JANUARY 1989 £1.95

Radio & Electronics World

The communications and electronics magazine

MULTIPLE OUTPUT LOW VOLTAGE POWER SUPPLY CIRCUIT

HEATSINKS: THE IMPORTANCE OF KEEPING YOUR COOL

DX-TV RECEPTION REPORTS

MEDIUM WAVE DXING

NETWORK 934

RAYCOM
COMMUNICATIONS SYSTEMS LTD

Raycom wish all customers a very merry Christmas and a happy New Year

New opening hours: 9.00am-5.30pm 5 Days, late night Friday (until 7.00pm). Closed all day Thursday

RAYCOM SPECIAL CHRISTMAS BOXES AVAILABLE DURING DECEMBER ONLY

Challenger BJ 200 Mk2

HF/VHF Scanning Receiver
☆ 26-520MHz (with gaps)
☆ Included Civil and Most of Military Airband
☆ 16 memory channels Search scan priority function and delay ☆ c/w Raycom Air Band antenna **FREE**

£189.00 P&P £10.00

2m starter package

CTE1600 (same as IC2E)
★ Inc **FREE** 2m mag mount ant
★ 144-148MHz, c/w NiCad chrgr
★ 2.5W output
★ Ideal mobile/ portable use

£149.00. P&P £10.00 (while present stocks last)

Dual-band mobile package

Icom IC3200 144-430 transceiver
★ C/w **FREE** dual band mobile ant
★ 25W on both bands, 10 memories
★ Built-in duplexer
£399.00. P&P £10.00 (while stocks last)

The ultimate receiving stations

Icom ICR7000 V-UHF receiver
★ Inc **FREE** Royal 1300 discone ★ 25-1300MHz (2GHz)
£925.00. Carr £10.00 (limited stocks)

Icom ICR71 SW receiver

★ **FREE** long wire receiving ant
★ Covers all short wave bands
£825.00. Carr £10.00 (limited stocks)

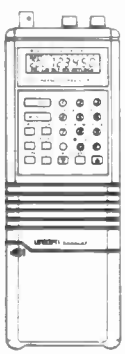
HF station package

Yaesu FT747GX all band/mode transceiver
★ C/w **FREE** 20A metered PSU
★ Inc Raycom Mk2 Rx mod ★ 120W RF output
★ Continuous coverage receiver
£725.00. Carr £12.50 (limited supplies)

Our famous Yaesu FRG9600 packages

★ **FREE** Royal 1300 25-1300MHz discone
★ Supplied with **FREE** mains PSU ★ Improved receiver specification ★ Wide choice of options
Mk2 60-950MHz £545.00
Mk5 100kHz-950MHz £699.00 P&P £10

Bearcat BC 200XLT



The super new scanning receiver
★ C/w **FREE** mobile antenna
★ 29-956MHz (with gaps)
★ 200 memory channels
★ Detachable NiCad
★ C/w NiCad/charger

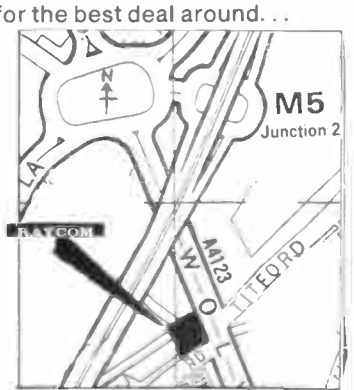
£239.00. P&P £10.00

Raycom news box

Just in. . .professional antennas from TCL, HF multiband dipole kits with balun. . .colinear antennas, dipoles, groundplanes. . .all at silly low prices. . .Ten-Tec transceivers. . .MFJ accessories. . .Butternut antennas. . .latest Icom mobile and hand-held transceivers. . .new range of 2/70 dual band mobile antennas. . .Sony receivers and accessories. . .super deals on Standard C500 transceivers. . .Royal 1300 antenna (same as Icom AH7000) now £59.50. . .full Bearcat-Uniden scanner range in stock. . .new range of mobile scanning antennas available. Remember we now close on Thursdays. . . by the time you read this, Uniden 2830s should be available again. . .please phone ASAP for details. . .73 es 88

New Icom super rigs

★ Icom IC2GE £265.00
★ Icom IC32E £399.00
★ Icom IC3210E £499.00
Expandable Rx POA
Call us for the best deal around. . .



Call in easy to get to, easy parking

Raycom Communications Systems Ltd
International House, 963 Wolverhampton Road
Oldbury, West Midlands B69 4RJ
Telephone 021 544 6767. Fax 544 7124. Telex 336483 Identi-G

Raycom gives you more purchasing power!

For fast service phone in your order with any major credit card, or in most cases we can offer you instant credit of up to £1,000.00 (subject to status). Raycom are licensed credit brokers. APR 29.8% subject to variation. Free credit on certain products at MRP prices, 50% deposit and six monthly payments. Please telephone for more details and application forms.

PLEASE TEL: 021 544 6767

RAYCOM COMMUNICATION SYSTEMS LIMITED

FOR THE BEST IN AMATEUR RADIO

Ordering information

All products we advertise are normal stock items, our new mail order department can now dispatch many items same day but please allow up to 14 days delivery time if subject to carriage method. If ordering by mail, please include carriage and state your daytime telephone number. All products over £750.00 carriage free. Please allow time for personal cheques to clear. Please call **before ordering** and for more information

New Infoline 0836 282228 available 5-9pm (weekdays only)

Full range of Icom, Yaesu, Bearcat-Uniden, MFJ, Butternut, Jaybeam, Tonna, Welz in stock. Most products available in this magazine available at Raycom, plus our special package deals. Call now for details.

CONTENTS

ON THE COVER

This month's cover shows: **(top)** the 2001A function generator. **Bottom:** the 6002D frequency counter. Both items are produced by: Global Specialties, 2nd floor, 2-10 St John's Street, Bedford MK42 0DH. Tel: (0234) 217856

Editorial
Iain Mackenzie
Penny Phillips

Advertisement Manager
Marian Vidler

Advertisement Executive
Maria Smith

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
6 Leigham Court Road
Streatham, London SW16
2PG. Tel: 01-677 8111

Subscriptions
Tel: 01-684 9542

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.

MULTIPLE OUTPUT LOW – VOLTAGE POWER SUPPLY

by W G Borland G3NXM

Many test instruments and other pieces of ancillary equipment require a low-voltage power supply and have a current consumption of less than 1 amp. Batteries are expensive, particularly as different types of equipment may require different voltages. These may be 5, 9 or 12V, or sometimes even have both a positive *and* negative 9V supply. This power supply was designed to provide these voltages at a maximum current of 1 amp for each one.

Transformer

The transformer came out of an old battery charger and provided 18V at 5 amps. Any transformer between 15 and 25V can be used as long as it will provide a minimum of 4 amps. The easiest method of obtaining the required voltages is to use voltage regulators. The circuit is shown in **Fig 1**.

Half-wave rectification was used for simplicity and proved to be satisfactory, no doubt due to the fairly large smoothing capacitors and the use of regulators. Three diodes, D1, D2 and D3 are connected to give positive outputs which are smoothed by capacitors C1, C2 and C3. Although the diodes shown in **Fig 1** are 1N4003, any diodes rated at a minimum of 1 amp can be used. If you pick up a 3 amp or larger diode, then D2, D3, C2 and C3 can be omitted and the output via C1 can be connected directly to regulators VR1, 2 and 3. A separate diode must be used for D4 which is connected to provide a negative voltage output. Make sure that C4 is connected so that its positive is to ground. One end of capacitors C5 to C12 must be connected to the voltage regulators with as short a lead as possible.

The required output voltages from VR1 and VR3 are 12 and 5V respectively. Unfortunately, 9V regulators are not available, so a 5V one is used for VR2 with the common raised above ground by R1. Admittedly, this will destroy the regulation to a small extent, but this was accepted as it is principally a 9V output which is required. A 4.7k ohm skeleton preset resistor was used for R1 and adjusted to give a 9V positive output from VR2. Once the correct value was found, it was replaced by a fixed resistor.

For the 9V negative output, a negative 5V regulator is used for VR4, with the common raised above ground by R2 in the same way as for the 9V positive. Note however, that the connections to the negative regulator differ from those for the positive one (see **Fig 2**). A 4.7k ohm preset resistor is also used for R2 and adjusted for a 9V negative output from VR4. After adjustment a fixed resistor replaced R2.

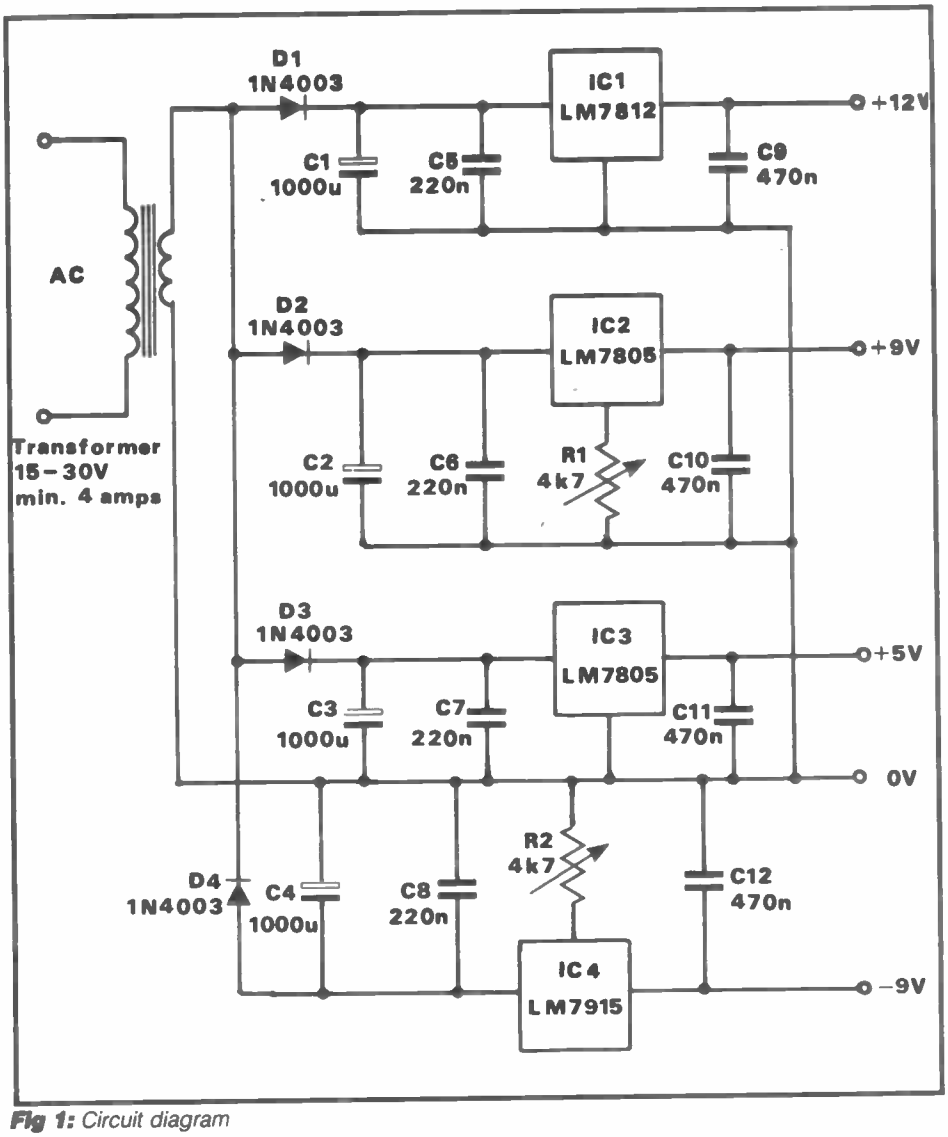


Fig 1: *Circuit diagram*

Built-in power supply

The power supply was built into an aluminium box. Voltage regulators VR1 and VR3, are bolted on to the case which acts as a heatsink. As the centre pin is connected internally to the metal backplate, both VR2 and VR4 are mounted on a piece of mica which is then bolted on to the case with a 4 or 6 BA nylon bolt. This insulates the common of VR2 and the input of VR4 from the case as well as from each other. A little heatsink compound is advisable.

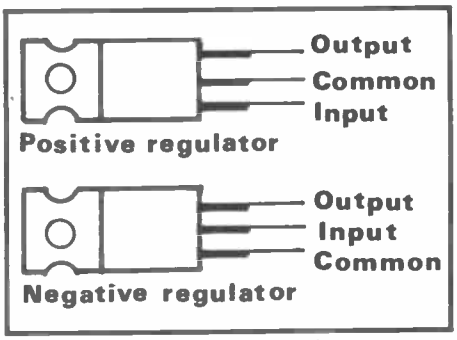


Fig 2: *Connections to DIN sockets*

Four 4 pin DIN sockets were mounted on the box and connected as shown in **Fig 3**. This particular socket was chosen as this configuration is not used elsewhere by the author, so preventing wrong connection to the power supply. However, any type of connector could be used as long as it has sufficient ways.

The power lead from each of the various pieces of equipment was connected to a 4 pin DIN plug which was wired to provide the required voltage. If the requirement was 5V, then the lead's positive would be connected to pin 1 and the negative to the shell. For both positive and negative 9V, the positive would be connected to pin 2, the negative to pin 4 and the common to the shell. This method ensures that the correct voltage is used for each piece of equipment.

Modifications

This power supply can be modified or added to quite easily. A variable voltage output can be provided by having a panel-mounted variable resistor connected to the common of a 5V regulator. Adding 15V outlets for the ICs will entail changing the 4 pin DIN plug to 6 pin ones.

When modifying the circuit, there are two points to bear in mind. Firstly, the transformer will provide the necessary current. Secondly, the dc voltage input to the 5V regulator has to be between 7 and 25V; into the 12V one between 14.5 and 30V, and into the 15V regulator between 17.5 and 30V, either positive or negative as required. NEW

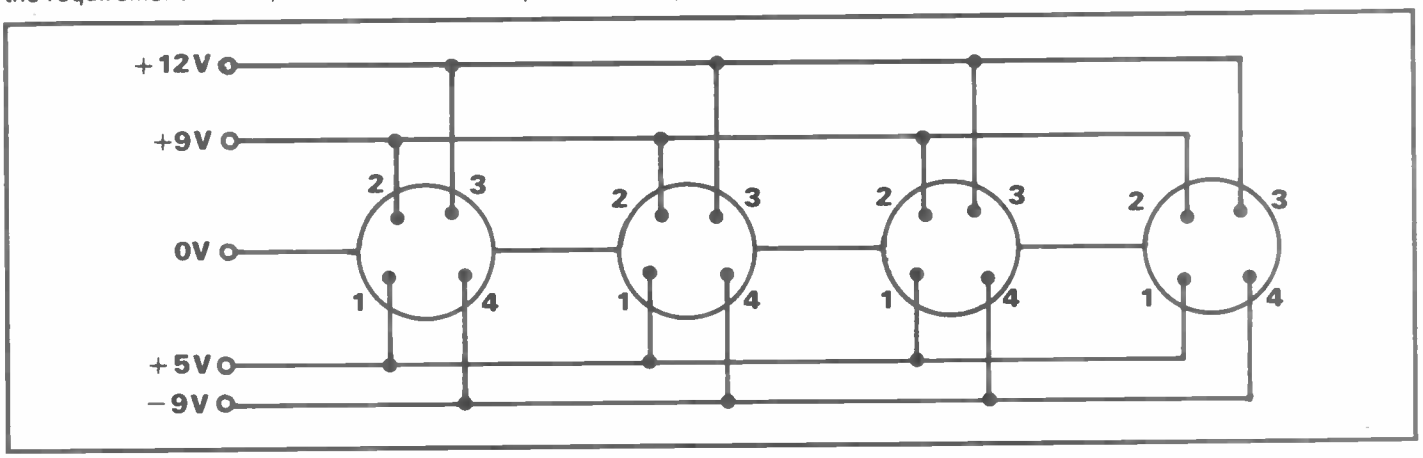


Fig 3: *Connections to DIN sockets*

DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

Although well on the decline, long-distance TV reception via Sporadic-E propagation occurred during the first few days of September. Much of this was fairly routine reception from various European countries rather than anything exciting from further afield.

A good deal of tropospheric DX reception was evident in Band III and UHF throughout the month, creating one or two surprises for enthusiasts. At least one DXer commented that he had seen Swiss signals six times in twenty-one days.

Mystery test card

DX reception isn't complete without a good mystery! At Derby, late on 18 September, a test pattern composed of blocks and squares was located at fair strength on channel E36. No identification was present but it was assumed to have originated from one of the new West German local stations operating in the north of the country. Did anyone else see this?

The RTBF-1 test pattern underwent a transformation during the Olympics. A message was superimposed across a white band in the lower part of the pattern advising viewers which network would be providing coverage.

DX-TV log for September

This month, we are featuring details of the reception log sent in by Kevin Jackson of Leeds.

01/09/88: TVE-1 (Spain) on channels E2 and E4 with Breakfast TV at 0944; TSS (USSR) on channel R2 showing the UEIT test card at 1022; RAI UNO (Italy) IA programme at 1127; ORF (Austria) E2a (Jauerling) and E4 (Patscherkofel) with clock caption at 1141 followed by the 'ORF FS1' PM5544 test pattern.

06/09/88: RAI UNO IA and IB displaying the 'RAI-1' PM5544 at 0624; TDF Canal Plus (France/Corsica) L2 programme at 0642 – all received via Sporadic-E. TDF tf1 L39, L42, L43 and L63; Antenne 2 L34, L35, L39, L45, L46 and L57; FR-3 L37, L40, L45 and L60; Canal Plus L5, L6, L7 (2 stations), L8, L9 and L10; LA CINQ L34, NED-1 (Netherlands) E39; NED-3 E34 and E35; BRT-1 (Belgium) E10 and E43; BRT-2 E46; RTBF-2 (Belgium) E49; RTL PLUS (Luxembourg) E7; ZDF (West Germany) E34 and E35; SWF-1 (West Germany-Südwestfunk) E8, E9 and E10; AFN-TV (American Forces Network at Soesterberg in the Netherlands) on channel A80; +PTT TSI (Switzerland-Italian language) E7 and E34 – all via tropospheric reception.

07/09/88: TDF tf1 L27, L30, L37, L39, L42, L43 and L63; Antenne 2 L21, L34, L35, L39, L43, L45, L46, L48, L53 and L57; FR-3 L34, L37, L40, L42, L45 and L60; Canal Plus L5, L6, L6 (vertical polarisation), L7 (2 stations), L8, L9 and L10; LA CINQ L30, L34 and L38; BRT-1 E10 and E43; BRT-2 E46; RTBF-1 E8 and E11; NED-1 E5 and E39; NED-2 E27, E31 and E45; NED-3 E30, E34, E35 and E42; RTL PLUS E7; ZDF E35 and E37; SWF-1 E8; +PTT SRG (Switzerland-German language network) E6 and E12; +PTT SSR (Switzerland-French language) E9 and E10 – all via tropospheric reception.

08/09/88 to **17/09/88:** Mainly French, Belgian and West German trops.

