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The communications and electronics magazine

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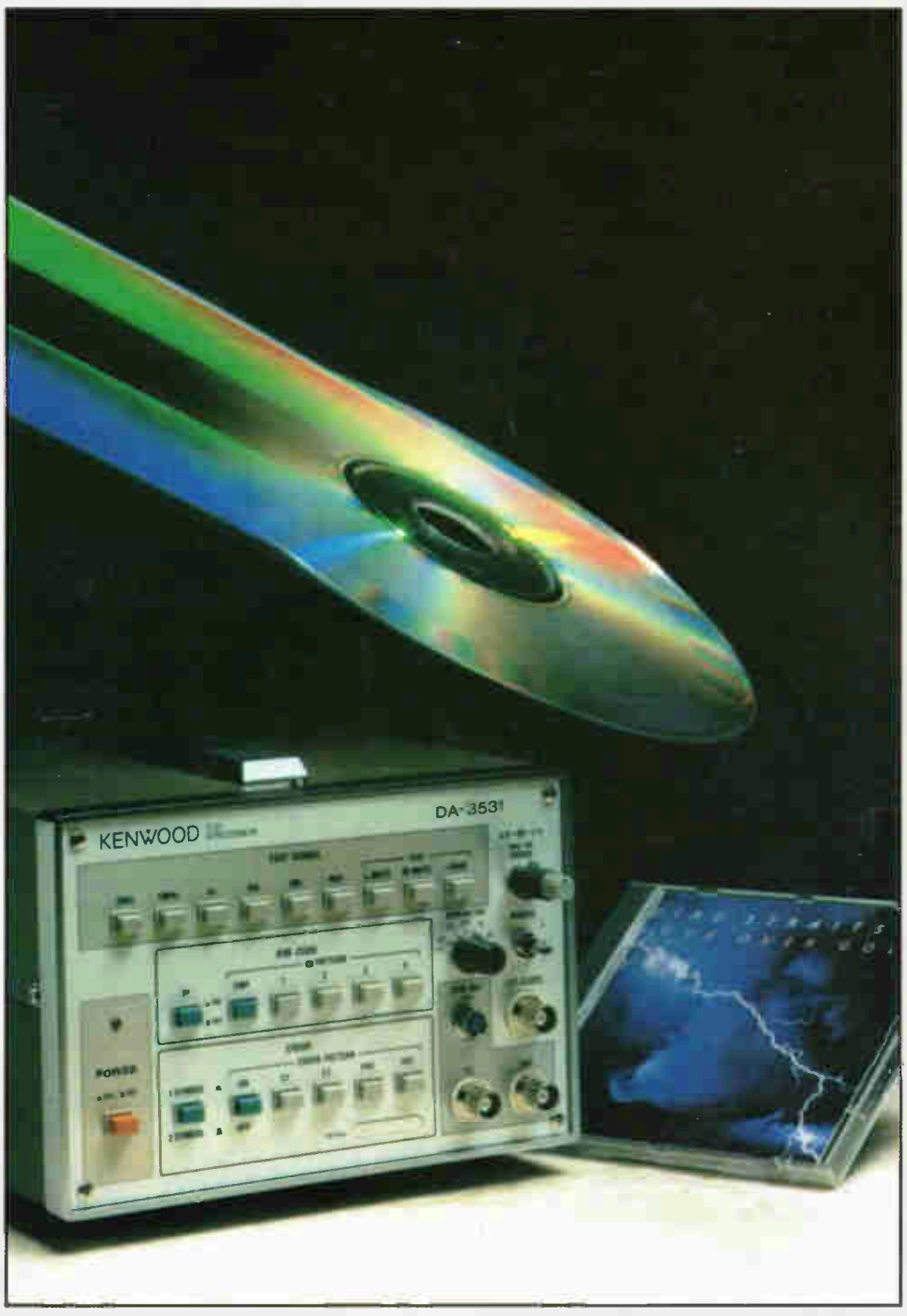

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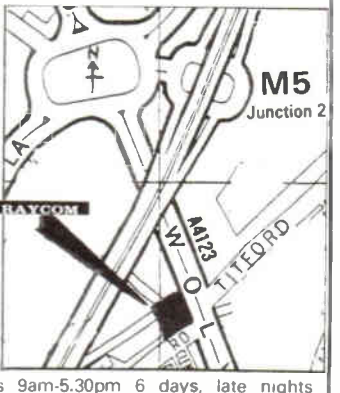

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CONTENTS

ON THE COVER

This month's cover features the Kenwood DA-3531 CD encoder, a reference signal generator to evaluate CD players. It is one of a range of professional CD test instruments available from Thurlby Electronics. For further details tel: (0480) 63570

PUBLISHER'S ANNOUNCEMENT

You may have noticed that the cover price has increased. This had been made necessary because of continually increasing paper and production costs.

As we are publishing a very specialised magazine, appealing to a dedicated band of readers, we are subject to higher unit production costs than other magazines of more general appeal. Our research indicates that the magazine content is what you have asked for, so in order to continue publishing ***Radio & Electronics World*** for you, we need to charge an economic cover price.

I hope you continue to enjoy the magazine.

Best wishes

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Iain Mackenzie
Penny Phillips

Advertisement Manager
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Safety in the shack

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

When building any constructional project, bear in mind that sometimes high voltages are involved. Avoid even the slightest risk – safety in the shack please, at all times.

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AC176K	0.31	BC212L	0.09	BD437	0.60	BFR91	1.75	OC26	1.50	2N2905	0.40
AC187	0.25	BC213	0.09	BD438	0.75	BFT42	0.35	OC28	5.50	2N3053	0.40
AC187K	0.28	BC213L	0.09	BD510	0.95	BFT43	0.35	OC29	4.50	2N3054	0.59
AC188	0.25	BC214	0.09	BD518	0.75	BFW10	0.55	OC32	5.50	2N3055	0.52
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BC108B	0.12	BC527	0.20	BF179	0.34	BSX60	1.25	RCA16039	0.85	2SC785	0.75
BC109	0.10	BC547	0.10	BF180	0.29	BT100A/02		RCA16181	0.85	2SC789	0.55
BC109B	0.12	BC548	0.10	BF181	0.29		0.85	RCA16334	0.90	2SC931D	0.95
BC109C	0.12	BC549A	0.10	BF182	0.29	BT106	1.49	RCA16335	0.85	2SC937	1.95
BC114A	0.09	BC550	0.14	BF183	0.29	BT116	1.20	RCA16572	0.85	2SC1034	4.50
BC115	0.56	BC557	0.08	BF184	0.35	BT119	3.15	S2060D	0.95	2SC1096	0.80
BC116A	0.55	BC558	0.10	BF185	0.28	BT120	1.65	SKE5F	1.45	2SC1106	2.50
BC116A	0.50	BC639/10	0.30	BF194	0.11	BU105	1.95	T602IV	0.45	2SC1124	0.95
BC117	0.19	BCY33A	19.50	BF195	0.11	BU108	1.69	T6027V	0.45	2SC1162	0.95
BC119	0.24	BD115	0.30	BF197	0.11	BU124	1.25	T6029V	0.45	2SC1172Y	2.20
BC125	0.25	BD124P	0.59	BF198	0.16	BU125	1.25	T6036V	0.85	2SC1173	1.15
BC139BC	0.20	BD131	0.42	BF199	0.14	BU126	1.60	T9002V	0.55	2SC1364	0.50
BC140	0.31	BD132	0.42	BF200	0.40	BU204	1.55	T9011V	0.75	2SC1413A	2.50
BC141	0.25	BD133	0.50	BC240	0.20	BU205	1.30	T9015V	2.15	2SC1449	0.50
BC142	0.21	BD135	0.30	BF241	0.15	BU208	0.95	T9034V	2.15	2SC1628	0.75
BC143	0.24	BD136	0.30	BF245	0.30	BU208A	1.15	T9038V	3.95	2SC1678	1.50
BC147B	0.12	BD137	0.32	BF256LC	0.35	BU208D	1.35	THY15/80	2.25	2SC1945	3.75
BC148A	0.09	BD138	0.30	BF257	0.28	BU326	1.20	THY15/85	2.25	2SC1953	0.95
BC149	0.09	BD139	0.32	BF259	0.28	BU326S	1.50	TIP25	0.40	2SC1957	0.80
BC153	0.30	BD140	0.30	BF271	0.28	BU407	1.24	TIP29C	0.42	2SC1969	2.95
BC157	0.12	BD144	1.10	BF271	0.26	BU408	1.50	TIP30C	0.43	2SC1985	1.50
BC159	0.09	BD150C	0.29	BF273	0.18	BU500	2.25	TIP31C	0.55	2SC2028	1.15
BC161	0.55	BD159	0.65	BF335	0.35	BU508A	1.95	TIP32C	0.42	2SC2029	1.95
BC170B	0.15	BD160	1.50	BF336	0.34	BU526	1.90	TIP33C	0.95	2SC2091	0.85
BC171	0.09	BD166	0.50	BF337	0.29	BU807	2.25	TIP34B	0.95	2SC2098	2.95
BC171A	0.10	BD179	0.72	BF338	0.32	BUY20	2.15	TIP41A	0.45	2SC2314	0.80
BC171B	0.10	BD182	0.70	BF355	0.37	BUY69B	1.70	TIP41C	0.45	2SC2371	0.36
BC172	0.10	BD201	0.50	BF362	0.38	BUY71	2.50	TIP42C	0.47	2SC931D	0.95
BC172B	0.10	BD202	0.50	BF363	0.65	BUV41	2.50	TIP47	0.65	2SD325E	1.55
BC172C	0.10	BD203	0.50	BF371	0.25	MJ3000	1.98	TIP48	0.65	2SK19	0.55
BC173B	0.10	BD204	0.70	BF394	0.19	MJE340	0.40	TIP50	0.65	2SK33	0.55
BC174A	0.09	BD222	0.46	BF422	0.32	MJE350	0.75	TIP120	0.60	2SK105H	1.50
BC177	0.15	BD223	0.59	BF423	0.25	MJE520	0.48	TIP125	0.65	3SK88	0.95
BC178	0.15	BD225	0.45	BF457	0.32	MJE2955	0.95	TIP142	1.75		
BC182	0.10	BD232	0.35	BF458	0.36	MPSA13	0.29	TIP146	2.75		
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BY182	0.55	1N4148	0.02
BY184	0.35	1N4448	0.10
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LOOKING AT THE LONG-TAILED PAIR

by Samuel Dick

Have you ever wanted a circuit which had lots of gain, rejects noise, and had a choice of single or balanced outputs? Perhaps even one which worked into the low megahertz region? Well, look no further. It's called the long-tailed pair, it's easy to design and make, and is one of the fundamental building blocks of electronics.

The first question about the circuit is why is it called the long-tailed pair? There is a simple answer to that – just look at *Figure 1*. It can be seen that the circuit consists of two transistors (the pair) with a high-valued resistor connected in common with the emitters of the transistors; this resistor gives the circuit its long tail.

The long-tailed pair is a differential amplifier. Indeed, it is probably the most commonly used configuration for this type of amplifier. Differential amplifiers are very important in electronics because they allow us to take in two signals at the same time and then to amplify the difference between the two signals.

The main reason why differential amplifiers are important is that they can reject noise. Take, for example, the case of two electrodes placed on the chest of a patient in hospital to pick up the faint electrical signals which come from the heart. These signals are in the microvolt region and the wires which carry the signal, although shielded, have to pass several items of mains powered equipment. The wires will pick up noise in the form of electrical signals from this and other electrically powered equipment in the room – eg the fluorescent lighting. The saving feature of this unwanted noise is that both wires will pick up the identical amount of noise (at least, in an ideal case) but will pick up the positive and negative signals from the patient.

So while we want the very small (differential) signals from the patient to be amplified we do not want the huge noise signals (in common to both inputs) to be registered at all. Enter the differential amplifier. The noise which appears as identical signals on both inputs to the amplifier will be rejected while the gain of the amplifier will be used to magnify the wanted signal. Of course, medical electronics is only one field where these devices are useful.

Another common use of the long-tailed pair is in audio equipment where a long line may be used to take the signal from a microphone on stage, say, to a power amplifier some metres away. They are also at the heart of every operational amplifier – even the humble 741. Differential amplifiers also have a very common use in digital circuits. Just as noise corrupts faint analogue signals it can also play havoc with the digital levels used by computers. So, again, the differential amplifier is used to reject the unwanted noise and to allow the wanted signal to pass, suitably amplified, to the computer. This function is so important that there are many chips devoted to the task of transmitting and receiving differential signals. For example, the 75110 and 75107 driver/receiver combination or the 75115 chip which can be driven by open-collector drivers.

Of course, the unwanted signal which the long-tailed pair is so good at rejecting need not be noise, it might be a steady state signal such as a dc level. For example, the configuration will allow any thermal drift in the two transistors to be nulled out. There will, of course, be some drift because the two transistors will not have exactly the same. If a dual transistor is used the drift will be very well matched; dual transistors are fabricated close to each other on the same minute piece of silicon and this allows their parameters to be matched. They both experience the same temperature too.

Looking at *Figure 1*, it can be seen that there are two output points from the long-tailed pair. Both do not have to be used. If a single output is needed then only one will be used while if a balanced output is required (perhaps for driving a balanced or differential line) then both can be used because the output from one is opposite in phase to the other.

Later, more applications of the long-tailed pair are considered – its use in radio frequency amplifiers is of particular interest.

Some jargon and calculations

Figure 1 shows the circuit to be

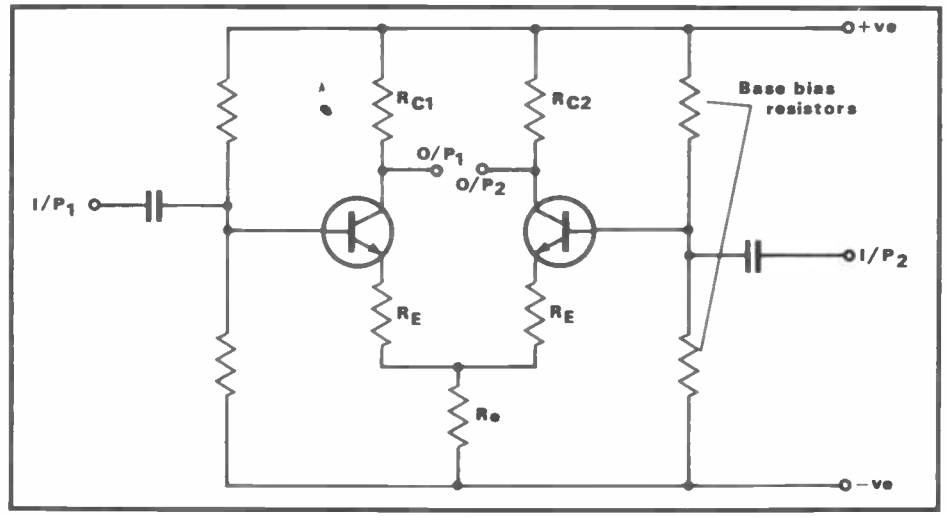


Fig 1: *Symmetric circuit of the long-tailed pair*

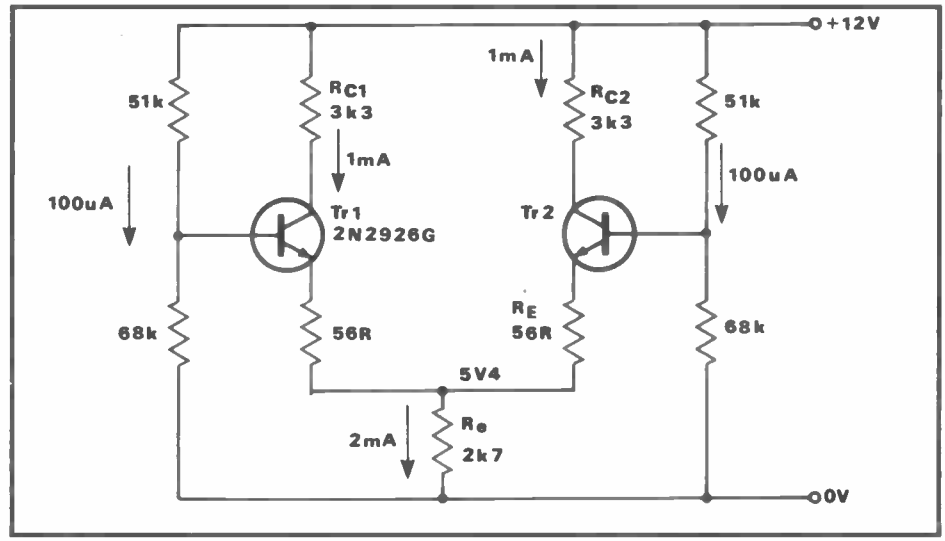


Fig 2: *Example of calculations*

completely symmetric. As mentioned before, the name comes from the fact that the resistor, R_e, which is connected to the emitters of both transistors is much larger than the two resistors, R_c1 and R_c2, which are connected to the collectors and so R_e has a large voltage across it – the long tail.

When the two inputs have identical voltages applied to them these are known as *common-mode* inputs; inputs to the two transistors which are different are known as *normal* or *differential*. One of the great strengths of the long-tailed pair is its ability to reject common-mode inputs. The measure of this ability is the *common mode rejection ratio* or CMRR. This is calculated as follows. Suppose that the same signal, V_{in}, is applied to both inputs. Because of imperfections, a small output voltage, V_1, will be generated. If another signal, V_{in}, was applied to one input only and it resulted in an output voltage, V_2, being generated, then the CMRR is the ratio of V_{in} to V_{in} when V_1 equals V_2. For simple designs with discrete transistors, this ratio might be only 100 but for more complex designs it can reach 10^5 or more.

