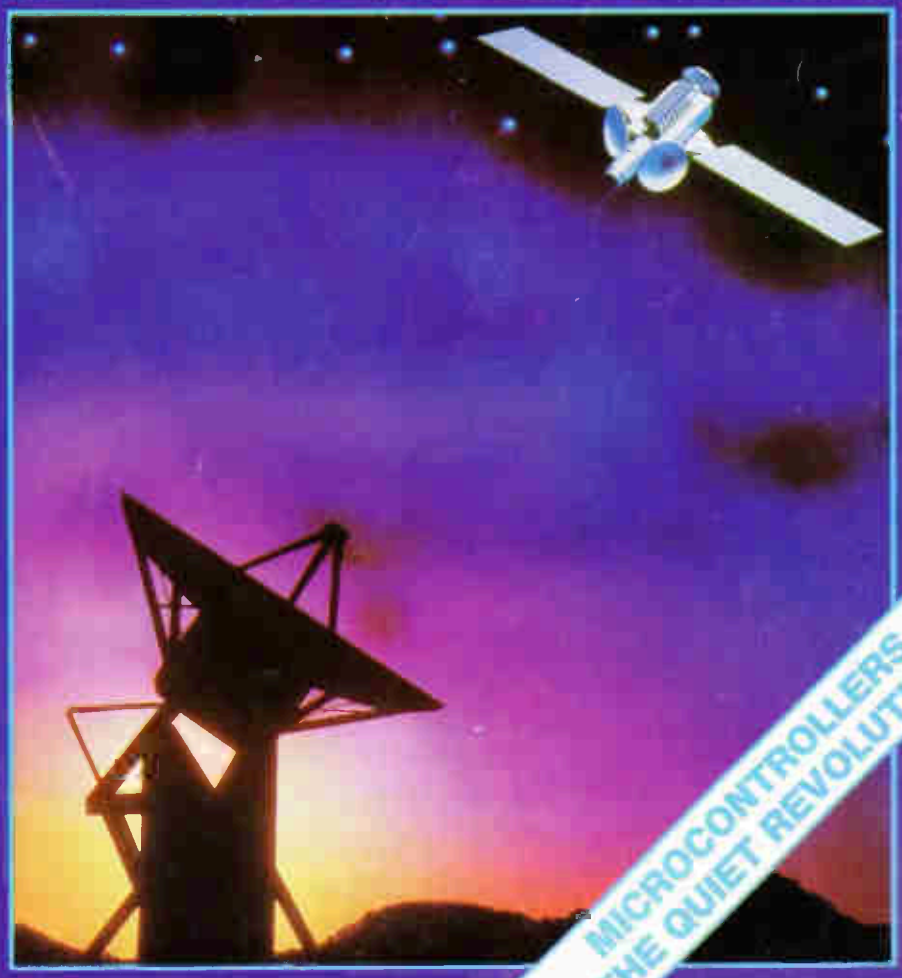
MARCH 1988 £1.45

AUSTRALIA
HOLLAND
NEW ZEALAND
NORTH AMERICA

Radio & Electronics World

The communications and electronics magazine



UHF BEAM:
A PRACTICAL HELICAL BEAM FOR UHF

CAD PROGRAM:
INTERSTAGE COUPLING MADE EASY

CONSTRUCTION:
AN INEXPENSIVE AUDIO FREQUENCY METER

USER REVIEW:
MS1 MONITORSCOPE FROM REVEX

MICROCONTROLLERS THE QUIET REVOLUTION

the polarization of the remote antenna. Therefore, one helix will do the job of three antennas: a vertical beam, a horizontal beam, and a circular beam.

Advantage

A further advantage is that the helix, like other ground plane designs, is inherently suited to a coaxial cable feed, without the need for a balun. True, the impedance is a somewhat awkward 140 ohms, but it is still much easier to match to co-ax than a dipole.

For this purpose, a quarter wavelength of coaxial line with a calculated intermediate impedance is usually used as a matching section. A quarter-wave of 83 ohm line would match 140 ohms to 50 ohms, for instance. This is not a normal impedance for transmission line, but 80 ohm cable is obtainable, which is near enough. However, this sort of matching section only works properly at the frequency at which the matching section is a quarter-wave long, so the matching would reduce the bandwidth available from the antenna.

To retain the helix's wide bandwidth, I designed a conical matching section, which is not only simple to make and mechanically robust, but also converts the reflector into something similar to the funnel-shaped ground planes seen in one of those theoretical diagrams of an idealised wideband antenna.

The principle of the conical transformer is that the impedance is 140 ohms at one end, varying continuously as the dimensions change, until at the other end it is either 75 or 50 ohms, depending on the final diameter of the outer conductor. For simplicity's sake, the inner conductor does not vary. This is similar in principle to the 'Delta Match' scheme often used with balanced feeders, but this one is coaxial.

The impedance transformation of the cone does not rely on the length of the matching section being a quarter wave, so it will work over a wider bandwidth. There is probably no need to make it a quarter wave at the design centre frequency of the antenna, but we do so anyway, because it is a convenient length and it can't hurt. While I don't claim to have invented this form of matching, I don't recall seeing it used on a practical antenna design before, perhaps because this is one of the few antennas in which it is of any use.

Construction

Partly due to the coincidence of the helix bandwidth covering the whole of the UHF television bands, and partly because I have a number of receivers and Yagi antennas already installed for TV reception which would be excellent for comparison testing, my initial helix was designed for UHF TV frequencies. At my location, thirty miles from any major town and the same distance from the nearest 70cm repeaters, my FRG9600 insists that there is no amateur UHF activity to be had anyway. The availability of some sort of signal was deemed necessary for the purposes of testing.

A 432MHz beam for the amateur bands would be only slightly larger than the TV version, and a 934MHz CB beam slightly smaller. A version for 1296MHz would probably be too small to be wound *through* plastic drainpipe, but could easily be wound *on* it.

The basic materials required are: several metres of quarter-inch copper tubing, a length of 2½in drainpipe (make it 2in for 934MHz or 3in for 432MHz), and either a big piece of 1.25 millimetre (18 swg) alloy sheet, or a whole lot of heavy copper wire or brazing rod. The copper tubing can be had from caravan or bottled gas equipment suppliers. Allow one wavelength per turn, and then add a bit. Plastic drainpipe grows in neglected corners of every DIY emporium – alloy sheet is harder to find.

Note: all the materials used should be non-magnetic.

Tools for the job

For tools, you will need an electric drill, and if you are making the ground plane/reflector from sheet, something to cut the sheet. I used a Monodex, a hand tool that cuts sweet curves in sheet metal. The alternative is to make up a wire ground plane in the manner of a dartboard grid, which may prove easier than sheet metal work for some. Don't try to get away with a sheet of mesh, as it won't be constructed in a circularly polarized fashion.

The first step is to wind the helix on a former, which should be the diameter given in *Table 1* minus the diameter of the copper tube, to adjust for the thickness of the material. The design dimensions are measured between the centres of the conductor. You may have to buy a tin of paint or a jar of pickles that you don't want just to get the right size former. And let's all wind right hand thread, shall we, like a standard woodscrew or bolt? Having closewound the coil, remove the former and stretch the coil to the pitch spacing required (*Table 1*), as close as you can manage.

Now make up a piece of card the width of your drainpipe and long enough to span several turns of the helix, and place it inside the helix. Make a mark on the card at each spot where the helix passes. This will give you a guide to the offset between the series of holes on one side of the drainpipe, and those on the other. Average out several measurements to obtain a reliable figure.

Drill 5/16in holes in a straight line down one side of the drainpipe at the pitch spacing from *Table 1*, then a similar series down the other side, but offset it by the amount worked out from your piece of card. My offset worked out to 5/8in, but my measuring was well out by the end of the drilling, which made subsequent steps more difficult. Don't worry about which direction to offset the holes in, you can always flip the pipe over.

It will be easier to get the tubing through the holes if after drilling each hole in its precise position, you angle the drill in the direction of the winding and give the hole a good ragging out.

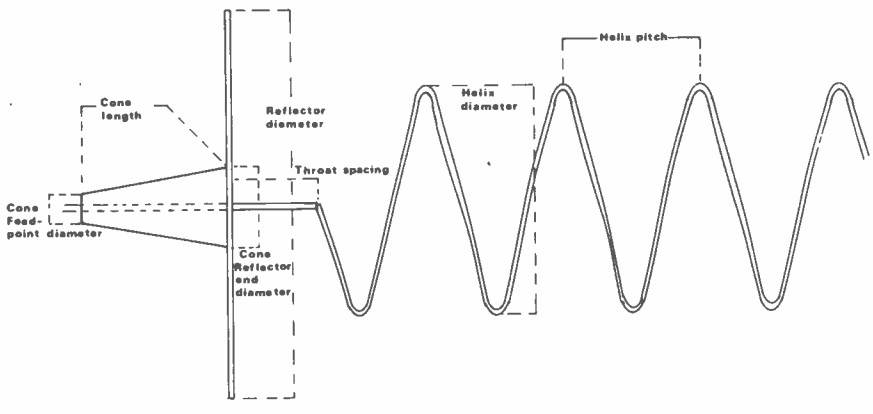
Now you can wind the helix through the drainpipe, turning it like a screw, and taking care not to force it out of shape. This is a fiddly business, especially toward the end, when you will have to inch things along one turn at a time. If it is too much of a struggle at the beginning, then you had better go back and enlarge the holes a bit, or you will bind up halfway through.

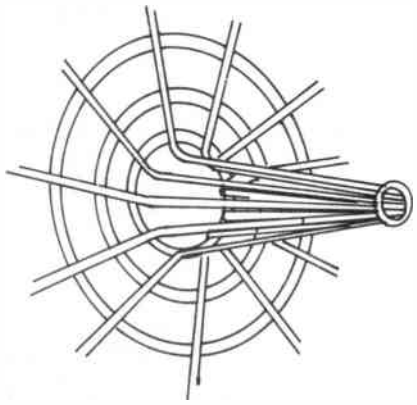
When the helix is completely wound on, test it against a flat surface to make sure each turn is the same size and not distorted by the struggle. Measure the diameter again, too. Minor adjustments can be made by eye, using the flat surface to even things up.

Straightforward

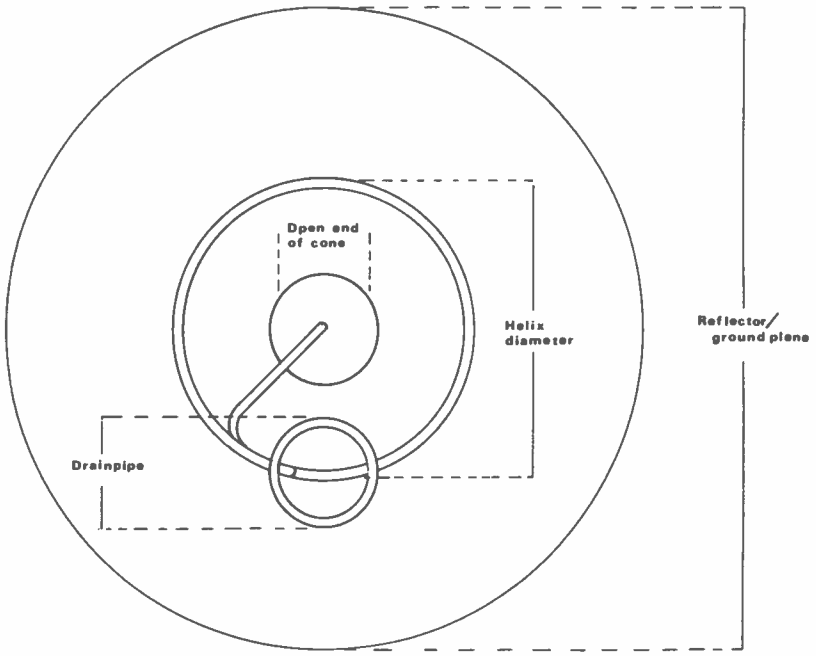
That's the clever bit done. The rest, building and mounting the ground plane, is straightforward enough. The main thing with the ground plane is to make it robust, with no gaps larger than about an eighth of the shortest wavelength

Diagram showing physical measurements required for construction





Method of forming cone with wire 'dart board' reflector construction



Overview of the beam showing physical dimensions

involved, but at the same time having plenty of holes to keep the wind resistance down. Mine turned out rather fancy, as I had a drill press and Monodex to play with. However, a home-made appearance can be advantageous. It helps reassure nervous neighbours who might otherwise think you have mounted a laser cannon on your roof!

Note that the length of the conical quarter-wave transformer varies with the centre frequency of the antenna, but the diameters of the two ends remain the same as long as the centre conductor is quarter-inch diameter. This becomes awkward at 1296MHz, so different dimensions are given using eighth-inch rod instead. At that frequency, eighth-inch material will be much more convenient for the helix as well, if you can get a long enough piece.

Making the cone is easy with a wire ground plane; you simply bend the ground plane radials out to the back, and solder them together in a ring at the right distance. Cutting a cone from sheet metal is more difficult. There is probably a formula to calculate the radii of the curves and angle of arc, but the easy way is to roll up a few trial cones in stiff paper until you get one the right shape, and use that as a pattern.

The cone should have a large number of connections to the reflector to conserve UHF continuity. When cutting the hole where the cone joins the reflector, leave a lot of tabs which can be bent out to provide connection points for pop rivets or self-tapping screws.

Fitting the ground plane to the drainpipe is made easy by cutting the plastic to leave four lugs sticking out from the pipe, behind the ground plane position. Corresponding tabs can be cut and folded from the alloy sheet, or constructed in wire and fastened to the lugs with small screws and nuts. The tabs protrude backwards to avoid having metal sticking up from the ground plane. Note also that a web of metal remains across the end of the drainpipe, to avoid a gap in the ground plane.

Before fitting the ground plane, you will have to straighten the end of the helix and re-bend it to form the throat of the antenna and the core of the matching cone. Don't try to make the bends too sharp, or you will kink the tubing. UHF doesn't like sharp bends anyway. It is worthwhile trying to get as close as possible to the RSGB design figure for the throat spacing, but I have seen a design in an American ham radio book, where this spacing was thought so unimportant that no figure was given.

Similarly, it does not seem to matter too much if the free end of the helix does not finish with exactly a whole number of turns; that is, if a fractional turn is left over. The Yanks reckon to trim this free end for lowest SWR, but I just made it long enough to trap the end in the drainpipe.

A small waterproof box (I used a 35mm film canister) can be Araldited onto the end of the cone, to house the connections and keep water out of the co-ax. All that now remains is to mount the antenna on a non-metallic mast (more drainpipe) using epoxy and a minimum of metal fasteners.

Those worried about the dielectric properties of grey polythene may want to decrease the lossiness of the helix's drainpipe by Swiss-cheesing it with the aid of a large drill bit or even a hole saw, but a few drain holes along the bottom are probably all that it needs.

On trial

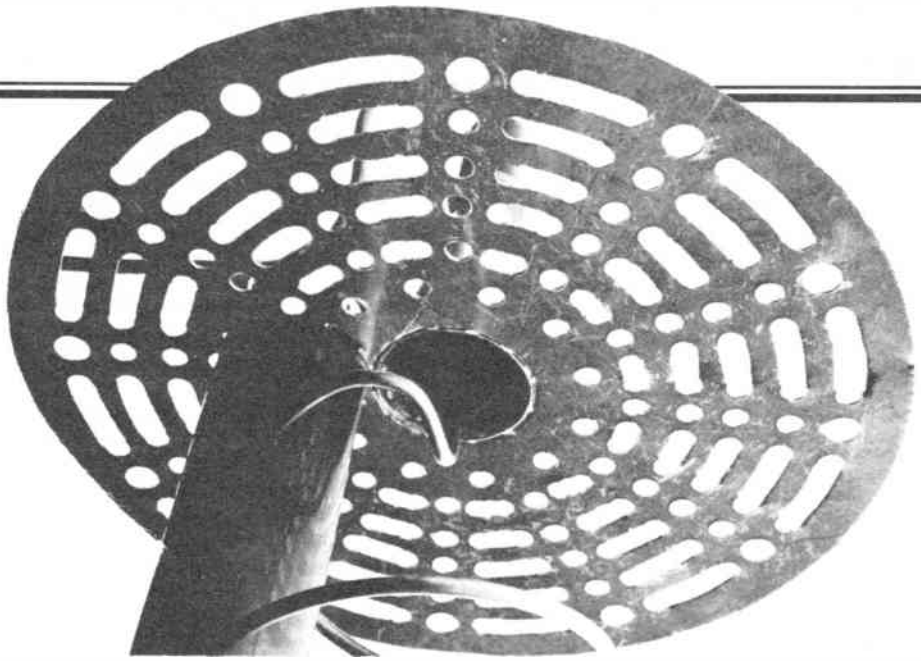
My 'test facility' is located high up at the edge of the Cotswolds near Tetbury in Gloucestershire, only a mile or so from the site of a Telecom microwave tower, but unfortunately in a local dip about a hundred and fifty feet below the crests of the surrounding hills.

Our normal domestic gogglebox reception is via two long Yagis fitted with masthead amplifiers, one pointed at the Mendip transmitter, and the other at Oxford. This is not mere duplication, as the Oxford transmitter carries Central Television's late night service, while Mendip's HTV has local news programmes more in keeping with our shopping patterns. Neither transmitter is nearby, and single barefoot Yagis provide snowy pictures. The masthead amplification is required to give good quality viewing.

rotator fitted with the helical beam attached. An initial trial was made with both the helix and an 18 element Antiference TC18 Yagi (on another mast) pointed at the Mendip transmitter, our strongest service. Both antennas were at the same height and un-amplified. Switching between the two very snowy signals revealed that the helix was giving markedly less gain than the Yagi, which is rated at 14dB. Presumably, this was due to the 3dB penalty for non-circular polarization.

At this signal level the transmission was unwatchable from either antenna, so the masthead amp was connected to the helix, and the signal from it fed into the building's distribution amplifier, hence to be split six ways (we do quite like telly!)

The masthead amplifier is a Labgear CM7065, with a gain of 26dB, a noise figure of 2dB and a bandwidth of 40 to 860MHz (£17.65 from Aerial Techniques). The further 17dB of the distribution amplifier is largely absorbed by losses in the splitters and cabling. This is a *lot* of amplification, and it may seem to make the quality of the antenna irrelevant, but remember that an amplifier boosts everything fed to it, including noise,



interference, and multipath reflections. Amplification is a solution to low signal strength, but only aggravates other reception problems.

With amplification, reception via the helix was indistinguishable from that given by the Yagi it had replaced. The difference in antenna gain is obviously swamped by the amplifer, at least on the strong signals of our two preferred transmitters.

Reception from Mendip and Oxford was of the highest quality, with well saturated colour and quiet blacks, without a hint of noise. It was easily possible to distinguish the difference in transmitted quality between filmed and taped programs. Some recent American series are of terrible visual quality, while early ones, delivered to British broadcasters on film, give marvellous pictures, whatever you may think of them otherwise. If you are not aware of this difference, it can distort assessment of the reception. Filmed adverts also shine out amongst the video tape.

Exploring the horizon with the rotator brought interesting revelations. HTV Wales and S4C, the Welsh Channel 4, could be received with watchable if not brilliant quality from Wenvoe, near Cardiff. Transmitter identification was made using a combination of the transmitter data in the Maplin catalogue and exploration of the Teletext pages, especially local theatre guides, which give a good fix on locality. The TV South transmitter at Hannington, near Basingstoke, could also be received, but not TVS itself, as it is broadcast on the same channel as the low power local 'fill-in' transmitter in Bristol used for HTV.

Hence the aforementioned advantages of the helix also proved to be the main limitations of the antenna, at least in the TV broadcast bands. Low power local transmitters are usually vertically polarized, while the main long distance transmitters use horizontal polarization. The helix receives both modes equally well, leading to a great deal of co-channel interference. A large number of weak stations were received from unidentifiable transmitters, either very distant or among the low power fillers which pervade the Cotswolds, most exhibiting the characteristic co-channel 'venetian blinds'.

Further, the helix proved less directional on vertically polarized signals. The off-beam response of the helix is elliptically polarized, which, when scanning around the horizon, affects horizontally polarized signals much more sharply than vertical ones. Hence the inability to sort the distant TVS from the local HTV, even though the polarizations were opposed and the bearings about 120 degrees apart.

Another problem resulted from the wide bandwidth overloading the masthead amp. Serious degradation of normally perfect reception occurred regularly at dusk, until a filter was fitted, restricting the signal input to the amp to the UHF TV band, from 470 to 860MHz. This had the side effect that I am no longer able to feed 2 metre amateur signals to my scanner from the TV antenna socket (!), although FM radio still comes through with the signal meter against the stop.

This overload never occurred when the amp was fed by the original Yagi. It is probably due to the fact that FM transmissions are now cross-polarized, and therefore much stronger on the helix than they were on the horizontally polarized Yagi, which also had a bandwidth restricted to UHF group C/D channels.

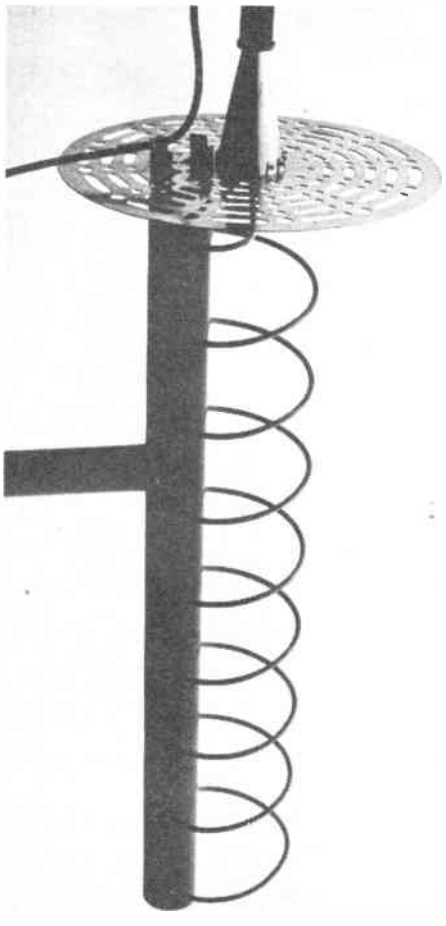
Bandwidth and lack of polarization sense are therefore not unmixed blessings, but for the purposes of exploration it was convenient to be able to pull in every channel on offer, even when it was occupied by two or more transmissions. Quality reception of fixed services is another matter, probably better provided by the more selective Yagi.

Considerations for other bands

It takes a plethora of high power transmissions to cause the above reception problems, so they are unlikely to occur in helixes wound for amateur bands (with the exception of the possible overload of sensitive receivers by broadcast FM). However, those with transmitting licences will have to watch their out-of-band spurii carefully. A 432MHz helix will happily radiate well into the TV bands if you feed it the signal. It is unlikely that the extremes of the stated bandwidth will hold for transmitting, but amateur bands are much narrower than this, and you can't rely on this antenna to filter your output.

It was not possible to come to any conclusions about the flatness of response using telly reception. The transmitters are grouped to have their channels in the same part of the band, so wide variations of frequency are not available from the same site. I did note, however, before fitting the UHF bandpass filter, that it was possible to null out the local 2 metre repeaters by rotating the antenna. Reception of these repeaters is largely due to the masthead amp, which has a bandwidth down to 40MHz, but the null has to be down to the antenna. For the beam to operate that far out of band would suggest that the response peak is fairly flat.

Perhaps the best use for this design is coupled to a scanner for use in that difficult area above the TV bands. Of course, there is hardly anything up there that you can legally listen to. . . NEW



RAYCOM for: Scanners, Handhelds, HF, VHF and UHF Transceivers, Receivers.

Before you purchase anything, call us last! For that special deal!

YAESU ICOM SONY

International House, 963 Wolverhampton Road, Oldbury, Warley, W Mids B69 4RL

Tel: 021-544 6767 (PBX)

STOCKTAKING SALE

Now that RAYCOM has taken over Ray Withers Communications, our annual stock check has revealed excess stock levels on many lines. We are therefore offering the following items at unbelievable prices. All equipment is new unused with full warranty. The following items are offered on a first come first served basis, some items are end of lines and cannot be repeated, hence the low prices.

ACT NOW TO AVOID DISAPPOINTMENT.

Please add p&p £5.00 or carrier £10.00.	NORMAL	SPECIAL
YAESU FT726 Base Station with 2 mtrs	£899.00	£695.00
UNIDEN-BEARCAT UBC-50XL new 10 ch H/H Scanner	£99.99	£90.00
UNIDEN-BEARCAT UBC70XL new V-UHF Scanner	£239.00	£199.00
UNIDEN-BEARCAT UBC-100XL 20 ch H/H Scanner	£229.00	£189.00
UNIDEN-BEARCAT UBC-175XL Desk-Top Scanner	£199.00	£179.00
Colour-Rotator 40kg loading. 3-core cable	£42.50	£37.50
Alignment Bearing for above Rotator. (1.5)	£14.50	£12.50
CTE1600 2 mtr Handheld (same as ICOM IC2E)	£199.00	£169.00
KENPRO KT400EE 70cm Handheld (same as IC4E)	£279.00	£199.00
RAYCOM 6E Discone Antenna (air band + VHF)	£19.50	£10.00
SO239 Guttermount assy. C/w 6 mtrs RG58CU	£12.50	£10.00
YAESU FT77 120W PA Unit (1-30MHz .5W input)	£149.00	£75.00
YAESU Horn Relay Unit with 555 Timer IC	£12.50	£4.50
YAESU YD844A 600 ohm/50K Desk Mic	£39.95	£19.95
RAYCOM 13.5V 5A Power Supply Unit	£29.50	£22.50

Please send large SAE for: Bargains List, Used List, Scanner Catalogue, or any other Information/Leaflets.

Full range of SONY Receivers now in stock, RAYCOM now appointed SONY dealers. SONY products post free.

SONY Air 7, famous Air/VHF Radio	£49.00
SONY PRO80 Short Wave/VHF Radio	£349.00
SONY 2001D Package including Active Antennas	£399.00

Now in stock: CUSHCRAFT, BUTTERNUT and HY-GAIN Antennas.

Why not visit our spacious new showrooms, 200 mtrs from M5 J2 on the Wolverhampton road, plenty of car parking and coffee!

SPECIAL CLEARANCE PYE W15FM Dash Mount Westminsters, 15W 3 ch, ideal for conversion to 2 mtrs/Packet Radio. Supplied as seen untested, with copy of conversion details @ £37.50 inc post.

FAX 021 544 7124

TELEX 336483 IDENTI-G

A division of Ray Withers Communications

ELMASET INSTRUMENT CASE
300x133x217mm deep ..... £10.00 ea (£2.20)

REGULATORS
LM317T Plastic T0220 variable £1
LM317 Metal £2
7812 Metal 12v 1A £1.00
7805/12/15/24 plastic ..... 50p 100 + 27p
7905/12/15/24 plastic ..... 50p 100 + 27p
CA3085 T099 Variable regulator £1
LM338 5A variable £5

COMPUTER ICS
27128 250n^9 NEW £3.00
68008 Processor Ex-Equip £5
27256-30 ex-eqpt £3.00
2764-30 USED £2
1702 EPROM ex equip £5.00
2732-45 USED ..... £2 100+£1.50
2114 EX EQPT 60p 4116 EX EQPT 70p
6264LP15 8K static ram £2.80
6116-3 (TC5517AP) £1.50
4416 RAM £3.50
ZN427E–8 ..... £4.00
ZN428E–8 ..... £4.00

SURFACE MOUNTED TRANSISTORS
BCW31 BCW72 NTAV70 1s2836 min 50/type ..... 100/£2.50

TRANSISTORS
BC107 BCY70. Pre formed leads full spec
20/£1 100/£4 £30/1000

POWER TRANSISTORS
POWER FET IRF9531 8A 60V P channel to 220 ..... 2/£1
2N3055H RCA House numbered ..... 5/£2
2SC1520 sim BF259 ..... 3/£1 100/£22
TIP141, 142/146, £1 ea, TIP112, 125, 42B ..... 2/£1
TIP35B £1.30 TIP35C £1.50
SE9302 100V 10A DARL SIM TIP121 ..... 2/£1
2N3055 Ex eqpt tested ..... 4/£1
Plastic 3055 or 2955 equiv 50p ..... 100/£35
2N3773 NPN 25A 160V £1.80 ..... 10/£16
BD132 ..... 5/£1

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

NICKEL CADMIUM BATTERIES
7.2 Volts 1.8 A/hr C Cells in packs of 6 ..... £5 P&P £1

ZIF SOCKETS
TEXTOLL single inline 32 way. Can be ganged for use with 24, 28 and 40 way DIL devices, Dual inline ..... 2/£1.50

MISCELLANEOUS
To – 220 Heat Sink sim RS 403-162 ..... 10/2.50
D.I.L. Switches 10 Way £1 8 Way 80p. 4/5/6 Way 50p
180 Volt 1 watt ZENERS ALSO 12V ..... 20/£1
Minature co-axail cable RG316U £0.50/metre
Olivetti logos calculator keyboard (27) key plus 12 Digit flourescent display on driver boad (ie calculator less case, transformer and printer) £1.30
Plastic Equipment case 9x6x1.25" with front and rear panels containing PCB with eprom 2764 -30 and ICS 7417 LS30 LS32 LS74 LS367 LM311 7805 Reg, 9 way D plug, push button switch, din socket £1.90
VNIOLM 60V 1/2 5ohm TO-92 mosfet ..... 4/£1. 100/£20
MIN GLASS NEONS ..... 10/£1
RELAY 5v 2 pole changeover looks like RS 355-741 marked STC 47WBO5T ..... 2/£1
OMRON RELAY 3.6volt coil 2p c/o contacts marked G4D-287P-BT2 ..... 2/£1
MINIATURE CO-AX FREE PLUG RS 456-071 ..... 2/£1
MINIATURE CO-AX FREE SKT RS 456-273 ..... 2/£1.50
STRAIN GAUGES 40 ohm Foil type polyester backed balco grid alloy ..... £1.50 ea 10+ £1
DIL REED RELAY 2 POLE n/o CONTACTS £1
Zettler 24v 2p c/o relay 30x20x12mm sim. RS 348-649 ..... £1.50 100+ £1
ELECTRET MICROPHONE INSERT £0.90
Linear Hall effect IC Micro Switch no 613 SS4 sim RS 304-267 ..... £2.50 100+ £1.50
Hall Effect IC UGS3040 + MAGNET £1.00
OSCILLOSCOPE PROBE SWITCHED X1X10 £10
CHEAP PHONO PLUGS ..... 100/£2 1000/£18
1 pole 12 way rotary switch ..... 4/£1
AUDIO ICS LM380 LM386 ..... £1 ea
555 Timer 5/£1 741 Op AMP ..... 8/£1
COAX PLUGS nice ones ..... 4/£1
4 x 4 MEMBRANE KEYBOARD £1.50
15.000uF 40V SPRAGUE 36D £2.50 (£1.25)
INDUCTOR 20uH 1.5A ..... 5/£1
NEW BT PLUG + LEAD £1.50
1.25" PANEL FUSEHOLDERS ..... 5/£1
CHROMED HINGES 14.5 x 1" OPEN ..... £1 ea
TOK KEY SWITCH 2 POLE 3 KEYS Ideal for car/home alarms £3
12v 1.2W small wire ended 1 amps fit AUDI VW TR7 SAAB VOLVO ..... 10/£1
12V MES LAMPS ..... 10/£1
STEREO CASSETTE HEAD £2
MONO CASS. HEAD ..... £1 ERASE HEAD 50p
THERMAL CUT OUTS 50 77 85 120C ..... £1 ea
THERMAL FUSE 121C 240V 15A ..... 5/£1
TRANSISTOR MOUNTING PADS TO-5/TO-18 ..... £3/1000
TO-3 TRANSISTOR COVERS ..... 10/£1
STICK ON CABINET FEET ..... 30/£1
PCB PINS FIT 0.1" VERO ..... 200/£1
TO-220 micas + bushes ..... 10/50p 100/£2
TO-3 micas + bushes ..... 20/£1
Kynar wire wrapping wire 2oz £1
PTFE min screen cable ..... 10m/£1
Large heat shrink sleeving pack £2
CERAMIC FILTERS 6M/9M/10.7M ..... 50p 100/£20
TOKIN MAINS RFI FILTER 250v 15A £3
IEC chassis plug rfi filter 10A £3
Potentiometers short spindles values 2k5 10k 25k 1M 2M5 new value ..... 5/£1
500k lin 500k log ..... 4/£1
40Khz ULTRASONIC TRANSDUCERS EX-EQPT NO DATA £1/pr
PLESSEY INVERTER TRANSFORMER 11.5-0-11.5V to 240v 200VA £6 (£3)

ZENERS
5.6V IW3 Semikron 50K available £25/1000

DIODES & RECTIFIERS
BAW76 Equiv IN4148 ..... £60/10,000
1N4148 ..... 100/£1.50
1N4004/SD4 1A 300V ..... 100/£3
1N5401 3A 100V ..... 10/£1
BA158 1A 400V fast recovery ..... 100/£3
BA159 1A 1000V fast recovery ..... 100/£4
120v 35A stud 65p
12FLO 12A 200V small stud ..... 4/£1.50 100/£26
BY127 1200V 1.2A ..... 10/£1
BY254 800v 3A ..... 8/£1
BY255 1300v 3A ..... 6/£1
6A 100V Similar MR751 ..... 4/£1
VM88 800mA 100VDIL b/REC ..... 5/£1
1A 800v bridge rectifier ..... 4/£1
4A 100V bridge ..... 3/£1
6A 100v bridge 50p
8A 200V Bridge ..... 2/£1.26
10A 200v bridge £1.50
25A 200v bridge £2 ea ..... 10/£18
25A 400v bridge £2.50 ..... 10/£22

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

TRIACS diacs 25p
NEC Triac ACO8F 600V TO 220 ..... 5/£2 100/£30
NEC Triac 150L Tab TO220 6A 400V ..... 2/£1
ACOV8FGM 800mA 400V T092 TRAC ..... 3/£1
Diacs ..... 4/£1
TXAL225 8A 400V 5mA gate 2/£1 ..... 100/£35
TRAL 2230D 30A 400V isolated stud ..... £4 each

CONNECTORS
34 way card edge IDC CONNECTOR (disk drive type) £1.25
Centronics BBC Printer lead £3.50
Centronics 36way IDC plug ..... £4 10+ £3.50
Centronics 36way IDC skt £4
Centronics 36way plug (solder type) £4
USED Centronics 36W plug & socket £3
'D' 9-way £1; 15-way £1.50; 25-way £2
37-way £2; 50-way £3.50; covers 50p ea

WIRE WOUND RESISTORS
W21 or Sim 2.5W 27R ..... 10 of one value £1
R10 0R15 0R22 2R0 2R7 3R9 4R7 5R0 5R6 8R2 10R 12R 15R 18R 20R 22R 27R 33R 36R 47R 56R 62R 75R 3R9 91R 100R 120R 180R 390R 430R 470R 560R 680R 820R 910R 1K15 1K2 1K5 1K8 2K4 2K7 3K3 3K0 5K0 10K R05 (50 milli-ohm) 1% 3W 4 for £1
W22 or Sim 6W ..... 7 of one value £1
R47 R62 1R0 1R5 1R8 3R3 6R8 9R1 10R 12R 20R 24R 27R 33R 51R 56R 62R 68R 100R 120R 180R 220R 270R 390R 560R 620R 910R 1K0 1K2 1K5 1K8 2K7 3K3 3K9 4K7 8K2 10K 20K
W23 or Sim 9W ..... 6 of one value £1
R22 R47 1R0 1R1 15R 56R 62R 68R 100R 120R 180R 220R 300R 390R 680R 1K0 1K5 5K1 10K
W24 or Sim 12W ..... 4 of one value £1
R50 1R0 2R0 6R8 9R1 10R 18R 22R 27R 56R 68R 75R 82R 100R 150R 180R 200R 220R 270R 400R 620R 6K8 8K2 1K0 10K 15K

PHOTO DEVICES
BPW50 Infra red photo Diode ..... 3/£1
Slotted opto-switch OPCOA OPB815 ..... £1.30
2N5777 ..... 50p only
TIL81 T018 Photo transistor £1
TIL38 Infra red LED ..... 5/£1
OPI2252 Opto Isolator 50p
Photo diode 50p ..... 6/£2
MEL12 (Photo darlington base n/c) 50p
RPY58A LDR 50p ORP12 LDR 70p
GREEN or YELLOW 3 or 5mm 10/£1 ..... 100/£6.50
FLASHING RED OR GREEN LED 5mm 50p ..... 100/£35

SUB MIN PRESETS HORIZONTAL
1K 4K7 10K 22K 47K 1M 10M ..... 15/£1 100/£5

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

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

TRIMMER CAPACITORS 5/50p
Grey larger type 2 to 25pF Transistors 2N4427 ..... 50p
Feed Thru Ceramic Caps 1000pF ..... 10/£1

SOLID STATE RELAYS NEW 10A 250v AC
Zero voltage switching Control voltage 8-28v DC £2.50
40A 250V AC Solid State relays £18

POLYESTER/POLYCARB CAPS
1n/3n3/5n6/8n2/10n 1% 63v 10mm ..... 100/£6
10n/15n/22n/33/47n/68n 220n 10mm rad ..... 100/£3.50
1uF 250V Mullard/Siemens AX ..... 10/£1 100/£8
2µ2 160v rad 22mm ..... 100/£10
33n/47n 250v AC X rated rad 15mm ..... 10/£1.00
1µ 600V Mixed dielectric ..... 50p ea

STC NTC BEAD THERMISTORS
G22 220R G13 1K G23 2K G54 50K G25 200K G16 1M Res@20'c directly heated type ..... £1 each
FS22BW NTC Bead inside end of 1" glass probe res @ 20'c 200R £1.00

BEAD TANTALUM CAPS
8 25V 47u 3V 12/£1 ..... 100/£6
2u2 20V 8/£1 ..... 100/£8

MONOLOTHIC CERAMIC CAPS
10n 50V 2.5mm ..... 100/£4.50
100n 50v ..... 2.5mm or 5mm 100/£6
100N 50V axial Shortleads ..... 100/£3
100n ax long leads ..... 100/£6

STEPPER MOTOR 4 PHASE 2 9v WINDINGS
£3.50 ..... 10/£30

KEYTRONICS

MAIL ORDER ONLY
P.o. Box 634
Bishops Stortford, Herts, CM23 2RX
TELEPHONE: 0279 505543

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

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

ADD 15% VAT TO TOTAL

ELECTRONIC COMPONENTS BOUGHT FOR CASH

CONTENTS

Editor
Anita Ley

Editorial Assistants
Lisbeth Stedman
Nicola Woodford

Advertisement Manager
Marian Vidler

Publisher
Peter Williams

Published by
Radio & Electronics World Magazines
Sovereign House
Brentwood, Essex.
CM14 4SE. England
Tel: (0277) 219876

ISSN
0262-2572

Printed
In Great Britain

Newstrade sales
S M Distribution
16/18 Trinity Gardens
London SW9 8DX.
Tel: 01-274 8611

Subscriptions
Tel: 01-760 0409

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 – the UVC 3101-8 combined AID and DIA converter IC from ITT Semiconductor (p5)

Bottom – the new VAD2150 flash conductor from ITT Semiconductor (p8)

SPECIAL FEATURES

REGULARS

READER SERVICES

NEXT MONTH

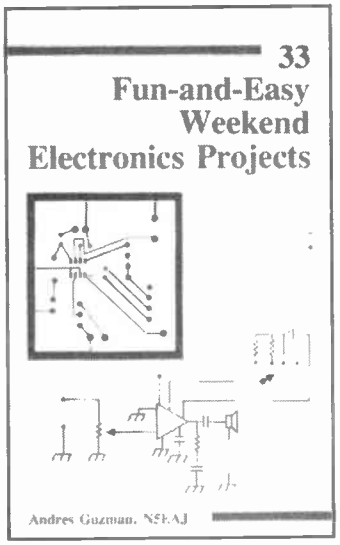
☐ **Next Issue**
Cover Date April 1988, on sale Thursday 10 March

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

Risky business – p25

Out of this world – p12

Easy analysis – p4



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

COMPACT OSCILLOSCOPE

The Hitachi V-1065 100MHz compact oscilloscope is now available ex-stock from Thurlby Electronics.

Measuring only 275mm (width) × 130mm (height) × 360mm (depth) and weighing just 6kg, it features cursor measurement, autoranging time base, trigger lock and a full 6in (8cm × 10cm) screen.

The use of two adjustable on-screen cursors enables voltage, time and frequency measurements to be made and the result displayed on the cathode-ray tube (CRT). This eliminates errors associated with lining up waveforms on graticules and visual estimations of observed values.

Time-base speeds range from 50ns/div (5ns/div with ×10 magnification) to 0.5s/div on the A (main) timebase with a continuously-variable control. The sweep time switch can be put into the autoranging mode, which will select the optimum sweep speed (approx 1.6 to 4 cycles of displayed signal). Manual override of this function is provided using an easy-to-use balance switch.

To reduce set-up time and errors, an on-screen display of CH1 and CH2 sensitivity, A and B sweep time, delay time and hold-off is provided. The delayed sweep function allows display of the A (main) and B (delayed) timebases simultaneously – thus providing a convenient method of partial magnification of waveforms. The delay time is displayed on the CRT.

The Hitachi V-1065 also incorporates a unique trigger lock function, which simplifies observation of complex pulse trains. With this function selected, the sum of the hold-off time and sweep time is kept constant, enabling changes of sweep time without loss of stable trigger.

Other features include a two channel X-Y display, a TV sync separation circuit, permitting triggering on vertical or horizontal signals, and a switching power supply accepting any line voltage between 90 and 250V ac.

The oscilloscope has been designed to meet the requirements of VDE0871 category B, and it costs £1450 plus VAT.

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

DIGITAL STORAGE ADAPTOR

The DSA524, new from Thurlby Electronics, is a low-cost adaptor which converts any oscilloscope into a high performance, dual channel digital storage oscilloscope.

The adaptor links to the oscilloscope using only one cable, so it is very quick and simple to connect or disconnect. The oscilloscope needs only one channel, and can have a bandwidth as low as 5MHz.

The DSA524 has a sampling rate of up to 20MS/s (megasamples per second) for single-event signals, and has a digitising memory size of 4096 words per channel. Repetitive signals of up to 35MHz can be captured, using an equivalent-time sampling rate of up to 2GS/s (gigasamples per second).

Digital summation averaging is provided for up to 256 recordings. This feature improves the signal-to-noise ratio of repetitive waveforms and can recover signals that are completely obscured by noise.

The DSA524 is fully programmable. Every front panel control, be it a switch or a rotary control, can be digitally programmed. An internal program memory can store up to 50 front panel settings which can then be recalled either randomly or in sequence for automated testing applications. Provided as standard is an RS232 compatible serial interface which can be used for remote programming, bi-directional waveform transfers, or driving hard-copy output devices. An IEEE488 interface, providing the same facilities, is available as an option.

The DSA524 digital storage oscilloscope adaptor is small and lightweight, measuring only 5.5 × 8.75 × 9in (140 × 220 × 230mm), and weighing 5lbs (2.25kg). It costs £585 plus VAT in the UK.

Thurlby Electronics Ltd,
New Road,
St Ives,
Huntingdon,
Cambs PE17 4BG.
Tel: (0799) 26699.

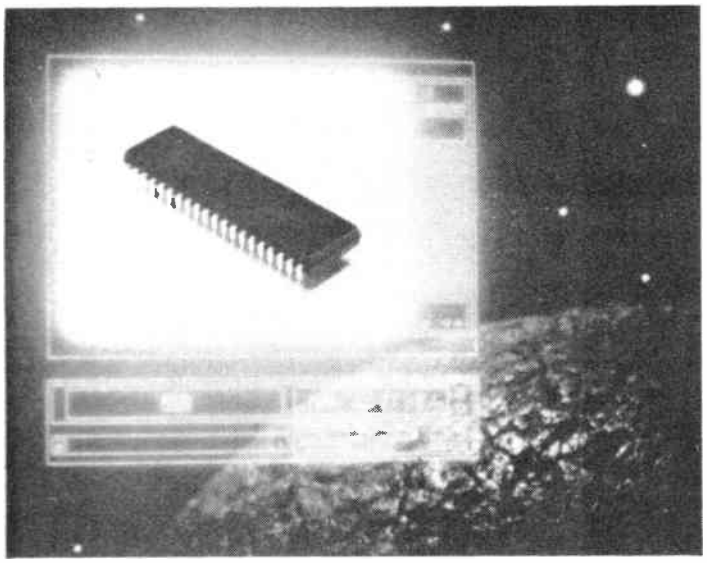
SPECTRUM ANALYSER

The HP8590A RF Spectrum Analyser, from Hewlett Packard, offers advanced features previously found only in high-performance models like the industry-standard 8568B, but it comes in a lightweight, sturdy package weighing only 13.5kg. The instrument has the versatility to handle virtually any RF signal measurement requirement, at a price that is significantly lower than previously-available instruments.

Designed for easy manual operation, the 8590A is the first HP spectrum analyser to have both dedicated pushbuttons, for frequently used functions, and menu-based softkeys, which access more than 80 additional functions. Most measurements require only frequency, span and amplitude selection, the analyser automatically adjusting remaining parameters for an optimised CRT display.

Under an exclusive distributorship agreement, Hewlett Packard's new HP8950A Spectrum Analyser is available ex-stock from Livingston Technical Sales, the first HP spectrum analyser to be made available through a distributor.

Livingston Technical Sales Limited,
Livingston House,
2-6 Queens Road,
Teddington,
Middx TW11 0LR.
Tel: 01-977 0055.



HIGH SPEED CONVERTER

The new UVC 3101-8 from ITT Semiconductors is a high speed combined A/D and D/A converter IC. It features on-chip auxiliary circuits to minimise the external component count in a variety of applications, including video.

This VLSI circuit, using collector-implant technology, comes in a 40-pin plastic DIL package. The circuit features an 8-bit flash A/D converter, a high-speed low-glitch 8/9/10-bit D/A converter (designed as an R-2R network with switched current sources), a reference voltage source, preamplifier, input clamping circuit, and feed-in output amplifier.

An impedance converter is connected upstream of the A/D converter to provide a high impedance signal input in spite of the high input capacitance of the A/D converter. The A/D converter reference voltage is generated on-chip, but both the ground of that circuit and the reference voltage are fed to pins, so that an external filter capacitor may be connected. The input is equipped with switches which optionally provide operation with keyed clamping or peak clamping or without clamping.

The D/A converter reference voltage is also generated on-chip, with a gated amplifier at the output of the D/A converter, so that an external analogue signal can be fed in instead of the signal delivered by the D/A converter.

Separate clock inputs are provided for the A/D and D/A converters, allowing them to be used for time compression. All inputs and outputs are TTL compatible.

Designed as a high speed video codec, the IC can be used in all applications calling for a high speed D/A-A/D converter: cable and satellite TV signal decoding, and industrial digital signal processing for example.

ITT Semiconductors,
145-147 Ewell Road,
Surbiton,
Surrey KT6 6AW.

FREQUENCY COUNTER/TIMER

The Kikusui FCO1130 frequency counter/timer, just announced by Telonic Instruments, joins Kikusui's range of oscilloscopes, power supplies and T & M products marketed in the UK by Telonic.

An 8 digit, 1GHz instrument, the FCO1130, is fully GPIB compatible. Utilising a 32 bit μP, this new frequency counter/timer has an automatic self check function (initiated on power up), and built-in frequency check.