PHOTO FILE ● PHOTO FILE ● PHOTO

Fig 1: *PM5544 test card received from Belgium on E11 during the 1988 Olympic Games*

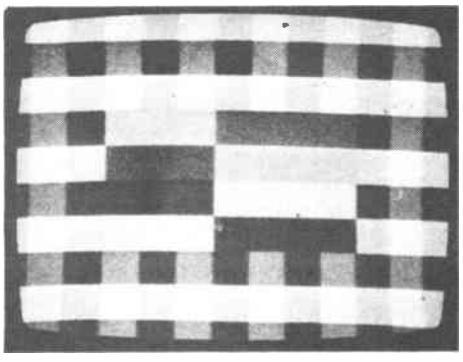


Fig 2: *Mystery test pattern received on channel E36, possibly from West Germany*

Fig 3: *New colour-bar pattern with identification from Ned-1 in the Netherlands*

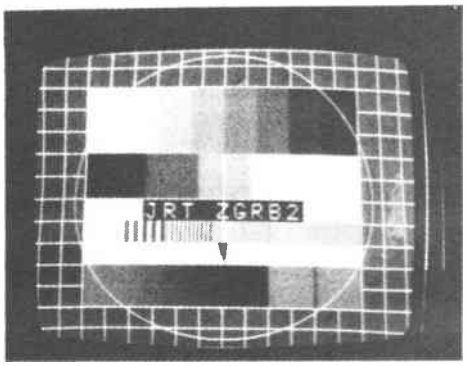


Fig 4: *FuBk test card used by the Yugoslavian second network from the Zagreb Studios*

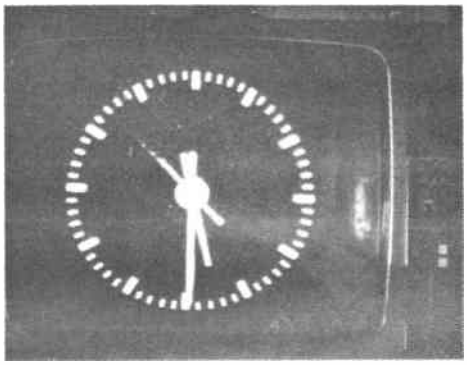


Fig 5: *Yuglosalvian clock caption radiated by JRT-Zagreb without indification*

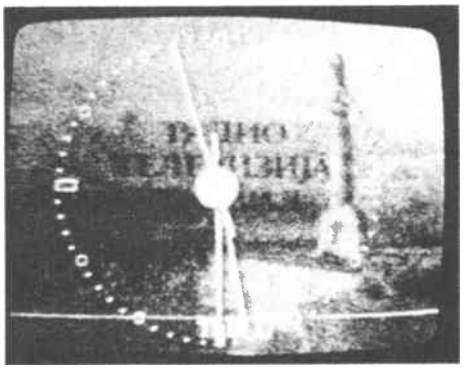


Fig 6: *Clock caption used by JRT-Beograd (Belgrade) with cyrillic identification*

18/09/88: French and Belgian trops, also +PTT TSI E34.
19/09/88: French and Belgian tropospheric reception in Band III and UHF; ZDF E34; HR-1 (West Germany-Hessischer Rundfunk) E8; SWF-1 E9; RTL PLUS E7; DDR:F1 (East Germany) E5; RTE-1 (Eire) Ch H; +PTT TSI E34.
20/09/88: French and Belgian tropospheric reception in Band III and UHF; ZDF E34 and E35; HR-1 E8; HR-3 E37; SWF-1 E9 and E10; SWF-3 E40 and E56; BR-3 E46; DDR:F1 E6; DDR:F2 E34; +PTT TSI E34; +PTT SRG E6 and E7 – all via enhanced trops.
21/09/88: French, Dutch and Belgian reception in Band III and UHF; LA CINQ L49; ZDF E34, E35 and E37; WDR-1 (Westdeutscher Rundfunk) E11; WDR-3 E39, E40, E48, E50, E53 and E60; HR-1 E7; HR-3 E37; SWF-1 E9; SWF-3 E40 and E56; BR-3 E49; AFN-TV (Soesterberg) A80; DDR:F1 E6; DDR:F2 E34; +PTT SRG E6 and E12; +PTT SSR E9; +PTT TSI E34.

Six metre record

Amateur reception on 50MHz occurred in West Germany on 6 June from the USA. There are no details regarding the state or states the signals originated from, but Joop Prosée of the Netherlands comments that an 'absolute record' was established between two amateurs in Holland and Texas on 6 metres on 6 and 7 June – a distance of 7500km! Also in the Netherlands, USA/Canadian TV-DX was received on channel A2 between 2030 and 2236UTC on 5 August.

Joop also mentions that the 5kW channel E3 outlet of Aramco-TV at Dhahran (Saudi Arabia) was noted on 12 July and the Bulgarian test card was seen on channel R3 (12 and 21 July) and channel R5 on 24 July.

Transatlantic trop?

The recent instances of transatlantic DX reception by both amateur radio and TV-DX enthusiasts have aroused new theories about how the signals were actually propagated. The usual assumption is that double-skip or multi-skip Sporadic-E is the cause of such reception because of the immense distances spanned. However, the sceptics argue that multi-skip or even double-skip Sporadic-E may not, in fact, exist and it is merely a way of explaining how signals traverse such distances.

Joop Prosée of the Netherlands has contacted us voicing his opinion on the subject. He writes 'the only unquestionable mode of propagation is single-skip Sporadic-E. Until now, no absolute proof has been found that double-skip Sporadic-E exists in the way it is commonly assumed to do so by radio amateurs and TV DXers. If double-skip Sporadic-E does exist, the only signals that are propagated and received will originate at a distance of about 5000km for the 40-70MHz spectrum.

'When the distances of the transatlantic opening on the 6 and 7 June are examined, one can see that there was no optimum reception distance of around 5000km. It appears that the transmitters are regularly divided over the total area received. The distances ranged from 3600km (Newfoundland to the UK) and 6800km (South Carolina to the Netherlands).

'So what mode of propagation accounts for this reception? It's certainly not Sporadic-E, and F2-layer DX is out of the question. Neither is it auroral reception or a form of TEP (transequatorial propagation). If I analyse the reception from across the Atlantic, I can draw no other conclusion than that it is caused by means of a sort of tropospheric propagation. Note that I do not say it *is* tropospheric reception, only that the actual propagation mechanism can be likened to a tropospheric one. I have found several factors which indicate this. These are:

1: Tropospheric reception paths of thousands of kilometres exist over both the Atlantic and Pacific Oceans (Hawaii to California is one example).
2: Tropospheric reception of Iceland has been possible on channels E3, E4, E5 and E6 in the Netherlands and Belgium via a long sea-path.
3: The areas on both sides of the Atlantic affected by reception, such as that on 6 and 7 June, are too extensive to be normal ionospheric propagation.
4: All known transatlantic reception (for example 1974, 1982, 1987 and 1988) has occurred in July.
5: The optimum time for reception seems to be in the late evening around 2200GMT, which is not a favourable hour for normal ionospheric DX.
6: Higher frequencies (such as USA channels A4 and A5) are often better propagated than the lower ones; this is typical of most tropospheric modes.
7: The extremely long duration of transatlantic reception (a 12-hour opening has been known to occur).
8: The maximum usable frequency (muf) was extremely high for ionospheric DX and was sometimes almost 90MHz.

'Proving the 'tropospheric' theory does not seem too difficult since this type of propagation is affected by weather conditions – usually anticyclonic systems. Therefore, weather reports pertaining to the day of reception should be examined concerning North-Eastern America, the North Atlantic and Western Europe. If they show major similarities, it is then inevitable that the propagation was a tropospheric phenomenon.'

Well that is the theory put forward by Joop Prosée. We would be interested to hear *your* thoughts on the subject.

Reception reports

As usual, Kevin Jackson of Leeds has logged signals which make many of us go Kermit-green with envy (see this month's reception log). Kevin informs us that he saw some outstanding tropospheric reception in August (the 17th to be precise) when ETB (Basque TV service operating in the north of Spain) was resolved on channel E35. It is not the first time this has been received in the UK, but it does illustrate that we should check all directions for DX activity and not just concentrate on signals arriving from the south-east!

Despite heavy interference from the local water authority at the lower end of Band III, Andy Webster of Billinge was fortunate enough to witness the 'ORF FS1' PM5544 on the 20th from Austria on channel E8. Luckily, the Belgian RTBF-1 station on E8 was off the air at the time. Earlier in the month, the '+PTT TSI 1' FuBK test pattern from Switzerland on channel E34 made an appearance between 1030 and 1100 on the 7th.

Simon Hamer of New Radnor, Powys, reported two 'firsts' during a mobile DX outing atop his local mountain, one with Sweden at UHF and the other with the Danish networks DR and TV2 on their new UHF channel allocations. During the same opening a low-power DR repeater station was received on channel E9. Simon's log shows that most RTE-1 and RTE-2 transmitters were received during the period including one on ch E on the 16th. All channel E outlets use low power. RTE-1 signals from the 50W Glanmire relay on channel C (61.75MHz vision, 67.75MHz sound) were evident during the same opening, which suggests that the channel E broadcasts originated from the co-sited RTE-2 transposer – also 50W. Other tropospheric signals worth mentioning were AFN-TV Soesterberg (Netherlands) on USA channel A80 and Switzerland E6 (SRG-1) and E34 (TSI-1). The latter two transmitters are situated on Rigi mountain in central Switzerland.

An intense late season Sporadic-E opening with high mufs on the 4th brought in Albania on channel IC, Rumania R3 and Russia R3. Other signals included Spain E2, E3 and E4, Portugal E3, Hungary R1 and R2, France (Canal Plus) on L3. Rumanian DX occupied channel R2 for a time and so did Russia. An interesting selection of DX signals filtered their way through on the 28th when the Icelandic 'RUV ISLAND' PM5544 test pattern appeared on E3, followed by Sweden and Finland on E4. Polish, Russian, Czechoslovakian and Italian stations completed the log for that day.

Bob Brooks of South Wirral also noted the Sporadic-E opening on the 4th with reception from early morning until mid-afternoon. Checking Band I on the 6th revealed more Sporadic-E activity – RAI UNO on channels IA and IB and Canal Plus L3. French Canal Plus transmissions were present on most Band III channels on the 7th via tropospheric propagation,

but a holiday soon after meant that his DXing activities were curtailed.

Lt Col Rana Roy in India reports that many of the DX signals seen this summer have originated in Russia or China. Sporadic-E deteriorated towards the end of August, although weak Chinese signals were evident on 9 September between 1700 and 1730 local time on channel R1. Tropospheric reception from transmitters in India and Pakistan was possible during the first half of September. The most impressive day was the 6th with Pakistan TV from Lahore on E5 (present from 2000 local time) along with Kasauli E6, Delhi (Channel 11 Delhi LPT) E7, Jalandhar E9 and, at times, there were co-channel signals from Pakistan TV on E10 (Bhawalpur) affecting Masoorie TV.

Co-channel confusion

A recent trip to the south of France has acquainted Iain Menzies of Aberdeen with the sights and sounds of Europe in more ways than one. While in Antwerp, NED-1 pictures were present on channel E3. At first he thought it might be leakage from a CATV system in the hotel where he was staying, but it was also present at good strength on the TV's rod aerial some distance away. He also confirms that the Swiss Band I transmitters are on air all night with the test pattern. At his destination, Nice, the UHF band was choc-a-bloc with Italian private stations. Every available UHF channel was occupied by at least one transmission and in many cases two or more. Needless to say co-channel problems were the order of the day – something the UK government seems bent on creating with extra terrestrial TV services!

Abandoned test card

Chris Howles of Lichfield has been out and about in Europe too. His journey took him through Luxembourg, West Germany, Austria and finally into Italy. RTL PLUS (Luxembourg) was 'everywhere' in West Germany since the introduction of local relays. While in Austria only the 'ORF FS1' PM5544 was seen during test periods, which confirms our suspicion that the old Telefunken TO5 test card which used to alternate with the PM5544 has been discarded. The only other test pattern seen was an electronic type resembling the FuBK which was switched in during a breakdown in the programmes.

Video inverter for DX-TV

Resolving French DX pictures is always a problem because of the inverted video system used. On a normal TV, French pictures will appear 'negative' with unstable synchronisation.

The NV148 video inverter unit has been designed to connect between the video output of a VCR and the aerial input of a TV set enabling French DX pictures to be displayed on a normal TV. The VCR is used solely to obtain a convenient video source although it can still be used to record normal negative modulated signals from other countries. The unit will not convert SECAM to PAL, nor will it handle audio signals which, in the case of France, are AM with 6.5MHz spacing.

Used in conjunction with a normal VCR fed from a D-100 DX-TV converter system, switched to its narrowest IF bandwidth, extremely weak French DX signals can be resolved. The unit features a switch for normal or French video and a control for optimum display. The video input is a standard 'phono' socket. The NV148 comes complete with a mains PSU and operating instructions. It is available, together with a whole range of other DX-TV products, including the D-100, from: HS Publications, 7 Epping Close, Derby DE3 4HR. Tel: (0332) 381699. The price is £29.95 including UK p&p. A suitable video lead is available at £2.45 but please state whether a BNC or PL259 connection is required. Export prices are available upon request.

An aerial system with wideband coverage of both Bands I and III will soon be available from the above suppliers. The aerial has been developed to provide a compact and cost-effective chimney-mounted system which should be readily accepted by the neighbours!

Stop press!

During the preparation of this column in October, signals via the F2 layer were received on channels R1 and E2. Solar cycle 22 is expected to peak during the next year or so and from what we've already experienced, it could be an excellent one. More on the exciting F2 layer phenomenon next month.

Service information

Switzerland: The FuBK test pattern is now radiated throughout the night from the main Band I transmitters. The German-language network DRS no longer uses an analogue clock. Instead, a small, rather pathetic-looking digital clock is superimposed during the first few seconds of the news programme's (Tagesschau) opening sequence.

West Germany: A report in a local newspaper, **Bremer Weser Kurier**, states that private TV will not be introduced in Bremen this year because the SPD political party has opposed it.

Italy: Breakfast TV is no longer shown according to recent programme schedules. It was broadcast early during the season, but from July 1988 many DXers reported seeing the PM5544 around 0800 followed by pages of sample teletext.

A new private station recently logged has been identified on IA called Tele Radio Broland.

Denmark: Since 17 August the TV2 transmitter at Videbaek has been on the air using channel E40.

Netherlands: Colour bars have been noticed prior to the PM5544. An identification, 'PTT-NL-AVVC' appears towards the top, superimposed on a black band.

Hungary: MTV-1 is now broadcast on channel R43 from Tokaj with 20kW ERP. This may indicate that the R4 Tokaj transmitter will soon be taken out of service.

This month's service information was kindly supplied by Gösta van der Linden and the Benelux DX Club (Netherlands), Thomas Graf (West Germany).

Photographs were supplied by HS Publications.

ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

News, news, news

Yes, we start off this time with some trade news. I consider the Leicester rally to be one of the most significant in the amateur's calendar, and as a result I always check out the prices of second-hand video equipment for new trends. Prices seemed to stabilise this year, with plenty of cameras in the £30.00 to £50.00 region – black and white ones of course! Vision monitors (as opposed to computer ones) were not so prominent. A professional monochrome special effects generator was (not) selling at £30.00 and overall I thought prices were pretty reasonable.

Kenzen of Birmingham (I've never quite fathomed the derivation of the name) has sent another one of their bargain lists. They offer a lot of the good old-fashioned types of components (transformers, fuses, pots, mains connectors) at surplus prices instead of the very high prices you would have to pay new. Particularly interesting are the very high resolution TV studio monitors in excellent condition. These are handy 6in screen units, ideal for a compact ham shack, and they cost just £29.95 including insured post. For more details and the full list tel: 021-472 3688 or send an SAE to: 1435 Pershore Road, Stirchley, Birmingham B30 2JL.

The autumn issue of **Der TV Amateur** (the German ATV magazine) has arrived. Technical articles include a 20W transistor PA for 2.35GHz and a dual band receiver (13 and 23cm bands). Klaus Engelmann DL4FAE is offering a radar blip killer for sale, ideal for those troubled with white lines from 23cm radars. It replaces the white lines with mid-grey ones which are a lot less obtrusive. The kit version costs just over £20.00, ready-made at just under £40.00. Send me an SAE for more details.

New ATV magazine

Yes, a new ham TV magazine is out from the ham that brought you ATV DX via balloon (WB8ELK) and the ham who got ATV into 'TV Guide' (KB9FO). **Amateur Television Quarterly** is a high-quality, technically orientated journal for TV amateurs. Each issue will contain forty-eight pages and virtually no editorial, just build-it projects, equipment reviews, theory articles and operating news. They even intend to pay for articles! Apart from the two hams mentioned, Tom O'Hara W6ORG and Dave Williams WB0ZJP are also on the editorial board, so we can expect some pretty expert features.

Subscriptions cost $15.00 a year in the USA, probably $25.00 for overseas. I am on the mailing list, so I'll let you know how it turns out. If you can't wait and wish to subscribe (and why not, it should be good), you can write to: ATVQ, 1545 Lee Street (Suite 73), Des Plaines, IL 60018, USA. Tel: 010 1-312 298 2269 (business hours).

Balloon video pix

The balloon man, Bill Brown WB8ELK, has sent me one of his VDG-1 PC boards. This is a compact board comprising sync pulse generator, graphics source and colour coder – the graphics comprise two different colour pictures and colour bars, selectable or controlled by a carousel-type timer.

Since the device was developed in the USA the colour is NTSC but that's all right – ***R&EW*** circulates in Canada and readers there can make good use of the VDG-1! In fact, the colour circuitry is virtually identical to that of the Radio Shack Colour Computer, which in turn is very similar to the Dragon micro. It should be easy to make this handy device work on PAL, therefore, and I am sure it would be an extremely popular project – the detail on the graphics screens is first rate. All I need is the circuit of the Dragon computer and work can commence – can any reader help with this please? I'll tell you more about the VDG-1 next time, when I have had more time to play with it.

TV *in* the air

In the meantime, Bill has been busy launching more ATV transmitters in balloons. One went up on 4 June from near Don Miller W9NTP's QTH (Don is the USA representative of the British ATV Club) and full details follow. Another was sent up on 8 October from Greensburg, Indiana, but was about a P-point weaker as a result of an antenna change. It was seen at 350 miles away and flew seventy-five miles south-east into Kentucky. It was found by the Indianapolis Fox Hunters Club in someone's front yard just off a highway, still sending out its picture! It took only one and a half hours to find after landing. The next project is a packet radio launch: this should be interesting, with thousands of packet stations trying to connect with a balloon digi-peater.

Why does nothing like this happen in Britain? Write and tell me, but after you have read Bill's fascinating story. Relax and enjoy!

Helium balloon experiment

A helium balloon amateur radio experiment was launched on 4 June 1988 at 0858EDT from a grass airstrip eight miles north-west of Greensburg, Indiana. The balloon package consisted of a 1W ATV transmitter (Wyman Research), a computer video ID generator with two graphics screens timed in sequence (Elktronics VDG-1), and a ½W 2m FM transmitter sending out a CW ID. The package was built and launched by Bob W9PRD, Bill WB8ELK and Chuck WB9IHS.

The balloon system consisted of a 6ft weather balloon (Kaysam 105G), a parachute for recovery, aluminium foil for FAA radar, and the 3.25lb transmitter package. The 2m antenna was a quarter-wave vertical whip and the ATV antenna was the omni-horizontal KS8J 'beachball' type, consisting of two loops at right angles to each other.

The beachball antenna is somewhat directional and has a deep null off the back. This resulted in deep fades in the ATV picture as the balloon package spun around. By observing the deep fades we determined the overall spin rate of the balloon throughout the flight. This varied between twenty seconds per revolution to as fast as four times per second. As our next flight will carry an on-board live TV camera, some way of stabilising the package is necessary or we will all get very dizzy!

The fading will be eliminated in future flights by using a phasing line to feed one of the loops to make it a true omni-directional antenna. Since a combination of cold temperatures and battery failure caused the WB8ELK flight last August to quit at 70,000 feet, a search for improved insulation and batteries was started. We used a styrofoam package 2.5in thick, painted black to absorb solar radiation, and WB9IHS found some 'super' lithium cell batteries. These are the SAFT LX 2649 'C' cells and are specifically designed to withstand low pressure and low temperatures. Ten cells were used (two chains of five cells) and after eight and a half hours continuous drain at 700mA they still had over three hours' life in them!

Quite a few ATVers from central Indiana were present at the launch site to help launch the balloon. A live link-up to the Indianapolis ATV repeater was established by Larry WA9YAJ from the airstrip, so that everyone within range of the repeater could view the launch activities. The weather was perfect with crystal clear skies and only a light wind at 0830 when we started inflating the balloon inside an aircraft hangar.

Mother nature didn't let us off that easy however, and gave us winds of over 10mph just a few minutes before launch! With the balloon fully inflated and the winds approaching impossible speeds for launch we decided to send it up before things got worse. With the balloon flailing around, narrowly missing the

hangar door, a telephone pole and several other sharp objects, we carried everything about 200 feet into the centre of the runway. Suddenly, the wind died down and the balloon floated straight up, gently taking the transmitter package on its journey to the edge of space!

