IEC 793-1 and is in the forefront of optical fibre technology. This is particularly true with regard to multimode fibres which are classified according to the refractive index profile, fibre properties and method of measurement (broadly divided into dimensional, optical, mechanical and environmental tests).

Also included is a backscatter test used mainly by cable-makers and installers to detect any irregularity in the fibre characteristic caused by microbending during manufacture or installation. Another (screen/proof) test is laid down to ensure that production fibres have no inherent flaws. The proof test limit provides information that can be used at the design stage to avoid direct strain on the fibre. Further tests are described which ascertain that the cable has adequate reserves to meet the various mechanical and environmental conditions likely to be met in service.

SPECTRUM WATCH — *USA!*

NIGEL CAWTHORNE G3TXF

Although there are many similarities between the usage of radio spectrum in Europe and in the US, there are also a number of major differences, including differences in trends.

Cellular radio in the US operates on a similar basis to the new cellular services in the UK in as much as there are two network operators in each area. Whereas in the UK there are two national operators, Cellnet and Vodafone, in the US every cellular operating area has different companies providing the two competing services. For instance, in the Washington area one cellular service is provided by Bell Atlantic and the other by a company called Cellular One,

Cellular operators

In general one of the cellular operators in each area is called the 'wire-line operator'. This is because the company providing one of the two competing cellular services was originally part of the giant AT&T organisation before it was broken up into a number of smaller operating entities. The second operating company in each area is referred to as the 'non-wire-line operator', because in general they are a consortium of interested companies made up to provide the competing cellular service. As in the UK, the US cellular user has the choice of two operators for each area.

In the UK the two cellular networks are racing ahead to achieve the greatest population coverage practicably possible. It is likely that the requirement of the cellular licences to provide a service for 90% of the UK population by 1989 will be exceeded by both network operators well before that date. In the US things are different. Distances are much greater between cities and land surfaces are much greater than in the UK.

Cellular radio users in the UK can expect to be 'in touch' both within city areas as well as on the major interconnecting motorways. In the US this would never be possible with terrestrial cellular networks because of the enormous and economically unviable investment that would have to be made in rural 'cells'. Cellular radio users in the US are only able to make and receive calls within or around major city areas. When travelling the vast distances of interstate highways, the US cellular radio user will be out of range.

In order to provide nationwide coverage in the US, projects are being discussed which include the use of a satellite for mobile communications. The satellite network could be linked into the city cellular networks, thereby providing truly national coverage. But for the moment the idea of a satellite for mobile public telephone networks is only in its early stages.

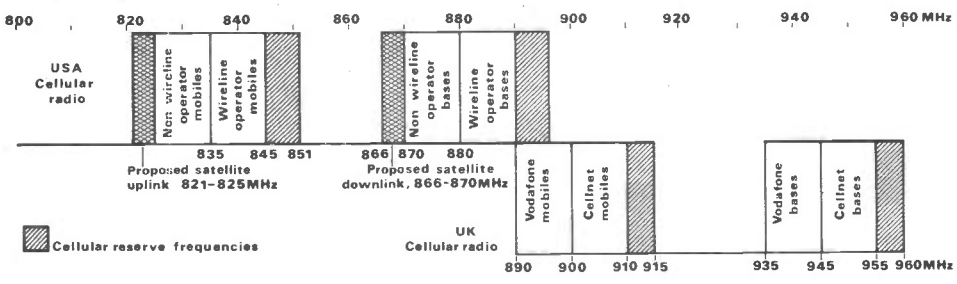
One proposal is to use frequencies in the ranges 821-825MHz and 866-870MHz. The relatively narrow band of frequencies available in the 800MHz band (4MHz bandwidth for the uplink and 4MHz for the downlink) has been used as an argument in favour of going up to L-Band (1.6GHz) for the proposed new satellite land mobile services.

800MHz

Although the UK cellular radio system, TACS, is based on the American AMPS, there are some major differences between the two networks. Two important differences are channel spacing and frequency range.

Traditionally US land mobile radio services have used 30KHz channel spacing, whereas in the UK this has been 25KHz with subsequent reductions to 12.5KHz and possibly 6¼KHz spacings. US cellular networks have stayed with 30KHz, and the UK system with 25KHz channel spacing.

The US cellular networks use frequencies approximately 65MHz lower than the UK operators



The satellite transmission equipment at Ted Turner's ground station in Atlanta

In the UK much of the 800MHz frequency spectrum is used by UHF television transmitters. This was also true in the US up until a few years ago, when UHF TV operators lost the use of the higher UHF TV channels 70-83. The frequency range 806-902MHz was then allocated to a number of land mobile services, including the cellular radio networks.

As in the UK, each of the two network operators in an area has a 10MHz block of bandwidth. In the US the non-wireline operators use 825-835MHz for the mobiles and 870-880MHz for the base stations. The wire-line operators have their 10MHz bands adjacent to and on the high side of the non-wire-line operators.

The mobile radio community in the US is vociferous, and the mobile radio industry has strong lobbying power. Their direct competition for frequencies has been the UHF TV broadcaster.

TV: American style

Terrestrial TV in the US is moving in a different direction to that in the UK and other European countries. For the US TV broadcasters it is the VHF bands that are still the most popular, in direct contrast to the UK where the VHF TV transmitters have now all been closed down. Whereas in many countries the planning objective is to extend and expand UHF TV transmission services, in the US the opposite appears to be the case. The higher UHF TV channels (70-83) have already been given over to other services, as mentioned earlier.

In addition to losing their exclusive use of the higher UHF channels, TV broadcasters in the US are now facing up to the idea of sharing TV broadcast

frequencies with land mobile services. With much greater distances involved in the US, this is a more practical possibility than it would be in the UK. For example, where one city uses channel 46 for UHF TV, another city some hundreds of miles away may be using the same frequencies for local mobile radio networks.

NAB Convention

During the National Association of Broadcasters (NAB) Convention, held in Las Vegas in April, FCC commissioner Rivera told a forum of US UHF TV broadcasters that unless broadcasters in the US made greater efforts to defend their frequencies there would be further losses to the land mobile radio community. Rivera told the broadcasters that the US mobile radio community 'smells blood and is being agressive in its search for spectrum', and added that broadcasters must make their views known.

The slow drift towards UHF-only TV transmissions (ie the close-down of VHF transmissions) that can be detected in some parts of the world (including the UK, which is one of the world's first UHF-only countries) is the exact reverse of what is currently happening in the US, where broadcasters have already lost UHF spectrum and may lose even more unless they can be more effective in their lobbying in opposition to the powerful land mobile radio industry.

CNN comes to Europe

Atlanta is the headquarters of the Ted Turner organisation. Ted Turner is a household name in the US, and may soon become a household name in Europe too. Ted Turner runs four broadcasting operations in addition to an Atlanta baseball team called the Braves: Superstation WTBS, Cable News Network, Headline News and CNN Radio are the four broadcasting outlets of the Turner Broadcasting System Inc.

It is the Cable News Network which is scheduled to come to Europe later this year. The 24 hours-a-day non-stop news service will be transmitted up to an Intelsat satellite on 6GHz link from the satellite antenna farm directly behind the CNN studios in Atlanta. The downlink will be at 12GHz. This requires 'cross-strapping' within the satellite. With a 6GHz uplink, the downlink would normally be at 4GHz. Similarly for a 12GHz downlink the uplink would usually be at 17GHz. This cross-strapping of transponders within the satellite is a technique not used before in broadcasting.

CNN will be providing feeds to European broadcasting organisations for use in their news programmes. The Turner organisation is an associate member of the EBU. The next target is to provide a continuous news service for hotels so that guests can tune in to up-to-the-minute news at any time of day or night.

Given the relatively low penetration of the cable TV networks in the UK and Europe in comparison with the US, the cable TV market is seen only as the third priority on the Turner list. But given the speed with which the Turner organisation has been seen to move and establish itself in the past, it would not come as a surprise to find CNN being fed to UK cable networks very early on.

The news presentation style of CNN is intense. Although initially the feeds will be direct from the US network, it is not impossible that a European version of CNN may be developed to provide more 'local' content.

The satellite antenna park behind the TV studios at TBS in Atlanta contains eleven dishes, both for receiving incoming feeds and transmitting signals up to satellites and down to cable head-ends all across the US.

Round-the-clock weather

As well as being the headquarters of the Turner organisation, Atlanta is also the corporate centre for 'The Weather Channel'. Whereas CNN provides continuous non-stop news for cable networks, 'The Weather Channel' transmits nothing but weather information (and associated advertising) to its network of 1,600 affiliate cable operators.

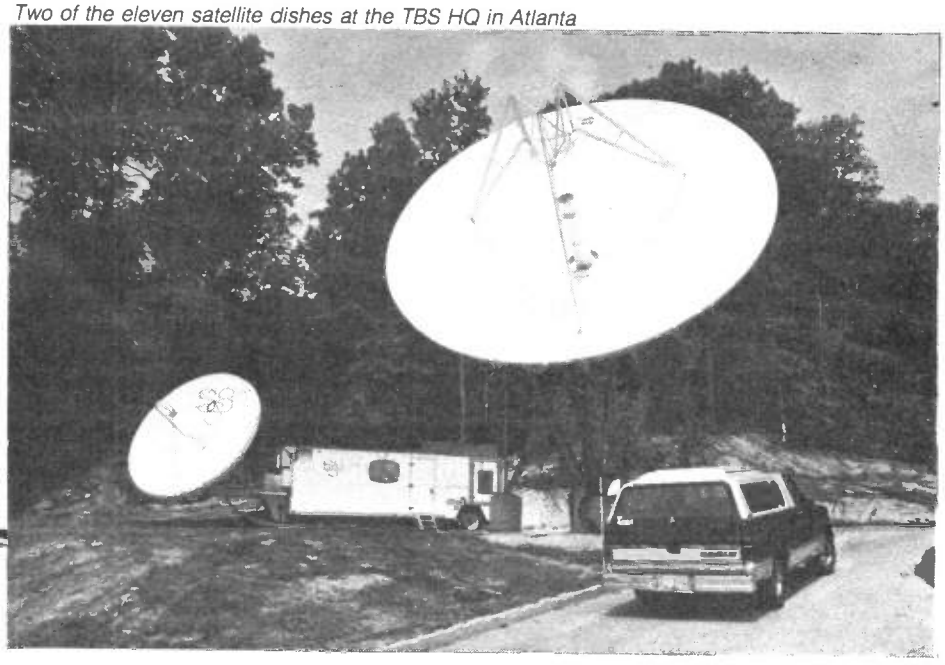
Operating on a thirty minute programme cycle, TWC provides a continuous update on the weather both in the US and world-wide. A staff of around 60 meteorologists work on round-the-clock shifts to analyse all the incoming weather data and to prepare the forecasts for transmission. As well as providing national forecasts, TWC uses a teletext system to provide local forecasts for cable viewers all over the US. Every 7½ minutes, five pages of teletext are transmitted over the network, each page containing local weather forecasts. The data for each area is held centrally on large computers and is transmitted through Weatherstar. Each cable operator sets his Weatherstar decoder unit to the correct code for his area. The data received during the 'local' broadcasts will then be the forecast for his area. The teletext data is transmitted on the vertical interval lines of the TV picture and is constantly updated.

Many American hotels have satellite dishes for a wider range of TV programmes

TWC claim to have 16 million potential viewers in the US. The programming is repetitive and it is unlikely that any one viewer would want to watch for too long! In order to break the monotony of continual weather forecasts, TWC provides short features on different aspects of the weather. Subjects include: 'How tornadoes are formed', 'The weather and your health' and 'The weather's effect on your futures investments'. This latter service tells agricultural product investors how the weather is going to effect the price of their shares!

Specialist weather forecasts are also provided for aviators, sailors, travellers and farmers. TWC's programme is transmitted directly up to a satellite from an RCA satellite earth station just 1½ miles from the studios. The video link from the studios to the satellite terminal equipment is through an underground fibre optic cable link. Whatever the weather is doing, fibre optic cables are usually totally immune! NEW

Two of the eleven satellite dishes at the TBS HQ in Atlanta



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AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

While the news bulletins transmitted regularly by the RSGB are pretty well-known, those from some other radio societies, which are equally praiseworthy, are not quite so well-known in this country. These include the Dutch VERON transmissions from their HQ station PA0AA.

This station is located at the Sikkens paint factory at Sassenheim, between the Hague and Amsterdam, and the writer had the pleasure of visiting this station some years ago. It was one of the first club stations to put out regular RTTY news bulletins in the early days of RTTY in Europe, and was much used at that time by enthusiasts for testing their gear, the electronic side of which had in those days to be home constructed.

At the time of writing, a shedule of transmissions takes place as follows. On Friday evenings, transmissions are put out on 80, 20 and 2 metres and on 70cm in CW, phone and RTTY at the following times:

1715 hrs GMT: CW exercises at 12 to 15 words a minute.
1830 hrs GMT: Dutch language news bulletin.
1845 hrs GMT: DX news in English.
1900 hrs GMT: CW exercises for beginners.
1930 hrs GMT: CW exercises for advanced operators.
2000 hrs GMT: RTTY transmissions.
2030 hrs GMT: Repeat of Dutch language news bulletin.
2045 hrs GMT: Repeat of DX news in English.

The Morse code exercises consist of 11 lessons for beginners and 11 lessons for advanced operators. The text of the exercises is available in English for 7 IRCs by writing to the VERON Service Bureau, PO Box 220, 5670 AE Nuenen, Netherlands. The 80 metre transmission is usually well received in many parts of this country and can be found on 3602KHz. Reports to and further information from PA0YZ, Julianalaan 62, 2215 HeVOORHOUT, Netherlands.

The 'Hiss Phenomenon'

We referred recently to the death of Denis Heightman G6DH, who had so much to do with the recognition of the 'Hiss Phenomenon'. Professor Woodruff Sullivan of the Astronomy Department of Washington University, USA, is writing a book on the early development of radio astronomy. He would much appreciate information on the detection of the Hiss Phenomenon by radio amateurs relating to the period before World War II. He would also be most interested in any information relating to detection of the 'hiss' during the solar maximum in the late twenties. He believes that radio amateurs may have detected solar radiation at that time but he has no specific information. Professor Sullivan's address is the Department of Astronomy, FM-20, University of Seattle, Seattle, Washington, 98195 USA.

Speaker wanted

BARTG have announced that they are preparing a register of persons willing to give lectures to clubs, etc on RTTY, data and Packet Radio. So much interest is being shown in these new forms of communication that BARTG is being overwhelmed with requests for speakers on these topics, and they hope that by making a register of these who are willing to give such lectures they will at least help in meeting the need. Those interested should contact Ian Wade G3NRW, 7 Daubeney Close, Harlington, Dunstable, Beds LU5 6NF.

Greenland beacons

The VHF/UHF RSGB Newsletter reports that two new VHF beacons have been in operation from Greenland since October 1984. They are on 50MHz and 144MHz and use the callsign OX3VHF. They are located at Danmarkshavn, Locator IQ06PS and run for 24 hours a day. If conditions are good, a separate 2 metre transmitter can be brought into use on 144MHz and operated manually by the beacon keeper, Tommy Frost Hansen OX3BX.

An interesting feature of these facilities is that if one can hear OX3VHF and would like to work Greenland, a telephone call on 010 299 16 10 225 will reach OX3BX and a QSO can be arranged.

The 50MHz beacon is on 50.045MHz with a groundplane omnidirectional aerial, 20 watts output. The 2 metre beacon is on 144.902MHz with a six element antenna radiating south-east, 10 watts output.

The original beacons OY6VHF and OY6UHF have been out of action for some time due to antenna breakdown and cable damage. These beacons have now been rebuilt and are located directly on the antenna supports. This will necessitate an expensive electricity bill of approximately £100 a year, which is more than the local radio society, FRA, can afford. Appeals are therefore being made to keep these important beacons running, and contributions will be welcomed from societies and individuals who may like to support this project. Any amount in any currency will be gratefully accepted by Ivan Stauning OZ7IS, Bartholin Str 20, DK-2630, Trastrup, Denmark, or Jon Dam, Sandagota 1, FR-3800, Argir, Faroe Islands.

Amateur radio observation service

Much of the work of the RSGB is done by voluntary bodies under the guidance of honorary officers. One of these bodies, the activities of which do not seem to get the publicity they deserve, is the Amateur Radio Observation Service.

This body endeavours to keep an eye on the standards of amateur radio operating, a topic much in the news these days. It concerns itself with Amateur Radio Licence and Telecommunication Act offences, serious interference, bad operating practice, band plan abuse and so on.

The co-ordinator of this service is R J Osborne G4FJN. Reports to him should be put in writing, giving the callsigns of the offenders along with witnesses, dates, times and frequencies and full details of the complaint. All correspondence relating to the matter in question is treated with the strictest confidence.

Use of 10, 18 and 24MHz bands

A discussion took place within the RSGB Council recently on the use, or lack of use, of the 'new' frequency allocations to amateur radio. It was reported that their use was very low, a fact which the writer can confirm. It was pointed out that CW operation only was permitted at present on these frequencies and there was no likelihood of phone activity being allowed on them for the time being. It was further stressed that if increased use caused interference to other users of these frequencies before the completion of the proper

transfer procedures in 1989, there would be a greater risk of losing these bands than through non-use at the present time.

Class B licence CW facility

The class B CW facility, recently introduced to encourage the use of CW by newcomers to amateur radio, has proved very popular. Over 5,000 applications for the transmitting licence variation were received in the first three months of this year. Official observers will be listening to see how this experiment works out and what progress in CW competence is being made. It should be noted that identification must be made by speech and that class B CW operators should keep to the 2 metre band plan.

Amateur radio licensee statistics

There were a total of 26,842 class A licensees and 27,211 class B licensees in the UK at the end of February 1985.

The satellite scene

Several active projects may result in as many as five major Oscar launches in the next 18 to 24 months. From *Amateur Satellite Report*, AMSAT's newsletter, we gather that major announcements of new satellite construction projects have recently been made. From the traditional centres of Oscar construction, Marburg, Washington and Moscow, comes news of new projects to be launched in the next two years. Furthermore, at two new centres, Boulder, in the USA, and Japan, projects are underway.

From Washington and Marburg, the home of Oscar-10, comes news that Phase 3C, an updated version of Oscar-10, is now scheduled for launch from Kourou in mid-1986 aboard the European Space Agency's Ariane 4. Also aboard will be the French amateur radio satellite, Arsene.

For the Phase 3C project, a new team is emerging from Boulder, Colorado, which will join forces with the teams in Marburg and Washington to work on the design, construction and testing of the new spacecraft.

From Moscow comes news of plans for the construction and launch of RS-9 later this year. RS-9 is completed and undergoing ground tests in Moscow, and RS-10 is also planned for launch later this year.

The Marshall Amateur Radio Club Experiment (MARCE), which has already been in space via the shuttle, was scheduled to fly again in May on shuttle flight 51G. The MARCE package is a 'Getaway Special' ('GAS can') but nothing will be deployed from the can. Instead, several active experiments will be performed and telemetry will be sent via the amateur bands from a battery powered transmitter during the flight.

Meanwhile, progress is being made in Japan where teams from the Japanese Amateur Radio League and JAMSAT are hard at work on their first satellite. And then there is PACSAT, a digital store-and-forward communications satellite. Placed in a low polar orbit from the shuttle, PACSAT will accept messages from originators on Earth and store them until the addressee interrogates the satellite for his mail. The choice of orbit allows several passes per day for every point on Earth.

A recent demonstration of a PACSAT-like store-and-forward function was accomplished in the digital communications experiment aboard UoSAT-2. PACSAT is tentatively planned for a 1987 shuttle launch. Of course our own team, under Dr Martin Sweeting at the University of Surrey, have some plans up their sleeve for a third UoSAT satellite. So with all these satellite plans there should be no fear of lack of activity in the amateur radio satellite scene for some time to come yet! REW

CONSTRUCTING POWER SUPPLIES

Roger Alban GW3SPA presents the third part of his series on PSU design

In recent years, power supply design has been simplified with the introduction of three-terminal integrated circuits which contain a high-gain voltage error amplifier, a temperature compensated voltage reference, and a suitable pass transistor. The more sophisticated integrated voltage regulators also contain sensing resistors and transistors for current limiting and circuitry for protecting against over-voltage.

Figure 12 shows a simple three-terminal integrated circuit regulator for providing a regulated dc output of 12 volts. This type of integrated circuit has a number of advantages. The main advantage is the simplicity of application. The three terminals are for a ground reference (common), an input (I/P) for the unregulated voltage and an output (O/P) for the regulated dc.

If the integrated circuit has been designed to handle large currents the ground reference terminal is usually connected to the mounting surface. Therefore it is not necessary for the integrated circuit to be electrically insulated from ground potential with a mica washer. This eases the heatsinking problem.

Another typical feature is the in-built protection against overheating as a result of overloading or insufficient heatsinking. If the integrated circuit should become excessively warm, the temperature rise that accompanies the excessive power causes the load current to decrease. Some of the newer three-terminal regulators even have an additional fail-safe protective device in-built into the design. Should excessive power dissipation occur, which under normal circumstances would result in the destruction of the IC, the device fails as a short circuit. This results in a blown fuse further back in the power supply. The circuit that is powered by the integrated circuit is therefore never subjected to excessive unregulated voltage as a result of the device failing.

As can be seen from *Figure 12*, most of the design work has been undertaken by the manufacturer: the power supply designer will deal with the practical applications of using the IC voltage regulator.

If the integrated circuit is handling large currents then adequate heatsinking must be provided. The power dissipation will be determined by the current in the output and the voltage difference between the regulated output and the unregulated input. Another precaution that should be followed is to prevent any undue instability of the voltage regulator. It is advisable to insert capacitors between the input and common terminal and output and common terminal as shown in *Figure 12*.

Even with this degree of protection, the author has found that stray RF in the shack causes problems. I was testing a 10 metre handheld portable with a telescopic aerial when I discovered that the power supply voltage fell from 12 volts down to 5 volts when the transmitter was keyed. The answer seems to be to keep unwanted stray RF out of the radio shack.

However, it is worthwhile taking a few steps to prevent problems arising as a result of stray RF. Firstly, build the power supply into a metal box. At the power supply terminals install an LC low-pass filter network. In addition, when using integrated circuit voltage regulators, hang capacitors at input, output and common terminals.

Variable voltage regulators

It is possible to modify the external circuitry of a three-terminal device to provide a means of making the regulated dc voltage variable.

In the common terminal, which is connected to ground on most three-terminal regulators, very little current flows. In *Figure 13* a 7805 three-terminal regulator, which is designed to give a regulated output voltage of 5 volts at a maximum load current of 1 amp, is used in a circuit configured to provide a variable regulated output voltage. To calculate the regulated output voltage, first let's assume that there is no current flowing between the common terminal and ground.

The minimum voltage output will occur when the common terminal is at ground potential, ie when the variable resistance is at its minimum value, this then representing the normal designed operating condition for the 7805 integrated circuit.

When the variable resistance is at its maximum value, this is the condition which provides the maximum regulated voltage output. The voltage drop across the variable resistor will be:

$$5 \text{ volts} \times \frac{5{,}000}{5{,}000 + 240}$$

which equals approximately 4.8 volts. The total regulated output voltage will be the sum of the voltage produced by the regulator plus the voltage dropped across the variable resistor. In *Figure 13* this will be 5V plus 4.8V, equalling 9.8V.

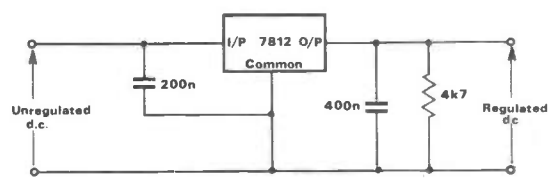

Fig 12 *Three-terminal regulator circuit*

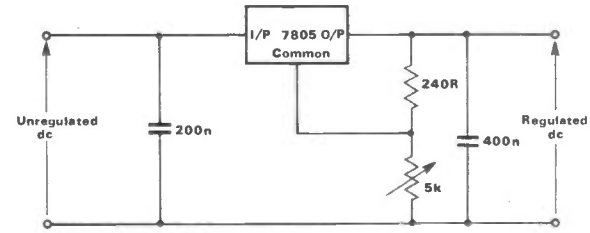

Fig 13 *Modified circuit giving variable output*

In practice there is a small current which flows between the common terminal through the variable resistor to earth. Therefore the voltage drop across the variable resistor will be slightly higher than 4.8V and consequently the regulated output voltage will be slightly higher than 9.8V.

Variable voltage IC regulators

There are a number of integrated circuit regulators on the market which provide for a variable regulated voltage. In particular the LM338 is capable of providing an adjustable regulated output voltage from 1.2V up to 32V from a maximum unregulated supply voltage of 35V dc. The maximum load current that can be handled by the integrated circuit is 5 amps. The circuit configuration is similar to that shown in *Figure 13* with the exception that the common terminal is replaced with a voltage adjust terminal.

If higher load currents are required the integrated voltage regulator will need to be buffered from the load by means of a pass transistor, as shown in *Figure 14.* The output current of the integrated circuit becomes the base current of the pass transistor, the base current being the load current divided by the current gain, beta, of the pass transistor. Therefore it is possible to use a low current voltage regulator as the reference voltage in a power supply that is capable of supplying a high load current.

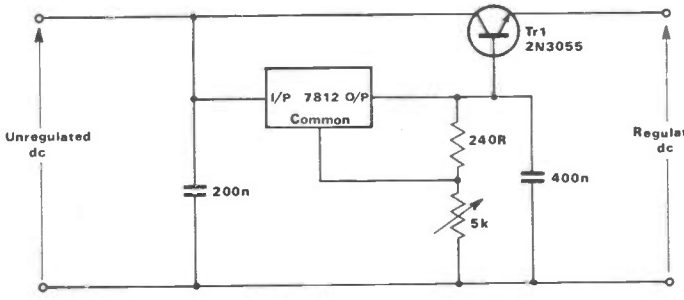

Fig 14 *The addition of a pass transistor for higher currents*

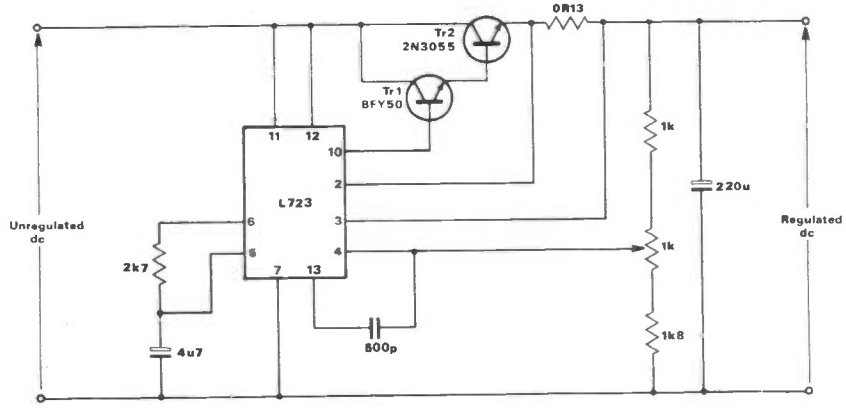

Fig 15 *Five amp supply using the L723 IC*

The L723 voltage regulator

Another voltage regulator that is commonly used in power supplies is the L723, which has an over-current protection circuit incorporated into the integrated circuit. This voltage regulator is capable of providing a regulated output voltage variable between 2V up to 37V with a maximum unregulated input voltage of 40V. However, the regulator can only provide a maximum output current of 150mA. Therefore if this device is to be used in high current power supplies then a pass transistor will have to be used together with a driver transistor.

Figure 15 shows a typical circuit configuration using the L723 integrated circuit. The unregulated dc voltage is fed to pin 11. The regulated output at pin 10 is fed to the base of Tr1, which is used as a driver transistor. The emitter of this transistor is connected to the base of the pass transistor.

The reason for using a driver transistor is to ensure that the output current from pin 10 is kept within the safe operating limits of the integrated circuit. For example, assume a load current of 5 amps. In *Figure 15* the pass transistor is a 2N3055 with a typical current gain of 47. Therefore the base current will be the load current divided by the current gain, which is approximately equal to 106mA and is well below the maximum output current of the L723 voltage regulator.

However, what happens if the load current should exceed 5 amps, or for that matter you are unlucky enough to select a 2N3055 which has a current gain lower than 47?

The possibility exists that the LC723 will be damaged. The typical spread of current gain expected for the 2N3055 ranges from 20 up to 70. It is always wise to design for the worst case. For example, with a load current of 5 amps and a current gain of 20 the base current of the 2N3055 will be 250mA, which is above the maximum output value of the L723. Therefore it is wise to use a driver transistor connected between the voltage regulator output, pin 10, and the base of the pass transistor.

In *Figure 15* the author has used a BFY50, which is a high voltage general purpose transistor with a current gain of 30. As the emitter of the BFY50 is connected to the base of the 2N3055 the emitter current of the BFY50 will be 250mA. The base current will be 250mA divided by 30, which is approximately 8mA: well within the safe operating limits for the output current of the L723 integrated circuit.

The regulated output voltage is adjusted by altering the voltage on pin 4 of the integrated circuit, which is the inverting input. This varying voltage is compared with the non-inverting voltage on pin 5. Pin 5 is connected via a resistor to an internal voltage reference which appears on pin 6. Therefore it is possible via an internal amplifier to control the magnitude of the regulated voltage, and also if necessary to adjust its value by means of the potentiometer.

Pins 2 and 3 are connected to either side of a load-sharing resistor. When a pre-determined voltage is reached which is positive on pin 2 with respect to pin 3, the integrated circuit will reduce output current from pin 10 to provide overload protection. Therefore the value of the load-sharing resistor determines the value of load current at which the integrated circuit will start current limiting.

To calculate the value of load sharing resistor it is necessary to divide 0.65 by the required load current at which current limiting is to commence. In the example given in *Figure 15,* for a maximum load current of 5 amps the load sharing resistance will be 0.65 divided by 5, which is equal to 0.13 ohms, the value of resistance used here.

Whoops!

Sharp-witted readers will have noticed a mistake last month, on page 30 (last column). The regulated voltage will, of course, be the voltage across the Zener *minus* V_{be} of Tr1.