Time or frequency measurements are displayed on an LED display – 8 digit plus exponent. The continuously variable gate time control enables optimum resolution of readings, with minimum possible gate time to be achieved. For low frequency measurements, cycle time is measured and the reciprocal calculated. The FCO1130 has two inputs – input A having high input impedance and covering 10Hz to 100MHz, and input B having 50 ohm impedance covering 80MHz to 1GHz. Sensitivity on Input A is 20mV on the X1 attenuation setting, and 0.4V on the X20 attenuation setting. Sensitivity on Input B is as low as 10mV.

The GPIB function – fully compatible with IEEE 488-1978 – enables remote mode section (frequency or period), and count transmission.

Telonic Instruments Ltd,
Boyn Valley Road,
Maidenhead,
Berkshire SL6 4EG.
Tel: (0628) 73933.

CD ENCODER

The Kenwood DA3531 CD encoder, now available from Thurlby Electronics, is a reference signal generator conforming to CD standards for use in evaluation testing of CD players.

In production use, the DA3531 can be directly connected to CD players to give symmetrically variable functions, and also to provide output from the laser pickup. It provides pickup simulation for all player signal patterns including dc bias addition, radial and focus error, and pickup simulation format.

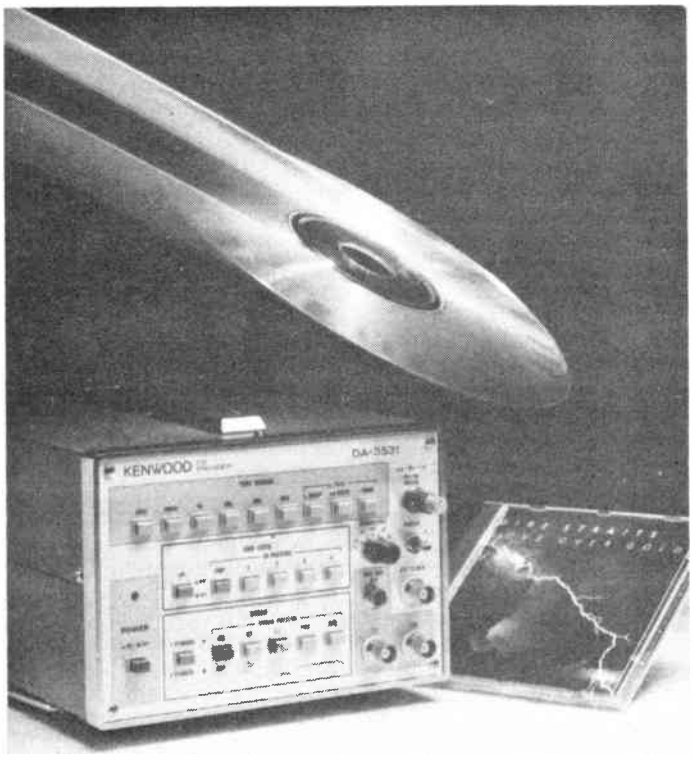
Nine test patterns in the range of 20Hz to 20kHz can be used to test audio frequency band characteristics, emphasis functions, crosstalk between left and right channels and inter-modulation distortion (IMD).

Sixteen sub-codes and eight error patterns are also available. An internal clock of 4.3218MHz is generated by a crystal oscillator and an external clock can be input as a TTL level signal.

The 16-bit precision and low distortion of the nine test patterns provide encoder performance fully adequate for testing D/A converters and lowpass filters.

The DA3531 is built to the normal high quality Kenwood standard, and offers value for money for a professional instrument. It costs £1850 plus VAT and is available from Thurlby Electronics.

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



NOISE GENERATORS

Two new bus-controllable sine and noise generators from Bruel and Kjaer combine accuracy, speed of operation and signal purity, for laboratory and production test and measurement in electronics and electroacoustics.

The 1049 and 1051 are multi-purpose signal generators with automatic sweep from 0.2Hz to 200kHz, and 1MHz resolution. They use digital synthesis for speed and accuracy, and the heterodyne principle for extremely low distortion, typically 0.0003 per cent.

Features include an IEEE interface for systems use, with fast settling time and no loss of speed when controlled via the bus. A high-accuracy output attenuator covers 100dB range with 0.3 per cent resolution. Phase-coherent frequency switching provides glitch-free output when the frequency is selected or swept, an important feature ensuring fast settling of the circuit under test.

The 1051 is a sine wave generator, and the 1049 provides sine waves plus white, pink, and narrow band noise.

The informative alpha-numeric display shows any three generator parameters simultaneously. The instrument can be automated to improve productivity with complex test and measurement tasks, including high-volume production testing applications. Up to nine set-ups can be stored and recalled, and sweep amplitude sequences can be learned, or low-frequency amplitude modulation obtained, using the Memory Learn feature.

The sweep control functions allow synchronous recording of frequency response using level and X-Y recorders.

The 1049 and 1051 are useful for R and D work, production testing and ATE. In electronics, they are especially useful in testing high-accuracy A/D converters. Other application areas include electroacoustic testing and vibration analysis. The 1049 with its compressor is ideal for automatic output level regulation of loudspeakers or vibration exciters.

Bruel & Kjaer (UK) Ltd,
92 Uxbridge Road,
Harrow HA3 6BZ.
Tel: 01-954 2366.

PINEAPPLE PCB

Pineapple has recently updated its popular PCB drafting program and, as well as many improvements in the standard ROM, there is now a second ROM available which gives the program full automatic track routing capabilities.

Sales of the standard PCB program have far exceeded the company's expectations, with many schools and colleges, as well as electronics companies, using the product.

The autorouting option is available to work with its full features, even on a standard unexpanded BBC micro, and the success rate of the autorouting is very high.

The autorouting update is available to registered PCB owners at £55.00.

Pineapple Software,
39 Brownlea Gardens,
Seven Kings,
Ilford,
Essex IG3 9NL.
Tel: 01-599 1476.

VIEWDATA SYSTEM

A low cost private viewdata host system running on a PC XT or AT compatible has been introduced by viewdata specialists, Tandata Communications.

Called Tanstar, it is a powerful system providing all the facilities required to create and manage a Prestel-type database, whilst its low cost makes it an economical proposition for a relatively small number of users.

Tanstar is run on a PC XT or AT compatible, which must have a minimum 10 megabyte hard disc. Users are connected via multiplexer cards, each of which has 4 ports. A maximum of 4 cards can be fitted to the PC, giving a maximum of 16 simultaneous users. The ports on the multiplexer cards can be either locally connected directly into a terminal or PC, or remotely accessed, when, obviously, an auto-answer modem and dedicated telephone line are also required for each port.

Many of the features usually found in word processing packages are combined with an easy-to-use menu-driven command structure. The Editor also includes a carousel facility, allowing a number of pages to be automatically displayed with a user defined interval between pages.

The interactive host software works in the same way as Prestel while the frame management system allows listing of the routes between pages, highlighting any discrepancies, listing frames which cross reference a particular page, copy or delete nodes of frames.

The basic software system retails for £3450 + VAT and at under £5,000 to include hardware. Tanstar can also form the basis of more sophisticated information databases to include the delivery of photographic quality pictures via interactive cable or data broadcast, while the database itself may be remotely updated via data broadcast.

Tandata Communications,
Albert Road North,
Malvern,
Worcs WR14 2TL.
Tel: (0684) 892421.

DISK CONTROL BOARD

Improved hard disk and floppy disk control functions are provided by a new IBM PC-AT compatible board developed by NEC.

In addition to incorporating the μPD7261A hard disk controller (HDC) and the μPD9306A digital hard disk interface to provide data separation and precompensation, the board also features a 512K-bit/32K-word data buffer. Combined with the HDC's powerful instruction set, allowing multi-sector read/write verify data etc, these facilities ensure operating speeds some 20%-30% faster than can be achieved with conventional controllers.

Floppy disk control utilises the μPD72065 (CMOS version of the industry standard μPD7635) supported by a high performance CMOS with separator, μPD71066. Maximum flexibility, for up to 4 drives, is achieved by automatic switching between standard and high density formats.

The floppy disk controller can also be used with a tape streamer for hard disk back-up.

NEC Electronics (UK) Ltd,
Cygnus House,
Linford Wood
Business Centre,
Sunrise Park Way,
Linford Wood,
Milton Keynes MK14 6NP.
Tel: (0908) 691133.

CLOCK/TIMEBASE SIGNAL

The SAF0300 from ITT Semiconductors is a CMOS integrated circuit for a car clock, which also provides a 64Hz timebase signal for an external device such as a speedometer with a recording facility.

The circuit is a good example of the reduction in space and costs that is possible by the use of ICs for automotive applications. It is one of a range of automotive ICs available from ITT.

Operating voltage for the SAF0300 is from 6 to 16.5V, nominally 12V.

The IC comprises an oscillator circuit, a fixed 4:1 frequency divider, a motor driver stage in bridge configuration, and a 64Hz push-pull output. The only additional component needed is a quartz crystal.

There are 16 pin connections to the circuit. Pins two to eight are frequency adjustment pins. They have an accuracy of 10^{-6}. When all the adjustment pins are open circuited, or connected to the supply voltage pin, then the output frequency is at a maximum. Grounding the adjustment pins successively decreases the output frequency. If all the pins are grounded, then the output frequency is reduced by 224ppm.

The divided-by-four oscillator frequency may be checked at a separate test terminal. Based on this check, the accuracy of the clock can be adjusted by using pins two to eight to control the output frequency.

ITT Semiconductors,
145-147 Ewell Road,
Surbiton,
Surrey KT6 6AW.
Tel: (0703) 229041.

ELECTROLYTIC CAPACITORS

Now available ex-stock from RR Electronics are two new Panasonic electrolytic capacitors. Both are improved versions of previous radial aluminium types.

The ESM series (0.1-100μF) is a replacement for tantalum capacitors. It therefore features low impedance and low leakage current. Temperature range is −40°C to +85°C. Voltage is −10V to 50V dc.

The HFS series (33-4700μF) is a small version of the HF series. It features low impedance at high frequency and low temperature, with long life at high temperature: 2000 hours at +105°C. It resists solvents Freon TE, TESm WD602 and TP-35.

RR Electronics Ltd,
St Martins Way,
Cambridge Road,
Bedford MK42 0LF.
Tel: (0234) 47211.

CMOS MICROPROCESSORS

The MHS 80C52 and 80C32 are now available from RR Electronics: two high-performance CMOS versions of the 8052/8032 NMOS single-chip 8 bit microcontrollers.

Applications for these microprocessors include telecommunications (modems, line card controllers), robotics, process control, automotive, computer peripherals and data terminals.

The two CMOS chips draw much less power than their NMOS equivalents, only 120mW at 12MHz, compared to 900mW for NMOS chips.

Clock frequency can be reduced to any value, even dc, without data loss, and radiation tolerance is greatly enhanced.

The 80C52 has all the features of the 8052, which include 8Kbytes of ROM; 256 bytes of RAM; 32 I/O lines; three 16 bit timers; 5-source, 2-level interrupt structure; full duplex serial port; on-chip oscillator and clock circuits.

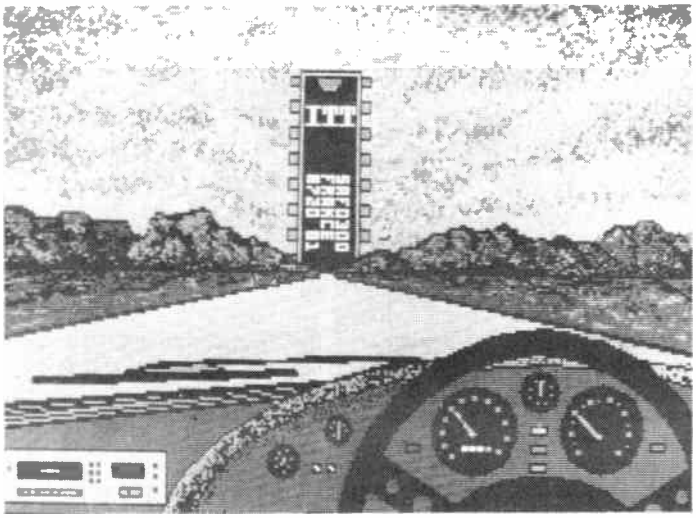
In idle mode the CPU is frozen while the RAM, the timers, the serial port and the interrupt system continue to function. In power down mode the RAM is saved, and all other functions are inoperative.

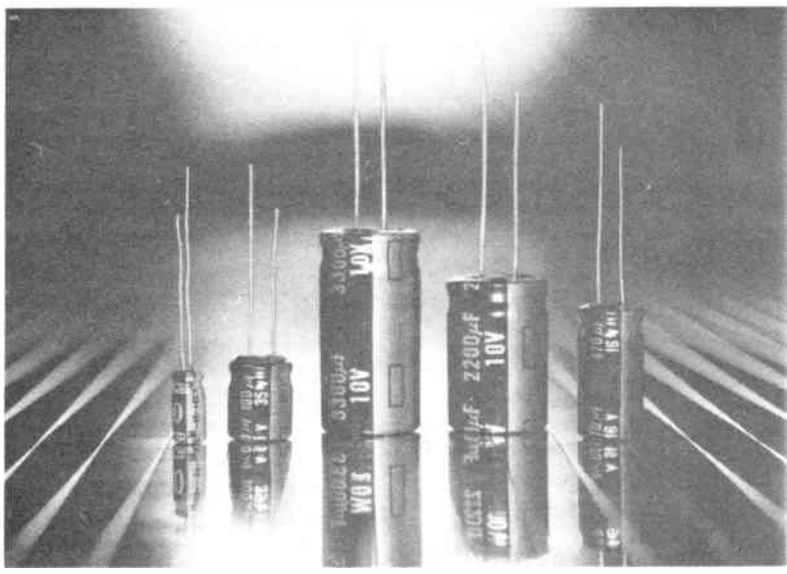
The 80C32 is identical to the 80C52, but without the on-chip ROM. The 80C32 is available ex-stock from RR; but there is a lead time on the 80C52 because of its factory-masked ROM.

Both chips feature a Boolean processor, five interrupt sources, programmable serial port and 64K of data memory space.

Temperature ranges include commercial, industrial and military.

RR Electronics Ltd,
St Martins Way,
Cambridge Road,
Bedford MK42 0LF.
Tel: (0234) 47211.





DATA COMMS CHIPS

Now available from Online Distribution are five new 68000 peripheral communications chips by Mullard.

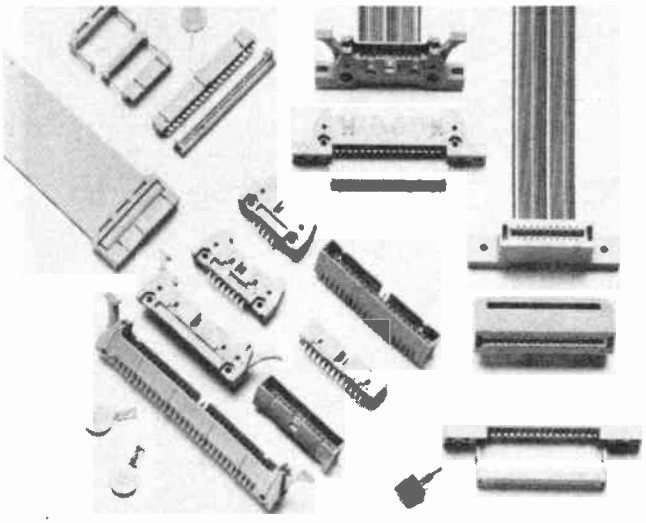
The SCN68681 dual universal asynchronous receiver/transmitter (DUART) comprises a dual channel, quad buffered receiver and double buffered transmitter. It features a parallel I/O port and 16 bit counter-timer.

SCN68652 dual universal serial communications controller (DUSCC): this handles asynchronous character and bit-oriented protocols, including X25 and BISYNC. A built-in digital phase locked loop provides NRZ, NRZ1, FM and Manchester encoding/decoding.

SCN68661 enhanced programmable communications interface (EPCI): a universal sync/async double receiver/transmitter with internal baud rate generator. The SCN68653 is a polynomial generator checker: a companion chip to the MPCC or EPCI. It is an error correction, code generation/comparator circuit.

The SCN68652 multi protocol communications controller (MPCC) is a synchronous communications controller; it has bit-oriented protocols SDLC, ADCCP, HDLC and character-oriented protocols BISYNC and DDCMP.

Online Distribution Ltd,
Melbourne House,
Kingsway,
Bedford MK42 9AZ.
Tel: (0234) 217915/272733.



FLAT CABLE CONNECTORS

The full range of 3M Scotchflex flat-cable connectors and accessories is now available from RR Electronics Limited.

The system does away with stripping, positioning and termination of individual wires. It connects flat cables to each other and to PCBs, DIPs and Delta-type subminiature racks and panels.

Connectors are in two grades: standard grade has 30μ inch gold plating; commercial grade has 10μ inch.

Headers are offered in 10-60 way straight or right-angle solder-tail versions. As well as the standard model, there is a low-profile version for PCBs with limited space.

There is also a wide choice of connectors for every application, including DIP, PCB, edgecards, Delta and DIN 41612.

A full range of Scotchflex tooling, junction shells, polarising keys and other accessories is available from RR Electronics.

RR Electronics Ltd,
St Martins Way,
Cambridge Road,
Bedford MK42 0LF.
Tel: (0234) 47211.

RFI FILTERS

A new range of filters from Corcom, the G Series, represents a compact, cost-effective solution to the suppression of noise in equipment that has to meet the conducted emission limits of internationally accepted specifications including VDE 0871, Level A and FCC, Part 15, Class B.

The G Series RFI filters are designed to provide excellent common-mode and differential-mode attenuation in most types of digital electronic equipment; in particular, switched mode power supplies, over the frequency range from 20kHz to 145kHz.

Two versions are available, both with a rated current of 6A. The 6VG1 offers maximum leakage currents of 1.25mA at 120V ac, 60Hz, and 2.1mA at 250V ac, 50Hz, while the corresponding figures for the 6EG1 are 0.3mA and 0.5mA, respectively. The EG model thus meets the very low leakage current requirements of SEV and VDE portable equipment, as well as UL544 non-patient connected medical equipment.

Corcom UK,
8 Westgarth Place,
College Milton North,
East Kilbride,
Scotland G74 5NT.
Tel: (03552) 44248.

SECURITY FILTERS

Corcom has developed a new range of filters designed to prevent unauthorised access to data via radiated emissions.

The new F3386 and F3387 filters are equally suited to high security applications in military, commercial or industrial systems. They also achieve a high rate of compliance to the US Government's TEMPEST standards by incorporating filter circuitry designed for extremely high common-mode and differential-mode attenuation over the frequency range 10kHz to 1GHz.

The mechanical packaging of the new filters complements the electrical design by bulkhead-mounting one surface of the filter and passing the leads through the panel to eliminate radiation round the filter.

The F3386 is rated at 3A and the F3387 at 6A. The filters are solder-sealed, and are designed to comply with all applicable UL requirements.

Corcom UK,
8 Westgarth Place,
College Milton North,
East Kilbride,
Scotland G74 5NT.
Tel: (0799) 26699.

NEW A/D CONVERTER

The new VAD2150 flash converter from ITT Semiconductors is manufactured in CI (collector implanted) technology. Designed in conjunction with ITT's Digit 2000 digital TV system, the integrated circuit is suitable for TV scramblers, digital Teletext decoders, video memory applications and D2-MAC satellite receivers; in fact anywhere a fast, low cost A/D converter is needed.

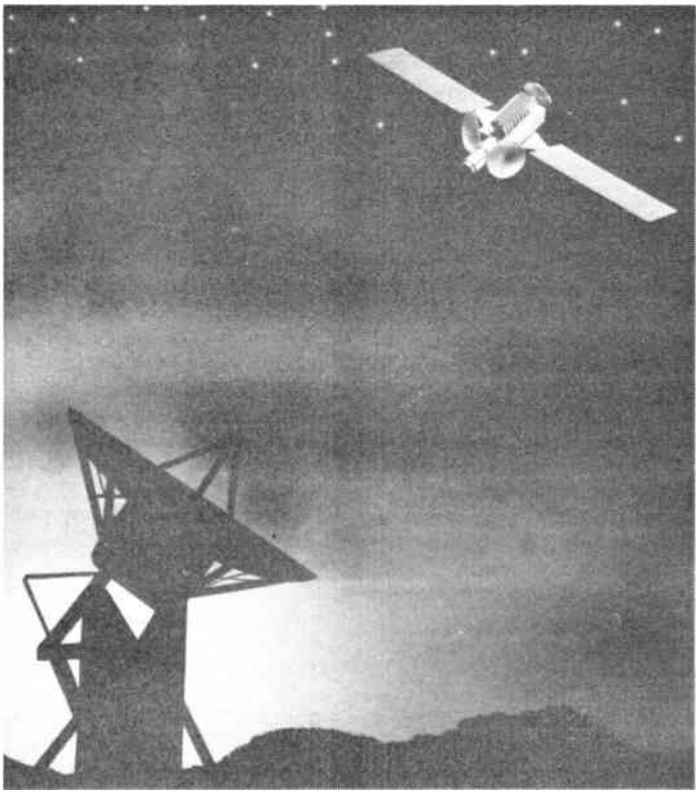
Mainly consisting of 127 fast comparators, the VAD2150 is a seven-bit converter. It operates at a high speed of 20MHz and is fully compatible with the Digit 2000 system.

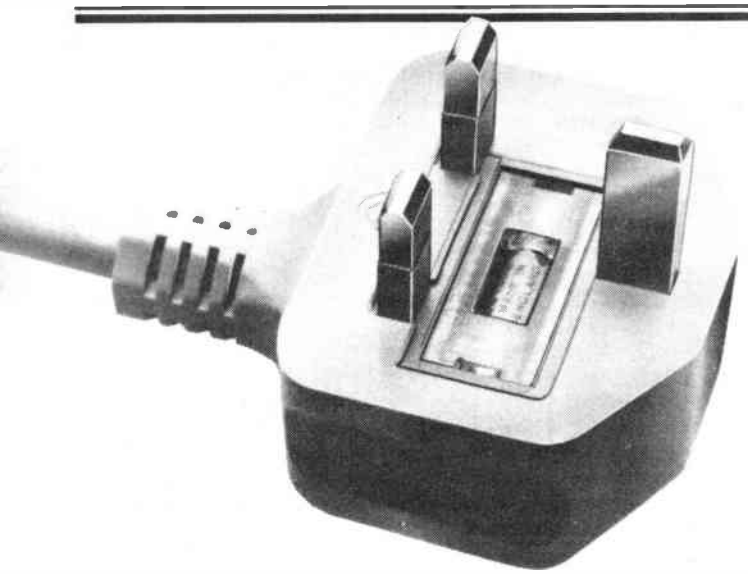
Two analogue inputs are provided for selection of different signal sources. Input A is used for large amplitude signals and input B for standard 1V signals. The sensitivity of the inputs can be doubled for increased resolution and better synchronisation of the output digital pulse.

A further option with the input circuitry is to create a pseudo 8-bit mode by toggling the input by half the LSB (least significant bit). The reference voltage is different for odd and even lines by half an LSB. This toggling increases the resolution of the video A/D conversion.

The analogue and digital sections of the VAD2150 have separate power supply pins to achieve a good decoupling between the analogue and digital circuitry.

ITT Semiconductors,
145-147 Ewell Road,
Surbiton,
Surrey KT6 6AW.





PLUG IT!

A new 13A plug from Feller UK provides good electrical isolation and mechanical integrity due to its seamless moulded body and part-sleeved live and neutral pins. A transparent plastic fuseholder allows quick and easy access to the fuse from the front of the plug. The snap-in fuseholder features a window which allows the fuse current rating to be seen at a glance.

Power supply cords and cordsets incorporating the new plug are available in a variety of cross-sections, lengths and colours. The cordsets feature equipment-end power connectors meeting UK and all existing international interconnection standards.

Specified lengths of cable, incorporating the new plug, are also supplied, allowing users to make the equipment-end connection.

Coiled or shielded cables are also supplied with the new plug attached. Supplied cords include HO5VV-F3G 0.75mm², HO5VV-F3G 1.00mm² and HO5VV-F3G 1.50mm². Two-wire ungrounded flat and round types include HO3-VV-H2F2 0.75mm², HO5VV-H2F2 0.75mm², HO3VV-F2 0.75mm² and HO5VV-F2 0.75mm².

Feller (UK) Limited,
Unit 1,
Middlefields Industrial Estate,
Throckley Way,
South Shields,
Tyne and Wear NE34 0NU.
Tel: (091) 455 1048.

SURVEILLANCE SYSTEMS

Ferguson is launching two new products to help protect the home under the 'Homescan' banner.

Increasingly, the public is concerned about what Crime Prevention Officers call 'access control', that is, monitoring exactly who comes into the home and why. There is rising awareness of the risk from con men, and women at home alone – particularly in major conurbations – who want to know who is visiting them.

Security consciousness is on the increase – and this is welcomed by the authorities. In the last six years, consumer spending on security has risen from £84 million to £175 million.

Ferguson is introducing two access control systems, both of which can be easily installed in a couple of hours by anyone competent in DIY.

The system comprises a video camera, which is capable of operating in total darkness, simple camera mounting plate, camera control unit and RF lead – everything needed to put the surveillance system into operation with the exception of a coaxial cable, which can be purchased from any good electrical retailer.

The camera should be mounted by the front door and the picture of the caller is fed through to a designated channel on a domestic television which gives one-way audio and visual communication.

By wiring the FHS1 through the doorbell system, an audible alarm will interrupt any TV programme being watched, to inform the viewer to switch to the appropriate channel to see and hear the caller.

The FHS1 can also be used inside the home as a baby minding device. The camera can easily be mounted on any 35mm camera bracket to focus on the cot or play pen, allowing you to see and hear that all is well.

The Ferguson FHS1 is simple to install, and is expected to retail at around £449.00.

The FHS2 system comprises a video camera mounted in a unit including a bell push, microphone and speaker, and a separate dedicated video monitor/control unit, both with wall-mount brackets.

Once again, the camera can work in total darkness and also offers two-way audio communication (a useful benefit for the blind and disabled). An electric door lock can be released by pressing a button on the monitor unit after the visitor has identified himself, and a light emitting diode (LED) indicator shows when the door is open, or unlocked. The system can be easily installed by anyone competent in DIY.

This versatile system is aimed at established family households, and will retail at around £749.00.

Ferguson Ltd,
Cambridge House,
Great Cambridge Road,
Enfield,
Middlesex EN1 1ND.
Tel: 01-363 5353.

CDS 37E

The CDS 37E is a digital CTCSS encode-only panel. This panel compliments the CDS VE tunable CTCSS encode panel, and provides a programmable encode-only facility for most two-way radio applications. The panel measures 19 × 21 × 10mm and has a 2.5mm header for convenient installation.

CDS Limited,
PO Box 83,
Basingstoke,
Hampshire RG25 2PX.
Tel: (0256) 83528.

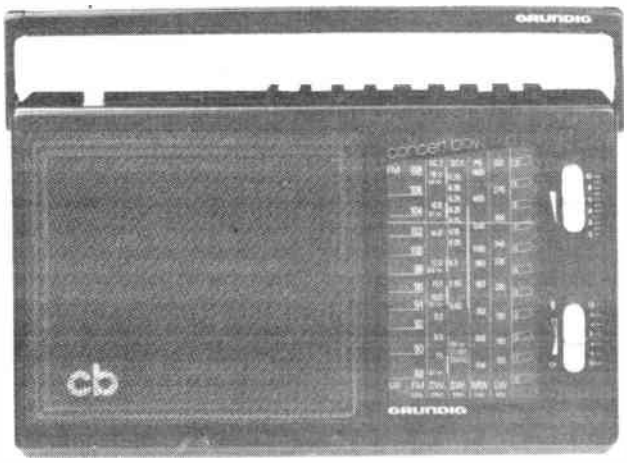
NEW MUSIC

Grundig have added the new Concert Boy 225 to their range of audio products – this brings their portable radio range up to four.

This compact, four band radio – MW, LW, FM (with AFC and four presets) and 2 SW bands: has a short wave coverage of 5.8 to 6.4MHz (49m band) and 6.8 to 18.5MHz (41m to 16m). Other features include slider volume and tone controls; large wide-band loudspeaker; 1.5 watt music power output and 3.5mm headphone socket. The radio can be mains or battery operated.

The Concert Boy 225 measures 31.5cm × 18.5cm × 7.2cm and weighs approximately 1.5 kilos. It is available in black, and the price is approximately £39.95.

Grundig International (UK),
Mill Road,
Rugby,
Warks CV21 1PR.
Tel: 01-379 7945.



NEWS DESK

Shuttle tests

NASA has announced that a major defect was found in the area of the shuttle solid motor nozzle during a test firing. NASA said this type of failure, had it occurred in actual flight, had the potential to replicate the Challenger disaster of nearly two years ago. The fault had to do with a burn-through of nozzle insulation. The failure was discovered after preliminary examination suggested that the test had been totally successful.

NASA acknowledged that the test failure was a 'major setback' and would definitely affect the planned June 1988 launch of shuttle Discovery.

Radio innovation

A revolutionary new radio service is being provided by BBC Radio with help from one of the UK's largest computer distributors, Rapid Recall, and its commercial end user division Rapid Solutions.

The new service, developed by the European Broadcasting Union, is being introduced throughout Europe and is called Radio Data System (RDS), which according to the BBC is the most significant advance in radio technology since the introduction of stereo broadcasting.

Because the broadcasting chain relies on a series of fail safe methods of operation, a computer with full back-up capabilities was specified.

The system supplied by Rapid is a MIRA System, manufactured by Digital Equipment Corporation, comprising two PDP-11 minicomputers running in tandem in 'Hot Standby' mode. If an error is detected in one computer, changeover to the other is automatic, and occurs without loss of data.

So advanced is the BBC computer installation, it is thought to be the first PDP based MIRA system to be installed in Europe.

Schools satellite link

The first live satellite videoconference between a British and an American school took place at 3pm on Thursday, December 17th 1987, from the London studio of the international television news agency Visnews.

Students of Acton High School, a west London comprehensive, linked with their counterparts at Hall High School, Milwaukee, Illinois, in a one-hour, two-way presentation and discussion via the BrightStar transatlantic satellite system.

The educational 'space-bridge', was inspired by Acton School's deputy Head, Tony Hewitt, and is the latest in a series of initiatives aimed at developing the technological and communication skills necessary for young people to succeed in an increasingly competitive and international environment. Robotics, computer communications and Japanese language, together with downlinks from CNN and the weather satellite, have all been introduced into the school's curriculum in the last two years, thanks to a grant made in 1986 by the Great Britain-Sasakawa Foundation and matched by the local Education Authority.

With further support from local and national enterprises, Mr Hewitt and the school's headmaster, John Leavold, are currently hoping to negotiate a regular one hour of transmission time on the Olympus satellite, so that visual links with European schools can foster friendship and understanding between youngsters of different countries and cultures.

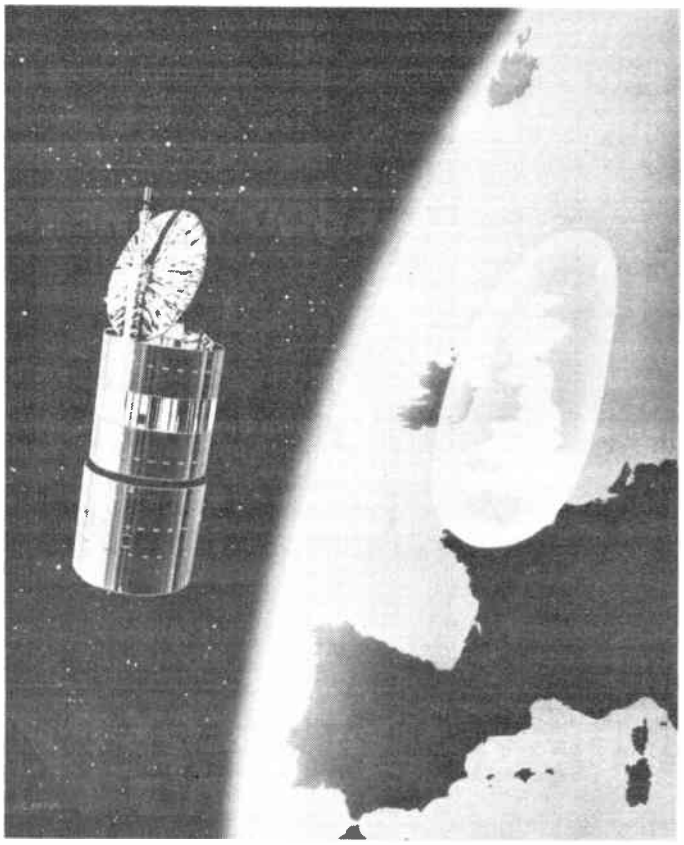
Thursday's videoconference, which was scripted and produced by the students themselves, included a presentation on the UK Education Reform Bill and a look at the stereotypes that other countries often assume exist in British society.

Each subject was discussed with the students in Milwaukee, who also made their own presentation on

24 hour broadcasting

In the two Hughes HS376 satellites to be tested in orbit before delivery to British Satellite Broadcasting (BSB) in August 1989, improved Super NiCad batteries will generate 110 watts of power for each of three direct broadcast channels, thus allowing the satellite's communications payload to be run at full power even while its solar cells are in eclipse – ie, in the Earth's shadow.

This will enable viewers to receive the powerful broadcasts through small antennas, only a fraction of a metre in diameter, at any time of the day or night and in any weather. For commercial communications satellites, which hover overhead in geostationary orbit, eclipse lasts from 20 to 70 minutes every evening during the spring and autumn.



But perhaps even more interesting is the way each channel's 110 watts is supplied. Instead of using high-power travelling wave tubes (TWTs), which have had questionable success in space, Hughes chose a design considered innovative for direct broadcasting services (DBS) simply because it uses medium-power travelling wave tubes in orbit.

Hughes' communications payload designers linked 55 watt TWTs in parallel with a common power supply to produce 110 watts per channel. This payload configuration makes it possible to transmit either three high-power channels or up to five channels at medium power.

The technique of doubling up tubes to produce increased power per channel is not new to Hughes. In 1982, tube paralleling was used, at Satellite Business System's request, on their HS376 satellite, SBS-3, for a possible medium power TV direct broadcast service. SBS-5, now being built by Hughes, has an even more sophisticated doubling scheme.

educational topics.

The involvement of Visnews and BrightStar in this unique event was prompted by Mr Frank Holmes, a Visnews engineer, who has spent much time helping Acton High School with its satellite programme in the past year. The companies also supported the event with a number of technical facilities.

Russian/Canadian Skitrek

Leo Labutin UA3CR and his colleagues in the joint Russian/Canadian Skitrek Expedition have returned to the USSR after training in Canada. The Skitrek is now due to depart on the three month cross-polar trek around March 1st.

An information pack about the Skitrek and the communications and navigation aspects using amateur radio has been prepared – tailored to educators who wish to include tracking the trekkers in their high school science classes. UO-11's speech synthesizer (Digitalker) will be carrying the trekker's position and should be easily heard on hand-held VHF-NBFM receivers.

To obtain the kit, please write to Richard Ensign N8IWJ, AMSAT Science Education Advisor, 421 North Military, Dearborn, MI, 48124, USA.

HF radio systems

The Fourth International Conference on HF Radio Systems and Techniques will be held at the Institution of Electrical Engineers (IEE), Savoy Place, London WC2R 0BL, from April 11th-14th, 1988.

The aim of the conference is to review recent advances in the theory, design, performance and operation of HF communication systems and networks. It will also provide a discussion forum for researchers, designers, manufacturers, users and others in the field.

Technical papers from 19 countries will be presented at the conference which will open with a keynote address by Mr Keith R Thrower, Technical Director, Racal-Chubb Ltd.

Sessions at the conference will cover the following topics: system design control and networking; antennas; noise, interference and modelling; propagation; RF equipment and techniques; HF radar and signal design and processing.

Next generation weather

British Aerospace Space and Communications Division has been awarded two study contracts, with a total value of over £150,000, for the second generation of European Meteosat weather satellites.

The studies, awarded by the European Space Agency, comprise a spacecraft systems study and a study for a microwave sounder – one of three principal instruments planned for the new generation of Meteosat satellites, expected to commence service in geostationary orbit by the mid 1990s.

Meteosat satellites, operated by the European weather satellite organisation Eumetsat, provide meteorologists with valuable data including the pictures which have become a regular feature of television weather forecasts. In addition to producing raw images and relaying processed data, Meteosat also relays data collected by remote Earth stations, weather balloons, buoys at sea, etc.

The new system will help to improve the accuracy of weather forecasts by providing better pictures and more data, including temperature and humidity profiles of the atmosphere.

Work on the study contracts, has been undertaken at the Division's Bristol site and will be completed by April 1988.

UoSAT operations

UO-11 has been returned to normal operations, running the original Diary software, following problems experienced with the new Forth Diary loaded in November.

Diagnostics have not shown up any software faults associated with the Forth Diary, and so memory 'worm' tests will be scheduled soon to assess whether there is a 'bad' portion of the 32kbyte memory which is normally used for WOD, but which Forth Diary was using.

Libration and spin built up during the Forth Diary problem – resulting in a z-spin period of around 15 seconds and the spacecraft losing gravity lock. Automatic despin manoeuvres carried out by the OBC just before Christmas succeeded in decreasing the spin to around 4 minutes (normal), ready for delibration manoeuvres. The 'old' Diary software cannot despin and delibrate simultaneously, and thus these manoeuvres take time, as despin increases libration, and delibration increases spin! The new Forth Diary (when operational!) can execute both these manoeuvres together.

USSR Mir

Three cosmonauts successfully docked with two of their colleagues on the Russian Mir Space Station on December 23rd. Mission Commander of the Soyuz TM-4 launch was Vladimir Titov, the pilot/engineer was Musa Manarov, and the research engineer was Anatoly Levchenko.

Later, on December 29th, three cosmonauts returned safely to earth – including Yuri Romanencko, who set a space endurance record of 326 consecutive days in space. He was accompanied by Alexandr Alexandrov and Anatoly Levchencko in the landing in Kazakstan.

Romanencko appeared weak as he disembarked from the Soyuz module and he was carried by stretcher to the waiting helicopter.

The Soviets have said the relief crew launched on December 21st will stay aloft as long as one year to study the effects of prolonged weightlessness as a prelude to a planned three year long flight to Mars in the next decade.

RR Electronics prize

Rob Smethers, director and general manager of RR Electronics, presented a Panasonic video recorder to customer Meng Leong of Balvin Electronics, London.

Mr Meng won the prize in a readers' competition in a recent issue of RR's customer newsletter, featuring Panasonic monitors and disc drives. Almost 1000 entries were received.

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

It was good to see amateur radio once again playing a part in the rescue of a ship's crew. In this country, amateur radio is justifiable by the authorities on the grounds that it contributes to the education and self-teaching of the electronics sciences. In America, the emphasis is on its contribution to community services. Its value in providing communications in disasters has a much higher priority there than here – no doubt because disasters in which amateur radio can provide much useful help occur more frequently in that part of the world than here, for which we should naturally be thankful.

However, occasions in which a radio amateur has been able to contribute significantly to life saving events have been quite frequent lately, and must help considerably in improving our public image. In the days when CB radio was trying to build up its public image, much was made of occasions when CB had contributed to some humanitarian activity, and as much media coverage as possible was sought for these occasions. Amateur radio here has been less ready to take advantage of occasions when it has participated in such activities.

It was encouraging therefore to see the good media coverage of Robert Watter's initiative; he intercepted a 'Mayday' call from the 2500 ton Panamanian-registered vessel 'Island Queen', bound from New York to Liverpool. He notified his local coastguards of the call, thus enabling them to start up rescue procedures with the minimum of delay. As most readers will no doubt have read, a successful rescue of 14 Pakistani sailors was made by a German fish factory trawler which was directed to the scene. Congratulations to Robert for his initiative.

Radio 4's 'Woman's Hour' recently gave some good amateur radio coverage when they interviewed Joan Heathershaw, the RSGB's President. Mentioning that there were one and a half million radio amateurs in the world, the interviewer started by asking Joan how she became involved in a hobby which is still usually regarded as a male rather than a female interest. It appears that when her husband came out of the RAF, he decided to take up amateur radio as a hobby, and Joan soon became fascinated with the contacts he made 'on the air', so much so that she too decided to apply for an amateur radio licence.

This she succeeded in getting and moreover learnt the Morse code, which she used more often than telephony, and she still enjoys using CW rather than phone. When she first got her licence, there were few female CW operators, so she was quite a rarity amongst amateur radio operators at that time and contacts with her station were much sought after. She has the callsign G4CHH.

The interview covered famous persons who have amateur radio as a hobby, the best known being no doubt the King of Jordan, who has the callsign JY1. The political taboos followed by radio amateurs in their contacts was covered as well as the amateur radio scene in the Soviet Union. Finally, the work amateur radio has done in 'emergency situations' as referred to above was mentioned. Altogether a very good interview, handled well by Joan and her interviewer.

Band plan crisis resolved

Last month we reported on the furore which had arisen over a proposal by the Japanese Amateur Radio League, that Japanese amateurs should be allowed to use FM transmissions in the satellite band, ie, 435 to 438MHz.

It is good to be able to report that, no doubt due to the extensive protests made to the Japanese authorities by radio amateurs interested in amateur radio satellite communications worldwide, the proposal has been dropped. So often, such protests seem to go unheeded and nothing comes of them. So it does pay to complain at times!

New radio control frequencies

Many radio amateurs are interested in building models of one sort or another, and any model which moves these days is usually expected to be radio controlled. There can be few radio amateurs who have not been asked to advise on applying R/C to someone's model, so at least it's useful to have some knowledge of the subject. The fact that the frequencies used by R/C participants are very near those used by radio amateurs makes this topic of particular interest.

For years, there have been complaints by each group that their activities interfered with each other. In the case of R/C controlled flying models, control may be lost through interference from a nearby high powered radio transmission. This was particularly so when the 28MHz band was 'open'. With the solar cycle once again giving good openings on ten metres, the problem is once again rearing its ugly head!

Radio amateurs were not the only ones to interfere with R/C. When CB radio was authorised, it was permitted primarily on the 27MHz band, and this caused very severe R/C interference. The writer knows of instances where regular flying had to be discontinued because of the presence of bystanders with CB radios who were using them whilst flying was in progress, thus jamming the model's R/C system.

Since 1st January 1981, it has not been necessary to have a Wireless Telegraphy Licence to use radio model control equipment, such as was required before that date. However, it is necessary for the R/C equipment to be designed and constructed in such a way as to operate in the specified frequency band, 26.96 to 27.28MHz, and the transmitter power must not exceed 1.5 watts. A secondary frequency of 458.5 to 459.5MHz may be used, when the output must not exceed 0.5 watts. There is also an allocation for model aircraft only, 35.005 to 35.205MHz, with a maximum power of 1.5 watts.

Citizens Band radio has now been taken under the wing of the Conference of European Posts and Telecommunications (CEPT), and frequencies in the 27MHz CB band have been formalised. The official notice dealing with this says: 'There is no compulsion for model control to move frequencies because of CEPT CB; however, model control has suffered in the past from CB interference, and this may increase with CB as a legitimate user of the band'.

The notice continues: 'The Department was conscious that model control would need additional radio spectrum to the 27MHz band. Consequently, the new frequencies at 40MHz were made available'. This refers to a new R/C band from 40.665 to 40.955MHz now being authorised. This is for 'surface' model control – the 35MHz band is still reserved for flying models only.

It is interesting to note that there is now a Joint Radio Control Users Committee (JRCUC), which meets from time to time with the DTI and industrial

representatives to discuss model control.

Further information about this committee may be obtained from the Secretary, Joint Radio Control Users Committee, Millett Street, Bury, Lancs BL9 0JA, and further information on radio control licence matters is contained in a leaflet on this topic, obtainable from: The Department of Trade and Industry, Radiocommunications Division, Model Control Information Unit, Room 712, Waterloo Bridge House, Waterloo Road, London SE1 8UA.

It might seem surprising that so much bureaucratic attention has been turned to what, at first sight, would seem to be solely a 'pastime interest'. It must be remembered, however, that R/C is nowadays applied to many 'professional' activities, ranging from aerial photography to data and telemetry systems. R/C has certainly moved up from being merely a 'hobby interest' to becoming a part of today's 'hi-tech' hardware.

Balloon flights project

More information has come in about the High Altitude Amateur Radio Transponder Balloon project which we reported in our January issue. The project has now been designated HART-1 – High Altitude Amateur Radio Transponder. The main technical details were given in our January issue report. We can now add the following details:

The aerials are both vertically polarised and omnidirectional. Due to the limited bandwidth, only SSB or CW should be used through the transponder. A station having a power output of 10 watts, into an antenna with 10dB gain, should be able to access the transponder at a distance of 250 miles when the balloon is at 30,000 feet.

To ensure that the weaker DX stations are not lost by QRM from stronger signals, no gain control has been designed into the transponder. This means that it is very important that the power limits of the ground stations must not exceed the limits set out above.

The power supply comes from a sealed rechargeable lead-acid battery supplying 14 volts at 2.6 amp hours, which it is anticipated will run the transponder and beacon for about six hours, when a low voltage sensor will switch the package off. The whole package measures 200×175×100mm, and weighs 2.7kg (6lb). If all goes well, in the near future Dani, the lady pilot, will attempt a new flight when it is hoped the transponder will be in operation.

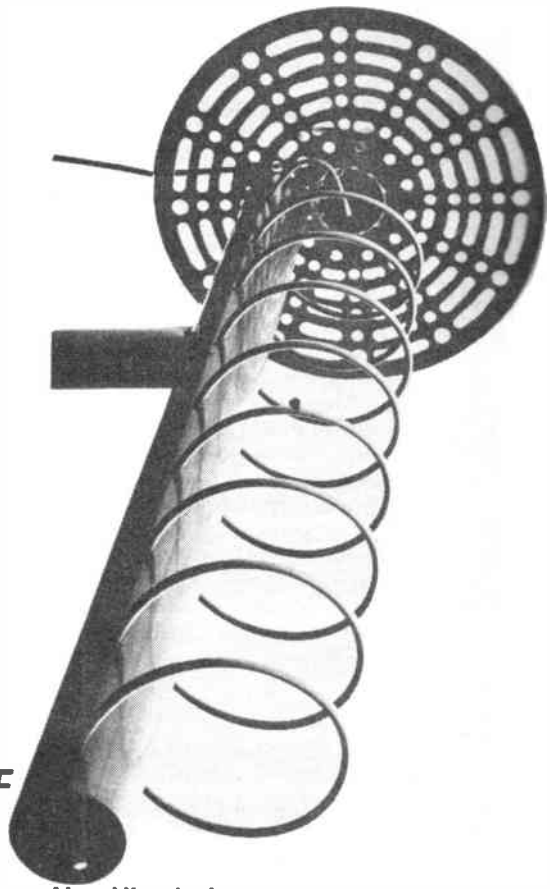
The 18 and 24MHz bands

Recent activity on these bands has raised the question of what modes of transmission are permitted on these bands. Whilst CW is the preferred mode, there are sections allocated for RTTY and SSB shown in some band plan schedules. However, in IARU Region 1 as a whole, CW is the designated mode of operation. Some countries within Region 1 may have a different schedule, but the UK 'A' Licence schedule states quite clearly that CW is the only mode permitted as far as we are concerned.