The Indianapolis Fox Hunters Club volunteered to be the ground tracking team and, armed with all kinds of direction-finding gear for 2m and 70cm, headed off for the chase across southern Indiana in six cars. The balloon was observed for fifteen minutes heading fairly quickly towards the south-west, rising at a rate of about 750 feet per minute. After the launch the kids present had loads of fun sending up party balloons with notes attached with the left-over helium. Nearly fifty balloons including the 'big' one were launched that morning!

Bill WB9SBY filmed the launch from a small chase plane for the first few minutes of the launch, however the balloon quickly gained altitude on them. Unfortunately, all of the bigger chase planes that had promised to come for the launch were unable to attend owing to maintenance problems.

HF net as well

There was a 40m net chaired by Rick WA3USG, in York Pa on 7.155MHz and an 80m net run by George N9CJD on 3.871MHz. Over eighty check-ins and reception reports were received on the net during the flight. It was quite exciting to hear the reports come in from greater and greater distances as the balloon gained altitude.

The whole HF operation sounded much like a space launch and Rick has my vote for a NASA controller position! Stations from over nine states received the balloon signals covering most of the mid-west and part of the south. S-meters were reported as 'pegged' out to nearly 300 miles in all directions and there were many reports of reception on walkie-talkies and scanners over the same area.

The furthest reception of the 2m signal was by Ralph W0RPK, in Indianola, Iowa at 450 miles. Sync bars and a brief locked picture were observed by VE3JO and VE3ZK in London, Ontario, at a distance of 400 miles. Mike WB0QCD had a P3 to nearly P4 picture at one time at 340 miles. W8YOS near Cleveland had a P2 at 334 miles. WA8KQQ reported a P5 during most of the flight from over 100 miles and, in fact, several P5 reports from over 100 miles were received. Joe WB8MSJ received P4 signals in full colour from 220 miles and in fact P3 to P4 levels were seen over 250 miles away by Henry KB9FO and Andy N9AB in the Chicago area. A brief P5 report came in from Jim K9MTE from over 270 miles!

After two and a half hours of flying time the balloon reached its final maximum altitude of 115,000ft, and with the exception of an intermittent relay on the 2m transmitter, everything was still operating well. Several internal temperature readings were taken which indicated that the new insulation was working very well. The temperature was actually over 90°F inside and never seemed to go below 60°F during the flight!

At 1127EDT, upon reaching the upper limit of its flight envelope the balloon burst and started its downward plunge! The first indication of the fall was a rapid fading and flutter on the ATV signal as the package started spinning madly. Also the furthest receiving stations started losing the signal fairly quickly. In the near vacuum at 115,000ft the package probably dropped at nearly 700mph until the parachute slowed it down around 50,000ft or so. It then dropped at around 2,000ft per minute from that point on. After falling for twenty-seven minutes the balloon finally landed at 1154EDT.

Since the jet stream was directly over southern Indiana we gave the chase team a real challenge. At times the balloon was speeding along at over 100mph. In what has to be the ultimate fox hunt, the tracking crews were nearly thirty miles from the balloon when it landed. After a dedicated search across a great deal of southern Indiana the three remaining cars finally got a good fix on the 2m signal at 1600. They were about ten miles north of it at that time when the 2m relay stuck again, killing the signal. However, after driving through a small town, a very weak signal was heard on 439.25MHz. After driving as far as he could down a dirt road, Paul W9DUU started on his way through incredibly dense underbrush and thorns in the worst possible terrain for direction finding – thick woods and rolling hills!

Lost forever?

Worried he might not find his way out again, Paul took one last reading after hacking his way through nearly a mile of woods. AT 1720 he looked up and saw the balloon hanging sixty feet up in a large tree! The transmitter package was dangling about twenty feet off the ground still sending out its ATV picture. Paul hooked it with a sapling and brought everything back intact. The balloon landed one mile east of English, Indiana, right in the middle of the Hoosier National Forest, after travelling eighty-six miles from the launch site!

Except for the fact that the beachball loop antenna now looks like a pair of coat hangers (probably hit a tree limb) the transmitter package will be ready in the near future for a repeat flight with a live TV. Also a future flight will have the first airborne ATV repeater! (*Too late, Bill, – the French have already done this with their Arsene balloon!*). It will have a 910.25MHz input, 439.25MHz output and the potential to link up two stations nearly 700 miles apart!

Hopefully, these balloon flights will serve to increase ATV activity and will also provide us with an indication of the feasibility of ATV aboard the space shuttle or space station. With the experienced launch team we've put together, who knows, maybe NASA will give us a chance to help launch the shuttle!

NETWORK 934

Andy Emmerson G9BUP

Feedback

A couple of readers' letters have arrived – most welcome, by the way; let's have lots more!

Bill Holroyd, UK 934 Club callsign UK1005, has dropped us a line from Kirkham, near Preston in Lancashire. He requested a copy of the construction dimensions for the 900MHz Alford Slot aerial we mentioned a few months ago, so I hope he will favour us with a letter when he has built and tested it.

In the meantime, he says that from his QTH west of the Pennines he can beam east and shout for Jack BDC69, in Moortown (Leeds). Using a preamp, Bill gets a good 'five lights' S3 signal from Jack, who is currently using just a collinear. With a beam at BDC69's end it would be even better. Bill's QTH is low down and the path length is roughly 100 miles, so this is a pretty good achievement for a system which was intended to give only 'short distance communication'. Incidentally, these communications are only pleasant outside business hours since Jack's preamp picks up too much cellular radio interference during the daytime.

Cellular problems

This may be a good time to point out why cellular interference occurs and what you can do about it. In radio receivers you should look for two things – sensitivity and selectivity. It is no use having one without the other. Sensitivity is important (otherwise you won't pick up the weaker signals) and you can usually 'wake up' a deaf receiver by using a preamplifier (also known as a preamp or aerial booster). Similar devices are used in areas of poor TV reception.

Boosting the received signal is no help, however, if the radio lacks selectivity, because you only wish to hear the station you are trying to tune into. If there is a stronger signal on an adjacent channel you hope that your radio will nonetheless ignore this. Now the fact is that Vodafone (not Cellnet) cellular radio has been allocated frequencies close to our 934MHz band and their signals are up to ten times stronger than ours. All this is totally legal and just an unfortunate planning accident.

All radios have some degree of selectivity, but there is always a point at which they give up under the strain when faced with a much stronger signal slightly off channel. This is what the 27 meggers call 'bleedover'. If you have a cellular base station very close, there is a strong risk that its signal will overpower those on 934MHz and if you add a preamp as well, this will amplify the difference in signal strengths even more.

Solutions

What can you do about this and why is the problem reduced at night? Well, one thing is to change hobbies but no true radio fan would do this. Alternatively, find out where your local Vodafone cell site is (ring them up if you can't recognise the distinctive aerials). They usually look like electric fires mounted vertically, often in a triangle of three, and tend to be on a tower or on top of tall office blocks or apartments. Once you know the direction of the base station (you may also work this out by noting the beam heading which gives you the worst interference) you can note this and switch off the preamp when beaming in that direction. This assumes you are using a beam antenna and not an omnidirectional (collinear) 'stick'.

If this is not the case, you should invest in a yagi beam and rotator. Your nearest dealer should be able to give advice, otherwise speak to the big mail order firms like Selectronic, Canvey Island or Nevada Communications, Portsmouth. They can give you some tips.

Interference is worse during the day because more people are making cellphone calls so more cellular channels are active. All these add up and while your preamp may be able to close its ears to two or three cellular conversations, it will certainly be deafened by, say, twenty. If you can confine your 934MHz contacts to evenings and weekends, and directed away from the cellular base station, you should have less trouble.

Or go Flatside . . .

I hate that expression but it has caught on in some areas. Another option is to change your aerials from the vertical polarisation, which most 934ers and cellphone owners use, and mount them horizontally (or have both polarisations). Jerry Wyatt UK845 and HC62, has written from Hersham, Surrey on this subject.

'I have read with interest the October 1988 issue when you returned to the subject of horizontal polarisation. You appear to have softened your attitude to that expressed in the May 1988 issue. The view that I advanced in the August 1988 issue is to enjoy contacts, particularly during the daytime, free from adjacent channel interference.

'It's interesting, too, to read about the Alford Slot antenna with its horizontal polarisation. Since scepticism abounds and as the saying goes, the proof of the pudding is in the eating, a group of interested operators wishing to make the best transmissions possible with such an antenna, which is manufactured and commercially available in the UK, expressed this objective to the makers. However, I am sorry to say their consent was not forthcoming.'

Perhaps . . . ?

Sad, Jerry, but I suppose the return was not considered sufficient to justify the investment. As amateurs we can do what the 'professionals' cannot, though. Perhaps one of our readers will make one from the diagram now available and let us know how easy this is (and how successful the antenna is).

Jerry continues: Frank UK933 (OD93) of Hayes (Middlesex), is a much travelled operator, who must by now be a well-known enthusiast of the frequency nationwide. Together with Eric UK369 (CO369), also of Hayes, he maintains a late weekday afternoon mobile net, which I occasionally join, speaking to stations passing from the North, central and south-west London, through to Surrey and Berkshire. I suggest that stations taking this route should participate.

'The 934MHz Club contest took place on Sunday 16 October and I heard a considerable number of contacts being made. Stuart UK1390 (ST90) at Worthing, had a great day working more than 100 stations to the north and south-west. It was a great pleasure for me to speak again to Glenys UK02 in Althorne, Essex, the club's secretary. My longest contact was made with Peter UK310, of Sheffield, Yorkshire – 175 miles – and I did, incidentally, work Charles MC232 in your neck of the woods, Northampton.'

Is it a record?

Good work Jerry and thanks for the reports. These are most appreciated, because everyone likes to see what has been happening on the bands (and what they missed). Also, how can we claim the 934MHz band is active and worth keeping if no-one appears to be active? Did anyone work a longer distance than 175 miles during the contest or is Jerry's contact a record? It is, unless we hear otherwise! Keep those letters rolling in, care of the editor . . .

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

Satellites and the SWL

It should not be thought that amateur radio satellite operation is confined to the transmitting amateur – an idea which seems to be around. Apart from those who use the UoSAT spacecraft for educational purposes, there is a lot to interest the short wave enthusiast in satellites that are used specifically for amateur radio communications. Apart from participating in the very latest amateur radio technology, there is a lot of fun to be had from listening and recording the signals heard from these satellites; in much the same way as SWLs listen for amateur signals and short wave broadcast stations and report on them. In fact, satellite users are more likely to appreciate reports on their signals than any other group of radio amateurs. At worst, those whose interest is solely collecting QSL cards are more likely to be successful if they report on satellite QSOs than any other amateur radio signals.

To encourage more SWLs to get involved in the satellite scene, AMSAT-UK propose to make awards available for satellite SWL activities. Details of these will be announced shortly. In the meantime it might be worth mentioning several publications which AMSAT-UK already produce with the beginner to satellite operations specifically in mind.

The first booklet was produced to enable teachers and youngsters to learn about the use of satellites. The contents could well assist others to do the same. It is called **The Sheffield Project**, and explains the very first principles of listening to and taking data from UoSAT satellites. The Sheffield Project originated at Jordanthorpe School, Sheffield, as a project associated with the University of Surrey UoSAT spacecraft programme. The students' aim was to 'learn by doing', and then to write about their experiences for the benefit of others. The booklet provides a 'snapshot' of their early progress from the reception point of view. It starts by explaining what an antenna and a 2m receiver are (very basic stuff) and follows on with the use of computer activities relating to satellite operations.

The **SEUK, A Guide for Teachers**, is a book which explains in layman's terms the use of all kinds of equipment that a school may acquire to teach pupils the basis of observing satellites and gathering data.

Then there is the **Guide to OSCAR Operating**, the latest edition of which has just been produced, written by Richard Limebear G3RWL, a long standing AMSAT-UK management committee member. It covers the subject in a way which introduces both the beginner and the more experienced radio amateur to all he needs to know to become operational – both as a listener and ultimately as a transmitting satellite operator.

All of these publications are available from: AMSAT-UK HQ, 94 Herongate Road, Wanstead Park, London E12 5EQ. **The Sheffield Project** costs £2.20. **SEUK, Teachers' Guide**, £2.60 (postage in the UK is free, but £1.75 for overseas). **Guide to OSCAR Operating** costs £2.06.

New BARTG publication

BARTG has just produced a nice little booklet outlining its aims and objectives, explaining the various modes of amateur radio including amateur radio teleprinting, AMTOR, packet and fax. The equipment needed for each of these is outlined, and operating techniques are explained as well as the various technical terms used in these modes. A useful little publication for those wishing to participate for the first time in this speciality. Available from: Pat Beedie GW6MOJ, Ffynnonlas, Salem, Llandeilo, Dyfed, Wales SA19 7NP, the price is 30p plus a large SAE.

Amateur radio on MIR

According to current rumours, amateur radio should now be in operation on the Russian spacecraft MIR. A 2m antenna has been fixed to the outside of the spacecraft and a 2W output FM transceiver has been installed. This will be replaced by a 10W installation later on. The callsign is U1MIR. Testing should have been completed by 14 November last, and QSOs started by 19 November. Transmission is on Channel S22-145.550MHz; reception is on 145.500 to 146.000MHz. Operation is likely to be on Saturdays and Sundays and limited to times dictated by their work schedule.

Chicken Little II Contest

This contest, the second of its type to be run by AMSAT-NA, was to predict the precise time of COSMOS 1900's re-entry into the atmosphere. This was the rogue Russian satellite with a nuclear reactor power supply on board which was gradually losing orbit. It was feared it might crash down to earth on re-entry without disintegrating. However, on Saturday 1 October Tass announced that the primary safety device had activated at 0008 Moscow time, shutting down the reactor and boosting the satellite into a stable orbit of 720km. The threat of radioactivity has now been removed.

More trouble on the 70cm band

Readers will recall that early last year we reported on the furore which had arisen over a proposal by the Japanese Amateur Radio League that Japanese radio amateurs should be allowed to use FM transmissions on the 70cm satellite band. We were able to report that due to the extensive protests made by radio amateurs world-wide, the proposal was dropped. Similarly, an earlier proposal by the Mexican Band Planning authorities to allocate 70cm amateur frequencies to commercial radio was dropped because of amateur radio protests.

Now, two more similar episodes are reported. The first is aired in 'The Westland Report', published by the Poco Press in the USA. It seems that the United States Army is testing a new missile system in North Alabama, which, whilst it may appear to have few connections with amateur radio, is bringing the 70cm band to a standstill. The system is called FOG-M, which stands for 'Fibre Optic Guided Missile'. Radio amateurs share the 420 to 450MHz band with some government agencies and this band is being used for low-power airborne sensors which are used in experimental development tests for this missile. Amateurs in Huntsville, Alabama, are being requested to keep off the air for periods of up to five hours at a time. As expected, reaction from the radio amateur community has in many cases not been sympathetic to the army authorities!

The second instance of 70cm band usage by non-amateur operation comes from Ireland. Reports from there suggest that the Irish Department of Transport and Power (Amateur Radio Licensing Department) were to allow transmissions of Fast Scan TV in the 70cm

amateur band. The use of 70cm for FSTV has been the subject of much discussion in recent years. It was thoroughly discussed at the recent Region 1 IARU conferences, and mutual agreement was reached that FSTV was not acceptable on 70cm due to the high power and wide bandwidth many TV amateur stations use. Most of those using this mode now use 23cm. AMSAT-UK has reminded the Irish Amateur Radio Licensing Department of these arrangements and it is hoped that they will act in accordance with these.

European 1992 Community Award

The 'E-1992-C Award' is being initiated to emphasise the objectives of the European Community. It is available to all licensed radio amateurs and short wave listeners from 1 January onwards. The idea is to work twelve different stations from each of the twelve countries making up the European Community. These countries are: Belgium, Denmark, France, Germany FRG, Greece, Ireland, Italy, Luxemberg, Netherlands, Portugal, Spain and the United Kingdom. Full details are available from: UBA HF Award Manager, Van Campenhout Mat ON5KL, Hospicestraat 175, 9080 Moerbeke-Waas, Belgium.

Third-party amateur messages

For a very long time there has been some confusion about the regulations governing the transmission of third-party messages by radio amateurs in this country.

The DTI has recently issued a statement clarifying the position following discussions with the RSGB.

The main principle is that the amateur service exists on the understanding that it is used 'for the purpose of self-training, intercommunication and technical investigation by amateurs'. The DTI has grouped its views under two headings: 'the passing of messages on behalf of other licensed radio amateurs' and 'the passing of messages on behalf of non-licensed people or organisations'.

The first of these is, of course, quite in order and should lead to no problems, but the DTI has gone to the trouble of especially mentioning one or two specific cases where some doubt may still exist.

'The passing of third-party messages initiated by, or intended for unlicensed persons in the case of special event stations where the authority of a letter of variation has been granted by the RSGB on behalf of the DTI and at the request of a "User Service", for which authorisation has been granted for the purpose of self-training for natural disaster planning and exercise'. User services are defined in the regulations and include such organisations as the Red Cross, St John Ambulance Brigade, county emergency planning officers, the police and so on. A variation is that third-party messages may be passed in the event of natural disasters where the established lines of communication have failed, without reference to user services.

Third-party messages on behalf of non-licensed people or organisations and for commercial purposes are still strictly prohibited. If UK radio amateurs were to pass messages on behalf of unlicensed persons thereby providing a service, a breach of the Telecommunications Act (1984) would be committed.

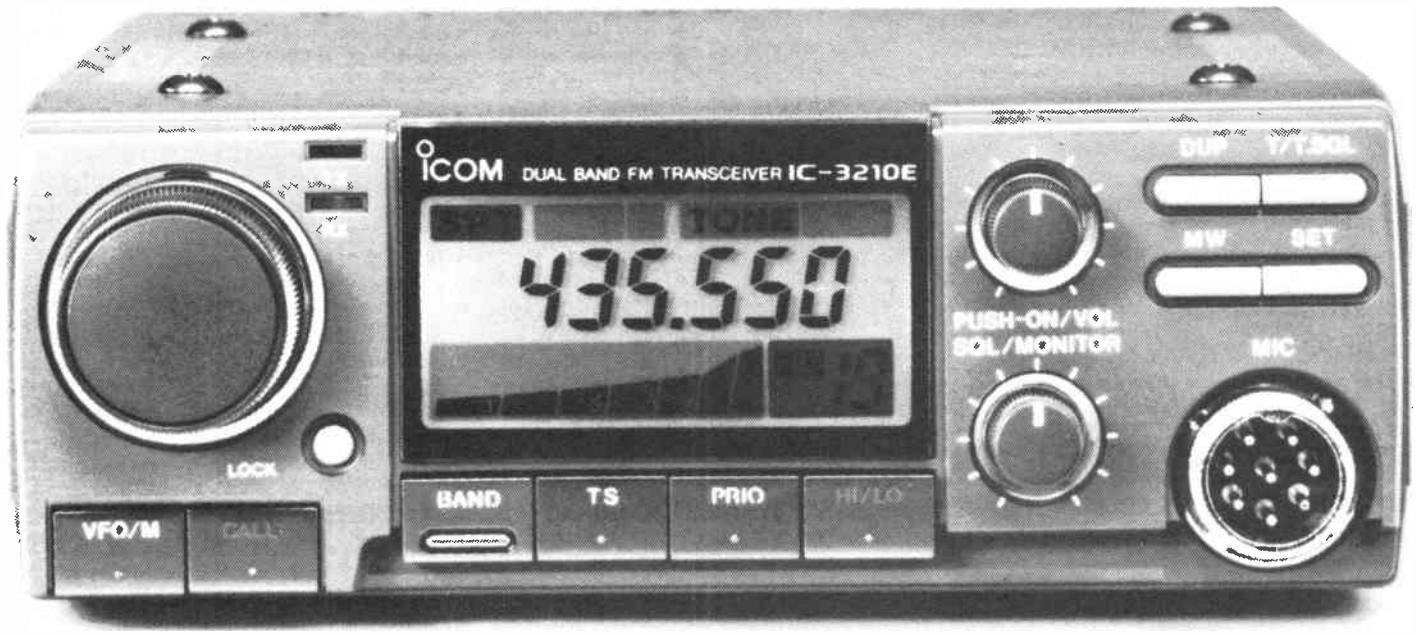
This statement permits the handling of international third-party traffic.

