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OCTOBER 1978

BRITAIN'S PREMIER MAGAZINE FOR THE DO-IT-YOURSELF RADIO AND ELECTRONICS CONSTRUCTOR

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FEATURES: Thermal shutdown—Very low distortion—Load line protection—Integral heatsinks—No external components

APPLICATIONS: Hi-Fi—Disco—Monitor—Power Slave—Industrial—Public Address

SPECIFICATIONS:
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APPLICATIONS: Public address—Disco—Power slave—Industrial

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<th>Length (metres approx.)</th>
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<td>1.6</td>
<td>10.0</td>
<td>For economical general purpose repairs and electrical wires.</td>
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MERRY-GO-ROUND

The world of radio and electronics is an exciting one. Developments and new ideas seem to occur almost daily—some are recorded in our regular feature ‘Hotlines’. For many, these new developments are a fascination and, often, the crux of what draws them into this field of technology either professionally or as an amateur or hobbyist.

But is all this development a double-edged weapon, and will familiarity sour to bewilderment or boredom? Let us indulge ourselves in a little electronic nostalgia.

The valve reigned supreme for some thirty years. Then the three wise men of electronics—Brattain, Shockley and Bardeen, introduced a little thing called a transistor. This latter device occupied the throne of technology for barely ten years and then—the coronation ceremony for the integrated circuit arrived. And it hasn’t stopped there. From a handful of “gates” on a silicon slice, technology has rampaged through MSI (medium scale integration) and on to LSI (large scale integration). Now, we hear terms like SSI (super scale integration) each term being more wonderful, more impressive, more technically advanced than its predecessor and the time gaps are also getting progressively less and less.

For the electronics industry itself this rampage has become a nightmare, albeit self inflicted, rather like riding a technological merry-go-round which is rushing faster and faster. True the results bring certain benefits but not without trade-off problems which affect both professional and hobbyist alike. In other words, a double-edged weapon. In the professional field, equipment is obsolete the day it is launched onto the market.

For the hobbyist it is also a double-edged weapon and at both ends of the scale, from the newest newcomer to the oldest old hand.

The beginner can no longer learn simple theory about a triode valve, nor indeed about a simple transistor. He comes straight into a galaxy of little black slabs with pins sticking out called DIPs (dual in-line packages), and hears that each one contains a few hundred transistors, resistors, diodes and heaven knows what else. If his enquiring mind wants to know more, he is buried in bewilderment by a deluge of meaningless terms like “slew rate”, “open loop gain” or “maximum current offset” and so on.

Even old hands don’t really benefit. They are offered a huge list of ICs to choose from and are probably confused (and bored!) by vast lists of meaningless numbers.

Isn’t it about time we stopped the merry-go-round or at least slowed it? Shouldn’t we learn to live with, and use wisely, what we already have?

Again, with so much circuitry crammed onto a single chip and so many chips available, has the home constructor become a mere “assembler” of IC building blocks? Is this also true for the designer?

Probably the fascination will now be to regard the vast army of available ICs as pieces in a jig saw puzzle. The trick for the future hobbyist-designers will be to juggle the pieces of the jig saw to make the picture they want. In other words, to ask themselves the question; how can the existing facilities on a particular chip be employed usefully and economically to fulfil a desired function. If this is true, then we have entered a new era in radio and electronics as a hobby.

However, it is also true that to design successfully by this method, a hobbyist-designer must know not only which chips are available, but exactly what each can do. So take another look at those long lists of IC numbers and ask yourself again what they all mean to you in practical terms, and you’ll appreciate the parallel of the merry-go-round and the inference of the double-edged weapon.

LIONEL E. HOWES—Editor

Growth of Telecommunications

In a recent speech to the Post Office Engineering Union, Mr. Gerald Kaufman, Minister of State, Department of Industry said, “During the last 10 years the number of telephone lines and the number of calls have both more than doubled. The U.K. now has more than 13 million exchange connections. A higher proportion of homes has a telephone in this country than in any other E.E.C. country except Denmark and Luxembourg.”

He continued, “Telecommunications is a growth industry. Traffic will continue to build up year by year. During the next decade or so emphasis may well shift from coping with the massive increase in new subscribers towards measures to deal with increased traffic growth while at least maintaining service standards.”

Microprocessors

The Society of Electronic and Radio Technicians (S.E.R.T.) is holding a residential symposium at Sussex University, September 26-29. The technical programme comprises 25 contributions spread over five sessions which will cover: devices evaluation, testing and diagnosis, programming and software; and two sessions on applications.

A small exhibition of microprocessors and peripheral equipment has been arranged in rooms adjacent to the Lecture Theatre and a visit to Sussex University is planned.

Delegates will get a chance to enter the S.E.R.T. Microprocessor Competition where the judges will seek a working application of a Microprocessor by a home constructor which is simple, economic, original and useful or entertaining. First prize will be £150 and the winning system will be played at an exhibition at the University of Sussex. Full information may be obtained by writing to: The Microprocessor Secretary, S.E.R.T., Faraday House, 8-10 Charing Cross Road, London WC2H 0HP.
BBC sells to Kuwait

BBC Enterprises has sold 132 educational and management training programmes to the Language Labs of Kuwait University. The programmes will all be shown in the original English versions, and cover a wide range of subjects—from "The Glory That Remains", "Heritage" and "Chronicle" series to "Economics of The Real World", "People Limited", and "Women at Work". Amongst the programmes selected by Kuwait University was "Rich Man, Poor Man".

"This sale means a substantial income for Enterprises", says Enterprises Sales Development Manager Peter Saxton. "Our agent in Kuwait is also interested in many other items in our 1000-programme catalogue. We are making a big push to sell in the Arab world, and have designed promotion material which incorporates Arabic calligraphy.

"We are very aware that each of the Arab countries has its own special requirements. You can't lump the whole Middle East together in marketing terms. Because of this we are currently meeting representatives from all the Middle East who can help us sell BBC programmes in their areas."

R.A.E. courses

OK Farm School, Farnborough, Hants. First class, Thursday, September 30, starting at 7.30p.m.

There will also be a Morse Proficiency Course beginning on Monday, September 27, at the Oak Farm School. Further gen from: J. Brett, Principal, Core School, St. John's Wood, Farnborough.

Harry Leeming, F.S.E.R.T., G3LLL tells us that providing there is enough interest, Blackburn will once again be running the City and Guilds R.A.E. Course.

Further gen from: The Principal, The College of Technology and Design, Fielder Street, Blackburn, Lancs.

Bridgnorth College of Further Education, Stourbridge Road, Bridgnorth, Shropshire.

That's the venue for the Monday evening R.A.E. Courses starting September 20. Further gen from Mr. R. A. Buckley, Deputy Head of Engineering Department, Bridgnorth College (address as above).

John F. Greenwood, G3ZJY, tells us that a R.A.E. Course will be run by him at a venue in Durham. The course starts September 20.

Further gen from John at 17 The Links, Belmont, Durham, DH1 2AG.

A course of study has been arranged at the Walsall College of Technology, St. Paul's Street, Walsall, West Midlands, to prepare for the R.A.E. Exam.

Further gen from: F. A. Fear, G8CVR, T.Eng, (CEI) MITE at the above college address or phone Walsall 25124.

Swinton (Manchester) — Moorside High School, East Lancashire Road. Thursday evenings, commencing September 30. Details from G8BFP, Tel: 061-794 3706.

Windy picture

What has happened to these BBC radio masts? Have any readers any explanation?
WITH the recent expansion of interest in In-Car Entertainment motorists have increasingly expensive radios and tape players in their vehicles and it becomes worthwhile to give them special anti-theft protection. This is especially true for soft top or convertible cars as these cannot be readily secured. It is the work of an instant to split a sports car hood and gain access to the equipment.

The units described in this article will sound an alarm, typically the vehicle’s own horn but any other form of alarm may be used, if the equipment is tampered with. They are designed to be left switched on, having a very low current consumption, and therefore there is no possibility of forgetting to set the alarm when leaving the vehicle.

**components list**

<table>
<thead>
<tr>
<th>In all circuits,</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1, R2 and, where fitted, R3 and R4 are 560Ω 10% ±W.</td>
</tr>
<tr>
<td>D1 and D3 are BY126.</td>
</tr>
<tr>
<td>D2 is OAG0.</td>
</tr>
<tr>
<td>FS1 is 95mA (see text for other ratings).</td>
</tr>
<tr>
<td>In Positive Earth, Earth Seeking and Negative Earth, Battery Seeking circuits Tr1, and, where used, Tr2 are AC128.</td>
</tr>
<tr>
<td>In Negative Earth, Earth Seeking and Positive Earth, Battery Seeking circuits Tr1, and, where used, Tr2 are AC187.</td>
</tr>
<tr>
<td>Miscellaneous. Switch, S1, single pole on/off low voltage at 1A. Relay RLA, 12V working, coil resistance 100Ω, two pairs of normally open contacts rated to suit the alarm used, size to suit the case used. An Alarm if vehicle’s horn isn’t used. Case to suit location in car. Wire for interconnections (see text for type). Epoxy resin or wax if encapsulated.</td>
</tr>
<tr>
<td>Note. The author has used three types of relay from Dorm with success, codes 348-385 (open), 348-755 and 348-807 (both with dust covers but require bases).</td>
</tr>
</tbody>
</table>

Two basic types are described. One, which is simpler to fit, will give an alarm when an earthed wire, the alarm unit sensing lead, is removed from the radio or tape player. In this article this type is referred to as earth seeking. The second type, referred to as battery seeking, can only be fitted if there is access to the internal wiring of the unit to be protected. A positive earth and a negative earth version of each is shown, as is an alarm unit to monitor more than one item.

**Description and Method of Use**

The alarm unit has five wires. Two are battery and earth, battery is fed via an on/off switch which acts as a reset. Two are from a pair of relay contacts which are normally open but which close if an alarm is detected. The remaining wire is the sensing lead.

With the earth seeking type the sensing lead must be connected to an earthed part of the equipment before the alarm unit is switched on. Whilst this connection is maintained the alarm unit will stay in a monitor condition. However, if the connection is broken and a thief must break it to remove the equipment, the alarm unit locks into the alarm condition. It can only be returned to the monitor condition by the reset switch.

The battery seeking version works in the same way except that the sensing lead is connected to the live side of the on/off switch inside the radio or tape player.

The alarm unit should be mounted in some inaccessible place, well out of reach of anyone tampering with the radio. The current consumption of the device is approximately 2mA in its monitor condition so there is no point in switching it off in normal use. The on/off switch need not, therefore, be readily accessible to the driver. The prototype has been in use for nearly two years without giving a false alarm.

The relay contacts can be used to operate a klaxon or similar warning device. If the vehicle’s own horn and battery are used, consideration should be given to extra protection for the wiring involved. It is too easy for a cool thief to open the bonnet, rip off the horn leads and swear at the horn switch for the benefit of passers-by. If he finds that he cannot stop the horn the average thief will panic.
If the earth seeking type is used the sensing lead should be frail and connected to a earthed part of the radio in an obvious position. This will tempt the thief to disconnect it at as early stage as possible. Once the alarm unit has been triggered, by the removal or cutting of the sensing lead, it can only be switched off by the reset switch or by disconnecting the battery.

The battery seeking version is used in a similar manner. The sensing lead, this time of more normal car wire, is taken inside the radio or tape player and connected to the live side of the on/off switch. It is then a good idea to leave the radio's in-line fuseholder in a prominent position. A thief will obviously prefer a set with undamaged leads and so disconnect the fuse early on. This will set off the alarm, scare off the thief, and leave an undamaged installation. As before, the alarm can only be reset by interrupting the supply.

**Circuit Description**

Fig. 1 shows a positive earth, earth seeking version. The sensing lead is connected to earth and holds the base of Tr1 at earth potential. Tr1 is thus normally cut off. The only current which flows in this quiescent, or monitor state is through R1. When the sensing wire is broken or disconnected the base of Tr1 is supplied, by R1, with enough current to operate the relay. The relay has its own hold path, through RLA1, and therefore the transistor and sensing lead become inoperative. The relay can only be de-energised by interrupting the supply.

Diodes D1, D2 and D3 are protection devices. D1 and D3 completely protect the alarm unit against incorrect connection. There is no combination of connections which will damage it. Equally, of course, there is nothing a thief can do to damage it. D2 protects Tr1 from voltage surges when RLA releases.

Fig. 2 shows a negative earth, earth seeking version. It is effectively the same as Fig. 1 except that the transistor is NPN and the diodes are reversed.

Figs. 3 and 4 show battery seeking versions. Fig. 3 is positive earth and Fig. 4 negative earth. They work in an identical manner to the earth seeking versions apart from the obvious difference that the sensing lead is normally at battery potential.

The four circuit variations for protecting a single item only. Fig. 1, bottom left, is for Positive Earth, Earth Seeking. Fig. 2, upper right, is for Negative Earth, Earth Seeking. Fig. 3, centre right, is for Positive Earth, Battery Seeking. Fig. 4, bottom right, is for Negative Earth, Battery Seeking.

*Practical Wireless, October 1976*
Protection of Two Units

If the earth seeking type is used it should be obvious that merely looping the sensing lead from radio to tape player will not have the desired effect. It would still be possible for a thief to remove one unit without affecting the alarm, as the remaining unit would maintain the earth on the sensing lead.