UoSAT usage

UoSAT 1 and UoSAT 2 are satellites for educational and scientific applications. According to a recent survey made on their use. The following countries signified that they are using these satellites in response to requests for activity reports on the UoSAT Bulletins: Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Czechoslovakia, Denmark, Finland, France, Germany, East Germany, Greenland, Guernsey, Hungary, India, Iran, Ireland, Israel, Italy, Japan, Malaysia, Mexico, Netherlands, New Zealand, Pakistan, Poland, South Africa, Sweden, Switzerland, UK, USA, USSR and Yugoslavia. RAW

THE STAR WARS BEAM



Not the latest in sci-fi weaponry, but a novel helical beam antenna design for UHF from Iolo Davidson

The axial mode helical antenna has many advantages including high gain, wide bandwidth, and compatibility with both vertical and horizontal as well as circular polarization. With all this going for the design it seems odd that it is entirely ignored, while Yagis sprout from every rooftop.

A possible reason for this neglect is that the construction of a helical beam looks like a daunting task, given the necessity of supporting a largish coil within precise limits using low-loss insulators. This need not be all that difficult however, as with this design all that is required is a length of the ubiquitous grey plastic drainpipe and a few carefully spaced holes. This method makes the helical beam actually simpler to produce than a Yagi of similar gain.

Table 1

Band	Diameter	Reflector	Pitch	Throat	Cone
General proportions, in fractions of a wavelength					
Any	.32	.8	.22	.12	.25
Practical measurements in inches –					
432MHz	8¾	22	6	3	6
UHF TV ★	5¾	14⅓	4	2⅐	4¼
934MHz	4	10	2¾	1½	3
1296MHz	3	7	2	1⅛	2¼
★ Centre frequency 660MHz					
Cone Matching Section Length as above, diameter below, all in inches –					
Conductor		**Reflector end**	**50 ohm feed**		**75 ohm feed**
¼		2½	9/16		⅞
⅛		1¼	9/32		7/16

Table 2

Turns	6	8	10	12	20
Gain in dB	12	14	15	16	17
Beamwidth (degrees)	47	41	36	31	24

About the design

The dimensions and electrical data for the antenna were taken from the RSGB Radio Communication Handbook. This contains a lovely exposition of the helix with lots of maths and data, but no constructional details.

The helix is made to have a circumference of one wavelength, with the turns spaced about a quarter wave apart, backed up by a one wavelength reflector. This reflector is not a parasitic element as on a Yagi, but is connected as a ground plane, and spaced about one eighth of a wavelength from the final turn of the helix. Exact figures are given in *Table 1*.

The helix array is inherently wideband, with a bandwidth from about three-quarters of the centre frequency to about one-and-a-third. Given a centre frequency of 660MHz, this would correspond almost exactly to the spread of the entire UHF television service, covering from 495 to 858MHz.

The gain of a helical beam is dependent on the number of turns in the helix. As you can see from *Table 2*, diminishing returns set in rapidly above ten or twelve turns, though some experimenters have gone to enormous lengths to obtain gains of over 20dB.

The fly in the ointment is that these gain figures apply to circularly polarized radiation. When sending to or receiving from a dipole based antenna, the gain will be 3dB less than the figure in the table. There is also a drop if the remote antenna is a helix wound in the opposite direction. My solution to this would be for *everyone* to wind their helix with a right hand thread.

If we accept the 3dB loss, we can still get a gain of 11 or 12dB with eight or ten turns, and this gain will be regardless of

ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

Mike Stone WB0QCD, head honcho of the US ATV Society (USATVS), made an interesting suggestion in the December issue of *Spec-Com* (the American ATV magazine). He wants to organise the biggest videotape swap ever and say 'Hello Europe'.

The plan is to fill a three-hour videotape with recordings of as many north American ATV stations as possible, introducing themselves and their shacks in two or three minutes. An invitation to them went out in the December 1987 issue of *Spec-Com* and Mike is confident that he will be swamped with entries. The best sixty or so will be edited together into a composite programme. This will then be converted from the American NTSC system to the PAL norms we use in most of Europe and the tape sent to EATWG for distribution among the national ATV organisations of Europe. They will then arrange for copies to be made available at cost to all who would like them.

It sounds like an admirable project and a superb showcase for amateur television. Obviously a lot of organisation will be involved, but so what? The end result will be worth it and we amateurs are no strangers to effort when it comes to worthwhile projects.

And what are we Europeans doing? The USATVS has invited us to reciprocate with our own videotape and EATWG has, of course, agreed. Since EATWG has member organisations in Britain, France, Belgium, Holland, Germany, Switzerland, Italy and Austria, we should be able to put together a pretty varied and comprehensive programme. Some ATVers will not be able to speak English and will have to make their tapes in their own language, but ATV is a universal language and I think this will add to the fun rather than detract from it. Watch out for more news on this project soon.

Activity in Belgium

Belgium has a new ATV club. ATVB (Amateur Television Belgium) is its name and the organiser is Jose Rabat ON7TP, who is at 41 rue Theodore Cuitte, B-4020 Liège. Jose is the ATV manager for Belgium and the Belgian representative on EATWG, the European ATV Working Group, which has achieved no small success in co-ordinating ATV operations in Europe.

The new Belgian club, too, is a sign of the growing interest in the television mode; it is also indirectly the result of the more tolerant attitude to amateur radio by the Belgian authorities. Only a few years ago ATV was impossible on 70cm in Belgium and banned on 23cm, and the old Belgian ATV club, called ATA, died out at the end of the 1970s. So it is good to have the Belgian ATVers back.

On screen news

So far ATVB has issued two quarterly newsletters, punningly entitled *ON SCREEN*. Apart from the obvious, the title incorporates ON, the call letters for Belgium. By giving the magazine an English title no offence is given to the Flemish and French-speaking inhabitants of Belgium, where language can be a political and inflammatory issue.

Inside the 14 pages of each issue the contents are printed in both languages and the club has two vice presidents, one Flemish and one Walloon. Most of the content is reprinted from the British *CQ-TV* and German *TV-Amateur* club magazines, but they hope to generate original material in due course. We wish them well . . .

Alford Slots for 70cm

The Alford Slot antenna is a favourite on the microwave bands. It combines low profile (and wind resistance) with all-round horizontal radiation and a fairly broad dimensional tolerance (you don't have to measure parts down to the last millimetre). It is cheap to build, fairly easy to construct and works well. Its omnidirectional characteristics and reasonable gain mean that it is used by several 23cm TV repeaters. All the same, I had never heard of its use on the lower frequencies, not until recently, that is.

In a recent *Spec-Com*, Merle Reynolds W9DNT of Moline, Illinois described how he had built an Alford Slot for seventy. Merle is a member of the Quad Cities UHF ATV repeater group (yes, they have TV repeaters on their 420-450MHz band there!) and they wanted an omnidirectional antenna for their repeater. Using a conventional kind of 'white stick' collinear would have meant altering to vertical polarisation and losing the chance of DX contacts, as well as causing problems with members who refused to change.

The reconfigured slot avoids that problem entirely, so here is the technical data in Merle's own words. A diagram is available, by the way. Send me an SAE care of the Editor.

This is a dual slot antenna and the overall length is 113in – yes, it's tall! It might be too tall for some installations placed at the peak of a tower mast. With the addition of a non-conductive PVC pipe attached to the top end of this antenna, it becomes an ideal mount for two side-arm brackets on a tower, or for nylon (or other non-interfering) tie-down guy wires to hold the lengthy slot in place as it will tend to be top heavy.

For a wider range of operating frequency the normal ½in slot openings may be increased slightly to ¾in. You'll have to play with the correct soldered placements of the dual feed phasing harness for the lowest SWR. It doesn't make any difference which side of the can is made 'hot' or grounded, as long as you do the same with both antennas, otherwise they will become out of phase.

How to make it

I used a recognised standard formula for designing the phasing harness. For example, at 435MHz (middle of band coverage) 246 (quarter wavelength) divided by 435 (frequency in MHz) works out as .5655ft or 6.786in. The velocity factor of RG-59U 75 ohm cable is 0.79.

American video

If you want to view American videotapes you will need a videorecorder and receiver/monitor capable of displaying the NTSC pictures they make there. The most attractive solution is to get a multi-standard recorder and TV: these tend to cost about 50 per cent more than single standard models.

If the tapes are VHS or Beta make sure they are standard play, because many multi-standard recorders cannot handle long play (LP) or extended long play (EP), also known as super long play (SLP) tapes.

New equipment is easiest bought from the specialist dealers in London's Edgware and Tottenham Court Roads, but you can often obtain second-hand (ex-rental) items at much lower cost from professional video dealers and video facilities houses (see Yellow Pages). This Hitachi CMT 2060 is typical of what you might pick up – the biggest market for this equipment is the Middle East, and the extravagant styling reflects this!

Therefore, 7.01 times 0.79 = 5.351103 which times 7 gives you about 37.5in per section of each phasing harness. On my testing, I ended up soldering these two contact points at exactly 21in up from the bottom of each antenna for the lowest obtained SWR.

Secure the coaxial leads somehow so that they do not get pulled down when erected and taped. Spray or goop some sort of weatherproof substance over the ends of the co-ax and soldering points. I spray painted the finished unit with flat black paint and covered up the slotted openings with thick, wide plastic tape. Do not be tempted to use grey or white cloth tapes as they deteriorate rapidly in the weather environment. Taping the slots also keeps the 'singing flute player' from playing any unwanted melodies.

Performance too

How did it perform at N9CAI-ATV/R? WB0QCD took down the four KLM 440-6 six element beam array used to receive at 439.25MHz (repeater input) and the single slot which had served the nearly 50-strong ATV group so well for the past three years. We stuck up my 'black' dual slot antenna and immediately began seeing great incoming coverage pictures from as far out as 30 miles in all directions, at P3 to P5 levels, and P1 to P2 at 40 miles and over. No one's signal was sacrificed in strength or coverage and, in fact, many had their picture levels improved.

It is hard to declare the actual gain of this antenna without taking it to an antenna range or VHF conference session. I don't like to guess, but the dual slot is best and honestly estimated at somewhere around 6 to 7dBd of gain. This is about what most UHF vertically polarised groundplane antennas perform at (and, after all, that is what we all set out to accomplish with the slots). Now we have a way to have our cake (be truly horizontal with no beam pattern distortion) and eat it too (remain horizontally polarised, in plane with the rest of Midwestern DX).

For those of you contemplating putting up an ATV repeater, remote transmitter or ATV weather radar transmitter in a horizontally polarised popular atmosphere, which until now has required the dangerous decision of making everyone go vertical, there is now an alternative. No one can say today that it just can't be done. We did it!

Sign-off

By the way, if you want to keep up to date with all that's going on in the north American ATV scene you ought to get hold of *Spec-Com*. An annual subscription (10 issues) will cost $30 (surface mail) or $50 (air mail). You can pay by credit card, avoiding the cost of international money orders, and the address is PO Box H, Lowden, Iowa 52255-0408, USA. Tell them you heard about them in *Radio and Electronics World!*

That's it for this month: it will soon be time for our next quarterly activity round-up, so send in those letters, photographs and reports. 73 until then.

NETWORK 934

Andy Emmerson G9BUP

Lots to relate this month, so let's pitch straight in. First of all some feedback from Brian BA172, alias UK105 from Weybridge in Surrey. He points out that some prices have risen a little compared with those I mentioned in a recent article. This is very likely; much of this equipment is imported and changing exchange rates can cause prices to rise and fall a bit. Also some dealers may charge different prices, but as a general guide the price levels mentioned hold good.

More interestingly, he mentions success in the opening of 5th and 6th November, when he worked stations in Cambridgeshire and Lincolnshire and heard others in north Humberside.

Fireworks in Tyne and Wear

Last month I mentioned that a despatch was promised from the Coastal Ducting Group of Tyneside, and ringleader Neil Jones (callsign LRDG) was as good as his word. His report of the 'Big Bang' lift on 5th November last follows...

Readers may be aware of several 934MHz stations active in north-east England, of whom some are keen to make DX contacts with other long distance stations in the south of England. Two stations in Tynemouth, north Tyneside, Neil (LRDG) and Gordon (GK05), are members of the North Tyneside Coastal Ducting Club and were recently in contact with a number of southern stations.

After having monitored the conditions in anticipation of an opening at the beginning of November, a lift nicknamed the 'Big Bang' occurred on the evening of the 5th November. A quick test the night previously between Neil and Andrew (NE01) from north Tyneside to Cleveland verified a pending lift. The resultant signals were positively above average over the distance of 33 miles.

The physical characteristics of the opening on the 5th were such that it moved from the west toward the east across the south of England, with many contacts made by LRDG and GK05 from Tynemouth. A list of stations contacted is given in the table; as can be seen from the contact distances there is no limit to the range achievable on 934MHz, given the right conditions, apart from actual ownership of equipment within European boundaries.

It is worth pointing out also from the list of contacts that the nearest distance was 102 miles and the furthest distant station was 400 miles, to the island of Jersey. The equipment used by Neil and Gordon was standard issue Delta One transceivers, Yagi beams and Nevada preamps, including long lengths of Pope H-100 cable.

The Ducters use computers constantly to calculate the distances in the list (using latitude and longitude co-ordinates). They also use their computers for designing aerials and working out their polar diagrams. In addition, they issue a special certificate to anyone making a contact in excess of 400 miles to one of the north Tyneside stations. Contact Neil on 091-252 9722 to stake your claim!

Well that's the word from Neil, and I hope it will encourage others to send in their news. I also hope that there will be a queue of people ready to work the Tynesiders during the next opening, all anxious to claim their certificates! Of course, not everyone has the good fortune (if that's what it is) to live at the far end of the country, though it does make claiming distance records easier. Those of us stuck in the middle of the country will have to mark our achievement with other awards!

Note that these results were obtained with normal, off-the-shelf equipment – no special high power amplifiers, negative attenuation co-ax or ultra low noise preamplifiers. All you need to work DX is patience and technique, which you can get by listening to the successful operators and by studying the signs. A good location helps, but everyone does well during an opening. And, in case you're wondering what the significance of coastal ducting is, it's a kind of enhanced propagation which tends to occur at low levels over water paths and enables long distance contacts to be made. Coastal ducting occurs across the English and Irish Channels and, for instance, between the north Kent coast and Essex, Suffolk and Norfolk.

Club news

Our two national clubs catering for the 934MHz movement have both just published their news bulletins. Newsletter 4 of the Personal Radio Club of Great Britain mentions the PRS demonstra-

tions made under the G9BSP callsign in the Birmingham area by John GB581 (we covered this in last month's *Network 934*). There is also a thought provoking piece on the future of CB radio in the UK, including letters from Nevada Communications and the DTI.

The 934MHz Club's magazine (issue 13) is a 40-page affair with area reports, an article on aerial planning and erection plus a report on the club's 1987 contest. On this occasion, the best DX was just 121 miles (mobile to mobile) and 102 miles (home base to home base), which probably represents the maximum range of 934MHz under normal conditions.

The winning stations were Cameron UK409 in the Mull of Galloway and David UK387 in Limvady, County Londonderry P(121 miles contact), and Cliff UK975 in north Yorkshire and Neil UK1132 in Lincolnshire (102 miles contact). Well done, and let's hope someone can beat these achievements in the next contest!

By the way, if you're not yet a member of either of these worthy organisations you can find out more by sending a stamped addressed envelope to PO Box 424, Althorne, Chelmsford, Essex CM3 6UP (for the 934MHz Club UK) or to 41 Twyford Avenue, Shirley, Southampton SO1 5NZ (for the PRCGB).

Contacts made from North Tyneside 5/6.11.87

Time	Name	Callsign	Location	Distance
5.11.87				
1905	Barry	JY808	Jersey	407 miles
1915	Charlie	UK2000	Sheffield	115 miles
2045	Frank	FC09	Melton Mowbray	159 miles
2100	Louise	LD815	Walbury Hill	255 miles
2130	Roy	RW39	Ripley (Derbys)	138 miles
2220	Dave	GB01	Leighton Buzzard	219 miles
2245	Paul	W91	Worcester Park	260 miles
2245	Ron	UK506	Surbiton	260 miles
2315	Derek	DT05	Lincoln	130 miles
6.11.87				
0010	Fred	ACME	Lincoln	130 miles
0125	Ron	RC06	Barton-on-Humber	102 miles
0125	Syd	KB249	Spurn Head	102 miles

Distances are approximate. No signal or radio reports are given because of variation in propagation. One mobile station who was outstanding was Louise (LD815) on Walbury Hill, 974 feet above sea level. She maintained a constant R5 S5 signal over two hours.

That's it for this month. Please make sure that 1988 is a bumper year for reader reports! Send them to me care of the Editor at Sovereign House. NEW

SPECTRUM WATCH

by John Andrews

For some while stories have been slipping out about the next generation of cordless phones, and Libera Communications, together with Ferranti, recently decided to launch their own particular second-generation cordless telephone (CT2 for short). The product is not in the shops yet and by the time it is, similar items from Shaye Communications (associated with Sinclair) and British Telecom (with a little help from STC) should also be on the scene. CT2 will be worth waiting for, as it offers a number of improvements on the existing cordless offerings.

The frequency band, in Band V, should minimise the risk of interference (but see below!), and there will be more channels available. Transmission will not be fixed on one frequency, but sets will instead scan up to 40 channels to find a clear one. Transmission will be digital, which will cut out eavesdropping and interfering noises, and secure calls. The new phones will give their users an additional facility, to use them not only with their home phone base station but also to make (not receive) calls out and about in the close vicinity of communal base stations. These, called 'Phone Zones' by Ferranti and 'Telepoints' by others, would be sited in shopping malls and transport terminals. Phone calls would be charged to the caller's home phone account, though the additional cost is not clear yet, nor whether signing up with one operator will give you access to all base stations.

CEPT, the standing conference of European post and telecom administrations, is trying to harmonise cordless telephone operations in Europe. Thus the frequency set aside for CT2 in Britain, 864-868MHz, will probably be the same in all western European countries. Can we therefore look forward to a universal, pan-European product, which can work in any country? Alas, probably not. It would be nice to think that the technology in our CT2 phones could be exported, and bring back a little kudos (and money). This might yet happen, but there are rival technologies being proposed by the Germans and by the Nordic countries, which have rival claims to being adopted as the CEPT standard.

Ah yes, that frequency. If you're a ham you will almost certainly have noticed that it's the second harmonic of 70cm and the sixth of two metres. I wonder if there will be any electro-magnetic compatibility problems, what we used to call interference? I hope not . . .

More cable-TV by microwave

Anticipating a trend towards delivering subscription TV by microwave rather than cable, British Telecom is experimenting with 29GHz television in Stowmarket, Suffolk. The system, devised at the company's Martlesham Heath laboratories, can deliver 10 to 20 channels of broadcast or high-definition TV over a radius of typically 1 to 2km. Transmitter height is 30 to 45 metres, so as to clear most obstacles. Receive antennas can be as small as 15cm in diameter, and the block downconverter is designed to feed a normal 950-1750MHz FM satellite TV tuner.

Dino-rad digs out bones

No, not Dyno-Rod, but dinosaur radar . . . radio in the form of a sub-surface radar is being used to detect the remains of fossilised dinosaurs possibly more than 100 feet long. This would make them half as large again as blue whales, according to estimates from vertebrae already found.

The remains of what may be the largest creature yet found lie beneath a 144 million years-old rock formation in the Jemez Mountains, New Mexico, and are being hunted electronically by scientists from Los Alamos National Laboratory. A radar pulse directed into the ground will be turned on and off, and the equipment will then listen for the returned echo. Penetration depth is expected to be up to 300 feet.

More transmissions for Germany

For many years the tuners of TV receivers sold in West Germany stopped at channel 60; this was because channels 61 to 69 were reserved for military communications and the authorities wanted to make sure nobody received these transmissions, even by accident. For the same reason, communications receivers sold in Germany do not cover the frequencies 26-30MHz, and TV sets in Germany have to contain circuitry that shuts them down if they tune into a non-

Rick Boran, an engineer from British Telecom's Mobile Communications division, fits a Cellnet antenna on the IBA transmitter tower at Beulah Hill, south London

Apart from Band III television and Band II radio antennas, this mast also carried the aerials of Britain's first two metre repeater, the fitting of which probably incurred considerably more risk!

video transmission such as mobile radio.

Pressure for additional (commercial) TV programmes is now making the federal German government reconsider its policy on channels 61 to 69 (808-862MHz), and public entertainment may over-ride considerations of national security.

If released, the new channels will not come into use before next year.

A new use of radio transmissions already in operation concerns the production of Volkswagen cars. The company is automating the manufacture of its Golf model, and is testing the use of radio transponders that emit and receive coded signals attached to car parts scheduled for assembly.

A central computer keeps track of the parts' locations and purpose, while intelligent workstations make use of the information received to make sure that processes are carried out correctly. The frequency employed is 433MHz, one of the bands set aside in each country for ISM (industrial, scientific and medical) purposes.

This particular ISM band lies within the 70cm amateur band, which is shared with several other users. Interference between users is, however, extremely rare.

Communications trivia again

High technology crosses the Atlantic fast, and two of the products I mentioned last time have reached these shores already.

Tandy's 'Blabber Mouse' radio – the one with an endearing looking mouse who 'talks' (or sings) faster as you turn up the volume – was in the shops in time for last Christmas, while the phoney cellular is also now with us. If 'status without the static' appeals to you, read on! Truly, it is the communications tool that keeps you in style without keeping you in touch. The features list is impressive:

maintenance free . . .

We have eliminated maintenance and costly repairs by eliminating the advanced solid-state circuitry.

static-free reception . . .

No fading, interference or irritating static, just crystal clear silence.

The mobile cellular phoney is a realistic plastic dummy cellphone, ready to mount in your vehicle, plus the mag-mount curly pigtail antenna to fix outside. You get an unconditional guarantee (that your phoney will never interrupt you, that you will never receive a bill for calls or rental and that the set is completely incompatible with all systems). There is even a security sticker to mount on the window, warning thieves that the phone is a fake and that any attempt to steal it will be the result of extreme stupidity. If your sense of humour is as warped as mine you will consider £12.99 money well spent. The seller is Status Systems, Main Road, Haisthorpe, Driffield, Yorks YO25 0NT.

News in brief

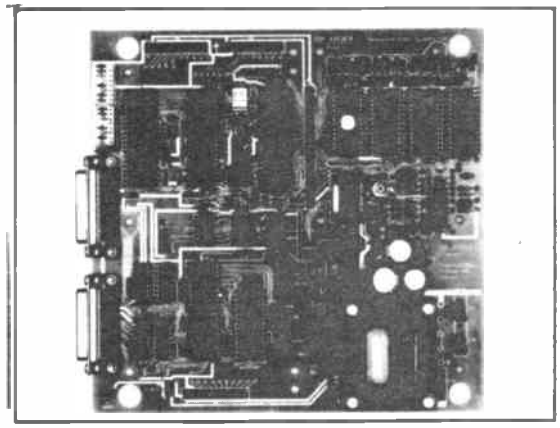
Phillip Smith, the inventor of the Smith Chart, died last August in Murray Hill, New Jersey . . . the United States currently spends about ten times as much as the UK on defence-related supplies and services. This is more than $100,000 million . . . at Menwith Hill in Yorkshire, the United States National Security Agency is to install a further eight 'golfball' radomes to supplement the seven already there. The first is almost complete . . . Cellnet has begun operation of ETACS transmitters at its Mayfair and North Paddington sites in London. ETACS (extended total access communications system) uses frequencies released by the Ministry of Defence to alleviate excessive demand for cellular radio in central London, the frequencies can only be used by modified cellphones but will relieve pressure on the remaining channels.

The Archer Z80 SBC

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

★ Top quality board with 4 parallel and 2 serial ports, counter-timers, power-fail interrupt, watchdog timer, EPROM & battery backed RAM.

★ **OPTIONS:** on board power supply, smart case, ROMable BASIC, Debug Monitor, wide range of I/O & memory extension cards.



The Bowman 68000 SBC

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

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

★ Extended width versions with on board power supply and case.

Sherwood Data Systems Ltd

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

UNIVERSITY OF OXFORD

Dyson Perrins Laboratory

RF Electronics Engineer

The Dyson Perrins Laboratory (The Organic Chemistry Department of Oxford University) requires an RF engineer to work on the development of instrumentation for nuclear magnetic resonance (NMR) spectroscopy. The work involves the design and construction of sub-systems for use with existing NMR spectrometers, and will entail the use of a wide range of RF and digital techniques. There will also be the opportunity to work with various microprocessor based control systems.

NMR is the major spectroscopic technique in organic chemistry, and is increasingly finding applications in biology and medicine. Oxford is an internationally renowned centre for work in this area, and this appointment provides an excellent chance to gain experience of an exciting new field in electronics. The instrumentation available is outstanding, including five spectrometers based on superconducting magnet technology and representing a capital investment in excess of £1M.

The Dyson Perrins Laboratory is situated in the main University Science Area in central Oxford, within easy reach of shops, theatres and other facilities. The working environment of the university provides both stimulation and flexibility. Salary will be negotiable according to age and experience, and the appointment will initially be for two years, with the possibility of renewal. Applications with the names of 2 referees should be sent to:

Dr A E Derome
Dyson Perrins Laboratory
South Parks Road, Oxford OX1 3QY.

Prices below normal trade. Some 1/10 quantity rate. Send 18p SAE or label for free catalogue. (OVERSEAS 2 REPLY COUPONS)

Millions of components: thousands of different lines

Rechargeable Nickel Cadmium batteries (ex unused equipment) AA(HP7) 1.25 volt 500 mA..... Set of four £2

ITT Mercury Wetted relay 20-60 VDC Coil. SPCo, 2A.....79p. 10-£5

LED illuminates Red, Green or Yellow depending upon polarity/current. 5 x 2½mm Face .....25p or 100 for £23 or 1000 for £200

10,000 Resistors. ⅓ to 2 watt. 1Ω to 22meg. ½% to 10% NOT a jumbled mass, but ready sorted into values .....£25 collected £29 Mail Order

5mm Red Flashing LED .....25p or 10 for £2.25

Watch/Calculator/Lighter etc Mercury Batteries Made by Ray-O-VAC 10 mixed popular sizes .....£1.50, 50 for £5.00

IN4004 or IN4006 Diodes..... 300 for £6.50

KBS005/01/02 3 amp 50 V/100 V/200 V/bridge rectifiers, 35p/36p/40p. 10 off £3.20/£3.40/£3.70. 100 off £30/£31/£34

Plessey SL403 3 Watt amp, From Bankrupt source, hence sold as untested.....4 for 60p or 10 for £1.20p

5mm LED, clear, lighting hyperbright (600mcd), red up to 200 times brighter (gives beam of light) ..... 25p, 100/£20, 1000/£150

Mullard 5mm LED, 40 red, 30 green, 30 yellow = 100 mixed £7

'HARVI' Hardware packs (nuts-bolts-screws-self tappers, etc) marked 35p retail, 100 mixed packs for £11.

Modern silver/black/aluminium, etc knobs 50 mixed, £6 (sent as 10 sets of 4 + 5 sets of 2 – 15 different type/sizes).

SEND PAYMENT PLUS 18p SAE

Postal orders/cash – prompt dispatch.
Cheques require 9 days from banking to clear.

Cheques drawn on Barclay's Bank not accepted.
Prices you would not believe before inflation!

BRIAN J REED

TRADE COMPONENTS, ESTABLISHED 31 YEARS
161 ST JOHNS HILL, CLAPHAM JUNCTION
LONDON SW11 1TQ.
Open 11am till 6.30pm Tues to Sat. Telephone 01-223 5016

THE EARLY COMMUNICATORS

By Stan Crabtree

The development of wireless telegraphy, as an acceptable means of transferring information, came about during the latter years of the 19th Century. Due to the perseverance of a small group of dedicated pioneers, the way was paved for radio communication as we know it today.

The academics are deservedly credited with the discovery of the principles. James Clark Maxwell, addressing the Royal Society in 1864, outlined the existence of wireless propagation in a paper entitled *A Dynamical Theory of the Electro-magnetic Field.* He proved it by mathematics. Heinrich Adolf Hertz, the German scientist, went a step further and actually produced radio waves in 1887. But these were all within the confines of the laboratory. In England, Sir Oliver Lodge had conducted experiments on the tuning or 'syntony' of oscillatory circuits producing radio waves, but had not progressed to, or been concerned with, their practical use for distance communications.

Forerunner of the practical men was undoubtedly Guglielmo Marconi. He had been taught the Morse code by a retainer on his father's estate near Bologna. This old gentleman had been a landline telegraphist and his reminiscences must have fired the enthusiasm of his protégé.

Marconi's early experiments, like most of his distinguished contemporaries, generally ended in the closure of contacts which would give a meter deflection or ring a bell. This proved the extent of the range of a system, but it cannot be said to have constituted the communication of information. However, in his ability to achieve an increase in range it was Marconi who first considered the possibilities if the hertzian waves he was radiating could be broken up into the Morse code.

The limitations of passing Morse signals at this time were undoubtedly on the receive side and in the form of the coherer. This was a glass tube which held loosely packed metallic filings which passed a current when influenced by electro-magnetic waves. Acting as a switch, this enabled the energising of a relay which actuated an ink recorder, a unit utilised from the landline telegraph service. It reproduced Morse characters on a paper tape.

The transmitter of the period was a battery powered 10in induction coil, keyed in the primary circuit with a spark gap across the secondary winding. At this stage no tuning arrangements were in use; both transmitter and receiver were lacking any form of planned resonant components. When the spark gap broke down, the 'damped' oscillations died away quickly, as there was no reinforced energy to maintain them. The coherer responded, albeit sluggishly, to a signal of sufficient power irrespective of frequency. Morse speeds were inevitably confined to around 5wpm; nowhere near the manual keying rate in everyday use on landline telegraph circuits. With the restriction imposed by the coherer, it is difficult to see how this could have been any higher.

The scientists were still experimenting, but their results were not readily available to the practical men. Lodge was aware of Marconi's experiments, but their relationship at this time was hardly conducive to the imparting of knowledge. Lodge had spent some time conducting tests on tuned circuits as far back as 1889, and had proved the effectiveness of transmitting and receiving circuits having the same resonant frequency. He had also replaced the Morse inker by a telephone earpiece. Noting it was more sensitive, he had patented the design in 1897. For some reason this device was not put into general practice until a few years later. The ink recorder was the accepted piece of equipment, possibly because of the permanent record it presented. The receiving operator could also take his time interpreting the Morse characters.

The first man to join Marconi was George Kemp, a laboratory assistant with William Preece, Engineer in Chief at the GPO. Kemp had the ideal background: an ex chief petty officer instructor, with electrical experience, he later became Marconi's chief assistant.

A contemporary of Marconi at this time was Captain H B Jackson RN, later to become Sir Henry Jackson and First Sea Lord. During 1895-1896, Jackson conducted his own experiments on HMS 'Defiance', the Royal Navy Torpedo School at Devonport. Having no knowledge of Marconi or his work, he had, quite independently, progressed to constructing his own induction coil spark transmitter and a coherer detector containing a mixture of tin and iron filings in an ebonite tube.

Jackson, although a practical man, had considerable technical knowledge. In 1883 he had been elected an Associate of the Society of Telegraph Engineers – forerunner of the Institution of Electrical Engineers. Like Marconi he had set himself the task of achieving distance communication by the use of Morse, and with the resources available he was in an ideal environment to do this. At this time the ranges obtained had not been

Early radio pioneers Guglielmo Marconi and Ernst F W Alexanderson in the 1920s (photo courtesy General Electric)

spectacular, but Jackson was keen to see his new apparatus utilised in the Royal Navy in a practical form – the passing of information between vessels at sea. In one report to his superiors he had pointed out that the power dissipated to transmit Morse signals 2 miles was 13 watts, whereas that for working the masthead flashing light was 250 watts. Jackson could see the potential of wireless telegraphy in a marine environment. In this, of course, he was akin to Marconi.

Jackson met Marconi in August 1896, during a conference at the War Office, and later during trials on Salisbury Plain. Their meeting was the start of a relationship which continued for many years. Marconi was at least one year ahead of Jackson in equipment development and distance performance, but Jackson was able to contribute with his knowledge of shipboard aerials and suggestions as to how the equipment of the time could be made sufficiently robust and stable for maritime operations. At this time Marconi had conducted no experiments on ships.

Lieutenant Luigi Solari of the Italian Navy is credited with significant improvements to the coherer. Holding a degree in electrical engineering he was also a very able, practical man. He first met Marconi in July 1897, when the latter was conducting a demonstration of his equipment for the Italian Navy at Spezia. Solari, on board the 'San Martino', was involved in these tests and with Signalman P Castelli was able to perfect his coherer in which a globe of mercury replaced the usual metal filings and was therefore 'self restoring'. Masts of 120ft were used on shore and the aerial span on the vessel was 115ft. Subsequently a range of 8 miles was achieved – a record at this time. Solari was appointed to the 'Carlo Alberto' when the warship was placed at Marconi's disposal for range checks from Poldhu. It was at this time that Marconi began work on his magnetic detector, which was eventually to supersede the coherer receiver.

The Wireless Telegraph & Signal Co Ltd was formed in July 1887 and a few months later Marconi built his first coast station at Alum Bay on the Isle of Wight. The idea of elevated aerials had finally been accepted and the use of copper reflectors abandoned. Being his first permanent site, he was able to erect aerials on masts 120ft high. Range tests were conducted by installing coherer receivers on the two daily ferry steamers on the triangular route to Bournemouth and Swanage. This resulted in successful telegraphic communication at 4wpm at a distance of 18½ miles at the most distant point. A further transmitter was fitted at the Haven Hotel, Poole to enable more tests.

During June 1898 Marconi and Kemp mounted an effective operation between them during the Kingstown Regatta off Dublin. Sponsored by a Dublin newspaper, this afforded the Company much publicity. Marconi operated from the tug *Flying Huntress* with a 65ft aerial. Keeping up with the leaders, he transmitted the placings of the yachts to George Kemp, who was manning the land station established in the Harbour Master's office. At times ranges of 15 miles were covered.

One of the first permanent marine fittings was on the East Goodwin light vessel in December 1898. This time Kemp went offshore to install the equipment whilst Marconi operated the South Foreland station some 12 miles distant. Kemp was unfortunate in that after his Christmas Dinner the weather deteriorated very badly and the lightship was subjected to very heavy seas. Kemp had planned to stay on board for 12 days, which expired on the 25th. As no relief boat could come alongside, it transpired that he was confined on the ship for a further 10 days.

From 1896 to 1900 there was very little change in the design of W/T apparatus. One serious limitation was the lack of effective tuning, especially in the transmitter. Because of this, receivers were susceptible to virtually all transmissions within range. This did not become apparent until more stations became operational. It meant the descrambling of Morse signals was left to the operators, but this was only possible when a telephone earpiece was used with the coherer. When the output of the coherer was taken direct to an inker or Morse sounder, a mixture of two transmissions would be indecipherable.

Some improvement was achieved by Marconi when he introduced an RF transformer in both transmitter and receiver. Known as a 'jigger', it provided a high impedance input to the coherer for a voltage fed signal. The transmitter aerial was no longer part of the oscillatory circuit, but now inductively coupled to it. Further, by using a large inductance and some, albeit small capacitance, some attempt was at last being made to resonate the aerial to the required wavelength of transmission. The frequency spread of radiated energy was reduced somewhat, but working in the range 300-2000 metres (1000-150kHz), keyed class B (damped) signals still occupied an appreciable stretch of the air waves.

Although the equipment was relatively basic, it needed care in its adjustment and maintenance. Aerial coupling was critical and when setting up, time had to be spent in obtaining the correct degree in order to produce as narrow a radiated wave as possible. Tight coupling meant a double peaked response, which resulted in a very wide passband being radiated, albeit of reduced power. This inevitably caused interference to other stations. The spark gap and the induction coil contact breaker required careful adjustment and also regular cleaning. In operation, optimum results would be obtained with the gap at a certain distance, but this could change with humidity or a change in temperature.

It became the general practice for operators to indicate the size of their respective spark gaps at the commencement of each contact. If signal strength was reported poor or less than usual, the distance between the spheres would be altered in an effort to improve communications.

The coherer also required careful handling. It soon became general practice to enclose the instrument in a metal screening box to reduce the effects of the station transmitter. The received output was low and therefore a relay was essential to actuate the Morse inker or sounder.

The continual interruption of the primary circuit, even with small induction coils, took its toll on the Morse key. These were quite large with platignum contacts, but soon became worn and corroded and needed diligent maintenance.

The Summer Manoeuvres, held by the Royal Navy in July 1899, presented an ideal opportunity to demonstrate just what wireless telegraphy could achieve at this point in time. Three ships were fitted with W/T and one of them, the cruiser 'Juno' was commanded by Captain Jackson. He invited Marconi to join him and observe the wireless operations. Marconi technicians were used in ships fitted with his equipment, but they shared watchkeeping duties with Naval ratings.

Wireless communication played an important part in the exercises, significantly so that the demonstration convinced the Admiralty of the advantages of wireless at sea. A range of 60 miles had been achieved between 'Juno' and the cruiser 'Europe'. At the start of the exercises, 'Juno' received signals from Alum Bay at a distance of 87 miles. This was a record for distance communication at this time. Traffic was exchanged at an average rate of 10wpm during weather that changed from bright sunshine to rain and fog. Another useful point noted was that signals were passed irrespective of whether the vessels were stationary or operating at high speed. Marconi was especially pleased to note the contribution of his new tuning arrangements on the transmitters. He discovered a distance of only 7 miles was obtained when the aerial transformers were removed.

Marconi gradually built up a staff of operators to man the various stations he was contracted to provide. In general he recruited from technical colleges. Some entrants came from the telegraph service, but his requirement for men who had some technical knowledge and background meant he had to be selective. In most cases the new company employees would be operating a station on a ship, or at some remote location, and therefore it was essential they should be fully competent. In September 1901 the first residential training school for W/T operators was opened in the quiet little coastal resort of Frinton on Sea, Essex. Two years later this was moved to Chelmsford.

The turn of the century saw a marked increase in this new system of communication. The first North Atlantic passenger vessel was fitted with wireless, and fixed land stations were contracted for as far afield as South Africa. And improvements in equipment resulted in a significant increase in workable ranges.

DATA FILE

Ray Marston looks at practical low-power voltage converter circuits

Electronic voltage converters are circuits that are used to generate a higher value voltage supply from an existing low voltage dc source, or to generate a negative dc supply from an existing positive dc voltage source. Such circuits are fairly easy to design and build, using either readily available components or a special purpose IC such as the ICL7660 voltage converter. A variety of low power versions of such circuits are shown in this edition of *Data File*.

Low voltage generation

The easiest way to convert an existing dc voltage into a dc voltage of greater value or of reversed polarity is to use the existing supply to power a free-running square wave generator which has its output fed to a multi-section capacitor diode voltage multiplier network (as shown in *Figure 1*), which thus provides the desired 'converted' output voltage. If a positive output voltage is needed, the multiplier must give a non-inverting action (as in *Figure 1a*), but if a negative output is required the multiplier must give an inverting action (as in *Figure 1b*).

Practical converters of this type can use a variety of types of multivibrator circuit (bipolar or FET transistor, CMOS or TTL IC, etc) as their basic free-running square wave generators; in all cases, however, the generator should operate at a frequency in the range 1kHz to 10kHz, so that the multiplier section can operate with good efficiency while using fairly low values of 'multiplying' capacitor.

One of the easiest ways of making practical voltage converters of this type is to use type 555 'timer' ICs (which can supply fairly high output currents) as the free-running square wave generators, and *Figures 2* to *5* show a selection of practical circuits of this type.

In all of these circuits the astable is wired as a free-running astable multivibrator or square wave generator and operates at about 3kHz (determined by the R1-R2-C2 values). Supply line capacitor C1 is used to prevent the 3kHz output of the 555 from feeding back into the IC, and C3 is used to further enhance circuit stability.

The *Figure 2* circuit acts as a dc voltage doubler, and generates a dc output voltage that has a value roughly double that of the 555 supply line voltage; the output of the 555 IC is fed into the C4-D1-C5-C2 capacitor diode voltage doubler network, which produces the '2 × Vcc' output voltage.

The 2 × Vcc value mentioned above is the approximate value of output voltage obtained when the output is unloaded; the precise value equals 2 × Vpeak, minus (Vdf1 + Vdf2), where Vpeak is the peak output voltage of the square wave generator and Vdf is the forward volt drop (about 600mV) of each 'multiplier' diode. The output voltage decreases when the output is loaded.

The *Figure 2* circuit can be used with any dc supply in the range 5 to 15 volts and, since it provides a 'voltage doubler' action, can thus provide outputs in the approximate range 10 to 30 volts. Greater outputs can be obtained by adding more multiplier stages to the circuit. *Figure 3*, for example, shows how to make a dc voltage tripler, which can provide outputs in the range 15 to 45 volts, and *Figure 4* shows a dc voltage quadrupler, which provides outputs in the range 20 to 60 volts.

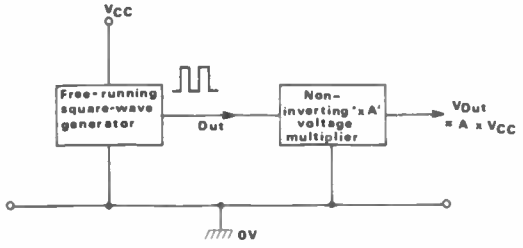


Fig 1a *Voltage converter with positive output*

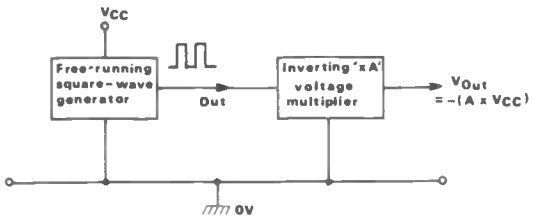


Fig 1b *Voltage converter with negative output*

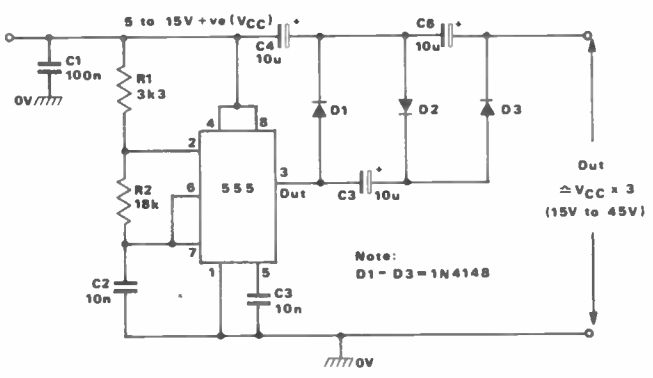


Fig 3 *dc voltage-tripler circuit*

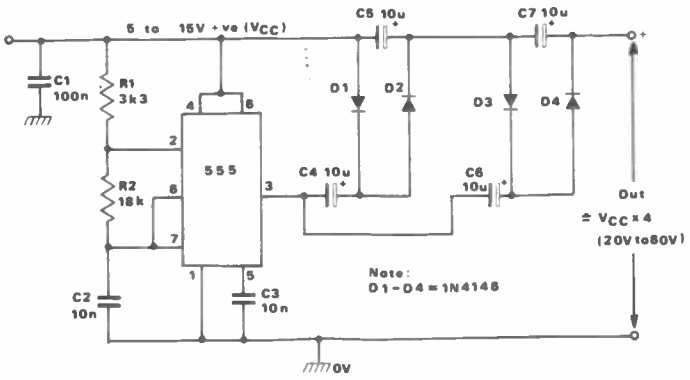


Fig 2 *dc voltage-doubler circuit*

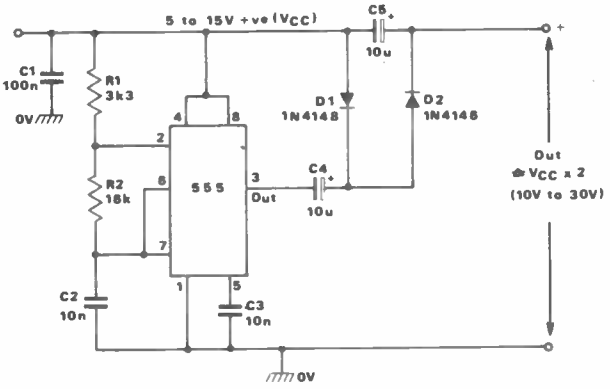


Fig 4 *dc voltage-quadrupler circuit*

A particularly useful type of 555 'converter' circuit is the dc negative voltage generator, which produces an output voltage that is virtually equal in amplitude but opposite in polarity to that of the IC supply line. This type of circuit can be used to provide a 'split-supply' output for powering op amps, etc, from a single-ended power supply. *Figure 5* shows an example of such a circuit, which also operates at 3kHz and drives a voltage doubler (C4-D1-C5-D2) output stage.

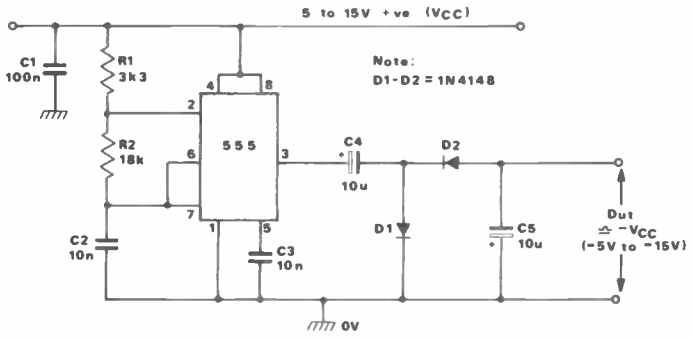


Fig 5 *dc negative voltage generator*

High voltage generation

The 'voltage multiplier' method of generating increased values of output voltage is normally cost effective only when multiplier ratios of less than six are needed. In cases where very large step-up ratios are required (as, for example, when hundreds of volts must be generated via a 12 volt supply), it is usually more cost effective to use the output of the low voltage oscillator or square wave generator to drive the input of a suitable step-up voltage transformer, which then provides the required high value voltage (in ac form) on its secondary (output) winding; this ac voltage can easily be converted back to dc via a simple rectifier-filter network, if required. *Figures 6* to *8* show some practical low power, high voltage generator circuits of these types.

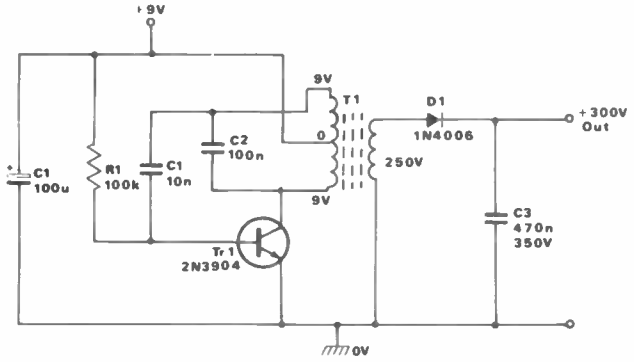


Fig 6 *9V-to-300V dc-to-dc converter*

The *Figure 6* circuit acts as a dc-to-dc converter which generates a 300 volt dc output from a 9 volt dc power supply. In this case Tr1 and its associated circuitry act as a Hartley L-C oscillator, with the low voltage primary winding of 9V-0-9V to 250V mains transformer T1 forming the 'L' part of the oscillator, which is tuned via C2.

The supply voltage is stepped up to about 350V peak at T1 secondary, and is half-wave rectified by D1 and used to charge C3. With no permanent load on C3, the capacitor can deliver a powerful but non-lethal 'belt'. With a permanent load on the output, the output falls to about 300V at a load current of a few mA.