The differential gain is $R_c/(r_e+R_E)$. Now R_c and R_E are both shown in *Figure 1* but r_e is a resistance which is internal to the transistor and has a value which is roughly $25/I_c$ in ohms where I_c is the collector current measured in milliamps.

The gain for common-mode signals is $-R_c/(2R_e+R_e+r_e)$. Remember that the common-mode gain should be small!

Let us design a simple long-tailed pair. *Figure 2* shows the results. The collectors of both transistors are set at voltages which will allow a good variation without clipping caused by the collector trying to exceed the supply voltage; the voltage across R_e is quite large because this resistor needs to act like a constant current sink – ie, it will have roughly the same current passing through it regardless of the voltage variations at the emitters of the transistors. The constant current action of this resistor is central to the way the long-tailed pair works; a drop in current through one transistor is balanced by an increase in the current through the other. So when the voltage level on one output rises, the other output drops.

Therefore, R_e has quite a large value. If we choose the current through each transistor to be 1mA then R_e has 2mA passing through it. For a 12 volt supply, we'll make R_e have about 6 volts across it and choose the collector voltages to be at the halfway point between this voltage and the supply – ie about 9 volts. This means that R_c is 3.3kohms and R_e is 2.7kohms. With R_E set at 56 ohms, the differential gain will be 20, the common mode gain 0.6 and the CMRR will be 33: not a very ambitious amplifier!

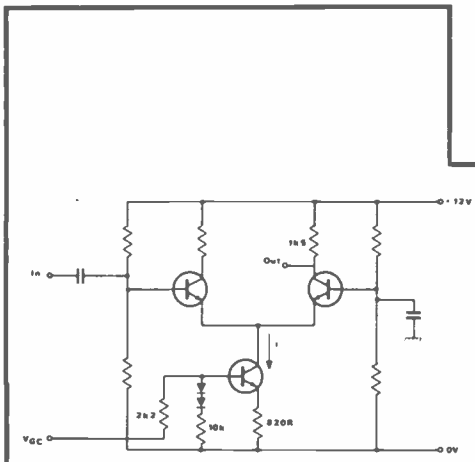
The base voltage of the transistors is set to be 600mV higher than the emitter voltage using a simple potential divider.

Variations on a theme

Now that we have seen how the basic circuit fits together, there are a number of interesting variations which broaden the range of applications where the long-tailed pair may be used.

Figure 3 shows the first variant. Here, a constant current arrangement is put into the tail instead of the resistor. Since constant current sources have a very high impedance, the common mode gain becomes very small which means that the circuit is good at rejecting noise. The differential gain, which depends on r_e and hence the collector current, can be altered by changing the current passing through the tail. This makes a neat gain-controlled amplifier and *Figure 3* shows how the gain varies with the current.

While on the subject of current controlled configurations, a current mirror can be used as the load 'resistor' for the transistors. While a full explanation of current mirrors is outside the scope of this article, it is sufficient to say that the current drawn by Tr1 is mirrored into Tr2, because the current mirror tries to maintain the same current on both its outputs. The result of this configuration is that the differential gain of the circuit is very high – several thousand – and so the circuit makes an ideal comparator. In a comparator, the output voltage is either high or low; it operates like a



VGC	i	Gain
6	6mA	50
2.4	2.4	20
1.2	1.2	10
0.6	0.6	5
0.25	0.25	2

Fig 3: *Diagram showing a constant current tail*

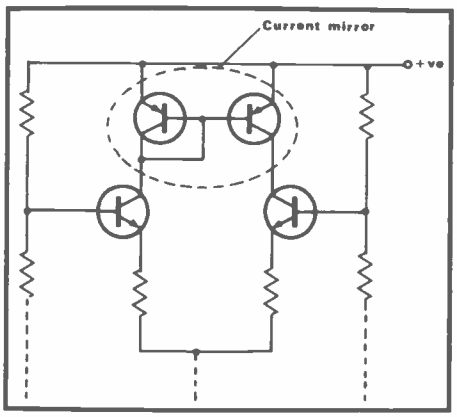


Fig 4: *Current mirror load*

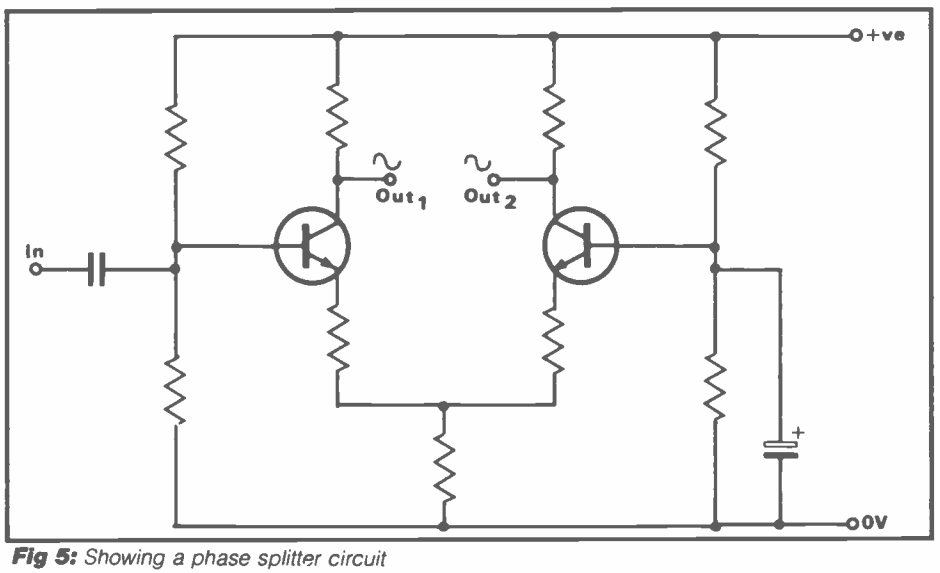


Fig 5: *Showing a phase splitter circuit*

digital circuit. Which state the output is in depends on the difference between two input voltages. So, by having a very high gain amplifier using these voltages as its inputs, the output of the amplifier will saturate to either the high or low level with a very small relative change in the input signals (see *Figure 4*).

Figure 5 shows the long-tailed pair in its single-ended mode. By using a capacitor to bypass all ac signals at the base of one of the transistors to ground, only one input is used. However, both outputs can be used. Since the outputs are opposite in phase, the circuit may be used as a phase splitter; balanced loads may be driven from a single input.

The final variant described is shown in *Figure 6*. The long-tailed pair has a rather special property which makes it suitable for use as a radio-frequency amplifier. This property is the circuit's ability to beat the Miller effect.

The Miller effect is explained as follows. Between the collector and the base of any transistor there is a small capacitance called C_{cb}. Assuming that we are taking the output of the transistor from its collector, a small input voltage at the transistor base will create an output voltage at the collector which is bigger by the gain of the transistor. This larger signal is directed back to the base through C_{cb} and makes the capacitor appear to be of higher value than it actually is – so a large value capacitor appears to be connected to the base. The (high frequency) signals applied to the base use the capacitor as a path to ground and so are partly lost.

By using the long-tailed pair with no collector resistor on the first transistor there is no multiplying factor and the Miller effect disappears. Hence the circuit is suited to RF applications. The circuit shown in *Figure 6* has useful gain up to a few megahertz despite using common transistors.

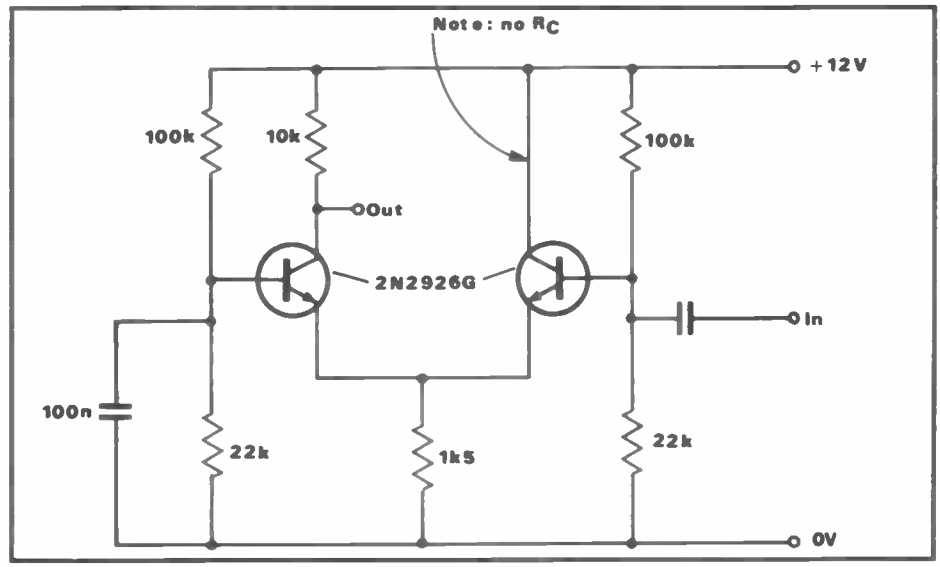


Fig 6: *RF amplifier circuit*

DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

As anticipated, August showed a steady fall in Sporadic-E activity, especially during the second half of the month. Most of the signals originated within the European area, except for one instance when Morocco showed during the early evening on test card and later programmes. Other forms of propagation provided some worthwhile DX reception during the month. For example, at least three countries were identified in Band III via meteor scatter (MS) DX during the Perseids which peaked on the 12th.

Tropospheric reception was impressive too, especially during the first half of August with 525-line pictures from AFN-TV Soesterberg on the 5th and Switzerland in colour on the 12th.

Early morning goodies

While checking the UHF band for DX reception at 0430 on the 6th, a rather odd-looking test pattern was discovered amid the usual all night screenings from the various UK stations. The signal was extremely strong and clear but without sound. At first it was assumed to have originated from the local Sutton Coldfield transmitter – the BBC may have been carrying out field tests. Further investigations revealed a 5.5MHz sound and vision difference. The test pattern resembled the FuBK, but had part of the cross-hatch showing through a central window. There was no identification present on the pattern, which disappeared at 0450 when the transmitter was switched off.

Another mystery occurred in Band I when the Swiss '+PTT' test pattern was noted via meteor scatter on channels E2 and E4 at 0440! In addition, at 0745 on the 6th, two Dutch stations were seen radiating colour bars with the identification 'PTT-NL-AVVC' superimposed over a black block in the upper portion of the pattern.

Reception reports

Chris Howles of Lichfield experienced what appeared to be tropospheric ducting during the morning of the 12th when the Swiss FuBK test pattern was resolved on channel E34. The signal was strong enough to lock colour. All other channels were inactive and only the Swiss signal was logged. Chris also tells us that Belgium switched over to a new colour test pattern immediately after station sign-off one evening. From his description, it sounds very much like the one received at UHF early on the 5th.

On that day, Chris located a PM5544 test pattern on channel E4 shortly after 1900. As the signal emerged the initials RTM, and their Arabic equivalent, could be clearly seen, confirming the reception of Morocco from the Younne transmitter which is located south of the country. The station eventually opened up and the Koran was shown. This is the first report of Morocco being received this season.

Vigilance from Simon Hamer (New Radnor, in Powys) rewarded him with meteor scatter reception in Band III on the 12th. This was the most productive day for this type of DX reception and his effort brought him YLE-1 from Finland on channel E9, possibly from the Lahti transmitter. The 'YLE-TV1' test pattern was being shown at the time so there was no mistake. It coincided with the appearance of the same test pattern from the E3 (Tervola) and E4 (Vuokatti) outlets in Band I. Other Band III signals that day, which he managed to positively identify, were Sweden on channel E8 and Denmark on channel E5. Band II TV reception was possible on several days. For instance, Russian signals were noted on channel R4 on the 15th.

Simon did well with tropospheric DX, especially the reception of the 525-line AFN-TV station at Soesterberg in the Netherlands. Most RTE transmitters were present during an opening to Eire on the 7th, including a mystery RTE-1 signal on channel E in Band III – there are no high-power outlets listed on this channel.

DX-TV log for August

The reception log for August comes from Simon Hamer. The names of transmitters are included where these are known.

04/08/88: YLE-1 (Finland) on channel E3 (Tervola) via meteor scatter DX, identified from the 'YLE-TV1' FuBK test pattern.

5/08/88: All tropospheric DX reception consisting of NED-1 (Netherlands) on channels E4 (Lopik), E5 (Roermond), E6 (Smilde), E7 (Markelo) and E39 (Wieringermeer); NED-2 E45 (Wieringermeer) and E47 (Smilde); NED-3 E30 (Lopik), E34 (Roermond), E35 (Goes) and E42 (Wieringermeer); AFN-TV (American Forces TV) on channel A80 from Soesterberg (Netherlands); RTBF-1 (Belgian French-language service) E3 (Liège), E8 (Wavre) and E11 (Léglise); RTBF-2 E42 (Liège); BRT-1 (Belgian Flemish language network), E10 (Wavre) and E43 (Egem); BRT-2 E46 (Egem) and E62 (Schoten); RTL PLUS (Luxembourg) E7 (Dudelange); WDR-1 (West Germany-Westdeutsches Fernesehen) E9 (Langenberg) and E32 (Münster); NDR-1 (Norddeutscher Rundfunk) E10 (Harz-West); ZDF (Zweites Deutsches Fernsehen) E27 (Hochsauerland), E34 (Niebüll), E35 (Kiel or Buderich/Wesel) and E37 (Lüdenscheid); DDR:F1 (East Germany) channel E6 (Brocken); DDR:F2 E34 (Brocken); DR (Denmark) E5 (Aalborg) and E8 (Aarhus); NRK (Norway) E6 (Bjerkreim).

06/08/88: Similar reception to the 5th but with the following additions: DDR:F1 E5 (Inselsberg), E11 (Schwerin) and E12 (Sonneberg); DR E7; NRK E8 (Bokn), Sporadic-E reception included TVE-1 E2 and E4; RTP (Portugal) E3 (Lousa); RTS (Albania) channel IC (Tirana); RAI UNO (Italy) IA and IB; ORF-1 (Austria) E2a (Jauerling) and E4 (Patscherkofel); TSS (Russia) R1 and R2.

07/08/88: Tropospheric reception from RTE-1 (Eire) on channels B (Maghera), D (Cork), E (unknown origin), F (Kilkenny), I (Sligo), 29 (Three Rocks – Dublin), 40 (Cairnhill) and 52 (Clermont Cairn – vertical polarisation); RTE-2 on channels G (Sligo or Cork), H (Maghera), I (Kilkenny), J (Dublin), 33 (Three Rocks – Dublin), 43 (Cairnhill) and 56 (Clermont Cairn – vertical polarisation), Sporadic-E reception included RUV (Iceland) on E3 (Stykkisholmur) and E4; MTV-1 R1 (Budapest) and R2 (Pecs).

08/08/88: DR E3 (Fyn) and E4 (Copenhagen); NDR-1 E4 (Flensberg); BR-1 (West Germany – Bayerischer Rundfunk) E2 (Grünten); SVT-1 (Sweden) E2; NRK E2 (Gulen); CST (Czechoslovakia) R1; TVP-1 (Poland) R1 and R2; TSS R1, R2 and R3; RAI UNO IA and IB; TVE-1 E2, E3 and E4; +PTT SRG 1 (Switzerland, German-language network) E2 (Bantiger).

12/08/88: Meteor scatter activity included DR E3, E4 and E5; SVT-1 E4 and E8; YLE-1 E3, E4 and E9; RUV E4; TVP R1 and R2; CST R2; NRK E4.

15/08/88: CST R1 and R2; TVP R1 and R2; MTV-1 R1 and R2; TSS R1, R2, R3 and R4; RAI UNO IA and IB; DR E3 and E4; TVE-1 E2, E3 and E4; TVE-2 E2 (Santiago); +PTT SRG 1 E2 and West Germany (unidentified region) E2.

16/08/88: SVT-1 E2, E3 and E4; NRK E4; NRK E2 (Gulen); DR E3 and E4.

30/8/88: TVP R1 and R2; CST R1.

Canal Plus sightings

It seems the French Canal Plus network in Band I has expanded with at least two new high-power outlets in service. During the 1986 season, Canal Plus was often received on channel L3 (just above R2) from the south during Spanish openings, presumably from the Carcassonne outlet. Already this season, the remaining two French Band I allocations, channels L2 (slightly above E3) and L4 (above E4), have been evident,

particularly during openings to the south-east. We assume the proposed Bastia L2 outlet and Ajaccio L4 outlet have now entered service, or increased their power. Both transmitters are located in Corsica, which explains why they often accompany Italian signals.

Scrambled pictures

Vision and sound are encrypted which means the picture verticals appear ragged with almost inaudible sound. The French TV system is unusual. Even in the early days of television, they opted for an odd TV standard composed of 819 lines. Fair enough, it was a high-definition system with a vision bandwidth of about 11MHz, compared with a modest 3MHz or so in the UK. To cram a sufficient number of channels into the VHF bands, the French used a method of interleaving, whereby some sound carriers would be above the vision and some below. Goodness knows what the IF circuitry looked like in their TV receivers!

After re-engineering, the 625-line system was chosen for the VHF bands. Positive-going video modulation is employed, as opposed to negative-going used in every other country. The sound is strange too – amplitude modulation is used rather than the intercarrier system. For UHF and Band III broadcasting, the sound carrier is located 6.5MHz above the vision frequency but in Band I the sound carrier is situated 6.5MHz (AM) *below* the vision frequency. When encrypted, it can produce confusing-looking carriers at various points throughout the band. In fact, it resembles an FM carrier. For instance, the L2 sound carrier is on 49.25MHz and when received during such transmissions it produces a blank raster, not unlike cordless 'phone interference over channel R1! The vision signal is easy to recognise as it appears negative (white looks black) because of the inverted video modulation used for the French system. The SECAM colour system is used for both normal and encrypted broadcasts.