The answer, apart from fitting two alarm units, is to build an alarm unit with two sensing leads. Suitable designs are shown in Fig. 5 and Fig. 6. As radios or tape players occasionally break down or require servicing, the alarm system must also work when one unit is temporarily removed. This is achieved by the simple expedient of connecting the sensing lead from the missing unit directly to the car chassis. The remaining unit will then be protected as normal.

In the case of the battery seeking version limited protection for two units can be obtained from a single alarm unit if the two audio units are fed from a common supply. However, this relies on the thief being tempted to remove the fuse. If he takes a pair of wire cutters to the wiring instead it would still be possible to remove one unit without setting off the alarm. Figs. 7 and 8 show the two input, battery seeking versions.

Construction

The average constructor will, no doubt, have his own favourite method of building simple circuits such as those given in this article. The author has used two methods successfully for this alarm unit. One involves making up the circuit on a scrap of Veroboard, a suitable layout is given in Fig. 9, and mounting this, together with the relay, in a diecast aluminium box. The wires are then taken to screw terminal blocks mounted on the outside of the box. The method works very well and allows for plenty of fiddling later on.

The second method is more permanent. The dust cover on the relay is firmly sealed and the relay mounted in a container. The author found a section

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Fig. 9. The layout used by the author in constructing his alarm. The pitch of the board is not critical nor is the size. Terminations to the board can be by flying leads soldered directly to the board, (push the ends through the holes first of course) or by inserting pins into the holes and then soldering wires to the pins.

of square plastic drainpipe to be ideal. The associated components are then attached and the whole encapsulated. Any mistake will lead to an expensive, and very solid, length of plastic drainpipe, so considerable care is needed. For the more timorous, (less foolhardy?), wax makes an excellent substitute for epoxy resin as the encapsulating medium as there is the possibility of correcting one’s mistakes. The leads must be anchored in such a way as to prevent the transmission of any strain to the circuitry.

None of the components specified are critical or difficult to obtain. The relay must have contacts suited to the load to be switched. For vehicles fitted with a horn relay this is no problem, for most other vehicles contacts rated at about 10 amps seem to be satisfactory. It is, of course, true that the relay will probably only switch a few times in its life and that even 5 amp contacts will handle a car horn under these conditions. However, any failure of the relay, especially sticking together of the contacts, would be at best embarrassing, at worst expensive. It is certainly worth the extra cost to do the job correctly.

The coil resistance must be high enough not to overload the transistor. In this case it is unlikely that any relay chosen would draw more than the 1 amp necessary to damage the specified devices. Coil resistances above 100 ohms are recommended, but values down to about 25 ohms could be used if the fuse rating is increased.

The only other possible difficulty involves mounting the Veroboard in the diecast box. The author found it impossible to purchase standoffs for this purpose and used long spacers. Threaded rod and locknuts would also do the job.

---

**KINDLY NOTE!**

Transistor Tester Part 2, August 1976

The following corrections to the text will make the setting-up and operation of the equipment easier to understand.

1. Page 302, R.H. colm., para. 3: Delete “across R30” and the whole of the bracket. Insert “to the end of R30 nearest C6 (positive lead) and the end of R5 nearest the edge of the board (negative lead)”.

2. Page 303, R.H. colm., last para. 4th line: Delete “I_{R30}” and insert “3mA”.

3. Page 304, L.H. colm., para. 2: In the sentence starting “Note that...” V_i should be V_o is set...

4. Page 304, section on diodes: After “V_o to 10 volts” add I_H to I_{CBE}.

Please accept our apologies if you have had problems.

---

**PW TECHNICROSS PUZZLE**

Solution to No. 15 presented last month

---

Practical Wireless, October 1976

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LISTENING below 28MHz is exciting, because, as the wavelengths get shorter and the frequency increases, the normal paths of radio signals become vulnerable to a variety of natural disturbances which frequently occur within the Earth’s atmosphere. Under normal atmospheric conditions the range of a VHF radio signal decreases as the frequency increases and the technology of the receiver becomes more sophisticated. Because of this limited range it is possible for VHF transmitters to work on similar frequencies, provided that they are, geographically, far enough apart not to interfere with each others accepted receiving systems.

Frequency sharing is essential, because every year there is an increasing demand upon the limited space available within the VHF part of the radio frequency spectrum and the authorities endeavour to get the maximum number of stations operating in the minimum possible frequency space. It is in this field that the RSGB’s negotiators play an important role in representing the interests of the amateur radio operators who use the 2m and 4m bands, as well as their allocations in the UHF and SHF parts of the spectrum.

It is essential, for the future of amateur radio, that these bands are used wisely, because there is only one radio frequency spectrum and the small space already allocated for amateur use must be treated like a precious commodity. It is important to bear in mind that the authorities in all countries could collect a large licence revenue if the present amateur bands were given over to commercial users.

International frequency sharing works well until a natural disturbance, such as an aurora, sporadic-E, or tropospheric opening takes place and multiplies the normal range of a VHF radio signal by ten which consequently causes considerable interference to the other systems operating on the same frequency.

SPORADIC-E

The ‘E’ region of the Earth’s ionosphere forms at sunrise about 60 miles above the Earth’s surface and disperses at sunset, but during the mid-summer months (May to August) this region may suddenly break up into clouds of more densely ionised gas and upset the normal paths of radio signals between 50 and 80MHz, and in extreme cases, it can spread it’s influence to 150MHz. Sporadic-E is a curse to the Band I (41-67MHz) viewers whose mid-summer enjoyment of afternoon sports such as the Test matches and Wimbledon, as well as some early evening programmes, are spoilt when their normal crisp picture is obliterated by patterns as their TV receives signals from a variety of distant transmitters which are sharing the same frequency.

When sporadic-E is present, radio amateurs using the 4m band have frequently heard very strong signals from FM broadcast stations, mainly Polish, operating between 69 and 72MHz. Parts of this band are used in eastern Europe for national broadcasting networks and under normal conditions they are far enough away not to interfere with 4m activity in the UK.

For many years the author has made a number of daily checks on the vision frequency of the R1 television service (Russian 49-75MHz) and has found that this signal is the first to “appear” (in southern England) at the beginning of a sporadic-E.
disturbance and the last to fade away at the end. Some of these disturbances last for several hours and it is interesting to hear the changes in signal strength of many DX stations as their particular frequency falls under the influence of the prevailing sporadic-E. It is not unusual to find that the disturbance is limited to between 30 and 50MHz, or the higher range, say 50 to 80MHz, but whatever happens, it all seems to hinge around 50MHz because the sync. pulses from the R1 system are present throughout the event.

TROPOSPHERIC OPENINGS

Normally a radio signal transmitted between 100 and 200MHz has a range of approximately 100 miles, but during a tropospheric opening these signals can travel more than 1,000 miles. Because of this, the general public suffers from distant-station interference to their television pictures when they watch one of the ITV stations in Band III (176-215MHz) during a disturbance.

A tropospheric opening usually follows a spell of fine weather accompanied by a ridge of high atmospheric pressure. The majority of radio amateurs who use the 2m band (144-146MHz) take advantage of the “good” conditions to work some DX. The following rule of thumb can be applied. If the Band III pictures are patterning, then switch on the 2m gear. On the other hand, if the interference is affecting Bands IV and V, then take a look on the 70cm band. However, if both systems are disturbed then be prepared for a long session at the receiver, because the DX should be rolling in.

BAND II

The FM broadcast band (88-108MHz) is on the borderline; it can be affected by extreme cases of sporadic-E and a minor tropospheric opening. Band II is used by most European countries for national and local broadcasting so when a disturbance takes place it is not uncommon to hear continental signals overpowering the BBC stations between 88 and 96MHz. Although it is not unusual to hear about 20 continental broadcast stations in Band II during an opening, the author has heard up to forty during a big event, with only a horizontal dipole feeding the receiver.

AUORAL PROPAGATION

Briefly, an aurora is a region of ionised gas caused by a stream of solar particles entering the Earth’s polar atmosphere. This temporary ionisation has a strange effect on terrestrial radio signals. For example, the letter ‘Q’ sent in Morse code under normal circumstances would sound like this “dah, dah, dit, dah” but when this signal is received, via auroral reflection it would sound like “ror, ror, ri ror”. In the first instance the signal has a clean T9 note and was received directly from the transmitter over a limited range but when the same signal bounces off an aurora it can travel for more than 1,000 miles and its note is so poor that the DXer logs it as Tone-A. An aurora is a beautiful sight but obviously it is only visible when it manifests itself during the hours of darkness, and then the skies must be clear, but now, with the aid of VHF radio, we can identify an unseen auroral event.

SOLAR ACTIVITY

The Sun is said to have “active” regions when dark patches, known as sunspots, can be seen on its apparent yellow disc. In the mid-1930s Denis Heightman (G6DH) and the late Nell Corry (G2YL) heard a strange “hissing” noise on the 10m band which they rightly concluded was coming from the Sun. In July 1938, Miss Barbara Dunn (G6YL) was the first to identify this noise in the 5m band.

We now know that when sunspots are present the sun may eject a stream of nuclear waste accompanied by a strong burst of metre-wave radio noise. The radio waves from this event take around eight minutes to reach the Earth, but the particles which left the sun at the same time may take between 20 and 40 hours to arrive in the vicinity of the Earth. Should these particles collide with the Earth’s atmosphere then an ionospheric disturbance (which would upset the HF bands) or an auroral event can be expected.
The author has observed the sun at 95 and 136MHz for several years and has found two definite types of activity when sunspots are present; first, there is the individual burst of radio noise which may last for several minutes, Fig. 1, and secondly, there is the continuous noise storm which may rage on the Sun for many days, Fig. 2. It is during the lifetime of one of these solar storms that an ionospheric disturbance or an aurora is most likely to occur. In fact, when one of these storms enters its second day the author telephones the information to Charles Newton (G2FKZ) the RSGB’s auroral co-ordinator.

**EQUIPMENT**

The following list of equipment is recommended for the enjoyment of VHF listening and the study of metre-wave disturbances:

1. A general-coverage communications receiver; AR88, Eddystone 680X, Hallicrafters SX122, Hammarlund HQ180, etc.
2. A VHF communications receiver; Eddystone 770R or ex-Govt. R216, both can be used to resolve FM signals.
3. A 2m-band converter, crystal controlled local oscillator.
4. An 8-element Yagi aerial to feed the 2m converter.
5. A barometer to monitor the atmospheric pressure.
6. A long-wire aerial suitable for the 10m band.
7. A vertical dipole cut to 50MHz for sporadic-E work.
8. A horizontal dipole cut to 100MHz for tropospheric work.
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**TRANSISTOR TESTER**

In-situ transistor tester. It’s much more convenient for an engineer to be able to check whether a transistor is OK or not without having to unsolder it and check it on a conventional tester. Our project next month is an in-situ go/no-go transistor tester which can be built easily and inexpensively. Two LEDs are used for indicating the state of the device under test.

The unit is particularly easy to use and can save a great deal of time and trouble.

**ASSESSING OLDER SETS**

The problem of whether or not to spend money on repairing an old set can be difficult. Vivian Capel outlines what to look for in assessing the overall condition of older receivers.

**REPLACING LINE OUTPUT TRANSISTORS SAFELY**

One of the major hazards of servicing modern solid-state TV receivers is the vulnerability of line output transistors under certain fault conditions. Care and knowledge are required if the replacement is not to suffer instant destruction. E. Trundle explains the problems and the precautions required.

**SURFACE WAVE FILTERS**

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Practical Wireless, October 1976
In our September article we limited the design to a battery powered unit. Now, to avoid the expense and bother of changing the batteries in the unit at frequent intervals when the machine is in constant use and, perhaps even more serious, to avoid finding the batteries flat when the unit is called into use after a long period of non-use, a mains power supply has been designed to fit into the case.

**Circuit description**

The unit employs full wave rectification of the LT output from the transformer and this rectified output is smoothed by capacitor C3. R9, C4, D6 and Tr6 provide a degree of stabilisation which prevents the relays chattering or the LEDs dimming.

 Provision is made for earthing the OV line but this should only be used if the connections to the recorder are such that another earth is not present, thereby avoiding a hum loop. The schematic is given as Fig. 7.

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**Components list**

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<td>560 5%, 1W</td>
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<td>C3</td>
<td>1000µF, 25V</td>
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<td>C4</td>
<td>10µF, 12V</td>
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<tr>
<td>D4 and D5</td>
<td>1N4001</td>
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<tr>
<td>D6</td>
<td>10V zener, type BZY88</td>
</tr>
<tr>
<td>Tr6</td>
<td>BFY51</td>
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<tr>
<td>T1</td>
<td>Mains transformer, 240V to 9-0-9V, 100mA</td>
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<td>S2</td>
<td>Double pole on/off, mains rated.</td>
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**Note:** These components were given in the main article and reference numbers have not been changed.
Photograph of the inside of the authors completed unit showing the mains board installed at the rear of the cabinet.

**Construction**

Except for the mains switch, all components are mounted on a single PCB similar in size to the electronics board described last month. Fig. 8 shows the wiring pattern for this board whilst Fig. 9 is the component side of the board. The position for the earth link is shown quite clearly.