The 4Ms – amateur radio's burden

A letter from John Branegan GM4IHJ, in last November's **Rad Comm**, praised OSCAR 13 J as being the most affordable satellite mode. 'It is affordable by those most valuable of radio amateurs – the newcomers, and those burdened by the 4Ms of: middle age, marriage, mortgages and multiple offspring'. Well said, John!

ICOM

IC-3210E Dual Band FM Mobile



- **Full crossband duplex.**
- **20 double-spaced memory channels.**
- **Built-in duplexer**
- **4 priority watch functions.**
- **25 watts output.**
- **Programmed, memory and selected band memory scan.**
- **Variable LCD backlight intensity.**
- **Tone squelch and pocket beep functions (optional).**

If you are newly licensed or just undecided about which band to operate first, then the new ICOM IC-3210 is just the answer. This dual band FM transceiver is ideally suited for the mobile operator. Transmit on one frequency and receive on the other and you're operating full duplex. It's just like talking on the telephone.

The simple and well laid-out front panel ensures quick and easy operation of all its many functions. A great convenience when driving. Optional accessories available are the UT40 tone squelch board. HS15 + SB mobile microphone and switch box SP8 external speaker and PS45 AC power supply.

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

Seasons Greetings to you all

"75" Series Transceivers

ICOM have a winning line-up for fixed, portable and mobile operations. The deluxe "75" series of transceivers offers a new standard of excellence from VHF to UHF communications. Each compact all mode unit delivers maximum performance, reliability and ease of operation.
The "75" series transceivers feature 99 tunable memories, twin VFO's, pass band tuning, I.F. notch, noise blanker and CW break-in. The scanning modes include memory scan, mode scan, programmable scan and frequency skip.
These transceivers can be used in a variety of ways, for propagation experiments, satellite communications, moonbounce, D'xing or straight rag chewing contacts.
When high speed digital systems such as PACKET or AMTOR data communications are used then the ICOM DDS system provides a lock-up time of just 5msec.

2 Meters

ICOM's 25 watt IC-275E is a superb transceiver for contest operating and for general DX working. This prestige 144MHz multimode is also available as a IC-275H 100 watt version, which requires an external AC supply.

70cms

Enjoy 430MHz operation with the 25 watt IC-475E, or go high power using the IC-475H. An optional CT-16 Satellite Interface Unit is available for combining ICOM "75" transceivers for easy tuning.

6 Meters/10 Meters

The 10 watt IC-575 covers 28-30MHz and 50-54MHz and includes the AC supply. Join in with the recent openings to the U.S.A. with this superb transceiver. Also to be released soon is the IC-575H 50/100 watt high power version, which will operate with an external AC supply.

With the introduction of the "75" series you now have all the technical quality you'll need to enjoy VHF and UHF communications. For more detailed information on these transceivers contact your local ICOM dealer of ICOM (UK) Ltd.

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.

HEATSINKS

The Importance of Keeping Your Cool

by Samuel Dick

The hardest part of many projects is the final assembly of the electronics into the case. Often, one of the main drudges is fitting the heatsink. After all, there is nothing very exciting about a heatsink! And it does not add any function to the project.

But keeping the electronics working at the right temperature is a vital part of project engineering. So how do you calculate how much heat is generated and what size of heatsink is needed to dissipate the unwanted heat?

When the temperature rises

Before we delve into the calculations, perhaps we should consider what the consequences are of failing to provide the correct cooling.

The most obvious danger is fire. Hot components, especially if they have been under-rated and are carrying more load than the manufacturer's limits, can, at worst, burst into flames. If there are any inflammable materials near (insulation on wires, plastic cases, etc) then these might be ignited, too. Even if the component does not burst into flames, copious quantities of smoke can be generated and these may contain poisonous fumes. If you have a smoke alarm fitted then this may well be set off. False alarms are a mere nuisance when they happen at home; industrial and commercial organisations usually have to pay a call-out charge to the local fire brigade if they cause a false alarm!

But even on less disastrous scales, components which are allowed to become too hot are unwelcome. For a start, the increase in their temperature will degrade their performance.

Looking at manufacturers' literature, you often see phrases like 'maximum operating temperature 50°C – derate by 2W per 10°C to 80°C'. This means the component will work at its maximum stated load at temperatures up to 50°C and for every 10°C rise above 50°C this maximum figure will be reduced by 2W; the component is not expected to function above 80°C. So why pay for a component which you cannot use up to its design limits?

A more serious problem results when we consider the life time of a component. As the temperature at which it is normally operated rises, so its life expectancy drops. Operating a device even just 20°C above its recommended (not maximum) temperature can often halve its life. Another 20°C rise will cause another factor of two to be taken away! Life time, of course, is only a convenient means of expressing the probability of component failure. The real problem when operating devices at too high a temperature is that the chance of failure rises. Your home-brew hi-fi amplifier fails in the middle of a party... or a safety monitoring device in a power station fails.

Calculating the watts

The simplest part of ensuring equipment is cooled correctly is calculating how much heat it dissipates. The number of watts for any part of a circuit is simply the product of the current (in amperes) which is flowing through it and the voltage across the component (in volts). This is trivial to calculate for components with dc currents passing through them. Ohm's Law allows V or I to be expressed in terms of the component's resistance, of course. *Table 1* gives a few equivalents.

Formulae for calculating watts from V, I or R

Watts = volts * amps
Watts = volts^2/resistance
Watts = resistance * amps^2
where Resistance is measured in ohms

Table 1

When ac currents and voltages are considered, the situation is not so simple (but it is not complicated). In this case, we have to use the root mean square (RMS) value of the quantities. With sinusoidal waveforms, if an oscilloscope can be used to measure the peak-to-peak value then the RMS value can be found by dividing the peak value by 1.4 (or, more precisely, the square root of 2). For waveforms with more complex shapes, the RMS value has to be calculated: it is, as its name implies, just the square root of the mean (ie average) of the squared values of the quantity being measured.

Removing the heat

Nature gives us several ways for dissipating heat: conduction, convection and radiation.

Radiation, in this context, is infra-red radiation. All objects with a temperature above 'absolute zero' radiate. Cool objects give off infra-red, while hot objects emit light eg, the wire in a tungsten bulb is so hot that it glows. Light can be thought of as higher-frequency infra-red, in this context. For most temperatures encountered in electronic systems, radiative cooling cannot be relied on as the sole source of cooling.

Emission from a black body

Temperature (°C)	Emission (watts per sq metre)
0	315
25	450
75	830
125	1420
175	2290

Table 2

How much heat is lost by this method? *Table 2* gives some figures. These refer to a perfect emitter of heat – the so-called 'black body' – and poor emitters (like highly polished surfaces) will emit much less than is indicated by the table. For a black body at temperature T, the Stefan-Boltzmann Law predicts the loss at $(5.7*10^{-8})*T^4$ when measured in watts per square metre of surface. To increase the amount of heat which an emitter will radiate, the colour is very important – that is why heatsinks are usually black. Note, too, that as well as emitting heat by radiation, any object will always receive heat from its surroundings; the surroundings have to be at a lower temperature for there to be a net loss of heat from the object we want cooled. The heat loss figures in the table assume surrounding objects are at absolute zero!

For practical purposes, convection and conduction usually work together in a heatsink. Conduction is responsible for carrying the heat from the component into the material of the heatsink, while convection is the main means by which heat is removed from heatsinks.

Conduction is fairly simple to understand. Hold a poker in a fire for long enough and sufficient heat will be conducted up the poker to make the handle hot! Air can conduct heat – but it is very poor at this. Hence the success of double glazing and cavity walls in houses – a still layer of air acts as a thermal insulator because its thermal conductivity is so poor. Conduction efficiency varies enormously with what the material is made from – the efficiency of heat conduction mimics that of electrical conduction. Silver is very good while plastics and most ceramics are poor. Aluminium is quite good – and has the advantage of being somewhat cheaper than silver – this is the material from which most heatsinks are made. *Table 3* shows the relative heat conducting abilities of some materials.

Convection is the process whereby the air in contact with a warm surface rises and is replaced by (colder) air from below. This new air is then warmed

before its density decreases and it, too, rises away from the surface – carrying heat with it.

Relative thermal conduction efficiencies for various materials	
Copper	385.0
Aluminium	211.0
Steel	47.6
Concrete	1.7
Polyurethane foam	0.035
Still air	0.026

Table 3

If we had to calculate the effects of convection from scratch, it would be very difficult! Convection, while being very common in nature (from air in houses to the fierce heat of stellar atmospheres), is not well understood – at least quantitatively. However, its effect from the point of view of heatsinks can be determined empirically. This enables manufacturers to say how well their heatsink works. The efficiency of convection can be increased by using a fan to blow air over the cooling surface (forced convection).

Effectiveness

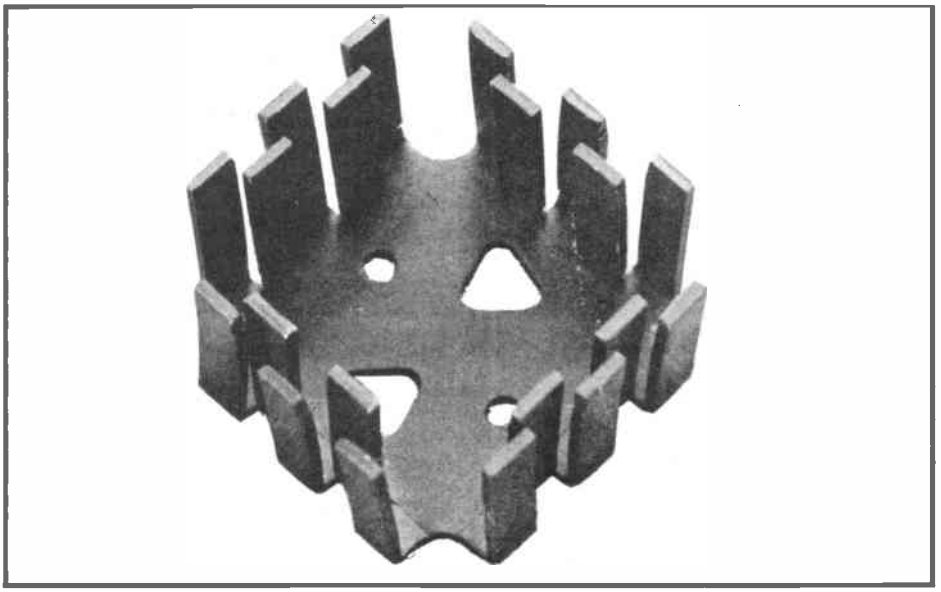
The figure of merit for a heatsink is its °C/W value. If a heatsink is quoted as having 10°C/W then it means that for every watt of heat which is put into the heatsink, its temperature will rise by 10°C above its surroundings. The bigger the heatsink, the lower this value will be. Typically, large heatsinks available from most mail-order companies have values around 2°C/W. Small heatsinks may have values as high as 50°C/W.

Apart from the intrinsic thermal properties of the heatsink, the efficiency of the cooling is dependent on how well the heat is transferred from the object being cooled to the heatsink. One major problem is preventing a layer of air (we said it was a relatively good insulator) between the object and the heatsink. Apart from ensuring a tight mechanical fit, the application of a special jelly (normally silicon grease) between the object and the heatsink will considerably improve efficiency.

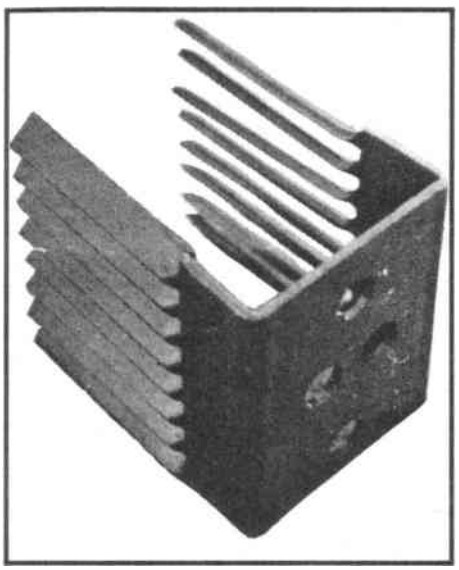
The correct type

This requires gathering basic information about the object to be cooled and some simple sums. The first essential piece of information is the 'junction to case thermal resistance', TR(JC). This will be found in the manufacturers' data sheets and will be quoted in °C/W. *Table 4* gives some approximate values for different types of device cases.

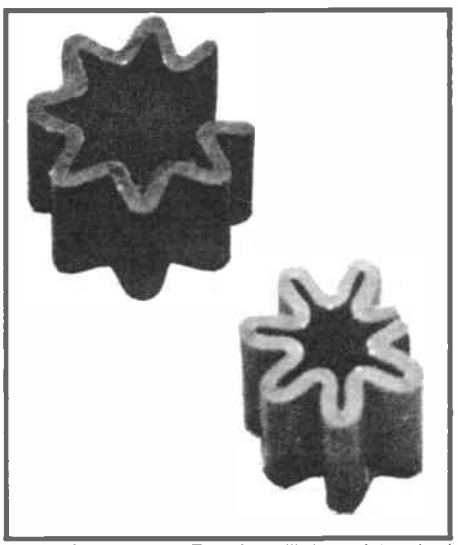
This figure tells us what temperature the case may be at for a given internal power dissipation, if we specify what the maximum internal temperature will be. Let this, T(max), be 100°C assuming we are dealing with a simple silicon semiconductor device; a smaller value (around 50°C) would be better for germanium devices. The allowable case temperature is then T(C)=100−(TR(JC)*W) where W is the power, in watts, being dissipated by the device. So if TR(JC) is 140°C/W (for a plastic small-signal transistor) and the power dissipation is 100mW then the case could reach 86°C before the junction reached 100°C.



T0220 fitting, 4°C/W heatsink



T03 fitting heatsink, 4.8°C/W



T018 (large) and T05 (small) heatsinks, both around 50°C/W

Typical junction-to-case thermal resistances	
Case style	TR(JC) (°C/W)
T092 plastic	137
T05	15
T0220	4
T03	2 approx

Table 4

What size?

To calculate what size of heatsink to use, we must also know the ambient temperature. If this is very near the case temperature then this will make it harder for any heatsink to dissipate the unwanted heat and so a larger heatsink must be used. Let us call the ambient temperature T(A) and the case-to-ambient temperature T(CA): T(CA)=T(C)−T(A). T(CA) is the available temperature drop for cooling at the required power dissipation. The size of the heatsink, in terms of its thermal resistance, is then just this temperature divided by the power dissipated. So if T(C)=75°C, T(A)=20°C, and 20W is to be dissipated then the thermal resistance of the heatsink has to be (75=20)°C/20W or 2.75°C/W.

Note that, in choosing a heatsink, a numerically smaller value (2.5°C/W) must be used.

MEDIUM WAVE DXING

by Steve Whitt

Callsign chaos

In the earliest days of radio, transmission was by Morse code from spark transmitters and it was some years before amplitude modulation became a popular means of conveying the spoken word. Even for an experienced radio telegraphist operating at, say, thirty words per minute, Morse was a slow means of communication. Naturally, in order to speed things up a range of codes and abbreviations were developed; the most famous, of course, being the distress call 'SOS'. These early codes led to the 'Q-codes' we use today. In the UK, in May 1910, the first official callsigns (LBX and LSX) were allocated to a radio experimenter in the Midlands. As radio developed and more stations appeared on the air, callsigns were internationally rationalised to enable a unique means of identification of station and country.

In the formative years of the 1920s and 1930s the majority of licensed stations (amateur and broadcasting alike) possessed and used a distinctive callsign. Gradually over the subsequent years the use of callsigns fell into disuse for many broadcasters around the world. This was in contrast to radio users who required precision of communication, such as the military, emergency services, shipping and, of course, radio amateurs. The demise of the callsign in broadcasting is almost complete on this side of the Atlantic and perhaps one of the first things a MW DXer discovers about broadcasters in North America and Australia is that callsigns are still widely used. Stations in Latin and Central America are also all issued callsigns but their use is more haphazard.

The main reason that calls are still heard in North America is because the Federal Communications Commission (FCC) insists that they be used. However, in recent years the FCC has succumbed to pressure from industry and the rules governing callsigns have been slackened considerably. It has now reached a point where in some instances the use of callsigns actually makes identification more difficult as the following examples illustrate.

There is one station in Baltimore, Maryland, officially christened WWMX that actually pretends to be WMIX. The FCC rules force a station to use a legal identification and callsign just once an hour so WWMX hides its real identity in the hourly weather forecast. Otherwise all media advertising, jingles and promotions only refer to WMIX.

If this causes confusion, imagine the situation where the bogus callsign is in fact allocated to another station. In the USA callsigns are deliberately allocated so that W??? stations are east of the Mississippi river whilst K??? calls are to the west. So even more confusion can be caused to the DXer when WKOS uses the bogus call KOST. As long as the station gives its legal ID at the top of the hour, it can get away with any call at other times since these are deemed to be slogans.

In contrast some stations proudly use their calls because they carry a message or have their roots in history and are therefore well known. Although the FCC makes the W/K distinction there are still a few historic stations in the east using K??? callsigns emanating from the early days of broadcasting: for example, KDKA in Pittsburgh.

Many stations have callsigns that reflect their location (eg, WCSC in Charleston, South Carolina or WKWF in Key West, Florida) but it is a minority that have a real message hidden in their official call letters. One of the best known is that of WSB in Atlanta, Georgia which stands for 'Welcome South Brother'. And in Canada VOWR is well-known as the 'Voice of Wesleyan Radio', having been owned and run by this Church for the last sixty-four years. There is only so much you can do with four letters in a callsign so one organisation in Orlando, Florida has gone a step further; it owns a two station AM/FM combo WPRD and WJOY – 'the Pride and Joy of Orlando'!

Newsdesk

USA: WNBC, New York City, on 660kHz closed down for good on 7 October after sixty-six years of continuous broadcasting. This move is part of NBC's plan to get out of radio broadcasting all together. Another New York station, the all-sports WFAN, immediately moved to the highly desirable vacant frequency. 660kHz is classified as clear-channel status and this means that reliable night-time reception is possible in thirty-five different states. Whereas WNBC operated a pop music format, it is arguable that the speech-based sports format of WFAN is much more suitable for long distance sky-wave reception and presumably WFAN wishes to capitalise on this huge potential audience. In a real example of musical chairs, the vacated 1050kHz channel has now been taken over temporarily by the Spanish station WSKQ, at Newark, New Jersey, which plans a further swap in the near future with the Jewish station WEVD.

International waters: Radio Netherlands Media Network recently reported that a Greek ship was being fitted with a 10kW transmitter and mast in Haifa, Israel. Since then, tests on 918kHz from Aruts Sheva (Channel 7) have been heard from the ship **Erets Hatsui** (which apparently means 'the land of the deer').

Meanwhile in the North Sea, Radio Caroline reactivated its 819kHz transmitter over the weekend of 23/24 October. At the time of writing, this channel has carried Dutch, English and religious programmes but on 6 November the station planned to relaunch a twenty-four hours a day Radio Caroline English service on 558kHz as well as a restyled Radio 819 Dutch service. It is likely that the short wave service will continue to be operated by World Mission Radio.

DX file

In early November I travelled to the very north of Scotland in search of super-DX. In the past I have reported on previous DXpeditions to Anglesey in North Wales and to Scotland but I was sure that my single trip to Scotland last year had not exhausted the potential of the location. In the past, luck has had it that I've gone on expeditions when DX conditions have been anything but favourable. Nevertheless, plenty of interesting and rare signals were heard for four good reasons.

– excellent Beverage aerials were employed offering good directivity and low noise;
– an electrically quiet location was chosen with no interference from TVs, home computers, car ignition, etc;
– location on the coast took advantage of sea gain in a westerly direction;
– location was far enough away from continental Europe to reduce broadcast interference.

This year I travelled up to Scotland with my fingers crossed for really good DX conditions and weather.

The DXpedition took place between 29 October and 7 November 1988 at Sheigra, Scotland (5° 06' 30" west, 58° 29' 45" north). The 'ears' belonged to Mark Hattam and Clive Rooms, both with Drake receivers and myself with a modified Sony ICF2001D. The antennas consisted of four Beverages ranging from 250m to 550m in length, which were erected to radiate like spokes on a wheel away from the farmhouse that was to become the DX nerve centre.