Next month: the pass transistor. REW

AA117	9p	BD682	45p	OC35	100p	3N.128	55p	ECL80	57p	4520	51p	74LS148	120p	MB3712	180p	AY3-1015	290p
AA119	9p	BDX32	100p	OC36	120p	3N.143	65p	ECL82	59p	4521	100p	74LS151	45p	MB3730	260p	AY5-3600	570p
AAY32	9p	BDX65	80p	OC45	60p	**DIODES**		ECL84	57p	4522	60p	74LS153	60p	MB3756	260p	SPO256AL2	550p
AC107	25p	BDY92	100p	OC71	30p	AA119	9p	ECL85	57p	4526	57p	74LS154	180p	MC1327	70p	Z80ACPU	260p
AC126	17p	BF180	15p	OC72	60p	BY100	40p	ECL86	49p	4527	57p	74LS155	58p	NE555	20p	Z80BCPU	500p
AC127	16p	BF181	18p	OC200	180p	BY103	32p	EF80	31p	4528	57p	74LS156	65p	NE556	40p	Z80ADMA	650p
AC128	16p	BF183	20p	R2008B	100p	BY126	8p	EF85	34p	4529	100p	74LS157	35p	SAS560	110p	Z80AP10	280p
AC128K	23p	BF184	20p	R2010B	100p	BY127	8p	EF89	43p	4532	62p	74LS158	60p	SAS570	110p	Z80BP10	600p
AC141K	30p	BF185	20p	TAG4443	75p	BY133	8p	EF183	46p	4551	98p	74LS160	58p	SN76003N	140p	Z80ACTC	280p
AC142K	30p	BF194	8p	TAG4444	75p	BY164	40p	EF184	53p	4553	230p	74LS161	58p	SN76013N	140p	Z80BCTC	600p
AC153K	23p	BF195	8p	TIP29	15p	BY176	85p	EL34	190p	4555	30p	74LS162	58p	SN76023N	140p	Z80AS10	880p
AC176	18p	BF196	8p	TIP29A	22p	BY179	35p	EL36	80p	4556	47p	74LS163	60p	SN76033N	160p	Z80AS10/1	700p
AC176K	20p	BF197	7p	TIP29C	25p	BY182	32p	EL84	50p	4557	220p	74LS164	65p	SN76110N	70p	Z80AS10/2	700p
AC187	16p	BF198	7p	TIP30	25p	BY184	32p	EL95	50p	4583	55p	74LS165	65p	SN76115	70p	Z80ADART	680
AC187K	20p	BF199	8p	TIP30C	30p	BY187	32p	EL500	80p	4584	42p	74LS166	120p	T2800D	52p		
AC188	17p	BF200	16p	TIP31A	24p	BY196	20p	EL504	100p	4585	55p	74LS168	120p	TA-7120	55p		
AC188K	23p	BF240	16p	TIP31C	30p	BY206	11p	EY86	31p			74LS169	80p	TA-7137P	83p	**LED**	
ACY18	48p	BF241	10p	TIP32	24p	BY207	11p	EY87	31p	**74 SERIES**		74LS170	120p	TA-7148P	400p	LED 3mm RED	5p
ACY19	48p	BF255	12p	TIP32A	24p	BY208	18p	EY88	42p	7400	22p	74LS174	58p	TA-7193P	400p	LED 3mm YEL	10p
AD142	90p	BF256	18p	TIP32C	28p	BY210	22p	EZ35	48p	7401	16p	74LS175	58p	TA-7200	200p	LED 3mm GRN	10p
AD149	48p	BF257	18p	TIP33	50p	BY223	72p	EZ80	50p	7402	18p	74LS190	70p	TA-7201	200p	LED 5mm RED	8p
AD161	22p	BF258	18p	TIP34	50p	BY225	120p	EZ81	58p	7403	22p	74LS191	58p	TA-7203	180p	LED 5mm YEL	10p
AD162	22p	BF259	18p	TIP41A	22p	BY226	18p	GZ34	180p	7404	40p	74LS192	60p	TA-7204	110p	LED 5mm GRN	10p
AF124	25p	BF262	25p	TIP41C	25p	BY227	19p	PC97	100p	7405	10p	74LS193	73p	TA-7205	90p		
AF125	25p	BF263	25p	TIP42A	22p	BY228	32p	PCC85	42p	7406	40p	74LS194	58p	TA-7210	200p	**OPTO ELECTRONICS**	
AF126	25p	BF270	18p	TIP42C	25p	BY296	20p	PCF80	58p	7407	40p	74LS195	60p	TA-7222AP	120p	2N.5777	40p
AF127	25p	BF273	18p	TIP47	40p	BY298	26p	PCF200	135p	7408	25p	74LS196	72p	TA-7310P	100p	OCP71	100p
AF139	22p	BF311	21p	TIP48	40p	BY299	28p	PCF801	110p	7409	20p	74LS197	52p	TA-7609	270p	ORP12	85p
AF239	22p	BF324	25p	TIP50	50p	BY476	90p	PCF802	87p	7413	35p	74LS221	78p	TAA550	16p	ORP60	100p
AL112	70p	BF336	20p	TIP51	120p	BYX10	18p	PCF806	115p	7414	45p	74LS240	60p	TBA120S	45p	ORP61	100p
AL113	80p	BF337	20p	TIP52	120p	BYX55/350	30p	PCH200	100p	7417	22p	74LS241	72p	TBA395	80p		
ASZ15	100p	BF338	20p	TIP53	120p	BYX55/600	30p	PCL81	54p	7420	22p	74LS242	78p	TBA396	80p	**DISPLAYS**	
ASZ17	100p	BF355	28p	TIP54	140p	BYX55/800	32p	PCL82	63p	7421	25p	74LS243	78p	TBA520	100p	MAN.72	115p
AU110	110p	BF362	30p	TIP105	65p	BYX70/300	29p	PCL84	50p	7425	16p	74LS244	80p	TBA530	100p	MAN.74	115p
AY102	180p	BF367	13p	TIP106	65p	BYX70/500	32p	PCL85	50p	7430	25p	74LS245	90p	TBA540	100p	MAN.4640	180p
AY106	180p	BF371	17p	TIP107	65p	BYX70/800	36p	PCL86	58p	7437	28p	74LS247	80p	TBA560	100p	MAN.8910	230p
BA145	10p	BF414	18p	TIP110	47p	BYX71/600	60p	PCL805	58p	7442	45p	74LS248	50p	TBA750	100p	DL.747	180p
BA148	10p	BF420	18p	TIP111	60p	OA47	8p	PFL200	85p	7447	60p	74LS249	98p	TBA800	35p		
BA154	8p	BF421	18p	TIP112	40p	OA90	4p	PL36	80p	7450	22p	74LS251	30p	TBA810S	80p	**TRIAC PLASTIC**	
BA157	12p	BF422	21p	TIP115	45p	OA91	4p	PL82	45p	7451	10p	74LS253	55p	TBA820	75p	TIC206D-4A/400V	60p
BB101	13p	BF423	15p	TIP116	45p	OA200	7p	PL83	32p	7454	25p	74LS256	55p	TBA920	100p	TIC225D-6A/400V	68p
BB103	18p	BF440	16p	TIP117	60p	OA202	7p	PL84	60p	7470	30p	74LS257	60p	TBA950	100p	TIC226D-8A/400V	68p
BB105B	18p	BF451	17p	TIP120	43p	IN.914	2p	PL95	140p	7473	30p	74LS258	60p	TBA990	100p	TIC236D-12A/400V	85p
BB205B	24p	BF455	14p	TIP121	45p	IN.4001	4p	PL500	110p	7474	40p	74LS259	90p	TCA270	40p	TIC246D-16A/400V	90p
BC107	7p	BF458	19p	TIP122	47p	IN.4002	4p	PL504	95p	7475	25p	74LS260	55p	TCA800	200p	TIC253D-20A/400V	190p
BC108	7p	BF459	19p	TIP125	47p	IN.4003	4p	PL508	170p	7481	90p	74LS266	28p	TCA940	100p	TIC263D-25A/400V	205p
BC109	7p	BF461	90p	TIP126	55p	IN.4004	4p	PL519	480p	7482	70p	74LS273	60p	TDA1170	100p	T2800D	52p
BC115	10p	BF462	62p	TIP127	55p	IN.4005	4p	PY81	70p	7485	45p	74LS279	55p	TDA1412	80p		
BC118	11p	BF469	30p	TIP141	90p	IN.4006	4p	PY88	48p	7486	28p	74LS280	180p	TDA2002	80p	**THYRISTORS**	
BC140	19p	BF470	28p	TIP142	90p	IN.4007	5p	PY500A	160p	7489	100p	74LS290	30p	TDA2003	180p	2N.5061-0.8A/60V	20p
BC141	19p	BF471	28p	TIP145	55p	IN.4148	2p			7490	35p	74LS293	30p	TDA2020	140p	2N.5062-0.8A/100V	23p
BC142	19p	BF479	30p	TIP146	80p	IN.5400	9p	**CMOS**		7492	45p	74LS365	44p	TDA2030	140p	2N.5064-0.8A/200V	28p
BC143	19p	BF493	18p	TIP147	100p	IN.5401	10p	4000	20p	7493	35p	74LS366	44p	TDA2522	80p	C106D 4A/400V	23p
BC147	8p	BF494	18p	TIP2955	42p	IN.5402	10p	4001	20p	7495	48p	74LS367	47p	TDA2530	100p	TIC116C 8A/300V	80p
BC148	8p	BF595	18p	TIP3054	45p	IN.5403	11p	4002	20p	7497	80p	74LS368	43p	TDA2532	100p	TIC116D 8A/400V	70p
BC149	8p	BF596	18p	TIP3055	42p	IN.5404	11p	4006	65p	74107	30p	74LS373	85p	TDA2540	100p	TIC116M 8A/600V	78p
BC157	8p	BF597	10p	TIS43	45p	IN.5405	12p	4007	23p	74111	52p	74LS374	85p	TDA2560	100p	TIC126D 12A/400V	78p
BC159	8p	BF615	30p	TIS44	40p	IN.5406	13p	4008	52p	74116	85p	74LS375	70p	TDA2593	100p	TIC126M 12A/600V	90p
BC182	8p	BF758	41p	TIS61	18p	IN.5407	13p	4009	40p	74119	85p	74LS399	85p	TDA2690	100p	2N.4444	78p
BC182L	8p	BF869	22p	TIS88A	45p	IN.5408	13p	4010	50p	74122	40p	74LS670	130p	UPC-555H	80p	BT106	90p
BC183	8p	BF870	22p	TIS90	18p			4011	20p	74123	20p			UPC-556H	80p	BT116	80p
BC183L	8p	BF872	23p	TIS91	18p	**ZENERS**		4012	23p	74125	40p	**LINEAR IC'S**		UPC-575C2	100p	BT119	100p
BC184	8p	BF960	38p	TIS93	20p	400MV		4013	30p	74126	45p	AN-214P	200p	UPC-577H	84p	BT120	100p
BC184L	8p	BF963	40p	VK1010	88p	BZY88 Range		4014	50p	74132	42p	AN-240P	160p	UPC-592H2	98p	TIC44	22p
BC212	8p	BF964	38p	VN.10KM	80p	2V7 to 39V	8p	4015	42p	74141	55p	AN-360	120p	UPC-1001H	220p	TIC45	27p
BC212L	8p	BF966	40p	VN.46AF	88p	1.3W Zeners		4016	30p	74145	70p	AN-7110	140p	UPC-1025H	230p	TIC47	32p
BC213	8p	BFR40	28p	VN.66AF	100p	BZX61 Range		4017	43p	74153	45p	AN-7114	180p	UPC-1026C	100p		
BC213L	8p	BFR51	21p	VN.88AF	115p	2V7 to 39V	12p	4018	48p	74155	45p	AN-7115	180p	UPC-1028H	90p	**BRIDGE RECTIFIERS**	
BC214	8p	BFR62	21p	VN.89AF	110p	**JAPANESE TRANSISTORS**		4019	50p	74157	45p	AN-7120	140p	UPC-1031H2	180p	W005 1A/50V	16p
BC214L	8p	BFR79	25p	ZTX107	11p	2SB324	55p	4020	72p	74160	50p	AY3-1270	880p	UPC-1032H	70p	W01 1A/100V	18p
BC237	7p	BFR90	52p	ZTX108	11p	2SB507	55p	4021	52p	74164	50p	AY3-1350	300p	UPC-1155H	200p	W02 1A/200V	19p
BC238	7p	BFR91	99p	ZTX109	12p	2SB754	80p	4022	52p	74167	35p	AY3-8910	380p	UPC-1156H	140p	W04 1A/400V	21p
BC300	18p	BFX29	20p	ZTX212	27p	2SC496	60p	4023	24p	74173	50p	AY3-8912	400p	UPC-1181H	118p	W06 1A/600V	23p
BC301	18p	BFX84	20p	ZTX300	13p	2SC1060	99p	4024	35p	74174	70p	AY5-3600	570p	UPC-1182H	160p	W08 1A/800V	28p
BC302	18p	BFX85	20p	ZTX301	18p	2SC1061	200p	4025	22p	74175	65p	CA270	40p	UPC-1185H2	280p	BR81D 2A/100V	35p
BC303	18p	BFX87	15p	ZTX302	18p	2SC1096	78p	4026	75p	74178	45p	CA3046	80p	UPC-1350C	160p	BR82D 2A/200V	38p
BC327	8p	BFX88	15p	ZTX303	24p	2SC1161	110p	4027	38p	74180	50p	CA3048	190p			BR84D 2A/400V	42p
BC328	8p	BFX89	50p	ZTX304	17p	2SC1172	160p	4028	40p	74182	45p	CA3060	280p	**COMPUTER ICS**		BR86D 2A/600V	45p
BC337	8p	BFY17	30p	ZTX320	20p	2SC1306	90p	4029	55p	74192	40p	CA3080E	70p	2114	200p	BR86D 2A/800V	58p
BC338	8p	BFY18	40p	ZTX326	29p	2SC1307	100p	4030	30p	74196	40p	CA3089E	160p	2516	200p	BR32 3A/200V	58p
BC557	8p	BFY41	28p	ZTX500	13p	2SC1678	120p	4031	120p	74197	45p	CA3090AQ	300p	2532	370p	BR34 3A/400V	58p
BCY32	150p	BFY50	14p	ZTX501	13p	2SC1969	130p	4032	64p	74393	70p	CA3130E	80p	2716	300p	BR36 3A/600V	75p
BCY33	150p	BFY51	14p	ZTX502	18p	2SC2028	75p	4033	115p			CA3130S	100p	2732	400p	BR62 6A/200V	100p
BCY34	150p	BFY52	14p	ZTX503	18p	2SC2029	120p	4034	140p	**74LS SERIES**		CA3140E	38p	2764	425p	BR64 6A/400V	80p
BCY42	20p	BFY56	20p	ZTX504	25p	2SC2078	120p	4035	80p	74LS00	24p	CA3189E	250p	27128	900p	BR251 25A/100V	160p
BCY56	18p	BFY57	28p	ZTX550	24p			4036	220p	74LS01	24p	CA3240E	90p	4116	75p	BY164	40p
BCY70	16p	BFY64	25p	2N.696	26p	**LOW PROFILE SOCKETS**		4037	100p	74LS02	24p	HA-1156W	110p	4164	300p	BY179	35p
BCY71	16p	BFY90	45p	2N.697	22p	8 pin	6p	4038	68p	74LS03	24p	HA-1197	180p	6116	400p		
BCY72	16p	BLY48	58p	2N.698	40p	14 pin	8p	4039	220p	74LS04	24p	HA-1306W	170p	6264-15	2000p		
BD115	26p	BLY49	58p	2N.699	45p	16 pin	8p	4040	52p	74LS05	23p	HA-1319	250p	6502	320p		
BD124P	80p	BR100	14p	2N.706A	22p	18 pin	12p	4041	40p	74LS08	24p	HA-1332	17p	6802	220p		
BD124	110p	BR101	43p	2N.708	22p	20 pin	14p	4042	47p	74LS09	25p	HA-1342	170p	6809	600p		
BD128	35p	BR103	37p	2N.914	28p	22 pin	16p	4043	42p	74S10	25p	HA-1366WR	180p	6821	180p		
BD131	25p	BSX20	16p	2N.918	35p	24 pin	18p	4044	45p	74S11	25p	HA-1368	160p	6840	320p		
BD132	25p	BSX26	16p	2N.930	15p	28 pin	20p	4045	95p	74S12	25p			6850	130p		
BD135	20p	BSX29	16p	2N.1131	28p	40 pin	28p	4046	55p	74S13	30p	HA-1377	220p	8080A	400p		
BD136	20p	BT106	90p	2N.1132	28p			4047	55p	74S14	40p	HA-1389	140p	8085A	530p		
BD137	20p	BT109	90p	2N.1613	24p			4048	48p	74LS15	24p	HA-1392	230p	8155	470p		
BD138	20p	BT116	90p	2N.1711	24p			4049	33p	74LS20	24p	HA-1397	250p	8156	380p		
BD139	20p	BT119	100p	2N.2102	50p	**VOLTAGE REGULATORS**		4050	30p	74LS21	24p	HA-1398	240p	8250	880p		
BD140	20p	BT120	100p	2N.2160	300p			4051	57p	74LS22	24p	LA-1201	85p	8251	470p		
BD144	90p	BT138/600	80p	2N.2218A	24p	7805	35p	4052	55p	74LS24	47p	LA-1352	120p	8253	580p		
BD150	80p	BT146/750	99p	2N.2219	24p	7812	35p	4053	64p	74LS26	24p	LA-1365	140p	8255	600p		
BD157	38p	BT151/650	88p	2N.2221	23p	7815	35p	4054	74p	74LS27	24p	LA-3301	120p	8288	1000p		
BD158	38p	BT151/800	85p	2N.2222	23p	7818	35p	4055	75p	74LS28	24p	LA-3350	120p				
BD166	30p	BTY79/500	140p	2N.2369	15p	7824	35p	4056	75p	74LS30	24p	LA-3361	115p				
BD175	30p	BU100A	110p	2N.2484	20p	7905	35p	4060	60p	74LS32	24p	LA-4030	200p				
BD177	30p	BU104	100p	2N.2646	40p	7912	40p	4063	78p	73LS33	26p	LA-4031	140p				
BD179	32p	BU105	80p	2N.2904	20p	7915	40p	4066	38p	74LS37	24p	LA-4032	140p				
BD181	48p	BU108	100p	2N.2905	20p	7918	40p	4067	220p	74LS38	24p	LA-4050	130p				
BD182	60p	BU110	110p	2N.2906	18p	7924	40p	4068	24p	74LS40	24p	LA-4051	160p				
BD183	90p	BU111	140p	2N.2907	18p	78L05	28p	4069	24p	74LS42	48p	LA-4100	120p				
BD201	33p	BU124	80p	2N.2926	8p	78L12	28p	4070	23p	74LS47	78p	LA-4101	100p				
BD202	36p	BU126	70p	2N.3019	28p	78L15	28p	4071	23p	74LS48	78p	LA-4102SK	140p				
BD203	42p	BU204	75p	2N.3053	18p	78L18	28p	4072	23p	74LS51	24p	LA-4112	250p				
BD204	42p	BU205	70p	2N.3054	35p	78L24	28p	4073	23p	74LS54	24p	LA-4125	210p				
BD222	31p	BU208	75p	2N.3055	35p	78L24	28p	4075	23p	75LS55	24p	LA-4140	70p				
BD225	31p	BU208A	80p	2N.3055H	60p	79L05	40p	4076	80p	74LS73	28p	LA-4201	120p				
BD232	31p	BU208D	100p	2N.3440	55p	79L12	45p	4077	24p	74LS74	33p	LA-4220	120p				
BD234	32p	BU325	55p	2N.3442	55p	79L15	45p	4078	24p	74LS75	36p	LA-4400	190p				
BD235	28p	BU326	55p	2N.3702	9p	LM309K	100p	4081	24p	74LS76	28p	LA-4420	140p				
BD236	30p	BU406	55p	2N.3703	9p	LM317K	220p	4082	24p	74LS78	35p	LA-4422	130p				
BD237	21p	BU406D	98p	2N.3704	9p	LM317T	180p	4085	55p	74LS83	65p	LA-4430	130p				
BD238	24p	BU407	75p	2N.3705	9p	LM323K	420p	4086	60p	74LS85	75p	LA-4460	170p				
BD244	60p	BU407D	98p	2N.3706	9p	LM723	32p	4089	110p	74LS86	32p	LA-4461	180p				
BD245	60p	BU408	85p	2N.3707	9p	78HGKC	570p	4093	32p	74LS90	45p	LA-5112	120p				
BD433	28p	BU408D	98p	2N.3708	9p	78HO5KC	520p	4094	55p	74LS91	55p	LM301	28p				
BD434	30p	BU409	98p	2N.3771	85p	78GU1C	190p	4095	55p	74LS92	60p	LM311	35p				
BD435	31p	BU426	120p	2N.3772	90p	79GU1C	215p	4098	70p	74LS93	48p	LM324	35p				
BD437	28p	BU500	110p	2N.3773	100p	79HGKC	670p	4099	70p	74LS95	60p	LM325	48p				
BD438	36p	BU526	80p	2N.3819	29p			4501	34p	74LS96	80p	LM339	40p				
BD439	40p	BU801	95p	2N.3866	65p	**VALVES**		4502	80p	74LS107	39p	LM348	80p				
BD440	40p	BU806	120p	2N.3903	11p	DAF96	60p	4503	38p	74LS109	39p	LM380	100p				
BD441	40p	BU807	95p	2N.3904	11p	DF96	50p	4504	72p	74LS112	40p	LM381	150p				
BD442	40p	C106D	23p	2N.3905	11p	DL92	47p	4505	340p	74LS113	32p	LM382	130p				
BD533	60p	MJ2500	100p	2N.3906	11p	DY86	50p	4506	80p	74LS114	42p	LM387	100p				
BD534	38p	MJ2501	110p	2N.4031	25p	DY87	50p	4507	34p	74LS122	55p	LM709 DIL	80p				
BD535	38p	MJ2955	65p	2N.4036	25p	DY802	45p	4508	110p	74LS123	70p	LM723	80p				
BD536	38p	MJ3000	115p	2N.4037	25p	EABC80	50p	4510	82p	74LS124	95p	LM741 DIL	18p				
BD537	40p	MJ3001	115p	2N.4058	13p	EB91	44p	4511	45p	74LS125	38p	LM741 MET	45p				
BD538	40p	MJE29A	30p	2N.4443	78p	EBF80	45p	4512	52p	74LS126	42p	LM747	58p				
BD675	40p	MJE30A	30p	2N.4444	78p	EBF89	50p	4513	120p	74LS132	53p	LM748	38p				
BD676	40p	MJE340	28p	2N.5061	20p	ECC82	40p	4514	100p	74LS133	45p	LM1458	33p				
BD677	38p	MJE350	80p	2N.5294	30p	ECC83	43p	4515	100p	74LS136	35p	LM3900	30p				
BD678	40p	MJE520	30p	2N.5296	30p	ECC84	40p	4516	53p	74LS138	47p	M-51513L	180p				
BD680	40p	MJE2955K	90p	2N.6106	40p	ECC85	40p	4517	205p	74LS139	45p	M-51515BL	270p				
BD679	40p	OC28	100p	2N.6107	40p	ECH81	49p	4518	45p	74LS145	90p	M-51516	280p				
BD681	45p	OC29	80p	2N.6109	40p	ECH84	52p	4519	32p	74LS147	130p	M-51517L	280p				

ELECTROLYTIC CAPACITORS

4700UF-16V CAN 80p
4700UF-40V CAN 80p
*4700UF-40V CAN 92p
*6500UF-50V CAN 100p
6800UF-40V CAN 85p
10000UF-16V CAN 83p
10000UF-25V CAN 87p
*15000UF-10V CAN 88p
33000UF-16V CAN 88p
47000UF-6.3V CAN 88p
2000+2K/35V CAN 68p
2200UF-40V CAN 35p
2350+2350-63V CAN 125p
*2800UF-100V CAN 92p

*Computer Grade Types
Computer grade types have screw terminals. Other types are tag terminal.

SONY THYRISTORS

SG613	500p
SG264	450p

CRYSTALS

FREQ IN MHZ	
1.0	260p
2.00	200p
2.45760(L)	180p
2.45760	180p
2.5	200p
2.662	200p
3.276	118p
3.5795	98p
4.0	110p
4.194	130p
4.43	98p
4.608	160p
4.9152	160p
5.0	130p
6.0	115p
7.0	125p
8.0	125p
8.867	125p
10.0	140p
10.50	200p
10.70	180p
11.0	250p
12.0	120p
14.0	125p
14.138	120p
14.756	200p
15.0	180p
16.0	130p
18.0	130p
18.432	130p
19.969	130p
20.0	160p
24.0	250p
48.0	160p

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TWO METRE AMPLIFIER

PART TWO

Having covered the theory last month, David Silvester G4TJG outlines the final design and construction of his amplifier for 144-146MHz

Most new amateurs start with a period on 2 metre FM using a portable rig with a power output in the range 1 to 3 watts. Having started in this way the author wanted to use his transceiver as part of a mobile rig, but felt that the TR2300's output of 1 watt was rather low for mobile work.

We have discussed the problems with the input power loss, and decided that 1 watt input would give an effective 0.12 watts to the transistor as class C or 0.5 watts as class B. Consequently the output power for the simple amplifier shown in *Figure 4* will be 1.2 and 5 watts respectively.

Practical results

Being rather surprised with this result the author set out to build the simple amplifier and test its capabilities. The values calculated *are* achieved in practice, which vindicates the mathematics and gives greater confidence in continuing with the design.

We have based all of our calculations on the values for the 2N6081 transistor used as the first stage of the amplifier. Our results show that if we put in 1 watt and we only get 1.2 watts out we are wasting our time continuing with this design.

There is however a second option; by using a 2N6080 transistor the input impedance rises to 3.18 ohms, and the transistor gain is 2½ times that of the 2N6081.

Allowing for the loss caused by the input system, the receive/transmit relay, and saying that one half-cycle is equal to 0.25W, we can calculate the transistor's useful input as 0.07W. The figure of 0.25W is not an estimate but a result produced by experimentation.

Figure 7 shows we will have an output of 3.5W. I had, however, wanted to achieve an output of about 15W. Rather than use a class B amplifier, which introduces problems with providing a small bias voltage and arranging that this voltage reduces as the transistor becomes warm (to prevent thermal runaway), it was decided to retain class C even though the power gain in the first stage is low.

Two stages

It would be impossible to obtain 15W with a single stage of either class B or class C, but a two-stage class C amplifier gives the required output. It is interesting to note that a 3W output transceiver will only need a single stage amplifier.

Figure 8 shows the complete design of the amplifier.

Using the equations given earlier we proceed with the calculations in the following way:

Firstly we calculate the maximum input voltage into the 3.18 ohms input impedance of the first stage:

$$V_{max} = \sqrt{\text{input power} \times \text{transistor input resistance}}$$
$$= \sqrt{1 \times 3.18}$$
$$= 1.78V$$

and using equation 3 we can find the conduction angle values θ_1 and θ_2.

Next we calculate 'k' as discussed earlier for the first stage, and then the usable input power to the first stage transistor. *Figure 7* gives the output power. We now repeat the calculation for the second stage transistor, remembering that the intermediate matching network will produce a full sinewave input to the second transistor.

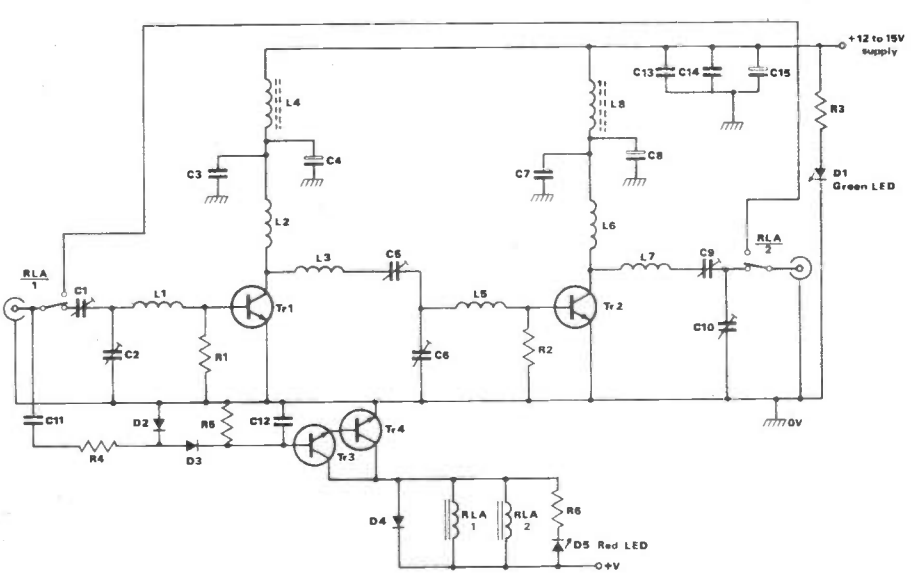
We now calculate the load resistance which needs to be presented by the matching networks, and we find that the first stage needs a load of 7.5 ohms and the second stage a load of 2.5 ohms approximately.

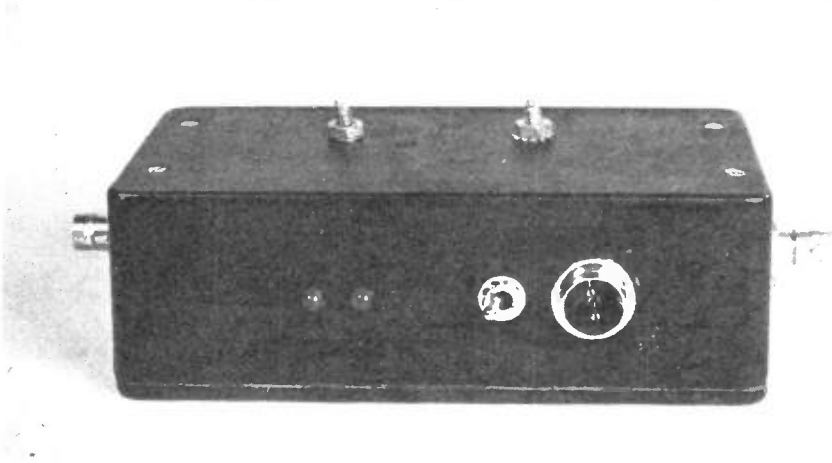
Referring to *Figure 3* and *Figure 8* we can see that the first stage input matches R_2 of 50+j0 ohms to 3.18–j3.40 ohms by the matching network shown in *Figure 3b*. The transistor coupling stage matches the 7.5–j5.96 (this is the calculated load resistance with the transistor output reactance, the transistor output resistance is ignored) to the 1.77+j0.60 input needed by the second transistor, and follows *Figure 3d*.