---

*Fig. 7. The schematic diagram of the mains unit.*

*Fig. 8. The wiring pattern for the component side of the board.*

*Fig. 9. The component side of the etched board giving the location and orientation of the components used. The wiring pattern is shown as if the board were transparent. This assists the correct insertion and circuit checking.*
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THOUGH this converter is primarily intended for 14, 21 and 28MHz Amateur bands, it also covers additional frequencies in the 12-30MHz region. The output of the converter is approximately the 2.5-5.5MHz region, the converter and receiver operating as a "tunable IF" arrangement. The converter thus allows HF band reception with a receiver otherwise unable to cover these frequencies. Numerous surplus and older receivers are able to give a good performance in the 2.5-5.5MHz range, so can give good HF band results with a converter. The converter also assures very good sensitivity, and an enormous improvement in second-channel rejection of interfering signals, compared to the performance of a receiver with one RF stage, and an IF of 470kHz. An incidental advantage is the "spread out" tuning which is obtained. A general-coverage receiver may tune the whole range from 28-30MHz...
over a very small section of the scale, but with the converter in use this coverage would be from 3·5-5·5MHz on the receiver, which is likely to be a large part of the receiver tuning scale.

**Crystal Frequencies**

With a fixed frequency crystal controlled oscillator, and tunable IF (the receiver), signal frequencies lie either above or below the oscillator frequency, and differ from the oscillator frequency by the frequency to which the receiver is tuned.

As an example, assume the oscillator frequency is 24·5MHz. If the receiver is tuned to 5·5MHz, signals at 24·5 plus 5·5 = 30MHz will be received. When the receiver is tuned from 2·5MHz to 5·5MHz, reception is over the range 27-30MHz. At the same time, wanted signals could lie at the other side of the oscillator frequency. For these, 24·5MHz minus Receiver Frequency = reception frequency. Thus the same receiver tuning range allows 19-22MHz to be covered. The required frequencies in the 27-30MHz or 19-22MHz ranges are selected by aerial and RF circuits tuned to the wanted frequency. In this way, a 24·5MHz crystal can provide both 21 and 28MHz Amatuer bands.

The converter uses two crystals, 24·5MHz and 17·5MHz. The latter thus gives reception over the 12-15MHz range and the 20-23MHz range.

**RF and Mixer**

Tr1, Fig. 1, is the RF stage, with aerial coupling winding L1, and winding L2 tuned to VC1. VR1 allows gain to be reduced. Drain primary L3 couples to L4, tuned by VC2. L2 and L4, with the 2-gang capacitor VC1/2, cover approximately 12-30MHz. TC1 and TC2 are for trimming these circuits, and no band-switching is required. The mixer Tr2 provides output for the receiver via C7.

S1/S2 is a DPDT switch, and in the "on" position, the aerial is connected to L1, and the battery negative circuit is completed. With the switch "off" the aerial is directly to the output socket, so that the receiver can be used on its LF bands without having to change connections by hand. If the converter is for permanent use with a receiver not employed for other frequencies, S1 can be omitted.

**Oscillator**

Oscillator frequency is controlled by the DPDT switch S3/S4. With S3 at B, the 24·5MHz crystal is in use, L5 being core-tuned to resonance and having C10 in parallel. With the switch in the A position, the lower-frequency crystal is in use, and TC3 is across L5 and C10, and is adjusted so that the oscillator is working at this frequency. Injection to the mixer gate is via C9.

When the oscillator is first tested, place a meter in series with R14. Tr3 should draw about 2·3mA.
which rises to about 4-12mA when oscillating. First adjust L5 core for the higher frequency crystal, then switch to the lower frequency and adjust TC3. These adjustments are not critical, but if Tr3 is not oscillating, the converter cannot function. Check that oscillation commences when switching on, as this usually requires L5 and TC3 to be set slightly off the peak settings giving strongest oscillation.

**Inductors**

All inductors are wound on 7mm diameter formers about 25mm long, with adjustable cores. Some change to diameter or wire gauge is unlikely to be

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*Photograph showing the underside of the unit, which houses the RF board and tagstrip.*

---

*Practical Wireless, October 1976*
important, provided the coils can be tuned correctly. Point 3 of L2 is near the tagged or board end of the former. Wind 15½ turns to point 4. Immediately adjacent, wind 5½ turns in the same direction, beginning at Point 2 and ending at point 1, for L1. L4 starts at point 4 near the board, and has 15½ turns to point 3. L3 has 6½ turns, in the same direction as L4, starting at point 2 and ending at point 1. All windings (including L3) except L5 are of 24SWG enamelled wire with turns side by side. L3 is thinner insulated wire such as 32SWG silk covered, over-wound near the earth end of L4.

L5 is 17 turns with the windings secured by a touch of adhesive at the ends. If the formers have tags, shape the ends to solder to these. If there are no tags, leave the wire ends long enough to run down to the required connecting points.

RF Board
Components for RF are located on plain perforated board, 0.15in matrix, and 50×32mm, Fig. 2. Each point MC is a 6BA 12mm bolt with tag. Later, extra nuts allow the board to be locked to the chassis with about 6.9mm clearance.

Drill a hole in the chassis so that a lead can pass straight through from pin 3 of L2, to VC1. Leave flying leads for S1, VR1, and from R4. The lead from R4 passes up through the chassis near L3.

OSC/Mixer Board
The osc/mixer board is prepared in a similar way, and is 87×50mm, 0.15 matrix, Fig. 3. The crystals are small plug-in types with 12mm spacing, but suitable crystals are made with different pin arrangements. It is necessary to use fundamental crystals, not overtone type crystals which are of lower frequency.

Wiring is carried out as for the RF board. Leave a pin or projecting lead from 1 of L3, so that the wire from R4 can be soldered on. A short wire, shaped to reach VC2, is soldered to the latter when the board is fixed. Drill holes in the chassis under the crystal tags and Tr3 base, so that leads can run down to S3 Fig. 4. Two further holes near TC3 are for the leads to S4. When the board is fitted, cut these leads to suitable length and solder them to S3 and S4 (see Fig. 1). If the reduced frequency coverage mentioned is sufficient, omit one holder, S3/S4, and TC3.

As Tr1 and Tr2 are gate-protected devices, no special care is needed in fitting them, except for that generally exercised to avoid overheating while soldering connections.

The trimmers TC1 and TC2 are soldered directly to VC1 and VC2, as in Fig. 5. These trimmers must have a low minimum capacitance, so that 50MHz can be reached, and 60pF trimmers are unsuitable.

For 'straight through' working a lead runs from S1 to the output socket, and this should be clear of the RF and mixer boards, emerging near the panel and C7.

Metal Case
A metal case is essential to prevent pick-up at the frequencies to which the receiver is tuned, and is made from universal chassis members. A 175×100mm flanged member forms the converter chassis, and 6mm must be cut from the back of this, if the case flanges are to fit outside the panel.

Drill the panel and chassis so that items can fit continued on page 518
ORTH, south, east and west, they come from everywhere to Radcomex, the first in a new series of Radio Communications Exhibitions, sponsored by the R.S.G.B., which took place at Alexandra Palace, London on July 30, 31 and August 1.

Day one saw a happy band of eager bargain hunters hoping for the choice pickings (and getting them) and many exhibitors were pleasantly surprised by the high level of activity. "We expected a quiet first day," said one.

Nearly 5,000 potential buyers invaded the Great Hall at Alexandra Palace and left clutching their bargains. It was an event of immense interest to anyone connected with Amateur radio, but it was also a bonanza for all radio and electronics constructors who found a wealth of items on offer including massive component varieties, black boxes, receivers, converters and counters.

Bargains were rife throughout the exhibition. Crystals were on sale at 40p and for the same price one could buy a crystal oven. Four-gang 300pF variable capacitors were offered at only 70p (just check the prices of that component in catalogues today), and for v.h.f. tyros, transistors giving 5W at 175MHz could be had for only 70p. Bill Sears, a visitor from Brighton confided gleefully, "Everything I've bought is a bargain".

AROUND THE STANDS

Perhaps the busiest stand at the exhibition was that of radio component suppliers J. Birkett of Lincoln. The stand offered a truly fantastic array of components both active and passive. All items had been laid out with the greatest of care, each class of component being in a separate compartment and very clearly labelled. All the effort certainly paid off and one always had to push (just a little) to get at the Birkett goodies. With quartz crystals offered at only 40p and hundreds of other components at giveaway prices, the pushing/queuing proved well worth while.

The feminine touch was provided by Cobham Engraving Company. Under the banner of "ZNI" callsigns, the company engravels some very attractive plaques, name plates and lapel badges. Mike Hawkins (G3ZNI himself) explained, "It's really my wife's company, I just help out".

Frank Chabile, a director of distributor Doram explained that his company (a stablemate of Radiospares/Electrocomponents) had made certain changes in direction. It has progressed from being a pure component distributor to supplying an expanding range of kits.

Of the exhibition itself Chabile had very definite ideas. "I like the response, the number of people, and I like the space—no overcrowding; I really hope the RSGB make a go of it."

Life had its ups and downs at Radcomex, especially for Clarbrook. This company showed a range of aerial masts which are raised and lowered by compressed air. Either a car tyre pump (foot operated) can be used or, for the more leisurely brethren, the Clarbrook special masts operated "Mast pumper-upper" can be employed. Doubtless it is rated at quite a few p's.

Readers near Wallington in Surrey will be pleased to hear that the Amateur Radio Bulk Buying Group has just opened a new showroom in Wallington. The company is already strong in components but in its new showrooms it will be stocking and exhibiting a full range of Amateur transmitting and receiving equipment also.

Steve Dean of Axial Products fame is an old exhibition addict. He claims that most three-day exhibitions follow a pattern; first day hectic (eager types looking to bag the best bargains); second day quiet; third day hectic (people who wished they'd gone on the first day).

The BBC engineers put on a convincing show of CEEFAX. The big question they are asking now is—what will happen when the experimental transmission stops officially in September.

Graham Berrell of the BBC engineering information department thought that if the CEEFAX service started, then the initial cost would be another £100-£200 on the price of a colour television receiver. However, he thinks that if the idea really caught on and production levels rose, then the cost could drop through mass production to as low as £30.

The R.S.G.B. page, transmitted and decoded by the B.C.C., Ceefax service. Photo taken "Off-Air".

Practical Wireless, October 1976
The exhibition boasted several Amateur radio stations on the air, including four operated by the R.S.G.B. and one on the Practical Wireless/Television stand (GB3PW).

Among the many exhibits which ranked high in terms of interest was the Easybuild Video-Writer shown on the Practical Wireless stand. It exerted a strange attraction on all who passed and many, too shy to demonstrate their literary talents, settled for seeing their own name in print on the monitor screen after trying their hand at “writing” using the keyboard.

Also of interest on the Practical Wireless stand was an array of recent past projects and a sneak preview of some which are scheduled to appear in future issues of the journal.

The “Television” side of the stand featured their Teletext decoder kit. It is claimed to be the world’s first kit for home constructors for decoding and displaying the ORACLE and CEEFAX television information display systems. The kit will be complete with PCBs, etc. The unit will be an r.f. to r.f. type decoder thus no mods will be necessary to the “insides” of TV sets.

Tucked up in a corner but bubbling with friendly enthusiasm was the Radio Amateur Invalid Bedfast Club. Anyone who is disabled is very welcome to join but helpers may also become members. The club has its own nets: 3750kHz SSB on Tuesdays (1000hr) and Wednesdays (1400hr). There is also a continued on page 526
You may not own a Rolls or Lamborghini, but our November issue is the next best 'thing. We'll show you how to equip your lowly buggy with electronic gadgets that'll make your car safer, cheaper to run, less prone to breakdowns and easier to work on. Be the envy of your friends.

'Clitest' Probe

Low Level Battery Indicator

Burglar Alarm

Electronic Thermostat

PLUS MANY OTHER FEATURES
ON SALE IN OCTOBER

VIDEO WRITER Part 4

HAVE YOU STARTED TO CONSTRUCT THIS PROJECT YET?
Parts 1-3 have covered the Power Supply and Sync Generator Board. Part 4 covers the Address Counters and Registers.
During the last few years many articles have appeared on various types of digital timekeeping devices. There is one type of digital clock, which we present here, which has not yet been described. That is a good attractive and relatively low-cost car clock. The features that distinguish this clock from mains powered clocks are as follows:

(a) The car clock has to generate its own 50 Hz timing signal.

(b) Most of the time it operates off the car battery—that is off 12V, but if this drops too low, when starting or in cold weather, or if disconnected, it runs off its own internal backup battery.

(c) The design includes a two-position intensity control switch. The display can be bright during the day and dim at night so as not to distract the driver.

Circuit description

The complete circuit diagram of the clock is shown in Fig. 1. One quarter of IC3, gate A, is used as a 3.2768 MHz crystal oscillator. R3 biases the gate in its linear region, and X1 and its associated capacitors create positive feedback at the crystals parallel resonant frequency, making the circuit oscillate. R4 reduces the drive to the crystal and reduces the amount the frequency shifts when the supply voltage is varied. In practice the frequency changes by about 2 ppm when the voltage is reduced from 12V to 5V. Constructors may be interested to know that the accuracy of their clock should be a bit better than that of most currently available digital watches. This is because the current drawn by the IC’s of a digital watch is approximately proportional to its crystal frequency. The manufacturers have made this as low as possible, in practice 32768 kHz (24 Hz). They usually use a rod-shaped piece of quartz supported at each end called an XY-bar. The timebase in this clock uses a 3.2768 MHz “AT CUT” crystal, (2⁴ x 100Hz) which is a thin disc of quartz supported at two points on its circumference with electrical contact pads on each face, Fig. 2.