DX window

Asian stations first became audible around 1700UTC and the earliest trans-atlantic DX was noted around 1930. In fact, in the morning dawn-induced fade-out occurred as late as 1100 on one day, though 0930 was rather more typical. With a schedule like that you'd imagine that there was little time to eat or sleep but in practice, conditions were fairly variable and good DX wasn't always present. For the first four days excellent signals were audible from North-Eastern USA and Eastern Canada, though very few rarities were noted.

By the middle of the week ionospheric storm conditions had upset things and North American stations were in decline whilst some Latin American and Caribbean stations became audible. For the next three days the band was completely dead to North America with the sole exception of a most unusual DX opening; for about four hours on the morning of 4 November, reception of stations in Manitoba and Alberta became possible. This was most peculiar since high latitude absorption of signals seemed to be making all other North American signals completely inaudible and even central European stations were weaker than usual.

This phenomenon failed to recur and the following two nights were so poor that there really was no point staying awake. At the end of my stay, just as I was packing up to drive south, the American stations began to stage a come-back and undoubtedly more interesting DX could have been heard; as I unplugged the Sony, a station from Atlanta, Georgia was playing through the headphones!

From about 190 different DX signals heard I've selected a few highlights to summarise the expedition (shown in the Table below).

Back home in Ipswich, I now have the daunting task of trying to get my reception reports written (and verified) but I'll make sure I have time to respond to your comments, queries and contributions to this column. Feel free to drop me a line care of the ***R&EW*** offices in Brentwood.

KHz	Station	Details (times are UTC)
765	ORTS Dakar, Senegal	Not heard for some years now owing to serious European interference
870	LRA1 Buenos Aires, Argentina	Furthest signal received from over 11,000km away
895	Voice of Nevis	A new Caribbean station only on the air a few weeks
930	CJYQ St John's, Newfoundland	A good barometer of DX conditions, heard as early as 1930 and as late as 1100
1230	CJOK Fort McMurray, Alberta	Just 500 watts from the frozen north
1240	CJAR The Pas, Manitoba	Another first in the UK, a local station of 1kW serving an isolated town of less than 6,000 people
1376	RFO	An unusual French station from the tiny country of St Pierre et Miquelon located next to Newfoundland
1566	HLAZ Cheju, Korea	Religious programmes in Russian from a super power transmitter

DATA FILE

Ray Marston looks at synchronous ac power controllers and electric heater control circuits in the penultimate part of his latest series

In the last few editions of 'Data File' we have looked at basic electrical/electronic power control principles and devices, and at a variety of practical ac power switching circuits. This month we start off by looking at a selection of synchronous on/off ac power switching circuits which can be used to switch power to lamps, heaters, motors and a variety of other domestic or industrial appliances. We will then look at a few dedicated electric heater power control circuits. All the designs shown use Triacs as their power switching elements, and can be used on either 115V or 230V ac power lines. In these designs the user must select the Triac rating to suit his own particular application; where applicable, components values for use on 115V power lines are shown in parentheses in the circuit diagrams.

Synchronous power switching

We pointed out last month that Triac power switches can be triggered (turned on and latched) either synchronously or non-synchronously with the ac mains voltage, and that synchronous circuits *always* turn on at the same point in each ac half-cycle (usually just after the zero-crossing point) and generate minimal RFI (radio frequency interference). Non-synchronous circuits are not invariably synchronised to a fixed point of the ac cycle and may generate significant RFI, particularly at the point of initial turn-on. In this month's edition of Data File we deal mainly with synchronous power switching circuits. **Figs 1** to **10** show a variety of synchronous Triac power switching circuits that can be used in various on/off line switching applications.

Fig 1 shows the practical circuit of a transistorised synchronised ac power switch that is triggered near the zero-voltage crossover points of the ac waveform. The Triac gate trigger current is obtained from a 10V dc supply derived from the mains via R1-D1-ZD1 and C1. This supply is switched to the gate via Q5, which in turn is controlled by SW1 and zero-crossing detector Q2-Q3-Q4.

The action of Q5 can turn on and conduct gate current when SW1 is closed and Q4 is off. The action of the zero-crossing detector means that Q2 or Q3 are driven on whenever the instantaneous mains voltage is positive or negative by more than a few volts (depending on the setting of RV1), thereby driving Q4 on via R3 and inhibiting Q5. Thus, gate current can only be fed to the Triac when SW1 is closed and the instantaneous mains voltage is within a few volts of zero. Hence, this power control circuit generates minimal switching RFI.

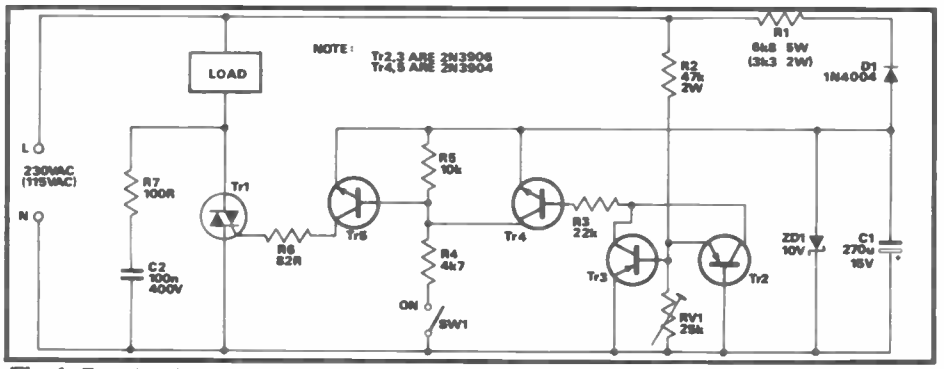


Fig 1: *Transistorised synchoronous line switch*

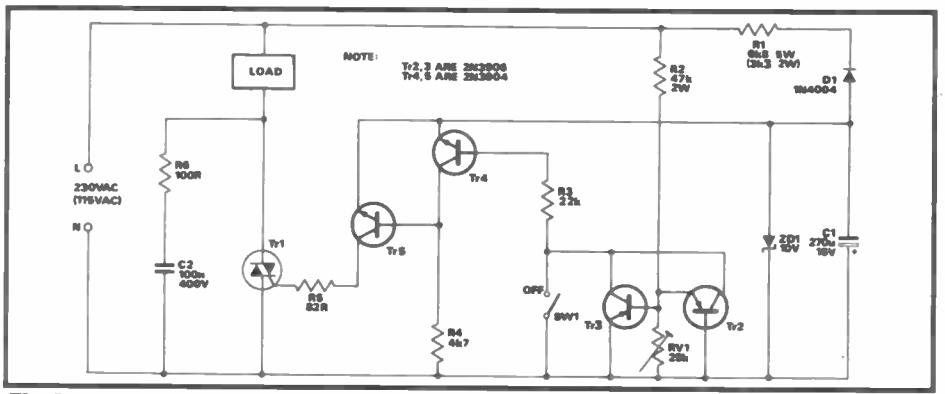


Fig 2: *Alternative version of the transistorised line switch*

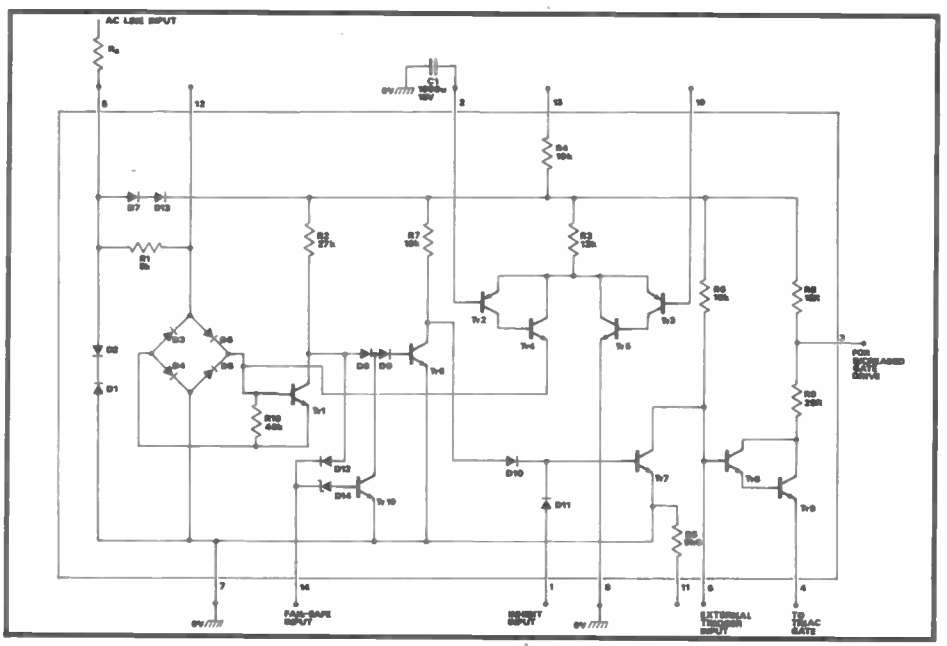


Fig 3: *Internal circuit and minimal external connections of the CA3059 synchoronous zero-voltage Triac driver IC*

Fig 2 shows how the above circuit can be modified so that the Triac can only turn on when SW1 is open. Note in both of these circuits that, since only a narrow pulse of gate current is sent to the Triac, the *mean* consumption of the dc supply is very low (about 1mA). Also note that SW1 can easily be replaced by an electronic switch to give automatic operation via heat, light, time, etc or by an optocoupler to give fully isolated operation from external circuitry.

Special ICs

A number of special-purpose synchronous zero-crossover Triac-gating ICs are available, the best known examples being the CA3059 and the TDA1024. These devices incorporate mains-driven dc power supply circuitry, a zero-crossing detector, Triac gate drive circuitry and a high gain differential amplifier/gating network.

Fig 3 shows the internal circuitry of the CA3059, together with its minimal external connections. Mains power is connected to pins 5 and 7 via limiting resistor Rs (22k, 5W when 230V mains is used). D1 and D2 act as back-to-back zeners and limit the pin 5 voltage to ±8V. On positive half-cycles D7 and D13 rectify this voltage and generate 6.5V across the 100μF capacitor connected to pin 2. This capacitor stores enough energy to drive all internal circuitry and provides adequate Triac gate drive, with a few mA of spare drive available for powering external circuitry if needed.

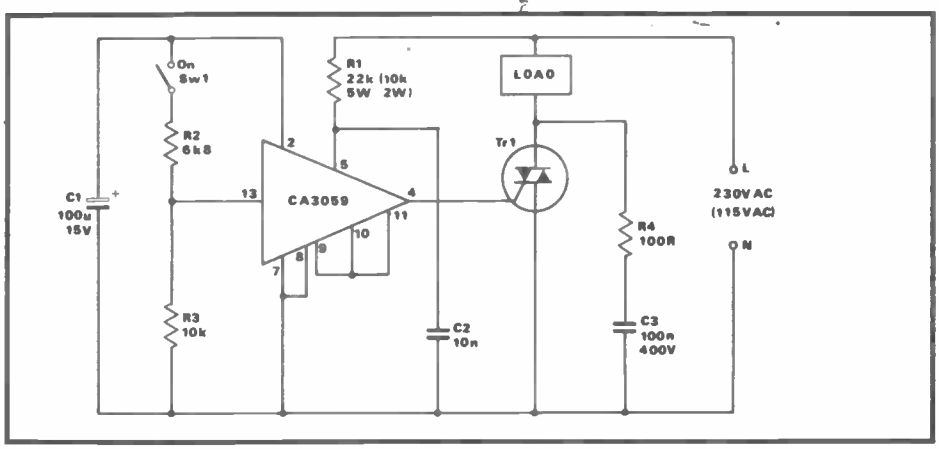


Fig 4: *Direct-switching IC-gated zero-voltage line switch*

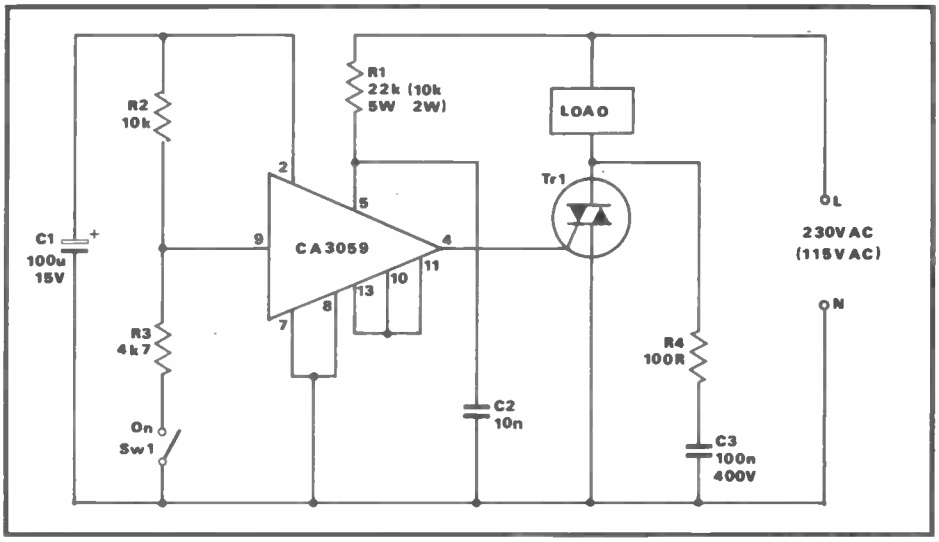


Fig 5: *Alternative method of direct-switching the CA3059 1C*

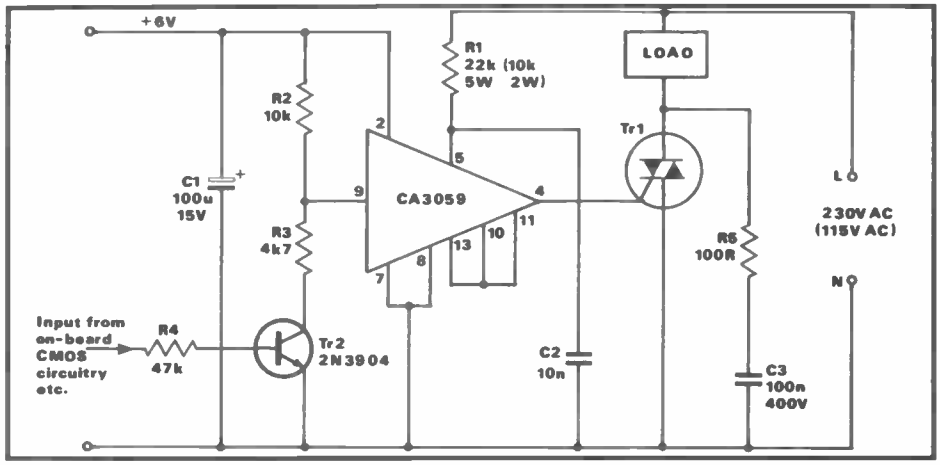


Fig 6: *Method of transistor-switching the CA3059 via on-board CMOS circuitry, etc*

Bridge rectifier D3 to D6 and transistor Q1 act as a zero-crossing detector, with Q1 being driven to saturation whenever the pin 5 voltage exceeds ±3V. Gate drive to an external Triac can be made via the emitter (pin 4) of the Q8-Q9 Darlington pair, but is available only when Q7 is turned off. When Q1 is turned on (pin 5 greater than ±3V) Q6 turns off through lack of base drive, so Q7 is driven to saturation via R7 and no Triac gate drive is available at pin 4. Thus, Triac gate drive is available only when pin 5 is close to the 'zero-voltage' mains value and is delivered in the form of a narrow pulse centred on the crossover point; its power is supplied via C1.

The CA3059 incorporates a differential amplifier or voltage comparator, built around Q2 to Q5, for general purpose use. Resistors R4 and R5 are externally available for biasing one side of the amplifier. The emitter current of Q4 flows via the base of Q1 and can be used to disable the Triac gate drive (pin 4) by turning Q1 on. The configuration is such that the gate drive can be disabled by making pin 9 positive relative to pin 13. The drive can also be disabled by connecting external signals to pin 1 and/or pin 14.

Figs 4 and **5** show how the CA3059 can be used to give manually controlled zero-voltage on/off switching of the Triac. These two circuits use SW1 to enable or disable the Triac gate drive via the IC's internal differential amplifier (the drive is enabled only when pin 13 is biased above pin 9). In the **Fig 4** circuit pin 9 is biased at half-supply volts and pin 13 is biased via R2-R3 and SW1. Thus, the Triac turns on only when SW1 is closed.

In **Fig 5** pin 13 is biased at half-supply volts, pin 9 is biased via R2-R3 and SW1 and the Triac again turns on only when SW1 is closed. In both of these circuits, SW1 handles maximum potentials of 6V and maximum currents of about 1mA. Note in these designs that capacitor C2 is used to apply a slight phase delay to the pin 5 'zero-voltage detecting' terminal and causes the gate pulses to occur after (rather than to 'straddle') the zero-voltage point.

In the **Fig 5** circuit the Triac can be turned on by pulling R3 low or can be turned off by letting R3 float. **Figs 6** and **7** show how this can be put to use to extend the versatility of the basic circuit. In **Fig 6** the Triac can be turned on and off by transistor Q2, which in turn can be activated by on-board CMOS circuitry (such as one-shots, astables, etc) that are powered from the 6V pin 2 supply.

In **Fig 7** the circuit can be turned on

and off by fully isolated external circuitry via an inexpensive optocoupler, which needs an input in excess of only a couple of volts to turn the Triac on.

Alternatively, **Fig 8** shows how the TDA1024 IC can be used in place of the CA3059 to give either directly switched or optocoupled 'zero-voltage' Triac control.

Finally, to complete this section, **Figs 9** and **10** show a couple of ways of using the CA3059 so that the Triac operates as a light-sensitive, dark-operated power switch. In these two designs the IC's built-in differential amplifier is used as a precision voltage comparator. This turns the Triac on or off when one of the comparator input voltages goes above or below the other.