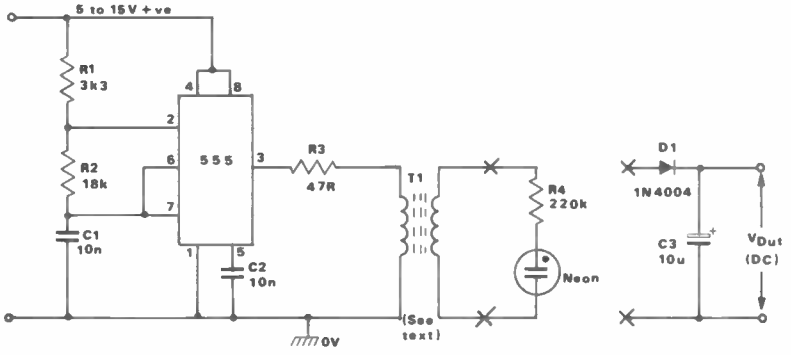


Fig 7 *Neon-lamp driver or 'high-voltage' generator*

The *Figure 7* circuit can be used for driving a neon lamp or generating a low current, high value (up to a few hundred volts) dc voltage from a low value (5 to 15 volt) dc supply. Here, the 555 is simply wired as a 3kHz astable multivibrator that has its square wave output fed to the input of transformer T1 via R3. T1 is a small audio transformer and has a turns ratio sufficient to give the desired output voltage, eg, with a 10V supply and a 1:20 T1 turns ratio, the transformer will give an unloaded dc output of 200 volts peak; this ac voltage can easily be converted to dc via a half-wave rectifier and filter capacitor, as shown.

Finally, the *Figure 8* dc-to-ac inverter circuit produces an ac output at mains line frequency and voltage. The 555 is wired as a low frequency astable (adjust-

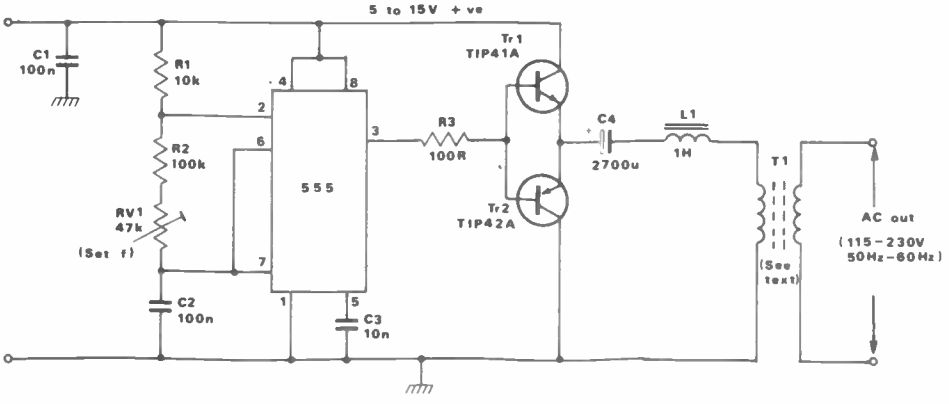


Fig 8 *dc-to-ac inverter*

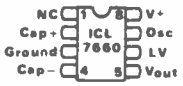


Fig 9 *Outline and pin notations of the ICL7660 voltage converter IC*

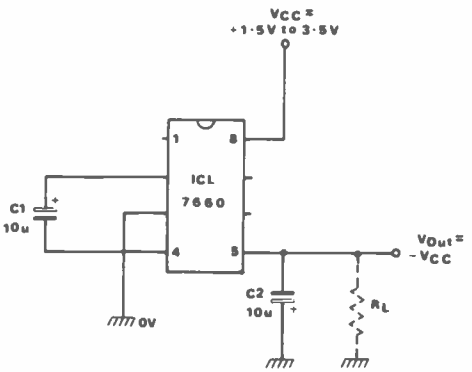


Fig 10 *Negative voltage converter using 1.5V to 3.5V supply*

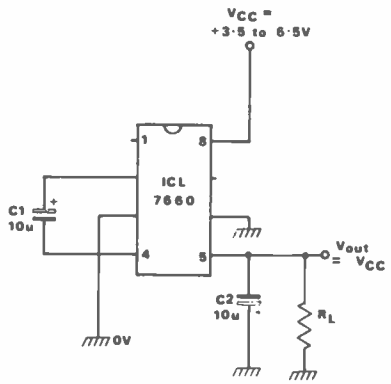


Fig 11 *Negative voltage converter using 3.5V to 6.5V supply*

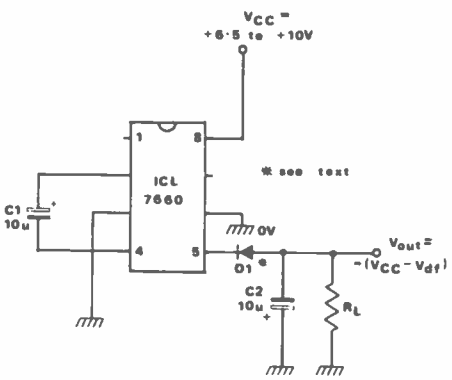


Fig 12 *Negative voltage converter using 6.5V to 10V supply*

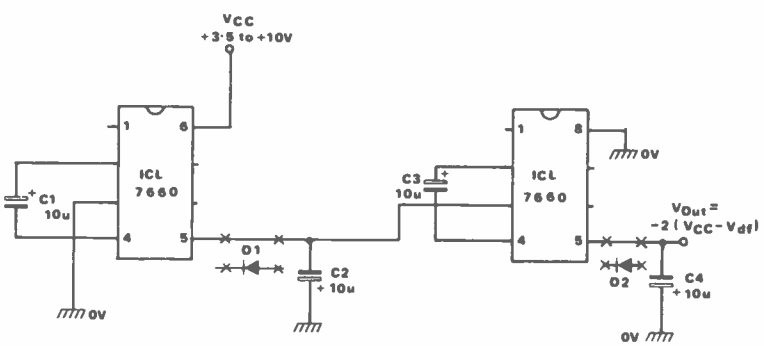


Fig 13 *Cascading devices for increased output voltage*

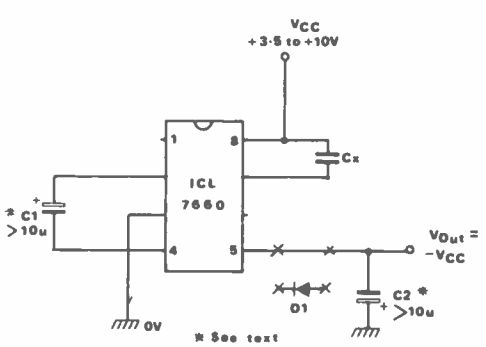


Fig 14 *Reducing oscillator frequency*

able over the 50Hz to 60Hz range via RV1) that feeds its power-boosted (via Tr1-Tr2) output into the low voltage 'input' of reverse-connected filament transformer T1, which has the desired 'step-up' turns ratio. C4 and L1 act as a filter to ensure that the power signal feeding into the transformer is essentially a sine wave.

The ICL7660

This IC is designed as a dedicated voltage converter that is specifically intended to generate an equal value negative supply from a positive source, ie, if powered from a +5V source, it will generate a −5V output. The device can be powered from any dc supply in the range +1.5V to +10V, and operates with a typical voltage conversion efficiency of 99.9% when its output is unloaded! When the output is loaded, the device acts like a voltage source with an output impedance of about 70 ohms, and can supply absolute maximum currents of only 40mA or so.

The ICL7660 is housed in an 8-pin DIL package with the connections shown in *Figure 9*. The device actually operates in a manner similar to that of the basic *Figure 2* 'oscillator and voltage-multiplier' circuit described earlier, but does so with far greater efficiency. The ICL7660 chip houses a very efficient self-contained square wave generator that operates (without the use of external components) at a free-running frequency of about 10kHz and has an output that switches fully between the supply rail values. The IC also houses an ultra-efficient set of logic-driven multiplier 'diodes' that, when used with two external capacitors, enables voltage doubling to be achieved with almost perfect efficiency.

The reader will recall from the description of the *Figure 2* circuit that the use of conventional multiplier diodes causes the circuit's unloaded output voltage to drop by about 1.2 volts, this being the sum of the forward volt drops of the two diodes. In the ICL7660 this volt drop is eliminated by replacing the conventional diodes with MOS power switches that are driven via logic networks in such a way that each diode switch automatically closes when it is forward biased and opens when reverse biased, thus giving near perfect operating efficiency.

The ICL7660 is an easy device to use, but note that none of its terminals must ever be connected to a voltage greater than V+ or less than *ground*. If the IC is to be used with supplies in the range 1.5 to 3.5 volts, the pin 6 'LV' terminal should be grounded; at supply values greater than 3.5 volts, pin 6 must be left open circuit. At supply values greater than 6.5 volts a protection diode must be wired in series with *output* pin 5. *Figures 10* to *18* show a selection of practical application circuits in which these design rules are applied.

ICL7660 circuits

The most popular application of the ICL7660 is as a simple negative voltage converter, and *Figures 10* to *12* show three basic circuits of this type. In each case, C1 and C2 are multiplier capacitors and each has a value of 10μF.

The *Figure 10* voltage converter circuit is intended for use with 1.5 volt to 3.5 volt supplies, and requires the use of only two external components. The *Figure 11* circuit is similar, but is intended for use with supplies in the 3.5V to 6.5V range and thus has pin 6 grounded.

Finally, the *Figure 12* circuit is intended for use with supplies in the range 6.5V to 10V, and thus has diode D1 wired in series with output pin 5, to protect it against excessive reverse biasing from C2 when the power supplies are removed. The presence of this diode reduces the output voltage by Vdf, the forward volt drop of the diode; to keep this volt drop to a minimum, D1 should be a germanium type such as an OA47.

A useful feature of the ICL7660 is that numbers of these devices (up to a maximum of ten) can be cascaded to give voltage conversion factors greater than unity. Thus, if three stages are cascaded, they will give a final output voltage of −3Vcc, etc. *Figure 13* shows the connections for cascading two of these stages; any additional stages should be connected in the same way as the right-hand IC of this diagram.

In some applications the user may wish to reduce the operating frequency of the ICL7660 oscillator. One way of achieving this is to wire capacitor Cx between pins 7 and 8, as shown in *Figure 14*. *Figure 15* shows the relationship between this capacitor value and the operating frequency of the oscillator. Thus, a Cx value of 100pF reduces the operating frequency by a factor of ten, from 10kHz to 1kHz. Note that, to compensate for this 10:1 reduction of frequency (and to maintain the circuit efficiency), the values of C1 and C2 should be increased by a similar factor (to about 100μF each).

Another way of reducing the oscillator frequency is to use pin 7 to over-drive the oscillator via an external clock, as shown in *Figure 16*. The clock signal must be fed to pin 7 via a 1k0 series resistor (R1), and should switch fully between the two supply rail values; in the diagram, a CMOS gate is wired as an inverting buffer stage, to ensure such switching.

Another use of the ICL7660 IC is as a positive voltage multiplier, to give a positive output voltage of almost double the original supply voltage value. *Figure 17* shows the circuit connections. The pin 2 oscillator output signal is used here to drive a conventional capacitor-diode voltage-doubler network, of the type used in *Figure 2*. Note that these two diodes reduce the available output voltage by an amount equal to their combined forward volt drops, so they should ideally be low-loss germanium types.

Finally, to complete this look at ICL7660 applications, *Figure 18* shows how the circuits of *Figures 11/12* and *17* can be used to make a combined positive voltage multiplier and negative voltage converter that provides dual output voltage rails; each rail has an output impedance of about 100 ohms.

Footnote: In case of difficulty, UK readers can obtain supplies of the ICL7660 IC from Maplin Electronic Supplies Ltd, PO Box 3, Rayleigh, Essex SS6 2BR. The current (February '88) price is £2.85, plus a postage/handling charge of about £1.00.

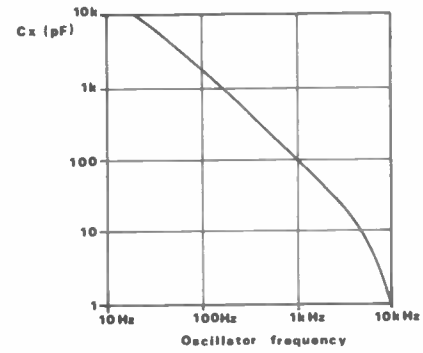


Fig 15 *Cx/oscillator frequency graph*

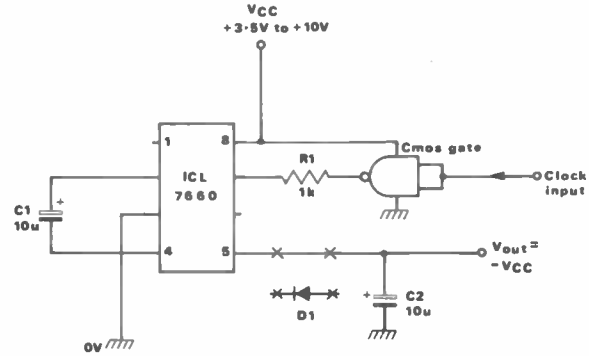


Fig 16 *External clocking of the ICL7660*

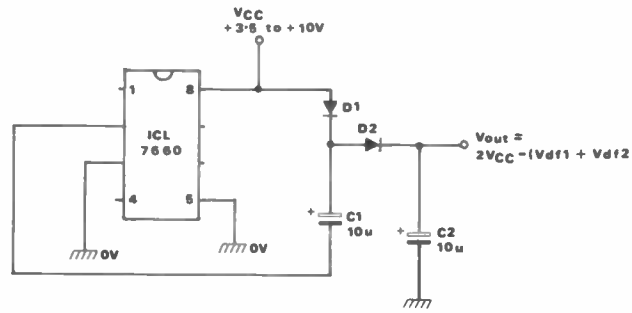


Fig 17 *Positive voltage multiplier*

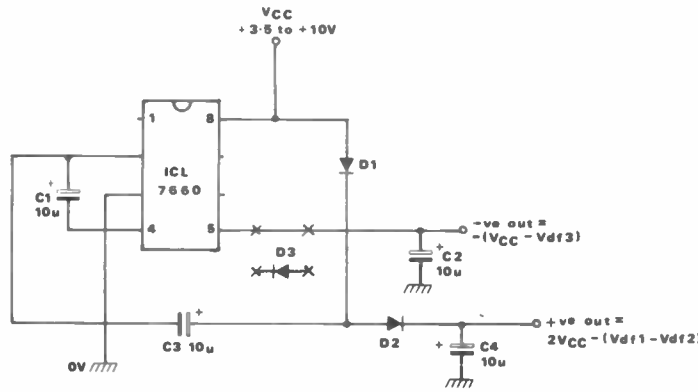
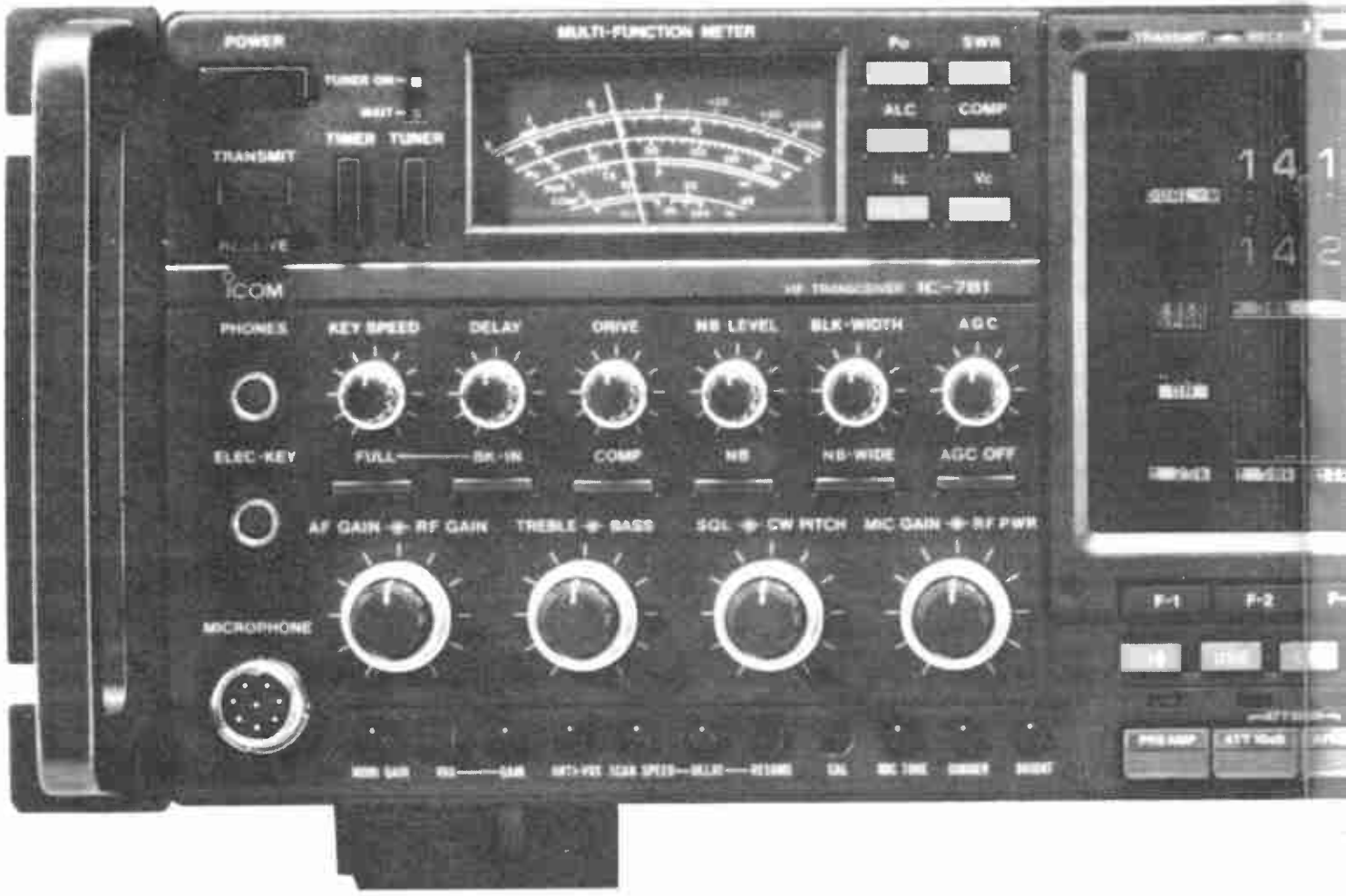


Fig 18 *Combined positive voltage multiplier and negative voltage converter*

ICOM

LOOK TO THE FUTURE WIT



Features:

- **AC power supply**
- **Automatic antenna tuner**
- **Multi function CRT display**
- **Twin passband tuning**
- **Dual-watch**
- **99 memories**

Advanced engineering from ICOM has produced the most sophisticated Amateur HF transceiver on the market today, whether DX'ing, contesting or simply enjoying top performance the IC-781 is a top of the line performer. A unique multi-functional CRT displays frequencies, modes, memory contents, operating notes, RIT, two menu and seventeen optional screens. The soft orange display also serves as a display for DATA modes such as RTTY, AMTOR and PACKET.

The PAN display continuously indicates all signal activities and pile-ups with your operating frequency in the centre. Selectable frequency spans of 50kHz, 100kHz and 200kHz. Vertical range indicates relative signal strength. Twin passband tuning with separate controls for second and third IF stages increases selectivity and narrows bandwidth, independently varies low and high frequency response or functions as a IF shift.

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

Count on us!

TH HF TRANSCEIVER IC-781

The IC-781 has a dual-watch function which allows simultaneous receive of two frequencies in the same band. Balance controls adjust VFO A/B receive strength levels. This feature is especially useful on Dx-expeditions or contests to check band activity or to tune in your next contact. The newly developed ICOM DDS (Direct Signal Synthesizer) system is incorporated to provide a fast transceiver lock-up time. This is essential for data communication systems.

The IC-781 communication system includes a built-in 100% AC supply, high speed automatic antenna tuner, iambic keyer, semi-automatic, or full QSK CW break in to 60 wpm, audio peaking filter, RF speech processor, multi-scanning plus much more. Look into the future of Amateur communications, ICOM products will be setting the pace others try to follow. For more information on the IC-781 contact your local authorised ICOM dealer or phone ICOM (UK) Ltd direct.

- **SSB, CW, FM, AM, RTTY**
- **160-10m/general coverage receiver**
- **Direct keyboard entry**
- **150 watt output**
- **QSK up to 60 wpm**
- **CI-V communications interface**

Helpline: Telephone us free-of-charge on 0800 521145, Mon-Fri 09.00-13.00 and 14.00-17.30. This service is strictly for obtaining information about or ordering Icom equipment. We regret this cannot be used by dealers or for repair enquiries and parts orders, thank you.
Datapost: Despatch on same day whenever possible.
Access & Barclaycard: Telephone orders taken by our mail order dept, instant credit & interest-free H.P.

AUDIO FREQUENCY METER

R. A. PENFOLD

Inexpensive ready-made and home constructed audio signal generators are extremely useful pieces of equipment, but they often have one major shortcoming. This drawback is the lack of a really accurate frequency readout, and in some cases quite large frequency errors of 10% or more have to be accepted. This obviously compromises the validity of any frequency response checks made with such an instrument. Worse still, when dealing with something like a RTTY decoder, with its narrow bandwidth filters, a signal generator with anything less than spot-on frequency readout is likely to be misleading rather than helpful.

The obvious solution to the problem is to use an add-on frequency meter to monitor the output of the signal generator, so that it can be adjusted with a high degree of precision, regardless of how good or bad the generator's dial calibration happens to be. There are two basic choices when it comes to the types of frequency meter that can be used. The meter can either be analogue (with a moving coil panel meter providing the frequency readout) or digital. Analogue frequency meters have been much used for audio applications in the past, but they are less than ideal. They do not necessarily offer better accuracy than the calibrated dial of the signal generator and, with the current relatively high cost of panel meters, they have less cost advantage over digital instruments than was once the case.

Consequently, I decided to develop an accurate but low cost digital circuit. The final design is a three digit (LED) display type. The three measuring ranges of 999Hz, 9.99kHz and 99.9kHz enable the full audio range and beyond to be covered with good accuracy. By using the over-ranging technique, the resolution is effectively 1Hz on any frequency up to the full 99.9kHz. When making tests at low frequencies there is an advantage in having a better resolution of (say) 0.1Hz, but this requires a long gate period of ten seconds, and results in very infrequent up-dating of the display. In practice this seemed to make the unit unusable for its primary purpose as a frequency readout for an audio signal generator, and the 99.9Hz range has been omitted from the final design.

The use of crystal control ensures that the unit has good accuracy, and it avoids the need for any form of setting up before the unit is ready for use. Note that, although the unit was designed primarily for operation as a frequency readout for a signal generator, it is also perfectly suitable for use as a general purpose audio frequency meter, and can be used to check the output frequencies of oscillators in faulty projects, etc. The unit has quite good sensitivity, with only about 5 millivolts RMS or so being needed in order to give a valid reading. The input impedance is quite high at approximately 250k. At the other end of the scale, input overload protection enables inputs of up to at least 10 volts RMS to be handled, without any risk of the input circuit sustaining any damage.

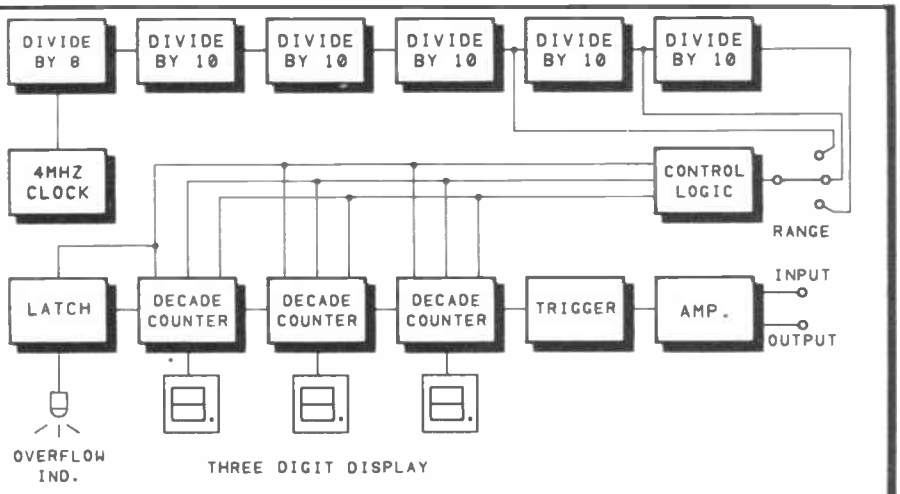


Fig 1 *Block diagram for the audio DFM*

System operation

There are two basic approaches to digital frequency measurement. One is to measure the period of one cycle and then calculate the frequency from this, and the other is to measure the number of cycles that occur in a certain period of time. The first method has the advantage of taking relatively little time to make each measurement, but it is comparatively difficult to implement in practice. Most frequency meters, including the present design, use the second method. This is basically just a matter of feeding the input signal through into a counter circuit via a gate. If the gate is opened for precisely one second, the number displayed on the counter will be equal to the input frequency in Hertz. If the gate time is shortened to 100ms (0.1 seconds), the reading will still accurately reflect the input frequency, but with a reduced resolution of 10Hz. Provided a sensible gate period is used, with this method there is no difficulty in translating the reading into a frequency in Hertz.

The block diagram of *Figure 1* shows the arrangement used in this frequency meter. Starting at the input, the input signal is coupled straight through to an output socket, which enables the unit to be easily connected for operation as a frequency readout for an audio generator. The output from the generator connects to the input of the frequency meter, and the test leads carrying the output signal connect to the meter's output socket. The input signal is also coupled to a high gain amplifier, which in turn drives a trigger circuit. These provide an output at standard logic levels from low level input signals, and also give an output having suitably fast rise and fall times to reliably operate the subsequent CMOS logic circuits.

These circuits consist of a chain of three decade counters, plus a latch which provides 'overflow' indication. The decade counter chips used in this design actually provide other functions as well. Each one consists of a decade counter, a seven segment decoder/driver and a latch, and can therefore replace the three devices needed in a conventional decade counter/seven segment display driver arrangement. They also incorporate a gate at their clock inputs.

The counter circuit requires three control signals in order to give the desired effect. First the gates must be opened for the appropriate period of time, after which the latches must be fed with a pulse that holds the displayed

frequency on the display. Then a reset pulse must reset the counters, but note that this does not affect the display, which continues to show the last frequency reading. Then the process must cycle back to the beginning again, with a fresh gate period being started.

These signals are all derived from a simple control logic circuit, which is driven from a crystal oscillator via a divider chain. The clock operates at 4MHz, but it is processed by a three stage binary divider, that provides a divide by eight action, and given a 500kHz output signal. This is then fed into a series of five divide by ten circuits that give a final output frequency of 5Hz. However, the control logic circuit provides a further division by ten, to give a 0.5Hz signal that is used to provide the gate signal. It is only one half cycle that constitutes the gate period, giving the required one second gate time and readout in hertz. The range switch enables one or two stages in the divider chain to be bypassed so that the gate time is reduced to 100ms or 10ns. The reading on the display is then tens of hertz or hundreds of hertz, but by driving the appropriate decimal point of the display, this is converted to a more convenient readout in kilohertz. The unit therefore has three ranges of 999Hz, 9.99kHz and 99.9kHz full scale.

The circuit

The input and display circuits are shown in *Figure 2*, with the divider and control logic circuits shown separately in *Figure 3*. R4, D1 and D2 form a simple clipping circuit at the input, which protects the unit against overload. IC1 is an input buffer stage and low gain (11 times) voltage amplifier. This is followed by IC2, which is an inverting amplifier, having a closed loop voltage gain of a little under 20 times. The output of IC2 is directly coupled to the input of an inverting Schmitt Trigger, based on IC3, and having a substantial amount of hysteresis provided by R13. The hysteresis aids good accuracy and stable readings on input signals that are infested with noise. Also, in the absence of an adequate input level, there will be no output from the trigger circuit, giving a zero reading, which makes it readily apparent that the input level is too low. Otherwise, there would be a risk of marginally inadequate signals producing erroneous but plausible readings.

The decade counters are CMOS 40110BE devices (IC5 to IC6), which can directly drive common cathode seven segment LED displays; although 'directly' drive is perhaps not strictly accurate. They have outputs that are capable of sourcing much higher currents than standard B series CMOS devices, and a current limiting resistor is needed at each segment output in order to keep the drive current down to an acceptable level. The 40110BE is actually an up/down counter, having separate up/down clock inputs and carry/borrow outputs. The down counter action is not required in this case, and so the unused clock input is simply connected to earth, and the borrow output is ignored.

IC4 is the overflow latch, but only one section of this dual D type flip/flop is utilized here. This operates in what is almost the standard divide by two configuration, but the Q output (which also drives LED indicator D3) is connected to the 'set' input. When one complete output cycle has been received from IC5 and an overflow has therefore occurred, the Q output of IC4 goes high and latches in that state. It is reset by the control logic circuit when the counters are reset, but this gives a long enough flash from D3 to clearly indicate that the input frequency is too high for the range in use, and that an overflow has taken place.

Turning to *Figure 3*, the crystal clock oscillator uses TR1 in a standard configuration. No trimmer capacitors are included to permit the oscillator to be trimmed to precisely 4MHz. This is not really necessary though, since the clock will have greater accuracy than is merited by a three digit display, even without any trimming.

The first divider device is IC8, which is a CMOS 4024BE seven stage binary type. In this circuit, only the first three stages are actually used, giving a divide by eight action. The next five stages are all 4017BE divide by ten circuits (IC9 to IC13). S1a is the range switch, which selects the appropriate output of the divider chain, S1b drives the decimal point segment of the correct display on the 9.99kHz and 99.9kHz ranges. On the lowest range the reading is in Hertz, and no decimal point is indicated.

IC15 acts as the basis of the control logic circuit, and this is another 4017BE. In this case we are making use of both its standard divide by ten ('carry') output, and some of its 'one of ten' decoder outputs. The latter, which are numbered from '0' to '9', go high in sequence for one clock cycle each, outputs '0' to '4' are left unused. The gate signal is provided by the 'carry' output, which is high for the initial five clock cycles. It is actually a low

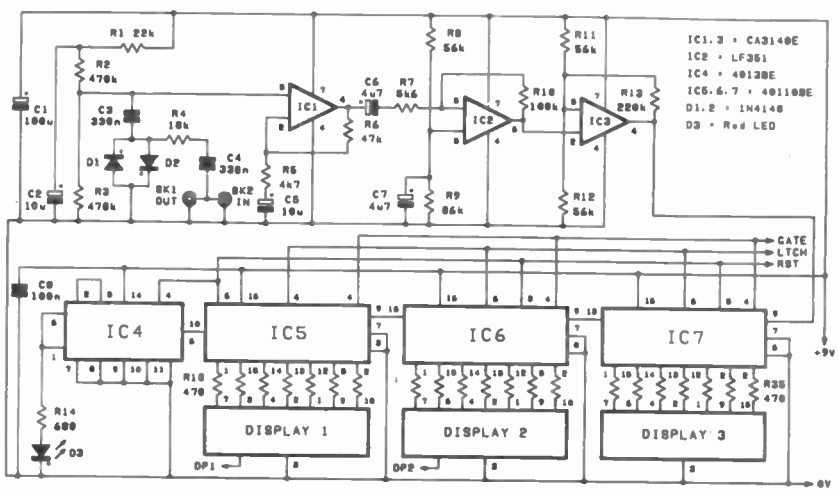


Fig 2 *The input and display circuits*

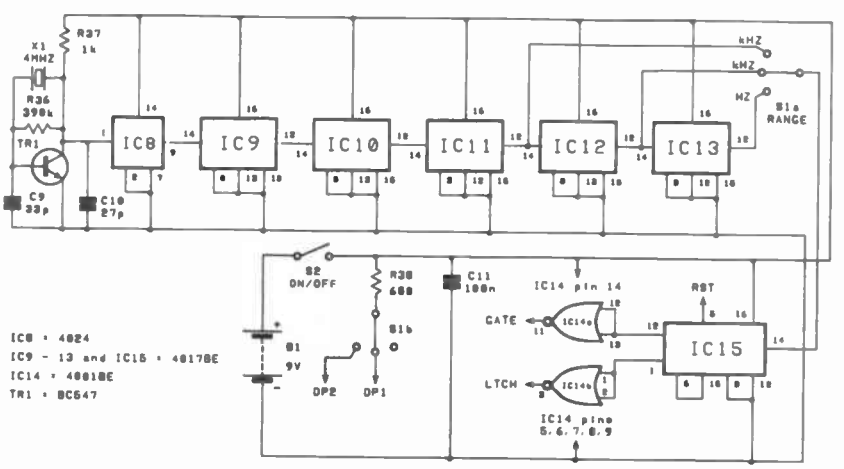


Fig 3 *The divider and control logic circuits*

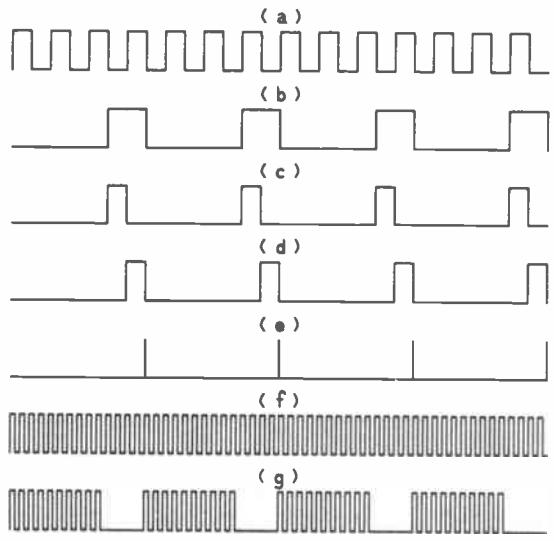


Fig 4 *Circuit waveforms (see text for explanation)*

signal that is needed in order to open the gates in the counter circuit, and accordingly, IC14a inverts this output of IC15 so as to give a gate signal of the correct polarity.

At the end of each gate pulse, output '5' of IC15 goes high. This signal is inverted by IC14b and used to latch the reading on the display. On the next clock cycle output '6' goes high, and this resets the counters. On the next clock cycle output '7' goes high, and this resets IC15 and starts a new gate pulse and measuring cycle. The waveforms of *Figure 4* help to show the overall sequence of events. The waveform in (a) represents the clock signal from the divider chain, while (b) is the inverted gate signal. The signals depicted in (c), (d), and (e) are the '5', '6', and '7' outputs (respectively) of IC15.

The waveforms of (f) and (g) represent the input signal and the gated signal respectively, but in practice the input signal would normally be at a much higher frequency than shown here. It should only be necessary to apply the gate signal to the least significant digit in the counter circuit, but when this was tried in the original circuit, the unit proved to be less than totally reliable. In the final design the gate signal has been applied to all three counter stages, and this seems to ensure totally reliable results.

Power is provided by a 9 volt battery. The current consumption of the unit is inevitably quite high, with the three displays requiring around 25 milliamps each in order to give reasonable brightness. I use a PP3 size rechargeable (nickel-cadmium) battery to power the unit, but a high capacity non-rechargeable type such as a PP9 should also provide an economic means of powering the unit.

Although this is not the simplest of projects, as all the components (apart from the battery and other usual off-board types) fit onto the printed circuit board, it is reasonably straightforward to construct. Details of the printed circuit board are provided in *Figure 5*.

The first point to note is that, with the only exception of IC2, all the integrated circuits are MOS types. They should therefore be mounted in holders, and the other normal anti-static handling precautions should be observed. Take special care with the 40110BEs, which are not the cheapest of integrated circuits. It is also advisable to mount the seven segment displays in holders. Apart from reducing the risk of damaging them due to overheating when connecting them to the board, this raises them so that they stand well above the surface of the board. This helps to bring them into a good viewing position behind the window in the front panel when the board is fitted in the case.

Suitable holders do not seem to be available, but they can be made from 14 pin DIL integrated circuit holders. Simply cut each holder into two seven way SIL holders, and then remove or trim down the pins at the ends of each holder. This gives two 5 way SIL holders which can be connected to the board and should accept a display without any problems. Note that the displays must be a common cathode type (not common anode). I used 0.56 inch displays, but 0.5 inch displays seem to have the same pin-out arrangement and will work properly in the unit.

The capacitors must be modern printed circuit mounting types if they are to fit onto the board easily. Ideally the polyester capacitors should have 7.5 millimetre lead spacing, and the ceramic types should have 5 millimetre lead spacing. Crystal X1 must have an HC18U encapsulation (a miniature wire ended type) if it is to fit easily into the layout. The resistors are packed quite densely onto the board in places, and consequently it is essential to use modern miniature types. The board is of the single-sided variety, but a number of link wires are required. These can be made from the leadout wires trimmed from the resistors.

I used a Verocase, having approximate outside dimensions of 205 by 140 by 40 millimetres, as the housing for this project. This will easily accommodate the board plus a PP3 size battery, but if you are going to use a larger battery, such as a PP9, it would probably be necessary to opt for a slightly larger case.

PARTS LIST

Resistors (all ¼ watt 5% carbon)

R1	22k
R2,3	470k (2 off)
R4	18k
R5	4k7
R6	47k
R7	5k6
R8,9,11,12	56k (4 off)
R10	100k
R13	220k
R14,38	680 (2 off)
R15 – R35	470 (21 off)
R36	390k
R37	1k

Capacitors

C1	100μ 10V radial elect
C2,5	10μ 25V radial elect (2 off)
C3,4	330n poly layer (2 off)
C6,7	4μ7 63V radial elect (2 off)
C8,11	100n disc ceramic
C9	33p ceramic plate
C10	27p ceramic plate

Semiconductors

IC1,3	CA3140E (2 off)
IC2	LF351
IC4	4013BE
IC5,6,7	40110BE (3 off)
IC8	4024BE
IC9 – IC15	4017BE (6 off)
IC14	4001BE
Tr1	BC547
D1,2	IN4148 (2 off)
D3	Red panel LED (see text)
Display 1,2,3	Red 0.56 inch common cathode

Miscellaneous

S1	3 way 4 pole rotary
S2	SPST toggle
SK1,2	3.5mm jack socket (2 off)
B1	9 volt (eg six HP7s in holder)
X1	4MHz HC18U

Case about 205 x 140 x 40mm
Control knob
Printed circuit board
8 pin DIL IC holder (3 off)
14 pin DIL IC holder (6 off)
16 pin DIL IC holder (9 off)
Battery connector
Wire, solder, fixings etc

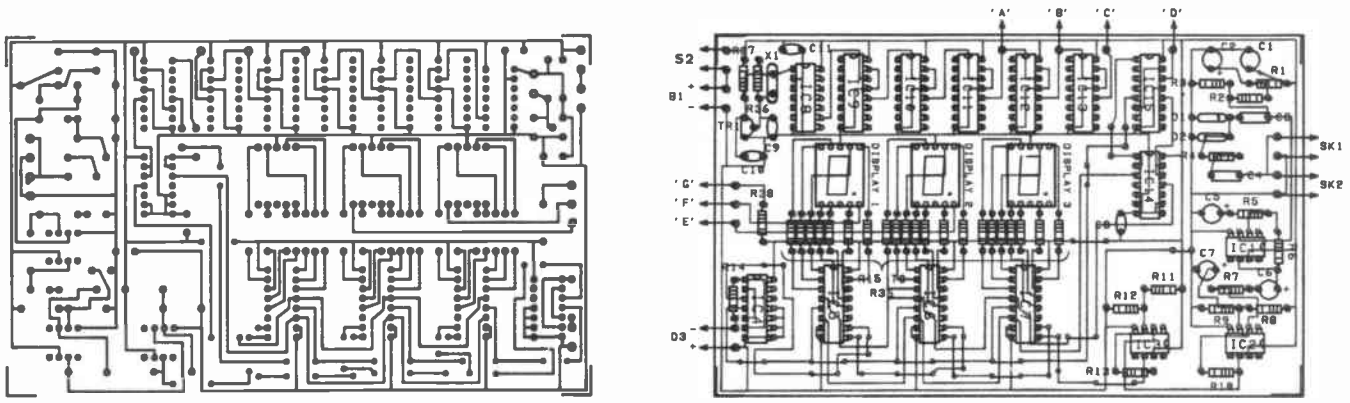


Fig 5 *Details of the printed circuit board*

The printed circuit board is mounted on the base panel of the case, positioning it where sufficient space is left for the battery to one side of the board. The controls and sockets are mounted on the front panel, but the case is used vertically so that this is effectively the top panel. D3 can also be mounted on this panel, but I took the alternative route of wiring the decimal point of display 3 to act as the overflow indicator. This simply requires an insulated wire to be added between the appropriate two pads of the board, and is something that is easily implemented if you also prefer this method.

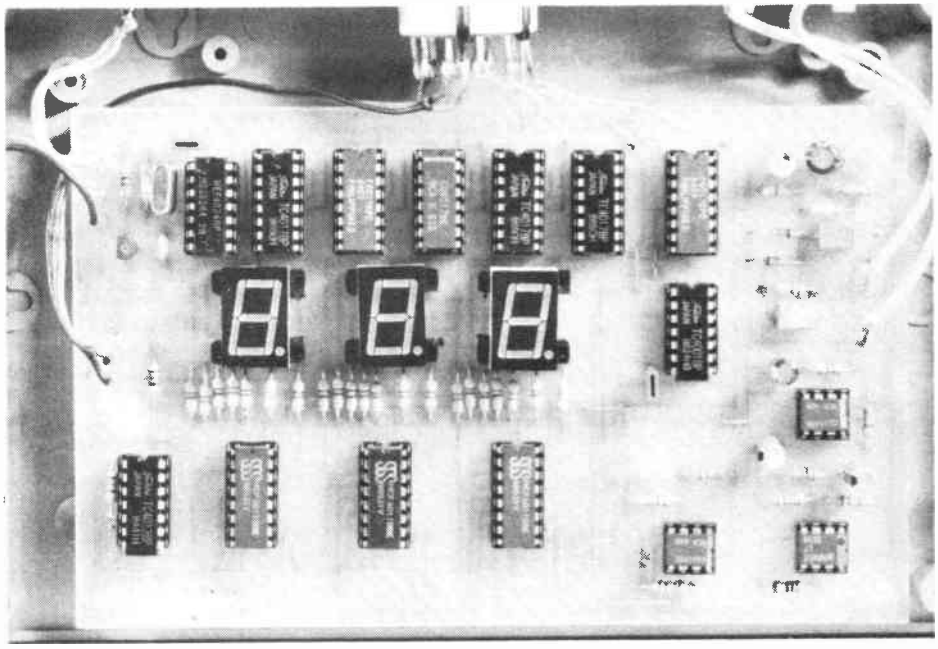
A display window must be made in the front panel at the correct position, and this can be cut using a fretsaw or a miniature round file. Some red display window material can be glued in place behind the cutout to give a neater finish and improve the contrast of the display.

Only a small amount of hard-wiring needs to be added in order to complete the unit. This is mostly straightforward, but the leads to SK1 and SK2 should be screened types. This avoids unwanted stray pick-up and feedback. S1 is a 3 way, 4 pole rotary switch, but in this case only two poles are used. *Figure 6* (in conjunction with *Figure 5*) shows the wiring to S1, and should help to iron out any difficulties when wiring in this component.

In use

The unit requires no adjustment before it is ready for use. At switch-on the display will probably show a random reading initially, but it should soon change to read zero. However, stray pick-up and amplifier noise could result in a low reading being obtained with no input connected. Connecting the unit to the audio signal generator should soon show whether or not it is functioning properly, with sensible readings being produced.

Although the unit is quite sensitive, it is possible that the output from the signal generator will sometimes fall below the level required by the meter. It is then just a matter of switching the attenuator on the signal generator up by 20dB or 40dB to permit the frequency to be accurately set, and then switching it back down again to make the test on the equipment.



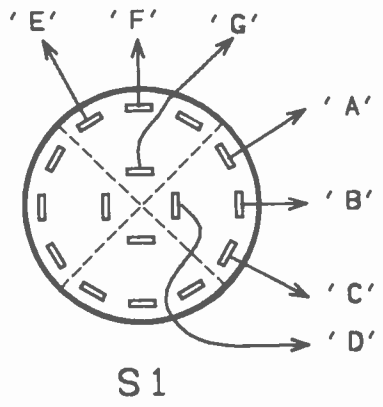


Fig 6 *The wiring to S1*

The gain of the amplifiers in the unit could be increased in order to give higher sensitivity, but I would not recommend this as it could easily lead to problems with instability and could be more of a liability than an asset.

As with any frequency meter of this type, the accuracy can be no better than plus and minus one digit, and this is the factor which places the main limitation on the accuracy of the unit. It represents an accuracy of plus and minus 0.1% though, which should be adequate for most purposes. The least significant digit of the display may sometimes alternate between two consecutive values, and this is quite normal for a digital frequency meter.

When using the unit as the frequency readout for a signal generator, bear in mind that the first reading after the frequency control of the generator has been adjusted might not be a valid one. A reliable reading will only be obtained if the frequency was constant for the full gate period.

Remember that on the higher ranges it is possible to use the over-ranging technique in order to give frequencies down to 1Hz resolution. For example, if a reading of 75.3kHz is obtained on the highest range, and the reading is 312Hz when the unit is on the lowest range, the input frequency is 75.312kHz. RBW

ASTRID +

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

Send for full details to:

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

SURPLUS/REDUNDANT STOCKS ELECTRONIC COMPONENTS

We offer cash for your surplus components including integrated circuits, transistors, memories, microprocessers, I/C sockets, connectors, caps etc, etc. Top prices paid, collection no problem. Please contact us today with your lists by , fax, telex, telephone or letter to:

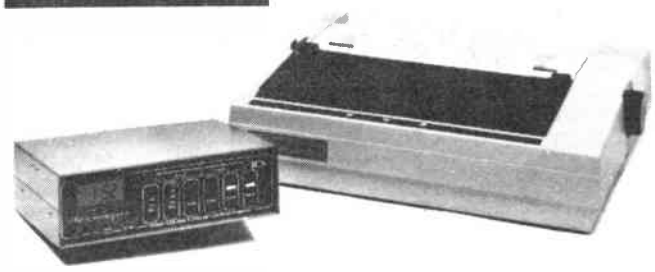
MARLOW MARKETING
ELECTRONIC COMPONENT SURPLUS DEALERS
151A Milton Road, Gravesend, Kent, DA12 2RG, England
Fax: 0474-327-960 Telex: 940-16512 (NWWO G),
Tele: 0474-320062

ALSO: COMPLETE FACTORY CLEARANCES UNDERTAKEN

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 10R to 1MO 5% E12 series – 2p, 1% E24 series 3p
Mixed metal/carbon film resistors ½W E24 series 1RO to 10MO 1½p
1 watt mixed metal/Carbon Film 5% E12 series 4R7 to 10 Megohms 5p
Linear Carbon pre-sets 100mW and ¼W 100R to 4M7 E6 series 7p
Miniature polyester capacitors 250V working for vertical mounting
.01, .015, .022, .033, .047, .068-4p. 0.1-5p. 0.15, 0.22-6p. 0.33, 0.47-8p
Mylar (polyester) capacitors 100V working E12 series vertical mounting
1000p to 8200p – 3p. .01 to .068 – 4p. 0.1 – 5p. 0.12, 0.15, 0.22-6p. 0.47/50V-8p
Subminiature ceramic plate capacitors 100V wkg vertical mountings. E12 series
2% 1.8 pf to 47 pf – 3p. 2% 56 pf to 330 pf – 4p. 10% 390p – 4700p 4p
Disc/plate ceramics 50V E12 series 1PO to 1000P, E6 Series 1500P to 47000P 2p
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
741 Op Amp – 20p. 555 Timer 22p
cmos 4001 – 20p. 4011 – 22p. 4017 ..... 40p
ALUMINIUM ELECTROLYTICS (Mfds/Volts)
1/50, 2.2/50, 4.7/50, 10/25, 10/50 ..... 5p
22/16. 22/25, 22/50, 47/16, 47/25, 47/50 ..... 6p
100/16, 100/25 7p; 100/50 12p; 100/100 ..... 14p
220/16 8p; 220/25, 220/50 10p; 470/16, 470/25 ..... 11p
1000/25 25p; 1000/35, 2200/25 35p; 4700/25 ..... 70p
Submin, tantalum bead electrolytics (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, 4.7/35, 6.8/16 15p; 10/16, 22/6 ..... 20p
33/10, 47/6, 22/16 30p; 47/10 35p; 47/16 60p; 47/35 ..... 80p
DIODES (piwamps)
75/25mA 1N4148 2p. 800/1A 1N4006 6p. 400/3A 1N5404 14p. 115/15mA OA91 ..... 6p
100/1A 1N4002 4p. 1000/1A 1N4007 7p. 60/1.5A S1M1 5p. 100/1A bridge 25p
400/1A 1N4004 5p. 1250/1A BY127 10p. 30/45mA OA91 6p. 30/15A OA47 ..... 8p
Zener diodes E24 series 3V3 to 33V 400 mW – 8p. 1 watt 12p
Battery snaps for PP3 – 6p for PP9 ..... 12p
L.E.D's 3mm. & 5m.m. Red, Green, Yellow-10p. Grommets 3mm – 2p, 5mm 2p
Red. flashing L.E.D.'s require 5V supply only 50p
Mains indicator neons with 220K resistor 10p
20mm fuses 100mA to 5A Q/blow 5p. A/surge 8p. Holders pc or chassis 5p
High speed pc drills 0.8, 1.0, 1.3, 1.5, 2.0m – 30p. Machines 12V dc £6.50
HELPING HANDS 6 ball joints and 2 croc clips to hold awkward jobs £4.50
AA/HP7 Nicad rechargeable cells 80p each. Universal charger unit £6.50
Glass reed switches wih single pole make contacts – 8p. Magnets 12p
TRANSISTORS
BC547/8/9-8p, BC557/8/9-8p, BC182L/4L-10p, BC183,183L-10p, BC212,212L-10p, BC337,337L-12p. BC727/737-12p, BD135/6/7/8/9-25p, BCY70-15p, BFY50,52-20p, BFX88-15p,2N3055-50p, TIP31,32-30p, TIP41,42-40p, BU208A-£1.20, BF195,197-12p
All prices are inclusive of VAT. Postage 20p (free over £5). Lists Free.