The XY bar crystal has a parabolic temperature coefficient, so there is no reasonably wide range of temperature over which its resonant frequency is constant. The AT-CUT crystal has an “S” shaped temperature coefficient, and its frequency may be virtually stable over a range of 10°C to 50°C, giving a higher accuracy than its watch counterpart. When carefully adjusted the clock should be accurate to within a few seconds per month.

Returning to the circuit in Fig. 1, the oscillator output is divided by 2⁴ by IC2, a 4020, 14-stage binary counter, to 200 Hz, and then to 50 Hz by IC4, a 4013 dual “D” flip-flop used as a divide-by-four counter. The 50 Hz signal is then buffered by gate B of IC2 and taken to the 50 Hz input pin of IC1. The crystal frequency is adjusted to exactly 3.2768 MHz by varying IC1. If IC1’s maximum capacitance is not high enough, an extra capacitor, C6, may be soldered in parallel with it.

The clock circuit—digit driving

When LED1 is to be lit up, Pin 7 of IC1 goes positive, firing thyristor TH1. At the same time the combination of IC1 segment output pins required to form the right character also go positive. As the
**M. FISCHER**

**CLOCK**

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**Specification**

**Display:**
- 4 digits: hours and minutes
- 12.5mm character height
- Red
- Peak segment current 130mA
- Average segment current 19.5mA

**Case:**
- Colour: white with red display window
- Size: 40mm x 154mm x 85mm

**Approximate power consumption:**
- Displays off: 14mA
- Displays on dim: 25mA
- Displays on bright: 340mA
- On battery backup: 9mA

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**Practical Wireless, October 1976**

*Fig. 1: Main circuit diagram of the digital car clock. Certain components may be altered or left out completely, but constructors should refer to the text for details. Supply to IC(4011) is to pin 14, while OV is to pin 7*

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*Only included for 24hr model
† See text*
emitters of the segment driving transistors $T_{r1}$ to $T_{r7}$ cannot now go more than about 2V positive of 0V because of conduction by LED1 diodes and $T_{h1}$ a current of about 3mA flows in the bases of the selected transistors and these turn hard "on". This causes about 130mA to flow through each of the required LED1 segments. The magnitude of this current is set by resistors R12 to R18. The peak digit current can be as much as 910mA, hence the use of thyristors $T_{h1}$ to $T_{h4}$.

When LED1 has been on for about 200µS the driving signals from $I_{c1}$ go low, the segment driving transistors turn off, and thyristor $T_{h1}$ turns off because there is no longer any current flowing through it. For an interval of about 60µS, called the inter-digit blanking time, no digits are selected, the sequence is then repeated for each of the digits in turn. Thus, although the eye sees a continuous display of four digits, what is actually happening is that the displays are flashing on one at a time, in sequence. This is called a "multiplexed" display. After the 10's of hours digit has flashed, there is a pause during which a positive pulse appears on the strobe line of $I_{c1}$, pin 6. The IC then "examines" pins 1, 11, 12, 13, 14, 15 and 16.

If D7 has been included, pin 13 will be pulled positive, and $I_{c1}$ will know that it is to operate in the 24hr mode. Also if S2 or S3 is being pushed, pin 16 or pin 1 will go positive and the IC will know that it must either advance the minutes or the hours digits.

**Power supply**

(all voltages given are with respect to 0V)

If the car battery voltage is 12V, point (1) will be at 12V. Point (2) will be about 11·1V due to the drop across $R_{2}$ and D5. If B1's voltage is 9V, D2 will be reverse biased, and no current will be taken from B1. If the car battery voltage drops below 9·3V, due to starting or disconnection, point (2) will drop below 8·4V, D2 will be forward biased and the clock IC and crystal timebase will draw power from B1.

R2 and D4 protect the circuitry from high voltage spikes on the car power supply, while the power for the displays is taken from the ignition switch.

When the ignition is off, point (3) is at 0V, the display drivers do not function, and the displays are off. In fact the displays will be on, but very very dim because the 3mA output from $I_{c1}$ segment driving pins will flow through the displays giving them one fourtieth of their "on" brightness. When the ignition is turned on, point (3) will go to +12V, and if S1 is closed, point (5) will go to +10·6V, and the displays will light up properly. If S1 is opened the total display current is limited by $R_{1}$, and the intensity drops to a level suitable for night driving. R1's value can be adjusted to individual taste. Constructors who intend to use the clock in an application where battery back-up will be used frequently, should place a 1·5V battery in series with B1 to increase the back-up endurance.

**Using soldercon pins**

Cut off two 8-pin and eight 5-pin strips of soldercon pins, insert the two 8-pin lengths into the $I_{c1}$ position on the clockboard with their carriers outwards and solder only one pin near the middle of each row. Inspect the pins and ensure that they are both vertical and flush with the PCB—if in doubt, reposition them with a fingertip while re-melting the solder. If the pins are not flush with the PCB they will have reduced resistance to tilting. Solder the remaining pins. Break off the carrier strips by twisting them right over backwards and up again several times, using long-nose pliers. In general, don't do this breaking off until all the soldering near the pins is finished as individual pins will topple over if the solder holding them melts. If you do want to solder near pins without carriers, first insert an IC to hold the pins in position.

Similarly use the eight 5-pin strips to make the sockets for the displays. Insert the displays into their sockets, the FND 500's have grooves at the top, TIL 322s have writing on the bottom. If you are using TIL 322s first shorten the leads to 4mm. The display board is the right way up when its markings are the right way up. Now using a pair of wire cutters, cut the 8 mounting pillars off the inside of the top and bottom halves of the case by "nibbling" around them until they come away. Mount and solder four tinned copper wire links on the display board as shown in Fig. 3.

**Mounting the display**

Prepare two pieces of stiff tinned copper (22SWG) wire as shown in Fig. 4 and insert them through the holes in the clock board marked "M", Fig. 5. Now solder them as shown in Fig. 4 and solder to the display board as shown in Fig. 6, with a 2mm

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**Fig. 2:** To the left is shown an XY bar crystal as used in most digital watches. To the right is the type of crystal used in this project—an AT-CUT crystal.

**Fig. 3:** Display PCB showing the foil side to the left and the component overlay to the right. Notice the four wire links required to bridge the tracks.

**Fig. 4:** Clock board showing the leads for the new circuitry. Note the extra holes in the top and bottom halves of the case.

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Practical Wireless, October 1976
gap between the clock board and the display board. Solder the struts to the display board, bend the ends over on the front and trim them off.

Place the partially assembled module in the bottom of the case with the aluminium rear panel and perspex front panel in position. The back edge of the clock board should be pressed up against the aluminium panel, resting on the plastic lip. If the displays protrude too far forward, put a kink in the struts to pull the display board closer to the clock board. Adjust the module so that the displays are central, and mark the positions of the two mounting holes at the rear of the clock board in the bottom of the case. Drill these out to 3mm dia.

Mount and solder the soldercon pin sockets and components, including the crystal, on the crystal board as shown in Fig. 7. Do not yet insert the ICs into their sockets. The crystal should be mounted without bending its leads, or the seal between them and the case may be broken. The leads should be cut to 5mm. Now using a small piece of double-sided self-adhesive tape, fix the crystal to the PCB with its leads vertically above its mounting holes. Use two pieces of tinned copper wire with one of their ends bent into a “walking stick” hook to connect the crystal leads to the PCB.

![Clockboard diagram](image)

**Fig. 4**: To attach the Display board to the Clock board, two pieces of stiff 22SWG wire are bent to the above shapes and soldered as shown.

### Wiring

Building a clock with very neat wiring involves more work than building one with untidy wiring, but the extra pleasure obtained is well worth the effort. Prepare two pieces of flat (ribbon) cable, strip and tin the ends, then trim the tinned ends to an apparently very short 5mm. Form cable to the shape shown in Fig. 8 and connect the “a” to “g” pads on the bottom of the clock board to the “a” to “g” pads on the display board. Similarly connect pads 1 to 4 on the right of the display board to the 1 to 4 pads on the bottom of the clock board. In each case the PCBs have been arranged so that the sequence of connections is the same on both PCBs. Wire up the clock board, the crystal board, back-up battery clip and the switches and power supply wires as shown in Fig. 1. A temporary 560Ω resistor, RX, should be included in series with the wire going to the ignition pad.

### Components list

**Resistors**

<table>
<thead>
<tr>
<th>Value</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1 560Ω</td>
<td>R12 68Ω</td>
</tr>
<tr>
<td>R2 15Ω</td>
<td>R13 68Ω</td>
</tr>
<tr>
<td>R3 10MΩ</td>
<td>R14 68Ω</td>
</tr>
<tr>
<td>R4 1.5kΩ</td>
<td>R15 68Ω</td>
</tr>
<tr>
<td>R5 3.3kΩ</td>
<td>R16 68Ω</td>
</tr>
<tr>
<td>R6 3.3kΩ</td>
<td>R17 68Ω</td>
</tr>
<tr>
<td>R7 3.3kΩ</td>
<td>R18 68Ω</td>
</tr>
<tr>
<td>R8 3.3kΩ</td>
<td>R19 3.3kΩ</td>
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<tr>
<td>R9 3.3kΩ</td>
<td>R20 3.3kΩ</td>
</tr>
<tr>
<td>R10 3.3kΩ</td>
<td>R21 3.3kΩ</td>
</tr>
<tr>
<td>R11 3.3kΩ</td>
<td>R22 3.3kΩ</td>
</tr>
</tbody>
</table>

All 1W except R12-R18 which are 1/4W 10%.

**Capacitors**

<table>
<thead>
<tr>
<th>Value</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 100µF 25V</td>
<td>C4 100µF 25V</td>
</tr>
<tr>
<td>C2 4.7nF to 10nF</td>
<td>C5 see text</td>
</tr>
<tr>
<td>C3 4.7nF to 10nF</td>
<td>C6 390pF</td>
</tr>
<tr>
<td>TC1 4 to 22 pF</td>
<td>Trimmer type Mullard 808 00006</td>
</tr>
</tbody>
</table>

**Semiconductors**

<table>
<thead>
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<th>Type</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tr1 2N3704</td>
<td>D8 1N4001</td>
</tr>
<tr>
<td>Tr2 2N3704</td>
<td>TH1 TIC44</td>
</tr>
<tr>
<td>Tr3 2N3704</td>
<td>TH2 TIC44</td>
</tr>
<tr>
<td>Tr4 2N3704</td>
<td>TH3 TIC44</td>
</tr>
<tr>
<td>Tr5 2N3704</td>
<td>TH4 TIC44</td>
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<tr>
<td>Tr6 2N3704</td>
<td>IC1 1N914</td>
</tr>
<tr>
<td>Tr7 2N3704</td>
<td>IC2 4020</td>
</tr>
<tr>
<td>D1 1N4001</td>
<td>IC3 4011</td>
</tr>
<tr>
<td>D2 1N4001</td>
<td>IC4 4013</td>
</tr>
<tr>
<td>D3 1N4001</td>
<td>LED1 FND500</td>
</tr>
<tr>
<td>D4 BZ 400mW</td>
<td>LED2 FND500</td>
</tr>
<tr>
<td>15V zener</td>
<td>LED3 FND500</td>
</tr>
<tr>
<td>D5 1N914</td>
<td>LED4 FND500</td>
</tr>
<tr>
<td>D6 1N914</td>
<td></td>
</tr>
<tr>
<td>D7 1N914</td>
<td>(only included for 24-hour mode)</td>
</tr>
</tbody>
</table>

**Miscellaneous**

S1, single pole changeover switch. S2 and S3, single pole push-to-make miniature switches. X1, 3-278MHz crystal. ICI perspex R400 display window 3 x 29 x 142mm. Length of flat cable of at least 7 insulated wires. Double-sided adhesive foam. 100 soldercon pins. White Vero case type 75-1237J. 22SWG tinned copper wire. PP3 battery clips. PP3 Manganese battery. Screws, nuts and grommets. Clock PCB 60 x 90mm. Crystal timebase PCB, 50 x 45mm. Display PCB, 115 x 32mm. All three boards available from the PW Readers PCB Service (page 485).

### Testing

If any step at all is not perfect, disconnect from power and find and correct fault before going further. Check that all the soldercon pin carrier strips have been broken off.
Connect a 9V battery to the backup battery clip, with a multimeter set to its 500mA range in series with one of the leads. No current should flow and the displays should be off. Remove the meter, connect the battery directly to the clip and check that there is approximately 9V between the following points, with the polarity indicated:
- IC1 socket pin 2 (+), pin 5 (-)
- IC3 socket pin 14 (+), pin 7 (-)

**MOS handling**

Check that the power is off. Insert all the ICs as follows:

(a) Remove IC from its conductive foam or foil, holding the IC with the right hand, while the left hand holds the foam or foil. The right hand should be touching some of the pins. If the IC has not been used before, its leads will probably be splayed apart and will need pushing together. Do this with your fingers. The leads almost always require more bending than one expects.