DX-TV on video

A new thirty-minute video with commentary is now available from HS Publications which provides an interesting insight into the TV DXing hobby. Following on from the first cassette in the series, in Part 2 a typical DX-TV installation is explored showing receiving aerials and the various pieces of equipment in action. Needless to say, the effects of Sporadic-E and tropospheric openings are also illustrated.

The video retails at £14.50 (including p&p in the UK, or £17.00 by airmail). The required video format (VHS or Beta) should be stated when ordering. The cassette is available from: HS Publications, 7 Epping Close, Derby DE3 4HR. Tel: (0332) 381699.

Service information

New Zealand: The TV3 network should commence in April 1989 with stereo sound using the NICAM system. It will be divided into four regions but there are a few snags. Due to New Zealand's mountainous topography, especially in the Wellington area, so many translators are required for the existing services that channels 1 – 9 are in full use. This means that any further transmitters will have to use the new New Zealand channels 10 and 11 (or UHF) and neither company wants to do this since so many sets won't receive them!

United Kingdom: Recently, some dramatic developments have taken place in satellite broadcasting. Firstly, there was the announcement of plans for at least three English language services on Astra, to be transmitted in PAL. Then the government announced its plan to discuss with the IBA, BSB (British Satellite Broadcasting) and the BBC, the possibility of transmitting BBC-2 and Channel 4 by satellite only – a rather strange move.

The idea is to use the two spare high-power DBS channels from the five allocated to the UK. BSB will use three, but the other two have not yet been allocated. One option is to put BBC-2 and Channel 4 broadcasts on the high-power satellite which BSB plans to launch next autumn.

This would enable viewers to receive all five channels on one small dish; BBC-2 and Channel 4 would continue to be transmitted terrestrially for a number of years. If, and when, the terrestrial transmissions ceased, the UHF channels could then be released for a number of additional services, which might be regional or national. However, this idea has now been dropped.

The government's future policy on satellite and terrestrial broadcasting is showing a trend towards deregulation and subscription, so viewers can have whatever they want at a price. Subscription television implies that scrambling techniques will be used – this being one of the great benefits of the MAC transmission system. The existing PAL signal is not suited to scrambling, so it comes as no surprise that Rupert Murdoch's recently announced channels on the Astra satellite will have to be funded from advertising. The high-power DBS channels from BSB next year, will all be scrambled, though only the feature film channels will require an actual subscription.

The MAC/packet 'family' of transmission formats was specifically thrashed out in Europe to pave the way for a common receiver for satellite television. The UK was prepared to compromise on its use of the optimum system, C-MAC (developed by the IBA), and decided on D-MAC for DBS, which is suitable for most cable systems. D-MAC also retains the maximum data rate to make the most of multi-channel digital audio and data services. For older European cable systems, D2-MAC, with its half-speed digital element is easily derived but ideally should not be transmitted via satellite.

The full data-rate D-MAC system also has great possibilities for the future. Even in its standard form, pictures will be cleaner, sharper and free from the many defects of PAL. There are options built in for wide screen pictures; potential for higher resolution (both vertically and horizontally) and the virtual elimination of flicker. Within the next decade or so, MAC will allow almost cinema quality viewing in the home. All this can be achieved compatibly, so that standard equipment can remain in use for those not wishing to pay for extra features.

Denmark: Since the end of June, TV2 test transmissions have been aired from the Aabenraa and Hedensted (Vejle) outlets. The PM5534 is used with an individual transmitter identification at the bottom.

West Germany: The channel E46 RTL+/Tele 5 outlet at Hamburg is now operating on full power with 15kW. The planned 10kW ERP of the SAT-1 relay on channel E48, in the Hamburg area, has been amended – it is now only 2kW. The reasons are due to objections from the East German TV service and the interference problems the Hamburg transmitter would cause to NDR-3 Cuxhaven, which operates on the same channel.

RTL+ now has a regional programme for Hamburg on E46 called 'Schlag 6' which is aired between 1800 and 1845 local time, Monday to Friday. A multi-burst pattern or colour bars are sometimes radiated during test periods with 'RTL-PLUS Köln' identification.

Since 5 July, Bremen's private TV station has been on test using channels E29 and E49 for the planned SAT-1 and RTL+ programmes.

SSVC has a new low-power outlet at Goch. The channel used is E23 with vertical polarisation but the ERP is unknown.

Dubai: Sample teletext pages in Arabic are currently being transmitted on channel E2 during test transmission periods. Could this mean the end of the special 'square' version of the PM5544 test card?

Belgium: A new colour test pattern is being aired over the BRT-1 and BRT-2 networks, usually after closedown. In some ways it resembles the familiar FuBK test pattern, but the black centre bar is lower down towards the bottom of the pattern. In the centre there is a window with a distinctive cross. No identification or circle is present.

This month's Service Information was kindly supplied by Gösta van der Linden (Rotterdam, Netherlands), Bertrand Prince (France), and the Independent Broadcasting Authority (United Kingdom). NEW

NIKOLA TESLA'S RADIO MYSTERIES

by David Lazell

Today, there is a revived interest in Nikola Tesla's radio related ideas. A new biography was recently published in the USA, whilst specialist book dealing magazines request original papers and publications. When, for example, a daily newspaper invited readers to imagine aspects of life in the next century, one of the predictions subsequently published could have come straight from the notebooks of Tesla, eighty or ninety years ago. This suggested that a portable radio transmitting device would be available for personal security. Pointed at any potential attacker, the device would effect an immediate, transient paralysis. Though the writer did not add further possibilities, one could assume accompanying use of an inaudible frequency to alert the nearest police mobile.

Such devices would be possible today and Nikola Tesla, though primarily interested in the civilian uses of radio and energy transmission, proposed various defence possibilities. Unfortunately for Tesla, and perhaps for Western democracy, he could not persuade the US military authorities to take his pioneering ideas seriously (at least not until the advent of the First World War). He was an immigrant in a nation of immigrants and, as far as the authorities were concerned, just another inventor in a land of gadget-makers and ideas men. His ideas in robotics certainly anticipated the industrial boom of the 1970s allied to radio control technology.

Little appreciation for his work

Tesla was only one of many aspiring creators of 'artificial life' but he was so advanced in his scientific ideas that his robotic principles were sound. He was keenly interested in the interaction of light energy and human or robotic mechanisms. Though primarily absorbed in radio developments at the time, by 1893 he had proceeded so far with a robot 'obeying orders' by the transmission of oscillating energy, that he was able to arrange a public demonstration in his adopted city, New York.

Tesla's work was little appreciated at first by the US Patents Office in Washington DC.

However, Tesla was already sufficiently well known as a scientist to receive a personal call from the head of the US Patents Office. An outline patent was soon granted.

From the 1890s onwards, Tesla offered his ideas to the US military establishment, but without apparent success. His 'tele-automaton', a radio controlled sea craft with submarine possibilities, worked well in Tesla's own trials in 1898. Had the authorities developed such a device, it could have lessened the effect of U-Boats on allied shipping. Alas, the powers that be on both sides of the Atlantic were still living in the spurs and horses era. When war in Europe was declared in August 1914, only the British Royal Navy had attempted on-going use of radio.

Tesla's work in 'electronic resonance' was so advanced, that robots were highly sensitive to pre-selected frequencies whilst able to ignore others. Of some importance to Tesla was his original work on the high frequency oscillator, ie a singularly effective generator of high frequency oscillations. Having developed this instrument, combining his dynamo with a condenser, Tesla spent much of his time exploring the possibilities of resonance. Transatlantic magazines, published simultaneously with minor variations in Britain and the USA, treated Tesla with respect.

From these technology immersed 1980s, one feels that Tesla (like Edison) entertained the press when the publicity would be useful. It may come as a shock for today's readers to read an article from the 1900s, showing an artist's impression of Tesla seated at what looks like a satellite dish antenna. Like Edison, who all but invented the thermionic valve whilst working on artificial lighting systems, Tesla was interested in expanding the experience of 'ordinary mortals'.

It was left to Tesla to indicate a likely 20th century development: world-wide personal radio communication. The 'wrist-watch two-way radio' beloved of detective stories and comic strips was, among many other things, anticipated by Tesla. Probably his best known idea, and still one offering intriguing possibilities, had to do with wireless transmission of electricity. In London during a lecture to the Royal Institute, and in the USA while attending an academic conference in Philadelphia, Tesla argued that high voltage (10 to 20 million volts) transmission was possible, using receiving and transmission stations several hundred miles apart and operating on an international basis. Here, we have yet to catch up with Tesla's ideas which (as in his ideas on regenerating the growing potential of the soil) could bring famine relief to our hungry world.

Tesla was anticipating a world-wide co-operative order, similar to President Wilson's 'League of Nations'. Ironically, Tesla's great experiment at Long Island where a massive oscillation generator of ten million horsepower was to have been installed, was scrapped at the onset of the First World War. In the 1940s, when Tesla's original biographer, Slavko Boksan, published his absorbing study, it was still possible to find local people who remembered Tesla's 'folly': the wireless power tower equipped with its immense spherical antenna. When the USA entered the war in 1917, the tower was demolished. However, Tesla did not give up the idea and the plan is referred to in a book published in the year of his death (see *On the Way to Electro-War* by Kurt Doberer, 1943).

Weapon against armies

It was perhaps the collapse of those international ideals which created the League of Nations, that revived interest in the use of radio as a weapon against armies. Among research that was considered in the mid 1930s, was the use of ultra short waves (3 to 8m) which would affect phosphorous based compounds in the body. Work on so-called death rays involved the use of ultra short wave frequencies to inhibit blood flow or actually coagulate the blood.

Another idea to disarm armies was to use radiated transmissions which would cause panic and/or apathy among military or even civilian populations. The perfect victory for any aggressor would be keeping property and resources in good condition, whilst killing human beings. In any case, any future thermonuclear attack would be preceded by an electro-magnetic pulse which would render useless communications based on transistorised and/or integrated circuits.

Yet Tesla, who was so often associated with military applications, thought that defence of democratic nations was vital. Andrew Carnegie, the steel maker and philanthropist, thought, as early as 1912, that a League of Nations could prevent war. Not so, responded Tesla, 'peace can only come as a natural consequence of universal enlightenment and the coming together of races, and we are still far from this happy state of affairs'.

Nikola Tesla's greatest invention was a polyphase system of alternating current. The patents were applied for in May 1888 and within weeks, George Westinghouse (1846-1914) had secured exclusive rights to the patents and invited Tesla to join his Electric Company based in Pittsburg. It took a further four years to perfect the system, making it ready for marketing on a US standard of sixty cycles per second.

There followed what might politely be called a friendly rivalry between Edison and Tesla. The great American inventor believed that the high voltages used in the Westinghouse alternating current system, meant that the proposed underground cables would prove a health hazard. Even Edison could be wrong sometimes. An odd by-product of the controversy was the development of the electric chair for convicted murderers. Using alternating current, the 'hot seat' was presented in the more flamboyant newspapers as proof that electricity was dangerous. As indeed it is.

Nikola Tesla anticipated most of today's radio marvels, plus some that haven't arrived in the shops yet. Despite his genius, he was a ham at heart. NEW

ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

The technology of amateur television has a rich history but even careful research in old issues of *CQ-TV* won't tell you a great deal about the equipment in the average TV amateur's shack at any given time. Recording history is not something that most ATV people are prone to, we are too busy trying out new techniques. Since I have more than a passing affection for 'the old stuff', I thought I would jot down a few lines to get established enthusiasts' memories going again, and perhaps interest some more recent recruits to our hobby.

Of course, when I first got involved with ATV a little over ten years ago, I never set out to acquire 'old junk'. I wanted modern equipment but since I could not afford it, I had to make do with cast-offs. In the process, I developed a feel for the outdated technology I have now preserved. It is easy to forget how rapidly things have changed in the television industry, and in our amateur television hobby, during the last decade. (Some people might not think so, looking at the composition of the club's committee!).

Joking apart, it is easy to forget how very different things were then. There was no home video market of course, and even surplus gear was difficult to come by unless you had connections. Video tape recorders were open reel affairs and out of the reach of most amateurs. Cameras were also a problem, at least for a cash hungry beginner. The choice lay between buying a second-hand surveillance camera or building something similar, either from a kit or from raw materials. You were probably looking at an expenditure of at least £100.00 (and you can at least double that figure in today's money). Colour was out of the question, even a colour receiver in the shack was a luxury!

So how did the ATVer of ten or fifteen years ago generate a picture if not with a vidicon camera? Well, many people made do with electronic test patterns, while others produced equally still images from a flying spot slide scanner (FSS) or a monoscope camera. None of these gave real moving pictures, though, and I set my sights on getting hold of a vidicon camera. I soon found out that although it cost £100.00 to build a new camera of indifferent performance from a kit, you could buy a commercial quality one, albeit elderly and second-hand, for just £50.00. Thus, I started on a trail of buying old cameras, refurbishing them and then selling them to get hold of something better. In the process, I stumbled across an amazing range of British and Japanese CCTV equipment; and noted the extinction of the former by the latter.

Ten years on the monoscope and FSS devices, which were already old hat back in 1978, have nearly all been scrapped, while those same cameras I once admired (and could not afford) are now turning up at rallies for pocket money prices. All these are more or less museum pieces now and a modest collectors' market has built up. Mainly for the benefit of these enthusiasts, then, here is a brief survey of some of the equipment I would consider collectable.

1 inch vidicon cameras

One of the oldest and most desirable models is the Sony CVC-2000B. It is extremely compact and was made to accompany the CV-2000 video recorder (imported by EMI Ltd in those days, remember?). It is for the 405-line system (though heretics can easily re-tune it to 625 lines). I picked one up at the Old Warden boot sale for £5.00 last summer, quite a bargain.

Another adjustable 405/625-line camera is the Pye Lynx, so well known that it doesn't require further description. The Pye Lynx is very common at rallies for around £20.00 and comes in several versions. I have one with a four-lens turret on the front. Beware of HT on the remote control socket below – cover this with several layers of insulation tape!

Incidentally, industrial TV used 625 lines from the early 1960s, even before BBC-2 started. The 405-line options were mainly for educational establishments which could not afford to ditch their existing receivers.

A very compact (and heavy) camera is made by Epsylon Industries. This particular model has a nuvistor head amplifier, and the reason it is so compact is that the power supply and camera control unit are in a separate box! Much of Epsylon's early output seems to have been badged for EMI Ltd.

The same organisation later redesigned the camera into a much better machine with the Aztec badge. This was a high performance version, with an alleged 800 lines horizontal definition and was sold by Dixons Technical (remember them?) as the Mirage HD800. I always wanted to find one of these but never succeeded! On the other hand, I did track down the designer, Dennis Beesley, who confessed some doubt as to whether the camera could manage 800 lines! The Aztec was generously built, with conveniently situated back panel test points, together with an ingenious system of enabling the camera to genlock to another video source looped through it.

A very stylish little camera is the Beulah D80S, with a wrap-around case and silver script metal badges on the sides. It gives quite a good picture and I was delighted to pick one up for just £7.50 at the Cranfield boot sale last September. This one has two nuvistors in the head-amp, plus a whole bunch of 'flower-power' geranium transistors. Checking up in *Practical Television*, I was amazed to find that in 1962 this camera cost £220.00, albeit with a small monitor. Yes, that's £220.00 at a time when the magazine it was reviewed in, cost a mere two shillings (10p). The price of the magazine has gone up fifteen-fold, yet a CCTV camera and monitor (of much better quality) can be bought for well under £220.00 now. How times (and values) change.

As well as making industrial cameras, the company also sold a kit for construction by amateurs. The Beukit was advertised in *Practical Television* during 1963 for £48.00 (or sixty-nine guineas assembled and tested). A gallon of petrol cost five shillings (25p) then, and you'll rapidly gather that this was pretty expensive for hobbyists, though ideal as a technical college project. I did once have one of these and its performance was very poor, even after it had been rebuilt with npn (instead of pnp) transistors; the D80S was definitely a much better animal.

George Hammond's Beulah Electronics was a member of the DTV (Direct TV Components) group of companies and had a connection with Derek Pattinson's Crofton Electronics, who also prepared kits of parts for cameras (to their own designs and by Mullard). The company was an early supporter of the BATC and advertised these kits on the back of *CQ-TV* around issue 100. I never owned one of these but Clive, G8EQZ, was pleased with his (it cost enough, so he had to be!).

Probably some of the strangest types of camera were the separate head models made by EMI and Marconi. Looking very similar, these were not unlike a piece of drainpipe 9 inches long with a lens one end and a cable on the other! This camera head contained a vidicon or staticon tube and a head amplifer, plus a small motor for controlling the lens. The remaining electronics were in a camera control unit (CCU) which was the size of a suitcase, and could be installed remotely.

Monitors

Old monitors tend to be very heavy for their size and less desirable to collectors. I would make a couple of exceptions, though. Sony made an interesting transistorised 9in monitor (in moulded

plastic case) to go with their 2100 VTR outfit. Another attractive monitor (in a weird way) is the PM8 8in valve monitor made by Epsylon. This has a round topped steel case in austere grey hammer finish paint, a glass implosion screen across the picture tube and little anodised aluminium labels, all very characteristic of the period. It is also very compact or would seem so, until you see that the power supply is in a separate case almost as large as the monitor itself!