Fig 9 is the circuit of a simple dark-activated power switch. Here, pin 9 is tied to half-supply volts and pin 13 is

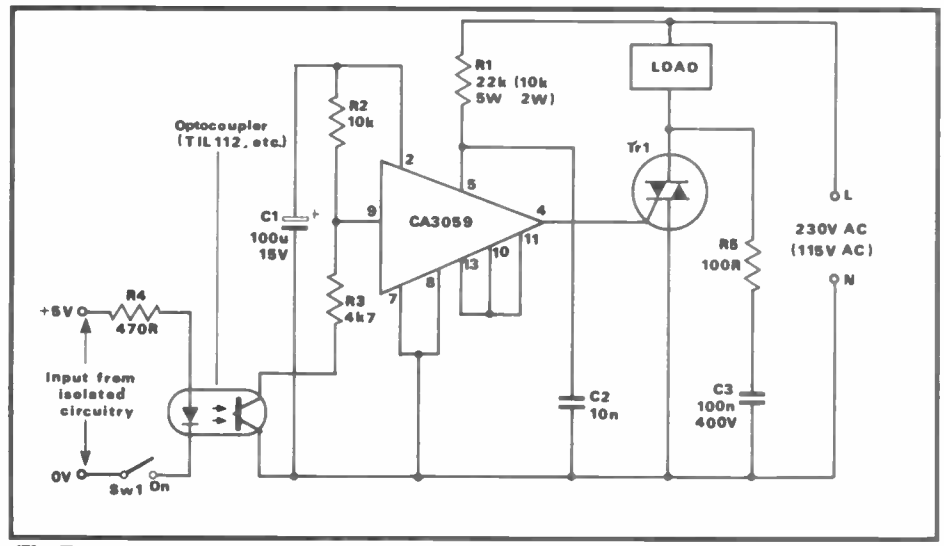


Fig 7: *Remote switching the CA3059 via an optocoupler*

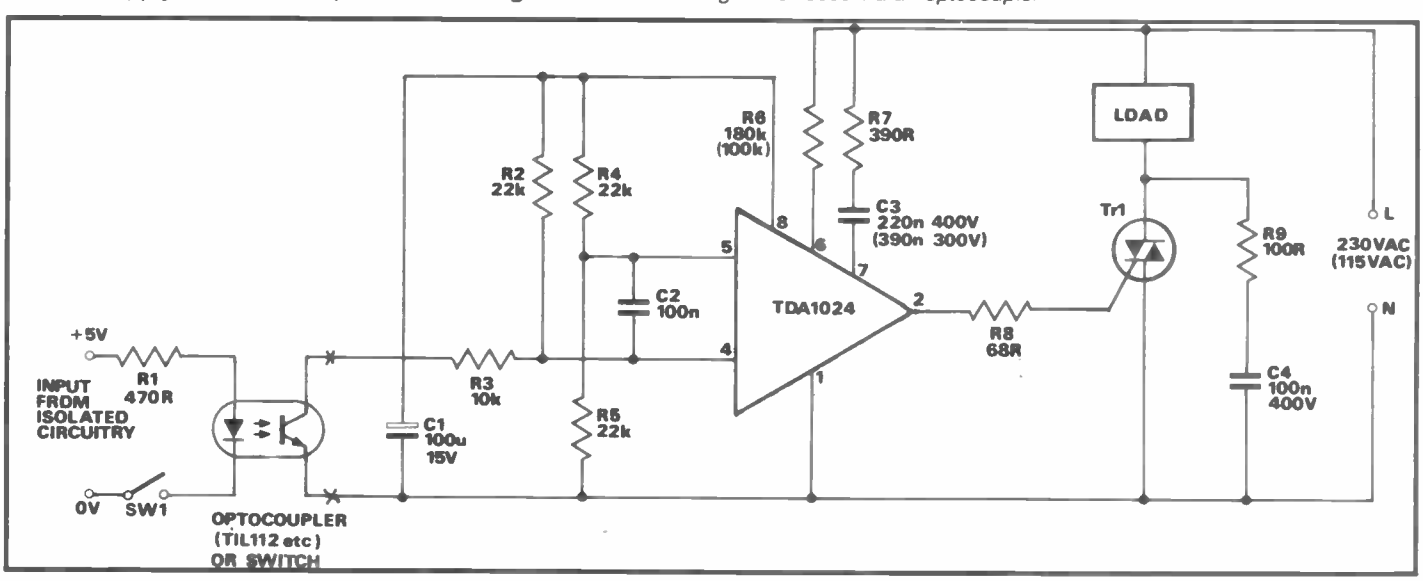


Fig 8: *The TDA1024 IC is used to give directly switched or optocoupled zero-voltage Triac control*

controlled via the R2-RV1-LDR-R3 potential divider. Under bright conditions the LDR has a low resistance, so pin 13 is below pin 9 and the Triac is disabled. Under dark conditions the LDR has a high resistance, so pin 13 is above pin 9 and the Triac is enabled and power is fed to the ac load. The threshold switching level of the circuit can be preset via RV1.

Fig 10 shows how a degree of hysteresis or 'backlash' can be added to the above circuit so that the Triac does not switch annoyingly in response to small changes (such as those caused by passing shadows, etc) in ambient light level. The hysteresis level is controlled via R3 which can be selected to suit particular applications.

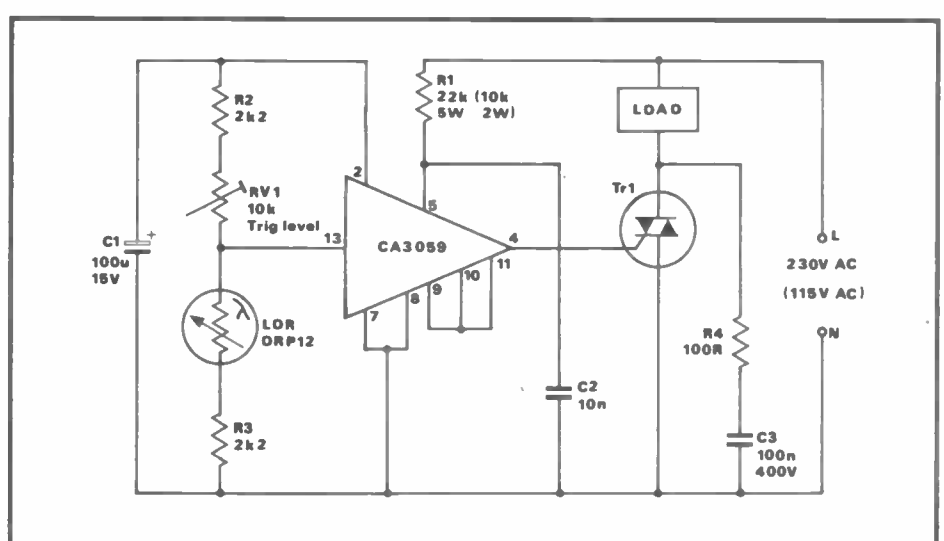


Fig 9: *Basic dark-activated zero-voltage switch*

Electric heater controllers

Triacs can be used to give automatic room temperature control by using electric heaters as the Triac loads and thermostats or thermistors as the Triac feedback control elements. Two basic methods of heater control can be used, either simple automatic on/off power switching, or fully automatic 'burst-fire' proportional power control (as described in part one of this series). In the former, the heater switches on fully

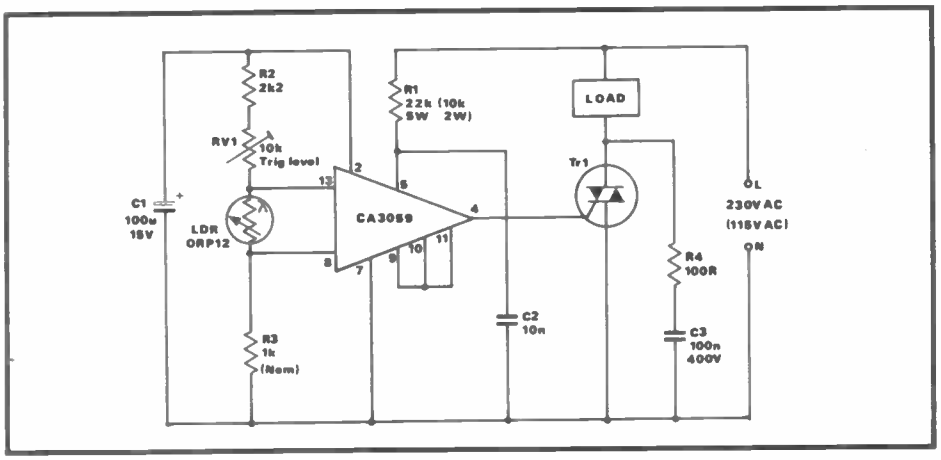


Fig 10: *Dark-activated zero-voltage switch with hesteresis provided via R3*

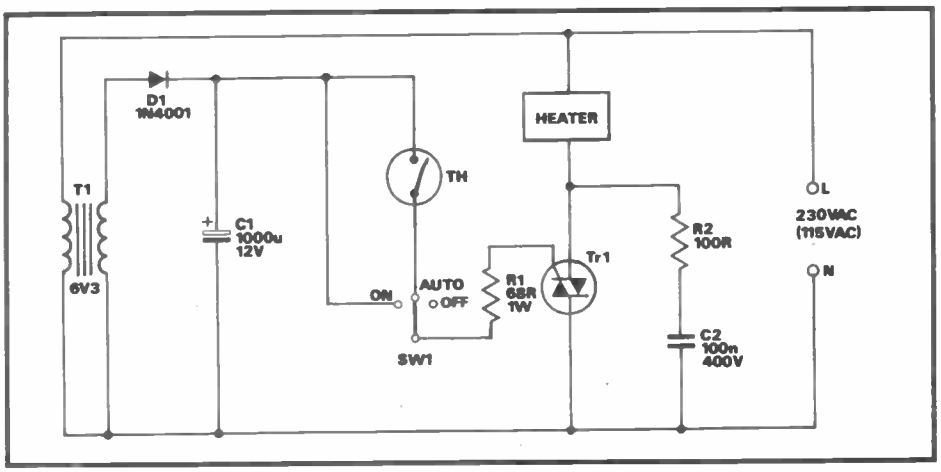


Fig 11: *Heater controller with thermostat-switched dc gating*

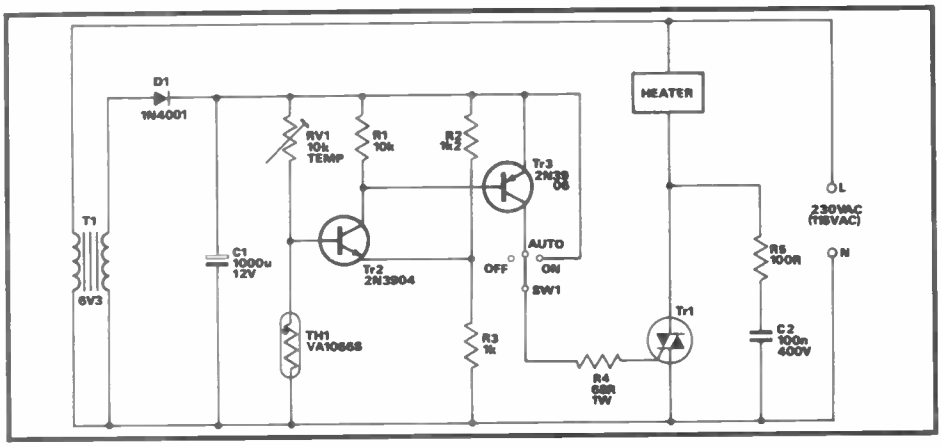


Fig 12: *Heater controller with thermistor-switched dc gating*

when the room temperature falls below a preset level and turns off when it rises above this. In the latter, the mean heater power is automatically adjusted so that, when the room temperature is at the precise preset level, the heater output power self-adjusts to exactly balance the thermal losses of the room.

Because of the high-power requirements of electric heaters, special care must be taken in the design of Triac controllers to keep RFI generation to a minimum. Two options are open to designers; to use either continuous dc gating of the Triac or to use synchronously pulsed gating. The advantage of dc gating is that, in basic on/off switching applications, the Triac generates zero RFI under normal (on) running conditions; the disadvantage is that the Triac may generate a very powerful RFI spike as it is initially switched from the off to the on condition.

The advantage of synchronous gating is that no high-level RFI is generated as the Triac transits from the off to the on condition; the disadvantage is that the Triac generates continuous very low-level RFI under normal (on) running conditions.

Dc-gated circuits

Figs 11 and **12** show examples of dc-gated heater controller circuits, in which the dc supply is derived via T1-D1 and C1, and the heater can be controlled either manually or automatically via SW1. The **Fig 11** circuit is auto-controlled via a thermostat and calls for no further explanation.

The **Fig 12** circuit, on the other hand, is controlled by ntc thermistor TH1 and transistors Q2-Q3. RV1-TH1-R2-R3 are used as a thermal bridge, with Q2 acting as a bridge-balance detector. RV1 is adjusted so that Q2 just starts to turn on as the temperature falls to the desired preset level; below this level, Q2-Q3 and the Triac are all driven hard on, and above this level all three components are cut off.

Note in this circuit that, since the gate-drive polarity is always positive but the Triac main-terminal current is alternating, the Triac is gated alternately in the so-called I+ and III+ modes or quadrants, and that the gate sensitivities are quite different in these two modes. Consequently, when the TH1 temperature is well below the preset level, Q3 is driven hard on and the Triac is gated in both quadrants and gives full-power drive to the heater.

However, when the temperature is very close to the preset value, Q3 is only lightly driven on, so the Triac is gated in the I+ mode only and the heater operates at only half of maximum power drive. The circuit thus gives fine control of temperature.

Synchronous circuits

Fig 13 shows how a CA3059 IC can be used to make an automatic thermistor-regulated synchronous electric heater controller that gives a simple on/off heater switching action. The circuit is similar to that of the dark-activated power switch of **Fig 9** except that ntc thermistor TH1 is used as the feedback sensing element; the circuit is capable of maintaining room temperature within a degree or so of the value preset via RV1.

Finally, in order that you are able to complete this heater controller section, **Fig 14** shows a burst-fire or proportional heater controller that is capable of regulating room temperatures to within ±0.5°C of a preset value. In this circuit a thermistor controlled voltage is applied to the pin 13 side of the CA3059's comparator, and a repetitive 300mS ramp waveform, centred on half-supply volts, is applied to the pin 9 side of the comparator from CMOS astable IC1.

The action of this circuit is such that

the Triac is synchronously turned fully on if the ambient temperature is more than a couple of degrees below the preset level, or is cut fully off if it is more than a couple of degrees above. When the temperature is within a couple of degrees of the preset value, however, the ramp waveform comes into effect and synchronously turns the Triac on and off (in the burst-fire or integral cycle mode) once every 300mS, with a mark/space (M/S) ratio proportional to the temperature differential.

Thus, if the M/S ratio is 1:1, the heater generates only half of maximum power and if the ratio is 1:3 it generates only one quarter of maximum power. The net effect of this action is that the heater output power self-adjusts to meet the room's heating needs. When the room temperature reaches the precise preset value, the heater does not switch fully off, but generates just enough output power to accurately match the thermal losses of the room. The system gives very precise temperature control.

Next month, we'll show a variety of practical ac lamp dimmer and motor control circuits, plus a selection of dc variable power control circuits.

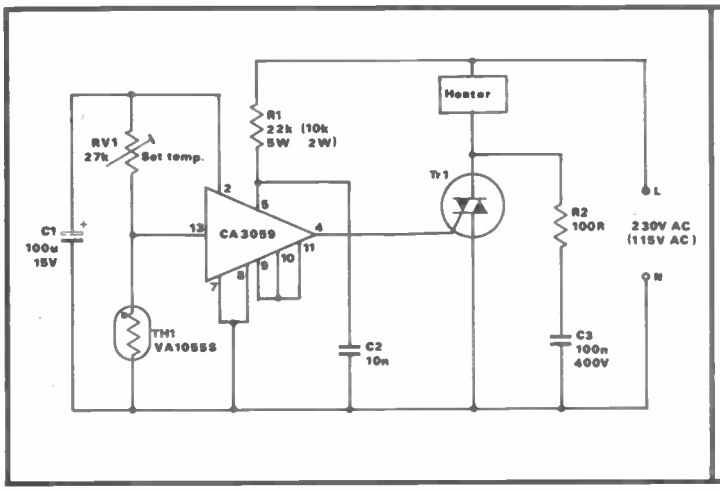


Fig 13: *Diagram showing the heater controller with thermistor-regulated zero-voltage switching*

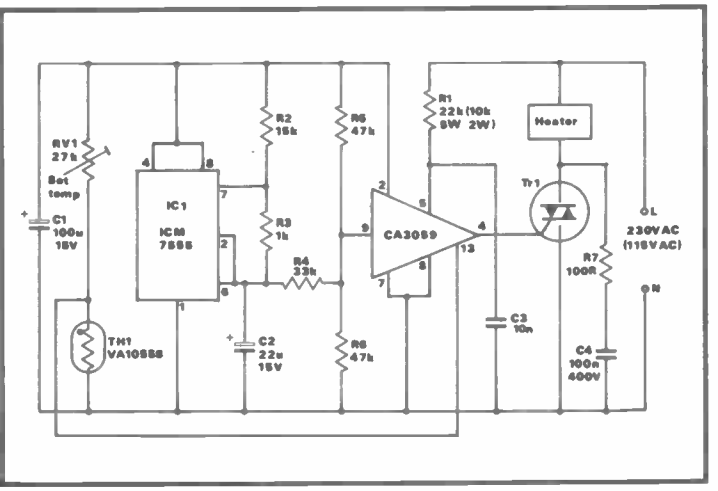


Fig 14: *Heater controller giving integral-cycle precision temperature regulation*

Short Wave News for DX Listeners

by Frank A Baldwin All titles in UTC, **bold** figures indicate the frequency in kHz

Signals from the Far East on the frequency range **2560** to **4735** are now at their peak for DXers residing in the UK. Attention is, therefore, directed to the following stations. It should be borne in mind that the entering into the receiver's memory of some of the channels specified here, is a factor which may well be considered by individual operators.

Past experience has shown that the peak times allowing the best chance for reception of some of these elusive signals is from 1515 to 1730 and 2200 to 2400.

CHINA

Xinjiang PBS, Urumqi, radiates the Home Service in Uigher on **2560** with a power of 15kW from 2300 to 0200, from 0330 to 0730 and from 1030 to 1700. It can also be heard in parallel on **4735** and on **5800**.

Voice of the Strait, Fuzhou, on **3200** carries the Haixia 2 programme in Chinese from 0800 to 1630 with a power of 10kW. It is sometimes reported in the SWL press.

CPBS (Chinese People's Broadcasting Station) Beijing, on **3220** has a power of 50kW with which it radiates the Home Service 1 programme in Chinese from 1958 to 2400 and from 1000 to 1730. An English language lesson is featured from 1430 to 1500.

Guizhou PBS at Guiyang, operates on **3260** at 10kW from 2155 to 0030 and from 0150 to 1600 radiating the Home Service 1 in Chinese and local dialects. English language lessons are featured from 2200 to 2230, from 0230 to 0300 and from 1300 to 1330. Guizhou PBS is in parallel on **7275**.

Radio Beijing irregularly transmits the Foreign Service in Chinese on **3270** with a power of 50kW from 1500 to 1600 and from 1730 to 1830, in Swahili from 1600 to 1730 and in French from 1830 to 2230. I should add that it is only rarely reported by European DXers.

The recently active Voice of Pujiang, Shanghai, reportedly operates on **3280** from 0955 to 1545 in Chinese and a Shanghai dialect. The power is unknown at the time of writing, parallel channels being **3990** and **4950**.

CPBS Beijing carries the Home Service 2 in Chinese from 2058 to 2330 and from 1030 to 1600 on **3290** with a power of 50kW.

The seldom logged Voice of the Strait, Fuzhou, on **3300** transmits the Haixia 2 programme in Chinese from 2200 to 0031 and from 0955 to 1751 at 10kW.

On **3310** is Jilin PBS, at Changchun. It features Chinese programmes in the Home Service from 2050 to 0630 and from 0820 to 1505 with English language lessons from 1340 to 1410 at 10kW. Jilin PBS is in parallel on **6070**. After an absence of some ten years from the logbook, this Chinese regional station was heard on one occasion during 1987 and again recently. Unfortunately, the frequency is subject to severe utility interference for most of the time, just occasionally being absent and thereby providing a chance of logging the Jilin PBS.

The ubiquitous Voice of the Strait appears again on **3535** with the Haikia 1 programme in Chinese from 2230 to 0030 and from 1340 to 1754 at 10kW, being in parallel on **2490**.

CPBS Beijing, on **3815** transmits the Taiwan Service 1 in Chinese, Amoy and Hakka from 0955 through to 2400, also being in parallel on **5125**.

The Chinese transmitter on **3940** is frequently reported in the SWL press, often being heard during our late evenings. Hubei PBS, Wuhan, radiates the Home Service 1 in Chinese from 2100 to 0610 and from 0850 to 1530 at 10/50kW.

JAPAN

The Home Service in Japanese from 2045 to 2030 (Saturday until 1630, Sunday until 1700) identifying as Radio Tampa may be heard on **3925**, being logged at times by European DXers. The power is 50kW.

Rarely heard in the UK, is the Japanese station NSB Chiba, Radio Tanpa, in Tokyo on **3945** carrying the Home Service 2 programme in Japanese from 2300 to 1300 with a power of 10kW.

NORTH KOREA

The 120kW KCBS (Korean Central Broadcasting Station) at Pyongyang, North Korea, radiates the Home Service 1 in Korean from 1958 to 1800 daily on **2850**. Reports of reception by European DXers occasionally appear in club journals. The writer recently logged this one at 1546 on a measured **2849.9** when featuring a choir. Some orchestral music, followed by announcements in Korean.

The rarely heard Korean station at Wonsan, Kangwon Province, carries the Home Service 1 in Korean from 1958 to 1800 on **3220**. The schedule includes regional programmes from 2230 to 2300, from 0430 to 0520 and from 1110 to 1800. The power is 1kW, hence the rarity rating. Furthermore, the frequency is slightly variable.

The **3250** frequency belongs to the 120kW KCBS at Pyongyang, North Korea. On this channel, Pyongyang is in Korean (from 2255 to 0100, 0555 to 0830 and 1500 to 2030) and Japanese (from 2100 to 2250, 0900 to 1050, 1100 to 1250 and 1300 to 1450). Messages in code are radiated from 1500 to 1520.