(b) Hold the PCB with the left hand making contact with some tracks. Maintain this contact during the next step.

(c) Insert the IC into its socket, the right way round. Don't be afraid to use a fair amount of pressure to plug an IC into a new soldercon socket. To remove an IC reverse this procedure.

Now connect a 9V battery between the point (1) position and the OV lead with a multimeter in series with one of the leads, set to its 50mA range. A current of about 9mA should flow and an extremely dim display of zeros should appear. Now connect point (5) to +9V as well, with S1 closed. The current drawn should rise to about 17mA and the display should dim zeros. Push the "set mins." button S3 and the "set hours" button S2 to check that all numbers are correctly displayed. Note that IC1 has built into it a "leading zero blanking" feature which turns the 10s of hours digit off, if it is a zero but only when the clock is in the 12 hour mode. Thus it will only come on to show a 1 or a 2.

Disconnect the batteries and connect the point (3) lead straight to the clock board, removing RX from the circuit. CAUTION: this will allow normal display currents to flow. If there are any faults present they may cause a digit to stay on continuously (due to multiplexing, a digit is normally only on one sixth of the time) and this may blow the digit and its associated thyristor. Connect power again with the
multimeter in series with the OV line set to its 500mA range (OV to OV, +9V to points (1) and (3) and the back-up battery in its clip). The display should be fairly bright drawing approximately 130mA. Although full brilliance will only be seen when operating from 12V. Check for correct operation of the various switches, and that the display dims considerably if S1 is opened.

**Final assembly**

Glue the Perspex window in position, drill three holes for S2, S3 and external wiring in the back panel and mount switches in position. Stick the back-up battery into the bottom of the case next to the clock board using double-sided adhesive foam. Also stick the crystal board to the inside of the top of the case using a small piece of plastic sandwiched between two pieces of double-sided adhesive foam. The adhesion of this material increases a lot in the first few days. Screw the clock board and display board module into the base of the case, run the cable out for the connection to the car, clip the case halves together and the clock is ready to install.

**Setting the time**

The clock does not show seconds but it is often desirable to make the minutes digit change at exactly the right moment. This requires synchronising the invisible seconds to the radio time signal or the speaking clock. The A at the end of ICl's part number, AY-5-1224A, indicates that it has “power on clear”. This sets the displays, and also the seconds to zero at the instant of turning the power on. The seconds counter does not start counting up from zero until either S2 or S3 is closed. So to synchronise the clock's seconds, disconnect from power including the back-up battery, reconnect power and at the instant the time signal indicates that an exact minute has been reached, momentarily close either S2 or S3. The hours and minutes can then be set without affecting the seconds counter.

**Adjusting the crystal timebase**

To speed up the clock the capacitance of TC1 should be reduced. With the Mullard 808 00 006 trimmer specified, minimum capacitance occurs when the brass vanes completely cover the nickle vanes. To slow the clock down, increase the capacitance of TC1. If at maximum capacitance, the clock is still too fast, change C7 to 82pF, and if that is not enough add a capacitor in position C5, first trying 22pF, then 39 pF, etc. If the clock is too slow with no capacitor C5 and TC1 at minimum capacitance then reduce C7.

**Modification for use with positive-earth cars:**

connect the OV wire to battery -ve (live)
connect the wire notated (1) to battery +ve (earth)
Instead of using the ignition switch to switch the display on, wire an extra “display on/off switch” from wire notated (3) to battery +ve (earth).
Dear Sir,

Yes to CB

I refer to your Editorial Comment on Citizens' Band (July Edition). CB does fulfil its purpose, although as Ginsberg seeks to show (overreacting to possible parity of problems in the UK) it has gone beyond reasonable bounds in the USA. A ratio of 40:1 represents a potential user population of British CB of less than 900,000; less than 10% of the US usage, assuming an allocation of as little as 0.25MHz.

Regrettably, CB and Amateur Radio both suffer from the activities of a childish, irresponsible minority. If we fail to learn by others' mistakes in CB we have only ourselves to blame. This is fundamental to the existence of the Citizens' Band Association. It is significant that the CBA is the brainchild of a group of British Licensed Radio Amateurs, who hold out self-disciplined responsibility as a foundation for CB in this country. As there will be a large demand for equipment, a British manufacturer with foresight and enterprise should be able to keep Nipon out of the running, as Japan produces 27MHz. AM equipment, whereas the CBA promotes the growing opinion that UK CB must be within the VHF spectrum and must be FM. A full technical specification is in preparation to cover all that is needed to eliminate the known problems of 27MHz. CB.

The object of CB is to provide a reasonable and reliable means of communication, at reasonable cost to the average person for whom CB will fill what is in many cases, an obvious need. Let there be no misunderstanding, the CBA is not a closed shop for the self-defence of the Radio Amateur— it is open to any person or organisation of persons genuinely interested in promoting well-planned CB and able and willing to contribute responsibly towards that end. It is not appropriate to involve the RSGB in CB. That Society is not intended to control or supervise a purely public radio service, which cannot and must not be equated in any way with the Amateur Radio Service.

Careful choice of frequency allocation coupled with sensible and responsible usage and behaviour, will overcome much that may presently be feared by many. The issue of the licence before equipment can be obtained, added to the recording of equipment serial numbers to each purchaser, should hold the potentially irresponsible element down to a minimum.

Those interested may communicate their views to the CBA at the address below, and seek membership. Further details on request, with SAE please.—John W. Dudbridge, G3UUO: Programme Co-ordinator; Citizens' Band Assoc. c/o Admin. Office, 16 Church Road, St. Marks, Cheltenham, Glos GL51 7AN.

Delivery delays

I, and no doubt, many other constructors are becoming very annoyed at the excessive delays and anomalies experienced in receiving equipment, kits, or components by mail order.

I will give, for example, two recent orders, one for a kit, the other for ready built equipment. The latter, a Power Supply Unit was ordered and after about ten days, my cheque was returned with a polite letter, stating, and I quote “Sorry, but we are still trying this idea out, therefore we cannot meet your requirements”. That was reasonable, at least I get my money back.

The former has been more disappointing. The order with cheque was sent on 2nd May 1976, this was confirmed by the manufacturer / distributor, delivery time three to four weeks.

On the fifth week I sent a letter for an estimated date of delivery. No reply received. The following week, I telephoned the company concerned, during office hours; more expense. The reason given for the delay was, that the Construction Brochures had not been received from the Printers. I was assured that the kit would be supplied ready built at no further cost and would be posted over the weekend.

Now, being well into the eighth week, I still have not received the equipment. I know that advertisements are usually submitted months in advance. My experience indicates that retailers etc are advertising products which either do not exist or are still in the experimental stages.

I do not propose to name the company concerned. This letter will, obviously, miss the next edition of “Practical Wireless”, so there will be some delay in publication. By that time, of course, the equipment may have arrived, but the implications in this letter will still be valid. There may be other would-be entrepreneurs wishing to build up working capital with cheques, money orders etc for equipment, kits and components which they cannot afford to design and market without first advertising—Catch 22? (name and address supplied).

Equal rights?

In case there are one or two who still don't know what the WARC is all about—it is a meeting of the world's countries to allocate (or reallocate) radio frequencies. Each country has one vote irrespective of the size of its population or requirements radio-wise.

This means that the citizen of some small country has the representative voting rights equal to a large number of Americans or Russians! Crazy—but that, it appears, is the only way they will play. From comments, in a certain amateur mag, it looks probable we will lose more from our HF bands.

This in spite of the fact that, world wide, the amateur has increased in numbers! In my view we should make some effort at fighting back and not act like a lot of sheep.

I suggest that we (amateurs and, I hope, supporting SWL's etc) have the right to know how

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each country votes on all the different issues that concern us. If we can find one magazine that will give us this information we will know our enemies. With this info we can organize some sort of action—or threatened action. But, first, there must not be any action against amateurs in hostile countries. This goes against our code. In fact the opposite tactics should be used so that they will support the rest of us against their own government, or whatever. When I write about retaliation I do hope no one will think I’m suggesting extreme action.

But some organised voluntary ban on listening to “enemy” broadcasting stations with no correspondence or asking for cards etc. Invite radio mags to exclude them from any publicity in reports etc etc. The threat of having their propaganda “blackened” might have some effect!

But I’m sure supporters could think up better ideas.

This is a free country and as long as we act within the law we have the right to protest. The alternative, with the present setup, is the decline of world wide amateur activity. Maybe what I advocate may be futile—but at least lets put up some sort of fight. This stiff upper lip stance gets me down.

Admittedly we, the British, can make little impact alone—but if someone more eloquent than I were to take it up I’m sure there would be a response in the free world.

Oh for an amateur Winston Churchill.—Hector Cole, G30HK (Workington).

**PW too complicated?**

I have been reading Practical Wireless for many years, and would like to thank you for a very informative, interesting magazine. However, I feel at this stage I must put forward a strong criticism. Your magazine is getting far too advanced for the “average enthusiast”. Your latest project the Video Writer would also come into this category of project. Instead of producing projects that cost £150+, and a laboratory of test equipment to complete, could we not start seeing articles that are a little easier and cheaper to “attempt”. This is how PW used to be, so couldn’t we start seeing this again?

In addition, in this country we readily take for granted the easy availability of Denco coils, which are used extensively in your radio projects. However, in certain places abroad these are not available. Therefore, could we see in future projects the value of inductances, and perhaps details of winding our own coils.—A. E. Skipper (Brighton).

**No to CB**

Who wants a citizens’ band in this country? The general public, or is there just commercial pressure? Personally, we can see no real need for one to be introduced into this country with its excellent telecommunications network. In America the original purpose of the CB was to provide reasonable communications between isolated communities and to enable aid to be summoned, for example, by motorists stranded on interstate highways etc. Misuse is, however, widespread in the US and licence conditions have been neither respected nor efficiently enforced.

We feel that in the editorial (July ’76) some valid points were made, but the following require further thought. The most important point is that of frequency allocation. In the UK 27MHz is extensively used for radio control as well as other important services but, with the availability of cheap Japanese equipment, commercial pressure will be applied to take over this band. Interference would also be a problem. Even some skilled radio amateurs cause interference but what 800,000 (to use the quoted figures) unskilled CB users would do in Britain, and the problems they would cause to the GPO, would be horrific. We agree with the comments that overcrowding would result if the CB were to be introduced but there is no solution to this problem as the RF spectrum is practically fully occupied from about 15kHz to about 450MHz.

From the minutes of the council meeting of the Radio Society of Great Britain on 23rd March (ref. Radio Communications, June ’76) it would appear that they are not in favour of the introduction of a CB and also that the answer to the citizens’ band problem does not lie in their hands.

We feel that if a citizens’ band were to be introduced, retailers should be required to hold a licence and perhaps register all sales. This would, of course, also apply to amateur equipment. CB operators would be required to hold a different licence entailing the passing of an examination on the licence conditions.

If commercial pressure by retailers and manufacturers is left unopposed then a citizens’ band will undoubtedly be forced upon us. We think that further views need to be expressed on this subject, including official comment, but anyone interested in communication should either use the facilities provided by the GPO more often, or preferably obtain an amateur transmitting licence from the Home Office. The RSGB and local radio clubs will be most willing to help anyone in gaining such a licence.—Nick Moyes, G8KMH, C. Evans, G4EYA, M. Grovewood, G4DCD, F. Emery, G3ZMF, L. Howell, G4DMA, PA5AQL, R. Westlake, SWL. A. Short, G4EHL, P. J. Lee, G8JGJ, S. Tompsett, SWL. G. Tompsett, M. Brosnan, G4BRO, P. Brosnan, G4DRO, P. Pique, G8KDQ.

**First time success**

I am writing to say that I have just successfully completed the construction of the General coverage receiver described in PW Feb & Mar 1976.

I have never tackled a project from PW before, although I have had some electronics education. I was absolutely amazed at the success I had.

I would therefore like to thank Mr. F. G. Rayer for the article on the receiver and Watford Electronics, one of your advertisers for the prompt and accurate mail order service, through which most of my components were obtained.

I would also like to thank you for publishing the article.—P. M. Ripley (Ilkley)
PART 3  M.J.HUGHES M.A.,C.Eng. MIERE

Parts 1 and 2 of the series dealt with the general theory behind the Video-Writer and the power supply unit construction.

Part 3 covers the Sync Pulse board, both the detail of its construction and the investigation of the various dividing and combining circuits required to provide a suitable system.

SYNC PULSE BOARD

The first printed circuit board to construct contains the sync pulse generator, the circuit of which is given in Figs 7, 8 and 9. Before starting assembly note that throughout this project you must take special care to DOUBLE CHECK the orientation of each integrated circuit on the boards. They vary in orientation to aid the printed layout's interconnections.

If double sides printed circuit boards are used it is necessary to make connections from one side to the other by means of “soldered stakes”. These are simply short lengths of tinned copper wire which are put through the “Stake Through” holes and soldered into position on either side. It is probably easiest to insert and solder all the DIL sockets first and then proceed to the staking through operation. The sockets will provide a useful “stand-off” from your work bench when it comes to inserting the short lengths of tinned copper wire. Lead-ins and lead-outs from each board are via printed board pins; these allow inter board wiring to be completed from the “Top side” only when all the boards are firmly fixed to the main aluminium chassis.