The output matching converts the 2.5–j2.02 output needed by the transistor to 50+j0 for the antenna, the output using the network of *Figure 3c*. The values can be calculated using the formulae given.

LEDs D1 and D5 are used to indicate power connected and amplifier in transmit mode. The circuit of C11, R4, D2, D3, R5, C12, Tr3 and Tr4 monitors the input of RF from the transceiver and switches the

Fig 8 *The final design*





relays RLA1 and RLA2 into transmit mode when any RF output from the transceiver is seen. When receiving, the relays join the input and output sockets via a lead on the PCB, leaving the amplifier out of circuit. If turned off, the amplifier will allow RF to bypass the transistors, allowing the transceiver to be used normally.

D4 provides protection to Tr3 and Tr4 when the relays switch. L4, C3 and C4, and L8, C7 and C8 with C13, C14 and C15 provide isolation between the stages and power supply line to prevent feedback sending the amplifier into oscillation.

Construction

It should now be possible for the constructor to design an amplifier and calculate the necessary component values and to actually achieve an expected output for a known input. The values actually calculated for this amplifier are shown in the parts list, along with the component types used.

Construction is considerably eased by the use of a single PCB to carry all of the components except the LEDs, input and output sockets, power input plug and on/off switch. The power input plug and switch are optional items and power may be supplied via a simple wire and grommet input if desired.

The amplifier is built into an aluminium die-cast box of internal dimensions 5¾ by 3 by 1½ inches, and the board in the prototype was a very close fit in the box (the board shown here is somewhat smaller). *Figure 9* shows the PCB design with an overlay of the component positions.

The two RF power transistors are mounted by soldering the tags to the underside of the PCB, and will require ⅜inch holes drilled into the wide strip which joins the emitter and collector tags in the undrilled PCB. Drilling will separate these two connections. The PCB is double-sided, with the whole upper surface used as a groundplane.

Having drilled the board, and before connecting any components, mark the positions of the mounting screws and centres of the RF transistor holes into the box and drill these. The box becomes the heatsink for the power transistors, so care must be used not to drill the holes oversize; 4mm is recommended, and these may be opened up very slightly with a needle file if necessary.

The mounting screws are now fitted into the box and will require two full size nuts of 6BA size to hold the PCB clear of the box, but close enough to allow the RF power transistors to have their heatsinks touching the box without any force between the transistor stud and tags. Drill the holes to mount the input and output sockets into the sides of the box as near as possible to the connections on the PCB.

The components may now be soldered to the PCB, remembering that those with an 'x' on one end do not have wires at this point which pass through the PCB, but are soldered to the upper groundplane. The upper and lower groundplanes are connected at a single point between the transistors.

Coil winding

Two of the coils are bought items, but as the ferrite cores are unable to withstand high power levels the remainder will need to be wound by hand from enamelled copper wire. The winding details are given in the parts list with regard to wire size, number of turns and drill shank size on which the coil is wound.

The formula for the calculation of the inductance of a coil of wire is:

$$L(\mu H) = \frac{a^2n^2}{9a + 10l}$$

where:

n = number of turns
a = radius of coil in inches
= ½drill size
L = inductance of coil produced
l = length of coil
= 2×n×wire diameter

The number of turns and spacing needs some explanation. In all cases the coil is made by taking two pieces of wire and winding these together on the drill shank. We produce two coils of which only one is actually used.

When winding, the two wires are held together tightly and wound in a single layer. After removing the drill and separating the coils we have a single layer coil of, say, 18swg with each turn spaced by one wire diameter.

The number of turns is the number of complete circles through which the wire is wound. A half-turn will leave 2 wires coming from one side of the coil (like a radial capacitor), whilst a 1 turn coil would have the wires in line.

Having wound the coils, bend the ends to fit the holes in the PCB. When building other designs of amplifier it is best to reduce the calculated value of inductance by 5 to 10nH to allow for the lead inductance.

The author used a microcomputer to calculate a table of inductances against number of turns and drill size used, with separate pages for wire sizes from 18 to 24swg. The constructor is then at liberty to select the number of turns and wire diameter he or she feels will best fit the application. This is a better method than using the formula for calculating a number of turns from given winding

COMPONENTS

Resistors: All ¼ watt metal film or carbon unless stated

R1	33Ω	
R2	10Ω ½ watt	
R3,6	330Ω	
R4	100Ω	
R5	10KΩ	

Capacitors

C1	calculated 13pF	2-22pF trimmer
C2	calculated 39pF	5-65pF trimmer
C3,7,13	ceramic 470pF	
C4,8,15	tantalum bead 10μF	
C5,6	calculated 15pF	2-22pF trimmer
C9	calculated 42pF	5-65pF trimmer
C10	calculated 93pF	5-65pF trimmer; balance provided by PCB capacitance due to long lead
C11	4.7pF ceramic	
C12,14	0.1μF ceramic	

Inductors

L1	Toko MC108 0.026μH
L2	Toko S18 0.297μH
L3	76nH 3 turns 20swg ⅜inch ID. Wound as described
L4,8	1½ turns 22swg through 2×FX1115 ferrite beads
L5	18nH 1½ turns 20swg ¼inch ID. Wound as described
L6	57nH 2½ turns 20swg ⅜inch ID. Wound as described
L7	38nH 3 turns 18swg ¼inch ID. Wound as described

Semiconductors

D1	green LED
D2,3	1N914 or 1N4148
D4	1N4001
D5	red LED
Tr1	2N6080
Tr2	2N6081
Tr3	BC108 or equivalent
Tr4	2N1613 or BFY51 or equivalent

Miscellaneous

1 each	PCB, die-cast box, single pole switch, power input plug
2 each	BNC or UHF sockets, Kuit A relays 12V type

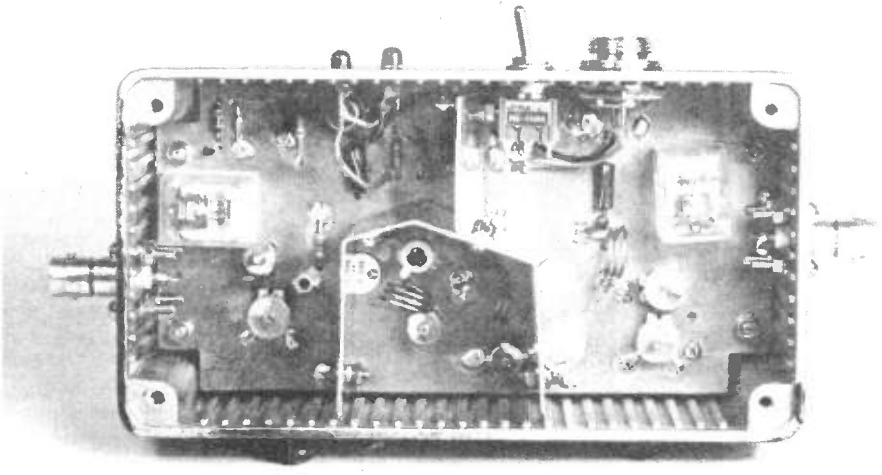
information, as frequently values such as 3.75 turns will be calculated, but this number of turns is impossible to fit onto the PCB even though it can be wound.

Final construction stages

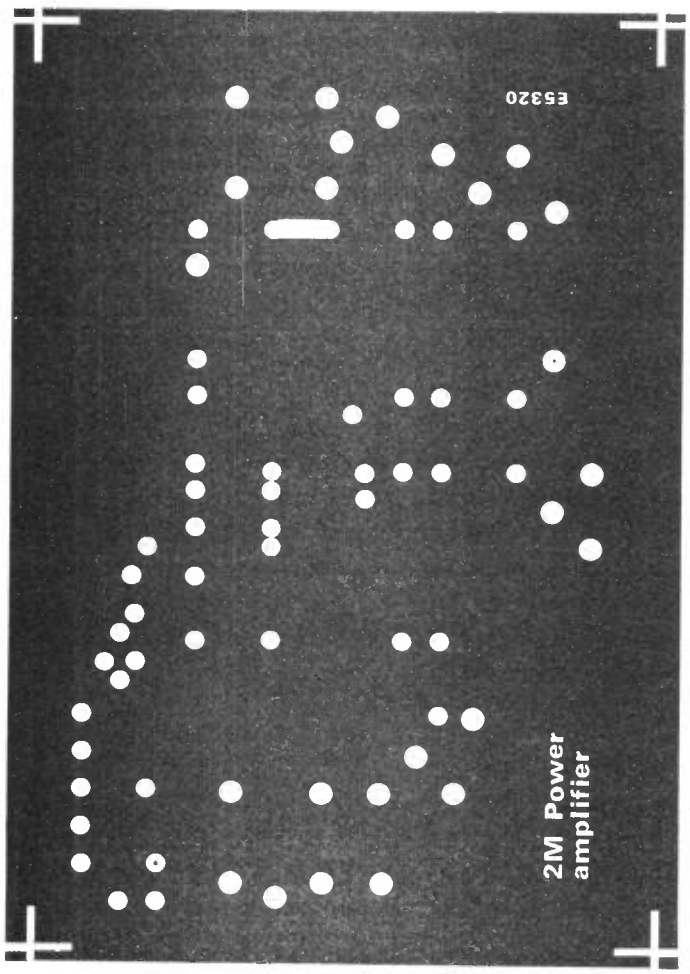
The power transistors have tags that are rather long, and these will need to be cut to ¼inch from the body before soldering. The power transistors are mounted on the etched side of the PCB with their top caps pushed through the board.

Before final soldering ensure that the transistors are connected correctly, as it is almost impossible to remove them from the PCB after soldering. Solder tinned copper wires for the RF input and output onto the PCB and connect wires for the power supply.

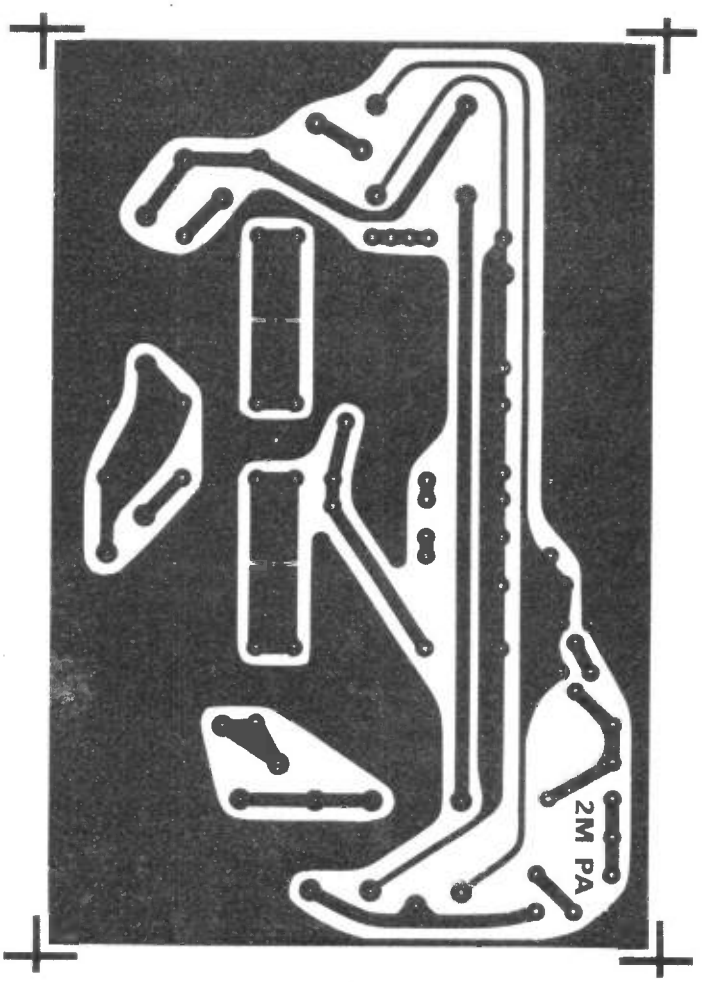
A screen will need to be made to separate the input, intermediate and output sections. If the PCB is placed into the box the height between the top of the board and the lid of the box can be measured. Knowing this, a thin strip of aluminium sheet can be bent to form the screen. This is attached to the upper groundplane of the PCB by screwing solder tags to the screen then soldering the other end of the tags to the PCB upper groundplane. *Figure 9* shows the design of the screen used in the prototype.



Mount the PCB in the box after covering the bases of the power transistors with heatsink compound, and tighten the nuts fully. The transistors have a flat on the end of the stud projecting from the heat flange. Whilst the transistor's top cap is made of alumina and is completely safe, the portion between the tags and the flange is made of beryllium oxide, and beryllium oxide dust is *very toxic*. Should the transistor break at this point, seal the



The groundplane



The PCB foil pattern

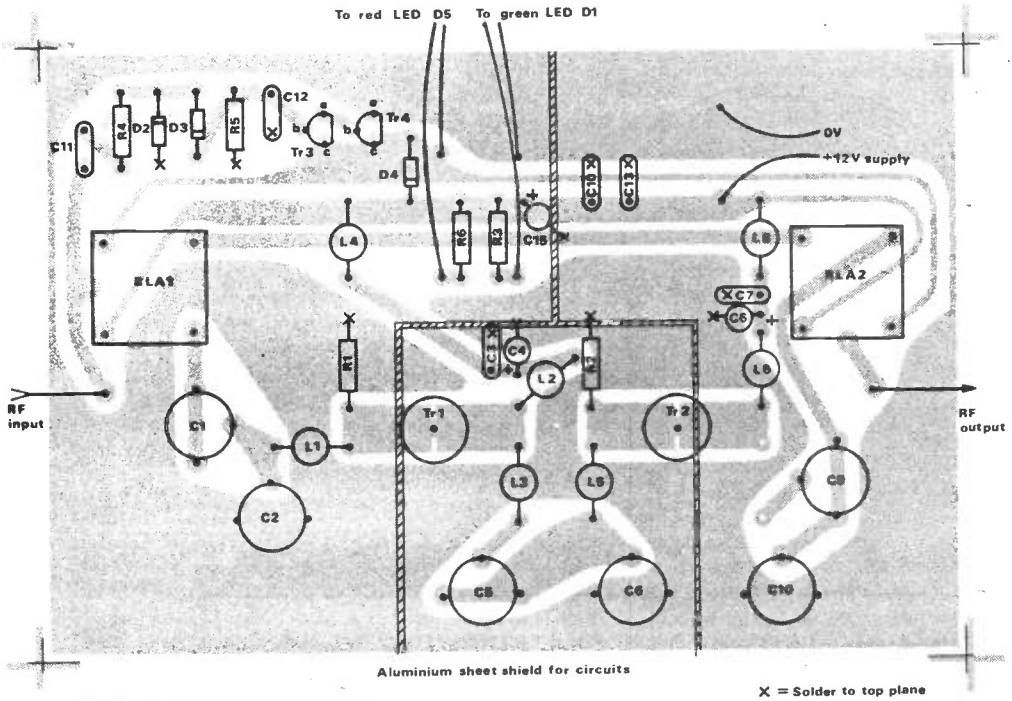


Fig 9 *The component overlay*

The PCB for this project is now available from Edwardschild Ltd, 28 Shenfield Crescent, Shenfield, Essex. The price is £3.70 including packing and postage

whole lot in a strong plastic bag and seek professional advice as to its disposal.

Finally, connect the RF input and output to their respective sockets and the power supply wires to the power input socket and switch.

Alignment

Having completed construction we must now set up the variable capacitors for the lowest input VSWR and highest output power. It is helpful if a simple SWR meter and a power meter are both available. If not, the amplifier will need to have the input SWR set to minimum before the meter is used in its 'forward power' position to tune the output to maximum.

The amplifier should be tuned using the following routine:

Adjust C1 then C2 to the minimum SWR at the input, then adjust C9, C10, C5, and C6, in that order, for maximum power output.

The design was for a 15W amplifier: the prototype gives 17W output at 145.5MHz and an input SWR of 1.1:1 over the whole 2 metre band, so I think it would be fair to say that the design objectives have been achieved.

I look forward to our QSO on 2; 73 till then.

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1S2	0.55
1S5	0.70
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1U5	1.00
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2C40	37.00
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2C51	0.75
2C53	32.00
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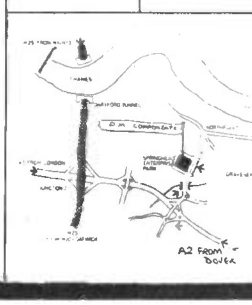

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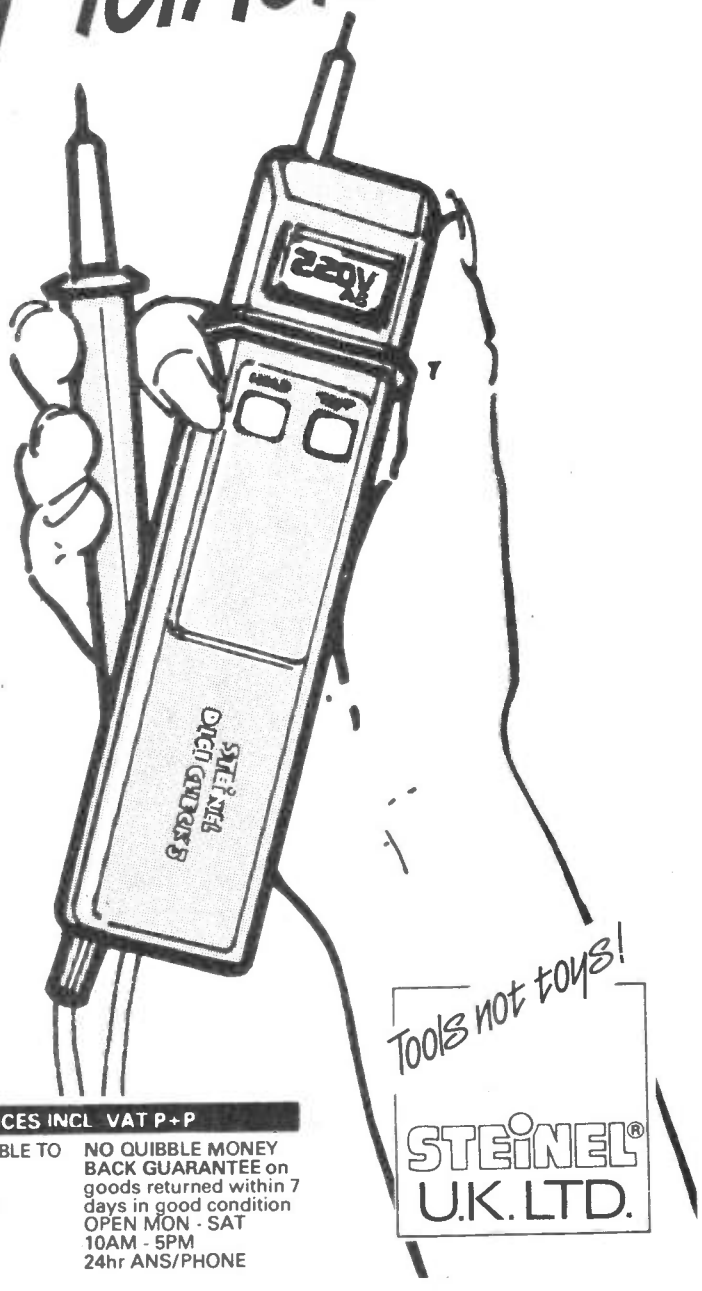

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Ray Marston looks at practical applications of the 555 timer IC

The IC known as the '555 timer' is one of the most popular chips ever produced. It is an inexpensive but highly versatile device specifically designed for use in precision timing applications, but which can also be used in a wide variety of monostable, astable and bistable multivibrator and Schmitt trigger applications. The device is available in both 'single' (555) and 'dual' (556) IC-package forms. CMOS versions of the device are also available.

The 555 and its relatives can be used in a vast range of different applications, and we shall look at a large number of these in the next three or four editions of *Data File*. We'll start off by looking at the basic operating principles of the standard 555 IC, and will conclude the mini-series by looking at CMOS versions of the device.

555 basics

The 555 timer IC was originally introduced by Signetics several years ago, but is now produced by most major semiconductor manufacturers. It can operate from supply voltages in the range 4.5V to 16V and its output can source (supply) or sink (absorb) load currents up to a maximum of 200mA. It can thus directly drive loads such as relays, LEDs, low power lamps and high impedance speakers, etc.

When the IC is used in the basic 'timer' mode it readily produces accurate timing periods that can be varied from a few microseconds to hundreds of seconds via a single R-C network. Timing periods are almost independent of actual supply rail voltage, have a temperature coefficient of only .005% per °C, and can be initiated via a 'trigger' command or aborted via a 'reset' command.

When used in the monostable multivibrator mode the IC produces output pulses with rise and fall times of a mere 100nS. Pulse width modulated (PWM) output signals can be produced, if required.

When used in the astable multivibrator mode both the frequency and the duty cycle of the output waveform can be accurately controlled via two external resistors and one capacitor. The output signals can easily be subjected to frequency-sweep control, frequency modulation (FM), or pulse-position modulation (PPM).

When used as either a monostable or astable multivibrator the multivibrator timing accuracy is almost independent of variations in supply voltage or ambient temperature.

The 555 is available under a variety of specific device-type numbers, but is generally known simply as a '555 timer'. The device is usually available in an 8-pin DIL package, with the pin notations shown in *Figure 1a*, but is also available in an 8-pin TO-99 package, as shown in *Figure 1b*. The 'dual' version of the device is known as the '556 dual timer', and is housed in the 14-pin DIL package shown in *Figure 2*.

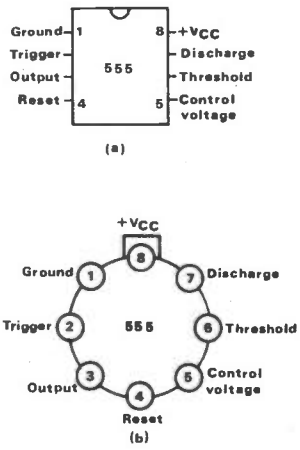


Fig 1 *Outline of (a) the 8-pin DIL 555, and (b) the TO-99*

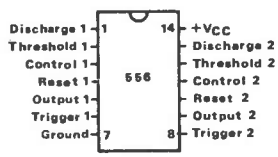


Fig 2 *The 14-pin DIL version of the 556 dual timer*

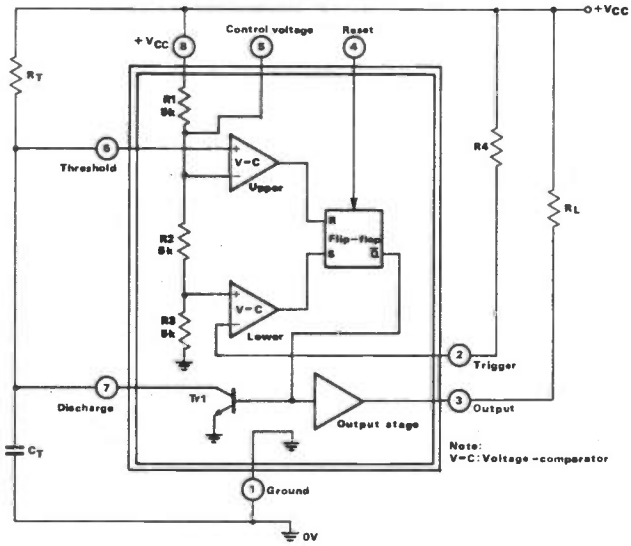


Fig 3 *Block diagram of the 555 timer*

555 parameter values

Parameter	Min	Typical	Max
Supply voltage	4.5V		16V
Power dissipation (max)		600mW	
Supply current (at Vcc = 15V)		10mA	15mA
Max output source/sink current		200mA	
Timing accuracy		±1%	
Drift with temperature		50ppm/°C	
Drift with supply voltage		0.1%/volt	
Threshold voltage		⅔Vcc	
Trigger voltage		⅓Vcc	
Reset voltage	0.4V	0.7V	1.0V
Output rise/fall times		100nS	

How it works

Figure 3 shows the functional block diagram of the 555 timer IC, together with the connections for using it as a basic 'timer' or monostable multivibrator. The following explanation of device operation assumes that the IC is connected in this timer configuration.

The 555 houses 23 transistors, 2 diodes and 15 resistors, arranged in the form of two voltage-comparators, one R-S flip-flop, a low power complementary output stage, a 'slave' transistor, and a voltage-reference potential divider. This divider comprises three 5K0 resistors in series, and is connected across the supply lines so that one third of the supply line voltage is developed across each divider resistor.

Consequently, $\frac{2}{3}V_{CC}$ appears at the R1-R2 junction and is fed to the inverting input terminal of the upper voltage-comparator, and $\frac{1}{3}V_{CC}$ appears at the R2-R3 junction and is fed to the non-inverting input terminal of the lower voltage-comparator. The outputs of the two comparators control the R-S flip-flop, which in turn controls the states of the complementary output stage and the slave transistor. The state of the flip-flop can also be influenced by signals applied to the pin 4 'reset' terminal of the IC.

When the timer circuit of *Figure 3* is in its quiescent state the pin 2 'trigger' terminal is held high via R4: under this condition Tr1 is saturated and forms a short circuit across timing capacitor C_T, and the pin 3 output terminal is driven low. The monostable 'timer' action can be initiated by feeding a negative-going trigger pulse to pin 2. As this pulse falls below the $\frac{1}{3}V_{CC}$ reference value of the built-in potential divider the output of the lower voltage-comparator changes state and causes the R-S flip-flop to switch over, turning Tr1 off and driving the pin 3 output high.

Completion

As Tr1 turns off it removes the short from C_T, so C_T starts to charge exponentially via R_T, until eventually the voltage across C_T rises to $\frac{2}{3}V_{CC}$. At this point the upper voltage-comparator of the IC changes state and switches the R-S flip-flop back to its original state, turning Tr1 on and rapidly discharging C_T, while simultaneously the pin 3 output terminal reverts to the low state. The operating sequence is then complete.

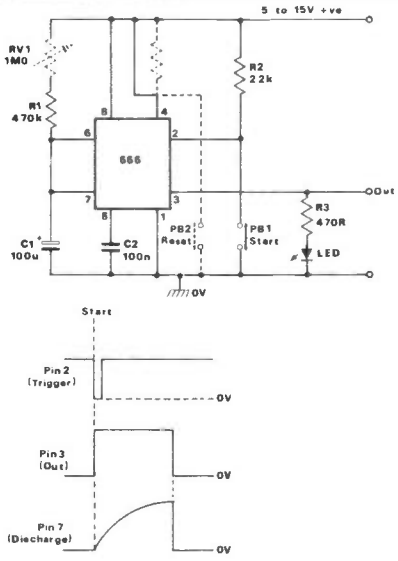


Fig 5 *Circuit and waveforms of a simple 50 second timer (modifications shown dotted)*

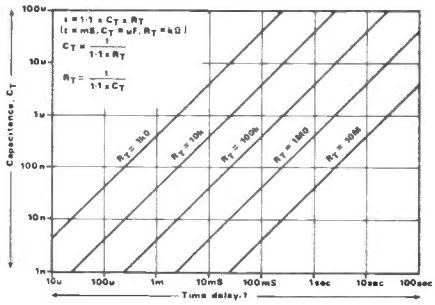


Fig 4 *555 time delays (t) for various values of R_T and C_T*

Note that, once triggered, this circuit cannot respond to additional triggering until the timing sequence is complete, but that the sequence can be aborted at any time by feeding a negative-going pulse to 'reset' pin 4. The 'timer' period of the circuit, in which the pin 3 output is high, is given as:

$$t = 1.1\ R_T\ C_T\ ,$$

where t = mS, R_T = Kohms, and C_T = μF.

Figure 4 shows how delays from 10μS to 100 seconds can be obtained by selecting suitable values of C_T and R_T in the range 1nF to 100μF and 1K0 to 10M. In practice, R_T should not be less than 1K0 or greater than 20M, and C_T must always be a low-leakage component. Note that the timing period is virtually independent of supply voltage value, but that the period can be varied by applying a variable resistance or voltage between the ground and the pin 5 'control voltage' terminal of the IC. This facility enables the periods to be externally modulated or compensated.

The pin 3 output terminal of the IC is normally low, but switches high during the active monostable timing sequence. The output can either source or sink currents up to a maximum of 200mA, so external loads can be connected between pin 3 and either the positive supply rail or the ground rail, depending on the type of load operation desired. The output switching rise and fall times are typically about 100nS.

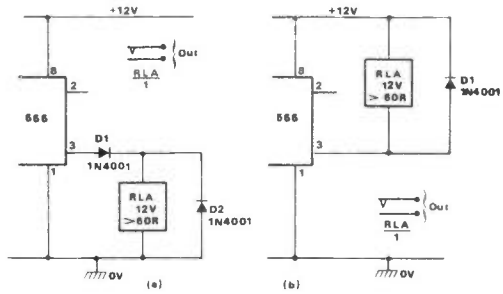


Fig 6 *Alternative methods of driving a relay from the output of a 555*

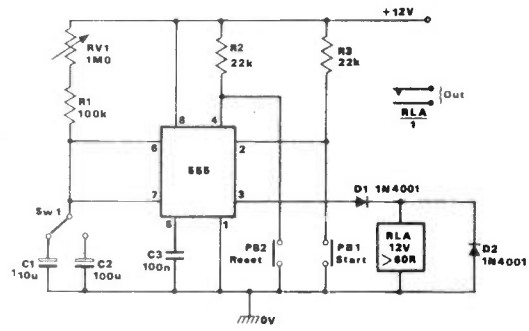


Fig 7 *Simple two-range 1.1 to 120 second relay-output timer*

Practical timers

Figure 5 shows the practical circuit of a simple fixed-period (roughly 50 seconds) manually-triggered 555 timer, together with relevant circuit waveforms. The circuit is similar to that of *Figure 3*, except that the timing action is initiated by briefly shorting pin 2 to ground via 'start' button PB1, pin 5 is decoupled via C2, and the output state is visible via an LED. Note that a fixed-period output pulse (determined by R1-C1) is available at pin 3, and an exponential sawtooth with an identical period is available at pin 7: this sawtooth waveform has a high output impedance.