Pyongsong, South Pyongyang Province, is sometimes reported by Asian DXers. It occupies the **3350** channel from 1958 to 1800 carrying the Home Service 1 and regionally originated programmes. The power is 10kW.

The signals emanating from the North Korean station at Shinuiju, in North Pyongyang Province, are sometimes logged in the UK during the winter. Radiating the Home Service 1 on **3920** is slightly variable. It is on the air in Korean from 1958 to 1800; this schedule also includes locally originated programmes.

SOUTH KOREA

On **3930** is the South Korean transmitter at KBS Suw'on, with the Home Service 1 from 2000 to 1500 and the Social Educational programme from 1500 to 2000. The power is 5kW.

TAIWAN

BCC (Broadcasting Corporation of China) Taipei, Taiwan, has a 10kW transmitter operating on **3335**. Transmitting the Network 6 programme in Hakka from 0950 to 2200, it is subjected to jamming from the Chinese mainland. Needless to state, it is seldom clearly heard far from its signal source.

ON THE AIR

The following stations have recently been heard by the writer. Interested readers may care to tune to the frequencies specified at, or near, the times stated when success may ensue if the prevailing conditions allow.

AFRICA

Burundi

Bujumbura on **3300** at 1820, OM with a talk in French followed by some pipe music then more talk. Unfortunately, this frequency is subject to utility interference during most of our evening periods but just occasionally, during a break in transmission, Bujumbura becomes audible.

Radiodiffusion TV Nationale du Burundi radiates the Home Service in French, Kirundi and Swahili from 0300 to 0700 (Sunday until 1000) and from 1600 to 2100 with an English newscast at 1645. The power is 25kW.

Cameroon

Garoua on **5010** at 0516, a newscast in English until 0517, some announcements then a French programme. Radio Garoua operates the Home Service in French and local vernaculars from 0425 to 0805 and from 1630 to 2315. The schedule includes relays of news bulletins in English from Yaounde at 0500, 1800 and at 2100. The power is 100/4kW.

Djibouti

Radiodiffusion TV de Djibouti on **4780** at 1842, weird sounding songs, chants and a song in Somali with drum accompaniment. The National Service is broadcast in Somali, Afar and Arabic and is timed from 0300 to 0800 (Friday from 0500 to 0900) and from 0900 to 1900. The power is 20kW.

Rwanda

Kigali on **3330** at 1805, OM with the news in French which included a phone-in report. Radiodiffusion de la Republique Rwandaise with the Home Service is on this frequency from 0300 to 0600 (Sunday until 2100), from 0900 to 1200 (Saturday until 2100) and from 1330 to 2100 in Kinyarwanda, Swahili and French. The power is 5kW.

South Africa

Radio Oranje, Johannesburg, on **3215** at 1728, a programme of recorded local pops with announcements in Afrikaans. The schedule is from 0300 to 0420 and from 1545 to 1930 entirely in Afrikaans. The power is 100kW.

CENTRAL AMERICA

Costa Rica

Radio Reloj, Irazu, on **4832** at 0319, OM with a political talk in Spanish. This station operates irregularly, but it is sometimes on the air around the clock or closes any time between 0400 and 0600. The power is 3kW.

Guatemala

Radio Cultural, Guatemala City, on **3300** at 0352, a USA tape-recorded religious talk, some announcements, choir with a hymn, the station identification then more religious talk, all in English. This station often puts a good signal into Europe from around 0400 to 0630, being frequently heard by UK DXers. The power is 10kW and the schedule is from 1000 through to 0730 with the English programme being timed from 0300 (Sunday from 2345) to 0430.

Nicaragua

Mangua on **6100** at 0631, a USA tape-recorded religious talk during the English programme scheduled from 0600 to 0700. The Voice of Nicaragua is on the air in Spanish from 1200 to 0600 with a power of 50kW.

SOUTH AMERICA

Bolivia

Radio Capitan Victor Ustariz (La Voz del Tropico), Villa Tunari, on a measured **4747.4** at 0023, songs and announcements in Spanish followed by some orchestral music. The schedule of this 0.25kW transmitter is from 1000 (sometimes 1030) to 1400 and from 2200 to around 0230. This one is elusive and heard only after many attempts with the use of receiver memory bank retrieval.

Brazil

Radio Bare, Manaus, on **4895** at 0224, a football (futebol) commentary in Portuguese, with the much excited commentator witnessing a scored goal. At 1kW, Radio Bare operates entirely in Portuguese from 0800 to around 0500.

Colombia

La Voz del Cinaruco, Arauca, on **4865** at 0426, songs and guitar music, the station and Caracol identification in Spanish and a local pop song; in the middle of which, LV del Cinaruco went off the air. The schedule is from 0900 to around 0400 (Sunday until 0200) and the power is 1kW.

Ecuador

Radio Zaracay, Santo Domingo de los Colorados, on **3394.8** at 0306, OM with the station identification in Spanish then some folk songs and music. Radio Zaracay is on the air from 1000 to 1300 and from 2100 to 0300, or often 0400 at 10kW.

Venezuela

Radio Mundial Bolivar, Cuidad Bolivar, on **4770** at 0150, OM with a talk in Spanish having mention of both Punta Arenas (Chile) and Caracas (Venezuela). This station operates on an irregular basis from 0900 to around 0200 at 1kW.

SOUTH EAST ASIA

China

Fujian PBS, Fuzhou, on **2339.9** at 2135, an announcement in Chinese then a western-type orchestral rendition of music from the Swan Lake ballet. The Home Service 1 in Chinese is scheduled from 2050 to 2400 and from 1020 to 1700. The power is 10kW.

CPBS Beijing on **4250** at 2134, when radiating a programme of Chinese songs and music. At 50kW, the Home Service 2 in Chinese is on the air from 2058 to 2330 and from 1100 to 1600.

CPBS Beijing on **4800** at 2302, much talking in Chinese in the Home Service 2 programme timed from 2230 to 0200, from 0955 to 1130 and from 1300 to 1600 with an English language lesson from 2230 to 2300. This is followed by relays of the Beijing Minority Language Service in Mongolian from 2200 to 2226 and 1230 to 1256.

India

AIR (All India Radio) Kurseong on **3355** at 1543, OM with a newscast in English which was also in parallel on **3905** and **4800**.

SOUTH EAST ASIA

Indonesia

RRI (Radio Republik Indonesia) Padang, Sumatra, on **4003** at 1524, a talk in Indonesian, some orchestral music then a choral song. The schedule of this 10kW transmitter is from 2200 to 0100 and from 0900 to 1600.

RRI Jakarta, Java, on **4774.3** at 2158, Song of the Coconut Islands, theme interval signal repeated, OM with the station identification and a news bulletin in Indonesian. Programa Nasional is radiated from 2158 to 0100 and irregularly from 0958 to 1710. Programa Khusus being timed from 0100 to 0200 (Sunday from 0800 to 0958) and sometimes to 1500. The power is 50kW and the frequency is liable to slight variation.

Sri Lanka

Colombo on **4870** at 1520, YL with songs, announcements, two pips and the news in Sinhala at 1530, OM with a series of promotions then more local style music and songs.

Colombo on **9720** at 1501, a news bulletin of both local and world events. This English programme for South Asia is timed from 1230 to 1530 daily.

PACIFIC

Tahiti

Papeete on **11826** at 0857, local-style music with songs in Tahitian then chimes followed by announcements and the station identification in French at 0900. With a power of 20kW, Papeete operates in French and Tahitian from 1600 to 0930.

Australia

ABC Brisbane on **9660** at 0852, a programme of pop music and songs with announcements in English. At 10kW, Brisbane is on the air around the clock to North-East Australia.

CLANDESTINE

Radio Voice of Ethiopian Unity on **9435** at 1835, OM with a talk in Amharic, the transmission being jammed. The policy is one of hostility to the Ethiopian regime headed by Mengistu Haile Miriam. The transmitter location is thought to be Omdurman in Sudan.

NOW HEAR THIS

Radio Candip, Bunia, Zaire on **5066** at 1753, the local-style hi-life music with songs in vernacular then the station identification in French at 1800. The Home Service in French, vernaculars and Swahili is scheduled from around 0330 to 0600 and from 1300 (Saturday from 1000) to around 1945. The power is 10kW.

KCBS Pyongyang on a measured **2849.9** at 1546, choir, some orchestral music then announcements in Korean. The Home Service 1 is timed from 1958 to 1800. The power is 120kW.

NOW LOG THESE

RTM (Radio Television Malaysia) Kuala Lumpur, Malaysia on **4845** at 1445, Indian-type music with songs followed by some announcements.

This Tamil programme is radiated from 2100 to 0100 (Saturday until 0300, Sunday until 1500), 0200 to 0300, 0515 to 0600 (Saturday until 1500) and 0700 to 1500. The power is 50kW. Also heard at 2250 over co-channel Nouakchott, Mauritania.

Radio Mondou, Mondou, Chad on **5286** at 0517, OM with announcements then some music and a song in vernacular, unfortunately wiped out by utility interference at 0520. Radio Mondou transmits the Home Service in vernaculars and French from 0500 to 0800 and from 1400 to 1830 with a power of 5kW.

The prime time for logging this one is undoubtedly from 0500 until around 0530.

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

■ About 2,000 Meccano parts, cheap, ideal Christmas present. Also for sale: electronic components. Write to K Bailey, 40 Seymour Close, Selly Park, Birmingham B29 7JD

■ 5in monochrome television set, battery and mains operated, offers. Tel: (0283) 221870

■ Invisible vinyl repair kit, ideal as a spare-time earner or for personal use, send SAE for full details. Photographic developing solutions and formulae, detailed guide for developing monochrome and colour film cheaply, £4. Matchbox-size transmitter, easy to build plans, £2. Stereo cartridge BSR SX5H, £3. Non-magnetic tweezers, ideal for etching circuit boards and handling small components, send 2x14p stamps to: Mr Lawrence, 7 Griffin Crescent, Littlehampton BN17 7LH

■ Swan 270B HF transceiver, manual, mic, internal PSU and matching frequency counter, £250. Icom IC202A USB/LSB/CW 2m transceiver with manuals, mint condition, £100. Tel: (05612) 697

■ Medium wave 'Sooper loop', fully built, with FET preamp, £25. Write to: Mike Evans, 120 Loughton Way, Buckhurst Hill, Essex IG9 6AR

■ Sony D40 compact CD player with mains power supply/charger, rechargeable battery pack, standard battery pack, Sony headphones, carrying case, Sony car mount/power supply and car mounting arm. All approximately three months old, in as new condition, £175 ono. Watford Electronics EPROM programmer MkII for the BBC B micro, hardly used, with handbook, £30. 5×200 scanner, 26-58MHz, 58-88MHz, 108-180MHz, 380-514MHz, vgc, handbook, power supply, etc, £130 ono. Collection of sixteen valve radios, please phone for details. Quantity of assorted magazines on electronics, radio, etc, approximately 600. Free to collector. Several books on the C programming language, about £65 worth, will accept £30 ono. Sansui D70 radio/amp, 80W per channel (rms), pair of speakers, good condition, £130 ono. Or £100 without speakers. Tel: (0525) 28543

■ FT-290, Ni-Cads, charger, flexi-whip, soft case, companion FL-2010 10W linear and mobile mount, £275. Cobra 148 GTLDX modified for 10 metres, plus 150W linear with preamp and four position power selection, £265. Going HF mobile, sorry no splits. Tel: (0903) 36780

■ Yaesu FT-747 with FM board and general coverage Tx, worked all over with simple antennas, as new and boxed, £600 ovno, cash only. Ask for Mike G0EIG. Tel: (0772) 424878 after 6pm

■ NEC 8201 lap-top computer, vgc, complete with 8206A RAM expansion, software pack, Grundig cassette recorder, Brother HR-5 printer, cables, ribbons, £250. MuTek GMFA144E 2m preamp, 0.7dB NF 1.2kW pass-thru, including sequencer, £150. Colecovision video game system, vgc, boxed twelve cartridges, including Pole Position, Atari VCS converter, offers. Ask for Mike. Tel: (04023) 45969 evenings

■ TR-2400 2m FM transceiver, hand-held, 1.5W with keypad and memory, etc, includes charger, instructions, carry-case, rubber antenna and flat Ni-Cad batteries, hardly used, £100 ono. Tel: 061-480 1451

■ KW1000, KW108, KW2000A, KW2000B, Viceroy, all mint, offers. Yaesu FT-200, badged as Tempo AC-one, PSU, offers. MM2002 RTTY modem with keyboard, £90. Various valve Rx/Tx NEC PC 8201. Lap-top computer, extra RAM, ultimate Rom II, disc drive, CRT controller, etc, £275. Epson PX8 lap-top, RAM expansion, SW, manuals, £225. Brother, portable, disc drive, new, for NEC/Tandy, £90. John. Tel: 01-328 9275

■ Heathkit R-C, bridge model G-3U, including handbook, £25. Maplin keyboard with metal case, £20. Philips car radio with push button control, £10. Aerial boot-mounts, £5. Photocopies of service manuals: TR-2400, TR-9500, TR-9000, TR-2500, TR-3500 and TR-3200, £5 each. TR-3200 operating manual photocopy, £3. All items ono, carriage extra. Des Thompson G8SBJ. Tel: (0395) 265059

■ 128k Spectrum with turbo interface, interspec and speech pack, £140. Memotech MTX512, 64k, £45. Three channel chart recorder with accessories and paper, £50. All brand new and unused. Racal Termicette cassette data terminal, £20. Gambrell Decade resistance box 2086/595, polished-wood case, £50. Sony camera adaptor CMA/3CE, £20. Tel: (0256) 893761

■ Icom 1200E, 23cm, mobile/base rig, latest model with 10W out, complete, mint with all accessories, hardly used, £425. Trio/Kenwood SW 200A SWR/PWR meter, plus SW2 (70cm range) head unit. £100. Professionally made 10GHz 'penny feed' unit, superb, £24. Jaybeam 10XY 2m antenna (new), £20. Paul G4XHF. Tel: (0293) 515201

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

MILITARY SURPLUS EQUIPMENT MANUAL

Giant collection Military Equipment Circuits/Data. Only **£10.00** including Post/Packing. Just one of many unique Repair and Data Guides. LSAE for your FREE catalogue.

FULL WORKSHOP SERVICE MANUALS
Video Recorders £12.00, All others £6.00 inclusive. State Make/Model/Type with order.

MAURITRON ELECTRONICS LIMITED (REW)
8 Cherry Tree Road, Chinnor
Oxfordshire OX9 4QY
Tel: (0844) 51694

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	0.66
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	9.56	6.36	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.

Selectronic

The UK's leading suppliers of 934MHz personal radio equipment

203 High Street
Canvey Island, Essex,
Tel: 0268 691481
(Open Mon-Sat 9-5.30)

Amateur radio equipment also in stock

TISREW

76 Church Street, Larkhall Lanarks ML9 1HE
for IMMEDIATE DESPATCH of all ACCESS Phone Orders. Ring 0698 884585 or 883334 outwith Business Hours.

Every issued FULL SIZE SERVICE SHEET in stock; CTVs or Combinations **£3.50**/Singles **£2.50**; Plus LSAE. **LSAE any Quotation, FREE Catalogue, Review, Prices.** Spectrum Repairs **£5.00**; Prac TV Repairs **£12.95**; Prac Radio Rep/Serv **£9.95**; Video Serv Mans ea **£15.00**. Almost any Circ Video **£7**; CTV **£4**; + lsae. Write in for details of our Integrated Servicing and Repair Systems for Video, all TV & Domestic Equipment.

MO Distributors for all Heinemann/Newnes Publications

AMATEUR TELEVISION

IS TELEVISION YOUR INTEREST? Then you need the BRITISH AMATEUR TELEVISION CLUB, only £6 per year – super magazine. Send SAE to:

'Grenehurst', Pinewood Road
High Wycombe, Bucks HP12 4DD

TURN YOUR SURPLUS

IC's TRANSISTORS etc, into cash, immediate settlement. We also welcome the opportunity to quote for complete factory clearance.

CONTACT:
COLES-HARDING & CO
103 South Brink, Wisbech, Cambs
TEL: 0945 584188/Fax. No. 0945-588844
Est Over 10 years

ETESON ELECTRONICS

E•E

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.

NEWMARKET TRANSFORMER LTD

Now manufacturing Toroidal transformers, 30va to 2.5kva. Competitive prices, prompt delivery, one-off to production runs. Phone M Durnan on 0638 662989/660799 for quotations.

AGRIMOTORS

MERTON CB AND RADIO CENTRE
MERTON GARAGE AND POST OFFICE, MERTON.
Nr OAKHAMPTON, DEVON EX20 3DZ
OPEN 6 DAYS 9-6 LUNCH 1-2pm
EARLY CLOSING THURSDAY 1.00pm
(SUNDAYS BY APPOINTMENT)
SPECIALIST IN 934 MHz
SUPPLIERS OF ALL 27MHz AND 934 MHz EQUIPMENT
AMATEUR ACCESSORIES CATERED FOR
06053 200

Radio & Electronics World

The communications and electronics magazine

This method of advertising is available in multiples of a single column centimetres — (minimum 2cms). Copy can be changed every month.

RATES
per single column centimetre:
1 insertion £9.65, 3 — £9.15, 6 — £8.65, 12 — £7.75.

SMALL ADS

BRENT ELECTRONICS & COMMS

49 Seaview Street, Cleethorpes
South Humberside DN35 8EU
Tel: 0472 690383

Pye M296 UHF mobiles..... **POA**
Pye A200 linear amp, 148/174MHz ..... **£35 each**

Airlight 62 headset EM mic.... **£35**
X-Band 20 inch dish and feed EL/AZ mount inc motor drives and syncros..... **£50**

Solid State indicator units ex. "Red Steer" radar **£65**

Marconi Apollo HF receiver **£295**

All + 15% VAT
Cheque with order – carriage included

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

ADVERTISERS INDEX

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

colour rates exclude cost of separations

depth mm x width mm	ad space	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 89	9 Nov 88	16 Nov 88	16 Nov 88	8 Dec 88
Feb 89	7 Dec 88	14 Dec 88	16 Dec 88	12 Jan 89
March 89	11 Jan 89	18 Jan 89	20 Jan 89	9 Feb 89
April 89	8 Feb 89	15 Feb 89	17 Feb 89	9 Mar 89

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.

No. 1 LIST BAKERS DOZEN PACKS

All packs are £1 each, if you order 12 then you are entitled to another free. Please state which one you want. Note the figure on the extreme left of the pack ref number and the next figure is the quantity of items in the pack, finally a short description.