MASTER OSCILLATOR

The heart of the system is the Master Oscillator set to operate at 4MHz. An LC oscillator was chosen for simplicity and stability. During the early stages of the project’s design, experiments were made to phase lock this oscillator to the mains (to provide a synchronous 50Hz field frequency) but the extra complexity was not justified in the final instance. The circuit for the oscillator is shown in Fig. 7. Although, in principle, any general purpose npn silicon transistor will do for Tr1 it is recommended that a branded device be used to ensure that it has a sufficiently high gain to oscillate with no difficulties. Coarse adjustment of frequency is by C2 but final trimming is best carried out by means of the slug inside the coil.

Apart from the modulation level of the r.f. modulator, this is the only portion of the circuit that needs setting up to get the time bases operating within the specified limits and is checked by viewing the final display on the television screen.

PULSE SHAPER

The sinusoidal output from the oscillator is squared and “Normalised” to TTL drive requirements by means of a Schmitt Trigger (IC1) which is shown on Fig. 8. The triple cascade of triggers is not really necessary and is inherited from some of the early design work when it was thought possible that an inverted clock and slightly delayed signals might be required. As it turned out neither of these provisions were needed but there was no economy to be effected by changing the layout with hindsight.

Fig. 7. The schematic diagram of the 4MHz oscillator section of the board. See the text for selection of Tr1.

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Fig. 8. The block diagram of the Principle Waveform Generator which provides the Interlaced Sync Pulses ready for combining into the final sync train. The power rail connections to all the ICs on this board are shown as a separate section to avoid confusion on the main interconnection drawing.

**DURATION OF PULSES**

Each cycle of the master oscillator lasts for 250nS and describes a picture point. The line period of a television raster is 64μS (from start of line sync to the end of the line) and this can conveniently be broken up into 256 picture points.

IC2 and IC3 form a simple “Divide by 256” chain which, when driven by the master oscillator, will complete a cycle of counting in a time exactly synchronous with the line period. They produce 8 binary outputs which can be decoded to designate...
any 250nS picture point period within a line. This is very convenient because it means the decoded outputs can be used to generate line sync pulses and the equalisation and broad pulses required for the field sync train in their correct time positions.

Because we are operating in integral factors of 250nS we cannot expect to be exactly on target when it comes to meeting a "Broadcast Standard" of sync pulses but if you compare the figures in the following table, which shows the broadcast specification (with tolerances) against what we obtain, you will see that in all instances we are within the permitted tolerances:

<table>
<thead>
<tr>
<th>Line sync duration</th>
<th>Broadcast Standard</th>
<th>PW Video Writer</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.7 ± 0.1uS</td>
<td>4.75uS</td>
<td></td>
</tr>
<tr>
<td>Equalisation pulse duration</td>
<td>2.55 ± 0.1uS</td>
<td></td>
</tr>
<tr>
<td>Broad pulse duration</td>
<td>4.7 ± 0.1uS</td>
<td>4.75uS</td>
</tr>
</tbody>
</table>

The same principle is used to generate the equalisation and broad pulses. There is a small difference however. Whereas the line sync occurs only once during a line scan the equalisation and broad pulses occur TWICE during the lines which occur in the field sync period. This is easily taken account of by ignoring the Q8 output of the divider in the gates made from IC14, 15 and 18.

ICs 4, 5, 6 and 7 provide a "Divide by 625" counter which, as its input, the signal emanating from Q7 (twice line frequency). The line counter will thus do a complete cycle of binary counting in the time it takes the picture point counter to generate 312½ lines. Obviously it is not possible to produce "Half a line sync pulse" and the meaning of the "1" is that the line sync pulses are staggered by half a line, relative to the field sync train, every other field. It is this that enables us to have "Interlaced Scanning".

DECODING

Fig 8 shows how the decoding of the signals from IC1 and IC2 was effected. The Line Sync starts when all outputs of the divider rise to "1" and remains high for the complete duration of 19 picture points. This is repeated every time the counter goes through a complete cycle.

SYNC PULSE TRAIN

The broadcast standard Field Sync pulse is rather complicated. The word "Pulse" is really a misnomer because it is made up of a train of pulses.

Reference to Figs 10 and 11 shows the complexity of this train together with the decoding required to produce it. Fig 11 shows the Field Sync DATUM as a line time coincident with the leading edge of waveform B and the trailing edge of waveform C. It is necessary to precede the Field Sync Datum by five narrow negative going pulses (equalisation pulses) at twice the line frequency. The Datum is immediately followed by five Broad negative going pulses at twice line frequency and these are followed by a further five equalisation pulses.

After the last equalisation pulse the line sync pulses are started either 32uS (half a line period) or 64uS (a full line period) later. This half line period displacement between the EVEN and ODD fields generates the interface we have mentioned.
Fig. 10, above, shows the relative edges of the various outputs forming line sync, equalisation and broad pulses.

Fig. 11, below, shows the stages of combining waveforms to produce the Standard Sync Pulse Train, in this diagram the time axis is not to scale.

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Fig. 12. The main wiring pattern on the etched board, shown full size. The extra wiring required to make the track pattern complete is shown in Fig. 13.

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Fig. 13. The component side of the board, showing position and orientation of the ICs and Transistors.
IMPORTANT CONSTRUCTIONAL NOTE

To prevent erratic logic conditions arising from current spiking—caused by the very high switching speeds of TTL and the heavy current drawn by its output during switching operations—it is usual to incorporate small value capacitors across the power rails. When the prototype was originally designed it was felt that these capacitors could be soldered across the power supply leads on the top of each board. As it turned out, there were no problems with spurious pulses hence the illustrations of the boards do not show the capacitors. If, after construction, there is any indication of erratic operation the constructor should connect four 0.22μF capacitors between the +5V and 0V rails at convenient positions on each board. These can be soldered directly to the topside printed wiring—if double sided boards are used. They should be distributed so that the de-coupling effect of each will affect as many of the IC packages as possible. There are no rules for this but, equally, there are unlikely to be any problems if the recommended layout is adopted.

We have already generated continuous running line sync, equalisation and broad pulses. It only remains to select the right number of the correct type of pulse at the right times and this is where the gating associated with the line counter in Fig. 8 comes in. IC12a produces a single pulse of length equal to 5 cycles of waveform C (Broad pulses), see Fig. 11. We call this Waveform D and it will be used to gate out the five broad pulses when we generate the complex sync train. It is available in either positive going form (Output of IC11b) or in negative going form D at IC12a.

The second gate (IC12b) generates two pulses, having time durations equal to 5 full cycles of Waveform B (Equalisation pulses) exactly, preceding and following the pulse of Waveform D. This signal is used to gate out the two sets of 5 equalisation pulses into the final complex train. We call this signal Waveform E and it is available at the output of IC11a or in inverted form at IC12b.

It now remains to combine all our signals to produce a combined sync pulse train. This is done by the circuitry of Fig. 9. You can follow this through by referring to the waveforms of Fig. 11. First, we AND waveforms D and C to give F. This is carried out by IC13d. Next we AND E with B in IC13c to give waveform G. The two new signals (F and G) are ORED together in IC13a to give H which is inverted by IC13b to give J. Waveforms D, E and A are ORED together in IC19a to produce an inverted line sync train with a gap in it where the field sync train will be inserted (shown as Waveform K). Finally Waveforms J and K are NANDed in IC19b to give the final sync train (Waveform L). This, of course, will have two possible forms depending on whether one is considering an ODD or an EVEN field.

CONSTRUCTION

Figs. 12 and 13. give the board patterns and the component layout for the sync board and, as you will see from the component side drawing, the board is double-sided. For those wishing to etch their own boards it is strongly recommended that two or three holes are selected and drilled before tracing is started. These holes will act as registers and assist the alignment of the two patterns. Whether the constructor buys or makes the board it will almost certainly be the item easiest to damage. Usually overheating is the culprit, so be warned!

Problems can arise in the staking operation and, in the authors experience, if the board fails to function then poor soldering (or even no soldering) of the stakes is the most likely cause, so check these first.

The second potential problem area lies in the actual insertion of the integrated circuits into their sockets. It has been arranged that IC8 to IC19 inclusive all face the same way whilst IC2 to IC7 all face the opposite way, so orientation should be easy. However, the ICs are normally supplied with the pins slightly splayed and it is very easy to fold a pin under the device during insertion and, because of the pin shape, these folded pins are difficult to see at a later date.

Our November issue will continue the details of the individual boards for this project, particularly the Address Board, covering the counters, registers and the comparators.

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100 SUB-MINIATURE ASSORTED DISCS 3-3½p each 0-1μF for 57p.

Please add 20p post and packing on U.K. orders under £2.
HE SPY

Isn't it funny how one thing leads to another. A Ginsberg ago I talked about the use of a special fusing mechanism in artillery shells which allowed the shell to be fused while actually in flight and on its way to the target. I mentioned this to a colleague recently who immediately retorted, "That's nothing, they're putting miniature television cameras in artillery shells now!" And so they are. When I checked I found that the American Military is, at this very moment, reported to be testing just such a system at the Yuma testing grounds in the heart of Arizona.

The basic idea is quite simple, though doubtless more difficult in practice. A minute television camera and its electronics (to transmit the picture back to base) is located inside a 155mm shell. The shell is then fired over enemy lines and at the best moment in its trajectory, the tv camcitra is released and allowed to float down on its own little parachute. All the time it's floating it is sending back real-time pictures of all enemy activities; troop movements, positions, tanks etc.

One of the major difficulties in making the system work was the tremendous acceleration of the projectile and its effect on the glass vidicon camera tube. Unfortunately, the acceleration of the shell when fired results in a force of some 15,000g which does truly terrible things to the glass vidicon—like smashing it into a million pieces!

The solution was to use a CCD (charge-coupled device) chip as the camera sensor and this is proving successful. I learn also that a small self-destruct mechanism is being built in so that the devices will not fall into enemy hands. Apparently, not only does Whiteman speak with forked tongue, him also watch from skies with floating eyeball!

HER—TZ SPY

X-ray photographs of various parts of the body have become commonplace in the medical field. Scanning the body with other types of radiation is a newer science. One such method is called Ultrasonic Scanning although the frequencies involved have crept up and up due to technical improvements and one wonders if 'ultrasonic' is really a true description.

The new ultrasonic approach is to wrap a little bag of water around the patient's neck. Of course, there is more in the bag than water—two tiny transducers to be exact. Each transducer has its own 'lens' which scans an artery at about 15 frames per second. One of the transducers gives a picture of the vessel and surrounding organs, while the other gives a doppler velocity graph which watches blood flow. By superimposing this second transducer's information over the picture obtained by the first transducer, it can be seen immediately whether the blood is flowing faster in one place compared to another (thereby showing a possible blockage building up) or any irregularity in blood flow.

The scanning transducer operates at 10MHz which is much higher than previous ultrasonic systems I have heard of (2MHZ is far more common). The second transducer operates at 5MHz. The higher the frequency the less the penetration but, luckily, the arteries are fairly close to the surface of the skin. Also, the higher the frequency the better the resolution—about half a millimetre in this system. Perhaps those body scanners in Star Trek are not so far fetched after all.

NOW YOU SEE IT

How fast is 'fast'? It all depends on what you are using as a base or standard against which to judge or measure. Offered as food for thought; have a ponder about the mode-locked laser which is shining happily away at a London College. The laser medium is rhodamine dye in a water solution and the power (peak) inside its cavity is around 300W. Where does the 'fast' bit come in? Well, this laser emits pulses which occupy only one third of a picosecond. Now consider that a picosecond is one millionth of one millionth of a second—and we're talking about a third of that!

Oh yes, the team working on the laser think that they can get this down to one tenth of one millionth of one millionth of a second. Good gracious Holmes!

NOW YOU DON'T

In an earlier Hotlines I made reference to an infra red audio system. I hear that Philips GmbH (a German subsidiary of the Dutch giant Philips) is marketing just such an IR system which may be simply plugged into any tv receiver, with accent on the word "any". It can, of course, also be used with other types of audio and hi fi equipment. The IR transmitter is located in the plug-in unit. The user has a small receiver which can be clipped to a pocket or worn round the neck. A tiny headset is connected to the receiver to complete the system. Perhaps some one will bring out an infra red system which modulates an electric fire bar. In Winter one could keep warm as well as listening to favourite records. Cooler moments would find one playing a Mozart minuet while in colder weather Bach's Fugues and Toccattas would give greater modulation peaks and thus greater warmth.

SUN SPOT

Interest in utilising solar energy continues to rise as the world eyes conflicting but no the less alarming reports about energy shortages of the future. I hear that a company has been formed called Japan Solar Energy. It is located in Japan but the interesting thing is that it is formed by three Japanese companies and two American companies. The first product is understood to be the fabrication of silicon ribbon which will be used to make solar batteries. Cor, stripe a light.

Ginsberg
as in Figs. 4 and 5. If S1/S2 is omitted for the reason mentioned, VR1 may include the on/off switch. The layout places the RF stage under the chassis, with the mixer and oscillator above.