The basic timer circuit of *Figure 5* can be varied in a number of practical ways. The timing period can be made variable between roughly 1.1 seconds and 120 seconds by replacing R1 with a 10K fixed and 1M0 variable resistor in series, and a 'reset' facility can be applied by inserting a push-button switch between pin 4 and ground, enabling the timing period to be aborted at any moment.

The 555 timer can be used to directly drive non-inductive loads (via pin 3) at currents up to 200mA. If inductive relay loads are used, however, the connections of *Figure 6* must be used. In *Figure 6a* the relay is normally off but goes on only when pin 3 goes high during the timing interval. In *Figure 6b* the relay is normally on but turns off during the timing interval. In these circuits the diodes protect the 555 against inductive-switching damage: relay contacts RLA/1 can be used to control external circuitry.

Figure 7 shows how a relay and a 555 can be connected to make a simple timer that spans the range 1.1 seconds to 120 seconds in two switch-selected decade ranges. This is a useful general purpose circuit, but suffers from two significant defects. Firstly, the circuit consumes continuous current even when the timer is in the 'off' mode. Secondly, because of the wide tolerances of electrolytic timing capacitors C1 and C2, control pot RV1 must be provided with two individually-calibrated scales. *Figure 8* shows how both of these defects can be overcome.

In *Figure 8*, power is normally prevented from reaching the 555 timer circuit by PB1 and RLA/1, which are both normally open, and the circuit consumes zero current. The timing cycle is initiated by momentarily closing push-button switch PB1, thereby connecting power to the 555 timer IC. At the moment of initial PB1 closure C3 is fully discharged, and therefore feeds a 'start' pulse to pin 2 of the IC via R4 and initiates a timing cycle. As the timing cycle starts relay RLA is driven on, so contacts RLA/1 close and maintain the power connection to the IC even when PB1 is released. At the end of the timing cycle the relay turns off again and contacts RLA/1 reopen, again disconnecting power from the timer circuit.

Timer control

The timing of the *Figure 8* circuit is controlled primarily by the values of R1-RV1 and either C1 or C2, which are switch-selected via SW1b. Note, however, that the timing is also influenced by the setting of RV2 and RV3, which are switch-selected via SW1a and connected to pin 5 of the IC and effectively shunt the built-in potential divider of the 555, thereby influencing the timing periods.

This factor enables the circuit to give precise timing periods even when wide-tolerance timing capacitors are used, and allows the use of a single calibrated timing scale to cover the two switch-selected timing ranges.

To set up the *Figure 8* circuit, first set RV1 to maximum value, set range switch SW1 to position '1', activate 'start' button PB1, and adjust RV2 to give a timing period of precisely 10 seconds. Next, set SW1 to position '2', activate 'start' button PB1, and adjust RV3 to give a timing

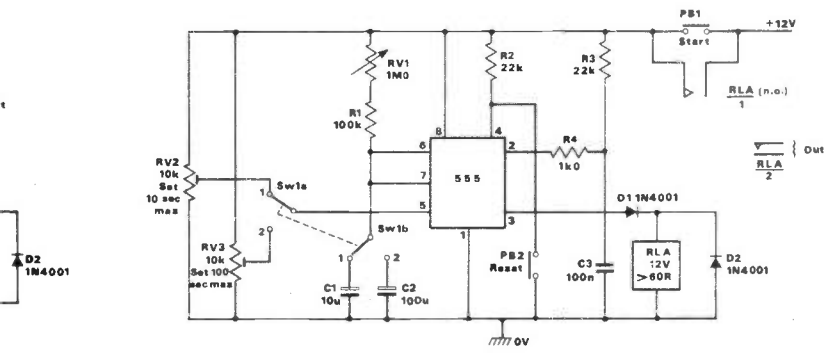


Fig 8 *Precision (compensated) two-range (0.9-10, 9-100 second) timer*

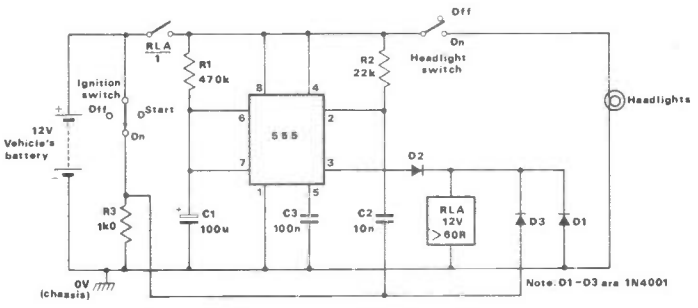


Fig 9 *Automatic delayed turn-off headlight control*

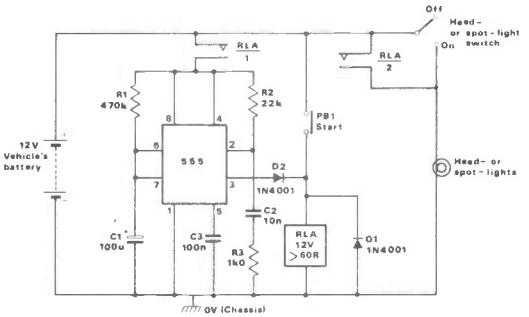


Fig 10 *Manually-triggered light control*

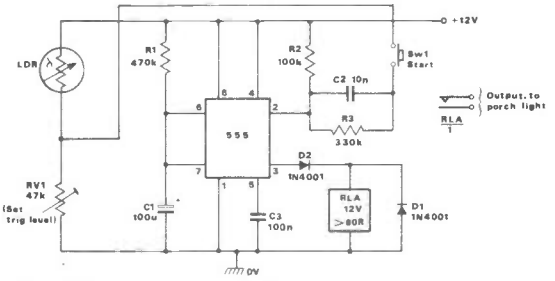


Fig 11 *Automatic porch light control*

period of precisely 100 seconds. Adjustments are then complete, and the timing scale can be calibrated over the full '10 seconds' range.

In-car timers

Figure 9 shows the practical circuit of an automatic delayed turn-off headlight control system for use in automobiles. This circuit lets the owner use the car lights to illuminate his path for a preset time after parking as he leaves the garage or walks along a driveway, etc. The circuit does not interfere with normal headlight operation under actual driving conditions. It works as follows.

When the vehicle's ignition switch is turned to the 'on' position current is fed to the relay coil via D3, so the relay turns on and contacts RLA/1 close, connecting the 12 volt supply to both the timer circuit and the headlight switch. Thus, under this 'ignition on' condition the headlights operate in the normal way. Note that since both sides of C2 are effectively connected to the positive supply rail, the capacitor is fully discharged under this condition.

The moment that the ignition switch is turned to the 'off' position, the R3 voltage falls to zero and current no longer reaches the relay coil via D3. Simultaneously, however, C2 applies a negative-going trigger pulse to pin 2 of the IC, thereby initiating a 50 second timing cycle that applies current to the relay coil via D2.

Turn-off delay

Consequently the relay remains on for roughly 50 seconds after the ignition switch is turned off, and contacts RLA/1 maintain the positive supply connection to the headlight switch throughout this period, holding the headlights on if the switch is in the 'on' position. At the end of this 50 second period the relay turns off and contacts RLA/1 open, breaking the supply connections to the timer circuit and the headlight switch.

Note that the *Figure 9* method of circuit operation is compatible with the normally used method of feeding the headlight switch via the ignition switch in modern vehicles, so that the headlights operate only when the ignition is turned on.

On older types of vehicle, in which headlight operation is independent of the ignition switch, a manually-triggered delayed turn-off headlight or spotlight control facility can be obtained by using the circuit of *Figure 10*. The action of this circuit is such that if the vehicle is parked with its lights off, they turn on for a preset 50 second period as soon as a push-button 'start' switch is momentarily closed, and at the end of this period turn off again automatically.

The *Figure 10* circuit uses a relay with two sets of normally-open relay contacts. The timing sequence is initiated by briefly closing push-button switch PB1. Normally both PB1 and the relay contacts are open, so zero power is fed to the timer circuit and the lights are off. C2 is discharged under this condition.

Operation

When PB1 is momentarily closed power is fed directly to the relay coil, and the relay turns on. As the relay turns on contacts RLA/2 close and apply power to the vehicle lights, and contacts RLA/1 close and apply power to the timer circuit, but pin 2 of the IC is briefly tied to ground via C2 at this moment, so a negative trigger pulse is immediately fed to pin 2 and a timing cycle is initiated.

Consequently pin 3 of the 555 switches high at the moment that the relay contacts close, and thus locks the relay into the 'on' state irrespective of the subsequent state of PB1, so the lights remain on for the duration of the 50 second timing cycle. At the end of the timing cycle pin 3 of the IC switches to the low state, so the relay turns off and contacts RLA/1 and RLA/2 open, disconnecting power from the timing circuit and the lights. The operating sequence is then complete.

Our final example of a simple 555 timer application is shown in *Figure 11*, which is the circuit of a relay-output automatic porch light control unit. This device turns the porch lights on automatically for a preset 50 second period when the presence of a visitor is detected, but does so only at night-time or under 'dark' conditions. The circuit is triggered via switch SW1, which can take the form of a microswitch activated by a porch gate, or a pressure-pad switch that is hidden under a porch mat and activated by body weight.

The *Figure 11* circuit operation depends on the fact that for correct timer operation the negative-going trigger pulse that is fed to pin 2 of the IC must fall below the internally-controlled '$\frac{1}{3}V_{CC}$' voltage value of the 555. If the trigger pulse does not fall below this value, timing cycles cannot be initiated by the trigger signal.

In *Figure 11*, light-dependent resistor LDR and RV1 are wired in series as a light-dependent potential divider. One side of SW1 is taken to the output of this potential divider, and the other side is taken to pin 2 of the IC via C2-R3. Under 'bright' or daylight conditions the LDR resistance is low, so a high voltage

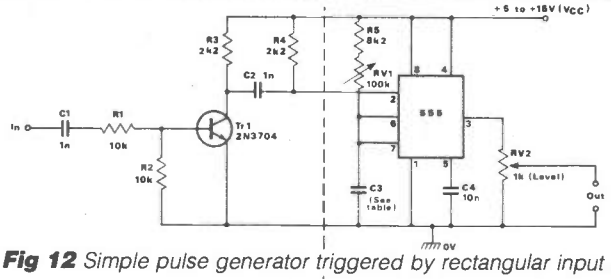
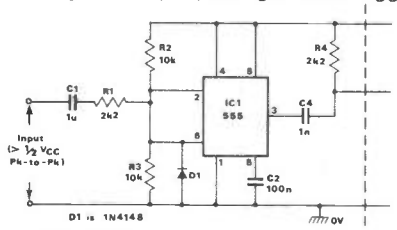


Fig 12 *Simple pulse generator triggered by rectangular input signals*



C3 value	Pulsewidth range
10μF	90mS – 1.2sec
1μF	9mS – 120mS
100nF	900μS – 12mS
10nF	90μS – 1.2mS
1nF	9μS – 120μS

Fig 13 *Improvements to Figure 12 circuit to allow any input waveform*

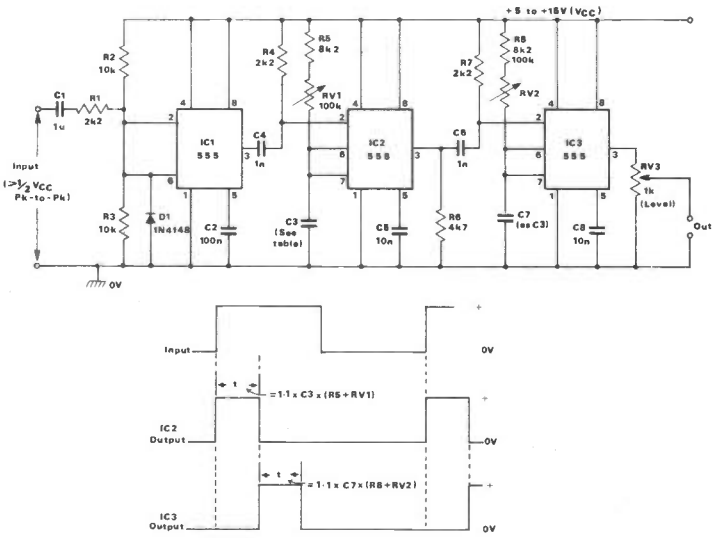


Fig 14 *Delayed-pulse generator triggered by any waveform*

appears at the LDR-RV1 junction. Consequently the act of closing SW1 causes a voltage pulse to be fed to pin 2 of the IC, but this pulse is too small to pull pin 2 below the $\frac{1}{3}V_{CC}$ value, so the timer cannot be triggered via SW1 under these 'daylight' conditions.

Conversely, the LDR acts as a high resistance under dark ('night') conditions, so a low voltage appears at the output of the potential divider. Consequently the act of closing SW1 generates a voltage pulse that pulls pin 2 of the IC well below the $\frac{1}{3}V_{CC}$ value, and the timer circuit can thus be triggered via SW1 under dark conditions.

In practice the LDR can be any cadmium-sulphide photocell that presents a resistance in the range 1K0 to 47K at the required minimum 'dark' turn-on condition, and RV1 can be adjusted to preset the minimum 'dark' level at which the circuit will trigger. Note that the trigger signal is fed to pin 2 of the IC via the C2-R3 combination, which acts as a trigger pulse shaping network that effectively isolates the dc component of the LDR-RV1 network from pin 2.

Pulse generators

The 555 timer circuits that we have looked at so far all act, basically, as monostable multivibrators or 'pulse' generators. The 555 can be used as a conventional electronically-triggered monostable 'pulse' generator by feeding suitable trigger signals to pin 2 and taking the output pulse signals from pin 3. The IC can be used to generate good output pulses with periods from 5μS to hundreds of seconds. The maximum usable pulse repetition frequency is approximately 100KHz.

The trigger signal reaching pin 2 must be a carefully shaped negative-going pulse. Its amplitude must switch from an 'off' value greater than $\frac{2}{3}V_{CC}$ to an 'on' value below $\frac{1}{3}V_{CC}$ (triggering actually occurs as pin 2 drops through the $\frac{1}{3}V_{CC}$ value). The trigger pulse must have a width greater than 100nS but less than that of the desired output pulse, so that the trigger pulse is removed by the time the monostable period terminates.

One way of making suitable trigger signals for the 555 monostable circuit is to convert the input signal to a good squarewave that switches between ground voltage and the full positive supply rail voltage, and then couple this squarewave to pin 2 of the IC via a simple short time constant C-R differentiating network, which converts the leading or trailing edges of the squarewave into suitable trigger pulses. *Figure 12* shows a practical circuit that uses this basic principle, but is intended for use only with input signals that are already of square or pulse form.

Add-on generator

Here, transistor Tr1 converts the rectangular input signal into a form that switches between ground and the positive supply rail, and the resulting signal is fed to pin 2 via the C2-R4 differentiating network. The circuit can be used as an add-on pulse generator in conjunction with an existing square or pulse generator. Variable-amplitude output pulses are available via RV2. Output pulsewidths can be varied over more than a decade range via RV1, and can be switched in overlapping decade ranges by using the values of C3 listed in the table. With the component values shown, the pulsewidth is fully variable from 9μS to 1.2 seconds. Note that C4 is used to decouple pin 5 and improve stability.

Versatility

Figure 13 shows how the above circuit can be modified so that it can be driven from any type of input waveform, including sinewaves. Here, IC1 is wired as a simple Schmitt trigger which converts all input signals into rectangular output signals, and these signals are used to drive the IC2 monostable in the same way as described above. The circuit can be used as an add-on pulse generator in conjunction with an existing waveform generator of any type that produces output signals with peak-to-peak amplitudes greater than $\frac{1}{2}V_{CC}$.

Figure 14 shows how two monostable circuits can be connected in series to make a delayed-pulse generator, in which IC1 is used as a Schmitt trigger, IC2 controls the delay width, and IC3 determines the output pulsewidth. The final output pulse appears some delayed time after the initial application of the trigger signal. This circuit can be made into a self-contained instrument by building it into the same cabinet as a simple squarewave generator, which can be used to provide the necessary drive signals.

Any number of basic monostable pulse generators can be wired in series in a similar manner to the *Figure 14* circuit to give a sequential form of operation.

Next month

In next month's edition of *Data File* we'll look at a variety of ways of using 555 ICs in astable multivibrator 'squarewave generator' applications. REW

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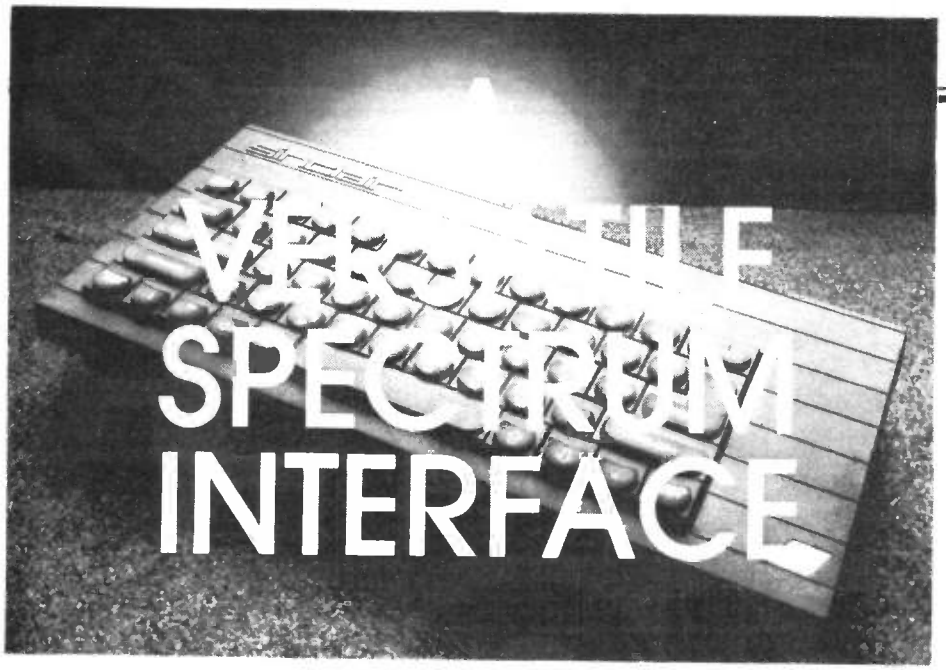

SPECTRUM INTERFACE

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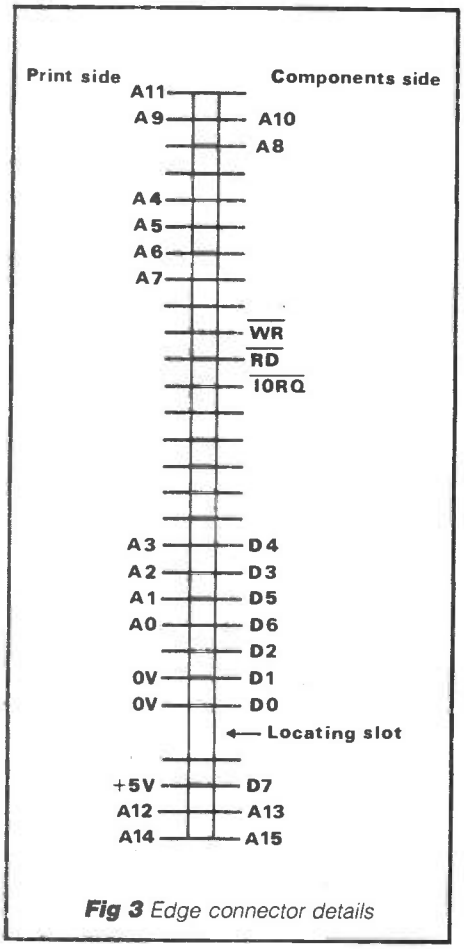

Fig 3 *Edge connector details*

Microcomputers are being used more and more by radio amateurs, but their use is normally restricted because of a lack of 'real world' interfacing. The simple circuit described below will allow the Sinclair Spectrum user to add on up to eight input/output devices of his own choice to enable the computer to interface with switches, LEDs, A/D and D/A converters, etc. It is hoped in future issues to cover other applications, including the decoding of RTTY.

Circuit description

The circuit diagram of the interface is shown in *Figure 1*, and may be considered in two parts: (1) the address decoding, and (2) input/output latches.

Address decoding is performed by IC1a-d, IC2 and IC3 – the actual addresses are given in *Figure 2*. The circuit uses the IORQ (input/output request) and so is not memory mapped, which means that it will operate successfully on 16K and 48K machines. Theoretically the interface can be placed anywhere within the 64K addressing capability of the machine, although in practice some areas are allocated to the Spectrum's hardware (keyboard, printer, microdrive etc): locations from 7455 to 7679 are free and are used by this interface.

The 'ADD 1-8' outputs from IC3 are normally high and each goes low when its corresponding address is selected, irrespective of whether an IN or OUT is issued to that address. The direction in which the data is to be sent is controlled by the RD and WR lines. These lines are 'anded' with the decoded address lines by IC6a-c, to control the latches (note that the decoded address lines and the RD and WR lines are active low).

The latches IC4 and IC5 are simple examples of the type of interfacing that can be performed with this circuit.

IC4 provides eight output lines, each of which can be turned on or off under program control by outputting the appropriate number (see examples). The information on the data lines is clocked into the internal flip-flops by the positive transition on the enable (pin 11), while the low on the output control (pin 1) transfers the data to the output pins. The latch itself is capable of sourcing about 3mA in the high state and sinking 24mA in the low state. If more current is required it will be necessary to buffer the outputs.

Inputs

IC5 provides eight inputs which can be read by the computer (see examples). Its enable is held high by R2 to make the internal flip-flops transparent, ie the outputs will follow the inputs. The information is sent to the output pins, and hence the data bus, by the low level on the output control during a read operation. If left open circuit the inputs will assume a high level. The external circuitry driving these inputs should be capable of pulling the inputs below 0.8V to ensure a true logic low (this involves sinking 0.4mA).

Construction

The circuit is probably best assembled on a large piece of Veroboard to allow for future expansion. Considerable care should be taken with construction since errors on the address/data lines could prove fatal to the Spectrum. Details of the pins required on the Spectrum's edge connector are shown in *Figure 3*, and it is worth noting that the diagram is as seen from the rear of the Spectrum (unlike the diagram in chapter 23 of the *Basic Programming Guide).*

Fig 2 *Table of in/out addresses*

Port No.	I/O Address
ADD1	7455
ADD2	7487
ADD3	7519
ADD4	7551
ADD5	7583
ADD6	7615
ADD7	7647
ADD8	7679

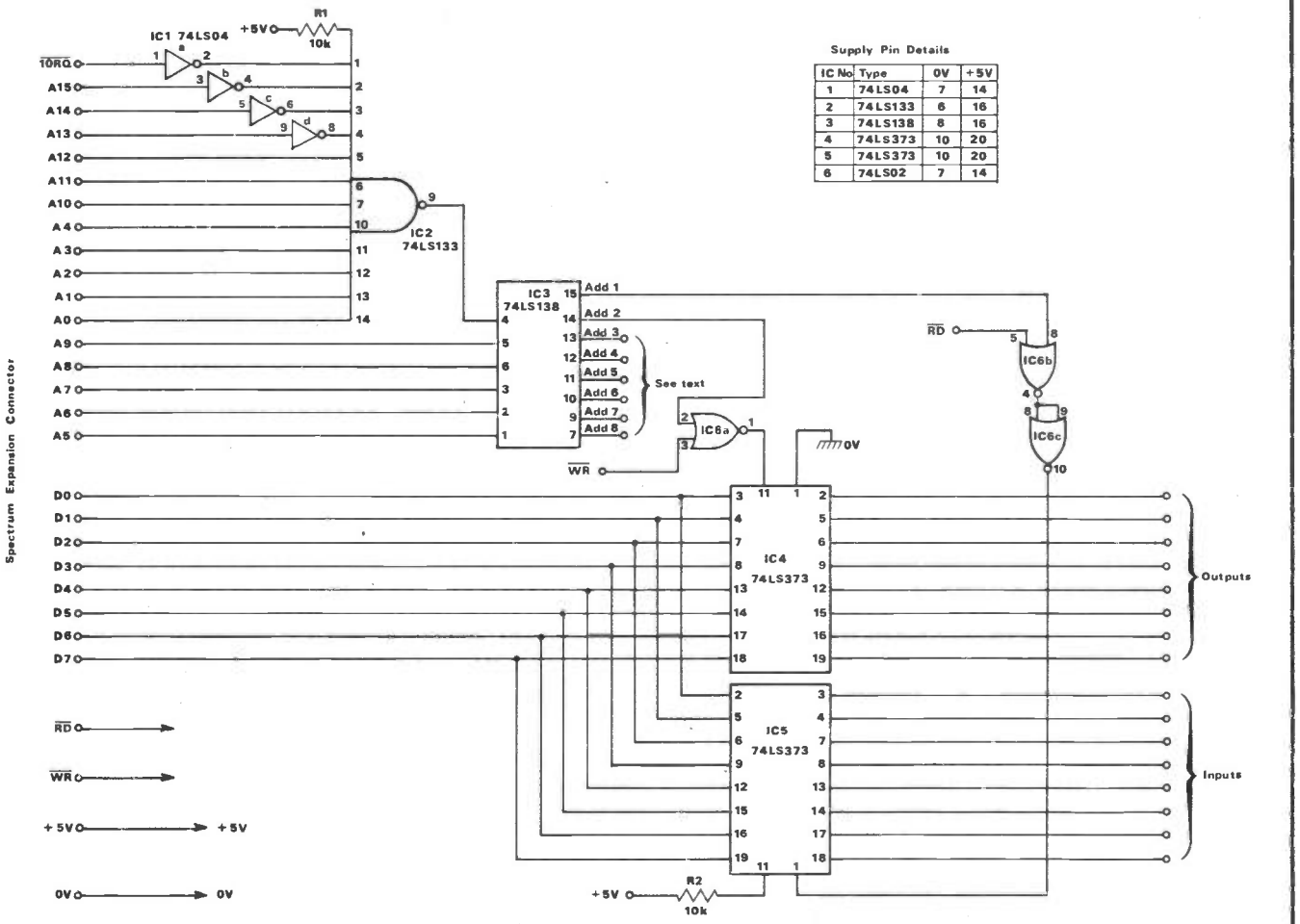

Fig1 *The circuit diagram*

The 5V supply for the interface is obtained from the Spectrum's edge connector, which is adequate in most cases.

If large currents are to be drawn from the interface (more than 50mA) an external 5V supply should be considered. Note that the 0V connection between the Spectrum and interface will still be required.

Program examples

The simple programs shown below, although of questionable practical use, serve to illustrate how the interface is controlled:

(a) Output routine

```
10 OUT 7487, 85
```

will cause alternate bits of the latch IC4 to be set high.

(b) Input routine

```
10 LET A = IN 7455
20 PRINT A
```

will print the decimal equivalent of the binary code applied to the input latch.

(c) Input/output routine

```
10 LET A = IN 7455
20 OUT 7487, A
30 GO TO 10
```

will read the input latch and turn on corresponding bit(s) of the output latch.

(d) Squarewave generator

```
10 OUT 7487, 0
20 GOSUB 100
30 OUT 7487, 1
40 GOSUB 100
50 GO TO 10
100 FOR I=1 TO 100
110 NEXT I
120 RETURN
```

will produce a squarewave output on IC4 pin 2 whose period is set in line 100.

Expanding the system

The addition of other I/O devices on the interface card is quite simple, but specific applications are beyond the scope of this article. Listed below however are the major points to note when adding to the system:

(a) The data bus is common to all I/O devices.

(b) If a device is able to put information onto the data bus, it must have tri-state outputs.

(c) The device must be LS TTL compatible.

(d) The device should use one of the remaining ADD lines from IC3 together with the RD or WR line (as applicable) to enable it. REW

COMPONENTS

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R1,2,3	10K, ⅛W

Integrated circuits

IC1	74LS04
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MORSE DECODING PROGRAM USING Z80 MODE 2 INTERRUPTS

— Dr M A Kiam-Laine

The first part of this article was published in the January 1985 issue of ***R&EW*** and provided an introduction to the general problems which need to be considered in this form of Morse decoding. In this part we examine the assembler language program itself, and the various algorithmic loops by which it functions, including its ability to automatically track changes in speed of the incoming pulse sequences.

Obviously this subject is primarily of concern to short wave operators who actually use Morse as a means of communication, but the emphasis on the use of Z80 Mode 2 interrupts might also interest computer owners who have not yet ventured into the inner mysteries of that amazingly complex IC.

Mode 2 interrupts are commonly avoided by most Z80 experimenters, not only because of the doubly indirect addressing confusions to be sorted out, but due to the usual need to build interfaces to provide the second half of the address bytes at the right microsecond, in accordance with the condition of whichever peripheral device happens to be calling for attention.

Industrial designers are well aware of the great flexibility which Mode 2 provides when it is fully exploited in conjunction with priority selecting logic, but this particular application may be somewhat novel in that it manages to avoid the need to add any extra electronics, by the method described in Part I.

Figure 1 shows the memory map used for this program. The total area allocated is only 700 HEX = 1792 bytes, and quite a few gaps are left amongst them so that any improvements can be squeezed in if and when they are thought of. Incidentally, no time has yet been spent in reviewing the style or efficiency of any of the coding since its first implementation, so readers may notice better ways of writing some of the routines.

An important consideration when using assembler language is whether or not to make the program relocatable. In other words, must it always be loaded into the originally designed memory zones, or can it run in some other location if subsequent users have reason to want it moved? You may think that the problem could be eliminated by always making programs relocatable from the outset, but until the designer has actually finished the coding he can rarely be sure just how long the total program is going to be, nor exactly how many stores and fixed address operations are going to be involved.