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

ICS



Incredible value at ONLY £399.95 inc VAT
Carriage and packing (Securicor) £12.50

Send large SAE for details, print sample and product review. Printer and FAX-1 available seperately if required

WEATHER FAX/RTTY/NAVTEX: COMPLETE RECEIVE SYSTEM

Operates with any HF SSB Receiver.
Easy to use. No computer knowledge needed. Fully automatic operation. Built in timer and tuning indicator

Gives superbly detailed weather maps, satellite cloud cover printouts, printed weather forecasts, navigation warnings and news bulletins from around the globe

Includes FAX-1 demodulator, mains power unit, Epson compatible printer, paper, ribbon and all connecting cables. **Nothing more to buy.** Just connects to receiver loudspeaker output

Hundreds of FAX-1s already in use world wide by professional and amateur weather forecasters, yachtsmen, aviators and enthusiasts. British designed and manufacturered

ICS Electronics Ltd

VISA

PO Box 2, Arundel,
West Sussex. BN18 0NX
Telephone: 024 365 590. Facsimile: 024 365 575

Access

12 months parts and labour warranty, Price includes VAT at 15%

MICROCONTROLLERS

– the quiet revolution

by Samuel Dick

It is very easy to believe that the world of computing and high-tech electronics is full of megabytes, kilobauds and lightning-fast operations, and it is. But, underneath, a quiet revolution has taken place, one that the lay person has probably seen more evidence of than many computer professionals. This is the microcosmic world of the microcontroller, a lilliputian system component which promises to bring the advantages of computing to the humblest of devices, while allowing designers to distribute intelligence over complex industrial or military systems; a world where memory is a few kilobytes and the assembler still rules.

Necessity and invention

The microcontroller was definitely born out of necessity. While most of computing was heading in the direction of bigger and faster systems, commercial and military interests realised that their need was sometimes not for a large powerful system, but for a small, highly integrated system. A system which had RAM and ROM, which had input/output ports, timers and clocks just like its bigger cousins, but which was small – small enough to fit on a single chip.

This microsystem could then be produced cheaply enough to go into everyday domestic appliances like cookers and washing machines. The sophisticated control would add attraction to a manufacturer's goods – the consumer would, in return, get a more versatile product. The advantage in power semiconductor technology, which has happened in step with the rise of the microchip, only helped to increase the potential of the microcontroller, because control of mains-driven devices became much easier with solid-state devices, rather than with mechanical relays.

The family

To examine what sort of devices are available to the designer, let us look at just one family: the 68XX5 family from Motorola. The main members of the family are NMOS devices, but some are available from second sources as CMOS devices, which bring with them the advantage of very low power consumption.

Within their 40 pin packages they contain a modified 6800 architecture: an accumulator, index register, program counter, stack pointer, and condition code register. The program counter and stack pointer are cut-down in size (only 12 and 5 bits in length respectively). This limits the address range to 4096 bytes and the stack is minuscule at 32 bytes, but remember what the designers were trying to achieve – a small system.

Input and output requirements are well catered for. Typically 24 I/O lines are available, with many having data direction registers similar to the 6821 PIA device. This allows the programmer great flexibility over how all the lines are used, as they can be individually assigned input or output functions.

The amount of memory that the family members have varies, but 2 to 3.5 kilobytes of ROM and some 100 bytes of RAM (with power-down protection) are available. The 687X5 series have this ROM as EPROM – the devices have a quartz window on top that allows the memory contents to be erased by ultraviolet light.

With microcontrollers being the only chips in some systems, any measurement of time has to be performed on-chip, so they have timers as standard. The clock signal from the system oscillator can be divided down by a prescaler circuit with the prescale factor held in RAM and programmable from the running software. The timer can be set to measure intervals of an external signal or to interrupt the processor at set intervals.

This latter feature is very useful for a 'wake-up' type feature – perhaps allowing the microcontroller to switch on some external equipment, make a

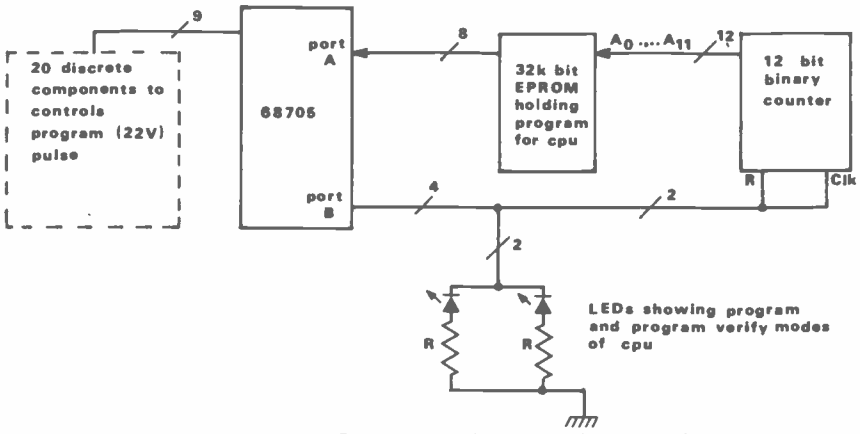


Fig 1 *Schematic circuit for self programming*

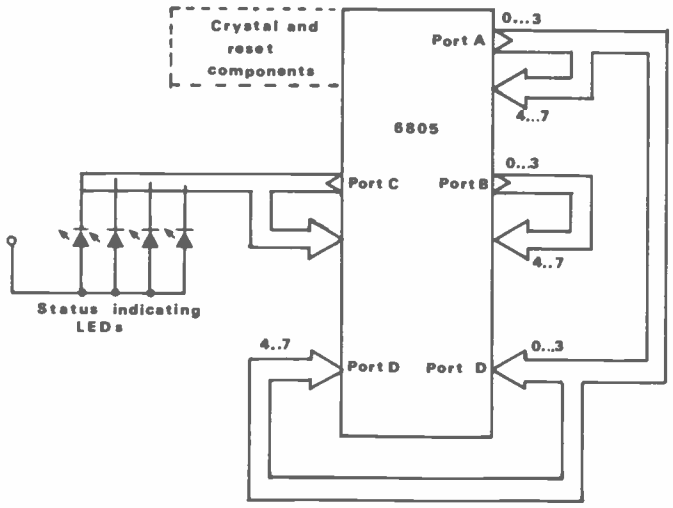


Fig 2 *Simple self-test circuit: by monitoring its own outputs, the chip is able to self-test. The LEDs indicate where any fault has been found*

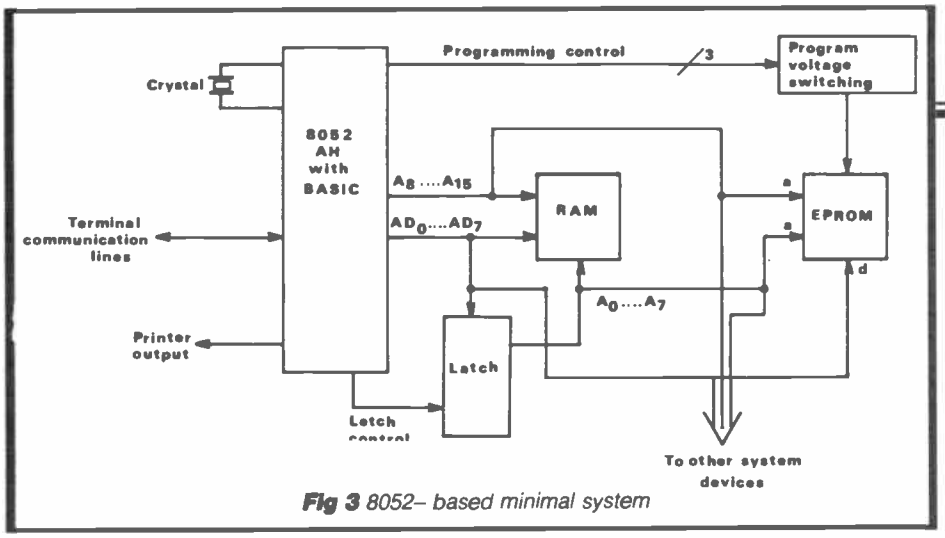


Fig 3 *8052– based minimal system*

decision, carry out some control function, and then to power-down most of the system until the next scheduled wake-up. The power supply requirement is just a single 5 volts with a dissipation of under 1 watt.

But not so simple

While some of the hardware features may seem a little restrictive to those working on large machines, the software features of the chips complement their limitations. The instruction set is described as 'byte efficient'. The usual range of test and branch, arithmetic, jump, and memory operations are present. The more exotic addressing modes, like the deferred or post-increment modes available on, say, a 6809 chip, are not there. But they are mainly used by high-level language programmers implementing position-independent code or for the extensive nesting undertaken by high-level language programming techniques and compilers; microcontrollers were never intended to be used for program development themselves. An Ada compiler will never run on a 68705, but such a compiler might generate code that is later down-loaded into the 68705's ROM.

Once you have written your code for the chip, set up the timers and decided whether or not to include a stand-by supply for the RAM, programming the chips can be very simple. Assuming that your machine code is stored in a ROM or write-protected RAM, then the circuit in *Figure 1* can be used to write the program into the ROM of the chip. All that is necessary is to open and close two switches in the right sequence and the chip will tell you when it has finished programming and verifying itself.

Some of the family also have a self-test facility built-in to them as standard. *Figure 2* shows a schematic circuit for testing the chip. The pattern on the LEDs will tell you which part of the device is faulty, so if you have another application which avoids that section, you could use that device there.

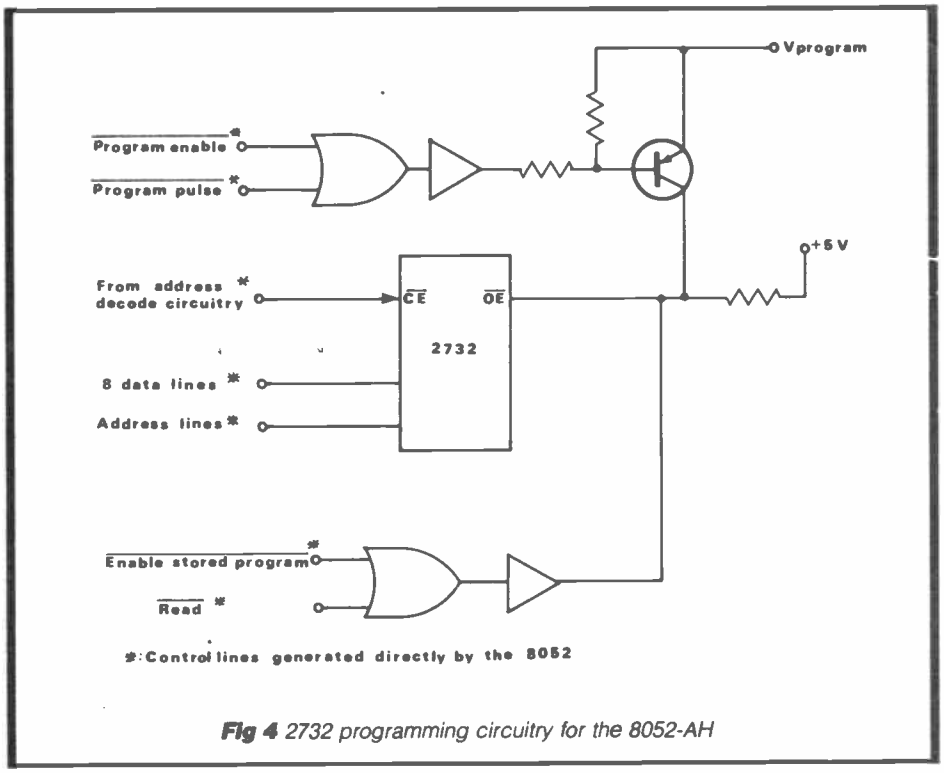


Fig 4 *2732 programming circuitry for the 8052-AH*

Just a little bit more

Some have other attributes. The 68705R3, for example, has its own analogue to digital converter (ADC). When linked with a suitable transducer it is an ideal chip for controlling or recording the real world. The conversion duration is around 30 machine cycles (from 30 to 300ms depending on the crystal used as the system oscillator).

The ADC has a resolution of eight bits and the non-linearity and quantification errors are both ± 0.5 bits. Typically, the converter will be used in the range 0 to 5 volts, so some amplifier circuitry may be needed to match a transducer's output so that the full dynamic range of the ADC can be utilised.

There are a vast number of applications for which such an ADC is very useful. The chip could cope with limited audio frequency signals and, perhaps, even be part of an implementation of a simple digital filter. Biophysical, medical and geophysical data logging often need to analyse signals up to a few kilohertz in frequency. In the hi-tech house of the future, monitoring the inside and outside temperature, the amount of direct sunlight and even wind velocity will be required to control solar cells, ventilation and solar collector facilities. A few samples per minute would be adequate for such operations.

Enter the high-level language

When a good product is around, someone is always sure to say 'Wouldn't it be nice if . . .?'. When you think about the microcontroller, one of the drawbacks to its use is the need for programming in assembler. It would be nice if you could connect up an RS232 line from your terminal or even your computer, and just type in the program in Basic or Forth.

Then you would have the advantages of both worlds – a simple chip which would do just about anything for small applications, and the ease of programming of a high-level language.

The Z8 device has been available for some time, of course, but it has a reduced version of Basic. Now, Intel's 8052AH device is also available. *Figure 3* shows the schematic circuit of a small system. Note that a few external components are now required, but this is a small price to pay for the increased ability obtained. The 8052AH has a full 8K Basic which is resident in the chip's ROM. Far from a simple language, this Basic contains a host of functions including loops, conditional branches, string operations, arithmetic functions and a BCD floating point mathematics implementation which includes transcendental functions

like Sin(x) and Log(x). The Basic's system commands include programming instructions to program ROMs with a number of application programs. These can be made to auto-run at power-up.

Of course, if you require the speed of machine code programming, then the 8052AH will allow that, too. The functions within the Basic language can be accessed from machine code subroutines, so that a highly integrated application can be generated.

A similar product is offered by Rockwell, which is based around the 6502 architecture. The R65F1x series are Forth-orientated chips which have Forth rather than Basic as the high-level language. Forth is well suited to this type of small system configuration. Starting from a few commands written in a processor's native assembler, the Forth programmer can add commands in Forth as required, providing that the new command can be defined in terms of previously defined commands. When the new command is executed, Forth jumps to each of the constituent commands and executes them in turn. This execution of an extensible language is analogous to a Basic program containing only subroutine calls.

Because Forth relies on a stack to pass information between commands, the stack pointer in the R65F1x series is an 8 bit register which accesses a stack located in zero-page RAM.

Both these devices can be programmed by simply hooking up an RS232 terminal line and typing the program as ASCII characters into the chip. Autobaud is a feature and the 8052 chip even has an output-only RS232 port so that you can drive a printer direct from the chip with minimal fuss.

The importance of these language-orientated microcontrollers becomes apparent when the development cycle of an application is considered. In the past, the programmer developing software for a minimal system would write the program in assembler (or in a high-level language if a cross-compiler was available), burn the resultant machine code into a PROM using a development system and then install the PROM into the system. Debugging could be a long process – every time an error was found, the source code would have to be edited and then the process of generating the PROM would have to be gone through again. A simple error in the assembler code could result in a half-hour delay.

With these new devices, the system can be tested with the software still at the soft stage – in RAM and able to be edited. The software supplied with the Intel chips allows a PROM to be written by just issuing a command from Basic. *Figure 4* shows the simple hardware that would be required to program a 2732-type EPROM. The use of Basic or Forth also makes the programmer's day much more productive. The industry-standard five lines of code per day per programmer is much better when the lines are in a high level language.

Only when the programmer is satisfied that the code is performing correctly will the program be commited to PROM.

Looking ahead

The future of microcontrollers is very bright. As the fabrication industry becomes more adept at packing their silicon real-estate with system components, the complexity and simplicity of use of the microcontroller species can be expected to increase. As eight bit processors have been used as the base architecture, so we can expect sixteen and then thirty-two bit processors to be customised into controllers.

If the manufacturers adopt hybrid-style techniques, there is no reason why disk controllers and large amounts of RAM and ROM should not be fabricated onto one package. Perhaps the Ada compiler on-a-chip will be reality.

INTERSTAGE COUPLING

by Brian Kendal and Jeff Howell

Over the past few years, *Radio and Electronics World* has published a number of our engineering programs intended to assist in equipment design. Most of these, however, have been concerned with RF design. This month's program, in contrast, is concerned with much lower frequencies – the audio or video stages.

When designing a capacitance coupled amplifier, whether valve or solid-state, most amateurs tend to use 'typical values', past experience, or copy from a published design for a similar purpose. Unfortunately, however, conditions in the new circuit are often different from the model and results may be disappointing.

About the program

This program is intended to remove all guesswork from the design process, and enable component values to be selected which will result in a predictable frequency response when complete. Furthermore, in order to assist in calculating the overall gain figures for the amplifier, the losses due to mismatch are also calculated.

The capacitance coupling circuit is the simplest form of interstage coupling which gives dc isolation between the stages. The output resistance of the signal source (R1) and the input of the following stage (R2) determine the mismatch loss. This signal loss is caused because the input and output resistances are not equal, and it ignores all frequency effects. The coupling capacitor (C1) sets the low frequency losses. The high frequency loss would be equal to the dc mismatch loss if it were not for the inevitable input capacitance (C2) of the following stage. This stray capacity is sometimes supplemented by a discrete capacitor to deliberately attenuate high frequencies.

A word of warning

The program has been written in Microsoft Basic and should therefore run with little or no modification on most home computers. However, care should be taken when entering line 60. The log function in this statement is to base *e*. On some computers this is represented, as shown, by LOG but on others, such as those using BBC Basic, by LN. With this modification applied as necessary, the program has been successfully tested on both BBC B and Sanyo machines.

```
10 REM Broadband Interstage Coupling
20 REM J.M.Howell September 1986
30 DIM FP(12),X(6)
40 DEF FNA(X)=INT(X*1000+.5)/1000
50 DEF FNB(X)=INT(X*100+.5)/100
60 DEF FNC(X)=4.342*LOG(X)
70 DATA "Source Resistance (Kohms)",0.001,10000
80 DATA "Coupling Capacitance (nF)",0.001,100000
90 DATA "Input Capacitance (nF)",0,10000
100 DATA "Input Resistance (Kohms)",0.001,10000
110 DATA "Lowest Frequency (KHz)",0.001,100
120 DATA "Highest Frequency (KHz)",0.01,1000
130 REM Next line is steps per frequency decade
140 DATA 3,1,2,5
150 CLS
160 PRINT
170 PRINT "Interstage Coupling"
180 PRINT
190 RESTORE
200 FOR I=1 TO 6
210 READ A$,MINV,MAXV
220 PRINT A$;TAB(27);"[";FNA(X(I));"] ";
230 INPUT B$
240 IF LEN(B$)>0 THEN X(I)=VAL(B$)
250 IF X(I)>=MINV THEN GOTO 280
260 PRINT "Value Too Low"
270 GOTO 220
280 IF X(I)<=MAXV THEN GOTO 310
290 PRINT "Value too High"
300 GOTO 220
310 NEXT I
320 A1=1/X(1)/X(2)+1/X(1)/X(3)+1/X(3)/X(4)
330 A0=1/X(1)/X(2)/X(3)/X(4)
340 RL=1/X(1)+1/X(4)
350 READ N
360 FOR I=1 TO N
370 READ FP(I)
380 NEXT I
390 PRINT
400 PRINT "DC Mismatch = ";FNB(FNC(4/RL/RL/X(1)/X(4)));" dB"
410 PRINT
420 PRINT "F (KHz)";TAB(9);"Loss (dB)";TAB(20);"Phase"
430 F0=1
440 FOR I=1 TO 6
450 FOR J=1 TO N
460 F=F0*FP(J)/1000
470 IF F<X(5) OR F>X(6) THEN 550
480 W=F/159.2
490 RED=A0-W*W
500 IMD=A1*W
510 PHA=90
520 IF IMD<>0 THEN PHA=57.2958*ATN(RED/IMD)
530 AMP=FNC((W/X(3)*RL)^2/(RED*RED+IMD*IMD))
540 PRINT;F;TAB(9);FNB(AMP);TAB(20);FNB(PHA)
550 NEXT J
560 F0=F0*10
570 NEXT I
580 PRINT
590 INPUT "run again (Y/N)";A$
600 IF A$="Y" OR A$="y" THEN GOTO 150
```

Fig 1 *Interstage coupling program*

In accordance with our usual practice, a test problem has been included to enable the user to confirm that the program has been entered correctly, and also provide a little practice before it is used 'in anger'.

Using the program

This program computes the frequency response, phase shift and dc mismatch . losses for a simple broadband interstage coupling circuit. Consequently, the first task on running the program is to enter the proposed values for the circuit. With this it must be remembered that these must reflect those actually present, not merely the component values. For example, if the coupling is being fed from an FET stage with a load of 10kohm and a drain dynamic resistance of 20kohm, then the input impedance is not only the value of the load, but the combination of that and the drain dynamic resistance, or 6.67kohm. Likewise, allowance must be made for the input capacitance of the succeeding stage because, for example, a valve may have an input capacitance up to 12pF.

Input values

With the circuit values entered, the frequency band of interest is specified and the computer then calculates the frequency response, dc mismatch loss and phase shift.

The frequency reponse table is printed in increments of 1,2 and 5, to enable a wide spectrum to be examined within available screen space. To save time if the calculation has to be repeated, unless an alternative value is entered, the one used previously will be assumed.

Program description

The program can be conveniently described in three sections: lines 30 to 140 contain the computational framework; 190 to 310 defines the problem; whilst the calculations are performed in lines 320 to 570.

The framework first sets up the functions FNA and FNB, whose purpose is to remove unnecessary decimal digits from the final printout. Many home computers include special format controls for the same purpose, but not all do, and lines 40 and 50 are guaranteed to work on all machines.

The purpose of function FNC is, by converting the natural log function, to take twice the logarithm to base 10. As mentioned before, care must be taken to ensure that the appropriate keyword for natural logarithm is used. This may be LOG or LN depending on the computer in use.

The series of data statements at lines 70 to 120 provide a convenient method of storing text and place sensible limits on component values entered. Finally, the number and ratio of the steps in each frequency decade of the printout is given on line 140.

The six values which describe the circuit are then read into array X and checked one at a time. If a value is not to be changed, the string B$ will be empty, and this is tested at line 240. The input process is repeated from line 220 if either test at lines 250 and 200 show the value in the array to be out of range. The arithmetic section of the program in lines 320 to 570 determines the circuit behaviour over the specified frequency range.

The transfer function constants are set up in lines 320 and 340, and the frequency steps are loaded at line 370. The dc mismatch calculation is based entirely on the ratio between the load and source resistance. It is therefore independent of frequency and may be calculated first.

The frequency response is calculated within two nested FOR-NEXT loops. The outer loop controls the base frequency over six decades starting at 1Hz. The inner loop selects all frequency ratios within the decade.

For each frequency, line 470 decides whether it lies within the range of interest, and will skip the computation if it does not. The real and imaginary voltages in the network, and hence the phase shift and amplitude, are calculated on lines 490 to 530. Line 560 updates the base frequency for the next pass of the outer loop. .

Using the program

As usual, we have included a test problem so that the reader can confirm that the program has been correctly entered, explain how it can be used and give a little practice in its use before approaching a practical problem.

The subject which we have selected is a section of a voice operated switch circuit, which couples the preamplifier output to the peak level detector stage. The 33kohm resistor is the preamplifier collector load – the dynamic impedance can, in this case, be neglected. The 100kohm bypass resistor is the bias resistor of the detector – again, the dynamic impedance of the detector diode itself can be ignored.

From the printout it can be seen that the response is only flat over a very narrow band, around 500Hz, but in practice it will pass signals from about 50Hz to 5kHz wihout significant loss.

The program also calculates the dc mismatch loss; however this is only a guide and the actual loss will never be less than this figure.

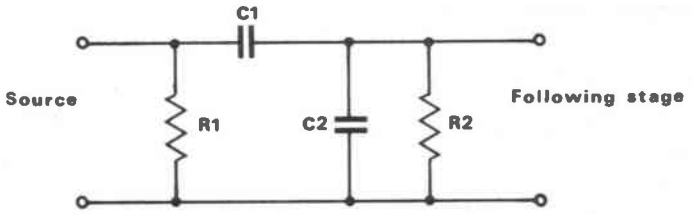


Fig 2 *Basic circuit of capacitance coupling*

```
>RUN

INTERSTAGE COUPLING

SOURCE RESISTANCE (KOHMS)[0]?33
COUPLING CAPACITOR (nF)  [0]?22
INPUT CAPACITANCE (nF)   [0]?1.5
INPUT RESISTANCE (Kohms) [0]?100
LOWEST FREQUENCY (KHz)   [0]?.02
HIGHEST FREQUENCY (KHz)  [0]?20

DC MISMATCH= -1.27 dB

F (kHz)   LOSS (dB)   PHASE
2E-2      -9.28       68.84
5E-2      -3.55       45.68
0.1       -1.39       26.35
0.2       -0.63       12.1
0.5       -0.43       -0.44
1         -0.56       -9.68
2         -1.14       -22.73
5         -3.88       -47.77
10        -8.16       -65.74
20        -13.6       -77.32
```

Fig 3 *Sample printout as described in text*

MEDIUM WAVE DXING

by Steve Whitt

In this month's special feature I'll be taking a look at the 25 year old radio battle being fought in the Caribbean between Cuba and the USA. It is of particular interest because of the close proximity of the two countries, which has meant that the medium wave band has proven to be the preferred battleground.

Wherever political tension runs high, radio has come to the fore as a means of communication, sometimes as a source of truth but more often as a propaganda voice. Relations between Cuba and its much larger neighbour located only 90 miles away have never been good, and at times have reached crisis proportions.

To circumvent international rules governing the allocation of frequencies, to which both the USA and Cuba subscribe, the first major propaganda station was set up semi-clandestinely by the CIA on tiny Swan Island, located south of Cuba near Honduras. This station called itself Radio Américas and operated from 1961 till 1968 using a 50kW MW transmitter on 1160kHz. There was also a 'Comité Pro Libertad de Cuba' which ran Radio Cuba Libre, a short programme that was aired over several mainland US stations that could be easily heard in Cuba, such as WGBS Miami, WWL New Orleans and WKWF in Key West.

At the height of the Cuban missile crisis in 1962, some dozen US AM commercial stations were carrying Voice of America programming to Cuba and one even voluntarily carried programmes in Russian! Subsequently, the VOA operated several outlets aimed at Cuba from sites at Marathon and Sugarloaf Keys, both in Florida. The latter operation lasted for three years from 1962 and involved 50kW on 1040kHz. Over the years there have been other radio operations in the area, but today there are just three transmitters beaming from the USA to Cuba. However, by way of retaliation, there are now two Cuban-based stations sending signals in the opposite direction.

Radio Marti came on air on 20th May 1985 (Cuban Independence Day), using the 50kW VOA transmitter at Marathon Key as well as VOA short wave facilities. This coincided with significant political posturing by both sides and claims by Castro that Cuba would launch a massive jamming/retaliation exercise. Indeed, US commercial broadcasters were very much anti-Radio Marti since they feared that they would be the victims of this battle. However, in the event, Cuba did not carry out its threat of serious jamming. Cuba's reluctance to increase jamming is not so much to do with the 'innocuous' programming as with a clause in the legislation that set up Radio Marti, which restricts operation to 1180kHz from Marathon Key unless Cuban interference increases by 25%. In other words, any attempt by Cuba to jam R Marti could, in fact, backfire.

Whilst Radio Marti is a government operation, a number of Florida-based commercial stations have been bought by Cuban exiles based in the Little Cuba district of Miami. These stations were not tied by the government constraints on R Marti, which attempted to ensure a reasonably balanced programme format, and were free to broadcast some highly vitriolic propaganda direct to Cuba. Not long after Radio Marti started operation, a Miami station formerly known as WGBS was bought by the Mambisa Broadcasting Co and, in October 1985, became WAQI Radio Mambi.

This station was purchased because it possessed a signal that could blanket Cuba day and night with a coverage even exceeding that of Radio Marti. However, within three days of coming on air Cuba had made moves to jam the station, probably assuming that WAQI was an underground attempt to circumvent the Congressional rules governing Radio Marti. The Cuban response was to move three 50kW Radio Rebelde transmitters to the R Mambi frequency of 710kHz. This consistently results in widespread interference throughout much of the Eastern USA where 710kHz used to be operated on a clear channel basis.

In addition to straightforward jamming, Cuba also set up two new high power broadcast facilities to aim English programmes to the USA on MW rather than the traditional SW facilities.

Since autumn 1986, tourists and visitors to Cuba have had their own special radio station called Tour Radio Taino, operating in English and Spanish with 75kW on 1160kHz from a 600ft radio mast located near Havana. This station is not really as new as it seems, since it had appeared previously in various guises (including the Voice of Cuba) since December 1981. It can put out an extremely potent skywave signal but currently restricts itself to daytime broadcasting, thus minimising potential interference in the USA.

More recently, a new Cuban station on 1040kHz has been relaying Radio Moscow in English, aiming an estimated 300kW signal to the USA.

The operation of these stations can give the DXer quite an insight into the changing political tensions affecting this part of the world. In contrast to the elusive world of clandestine broadcasters, government-run propaganda stations tend to be powerful voices that make the DXer's task somewhat easier. Indeed, all the stations discussed earlier have been heard by DXers here in the UK.

News desk

Jamming: At 1700hrs on New Year's Day the VOA News reported that Soviet jamming of the Polish broadcasts from Radio Free Europe had ceased, and that programmes were being heard clearly all over Poland for the first time in years. Since RFE employs highly directional aerials in order to get its signal into Poland from the transmitter site in West Germany, it is not that easily heard in the UK, despite a power of 150kW. Previously, all that could be heard here was the powerful jamming signal interfering with several low power relays of BBC Rádio 4. However, my Italian correspondent Stefano Valianti, in Bologna, is better placed to hear RFE and he confirms that a very clear signal can now be heard in the evenings on 720kHz with the identification 'Radia Wolna Europa'.

Shetland Islands: Until recently the only local radio service for the Shetlands was provided on a part time basis by BBC R Shetland, which opts out of R Scotland for 2¼ hours a day. Since late December, however, a new (unlicensed) station has taken to the air from studios in Lerwick. For many years now the Shetland Island Broadcasting Company (SIBC) has been trying to obtain a licence to operate legitimately; it was refused a franchise by the IBA because the population was too low and it lost out when the Government cancelled its plans for community radio in 1986. Now SIBC, which was the brainchild of Ian Anderson, has gone it alone and, although initial plans included operation on medium wave, it seems that broadcasting is restricted to the Lerwick area since just one FM transmitter is currently in use.

The broadcasts are in stereo on 96.3MHz with an ERP of 650W and programming is provided 24hrs a day, although with a staff of only four the night-time programmes are necessarily tape automated. If SIBC continues its operations it may activate its MW transmitter, which is likely to be on either

558kHz or 585kHz with approximately 1kW from a vertical monopole aerial.

Germany FRG: Deutschlandfunk (DLF) is still suffering generally from poor reception on 1269kHz of its English service, despite modernisation of its Neumünster transmitter. As a result, DLF has been investigating a device called the Magic Disc, which is placed next to a portable radio and acts basically as a user friendly MW loop aerial. The winter edition of DLF's magazine, *Print Out*, also contains a four-page feature on MW reception and loop aerials – well worth reading. DLF has a daily programme in English at 1915, until 2000hrs GMT daily.

Germany DDR: Radio Berlin International has reintroduced its English MW service on 1359kHz at 1915hrs and 2300hrs GMT.

Monaco: Trans World Radio has a new transmitter on 1467kHz rated at 1000kW, replacing the old 1200kW unit. The transmitter is now sited at Roumoules in Southern France, some distance (100km west) from the old site which was just above Monaco. The new site was chosen for its better earth conductivity and for the space to erect a five tower directional aerial. The new, improved aerial system compensates for the slight power reduction. TWR is now able to beam its religious programmes to target audiences in the following four directions: 25°, 85°, 240° and 320°. The overall aim of this work was to improve reception at distances in excess of 800km; however, programming continues unaltered.

USA: On 1st October 1987 there were 5266 licensed stations operational in the USA and Canada. In addition, there were 191 construction permits (CPs) for new stations, 50 CPs for frequency changes still outstanding and a further 80 stations were temporarily off the air for one reason or another.

Interesting info: The Department of Trade and Industry's Radiocommunications Division (Waterloo Bridge House, Waterloo Road, London SE1 8UA) has published its annual report for 1986/87, which is available *free*. This 50-page, glossy, A4 style booklet is an interesting source of information and a good read.

DX file

Every so often DXers get caught by surprise when a very good period of DX conditions occurs, and several times during December there were periods of low solar activity. However, the one most significant period started to develop from 1st December when the solar radio flux (a measure of solar activity) fell back to a stable value of 88-89 for six days. This value had seemingly been irretrievably passed a few months earlier due to the steady increase in solar activity associated with the start of the new Solar Cycle. Additionally, between 7th and 9th December very low geomagnetic activity occurred and the combination of these two phenomena led to some very good MW radio conditions. Reception from Eastern Canada and the USA was favoured rather than from further afield, but the signals that were audible were unusually strong and stable with little fading. Indeed, reception was often possible on ordinary portable radios! Here are some examples of stations that were heard:

570 – WKBN Youngstown OH; possible UK first, heard on 9th December.
590 – VOCM St John's NF; heard well all night from 1930-0830hrs!
600 – CBS Taiwan; in Chinese around 1630hrs.
930 – CFBC St John NB; completely dominant over the more usual CJYQ.
1010 – WINS New York; stable strong signal for five nights in a row.
1030 – WBZ Boston MA; exceptional signal between 5th and 10th December.
1050 – CHUM Toronto ON; sometimes completely dominant over WFAN.
1140 – WRVA Richmond VA; an infrequent visitor to these shores.
1190 – WLIB New York; daytime only station heard around 2130hrs.
1220 – CKCW Moncton NB; another strong stable signal.
1510 – WSSH Boston MA; another rock solid signal.

That just about wraps it up for another month, so until next time keep your dials tuned, and let me know what you heard. Good DXing. REW

USER REVIEW

by Ken Michaelson G3RDG

The MS1 monitorscope, a new product from the Revex Co Ltd, of Japan, is the subject of this review. My first impression was of a thoroughly workmanlike, solidly made instrument. It measures 270mm (10.6in) wide by 100mm (4in) high by 280mm (11in) deep, excluding projections, and is finished in black crackle paint, the front panel being covered with a plastic sheet with the lettering and graticule etc being printed on it. Its weight is approximately 4.2kg (9.2lbs) and the technical specifications quoted are included in the table.

The monitor tube is on the left hand side of the panel, having a blue tinted display which is flanked by two rotary controls, intensity, focus and power on/off switches on the left, and three rotary controls, attenuator, sweep and vertical gain switches on the right. To their right are six switches, the top three being the modes (SSB, TRAP and RTTY), and the lower three the ranges (100Hz, 1kHz and 10kHz). Below these are three more rotary controls, from left to right, Vertical Position, Horizontal Gain and Horizontal Position. Above the Horizontal Position knob are the last two switches, the top one giving a choice of the audio input from the front or rear panel, the lower one being the audio input attentuator giving either 1 volt RMS or 10 volts RMS. The two BNC input sockets are on the far right and are marked 'V input' and 'H input'. The rear panel contains only the alternative audio input socket, this time being a 'phono' type, and the two SO239 sockets for the Tx in and Ant out.

The unit was easy to connect up, having only the audio input and antenna connections to make. I used the phono sockets at the rear for audio in as being the most convenient and took an extra piece of co-ax to route the transmitter output through the MS1. I first used it for Amtor and got the cross pattern on the first station I tuned in. The routine for this was to depress the RTTY button (at which a red LED indicator light came on), turn the 'Sweep' control fully clockwise and depress the 10kHz Sweep Frequency switch, which also had an indicator light. The cross pattern could then be adjusted with the vertical and horizontal gain controls. My own transmission picture could also be shown if I switched in the monitor on my rig, and therefore it was possible to get my frequency to match the other end exactly.

The same routine was carried out for RTTY transmissions with complete satisfaction. The unit provided, in my view, an ideal method of tuning in any type of two tone or frequency shift signal, and functioned as well with Packet transmissions on HF as it did with RTTY and Amtor.

I also monitored incoming audio signal patterns by depressing the SSB button. Both the Sweep control and the Attenuator switch (as opposed to the switched attenuator used for transmissions) were adjusted to get the desired pattern. I also monitored my SSB transmissions, this time using the rotary Attenuator switch in conjunction with the other two controls mentioned above. The same procedure applied to CW transmissions, and I tried out AM into a dummy load. Drawings of what the various transmissions should look like were given in the instruction sheet.

The final display available to the user was the RF trapezoid pattern. This would check the linearity of an amplifier, as well as being a means of checking the modulation factor of SSB and AM transmissions. To get this display, one depressed the Trap button, turned the Sweep control fully clockwise, depressed the 10kHz range button and turned the Vertical gain fully counter clockwise. I was interested and satisfied to see that my rig showed no distortion or over driving when running at full output both in the SSB and AM modes.

The unit could not be used as a normal oscilloscope because of the lack of direct calibration, but nevertheless fulfilled its role as a monitorscope excellently. I would consider it a worthy addition to anyone's shack. The price of the MS1 is £269.00 including VAT, but carriage is extra (Securicor £7.00). Thanks are due to Waters and Stanton, 18-20 Main Road, Hockley, Essex (telephone (0702) 206835), for the loan of the unit for this review.

MS1 MONITORSCOPE TECHNICAL SPECIFICATIONS

RF section	Frequency range	1.8 – 54MHz
	Transmission power	1000 watts PEP
	Impedance	30 – 75 ohms
Vertical amplifier	Input impedance	1Mohm approx
	Frequency response	10Hz – 40kHz
Horizontal amplifier	Input impedance	1Mohm approx
	Frequency response	10Hz – 300kHz
Sweep generator	Frequency range	100Hz/1kHz/10kHz
CRT		Round 3in monitor
Power requirements		100/117Vac or 220/240Vac
		Approx 30 watts

Latest Literature

THE REAL HI-FI STORY

An LP-sized book, which has been produced by the British Audio Dealers Association to debunk some of the myths that surround the business of purchasing hi-fi.

Not only is this book highly readable, but it will be given free to anyone who applies to the address below. It's certainly worth the price of a stamp and gives plenty of information about how to set about such a purchase, what to expect from a dealer and so forth.

Some of the advice is quite an eye-opener – the idea of a retailer actually demonstrating a system in the home, to take but one point, should be seen as a necessity rather than an extremely optional extra. Well, well!

This book is designed to shake the complacency of the chain stores who consider a five quid plastic tranny to be 'hi-fi'. It is not so much a guide to the facilities of different set-ups as a campaign to get the general public to be more demanding and critical buyers. Think before you buy, is the message, and this book gives plenty of suggestions as to what you should be thinking about.

Lloyds bank have sneaked in an instant debtmaker at the back, with a finance application form (word of advice from *this* disinterested body – check around before you accept finance, the cheapest isn't always the one at hand). There are also several pages of tear-out SAEs for information about many leading and very reputable makes of equipment, which is extremely helpful.

The Sound Advice Centre, 40/41 Great Castle Street, London W1N 7AF.

RADIOWAVE PROPAGATION

by L Boithias

Many books deal with the various ways in which radio waves are propagated, but this one goes into minute, technical and painstaking detail. The publishers call it a state-of-the-art review and it certainly is; comprehensive would be a mild description.

Equations and diagrams abound in this highly-structured text, but a beginner would have to be well-grounded in general electronics to begin to use the abundance of information.

The book starts with a review of line-of-sight propagation and the characteristics of major physical phenomena affecting propagation, including the anomalies known to exist. The second part deals with the mechanisms involved in non line of sight propagation and types of interference, including electromagnetic disturbance.

Aimed at practising electrical and electronic engineers, there must be enough detail in this text to keep the most enquiring of minds occupied for hours.

North Oxford Academic Publishers Ltd, £35. ISBN 0-946536-06-6

WEEKEND ELECTRONICS PROJECTS

by A Guzman N5EAJ

'Fun and Easy Weekend Electronics Projects' is the full title of this wonderful little book, which should provide quite a few weekends' worth of entertainment for soldering-iron wizards.

Many of the projects look truly simple, including some that are of general use like the car alarm and headlight alarm, and many that the electronics enthusiast will love, like the RFI sniffer, the VHF receiver, LED meter, and so on, to a total of thirty-three different things to build of varying complexity, but none beyond the resources of the majority of electronics enthusiasts.

As this is an American publication, some of the appendices have a strong US flavour. The copper wire table gives AWG only, for instance, and the list of parts suppliers comprises only US suppliers, though Radio Shack (Tandy over here) is mentioned several times, and in all probability they and most other reputable UK suppliers could supply the necessary components.

John Wiley & Sons Ltd, £6.95. ISBN 0-8306-2861-4

OSCILLOSCOPES

by I Hickman

This is a revised edition of a popular and inexpensive book which caters for anyone who needs to use one of these instruments.

The text has been updated to include recently introduced oscilloscopes, and it has consequently been considerably enlarged. Starting with a description of the instrument's purpose and performance, the book moves in easy stages with simple, easy-to-follow details.

The controls of a basic scope are described with their functions, and the various terms involved are explained without unnecessary jargon, which will be a relief to beginners.

The oscilloscope is such an essential tool that this no-nonsense text will be welcomed in its revised form. 'The right scope for the right application' is the watchword, with discussions of what constitutes an essential feature, and how to apply the scope in a particular situation.

This book would provide useful reference material in an easily understood format for anyone who might want to purchase a 'scope'. Covering all the major types of scope, this handy book is bound to be in great demand.

William Heinemann Ltd, £5.95. ISBN 0-434-90738-3

TELECOMMUNICATIONS

This glossy magazine is published by the Swiss Office for Trade Promotions, and is a directory of companies in Switzerland dealing with telecommunications systems.

Product details, services and biographies of firms appear in alphabetical order. An alphabetical product index is provided for those who know what they want, but

LATEST LITERATURE

not where to get it.

If you need to deal with a Swiss firm, or you suspect that your needs can only be fulfilled by dealing with the Swiss, this book gives names, addresses, telephone, telex and FAX numbers, and can be obtained at the address below.

We'd like the wireless that fits in the ear, complete with mini-microphone and control switch concealed in a ball point pen...

Swiss Office for Trade Promotion, PO Box 1128, Avant-Poste 4, CH-1001 Lausanne. Tel: (021) 20 32 31.

HHB hire and sales

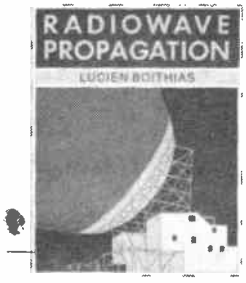
Hi-fi rental with a difference – this isn't the mundane video and telly corner, HHB rent the real thing – complete sound systems, multi-track recorders, digital mixers and so forth.

This is just the thing for the man who wants to set up his own recording studio.

To cater for this market, HHB plan to issue a magazine on a regular basis, to keep customers informed about the latest developments in the field and the most up-to-date prices for hiring these high-powered items.

With a back up advisory service, this is definitely the magazine for the man who has everything.

HHB Hire & Sales, 73-75 Scrubs Lane, London NW10 6QU. Tel: 01-960 2144.



Mitsubishi Semiconductors

The latest general catalogue from Mitsubishi features information in tabular form about their range of semiconductors.

Starting with IC memories, the catalogue lists the characteristics and type numbers of the numerous items stocked. A very useful reference work.

Mitsubishi Electric UK Ltd, Hertford Place, Maple Cross, Rickmansworth, Herts WD3 2BJ. Tel: (0923) 770000.

Siemens Ltd

Siemens' latest magazine looks at the newest developments within the company, examining recently introduced devices such as the SAB8220 bus interface controller; the smart SIPMOS intelligent power semiconductor; Sidecon, a double multipole connector for use on double Eurocard PC boards, and the new ADMA co-processor.

A further article deals with motor control with electrical isolation of the operator module and power unit, and the magazine concludes with the components service, news and a brief explanation of RISC, a new type of processor architecture.

Siemens Ltd, Siemens House, Windmill Road, Sunbury on Thames, Middlesex TW16 7HS. Tel: (0932) 785691.

Technology update

This book is a collection of eight papers, written by PA Technology consultants, about a variety of general technology-related subjects.

Some of these papers deal with specific areas, such as microprocessor applications in the food industry, but others will be of interest to a wide spectrum of readers who would like to know more about the latest developments in electronics.

Paper titles include 'Satellite Paging in Cellular Communications' by Dr G Maile, 'Speech Recognition Technology: How Well Does it Satisfy the Need?' by N Sedgwick, plus others on biosensors, voice input methods and ASIC technologies.

All provide an interesting insight into what's going on in the research field at this moment. For copies of the papers, or further information, contact PA Technology at the address below.

PA Technology, Melbourn, Nr Royston, Herts SG8 6DP. Tel: (0763) 61222.