**OPERATING THE EQUIPMENT**

An arrangement can be made to switch the aerial socket of the general coverage receiver from the output of the 2m converter to the long-wave aerial so that the GC receiver can be used directly on the 10m band to check the signals (if any) coming from the International Beacon Project stations situated in Cyprus (5B4CY 28-180MHz), Mauritius (3BBMS 28-190MHz) and Germany (DLOIIG 28-195MHz). The German beacon is usually very strong in the UK when sporadic-E is present.

The VHF receiver, fed with the vertical dipole and tuned to the R1 frequency (49-75MHz), will serve as an early warning for sporadic-E, and when the R1 sync. pulses are heard the receiver can then be tuned through Band I television (41-67MHz) and then through the 4m and 6m bands. Using the horizontal dipole to feed the VHF receiver tune through Band II and log the continental broadcast stations which appear during a tropospheric opening. By doing this, the operator can plot the extent and direction of the prevailing disturbance.

When the barometer is reading above 30in and rising, a tropospheric opening can be expected at the time when the pressure begins to fail. The author has found that before an opening begins, French FM stations usually appear between 98-100MHz and when it is in full swing the “DX” signals are so strong, on the 2m band, that the direction of the beam is not so critical as it is under normal circumstances.

To detect VHF signals which are bouncing off an aurora the beam must be directed toward the north irrespective of the geographical location of the transmitter. The auroral reflected signal will be identified by its tone which sounds like someone “keying a bath waste”. During the lifetime of an aurora a lot of Tone-A signals should be heard at the CW end of the 2m band, and it is worthwhile tuning the VHF receiver through the broadcast bands to see how many European commercial stations are subjected to the auroral tone. All reports should go to G2FKZ, c/o RSGB.

It is worth directing the beam toward the Sun when sunspots are present and tuning the 2m receiver just outside the band (say 145-9MHz) and listening to the receiver background noise. If the sun is “active” strong hissing and whooshing will be heard, as the aerial collects the solar radio waves. A further check can be made by turning the aerial away from the Sun when the noise should stop.

Apart from the normal enjoyment one gets from VHF listening, every enthusiast can make a contribution to science by sending a report of his observations to the right place in our selection of journals. Remember, every report that is published now is providing posterity with a contemporary record of the natural disturbances which affect the behaviour of our VHF radio signals.

*S The author has built and developed a private radio observatory situated in Storrington, Sussex. He is a Fellow of the Royal Astronomical Society and a member of both the British Astronomical Association and the Radio Society of Great Britain. He has programmed the work of his observatory to suit these organisations and to further his own interest in the science of radio.

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**SATELLITE COMMUNICATIONS**

**September 1976**

On page 306, in the section on ISD, we have a paragraph beginning “ISD calls are...”. In that paragraph we say that the timing meter pulses can be heard in the telephone.

The Post Office have pointed out that although these pulses occur at the intervals stated they cannot be heard. Makes sense when you think about it. Who wants their conversation interrupted every 1-71 seconds?

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**KINDLY NOTE!**

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Practical Wireless. October 1976

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For full details write to:

Decca Special Products, Imperial Place Queenstown Road, London SW8 3NT.
Perhaps you have to be of my vintage to know the phrase "a Double Feature", but up to a few years ago cinemas always ran a main film and a supplement. I'm reminded of it because with their new catalogue Home Radio Components are now giving away a supplementary catalogue of bargain lines.

It sounds a very practical and sensible idea. After all, most electronic component firms accumulate surplus stocks of various items, and rather than dispose of them, why not offer them to customers at exceptionally low prices? I'm told that this bargain list will continue for several months and be updated from time to time.

No constructor should be without the Home Radio Components Catalogue (it contains 5,000 items clearly listed plus about 2,000 illustrations) but now you have a double incentive for buying one. In addition to getting one of the finest component catalogues available, you also receive a list of items at unbelievably low prices. For example, Gemini Malms Transformers: normal price £11.48, bargain list price £5.50, saving £5.98! This means that with a single purchase from the bargain list you can save the price of your catalogue several times over!
by Eric Dowdeswell G4AR

My apologies for the small number of reports which I was able to deal with last month owing to the fact that I was in hospital. Back home recuperating at the moment and endeavouring to catch up with the backlog of letters, so I'll cut the chat this month and get on with logs and reports.

My comments on the simplicity of the Radio Amateurs Examination brought in several replies. My point was that considering the very great privileges that are granted with either the 'A' or 'B' licence and the consequent interference that could be created by an inexperienced operator then the exam is far too simple and should be supplemented by a practical examination or evidence of experience of transmitters either on low power or on an artificial aerial. H. W. Portch of Bristol recalls making a receiver in 1922, before the days of 2LO, yet he made the effort and is now G8EQP and looking forward to a G4+3 call before too long. Congrats OM and obviously it is never too late to have a go!

David Kennedy residing in Chertsey, Surrey, has an S108 set and a temporary aerial in the form of a TV beam but nevertheless got stations around the world on 20m with ZL1 and 3 on 80m. Jeremy Hinton continues to keep in touch although very busy on the HF bands and on 2m with his new call G4EZE, using a Europa transverter for the latter band. Thanks for the QSL card Jeremy and good luck with the DX.

Ray Woodward in Colne has been using a Microwave Module converter on 2m and says he has nothing to report! I have already written to Ray pointing out that few would agree with this finding and suggesting he gives his set-up a good check-over because there must be something wrong somewhere! On the HF bands Ray has a Yaesu FR50B and 132ft of wire, where he does a lot better than on 2m.

What with exams and a fault on his CR300/2 Paul Cowburn of Leyland (Lancs) has little to report. Paul is one of many who look forward to the article on SSTV promised by Paul Barker. Neil Whiteside, Hitchin, also reports QRM from exams but promises to go all out for the RAE in December. He listens mainly on 2m and 70cm, when he can find the time.

Andrew Work A9091 is a newcomer reporting from Beverley, E. Yorks, where he uses a CR150/3 with 66ft of wire with an ATU. A current project is a converter for 2m. Andrew is another who would like to see PW running a series of articles to enable readers to attempt the RAE. From Bishop's Stortford, Paul Turner BRS6843, reports little time to get on the best bands at the right time, finding 15m the best for DX in the late afternoons.

Steve Cottis A8961 is still notching up new countries his latest including 9N1, FM7, VR3, KS6, BV2 and ST2. Peter Allen from Taunton has stuck to 2m and went portable with G8IXK and their best DX heard, but not worked was EA1AM. From Bognor Regis comes Kevin Piper for the first time. He's been searching around on 20m with a homebrew PW superhet plus a 30ft vertical. Unfortunately he is in a basement flat with little room for aerials. Our SSTV wizard Paul Barker of Sunderland found seven new stations using that mode, including W5GZL. It is some years since Stephen Fletcher last reported in to this column and in the meantime he has become G8LJM but he is going hard at the code in order to get a 'proper' licence, as he puts it! He recommends a look round the 160m band for many stations that send Morse at quite low speeds if you are swotting up the code. More from Neil Whiteside who has now had offers of help with the code from a couple of local amateurs and reckons he can now manage around 7wpm. During the excellent conditions on 2m and 70cm Neil has been copying many DX repeaters including the Otrebro one SK4RGN.

J. W. Hodgson of Morpeth, Northumberland admits to being a complete beginner and asks many questions about our hobby. By this time he will have got the RSGB's Guide to Amateur Radio which will have answered just about all his queries. He has a Codar Mini-Clipper and an old TV aerial so there is plenty of room for improvement in the equipment. Very nice to hear from Julie Rose once again, I thought we had lost you to another hobby! Julie in Warley, West Midlands, has a 9RS9DS and a couple of long wire aerials via a home-made preselector. So far she has logged 204 countries and is looking mainly for Pacific and Indian Ocean stations for some of the rarer ones. Julie took the May RAE and I hope we shall be able to congratulate her in the next issue when she has the results.

Back in circulation is Steve Budd A8713, after taking his 'O' levels. Projects include a quad for 10m and a 10 element job for 2m. Personally I have always reckoned that the best place to spend one's time and
money is where the signal arrives, at the aerial system. The best receiver will not put up much of a show if the signal is poor to start with! R. Donaldson, of Trimdon Colliery, Co. Durham, sent a list of things heard on 2m recently using a Telford TC7 MkII receiver and G8AEV converter. At the moment his Yagi and crossed dipoles are fixed but he hopes to fit a rotator very soon. That ought to make quite a difference to the log. Paul Barker, again, sends in his first loggings on 2m using an MARC 56 receiver, a new one on me. Aerial is just a 20m whip at the moment. On 20m SSB station D6A was a good catch from the new Republic of the Comoros.

A late letter from Paul Turner enthuses over his new 70cm converter which has been bringing in the Euro DX to his QTH in Bishop's Stortford. Another note from Steve Cottis queries 7X2EPM who gives his QSL address as PO Box 2, Algiers. Only one way to find out Steve, send a QSL! Stan Sutherland GM3BSQ of the Aberdeen ARS writes to say that they will be starting RAE classes again soon as last year's course was a great success. Write to him immediately at 67 Greenfern Road, Aberdeen AB2 6TP.

Whew! bang up to date now and I trust that no-one has been forgotten!

Log extracts

S. Cottis:—15m TU2FW 20m BV2B C311JW HM1BO K6CC KZ5AS ST2SA VR3AR VR8A 7X2EPM

P. Turner:—15m KP4DE ZPSNA 70cm D1C1XG PA0VTW OZ2KO/A ON5NK/A GW3UBX 2m LA6KH

S. Budd:—80m C220 (Olympic Games) KZ5HP ZD9GF 9G1JX 40m AP2P H6CTA H8LC 20m FG0CRZ/FS7 JWISO (Bear Is) KJ6DL KX6BU ST2SA/ST0 (Juba, Equatoria) VR3AK (QSL KH6AZH) ZK1BA 7Z1AB 15m FG7TD HP7XIS 5N2NAS 10m H18MOG VP9AD YV4BDB ZB2DL 9Y4NP

P. Barker:—2m DB2XI LA6OH PA9AR PE0M5BU 20m SSTV DK3IV F5YO HASLP 1IRHB OE9JIM SP3PJ W5GCR 20m D6A H18FVC KZ5AS OE5GM/YK (Golan Heights) TUXDB 7X2EPM 9K3TC

R. Donaldson:—2m DF3BU LA6X OZ1CX PA0EX SMG6FC UK4AA UR2RDR

N. Whiteside:—80m PY1RO JW7FD (Bear Is) 2m PI3ALK DB0WU DB0UO SK4RGN all repeaters. W9JFY via Oscar 7.

K. Piper:—20m HClHE SV0WZ (Rhodes) YS1GMV ZFI1GK

P. Cowburn:—80m EA8CR HK0AA (Serrana Bank) KZ5JM VP2LCX VP2VBG ZS6BW 8P6AH 40m HK6DNK PY8RH VK2AM YN1JIA ZL2HE 20m HR6MW VE8RCS VR3AK 6Y5GB

R. Woodward:—40m VK6XI ZP5GE 20m H18MOG HZITA VP9IG 8R1C8 9Y4NP 15m LU2OF

J. Hinton:—Worked 20m 6Y5DE OY8I DK4HB/OH0 15m TU2GF 2m DC2BE FOCK/P ON4UN PA0RVP

SHORT WAVE BROADCASTS

by Derek Bell

I n a recent column I asked if anyone had heard of two Russian stations Stancia Atlantika and Stancia Rodina. Imagine my surprise when no less than fifty per cent of this month’s mail mentioned these stations and supplied an explanation. They are, as I suspected, offshoots of Radio Moscow, Rodina being for Russian nationals living abroad and Atlantika for Soviet merchant seamen. The language is Russian and the times are as follows: Rodina 0600 on 227m, 49, 41, 31, 25, and 19 metre bands, and 14550 and 18080m on 41, 31, 25, 19, 16, metres; Atlantika, 1000, 1230, 1530, and 1830 GMT on medium waves from Riga.

That of course was a digest of the information that poured in and you will understand and perhaps forgive me if I do not name everyone who wrote but space does not permit that but thank you all, and an extra little ‘thank you’ to the gentleman from the north east who wrote an interesting letter to point out that they were not “stations” in the sense of the word but merely programmes which call themselves stations. The address for QSLs is Radio Station Atlantika (or Rodina), Moscow Radio, Moscow U.S.S.R.

It’s nice to be able to report a success once in a while and especially when it is caused by the demands of listeners. This one however will be tinged with a little regret for one reader. John Goodwin of Rugeley had what he thought was one of the last QSLs from Radio New Zealand for a transmission on 11690 at 0815 in April. You will remember that RNZ announced the closure of its overseas service and I mentioned in this column that it would be a pity for one of the rare DX stations, for us in the UK, to go off the air. Twickenham DX Clubs magazine “Communication”, in its July edition, carried an item that on June 5th RNZ was back on air again relaying its domestic service “in answer to public demand”.

Radio Netherlands news this month comes from Robin Bayley of Kingswood School, Albrighton. He sends a letter packed with information, firstly Radio Nederland is issuing a QSL in memory of Eddy Starkz who died recently, and this is the first commemorative QSL I have come across! Next, that other stalwart of RN Jim Vastenhoud (the one who writes the leaflets) has been awarded the gold plaque of the European DX Council, so our heartiest congratulations go to Jim. Finally, on Radio Nederland, the 7210 transmissions at 0930, 1230 and 1400 are now changed to 0960.