BD1 5 13A junction boxes for adding extra points to your ring main circuit.
BD2 5 13A spurs provide a fused outlet to a ring main where devices such as a clock must not be switched off.
BD7 4 In flex switches with neon on/off lights, saves leaving things switched on.
BD9 2 6V 1A mains transformers upright mounting with fixed clamps
BD11 1 6½in speaker cabinet ideal for extensions, takes our speaker. Ref BD137.
BD13 12 30 watt reed switches, it's surprising what you can make with these—burglar alarms, secret switches, relay, etc , etc
BD22 2 25 watt loudspeaker two unit crossovers.
BD29 1 B.D.A.C stereo unit is wonderful value.
BD30 2 Nicad constant current chargers adapt to charge almost any nicad battery
BD32 2 Humidity switches, as the air becomes damper the membrane stretches and operates a microswitch.
BD34 48 2 meter length of connecting wire all colour coded.
BD42 5 13A rocker switch three tags so on/off, or change over with centre off
BD45 1 24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day. original cost £40 each
BD49 10 Neon valves, with series resistor, these make good night lights
BD56 1 Mini uniselector, one use is for an electric jigsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole.
BD59 2 Flat solenoids—you could make your multi-tester read AC amps with this.
BD67 1 Suck or blow operated pressure switch, or it can be operated by any low pressure variation such as water level in water tanks.
BD91 2 Mains operated motors with gearbox Final speed 16 rpm, 2 watt rated.
BD103A 1 6V 750mA power supply, nicely cased with mains input and 6V output leads.
BD120 2 Stripper boards, each contains a 400V 2A bridge rectifier and 14 other diodes and rectifiers as well as dozens of condensers, etc.
BD122 10m Twin screened flex with white pvc cover.
BD128 10 Very fine drills for pcb boards etc Normal cost about 80p each.
BD132 2 Plastic boxes approx 3in cube with square hole through top so ideal for interrupted beam switch.
BD134 10 Motors for model aeroplanes, spin to start so needs no switch.
BD139 6 Microphone inserts—magnetic 400 ohm also act as speakers.
BD148 4 Reed relay kits, you get 16 reed switches and 4 coil sets with notes on making c/o relays and other gadgets.
BD149 6 Safety cover for 13A sockets—prevent those inquisitive little fingers getting nasty shocks.
BD180 6 Neon indicators in panel mounting holders with lens.
BD193 6 5 amp 3 pin flush mounting sockets make a low cost disco panel.
BD196 1 In flex simmerstat—keeps your soldering iron etc. always at the ready.
BD199 1 Mains solenoid, very powerful, has 1in pull or could push if modified.
BD201 8 Keyboard switches—made for computers but have many other applications.
BD210 4 Transistors type 2N3055, probably the most useful power transistor.
BD211 1 Electric clock, mains operated, put this in a box and you need never be late.
BD221 5 12V alarms, make a noise about as loud as a car horn. Slightly soiled but OK.
BD242 2 6in x 4in speakers, 4 ohm made from Radiomobile so very good quality
BD246 2 Tacho generators, generate one volt per 100 revs.
BD252 1 Panostat, controls output of boiling ring from simmer up boil.
BD259 50 Leads with push-on ¼in tags—a must for hook-ups—mains connections etc.
BD263 2 Oblong push switches for bell or chimes, these can mains up to 5 amps so could be foot switch if fitted into pattress.
BD268 1 Mini 1 watt amp for record player. Will also change speed of record player motor.
BD275 1 Guitar mic—clip-on type suits most amps.
BD283 3 Mild steel boxes approx 3in x 3in x 1in deep—standard electrical.
BD293 50 Mixed silicon diodes.
BD296 3 Car plugs with lead, fit into lighter socket.
BD305 1 Tubular dynamic mic with optional table rest.

Most other packs still available and you can choose any as your free one.

VERY POWERFUL 12 VOLT MOTORS—⅓rd HORSEPOWER Made to drive the Sinclair C5 electric car but equally adapable to power a go-cart, a mower, a rail car, model railway, etc. Brand new. Price £15.00 plus £2.00 postage. Our ref.15P8

OVER 400 GIFTS YOU CAN CHOOSE FROM

There is a total of over 400 packs in our Baker's Dozen range and you 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.

ATARI 65XE COMPUTER At 64K this is most powerful and suitable for home and business. Brand new, complete with PSU, TV lead, owner's manual and six games. Can be yours for only £45 plus £3 insured delivery.

DATA RECORDERS ACORN for Acorn Electron, etc., reference number ALF03, with TV lead, manual and PSU. Brand new. Price £10 plus £1.50 post. Order ref 10P44.
ATARI XC12 for all their home computers. With leads and handbook. Brand new. Price £10 plus £2 post. Order ref 10P53.

JOYSTICK FOR ATARI OR COMMODORE for all Atari and Commodore 64 and Vic20. New. Price £5. Order ref 5P126.

EXTRA SPECIAL OFFER We will supply the Atari 65XE, data recorder XC12, joystick and six games for £57.50 plus £4 insured delivery.

SUB-MIN TOGGLE SWITCH Body size 8mm x 4mm x 7mm SBOT with chrome dolly fixing nuts. 4 for £1. Order Ref. BD649.

Ex GPO MULTI-RANGE TEST METER 12/C1 Complete in real leather case with carrying handle–this is a 20,000 OPU instrument, with 19 ranges including AC and DC volts-dc current 5mA to 1A 3 ohms ranges up to 20meg— the low ohms range is particularly useful, you will be able to read right down to one ohm and below. Not new but are in first class condition—tested and guaranteed. Price is £7.00. order ref 7P5.

RE-CHARGEABLE NICADS 'D' SIZE
These are tagged for easy joining together but tags, being spot welded, are easy to remove. Virtually unused, tested and guaranteed. £2.00 ref 2P141 or 6 wired together for £10.00 ref 10P47.

RECORD PLAYER DECK BRS, 12volt operated, belt driven with an 11in turntable, stereo cartridge. It will play 7in-10in or 12in individually at either 45rpm or 33rmp. Fitted speed selector and pick-up cueing lever. Price £12 plus £3 postage. Order ref 12P4.

2.5kw TABGENTIAL BLOW HEATER has an approximate width of 8in (plus motor), elements made up of two 1.2kw sections so with switch available you can have 2.5kw, 1.2kw or cold blow. Over-heat cutout eliminates fire risk should fan stop or air flow be impeded. Fan blades are metal. Price £5 plus £2.50 post. Our ref 5P62. Switch 50p.

ALBA TWIN CASSETTE RECORDER AND PLAYER WITH STEREO RADIO This is a mains/battery portable made to sell, we understand, at about £50 but the ones we have are line rejects. They are brand new still in the manufacturers' boxes but have a slight defect associated with the cassette section. The radio and amplifier section, both mono and stereo, is perfectly OK. If you are handy at mending things then this should be for you. Price £20 or two for £38 plus £3 insured post, either package. Our ref 20P7 or 2 x 20P7.

LASER TUBE

Made by Philips Electrical. New and unused. This is helium-neon and has a typical power rating of 1.6mW. It emits random polarised light and is completely safe provided you do not look directly into the beam when eye damage could result. DON'T MISS THIS SPECIAL BARGAIN! Price £29.95 plus £3 insured delivery.

POWER SUPPLY FOR PHILIPS LASER is now available in kit form. Price £13 plus £2 postage, or make-up ready-to-use at £18 plus £2.50 postage. Our ref 13P1 for the kit and 18P1 for the made-up version.

PAPST AXIAL FAN–MANUFACTURERS REF NO. TYP4580N.
This is mains operated. 15 watt rating and in a metal frame with metal blades so OK in high temperatures. Body size approx. 4¾" square x 1⅝" thick. £6.00 each, plus £1.00 postage. Our ref 6P6.
VERY POWERFUL MAGNETS Although only less than 1" long and not much thicker than a pencil these are very difficult to pull apart. Could be used to operate embedded reed switches, etc. Price 50p each, 2 for £1.00. Ref BD642.

ORGAN MASTER is a three octave musical keyboard. It is beautifully made, has gold plated contacts and is complete with ribbon cable and edge connector. Brand new, only £15 plus £3 postage. Order ref 15P15.

MUSIC FROM YOUR SPECTRUM 128 We offer the Organ Master three octave keyboard, complete with leads and the interface which plugs into your 128. You can them compose, play, record, store, etc., your own music. Price £28 plus £3 special packing and postage. Order ref 28P2.

20A DOUBLE POLE RELAY WITH 12V COIL complete with mounting brackets. made by the Japanese Omron Company. Price £2 each. Our Ref. 2P173A.
TORROIDAL MAINS TRANSFORMER with twin outputs. 6.3V 2A and 12V 600mA, so ideal for FOD power supply. Price £5. Our Ref. 5P122.
DOUBLE MICRO CASSETTE DECK made by the Japanese ABS company. This takes two micro cassettes and is complete with motors, solenoids to select the deck to use and record and playback heads. Price £10. Our Ref. 10P49.
QUICK FIX MAINS CONNECTOR A must for your workshop. Saves putting on plugs as you just push the wires under the spring clips. Automatically off when lid is up. Price £7.50. Our Ref. 7P5/1.
BT HANDSET with curly lead terminating with flat BT plug. Colour cream. Price £5. Our Ref. 5P123.

J & N BULL ELECTRICAL
Dept REW, 250 PORTLAND ROAD, HOVE BRIGHTON, SUSSEX BN3 5QT

MAIL ORDER TERMS: Cash, PO or cheque with order. Orders under £20 add £1.50 service charge. Monthly account orders accepted from schools and public companies. Access and B/card orders accepted. **Brighton (0273) 734648 or 203500**

POPULAR ITEMS
Some of the many items described in our current list which you will receive if you request it

3½in FDD CHINON 80 track 500k. Shugart compatible interface. Standard connections, interchangeable with most other 3½in and 5¼in drives. Brand new. £28.50 plus £3 insured post.

CASE NOW AVAILABLE FOR THE CHINON F353 This is the 80 track, single sided one which we have been selling at £28.50. The case is sheet metal, finished in hammer-beige with ample ventilation and rubber feet. Overall size 4¼in x 7in x 1½in approx. Designed to take the ribbon cable and 3 core power lead. Price £8. Our ref 8P21.

3in FDD HITACHI HFD305SXA Shugart compatible interface. 500k on 3in disc. Recommended for many Amstrads but interchangeable with most drives. £29.50 plus £3 insured post.

FDD CASE AND POWER SUPPLY KIT for the 3in or 3½in. £11.00. Ref 11P2 for the Chinon, 11P3 for the Hitachi.

9in MONITOR made for ICL, uses Phillips black and white tube. Brand new and complete but uncased. £16.00 plus £5.00 post.

ACORN COMPUTER DATA RECORDER REF ALF03 Made for the Electron or BBC computers but suitable for most others. Complete with mains adaptor, leads and handbook. £10.00. Ref 10P44.

POWERFUL IONISER Uses mains transformer. Generates approx. 10 times more ions than the normal diode/cap ladder circuits. Complete kit £11.50 plus £3.00 post.

FREE POWER! Can be yours if you use our solar cells—sturdily made modules with new system bubble magnifiers to concentrate the light and so eliminate the need for actual sunshine—they work just as well in bright light. Voltage input is .45—you join in series to get desired voltage—and in parallel for more amps. **Module A** gives 100mA, Price £1, Our ref. BD631. **Module C** gives 400mA, Price £2, Our ref. 2P199. **Module D** gives 700mA, Price £3, Our ref. 3P42.

SOLAR POWERED NI-CAD CHARGER 4 Ni-Cad batteries AA (HP7) charged in eight hours or two in only 4 hours. It is a complete, boxed ready to use unit. Price £6. Our ref. 6P3.

50V 20A TRANSFORMER 'C' Core construction so quite easy to adapt for other outputs—tapped mains input. Only £25 but very heavy so please add £5 if not collecting. Order Ref. 25P4.

SWITCH AC LOADS WITH YOUR COMPUTER This is easy and reliable if you use our solid state relay. This has no moving parts, has high input resistance and acts as a noise barrier and provides 4kW isolation between logic terminals. The turn-on voltage is not critical, anything between 3 and 30V, internal resistance is about 1K ohm. AC loads up to 10A can be switched. Price is £2 each. Ref. 2P183.

METAL PROJECT BOX Ideal size for battery charger, power supply etc.; sprayed grey, size 8in x 4¼in x 4in high, ends are louvred for ventilation other sides are flat and undrilled. Order Ref. 2P191. Price £1.

BIG SMOOTHING CAPACITOR. Sprague powerlytic 39,000uF at 50V. £3. Our ref. 3P41.

4-CORE FLEX CABLE. Cores separately insulated and grey PVC covered overall. Each copper core size 7/0.2mm. Ideal for long telephone runs or similar applications even at mains voltage. 20 metres £2. Our ref.2P196 or 100 metres coil £8. Order ref. 8P19.

6-CORE FLEX CABLE. Description same as the 4-core above. Price 15 metres for £2. Our ref. 2P197 or 100 metres £9. Our ref. 9P1.

TWIN GANG TUNING CAPACITOR. Each section is .0005uF with trimmers and good length ¼in spindle. Old but unuse3d and in very good condition. £1 each. Our ref. BD630.

13A PLUGS Good British make complete with fuse, parcel of 5 for £2. Order ref. 2P185.

13A ADAPTERS Takes 2 13A plugs, packet of 3 for £2. Order ref. 2P187.
20V-0-20V Mains transformers 2½ amp (100 watt) loading, tapped primary. 200-245 upright mountings £4. Order ref. 4P24.

BURGLAR ALARM BELL—6" gong OK for outside use if protected from rain. 12V battery operated. Price £8. Ref. 8P2.

24 HOUR TIME SWITCH—16A changeover contacts, up to 6 on/offs per day. Nicely cased, intebnded for wall mounting. Price £8. Ref. 8P6.

CAPACITOR BARGAIN—axial ended, 4700μF at 25V. Jap made, normally 50p each, you get 4 for £1. Our ref. 613.

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 two vibrating arms. It is American made, mains operated, very economical and causes no interference, so is ideal for computer and instrument cooling. Price is only £1 each. Ref. BD598.

SPRING LOADED TEST PRODS—Heavy duty, made by the famous Bulgin company. very good quality. Price 4 for £1. Ref. BD597.

ASTEC P.S.U.—Switch mode type. Input set for +230V. Output 3.5 amps at +5V, 1.5 amps at +12V, and 3 amps at +5V. Should be OK for floppy disc drives. Regular price £30. Our price only £10. Ref. 10T34. Brand new and unused.

APPLIANCE THERMOSTATS—Spindle adjust type suitable for convector heaters or similar. Price 2 for £1. Ref. BD582.

3-CORE FLEX BARGAIN No. 1—Core size 5mm so ideal for long extension leads carrying up to 5 amps or short leads up to 10 amps. 15mm for £2. ref. 2P189.

3-CORE FLEX BARGAIN No. 2—Core size 1.25mm so suitable for long extension leads carrying up to 13 amps, or short leads up to 25A. 10m for £2. Ref. 2P190.

ALPHA-NUMERIC KEYBOARD—This keyboard has 73 keys giving trouble free life and no contact bounce. The keys are arranged in two groups, the main area is a 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.

WIRE BARGAIN—500 metres 0.7mm solid copper tinned and p.v.c. covered. Only £3 plus £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 infra-red or ordinary light is broken. Main components—relay, photo transistor, resistors and caps, etc. Circuit diagram but no case. Price £2. Ref. 2P15.

1/8th HORSEPOWER 12 VOLT MOTOR Made by Smiths, the body length of this is approximately 3in, the diameter 3in and the spindle 5/16th of an inch diameter. It has a centre flange for fixing or can be fixed from the end by means of 2 nuts. A very powerful little motor which revs at 3,000rpm. We have a large quantity of them so if you have any projects in mind then you could rely on supplies for at least two years. Price £6. Our ref 6p1, discount for quantities of 10 or more.

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**
CA3085 T099 Variable regulator **£1**
LM338 5A variable **£5**

COMPUTER ICS
8741 Micro Ex equipment **£1.30**
8039 Ex equipment **£1.00**
4164-15 Ex Eqpt **£1**
27128 250n® NEW **£3.00**
68008 Processor Ex-Equip **£5**
27256-30 wiped and verified **£3.00**
2764-30 2176 USED **£2**
1702 EPROM ex equip **£5.00**
2732-45 2716 USED **£2** ..... **100+£1.50**
2114 EX EQPT 60p 4116 EX EQPT **70p**
4416 RAM **£3.50**
ZN427E–8 ..... **£4.00**
ZN428E–8 ..... **£4.00**
41256-15 USED **£4**
41256-12 USED **£4.50**
41256-10 Surface Mount Ex. New Boards **£4**
HD146818 Clock Chip **£2**
2864 EEPROM **£6**
51mm Modules 9x41256-15 New **£36**

CRYSTAL OSCILLATOR
1.8342MHz ..... **2/£1.50**

SIL RESISTOR NETWORKS
8 pin 10K 22K ..... **5/£1.00**
9 pin 22K ..... **5/£1.00**
10 pin 68R 180R 22K ..... **5/£1.00**

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 1000/£30

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, TIP110, 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
TEXTOOL single inline 32 way. Can be ganged for use with any dual inline devices ..... **2/£1.50**

MISCELLANEOUS
BNC to croc clips lead 1 metre **£1**
Small Microwave Diodes AEI DC1028A ..... **2/£1**
Moulded inductor 470uH size of a 1 watt film resistor ..... **5/£1**
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**
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 1/25ohm 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**
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**
ELECTRET MICROPHONE INSERT **£0.90**
Linear Hall effect IC Micro Switch no 613 SS4 sim RS 304-267 ..... **£2.50 100+ £1.50**
Hall Effect IC UGS3040 + MAGNET **£1.00**
OSCILLOSCOPE PROBE SWITCHED X1X10 **£10**
CHEAP PHONO PLUGS ..... 100/**£2 1000/£18**
1 pole 12 way rotary switch ..... **4/£1**
AUDIO ICS LM380 LM386 ..... **£1 ea**
555 Timer 5/£1 741 Op AMP ..... **5/£1**
COAX PLUGS nice ones ..... **4/£1**
4 x 4 MEMBRANE KEYBOARD **£1.50**
15.000uF 40V SPRAGUE ..... **£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 ..... **10/£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)**
Op amp LM10 CLN **£2.90**
Powerful small magnets ..... **3/£1**
12 Volt CO-AX relays similar to RS349-686 with short BNC Tails. Change over contracts **£6**
Sonnerschein dryfit batteries 12 Volt 20 A/HR
£20 (£3.50 carr)
Multicore cable 12 core 7/0. 2mm screemed
£1 for 3 metres

ZENERS
5.6V 1W3 Semikron 49K available **£25/1000**
Supressor OF606 120V BI Directional Zener in 3 amp W/E package ..... **5/£1.00**

DIODES & RECTIFIERS
1N4148 ..... **100/£1.50**
1N4004/SD4 1A 300V ..... **100/£3**
1N5401 3A 100V ..... **10/£1**
BA158 1A 400V fast recovery ..... **100/£3**
BA159 1A 1000V fast recovery ..... **100/£4**
120v 35A stud **65p**
12 FL10 12A 200V small stud ..... **4/£1.50 100/£25**
BY127 1200V 1.2A ..... **10/£1**
BY254 800v 3A ..... **8/£1**
BY255 1300v 3A ..... **6/£1**
6A 100V Similar MR751 ..... **4/£1**
1A 800v bridge rectifier ..... **4/£1**
4A 100V bridge ..... **3/£1**
6A 100v bridge **50p**
8A 200V Bridge ..... **2/£1.25**
10A 200v bridge **£1.50**
25A 200v bridge £2 ea ..... **10/£18**
25A 400v bridge £2.50 ..... **10/£22**

SCRs
2P4M equiv C106D ..... **3/£1 100/£20**
MCR72-6 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
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 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 4R7 5R0 5R6 8R2 10R 12R 15R 18R 20R 22R 27R 33R 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 **R05 (50 milli-ohm) 1% 3W ..... 4 for £1**
W22 or Sim 6W ..... 7 of one value £1
R47 1R0 1R5 3R3 6R8 9R1 10R 20R 27R 33R 51R 56R 62R 68R 100R 120R 180R 390R 500R 560R 620R 910R 1K0 1K2 1K5 1K8 2K7 3K3 3K9 4K7 **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 200R 220R 270R 400R 620R 6K8 8K2 1K0 10K 15K

WIRE WOUND RESISTORS — BOLT ON HEATSINK TYPE
10 watt 39R, 180R ..... **40p each**
25 watt R33, 1R2, 1R5, 4R7, 25R, 100R ..... **50p each**
50 watt 3R3, 5R1, 18R, 27R ..... **60p each**

PHOTO DEVICES
BPW50 Infra red photo Diode ..... **3/£1**
Slotted opto-switch OPCOA OPB815 ..... **£1.30**
2N5777 ..... **50p only**
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**
LEDS assorted RD/GN/YW + INFRA/RED ..... 200/**£5**

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

CERMET MULTI TURN PRESETS 3/4"
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 5 to 50pF, 2 to 22pF Transistors **60p**
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**
Miniature relays suitable for RF 5 volt coil 1 pole changeover **£1**
12 volt coil 1 pole changeover **£1**

POLYESTER/POLYCARB CAPS
1uF 100v 10mm SIEMENS block polycarb 10k available 1000/**£80**
1n/3n3/5n6/8n2/10n 1% 63v 10mm ..... **100/£6**
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
6UB 25V, 47U 3V, 2U2 20V, 10U 10V ..... 12/**£1**. ..100/**£6**

MONOLITHIC 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**
100n 50v RAD 0.3" centres ..... 100/**£10**

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

KEYTRONICS

MAIL ORDER ONLY
P.o. Box 634
Bishops Stortford, Herts, CM23 2RX
☎ 0279 505543 : FAX 0279-757656

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