Siliconix Ltd

Siliconix Ltd have recently published a new shortform, which carries a brief outline of all Siliconix products currently being made, including new devices recently added to the range.

The shortform also includes a cross reference section which gives Siliconix equivalents to industry part numbers, and a list of sales representatives worldwide.

Siliconix Ltd, 3 London Road, Newbury, Berks RG13 1JL. Tel: (0635) 30905.

Online Distribution

Available free from Online Distribution is a 48-page illustrated shortform catalogue of passive, electromechanical and connector products.

Illustrated with photos, drawings, prices and ordering information, the catalogue features components by Erg (reed relays, switches, low-cost wire-wound resistors); General Hybrid (carbon resistors, resnets, cermet trimming potentiometers); Harwin (IC sockets, PCB interconnect system); Texas Instruments (IC sockets) and Wimpey-Dubilier (resin-dipped tantalum capacitors).

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

Highland Electronics

Highland Electronics has produced a new 92-page catalogue giving full details of the company's ranges of control products.

Products in the catalogue include miniature magnetic circuit breakers, programmable logic controllers, control modules and motor load monitors.

Each section of the catalogue gives full technical details, a selection guide, and applications and installation information.

Highland Electronics Ltd, Albert Drive, Burgess Hill, West Sussex RH15 9TN.

RF power FETs

The extensive range of Polycore PolyFET gold-metallised RF power FETs is now being shown in a new shortform catalogue from Anglia Microwaves Limited.

The shortform contains all of the data necessary to select a device. It has detailed facts and figures on each type and illustrates the wide choice of package styles offered.

Among the series covered are the PolyFET F1000, operating from HF to GHz frequencies, the F1200 Mobile series, F2000 – HF to 2GHz and F3000 Superpower range for operation from HF to VHF bands.

The impressive performance figures illustrate the advantages of gold metallisation, including the highest reliability and mean time between failure MTBF figures of any FET.

The Polycore PolyFET provides low capacitance, high Gm (typically 10-13) and high Ft specifications, for use in VHF, UHF and microwave circuits.

Engineers now have access to a range of devices covering frequency ranges from 1MHz to 2GHz with power levels from 1W to 300W in Class A, B and C.

Anglia Microwaves Ltd, Radford Business Centre, Radford Way, Billericay, Essex CM12 0BZ. Tel: (0277) 630000.

DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

There was certainly nothing tame about long-distance TV reception during November. The super-enhanced tropospheric conditions during the first week caused quite a stir among enthusiasts. Many confided that the opening was the best they had experienced. By comparison, sporadic E activity was minimal, with only a few insignificant openings of short duration.

Super trops

Over a period lasting at least five days, many British TV channels were severely bombarded with high-level continental signals. One DXer commented that foreign pictures had invaded his ITV channel, even though the local 1000kW transmitter was all but a stone's throw away!

Throughout the opening, reception was predominantly from central Europe rather than from the Benelux countries. Consequently, a profusion of East German and West German stations close to the Czechoslovakian border were received (see *Figure A*). In fact, conditions were such that on November 6th and 7th, Czechoslovakian transmissions at UHF were noted over a large part of the UK. On the 6th, Czechoslovakian signals in Band III from Plzen on channel R10 remained steady from transmitter switch-on until closedown. Unfortunately, colour could not be resolved due to the effects of strong Belgian signals on channel E10, but UHF proved to be a different story.

Colour from Czechoslovakia

CST-2 on channel R35 from Susice was strong enough to resolve SECAM colour. The 'RS-KH' EZO test pattern appeared in full glorious colour, and it was a novelty to see it without any fading. Surprisingly, the Polish PM5544 test card appeared at times as a co-channel signal. This was also in colour. At 1600 the test card changed to the 'TP' clock, followed by an English programme. A video recording was made, and on replay a 'Programme 35' caption was noticed. This was confusing at first, especially since the transmission was received on channel 35. Was it a local or regional broadcast on this channel 35? No, it wasn't! It related to the 35th programme in a foreign language series!

On the 5th and 6th, the low power Belgian BRT-1 relay was logged on channel E2, which must be classed as a rare event. Another interesting Band I signal occurred on the 6th on channel R1, when a weakish Russian UEIT test card emerged from the noise and remained steady for over 20 minutes. Several DXers are convinced it was a trop signal, while others thought it was sporadic E!

Finally, here at Derby on November 10th, an unusual test card fluttered up via MS (meteor shower propagation) on channel E3 at 1248GMT. It resembled the type favoured by many of the Italian private stations, and had a distinctive dark appearance.

DX-TV log for November

The log this month was kindly supplied by Kevin Jackson of Leeds:

04/11/87: *Russia*: TSS on channel R1, with the '0249' monoscopic test card at

PHOTO FILE ● PHOTO FILE ● PHOTO

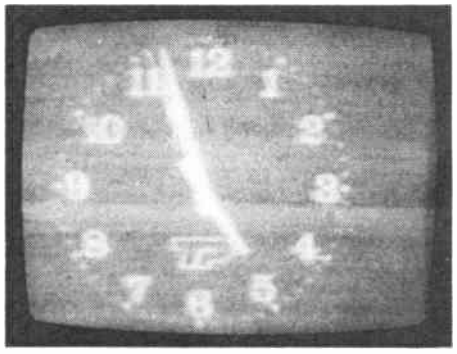


Fig 1 *Polish clock caption received on channel R35 from Jelenia Gora*

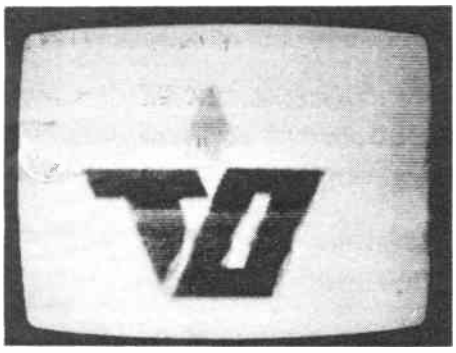


Fig 2 *Programme caption from TVP-1 in Poland on R35, received via enhanced trops*

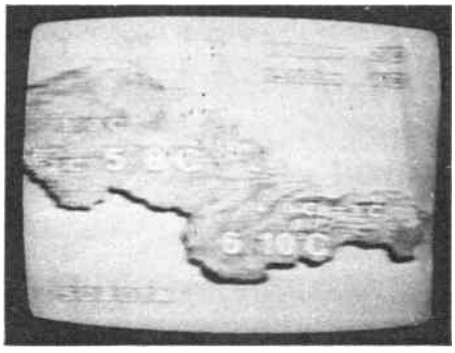


Fig 3 *Weather chart from CST in Czechoslovakia from the R10 Plzen outlet*

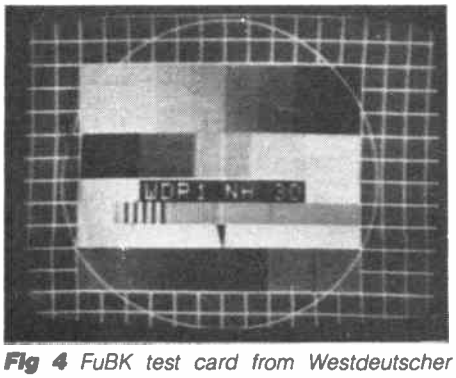


Fig 4 *FuBK test card from Westdeutscher Fernsehen radiated by E30 at Nordhelle*

Fig 5 *Programme schedule for 6/11/87 from the E7 HR-1 outlet at Hoher Meissner*

Fig 6 *ZDF news, West Germany, received via November's excellent tropospheric conditions*

1040 and the UEIT test pattern at 1042, via sporadic E.
France: TDF tf1 L27 (Lille), L39, L42 and L43; TDF Antenne 2 L21, L34, L39, L46, L48 and L57; TDF FR-3 L24, L37, L42, L45 and L60; Canal Plus L5, L7 and L9; La Cinq L34 and L49.
Luxembourg: RTL Plus E7; RTL E27 (Dudelange).
Belgium: BRT-1 E10 (Wavre) and E43 (Egem); BRT-2 E46 (Egem); RTBF-1 E8 (Wavre); E11 (Leglise), E52 (Riviere) and E57 (Froidmont – vertical polarisation); RTBF-2 E42 (Liege); E49 (Oostvleteren); E60 (Leglise); E61 (Anderlues) and E63 (vertically polarised).
Netherlands: NOS-1 E5 (Roermond) and E29 (Goes); NOS-2 E27 (Lopik) and E31 (Roermond); NOS-3 E30 (Lopik) and E34 (Roermond).
West Germany: NDR-1 E10 (Harz West); NDR-3 E53 (Torfhaus); WDR-1 E9 (Langenberg); E11 (Teutoburger Wald); E30 (Nordhelle); E46 (Kleve) and E50; WDR-3 E40, E42, E48, E50, E53 and E60; SWF-3 E40, E42, E56 and E60; HR-1 E7 (Hoher Meissner); E8 (Grosser Feldberg) and E57 (Rimberg); HR-3 E37 (Rhön), E39, E52 and E54; SFB-1 E7 (Berlin); BR-3 E49 (Rhön) and E57 (Hof); SDR-1 E50 (Heidelberg); ZDF E21, E23, E27, E28, E29, E30, E33, E34, E35 and E37.
East Germany: DDR:F1 on channel E5 (Inselsberg or Berlin), E6 (Brocken) and E12 (Sonneberg); DDR:F2 E31 (Inselsberg) and E34 (Brocken).
05/11/87: *France*: TDF tf1 L27, L37, L39, L42 and L63; TDF Antenne 2 L21, L34, L35, L39, L45, L46, L48, L57; TDF FR-3 L24, L37, L40, L42 and L45; Canal Plus L5, L6, L7, L8, L9 and L10; La Cinq E49.
Luxembourg: RTL Plus E7.
Belgium: BRT-1 E10, E43 and E49 (vertically polarised); BRT-2 E55 (vertically polarised); RTBF-1 E8, E52 and E57 (vertically polarised); RTBF-2 E42, E45 (Brussels – 500W outlet), E60, E61 and E63 (vertically polarised).
Netherlands: NOS-1 E5 and E29; NOS-2 E27, E31 and E32 (Goes); AFN-TV on channel A80 (system M 525 lines) from Camp New Amsterdam.
West Germany: NDR-3 E53; WDR-1 E9, E11, E30 and E50; WDR-3 E39, E40, E48, E49, E58 and E60. SWF-3 E40, E42 and E56; HR-1 E8; HR-3 E37, E52 and E54; BR-1 E6; BR-3 E49 and E57; ZDF E21, E33, E34, E35, E37, and E45.
East Germany: DDR:F1 E12 (Sonneberg); DDR:F2 E34 (Brocken).
Czechoslovakia: CST-2 channel R35 from Susice.
06/11/87: *France*: TDF tf1 L27, L42, L43, L63; TDF Antenne 2 L34, L39, L46, L48 and L52; TDF FR-3 L40; Canal Plus L5, L7, L8, L9, L10; La Cinq L49 and L52.
West Germany: ZDF E21, E23, E26, E28, E33, E34, E35 and E37; HR-1 E7 and E8; HR-3 E37, E45, E52, E54 and E55; NDR-3 E53; WDR-1 E24, E30 and E50; WDR-3 E40, E49, E50, E58 and E60; SWF-3 E56 and E60; BR-3 E49, E51, E52, E54 and E57.
Belgium: RTBF-2 E42, E45, E49, E60, E61 and E63 (vertically polarised); BRT-1 E10 and E43; BRT-2 E46.
Netherlands: NOS-1 E29.
Luxembourg: RTL Plus E7.
East Germany: DDR:F1 E5, E6, E8 and E12; DDR:F2 E31 and E34.
Czechoslovakia: CST-1 R10 (Plzen); CST-2 R35 (Susice) and R38.
Poland: TVP-1 R35 (Jelenia Gora).
07/11/87: *France*: TDF tf1 L22, L27, L35, L42, L46, L48, L54, L55 and L63; TDF Antenne 2 L21, L23, L33, L34, L39, L48, L51 and L57; TDF FR-3 L24, L26, L28, L37, L40, L44, L45, L50, L51, L60 and L62; Canal Plus L5, L6, L7, L8, L9 and L10; La Cinq L32, L39, L49 and L51; Metropole 6 L34.
West Germany: ZDF E24, E26, E27, E28, E29, E30, E31, E34, E35, E37 and E45; HR-1 E7, E8, E56 and E57; HR-3 E37, E52 and E54; NDR-1 E10; WDR-1 E9, E11, E30 and E50; WDR-3 E39, E40, E42, E48, E49, E50, E55, E58 and E60; SWF-3 E40, E44, E48 and E56; BR-1 E7 (Brotjacklriegel); BR-3 E49, E57 and E59; NDR-3 E53.
Belgium: BRT-1 E10 and E43; RTBF-1 E8, E52 and E57 (vertically polarised).
Netherlands: E5 and E29; NOS-2 E27 and E32.
Denmark: Channel E7.
East Germany: DDR:F1 E5, E6 and E12; DDR:F2 E27, E31, E32, E33 (Sonneberg) and E34.
Czechoslovakia: CST-1 R10; CST-2 R35 (Susice), R36 (Cheb), R38 (Jachymov) and R39 (Ceske Budejovice).
08/11/87: *France*: TDF tf1 L37 and L43; TDF A2 L21, L23, L34, L39, L46 and L56; TDF FR-3 L31 and L43; Canal Plus L5, L7 and L9.

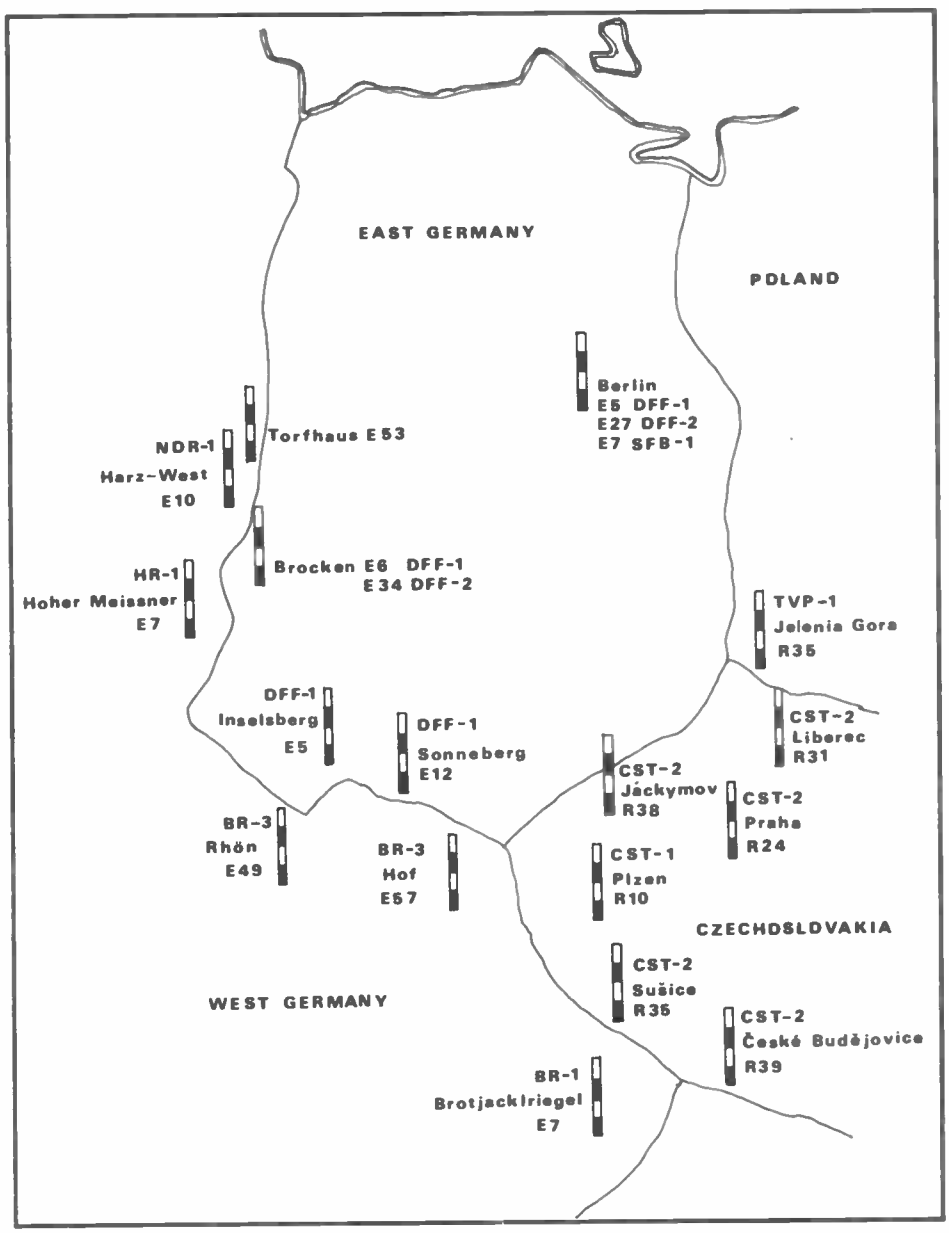


Fig A *Distribution of some of the many TV stations received during the enhanced tropospheric conditions between 4th and 8th November 1987*

West Germany: ZDF E29, E33, E34, E35, E37 and E45; NDR-3 E53; WDR-1 E30, E43 and E46; WDR-3 E39, E40, E42, E48, E49, E50, E55, E58 and E60; SWF-3 E40, E42 and E56.
Netherlands: NOS-1 E5, E7 (Markelo) and E29; NOS-2 E27, E31, E32 and E53 (Arnhem).
Belgium: BRT-1 E10 43; RTBF-1 E8 and E52.
East Germany: DDR:F1 on channel E5.

Reception reports

Mark Dent of Leeds spotted an HR-3 transmission on channel E27, which he describes as 'liney and speckly'. He assumes it was a ZDF outlet accidentally taking its feed from Rhön on E37. An unidentified FuBK test card on E38 was seen by Mark at 1322GMT on the 6th, which was floating with CST-2. The signal is a mystery, since there are no high-power transmitters on channel E38 using system G/H.

Mark had no trouble recognising the Bayerischer Fernsehen test card on channel E7 from Brotjacklriegel – it appeared proudly displaying the full name of the transmitter across the centre. It makes you wonder how it all fits on!

The 6th provided plenty of Czechoslovakian DX, with the CST-2 network logged at UHF on channels R31, R35, R36, R38 and R39. Several 'R' channels were received in Band III. CST-1 from Plzen on R10 was the most consistent signal, but another CST-1 outlet was in evidence lower down the band at R7. The closest transmitter on this channel is located at Jachymov with an ERP of 2kW.

The 7th brought in CST-1, again on channel R10, but on R9 a different programme was noted. The latter could not be identified, but it is thought to have originated from the Polish TVP-1 outlet at Poznan.

A system M (525 lines) broadcast was located on channel 34 on the 6th. This was subsequently identified as AFN-TV from SHAPE in Belgium. Kevin Jackson – also of Leeds – did exceedingly well, with many stations being received in excess of 1200km. The first hint of DX occurred on the 3rd, with Switzerland on channel E34. The rest of his bumper exotic-packed log is featured this month.

Ray Davies of Happisburgh in Norfolk was amazed to find BRT-1 on channel E2 via trop from the 100W Antwerp relay. So was Simon Hamer – in Wales! Simon, of New Radnor, also noted a system G/H picture on channel E38 on the same day as Mark. Reception on all the TV bands was exceptionally good, considering Simon's valley location.

Some of the 'goodies' included Denmark E10 (Vestylland), Belgium E3 (Liège), West Germany with HR-1 E5 (Hardberg), BR-1 E6 (Dillberg), East Germany E5 (Berlin), E6 (Brocken), E27 (Berlin) and E37 (Helpterberg). Canal Plus signals occupied the whole complement of Band III 'L' channels, and other French broadcasts from tf1, Antenne 2 and FR-3 were littered throughout UHF.

Bob Brooks, of South Wirral, identified many Continental stations during the period. Unfortunately, Bob is not equipped for UHF DX, so most of the November reception took place at Band III using a loft aerial. Several East German and West German stations were noted, the furthest being DDR:F1 on channel E6 from Brocken and Hessischer Rundfunk on E7 from Hoher Meissner. The latter was identified from the FuBK test pattern bearing the identification 'hrl M' and a large digital clock superimposed over the colour bars.

Scramble at the BBC

The BBC are seeking the Government's approval to screen specialist programmes when the network is not in use overnight. The broadcasts would use scrambling techniques to ensure they reached only their target audience, such as medical specialists and students.

Test transmissions using scrambling techniques have taken place during the early hours. The scrambling system undergoing tests is known as 'Discret 12', which is similar to the one in use by Canal Plus in France. The aim is to ensure that the terrestrial transmitter network is capable of handling such a system, although there are no immediate plans to launch a scrambled service as in France.

The more recent tests occurred after closedown via BBC 1 and BBC 2 transmitters during mid-November. Digital test card 'F' was radiated, and at times the 'count-down' number '1' or '0' was superimposed, but in its halted state. A scrambled test film followed consisting of various clips of programmes including a few seconds of the old 'BBC 2 COLOUR' test card 'F', and the globe caption from the early seventies. Although colour was present, picture verticals were severely displaced. The sound was very tinny and virtually inaudible.

Service information

Sweden: Swedish TV was reorganised on August 31st, 1987. The first programme is now called 'KANAL 1' and originates in Stockholm. The second network is still called 'TV 2', but it is an association of the various regional studios throughout the country. The appropriate network name appears at the top of the PM5534 test pattern with 'SVERIGE' at the bottom. TV 2 regional programme times remain unchanged apart from Friday. These are as follows: Monday-Thursday 1915-1930 local time, and Friday 1900-1930 local time. 'ABC-nytt', a regional news programme for Stockholm and Uppsala regions has been introduced.
Denmark: Although TV Syd now shows regular commercials daily between 1900-1905 local time, advertising is the responsibility of the newly-formed TV 2 company.
Norway: There are plans for YLE relays in the north of the country for the benefit of Finns living there.
West Germany: Further private stations are planned for relaying SAT-1 and RTL+ programmes, as shown in the table.

One of the two outlets for private TV in Hamburg is now on the air. Tests are being carried out on channel E46 with 1.7kW ERP. This will be increased to 15kW in January 1988. The station is broadcasting teletext and detailed announcements about the tests and characteristics of the transmitter. The test pattern is the DBP Cable TV test card with 'HMB K46' identification.

Transmitter identification slides (known as *Senderdias*) have made a welcome comeback, and during the recent trops some were noted from several West German outlets. Years ago these were displayed at regular intervals during test transmissions thus making transmitter identification easy.
Switzerland: In addition to the relays mentioned in last month's column, the following are in operation: Lopper E53 ARD-1, E56 ZDF and E59 ORF-1 (all 3kW); Celerina E57 ARD-1 (3.2kW).
Russia: It is thought that the identification 'TM' originates from Moldavian Television. During July the UEIT card was seen with the letters 'TM 1987' at the top.
Hungary: The Tokaj R4 outlet is on reduced power, due to aerial maintenance. Since September, the MTV-1 programme has been aired on R43 with an ERP of 80kW. This could eventually mean the end of the R4 outlet.

This month's Service Information was kindly supplied by Gösta van der Linden (Rotterdam) and the Benelux DX Club (Netherlands). NEW

SAT-1:			RTL PLUS:		
E24	Kiel	400W	E28	Flensburg	200W
E24	Flensburg	100W	E42	Lübeck-Barkenthin	34kW*
E36	Lübeck-Birkenthin	34K*	E52	Schleswig	
E37	Eckernforde		E53	Kiel	400W
E42	Schlewsig		E59	Itzehoe-Hennstedt	100kW
E49	Itzehoe-Hennstedt	100k	E60	Lübeck-Stadt	3kW
E57	Lübeck-Stadt	3k	E60	Eckerndorf	

*Beamed to the south-west

COMPUTER WAREHOUSE

1000's OF BARGAINS FOR CALLERS

THE "ALLADINS" CAVE OF COMPUTER AND ELECTRONIC EQUIPMENT

HOT LINE DATA BASE

DISTEL©

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

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

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

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

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

COLOUR & MONOCHROME MONITOR SPECIALS

'SYSTEM ALPHA' 14" COLOUR MULTI INPUT MONITOR
Made by the famous **REDIFFUSION** Co. for their own professional computer system this monitor has all the features to suit your immediate and future requirements. Two video inputs: **RGB** and **PAL** Composite Video, allow direct connection to **BBC/IBM** and most other makes of micro computers or **VCR's**, including our very own **TELEBOX**. An internal speaker and audio amp may be connected to computer or **VCR** for superior sound quality. Many other features: PIL tube, Matching **BBC** case colour, Major controls on front panel, Separate Contrast and Brightness – even in **RGB** mode. Separate Colour and audio controls for Composite Video input, **BNC** plug for composite input, 15 way 'D' plug for **RGB** input, modular construction etc etc.
This Must Be ONE OF THE YEAR'S BEST BUYS. PC USER
Supplied **BRAND NEW** and **BOXED** complete with DATA and 90 day guarantee **ONLY £149.00** as above **OR IBM PC Version £165.00**
15 Day 'D' skt **£1.00**, **BNC** skt **75p** BBC interface cable **£5.50**

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

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

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

BUDGET RANGE EX EQUIPMENT MONOCHROME video monitors.
All units are fully cased and set for 240v standard working with composite video inputs. Units are pre tested and set up for up to 80 column use. Even when MINOR screen burns exist – normal data displays are unaffected. 30 day guarantee.
12" KGM 320-1 B/W bandwidth input, will display up to 132 x 25 lines. **£32.95**
12" GREEN SCREEN version of KGM 320-1. Only **£39.95**
9" KGM 324 GREEN SCREEN fully cased very compact unit. Only **£49.00**
Carriage and insurance on all monitors £10.00

DC POWER SUPPLY SPECIALS

GOULD OF443 enclosed, compact switch mode supply with DC regulated outputs of +5v @ 5.5a, +12v @ 0.5a, –12v @ 0.1a and –23v @ 0.02a. Dim 18 x 11 x 6 cm. 110 or 240v input. **BRAND NEW** only **£16.95**
GOULD G6-40A 5v 40 amp switch mode supply **NEW £130.00**
AC-DC Linear PSU for **DISK** drive and **SYSTEM** applications. Constructed on a rugged ALLOY chassis to continuously supply fully regulated DC outputs of +5v @ 3 amps, –5v @ 0.6 amps and +24v @ 5 amps. Short circuit and overvoltage protected. 100 or 240v AC input. Dim 28 x 12.5 x 7 cm **NEW £49.94**
Carriage on all PSU's £3.00

KEYBOARDS

Manufacturer's BRAND NEW surplus.
DEC LA34 Uncoded keyboard with 67 quality gold plated switches on X-Y matrix – ideal micro conversions etc. **£24.95**
AMKEY MPNK-114 Superb word processor chassis keyboard on single PCB with 116 keys. Many features such as On board Micro, Single 5v rail, full ASCII coded character set with 31 function keys, numeric keypad, cursor pad and 9600 baud SERIAL TTL ASCII OUTPUT!!! Less than half price
Only **£69.00** with data. Carriage on Keyboards £3.50

DON'T MISS THE CPM Deal OF the CENTURY

The FABULOUS CPM TATUNG PC2000 Professional Business System

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

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

The central processor plinth contains the **64K, Z80A** processor, **DUAL TEAC 55F 5¼"** Double sided 40/80 track disk drives (1Mb per drive), **PSU, 4K** of memory mapped screen RAM, disk controller, **RS232, CENTRONICS** and system expansion ports, and if that's not enough a ready to plug into **STANDARD 8" DRIVE** port for up to **FOUR** 8" disk drives, either in double density or **IBM** format. The ultra slim **92** key, detachable keyboard features 32 user definable keys, numeric keypad and text editing keys, even its own integral microprocessor which allows the main **Z80A** to devote ALL its time to **USER** programs, eliminating "lost character" problems found on other machines. The attractive, detachable 12" monitor combines a green, anti-glare etched screen, with full swivel and tilt movement for maximum user comfort. Supplied **BRAND NEW** with CPM 2.2, user manuals and full 90 day guarantee. Full data sheet and info on request.

PC2000 System with CPM Etc. COST OVER £1400
NOW only £399

PC2000 Business System with CPM and 'Ready to Run' FAST Sales and Purchase ledger, supports up to 9000 Accounts, VAT etc. COST OVER £1700
NOW only £499 Carriage & Insurance £12.00

PC2000 Wordprocessor System with CPM and TEC FP25 daisywheel printer
NOW only £799

SURPLUS SPECIALS ON PRESTEL – VIEWDATA – TELEX

PLESSEY VUTEL, ultra compact unit, slightly larger than a telephone features **A STANDARD DTMF TELEPHONE** (tone dial) with 5" CRT monitor and integral modem etc. for direct connection to **PRESTEL VIEWDATA** etc. Designed to sell to the EXECUTIVE at over £600!! Our price **BRAND NEW AND BOXED** at only **£99.00**
DECCAFAX VP1 complete Professional **PRESTEL** system in slimline desk top unit containing Modem, Numeric keypad, CPU, PSU etc. Connects direct to standard RGB colour monitor. Many other features include: Printer output, Full keyboard input, Cassette port etc. **BRAND NEW** with DATA **A FRACTION OF COST** only **£55.00**
ALPHATANTEL. Very compact unit with integral **FULL ALPHA NUMERIC** keyboard. Just add a domestic TV receiver and you have a superb PRESTEL system and via **PRESTEL** the cheapest **TELEX** service to be found!! Many features. **CENTRONICS** Printer output. Memory dialling etc. Supplied complete with data and DIY mod for RGB or Composite video outputs. **AS NEW** only **£125.00**
Post and packing on all PRESTEL units £8.50

EX-STOCK INTEGRATED CIRCUITS

4164 200 ns **D RAMS 9 for £11 4116** ns £1.50 **2112** £10.00 **2114** £2.50 **2102** £2.00 **6116** £2.50 EPROMS **2716** £4.50 **2732** £3.00 **2764** £4.95 **2712B** £5.50 **6800** £2.50 **6821** £1 **68A09** £8 **6BB09** £10 **8085A** £5.50 **8086** £15 **8088** £8 **NEC765** £8 **WD2793** £28 **8202A** £22 **8251** £7 **8748** £15 **Z80A** DART £6.50 **Z80A** CPU £2.00 Thousands of IC's **EX STOCK** send SAE for list.

DISK DRIVES

Japanese 5¼" half height, 80 track double sided disk drives by **TEAC, CANON, TOSHIBA** etc.
Sold as **NEW** with 90 day guarantee **ONLY £85.00**
TEC FB-503 Double sided HH 40 TRK **NEW £75.00**
SUGART SA400 SS FH 35 TRK **£55.00**
SIEMENS FDD100 SS FH 40 TRK **£65.00**
carriage on 5¼" drives £5.50
Brand NEW metal 5¼" DISK CASES with internal PSU.
DSKC1 for 2 HH or 1 FH drive £29.95 +pp £4.00
DSKC 2 for 1 HH drive £22.95 +pp £3.50
DKSC 3 As DSK1 LESS PSU £12.95 +pp £2.50
DSKC 4 As DSK2 LESS PSU £10.95 +pp £2.00
8" **IBM format TESTED EX EQUIPMENT.**
SHUGART 800/801 SS £175.00 +pp £8.50
SHUGART 851 DS £250.00 +pp £8.50
TWIN SHUGART 851's 2 Mb total capacity in smart case, complete with PSU etc. £595.00
MITSUBISHI M2894-63 8" DS 1 Mb equiv. to **SHUGART SA850R. BRAND NEW** at **£275.00** +pp £8.50
DYSAN 8" Alignment disk £29.00 + pp £1.00
Various disk drive PSU's **Ex Stock SEE PSU section.**
HARD DISK DRIVES
DRE/DIABLO Series 30 2.5 Mb front load **£525.00**
Exchangeable version **£295.00. ME3029** PSU **£95.00**
DIABLO 44/DRE4000A, B 5+5 Mb from **£750.00**
CDC HAWK 5+5 Mb £795.00. CDC 9762 80 Mb RMO3 etc. **£2500.00.**
PERTEC D3422 5+5 Mb **£495.00**
RODIME 5¼ Winchesters ex-stock from **£150** CALL
Clearance items – Sold as seen – No guarantee.
ICL 2314 BRAND NEW 14" Mb Removable pack hard disk drive, cost over **£2000** with data **ONLY £99.00**
BASF 6172 8" 23Mb Winchesters **£199.00**
Unless stated all drives are refurbished with 90 day guarantee. Many other drives and spares in stock – call sales office for details.

MODEMS

Join the communications revolution with our super range of **DATA MODEMS**, prices and specifications to suit all applications and budgets.
BRAND NEW State of the art products.
DACOM DSL2123 Multi standard 300-300, 1200-75 Auto answer etc. **£268.00**
DACOM DSL2123AQ Auto dial, smart modem with multi standard AUTO SPEED detect, and data buffer with flow control etc. **£365.00**
DACOM DSL2123GT The CREAM of the intelligent modems, auto dial, auto call, index, buffer etc etc. **£498.00**
Steebeck SB1212 V22 1200 baud FULL DUPLEX sync or async, optional auto dial **£465.00**
TRANSDATA 307A Acoustic coupler 300 baud full duplex, originate only, RS232 interface **£49.00**

Ex **BRITISH TELECOM** full spec. CCITT, ruggedised, bargain offers. Sold TESTED with data. Will work on any MICRO or system with RS232 interface.
MODEM 13A 300 baud unit, only 2" high fits under phone. CALL mode only **£45.00**
MODEM 20-1. 75-1200 baud. Compact unit for use as subscriber end to **PRESTEL, TELECOM GOLD, MICRONET** etc. **£39.95** +pp £6.50
MODEM 20-2 1200-75 baud. Same as 20-1 but for computer end **£65.00** +pp £6.50
DATEL 2412. Made by SE Labs for BT this two part unit is for synchronous data links at 1200 or 2400 baud using **2780/3780** protocol etc. Many features include 2 or 4 wire working, self test, auto answer etc. **COST OVER £800. Our price ONLY £199** +pp £8.00
DATEL 4800, RACAL MPS4800 baud modem, EX BT good working order, **ONLY £295.00** +pp £8.00

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

For more information contact our Sales Office.

MATRIX PRINTERS

SPECIAL BULK PURCHASE of these compact, high speed matrix printers. Built in Japan for the Hazeltine Corporation this unit features quality construction giving 100cps bidirectional, full pin addressable graphics, 6 type fonts, up to 9.5" single sheet or tractor paper handling, RS232 and CENTRONICS parallel interface. Many other features **BRAND NEW** and **BOXED**. COST £420. **Our price Only £199.00**

RECHARGEABLE BATTERIES

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

VDU TERMINALS

Standard VDU data entry terminals at give away prices!!
QUME QVT108. Current product, state of the art terminal with detachable keyboard, 12" Green screen, 2 page **RAM**, TVI 925, Hazeltine, **ADMSA** emulations, software setup, 25 x 80, Clock, Swivel and tilt base, Printer port, Function keys etc. **BRAND NEW** and **BOXED AT ALMOST HALF PRICE** Only **£425.00**
AJ510 – EX RENTAL, Z80 controlled, 15" green screen 24 x 80 display, graphics, cursor addressing, printer port etc. Very good condition **TESTED** complete with manual only £225.00
ADDS 520 – Dumb terminal, used, 12" b/w screen RS232 interface and printer port. **TESTED. ONLY £125.00.** Carriage on terminals £10.00
100's of other terminals in stock, CALL for more details.

DISPLAY ELECTRONICS

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

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

ERS — PRINTERS — PRINTERS — PRINTERS

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

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

SUMMER OFFER ONLY £399.99!!

DIY PRINTER MECH

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

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

TELETYPE ASR33
DATA I/O TERMINALS

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

EX NEWS SERVICE PRINTERS

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

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

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

Carriage and Insurance £7.50

GE TERMIPRINTER

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

SEMICONDUCTOR 'GRAB BAGS'

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

CENTRONICS 710 PRINTERS

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

MAINS FILTERS

CURE those unnerving hang ups and data glitches caused by mains interference with professional quality filters. **SD5A** matchbox size up to 1000 **watt** 240 V Load **ONLY £5.95. L12127** compact completely cased unit with 3 pin fitted socket up to **750 watts ONLY £9.99.**

EPROM COPIERS

The amazing **SOFTY 2** The "Complete Toolkit" for copying, writing, modifying and listing **EPROMS** of the **2516, 2716, 2532, 2732** range. Many other functions include integral keyboard, cassette interface, serial and parallel i/o **UHF** modulator **ZIF** socket etc.
ONLY £195.00 + pp £2.50.
"GANG OF EIGHT" intelligent Z80 controlled 8 gang programmer for **ALL** single 5v rail **EPROMS** up to 27128. Will copy 8 27128 in **ONLY 3 MINUTES** Internal **LCD** display and checking routines for **IDIOT PROOF** operation. Only **£395.00** + pp £3.00.
"GANG OF EIGHT PLUS" Same spec. as above but with additional **RS232** serial interface for down line loading data from computer etc. **ONLY £445.00** + pp **£3.00**
Data sheets on request

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

DEC CORNER

PDP 1140 System comprising of CPU, 124k memory & MMU 15 line RS232 interface. RP02 40 MB hard disk drive. TU10 9 track 800 BPI Mag tape drive, dual track system. VT52 VDU, etc. etc. Tested and running	**£3,750.00**
BA11-MB 3.5" Box, PSU, LTC	**£395.00**
DH11-AD 16 x RS232 DMA interface	**£1,900.00**
DLV11-J 4 x EIA interface	**£350.00**
DLV11-E Serial. Modem support	**£190.00**
DUP11 Synch. 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 PLUS	**£1,100.00**
LA30 Printer and Keyboard	**£80.00**
LA36 Decwriter EIA or 20 mA loop	**£270.00**
MS11-JP Unibus 32kb Ram	**£80.00**
MS11-LB Unibus 128kb Ram	**£450.00**
MS11-LD Unibus 256kb Ram	**£850.00**
PDP11/05 Cpu Ram, i/o etc	**£450.00**
PDP11/40 Cpu, 124k MMU	**£1,850.00**
RT11 ver **3B** documentation kit	**£70.00**
RK05-J 2.5 Mb disk drives	**£650.00**
KL8 JA PDP 8 async i/o	**£175.00**
M18E PDP 8 Bootstrap option	**£75.00**
VT50 VDU and Keyboard - 20 mA	**£175.00**
VT52 VDU and RS232 interface	**£250.00**

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

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

MAG TAPE DRIVES

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

CALL FOR DETAILS

COMPUTER/SYSTEM CABINET & PSU

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

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

66% DISCOUNT ON ELECTRONIC COMPONENTS EQUIPMENT

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

2.5kls £5.25 + pp £1.25 — 5 kls £6.90 + £1.80
10kls £11.25 + pp £2.25 — 20kls £19.50 + pp £4.75

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

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

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

Book rack in hangar

Swindon and District ARC have got together with the British Science Museum to put on the rally to end all rallies.

The event is being staged at the museum's outstation at Wroughton Airfield, near Swindon, Wilts, where various aircraft, fire appliances and transport vehicles grace the large hangars.

The exhibitors and traders will be accommodated in between the existing exhibits, so the public will be able to look at the books, amateur radio equipment and exhibits while viewing those marvellous machines of yesteryear.

Beside the delights already mentioned, there will be helicopter sightseeing trips around Swindon, a model steam rally and various other attractions for all the family. A rally, hobby fair and good family day out rolled into one.

The rally will take place on Sunday, May 8th, access to the site is from Junction 15 of the M4 and is signposted with AA markers for the Science Museum.

For more information about the rally, contact K Saunders on (0666) 89307.

Firth aid

If you turn left at Carlisle, you will find yourself in the scenic lowlands of Scotland – Dumfries and Galloway, to be exact. This is the home of the Dumfries and Galloway Radio Amateur and Electronic Club, whose new chairman, John Young, wrote to tell us more about the club's activities.

Meetings are held on the first and third Mondays of the month, the first evening being an activity night and the latter a natter night.

Various lectures are planned for the year ahead, including one on first aid – very handy for anyone who misreads the directions and drops off into the Solway Firth. Or stops at Gretna Green, for that matter!

The club meets at the Eden Bank Hotel, Dumfries at 7.30pm on the nights mentioned above. To find out more about club activities, contact John GM6LYJ at 22 Hallmeadow Place, Annan DG12 6BZ.

Soapfully

OK, quiz time – which soap firm is celebrating its hundredth anniversary this year?

Actually, W H Lever is a bit more than a 'soap firm', and yes, it is a century since work started on the construction of the factory and village, named Port Sunlight.

Many celebrations are planned to commemorate this combination of Victorian enterprise and philanthropy, and one of them is an amateur radio special event station.

Using the callsign GB0LBL, the station will operate from the Gladstone Hall, within the village, during the weekend of March 18th to 20th. The station will operate on 20m, 40m, 80m, 2m and 70cm, in addition to Packet Radio on the two metre band.

All QSL cards received within one month of the event will be entered in a prize draw for a bumper pack of Lever products. Sounds like good clean fun!

Full details can be obtained from Eric Gerhin G6HWD, QTHR.

Memorial lecture

Verulam ARC has an activity evening scheduled for March 8th, and on March 22nd the club will be holding the 1988 G3PAO memorial lecture. This event is held annually to commemorate the late George Slaughter G3PAO, a founder member of the club, and a past chairman and secretary.

This year's lecture is entitled 'Aspects of Pan-European Cellular Radio Networks', and will be delivered by Chris Morcom G3VEH.

The club meets at the RAF Association Headquarters, New Kent Road, St Albans at 7.30pm. Further information can be obtained from Hilary G4JKS on St Albans 59318.

In training

If you happen to be out and about in Wimbledon on March 11th, you might not recognise the Wimbledon and District Amateur Radio Society's meeting for the month, for they have really gone off the beaten track this time.

If the club has its own station, it must have gone to its head – the talk for the month is about the Metropolitan Railway, by David G1ADW. What a well trained club *(groan! – Ed)!*

All meetings are held on the second and last Fridays of each month at 7.30pm, in St Andrew's Church Hall, Herbert Road, Wimbledon, London SW19, unless otherwise stated. Enquiries about club activities should be directed to David Lowe on (07373) 51559.

Food, glorious food

Time to break that New Year's resolution – if it has held out this long – Torbay Amateur Radio Society's annual dinner is taking place on March 12th at the Temlestow Hotel. It seems like no time at all since the Christmas party...

On Saturday, March 26th, Fred G4FLW will give a slide show, the subject being DX trips – there should be many an exotic and interesting sight to see.

The club normally meets every week on Friday at 7.30pm at the English China Clay Social Club, Highweek, near Newton Abbot. Further information can be obtained from Bob McCreadie G0FGX on (03646) 233.

GeroniMorse!

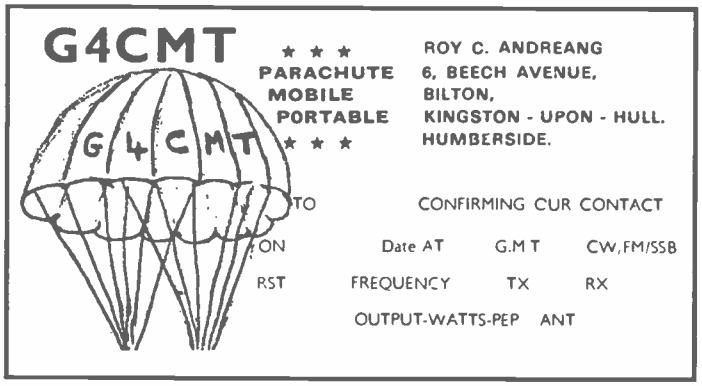
The mind may only be able to boggle so far, but here goes: an intrepid amateur called Roy Andreang has decided to help his local scouting movement in Humberside, who wanted support. They probably didn't expect anything like what Roy has in mind...

Roy is going to make a parachute jump shortly before his 64th birthday, on April 2nd. Nothing new, you think? Well, Roy intends to jump from 10,000 feet and send a birthday greeting to all Venture Scouts in the UK – they are celebrating their 21st anniversary – over the airwaves, in Morse...!

Roy will also make contact with as many other hams as possible on the way down (wonder what the record number of QSOs while free-falling is?)

This speedy gentleman also intends to make a cup of tea on the way down, and is hoping to be sponsored by Brooke Bond for doing it. No monkeying around allowed!

You can sponsor Roy on his extraordinary venture by contacting him on (0482) 812115, or by writing to the Humberside Scouts County Office, Raywell Park Scout Centre, Riplingham Road, near Cottingham, Hull, North Humberside.



Marconi day

Cornwall, as every amateur knows, is the duchy which houses Poldhu Cove. This cove has gone down in the history books as the place from which Marconi sent the first transatlantic radio signals.

To celebrate this unique feat, the Cornish Radio Amateur Club has, in the past, organised an International Marconi Event – a special event station which, nearly ten years ago, ran for a full seven days.

A decade later the club, in collusion with the South East Amateur Radio Club of Ireland, has decided to hold an International Marconi Day which, it is hoped, will become an annual event.

The Cornish special event station will have the callsign GB4IMD and will operate from Poldhu Cove itself, near the Coonhilly satellite station. The Irish station will operate at a site close to the spot where Marconi carried out his first Irish experiments, at Crookhaven. The callsign will be EI2IMD.

Several other stations will be operating internationally, from places which have some connection with Marconi. In the US, K1VV will be transmitting, with his friends, from the Cape Cod area, from where the first US-Europe contact was made. The callsign will be K1VV/IMD.

In Newfoundland, the Society of Newfoundland Radio Amateurs will be operating from Signal Hill, St Johns, where the first transatlantic contact was made. Their callsign will be VO1IMD.

Another Canadian group taking part is the Sydney ARC of Nova Scotia, whose station will be set up at the Marconi Museum in Glace Bay, where the first East/West Atlantic contact was made. The callsign will be VE1IMD.

Last, but by no means least, the Sasso Marconi Radio Club will be operating from Bologna, Marconi's birthplace, using the official Marconi call, IY4FGM.

The date on which this event will take place is April 23rd, chosen for its proximity to Marconi's birthday. Operation will be on five bands, SSB (J3E) only. All stations will be on the air from 0001GMT to 2359GMT. The Cornish club will be operating on these frequencies: 3.770 to 3.780; 7.070 to 7.080; 14.270 to 14.280; 21.250 to 21.260 and 28.530 to 28.540. A special award will be offered for any station working five of the six stations mentioned above. Claims should be accompanied by three IRCs or $5 for the US, a pre-paid envelope for the UK or overseas IRCs to cover postage of QSLs. All claims should be sent to CRAC, PO Box 100, Truro, Cornwall TR1 1XP.

Barry Rally

The great Barry Rally is taking place on March 6th this year, opening the month's events for Barry College of Further Education Radio Society.

On March 17th, there will be a video film presentation, the subject being amateur television.

The club meets on Thursday evenings from 7.30pm at the annex of the Barry College of Further Education, on the A4226. Visitors and SWLs are welcome. For more information about the club, contact Dr Kevin Johnston GW4BCB, the club's publicity officer, at the college address: Colcot Road, Barry, South Glamorgan CF6 8YJ.

Puniverse

March must be a good month for surplus equipment sales, as Coventry Amateur Radio Society is holding one on the 4th.

March 11th brings a night on the air and Morse tuition, a twice-monthly event that recurs on the 25th.

The highlight of the month is an illustrated talk on astronomy, when the club will doubtless be seeing some extremely high lights. We apologise for the pun – we didn't planet...