Static picture devices

At one time or another, I think I have owned every model of studio and mobile monoscope camera made by Marconi and Pye, but I have since passed these on to other collectors. The only monoscope I have retained is a French one made by Ondyne and formerly owned by Rediffusion. It uses miniature valves and manages 800 lines resolution with ease. A few of these have sold in recent years for around £50.00. More versatile, but very hard to find, are diascopes or self-illuminated test slide projectors which replace the lens of a normal camera. I have one by Philips (imported by Pye) which takes normal 2 x 2in slides and a French Monital item which uses special round transparencies. The prime purpose of these was for testing vidicon cameras.

Restoration

Having acquired gems like these, the first priority is to get them going and to make them look smart. Most of the items I have bought have worked when switched on, with little more than the odd tweak of a preset. Finding documentation may present a problem, though the BATC has many service manuals in its library. It is worth running up old equipment every few months, as this particularly seems to help keep capacitors in trim.

Cosmetic restoration should be simple. Painted cabinets generally need cleaning with car paintwork restorer and little else. Panel knobs benefit from cleaning with soapy water or meths and an old toothbrush, and if the mains cable is scruffy I replace this (with brown or black cable, not white!) and attach an authentic brown bakelite mains plug (from the 10p boxes at rallies!). Cameras are often missing lenses, for complete authenticity you should replace these with the British made Dallmeyer ones which were normally fitted. These are still commonplace at rallies and are generally ignored in favour of Japanese ones!

I hope that this article has portrayed some of the old junk in a more favourable light, though if I am too successful I may price myself out of the market. At the moment, you can still build up a collection at pocket money prices, so start now while stocks last! Oh yes, if anyone has circuit diagrams for the Sony CVC-2000 or any Beulah or Crofton cameras, please get in touch with me, as I'll be eternally grateful.

NETWORK 934

Andy Emmerson G9BUP

Delta base station

For several years now there have been rumours of a base station to complement the highly successful Delta-1 mobile transceiver. None of these have come true and in fact there has been no base station made for 934MHz since the original offering from Reftec. This, by the way, was a rather tasty piece of work: expensive but elegant and highly prized by owners. It was made in rather small numbers and though I don't know why, the examples I have seen work rather better than the corresponding mobile rigs. Enough of the Reftec base station; if you don't possess one now, you are not very likely to in future!

Getting hold of a Delta-1 is not difficult at present, although it may be soon, and many folk use them as base stations as well as mobiles. They perform equally well as home bases, of course, but some people feel they look a bit bare. The built-in loudspeaker sounds a bit inadequate, and not everyone is happy with the utility look of a power supply and a spaghetti junction of red and black power leads, coax feeders and possibly more wires for preamps, power meters and so on. What would be nice is a console which tidies all this up and does everything in one box . . .

The SEL-2PE from Selectronic (203 High Street, Canvey Island, Essex SS8 7RN. Tel: 0268-691481) is therefore the answer to a maiden's prayer. It comes as a silver grey box (measuring 12x3x8in WHD) into which you drop your transceiver. The console contains a hefty power supply and a loudspeaker, which takes over from the unit built in to the Delta-1. The only wires from the back of the console are the coax feeder and a mains lead for power.

Easy installation

After you have installed your transceiver in the base unit it certainly looks a lot smarter and neater. The cabinet work is in steel, with no sharp corners, covered in a textured silver grey epoxy paint which feels a bit like sand. The front panel is finished in a smooth pearl grey, closely matching the Delta-1's own finish, and carries the Selectronic logo and simple power on/off legends, together with a slotted grille for the loudspeaker. It will not win any prizes for aesthetic design but at least it is plain and workmanlike. The power supply itself is massive and professionally built, using a toroidal transformer to avoid background interference from the transceiver. It is fused internally at 6 amps, so it will have ample power to drive your transceiver and any accessories. Voltage was measured at 13.5V and after extended use the heatsink on the back of the unit only became luke warm – a reassuring sign. The whole thing (apart from the loudspeaker) is made from British components, by BNOS Ltd, who have an excellent reputation for their power supplies and amateur band power amplifiers. All in all, a very acceptable piece of work.

Setting up the unit is easy and takes five minutes or less. First you remove eight screws to release the wrap-around lid of the case and drop in your transceiver. A little care is necessary here, since the protruding knobs and cables of the Delta-1 make this a fairly tight fit. More importantly, you will want to take care to avoid scratching your transceiver's paintwork and this is quite tricky; be warned.

When fitted, the front of the transceiver protrudes slightly through the slot pierced in the base unit's front panel. How you retain it in place is another matter. The base of the console is drilled to hold the mobile mounting bracket of the transceiver, into which you then screw the transceiver itself. You do have to drill the mounting bracket as well, though. As I lost my Delta's mounting bracket ages ago (it must be somewhere in the loft!), I would opt for using double sided foam tape, which is quicker and simpler and just as effective.

After this, all you need do is connect the coaxial cable from the aerial and plug in the fly-leads for 13.5 volts power to the loudspeaker which already has the correct plugs fitted. The mains lead has a moulded-on 13amp plug supplied (a nice touch) but the cable is only two metres long. I found this too short for my shack; three metres would have been better. Tucked inside the console there is a white lead and a loose matching plug which are not mentioned in the instructions (because there aren't any!). I only noticed that the lead was live when the transceiver was actually connected. It is in fact used for feeding accessories, such as a preamp, aerial changeover switch or electronic power meter (or all three – the power supply is adequate). The loudspeaker is a straightforward 2.5in diameter job, but the sound quality is far better than the rig's own one; it makes listening far more pleasant.

Fit for purpose

There is no doubt the SEL-2PE does its job very well. It looks smart and tidies up the shack. A nice touch are the fold down feet, so you can tilt it up if you wish. I'm not quite sure what you do with the microphone; Selectronic's picture shows a stand, but they have sold out of these and cannot obtain any more. You could screw or tape a bracket to the side of the case. The console should satisfy

all those people who want a 934MHz base unit but are too busy (or not quite sure how) to make their own. The flat lid leaves you room for placing power and S meters on top, and it will be easy to power them with the white fly-lead provided. I also use a remote antenna changeover relay which needs switching. If I was feeling confident I might drill the console's case to the right of the mains on/off switch to accommodate the antenna switch and LED indicator. There again, I might not, because I also need another switch and LED for the preamplifier and I'd be running out of panel space!

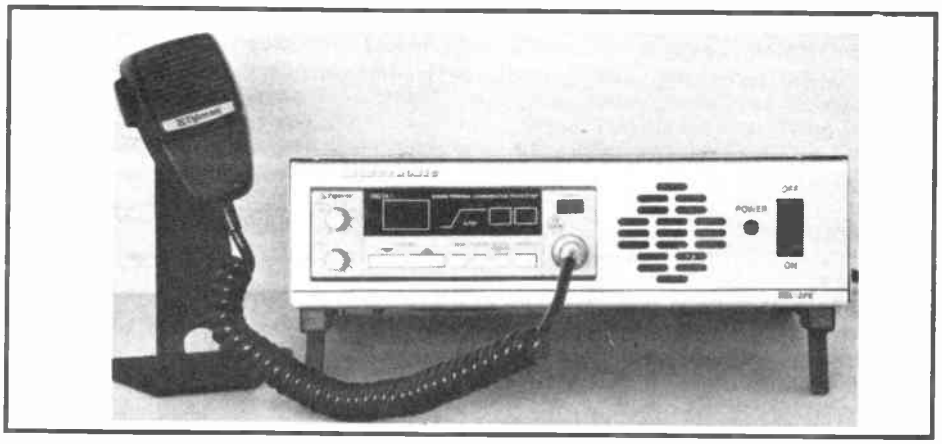
Value for money?

Judging this is difficult, though I am sure many people will be happy to order this accessory. Certainly, if you want a commercial unit you have little choice, it's this product or nothing! A price tag of around £135.00 is not unreasonable for a well-made British product, for which there will inevitably be only a limited demand. Of course, you can buy a second-hand transceiver with adequate power supplies for £10.00 or £20.00, and communications quality loudspeakers are not that expensive either. But then you are stuck with spaghetti junction again and if you are one of those people who has the rig in the living room, I think you would get permission to buy one of these consoles. While it doesn't look like a piece of fancy Hi-Fi, its appearance is a lot better than any box of plywood and silver foil you could make at home. Or prove me wrong!

Second-hand sales prospects

When Mike Machin rang me from Selectronic to tell me the SEL-2PE was on its way, I took the opportunity to ask him about trade. Having seen the odd 934MHz rig up for sale in the ***R&EW*** small ads, I wondered if people were leaving the band in any quantity. Apparently not, although some people were leaving the band (eg after passing the RAE and migrating to 2 metres). They were replaced by newcomers who had been impressed by the civilised operating on 934. (Not like 2 metres!). In fact, there was a waiting list for second-hand Delta-1 transceivers at Mike's Canvey Island shop and there are not so many new rigs still in stock. The specification runs out in December 1988, which means that sets can no longer be manufactured or imported after this time. There is nothing to stop you using them after this, nor to prevent shops from selling existing stocks, but there will be no more new sets made. The average price for a second-hand Delta is £250.00 and likely to go up from now on. Draw your own conclusion about what to do if you haven't bought one yet!

See you next month... And why weren't you working the tropo DX last month? REW



The SEL-2PE transceiver

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

Hurricane Gilbert

The media has highlighted amateur radio's role in relief work for the Jamaican and Cayman Islands' hurricane. It appears radio amateurs were the first to alert the outside world about the disaster in the Cayman Islands. Their communications also enabled tour operators to arrange quick return flights for holidaymakers.

UoSAT-D and UoSAT-E

More details are available about the in-flight experiments on these spacecraft.

The primary payload on UoSAT-D will be the Packet Communications Experiment. This advances the work done on UoSAT-2 with the Digital Communications Experiment. The PCE system is being developed under contract from VITA (Volunteers in Technical Assistance). This American organisation provides technical assistance to underprivileged countries which hope to use 'store and forward' communications as a link with development workers in remote areas. The flight of the PCE on UoSAT-D, and its use by radio amateurs, will be funded by the University of Surrey and AMSAT-UK.

UoSAT-E will be, primarily, a technology demonstration mission, flying the Transputer Data Processing Experiment (TDPE), Solar Cell Experiment (SCE) and CCD Imaging System, which should have flown on UoSAT-C.

SCE monitoring system

The UoSAT Solar Cell Experiment comprises an array of solar cell samples from several manufacturers. These will be constantly monitored for change in performance caused by radiation, temperature and other environmental effects. The cells under development will be covered by various cover slides designed to enhance panel efficiency and investigate panel degradation due to radiation. The Solar Cell Experiment will be mounted on a panel that will replace part of a solar panel on the side of the UoSAT-E spacecraft. The SCE monitoring system, to be used when the sun is shining on the SCE, will make a series of current/voltage measurements on each cell. As well as the SCE, UoSAT-D will also carry the first gallium arsenide solar cells manufactured by the Italian FIAR/CISE organisation.

RSGB '75' Award

This follows the activities which took place to mark the 75th Anniversary of the Radio Society of Great Britain. To qualify, UK amateurs and SWLs must make one contact with GB75RS during 1988 and 75 different contacts with RSGB members. These may be made on any band using any mode, including satellites but not duplicate contacts or contacts via repeaters. Amateurs and SWLs overseas may also apply for the award, but different conditions apply. Details from: John Harvey, G4IVJ, RSGB 75 Award Manager, 38 Bodenham Road, Northfield, Birmingham B31 5DS. Claims must be postmarked no later than 1 April 1989 and accompanied by a £1.50 cheque made payable to the RSGB to cover postage and packing.

AMSAT Oscar 13

This is gradually settling down to a regular schedule. Various engineering tests, measurements and operations, directed at getting it into its proper attitude, have produced alterations to its published schedule since its launch. The attitude control mechanism on AO-13 consists of a group of subsystems which can be used to steer the satellite with the help of sun and earth sensors. The In House Computer (IHC) computes the spacecraft's attitude from these measurements and the magnetorquers, responding to the computer commands, generate magnetic fields. These magnetic fields interact with the geomagnetic field to produce a torque to change the spacecraft's orientation in space.

The geomagnetic field intensity falls off rapidly with attitude and also varies with latitude. Since AO-13 is at a much higher perigee than originally planned, ie 2500km instead of 1500km, the geomagnetic field is much less. The field drops off as the cube of the distance. Therefore, by doubling the attitude, the field is reduced eightfold. Hence, the time required for 'torquing' is much greater.

HEALTHSAT-1

Representatives from the Soviet Space Research Institute, the International Telecommunications Union, the League of Red Cross and Red Crescent Societies, the United Nations and AMSAT-NA, met recently at Annecy, France. They discussed the possible launch of a small Packet radio 'Store and Forward' satellite for the SatelLife Group, based in Boston, USA. Tentatively designated HEALTHSAT-1, the satellite would provide a prototype electronic mail service for physicians working in remote areas where communications are difficult or non-existent.

It is proposed that HEALTHSAT-1 would operate near but not actually in the amateur bands, if licensing on space research frequencies can be agreed with international authorities. If not, the satellite would be licensed for amateur radio frequencies and regulations, when it would revert to one of the OSCAR series and be used by the general amateur radio satellite community. In this case, it could be used by SatelLife for limited use to prove the feasibility of the idea.

This satellite is intended for launch from a space station such as the Soviet Mir. It would be transported to Mir by a Progress cargo rocket and launched into orbit by one of the cosmonauts aboard. As Mir is in a low orbit, its orbital time is not expected to be very long, possibly a year or less. Mode J operation is proposed, requiring only a low-powered ground station.

Brazil's Peacetalker satellite

This proposed satellite differs from the established satellite concept, exploring new possibilities of using space. It will be the first satellite specifically designed to transmit spoken messages that promote peace between nations using space communications. It will be equipped with a phonetically-based programmable speech synthesizer. Initially, it will transmit in Portuguese, English and Russian. It will also transmit various telemetry parameters, therefore providing a source of study for satellite 'in-orbit' behaviour.

This project, which is also called DOVE (Digital Orbiting Voice Encoder) is sponsored by BRAMSAT, under the co-ordination of its President, Dr Junior de Castro, PY2BJO. For further information contact: BRAMSAT, Rua Macaubal No 119, CEP 01256, Sao Paulo, Brazil.

Microwave beacon news

Just a reminder that following the installation of a new transmitter, the

callsign of the microwave beacon at Martlesham Heath, near Ipswich, has been changed from GB3BPO to GB3MHL. The frequency remains at 1296.830MHz. Reports are welcome and should be sent to: John Quarmby, G3XDY, 12 Chestnut Close, Rushmere St Andrew, Ipswich IP5 7ED.

The microwave station GB3NWK, in northwest Kent, has returned to service. The 1296.810MHz transmitter failed towards the end of last year and a few weeks later, the aerial mast came down in the hurricane which swept across the south of England last October. This put the 13cm beacon on 2320.850MHz out of action as well. Repairs were rapidly carried out and both beacons were restored to full operation. The cost of the repairs seriously depleted the North Kent Beacon Group's finances. It should be remembered that the provision and running of beacons such as these, are the responsibility of the volunteers who establish these units. They are not available from any 'central beacon funds'. Users should remember this and make a fair contribution to their upkeep.

10 metre band looking up

The 10 metre band has been giving good DX propagation again recently. The progress of the solar cycle, towards maximum activity, has reached the stage where the renowned DX possibilities of this band at times of great solar activity are being experienced again. Reports are widespread of JA and VK stations again being heard and contacted using quite low transmitting power. And QSOs have been had through repeaters in the USA from 10 metre FM stations in this country!

Now that activity is increasing on the 10 metre band, it is well to remind users that the frequency band 29.300 to 29.515MHz is within the Amateur Radio Satellite Service band allocation and should, if possible, be kept free for this service.

Britannia rules the (air) waves

The September issue of *RadCom* reports, under the above heading, in the news bulletin feature, an amateur radio 'first', which took place on Thursday 21 July. At 1815GMT, the Plymouth Radio Club made direct contact with the Royal Yacht **Britannia**, while operating the Special Event station, GB400A, as part of the Armada celebrations. The Royal Yacht used its international callsign to receive a greetings message sent by the Club's Vice-President, Paul, G3VCN, as it approached Plymouth Hoe. Permission for this historic event was given by the DTI. The message sent was as follows:

'On the occasion of the Armada celebrations, the President and members of the Plymouth Radio Club send, with humble duty, loyal greetings to Her Majesty from their special radio station on Plymouth Hoe. They also wish to convey to His Royal Highness Prince Philip, The Duke of Edinburgh, as Patron of the Radio Society of Great Britain, sincere greetings from the assembled radio amateurs in this, the 75th Anniversary of the Society.'

The following reply was received at GB400A:

'The Queen and Duke of Edinburgh have asked me to send you their warmest thanks for your message of greeting and their congratulations on your 75th Anniversary'. The message was signed by the Queen's Private Secretary.

RSGB's convention

The RSGB's 75th Anniversary convention, at the Birmingham National Exhibition Centre, was described officially as a 'stunning success'. Just under 7,500 people attended, and traders reported 'brisk business after a slow start'. Much of the success was due to the visit by HRH Prince Philip. REW

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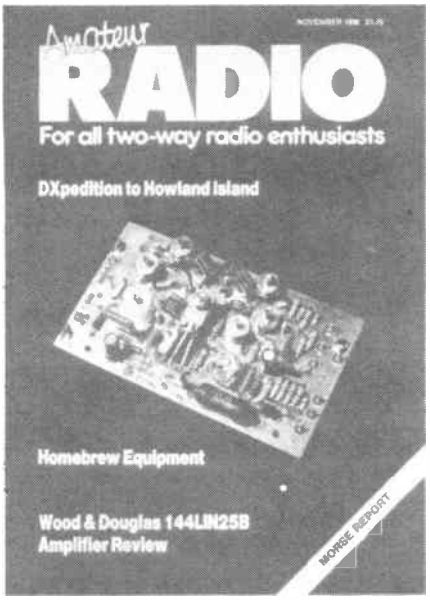

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DATA FILE

Ray Marston looks at a selection of practical circuits in the fourth part of his series on power control circuits

This month we continue the 'power control' theme by showing a further selection of practical on/off switching circuits. We start off by looking at simple Triac power switches that can be used on either 115V or 230V ac power lines. They can also be used to switch power to lamps, heaters, motors and many other domestic or industrial appliances. In these designs, the user must simply select the Triac rating to suit his own particular application. Where applicable, component values for use on 115V power lines are shown in parentheses in the circuit diagrams.