Turning to Norway, Robin writes that Radio Norway’s new 250 kW station is now on the air and that they are asking for reception reports for the following: 1300, 1900 and 2100 on 15175. So if you fancy a QSL from a new transmitter why not try your luck. Stuart Eyre is keen to join our fraternity.
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The main problem, he writes, is that he lacks a good receiver and in his search has become bogged down in a plethora of advice that it is possible to receive from the various books and pamphlets that are in circulation. Stuart asks that I recommend a good set for under thirty pounds! I will say that the set I would go for would be low on spurious signals, have perhaps a bandspread dial and cover as much of the short wave spectrum as possible since even though we are in the sunspot minimum I would hope the set would last long enough to be of use when the full range of SW bands comes back. In this world one gets what one pays for and most sets are a compromise in that they sacrifice one aspect in order to meet another or to keep to a price. It is however possible to improve a set by either building “bolt on” extras such as ATUs or by buying them from one of the reputable manufacturers. Stuart, it seems, has explored the homebrew aspect of our hobby for he asks “what is a permeability tuned oscillator”. The answer to this, in a nutshell, is a coil with an adjustable ferrite core. This may sound simple but the advantage of the PTO is that it can be used to tune a station by either a pushbutton or screw adjustment. In other words the position of the rod in the coil can be preset in order to tune a particular frequency.

While on matters technical we turn to David Thompson from York who is eager to identify a mystery set that is merely marked “FRC reception set R107T”. This sounds to me a little like an serviceset but perhaps some one can throw a little light. David also wants to improve his pulling power by putting an aerial in the loft. This I dealt with recently by explaining the method of erecting a long wire in the loft and feeding the downlead through the shack window (no mesh is a simple job and only involves running the copper wire as near as possible to a square around the outer limits of the loft and feeding down through the eaves. David’s final problem is a lack of books or leaflets, and this is solved by Matthew Phillips who recently had through his letter box a set of seven leaflets from Radio South Africa; these are free and the address is RSA PO Box 8606 Johannesburg.

David also logs three Africans and they are: Radio Uganda on 15325 at 1805, RTV Congolaise on 4765 at 2245 and Radio Lome, Togo on 5047 at 2245. However technical problems rear their ugly head in the form of noise in the 14 to 30MHz section of David’s HRO receiver. This apparently gets worse “as the night progresses”. From this distance it would seem to be a local phenomena, perhaps a factory nearby. As you say David that it varies with the amount of daylight I would not expect it to be the “innards” of the HRO. I can only advise you to contact your friendly local radio amateur and ask if they know from whence it comes, and if your local radio club can help.

Still on the African theme, J. Hershbaum of Plumstead, South Africa, sends an interesting insight on what is pulled in by our friends there. JH’s loggings include Radio Veritas, Philipsines on 11725 at 1340, FEBA Seychelles on 9665 at 1000 and Radio Pyongyang on 1000 at 1800. These were captured with a Bush EBS35 hanging on the end of a 300ft ‘L’ shaped long wire. This welcome letter keeps up the average of one overseas letter a month and it is pleasant to know that one’s column is so well thought of as to inspire missives from so far afield. Not so far afield our Argentinian friend Roberto Levinstein, who is studying in London, tips us off that Radio Nacional de Brasilia is now on 11795 and in English from 2200 with a DX show fortnightly on Fridays at 2135. I am sorry that many letters will have to be held over this month due to a heavy postbag but may I wish you and yours best 73s.

**MEDIUM WAVE DX**

by CHARLES MOLLOY

A USEFUL log of North and South American DX comes from Preston in Lancashire where Derek Taylor used his Realistic DX160 and medium wave loop to pull in four stations from Newfoundland; CBT on 540kHz, CBNA on 600kHz, CBN on 640kHz and CKVO on 710kHz. Two outlets from Nova Scotia, CHER on 950kHz and CHNS on 960kHz were heard plus New York City on 860kHz (WCBS), 1010kHz (WINS), 1050kHz (WHN) and WMEX is Boston near the top of the band on 1510kHz.

Four South Americans were heard between 0130 and 0330 GMT; Radio Belgrano in Buenos Aires on 950kHz, Radio Sutatenza in Magangue Colombia on 960kHz, Radio Colosal in Nieva Colombia on 1005kHz. Derek, who is a regular reader of Medium Wave DX, makes a point of interest which may save readers an unnecessary report. He says that CKVO on 710kHz in Clarencville, Newfoundland is a pure relay station. Reports should go to the key station which is CHCM 560kHz in Marystown whose address is Box 560, Marystown, Newfoundland, AOE 2MO. Derek confirms that North Americans are good verifiers. A recent report to CJON (950kHz) produced, in ten days, a QSL card, 2 car stickers, 2 metication templates, a pamphlet about broadcasting in Newfoundland and a book about Newfoundland. It could have been worse, Derek! Your scribe once had his reception report (to WKBW) read out over the air by a DJ who asked members of the audience to reply!

Middle East enthusiast Stewart Hinsley reports from Annan in Dumfrieshire with an interesting log of DX heard on a CR70A receiver and 80ft end fed aerial. Istanbul was logged on 1016kHz, Diyarbakir on 1061kHz, Tripoli on 1250kHz, Algiers on 860kHz, Conakry in Guinea on 1402kHz (at surprising strength with the identification “La voix de la Revolution” at 1210), Tangiers on 1232kHz and Funchal in Madeira on 1331kHz.

*Practical Wireless*, October 1976
Stewart asked for up-to-date information about medium wave broadcasting in Jordan, Sudan, Libya, Saudi Arabia and Syria. The new 1200kW outlet in Amman has been on 912kHz since October 1975 but has not yet been reported in the UK. In Sudan, Radio Juba is on 829kHz while Omdurman has been allotted 575kHz. No word yet about the new stations planned for Nyala and Sennar. Dair es Zor in Syria has moved from 960kHz to 953kHz. Two new super power stations have been reported from Libya on 827kHz and 1570kHz but locations and powers uncertain. Saudi Arabia does not use 611kHz, 899kHz and 1520kHz but Riyadh is on 540kHz with 50kW. Turkey is usually thought of as being in Asia although that part of the country to the west of the Bosporus, which includes Istanbul, is actually in Europe. A ferryboat from Istanbul will take you from Europe to Asia in a few minutes. (There is a bridge, too! ED.) DXers generally regard the whole of Turkey as being in Asia but the purist may hesitate to say that he has heard Asia on the medium waves if his sole catch is Istanbul. This is the sort of problem that confronts organisations such as the European DX Council when it attempts to compile a list of countries for DX purposes. The EDXC list of Radio Countries classifies "Turkey including European parts" under Asia, which may seem rather strange on the face of it.

Malcolm Laughrane of Witney in Oxfordshire used an aerial tuning unit (ATU) to match his 30ft longwire aerial to his Philips receiver. With this set-up he logged Manx Radio on 1295kHz and Radio Norway, in English on 1578kHz. The overseas service of Radio Norway is relayed over the medium wave transmitter on 1578kHz after the closedown of the home service. "Norway this Week" is on the air every Sunday night from 2330 until 0030GMT.

Stewart Hinsley raises an interesting question when he asks "what is the status of Spanish Sahara?" This country had two medium wave outlets, both of which have been logged occasionally in the UK. In the north of the country EA2J03 Radio Television de Sahara broadcasts on 656kHz with 50kW, while from the south EA2J02 Radio Villa Cisneros was on 998kHz with 10kW. Does anyone know if they are still on the air? The current status of the country is uncertain. It is due to be divided between Morocco and Mauretania and when this happens "Spanish Sahara" will join the list of other odd medium wave countries such as Swan Island (now part of Honduras), Biafra (Nigeria) and Tangiers (now Morocco).

There are still two Spanish enclaves in Morocco which count as radio "countries". Mellila is represented by EA2J1 on 1520kHz with the call Radio Mellila, while Ceuta, which is directly south of Gibraltar, has EA2J26 on 1106kHz with the call Radio Ceuta. Both use 2kW. Radio Ceuta can be heard during the day on the Costa del Sol with a transistor portable receiver and any DXer on holiday at Torremolinos should listen for the call "Radio Thayootah de la Cadena SER".

Cheshire Homes net between 3650 and 3700kHz on SSB at 1530hr on Thursdays.

The RAIBC has a membership which is fast approaching the 1,000 mark and includes some members abroad. If you'd like to join, help, or know anyone who is invalided and might like some assistance, drop a line to Rita Shepherd, 59 Pantain Road, Loughborough, Leics LE11 3LZ.

Interesting information obtained was that the company trading as Burns had been bought out by another company, SCS, but that neither company is a limited company.

"This will continue now as Burns SCS until we go Limited, then there might be a name change," says spokesman Steve March.

AND WHAT'S NEXT

The RSGB, delighted with its first effort in the new series of annual exhibitions, has already booked the Hall for next year.

For traders, the London event must be an annual certainty. With a huge purchasing potential, Radcomex offers an extremely good shop window for all types of radio and electronics goods, from components to complete Amateur stations and accessories.

Many exhibitors have claimed their stand space for next year, even before the current show had closed and an outside company who missed this years' Radcomex has firmly booked 800ft² for next year.

Radcomex had just about everything for Amateurs, Hobbie-st, constructors and their families. Quite apart from the exhibition there was an 18-hole pitch and putt golf course, boating lake, ski slope, children's playground, creche, plus superb picnic facilities backed by an all-day buffet plus two bars and a restaurant. There was even wheelchair facilities for the disabled.

The exhibition ran extremely smoothly and suspicions for this must centre on John Hitchins, G4FGN, and on retired, veteran exhibition whizz-kid, Phil Thorogood, G4KD, although one of the great mysteries of the exhibition was the organiser's office. This was clearly signposted and the door boldly marked—but it was always locked and knocking produced no response. Ah well, perhaps next year?

Touring the stands in comfort around the 40,000ft² exhibition, optimism was the obvious keynote and without exception every exhibitor questioned replied, "Definitely back again next year".

There can be no doubt that the first Radcomex was a success. With nearly 5,000 potential buyers, the exhibitors were obviously pleased and will certainly be the envy of anyone who didn't attend or who pulled out whatever the reason.

Radcomex next year will take place at Alexandra Park, London. The Great Hall has already been booked for May 6, 7 and 8, 1977. But next year will be even better. It is to incorporate a convention which will include such things as v.h.f. and h.f. It is also planned to hold a dinner/dance on one evening. Add this increased programme to the attractions already existing and it is clear that next years' RSGB show will be an absolute must not only for the radio and electronics enthusiast, but as a day out for the whole family. Quick—put a note in your diary, you don't want to miss all those fantastic bargains a second time, do you?
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Practical Wireless, October 1976

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Practical Wireless, October 1976
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2. The Publishers reserve the right to refuse to print any advertisement.

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5.000 8µF 8µF 8µF
5.600 8µF 8µF 8µF
10.000 8µF 8µF 8µF
15.000 8µF 8µF 8µF
22.000 8µF 8µF 8µF
22.500 8µF 8µF 8µF
33.000 8µF 8µF 8µF
47.000 8µF 8µF 8µF
50.000 8µF 8µF 8µF
56.000 8µF 8µF 8µF
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- 100 220 mm

DIALLE: 100V, 0.1, 0.15, 0.22, 0.47, 1.0, 1.5 2.2, 4.7, 1.0 15 mm.

CERAMIC CAPACITORS: Values are in pF.
- 0.15 2.5 mm
- 0.22 3.5 mm
- 0.47 7.5 mm
- 1.0 15 mm
- 2.2 25 mm
- 4.7 36.5 mm
- 10 50 mm
- 15 76 mm
- 22 105 mm
- 47 160 mm
- 100 220 mm

DIALLE: 100V, 0.1, 0.15, 0.22, 0.47, 1.0, 1.5 2.2, 4.7, 1.0 15 mm.

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- Drum 5mm: 6 pF.
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CERAMIC TRIMMER CAPACITORS:
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- 4.7-3: 22-25 pF.
- 25-2: 56-68 pF.

MINIATURE TYPE:
- 2.2-5: 14-15 pF.
- 4.7-3: 22-25 pF.
- 25-2: 56-68 pF.

CONVERSION TYPE:
- 3.3-15: 33-100 pF.

SILVER MICA:
- Values in pF.
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**POWER TRANSISTORS**

<table>
<thead>
<tr>
<th>Transistor Type</th>
<th>Max. Collector Current (mA)</th>
<th>Max. Collector Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC24</td>
<td>0.60</td>
<td>200</td>
</tr>
<tr>
<td>OC25</td>
<td>0.50</td>
<td>200</td>
</tr>
<tr>
<td>OC26</td>
<td>0.40</td>
<td>200</td>
</tr>
<tr>
<td>OC28</td>
<td>0.60</td>
<td>200</td>
</tr>
<tr>
<td>OC32</td>
<td>0.50</td>
<td>200</td>
</tr>
<tr>
<td>OC36</td>
<td>0.65</td>
<td>200</td>
</tr>
<tr>
<td>AD1 0</td>
<td>0.45</td>
<td>200</td>
</tr>
<tr>
<td>AD1 6</td>
<td>0.38</td>
<td>200</td>
</tr>
<tr>
<td>AD2 1</td>
<td>1.25</td>
<td>200</td>
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