CARS meets every Friday at 8pm in Baden Powell House, 121 St Nicholas Street, Radford, Coventry. Details of forthcoming events can be obtained from Jon G4HHT on (0203) 610408.

Star-gazing

News from the Isle of Wight – the Binstead Isle of Wight Radio Society members are

Notes from the Past

The cylindrical chassis arrangement of one of the newer TV receivers, which has four sub-chasses arranged radially around the neck of the cathode ray tube, makes one wonder how long the present conventional flat chassis style will last, and also reflect on the evolution of ordinary radio receiver design. In the earliest days of broadcasting, all the components, including a whole lot of unnecessary switches, terminals, rheostats, etc, were mounted on both sides of a slab of ebonite, which was then laid flat across the top of a box.

The valves were stood on top, mounted in loose pins. Incidentally, it was not until some time later that holders were introduced, and then they were of solid ebonite as deep as the valve base itself.

The bright emitters of those far-off days gave off a brilliant light, so in any case we should have probably felt it a shame to waste it by shutting them up in a box, even if such a revolutionary idea had occurred to us!

Then came the breadboard era, and during that period we sometimes, by way of variation, arranged the valve line-up to run from right to left instead of the more usual left to right. Quite why, no one has ever discovered. Obviously, with those crude straight sets there was no real improvement in the layout, and we still cheerfully tolerated grid and anode leads of longer-than-strictly-necessary proportions.

As the circuits began to get more complicated, panel and breadboard construction became universal, and its influence remains with us today; but before the breadboard itself was finally abandoned it became the mode to metallise it. This was sometimes done by spraying one surface with metallic paint, or more usually by lining the upper surface with copper or brass foil.

In turn, this led to the inverted tray, which could hardly be bettered for the design of most simple apparatus, until quite recently. The miniaturisation of valves and components, and the additional space demands of modern equipment (especially that incorporating a CRT, such as test gear and TV receivers), is causing designers with more advanced ideas to ponder whether, after all, the single chassis is the best constructional form. It seems wasteful and irrational to cluster everything on to the two surfaces of a single sheet.

The popular demand for a booming bass requiring a large baffle area, and the cheapness of materials entailed, gave no great incentive to designers to cut down the cabinet dimensions in pre-war years. It is now easier to get an adequate bass response with a much reduced baffle area.

QSO

alive, kicking and meet every Monday at 7.30pm. We always knew that the island had plenty of attractions . . .

The first meeting of the month is 'auction night', but you'll have to go along to find out what they auction. The last Monday of each month is 'lecture night'; this month's talk is by Ken G1RHU, and will be about astronomy.

Another star-struck club! Perhaps they know something we don't, although we don't remember receiving any award claims for DXing Alpha Centauri!

The club meets on this planet, though, at 'Brickfields', Newnham Road, Binstead, Isle of Wight.

To find out more about club activities, get in touch with Bob Griffiths G0ISB, whose address is 29 Dubbers Godshill, Isle of Wight.

Magazine sale

Worksop Amateur Radio Society is in the 'read' this month – it is holding a magazine sale; a great opportunity to pick up back issues of this publication for paltry sums. This feast of literary magnificence will be on March 1st.

The club's two natter nights for the month are on March 8th and 22nd, and the remaining evening is an official club meeting, taking place on March 15th.

The club meets every Tuesday night at 7.30pm, but to find out where the meetings are held you will have to contact Kevin Fox G4MDQ, the club's public relations officer, on (0909) 566724.

Fired with enthusiasm

North Wakefield Radio Club has a busy month ahead, and they may well be getting some tips on achieving speed in the first meeting of the month. This will be a trip to Birkenshaw Fire Station, where club members are sure to receive a warm welcome.

March 10th brings a night on the air, G4NOK will be in the new shack on 2m, 70cm and HF. March 17th is the club project night, when the workshop and test gear will be ready.

Trevor Parkinson of the CEGB will be giving a talk on power generation and Dinorwig on March 24th, and the agenda for the month concludes with the monthly meeting.

The club meets every Thursday at 8pm in the White Horse Public House, Fall Lane, East Ardsley. To find out more about club activities, please contact Steve Thompson G4RCH on Leeds 536633.

WRx

If you believe that your ATU is absolutely, totally useless, if your Tx is tatty or your amplifier acting up, why not go to Chelmsford Amateur Radio Society's meeting for the month, which is all about the general servicing and repair of amateur equipment.

The meeting takes place on March 1st at 7.30pm in the Marconi College, Arbour Lane, Chelmsford. For further details please contact Roy G3PMX or Ela G6HKM on (0245) 360545.

Banbury AGM

Banbury Amateur Radio Society is holding its AGM on Wednesday, March 23rd at 7.30pm in 'The Mill Club', Spiceball Park, Banbury. All members and anyone interested in radio are invited.

Further details may be obtained from the secretary, Bryan G1IIO QTHR or on Banbury 51774.

Errata

In Osborne Postle's article 'ST900 – Fifty Years On', published in the January 1988 issue of the magazine, the following errors have been found:

The value of the grid leak R5 on p47 is given as 20M instead of 2M0.

The long wave extractor unit on p47 is labelled as *photograph 3* on the picture, and *photograph 4* in the text. We apologise for any inconvenience to our readers.

SHORT WAVE NEWS FOR DX LISTENERS

By Frank A Baldwin All times in UTC, **bold** figures indicate the frequency in kHz

The reception of broadcasts from the South American country of Brazil is a facet of short wave listening activity which some DXers specialise in. Being experts in that particular aspect of the hobby, they often report hearing some of the lower powered transmitters, which are only seldom logged, therefore justifying the label of choice DX.

Brazilian stations are well in evidence on the 60 metre band (**4750** to **5050**), but if conditions are good for the reception of signals from that country, they may also be heard on the more hazardous 90 metre and 120 metre bands (**3200** to **3400**)and (**2300** to **2498**) respectively.

Not every hobbyist is, or aspires to be, a DXer. Many are SWLs (short wave listeners) who seek and enjoy the programme material radiated by such transmitters, even those on the 60 metre Tropical Band mentioned above. The 90 metre band is, however, most certainly the reserve of the DXer. This latter range of frequencies is featured next in this update.

90 metre band Brazilians

Near the low end of the band, on **3205** in fact, may be heard the signals of Radio Ribeirao Preto in the town of that name. It is on the air with a power of 1kW from 0700 through to 0400. It is occasionally reported by European DXers, the channel being well worth a visit should conditions be favourable on the occasions listening sessions are made. However, note should be made of the fact that a newly reported Brazilian has also appeared on channel, in the shape of Radio Vale do Rio Madeira, Humaita, ex **2310** ; the power is 1kW but the schedule is unknown at the time of writing.

The seldom heard Radio Clube in Marilia transmits from 0800 to 0400, but with a power of 0.5kW it represents both a difficult proposition and a lucky chance. The frequency is **3235.**

On **3245** is Radio Clube, Varginha. It is on the air from 0900 to a sign-off varying from 0100 to 0130, the power being 1kW. The rarely heard Radio Educadora Carari, Crato is on **3255**, on which channel it radiates from 0800 to a close-down varying from 0200 to 0400.

Radio Difusora in Caceres operates irregularly. When on the air it conforms to a 24-hour schedule on **3275.** The power is 1kW. On **3285** is Radio Bandeirantes in Cachoeira. This one is on the air from 0900 to 0300 with a power of 2.5kW. Often heard in Europe are the signals from Radio Liberal in Belem. Working around the clock at 5kW, the frequency varies between **3324.5** to **3325.3.**

Radio Alvorada, Londrina transmits from 0800 to 0300 on **3335** with a power of 1kW. Previously thought to be inactive, it has recently been reported back on the air. From the town of Araraquara, Radio Cultura is scheduled around the clock. At 1kW it is seldom heard, but has recently appeared in a DXer report. The channel is **3365.**

On the frequency of **3375** there exists the problem of three Brazilian stations co-channel, each having a power of 5kW. Two of these sign off at the same time, which makes life difficult for DXers straining their ears to catch the station identification. That most often heard is Radio Educadora in Guajara Mirim, which transmits from 0900 to 0200. Also closing at 0200 is Radio Equatorial in Macapa, which opens at 0830. Radio Dourados, Dourados is on frequency from 0800 to 0300, this one often being heard in Europe after the other two contenders have signed off.

Each of these stations programmes in Portuguese to the local populations, reception of signals here in the UK being anything but an easy proposition. If DXing Latin America on the band was that easy, there would be no great satisfaction on the occasions when any successes are attained.

All of the above, then, is the Brazilian update of the 90 metre band.

120 metre band Brazilians

Rarely visited by most short wave listeners and even some DXers, this band can provide DX catches of the highest order if one is sufficiently dedicated, and at the receiver controls at the right times during our winter periods. It then remains a matter of chance as to whether the prevailing conditions prove to be favourable.

The low powered 0.25kW Radio Educadora, Limeira, is scheduled around the clock on **2380.** Also at 0.25kW, Radio Transamazonica in Senador Guiomard is on the air from 1000 to 0200 on **2410.** Needless to say, these two Brazilians are rarely heard far from signal source, but one can never guarantee permanent failure on the short waves. Perhaps just once during one lonely night in the shack, Lady Luck may grant a favour!

Radio Sao Carlos in the town of that name may be heard on **2420,** on which frequency it operates from 0800 to a variable sign-off around 0300. The power is 1kW.

On the air irregularly is Radio Cacique in Sorocaba from which location it transmits from 0800 through to 0430 with a power of 1kW. On **2490,** Radio Oito de Setembro, Descalvado radiates from 0900 to 0200 at 1kW.

Most of the above have been heard and confirmed by DXers residing nearer to Brazil than listeners here in Europe, one exception being a logging of Radio Sao Carlos by the writer at 0153 during May of last year.

ON THE AIR

AFRICA

Angola

Radio Nacional, Luanda on **5953** at 1902, news of both local and African events. R Nacional is scheduled carrying Programme A, which is entirely in Portuguese, from 1800 to 0530 with a power of 10kW.

Chad

Mondou on **5285** at 0458, three note interval signal, an orchestral version of the National Anthem, some electronic organ music, announcements in vernacular and French then a song in vernacular. The Home Service in French and vernaculars is on this frequency from 0515 variable to 0800 and from 1400 to 1800 variable at 2.5kW.

Ghana

GBC Accra on **3366** at 2232, UK made pops, announcements in English. GBC2 programmes are entirely in English, being on this channel from 0525 to 0905 and from 1700 to 2305. The power is 50kW.

GBC Accra on **4915** at 0559, the station identification, African drums, four pips and one tone followed by the news in English. GBC1 operates in English and vernaculars from 0525 to 0905 (Saturday and Sunday through to 2305) and from 1200 to 2305 at 50kW.

Mali

Bamako on **9635** at 0703, OM with announcements and the station identification in French, this being followed by martial music in the French manner.

Niger

Niamey on **5020** at 0554, Network 2 with announcements, a folk song in vernacular, six pips, OM with the station identification in French, the interval signal consisting of a few bars of local flute music, this being followed by a newscast in French. ORTN Niamey is on

the air from 0530 to 0705 (Saturday until 2300, Sunday until 2200) and from 1700 to 2200. La Voix du Sahel has a power of 30/100kW.

Nigeria

FRCN Lagos on **4990** at 0433, African horn, drum beats, talking drum, the station identification 'This is Radio Nigeria, Lagos', timecheck, choral rendition of the National Anthem, the station identification again, the date, then the news in English. The Home Service 1 is on the air in English and vernaculars from 0430 to 2310 with a power of 50kW.

CENTRAL AMERICA

Honduras

Radio Luz y Vida, San Luis on **3249** at 0222, a talk, a folk ballad then some announcements all in Spanish. This Honduran (Radio Light and Life) is on the air from 1230 to 1630 and from 2200 to 0400 at 1kW.

SOUTH AMERICA

Brazil

Radio Nacional, Brasilia on **11780** at 1954, OM with a talk during Portuguese programmes intended for South American consumption, scheduled from 0855 to 2155.

Colombia

Radio Sutatenza, Bogota on **5095** at 0327, OM with a talk in Spanish which included several mentions of Colombia and station identification. This Colombian station is scheduled in Spanish from 0900 to 0400 with 50kW.

Equador

Radio Iris, Esmeraldas on **3381** at 0213.

La Voz de los Campesinos entertains its audience from 1000 to 1300, and from 2100 to 0400. The power is 5kW and the frequency is variable.

Paraguay

Radio Nacional, Ascuncion on **9735** at 2232, a talk in Spanish, the station identification at 2242, some folk music then another identification at 2244.

Peru

Estacion C, Moyobamba on **6323.5** at 2345 and 2250, songs and music, some promos (promotions) then some choral songs. The power is 0.6kW but the channel is sometimes clear of QRM (interference). The schedule is from 1030 to past 0300.

ASIA

Burma

Rangoon on **4725** at 1420, a talk in vernacular, songs and music in the local manner, OM with a talk, stringed instrumental music, tinkling chimes tune, YL with announcements and sign off at 1547.

China

Several Chinese regional stations have been heard of late on the LF (Low Frequency) bands. A few are listed below. Fujian PBS (People's Broadcasting Station), Fuzhou on **2340** at 2212, a talk followed by some music. With a power of 10kW, Fujian PBS on this frequency is on the air carrying the Home Service 1 in Chinese from 2050 to 2400, and from 1020 to 1700.

Yunnan PBS, Kunming on **2460** at 2315, radiating a talk in a Home Service 1 programme. The schedule is from 2150 to 0100, from 0255 to 0600 and from 0855 to 1640 at 15kW.

Voice of the Strait, Fuzhou on **2490** at 2125, OM with a talk in Chinese. Haixia 1 programmes are featured on this channel from 2058 to 2330, and from 1200 to 1758. The power is 10kW.

Voice of the Strait, Fuzhou on **3200** at 1526, OM with a talk in Chinese. At 10kW, this regional station carries Haixia 1 in Chinese from 2058 to 0028, and from 0958 to 1758.

Voice of the Strait, Fuzhou on **3535** at 1622, YL with a talk in Chinese. This channel is scheduled from 1000 to 1630 at 10kW.

Voice of the Strait, in Chinese Hai-xia-zhi-sheng guangbo dian-ti, are all PLA (People's Liberation Army) transmitters radiating a First or Second programme on several channels, being differentiated in DXers' terminology as Haixia 1 or Haixia 2.

Pakistan

Islamabad on **7010** at 0230, the station identification followed by the news in English read at slow speed and directed at South East Asia from 0230 to 0245.

SOUTH EAST ASIA

Indonesia

RRI (Radio Republik Indonesia) Padang, Sumatra on **4002.7** at 1534, OM with a talk in Indonesian (Bahasa Malaysia). With a power of 10kW, the schedule is from 2200 to 0100 and from 0945 to 1700.

RRI Ujung Pandang, Celebes on **4719.3** at 1537, local style orchestral music then a talk in Indonesian. The schedule is from 0855 to 1605 at 50kW. Ujung Pandang is the Indonesian transmitter most often heard in our part of the world.

RRI Medan, Sumatra on **4764.2** at 1539, YL (young lady) with folk songs complete with orchestral backing. Medan operates from 2100 to 0300, from 0500 to 0800 (Sunday from 2300 to 0800), and from 1000 to 1600 with a power of 50kW.

North Korea

Radio Pyongyang on **3320** at 2142, sombre orchestral music, YL with a song in Korean, the transmission mixing with that of co-channel Radio Orion of Johannesburg, South Africa. The Foreign Service in Korean is radiated on this frequency from 2100 to 1900 with a power of 120kW.

Shinuiju on **3919.9** at 1610, a duet followed by choral works, some local classical music, announcements, more choral songs.

Singapore

Radio Singapore on **5010** at 1530, UK made pop records, YL with announcements in English. The Home Service in English is radiated from 2200 to 1605 with a power of 10kW, and may also be heard in parallel on **5052** where a power of 50kW is utilised.

PACIFIC

Australia

Shepparton on **9655** at 0730, the station identification, announcement of frequencies in use. This English transmission to the Pacific is timed daily from 0700 to 1030.

Shepparton on **15240** at 0626, a talk about the discovery of Australia, OM with the identification and a time check UTC. Directed to the South Pacific, Africa, Asia and South East Asia, this English presentation is timed from 2100 to 0800.

New Zealand

Wellington on **11780** at 0512, news of local sports events and results. This English transmission is directed to the Pacific area from 0345 to 0730.

CLANDESTINE

Voice of Kmer on **6325** at 2300. Twelve tone chimes Big Ben style followed by three pips, YL with the station identification, announcements, Buddhist chants, Asian style music then OM and YL alternate in Kmer. The schedule of this clandestine is from 2300 to 2400 in Kmer. The transmitter is thought to be located in Thailand.

NOW HEAR THESE

Bangkok, Thailand on **4830** at 1500, announcements, YL with songs in Thai. Radio Thailand is on the air with the Home Service 1 from 2245 to 1600 in Thai, 10kW power.

Moundou, Chad on **5286**, mentioned in the previous issue, has been logged again from 0458. A three note interval signal repeated, an orchestral rendition of the National Anthem, choir with a patriotic song, some electronic organ music then OM with announcements.

NOW LOG THESE

Jilin PBS Changchun, China on **3210** at 2224, OM and YL with a talk in Chinese. The Home Service in Chinese is scheduled from 2050 to 0630 and from 0820 to 1505 at 10kW.

Radio Zaracay, Santo Domingo de los Colorados on **3395** at 0417, announcements with local folk songs and music in Spanish. At 10kW, the transmission times are from 1000 to 1400 and from 1900 to any time between 0330 and around 0500.

Santo Domingo de los Colorados is a town some sixty miles west of Quito, the area being the home of the few remaining Colorado Indians. Radio Zaracay is named after Zaracay, the old chieftain of the tribe. NEW

TX-3 RTTY/CW/ASCII TRANSCEIVE

The high performance, low cost system

Split-screen, type-ahead operation, receive screen unwrap, 24 large memories, clock, review store, callsign capture, RTTY auto CR/LF, CW software filtering and much more. Needs interface or TU. **BBC-B and Master, CBM64** tape £20, disc £22. **Spectrum** tape £35, +3 disc £37 inc adapter board (needs interface/TU also). For **VIC20** we have our RTTY/CW transceive program. Tape £20.

RX-4 RTTY/CW/SSTV/AMTOR RECEIVE

This is still a best-selling program and it's easy to see why. Superb performance on all 4 modes, switch modes at a keypress to catch all the action. Text and picture store with dump to screen, printer or tape/disc. An essential piece of software for trawling the bands. Needs interface. **BBC-B and Master, CBM64** tape £25, disc £27. **VIC20** tape £25. **Spectrum** tape £40, +3 disc £42 inc adapter board (needs interface also). The Spectrum software-only version (input to EAR socket) is still available, tape £25, +3 disc £27.

TIF1 INTERFACE

Perfect for TX-3 and RX-4, it has 2-stage filters and computer noise reduction for excellent reception. Transmit outputs for MIC, PTT and KEY. Kit £15 (assembled PCB + cables, connectors) or ready-made £25, boxed with all connections. State rig for transceive.

MORSE TUTOR, LOGBOOK, LOCATOR, RAE MATHS programs also available for BBC-B, Master, CBM64, Spectrum, VIC20.

Prices include VAT and p&p, 1st Class inland, airmail overseas, normally by return. Eire, CI, BFPO deduct 13%.

Technical Software (REW)

Fron, Upper Llandwrog, Caernarfon LL54 7RF

Tel 0286 881886

VISA

RADIO & ELECTRONICS WORLD
BACK ISSUES

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

NAME .....

ADDRESS .....

.....

.....

..... POSTCODE .....

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

.....

.....at £1.45 each

PAYMENT ENCLOSED: £ -

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

CREDIT CARD PAYMENT: ☐ VISA ☐

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

EXPIRY DATE ☐☐ / ☐☐

SIGNATURE.....

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

SECURITY

Modules
Systems
Accessories

SAVE £ £ £ £'s

BY INSTALLING YOURSELF

MINIATURE PASSIVE INFRA-RED SENSOR

ONLY £23.95 Plus VAT

Size only 80x60x40mm. Detects intruders up to 12 metres away.

- 12 metre detection range.
- Size only 80x60x40mm.
- 24 Detection zones.
- Wide 85° coverage.
- Switchable LED indicator.

This advanced new intrusion detector operates by detecting the body heat of an intruder moving within the detection field. The use of a dual element pyroelectric sensor means that changes in ambient temperatures are ignored, thus providing a stable and reliable performance. Easily installed in a room or hallway, the unit will provide effective detection of any intrusion. Operating from a 12V supply and consuming only 15mA, it is ideal for use with the CA 1382, CA 1250 or any equivalent high quality control unit. Supplied with full instructions, its performance compares with detectors costing more than twice the price.

CA 1382 ADVANCED CONTROL UNIT that's simple to install and operate.

- Fully automatic siren re-set.
- Audible entry/exit warning.
- Alarm Sounded memory.
- 2 separate loop inputs + 24hr circuits.
- Built-in electronic siren.
- Easily installed, full instructions supplied.

The latest control panel provides effective and reliable control for all types of security installations. Its advanced circuitry checks the loop circuits every time it is switched on, preventing incorrect operation. Using a simple 'on/off' key switch, it is easily operated by all members of the family. In addition it provides 24 hr. personal attack protection. Housed in a steel case, it is supplied with full operating instructions.

Only £44.95 + VAT Available in kit form with fully-built electronics, £39.95 + VAT.

CA 1250 LOW COST ALARM CONTROL MODULE

This tried and tested control unit represents the finest value for money in control systems, providing the following features:

• Built-in electronic siren drives 2 loud speakers • Provides exit and entrance delays together with fixed alarm time • Battery back-up with trickle charge facility • Operates with magnetic switches, pressure pads, ultrasonic or I.R. units • Anti-tamper and panic facility • Stabilised output voltage • 2 operating modes full alarm anti tamper and panic facility • Screw connections for ease of installation • Separate relay contacts for external loads • Test loop facility.

Price £19.95 + VAT

HW 1250 - ATTRACTIVE HOUSING plus HARDWARE FOR CA 1250

An attractive steel case designed to house the Control Unit CA 1250 together with the appropriate LED indicators and key switch (available separately).

Supplied with the necessary pillars, fixings, and punched front panel, the unit is given a professional appearance by the adhesive silk screened label.

Size: 200x180x700mm. Only £9.50 + VAT

COMPLETE SYSTEM FROM £39.95 + VAT

FULL TECH ADVISORY SERVICE

MON-FRI 9-5
CLOSED ALL DAY SAT & SUN

DP 3570 LIGHTING CONTROLLER

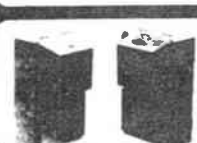
This versatile module provides timed switching of loads up to 3A for pre-set times between 10 secs and 5 mins, the timed period being triggered by the opening or closing of an external loop or switch. The built-in 12V 250mA power supply is available for operating external sensors. Suitable plastic enclosure £2.85 + VAT.

Only £13.95 + VAT

FL 500 QUARTZ HALOGEN FLOOD LIGHT

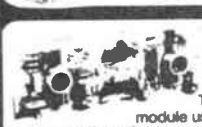
Whilst intended for security lighting applications, this unit is suitable for lighting patios, pathways and gardens etc. Supplied complete with 500W lamp, priced Protective grill, £1.95 + VAT.

Only £14.95 + VAT



IR 1470 - 50ft. INFRA-RED BEAM SYSTEM

Consists of a separate transmitter & receiver, the system provides an invisible modulated beam which when broken operates the built-in relay. For use with security systems, but also ideal for photographic purposes and industrial applications. Size: 80x50x35mm. Only £25.61 + VAT



US 5063 DIGITAL ULTRASONIC DETECTOR

• 3 levels of discrimination against false alarms • Crystal control for greater stability • Adjustable range up to 25ft • Built-in delays • 12V operation.

This advanced module uses digital signal processing to provide the highest level of sensitivity whilst discriminating against potential false alarm conditions.

Only £13.95 + VAT

ULTRASONIC MODULE ENCLOSURE

Suitable steel enclosure for housing the US 5063 supplied with the necessary mounting pillars and fixings.

Only £2.95 + VAT

RISCOMP LIMITED

Dept RE3
Poppy Road
Princes Risborough. BUCKS
HP17 9DB.

The Security Specialist

P&P UK ORDER 75p EXPORT ADD 10%

ORDER BY MAIL OR TELEPHONE VISA

Tel: (084 44) 6326

FREE CLASSIFIED ADS

FREE CLASSIFIED ADS CAN WORK FOR YOU

We are pleased to be able to offer readers the opportunity to sell your unwanted equipment or advertise your 'wants'.

Simply complete the order form at the end of these ads, feel free to use an extra sheet of paper if there is not enough space on the order form. We will accept ads not on our order form.

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

DEADLINE AND CONDITIONS

Advertisements will be inserted in the first available issue on a first come first served basis. We reserve the right to edit and exclude any ad. Trade advertisements are not accepted.

FOR SALE

■ Scopex 4S6 scope, £65. Eddystone 770R, £75. Eddystone 770U/2, £75. ICS-FAX, 1 (RTTY+FAX) and cable, £250. STAR Delta 10 dot matrix printer, £80. HRO+PSU+spkr + all nine coils for 50kHz to 30MHz, superb condition, £100. IBM 3101 intelligent terminal, VDU + k/board + CPU, £150. IBM 3102 matching printer serial input, £60. BC221 and UHF version TS175 professional mains PSU in each, by Brit Aerospace, as new condition, £25 each. Sinclair/Thandar DVM-DM235 bench/portable, £25. Grundig Stenorette, £20. Teletype test set – includes 3in scope, mains operation, £20. Any near offers. Tel: (070621) 8290 after 7pm

■ Printers and monitors for home computers: 6800 computer with EPROM programmer, £250. Cossor oscilloscope, £165. Zicon logic analyser, £800. Lightbox. Drawing board. Many components and related books. All to be cleared, prices negotiable. Vidhya. Tel: (0628) 36121

■ Icom IC-H6 VHF hand-held transceivers on 169MHz, six channels each. Two for sale, both excellent condition with rechargeable batts, £140 or swap for G/C 2m hand-held. Mr Wilson, 289 South Avenue, Southend, Essex SS2 4HS. Tel: (0702) 65181

■ Stock of older type valves. Some rare. Some new, some ex-eqpt. One lot magazines, *Wireless World*, Jan 1950-Apr 1963. One lot *Electrical Review*, Jan-Dec 1950. One lot manufac service sheets, 1945 onwards. One lot Ball-Sok insulating beads in 2lb boxes. Sensible offers invited for above lots. Buyer(s) collect. Tel: 01-310 4770, anytime

■ Telephone patch (BT approved) CES 510SA, microprocessor controlled, fits any simplex radio, £200. CES 520D duplex patch, £200. CES DTMF microphone, £50. Tel: Dublin (0001) 689249, evenings

■ TR9000 with PSU, mobile mount. 2m collinear, 10XY (unused). Preamp. LSG16 signal generator, wavemeter, SWR meter. All in very good condition. First £400 takes all. Prefer buyer collects. Will split for good offers. Also various CBM64 software for sale. SAE for list. Spectrum 48K plus 20 programs and books, £75 ono. Ron G6BMY. Tel: (061) 437 0916

■ Akai GXC 760D service manual and parts list, £2.50. Post free. Tel: (0424) 221636

■ Bearcat base station scanner, £80. SEM HF converter for scanners, £30. TH21E mini hand-held with spare NiCad pack, soft case and speaker mike, £165. FT73R 70cm mini hand-held with dc charger, soft case and speaker mike, £200. Two metre small hand-held receiver, only £60. FDK mult 700E, 2 metre 25 watt transceiver, £110. Moving house, selling off surplus gear. 66 Spectrum computer programs, 50p and £1. J Barton, 51B Brownhill Road, Catford, London SE6. Tel: 01-248 4252 or Mike, 01-461 5398

■ Hewlett Packard 1415A TDR, cable reflectometer, £10. Alan. Tel: (0342) 312329 home, or (0342) 21231 ext 435

■ Yaesu FRG9600M 60 to 950MHz Rx. LSB/USB/AM/FM 100 memory channels, £400 or exchange for PRO2004 + £70. Tel: Doncaster (0302) 868176. Buyer collects/pay postage

■ TR9500 Trio 70cm multimode, mobile, 10 watt. BO9 base plinth (inc memory back-up). SP120 ex-spk, £399 ovno. Trio TR3200 70cm portable 12ch fitted (old type rig), £70 ono. M/Modules MTV435 ATU video transmitter, £100. Receive conv, £15.00. 2 x b+w video cameras, comp, £80 pair or £45 each. Would consider part-ex on all items for 2 metre or 6 metre gear or WHY? Radio related equip. Phone me and haggle! Chris Barker, 52 Spode Street, Stoke-On-Trent, Staffs ST4 4DY. Tel: (0782) 46570

■ Steepletone nine band receiver, mint condition MB, Air, FM, SW, genuine reason for sale, £45. ITT Golf 330 short wave receiver, mint condition, genuine reason for sale, £25. Matsui MR4099 world band receiver, SSB, 150kHz to 29999kHz AM. Mint condition (selling to buy Sony 2000IO), £90 bargain. Contact Martin Andrews, Flat 20, Dana Lodge, Central Avenue, Telscombe Cliffs, Newhaven, E Sussex BN9 7LX. Tel: Peacehaven 87723

■ Comms receiver FRG7700M, £250. Offers considered. Reason for sale – upgrade to JRC. Tel: (073081) 6798 after 7pm or w/e

■ Digico 16E 3 terminal mini computer (filing cabinet size), incorporating 2 Peritel D3000 (203 megabit) hard disc drives. Manuals included – Basic, test progs, disc drive and others. Many discs (these retail at £60+ each). £200 or exchange for 70cm base station or mobile or HF Tx/Rx. Can be seen Tues evenings at Ealing and District Radio Club. Tel: (0932) 247486, evenings

■ Einstein computer software, split screen, TTY program, type ahead buffer, supports files, printer, onscreen clock, all baud rates. Versions available for G0BSX TNC or general purpose TNC220, etc. 40 col available now, 80 col later. Send disc + £9 or £12 to G8JTL QTHR. Tel: (0384) 824019

■ FAX-1 with RTTY option and printer interface cable, cost over £300, only used few hours. Fax unit as recommended by magazine reviewers. Sell for £250 or swop WHY of equal value. Also Star DELTA 10 NIQ printer, serial and parallel inputs, RTTY or fax. Manuals for both units. Tel: (070621) 8290 after 7pm

■ Eddystone 770R, 19 to 165MHz and Eddystone 770U/2 145 to 520MHz, both in lovely condition and some history known, good for civil and military air band, public services and six VHF/UHF ham bands. Only selling as space needed in shack. Manuals and circuit for both, £75 each plus any delivery charges. Tel: (070621) 8290 after 7pm

■ Sony SQD2010 4 track-decoder, £50. *Thermionic Vacuum Tubes*, 150 page book by Aldous and Appleton, £2.50. *Textbook on Sound*, Winstanley, £2.50. 1960s Radford valve stereo VHF tuner, £20. 1935 Murphy wireless, £5. Bakelite Ferranti 1940s wireless, £5. Pye late 1940s wireless, £5. Commodore Vic 20 computer interface, tons of chips, £5. Peter Wilson, 108 Coventry Road, Coleshill, Birmingham B46 3EE. Tel: Coleshill 62308

■ FT101E perfect mike manual fan, £300. Mr Hambidge. Tel: (021) 706 8752

■ Realistic PRO2009 scanner, 66-88 144-174, 410-512MHz. Mint, still boxed, £70.00 or will swap for Cobra 148GTL DX multimode or similar. Stewart. Tel: Cheddington (0296) 681452, 9am-5pm

■ Antex TCSU-1 soldering station, CTC iron, £40 (new £80). Mega PL-1 photolab exposure unit, spare tubes, £30 (new £60). Tel: (0872) 864183

■ Icom IC28H, 50W 2 metre mobile radio, will Rx from 138 to 174MHz, 9 months old in vgc with handbook, box, mobile mount etc, £250 ono. Also ⅝ whip with quick release mount, £15. Free with the K28H. Martin. Tel: (052528) 543, after 5pm

■ Sony active antenna AN-1 LW/MW/SW wide range antenna, new, only two weeks old, £40.00. Mr Hiron Khan, 12 Braemar Road, Fallowfield, Manchester M14 6PS. Tel: (061) 224 7387

■ 2 GEC hand-held low band AM sets on 86.00MHz. Should go to 70.00MHz, 3 channel with 2 extra batteries and new Tandy charger, £45.00. New Howes HC220 kit, transverter kit, 2 metres to 20m, £40.00. Several 2 metre preamps, £5.00 each. 2 PA boards from Goodmans tuner-amp. Motorola MJ802/MJ4502 transistors. Huge heatsinks. Offers please. Postage? Forget it! I pay. John GJ8RRP, 2 Thornley Bagatelle Road, Jersey, CI

■ 2m multimode transceiver, Yaesu FT225-RD, boxed. Not been used since purchase. Workshop manual. Offers. Yaesu computer interface, type FIF-232C for full computer control of FT9600 or FT90. New cost, £68.00. Would accept £35.00. Would also consider exchange of above equipment for FT9600, fully modified and in excellent condition. Tel: Bob (0705) 731722

■ Fluke 75 DVM c/w holster, good cond, £65. AVO 8 MK4 multimeter with tatty leather carrying case, £50. Peter. Tel: (0703) 615306

■ Heathkit laboratory oscilloscope, 5in screen, single beam, 10MHz, 10MV. Excellent condition, £40. Tel: 01-748 1410

■ Super Star 360, suitable to convert to 10, £125 ovno. ATU, £15. Amteck Rotel CB, good working order, £30. Tel: (0283) 221870

■ Regency digital flightscan receiver 108-136 (air bands), 16 channels scanning, exc condition with handbook, push-button programming, £125. Mr George Jacob, 23 Waterloo Gdns, Penylon, Cardiff CF2 5AA. Tel: (0222) 487299 after 5pm

■ Trio R600 as new, £180. 10 to 80 metre ATU, £40. Filter model no 600 oscilloscope, ex-lab, £120. DX-TV converter. The goods can be sent but please add the cost of post. Tel: (0288) 4892

■ Hand-held radio receiver 54-174MHz and CB in good working order. Cheap alternative to an expensive scanner, £20. Also Goldring GL75 record deck, £20. Four track Sony reel to reel, Sony tape recorder, £50. Tel: (061) 748 9604

■ Sommerkamp FT250 HF transceiver, FP250, 100W PEP matching power supply with speaker, plus Shure 450 mic, manual with diagram (mint condition), bargain at £350. Also have Grundig Satellit 2100, 21 band world zone Rx, SSB adaptor plus 476 Dryfit battery (showroom condition). Direct exchange the latter for Sony CRF330K or GEC RC410R synthesized Rx. Tel: (061) 7431570

■ Hallicrafters valved communications receiver, classic series (Model S120) as featured in *PW* September 1987, giving excellent general coverage 550kHz to 30MHz, in four bands plus BFO, SSB, Receive/Standby, bandspread, etc. Beautiful condition, grey metal cabinet, perfect working order. Phones and speaker. Brand new set of easily available valves, owner's manual, circuit diagram/alignment chart. Ideal for DXer. Snip at £45 plus p&p £4.50. Contact Dr Milego. Tel: (0753) 869464

■ Yaesu FRG9600 VHF/UHF scanning receiver FMN, FMW, AMN, AMW 60-905MHz, SSB 60-460MHz. 100 channel memory, excellent condition, little used, £350. Tel: (0692) 405567 evenings/weekends

■ Deceased sale: BRS90083, Racal receiver RA1218, £150. Racal receiver RA117E, £100. Wayne Kerr universal bridge CT492, £30. Electronic multimeter CT471, £40. Standard telephone attenuator .1-90dB, £35. Advance FM/AM signal generator type 63A 7.5/230MHz, £60. Marconi signal generator TF144G 55kHz-25MHz, £40. Avo Mk IV valve tester, £35. Commodore mini computer SR1800, £15. Oscillator test set CT212, £30. Thermal noise generator CT82 15kHz-160MHz, £25. Send for list. Mrs Stanley, 21 Kewhurst Avenue, Little Common, East Sussex TN39 3BJ. Tel: Cooden 2829

■ Marconiphone radio, at least 25 years old, original valves were X61M, KTWG1M, DH63M, KT61 and U10. No longer working due to suspected failure of winding of 2nd IF transformer. Any reasonable offer accepted. Write to Tandy, 10 Haygrove Road, Bridgwater, Somerset TA6 7HZ. Please include SAE

■ Sommerkamp TS788Dx, NATO 2000, Eddystone S640, other FM/AM, SSB, CB rigs for disposal. Bill Hall, 1 Crookhill Terrace, Ryton, Tyne and Wear NE40 3ER. Tel: (091) 4132707

■ Vintage radios: 1927 AJS Symphony Three; 1923 Burndept Ethophone 'V' 4 valve; Burndept Screened Four 1927; Brunswick Panotrope c1926 very first valve record reproducer, massive; Gambrell c1929 mains console; Philips collection,

seven radios 1930 to 1935 includes models 2634, 930A, 940A, 830A, 834A, 634A, 580A, all first class, as one lot only; Ekco's SH25 console, M23, 313. Sell or swap. Wanted: early American mains radios, also Drake R4C or similar. Jim Taylor G4ERU, 5 Luther Road, Winton, Bournemouth. Tel: (0202) 510400

■ Sony receiver ICF7600D FM/LW/MW/SW, still with Sony guarantee, boxed, £120. AN1 antenna, boxed, £35. Tandy Pro30 scanner 68-88, 108-136, 144-148, 380-450, 450-470MHz, boxed, £120. Tel: 01-998 43336

■ Rack mounting Hammarlund SP600, good working order, panel rather shabby, £70. Also Rediffusion R52, offers. Both property of deceased SWL. Alan. Tel: Manchester (061) 445 7274

■ SX200N 27-570 scanner, cost over £300, will sell for £180 ovno. Tel: (0283) 221870

■ Dawe distortion factor meter 700C, 20Hz to 20kHz, 0.1% to 50% with handbook, £25. Westrex 31372-A audio oscillator 20Hz to 20kHz, £20. Verispot galvo 25μA to 1mA, 0-25mV to 50mV, £15. Pye potentiometer 7569P with good standard cell, £10. Solartron bench standard amplifier (valve), £15. Buyer to collect the heavy ones. Write to Brian Clarke, Flat 6, 56 Warwick Place, Leamington Spa CV32 5DF. Tel: (0926) 315580

■ Maplin modem with interface for Spectrum, perfect working order, set up and tested by Maplin, £30 inclusive of postage. Also 12V power supply, 2 amp, with facility for charging dry cell battery of 12V, suitable for alarm system etc, no case hence price, £5 plus £1.50 P&P. Also 24 volt system as above, £7.50 plus £1.50 P&P. Would swap modem for SW receiver in working order. Mr M Day, 39 Valnord Lane, Saint Peter Port, Guernsey, Channel Islands

■ 13.8V dc 25A linear PSU, £25. 13.8V dc 15A PSU, £15. Army transceiver No 38 (Marconi) complete but untested, ideal for spares or rebuild, £12. Navy d/beam monitor mini-scope with PSU, complete but untested, £15. Bradley electronic multimeter (solid-state) dc-1500MHz with RF probes and manual, £18. S G Brown professional padded headphones, £5. 2m mobile whip and pod, £3. Mobile h/held PTT mic (Racal), £3. Mobile 12V PSU for scanner Rxs Bearcat, SX200N etc, £5. 4 off h/duty ribbed AE insulators, £3. 13A 6 skt mains distribution block, £5. Box of Tx parts, caps, chokes, meters, PSU modules, £5 the lot. Over 100 mostly new and boxed valves, octals, B7G, B9A etc, £20 the lot. 50ft 300Ω ribbon cable, £3. Approx 100ft of ½in RG214 Tx co-ax, unused, £5. GHFZG QTHR. Tel: (0242) 580329

WANTED

■ Clear out your attic! Philips 580A mains radio 1935 vintage wanted, in any condition, even cabinet or chassis only. Pure nostalgia for old-timer. Not a collector, but will pay good price. Please contact Roy G0EWC QTHR or tel: Bristol 776891

■ Racal RA1772 professional monitoring receiver. Must have LSB filter and preferably the handbook. Michael O'Beirne. Tel: 01-405 7554 day or (0372) 62268 after 8pm

■ 50MHz module for FT726R, straight swop for HF module 70cm SWR meter. 50MHz wavemeter. Manual for Dragon 32, buy or borrow. Mike G3XGM. Tel: 01-461 5398 or J Barton, 01-248 4252

■ Muirhead K-346 synchronizing unit for use with Muirhead K-401-D fax receiver. Also wanted manuals for GEC HF communication receiver type RC411 or photocopy of. M Levers, 'Waverley', Independent Hill, Alfreton, Derbys DE5 7DG

■ Wow and flutter meter, solid-state or valve type wanted by retired audiophile. Contact Mr Willmot, 5 Southcourt Avenue, Bexhill TN39 3AR. Tel: (0424) 221636

■ Kenwood VFO 520S, DG5 digital display, MC50 microphone for TS520SE transceiver. Also British or early Japanese GC receiver. Fair prices please as student, or exchange Epson PX8 portable computer complete with microdrive standard software, manuals etc. Perfect condition. All letters answered and acknowledged. John Lee, Sorby Hall, Endcliffe Vale Road, Sheffield S10 3ES

■ Service manual NRD515 and details of any improvement mods. Also 1.8kHz filter. Reasonable prices paid. Tel: (0254) 397743

■ Tandy TRS80 model 100 portable computer, with disc drive/printer if possible. Model 102 or 200 also considered. Contact G4HNH. Tel: (021) 472 3845

■ Instruction book or service help for ISD Prism 132 serial printer. Also Amstrad CPC keyboard with disc drive 464 or 6128 only. G3VMR. Tel: (0628) 24929

■ AR88 or R107. Also SSTV interface or anything for radio for Spec 48. Len. Tel: (0977) 797063

■ Wanted in any condition for spares and project test beds. Codar AT5 Txs plus ac/PUs. Also Heath RA1, RG1 Rxs. Details of condx and price to R Marris, 35 Kingswood House, Farnham Rd, Slough, Berks SL2 1DA

■ *Practical Wireless* 1930, 1960 *Radio Constructor, Aero Modeller, Model Aircraft*, Banbini Books on Radio, George Newnes Radio Books, Eagle Book Model Aircraft, *Simple Radio Circuits*, Keyline Books, *Simple Short Wave Receivers*, Data Books, 1964. Has anyone built 50-70MHz hand-held transceiver? Mr Savage, 7 Weyhill Close, Park North, Swindon, Wilts

■ Historian seeks very early transistor types in any condition, especially point-contact transistors. Early data books and data sheets also wanted. List of wanted types and prices offered is available on request. Andrew Wylie, 5 Lyncroft Gardens, West Hampstead, London NW6 1LB

■ 10.7MHz SSB generator, mixer and buffer kits or PCBs wanted for project featured in *Radio and Electronics World* magazine July-Oct 1982. Also wanted, non-working ICF2001 receiver. Please write only. K Kumar, 24 York Road, London W5 4SG

FREE CLASSIFIED AD ORDER FORM

Send to: Radio & Electronics World Classified Ads·Sovereign House · Brentwood · Essex · CM14 4SE

Classification: (tick appropriate box) If you want to insert ads under more than one classification use separate sheets for second and subsequent ads

For Sale ..... ☐ Wanted ..... ☐

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

Name/Address Postcode/Telephone							

USE SEPARATE SHEET FOR MORE WORDS

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

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

SMALL ADS

JAYCEE ELECTRONICS LTD

JOHN GM30PW

20 Woodside Way, Glenrothes, Fife KY7 5DP

Tel: 0592 756962

Open: Tues-Sat 9-5

Quality secondhand equipment in stock. Full range of TRIO goodies. Jaybeam – Microwave-Modules – LAR.

G4 DXX Video Electronics

For Icom, Dray, Wells, DAIWA, Datong. N934 MHz equipment, logbooks, rotetors, cable, etc.

OPEN 9-5pm, Closed Wednesdays

141 Lancaster Road, Morecombe, Lancashire LA4 SQJ

Phone (0524) 418873

THE SCIENTIFIC WIRE COMPANY

811 Forest Road, London E17. Telephone 01-531 1568

ENAMELLED COPPER WIRE

SWG	1lb	8oz	4oz	2oz
8 to 34	3.63	2.09	1.10	0.86
35 to 39	3.82	2.31	1.27	0.93
40 to 43	6.00	3.20	2.25	1.61
44 to 47	8.67	5.80	3.49	2.75
48	15.96	9.58	6.38	3.69
SILVER PLATED COPPER WIRE				
14 to 30	9.09	5.20	2.93	1.97
TINNED COPPER WIRE				
14 to 30 Fluxcore	3.97	2.41	1.39	0.94

Please add 15% VAT. Orders under £3 add 50p.
SAE for list of copper and resistance wire.
Dealer enquiries welcome.

JAPANESE Ic's (PART OF OUR RANGE)

AN7178 £2.95, BA5406 £2.20, HA1377 £2.20, HA1392 £2.50, HA1394 £2.95, HA1397 £2.75,HA1398 £2.75, HA13001 £2.95, LA4460 £1.80, LA4461 £1.80, LA4507 £4.25, LC7137 £2.75, M51517 £2.80, MB3705 £1.80, MB3712 £1.50, MB3722 £3.50, MB3730 £2.50, MB3731 £3.50, STK461 £7.50, STK463 £8.40, TA7205AP £1.00, TA7222AP £1.30, TA7240 £2.95, TA7241 £2.95, TA7270 £2.75, TA7271 £2.75, TA7274 £2.95, TA7280 £3.50, TA7281 £2.95, TA7282 £2.95, TA7283 £2.95, TA7288 £2.95, TA7611 £3.20, UPC575 £1.00, UPC1156 £2.95, UPC1181 £1.10, UPC1182 £1.10, UPC1185 £2.50, UPC1188 £2.75, UPC1230 £2.50, UPC1263 £2.50, UP1277 £2.75, UPC1278 £2.75, UPC1365 £3.60, UPC1394 £1.95.

ADD 60p POST AND PACKING AND THEN ADD 15% VAT TO TOTAL

T POWELL 16 PADDINGTON GREEN LONDON W2 1LQ
OPEN MON-FRI 10AM-5PM, SAT 9AM-12 NOON.
TELEPHONE: 01 723 9246
ACCESS/VISA. TELEPHONE ORDERS ACCEPTED OVER £5.00

RF DEVICES AT ROCK BOTTOM PRICES!

Nobody beats us!

Over 30,000 RF devices at low prices

REPLACEMENT RF TRANSISTORS

MRF454 HF/SSB 80W	£24.50
MFR450 HF/SSB 50W	£11.60
MRF238 VHF/FM 25W	£12.80
MRF475 HF/SSB 20W	£3.25
2SC1969 HF/SSB 18W	£2.75
2SC2043/1307 HF 16W	£2.00
2SC1947 VHF 3.5W	£7.60
2SC1946A VHF 32W	£15.30
BLW 60R HF/VHF 50W (Special)	£7.50

REPLACEMENT RF POWER MODULES

M57704/SAU3 UHF 15W	£39.20
M57712/37 SAV7 VHF/FM 25W	£39.50
M57713/SAV8 VHF/SSB 15W	£39.00
M57716/SAU4 UHF/SSB 15W	£39.00
M57716/SAU4 UHF/SSB 15W	**£49.50**
M57719 VHF/PMR 15W	£31.20
M57727 VHF/SSB 38W	£47.50
M57749/SAU11 934/FM 7W	£39.20

Send £1.00 p&p. SAE for full list
All prices inc. VAT
Many Ic's and other types in stock
Equivalent for most devices available

RAYCOM LTD

DEPT RE International House, 963 Wolverhampton Road, Oldbury, W. Midlands B69 4RL

021 544 6767

ETESON ELECTRONICS

15B Lower Green, Poulton-le-Fylde, Blackpool
Tel: (0253) 885107

Open: 9.30am - 12.30, 1.30 - 5.30. Closed Wed & Sun.
Electronic Component Specialists.
A wide range of electronic components, IC's, capacitors, transistors, resistors, plugs and sockets etc.