Triac power switches

Triacs are solid state power switches that can be triggered (turned on and latched) either synchronously or non-synchronously with the ac mains voltage. Triacs turn off automatically at the end of each mains half-cycle when their main terminal currents fall below the device's 'minimum holding' value.

Synchronous circuits *always* turn on at the same point in each ac half-cycle (usually just after the zero crossing point) and generate 'minimal radio frequency interference' (RFI). We will describe a variety of synchronous designs in the next two editions of 'Data File'.

The trigger points of 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. This month, we will only deal with non-synchronous power switching circuits. *Figures 1* to *8* show a variety of non-synchronous Triac power switch circuits that can be used in basic on/off line switching applications.

The Triac shown in *Figure 1* is off and acts like an open switch when SW1 is open, but it acts like a closed switch that is gated on from the mains via the load and R1 shortly after the start of each mains half-cycle when SW1 is closed. Note that the Triac's main terminal voltage drops to only a few hundred millivolts as soon as the Triac turns on, so R1 and SW1 consume very little mean power. Also note that the Triac's trigger point is *not* synchronised to the mains when SW1 is initially closed, but becomes synchronised on all subsequent half-cycles. Finally, the R2-C1 forms a 'snubber' network that (as described last month) provides the Triac with rate effect suppression; similar networks are fitted to all of this month's Triac circuits.

Figure 2 shows how the Triac can be used as a power switch that can be triggered via a mains derived dc supply. C1 is charged to +10V on each positive mains half-cycle via R1-D1, and the C1

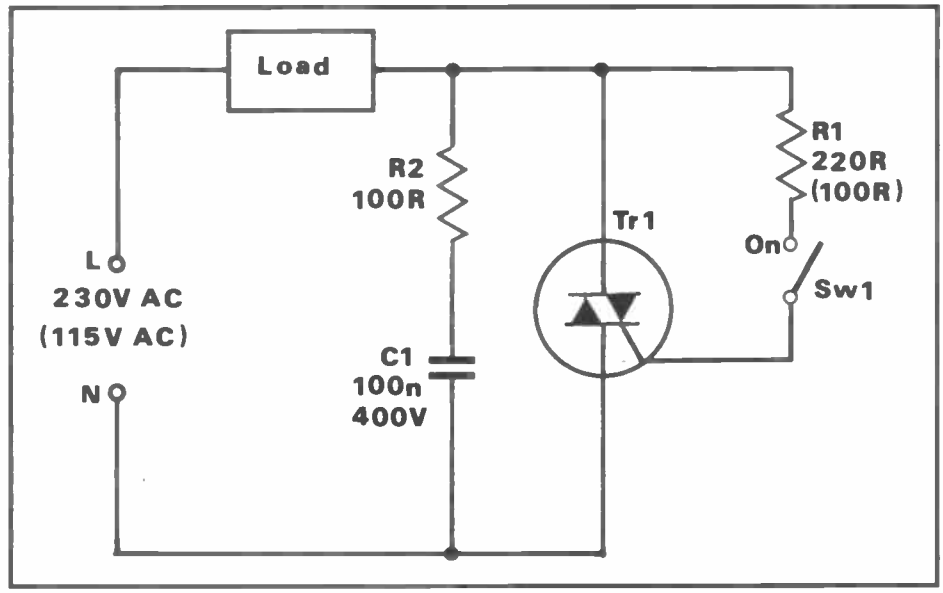

Fig 1: *Simple ac power switch, ac line triggered*

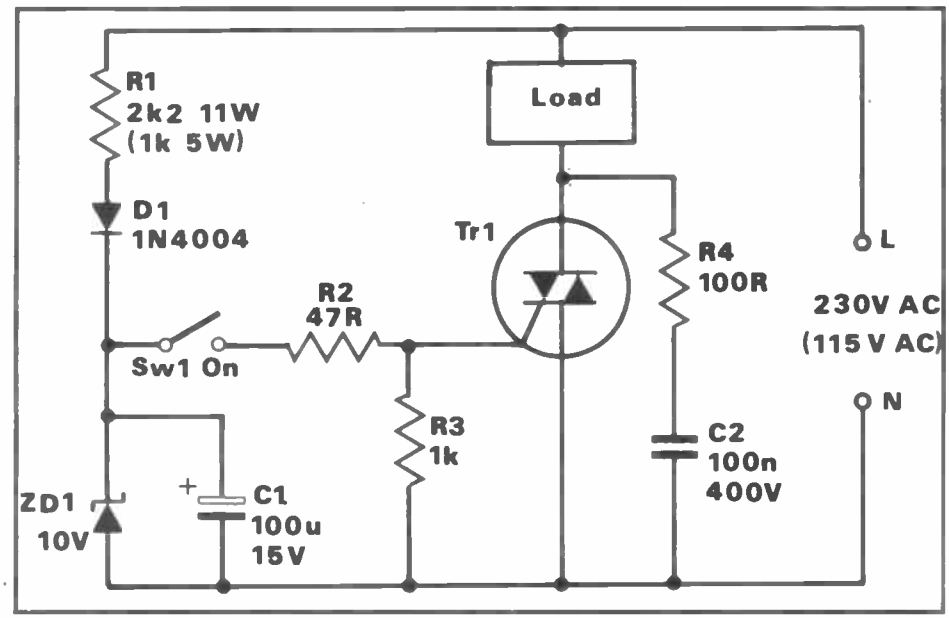

Fig 2: *ac power switch with line-derived dc triggering*

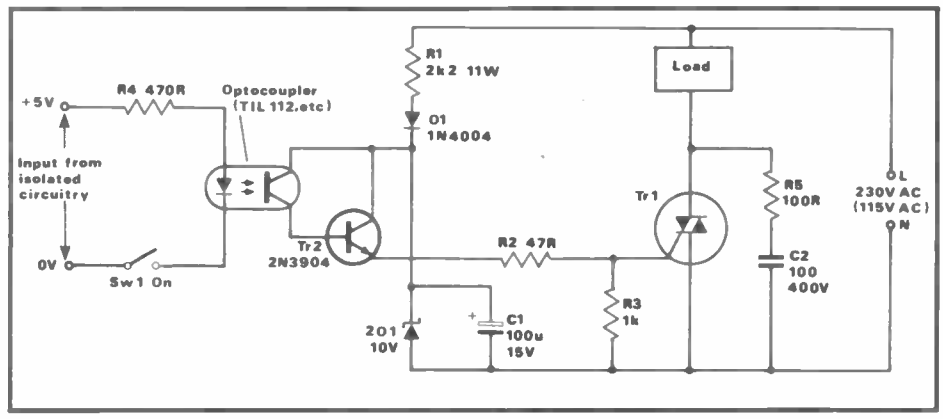

Fig 3: *Isolated input (optocoupled) ac power switch, dc triggered*

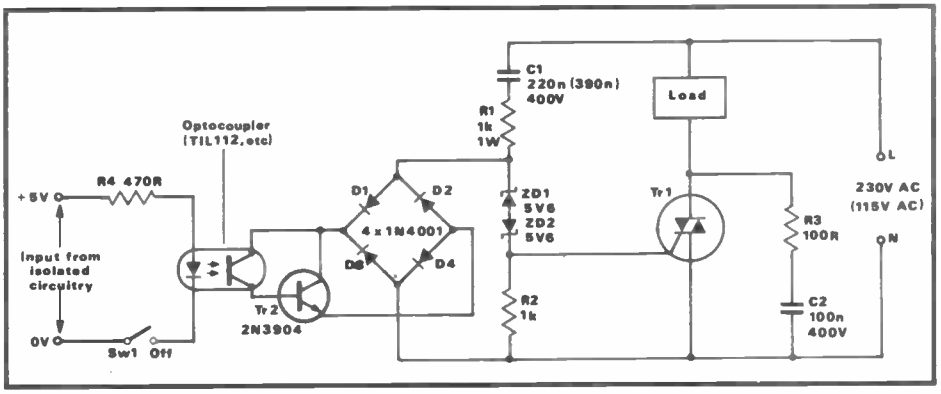

Fig 4: *Isolated input ac power switch, ac triggered*

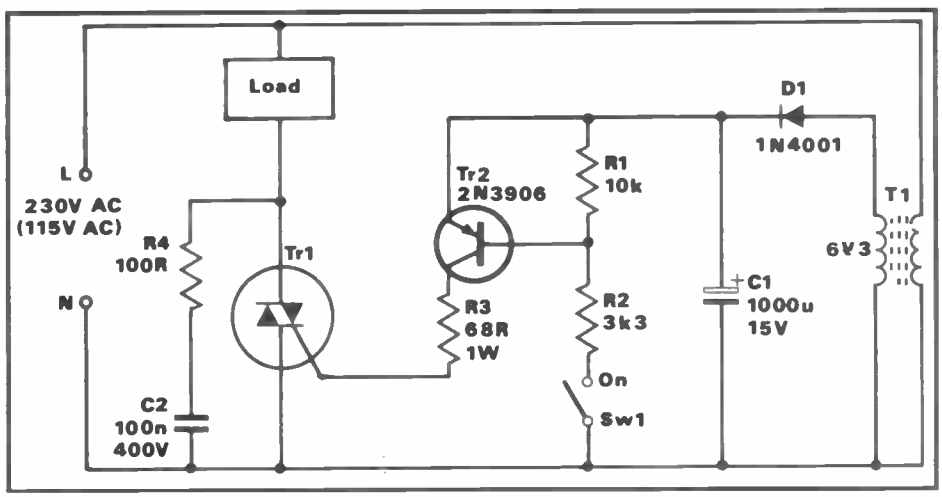

Fig 5: *ac power switch with transistor-aided dc triggering*

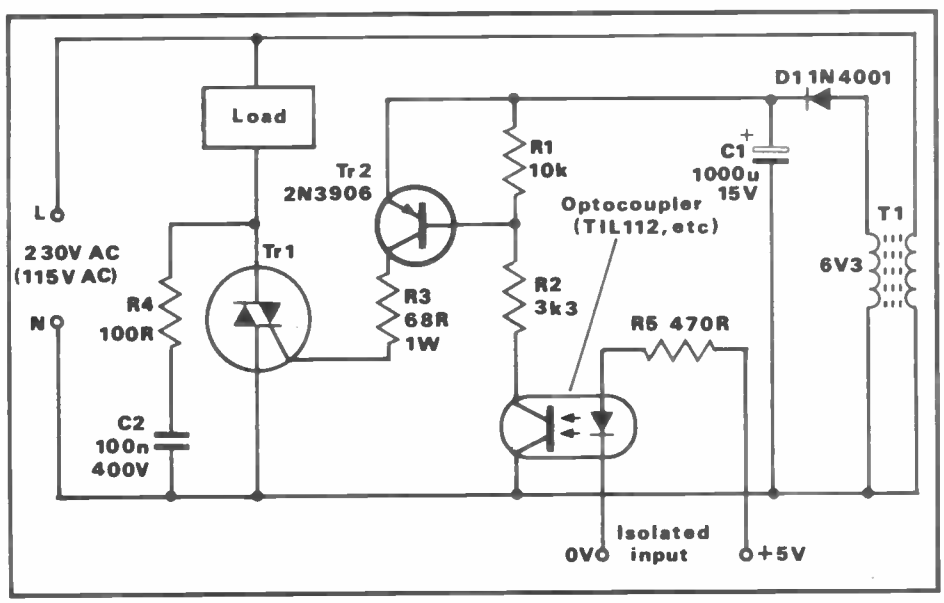

Fig 6: *Isolated input ac power switch with dc triggering*

charge triggers the Triac when SW1 is closed.

Note that R1 is subjected to almost the full alternating current line voltage at all times, and thus needs a fairly high power rating. Also note that all parts of this circuit are 'live', making it difficult to interface to external control circuitry.

Isolated input control

Figure 3 shows how the *Figure 2* circuit can be modified so that it can easily be interfaced to external control circuitry. Here, SW1 is simply replaced by transistor Q2, which in turn is driven from the 'photo-transistor' side of an inexpensive optocoupler. The 'LED' side of the optocoupler is driven from a 5V (or greater) dc supply via R4. The Triac turns on only when the external supply is connected via SW1.

Optocouplers have typical insulation potentials as high as several thousand volts, so the above external circuit is fully isolated from the mains driven Triac circuitry. This can easily be designed to give any desired form of automatic 'remote' operation of the Triac, by replacing SW1 with a suitable electronic switch.

Figure 4 shows an interesting variation of the circuit shown in *Figure 3*. In this case, the Triac is ac triggered on each mains half-cycle, via C1-R1 and back-to-back zeners ZD1-ZD2. Note that the mains impedance of C1 determines the magnitude of the Triac gate current but that C1 dissipates near zero power. Bridge rectifier D1 to D4 is wired across the ZD1-ZD2-R2 network and is loaded by Q2. When Q2 is off, the bridge is effectively open and the Triac turns on shortly after the start of each mains half-cycle. When Q2 is on, a near-short appears across ZD1-ZD2-R2, inhibiting the Triac gate circuit and the Triac is off. Q2 is actually driven via the optocoupler from the isolated external circuit, so the Triac is normally on but turns off when SW1 is closed.

Dc triggering

Figures 5 and *6* show a couple of ways of triggering a Triac power switch via a transformer derived dc supply and a transistor aided switch. In the *Figure 5* circuit, the transistor and the Triac are both driven on when SW1 is closed, and are off when SW1 is open.

In practice, of course, SW1 can easily be replaced by an electronic switch, enabling the Triac to be operated by heat, light, sound and time, etc. Note, however, that the whole of this circuit is 'live'. Figure 6 shows how the circuit can be modified for optocoupler operation, so that it can be activated via fully isolated external circuitry.

UJT triggering

Finally, to complete this look at basic non-synchronous Triac on/off power switching circuitry, *Figures 7* and *8* show a couple of alternative ways of obtaining Triac triggering via a fully isolated external circuit. In these two circuits the triggering action is obtained from pulse generating the UJT (unijunction transistor) oscillator Q2. This operates at a frequency of several kHz and has its output pulses fed to the Triac gate via pulse transformer T1, which provides the desired isolation. Because of the fairly high operating frequency of the UJT oscillator, the Triac is triggered on within a few degrees of the start of each mains half-cycle when the oscillator is on.

In the *Figure 7* circuit, Q3 is wired in series with the UJT's main timing

resistor, so the UJT and Triac turn on only when SW1 is closed. In the *Figure 8* circuit, Q3 is wired in parallel with the UJT's main timing capacitor, so the UJT and Triac turn on only when SW1 is open. In both of these circuits, SW1 can easily be replaced by an electronic switch, thus giving some form of automatic power switching action.

Automatic control

The main advantage of the *Figure 3* to *8* Triac circuits, when compared to ordinary electro-mechanical switching circuits, is that they can easily be modified to give an automatic switching action in response to variations in time, light, or heat, etc. This is achieved by simply using suitable circuitry in the input control position. An almost infinite variety of control circuits can easily be devised (*Figures 9* to *13* show a few examples of these). All of these circuits are shown with relay outputs, enabling them to be used directly as ac or dc power switches. However, each circuit can easily be modified to give direct Triac activation.

Time control

The most popular type of automatic control circuit is that related to time and *Figures 9* to *11* show circuits of this type. *Figures 9* and *10* show a simple 'timer' type of action, in which the relay turns on as soon as the circuit is activated, but then turns off again automatically after a preset period. *Figure 11* shows a pulser action, in which the relay repeatedly switches on and off at a preset rate.

The action of the *Figure 9* automatic turn off relay switch is as follows. The 4001B CMOS gate is used as a digital inverter, with its output feeding to the relay coil via npn transistor Q1, and with its output taken from the junction of the time controlled potential divider which is formed by R2 and C1. When power is initially applied to the circuit, C1 is fully discharged, so the inverter input is grounded and its output is at its full positive rail potential; Q1 and the relay are thus driven on. As soon as power is applied, C1 starts to charge up via R2, and a rising exponential voltage is fed to the inverter input. After a delay determined by the C1-R2 values, this voltage rises to the threshold value of the CMOS inverter stage, and its output swings low and switches Q1 and the relay off, thus completing the action. D1 and R1 ensure that C1 discharges rapidly as soon as power is removed from the circuit, giving a rapid reset action.

The circuit gives a time delay of about 0.5sec/μF of C1 value, thus enabling delays of up to several minutes to be obtained. If required, the delay can be made variable by replacing R2 with a fixed and a variable resistor in series.

The circuit shown in *Figure 9* offers only medium accuracy timing operation; far greater accuracy can be obtained by using a type-555 timer IC as the basic timing element, as in the case of the simple six to sixty seconds timer of *Figure 10*, in which the IC is wired in the monostable or one-shot mode. Here, the circuit starts a timing cycle when the 'start' switch S1 is briefly closed. The RLA relay immediately turns on and C1 starts to charge towards the positive rail via R2 and RV1 until eventually, after a delay determined by the RV1 setting, C1 rises to ⅔ of the supply rail voltage. At this point, the IC changes state and the relay turns off. The timing cycle is then complete.