Thus the normal procedure is to first get a program working and tested, and later rewrite it with relative jumps and any other modifications needed to free it from restricted running.

The listing

Turning now to the program listing and starting at address 1000 HEX, the block up to 106D HEX merely clears the VDU screen and displays the titles.

Block 106E-10AA HEX sets the various working stores to their necessary starting conditions, and the instruction at 10AB HEX leads into the main program by jumping over the block 10AE-118F HEX which contains the Morse conversions.

The routine labelled 'DECIDE' between 1190-11B3 HEX is the one which continuously looks for interrupts to occur in the window at 1190 HEX, between the enable (EI) and disable (DI) instructions which switch the interrupt facility on and off. Remember that at this stage both dots and dashes actually cause the interrupts, and are both termed 'marks', to distinguish them from 'spaces' which do *not* cause interrupts.

Thus the program can be visualised as having the primary duty of looping round and round 'DECIDE', and either calling 'INT' (and then 'MARK') when a Morse pulse is being presented by the *Elektor* interface, or calling down to the routine 'SPACE' at 11B4 HEX.

Having gone to either, the first job is to measure the length of whatever state preceded it, so routines 'MLENGTH' and 'SLENGTH' do just that and return to either 11B7 or 122B HEX.

Next follows a call to 'DELAY', which prevents the pulse length counter from racing off beyond its capacity. 'SPACE' or 'MARK' then increment their counts and check they have not exceeded 450mS (= 127 ★ 3½mS/delay), before going back into the main 'DECIDE' routine. Looking back into 'MLENGTH', we see it compares the sum in the B-register with the contents of location 10C1 HEX to decide if the previous mark had been a dot or a dash, and also contains calls to the speed tracking routines.

In Z80 code a (CD) 'CALL' instruction such as 'CD B4 13' has the second byte of its address first, so 'ADJ 1' is located at 13B4 HEX. This dot store adjusting routine continually takes and holds the latest dot length but never lets it exceed (1F) HEX, which corresponds to the slowest speed (about 4wpm) that this program caters for. The routine 'DSIZE' actually does the store updating, and 'ADJ 2' at 138B HEX prevents the dash length ever exceeding dot ★ 4.

Note the use of instructions like LD BC (10C3) at 138E HEX, which are a bit deceptive. The program needed the contents of location 10C4 HEX (not 10C3 HEX) to be loaded into the B-register for subtraction from the A-register, but the Z80 does not have an instruction specifically to do that. The nearest it offers is to load two bytes in reverse order into the B- and C-registers by one instruction. Thus (10C3) goes unwantedly into the C-register and the real use is to put (10C4) into the B-register.

Obviously one has to be sure that the contents of the C-register were not required prior to this overwriting of it.

Fig 1 *The memory map*

1000HEX – 10CF	10D0HEX – 118F	1190HEX – 1700
Initialisations and parameter stores	Morse to ASCII conversions	The actual processing routines

MEMORY LOCATION	CONTENTS	MORSE DECODING PROGRAM	
1000	00	NOP	
	EF	RST 28	OUTPUT STRING
	4D 4F 52 53	DB" MORS	
	45 20 20	E ^^	
	44 45 43 4F	DECO	
	44 49 4E 47	DING	
	20 20	^^	
1013	50 52 4F 47	PROG	
	52 41 4D	RAM"	
	00	NOP	DELIMITER
	DF 6A	CRLF	NS3 ROUTINE
	EF	RST 28	
101E	2B	DB" ++++	
	(24)	++++	
		++++	
		++++	
		++++	
1035	2B	++++	
	00	NOP	
	DF 6A	CRLF	
	EF	RST 28	
	53 54 41 52	DB" STAR	
	42 49 52 44	BIRD	
	20	^	
	43 4F 4D 50	COMP	
1047	55 54 45 52	UTER	
	20	^	
	53 59 53 54	SYST	
	45 4D 53	EMS	
	20 20	^^	
1055	40 20 20	@^^	
1058	4B 49 41 4D	DB" KIAM	
	2D	—	
	4C 41 49 4E	LAIN	
	45 20 20	E^^	
	31 39 38 34	1984"	
1068	00	NOP	
	DF 6A	CRLF	
	DF 6A	CRLF	
	00	NOP	
106E	3E 00	LD A, 00	
	32 B0 10	LD (10B0) A	
	32 B1 10	LD (10B1) A	SET ZERO
	32 B2 10	LD (10B2) A	AT START
	32 B3 10	LD (10B3) A	
	32 B4 10	LD (10B4) A	
	00 00 00		
	00		
1083	3E D9	LD A, D9	INT JUMPS
	32 00 14	LD (1400) A	TO 1400 HEX
	3E 11	LD A, 11	THEN 11D9
	32 01 14	LD (1401) A	
	3E 06	LD A, 06	BIT COUNT 6
	32 B5 10	LD (10B5) A	
1092	31 00 17	LD SP, 1700	STACK
	00	NOP	
1096	3E 0D	LD A, (0D)	SET FOR 12WPM
	57	LD D, A	STARTING SPEED
	CD C2 13	CALL DSIZE	
109C	00 00 00		
	00 00 00		
	00 00 00		
	00 00 00		
	00 00 00		
10AB	C3 90 11	JP 1190	
	00 00		
10B0			SPACE COUNT
10B1			MARK COUNT
10B2			INT FLAG (01)
10B3			CHARACTER
10B4			CHAR COUNT
10B5			BIT COUNT
10B6			
10B7	00	NOP	
	3E 04	LD A, 04	BUZZER
	D3 00	OUT 00, A	ROUTINE
	18 FE	JR–2	
10BE	D9	DATA	INT JUMP
10BF	11	DATA	FROM JR–2 ONLY

MEMORY LOCATION	CONTENTS	MORSE DECODING PROGRAM	
10C0	12WPM 39WPM	5WPM	
10C1	0D (13) 04	1F (31)	DOT * 1
10C2	1A (26) 08	3E (62)	DOT * 2
10C3	27 (39) 0C	5D (93)	DOT * 3
10C4	34 (52) 10	7C (124)	DOT * 4
10D0		DATA	MORSE CODE
			CODE CONVERSIONS
1158		DATA	(SEE TABLES LATER)
"DECIDE"			
1190	18 03	JR + 3	
	CD B4 11	CALL SPACE	
1195	ED 5E	IM 2	SET MODE 2
	3E 14	LD A, 14	WW
	ED 47	LD I, A	
119B	FB	EI	ENABLE
	00	NOP	INT WINDOW
	F3	DI	JUMPS TO WW00 HEX
119E	00 00 00		THEN 11D9 HEX
11A1	3A B2 10	LD A (10B2)	
	D6 01	SUB 01	TEST FLAG
11A6	FA 92 11	JPM 1192	
11A9	3E 00	LD A, 00	
	32 B2 10	LD (10B2) A	RESET FLAG
11AE	C3 95 11	JP 1195	
"SPACE"			
11B4	CD E9 11	CALL MLENGTH	
	CD 14 12	CALL DELAY	
11BA	00 00 00		
11BD	3A B0 10	LD A (10B0)	
	3C	INC A	
11C1	FA C8 11	JPM 11C8	
11C4	32 B0 10	LD (10B0) A	
	C9	RET	
11C8	3E 7F	LD A, 7F	THUS SPACE COUNT
	32 B0 10	LD (10B0) A	NEVER EXCEEDS
11CD	CD 58 12	CALL CHAROUT	7F (127)
	C9 00 00	RET	* 3½ ≈450mS
	00 00 00		
"INT"			
11D9	F3	DI	DISABLE ANY
	CD 28 12	CALL MARK	FURTHER INT
	3E 01	LD A, 01	SET FLAG
	32 B2 10	LD (10B2) A	
11E2	C9	RET	
	00 00 00		
"MLENGTH"			
11E9	3A B1 10	LD A (10B1)	
11EC	A7	AND A	SET FLAGS
	C8	RET Z	
11EE	ED 4B C1 10	LD BC (10C1)	B ← (10C2)
	90	SUB B	
	FA 05 12	JPM, 1205	< DOT * 2
	00 00 00		
11F9	CD 42 13	CALL DASH	
11FC	CD 8B 13	CALL ADJ 2	
11FF	3E 00	LD A, 00	
	32 B1 10	LD (10B1) A	
1204	C9	RET	
1205	CD A2 13	CALL DOT	
1208	CD B4 13	CALL ADJ 1	
120B	18 F2	JR-14	
	00 00 00		
	00 00 00		
	00		
"DELAY"		2MHZ CLOCK	
		=½μS CYCLES	
1214	3E (40)	LD A, (40)	SET TO ABOUT
1216	DD 23	INC IX 10	0.7 OF THAT
	DD 2B	DEC IX 10	VALUE (36 HEX)
	DD 23	INC IX 10	WHICH ONLY JUST
	DD 2B	DEC IX 10	CAUSES A DASH WHEN
	3D	DEC A 4	STARTING FROM > E1000
121F	20 F5	JRNZ–11 12/7	& INPUTTING
	C9	RET	A 12 WPM DOT
"MARK"			
	00 00 00		REDUCING THE
1228	CD 45 12	CALL SLENGTH	DELAY INCREASES
	CD 14 12	CALL DELAY	THE COUNT FOR
	00 00 00		A GIVEN PULSE LENGTH
1231	3A B1 10	LD A (10B1)	

MORSE DECODING

MEMORY LOCATION	CONTENTS	MORSE DECODING PROGRAM	
	3C	INC A	
1235	FA 3C 12	JPM, 123C	
	32 B1 10	LD (10B1) A	
	C9	RET	
123C	3E 7F	LD A, 7F	
	32 B1 10	LD (10B1) A	
1241	C9	RET	
	00 00 00		
"SLENGTH"			
1245	3A B0 10	LD A (10B0)	
	A7	AND A	SET FLAGS
	C8	RET Z	
124A	ED 4B C1 10	LD BC (10C1)	B ← (10C2)
	90	SUB B	
124F	FA 21 13	JPM 1321	< DOT * 2
	00 00 00		
"CHAROUT"			
1258	3A B5 10	LD A (10B5)	BIT COUNT
	A7	AND A	
	FA 17 13	JPM, 1317	RESET
	ED 4B B3 10	LD BC (10B3)	C ← (10B3)
	06 06	LD B, 06	
	B8	CPB	SET Z FLAG
	CA 21 13	JPZ, 1321	IF REG A = B
	05	DEC B (5)	
	B8	CPB	
126B	CA 99 12	JPZ, 1291	SER 1
	05	DEC B (4)	
	B8	CPB	
1270	CA AF 12	JPZ 12AF	SER 2
	05	DEC B (3)	
	B8	CPB	
1275	CA D5 12	JPZ 12D5	SER 3
	05	DEC B (2)	
	B8	CPB	
127A	CA DC 12	JPZ 12DC	SER 4
127D	05	DEC B (1)	
	B8	CPB	
	CA E3 12	JPZ 12E3	SER 5
	C3 EA 12	JP 12EA	SER 6
1285	00 00 00		
	00 00 00		
	00 00 00		
	00 00 00		
	00 00 00		
	00 00 00		
"SER 1"			
1299	CB 69	BIT 5, C	SET Z FLAG IF
	28 08	JRZ+8	BIT IS "0"
129D	3E 54	LD A, 54 (T)	
	F7 00 00	RST 30	OUTPUT TO
12A2	C3 07 13	JP 1307	SCREEN
12A5	3E 45	LD A, 45 (E)	
	18 F6	JR–10	
	00 00 00		
"SER 2"			
12AF	CB 69	BIT 5, C	
	28 10	JRZ + 16	FIRST DOT
	CB 61	BIT 4, C	
	28 08	JRZ + 8	SECOND DOT
	3E 4D	LD A, 4D (M)	
12B9	F7 00 00	RST 30	
	C3 07 13	JP 1307	
	3E 4E	LD A, 4E (N)	
	18 F6	JR–10	
12C3	CB 61	BIT 4,C	
	28 04	JRZ + 4	SECOND DOT
	3E 41	LD A, 41 (A)	
	18 F6	JR–10	
12CB	3E 49	LD A, 49 (I)	
	18 FA	JR–6	
	00 00 00		
"SER 3"			
12D5	06 09	LD B, 09	TABLE LENGTH + 1
	21 CE 10	LD HL, 10CE	TABLE START –2
"SER 4"	18 05	JR + 5	
12DC	06 11	LD B, 11	17 DECIMAL
	21 DF 10	LD HL, 10DF	
"SER 5"	18 05	JR + 5	
12E3	06 21	LD B, 21	33 DECIMAL
	21 00 11	LD HL, 1100	

MEMORY LOCATION	CONTENTS	MORSE DECODING PROGRAM	
"SER 6"	18 0B	JR + 11	
12EA	06 0C	LD B, 0C	12 DECIMAL
	21 41 11	LD HL, 1141	
	00 00 00		
"SEARCH"			
12F5	3A B3 10	LD A (10B3)	
12F8	05	DEC B	
	CA 3A 13	JPZ, 133A	NOT ON TABLE
	23	INC HL	
	23	INC HL	
	BE	CP (HL)	
12FF	20 F7	JRNZ–9	
	23	INC HL	NEXT ONE
	7E	LD A (HL)	TAKE ASCII EQUIV
1303	F7	RST 30	
	00 00 00		
"RESET"			
1307	3A B0 10	LD A (10B0)	
	ED 4B C3 10	LD BC (10C3)	B ← (10C4)
	90	SUB B	
	FA 17 13	JPM 1317	< DOT * 4
	00 00		
1314	DF 69	SPACE	NS3 ROUTINE
	00	NOP	
1317	3E 06	LD A, 06	
	32 B5 10	LD (10B5) A	BIT COUNT
	3E 00	LD A, 0	
	32 B3 10	LD (10B3) A	
1321	3E 00	LD A, 0	
	32 B0 10	LD (10B0) A	
1326	C9	RET	AN ASTERISK
"ERROR"			CAN BE
1328	3E 2A	LD A, 2A (*)	DELIBERATELY
	F7	RST 30	CAUSED BY
	DF 69	SPACE	SENDING 7 OR 8 DOTS
	00 00 00		
	3E FF	LD A, –1	
	A7	AND A	SET FLAGS
1333	C9	RET	
	00 00 00		
	00 00 00		
133A	3E 25	LD A, 25 (%)	NOT ON
	C3 03 13	JP 1303	6 BIT TABLE
	00 00 00		ASCII 23 PRINTS £ ON NS3
"DASH"			
1342	3A B5 10	LD A (10B5)	BIT COUNT
	3D	DEC A	
	FC 28 13	CALL (M), ERROR	
	32 B5 10	LD (10B5) A	
	F5	RET (M)	
134D	ED 4B B3 10	LD BC (10B3)	C ← (10B3)
	06 05	LD B, 05	CHARACTER
	B8	CPB	INTO C REGISTER
	28 14	JRZ + 20	
	05	DEC B (4)	
	B8	CPB	
	28 14	JRZ + 20	
	05	DEC B (3)	
	B8	CPB	
	28 14	JRZ + 20	
	05	DEC B (2)	
	B8	CPB	
1360	28 14	JRZ + 20	
	05	DEC B (1)	
	B8	CPB	
	28 14	JRZ + 20	
1366	C3 7E 13	JP 137E	
	00	NOP	
136A	CB E9	SET 5, C	
	18 12	JR + 18	
136E	CB E1	SET 4, C	
	18 0E	JR + 14	
1372	CB D9	SET 3, C	
	18 0A	JR + 10	
1376	CB D1	SET 2, C	
	18 06	JR + 6	
137A	CB C9	SET 1, C	
	18 02	JR + 2	
137E	CB C1	SET 0, C	
1380	79	LD A, C	
	32 B3 10	LD (10B3) A	

MEMORY LOCATION	CONTENTS	MORSE DECODING PROGRAM	
1384	C9	RET	
	00 00 00		
"ADJ 2"	00 00 00		
138B	3A B1 10	LD A (10B1)	
	ED 4B C3 10	LD BC (10C3)	B ← (10C4)
	90	SUB B	
1393	F8	RET M	< DOT * 4
	00		
1395	3E 1F	LD A (1F)	
	57	LD D, A	
	CD C2 13	CALL DSIZE	
	C9	RET	
139C	00 00 00		
"DOT"			
13A2	3A B5 10	LD A (10B5)	BIT COUNT
	3D	DEC A	
	FC 0B 13	CALL (M) ERROR	
	32 B5 10	LD (10B5) A	
13AC	C9 00	RET	
	00 00 00		MAX DOT = 3E
	00 00 00		MIN DOT = 04
"ADJ 1"			
13B4	3E 1F	LD A, 1F	
	ED 4B B0 10	LD BC (10B0)	B ← (10B1)

MEMORY LOCATION	CONTENTS	MORSE DECODING PROGRAM	
	90	SUB B	
	FA D2 13	JPM 13D2	> DOT * 1 MAX
	00 00		
13C0	78	LD A, B	
"DSIZE"	50	LD D, B	
13C2	32 C1 10	LD (10C1) A	
	82	ADD A, D	
13C6	32 C2 10	LD (10C2) A	
	82	ADD A, D	
	32 C3 10	LD (10C3) A	
	82	ADD A, D	
	32 C4 10	LD (10C4) A	
13D1	C9	RET	
13D2	3E 1F	LD A, 1F	
	57	LD D, A	
13D5	18 EB	JR–21	
	00 00 00		
1400	D9	DATA	} INT
1401	11	DATA	} DESTINATION
1700			STACK

Read page 291 of Rodnay Zaks' book *Programming the Z80* for full details.

The fundamental idea by which 'ADJ 1' and 'DSIZE' continually track the speed of the incoming Morse is quite simple, but as with most programming, the worst problems are concerned with fringe conditions which only occur once a fortnight but would then immediately disrupt the system if they had not all been predicted and dealt with. Such details can only be properly appreciated once your mind is fully immersed in a particular algorithm, and the positioning of some trivial looking instructions can often have a serious effect on some unexpected condition.

Location 10B3 HEX holds each Morse character as it is built up, dots causing bits to be set to logic 0 and dashes to logic 1. The longest Morse character is only 6 marks, so a one byte store of 8 bits can take any Morse, but a further store at 10B5 HEX is needed to act as a pointer moving along the character marks to tell the program which is the next bit to set.

Each time the routine 'CHAROUT' at 1258 HEX has finished searching and decoding bit sequences for display on the VDU, it enters 'RESET' at 1307 HEX and the instruction at 131E HEX clears the character store to all zeros. Thus the routine 'DOT' at 13A2 HEX never has to actually set any bits to logic 0, only decrement the bit count from its starting value of 6 (more convenient than incrementing from 1) and then return.

By contrast, the 'DASH' routine at 1342 HEX is much longer, as it has to measure the bit counter each time before it knows which of the 'SET BIT' instructions to operate. Unfortunately the Z80 has no instruction which could more simply just set the 'NEXT' bit, it has to know exactly which one and in which register (see Zaks page 425 for details).

The final routine to be explained is 'CHAROUT', in which the character store at 10B3 HEX is decoded by searching through the Morse to ASCII data tables between 10D0-1158 HEX. Since characters of only one or two bits are easy to recognise, the 'SER 1' and 'SER 2' routines do not really search; rather they operate by saying, "If it's not an 'E' then it must have been a 'T'," etc.

Routines 'SER 3/4/5/6' load the appropriate length of the table to be searched (plus 1 for coding convenience) into the B-register, and its start address (minus 2 for convenience – you won't appreciate such expedients until you try doing it some other way!) is loaded into the HL-register prior to jumping to the actual 'SEARCH' routine at 12F5 HEX.

When a match is found, the program passes through the JRNZ-9 instruction at 12FF HEX, increments the HL value to point to the next location which holds the ASCII alphabet to be printed, and then displays it on the screen with the RST 30 instruction. This use of RST 30 applies to Nascom monitors only, and other machines have different ways of outputting to the screen.

Results

The program is not perfect in the sense that occasionally it puts a space into the text when it shouldn't, or it misinterprets the first letter of words which start abruptly, but when receiving commercial Morse over a fairly steady speed range it is quite delightful to watch the characters appearing on the screen, and realise just how many thousands of precision routed Z80 instructions were involved in the presentation of each one.

If your 14 year old son seems to know more about computing than you do, don't be dismayed, as the key word is 'seems'. It is relatively easy to write some instructions in a simple language like BASIC and get rapid screen effects, but an entirely more complicated world lies under the keyboard at the electrical and hexadecimal machine code level (so perhaps you ought to be doubly dismayed! Depends on how you read the encouragement).

Readers of the magazine *Ham Radio Today* should look up the review of the Japanese Tono Theta 5000E written by Ken Michaelson in October 1984. That machine is considered to be the Rolls Royce of telegraphy decoders, and yet even their program is apparently upset by erratic amateur styles of sending Morse.

Furthermore its tracking ability is not entirely automatic due to the 'weight setting' and 'speed' adjustments which have to be typed in (compare with the LDA, 09 and LDA, 40 instructions at 1096 HEX and 1214 HEX respectively in this program). These points indicate that the Japanese programmers had encountered similar problems in trying to achieve faultless decoding.

Nevertheless, this is a great project if you are an amateur radio operator anxious to comprehend and use computers.

Complete 98% decoding accuracy can only be obtained in more complicated systems which actually return each character to the sender and ask, 'Is this the one you just sent me?' and only display it after acknowledgement is received. Even in these systems, two per cent short of the perfect 100 must be allowed for fluke errors.

Generally speaking then, all hand sent Morse is quite rough compared with machine transmitted coding, and the added distortions caused by weak signals and atmospheric noise mean that if you can get 90% of a message onto your TV screen then you have done very well indeed!

MORSE DECODING

MEMORY LOCATION		MORSE	BINARY	HEX	
10D0	S	• • •	00 000	00	6 BIT CODE &
				53	ASCII EQUIV.
	U	• • –	001	08	
				55	
	R	• – •	010	10	
				52	
	W	• – –	011	18	
				57	
	D	– • •	100	20	
				44	
10DA	K	– • –	101	28	
				4B	
	G	– – •	110	30	
				47	
	O	– – –	111	38	
10DF				4F	
					TOTAL 8 ↑
10E1	H	• • • •	0000	00	
				48	
	V	• • • –	0001	04	
				56	
	F	• • – •	0010	08	
				46	
	Ü	• • – –	0011	0C	
				23	FILL ALL
	L	• – • •	0100	10	UNALLOCATED
				4C	CODES WITH
	Ä	• – • –	0101	14	23 HEX = #
				23	ASCII BUT
	P	• – – •	0110	18	£ ON NASCOM
10EE				50	
	J	• – – –	0111	1C	
				4A	
10F1	B	– • • •	1000	20	
				42	
	X	– • • –	1001	24	
				58	
	C	– • – •	1010	28	
				43	
	Y	– • – –	1011	2C	
				59	
	Z	– – • •	1100	30	
				5A	
	Q	– – • –	1101	34	
				51	
	Ö	– – – •	1110	38	
				23	
	ch	– – – –	1111	3C	
1100				23	
					TOTAL 16 ↑
1102	5	• • • • •	000000	00	
				35	
	4	• • • • –	000010	02	
				34	
	VE	• • • – •	000100	04	
				23	
	3	• • • – –	000110	06	
				33	
	é	• • – • •	001000	08	
				23	
		• • – • –	001010	0A	
110D				23	
		• • – – •	001100	0C	
				23	
1110	2	• • – – –	001110	0E	
				32	
	LE	• – • • •	010000	10	WAIT
				23	
	LT	• – • • –	010010	12	NUM/FRAC
				23	
	RN	• – • – •	010100	14	
				23	
		• – • – –	010110	16	
				23	
		• – – • •	011000	18	
				23	
		• – – • –	011010	1A	
				23	
		• – – – •	011100	1C	

MEMORY LOCATION		MORSE	BINARY	HEX	
111F				23	
1120	1	• – – – –	011110	1E	6 BIT CODE &
				31	ASCII EQUIV.
	6	– • • • •	100000	20	
				36	
	=	– • • • –	100010	22	
				3D	
	/	– • • – •	100100	24	
				2F	
		– • • – –	100110	26	
				23	
		– • – • •	101000	28	
112B				23	
112C		– • – • –	101010	2A	
				23	
	(	– • – – •	101100	2C	
				28	
1130		– • – – –	101110	2E	
				23	
	7	– – • • •	110000	30	
				37	
		– – • • –	110010	32	
				23	
		– – • – •	110100	34	
				23	
		– – • – –	110110	36	
				23	
	8	– – – • •	111000	38	
				38	
		– – – • –	111010	3A	
				23	
	9	– – – – •	111100	3C	
				39	
	0	– – – – –	111110	3E	
1141				30	
					TOTAL 32 ↑

THE FOLLOWING SHOWS 6 BIT CODES ONLY FOR INTERNATIONALLY ALLOCATED MORSE, WHEREAS THE LISTS ABOVE ARE COMPLETE FOR ALL BINARY COMBINATIONS OF 3, 4, 5 BITS

1143	VA	• • • – • –	000101	05	END
				23	
	?	• • – – • •	001100	0C	
				3F	
	—	• • – – • –	001101	0D	
				23	
	"	• – • • – •	010010	12	
				22	
	.	• – • – • –	010101	15	
				2E	
	'	• – – – – •	011110	1E	
				27	
114F	–	– • • • • –	100001	21	
				2D	
	;	– • – • – •	101010	2A	
				3B	
	)	– • – – • –	101101	2D	
				29	
	,	– – • • – –	110011	33	
				2C	
	:	– – – • • •	111000	38	
1158				3A	
					TOTAL 11 ↑

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2732 ex equip **£3.25. 27128** – 250ns **NEW £12.00.**
6116-200 **£4.50, 6116**-250 **£3.95,**
6264LP-150 **£22.00. 4164**-200 **£3.50. 4864**-150 **£4.00.**
4116-300, **£1.20. 2114 £1.75. 6800 £2.50, 8821 £1.00,**
68A09 £8.00, 68B09 £10.00, 68B09E £14.50,
D8085AH-2 £12.00, D8086 £20.00, Z80A £2.99.

HOT LINE DATA BASE

DISTEL ©

THE **ORIGINAL FREE OF CHARGE** dial up data base 1000's of stock items and one off bargains.
ON LINE NOW – 300 baud, full duplex CCITT tones, 8 bit word, no parity

01-679 1888

MAINS FILTERS

Cure those unnerving hang ups and data glitches caused by mains interference.
SD5A As recommended by ZX81 news letter matchbox size up to 1000 watt load **£5.95**
L2127 compact completely cased unit with 3 pin fitted socket Up to 750 watts **£9.99**

Anderson Jacobson AJ510 VIDEO DISPLAY TERMINAL

Made by one of the USA's largest peripheral manufacturers the AJ510 Professional VDU terminal has too many features to include in space available – just a few are: internal Z80 cpu control, very readable 15" non glare green screen, 24 lines by 80 characters, 128 ASCII character set with lower case and graphics, standard RS232 interface, Cursor addressing, numeric key pad etc. Supplied in good **TESTED** second hand condition with full manual **£225.00** + carr £10.00. Data sheet on request.

COOLING FANS

Keep your hot parts COOL and RELIABLE with our range of **BRAND NEW** professional cooling fans.
ETRI 99XUO! Dim. 92 x 92 x 25 mm. Miniature 240 v equipment fan complete with finger guard. **£9.95.**
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BUHLER 69.11.22. 8-16 v DC micro miniature reversible fan. Uses a brushless servo motor for extremely high air flow, almost silent running and guaranteed 10,000 hr life. Measures only 62 x 62 x 22 mm. Current cost £32.00 **OUR PRICE ONLY £12.95 complete with data.**
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At a price YOU can afford, our range of **EX EQUIPMENT** video monitors defy competition!! All are for 240v working with standard composite video input. Units are pre tested and set for up to 80 col use on BBC micro. Even where MINOR screen burns MAY exist – normal data displays are unaffected

1000's SOLD TO DATE

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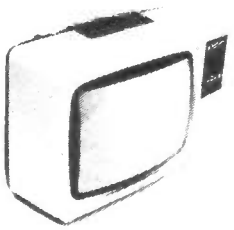
24" KGM large screen black & white monitor fully enclosed in light alloy case. Ideal schools, shops, clubs etc.
ONLY £55.00 Carriage £10.00

A Major company's over production problems, and a special **BULK PURCHASE** enable **TWO** outstanding offers.

COLOUR MONITOR SPECIALS

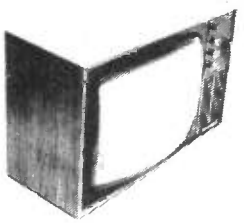


'SYSTEM ALPHA' 14" Multi Input Monitor.

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

This must be **ONE OF THE YEAR'S BEST BUYS!!!**

Supplied **BRAND NEW** and **BOXED**, complete with **DATA** and 90 day guarantee. **SUPPLIED BELOW ACTUAL COST – ONLY £149.00** + Carr.



DECCA RGB 80-100 Monitor.

Little or hardly used manufacturer's surplus enables us to offer this special converted **DECCA RGB** Colour Video TV Monitor at a super low price of only **£99.00**, a price for a colour monitor as yet unheard of!! Our own interface, safety modification and special 16" high definition **PIL** tube, combine with the tried and tested DECCA 80/100 series chassis to give 80 column definition and picture quality found only on monitors costing **3 TIMES OUR PRICE.** In fact, **WE GUARANTEE** you will be delighted with this product, the quality for the price has to be seen to be believed. Supplied complete and ready to plug directo to a **BBC MICRO** computer or any other system with a **TTL RGB** output. Other features include internal audio amp and speaker, Modular construction, auto degaussing 34 H x 24 D, 90 day guarantee. Supplied in **EXCELLENT** condition, **ONLY £99.00** + Carr. Also available **UN-MODIFIED** but complete with MOD DATA. Only £75.00.

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Join the communications revolution with our super range of **DATA MODEMS** with prices and types to suit all applications and budgets!!
Most modems are **EX BRITISH TELECOM** and are made to the highest standard for continuous use and reliability. RS232 interfaces are standard to all our modems, so will connect to ANY micro etc. with an RS232 serial interface.