NEXT ISSUE ON SALE 10th MAR 1988

AGRIMOTORS

MERTON CB AND RADIO CENTRE
MERTON GARAGE AND POST OFFICE, MERTON.
Nr OAKHAMPTON, DEVON EX20 3DZ

OPEN 6 DAYS 9-6 LUNCH 1-2pm
EARLY CLOSING THURSDAY 1.00pm
(SUNDAYS BY APPOINTMENT)
SPECIALIST IN 934 MHz
SUPPLIERS OF ALL 27MHz AND 934 MHz EQUIPMENT
AMATEUR ACCESSORIES GATERED FOR
08053 200

AMATEUR TELEVISION

IS TELEVISION YOUR INTEREST? Then you need the BRITISH AMATEUR TELEVISION CLUE, only £6 per year – super magazine. Send SAE to:

'Grenehurst', Pinewood Road
High Wycombe, Bucks HP12 4DD

Radio & Electronics World

The communications and electronics magazine

SMALL ADS

This method of advertising is available in multiples of a single column centimetres — (minimum 2cms). Copy can be changed every month.

RATES

per single column centimetre:
1 insertion £9.65, 3 — £9.15, 6 — £8.65, 12 — £7.75.

RADIO & ELECTRONICS WORLD SMALL AD ORDER FORM

TO: Radio & Electronics World · Sovereign House Brentwood · Essex CM14 4SE · England · (0277) 219876

PLEASE RESERVE.....centimetres by.....columns

FOR A PERIOD OF 1 issue.....☐ 3 issues.....☐ 6 issues.....☐ 12 issues.....☐

COPY enclosed.....☐ to follow.....☐

PAYMENT ENCLOSED:..... £ —

Cheques should be made payable to Radio & Electronics World. Overseas payments by International Money Order ‹ Credit Card

CHARGE TO MY ACCOUNT.....☐

CREDIT CARD EXPIRY DATE ☐☐☐☐

COMPANY .....

ADDRESS .....

SIGNATURE .....TELEPHONE.....

.....

C P I

Radio & Electronics World
The communications and electronics magazine

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES

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
128 x 90 or 61 x 186	¼ page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	½ page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

COLOUR AD RATES

depth mm x width mm	ad space	colour rates exclude cost of separations: 1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
128 x 186 or 263 x 90	½ page	£420.00	£395.00	£375.00	£335.00
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00

SPECIAL POSITIONS

Covers: Outside back cover 20% extra, inside covers 10% extra
Bleed: 10% extra [Bleed area = 307 x 220]
Facing Matter: 15% extra

DEADLINES

*Dates affected by public holidays

issue	colour & mono proof ad	mono no proof and small ad	mono artwork	on sale thurs
Jan 88	12 Nov 87	18 Nov 87	20 Nov 87	10 Dec 87
Feb 88	10 Dec 87	16 Dec 87	18 Dec 87	14 Jan 88
Mar 88	14 Jan 88	20 Jan 88	22 Jan 88	11 Feb 88
Apr 88	11 Feb 88	17 Feb 88	19 Feb 88	10 Mar 88

CONDITIONS & INFORMATION

SERIES RATES
Series rates also apply when larger or additional space to that initially booked is taken.
An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.
Previous copy will automatically be repeated if no further copy is received.
A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.
Display Ad and Small Ad series rate contracts are not interchangeable.

If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

COPY
Except for County Guides copy may be changed monthly.
No additional charges for typesetting or illustrations (except for colour separations).
For illustrations just send photograph or artwork.
Colour Ad rates do not include the cost of separations.

Printed — web-offset.
PAYMENT
Above rates exclude VAT.
All single insertion ads are accepted on a pre-payment basis only, unless an account is held.
Accounts will be opened for series rate advertisers subject to satisfactory credit references.
Accounts are strictly net and must be settled by publication date.

FOR FURTHER INFORMATION CONTACT
Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE.
(0277) 219876

Overseas payments by International Money Order.
Commission to approved advertising agencies is 10%.

CONDITIONS
10% discount if advertising in both Radio & Electronics World and Amateur Radio. A voucher copy will be sent to Display and Colour advertisers only.
Ads accepted subject to our standard conditions, available on request.

ADVERTISERS INDEX

£1 BAKERS DOZEN PACKS

Price per pack is **£1.00**.* Order 12 you may choose another free. Items marked (sh) are not new but guaranteed OK.

1 – 513 amp ring main junction boxes
2 – 513 amp ring main spur boxes
5 – 3 flush electrical switches
7 – 4in flex line switches with neons
8 – 2 80 watt brass cased elements
9 – 2 mains transformers with 6V 1A secondaries
10 – 2 mains transformers with 12V ½A secondaries
11 – 1 extension speaker cabinet for 6½" speaker
12 – 5 octal bases for relays or valves
13 – 12 glass reed switches
14 – 4 OCP 70 photo transistors
16 – 4 tape heads, 2 record, 2 erase
17 – 1 ultrasonic transmitter and 1 ditto receiver
18 – 2 15000 mfd computer grade electrolytics
19 – 2 light dependent resistors
20 – 5 different micro switches
21 – 2 mains interference suppressors
22 – 2 25 watt crossover units 2 way
23 – 1 40 watt 3 way crossover unit
28 – 1 6 digit counter mains voltage
30 – 2 Nicad battery chargers
31 – 1 key switch with key
32 – 2 humidity switches
34 – 96 x 1 metre lengths colour-coded connecting wires
36 – 2 air spaced 2 gang tuning condensors
37 – 2 solid diaelectric 2 gang tuning condensors
38 – 10 compression trimmers
41 – 6 Rocker Switches 10 amp mains SPST
43 – 5 Rocker Switches 10 amp SPDT Centre Off
44 – 4 Rocker Switches 10 amp DPST
45 – 1 24 hour time switch mains operated (sh)
46 – 1 6 hour clock timeswitch
48 – 2 6V operated reed switch relays
49 – 10 neon valves – make good night lights
50 – 2 x 12V DC or 24V AC, 4 CO relays
51 – 1 x 12V 2C O very sensitive relay
52 – 1 12V 4C relay
55 – 1 locking mechanism with 2 days
56 – Miniature Uniselector with circuit for electric jigsaw
57 – 5 Dolls' Houses switches
60 – 5 ferrite rods 4" x 5/16" diameter aerials
61 – 4 ferrite slab aerials with L & M wave coils
62 – 4 200 ohm earpieces
63 – 1 Mullard thyristor trigger module
64 – 10 assorted knobs ¼ spindles
65 – 5 different thermostats, mainly bi metal
66 – Magnetic brake – stops rotation instantly
67 – Low pressure 3 level switch
69 – 2 25 watt pots 8 ohm
70 – 2 25 watt pots 1000 ohm
71 – 4 wire wound pots – 18, 33, 50 and 100 ohm
73 – 4 3 watt wire wound pots 50 ohm
77 – 1 time reminder adjustable 1-60 mins
78 – 5 5 amp stud rectifiers 400V
85 – 1 mains shaded pole motor ¾" stack – ¼ shaft
86 – 2 5" ali fan blades fit ¼" shaft
87 – 2 3" plastic fan blades fit ¼" shaft
88 – Mains motor suitable for above blades
89 – 1 mains motor with gearbox 1 rev per 24 hours
91 – 2 mains motors with gearbox 16 rpm
93 – 4 11 pin moulded bases for relays
94 – 5 B7G valve bases
95 – 4 skirted B9A valve bases
96 – 1 thermostat for fridge
98 – 1 motorised stud switch (sh)
101 – 1 2½ hours delay switch
103 – 1 6v mains power supply unit
104 – 1 4½ V mains power supply unit
105 – 1 5 pin flex plug and panel socket
107 – 15" speaker size radio cabinet with handle
109 – 10¼" spindle type volume controls
110 – 10 slider type volume controls
112 – 1 heating pad 2000 watts mains
114 – 1 1W amplifier Mullard 1172
115 – 1 Wall mounting thermostat 24V
118 – 1 Teak effect extension 5" speaker cabinet
120 – 2 pcb with 2 amp full wave and 17 other recs
122 – 10 mtrs twin screened flex white pvc outer
132 – 2 plastic boxes with windows, idealfor interrupted beam switch etc
155 – 3 varicap push button tuners with knobs
188 – 1 plastic box, sloping metal front, 16x95mm, average depth 45mm
241 – 1 car door speaker (v flat) 6½" 15 ohm made for Radiomobile
243 – 2 speakers 6" x 4" 15 ohms 5 watt made for Radiomobile
266 – 2 mains transformers 9V ½A secondary split primary so OK also for 115V
267 – 1 mains transformers 15V 1A secondary pcb mounting
330 – 2.6V 0.6Vmains transformer .3a pcb mounting
350 – 40 double pole leaf switches
365 – 1 7uf 660V 50hz metal cased consenser
453 – 453 – 2 2¼ in 60 ohm loudspeakers
454 – 2 2¼ in 8 ohm loudspeakers
453 – 1 mains operated relay with 2 sets c/o contacts
464 – 2 packets resin filler/sealer with cures
465 – 3 5A round 3 pin plugs will fit item 193
466 – 4 7 segment led displays
470 – 4 pc boards for stripping, lots of valuable parts
480 – 1 3A double pole magnetic trip, saves repairing fuses
498 – 4 1000uf 25V axial electrolytic capacitors
504 – 1 Audax PM 8" speaker 15 ohms 5 watt rating
515 – 100 4BA 1½" cheesehead plated screws and 100 4BA nuts
541 – 1 pair stereo tape head as in cassette recorder/players
546 – 1 bridge rectifier 600V international rectifier ref 3SB100
548 – 2 battery operated relays (3-6v) each with 5A c/o contacts 2 pairs
553 – 2 lithium 3V batteries (everlasting shelf life)

OVER 400 GIFTS YOU CAN CHOOSE FROM

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

THIS MONTHS SNIP

3½ floppy Disk Drive, made by the Chinon Company of Japan. Beautifully made and probably the most compact device of its kind as it weighs only 600g and measures only 104mm wide, 162mm deep and has a height of only 32mm, other features are high precision head positioning – a single push loading and eject – direct drive brushless motor – 500K per disc – Shugart compatible interface – standard connections – interchangeable with most other 3½ and 5¼ drives. Brand new with copy of makers manual. Offered this month at **£28.50** post and VAT included.

CASE – adaptable for 3" or 3½" FDD, has room for power supply components price only **£4** includes circuit of PSU Our Ref 4P8.

POWER SUPPLY FOR FDD – 5V and 12V voltage regulated outputs, complete kit of parts will fit into case 4P8 price **£8** or with case **£11**.

MULLARD UNILEX AMPLIFIERS
We are probably the only firm in the country with these now in stock. Although only four watts per channel, these give superb reproduction. We now offer the 4 Mullard modules – ie Mains power unit (EP9002) Pre amp module (EP9001) and two amplifier modules (EP9000) all for **£6.00** plus £2 postage. For prices of modules bought separately see TWO POUNDERS.

CAR STARTER/CHARGER KIT
Flat Battery! Don't worry you will start your car in a few minutes this unit – 250 watt transformer 20 amp rectifiers case and all parts with data case **£17.50** post £2

MINO MONO AMP on pcb size 4" x 2" (app)
Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms.
More technical data will be included with the amp. Brand new, perfect condition, offered at the very **low price of £1.15 each, or £13 for £12.00.**

LIGHT BOX
This when completed measures approximately 15" x 14". The light source is the Philips fluorescent 'W' tube. Above the light a sheet of fibreglass and through this should be sufficient light to enable you to follow the circuit on fibreglass PCBs. Price for the complete kit, that is the box, choke, starter, tube and switch and fibreglass is **£5** plus £2 post; order ref 5P69

TANGENTIAL HEATERS
We again have very good stocks of these quiet running instant heat units. They require only a simple case or could easily be fitted into the bottom of a kitchen unit or book case etc. At present we have stocks of 1.2kw 2kw 2.5kw and 3kw. Prices are **£5** each for the first 3 and **£6.95** for the 3k. Add post £1.50 per heater if not collecting.

CONTROL SWITCH enabling full heat, half heat or cold blow with connection diagram. 50p for 2kw, 75p for 3kw

FANS & BLOWERS
5" **£5** – £1.25 post. 6" **£8** – £1.50 post
4" x 4" Muffin equipment cooling fan 115V **£2.00**
4" x 4" Muffin equipment cooling fan 230/240V **£5.00**
9" Extractor or blower 115V supplied with 230 to 115V adaptor **£9.50** – £2 post
All above are ex computers but guaranteed 12 months
10" x 3" Tangential Blower. New. Very quiet – supplied with 230 to 115V adaptor on use two in series to give long blow **£2.00** + £1.50 post or **£4.00** + £2.00 post for two.

9" MONITOR
Ideal to work with computer or video camera uses Philips black and white tube ref M24/306W. Which tube is implosion and X-Ray radiation protected. VDU is brand new and has a time base and EHT circuitry. Requires only a 16V dc supply to set it going. It's made up in a lacquered metal framework but has open sides so should be cased. The VDU comes complete with circuit diagram and has been line tested and has our six months guarantee. Offered at a lot less than some firms are asking for the tube alone, only **£16** plus £5 post.

LOW COST OSCILLOSCOPE – kit to convert our 9" monitor into an oscilloscope with switched time bases to allow very high and very low frequency waveforms to be observed and measured. Signal amplitudes from as low as 10mV and as high as 1kV can easily be observed and measured. Ideal for servicing, also for investigating TV, radio and audio circuits.
Kit containing all the parts for the conversion and the power supply to operate from mains **£25** our ref 25P3

TELEPHONE LEAD
3 mtrs long terminating one end with new BT, flat plug and the other end with 4 correctly coloured coded wires to fit to phone or appliance. Replaces the lead on old phone making it suitable for new BT socket. Price **£1** ref BD552 or 3 for **£2** ref 2P164

COMPACT FLOPPY DISC DRIVE EME-101
The EME-101 drives a 3" disc of the new standard which despite its small size provides a capacity of 500k per disc, which is equivalent to the 3½" and 5½" discs. We supply Operators Manual and other information showing how to use this with popular computers. BBC, Spectrum, Amstrad etc. All at a special snip price of **£27.50** including post and VAT. Data available separately **£2**, refundable if you purchase the drive.

POWERFUL IONISER
Generates approx 10 times more IONS than the ETI and similar circuits. Will refresh your home, office, shop workroom etc. Makes you feel better and work harder – a complete mains operated kit case included **£11.50** + £3 P&P

J & N BULL ELECTRICAL
Dept RE, 250 PORTLAND ROAD, HOVE BRIGHTON, SUSSEX BN3 5QT

MAIL ORDER TERMS: Cash, PO, or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access & B/card orders accepted. Brighton (0273) 203500.

NEW ITEMS

Some of the many described in our current list which you will receive with your parcel

SUPER WATER PUMP – Approx ½hp mains operated originally intended to operate a £300 shower unit at controlled pressure – but of course suitable for many other water or liquid moving operations – where a good flow at a constant pressure is required – Price £25 each VAT and Post Paid. Our Ref 25P2
VERY USEFUL MULTI TESTERS – These have all usual ranges AC & DC volts – DC MA and OHMS etc but an unusual and very useful feature is a "low OHMS" range. Very useful for checking dry joints etc. They are ex GPO and may have faults but we test and guarantee the movement to be OK. Price £3 each. Ref 3P30
AGAIN AVAILABLE – 12" mini flourescent tubes – Price £1 each. Ref: BD314
POWER PACK OF AMPLIFIER CASE – Size approx 10" x 8¼ x 4¾" plated steel – with ample perforations for cooling. Front panel has on/off switch and EEC mains inlet plug with built-in RF filter – undoubtedly a very fine case which would cost at least £50 from regular sources, our price is £5 each and £3 post. Ref: 5P111
MINIATURE BCD THUMP WHEEL SWITCH – Matt black edge switch engraved white on black – gold plated, make before break contats – size approx 25mm high, 8mm wide, 20mm deep – made by the famous Cherry Company and designed for easy stacking – Price £1 each. Ref: BD601
EDGE METER – miniature, whole size approx 37mm x 13mm 100 ua fsd – centre zero scaled 0 to –10 and 10 to +10. Price £1 each. Ref BD602
LARGE 2 SPEED MOTOR – 1hp at 2500rpm and ¼hp at 200rpm – continental make, intended originally to power an industrial machine – regular price over £60, our Price £15 plus 15 carriage. Ref 15P5
RUBBER FEET – Stick on – ideal for small instruments and cabinets – pack of 56 for £1. Ref: BD603
CLEANING FLUID – Extra good quality – intended for video and tape heads – regular price £1.50 per spray can – our Price – 2 cans for £1. Ref: BD604
DON'T FREEZE UP! – We have had the strongest winds for over 200 years and who knows we may be in for the coldest winter so if you have not already protected your water pipes you should do so now – our heating wire wound arond the pipes will do this and will only about 50p per week to run – 15 metres (minimum length to connect to 230/240v mains! Price £5. Our Ref 5P 109
PIEZO ELECTRIC FAN an unusual fan, more like the one used by Madame Butterfly, than the conventional type, it does not rotate. The air movement is caused by the two vibrating arms. It is American made, mains operated, very economical and causes no interference. So it is deal for computer and instrument cooling. Price is only £1 each. Ref: BD605
SPRING LOADED TEST PRODS – heavy duty, made by the famous Bulgin company. Very good quality. Price four for £1. Ref: BD599
CURLY LEAD four core, standard replacement for telephone handset, extends to nearly two metres. Price £1 each. Ref BD599
TELEPHONE BELLS – these will work off our standard mains through a transformer, but to sound exactly like a telephone, they then must be fed with 25hz 50v. So with these bells we give a circuit for a suitable power supply. Price 2 bells for £1. Ref BD600
ULTRA SENSITIVE POCKET MULTIMETER – 4k ohms per volt – 11 ranges – carry one of these and os be always ready to test ac/dc volts to 1000. DC milliams and have an ohms range for circuit testing – will earn its costg in no time. Price only £7. Ref 7P2
BLOW YOUR ROOF OFF 140 watt speaker systems – new type you must not hide! They have golden cones and golden surrounds and look really "Bootiful" 12 Woofer, Midrange and Tweeter and comes with a crossover at a special introductory price of £49, carriage paid. Two sets for £95 carriage paid! 140w Woofer only £35 carriage paid
SWITCH MODE PSU Mains input 2 output plus 5v at 3.5 amps plus 12v at 1.5 amps. Very compact (6½" x 4" x 2"), ideal for driving 1 or more floppy discs. Regular price around £30. Our price only £10 brand new. Ref: 10P34
APPLIANCE THERMOSTATS – spindle adjust type suitable for convector heaters or similar price 2 for £1. Ref: BD582

COMPUTERS
Big consignment of computers expected in mid Jan, various makes and numbers, write or phone for details

NOVEL NIGHT LIGHT – plugs into a 13A socket. Gives out a surprising aamount of light, certainly enough to navigate along passages at night or to keep a nervous child happy. Very low consumption, probably not enough to move the meter. Price £1. Ref: BD563
CASE WITH 13A PRONGS – to go into 13A socket nice size and suitable for plenty of projects such as car battery trickle charger, speed controler, time switch, night light, noise suppressor, dimmers etc. Price – 2 for £1. Ref: BD565
SPEAKER EXTENSION CABLE – twin 0.7mm conductors so you can have long runs with minimum sound loss and for telephone extensions or burglar alarms, bells, intercoms, etc. 250m coil only £3 plus £1 post. Ref: 3P28
ALPHA-NUMERIC KEYBOARD – this keyboard has 73 keys with contactless capacitance switches giving long trouble free life and no contact bounce. The keys are arranged in two grouns, the main area field is QWERTY array and on the right is a 15 key number pad, board size is approx 13" x 4" – brand new but offered at only a fraction of its cost namely £3, plus £1 post. Ref: 3P27
TELEPHONE EXTENSIONS – it is no legal for you to undertake the wiring of telephone extensions. For this we can supply 4 core telephone cable, 100m coil £8.50. Extension BT sockets £2.95. Packet of 500 plastic headed staples £2. Dual adaptor for taking two appliances from one socket £3.95. Leads with BT plug for changing old phones, 3 for £2
MODULAR SWITCH – Panel mounting highest quality and ideal where extra special front panel appearance is required, can be illuminated if required dpdt and latching. Price – 2 for £1. Ref: BD607
WIRE BARGAIN – 500 metres 0.7mm solid copper tinned and pvc covered. Only £3 + £1 post. Ref: 3P31 – that's well under 1p per metre and this wire is ideal for push on connections
INTERRUPTED BEAM KIT – this kit enables you to make a switch that will trigger when a steady beam of infr-ref or orindary light is broken. Main components – relay, photo transistor resistors and caps etc. Circuit diagram but no case. Price £2. Ref: 2P15
3-30V VARIABLE VOLTAGE POWER SUPPLY UNIT – with 1 amp DC output. Intended for use on the bench for experiments, students, inventors, service engineers etc. This is probably the most important piece of equipment you can own. (After a multi-range test meter). It gives a variable output from 3-30 volts and has an automatic short circuit and overload protection which operates at 1.1 amp approx. Other features are very low ripple output, a typical ripple is 3mV pk pk 1mV rms. Mounted in a metal fronted plastic case, this has a voltmeter on the front panel in addition to the output control knob and the output terminals. Price for complete kit with full instructions is £15. Ref: 15P7
TRANSMITTER SURVEILLANCE (BUG) tiny, easily hidden, but which will enable conversation to be picked up with FM radio. Can be housed in a matchbox, all electronic parts and circuit. Price £2. Ref: 2P52

BI-PAK BARGAINS

THE UNDISPUTED PACK KING FOR OVER 20 YEARS, we offer you the very best in Electronic Components and Semiconductors that your money can buy. Look at our lists and prices, they are unbeatable in value and quantity and you always have our "Satisfaction or money back guarantee". For 1988 we offer more and more Super Value Packs. All goods advertised in stock at time of going to press.
Please note our new mail order address: **BI-PAK, PO BOX 33, ROYSTON, HERTS, SG8 5DF. Telephone orders: 0763-48851.**

Pak No	Qty	Description	Price
RESISTORS			
VP1	300	Assorted Resistors, mixed values and types	£1.00
VP2	300	Carbon Resistors, 1/4-1/2 watt preformed mixed	£1.00
VP4	200	1/2-1 watt Resistors, mixed values and types	£1.00
VP16	50	Wirewound Resistors, mixed watt values	£1.00
VP140	50	Precision Resistors, 1% tolerance	£1.00
VP180	100	1 and 2 watt Resistors assorted values	£1.00
VP287	100	Close tolerance Resistors, 05-2% 10-910 ohms mixed	£1.50
VP288	100	Close tolerance Resistors, 05-2%, 1K-820K mixed	£1.50
VP289	100	Metal oxide high stab. Resistors 1/4w 2% mixed values	£1.50
CAPACITORS			
VP5	200	Assorted Capacitors, all types	£1.00
VP6	200	Ceramic Capacitors, all types	£1.00
VP9	100	Assorted Polyester/Polystyrene Capacitors	£1.00
VP10	60	C280 Capacitors, metal foil, mixed values	£1.00
VP11	50	Electrolytics, all sorts	£1.00
VP12	40	Electrolytics, 47mf-150mf, mixed volts	£1.00
VP13	30	Electrolytics, 150mf-1000mf, mixed volts	£1.00
VP14	50	Silver Mica Caps, mixed values	£1.00
VP15	25	.01/250v Min. Layer Metal Caps	£1.00
VP180	25	Tantalum Bead Caps, assorted values	£1.00
VP182	4	1000uf 50v Electrolytics	£1.00
VP192	30	Min. Electrolytics, mixed values .47mf-1000mf 6/16v	£1.00
VP193	6	Sub Min Electrolytics 2 x 1000/2200/3300mf 10/16v	£1.00
OPTOS			
VP24	10	.125" clear lens showing Red LED's	£1.00
VP25	10	Mixed shape and colour LED's	£1.00
VP26	15	Small .125" Red LED's	£1.00
VP27	15	Large .2" Red LED's	£1.00
VP28	10	Rectangular .2" Red LED's	£1.00
VP57	25	Opto Special Pack Assorted super value	£3.00
VP130	6	RED 7 Seg. CC 14mm x 7 5mm RDP FND353 LED Display	£2
VP131	4	GREEN 7 Seg. CA .6" LDP XAN6520 LED Display	£2.00
VP134	6	RED Overflow .6" 3 x CA 3 x CC 6630/50 LED Display	£2.00
VP133	5	GREEN Overflow .6" CA XAN6530 LED Display	£2.00
VP138	20	Assorted LED Displays Our mix, with data	£5.00
VP147	1	Pair Opto Coupled Modules	£0.60
VP199	4	LD707R LED Displays, CA	£1.00
VP203	15	Triangular shape LED's, mixed colours	£1.00
VP204	10	Large Green LED's, 5mm	£1.00
VP205	10	Small Green LED's, 3mm	£1.00
VP206	10	Large Yellow LED's, 5mm	£1.00
VP207	10	Small Yellow LED's, 3mm	£1.00
VP208	10	Large LED's clear showing Red, 2"	£1.00
VP241	2	ORP12 Light Dependant Resistor	£1.50
VP242	3	Tri-colour LED's, 5mm dia. 5mA 2v R.G.Y.	£1.00
VP243	3	Tri-colour LED's, Rectangular 5mm R.G.Y	£1.00
VP266	10	Orange LED's, 5mm large	£1.00
VP267	8	Stackable LED's Rectangular, mixed R.G.Y.	£1.00
VP268	15	LED Panel Mounting Clips, metal and plastic, 3-5mm	£1.00
VP269	2	Red Flashing LED's, 5mm	£1.00
VP284	2	Opto-Isolator IL74-4N27, single	£1.00
VP285	1	Dual Opton-Isolator ILD74	£1.00

Pak No	Qty	Description	Price
DIODES & SCRS			
VP29	30	Assorted volt Zeners50mw-2w	£1.00
VP30	10	Assorted volt Zeners 10w, coded	£1.00
VP31	10	5A SCR's T066, 50-400v, coded	£1.00
VP32	20	3A SCR's T066, up to 400v, uncoded	£1.00
VP33	100	Sil. Diodes like IN4148	£1.00
VP34	200	Sil. Diodes like OA200/BAX13-16 40v 200mA	£1.00
VP35	50	1A IN4000 Diodes, all good, uncoded, 50v min	£1.00
VP49	30	Assorted Sil. Rectifiers 1A-10A, mixed volts	£1.00
VP141	40	IN4002 Sil. Rectifiers, 1A 100v preformed pitch	£1.00
VP142	4	40A Power Rectifiers, silicon, T048 300 PIV	£1.00
VP143	5	BY187 12KV Sil. Diodes, in carriers, 2.5MA	£1.00
VP184	3	4A 400v Triacs, plastic	£1.00
VP187	10	SCR's 800MA, 200v, 2N5064, plastic, T092	£1.00
VP194	50	0A91 point contact germanium Diodes, uncoded	£1.00
VP195	50	0A47 gold bonded germanium Diodes, uncoded	£1.00
VP196	50	0A70-79 detector germanium Diodes	£1.00
VP197	50	0A90 type germanium Diodes, uncoded	£1.00
VP198	40	BA248 Sil. Diodes, 350v 2A, fast recovery	£1.00
VP222	20	3A Stud Rectifiers, 50-400v assorted	£1.00
VP274	12	SCR's (Thyristors) 1A 100-400v. T0-39	£1.00
VP275	3	5A 400v SCR's, T0220, TIC106D	£1.00
VP276	5	SCR's standard type, 5-16Amp to 400v	£1.00
VP277	4	Triacs 2Amp 400v T0-39	£1.00
VP278	4	6Amp 1000v plastic Silicon Rectifiers	£1.00
VP283	5	Diac BR100, triac trigger	£1.00
TRANSISTORS			
VP38	100	Sil. Transistors NPN plastic, coded, with data	£3.00
VP39	100	Sil. Transistors, PNP plastic, coded, with data	£3.00
VP47	10	Sil. Power Transistors, similar 2N3055, uncoded	£1.00
VP48	5	Pairs NPN/PNP plastic Power Transistors 4A, data	£1.00
VP50	60	NPN Sil. Switching Transistors, T0-18 and T0-92	£1.00
VP51	60	PNP Sil. Switching Transistors, T0-18 and T0-92	£1.00
VP60	100	All sorts Transistors, NPN/PNP	£1.00
VP150	20	BC183B Sil. Transistors, NPN 30v 200mA Hfe240+ T092	£1.00
VP151	25	BC171B Sil. Transistors, NPN 45v 100mA Hfe240+ T092	£1.00
VP152	15	TIS90 Sil. Transistors, NPN 40v 400mA Hfe100+ T092	£1.00
VP153	15	TIS91 Sil. Transistors, PNP 40v 400mA Hfe100+ T092	£1.00
VP154	15	MPSA56 Sil. Transistors, PNP 80v 800mA Hfe50+ T092	£1.00
VP155	20	BF595 Sil. Transistors, NPN eqvt BF184 H.F. T092	£1.00
VP156	20	BF495 Sil. Transistors, NPN eqvt BF173 H.F. T092	£1.00
VP157	15	ZTX500 series Sil. Transistors, PNP plastic	£1.00
VP158	15	ZTX107 Sil. Transistors, NPN eqvt BC107 plastic	£1.00
VP159	15	ZTX108 Sil. Transistors, NPN eqvt BC108 plastic	£1.00
VP161	25	BC183L Sil. Transistors, NPN 30v 200mA T092	£1.00
VP162	5	SJE5451 Sil. Power Transistors, NPN 80v 4A Hfe20+	£1.00
VP163	2	NPN/PNP pairs Sil. Power Transistors, like SJE5451	£1.00
VP164	4	2N6289 Sil. Power Transistors, NPN 40v 40w 7A Hfe30+	£1.00
VP165	6	BFT33 NPN Sil. Transistors, 80v 5A Hfe50-200 T039	£1.00
VP166	5	BFT34 NPN Sil. Transistors, 100v 5A Hfe50-200 T039	£1.00
VP167	1	BUY69C NPN Transistors, T03 VCB 500,10A,100w,Hfe15+	£1
VP168	10	BC478 eqvt BCY71 PNP Sil. Transistors T018	£1.00
VP169	10	BXS21 eqvt BC394 NPN Sil. Transistors, 80v 50mA T018	£1.00
VP170	10	Assorted Power Transistors, NPN/PNP coded and data	£1.00
VP171	10	BF355 NPN T0-39 Sil. Transistors, eqvt BF258 225v 100mA	£1

MINIATURE CARBON FILM RESISTORS 1/4 & 1/2 WATT 5%
Resistance values from 1ohm – 10meg ohms.
Available in lots of 100 pieces per value.
To order state R100 1/4 watt or R200 1/2 watt, plus resistance required, eg R100 1K= 1/4 watt 1K
BI-PAK price per 100 pieces R100 £1.00 per pack. R200 £1.30 per pack

Pak No	Qty	Description	Price
TRANSISTORS			
VP172	10	SM1502 PNP T0-39 Sil. Transistors 100v 100mA Hfe100+	£1
VP200	30	0C71 type germanium AF Transistors uncoded	£1.00
VP201	25	0C45 germanium RF Transistors	£1.00
VP261	4	Programmable Unijunction Transistors MEU22	£1.00
VP270	10	FET's UHF/VHF Amplifiers switching & choppers data	£1
VP271	10	FET's general purpose like 2N3819-2N5457 data	£1.00
VP272	10	MOS-FET's Signetics SD304	£1.00
VP 280	12	ZTX300 NPN Silicon Transistors	£1.00
VP290	15	MPSA06 Sil. Transistors NPN 80v 500mA HFE50+ T092	£1
VP428	10	AC128K PNP Germanium Transistor 1A 32v	£1.00
VP429	10	AC176K NPN Germanium Transistors 1A 32v	£1.00
VP430	4	2N3055 Sil. Power Transistors full spec	£2.00
VP431	25	PNP Sil. Transistors T0-39 like 2N2905A	£1.00
I.C.S			
VP40	40	TTL I C S all new gates - Flip Flop - MSI data	£4.00
VP54	20	Assorted I C DIL Sockets 8 - 40 pin	£2.50
VP59	20	Assorted I C's linear etc. all coded	£2.00
VP209	12	74LS00	£2.00
VP210	12	74LS74	£2.00
VP211	10	CD4001B	£2.00
VP212	10	CD4011B	£2.00
VP214	10	CD4069B	£2.00
VP215	10	741P 8 pin	£2.00
VP216	10	555 Timers 8 pin	£2.00
VP223	50	Asst 74 TTL I C's ALL GATES new & coded our mix 7400-7453	£6.00
VP224	100	Asst 74 TTL I C's ALL GATES new & coded our mix 7400-7453	£10.00
VP282	1	Prog. Sound Gen. Chip AY-3-8912	£3.00
VP291	1	Z80ACPU Microprocessor 40 pin DIL	£2.00
VP292	1	Z80AP10 Parallel Interface Controller 40 pin DIL	£2.00
VP293	1	Z80ACTC Counter Timer Circuit 28 pin DIL	£2.00
VP294	1	2732D 32K Eprom	£3.00
VP295	1	6821P Peripheral Interface Adaptor (PIA)	£1.50
VP296	6	LM324 14 pin DIL Quad Op-Amp	£2.00
VP297	5	CA3130E MOS-FET I/P, CMOS O/P Op-Amp	£2.00
VP298	3	MC1310P Stereo Decoder, 14 pin DIL	£2.00
VP299	3	CA3085 Pos. Volt. Regulator, 1.7v - 46v 8 pin T05	£2.00
VP400	1	27128 128K Eprom	£2.50
VP401	2	LM317T Adjst. Voltage Regulator 1.5A	£1.00
VP402	1	2114 4K Static Ram	£2.00
VP403	1	TA7204 Audio Amp I C 4.2w 13v 2-4 ohms	£1.00
VP404	1	TBA461 Audio Power Amp. 4.5w	£1.50
VP432	8	CD4016B	£2.00
VP433	6	CD4017B	£2.00
VP434	10	CD4024B	£2.00
VP435	10	CD4028B	£2.00
VP7413	4	7413 Dual Nand Schmitt Trigger 4-input	£1.00
VP7440	4	7440 Dual 4-input Positive-Nand Buffer	£1.00
VP7470	4	7470 And-gated Positive-edge-triggered Flip-Flop with preset	£1.00
VP7480	4	7480 Gated full Adder	£1.00
VP7481	4	7481 16-bit Random Access memories	£1.00
VP7490	4	7490 Decade Counter	£1.00
VP7491	4	7491 8-Bit Shift Register	£1.00

Pak No	Qty	Description	Price
I.C.S			
VP7492	4	7492 Divide by 12 Counter	£1.00
VP7493	4	7493 4-bit Binary Counter	£1.00
VP7494	4	7494 4-bit Shift Register	£1.00
VP7495	4	7495 4-bit Shift Register	£1.00
VP74111	4	74111 Dual J-K Master Slave Flip-Flop	£1.00
VP74141	4	74141 BCD - Decimal Decoder/Driver	£1.00
VP74151	4	74151 1 of 8 Data Selectors/Multiplexers	£1.00
VP74153	4	74153 Dual J-K master slave flip-flop	£1.00
VP74164	4	74164 8-bit Parallel Output Serial Shift Registers	£1.00
VP74167	4	74167 Synchronous Decade Rate Multipliers	£1.00
VP74174	4	74174 Hex D type Flip-Flops	£1.00
VP74181	4	74181 Arithmetic Logic Units/Function Generators	£1.00
VP74193	4	74193 Synchronous Up/Down Clock Counters Binary	£1.00
VP74279	4	clear 74279 Quad S-R Latches	£1.00
BPX6	1	TTL Data Book 74 Series, incl LS. Complete with Pin out diagrams. 7400-74670. TTI exchange guide. Function selection guide and explanation of function tables. **'NO VAT'**	£1.00
BPX5	1	IC555 PROJECTS BOOK (timer) 167 pages. Over 50 project circuits to build and other information on IC555 Timers. Plus FREE with our compliments 3 x IC 555 Timer worth 90p. **Special offer price just £2.95 'NO VAT'**	
BPX4	1	INTERNATIONAL TRANSISTOR EQUIVALENTS GUIDE. Babani Publishing's latest edition BP85, plus FREE with our compliments 10 popular Silicon Transistors worth £1.00. **Special offer price just £3.50 'NO VAT'**	
MISC.			
VP17	50	Metres PVC single strand Wire, mixed colours	£1.00
VP18	30	Metres PVC multi strand Wire, mixed colours	£1.00
VP19	40	Metres PVC single-Multi strand Wire, mixed colours	£1.00
VP22	200	Sq. Inches total Copper Clad Board	£1.00
VP23	10	40mm Track Slider Pots 100K Lin	£1.00
VP42	10	Black Heatsinks, fit T03 and T0220, drilled	£1.00
VP43	4	Power-fin Heatsinks 2 x T03 2 x T066	£1.00
VP44	15	Assorted Heatsinks T01/3/5/18/220	£1.00
VP56	100	Semiconductors from around the world mixed	£4.00
VP82	1	Electronic Buzzer 3v 25MA	£0.95
VP83	1	Electronic Buzzer 6v 25MA	£0.95
VP84	1	Electronic Buzzer 9v, 25MA	£0.95
VP85	1	Electronic Buzzer 12v 25MA	£0.95
VP86	1	TECASBOTY Components Pack semiconductors caps wire etc	£8.00
VP87	1	Telephone Pick-up Coil with 3.5mm jack plug	£1.25
VP88	1	Pillow Speaker with 3.5mm jack plug	£1.45
VP107	1	Piezo Buzzer, miniature 12v	£1.25
VP108	1	Piezo Buzzer, miniature 240v	£1.25
VP113	1	Coax Antenna Switch, 2 way	£4.50
VP114	1	Coax Antenna Switch, 3 way	£4.75
VP115	1	High Pass Filter/Suppressor CB/TV	£0.50
VP116	1	Low Pass Filter VHS/TV bsnd	£3.00
VP122	1	Precision Morse Key, fully adjustable	£1.85
VP144	4	100K Lin multi turn Pots, ideal vari. cap. tuning	£1.00

VOLTAGE REGULATORS

Pos. 1 amp 7805-12-15-18-24	35p each
Neg. 1 amp 7905-12-15-18-24	40p each
Pos. 100mA 78L05-12-15-18-24	28p each
Neg. 100mA 79L05-12-15-18-24	30p each

Pak No	Qty	Description	Price
MISC.			
VP145	10	Assorted Pots, inc dual and switched types	£1.00
VP148	30	Presets, horizontal and vertical, mixed values	£1.00
VP174	5	DIL switches 1 and 2 way slide, 6 way SPST assorted	£1.00
VP176	30	Fuses, 20mm and 1 1/4" glass assorted values	£1.00
VP177	1	Pack assorted Hardware, nuts, bolts, etc	£1.00
VP178	5	Assorted Battery Holders and Clips PP3/9 AA/D, etc	£1.00
VP223A	6	Tag Boards, 18 way paxaline	£2.50
VP225	20	DIN Plugs, plastic 2-8 pin 180° 240° 360° mixed	£2.50
VP226	20	DIN chassis skts, metal 2-8 pin 180° 240° 360° mixed	£2.50
VP227	18	DIN in-line skts, plastic 2-8 pin 180° 240° 360° mixed	£2.50
VP228	10	C15 Computer Cassette Tapes, leadless	£3.00
VP232	1	Cassette Head Cleaner/Demagnetizer, in case	£2.00
VP233	1	Revolving Cassette Rack, holds 32, smokey perspex	£2.50
VP244	1	High Power Piezo Electric Siren. Emits earpiercing warbling sound. Ideal alarm. White plastic body with mounting bracket. Power 12vDC 150mA. Output 100db (A) at 1m typ. freq. 2.5KHz. Size: 57 x 42 x 37mm	£6.00
VP260	1	9" x 6" Elliptical 8 ohms 10W RMS Speaker. Freq. Res. 60-10000 Hz. Gauss 10000. Centre HF cone	£4.50
VP260A	1	2 1/4" Transducer Waterproof Speaker. Polyester diaphragm. Moisture res. 8 ohms 300mW Freq. Res. 20-20000 Hz	£1.00
VP273	10	10K Lin Rotary Potentiometers, slim spindle	£1.00
VP281	4	Plug-in Relays. Mixed volts, etc	£1.00
TOOLS			
VP95	1	Plastic Vice, small, with suction base	£1.75
VP97	1	Logic Probe/Tester, supply 4.5v - 18v, DTL TTL CMOS	£8.50
VP99	1	Universal Tester, with ceramic buzzer	£5.00
VP103	1	6 Pc STANLEY Screwdriver Set. Flat and crosspoint	£3.50
VP139	1	Pick-up Tool, spring loaded	£1.75
VP217	1	Helping Hand	£4.00
VP218	1	Watchmakers Screwdriver Set. 6 Pieces	£1.75
VP219	1	Miniature Side Cutters	£1.55
VP220	1	Miniature Bent-nose Pliers	£1.55
VP221	1	Miniature Long-nose Pliers	£1.55
VP237	1	Universal Ni-Cad Battery Charger. AA-HP11-HP2-PP3	£6.00
VP238	4	AA Ni-Cad Batteries. 1.25v 500mAh C/R mA	£4.00
VP239	2	C-HP11 Ni-Cad Batteries. Rechargeable	£3.50
VP240	2	D-HP2 Ni-Cad Batteries. Rechargeable	£4.00
VP246	1	25w Quality Low Cost Soldering Iron. 240vAC	£3.50
VP247	1	15w 'Lightweight' Quality Low Cost Soldering Iron. 240vAC	£3.50
VP248	1	High Suction Desoldering Pump. Teflon nozzle. Auto eject heavy duty return spring	£4.00
VP250	1	Long Finger Grip, soldering aid. Heavy metal base. Serrated jaws with rev. tweezer action. Ideal for holding small components. Fully adjustable	£3.00
VP254	1	250g Etchant Granules (Ferric Chloride) makes 1/2 pint	£1
VP255	1	Etching Pen. Etch resistant. Spare tip. Blue	£1.00
VP258	1	Multicore Solder 5m total. 10 and 22 SWG	£1.00
VP259	1	PCB Holder. Fully adjustable from 0-320mm wide and to any angle. Complete with iron stand and sponge. Strong metal construction with rubber feet. Very high quality	£15
VP286	2	Etch Resist PCB Transfer Sheets. Asst. symbols/lines	£1.00
VP405	2	Steel Rules 1 x 4", 1 x 4", measuring ins and mm	£1.00
VP406	1	Junior Hacksaw & 3 blades + hobby knife & 2 blades	£1.00
VP407	1	10 Piece Needle File Set	£3.00
VP408	1	4 Piece Stainless Steel Tweezer Set	£4.00
VP409	1	Set of 4 min. low cost Side & End Cutters, snipe & combination Pliers. 5" insul. handles	£4.50

Pak No	Qty	Description	Price
TOOLS			
VP410	1	18 Pc Hex Wrench Keys. AF sizes in wallet	£1.50
VP411	1	16 Pc Hex Key Wrench Set. SAE and Metric	£2.00
VP412	1	Crimping Pliers, Wire Strippers & Bolt Cutters	£1.00
VP413	2	IC Extraction Tools, jaw width 18 and 29mm	£2.00
VP414	1	End Action Stripping Pliers. Adjustable jaws	£1.00
VP415	1	5" Grip Locking Pliers	£3.00
VP416	1	6" Long Nose Grip Locking Pliers	£3.00
VP417	1	6" Adjustable Wrench. Forged alloy steel	£2.50
VP418	1	8" Tin Snips. Hardened steel, spring joint	£2.00
VP419	2	Chubby Screwdrivers. Crosspoint No 1 and 2	£1.50
VP420	2	Chubby Screwdrivers. Flat blade 4.5 and 6mm	£1.50
VP421	1	Screwdriver 400mm long, 6mm flat blade	£3.00
VP422	1	Screwdriver 400mm long, No 2 crosspoint	£3.00
VP423	1	Vernier Caliper-Crosshorns. Depth gauge. Vernier Cap. 4 1/2"/110mm reading 1/128", 1/10mm	£2.50
VP424	1	Helping Hand with Magnifier	£4.50
VP425	1	7 Pc high quality Screwdriver Set	£8.50
VP426	1	7 Pc high quality Screwdriver Set 1000v	£12.50
VP427	1	6 Pc Cushion Grip Screwdriver Set	£4.00
LEADS			
VP300	1	10m Speaker Lead 2 pin DIN Plug to 2 pin DIN Skt	£1.00
VP301	1	2m Video Lead Coaxial Skt to Coaxial Skt – 2 adaptors	£1.20
VP302	1	3m 4 core cable indv. screened 5 pin DIN Plug – pin DIN Plug	£1.80
VP303	1	TV Ext. Lead Coax plug to Coax Plug White	£1.00
VP304	1	1.5m 4 core indv screen 5 pin DIN Plug –tinned open end	£1
VP305	1	1.5m cable 5 pin DIN Plug-3.5mm Jack Plug Pin 1 & 4 connect	£1.00
VP306	1	2m Typewriter/Calculator Lead 3 pin Plug, angled European IEC configuration. 6A 250vAC	£2.00
VP307	1	60cm Patch Lead. PL259 Plug to PL259 Plug	£1.00
VP308	1	1.2m Patch Lead. PL259 Plug to PL259 Plug	£1.50
VP309	1	1.2m Lead 4 Phono Plugs to 4 Phono Plugs	£1.50
VP310	1	20cm Lead 2 x 2 pin DIN Plug to Stereo Inline Jack Skt	£1.00
VP311	1	2m Lead Scart Plug to 5 pin DIN Plug & 2 BNC Plugs	£6.00
VP312	1	1.2m Video Lead. BNC Plug to Phono Plug	£1.50
VP313	1	3m Headphone Lead. 3.5mm Jack Plug to 3.5mm Jack Skt	£1
VP314	1	2m Coax Lead BNC Plug to BNC Plug. 75 ohms	£3.00
VP315	1	2m Coax Lead BNC Plug to UHF Plug. 75 ohms	£3.00
TELEPHONE ACCESSORIES			
VP316	1	5m Telephone Ext. Lead. Plug to Socket	£4.50
VP317	1	10m Telephone Ext. Lead. Plug to Socket	£6.00
VP318	1	3m Line Jack Cord. BT 4 way Plug to 4 Spade Terminals	£1.75
VP319	1	Double Adaptor. One IDC plug, 2 socket	£3.50
VP320	1	IDC Telephone Plug 4 way	£0.50p
VP321	1	Telephone Master Skt Surface Box. Screw terminals	£3.50
VP322	1	Telephone Slave Socket Surface Box. Screw terminals	£2.25

VPS30 REGULATED VARIABLE STABILISED POWER SUPPLY MODULE
This versatile regulated variable stabilised power supply with short circuit protection and current limiting is a must for all electronics enthusiasts. It incorporates adjustable voltage from 2v – 30v with a current limiting range of 0-2A. AC input max. 25v. Dimension 110x75x25mm. Price each £8.50