Finally, the *Figure 11* circuit shows a simple relay pulser, which repeatedly switches the relay on and off at a variable rate (via RV1) of 26 to 80 cycles per minute via Q1 between the astable multivibrator (designed around R1-RV1-C1) and the two CMOS 4001B NOR gates.

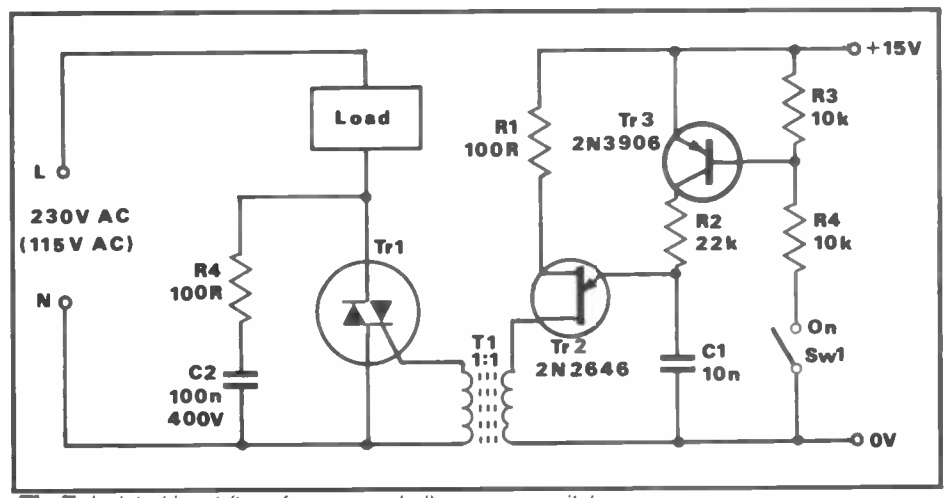

Fig 7: *Isolated input (transformer coupled) ac power switch*

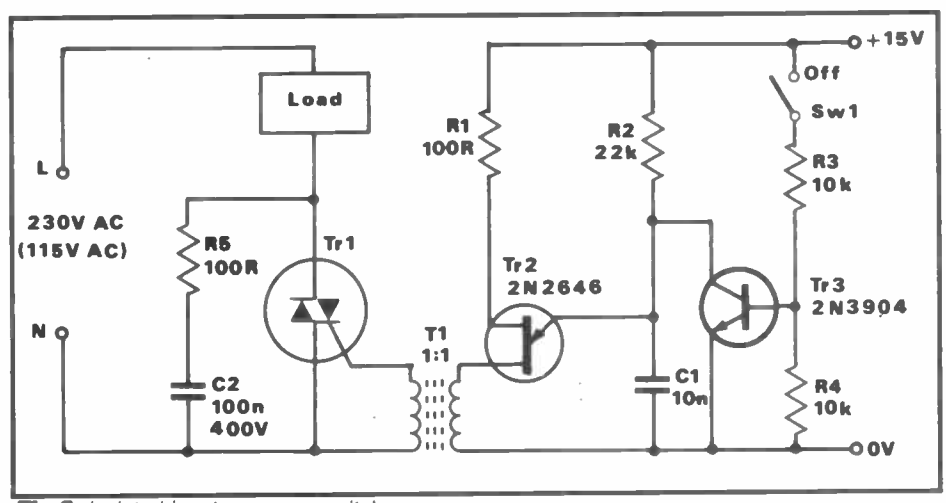

Fig 8: *Isolated input ac power switch*

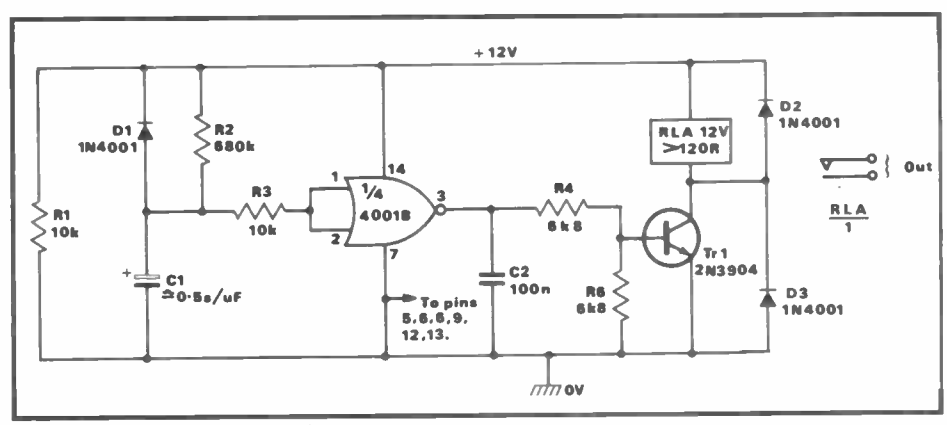

Fig 9: *Auto turn-off relay switch*

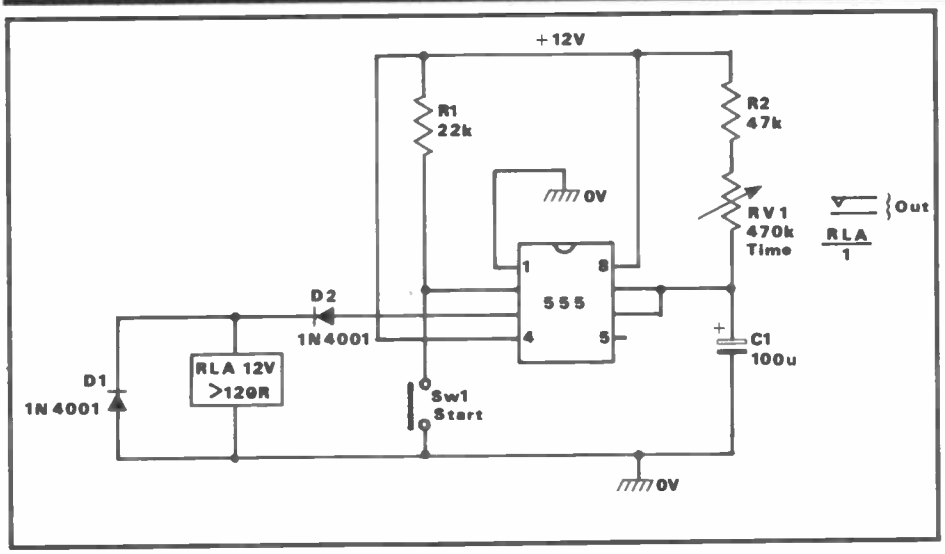

Fig 10: *Simple six to sixty seconds timer circuit*

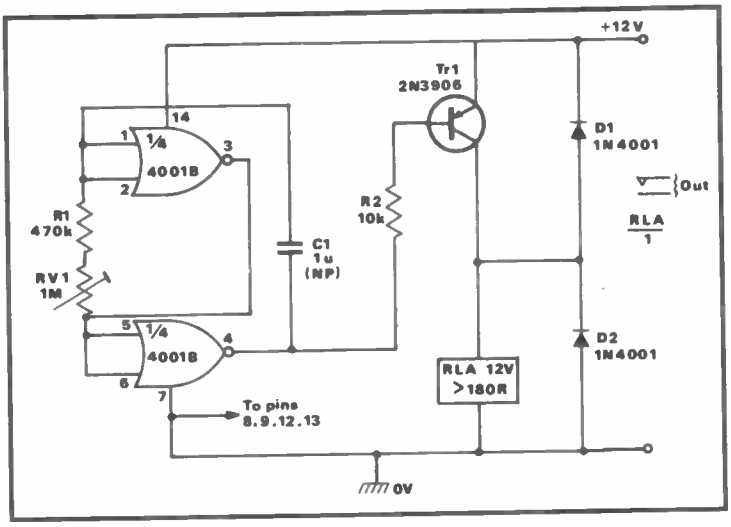

Fig 11: *Relay-pulser circuit*

Heat/light control

To complete this edition of 'Data File' *Figures 12* and *13* show circuits that can be used to activate a relay in response to variations in light or temperature levels.

The *Figure 12* circuit acts as a dark-activate switch that turns the relay on when the light intensity falls below a preset level. RV1 and LDR (a light dependent resistor) are wired as a light-sensitive potential divider which has its output filtered (to give transient suppression) via R1-C1 and is fed to the input of the 4001B digital inverter stage, thus driving the relay via Q1. Under bright conditions, both the LDR resistance and the inverter input are low. Their output is high and Q1 and the relay are off. Under dark conditions the LDR resistance is high, so the inverter input is high, its output is low and Q1 and the relay are on. The precise 'trip' level of the circuit is fully variable via RV1. Note that the LDR used here can be any cadmium sulphide photocell that gives a resistance in the 2k0 to 2M0 range at the desired 'trip' level, and that (when adjusted) the RV1 value should balance that of the LDR.

Finally, *Figure 13* shows a precision over temperature switch that turns the relay on when the temperature exceeds a preset level. Here, the op-amp and Q1 are wired as a relay driving precision voltage comparator, with one input driven via the fixed R1-R2 voltage divider, and the other driven via the temperature sensitive divider formed by RV1 and thermistor TH1. This divider gives a low output at low temperatures (thus switching the relay off) and a high output at high temperatures (thus driving the relay on). The precise trip temperature of the circuit is fully variable via RV1 and is virtually indepen-

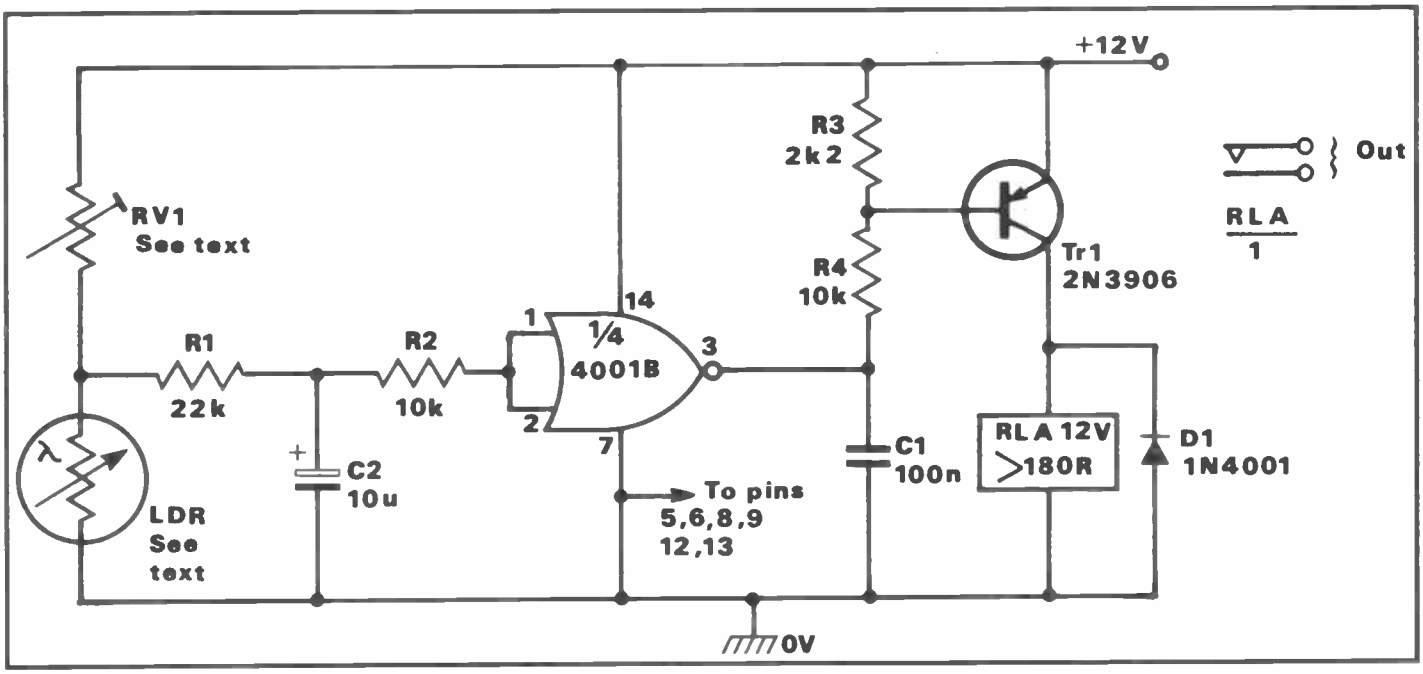

Fig 12: *CMOS aided dark-operated switch with transient suppression*

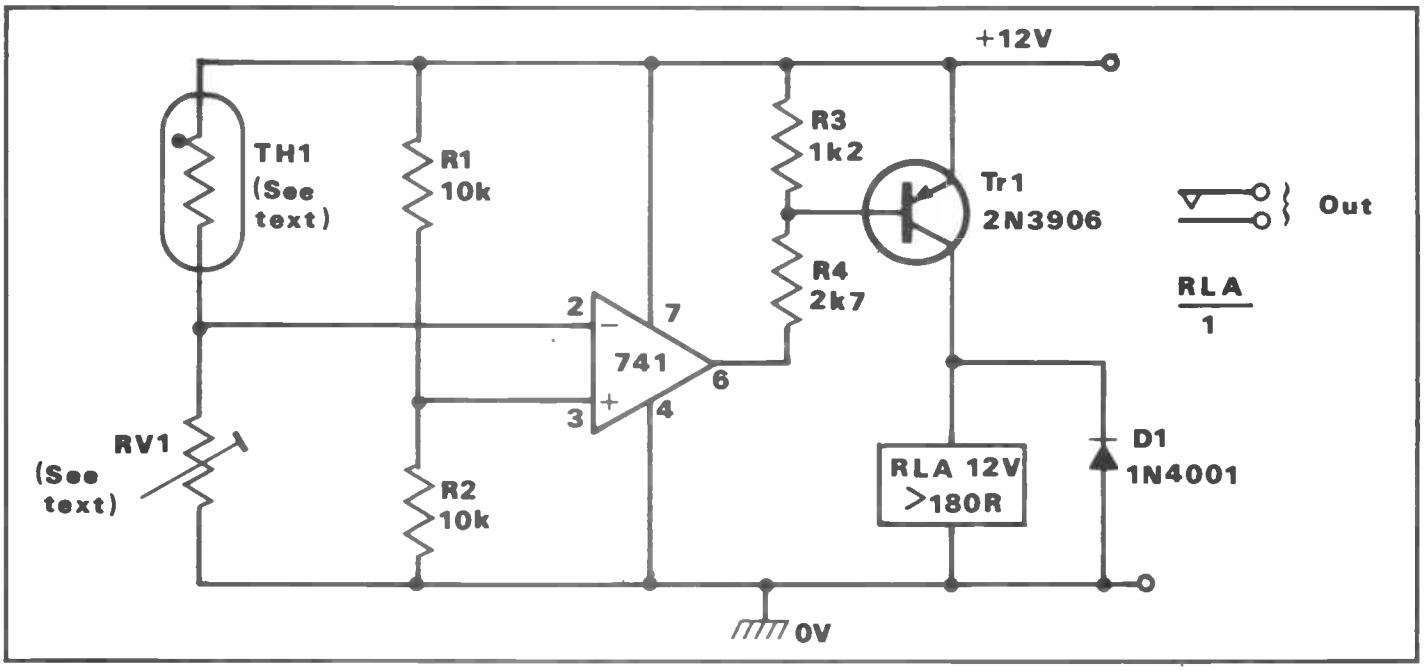

Fig 13: *Precision over-temperature relay switch*

dent of variations in the supply rail voltage.

The thermistor used in this circuit can be any negative temperature coefficient (ntc) type that presents a resistance in the range 1k0 to 20k at the required trigger temperature. The RV1 resistance should equal this value at the same temperature. Note that this circuit can be made to act as an 'ice' or under temperature switch, by simply transposing TH1 and RV1. REW

Short Wave News for DX Listeners

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

During this time of year signals from the Far East can be heard by listeners in the UK and Europe. From around mid-September to mid-March avid DXers turn their attention not only to the 60 and 90m bands but also to the 120m band (**2300 – 2498**). This frequency range is not often visited by many SWLs, which is not surprising considering the time involved and the usual lack of success.

Apart from the obvious necessity of a highly sensitive and selective communications receiver, a further prime requirement is that of an outdoor aerial array as long and as high as possible. Whilst it is perfectly possible to utilise a relatively short length, this will not be as successful. The recommended length is 132 feet. Unfortunately, not every enthusiast is able to erect such an array, garden dimensions these days tending to be somewhat smaller. However, don't give up, when the prevailing conditions for Far Eastern reception are at their best, usually mid-term, a successful logging may well be possible.

The times which usually provide the maximum opportunity for hearing such transmissions are from around 1500 to 1730 and from 2100 to 2330UTC.

CHINA

For the past few years, this country has provided us with the opportunity to log some Far Eastern signals on the 120m band. Chinese regional transmitters serving their various local communities are well in evidence on this band. I suggest that 120m band beginners focus their attention on the channels below. Should the receiver exhibit a memory facility, a selection of the frequencies should be entered and retained for some of the 'season', particularly to the mid-term period.

TRY THESE

The lowest in frequency is Yunnan PBS (People's Broadcasting Station) in Kunming on **2310**. This transmitter carries Home Service 3 programmes in the local vernaculars Dehong Dai and Jingpo from 2225 to 0030 and from 1025 to 1630. This schedule includes a relay of the Radio Beijing English language lesson timed from 1030 to 1100, the power being 15kW. A parallel channel is **5960**.