DATEL 2B see **SPECIAL OFFER** centre of this ad
MODEM 13A, 300 baud. Compact unit only 2" high and same size as telephone base Standard CCITT tones, CALL mode only Tested with data. ***ONLY £45.00 + PP £4.50.***
MODEM 20-1, 75-1200 baud. Compact unit for use as subscriber end to PRESTEL MICRONET or TELECOM GOLD. Tested with data. ***£39.95 + PP £6.50.***
MODEM 20-2. same as 20-1 but 1200-75 baud ***£99.00.***
TRANSDATA 307A. 300 baud acoustic coupler. Brand new with RS232 interface. **ONLY £49.95**
DACOM DSL2123 Multi Standard Modem. switchable CCITT or USA BELL 103 standard. V21 300-300, V23 75-1200, V23 1200-75 or 1200-1200 half duplex.
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- CALL, ANSWER and AUTO modes
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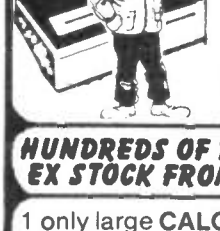
- 1 year full guarantee
- Just 2 wires to comms. line

NOW ONLY £29.95

Order now – while stocks last. Carriage and Ins. £10.00

SAVE £250 SUPER PRINTER SCOOP



BRAND NEW CENTRONICS 739-2

The "Do Everything Printer" at a price that will **NEVER** be repeated. Standard **CENTRONICS** parallel interface for direct connection to **BBC, ORIC, DRAGON** etc. Superb print quality with full pin addressable graphics and 4 type fonts plus **HIGH DEFINITION** internal **PROPORTIONAL SPACED MODE** for **WORD PROCESSOR** applications. 80-132 columns, single sheet, sprocket or roll paper handling plus much more. Available **ONLY** from **DISPLAY ELECTRONICS** at the ridiculous price of ***ONLY £199.00*** + VAT Complete with full manual etc. Limited quantity –Hurry while stocks last.

ONLY £199

Options. Interface cable (specify) for BBC, ORIC, DRAGON or CENTRONICS 36 way plg £12.50. Spare ribbon £3.50 each BBC graphics screen dump utility program £8.60. Carriage and Ins. £10.00 + VAT

HUNDREDS OF PRINTERS EX STOCK FROM £49.00. Call Sales Office for Details.

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EX STOCK

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PDP 1140 System comprising of CPU. 124K memory + MMU 16 line RS232 interface. RP02 40 MB hard disk drive. TU10 9 track 800 BPI Mag tape drive. dual rack system. VT52 VDU etc. etc. Tested and running ***£3750.00***

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DLV11-J 4 x EIA interface	£310.00
DLVII-E Serial. Modem support	£200.00
DUP11 Sych. Serial data i/o	£650.00
DQ200 Dilog – multi RK controller	***£495.00***
DZ11-B 8 line RS232 mux board	£650.00
KDF11-B M8189 PDP 1123+	£1100.00
LA36 Decwriter EIA or 20 ma loop	£270.00
LAX34-AL LA34 tractor feed	£85.00
MS11-JP Unibus 32 kb Ram	£80.00
MS11-LB Unibus 128 kb Ram	£450.00
MS11-LD Unibus 256 kb Ram	£850.00
MSC4804 Qbus (Equiv MSV11-L) 256 kb	£499.00
PDP11/05 Cpu, Ram, i/o, etc.	£450.00
PDP11/40 Cpu, 124k MMU	£1850.00
RT11 ver. 3B documentation kit	£70.00
RK05-J 2.5 Mb disk drives	£650.00
KL8JA PDP 8 async i/o	£175.00
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VT52 VDU with RS232 interface	***£250.00***

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

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The FABULOUS 25CPS TEC Starwriter

BRAND NEW AT ONLY £499 + VAT

Made to the very highest spec the **TEC Starwriter FP1500-25** features a heavy duty die cast chassis and DIABLO type print mechanism giving superb registration and print quality. Micro-processor electronics offer full DIABLO/QUME command compatability and full control via CPM Wordstar etc. Many other features include bi directional printing, switchable 10 or 12 pitch, full width 381 mm paper handling with upto 163 characters per line, friction feed rollers for single sheet or continuous paper, internal buffer, standard RS232 serial interface with handshake. **Supplied as BRAND NEW** with 90 day guarantee and **FREE** daisy wheel and dust cover. Order **NOW** or contact sales office for more information. Optional extras: RS232 data cable **£10.00**. Tech manual **£7.50**. Tractor feed **£140.00**. Spare daisy wheel **£3.00**. Carriage & Ins (UK Mainland) **£10.00**.

PROFESSIONAL KEYBOARD OFFER

An advantageous purchase of brand new surplus allows a great **QWERTY**, full travel, chassis keyboard offer at fractions of their original costs.
ALPHAMERIC 7204/60 full **ASCII** 60 key, upper, lower + control key, parallel TTL output plus strobe. Dim 12" x 6" +5 & -12 DC. ***£39.50***.
DEC LA34 Uncoded keyboard with 67 quality, **GOLD**, normally open switches on standard X, Y matrix. Complete with 3 LED indicators & I/O cable – ideal micro conversions etc. pcb DIM 15" x 4.5" ***£34.95*** Carriage on keyboards £3.00

66% DISCOUNT ELECTRONIC COMPONENTS EQUIPMENT

Due to our massive bulk purchasing programme which enables us to bring you the best possible bargains, we have thousands of I.C.'s, Transistors, Relays, Cap.s, P.C.B.'s, Sub-assemblies, Switches, etc. etc. surplus to our requirements. Because we don't have sufficient stocks of any one item to include in our ads. we are packing all these items into the *BARGAIN PARCEL OF A LIFETIME*. Thousands of components at giveaway prices! Guaranteed to be worth at least *3 times* what you pay. Unbeatable value!! Sold by weight.

2.5kls *£4.25* + pp £1.25 — **5kls *£5.90*** + £1.80
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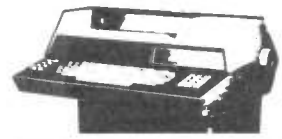
GE MODEL 30



A large purchase of these stand alone terminal units offers an EXTREMELY LOW PRICE for a professional printer for direct connection to your micro. The printer has a standard RS232 serial interface with switchable rates of 110, 200 and 300 baud. Upper and lower case characters are printed by a matrix head with character widths up to 132 columns. Unit accepts standard fan fold sprocket fed paper from 4" to 9.5". Many other features such as numeric keypad, electronic keyboard, auto motor on/off and FREE floor stand.
Supplied in good S/H working condition – complete with manual ***ONLY £95.00***
CARRIAGE & INS. £10.00

GE TERMIPRINTER

A massive purchase of these desk top printer-terminals enables us to offer you these quality 30 cps printers at a **SUPER LOW PRICE** against their original cost of over £1000. Unit comprises of full QWERTY, electronic keyboard and printer mech with print face similar to correspondence quality typewriter. Variable forms tractor unit enables full width – up to 13.5" 120 column paper, upper – lower case, standard RS232 serial interface, internal vertical and horizontal tab settings, standard ribbon adjustable baud rates, quiet operation plus many other features. Supplied complete with manual. Guaranteed working ***£130.00*** or untested ***£85.00***, optional floor stand £12.50 Carr & Ins £10.00

EXTEL PRINTERS

EX NEWS SERVICE compact, quality built 50 column matrix printer, type AE11. Unit operates on 5 BIT BAUDOT code from current loop, RS232 or TTL serial interfaces. May be connected direct to micro, or comms receiver via simple filter network to enable printing of most world wide NEWS, TELEX and RTTY services. Supplied in tested second hand condition with 50 and 75 baud xtals, data sheet and large paper roll. ***ONLY £49.95.***
Dimensions 15" D x 5" H x 10" W
CARR £6.00 Spare paper rolls £4.50 each

TELETYPE ASR33 I/O TERMINALS

FROM £195 + CAR. + VAT

Fully fledged industry standard ASR33 data terminal. Many features including ASCII keyboard and printer for data I/O auto data detect circuitry. RS232 serial interface. 110 baud, 8 bit paper tape punch and reader for off line data preparation and ridiculously cheap and reliable data storage. Supplied in good condition and in working order
Options: Floor stand ***£12.50*** + VAT
KSR33 with 20ma loop interface ***£125.00*** +
Sound proof enclosure ***£25.00*** + VAT

20,000 FEET OF ELECTRONIC AND COMPUTER GOODIES
ENGLAND'S LARGEST SURPLUS STORE – SEEING IS BELIEVING!!

D.C. POWER SUPPLY SPECIALS

Experimentors PSU Ex-GPO. All silicon electronics. Outputs give +5v @ 2 amps +12v @ 800 ma –12v @ 800 ma +24v @ 350 ma and 5v floating @ 50 ma. Dim 160 x 120 x 350 mm. All outputs are fully regulated and short circuit proof. Supplied in NEW or little used condition. Complete with circuit. Only £15.50 +2 £2.50 pp
FARNELL 5 Volt 40 amps. Type number **G6-40A.** This miniature switching PSU measures only 160mm wide 175mm deep and 90mm high, yet delivers a massive 40 amps!! Fully regulated and smoothed with over voltage protection etc. 120 or 240 volts AC input. Supplied **BRAND NEW** and boxed with circuit at a fraction of the current list price. Only **£130.00 + £3.00** carr & ins.
LAMBDA LMCC 5V BRAND NEW 240v AC input with 5 volts DC at 8 to 10 amps fully regulated output. Completely enclosed unit measures only 9" x 4" x 5" **£29.99**
LAMDA LMCC5V 110v AC input with 5 volts DC at 8 to 10 amps fully regulated output. Slightly smoke damaged, hence **ONLY £10.95**
PERIPHERAL SYSTEM SUPPLY. Runs almost any system. Fully cased unit supplied in a brand new or little used condition. Outputs give 5v @ 11 amps "+" 15-17v @ 8 amps "–" 15-17v @ 8 amps and "+" 24v @ 4 amps. All outputs are crowbar protected and the 5 volt output is fully regulated. Fan cooled. Supplied tested with circuit. £55.00 + £8.50 carr.
1000's of other POWER SUPPLIES EX STOCK – CALL SALES OFFICE FOR DETAILS

DUAL DISK DRIVE/ WINCHESTER CASES

Very smart, fully enclosed case unit custom made to accept two full height 5¼" floppy disk drives or two 5¼" winchesters such as the RHODIME RO200 or TANDEM series etc. An internal switched mode PSU supplies all the required voltages to enable you to plug in your drives and go!!
Other features include mains filter, internal cables with standard drive connectors, space for internal PCB, standard fan cut out and mounting, air filter. Overall dimensions 28 cm W x 30 cm D x 19 cm H
ONLY £55.00 + £6.00 CARR.

SEMICONDUCTOR 'GRAB BAGS'

Mixed Semis amazing value contents include transistors, digital, linear, I.C.'s triacs, diodes, bridge recs., etc. etc. All devices guaranteed brand new full spec. with manufacturer's markings, fully guaranteed.
50+ ***£2.95*** 100+ ***£5.15.***
TTL 74 Series A gigantic purchase of an "across the board" range of 74 TTL series I.C.'s enables us to offer 100+ mixed "mostly TTL" grab bags at a price which two or three chips in the bag would nnormally cost to buy. Fully guaranteed all I.C.'s full spec. 100+ ***£6.90*** 200+ ***£12.30*** 300+ ***£19.50***

NORTH STAR HORIZON

Pro S100 system with dual 5" floppy drives, software, manuals etc.
£850.00 Call sales office for details

ULTRA COMPACT 300 BAUD ACCOUSTIC MODEM — COUPLER

A Major manufacturer's over production and a bulk buy special enables us to offer this **BRAND NEW TRANSDATA 307A** ultra compact, **BT APPROVED**, 300 baud full duplex accoustic modem at a fraction of manufacturer's list price. The unit operates on the standard **CCITT V21** frequencies with **RS232** interface via 25 way 'D' skt.
Combine the adjustable cup system, which fits almost any phone with the benefit of "No jacks or phone cables" and a light weight of only 1.2 Kg and you have a truly portable modem!! Supplied complete with data, 90 day guarantee and ready to use.

ONLY £49.95 + £3.00 pp

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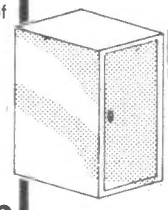

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ATV ON THE AIR

Presented by Andy Emmerson G8PTH

Having upset the Wess Vinglun in the May issue shall I now offend the locals? No, not really, but it was a meaningful question. 'Am I wasting my time with ATV?' asked one of the locals, and certainly it did seem as if ATV had become pretty moribund lately, with people selling off their cameras and rigs.

Not for the faint-hearted

I guess ATV is more affordable than it used to be; the main stumbling block used to be the camera, but nowadays a home micro will act as a video source and most transmitters can be modulated with TV. The trouble is that computer video is a pretty poor substitute for live camera action, and once the novelty of exchanging actual pictures over the air has worn off what comes next?

You either need a large number of operators or something else to sustain the interest if activity is not going to flag. Unfortunately the TV this month, RTTY next month crowd look to others to supply this interest, and as you can't rely on tropo DX every night how is this spark to be supplied?

In fact ATV *is* alive and well among the faithful, only it has to be sought out. TV is not just swapping pictures; that would bore anyone after two nights. It also involves trying out new ideas. In my case, and for many others, it's exploring FM transmission and 24cm propagation – this is truly a whole new world for us. Of course you have to have a basic interest to find this absorbing, but it's amazing how much there is to do and sort out. Let me explain...

For a start I do a fair bit of experimenting with 'known paths', that is with the Dunstable repeater and a 24cm TV pioneer, John Wood G3YQC. In fact it is very instructive comparing day-to-day propagation over what I'd like to call extended paths, and also testing intercarrier sound, different deviation levels, pre-emphasis in and out and different aerials.

John YQC is about 16 or so miles away from my Northampton location at 500ft asl (I am 400ft), but the path is fairly cluttered, with 600ft hills in the way. We get P4 results generally, with John running .about 35/40 watts and me running up to 100.

The Dunstable repeater is 35 miles or so away, with a path unobstructed except just here (trees and rooftops, etc) and again I can get a P4 signal into it (or could until my valves started to die on me – I find I do need to run a full 100W to get into the box). The repeater has a limited ERP output and I get it a noisy P3 here (though nearly always in colour). The signal level does seem to vary a little from day to day.

Equipment in use is a Fortop transmitter giving 1 watt or so, LMW solid-state PA (8W) and EME 2 x 2C39 PA. The Fortop takes about a minute to drift onto frequency, which is aggravating. I am hoping to try out one of Allan Latham's new transmitters soon.

On the receive side I am currently using a Wood & Douglas tunable downconverter and VIDIF. To this is added a sound board from a GEC TV, which gives very good intercarrier sound. Adjustment of these modules is a little tricky, but with proper tweaking (thanks G4CPE!) results are most satisfactory.

Intercarrier sound is all the rage round here, though some transmitters seem to be unable to remain on frequency, with the result that the audio becomes very scratchy. With the use of free-running oscillators, some clever circuitry might make all the difference.

John and I still think 5.5MHz should be the frequency, in order to retain compatibility with the rest of Europe, but we seem to be almost on our own here. At least Allan (Solent Scientific) Latham designs his transmitters with a choice of sound frequency, and his receiver, which works rather well, has externally-tunable sound (essential for these people with drifting or off-frequency sound!).

Antenna choice

For aerials I originally used a 15 over 15, but now I use the 20 turn helix which almost alone has the bandwidth for transmitting on 1249 and receiving on 1318.5MHz. The Dunstable repeater crowd adopt a different approach and most users of the box have a 1250MHz Tonna for transmit and a 1296 Tonna or loop yagi for receive.

They use separate Tx and Rx feeders, which avoids the need for a changeover relay with the masthead pre-amp, and by fairly simple filtering in the Rx downlead they can have 'lookthrough' and 'listen-through', which is extremely useful for checking if your vision and sound carriers are still on frequency.

John YQC also has a helix and is currently experimenting with a loop yagi. I too have a loop yagi on loan and will put this up for receiving GB3TV. These loop yagis apparently have a lot more gain than the helices, although on the other hand they are more sharply tuned. In the long run I hope to be able to relay the repeater to John, who at Rugby is well out of sight of it; others might consider helping less fortunate brethren too, either on 24 or 70cm.

I make no apology for harping on about 24cm: it really is the mode of the future and is waiting to be exploited now! Where else have you the room for full colour and intercarrier sound? Many parts of the country have activity on this band and I'll be happy to supply a list of the seventy odd stations active to anyone who sends me an SAE care of *Radio and Electronics World*.

Solid-state imaging

Staying with the new frontier theme for just a moment more I must mention the new breed of CCD camera chips. First hailed as a replacement for vidicons several years ago, they are now a reality in many cameras.

I had a demo of one in a JVC camera on the air recently; it's amazing what you can do with these little devils. You can point the camera at a light bulb (try doing that with a vidicon!) and it will depict the wattage inscription, then put it right under a workbench and still get a noisy but watchable picture. Colour performance under low light levels is remarkable. The cameras are not cheap of course, but the performance now exceeds that of vidicons, with no fear of damage from burn-out or jarring.

Mullard are currently promoting a Philips chip (they call in the NXA1020 Frame Transfer Sensor) which has a fascinating specification. Mounted on a 24-pin chip, it features a 7.5mm diagonal pick-up area, compatible with half-inch camera tube optics. It produces two interlaced 289-line fields with an aspect ratio of 4:3 and a horizontal resolution of 300 TV lines, is equipped with a three colour-separation stripe filter for PAL or SECAM colour systems, and has a 500:1 dynamic range. When will it be available on the surplus market – and what will the state of the art be by that time?

April fool?

In the April issue I offered a genlock circuit which I suggested might be suitable for the BBC and other micros. I also pointed out that it was untried by myself. So far I have had little feedback, only that it might crash the computer, and I hope someone will write in with a more categoric verdict. In the meantime the cheapest commercial genlock board for the Beeb is that by Electro Craft (Liss Mill, Liss, Hants GU33 7BD). The price they quote for the kit version is £75, though it is not clear whether VAT is included in this sum. NEW

LATEST LITERATURE

Clubs, manufacturers, publishers and agents are invited to send details of new books, catalogues, data sheets, etc for inclusion on this page

AUDIO

By F A Wilson

This is the sixth book of Babani's 'Elements of Electronics' series, the first five of which were also written by F A Wilson. In common with its predecessors, *Audio* is aimed at the reader who wants a thorough understanding of the subject without necessarily indulging in formulae of Quantum Theory complexity.

A certain basic understanding of electrical theory is required, such as could be gained from the earlier books in the series (which covered, amongst other things, simple electronic circuits, ac theory and semiconductor technology).

The scope of this 308-page book is certainly very broad, ranging as it does from the vibration which causes sound waves to digital recording and actually making music. In between it covers such diverse topics as the human mechanism of hearing, various electroacoustic transducers and amplifiers.

Throughout the text there are useful references to previous volumes in the series, so a reader armed with all six books is well enough equipped to gain as much knowledge of the subject as he could usefully apply outside a professional environment. On the whole it is well written and easy to follow. However, the grammar at times seems close to appalling: there is, for instance, a lamentable disregard for the humble comma, which occasionally necessitates the re-reading of a sentence to properly grasp its meaning. This is a shame in view of the generally excellent treatment of the subject.

The only other criticism is a purely subjective one, and concerns the actual format of the book. My own preference when reading a reference book of this nature is for something a little larger than about 4½ x 7 inches. This is a fine size for a novel, but is hardly ideal for a volume that will be referred to frequently.

This is a book that I would recommend with few reservations to the audiophile who wants a working understanding of the subject.

Bernard Babani (publishing) Ltd, £3.50. ISBN 0 85934 086 4

BASIC RADIO ELECTRONICS

By Sam Kelly

Basic Radio Electronics is one of two recent imports from American publisher TAB Books Inc, distributed in this country by John Wiley & Sons, and with more than 300 pages of about 5¼ x 8¼ inches is a fairly hefty paperback.

The title is possibly slightly misleading, for although the book covers the subject of electronics as it applies to radio propagation in reasonable detail, there is also slightly wider coverage of radio generally. This includes the first chapter, which gives an interesting outline of the history of radio experimentation (Hertz, Marconi, *et al*) and a chapter on short wave listening, which does not confine itself strictly to the short wave bands: a wealth of general information is also included.

The treatment of radio electronics strikes a good balance between being too simplistic and overly complex. The text is not as clear at times as it might be, and the odd mistake has crept in (the diagram representing bipolar transistors, for instance: both types appear to be pnp). The section concerning troubleshooting and repair is useful, as is that concerning tools and soldering.

Some good constructional projects are included. They are not intended as step-by-step idiot-proof Meccano kits, but should nevertheless prove fairly straightforward for most readers.

Anyone who is put off by the fact that this book is American, and therefore contains much that is irrelevant in this country, need not be. There is, of course, some information that is only of relevance in the States, but this really is a minimal amount.

Prospective purchasers might be more discouraged by the price. It's a good book, but whether you regard it as *that* good will depend upon the state of your bank balance.

John Wiley & Sons Ltd, £16.00. ISBN 0 8306 1542 3

SOFTWARE FOR AMATEUR RADIO

By Joe Kasser G3ZCZ

This is another import from TAB Books in the States, who claim on the back cover that this is the 'definitive volume on BASIC language software for amateur radio'. This example of publisher's hype is slightly removed from the truth, but the book is nevertheless a very good guide to using a computer in this hobby.

The book begins with one of the worst introductions I have read in a long time, and any reader would be well advised to skip this and start straight into the text. Fortunately the rest of the book is unembellished with such unnecessary garbage. Indeed, the text is generally well written, apart from a few curious spelling errors (which I'm sure are not just a result of the funny attitude to English of our transatlantic neighbours).

The first chapter covers some elementary CAD/analysis applications, and forms an easily understood introduction to the style and approach of the author. All the programs featured are in either Microsoft or Northstar BASIC, and the accompanying text gives a step by step breakdown of the operation of the program. The programs will, of course, need slight modifications to suit particular computers, but with the clarity of the text this should be fairly easy (as long as you've read your computer's manual!).

The book moves on to cover logging, awards and contests (which the contents page lists as 'Contents' rather than contests, typical of some of the poor proof reading by the publisher), antenna positioning, satellites, RTTY, SSTV, etc.

In all these areas the programs are preceded by a fairly clear and comprehensive outline of the mode of communication itself, and an explanation of the problems to be solved.

The format of the book is a little confusing at times, with the text broken up by programs, listings and diagrams in a manner liable to induce minor irritation. There are also some programs which are not directly applicable in this country, such as that for the ARRL Sweepstakes contest, but in these cases the outline of how to tailor the program to a specific requirement is useful.

The various examples given of the results are possibly a bit extensive, but it is probably better to print too much rather than too little.

The book is a useful addition to any computer buff's library, but as with the other recent import from TAB it's price tag is a little heavy due to the poor exchange rate. I'd hesitate to recommend that anyone shells out so much for one book (since I'd not want to take the blame if they were then unhappy with it!), but after spending a few hundred pounds on hardware no-one should baulk at this comparatively low sum.

John Wiley & Sons Ltd, £17.15. ISBN 0 8306 0260 7

LATEST LITERATURE

Catalogues

Carston Electronics

A stock sheet listing items from an extensive range of guaranteed used test equipment and computer peripherals is now available from Carston Electronics Ltd, the second-user specialist company.

All equipment is recalibrated to manufacturer's original specifications and offered at highly competitive prices. Details of Carston's special offers are included.

Many of the items listed are from the industry's most respected manufacturers, with current and recently discontinued lines giving customers the opportunity to obtain reliable 'as-new' items at a fraction of the new cost.

Carston Electronics Ltd,
99 Waldegrave Road,
Teddington,
Middlesex TW11 8LL.
Tel: (01) 943 4477.

Digivision

Digivision Broadcast Limited has published a two-page illustrated leaflet giving all essential technical information on the company's range of colour and monochrome television picture monitors.

This range, claimed to be the widest currently available from any single manufacturer, includes nine colour and nine monochrome monitors, each available with a number of optional variations. The leaflet gives a full performance specification, with additional tabulated data on individual models. Mechanical data on single and multiple cabinets is given, together with line drawings of the front and side view of each.

The leaflet is freely available on request.

Digivision Broadcast Limited,
Parker Drive,
Leicester LE4 0JP.
Tel: (0533) 351224.

Cirkit

Packed with over 4,000 different components plus associated new products for the electronics hobbyist, and sporting a lively new format, Cirkit's spring components catalogue was published on 11 April. It is available from leading newsagents throughout the country at the cover price of £1.15.

Products introduced for the first time in the catalogue include the BBC Model B microcomputer as well as a range of computer add-ons such as disc drives, expansion boards, speech synthesisers, disc interfaces and the new widely acclaimed AMX Mouse, which performs such useful functions as computer aided design and word processing with fingertip control.

Additional product introductions are calculators from Texas Instruments, Cooper Tools' Weller W12D soldering iron, plus new tools, kits and modules. Among the innovative new kits is a heart rate monitor, which will enable hobbyists to test their own fitness. The assembled unit provides audio/visual and analogue output which facilitates connection to a chart recorder, oscilloscope or personal computer.

Cirkit Holdings plc,
Park Lane,
Broxbourne,
Herts EN10 7NQ.
Tel: (0992) 444111.

Thorn EMI Electronics

Thorn EMI Electronics has just published a new A4 16-page brochure covering the company's capability in test and measurement instrumentation.

The product portfolio includes portable instruments for electrical and electronic test and measurement, with such well-known brand names as AVO and Megger, communication systems test instruments, nucleonics, electrical power system test and measurement together with automatic test equipment, programmable power supplies, panel meters and chart recorders.

These activities are all carried out within the Measurement Division of Thorn EMI Electronics, which includes fourteen businesses around the world.

Copies of the brochure are available on request.

Public Relations Department,
Thorn EMI Electronics,
120 Blyth Road,
Hayes,
Middlesex UB3 1DL.
Tel: (01) 573 3888.

Siemens

The latest issue of *Siemens Components* contains company news and trends as well as detailed descriptions of the company's products and their possible uses.

This illustrated catalogue includes news of Siemens' big microelectronics investment, a piece on a SIPMOS half-bridge power circuit, a 100KHz SMPS for halogen lamp dimming, details of Siemens' modular fibre-optic connector series and an article on capacitors for GTO thyristors.

Siemens Ltd,
Siemens House,
Windmill Road,
Sunbury-on-Thames,
Middlesex TW16 7HS.
Tel: (09327) 85691.

MicroLease

The 1985/86 catalogue of electronic equipment available for rental from Microlease has just been published.

Almost twice the size of last year's catalogue, this 114-page publication gives an outline specification and the weekly rental charge for more than 1,100 products. Included in Microlease's hire inventory is equipment for test and measurement, communications, data acquisition and recording, and power supply analysis. Microprocessor development systems from nine different manufacturers, complete computers and a wide range of peripherals can all be hired from Microlease.

The range now includes Motorola's EXORmacIII micro development system for 16-bit microprocessors, and features new 'scopes from Tektronix, Hewlett-Packard, Gould, Philips and Nicolet.

Microlease offers five discount plans giving all customers a cumulative discount for hire periods exceeding four weeks, and substantial discounts for long-term rental.

Microlease plc,
Forbes House,
Whitefriars Estate,
Tudor Road,
Harrow,
Middlesex HA3 5SS.
Tel: (01) 427 8822.

IFS (Publications) Ltd

IFS has published its updated price list which features all the books, newsletters and magazines currently available from the company, plus details of forthcoming publications.

Notable amongst these is *The International Journal of Advanced Manufacturing Technology*, which will commence publication from September 1985. IFS intends this journal to bridge the gap between pure research journals and more practical publications on automation.

The price list also includes details of the company's range of books on robotics, assembly, FMS, lasers etc.

IFS (Publications) Ltd,
35-39 High Street,
Kempston,
Bedford MK42 7BT.

Dage

A new brochure from Dage (GB) Ltd gives information on the company's range of anti-static products for electronics manufacturing.

The 16-page full-colour booklet describes and illustrates the Dage range, including packaging and storage materials for static-sensitive devices, furnishings for special handling areas, static detection and control equipment and operator safety materials.

Colour-coded for ease of reference, the brochure includes ordering information. It is available free of charge.

Dage (GB) Ltd,
Eurosem Division,
Rabans Lane,
Aylesbury,
Bucks HP19 3RG.

MEDIUM WAVE DXING

by Steve Whitt

By the time you read this issue, summer should be upon us with a vengeance. For many DXers the summer, with its high static levels and poor MW propagation conditions, is a time to put the receiver away and go on holiday! However, not all is lost for the keen DXer; the transatlantic path to the Americas, for example, is often open in the few hours before sunrise. In addition, one may well be surprised by the results of ground-wave DX during the daytime and short-skip DX around dawn and dusk.

One of the most valuable assets for any DXer, after a receiver and an aerial, must be information: what to hear, when to hear it and how to hear it. You can never really have too much information – but it must be as up to date as possible. Good sources are books, DX clubs and special radio programmes aimed at the DXer.

Books and clubs

Undoubtedly the most essential book for any DX shack is the 1985 edition of *World Radio & TV Handbook* published by Billboard (reviewed in ***R&EW*** May '85). This book lists just about every radio and TV station in the world with very comprehensive details on each one. Unfortunately, this year the price has leapt to around £18. However, for an MW DXer interested in North America a more comprehensive list of stations is required. One such book is *White's Radio Log* which is published by Worldwide Publications Inc, PO Box 5206, North Branch, NJ 08876, USA. This lists all stations in the USA and Canada by frequency, callsign and location. (I have a limited number of copies of this book available for £4.80 per copy, including p&p. Write to me c/o *Radio & Electronics World.)*

As far as I am aware there is only one specialist club purely for the MW DXer and it is well worth joining. For £5 (in the UK) the MW Circle will provide you with a year's supply of their newsletter, called *MW News*. For further information write to the Club Secretary (Ed Baker) at 69 Alderley Way, Cramlington, Northumberland.

Other DX clubs tend to specialise in other areas; generally concerning themselves with SW radio. One such club which does in fact include MW DXing in its scope is the British DX Club, which produces a substantial monthly newsletter called *Communication*. For more information write to the BDXC Treasurer (Nick van Stigt) at 37 Pope's Grove, Twickenham TW1 4JZ.