Fujian PBS, Fuzhou, features programmes in Chinese on **2340** from 1020 to 1700 and from 2050 to 2400 carrying the Home Service 1, the power being 10kW. An English language lesson is timed from 1330 to 1400.

Zhejiang PBS, Wenzhou, with programmes in the Chinese Home Service on **2415** from 2135 to 0005 (Sunday until 0205), from 0225 to 1445 (Sunday until 0715) and from 0805 to 1420. The schedule includes relays of the CPBS 1 programme from 2230 to 2300 and from 1200 to 1230. The present power is unknown.

Jiangxi PBS, Nanchang, is in irregular operation on **2445** from 1900 to 1420 in Chinese at 10kW. It is, therefore, a matter of luck whether one logs this station or not.

Yunnan PBS, Kunming, appears again on **2460** where it is on the air with Home Service 1 programmes in Chinese from 2150 to 2400, from 0255 to 0600 and from 0855 to 1540. English language lessons are timed from 2200 to 2230, 0500 to 0530 and from 1400 to 1430. The power is 15kW.

Zhejiang PBS, Hangzhou, may be located on **2475** where it carries the Home Service 1 in Chinese from 2055 to 0510 and from 0755 (Tuesday from 0855) to 1500. English language lessons are featured from 2140 to 2210 and from 1330 to 1400. With a power of 10kW, it is in parallel on **4785**.

Voice of the Strait, Fuzhou, on **2490** transmits Haixia 1 in Chinese from 2055 to 0031 and from 0955 to 1751, the frequency being an alternative to **6765**. The power is 10kW.

Voice of the Strait transmitters carry either the First or Second Programme; in DXers' language known as Haixia 1 or Haixia 2. The term Haixia derives from the Chinese language identification *Hai-xia-zhi-sheng guang-bo dian-tai*. Broadcasting to Taiwan and other offshore islands, Voice of the Strait transmitters are also active on the 90m band (**3200** to **3400**).

NORTH KOREA

The following North Korean regional stations are rarely heard outside the immediate localities but reports do sometimes appear in the SWL press signifying success for a few fortunate DXers residing nearer to the respective signal sources. For those aspiring to supreme feats of DXing, these details should prove to be of some assistance.

The frequency of **2300** is occupied by Hyesan in Yanggang Province. This station transmits the Home Service 1 from 1958 through to 1800, the language being Korean. The following two transmitters have the same schedule and programme. Sariwon in North Hwanghae Province is on **2350**. Hamhung in South Hamgyong Province was on **2400** but is now thought to be inactive.

These station schedules include locally originated programmes timed from 2230 to 2300, from 0430 to 0520 and from 1110 to 1800 and each have a power of just 1kW – hence the supreme DX rating.

ON THE AIR

Listed below are some of the stations logged during the month prior to publication. Tuning some of the frequencies specified at the times stated, should result in a successful outcome providing the prevailing conditions are good.

AFRICA

Equatorial Guinea

Radio Nacional, Bata, on **5003.7** at 2028, typical fast and rhythmic music, some songs in vernacular. The Home Service in Spanish and vernaculars is radiated from 0500 to 0700 and from 1700 to 2200, the power being 100kW.

Radio Nacional, Malabo, on **6250** at 2032, music and songs in Spanish. Malabo is on the air from 0500 to 2205 in Spanish and vernaculars at 10kW.

Angola

Radio Nacional, Luanda, on **4953** at 0417, OM with a talk in Portuguese followed by a song then more talk. This station can also often be heard from around 1830 onwards at this time of the year. At 10kW, Radio Nacional operates around the clock in Portuguese but the frequency is subject to slight variation.

Burundi

Bujumbura on **3300** at 2037, a discussion in vernacular than OM with a song. The Home Service in French, Kirundi and Swahili is radiated from 0300 to 0700 (Sunday from 1000) and from 1600 to 2100 with an English newscast at 1645. The power is 25kW.

Ghana

GBC2 Accra on **3366** at 1802, local and African news in English during which the announcement 'This is coming to you from GBC Accra' was made. At 50kW, Accra on this frequency broadcasts entirely in English from 0525 to 0905 and from 1705 to 2305. Unfortunately, the channel is often subject to utility interference but on occasions the station is clearly audible here in the UK.

Kenya

Nairobi on **4934** at 1859, African drums and music then YL in English with the station identification and time check. The Voice of Kenya operates the General Service entirely in English on this channel from 0200 (Sunday from 0230) to 0630 and from 1300 to 2010 (Saturday and Sunday until 2110).

Niger

Niamey on **5020** at 0557, OM with a talk, YL with a song, four pips time check, the station identification in French then some pipe and drum music. The Home Service 2 programme on this channel is timed from 0530 to 0700 and from 1700 (Saturday and holidays from 1600) to 2200 (Saturday and holidays until 2300). An English programme is broadcast from 2000 to 2030. The power is

30/200kW. Niamey has also been heard on **3260** at 2136 in parallel with **5020**, the power being 4kW.

South Africa

SABC Johannesburg on **4880** at 0403, OM with news in English of local sporting events and results. This Radio 5 programme is aired from 0300 to 0510 and from 1625 to 2200, our evening periods often providing a chance of logging this station. The power is 100kW.

Swaziland

Swazi Radio, Sandlane, on **4975.9** at 1830, OM with the station identification in English followed by a religious talk. This 100kW transmitter operates in English on Sunday from 0500 to 0600, Monday to Friday from 1630 to 2045 and Saturday from 1700 to 1800, religious programmes being from 1800. It operates in Portuguese on Monday to Friday from 0600 to 1000 and on Saturday and Sunday from 1100 to 1400.

CENTRAL AMERICA

Costa Rica

Faro del Caribe (Lighthouse of the Caribbean), San Jose, on **5055** at 0515, music and songs in Spanish then a talk with mentions of music titles such as *La Paloma*. This 5kW station is timed on the air in Spanish from 1030 to 2000 and from 2300 to 0600. The schedule includes an English programme from 0300 to 0400.

Cuba

Havana on **6035** at 0511, OM with the station identification followed by a talk about the Seoul Olympic sporting events. This English programme for North and Central America is timed from 0400 to 0600 daily.

SOUTH AMERICA

Peru

Radio Andahuaylas, Andahuaylas, on **4840** at 0259, folk songs and music with announcements in Spanish, clearly heard after the co-channel Venezualan Radio Valera had signed off with a choral rendition of the National Anthem at 0258. Radio Andahuaylas is on the air from between 1000 and 1100 until sign-off at sometime from 0200 to 0300. The power is 2kW.

Brazil

Radio Anhanguera, Gioania, on **4915** at 0331, announcements in Portuguese followed by the station identification with echo effect. The schedule is from 0800 through to 0400 with a power of 10kW.

Chile

Radio El Espactador (Voice of Chile) Santiago, on **15139.7** at 0021, a talk in Spanish about the return of Mrs Alliende to Chile and its implications. Broadcasting in Spanish to South America, the Voice of Chile is on the air from 1030 to 1330, from 1600 to 1900 and from 2200-0100.

Ecuador

Radio Quito, Quito, on **4920** at 0455, announcements in Spanish, jingle, promotion, choir, more announcements followed by the station identification, a few bars of violin music from the Rose Marie musical then off without the National Anthem at 0500.

Venezuela

Ecos del Torbes, San Cristobal, on **4980** at 0338, announcements in Spanish, folk songs with guitar music. At 10kW, Ecos del Torbes is active from 0900 (Sundays from 1000) to 0400, sometimes around the clock.

ASIA

Bangladesh

Dhaka on **11820.3** at 1444, YL with announcements in Hindi followed by some Indian music.

China

Hubei PBS, Wuhan, on **3940** at 2041, OM with a talk in Chinese. The Home Service 1 in Chinese is on this frequency from 2000 to 0610 and from 0850 to 1530 at 10/50kW. Our evening period is the most favourable for reception of this station.

Radio Beijing on **4020** at 2049, OM with a talk in French. On this channel the Foreign Service in Korean is from 1100 to 1500, in Chinese from 1500 to 1600 and from 1730 to 1830, in Swahili from 1600 to 1730 and in French from 1830 to 2230. The power is 50kW.

India

AIR Delhi on **3365** at 1745, Indian orchestral music. The schedule is from 0025 to 0229 and from 1230 to 1840 with English newscasts at 0035 and 1830. The power is 10kW.

AIR Hyderabad on **4800** at 1733, YL in English with the local and world news. Hyderabad radiates from 0025 to 0215 and from 1200 to 1741 or 1830. The power is 10kW.

Mongolia

Ulan Bator on **4080.4** at 2148, OM with a talk in Mongolian, three descending chimes repeated, more talk, some orchestral music, six pips at 2200 then more talk (news?). The Home Service 1 in Mongolian is timed from 2200 to 1600. Relays of the Moscow Foreign Service are broadcast in Mongolian from 0600 to 0630, 0930 to 1000 and 1200 to 1245, and in Russian on Tuesday and Friday from 1130 to 1200. The power is 50kW.

Sri Lanka

Colombo on **4902** at 1711, monks with Buddhist chants. The National Service in Sinhala is broadcast on this channel from 2330 to 0230 and from 1000 to 1730 (to 2330 on full moon days). The power is 10kW.

Taiwan

The Voice of Free China, Taipei, on **9955** at 2009, the news in Arabic during a transmission to North Africa and the Middle East, timed from 2000 to 2100.

SOUTH EAST ASIA

Indonesia

RRI Sibolga, Sumatra, on **5256.3** at 1603, a newscast in Indonesian until 1607, followed by some orchestral music. Sibolga is scheduled on the air from 0900 to 1900, the power being 1kW.

RRI Pekanbaru, Sumatra, on **5894** at 1542, Indonesian gamelan music, YL with some songs, ann and off at 1600. Pekanbaru radiates to the local population at 5kW from 2200 to 0200 and from 0830 to 1600, sometimes to 1700 or 1800.

Philippines

FEBC Manila on **11850** at 0920, OM with a religious talk in English to Central and South East Asia timed from 0830 to 0930, followed by the interval signal and then into Chinese (Hakka) at 0930.

CLANDESTINE

Radio Iran Toilers on **10870** at 1555, YL with a talk in Farsi (Persian), folk music and a song, also heard on **6230** in parallel. This clandestine is operated by the Iranian Tudeh (Communist) Party which is based in Kabul, transmissions being made via Radio Afghanistan facilities. The identification is *Radio-ye Zahmatkeshan-e Iran*.

NOW HEAR THESE

La Voz Evangelica de la Mosquitia, Puerto Lempira, Honduras on **4910.4** at 0232, a US recorded religious talk in English until 0235 then a hymn and talk in Spanish. Off without the National Anthem at 0302 after some announcements, a talk and a song in Meskito. This one is on the air in Meskito and Spanish from 2300 to 0300 but includes an English transmission from 0215 to around 0235. The power is 0.5kW.

Radio Nueva Vida, Cucuta, Colombia on **5567.3** at 0106, OM with a talk in Spanish, a sad slow song (pasillo) with guitar. The schedule is from 2300 to around 0230 and the power is just 0.1kW.

Radio 2 de Febrero, Rurrenbaque, Bolivia on **5505.3** at 0120, folkloric music and songs with announcements in Spanish at 0131. This station operates irregularly from 1200 to 1500 and from 2130 to around 0300 with a power of 0.4kW.

NOW LOG THESE

Radio Ancash, Huaraz, Peru on **4990.7** at 0318, announcements in Spanish, folkloric music and songs, promotions and ann. Radio Ancash is active from sign-on between 0900 and 1200 until close around 0500, featuring a tourist programme in Spanish and English irregularly from 2300 to 2400. The power is 3kW.

Radio Satellite, Santa Cruz, Peru on **6726.5** at 0111, YL with a talk in Spanish. The schedule is from 2400 to 0400. NEW

MEDIUM WAVE DXING

by Steve Whitt

DXing in your sleep

The easiest way to identify an MW DXer is if they fall asleep during the day. Since the fundamental characteristics of the ionosphere favour long distance MW radio reception at night, this hobby will be the province of the shift worker, the insomniac or the outright fanatic. There is one solution and that is to DX in your sleep!

All you need apart from the standard aerial and receiver are a tape recorder, timer and a fairly methodical approach to listening. Neither the tape recorder nor timer should be expensive and, indeed, I don't know any serious DXer (SW or MW) who doesn't already use a recorder. Depending on your selection of equipment there are two ways of DXing in your sleep.

If you have an ordinary radio and a separate cassette recorder you'll need to buy a mains timer unit (get one with a digital display since these can be set precisely to the minute) which will cost about £15.00-£20.00. With such a timer connected in series with the mains lead of the recorder you are able to make a recording at any time of the day or night when you're not around. Just make sure that your radio is tuned to the frequency of the station you want to hear.

Unfortunately, such remote control is trickier for really tough DXing, since in these circumstances you might want to be making continuous adjustments to your receiver or aerials to improve reception. However, for less marginal conditions this technique is very valuable, particularly for night after night monitoring of one frequency. I use it, for example, for monitoring 1440kHz after Radio Luxembourg closes down at 3am. It would be impossible for me to be awake at this time every night and I would soon be put off by the DX-less nights. Indeed, taping for an hour every night allows me to quickly find the nights that are good for DX (just 5–10% say) and then to listen more closely for DX signals. On 1440kHz, for example, I've heard three different North American and a couple of Latin American stations that I would have otherwise missed.

If you have a receiver with a built-in programmable timer (eg Sony 2001D) you do not necessarily need a separate mains timer. It might be possible to activate the cassette recorder from the radio or if this is not directly practical an external unit called a VOX or voice activated switch might be the answer. This piece of equipment connects in the audio lead from radio to cassette and detects when audio starts, ie, when the internal timer has turned on the radio. It then switches on the recorder for as long as sound is present. So if you have the equipment but have not tried this before, why not give it a go and let me know how you get on?

Half a century on

In the eighty-odd years that radio has 'existed', each decade has seen an ever increasing rate of change so it is sometimes worth standing still and having a look back in time. Going back fifty years takes us to 1938 which in retrospect was a very significant year for radio as the war clouds started to build over us.

In Europe, this year saw the first broadcasts from the newly formed Radio Sweden, this being the Swedes' first step into international broadcasting. In contrast, Swedish domestic radio provided by the Swedish Broadcasting Corporation had been operating since 1925.

Meanwhile, across the Atlantic, one of the most celebrated events in all of radio broadcasting took place on 30 October 1938. On this night before Hallowe'en the Columbia Broadcasting System carried Orson Welles' adaptation of H G Wells' *War of the Worlds*, causing mass panic among several hundred thousand listeners in the Eastern USA who mistook the play for real life. Welles employed his mastery of the dramatic to present *War of the Worlds* in a news format style, adopting the emotion and trauma that had filled the real live coverage of the Hindenberg disaster. Today it is amazing to think that a one hour radio play could have had such impact. So, was it the play that caused such panic or was it just a catalyst for the anxiety and tension of a world on the brink of war?

Back in Europe, 1938 saw the start of a European service from the BBC, which for the past six years had only operated its Empire service, despite extensive propaganda from the powerful Zeesen transmitters operated by the Germans. In fact, the European service was pre-empted by the Arabic service to the Near East which was shortly to be joined by the Spanish and Portuguese languages of the Latin American service that started on 14 March. By the end of 1938 the BBC was producing programmes in nine languages.

BBC Radio Show

At seemingly considerable expense BBC Radio stations 1, 2, 3 and 4 celebrated their 21st birthday during the first week of October. The show was mounted at Earl's Court but only occupied a small fraction of this massive exhibition hall. I visited on Friday 7th, having missed the official press day a week earlier due to other commitments. Though I'm sure that the vast majority of visitors enjoyed themselves, I couldn't help feeling a bit disappointed, rather like wanting more food two hours after eating a Chinese meal.

Radio Show it was in name but in reality the hall was dominated by Hi-Fi and in-car entertainment. Even more unforgivable was the large display area called *The Story of Radio*, in which it appeared that the history of broadcasting centred solely around the BBC. There were no mentions of Lord Haw Haw, Radio Normandie, Radio Luxembourg, the offshore pirates or independent local radio, to name just a few gaps. Unfortunately, the casual visitor could be excused for thinking that Radio 1 was the be-all and end-all of radio.

Behind the glossy facade, the one glimmer of hope was the small stand manned by the European DX Council whose volunteers were working overtime introducing many a newcomer to the delights of international radio. Sadly, in the whole hall only seven world-band receivers could be found; four on the EDXC stand and three on the Grundig stand. BBC World Service should have had one on their stand to show visitors how to tune in a short wave radio to their programmes. In radio technology terms the centrepiece was the promotion of the VHF Radio Data System (RDS) though exactly what Joe Public made of this is anyone's guess.

Newsdesk

International waters: Radio Caroline has recently changed its address so all mail should go to PO Box 146, Playa d'Aro, Gerona, Spain. Programming hasn't altered so it is not clear if this indicates a change in management. Listeners who have had difficulty getting a QSL card confirming reception of the 558kHz signal could try writing directly to the religious broadcasters who buy airtime on Caroline transmitters. For instance, correct reports are verified by the evangelist Johan Maasbach whose programmes go out on 558kHz after the Dutch daytime programmes end.

United Kingdom: Some months back I discussed the topic of networking

amongst Independent Local Radio in the UK. Well, the phenomenon continues to spread with the recent emergence of GEM-AM in the East Midlands. This is a new network comprising the MW outlets of Radio Trent and Leicester Sound. While their respective FM outlets have acquired new 'contemporary' images, the MW stations have adopted the rather predictable AM Gold format with hits from the past four decades. You'll hear GEM-AM on 945 from Derby, 999 from Nottingham and 1260kHz from Leicester. It won't be long before every ILR station is playing golden oldies on MW. What ever happened to individuality or creative programming?

USA: Long wave in the USA is not used for broadcasting but certain frequencies are used by 'amateur' experimenters. The Space and Naval Warfare Systems Command (SPAWAR) is to conduct research tests on low frequency (LF) transmitting antennas and this will result in sporadic tests from Bumpus VA and Carol Island MD. Transmitter power will be 1kW fed into a triangular loop antenna 65ft high at the apex and 400ft wide at the base. The main frequency will be 185kHz with 175kHz reserved as back-up. Transmissions will be blank carrier with ID in Morse code in the following format 'NWA test + identification letter + possibly more info'. Reception reports will be greatly appreciated. Send them to SPAWAR, NWA Test, Washington DC 20363-1539. Tests were due to start in September this year.

For the latest information a telephone message can be heard by calling (from the UK) 010-1-703-471-1539.

The main reason the military is interested in these frequencies is because of their ability to survive after nuclear war. Very low frequencies propagate over great distances via groundwaves and are less reliant on ionospheric refraction to reach their destination; one of the consequences of nuclear war is likely to be a highly disturbed ionosphere which may lead to effects similar to a prolonged short wave fade-out.

DX file

Recently MW DX has been a mixed bag with some good DX days and plenty of days afflicted by increased solar activity leading to ionospheric disturbance. On better days I've pulled in the following:

590kHz VOCM, St John's, NF, Canada; heard as early as 2200hrs.

1010kHz WINS, New York, USA; heard as early as 2330hrs (despite Irish and Spanish stations on 1008kHz).

1050kHz WFAN, New York; sports radio from 2315hrs (now likely to be somewhat harder since BBC R1 is on 1053kHz till 0200 (UK local time).

1060kHz WBIV, Boston, MA, USA; heard more regularly since recent power increase to 25kW. Since a programming change in mid-September it is most likely to be heard in Spanish as 'Super Continental'.

1440kHz WWGT, Portland, ME, USA; heard 'DXing in my sleep' with unusual identification as 'Q-98'. This is the slogan based on call letters of the FM sister station which is just relayed on MW.

1510kHz WSSH, Boston, MA, USA; fairly regular with easy listening music from about 2330hrs.

Note all times are UTC/GMT. It is regrettable to note that this month two popular MW frequencies for transatlantic DX have become that much harder to DX on (do any ever get easier?). BBC R1, as part of their new FM stereo image, have extended broadcasting hours to 0200 from midnight, and this affects their MW frequencies as well. Thus, it will now only be late night DXers (or those listening in their sleep) who'll hear much on either 1050kHz or 1090kHz.

On that note it is time to go for yet another month. See you next time. NEW

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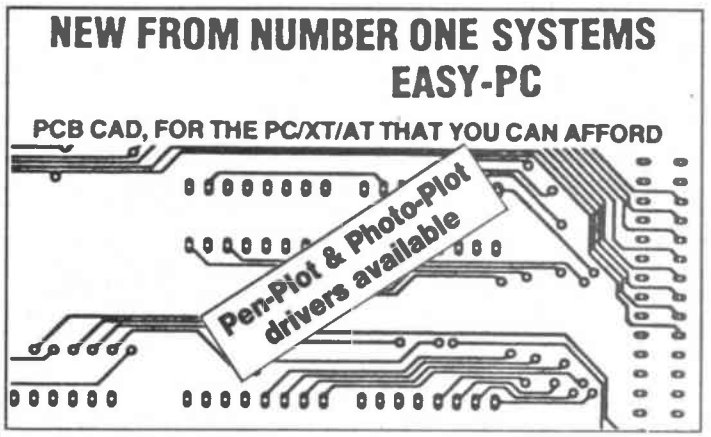

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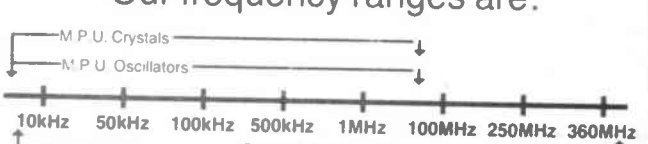

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■ Discone aerial urgently required. Must be suitable for 9600 Yaesu. Tel: (0283) 221870

■ Sony 2001D, 2m hand-held portable, any test gear. WHY? Tel: (0843) 294446

■ Telereader or RTTY decoder, anything considered: CD600, CW610, etc. Also any test gear, scope, AF and RF sig/gen etc. Tel: (0843) 294446

■ Telefunken music centre, must be in good working order. If anyone has one of these to sell, please write to: Dilwyn Edwards, Berllan Glyd, Llanynys, Denbigh, Clwyd LL16 4PA

■ Practical Wireless magazines (1930-1960) good prices paid. Aero modeller's radio. Tel: (0793) 485124

■ Private collector wants old style video recorders. Also laser vision video disks, reel to reel video tapes and Beta tapes. Must be cheap. Len Sutton. Tel: (0977) 797063

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

24v ni-cad battery contains twenty XD type cells, used condition, some cells may be faulty **£12.00**
Spring tension gauges, set of 3. 0-4 ounce, 0-16 ounce, 0-6lb..... **£8.00**
Ex Vulcan bomber hitch and roll assembly, contains gears, shafts, bearings etc **£15.00**
Range and bearing marker unit, contains bevel gears, servos, shafts etc **£15.00**
Ex Government Geiger counter with 3 probes x-ray, alpha, beta **£45.00**
Eddystone type 770R VHF receiver, 19-155 MHz **£120.00**
Type R210 receiver 2-15 MHz, complete with plug and headphones..... **£55.00**
ITT UHF TX-RX base station **£40.00**
ITT 149 MHz VHF transmitter **£40.00**
Collins R390A receiver, poor condition **£150.00** Ring for details
Readyphone 100 watt, LIN, amplifier, complete with ATU **£75.00**

Prices include postage and packing

A C ELECTRONIC SERVICE
17 APPLETON GROVE, LEEDS LS9 9EN
TELEPHONE: 0532 496048

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	9.58	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.

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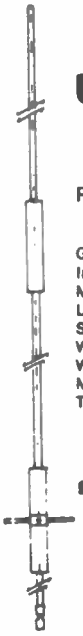
2 METRE COLLINEAR UVRAL X2⅝over⅝



An omni directional antenna giving low angle radiation. The ideal base station vertical. Ruggedly constructed for long life

Technical Specification

Gain	:- 6 dB
Impedance	:- 50 Ohms
Max Power	:- 100 Watts
Length	:- 3.14 metres
SWR 144 to 146Mhz	:- Less than 1.5
Wind Loading	:- 4.6 Kgf at 100mph
Weight	:- 1.2 Kgs
Mounting Diameter	:- 25mm
Termination	:- Free 'N' Socket

N Plug extra, costs **£4.82 inc VAT**

Send cheque or postal order for **£33.96** inc VAT plus **£2.60** postage to:

BUCKLEYS (UVRAL) LTD
Beta Works, Range Road
Hythe, Kent CT21 6HG
Tel: (0303) 60127/60126

Various Frequencies Available

WORKSHOP SERVICE MANUALS

Any Colour/Mono TV, Amateur Radio, Military Surplus, Music System, Vintage Valve Wireless etc, etc..... **£5.00 plus LASE**
Any Video Recorder..... **£15.00 plus LSAE**

FREE Catalogue Unique Repair and Data Guides for LSAE.

MAURITRON (REW)
8 Cherry Tree Road, Chinnor
Oxon OX9 4QY

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.

JAPANESE Ic's (PART OF OUR RANGE)

AN7178 £2.95, BA5406 £2.20, HA1377 £2.20, HA1392 £2.50, HA1394 £2.95, HA1397 £2.75,HA1398 £2.75, HA13001 £2.95, LA4460 £1.80, LA4461 £1.80, LA4507 £4.25, LC7137 £4.50, M51517 £2.80, MB3705 £1.80, MB3712 £1.50, MB3722 £3.50, MB3730 £2.50, MB3731 £3.50, STK461 £7.50, STK463 £8.40, TA7205AP £1.00, TA7222AP £1.30, TA7240 £2.95, TA7241 £2.95, TA7270 £2.75, TA7271 £2.75, TA7274 £2.95, TA7280 £3.50, TA7281 £2.95, TA7282 £2.95, TA7283 £2.95, TA7288 £2.95, TA7611 £3.20, UPC575 £1.00, UPC1156 £2.95, UPC1181 £1.10, UPC1182 £1.10, UPC1185 £2.50, UPC1188 £2.75, UPC1230 £2.50, UPC1263 £2.50, UP1277 £2.75, UPC1278 £2.75, UPC1365 £3.60, UPC1394 £1.95,
ADD 60p POST AND PACKING AND THEN ADD 15% VAT TO TOTAL

T POWELL 16 PADDINGTON GREEN LONDON W2 1LG
OPEN MON-FRI 10AM-5PM, SAT 9AM-12 NOON.
TELEPHONE: 01 723 9246
ACCESS/VISA. TELEPHONE ORDERS ACCEPTED OVER £5.00

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

Radio & Electronics World
The communications and electronics magazine

SMALL ADS

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

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

RADIO & ELECTRONICS WORLD SMALL AD ORDER FORM

TO: **Radio & Electronics World · Sovereign House**
Brentwood · Essex CM14 4SE · England · (0277) 219876

PLEASE RESERVE.....centimetres by.....columns

FOR A PERIOD OF 1 issue.....☐ 3 issues.....☐ 6 issues.....☐ 12 issues.....☐

COPY enclosed.....☐ to follow.....☐

PAYMENT ENCLOSED:..... £ —

CHARGE TO MY ACCOUNT.....☐

Cheques should be made payable to Radio & Electronics World Overseas payments by International Money Order Credit Card
CREDIT CARD EXPIRY DATE ☐☐☐☐

COMPANY .....
ADDRESS .....
SIGNATURE .....TELEPHONE.....
.....

		C	P	I							

SOUTH WALES

ELECTRO DISPOSALS

2000 sq ft of surplus equipment and components

UNIT 31, LONLAS WORKSHOPS SKEWEN, NEATH
Tel: 0792 818451

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

PSSS....

ALL THE SUPER BARGAINS ARE ON THE INSIDE FRONT COVER

PROFESSIONAL SURVEILLANCE EQUIPMENT

Crystal Controlled Micro Transmitters, Telephone Transmitters and Covert Body Transmitters

High Grade, Superb Stability

Countersurveillance

Portable and Pocket Bug Detectors and the Unique CS420 Tap Defeat System which will Nullify the Effect of ANY Telephone Interceptions

(includes auto tape recorders, tape transmitters etc)

Cyberscan International
3 Eastcote View, Pinner, Middlesex HA5 1AT.
01-866 3300. FAX: 01 429 0950

MRZ MICROWAVE MOBILE ANTENNA

ICOM-BUSINESS/AMATEUR/ MARINE/AIR UK AND EXPORT

MRZ COMMUNICATIONS LTD
NEWCASTLE UNDER LYME

ICOM

VISA

TEL: (0782) 619658
7 DAY SERVICE

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
08053 200

USED AMATEUR EQUIPMENT?

I buy, sell and exchange

For the deal you've been looking for, phone Dave, G4TNY, anytime on Hornchurch (0708) 862841 or (0836) 201530 9am-7pm Mon-Sat or send SAE
Personal callers by appointment please

G4TNY Amateur Radio
Thurrock Commercial Centre, Juliet Way, South Ockendon, RM15 4YG

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

JAYCEE ELECTRONICS LTD

JOHN GM30PW

20 Woodside Way, Glenrothes, Fife KY7 5DP
Tel: 0592 756962

Open: Tues-Fri 9-5 Sat 9-4

Quality secondhand equipment in stock. Full range of TRIO goodies Jaybeam – Microwave Modules – LAR

Service sheets from £2.50/1sae ctv/mus-c/combis £3.50/1sae. Sae Newnes & TV Technic books in stock. Thousands service & repair manuals. SAE Free review/Pricelists

IS (REW) 76 Church Street, Larkhall (0698 883334), Lanarkshire

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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.

MORSE CODE PREPARATION

Cassette A 1-12 wpm for amateur
Cassette B 12-25 wpm for professional examination preparation
Each cassette is type C90
Price of each cassette (including booklets) £4.95
Morse key with separate batter (PP3) – driven solid-state oscillator and sound transducer produces clear tone for sending practice
Price of key with electronic unit £8.95
Price includes postage etc Europe only
MM ELECTRONICS (Dept RER)
12 Longshore Way, Milton, Portsmouth PO4 8LS

COUNTY GUIDE

RATES
BOXES ad sizes
20mm x 59mm single
40mm x 59mm double

Total prepayment rates	Ad space	3 issues	6 issues	12 issues
	single	£47.00	£88.00	£158.00
	double	£94.00	£176.00	£316.00

RADIO & ELECTRONICS WORLD COUNTY GUIDE ORDER FORM

TO: Radio & Electronics World · Sovereign House · Brentwood · Essex CM14 4SE · England · (0277) 219876

print your copy here .....

.....

.....

.....

.....

NUMBER OF INSERTIONS REQUIRED

Single County Guide 3 ..... £47.00 ☐ 6 ..... £88.00 ☐ 12 ..... £158.00 ☐
Double County Guide 3 ..... £94.00 ☐ 6 ..... £176.00 ☐ 12 ..... £316.00 ☐

PAYMENT ENCLOSED £ —

Cheques should be made payable to Radio & Electronics World. Overseas payments by International Money Order

Conditions — Payment must be sent with order form. No copy changes allowed. Ads accepted subject to our standard conditions, available on request.

Registered No 2307667 (England)

C P I

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	18 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.

ADVERTISERS INDEX

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 158.

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.

NEWLY ADVERTISED ITEMS

FET CAPACITOR MICROPHONE Eagle CI 200 Electret type microphone. An FET amplifier is built in for obtaining an output equivalent to a high class dynamic microphone while retaining the characteristics of a capacitor microphone. External influence by magnetic and electrostatic noise is minimised since no magnets or coils are used. The small size of this microphone and the low power supply needed for its operation makes this microphone a very versatile unit. Electrical specifications are as follows: Output impedance: 500ohms±30% at 1kHz. Sensitivity: −65dB±3dB (0dB=1V/ubar at 1000Hz). Frequency response: 50-8000Hz. Price £1 each. Order Ref. BD646.

SUB-MIN TOGGLE SWITCH Body size 8mm x 4mm x 7mm SBDT 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 DPU instrument, with 19 ranges including AC and DC volts-dc current 5mA to 1A, 4ohms ranges up to 20meg— the low ohms range is particularly useful, you will be able to read right down to one ohm and below. This meter also has provision for reading dc current 0-5 amp and 0-25 amp. Meter size 6" long × 3" wide ×2" deep. Leather case has compartment for test leads, prods, and croc clips all of which are included. Can be used in the case. 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.

8 TRACK CASSETTE DECK Complete with cassette holder. In fact, if you have any 8 track cassettes, then with the addition of 2 speakers this unit would play them. As 8 track cassettes are no longer made the units have become surplus, however, they do contain lots of useful parts: motor, tape head and drive, pulley wheels, etc. and a stereo amplifier. Mains operated. Brand new in makers packing. Only £3.00 each plus £1.00 additional postage. Order ref 3P46.

TWIN CASSETTE & STERED RADIO—Covers long, medium and FM bands. Twin cassettes allow copying, editing, recording, playback, etc. A beautifully made portable unit which normally retails at about £60. Our price only £30, plus £3 insured delivery.

STERED SPEAKERS Each 10 watts 8 ohm and twin speakers mounted in Walnut-finish cabinets, size 16" high × 10" wide × 6" deep. Front is black Dacron and the finish is very pleasing. Price £7.00 per pair. Extra postage and packing £3.00.

UNUSUAL MAINS MOTOR Quite small, measures only 2"×2"×1" approx., but is surprisingly powerful. It revs at 3,000rpm and is reversible. It has good length ⅛" diameter spindle. Price £1.00. Our order ref BD640.

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 KIT for our laser gives 8kV striking and 1.25 running at 5mA. price £13 (plus £2 post unless ordered with tube).

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.

FLIP-OVER DIGITAL CLOCK Quite an eyecatcher, this is mains operated. The figures flip-over per minute and per hour and give a larger than usual visual display. Supplied complete with front and perspex panels to glue together to make its case. £2.00 each. Our ref 2P205.

STABILISED 15V 2A PSU kit which mounts on SRB panel. Mains operated. Ideal to drive monitor, etc. Price only £6. Our Ref 6P7.

SMOOTHING CAPACITOR 2300uF 63V 10A at 50 deg. C. Can type with mounting bracket. Price £2. Our Ref. 2P206.

SMOOTHING CAPACITOR 2200uF 63V 5.8A at 50 deg. C. Can type with mounting bracket. Price £1. Our Ref. BD644.

10A 100V BRIDGE RECTIFIER ASSEMBLY comprising 4 diodes mounted on two 4in x 3in sinks with bottom insulators. Price £2. Our Ref. 2P207.

DO YOU WANT TO MEASURE AC AMPS? We have found a few more of the 50Hz 0-40A AC 2½in diameter panel meters, made for RAF equipment these are very reliable and robust. Price £5 each. Our Ref 5P105.

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 FDD 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.

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

MINIATURE DRIVER TRANSFORMER—Reference LT44. Impedance ratio 20K ohm to 1K ohm centre tapped. Size approx. 19.5mm. 2 for £1. Order Ref. BD653.

2764 EPROM 65K bits. BBC micro compatible. £3 each. Order Ref. 3P48.

PIEZO SOUNDER. Reference PKM11 3-30V operation, 90dB output. 2 for £1. Order Ref. BD647.

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.

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.

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