DX programmes

Finally in this section on information for the MW DXer we come to special programmes broadcast for the radio enthusiast. To attract a reasonably sized audience most of these programmes tend to be non-specialist, although useful news for the MW DXer is featured from time to time. There are three such radio programmes that are actually broadcast on the MW band:

Sweden Calling DXers, every Tuesday at 2115 and 2315GMT on 1179KHz;

Radio World, from BRT Brussels, at 1800 on Sundays, repeated at 2135 on Wednesdays on 1512KHz;

DX Circle, from DLF Cologne, at 1830 every Tuesday on 1269KHz.

Obituary

MW and SW DXers will be saddened to learn of the death, on 11 April, of Charles Molloy at the age of 64. Charles was well-known in the radio world for his regular features on MW and SW radio published over the years in *Practical Wireless*. In addition, since the start of 1985 Charles had taken over the role of editor of *Medium Wave News*.

Having been formerly employed by Plessey and active within the ASTMS trade union, Charles had many interests apart from radio, including sailing and birdwatching. He leaves a wife and daughter and will be sadly missed.

Starting point

Last month I mentioned how a logging scale could help you to pin-point a frequency on the simple dial of a low cost radio. The next step up from logging scales and calibration curves is the crystal calibrator. This device (sometimes built into a receiver) is a simple yet highly stable crystal oscillator, generally operating at 1MHz. Its output is usually frequency divided down to 100KHz or 10KHz (switch selectable) before being fed to the receiver aerial socket.

This signal is rich in harmonics and, depending on which output frequency has been selected, a marker signal will be noticed every 100 or 10KHz as the radio is tuned from one end of the dial to the other. By counting the number of 10KHz markers passed since the last 100KHz marker it is possible to know the frequency to which the radio is tuned with an accuracy better than 10KHz (remember that on the MW band in Europe stations use channels that are 9KHz apart). Unfortunately a crystal marker is a bit tedious to use all the time, but it still is the cheapest and simplest method of obtaining reasonable accuracy for a radio with a poor dial arrangement. A marker makes a good DIY project and many designs have been published over the years in radio magazines.

Well how did you get on with last month's listening suggestions? Here are another half a dozen tips, including one outside Europe. Again the programmes are in English and all times are GMT/UTC (valid until October).

981KHz RTA R Algiers 2000-2030
1062KHz R Denmark (not Sun) 0630-0635
1197KHz VOA Munich, 0000-0200
1269KHz DLF Cologne, 1815-1900
1440KHz RTL Luxembourg 1800-0200
1503KHz R Polonia, Warsaw 2230-2300

More tips next month, when I hope to look at the subject of QSL cards.

DX file

I was intrigued to see how good DX conditions remained this year as spring arrived. For instance the North Atlantic path was open most of April, and in fact on the 14th both WMRE (1510) and WHN (1050) were coming through at 2340hrs, which is only ten minutes after sunset in New York.

Now that summer is here I've been preparing to do some daytime ground-wave DXing, catching up on the more elusive UK local stations. Experiments with two separate loop aerials inductively coupled to simulate the behaviour of a cardioid aerial array proved fruitful, and very deep directional nulls were possible on stable ground-wave signals. In this manner I could hear (at my QTH in Ipswich) Northsound in Aberdeen by nulling out Radio Kent and likewise Radio Aire in Leeds could be separated from Chiltern Radio at Luton.

Finally don't forget to drop me a line with your suggestions for this column as well as any DX tips or problems you may have. Until next month, good DXing. REW

If you're interested in the medium waves, why not send us details of your equipment, reception reports or operating tips?

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

Sussex Mobile Rally

The Sussex Mobile Rally, one of the largest events of its kind on the south coast, will be held on Sunday 14 July at the Brighton Racecourse.

The rally is organised by the Brighton and District Amateur Radio Club, who anticipate a great day out. The event will include all the usual stalls and items of interest, including a bring-and-buy stall and free mini-bus trips to the beach. Talk-in will be on S22 via GB2SMR.

The club meets every other Wednesday at the Seven Furlong Bar at the Brighton Racecourse and meetings start at 8.00pm.

Further details of the club and the rally are available from the secretary, G4IIL, tel: Brighton 607737.

McMichael ARS rally

The McMichael Amateur Radio Society, in conjunction with the Burnham Beeches RC, the Chiltern ARC and the Maidenhead and District ARC, is staging the third annual Home Counties Mobile Rally at the McMichael Sports and Social Club, Bells Hill, Stoke Poges, Bucks. The date is Sunday 21 July and the doors will open at 11am.

A large number of national and local traders have been invited, displaying everything from 'black boxes' through to kits and surplus components. A flea market will be in operation for those with a bootfull of items to sell and there are many other attractions, such as amateur TV and Packet Radio demonstrations, HF stations, radio-controlled models, vintage wireless and a variety of displays and exhibitions. Refreshments, including a CAMRA beer tent, will be available.

An unusual feature of this rally is the emphasis placed on creating a family atmosphere. To this end, there are a number of general interest stalls, fairground attractions and children's rides.

BARTG rally

The annual rally of the British Amateur Radio Teleprinter Group (BARTG) will take place at Sandown Park this year on Sunday 25 August.

Exhibitors are advised to contact the rally manager as soon as possible to reserve a place at this very popular rally.

Further details are available from: *Peter Nicol G8VXY (rally manager), 38 Mitten Avenue, Rubery, Rendal, Birmingham B45 0JB. Tel: (021) 453 2676.*

BARTG net

BARTG has started a net for those interested in any aspect of data communication, RTTY, Amtor and Packet Radio. It meets on Sundays at 1000hrs on 3660MHz plus or minus a few KHz to clear QRM.

Details of membership of BARTG are available from: *John Beedie GW6MOK, BARTG, PO Box 3, Llandeilo SA19 6EU, Wales. Tel: (0558) 822286.*

TDARS expedition

The Telford and District Amateur Radio Society plan to operate from the Isle of Islay (pronounced 'eye-la') as their portable expedition this year.

The visit will last one week from 27 July and operation will be on various bands, according to individual interests.

Further information is available from the secretary at the club HQ, *Dawley Bank Community Centre, Bank Road, Dawley, Telford, Shropshire TF4 2AZ.*

'CQ-TV'

The British Amateur Television Club (BATC) have sent us the spring issue of their very informative and interesting magazine, *CQ-TV.*

This latest edition includes contributions from Andy Emmerson *(SSTV Standards, Passive Repeaters)* plus articles on various aspects of the hobby, including *Interfacing the Spectrum, Single Chip Colour Encoder, Contest News* and *Ideas for an FM-TV Transmitter.*

Membership and subscription enquiries should be sent to: *D Lawton G0ANO, 'Grenehurst', Pinewood Road, High Wycombe HP12 4DD.*

Dunstable Downs RC

The Dunstable Downs Radio Club have sent us details of their planned events for July and August. They are holding a junk sale on 5 July, followed on the 27th and 28th by the 144 and 432MHz Low Power Contest. On 2 August there will be a talk on radio controlled models, and G8VR will be discussing improving DX on 2m on 16 August.

For further details of these events, and the club generally, contact: *Phill Morris G6EES, 10 Seamons Close, Dunstable LU6 3EQ. Tel: Dunstable 607623.*

GB0RAR special event

The Reading and District Amateur Radio Club will be organising the special event station GB0RAR over the weekend of 27/28 July. GB0RAR (Reading Amateur Radio) will be active on all HF bands, and also 2m and 70cm.

The venue is the foyer of Shire Hall, Berkshire County Council HQ, Shinfield, Reading, Berkshire. Shire Hall is easy to find, being adjacent to Junction 11 of the M4 to the south of Reading. A large free car park is available.

Over the past year there have been many excellent fund raising events to raise money for charity, mainly to alleviate the suffering in Northern Africa (Ethopia and the Sudan). The committee of the Reading Amateur Radio Club thought that amateur radio could, and should, be able to make a contribution. Accordingly this event has been organised. The idea is as follows:

GB0RAR will be run in the normal manner for a special event station, contacting as many other amateur radio stations as possible in the period from 12.00hrs on Saturday until 12.00hrs on Sunday. People will be asked to sponsor each contact (or tens of contacts) for an amount of money in much the same way as a sponsored walk. The catchment area will obviously be around Reading, but donations from elsewhere will be gratefully received.

It is hoped that this special event station will increase the awareness of the general public to amateur radio and also raise much needed sums for charity. Should this be referred to as 'Ham-Aid?'

All queries regarding GB0RAR should be addressed to: *Andrew Barrett G8DOR, Chairman, Reading Amateur Radio Club, 38 Haw Lane, Bledlow Ridge, Bucks.*

ARE sale

An announcement made recently by Amateur Radio Exchange and Amateur Electronics Limited confirms that Amateur Electronics Limited of Birmingham has purchased the lease and goodwill of the shop occupied by Amateur Radio Exchange of London.

ARE will continue to operate under the ownership of Amateur Electronics Limited, but both Bernie and Brenda Godfrey, the previous owners, will be available to Amateur Electronics Limited on a consultancy basis for continuity of the London business for a limited period.

Customers who frequent the London shop can be assured that Amateur Electronics Limited will continue to offer the same policies adopted by the previous owners, offering good service and a friendly welcome to all callers.

This sale is for the London shop only and the northern branch of ARE will continue under the ownership of Bernie and Brenda as before, managed by Peter Roberts G4KKN, and will trade as ARE Communications. Under this banner they will continue to exhibit at rallies and exhibitions throughout the UK, and both Bernie and Brenda will attend as many as possible.

Russian satellites

Feedback from our *Russian Satellites* series (***R&EW*** January, February and March 1985) has prompted the authors to update the orbital parameters of the USSR Cosmos navigation satellites (below). The original table appeared in the March issue.

Heineken help radio group

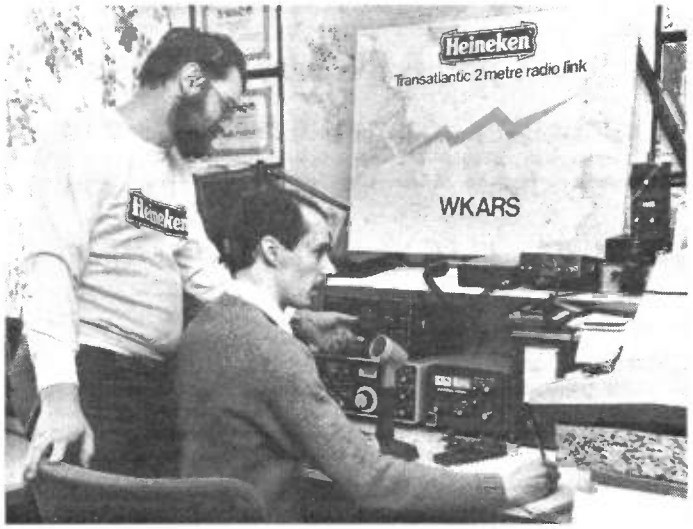
Heineken lager has stepped in to help a local radio group set a world record by refreshing the parts no-one else can reach on the 2 metre VHF band.

The top selling lager is to sponsor the West Kent Amateur Radio Society's attempt to make the first ever direct transatlantic QSO on the 2 metre band.

The group will be travelling to western Ireland in August to set up a temporary station 1,500 feet up a Galway mountainside.

They will transmit entirely over sea to the east coast of America and Canada, using high power to four stacked and bayed long Yagi antennae.

Schedules have already been arranged with several groups across the Atlantic. Transmission will be round the clock from 19 August to 30 August 1985. Modes of operation will be on CW, Amtor and SSB. HF talkback will be set up to assist the attempt.



Expedition member Dave Green comments: 'We're obviously delighted to have Heineken's support, particularly in attracting a sponsor who may be able to refresh the summer – weather is going to be a critical factor. We'll need a bit of luck to overcome the obvious technical problems associated with a 2 metre contact over such a long distance. If we don't get the high pressure we need, it will be really tough going'.

For info contact: *Dave Green G4OTV, 13 Culverdon Down, Tunbridge Wells, Kent.*

Special prefix

All Australian radio amateurs will be able to use the alternative prefix of Victor India from 1 June to 31 December, to celebrate the Wireless Institute of Australia's 75th anniversary.

The WIA is the world's first and oldest national radio society, having been founded in 1910.

This will be the first time VI has been available for use throughout VK – although the prefix was used for a short period for a local event in VK3. The WIA is encouraging radio amateurs to only use VI if they intend to QSL with a card bearing the prefix.

A commemorative callsign VK75A will also be on air until December and will be looking for DX contacts. The prefix VK75 with the suffix A is authorised for use throughout the Commonwealth of Australia.

QSL information is via the VK3 bureau, or direct cards can be sent to VK3WI QTHr.

'RUGnews'

Peter Barker G8BBZ has sent us the second issue of the Racal User Group newsletter (*Rugnews*).

It appears that the response to the first edition was very good and as a result Peter has received some useful and interesting information from readers.

Many correspondents have suggested that a list of users would be a good idea, and Peter intends to publish this in the third *Rugnews*.

In this issue Racal identification plates are explained and the Equipment Feature (a regular inclusion) covers the MA197 preselection and protection unit.

Potential contributions should be sent to: *Peter Barker G8BBZ, 15 Epping Green, Woodhall Farm, Hemel Hempstead HP2 7JP.*

Orbital parameters of the USSR Cosmos navigation satellites using the VHF frequency band for data transmission in February 1985

ID	W long (°)	incl (°)	sma Kms	period min	date	asc.node GMT	ecc(e)	$\dot{\omega}$ (°/day)	Cosmos no
01	329.50	82.92	7372.31	104.9260	13.02.85	18:04:18.0	0.0030	−0.737	1627 85-11A
02	105.97	82.96	7374.59	104.9727	13.02.85	05:16:40.4	0.0042	−0.736	1610 84-118A
03	287.25	82.95	7376.80	105.0226	13.02.85	19:20:54.4	0.0023	−0.735	1598 84-100A
04	273.81	82.95	7369.41	104.8622	13.02.85	20:26:48.2	0.0042	−0.738	1605 84-109A
05	301.61	82.96	7369.03	104.8535	13.02.85	00:26:40.1	0.0045	−0.737	1577 84-67A
06	287.09	82.94	7373.03	104.9428	13.02.85	01:29:35.3	0.0038	−0.737	1513 83-120A
07	79.18	82.95	7376.46	105.0127	13.02.85	05:42:26.7	0.0042	−0.735	1333 82-03A
08	—	—	—	no longer operational		—	—	—	—
11	78.07	82.94	7369.66	104.8693	13.02.85	14:30:32.4	0.0021	−0.739	1553 84-46A
12	285.36	82.94	7366.46	104.7989	13.02.85	07:27:46.3	0.0055	−0.740	1506 83-108A
13	279.93	82.95	7370.09	104.8799	13.02.85	09:57:39.3	0.0038	−0.737	1447 83-21A
14	100.39	82.96	7372.62	104.9307	13.02.85	01:06:48.0	0.0017	−0.736	1574 84-62A

DX-TV

RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

March has been the brightest month this year as far as long-distance television reception is concerned. Having said that, however, activity has been very poor compared with the same period in other years. Looking back through the reception logs of past years it is evident that there have been several notable Sporadic-E openings indicating the onset of the main SpE season.

Fortunately there have been some signs of Sporadic-E activity this March. A few enthusiasts noted improved conditions on the 24th during the afternoon, while here in Derby signals from the east were in evidence during lunchtime. In fact, an opening on Eastern-bloc OIRT channels R1 and R2 was already in progress upon switch-on at 1245GMT. A much smaller opening lasting a mere three minutes or so occurred on the 26th at 0755 with fairly short-skip activity from Denmark and Switzerland.

Tropospheric DX in Band III and at UHF was virtually non-existent during the month apart from the 8th, which produced improved reception of TDF (France) from Lille on channel F5 and BRT (Belgium) on channel E43 from Egem. This reception was noted by enthusiasts in the north of England.

DX-TV log for March

The following log shows the reception conditions noted by the authors in Derby:

1/3/85: TSS (Russia) on channel R1 with the colour electronic test card ('Leningrad' type).

4/3/85: NRK (Norway) on E2 radiating the 'NORGE GULEN' PM5534 electronic test card.

13/3/85: CST (Czechoslovakia) on R2 using the EZO-type test pattern with the identification 'RS-KH'; unidentified programmes on channel R1. All reception via Sporadic-E from around 1245GMT.

14/3/85: CST on R1 with EZO-type test card.

16/3/85: Several programmes noted on channel R1 via meteor-shower (MS), although nothing could be positively identified.

18/3/85: SRG-1 (Switzerland, German-language service) received on channel E2 with their FuBK test card carrying the usual '+PTT SRG 1' identification.

20/3/85: SRG-1 on E2 with the FuBK test card; SR-1 (Sweden) on E3 transmitting the 'TV1 SVERIGE' PM5534 test card which includes a digital clock.

21/3/85: ORF (Austria) on channel E2a with the monoscopic Telefunken TO5 test card and the inscription 'ORF FS1'; CST on R1 and R2 showing the EZO-type test card with 'RS-KH' identification.

22/3/85: ORF on E2a radiating the 'ORF FS1' PM5544 test card; CST on channel R1 with their EZO-type pattern.

24/3/85: Unidentified programmes on channel E3 with clowns at approximately 1735GMT. Other signals were noted on channels E2 and R1.

26/3/85: SRG-1 with the '+PTT SRG 1' FuBK test card on channel E2 at 0755GMT; DR (Denmark) on E3 with a clock caption at 0757GMT going on to the PM5544 test card which carried the usual 'DR DANMARK' identification; unidentified caption seen on channel E2 during this short Sporadic-E opening with the word 'Mixtures'.

Hopefully, with the forthcoming SpE season not too far away, we'll soon have a more impressive log to feature!

Reception reports

Iain Menzies (Aberdeen) has recently returned from a skiing holiday in Bulgaria. Apart from sampling the local wine and tourist spots, he also found time to sample some TV programmes. The offerings which Iain saw left much to be desired and he jokingly rates them a little worse than those from TVE in Spain.

The local transmissions were on channel R6, which has the same vision frequency as E5. He took along his Sinclair 2-inch flat screen TV, and the Bulgarian station made its presence well known. In fact there was breakthrough over the entire UHF spectrum!

There is a second TV network operating in that country. Transmissions take place at UHF and the service operates only at weekends.

Once back in Aberdeen the only DX-TV reception noted by Iain occurred on the 2nd, 5th and 31st. An aurora was present on the 2nd which affected frequencies as high as 144MHz. Television signals which could be positively identified came from Spain and Norway on channels E2 and E3. On March 5th signals arrived from Norway on E2 and E4 as well as from Russia on channel R2.

A regular lunchtime vigil by John Bray (St Neots, Cambridgeshire) paid off during the month. Despite the generally poor conditions he managed to log something on most days. The Czechoslovakian EZO-type test card has appeared regularly at around 1230GMT on channel R1. Lunchtime has been a favourite period for Dutch reception too. On several days the PM5544 test card has emerged from the noise on channel E4 to become strong enough to lock chroma. When this happened it was often the case that Belgian transmissions were present on channel E8 in Band III from the transmitter at Wavre.

Sporadic-E

A few Sporadic-E openings, albeit of short duration, have been noted by John. For instance, on the 13th, 17th, 24th and 26th Russian programmes appeared on channel R1. Towards the end of the month John telephoned to report an early morning opening from Hungary with the PM5544 test card present on channel R1. The identification was 'MTV 1 BUDAPEST'. Other signals to arrive during the month included some from West Germany, Sweden, Poland and Switzerland. All reception was positively identified thanks to test cards or clock captions.

Simon Hamer, of New Radnor in Powys, has done it again! You may recall his reception of the old Czechoslovakian monochrome test card of a few months ago. Well, this time he's seen an old tuning card from Sveriges Radio (Sweden) on channel E2. John Bray noted this earlier in the year, so at least there is a slight chance of receiving it via Sporadic-E during the summer. The pattern concerned does not carry any form of identification but even so it is easily recognisable. A central circle carries a photograph of the head and shoulders of a young girl. Underneath is a ten-step greyscale.

Simon also noted Italian programmes on the 17th on channel IA. A Sporadic-E opening on the 24th rewarded him with basketball followed by commercials on channel E3 from TVE-Spain. On the 14th he saw signals from Hungary on R1, while on the 3rd SR-1 from Sweden was noted with the PM5534 test card on channel E2. Signals from NRK-Norway were also logged on E2 with the typical 'NRK' identification caption.

Andy Webster, of Billinge near Wigan, reports almost daily reception of the East German TV service (DDR:F) on channel E4 from the Cottbus transmitter via meteor-shower DX. Despite the British Bands I and III channels being free of any 405-line transmissions Andy has encountered problems from a number of interference sources, mainly of the totally illegal variety. The latest intruder is Southside Radio, operating from an illicit FM pop music station in Stockport. The station's 2nd harmonic causes

interference at around 206MHz in Band III. On a different note, Andy tells us that Radio Telefís Eireann (RTE-Eire) is experimenting with the Antiope teletext system. This is similar to the one developed by TDF in France.

Bob Brooks (South Wirral) always sends in a spectacular log and the one for March is no exception. In fact it resembles a typical log for summer! Even with the use of loft aerials the number of signals noted is amazing. Sweden is frequently received by Bob, so much so that it's logged practically every day, usually in the morning prior to 0900. The signal is normally the PM5534 test card with the familiar 'TV1 SVERIGE' identification. On the 20th however it appeared with only the 'TV1' at the top at 1100GMT.

East Germany was noted on several occasions by Bob. On the 9th signals appeared from this country with the electronic test card which carried the inscription 'DDR:F1' across the centre. On the 23rd a newsreader was seen on channel E4 with the familiar 'ak' symbol in the background.

Signals from the south have also been present with the Spanish GTE colour test card emerging on E3 and at times on E2. On the 24th a football match was noted from TVE at 1215GMT.

The 20th proved to be an interesting day with the Norwegian PM5534 test card on channel E2 complete with 'NORGE GULEN' identification. During the late morning a news programme appeared from Russia on channel R2. At 1245GMT a programme schedule was shown with the 'EESTI TV' logo in the lower right-hand corner of the caption.

It is interesting to note that although it is Russian TV the Cyrillic alphabet isn't used. The language looks very similar to Finnish, especially with use of double vowels. The test pattern used is a colour blockboard type. A characteristic of this pattern is a broad horizontal black band across the picture.

What can SpE bring?

We mentioned last month the various receiver requirements and conditions necessary in order to see TV signals from abroad. Some of these transmissions may well originate hundreds of miles away.

Well, if you've got your equipment set up and the aerials in place, now is the time to watch out for DX-TV signals because as you read this column Sporadic-E conditions should be producing them in abundance.

So what are we likely to receive? Tuning through the channels in Band I will reveal not only programmes but also weird-looking test cards. Newcomers to DX-TV will almost certainly have problems in working out where the signals originated from. Experienced enthusiasts develop a 'feel' over the years as to which signals may be present under certain conditions.

Most reception via Sporadic-E propagation originates from transmitters which are between 600 and 900 miles away from the receiving site. Consulting a map of Europe should give a rough indication as to which countries to expect. The accompanying chart should give newcomers to DX-TV an idea of which countries and channels are relatively easy to receive and those which are nigh-on impossible!

If an opening occurs from the south-east and Italian signals are present it is certainly worth looking for other countries in the same general direction. Many DXers favour the use of several receivers which can be left tuned to different 'key' channels. We personally favour sets tuned to channels R1, E3 and E4. Most Eastern-bloc TV services use channel R1 and reception is more likely on this frequency than on R2 since it is lower. Channel E3 is used by most Western European countries which employ transmission system 'B'. Fewer services radiate on channel E2. Channel E4 is also used by most system 'B' countries. It is shared by Italy, although the channel is designated 'IB'.

Of course it does pay to keep a check on the other channels from time to time since openings can occur on, say, E2 or R2 without any other channels being active. An aerial system with omni-directional pick-up characteristics is perhaps best for an initial search for signals. One drawback of such a system however occurs when an opening is in full swing with signals arriving from all points of the compass on the same channel. Norwegian and Spanish reception on the same frequency is a typical example. Both services occupy the same channels and often fight each other for supremacy. The use of a beam array will considerably ease the problem. Consequently, selective DXing from a particular direction may be enjoyed with such a system.

During intense openings to the south

BAND I CHANNELS

Country	E2 (48.25MHz)	R1 (49.75MHz)	IA (53.75MHz)	E3 (55.25MHz)	R2 (59.25MHz)	E4 (62.25MHz)
Spain (TVE)	Frequently at overload levels			Frequently at overload levels		Frequently at overload levels
Portugal (RTP)	Frequent			Frequent		Rare – only low ERP relay on this channel
Italy (RAI)			Frequent, often early morning			Frequent
Yugoslavia (JRT)	Extremely rare – no official E2 Tx listed			Frequent		Frequent
Sweden (SR)	Frequent			Frequent		Frequent
Norway (NRK)	Frequent			Frequent		Frequent
Denmark (DR)	No E2 Tx			Fair – short skip		Rare – short skip
Finland (YLE)	No E2 Tx			Fair		Fair
Iceland (RUV)	No E2 Tx			Fair – although most DXers miss it! It's often a late evening or after midnight signal		Same as E3
Switzerland (+ PTT/SRG/ SSR/TSI)	Fair – short skip. SRG German language			Remarks as E2		Fair – SSR-1 French language
West Germany (ARD)	Fair			Rare – only BR-1 Kreuzberg on this channel		Fair – usually during good openings
East Germany (DDR:F)	No E2 Tx			No E3 Tx		Fair – during good openings
Austria (ORF)		Frequent (System B but called channel E2a)		Rare – only low ERP Tx. Seen mainly during intense openings		Rare
Russia (TSS)		Very frequent, sometimes as early as 0400			Frequent	
Poland (TVP)		Fair			Fair	
Czechoslovakia (CST)		Frequent			Fair	
Hungary (MTV)		Frequent			Fair	
Rumania (TVR)		No R1 Tx			Fair – usually during intense openings	

enthusiasts should watch out for the Canary Islands on channel E3 (from TVE) and Morocco (RTM) on E4. Signals from RTM usually arrive in the UK via double or even triple hop Sporadic-E. There is also the possibility of receiving Ghana (GBC) and Nigeria (NTV) on channels E2, E3 and E4 under these rare conditions. When Italy (RAI) and Yugoslavia (JRT) are noted simultaneously during an intense opening, keep a look out for Jordan (JTV) on E3. Signals from JTV often appear during the late afternoon or early evening period.

Line-of-sight reception – plus!

Dave Lauder of Barnet has commented on Kevin Jackson's recent correspondence concerning maximum reception distances involved with TV signals under everyday conditions (see ***R&EW,*** March 1985). Several sources have suggested that it's possible to receive TV signals from transmitters located 300 miles or more away virtually on a daily basis if the outlet has an ERP of about 100KW. Admittedly the signals are only just detectable and are not of entertainment quality.

Dave suggests that anyone wishing to read in depth on the subject should obtain a copy of the *VHF/UHF* Manual by Jessop, published by the RSGB. There is a chapter on propagation which goes into great detail. Dave tells us that basically, due to a decrease of atmospheric pressure with increasing height, there is a slight refraction of radio waves over the visible horizon under normal conditions. By taking the radius of the Earth as 4/3 times its true value the 'line-of-sight' propagation distance between the transmitter and a receiver, located at given heights, can be calculated.

Dave adds that this does not perhaps explain Kevin's reception of the French station in Lille on a daily basis at his location in Leeds. This is probably due to his aerials being installed high up in a block of flats, since the effects caused by ground reflections are decreased. Any other views from readers on this subject will be most welcome.

Service information

Belgium and The Netherlands: The Flemish service of BRT-2 (Belgium) and the Dutch TV service (NOS) are co-operating to produce a combined programme at weekends, so look out for unusual identification captions.

West Germany: The WDR-1 television transmitter at Teutoburger Wald, which collapsed last January due to the severely cold weather conditions, is now back in service.

Apart from the channel E11 TV service being disrupted, the VHF radio services of WDR 1-4 were also affected. Shortly after the collapse, WDR-1 TV was radiated on channel E36 with an ERP of 100KW.

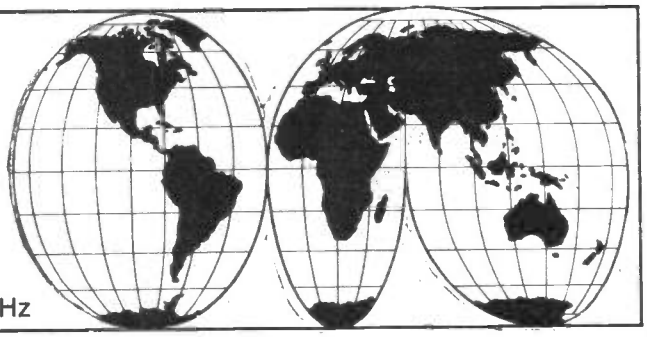
The temporary transmitter was sited at Bielefeld. Special identification was noted, thus: 'Deutsche Bundespost, Fernsehsender Bielefeld, Kanal 36'. Eventually programmes were resumed from Teutoburger Wald via a standby mast and transmitter.

Switzerland: A new outlet on Mt Celerina is radiating the Swiss-German service of SRG-1 on channel E57. SSR-1 (Swiss-French network) is on E60 and the Swiss-Italian network of TSI-1 operates on channel E62. All transmitters have an ERP of 3.2KW.

SSR-1 has introduced teletext transmissions and a similar service for TSI-1 is expected to start next year. Special computer-controlled teletext decoders are necessary to cope with the trilingual network operated in Switzerland.

Service information this month was kindly supplied by Gösta van der Linden (Rotterdam, Netherlands) and Alexander Wiese (München, West Germany). REW

SHORT WAVE NEWS FOR DX LISTENERS



By Frank A Baldwin

All times in GMT, **bold** figures indicate the frequency in KHz

Many established DXers tend to concentrate their attention on such areas of the world as Latin America, the Far East, the Pacific and South-East Asia, and for a good reason – most of the DX emanates from these regions with respect to UK-based listeners. There is another area however which presents the new DXer with a chance to become initially involved in the hobby at a level requiring, in the main, less skill and experience than that needed in dealing with the foregoing areas. I refer of course to the place once termed the Dark Continent – Africa.

About Africa

The African continent is separated from Europe by the Straits of Gibraltar and from Asia by the Suez Canal. The continent is largely a plateau, the highest point being Mount Kilimanjaro at 19,565ft. With a few natural harbours and a varied climate, it has several large river systems such as the Congo, the Niger, the Nile and the Zambesi, with Lake Victoria being the largest lake. Deserts such as the Sahara are bounded by savannahs, with the jungle area being in West Equatorial Africa.

Logging Africans

The 250KW signal of Africa No 1 in Moyabi, Gabon on **4810** is that most reported in the SWL press and represents a first 'target' for the beginner. It operates from 1700 to 2300, announcements being made in French. It should be noted that only the evening schedules are mentioned here.

Radio Douala, Cameroon is to be found on **4795**, the evening schedule being from 1630 to 2300, the languages used being French, English and local vernaculars. Programmes in English are radiated from 1745 to 1845 (not on Sunday) and from 1730 to 1845 on Saturday at 100KW.

Another Cameroon station is that of the 100KW Radio Yaounde on **4850**, working to an evening schedule from 1630 to 2400 with English transmissions at 1830 and at 2100. Both of the Cameroon stations feature regularly in SWL journals.

Maseru in Lesotho operates on **4800** in Sesotho from 0300 through to 2200 with an English newscast timed at 1600. The power is 100KW.

Nouakchott in Mauritania may be heard on **4845.** This 100KW transmitter has an evening transmission commencing at 1600 and ending at 2400. The languages used are Arabic, French, Spanish and some local vernaculars.

In Senegal, Radio Diffusion in Dakar is on the air from 1800 to 0100 on **4890** at 100KW, this being the National Service in French and vernaculars.

Two South African stations on the 60 metre band (**4750** to **5050**) may now claim the attention of the budding DXer. The first is to be found on **4835,** this being SABC (South African Broadcasting Corporation) Johannesburg. This 100KW transmitter is on the air from 1520 to 2220, identification being easy for the beginner in that the language used is English. The second is on **4880,** also being rated at 100KW and having the same schedule times as those above, but is in Afrikaans.

FRCN (Federal Radio Corporation of Nigeria) Kaduna is to be found on **4770.** At 50KW it radiates the Channel 2 service which is predominantly in English but with some Hausa usage and is on this channel from 0400 through to 2300. The power is 50KW.

Gaborone in Botswana with its recently installed 50KW transmitter may be heard on **4820** where it is scheduled from 1420 (Monday to Wednesday inclusive from 1500) to 2100. This is the Home Service in SeTswana and English with an English newscast at 1910.

AROUND THE DIAL

Switch on, tune and listen – you may then be able to log many of the stations listed.

AFRICA

An easy one for beginners is Radiodiffusion Nationale Tchadienne in N'djamena, Chad. At 100KW, it radiates programmes in French, Arabic and local languages from 0455 to 0730 (Sunday to 0700) and from 1555 to 2100 (Saturday until 2200, Sunday from 1455) on **4904.** N'djamena was recently logged at 0459, interval signal (a short repeated tune on a balafon – local xylophone), the National Anthem (French-style martial music with YL chorus) then OM with the station identification in French at 0502 and a programme preview. The address is BP 892, N'djamena, Tchadienne.

Egypt

Cairo on **9805** at 2140, YL with a talk about disarmament during an English programme directed to Europe, being scheduled from 2115 to 2245.

Namibia

SWABC (South West Africa Broadcasting Corporation) Windhoek on **3270** at 2020, OM with a pop song in English even though this is the Home Service I in the local vernaculars Damara, Herero and Nama, being scheduled from 1625 to 2200 and from 0400 to 0630. The power is 100KW.

Nigeria

FRCN Kaduna on **4770** at 0435, OM with recitations from the Holy Quran. Kaduna opens at 0430 but the following closing and re-opening times are not known at the time of writing. The final sign-off is at 2300 nowadays; formerly it was at 0100 but financial considerations have resulted in a restricted operation. These Channel 2 programmes are in English and Hausa, the power being 50KW.

South Africa

RSA Johannesburg on **9585** at 2144, OM with a very interesting talk about the culture of the Zulu people in an English presentation to Europe and West Africa, timed from 2100 to 2200.

Tanzania

Dar-es-Salaam on **5050** at 0407, OM with a newscast in Swahili. Radio Tanzania is on the air from 0300 to 0700 with the National Service and from 1300 to 2015 with the Commercial Service, all in Swahili. The power is 10KW.

Zaire

Lubumbashi on **4750** at 0400, the National Anthem, announcements in Swahili then at 0410 some local-style music. Some QRM from Radio Bertoua, Cameroon which eventually blotted out signals from Lubumbashi. Now reactivated, the present power and schedule of Lubumbashi is unknown. To differentiate on this channel, R Bertoua operates in French, English and vernaculars.

Zambia

ZBS Lusaka on **4910** at 0416, OM with a local pop song in English, complete with a backing of guitars. This is the Home Service in English and vernaculars which is on the air from 0355 to 0530 and from 1530 to 2105 (Friday and Saturday until 2205) with a power of 50KW.

THE AMERICAS

Brazil

Radio Bandeirantes, Sao Paulo on **11925** at 2155, OM with a talk about Nicaragua in Portuguese. ZYE958 R Bandeirantes is on channel from 0700 to 0500 with a power of 10KW.

Canada

RCI (Radio Canada International) Montreal on **11905** at 1930, YL with the station identification in the English

programme for Europe timed from 1900 to 2000 on Saturday and Sunday only.

Costa Rica

Emisora Radio Reloj, San Jose on **4832** at 0321, OM with a sports commentary in Spanish. Em R Reloj is scheduled from 1100 to 0800 but does sometimes work around-the-clock. The power is 3KW.

Cuba

Radio Havana on **11850** at 2014, OM with a newscast during the English transmission for Europe, timed from 2010 to 2140.

Radio Havana on **11950** at 2000, OM and YL with the station identification in Spanish and then French just prior to the French programme for Europe, timed from 2000 to 2140.

Ecuador

Sistema de Emisora Atalaya, Guayaquil on **4792** at 0429, OM with a ballad in Spanish then OM with station identification at 0430. This one is scheduled from 1000 (variable until 1100) until 0455 with a power of 5KW.

HCJB Quito on **17790** at 1946, OM with a religious programme in English for Europe scheduled from 1900 to 2000. Also logged in parallel on **15295.**

Honduras

La Voz Evangelica, Tegucigalpa on **4820** at 0321, OM with a religious talk in Spanish. LV Evangelica operates in Spanish from 1030 through to 0600 except for an English transmission from 0300 to 0500 on Monday. The power is 5KW.

Venezuela

Radio Occidente, Tovar on **3225** at 0325, OM with announcements in Spanish then OM with a ballad. The schedule is from 1000 to 0300 (Saturday and Sunday until 0400), the power being 1KW. As my logging was made on a weekday, it would appear that the schedule is now extended – it was still audible at 0435!

Radio Valera, Trujillo on **4840** at 0350, OM with a pop song in Spanish. 'Su Nueva Radio Valera' is on the air from 0900 to 0400 at 1KW.

ASIA

China

Radio Beijing on **7010** at 1950, YL with the Rumanian programme timed from 1930 to 2000 – much to the annoyance of 7MHz CW buffs such as myself!

Radio Beijing on **11600** at 1452, OM and YL with a Chinese/English language lesson during the English transmission for South Asia, timed from 1400 to 1500.

Israel

Jerusalem on a measured **12027** at 1830, pips time-check, OM with the station identification and commencement of the Hebrew programme for Europe and North America, scheduled from 1830 to 1900. Also logged in parallel on **11655, 11700** and **11960,** by which time a YL was presenting a newscast.

Kuwait

Radio Kuwait on **11675** at 1950, OM and YL with the news in English followed by the station identification, this being part of the English Service for the Arabian Gulf, North and South Africa, Europe and North America, scheduled from 1800 to 2100.

Pakistan

Karachi on **11670** at 1652, OM with songs, music in the Turkish transmission for Europe, timed from 1630 to 1730.

Karachi on **17660** at 1025, OM with a song in Urdu with local-style musical backing during the Urdu programme in the World Service to the UK, scheduled from 0715 to 1100. Also logged in parallel on **15595.**

Sri Lanka

Colombo on **4902** at 1904, continuous chanting in Sinhala by monks on a full moon day. SLBC Colombo is scheduled from 0000 to 0230 and from 1030 to 1745 with the Home Service 1 in Sinhala. On full moon days there is an additional All Night Service from 0930 to 2400.

North Yemen

San'a on **9780** at 1526, OM with announcements in Arabic, instrumental music in the local style then OM with the station identification in Arabic. This is the Domestic Service which is on this channel from 0230 through to 2110 (to 2310 during Ramadan).

USSR

Radio Tashkent, Uzbekistan on **9600** at 1425, OM with the station identification followed by some local music, YL with the identification and announcements at 1430 at the end of the English programme to South-East Asia, timed from 1400 to 1430.

EUROPE

Albania

Radio Tirana on **11985** at 1419, YL with the station identification during the English presentation for Australia and South-East Asia, scheduled from 1400 to 1430.

Finland

Helsinki on **6120** at 1955, YL with station identification, announcements and QTH at the end of the English programme for Europe, timed from 2030 to 2055.

Norway

Oslo on **6015** at 1959, interval signal, OM with the station identification in English and Norwegian followed by the Norwegian programme for Africa, Europe and South America, scheduled from 2000 to 2045.

CLANDESTINE

'Voice of the Libyan People' on **15040** at 1932, OM with a talk in Arabic, many mentions of Libya, the jamming being ineffective. Hostile to the present Libyan government, this clandestine operates entirely in Arabic, the session reported here being timed from 1800 to 2000.

NOW LOG THIS

Radio Los Andes, Huamachuco, Peru on **5030** at 0520, YL and OM duet, OMs promos in Spanish, OM with clear station identification.

NOW HEAR THIS

KTWR Merizo, Guam on **11840** at 1015, OM with a religious talk in the English programme for Japan, timed from 0845 to 1030. New

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FOR SALE

■ Valves, valves, valves! Many types new and old, even a few collectors items. Most newer types, £1.50 each and I will test before you buy. Contact GW4BZD, 8 Blaen Y Wawr, Bangor, Gwynedd LL57 4TR, or tel: (0248) 361315 after 6pm. SAE for list.

■ Yaesu FT102 with AM/FM board, never Txed, boxed for last year. Immaculate hence £600. Neil GM1JTA Tel: (031) 229 8449 (evenings).

■ Attention 35mm slide enthusiasts/lecturers! Imatronix digital 2500S auto-dissolve projector controller for sale. Will flash, slow or fast cross fade two projectors automatically. Including 'optional' manual controller for effects. This represents over £200 worth of equipment. To you – £100 ono or WHY in the fields of amateur radio, SWLing. Handbook included, easily connected. Call in the evening please – crust-earning daily! Dave Gilligan. Tel: (01) 478 5903.

■ FLDX 500 HF Tx, 80-10m plus 3 spare bands, 240W PEP £90. 19 inch rack 2ft high suit base stn or rept £10. Datong speech processor £30. 2m Burndept B473 handheld Rx R5, S22, S17 no Tx xtals, + CCT and details and batteries £55. 1KW mains isolation transformer, new £15, all collect or post extra, Ben G4BXD. Tel: (021) 525 9772.

■ Yaesu FT101 HF transceiver £200 ono. Trio JR310 amateur bands Rx, £75 ono. Eddystone 840C comms Rx £75 ono. OKI Microline 80A printer (Centronics interface) £100 ono. Used 4CX250Bs, £4 each, tested. Much other equipment. Tel: Graham G4DML (0376) 27568.

■ Medical books and software: Microcomputer Programs in Medicine, Vol I: appointments, patient record filing, utilisation, billing, graphs, statistics, linear curve fitting £50. Volume II: patient history taking, respiratory function, pediatric growth, obesity weight loss, analysis of variance, chi square £50. Computers in Medicine – An Introduction, £12. Send for free list of software. Enlander, 4 Longbeach Road, London SW11 5ST.

■ Quad 9HIGL version for 20,15,10, eight resin coated bamboos, 8ft boom, cast alloy X end pieces, four tuned traps £50 ono or swap, eg power supply. G4SQA QTHr, tel: Peterborough (0733) 232211.

■ Wireless text books. Various titles including Practical Wireless Encyclopaedia, by Camm, Radio Engineering Handbook by Henney, Radio Upkeep and Repairs by Witts. For further information tel: Reading 883799.

■ G4GOC ROM £25, two ICs for suitable TV £10 ideal RTTY with Beeb. Tx and Rx. Split screen working. Store MSGs and type ahead. Going Amtor hence reason for sale. Tel: (0908) 313379 (Milton Keynes) anytime.

■ Honeywell dot matrix printer 120cps £150. ICL letter quality printer with keyboard £75, both used with BBC. Tektronix 561A scope, manuals, probes £150. Marconi signal generator 4 to 12GHz £40. Intel 8086 and 8087 maths chip £40. Wanted G3LLL FT101 RF Clipper, BBC B, Sinclair QL, Black Star 600MHz counter, SX400, AR2001, MMT432/144R. Part exchange with above. Tel: (07842) 51409 after 8pm.

■ Standard C146A, FM handheld + Nicads, base charger £65, Yaesu FT202, two FM handhelds + charger, cases, mic £130. Trio 2300 £110/CRV46147, 0.5 to 4MHz in 4 bands ex USN £50. Hallicrafters SX28A, needs work (capacitors) £55, SCR522 transceiver 100 to 156MHz, various other military sets and accessories. Hallicrafters, Hammerlund RCA, Eddystone valve receivers in various conditions. Please telephone John Baker (01) 833 3008.

■ Midland 3001 FM CB, less than a year old in vgc. Use it or convert to 10 metres. £16 post paid or will swap for selection of larger AF transistors, op-amps, audio ICs. Will answer everybody enclosing SAE. S Williams, 55 Fairfield, Hebden Bridge, W Yorkshire HX7 6JD.

■ Scanner PRO-30 handheld hi, lo, VHF, UHF, air, mint condition with Nicads charger and helical £180 ono. Tel: Birmingham (021) 4215125.

■ Complete 934MHz station comprising 'Reftec' mark 2 transceiver + professional 7.5dBi colinear base antenna, 'Crest' SWR/power meter, additional external S-meter, 'Realistic' noise cancelling pre-amplifying microphone + magnetic mount 3dBi mobile antenna £299, carriage extra or exchange for 'Icom' IC120 23cm transceiver in excellent working condition. Reason for sale need 23cm urgently for forthcoming contest and XYL won't let me have both!! Mr Philip Lancaster, Ruislip, Middlesex. Tel: (01) 845 4008.

■ Softy MkII EPROM programmer £75. TR9000 multi-mode, mobile mount, original packing, inc mains PSU £250. 40 channel CB handheld, helical aerial £30. Communication quality mic inserts, dynamic, new 5 for £1.00 inc p+p. Masses of surplus components, transistors, diodes, ICs, LEDs, capacitors, xtals, LDRs, switches. All new, SAE for complete list. Wanted 1155, AR88. GW8BXD, Edgecombe, 'Y-Maes', Llangynog, Carmarthen, Dyfed SA33-5BT. Tel: (026782) 432, weekends only.

■ Heathkit Rx, any offers. Also Colt Z10 AM/FM 120 chan CB, any offers. Tel: Bob on Keynsham 67737.

■ Stalker 9DX CB, AM, USB, LSB, FM, American legal FM, new condition boxed, £75.00. Also Rotel 40 channel and communicator 40. Mobile aerial mag mounts all perfect, station closing down, must be seen to be believed, used only by one pensioner and looked after. Tel: (01) 550 3262, Ilford district.

■ Praktica Nova 1 camera, complete with tripod, telescopic lens, Rank Aldis flash unit, with various other attachments. All in vgc will exchange for amateur band receiver, Also have collectors item No2 box camera Brownie, offers please. A W Hyde. Tel: Pagham 3256 any time.

■ Eddystone 730/1A communications receiver 0.48-30MHz, 5 bands complete with manual, good condition. £85. Hallicrafters S-38 communications receiver 0.55-30MHz, 4 bands, complete with manual, excellent condition. £55. Joymaster ATU and collapsible antenna 1.8-30MHz, nice condition. £30. AEC SWR50A 1KW SWR/power meter, new, boxed with instructions. £10. Sirignano G4FZG. Tel: Cheltenham (0242) 580329.

■ Acorn Electron software for sale. Chess, boxer, hopper, business games, Arcadians. All £6 each. Turn your Electron into a random Morse code generator, will help to get your G4, will send Morse at various speeds. Records all letters or numbers on screen so you can check. £2.50. Gino Martorano G4NNZ. Tel: (0664) 500228.

■ Sell ATU audio filter. Panel meters 100 and 200 amp. 230V ac relays, valves, music colour 3 channel 2500 watt. 4116 IC computer upgrade VOM and other items. Listening post clear out. Surplus items. Send SAE in N2 or 2 IRCs for list to: Rout, 3/137 Champion Street, Christchurch, New Zealand.

■ Dual band mobile. FDK 750E and 430 expander, 2m and 70cm multimode FM/SSB/CW 1W and 10W, dual VFOs, repeater shifts, auto toneburst. Boxed, as new with handbook and mobile mount. Sold complete with diplexer and dual band mobile antenna. £350. J Taylor G1EJE. Tel: (05436) 72275. W Midlands.

■ Fujion RDF portable AM/FM/VHF. 6 volt battery or 6V dc marine 2m etc, new £65. Or WHY? Also Uniden CR2021, new £125. Or WHY? Tel: (0274) 676556 after 6pm.

■ FT790 70cm rig, excellent condition, without Nicads £190 ono, with Nicads (2.2ha), £230. Would swap for 2 FT708S 70cm handhelds or 2 TR2300s or a combination of both, or WHY? All cash only. Chris G1EZJ, 52 Spode Street (West End), Stoke-on-Trent, Staffs ST4 4DY. Tel: (0782) 46570.

■ Tandy model 100 portable computer, PSU, Centronics cable, original packing and manuals, plus fitted executive case. Sell or p/ex portable micro with CRT and disk drive; Kaypro, Osbourne or similar. Have modern Racal TRA906 SSB/CW transceiver, plus many accessories to sell or p/ex. Bob Sayers, 120 B'ham Road, Redditch, Worcs.

■ EPROMs ex project 2516, 2716, 2732 and 2764, all erased and checked, some new 2764s. Tel: (0843) 33398, after 6pm only. Ask for Don.

■ Audioline home base, PT-345 FM CB radio. £60, or will exchange for any general coverage receiver, or 2m FM transceiver, 144-146MHz. Willing to pay small amount of cash if necessary. Please write, giving full details, plus telephone number and address, and you will be contacted. P Lomax, 43 Whittington Hill, Old Whittington, Chesterfield, Derbyshire.

■ Sonatest ultrasonic test scope, model TE/8, good working order, complete with battery charger box. Open to offers or may swap for plain scope or digital multimeter, or WHY? Please write to: Mike Day, 39 Valnord Lane, St Peter Port, Guernsey, Channel Islands. Tel: (0481) 26168 after 6pm.

■ Circuit diagrams and service data for most British radio receivers from 1947-1957. Photo-copying charge only. Send SAE or phone. A Calderhead, 27 Glencairn Drive, Glasgow G41 4QP. Tel: (041) 423 1935.

■ Have MH473 DX-TV wide-band aerial, colinear elements covers bands 1-47.68, 2-175.230. Also 200ft RG58U low-loss co-ax cable. Sell or swap for CB side-band rig or any scanner, or good radio that covers UHF and VHF air-bands 108 to 139. John, 71 Harris Drive, Orrell, Bootle, Liverpool L20 6LF. Tel: (051) 922 9632 evenings.

■ G3WW QSYing seeks offers, aerial installation of 2 x 4 guyed 56ft Western 3HD base bolted tower supporting Hy-gain 205BA, Moseley Elan 10/15 beam, and on 16ft extension tubing 2 x 16 Tonna beams, rotated by heavy-duty Emoto, complete with separate co-ax and Emoto feed-lines, the 70ft to the shack. Two 240 ac motors with gearboxes raise and tilt over the tower. Also 56ft 4in diameter Ali mast in two sections guyed 2 x 3. R F G Thurlow, 2 Church Street, Wimblington, March, Cambs PE15 0QS. Tel: (0354) 740255.

■ FT290 multimode 2m. £220. Scarabs RTTY complete system for spectrum split screen version. £100. Realistic PRO47 scanner crystalled 70cm. £35. Midland FM CB. £25. Big Jim antenna. £30. 2m home base and mobile antenna. £40. Pair Sinclair ZX81s. £15. 30 Batfod Road, Harpenden, Herts AL5 5AT. Tel: Harpenden 64349.

■ Dragon 32 computer, plus RTTY cartridge software, books, mags, all vgc, boxed with all cables, plugs. £75 ono. Cowan, 20 Keynsham House, Woodberry Down, London N4 2TX. Tel: (01) 802 3971.

■ Marconi signal generators type 801/D 10MHz, 470MHz AM. £125. 1064B AM/FM 68MHz, 470MHz. £250. Maplin 600MHz counter built and calib. £150. Two Roband 1500 dc voltmeters, digital. £30 each. 100m H100, unused. £60. Sharp M2713 computer with built-in printer, cassette, six games, tapes, manual, etc. 6 months old. £300. Discone aerial. £20. 5-ele 2m aerial. £15, new unused, owner needs space. Bob Brown, 15 Windsor Place, Conon Bridge, Ross Shire, Scotland IU7 8BX.

■ Leak valve stereo amp with Goldring GL75 record deck and (old) Sony cassette deck in large cabinet, complete with pair Leak sandwich speakers. £85. Tel: Brown. (0442) 59583 (evenings)

■ Ferranti model 146 radio, ac, all wave, superhet, circa 1939, brown and cream plastic, excellent condition, full working order. £20. Tel: Wargrave 2037

■ Unique opportunity to get on 934MHz for £150, with Reftec, new July '84. Very good working order, never needed service. Specially suitable p/pack available cheap. Full dimensions available to convert TV antenna to 934. C Dobson, 16 Lowick Road, Islip, Kettering NN14 3JY. Tel: Kettering 2466

■ Racal RA17L professional quality general coverage receiver. 0.5 to 30MHz. Excellent condition, with dust cover and manual. £155. Tel: (0684) 295286 (evenings/weekends)

■ Disc drive Canon dual 40 track in office case with PSU software and new box of discs, cable suitable BBC Micro. £220. Tel: (01) 941 0505

WANTED

■ Any 10m conversion details on the old AMs, or 27MHz to 49MHz. Plus one pair of Starphones must be in working order, plus any service manuals. Any TV to video monitor conversion details on 12 inch B/W or 26 inch colour. Any CB manuals, circuits or service manuals. Tel: Derby 49390 daytime or write to Gef Ford, 42 Princes St, Normanton, Derby.

■ Wanted urgently KW2000B mobile PSU with manual if possible. Also good HF mobile antennae. Good price paid. A Mercer, 46 Highworth Road, London N11 2SH. Tel: (01) 361 1922.

■ Information on Siemens S-H-Schreiber-F. Morse printer, T-typ 73, T184, PE211. Manual for Collins AN/URC-32 radio. John Cooper, Churchfield Road, Outwell, Nr Wisbech, Cambs PE14 8RL. Tel: (0954) 773558.

■ For B28 receiver, 5-pin power plug and socket. TCC electrolytic capacitor 8+8+8 400V wkg type CE22M. Six and twelve pin plugs for front panel of 19 set. Power plug for rear of 52 set receiver. Service manual for receiver type R206. Steadman, 4 Vineyard Way, Buckden, Cambs. Tel: (0480) 810382 evenings.

■ Video display unit QDM -9 No 61868 by 3Q of Tokyo. I need info and circuit, will pay cost of your call and for circuit data. Please tel: (0706) 874928 ask for Ted, after 6.00pm.

■ Space communications – information required on reception of communications from space shuttle and other current space projects. Please write airmail, all postage costs refunded. M Shepherd, 38 Weston Avenue, Mount Albert, Auckland, New Zealand.

■ I require one portable Pye PF-70 Series Tx/Rx, in working order, complete with xtals for use on the 70 centimetre band. Fair price will be paid. Around £50 price range. Wanted urgently: one pair of Pye PF1 pocket phones Tx/Rx, complete with xtals for the 70cm band. In working order, willing to pay up to £30. Martin c/o 4A Portwall Road, Maida Vale, London W9.

■ Radio-Constructor wanted, volumes 1 to 5 (1947-1951), bound or not. High price offered! Marcel Volery, Poste Restante, CH-8953 Dietikon/2, Switzerland.

■ PF1 Pocketfone Rxs cheap, qty only. Sorry, cannot collect. 52 Spode St (west end), Stoke on Trent, Staffs ST4 4DY. G1EZJ (Chris). Tel: (0782) 46570.

■ Books wanted: Bench Servicing Made Easy, 2nd edition, by Robert G Middleton or any other TV repair books considered. Please write: D Martin, 29 St Johns Close, Leatherhead, Surrey.

■ Modern military manpack transceiver, Racal, Plessey etc. Have modern Racal TRA906 SSB/CW transceiver, plus many accessories, to sell or p/ex. Superb portable QRP rig. Urgently require batteries, manual, any info on A41 No3 VHF transceiver. Bob Sayers, 120 B'ham Rd, Redditch, Worcs.

■ External 'T' plug wanted for Eddystone 'comm' receiver, model 840A. Will pay all costs etc. I Cobbold, Warren Lane, Elmswell, Bury St Edmunds, Suffolk IP30 9DT.

■ Wanted to complete military radio WS22 control unit F No2: aerial remote control unit J, aerial set unit J, transmitter T1083 plus coils, handbooks for WS1 and WS21. Good price paid for any of above items. Warner, 45 Eastry Close, Ashford, Kent TN23 2RS. Tel: (0233) 36185.

■ Woden 240V in 400/0/400 200mA 4,5 and 6.3. Advance Voltstat 190/250 primary 64V, 300 watts output, 1 off QV06/20, pair CV345. Offers or exchange part/ex for 1155, BC342N, B41. Tel: Whitlam, (0272) 842155 (Bristol area).

■ Pre-war wireless sets of moderate or small dimensions, preferably battery operated and portable. Working condition immaterial. Also wanted: Hacker radio in good condition. Tel: Reading 883799.

■ Details on conversion of Dymar 880 transceivers to 2m, any info, details, etc. Also any xtals for use in FDK Quartz 16, price negotiable. Would be prepared to purchase cheap Dymar 880 if price right! (Converted). Please contact Mr K Johnson, tel: Penketh (092572) 2998 evenings.

■ Yaesu FT225RD all mode 2 metre transceiver. Mr Elvin Bailey, 23 McCallum Gardens, Strathview, Bellshill, Lanarkshire ML41 HD. Tel: (0698) 747448.

■ Valves: any quantity, Pip-Top to KT88 and all output triodes and transmitting valves. Clandestine suitcase radio sets, working or incomplete. Also portable or compact military HF receivers, transceivers. Early wireless equipment, WWI military communications equipment, crystal sets and tuners, horn speakers, boxed components etc. Amateur, commercial valve receivers and early hi-fi amplifiers, tuners, turntables, pick-up arms, heads, speakers. Please tel: John Baker (01) 833 3008.

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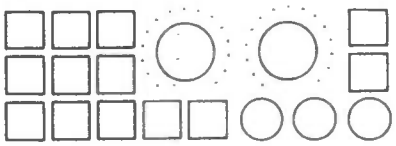

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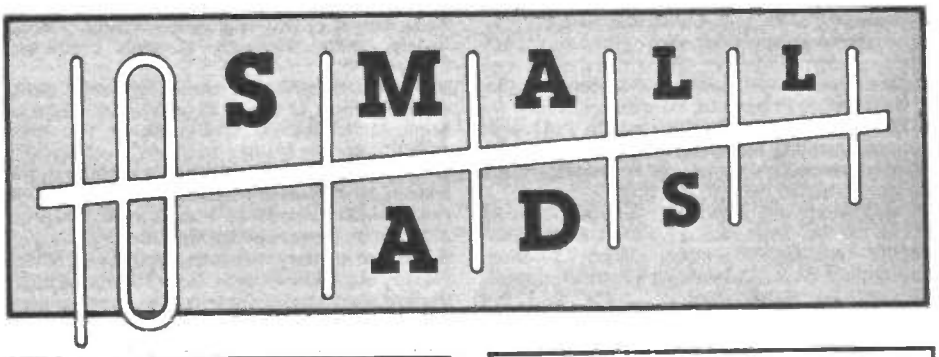

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Radio & Electronics World
For all aspects of practical amateur radio

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depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
61 x 90	⅛page	£91.00	£86.00	£82.00	£73.00
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Sep 85	11 Jul 85	17 Jul 85	19 Jul 85	8 Aug 85
Oct 85	15 Aug 85	21 Aug 85	23 Aug 85	12 Sep 85
Nov 85	12 Sep 85	18 Sep 85	20 Sep 85	10 Oct 85

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FOR FURTHER INFORMATION CONTACT
Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE.
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T 6049	40p
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T 6052	40p
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T 9005	40p
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BC119	20p
BC125	10p
BC126	10p
BC139	10p
BC140	30p
BC141	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC158	10p
BC159	10p
BC160/16	25p
BC171	10p
BC172	10p
BC173	10p
BC174	10p
BC183	10p
BC184	10p
BC204	10p
BC207	10p
BC212	10p
BC213	10p
BC214	10p
BC237	10p
BC238	8p
BC239	10p
BC250	8p
BC251	10p
BC252	10p
BC262	10p
BC263b	20p
BC294	30p
BC298	10p
BC300	30p
BC301	30p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
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BD510	30p
BD517	30p
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BD535	30p
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BD562	30p
BD610	40p
BD646	50p
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BF127	20p
BF137	20p
BF157	20p
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BF161	20p
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BF180	20p
BF181	20p
BF182	20p
BF184	20p
BF194	10p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
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